Job Name
Control Systems Description
Date

Project Overview

The project is a…describe the building and its major HVAC systems (e.g. three-story office building, served by a rooftop unit VAV system…).

In the second paragraph (as required), discuss various other equipment that make up the facility's HVAC systems.

Other miscellaneous unitary equipment round out the building's HVAC requirements, as will be discussed herein.

Control Systems Overview

The major systems and equipment on this project will be monitored and controlled via a networked Direct Digital Control (DDC) system. The systems and equipment to be monitored and controlled by the DDC system include the following:

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The DDC system is to allow for the proper control of all equipment as listed above and described herein. Access to control parameters is either via an on-site "front end" (PC or laptop), or via a remote station through a dial up connection. Setpoint programming, time-of-day scheduling, night setback, unoccupied period overrides, and whatever other control schemes may apply, can all be performed through the computer interface running the appropriate software. Monitoring of critical points and alarming of failures and system malfunctions will also be provided via the interface.

The DDC system will be programmed and configured to operate the various HVAC systems and equipment in accordance with the Description of Control (included herein). A complete Sequence of Operation will be developed for the project as it is required, describing in detail the various systems and operational attributes. Given the nature of the project, the Sequence of Operation may be revised throughout the course of the project. The DDC system will accommodate the appropriate input and output points, so as to ensure that the system has enough flexibility to allow for potential revisions to the Sequence of Operation. The final version of the Sequence will be included on the "as built" set of the control drawings.

All required DDC controllers, as well as all required sensors, transmitters, relays, damper actuators, control valves, etc., will be provided so as to ensure a complete, functional control system.

Packaged equipment with factory wired control systems will have limited control from the DDC system. For these types of equipment, this is typically limited to enable/disable and point monitoring, unless otherwise indicated. For equipment having the capability of accepting a setpoint signal from a digital controller, this point may be provided. For equipment capable of offering monitoring and/or alarm output points, these may be utilized as inputs to the DDC system.

All required engineering, support, programming, and system commissioning will be provided. This will include a complete set of wiring diagrams and control drawings, for use by the installing electricians. Mounting of all controllers, sensors, relays, etc. will be performed by the mechanical contractor's electricians. All control wiring associated with the DDC system will be performed by the mechanical contractor's electricians as well. This includes providing the DDC controllers with control power, wiring of DDC controllers to equipment terminal strips and starters, wiring of sensors and relays, communication wiring, etc. Power wiring will be performed by others, and includes mounting and three-phase wiring of starters and disconnects, and power wiring to three-phase and single-phase equipment.

This project also consists of **HVAC equipment *not* controlled by the DDC system**. The equipment not controlled by the DDC system includes the following:

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[NON-DDC OVERVIEW]

The HVAC control systems for this project are “non-DDC” in nature, and thus there will be no control system network and no centrally located user interface. The various equipment making up the HVAC systems are “stand-alone”, meaning that they will operate via local controls, with no support from a higher tier “supervisory control system”. The individual control systems serving the various equipment may be simple electric, electronic, or even microprocessor-based, depending upon the equipment, its application, and the factory offering with regards to packaged controls and controllers.

Interface to operating parameters will be described herein, and will take the form of local thermostats or zone temperature controllers, or equipment mounted operator interface panels. Establishment of setpoints, occupancy schedules, override periods, and other important operating parameters will be done via these local level controls and controllers.

Description of Control

For each piece of equipment, a description of how it will be controlled is included here. These descriptions will not necessarily explain in full detail the sequence of control for each part, but instead will define in general how each piece of equipment is to operate.

Air Handling Units

AHU-1 & AHU-2

(Customize a description, or create it from scratch)

Rooftop Units

(Pick one of the following two short descriptions for single zone CV RTUs, or find a more appropriate description to customize)

RTU-1

Packaged rooftop unit **RTU-1** serves the elevator machine room, and is controlled by a non-programmable thermostat located in the space served.

RTU-2

A programmable thermostat is located in the space served. Time-of-day scheduling is set via this device, as well as occupied and unoccupied space temperature setpoints.

During occupied modes, the supply fan runs continuously, and the thermostat operates the rooftop unit to maintain space heating and cooling temperature setpoints (of 72 and 74 degrees, adj.). During unoccupied modes, supply fan operation is intermittent, and the thermostat operates the rooftop unit to maintain the space temperature between unoccupied setpoints (of 60 degrees heating and 80 degrees cooling, adj.).

Make Up Air Units

MAU-1

(Customize a description, or create it from scratch)

Fan Coil Units

FCU-1 though FCU-10

(Pick one of the following three paragraphs, or find a more appropriate description to customize)

Split system fan coil units have a DX coil, an electric heating coil, and a hot water coil. Each unit is set up to bring in a minimal fixed amount of outside air. The units are controlled by non-programmable thermostats, as staged cooling and staged heating. A freezestat mounted to the leaving side of each unit's hot water coil shuts down the unit if air temperatures across the coil become too low.

Four-pipe fan coil units, each consisting of a fan, a hot water coil, and a chilled water coil, condition their respective spaces by recirculating air and heating or cooling it as required in order to maintain space temperature setpoints. The units are controlled by integral, unit mounted thermostats.

Two-pipe fan coil units serve the living spaces, and are controlled via integral thermostats. Automatic changeover occurs between heating and cooling seasons, via local aquastats that sense the temperature of the water feeding each unit, and determine which mode (heating or cooling) is allowable. Cooling is not possible when there is hot water feeding the coils of the units. However, heating is possible when there is chilled water feeding the coils, as each fan coil unit is equipped with an electric strip heater.

VVT System

Overall System Control

Rooftop unit mode (heating, cooling, or ventilation) is determined by the needs of the individual zones. For instance, if more zones are in need of cooling rather than heating, then the rooftop unit will operate in a cooling mode. Conversely, if more zones are in need of heating rather than cooling, then the rooftop unit will operate in a heating mode.

If there is no heating or cooling demand by any of the zones, then rooftop unit heating and cooling are disengaged, and the supply fan continues to run (ventilation mode).

Individual Zone Control

Once the mode of operation is established, then the zone dampers for those zones that are in need of the current mode (cooling or heating) will "modulate", or periodically adjust position, in order to maintain the desired zone temperature setpoints.

The zone dampers for those zones that aren't in need of the current mode will drive fully closed or to their minimum positions.

As setpoints are reached and consequently zone dampers close off, the system bypass damper will modulate open in order to maintain airflow through the rooftop unit, and also to prevent excessive pressure buildup in the ductwork.

Terminal Units

(Use only what the particular project consists of, and delete the rest of the descriptions)

Cooling-only VAV Boxes

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the VAV box controller. The controller in turn modulates the primary air damper in order to deliver the appropriate amount of cool air from the medium pressure duct into the zone. As the zone temperature falls toward setpoint, the damper is modulated closed toward its minimum position. When the zone temperature reaches setpoint, the damper reaches its minimum position.

Unoccupied and Morning Warmup Modes

The primary air damper is driven fully open during the unoccupied mode, to allow for main air handler night setback and morning warmup heating cycles.

VAV Boxes with Electric Reheat

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the VAV box controller. The controller in turn modulates the primary air damper in order to deliver the appropriate amount of cool air from the medium pressure duct into the zone. As the zone temperature falls toward setpoint, the damper is modulated closed toward its minimum position. When the zone temperature reaches setpoint, the damper reaches its minimum position. If the temperature in the zone continues to fall, then the primary air damper opens to an intermediate “heating” position, and electric heat is staged. The further the temperature falls from zone setpoint, the more stages of heat are engaged.

Unoccupied and Morning Warmup Modes

The primary air damper is driven fully open during the unoccupied mode, to allow for main air handler night setback and morning warmup heating cycles. VAV box electric heat is disabled.

VAV Boxes with Hot Water Reheat

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the VAV box controller. The controller in turn modulates the primary air damper in order to deliver the appropriate amount of cool air from the medium pressure duct into the zone. As the zone temperature falls toward setpoint, the damper is modulated closed toward its minimum position. When the zone temperature reaches setpoint, the damper reaches its minimum position. If the temperature in the zone continues to fall, then the primary air damper opens to an intermediate “heating” position, hot water heat is engaged, and the hot water valve is modulated. The further the temperature falls from zone setpoint, the more hot water is allowed to flow through the coil.

Unoccupied and Morning Warmup Modes

The primary air damper is driven fully open during the unoccupied mode, to allow for main air handler night setback and morning warmup heating cycles. VAV box hot water heat is disabled.

Series Fan Powered Boxes with Heat

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the fan powered box controller. The controller in turn modulates the primary air damper in order to allow the appropriate amount of cool air from the medium pressure duct into the box. The air is then blended with warm air circulated from the plenum by the fan, which is in continuous operation during the occupied mode. The resulting air delivered into the zone is of constant volume (as dictated by fan speed) and variable temperature. As the zone temperature falls toward setpoint, the damper is modulated closed toward its minimum position, allowing less and less cool air to be blended with the plenum air. When the zone temperature reaches setpoint, the damper reaches its minimum position. If the temperature in the zone continues to fall, then terminal unit [electric / hot water] heat is engaged. The further the temperature falls from zone setpoint, the more heat is engaged.

Unoccupied and Morning Warmup Modes

The primary air damper is driven [fully open / fully closed] during main air handling unit shutdown modes. The fan and heat cycle to maintain a reduced zone temperature setpoint. During air handler night setback and morning warmup heating cycles, the primary air damper assumes its [fully open / minimum] position, and terminal unit heat is [disabled / controlled to occupied mode zone setpoint].

Parallel Fan Powered Boxes with Heat

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the fan powered box controller. The controller in turn modulates the primary air damper in order to deliver the appropriate amount of cool air from the medium pressure duct into the zone. The air delivered into the zone is of variable volume and constant temperature. As the zone temperature falls toward setpoint, the damper is modulated closed toward its minimum position. When the zone temperature reaches setpoint, the damper reaches its minimum

position. If the temperature in the zone falls below setpoint, the fan energizes to circulate warm air from the plenum. The plenum air is blended with the minimal cool air from the primary air damper, and delivered to the zone. If the temperature in the zone continues to fall, then terminal unit [electric / hot water] heat is engaged. The further the temperature falls from zone setpoint, the more heat is engaged.

Unoccupied and Morning Warmup Modes

The primary air damper is driven [fully open / fully closed] during main air handling unit shutdown modes. The fan and heat cycle to maintain a reduced zone temperature setpoint. During air handler night setback and morning warmup heating cycles, the primary air damper assumes its [fully open / minimum] position, and terminal unit heat is [disabled / controlled to occupied mode zone setpoint].

Constant Volume Terminal Units with Reheat

Occupied Mode

An individual zone sensor (one per zone/box) transmits zone temperature and zone setpoint information to the terminal unit controller. The controller modulates the primary air damper in order to deliver a constant amount of air from the medium pressure duct into the zone, independent of the temperature needs of the zone. If the temperature in the zone falls below setpoint, then terminal unit [electric / hot water] heat is engaged. The further the temperature falls from zone setpoint, the more heat is engaged.

Unoccupied and Morning Warmup Modes

The primary air damper is driven fully open during the unoccupied mode, to allow for main air handler night setback and morning warmup heating cycles. Terminal unit heat is disabled.

Reheat Coils

ERH-1 through ERH-16

(Modify the following description, or find a more appropriate one to customize)

Reheat system air handler serves a system of electric reheat coils. The duct heaters are disabled, via their integral air proving switches, if the air handler supply fan is off. When enabled, the heaters operate to maintain individual zone comfort levels.

For heaters with two stages (or less), a zone mounted multistage thermostat controls the heater. As the zone temperature falls from setpoint, the thermostat steps through stages of heat as required to maintain the desired comfort level within the zone.

For heaters with more than two stages, a unit mounted step controller, wired to a zone mounted temperature sensor, controls the heater. As the zone temperature falls from setpoint, the step controller steps through stages of heat as required to maintain the desired comfort level within the zone.

Exhaust Fans

(Roof mounted / Wall mounted / Inline / Ceiling…appropriate electrical characteristics…appropriate control method)

EF-1

Wall mounted exhaust fan **EF-1** (fractional HP @ 120/1/60) serves the trash room, and runs continuously.

EF-1

Inline exhaust fan **EF-1** (fractional HP @ 120/1/60) serves the pantry, and is controlled by a wall switch located in the space served.

EF-1

Wall mounted exhaust fan **EF-1** (fractional HP @ 120/1/60) serves the electrical room, and is controlled by a wall mounted thermostat located in the space served.

EF-1

Wall mounted exhaust fan **EF-1** (fractional HP @ 120/1/60) serves the electrical vault, and is controlled by a wall mounted thermostat located in the space served. A motorized outside air intake damper is interlocked with the operation of the fan.

EF-1

Roof mounted exhaust fan **EF-1** (3/4 HP @ 460/3/60) serves the main bathrooms, and operates via a time-of-day schedule as per [a local time clock / the DDC system].

EF-1

Wall mounted exhaust fan **EF-1** (fractional HP @ 120/1/60) serves the generator room, and is interlocked to the operation of the generator. A motorized outside air intake damper is interlocked with the operation of the fan.

Garage Ventilation System

GEF-1 through GEF-4 , CO Detection & Ventilation

(Customize a description, or create it from scratch)

Computer Room A/C System

CRU-1 & CU-1

(Modify the following description for an air-cooled split system, or find a more appropriate description to customize)

Indoor unit **CRU-1** and outdoor unit **CU-1** make up a split system that serves the Server Room. The indoor unit operates via local wall mounted controls [temperature and humidity controllers / microprocessor panel] in order to maintain the proper level of environmental control in the space. The outdoor unit is engaged upon calls for cooling and/or dehumidification by the indoor controls.

Hot & Chilled Water System

B-1 & B-2
CH-1 & CH-2
P-2 & P-2

(Customize a description, or create it from scratch)

(Combustion Air and/or Refrigerant Monitoring/Ventilation System as required)

Unitary Heating Equipment

Electric Wall Heaters EWH-1 & EWH-2
Electric Unit Heaters EUH-1 & EUH-2
Electric Baseboard EBH-1 thru EBH-4

(Modify the following description, or find more appropriate ones to customize…gas fired, hot water, steam…)

Miscellaneous electric heaters located throughout the facility are to operate via integral, unit mounted thermostats. See plans for locations.

Miscellaneous Equipment

(Include any miscellaneous equipment not covered herein, and customize a description for it)

Split System A/C-1 & CU-1…