

VRF-VAV

Mobile App based **GEN XV** System

Using Programmable Thermostats controlling Pressure Independent Self Balancing
Smart Air Valves

Automatic Temperature Control Specification

Section 15950 - Controls and Automation

PART 1: General

- 1.1 The automatic temperature controls (ATC) under this section will be supplied and installed in accordance with the General Conditions, Supplementary Conditions, and all Division I General Requirements and Referenced Documents.
- 1.2 The installation of the ATC shall be in accordance with all National, State and Local codes pertaining to this type of work.
- 1.3 All work must comply with Section 15050 – Basic Materials and Methods – and all other Division 15 Sections, as applicable.
- 1.4 The scope shall include furnishing and installing a temperature control system to include remote control panels, temperature control devices, appurtenances, etc. to accomplish specific control sequences specified herein, sensing and indicating devices, temperature indicating instruments, supporting structures and other required components.
- 1.5 The scope shall include all thermostats, sensors, VAV-SMART AIR VALVES (SAV), actuators, microprocessor central controllers, VAV diffusers, static pressure sensors, fan powered boxes, and reheat products and all other new components of the system requiring connections.

PART 2: General Instructions

- 2.1 The Building Automation System/Automatic Temperature Control (BAS/ATC) Systems as specified herein shall be provided in their entirety by the BAS/ATC Contractor. The BAS/ATC Contractor shall base his Bid on the system as specified and on the sequence of operations.
- 2.2 As part of his Bid, the BAS/ATC Contractor shall submit for review by the owner's authorized representatives a written description of his BAS/ATC systems, including block diagrams, showing all major components and control panels and required cabling between each.
- 2.3 The BAS/ATC contractor shall include manufacturer's literature for each type of panel, controller, or device that may be shown on the Riser Diagram.
- 2.4 The Riser Diagram shall show schematically the entire building system with all major components identified.

PART 3: Scope of Work

- 3.1 The BAS/ATC systems shall be supplied and installed completely under the BAS/ATC Contract. Control components shall be mounted and wired by the BAS/ATC Contractor.
- 3.2 The BAS/ATC Contractor shall provide the engineering, installation, calibration, software programming and checkout necessary for complete and fully operational BAS/ATC systems, as specified hereafter.
- 3.3 Wiring in exposed areas and in mechanical rooms shall be in EMT. Wiring in accessible, concealed areas shall be plenum rated cable.

PART 4: Submittals

- 4.1** The following data/information shall be submitted for approval:
- 4.2** Complete sequence of operation.
- 4.3** Control system drawings, including all pertinent data, to provide a functional operating system.
- 4.4** Damper / SAV schedules showing size, configuration, capacity and location of all equipment.
- 4.5** Data sheets for all hardware control components.
- 4.6** A description of the installation materials including conduit, wire, flex, etc.
- 4.7** Thermostat/Sensor locations.
- 4.8** Control panel locations.
- 4.9** Provide as part of the submittal five copies of all data and control drawings.

PART 5: Qualifications

- 5.1** The BAS/ATC Contractor shall participate in an on-line training with Zonex Systems prior to installation of the GEN XV VRF-VAV control system.
- 5.2** The BAS/ATC Contractor shall complete Zonex Job Completion and Start-Up Check List and review with building owner or representative at the conclusion of the controls system installation.
- 5.3** The BAS/ATC Contractor shall have an office within a 100-mile radius of the job site, staffed with factory trained personnel capable of providing instruction, routine maintenance and 24-hour emergency maintenance service for all system components.
- 5.4** The BAS/ATC Contractor shall have a minimum of three years' experience installing and servicing similar microprocessor based control systems.
- 5.5** The Contractor shall be prepared to provide evidence of this history as a condition of acceptance and approval prior to bidding.

PART 6: System Description

- 6.1** The SYSTEM shall be a pressure independent Auto Changeover VRF-VAV zoning system that controls one or multiple VRF Fan Coils networked together, supporting up to 20 Independent VRF fan coils or VRF rooftop units with each supporting 2 - 20 Pressure Independent Smart Air Valves (SAV) - zones per ducted VRF Fan Coil. Each SAV shall emulate the operation of an indoor VRF fan coil / rooftop unit. VRF-VAV system shall allow for the addition of VAV or Variable Air Volume control with VRF systems controlling up to 20 SAV zones per fan coil. Zones shall be controlled via programmable thermostats, Pressure Independent SAV self-balancing dampers and a mobile web based App to configure and monitor system operation, remotely or on-site. The *GEN XV* control panel shall be Universal and support Cooling Only/Heat Pump/Gas – Electric applications.
- 6.2** The System shall be expandable to add additional VRF condensers, fan coils and pressure independent SAV controls, all controllable via the Zonex Mobile App.
- 6.3** Each pressure independent SAV shall include built-in Pitot tube measuring section to monitor air velocities, which are measured by differential pressure sensors. The SAV velocity setting potentiometers shall assign a target air velocity at each damper; these settings shall be set at the factory. The damper air delivery shall adjust itself to match the target velocity. SAV will hold assigned air delivery regardless of static pressure changes in the system. Each EzTouchXV zone thermostat can request air volume targets based on demand for cooling, heating or ventilation. SAV Round Air Valves shall have elliptical blades and SAV Rectangular dampers shall have louvered blades.

- 6.4 The system shall poll each thermostat every 60 seconds to evaluate the number of heating and cooling calls in the System. Control decisions shall be Vote based.
- 6.5 The system shall allow for zone thermostats to be configured with weighted voting, priority, for each thermostat. Via the mobile App, a thermostat shall be configurable to establish priority votes. Priority selections shall be 0 or Null Vote, 1, 2, or 3 votes selectable for each thermostat independently. System shall also provide an Opposed Call feature to address maverick zones in the system.
- 6.6 Mobile App shall digitally display Leaving Air Temperatures from the VRF fan coil.
- 6.7 Occupied and unoccupied set up and set back capability shall also be available with 2–8-hour override capability.
- 6.8 Zone thermostat locking function shall be available from the App with minimum local control at each thermostat in the system.
- 6.9 The System shall provide full control of HVAC heating and cooling equipment in multiple zone applications.
- 6.10 The System shall integrate with the VRF unit via the VRF Manufacturer's 24 VAC legacy thermostat interface to provide calls for cooling and heating.
- 6.11 The System shall use SAV - self balancing process to measure air velocity to adjust damper to meet zone airflow requirements.
- 6.12 The System shall use SAV self-balancing damper that is configured for zone design.
- 6.13 The System shall automatically reset damper position based on zone thermostat call for cooling, heating or ventilation targets based upon SAV design.
- 6.14 The System shall be Wifi enabled to communicate via the Zonex Mobile App.
- 6.15 The Systems shall communicate via a local area network (LAN).
- 6.16 The System shall communicate with Zonex Mobile App by way of AWS – Amazon Web Service.
- 6.17 The System shall provide alarming features for high temperature, low temperature, and communications errors via Email alerts.
- 6.18 The System shall provide system diagnostics via the Zonex Mobile App.
- 6.19 The System shall not alter the operation of the VRF System, Outdoor Unit or Air Handler, in any way.

PART 7: Controls Manufacturer

- 7.1 The control system will be the GEN X VRF-VAV Commercial Zoning System, as manufactured by Zonex Systems, Huntington Beach, CA. Any substitution of the above specified control system will require a 10-day prior approval by the engineer.
- 7.2 For pricing, contact the factory at 800-228-2966 or visit www.zonexproducts.com
- 7.3 For substitution, submit a complete description, engineering data, and names of existing installations of substitute products.
- 7.4 Be prepared to provide a field inspection by the engineer, if he chooses to observe the actual installation of proposed substitution.

PART 8: Stand Alone System Controller

- 8.1 Each zoned VRF Ducted Fan Coil unit shall contain a standalone microprocessor controller capable of supporting up to 20 pressure independent SAV zone valves, to be controlled with thermostats or sensors on site or remotely via a mobile App (GEN XV - *VRF-VAV*).
- 8.2 The system controller shall be universal and equipped to handle Cooling Only, Heat Pump or Gas Electric VRF units which will communicate and power all zones with one plenum rated

twisted data link and one transformer – 24 VAC power daisy chained from SAV damper to SAV and thermostat to thermostat with no home run wiring. System controller shall power all SAV zone dampers and thermostats in the system with only 1– 24V 100 VA transformer.

- 8.3** The system controller shall provide and operate with automatic changeover logic. The system algorithm is based on a first call first serve majority wins on changeover strategy. System shall address or have the ability to address opposing calls. When a call is made to the system, the VRF system shall be energized to the proper mode. During the operation of the VRF unit the VRF-VAV system controller shall poll all zones every 60 seconds to determine the majority and minority of votes to set system to proper mode of operation.
- 8.4** The system controller shall communicate to the zone thermostats the mode of system operations and the zone thermostats will notify the SAV damper of which position is required to meet zone needs.
- 8.5** System controller shall rely on the VRF unit's built high and low limits for capacity control.

PART 9: Mobile APP (Communications Hub)

- 9.1** The mobile app shall be accessible from any IOS or Android device and any web browser to monitor, control, and systems operation.
- 9.2** System schedules, i.e. set up and set back times along with days of operation or vacation scheduling shall be established at the Mobile App.
- 9.3** Set points shall be lockable, either individually or globally, from the Mobile App, allowing for minimum temperature adjustment at each local thermostat.
- 9.4** Zone Temperature Settings, both occupied and unoccupied set points, shall be established either individually or globally from the Mobile App.
- 9.5** The Mobile App shall provide adjustable override hours for system thermostats for 2 – 8 hours.
- 9.6** Mobile App shall have a selectable fan option for continuous or AUTO operation.
- 9.7** System shall be vote based and the Mobile App shall provide the ability to establish system priority with 0, 1, 2 or 3 additional votes on one or all thermostats in the system, establishing priority votes to accelerate changeover operation. A "0" vote, or null option, shall also be available.
- 9.8** The system controller shall be equipped with an onboard diagnostic routine; accessed via the Mobile APP to ensure the installing contractors control wiring and communication wiring are operational.
- 9.9** The system controller shall allow the contractor to provide default occupied and unoccupied set points for every thermostat or sensor in the system directly from the Mobile App.
- 9.10** Maverick or rogue system calls shall be recognized and, if not addressed within a field selectable 15 – 30- minute period, system shall purge and satisfy the maverick call. This feature may be enabled or disabled from the Mobile App.
- 9.11** Temperature format F Fahrenheit or C Celsius shall be selectable at the Mobile App and, when selected, any and all temperature or sensing devices shall be displayed in that temperature format.
- 9.12** The systems Mobile App shall provide e-mail alerts if temperatures or other system functions are out of range.
- 9.13** Mobile APP shall provide all time clock updates for the system.
- 9.14** Morning warm-up shall be enabled from the Mobile App.
- 9.15** Mobile APP shall provide password capability to protect the system and to ensure only authorized operators interact and control the system functions.
- 9.16** VRF-VAV controller shall retain all set points in non-volatile memory.
- 9.17** All Thermostat functions shall be available for review only from each system thermostat to streamline service and system trouble shooting.

9.18 Manufacturer's Default settings may be established or reset from the Mobile App.

PART 10: Zone Temperature Sensors (Zone Thermostats)

- 10.1** The typical Zone Temperature Sensor (Model EzTouchXV) shall contain all of the electronics to:
- 10.2** Control SAV pressure independent self-balancing zone dampers and provide for proper temperature requirement.
- 10.3** Thermostats shall direct pre-selected air velocity targets to its respective zone SAV.
- 10.4** Thermostats shall include color LCD touchscreens on the face to set independent heating and cooling set points and to maintain a minimum two-degree dead band.
- 10.5** Thermostats shall have color LCD touchscreens allowing the operator to change or review the thermostat set points.
- 10.6** Thermostat shall be capable of being remotely locked from the Mobile App and shall provide local control of +/- 2 degrees from the locked heating or cooling set point. The adjustable temperature range is from 55 to 95 degrees F. Celsius display, 12 to 35C shall also be available.
- 10.7** Thermostats shall be capable of being remotely locked to a level that does not allow for local set point changes.
- 10.8** Each zone thermostat shall contain one microprocessor that receives the current temperature from the space, which communicates this information to the SAV controller and to the central VRF-VAV control microprocessor via a 2-wire plenum rated, RS 485 data communications link.
- 10.9** The zone thermostat shall have a color LCD touchscreen showing current space temperature, time, current mode of operation, duct/outside air temperature, the heating and cooling set points established for that zone.
- 10.10** Each zone thermostat shall also be equipped with an off mode; when initiated, its zone damper will go fully closed, or established minimum position.
- 10.11** The thermostat shall be available with Remote sensor capability.
- 10.12** Thermostat shall be configurable for Baseboard, AUX, and Reheat operations.
- 10.13** When utilizing perimeter electric or hot water baseboard heating for supplemental heating, the thermostat operates a zone damper only for airflow and energizes the supplemental heat when the temperature drops two degrees below set point. At one degree below set point, it signals the system of a heating call. Heat range shall be adjustable at the Mobile App from 2-4 degrees.
- 10.14** When utilizing reheat feature, the thermostat shall energize reheat and position the damper to provide space temperature heating.

PART 11: SAV Damper Controller

- 11.1** The SAV Damper Controller shall include the ability to configure three target air velocities for each independent zone. Heat/ Cool/ Ventilation.
- 11.2** Each fan coil or indoor unit shall have the ability to support up to 20 SAV dampers.
- 11.3** SAV Controller shall have the ability to set up target CFM-Velocities for Heat, Cool, and Ventilation air flows.
- 11.4** SAV Controller shall receive mode of operation information from VRF-VAV controller as to current mode of operation and self-balance dampers to meet current zone demand and system mode of operation.
- 11.5** SAV shall monitor air velocity and adjust damper position to maintain configured damper air velocities to deliver specific CFM to each zone.
- 11.6** SAV controller shall communicate with assigned zone thermostat.

PART 12: Zone Dampers / Smart Air Valves

- 12.1** SAV – Smart Air Valves shall be available in either round or rectangular sizes and configuration.
- 12.2** Each round SAV zone damper (Model SAV) shall consist of 20-22 gauge galvanized metal duct fitted with an elliptical damper to provide linear airflow. The damper shall contain a seal to prevent leakage when fully closed. Each damper shall contain a full stall 24-volt modulating actuator, which shall not draw more than 5 VA on one drive assembly. The damper shell will be crimped on one end and beaded on both ends for damper rigidity. Each damper will have an SAV self balancing damper control board to accommodate 24 V power and communications link and outputs to adjust damper position.
- 12.3** Each rectangular SAV zone damper (MODEL SAV WxH) shall be constructed of 20-gauge “snap-lock” steel frame with S & Drive connections. The total length of the damper will be 16”. Dampers 10” and smaller in height will utilize a single blade construction: those dampers larger than 10” height will utilize opposed blade construction. The damper shall contain a seal to prevent leakage when fully closed. Each damper shall contain a full stall 24-volt modulating actuator, which shall not draw more than 5 VA on one drive assembly. The damper shell will be equipped with “S” and drive type connections at each end of the SAV. Each damper will have an SAV self balancing damper control board to accommodate 24 V power and communications link and outputs to adjust damper position.
- 12.4** SAV will be installed with a minimum of 3 feet of branch duct between the SAV damper and main trunk ducting.
- 12.5** SAV board shall also be equipped with three potentiometers to set air velocity requirements to meet zone design.
- 12.6** Self-balancing SAVs shall adjust airflows for Cooling, Heating (including Reheat) and ventilation modes of operation.
- 12.7** SAV board shall monitor air velocity and self balance damper to meet configured air flow requirements for cooling, heating, and ventilation modes.
- 12.8** SAV shall sense varying air flows, the fan coils expansion valve shall direct information to the VRF systems inverter to slow or reduce compressor RPM to enhance energy savings operation.

PART 13: Transformers and Wiring

- 13.1** An independent 24-volt transformer sized at 5 VA per zone SAV shall power the *VRF-VAV* System GEN XV Controller and all SAV dampers in the system.
- 13.2** All power wiring shall be 24-volt AC.
- 13.3** A twisted two wire plenum rated communication bus shall be used to daisy chain VRF-VAV GEN XV controller, EzTouchXV thermostats, and SAV boards. The two wire communication bus shall be Zonex Part # STPR.

END OF SECTION 15950

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