Part 1 General

1.1 Exhaust Fan - On/Off

.1 Run Conditions - Interlocked:

.1 The fan(s) EF --- shall be interlocked to run whenever Air Handling Unit ---- runs unless shutdown on safeties.

.2 Fan:

.1 The fan shall have a user definable (adj.) minimum runtime.

.3 Exhaust Air Damper:

.1 The exhaust air damper shall open anytime the unit runs and shall close anytime the unit stops. The exhaust air damper shall close 30 sec (adj.) after the fan stops.

.2 Alarms shall be provided as follows:

.1 Damper Failure: Commanded open, but the status is closed.

.2 Damper in Hand: Commanded closed, but the status is open.

.4 Fan Status:

.1 The controller shall monitor the fan status.

.2 Alarms shall be provided as follows:

.1 Fan Failure: Commanded on, but the status is off.

.2 Fan in Hand: Commanded off, but the status is on.

.3 Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Fan Status			×					×		×
Fan Start/Stop				×				×		×
Exhaust Air Damper				×				×		×
Fan Failure									×	
Fan in Hand									×	
Fan Runtime Exceeded									×	
Totals	**0**	**0**	**1**	**2**	**0**	**0**	**0**	**3**	**3**	**3**

Total Hardware (3) **Total Software (6)**

1.2 Makeup Air Unit - Supply Air Temp

.1 Run Conditions - Interlocked:

.1 The unit MAU --- shall be interlocked to run whenever Exhaust fan---- runs unless shutdown on safeties.

.2 Freeze Protection:

.1 The unit shall shut down and generate an alarm upon receiving a freezestat status.

.3 Outside Air Damper:

.1 The outside air damper shall open anytime the unit runs and shall close anytime the unit stops. The supply fan shall start only after the damper status has proven the damper is open. The outside air damper shall close 4sec (adj.) after the supply fan stops.

.2 Alarms shall be provided as follows:

.1 Outside Air Damper Failure: Commanded open, but the status is closed.

.2 Outside Air Damper in Hand: Commanded closed, but the status is open.

.4 Heat Recovery - Cartridge:

.1 The integral controller shall modulate the change-over damper as required for energy recovery as required.

.5 Supply Fan:

.1 The supply fan shall run anytime the unit is commanded to run. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime, unless shutdown on safeties.

.2 Alarms shall be provided as follows:

.1 Supply Fan Failure: Commanded on, but the status is off.

.2 Supply Fan in Hand: Commanded off, but the status is on.

.3 Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

.6 Exhaust Fan:

.1 The exhaust fan shall run whenever the supply fan runs, unless shutdown on safeties.

.2 Alarms shall be provided as follows:

.1 Exhaust Fan Failure: Commanded on, but the status is off.

.2 Exhaust Fan in Hand: Commanded off, but the status is on.

.3 Exhaust Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

.7 Supply Air Temperature Setpoint - Outside Air Reset:

.1 The controller shall monitor the supply air temperature and shall maintain supply air temperature setpoint. The supply air temperature setpoint shall reset for cooling as follows:

.1 As outside air temperature drops from 85°F (adj.) to 20°F (adj.) the supply air temperature setpoint shall reset upwards from 55°F (adj.) to 95°F (adj.).

.8 Heating Coil Valve:

.1 The controller shall measure the supply air temperature and modulate the heating coil valve to maintain its heating setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the supply air temperature is below heating setpoint.

.3 AND the fan status is on.

.3 The heating coil valve shall open to 100% (adj.) whenever the freezestat is on.

.9 Prefilter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the prefilter.

.2 Alarms shall be provided as follows:

.1 Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

.10 Final Filter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the final filter.

.2 Alarms shall be provided as follows:

.1 Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).

.11 Supply Air Temperature:

.1 The controller shall monitor the supply air temperature.

.2 Alarms shall be provided as follows:

.1 High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).

.2 Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Coil Discharge Air Temp	×							×		×
Outside Air Temp	×							×		×
Return Air Temp	×							×		×
Exhaust Air Temp	×							×		×
Prefilter Differential Pressure	×							×		
Final Filter Differential Pressure	×							×		
Supply Air Temp	×							×		×
Heating Valve		×						×		×
Freezestat			×					×	×	×
Outside Air Damper Status			×					×		×
Supply Fan Status			×					×		×
Exhaust Fan Status			×					×		×
Outside Air Damper				×				×		×
Supply Fan Start/Stop				×				×		×
Exhaust Fan Start/Stop				×				×		×
Supply Air Temp Setpoint					×			×		×

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Outside Air Temp					×					×
Outside Air Damper Failure									×	
Outside Air Damper in Hand									×	
Supply Fan Failure									×	
Supply Fan in Hand									×	
Supply Fan Runtime Exceeded									×	
Exhaust Fan Failure									×	
Exhaust Fan in Hand									×	
Exhaust Fan Runtime Exceeded									×	
Prefilter Change Required									×	×
Final Filter Change Required									×	×
High Supply Air Temp									×	
Low Supply Air Temp									×	
Totals	**7**	**1**	**4**	**3**	**2**	**0**	**0**	**16**	**13**	**17**

Total Hardware (15) **Total Software (31)**

1.3 Cabinet Heater

.1 Run Conditions - Continuous:

.1 The unit shall run continuously and shall maintain a heating setpoint of 70°F (adj.).

.2 Alarms shall be provided as follows:

.1 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

.2 Zone Setpoint Adjust:

.1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

.3 Fan:

.1 The fan shall run anytime the zone temperature is below heating setpoint, unless shutdown on safeties.

.4 Heating Coil Valve:

.1 The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the zone temperature is below heating setpoint.

.3 AND the fan is on.

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Zone Temp	×							×		×
Zone Setpoint Adjust	×									×
Heating Valve		×						×		×
Fan Start/Stop				×				×		×
Heating Setpoint								×		×
Low Zone Temp									×	
Totals	**2**	**1**	**0**	**1**	**0**	**0**	**0**	**4**	**1**	**5**

Total Hardware (4) **Total Software (5)**

1.4 Variable Air Volume – AHU (Typical of 2 Operating in Parallel)

.1 Run Conditions - Requested:

.1 The unit shall run whenever:

.1 Any zone is occupied.

.2 OR a definable number of unoccupied zones need heating or cooling.

.2 Freeze Protection:

.1 The unit shall shut down and generate an alarm upon receiving a freezestat status.

.3 High Static Shutdown:

.1 The unit shall shut down and generate an alarm upon receiving an high static shutdown signal.

.4 Supply Air Smoke Detection:

.1 The unit shall shut down and generate an alarm upon receiving a supply air smoke detector status.

.5 Supply Fan:

.1 The supply fan shall run anytime the unit is commanded to run, unless shutdown on safeties. To prevent short cycling, the supply fan shall have a user definable (adj.) minimum runtime.

.2 Alarms shall be provided as follows:

.1 Supply Fan Failure: Commanded on, but the status is off.

.2 Supply Fan in Hand: Commanded off, but the status is on.

.3 Supply Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

.6 Supply Air Duct Static Pressure Control:

.1 The controller shall measure duct static pressure and shall modulate the supply fan VFD speed to maintain a duct static pressure setpoint of 1.5in H2O (adj.). The supply fan VFD speed shall not drop below 30% (adj.).

.2 Alarms shall be provided as follows:

.1 High Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) greater than setpoint.

.2 Low Supply Air Static Pressure: If the supply air static pressure is 25% (adj.) less than setpoint.

.3 Supply Fan VFD Fault.

.7 Return Fan:

.1 The return fan shall run whenever the supply fan runs.

.2 Alarms shall be provided as follows:

.1 Return Fan Failure: Commanded on, but the status is off.

.2 Return Fan in Hand: Commanded off, but the status is on.

.3 Return Fan Runtime Exceeded: Status runtime exceeds a user definable limit (adj.).

.4 Return Fan VFD Fault.

.8 Building Static Pressure Control:

.1 The controller shall measure building static pressure and modulate the return fan VFD speed to maintain a building static pressure setpoint of 0.05in H2O (adj.). The return fan VFD speed shall not drop below 20% (adj.).

.2 Alarms shall be provided as follows:

.1 High Building Static Pressure: If the building air static pressure is 25% (adj.) greater than setpoint.

.2 Low Building Static Pressure: If the building air static pressure is 25% (adj.) less than setpoint.

.9 Supply Air Temperature Setpoint - Optimized:

.1 The controller shall monitor the supply air temperature and shall maintain a supply air temperature setpoint reset based on zone cooling and heating requirements

.2 The supply air temperature setpoint shall be reset for cooling based on zone cooling requirements as follows:

.1 The initial supply air temperature setpoint shall be 55°F (adj.).

.2 As cooling demand increases, the setpoint shall incrementally reset down to a minimum of 53°F (adj.).

.3 As cooling demand decreases, the setpoint shall incrementally reset up to a maximum of 72°F (adj.) .

.3 If more zones need heating than cooling, then the supply air temperature setpoint shall be reset for heating as follows:

.1 The initial supply air temperature setpoint shall be 82°F (adj.).

.2 As heating demand increases, the setpoint shall incrementally reset up to a maximum of 85°F (adj.).

.3 As heating demand decreases, the setpoint shall incrementally reset down to a minimum of 72°F (adj.).

.10 Cooling Stages:

.1 The controller shall measure the supply air temperature and stage the cooling to maintain its cooling setpoint. To prevent short cycling, there shall be a user definable (adj.) delay between stages, and each stage shall have a user definable (adj.) minimum runtime.

.2 The cooling shall be enabled whenever:

.1 Outside air temperature is greater than 60°F (adj.).

.2 AND the economizer (if present) is disabled or fully open.

.3 AND the supply fan status is on.

.4 AND the heating (if present) is not active.

.3 Alarms shall be provided as follows:

.1 High Supply Air Temp: If the supply air temperature is 5°F (adj.) greater than setpoint.

.11 Heating Coil Valve:

.1 The controller shall measure the supply air temperature and modulate the heating coil valve to maintain its heating setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the supply fan status is on.

.3 AND the cooling (if present) is not active.

.3 The heating coil valve shall open whenever:

.1 Supply air temperature drops from 40°F to 35°F (adj.).

.2 OR the freezestat (if present) is on.

.4 Alarms shall be provided as follows:

.1 Low Supply Air Temp: If the supply air temperature is 5°F (adj.) less than setpoint.

.12 Economizer:

.1 The controller shall measure the mixed air temperature and modulate the economizer dampers in sequence to maintain a setpoint 2°F (adj.) less than the supply air temperature setpoint. The outside air dampers shall maintain a minimum adjustable position of 20% (adj.) open whenever occupied.

.2 The economizer shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the outside air temperature is less than the return air temperature.

.3 AND the supply fan status is on.

.3 The economizer shall close whenever:

.1 Mixed air temperature drops from 40°F to 35°F (adj.).

.2 OR the freezestat (if present) is on.

.3 OR on loss of supply fan status.

.4 The outside and exhaust air dampers shall close and the return air damper shall open when the unit is off. If Optimal Start Up is available the mixed air damper shall operate as described in the occupied mode except that the outside air damper shall modulate to fully closed.

.13 Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control:

.1 When in the occupied mode, the controller shall measure the return air CO2 levels and modulate the outside air dampers open on rising CO2 concentrations, overriding normal damper operation to maintain a CO2 setpoint of 750 ppm (adj.).

.2 Alarms shall be provided as follows:

.1 High Return Air Carbon Dioxide Concentration: If the return air CO2 concentration is greater than 1000 ppm (adj.).

.14 Dehumidification:

.1 The controller shall measure the return air humidity and override the cooling sequence to maintain return air humidity at or below 60% rh (adj.). Dehumidification shall be enabled whenever the supply fan status is on.

.15 Humidifier Control:

.1 The controller shall measure the return air humidity and modulate the humidifier to maintain a setpoint of 50% rh (adj.). The humidifier shall be enabled whenever the supply fan status is on.

.2 The humidifier shall turn off whenever:

.1 Supply air humidity rises from 90% rh to 95% rh (adj.).

.2 OR on loss of supply fan status.

.3 Alarms shall be provided as follows:

.1 High Supply Air Humidity: If the supply air humidity is greater than 90% rh (adj.).

.2 Low Supply Air Humidity: If the supply air humidity is less than 30% rh (adj.).

.16 Prefilter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the prefilter.

.2 Alarms shall be provided as follows:

.1 Prefilter Change Required: Prefilter differential pressure exceeds a user definable limit (adj.).

.17 Final Filter Differential Pressure Monitor:

.1 The controller shall monitor the differential pressure across the final filter.

.2 Alarms shall be provided as follows:

.1 Final Filter Change Required: Final filter differential pressure exceeds a user definable limit (adj.).

.18 Mixed Air Temperature:

.1 The controller shall monitor the mixed air temperature and use as required for economizer control (if present) or preheating control (if present).

.2 Alarms shall be provided as follows:

.3 High Mixed Air Temp: If the mixed air temperature is greater than 90°F (adj.).

.4 Low Mixed Air Temp: If the mixed air temperature is less than 45°F (adj.).

.19 Return Air Humidity:

.1 The controller shall monitor the return air humidity and use as required for economizer control (if present) or humidity control (if present).

.2 Alarms shall be provided as follows:

.3 High Return Air Humidity: If the return air humidity is greater than 70% (adj.).

.4 Low Return Air Humidity: If the return air humidity is less than 35% (adj.).

.20 Return Air Temperature:

.1 The controller shall monitor the return air temperature and use as required for setpoint control or economizer control (if present).

.2 Alarms shall be provided as follows:

.3 High Return Air Temp: If the return air temperature is greater than 90°F (adj.).

.4 Low Return Air Temp: If the return air temperature is less than 45°F (adj.).

.21 Supply Air Temperature:

.1 The controller shall monitor the supply air temperature.

.2 Alarms shall be provided as follows:

.3 High Supply Air Temp: If the supply air temperature is greater than 120°F (adj.).

.4 Low Supply Air Temp: If the supply air temperature is less than 45°F (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Supply Air Static Pressure	×							×	×	×
Building Static Pressure	×							×		×
Outside Air Temp	×							×		×
Exhaust Air Temp	×							×		×
RA Carbon Dioxide PPM	×							×		×
Supply Air Humidity	×							×		×
Prefilter Differential Pressure	×							×		
Final Filter Differential Pressure	×							×		
Mixed Air Temp	×							×		×
Return Air Humidity	×							×		×
Return Air Temp	×							×		×
Supply Air Temp	×							×		×
Supply Fan VFD Speed		×						×		×
Return Fan VFD Speed		×						×		×
Heating Valve		×						×		×
Mixed Air Dampers		×						×		×
Humidifier		×						×		×
Freezestat			×					×	×	×
High Static Shutdown			×					×	×	×
Supply Air Smoke Detector			×					×	×	×

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Supply Fan VFD Fault			×						×	×
Supply Fan Status			×					×		×
Return Fan VFD Fault			×						×	
Return Fan Status			×					×		×
Coil Pump Status			×					×		×
Supply Fan Start/Stop				×				×		×
Return Fan Start/Stop				×				×		×
Coil Pump Start/Stop				×				×		×
Cooling Stage 1				×				×		×
Cooling Stage 2				×				×		×
Humidifier Enable				×						×
Supply Air Static Pressure Setpoint					×			×		×
Building Static Pressure Setpoint					×					×
Supply Air Temp Setpoint					×			×		×
Economizer Mixed Air Temp Setpoint					×			×		×
RA Carbon Dioxide PPM Setpoint					×			×		×
Dehumidification Setpoint					×			×		×
Humidifier Setpoint					×					×
High Supply Air Static Pressure									×	
Low Supply Air Static Pressure									×	
Supply Fan Failure									×	
Supply Fan in Hand									×	
Supply Fan Runtime Exceeded									×	
High Building Static Pressure									×	
Low Building Static Pressure									×	
Return Fan Failure									×	
Return Fan in Hand									×	
Return Fan Runtime Exceeded									×	
Coil Pump Failure									×	
Coil Pump in Hand									×	
Coil Pump Runtime Exceeded									×	
High Supply Air Temp									×	
Compressor Runtime Exceeded									×	
Low Supply Air Temp									×	

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
High RA Carbon Dioxide Concentration									×	
High Supply Air Humidity									×	
Low Supply Air Humidity									×	
Prefilter Change Required									×	×
Final Filter Change Required									×	×
High Mixed Air Temp									×	
Low Mixed Air Temp									×	
High Return Air Humidity									×	
Low Return Air Humidity									×	
High Return Air Temp									×	
Low Return Air Temp									×	
High Supply Air Temp									×	
Low Supply Air Temp									×	
Totals	**14**	**6**	**8**	**6**	**7**	**0**	**0**	**36**	**35**	**40**

Total Hardware (34) **Total Software (78)**

1.5 Two Boiler System

.1 Boiler System Run Conditions:

.1 The boiler system shall be enabled to run whenever:

.1 A definable number of hot water coils need heating.

.2 AND outside air temperature is less than 65°F (adj.).

.2 To prevent short cycling, the boiler system shall run for and be off for minimum adjustable times (both user definable), unless shutdown on safeties or outside air conditions.

.1 The boiler shall run subject to its own internal safeties and controls (C-more control panel).

.2 The boiler system shall also run for freeze protection whenever the outside air temperature is less than 38°F (adj.).

.2 Boiler 1 Safeties:

.1 The following safeties shall be monitored:

.1 Boiler alarm.

.2 Low water level.

.2 Alarms shall be provided as follows:

.1 Boiler alarm.

.2 Low water level alarm.

.3 Boiler 2 Safeties:

.1 The following safeties shall be monitored:

.1 Boiler alarm.

.2 Low water level.

.2 Alarms shall be provided as follows:

.1 Boiler alarm.

.2 Low water level alarm.

.4 Hot Water Pump Lead/Lag Operation:

.1 The two hot water pumps shall operate in a lead/lag fashion.

.1 The lead pump shall run first.

.2 On failure of the lead pump, the lag pump shall run and the lead pump shall turn off.

.3 On decreasing hot water differential pressure, the lag pump shall stage on and run in unison with the lead pump to maintain hot water differential pressure setpoint.

.2 The designated lead pump shall rotate upon one of the following conditions (user selectable):

.1 manually through a software switch

.2 if pump runtime (adj.) is exceeded

.3 daily

.4 weekly

.5 monthly

.3 Alarms shall be provided as follows:

.1 Hot Water Pump 1

.1 Failure: Commanded on, but the status is off.

.2 Running in Hand: Commanded off, but the status is on.

.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.4 VFD Fault.

.2 Hot Water Pump 2

.1 Failure: Commanded on, but the status is off.

.2 Running in Hand: Commanded off, but the status is on.

.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.4 VFD Fault.

.5 Hot Water Differential Pressure Control:

.1 The controller shall measure hot water differential pressure and modulate the hot water pump VFDs in sequence to maintain its hot water differential pressure setpoint.

.2 The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

.3 The controller shall modulate hot water pump speeds to maintain a hot water differential pressure of 12lbf/in2 (adj.). The VFDs minimum speed shall not drop below 20% (adj.).

.4 On dropping hot water differential pressure, the VFDs shall stage on and run to maintain setpoint as follows:

.1 The controller shall modulate the lead VFD to maintain setpoint.

.2 If the lead VFD speed is greater than a setpoint of 90% (adj.), the lag VFD shall stage on.

.3 The lag VFD shall ramp up to match the lead VFD speed and then run in unison with the lead VFD to maintain setpoint.

.5 On rising hot water differential pressure, the VFDs shall stage off as follows:

.1 If the VFDs speeds drops back to 60% (adj.) below setpoint, the lag VFD shall stage off.

.2 The lead VFD shall continue to run to maintain setpoint.

.6 Alarms shall be provided as follows:

.7 High Hot Water Differential Pressure: If 25% (adj.) greater than setpoint.

.8 Low Hot Water Differential Pressure: If 25% (adj.) less than setpoint.

.6 Circulation Pump 1:

.1 The Circulation Pump 1 shall run anytime Boiler 1 is called to run and shall have a user definable delay (adj.) on stop.

.2 Alarms shall be provided as follows:

.1 Circulation Pump 1 Failure: Commanded on, but the status is off.

.2 Circulation Pump 1 Running in Hand: Commanded off, but the status is on.

.3 Circulation Pump 1 Runtime Exceeded: Status runtime exceeds a user-definable limit.

.7 Circulation Pump 2:

.1 The Circulation Pump 2 shall run anytime Boiler 2 is called to run and shall have a user definable delay (adj.) on stop.

.2 Alarms shall be provided as follows:

.1 Circulation Pump 2 Failure: Commanded on, but the status is off.

.2 Circulation Pump 2 Running in Hand: Commanded off, but the status is on.

.3 Circulation Pump 2 Runtime Exceeded: Status runtime exceeds a user-definable limit.

.8 Boiler Lead/Standby Operation:

.1 The two boilers shall operate in a lead/standby fashion when called to run and flow is proven in accordance with its own control panel.

.1 The lead boiler shall run first.

.2 On failure of the lead boiler, the standby boiler shall run and the lead boiler shall turn off.

.2 The designated lead boiler shall rotate upon one of the following conditions: (user selectable):

.1 manually through a software switch
.2 if boiler runtime (adj.) is exceeded
.3 daily
.4 weekly
.5 monthly

.3 Alarms shall be provided as follows:

.1 Boiler 1

.1 Failure: Commanded on but the status is off.
.2 Running in Hand: Commanded off but the status is on.
.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.2 Boiler 2

.1 Failure: Commanded on but the status is off.
.2 Running in Hand: Commanded off but the status is on.
.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.3 Lead Boiler Failure: The lead boiler is in failure and the standby boiler is on.

.9 Hot Water Supply Temperature Setpoint:

.1 The boiler shall maintain a hot water supply temperature setpoint as determined by its own internal controls (provided by others).

.10 Primary Hot Water Temperature Monitoring:

.1 The following temperatures shall be monitored:

.1 Primary hot water supply.
.2 Primary hot water return.

.2 Alarms shall be provided as follows:

.1 High Primary Hot Water Supply Temp: If greater than 200°F (adj.).
.2 Low Primary Hot Water Supply Temp: If less than 100°F (adj.).

.11 Boiler 1 Hot Water Temperature Monitoring:

.1 The following temperatures shall be monitored:

.1 Boiler 1 hot water supply.
.2 Boiler 1 hot water return.

.2 Alarms shall be provided as follows:

.1 High Hot Water Supply Temp: If greater than 200°F (adj.).
.2 Low Hot Water Supply Temp: If less than 100°F (adj.).

.12 Boiler 2 Hot Water Temperature Monitoring:

.1 The following temperatures shall be monitored:

.1 Boiler 2 hot water supply.

.2 Boiler 2 hot water return.

.2 Alarms shall be provided as follows:

.1 High Hot Water Supply Temp: If greater than 200°F (adj.).

.2 Low Hot Water Supply Temp: If less than 100°F (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Hot Water Differential Pressure	×							×		×
Primary Hot Water Return Temp	×							×		×
Primary Hot Water Supply Temp	×							×		×
Boiler 1 Hot Water Return Temp	×							×		×
Boiler 1 Hot Water Supply Temp	×							×		×
Boiler 2 Hot Water Return Temp	×							×		×
Boiler 2 Hot Water Supply Temp	×							×		×
Hot Water Pump 1 VFD Speed		×						×		×
Hot Water Pump 2 VFD Speed		×						×		×
Boiler 1 Alarm Status			×					×	×	×
Boiler 1 Low Water Level			×					×	×	×
Boiler 2 Alarm Status			×					×	×	×
Boiler 2 Low Water Level			×					×	×	×
Hot Water Pump 1 VFD Fault			×						×	×
Hot Water Pump 2 VFD Fault			×						×	×
Hot Water Pump 1 Status			×					×		×
Hot Water Pump 2 Status			×					×		×
Circulation Pump 1 Status			×					×		×
Circulation Pump 2 Status			×					×		×
Boiler 1 Status			×					×		×
Boiler 2 Status			×					×		×
Hot Water Pump 1 Start/Stop				×						×
Hot Water Pump 2				×						×

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Start/Stop										
Circulation Pump 1 Start/Stop				×				×		×
Circulation Pump 2 Start/Stop				×				×		×
Boiler 1 Enable				×						×
Boiler 2 Enable				×						×
Hot Water Differential Pressure Setpoint					×					×
High Hot Water Differential Pressure									×	
Low Hot Water Differential Pressure									×	
Hot Water Pump 1 Failure									×	
Hot Water Pump 1 Running in Hand									×	
Hot Water Pump 1 Runtime Exceeded									×	
Hot Water Pump 2 Failure									×	
Hot Water Pump 2 Running in Hand									×	
Hot Water Pump 2 Runtime Exceeded									×	
Circulation Pump 1 Failure									×	
Circulation Pump 1 Running in Hand									×	
Circulation Pump 1 Runtime Exceeded									×	
Circulation Pump 2 Failure									×	
Circulation Pump 2 Running in Hand									×	
Circulation Pump 2 Runtime Exceeded									×	
Boiler 1 Runtime Exceeded									×	
Boiler 2 Failure									×	
Boiler 2 Running in Hand									×	
Boiler 2 Runtime Exceeded									×	
Lead Boiler Failure									×	×
Boiler 1 Failure									×	
Boiler 1 Running in Hand									×	

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
High Primary Hot Water Supply Temp									×	
Low Primary Hot Water Supply Temp									×	
Boiler 1 High Hot Water Supply Temp									×	
Boiler 1 Low Hot Water Supply Temp									×	
Boiler 2 High Hot Water Supply Temp									×	
Boiler 2 Low Hot Water Supply Temp									×	
Totals	**7**	**2**	**12**	**6**	**1**	**0**	**0**	**21**	**33**	**29**

Total Hardware (27) **Total Software (55)**

1.6 Unit Heater

.1 Run Conditions - Scheduled:

.1 The unit shall run according to a user definable time schedule in the following modes:

.1 Occupied Mode: The unit shall maintain a heating setpoint of 70°F (adj.).

.2 Unoccupied Mode (night setback): The unit shall maintain a heating setpoint of 65°F (adj.).

.2 Alarms shall be provided as follows:

.1 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

.2 Zone Setpoint Adjust:

.1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

.3 Fan:

.1 The fan shall run anytime the zone temperature drops below heating setpoint, unless shutdown on safeties.

.4 Heating Coil Valve:

.1 The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the zone temperature is below heating setpoint.

.3 AND the fan is on.

.5 Fan Status:

.1 The controller shall monitor the fan status.

.2 Alarms shall be provided as follows:

.1 Fan Failure: Commanded on, but the status is off.

.2 Fan in Hand: Commanded off, but the status is on.

.3 Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Zone Temp	×							×		×
Zone Setpoint Adjust	×									×
Heating Valve		×						×		×
Fan Status			×					×		×
Fan Start/Stop				×				×		×
Schedule							×			
Heating Setpoint								×		×
Low Zone Temp									×	
Fan Failure									×	
Fan in Hand									×	
Fan Runtime Exceeded									×	
Totals	**2**	**1**	**1**	**1**	**0**	**0**	**1**	**5**	**4**	**6**

Total Hardware (5) **Total Software (10)**

1.7 Fan Coil Unit

.1 Run Conditions - Continuous:

.1 The unit shall run continuously and shall maintain:

.1 A 74°F (adj.) cooling setpoint

.2 A 70°F (adj.) heating setpoint.

.2 Alarms shall be provided as follows:

.1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

.2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

.2 Zone Setpoint Adjust:

.1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

.3 Smoke Detection:

.1 The unit shall shut down and generate an alarm upon receiving a smoke detector status.

.4 Fan:

.1 The fan shall run anytime the unit is commanded to run, unless shutdown on safeties.

.5 Heating Coil Valve:

.1 The controller shall measure the zone temperature and modulate the heating coil valve to maintain its heating setpoint.

.2 The heating shall be enabled whenever:

.1 Outside air temperature is less than 65°F (adj.).

.2 AND the zone temperature is below heating setpoint.

.3 AND the fan is on.

.6 Fan Status:

.1 The controller shall monitor the fan status.

.2 Alarms shall be provided as follows:

.1 Fan Failure: Commanded on, but the status is off.

.2 Fan in Hand: Commanded off, but the status is on.

.3 Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Zone Temp	×							×		×
Zone Setpoint Adjust	×									×
Heating Valve		×						×		×
Smoke Detector			×					×	×	×
Fan Status			×							×
Fan Start/Stop				×				×		×
Heating Setpoint								×		×
Cooling Setpoint								×		×
High Zone Temp									×	
Low Zone Temp									×	
Fan Failure									×	
Fan in Hand									×	
Fan Runtime Exceeded									×	
Totals	**2**	**1**	**2**	**1**	**0**	**0**	**0**	**6**	**6**	**8**

Total Hardware (6) **Total Software (12)**

1.8 Variable Air Volume - Terminal Unit

.1 Run Conditions - Scheduled:

.1 The unit shall run according to a user definable time schedule in the following modes:

.1 Occupied Mode: The unit shall maintain

.1 A 74°F (adj.) cooling setpoint

.2 A 70°F (adj.) heating setpoint.

.2 Unoccupied Mode (night setback): The unit shall maintain

.1 A 80°F (adj.) cooling setpoint.

.2 A 65°F (adj.) heating setpoint.

.2 Alarms shall be provided as follows:

.1 High Zone Temp: If the zone temperature is greater than the cooling setpoint by a user definable amount (adj.).

.2 Low Zone Temp: If the zone temperature is less than the heating setpoint by a user definable amount (adj.).

.2 Zone Setpoint Adjust:

.1 The occupant shall be able to adjust the zone temperature heating and cooling setpoints at the zone sensor.

.3 Zone Optimal Start:

.1 The unit shall use an optimal start algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up or cool-down period while still achieving comfort conditions by the start of scheduled occupied period.

.4 Zone Unoccupied Override:

.1 A timed local override control shall allow an occupant to override the schedule and place the unit into an occupied mode for an adjustable period of time. At the expiration of this time, control of the unit shall automatically return to the schedule.

.5 Reversing Variable Volume Terminal Unit - Flow Control:

.1 The unit shall maintain zone setpoints by controlling the airflow through one of the following:

.2 Occupied:

.1 When zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

.2 When the zone temperature is between the cooling setpoint and the heating setpoint, the zone damper shall maintain the minimum required zone ventilation (adj.).

.3 When zone temperature is less than its heating setpoint, the controller shall enable heating to maintain the zone temperature at its heating setpoint. Additionally, if warm air is available from the AHU, the zone damper shall modulate between the minimum occupied airflow (adj.) and the maximum heating airflow (adj.) until the zone is satisfied.

.3 Unoccupied:

.1 When the zone is unoccupied the zone damper shall control to its minimum unoccupied airflow (adj.).

.2 When the zone temperature is greater than its cooling setpoint, the zone damper shall modulate between the minimum unoccupied airflow (adj.) and the maximum cooling airflow (adj.) until the zone is satisfied.

.3 When zone temperature is less than its unoccupied heating setpoint, the controller shall enable heating to maintain the zone temperature at the setpoint. Additionally, if warm air is available from the AHU, the zone

damper shall modulate between the minimum unoccupied airflow (adj.) and the auxiliary heating airflow (adj.) until the zone is satisfied.

.6 Reheating Coil Valve:

.1 The controller shall measure the zone temperature and modulate the reheating coil valve open on dropping temperature to maintain its heating setpoint.

.7 Discharge Air Temperature:

.1 The controller shall monitor the discharge air temperature.

.2 Alarms shall be provided as follows:

.1 High Discharge Air Temp: If the discharge air temperature is greater than 120°F (adj.).

.2 Low Discharge Air Temp: If the discharge air temperature is less than 40°F (adj.).

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Zone Temp	×							×		×
Zone Setpoint Adjust	×									×
Airflow	×							×		×
Discharge Air Temp	×							×		×
Zone Damper		×								×
Reheating Valve		×						×		×
Zone Override			×					×		×
Airflow Setpoint					×			×		×
Heating Mode						×		×		
Schedule							×			
Heating Setpoint								×		×
Cooling Setpoint								×		×
High Zone Temp									×	
Low Zone Temp									×	
High Discharge Air Temp									×	
Low Discharge Air Temp									×	
Totals	**4**	**2**	**1**	**0**	**1**	**1**	**1**	**9**	**4**	**10**

Total Hardware (7) **Total Software (16)**

1.9 Hot Water Loop Pumps (Refer to Boiler control)

.1 Hot Water Pump Run Conditions:

.1 The hot water pumps shall be enabled whenever:

.1 A definable number of hot water coils need heating.

.2 AND outside air temperature is less than 54°F (adj.).

.2 The pumps shall run for freeze protection anytime outside air temperature is less than 38°F (adj.).

.3 To prevent short cycling, the pump shall run for a minimum time and be off for a minimum time (both user adjustable).

.2 Hot Water Pump Lead/Lag Operation:

.1 The two variable speed hot water pumps shall operate in a lead/lag fashion.

.1 The lead pump shall run first.

.2 On failure of the lead pump, the lag pump shall run and the lead pump shall turn off.

.3 On decreasing hot water differential pressure, the lag pump shall stage on and run in unison with the lead pump to maintain hot water differential pressure setpoint.

.2 The designated lead pump shall rotate upon one of the following conditions (user selectable):

.1 manually through a software switch

.2 if pump runtime (adj.) is exceeded

.3 daily

.4 weekly

.5 monthly

.3 Alarms shall be provided as follows:

.1 Hot Water Pump 1

.2 Failure: Commanded on, but the status is off.

.3 Running in Hand: Commanded off, but the status is on.

.4 Runtime Exceeded: Status runtime exceeds a user definable limit.

.5 VFD Fault.

.4 Hot Water Pump 2

.1 Failure: Commanded on, but the status is off.

.2 Running in Hand: Commanded off, but the status is on.

.3 Runtime Exceeded: Status runtime exceeds a user definable limit.

.4 VFD Fault.

.3 Hot Water Differential Pressure Control:

.1 The controller shall measure hot water differential pressure and modulate the hot water pump VFDs in sequence to maintain its hot water differential pressure setpoint.

.2 The following setpoints are recommended values. All setpoints shall be field adjusted during the commissioning period to meet the requirements of actual field conditions.

.3 The controller shall modulate hot water pump speeds to maintain a hot water differential pressure of 12lbf/in2 (adj.). The VFDs minimum speed shall not drop below 20% (adj.).

.4 On dropping hot water differential pressure, the VFDs shall stage on and run to maintain setpoint as follows:

.1 The controller shall modulate the lead VFD to maintain setpoint.

.2 If the lead VFD speed is greater than a setpoint of 90% (adj.), the lag VFD shall stage on.

.3 The lag VFD shall ramp up to match the lead VFD speed and then run in unison with the lead VFD to maintain setpoint.

.5 On rising hot water differential pressure, the VFDs shall stage off as follows:

.1 If the VFDs speeds drops back to 60% (adj.) below setpoint, the lag VFD shall stage off.

.2 The lead VFD shall continue to run to maintain setpoint.

.6 Alarms shall be provided as follows:

.1 High Hot Water Differential Pressure: If 25% (adj.) greater than setpoint.

.2 Low Hot Water Differential Pressure: If 25% (adj.) less than setpoint.

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Hot Water Differential Pressure	×							×		×
Hot Water Pump 1 VFD Speed		×						×		×
Hot Water Pump 2 VFD Speed		×						×		×
Hot Water Pump 2 VFD Fault			×						×	×
Hot Water Pump 1 Status			×					×		×
Hot Water Pump 2 Status			×					×		×
Hot Water Pump 1 VFD Fault			×						×	×
Hot Water Pump 1 Start/Stop				×				×		×
Hot Water Pump 2 Start/Stop				×				×		×
Hot Water Differential Pressure Setpoint					×					×
High Hot Water Differential Pressure									×	
Low Hot Water Differential Pressure									×	
Hot Water Pump 1 Failure									×	
Hot Water Pump 2 Failure									×	
Hot Water Pump 1 Running in Hand									×	
Hot Water Pump 2 Running in Hand									×	
Hot Water Pump 1 Runtime Exceeded									×	
Hot Water Pump 2 Runtime Exceeded									×	
Totals	**1**	**2**	**4**	**2**	**1**	**0**	**0**	**7**	**10**	**10**

Total Hardware (9) **Total Software (18)**

1.10 Outside Air Conditions

.1 Outside Air Conditions:

.1 The controller shall monitor the outside air temperature and humidity and calculate the outside air enthalpy on a continual basis. These values shall be made available to the system at all times.

.2 Alarm shall be generated as follows:

.1 Sensor Failure: Sensor reading indicates shorted or disconnected sensor. In the event of a sensor failure, an alternate outside air conditions sensor shall be made available to the system without interruption in sensor readings.

.2 Outside Air Temperature History:

.1 The controller shall monitor and record the high and low temperature readings for the outside air. These readings shall be recorded on a daily, month-to-date, and year-to-date basis.

.3 Cooling Degree Day:

.1 The controller shall provide a Degree Day history index that reflects the energy consumption for the facilities cooling demand. Computations shall use a mean daily temperature of 65°F (adj.). The Degree Day peak value readings shall be recorded on a daily, month-to-date, and year-to-date basis.

.4 Heating Degree Day:

.1 The controller shall provide a Degree Day history index that reflects the energy consumption for the facilities heating demand. Computations shall use a mean daily temperature of 65°F (adj.). The Degree Day peak value readings shall be recorded on a daily, month-to-date, and year-to-date basis.

	Hardware Points				Software Points					
Point Name	**AI**	**AO**	**BI**	**BO**	**AV**	**BV**	**Sched**	**Trend**	**Alarm**	**Show On Graphic**
Outside Air Temp	×							×		×
Outside Air Humidity	×							×		×
Outside Air Enthalpy					×			×		×
High Temp Today								×		×
High Temp Month-to-Date								×		×
High Temp Year-to-Date								×		×
Low Temp Today								×		×
Low Temp Month-to-Date								×		×
Low Temp Year-to-Date								×		×
Sensor Failure									×	
Totals	**2**	**0**	**0**	**0**	**1**	**0**	**0**	**9**	**1**	**9**

Total Hardware (2) **Total Software (11)**

1.11 Sprinkler Room Temperature Alarm

.1 Low Temperature Alarm:

.1 The controller shall monitor the sprinkler room space temperature. If the space temperature drops below 5°C (adj.) send an alarm to the DDC system.

Part 2 APPENDIX A: Glossary of Terms

.1 Terms used within the Specification Text:

.1 Advanced Application Controller (AAC):

.1 A fully programmable control module. This control module may be capable of some of the advanced features found in Building Controllers (storing trends, initiating read and write requests, etc.) but it does not serve as a master controller. Advanced Application Controllers may reside on either the Ethernet/IP backbone or on a subnet.

.2 Application Specific Controller (ASC):

.1 A pre-programmed control module which is intended for use in a specific application. ASCs may be configurable, in that the user can choose between various pre-programmed options, but it does not support full custom programming. ASCs are often used on terminal equipment such as VAV boxes or fan coil units. In many vendors' architectures ASCs do not store trends or schedules but instead rely upon a Building Controller to provide those functions.

.3 BACnet/IP:

.1 An approved BACnet network type which uses an Ethernet carrier and IP addressing.

.4 BACnet MS/TP:

.1 An approved BACnet network type which uses a Master-Slave Token Passing configuration. MS/TP networks are unique to BACnet and utilize EIA485 twisted pair topology running at 9600 to 76,800 bps.

.5 BACnet over ARCNET:

.1 An approved BACnet network type which uses an ARCNET (attached resource computer network) carrier. ARCNET is an industry standard that can utilize several speeds and wiring standards. The most common configuration used by BACnet controllers is an EIA485 twisted pair topology running at 156,000 bps.

.6 Building Controller (BC):

.1 A fully programmable control module which is capable of storing trends and schedules, serving as a router to devices on a subnet, and initiating read and write requests to other controllers. Typically this controller is located on the Ethernet/IP backbone of the BAS. In many vendors' architectures a Building Controller will serve as a master controller, storing schedules and trends for controllers on a subnet underneath the Building Controller.

.7 Direct Digital Control (DDC):

.1 A control system in which a digital computer or microprocessor is directly connected to the valves, dampers, and other actuators which control the system, as opposed to indirectly controlling a system by resetting setpoints on an analog pneumatic or electronic controller.

.8 PICS - Protocol Implementation Conformance Statement:

.1 A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device.

.9 Smart Actuator (SA):

.1 An actuator which is controlled by a network connection rather than a binary or analog signal. (0-10v, 4-20mA, relay, etc.)

.10 Smart Sensor (SS):

.1 A sensor which provides information to the BAS via network connection rather than a binary or analog signal. (0-10000 ohm, 4-20mA, dry contact, etc.)

.11 Web services:

.1 Web services are a standard method of exchanging data between computer systems using the XML (extensible markup language) and SOAP (simple object access protocol) standards. Web services can be used at any level within a Building Automation System (BAS), but most commonly they are used to transfer data between BAS using different protocols or between a BAS and a non-BAS system such as a tenant billing system or a utility management system.

.2 Terms used within the Sequences of Operation:

.1 adj.

.1 Adjustable by the end user, through the supplied user interface.

.2 AI, AO, etc. (Column Headings on Points List)

AI = Analog Input. A physical input to the control module.
AO = Analog Output. A physical output from the control module.
AV = Analog Value. An intermediate (software) point that may be editable or read-only. Editable AVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only AVs are typically used to display the status of a control operation.
BI = Binary Input. A physical input to the control module.
BO = Binary Output. A physical output from the control module.
BV = Binary Value. An intermediate (software) point that may be editable or read-only. Editable BVs are typically used to allow the user to set a fixed control parameter, such as a setpoint. Read Only BVs are typically used to display the status of a control operation.
Sched = Schedule. The control algorithm for this equipment shall include a user editable schedule.
Trend =. The control system shall be configured to collect and display a trend log of this object. The trending interval shall be no less than one sample every 5 minutes. (Change of Value trending, where a sample is taken every time the value changes by more than a user-defined minimum, is an acceptable alternative.)
Alarm. = The control system shall be configured to generate an alarm when this object exceeds user definable limits, as described in the Sequence of Controls.

Note: If the specifications require use of the BACnet protocol, all of the above shall be provided as BACnet objects.

.3 KW Demand Limiting: *

.1 An energy management strategy that reduces energy consumption when a system's electric power meter exceeds an operator-defined threshold.

.2 When power consumption exceeds defined levels, the system automatically adjust setpoints, de-energizes low priority equipment, and takes other pre-programmed actions to avoid peak demand charges. As the demand drops, the system restores loads in a predetermined manner.

.4 Occupant Override Switch, or Timed Local Override:

.1 A control option that allows building occupants to override the programmed HVAC schedule for a limited period of time.

.2 When the override time expires, the zone returns to its unoccupied state.

.5 Occupant Setpoint Adjustment:

.1 A control option that allows building occupants to adjust - within limits set by the HVAC control system - the heating and cooling setpoints of selected zones. Typically the user interface for this function is built into the zone sensor.

.6 Optimal Start-Up: *

.1 A control strategy that automatically starts an HVAC system at the latest possible time yet ensures comfort conditions by the time the building becomes occupied.

.2 In a typical implementation, a controller measures the temperature of the zone and the outside air. Then, using design heating or cooling capacity at the design outside air temperature, the system computes how long a unit must run at maximum capacity to bring the zone temperature to its occupied setpoint.

.3 The optimal start algorithm often includes a self-learning feature to adjust for variations from design capacity.

.4 A distributed system must use Run on Request with Optimal Start. (See below.)

.7 Requested, or Run on Request: *

.1 A control strategy that optimizes the runtime of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service. Source equipment runs only when needed, not on a fixed schedule.

.2 The source equipment runs when one or more receiving units request its services. An operator determines how many requests are required to start the source equipment.

.3 For example, if all the zones in a building are unoccupied and the zone terminal units do not need heating or cooling, the AHU will shut down. However, if a zone becomes occupied or needs cooling, the terminal unit will send a run request to the AHU to initiate the start-up sequence. If this AHU depends on a central chiller, it can send a run request to the chiller.

.4 The run on request algorithm also allows an operator to schedule occupancy for individual zones based on the needs of the occupants without having to adjust the schedules of related AHUs and chillers.

.8 Trim and Respond, or Setpoint Optimization: *

.1 A control strategy that optimizes the setpoint of a source piece of equipment that supplies one or more receiving units - such as an air handler unit supplying zone terminal units with heating, cooling, ventilation, or similar service.

.2 The source unit communicates with receiving units to determine heating, cooling, and other requirements, and then adjusts its setpoint.

.3 For example, if all zones are comfortable and do not request cooling, the AHU will gradually increase (trim) its supply air setpoint. When a zone requests cooling, the AHU responds by dropping its setpoint. The more zones that request cooling, the more it drops the setpoint. The AHU repeats this process throughout the day to keep zones cool, but with a supply air setpoint that is no cooler than necessary.

.3 Contracting Terms:

.1 Furnished or Provided:

.1 The act of supplying a device or piece of equipment as required meeting the scope of work specified and making that device or equipment operational. All costs required to furnish the specified device or equipment and make it operational are borne by the division specified to be responsible for providing the device or equipment.

.2 Install or Installed:

.1 The physical act of mounting, piping or wiring a device or piece of equipment in accordance with the manufacturer's instructions and the scope of work as specified. All costs required to complete the installation are borne by the division specified to include labor and any ancillary materials.

.3 Interface:

.1 The physical device required to provide integration capabilities from an equipment vendor's product to the control system. The equipment vendor most normally furnishes the interface device. An example of an interface is the chilled water temperature reset interface card provided by the chiller manufacturer in order to allow the control system to integrate the chilled water temperature reset function into the control system.

.4 Integrate:

.1 The physical connections from a control system to all specified equipment through an interface as required to allow the specified control and monitoring functions of the equipment to be performed via the control system.

Part 3 APPENDIX B: Abbreviations

.1 The following abbreviations may be used in graphics, schematics, point names, and other UI applications where space is at a premium.

AC - Air Conditioning
ACU - Air Conditioning Unit

AHU - Air Handling Unit
AI - Analog Input
AO - Analog Output
AUTO - Automatic
AUX - Auxiliary
BI - Binary Input
BO - Binary Output
C - Common
CHW - Chilled Water
CHWP - Chilled Water Pump
CHWR - Chilled Water Return
CHWS - Chilled Water Supply
COND - Condenser
CW - Condenser Water
CWP - Condenser Water Pump
CWR - Condenser Water Return
CWS - Condenser Water Supply
DA - Discharge Air
EA - Exhaust Air
EF - Exhaust Fan
EVAP - Evaporators
FCU - Fan Coil Unit
HOA - Hand / Off / Auto
HP - Heat Pump
HRU - Heat Recovery Unit
HTEX - Heat Exchanger
HW - Hot Water
HWP - Hot Water Pump
HWR - Hot Water Return
HWS - Hot Water Supply
MAX - Maximum
MIN - Minimum
MISC - Miscellaneous
NC - Normally Closed
NO - Normally Open
OA - Outdoor Air
PIU - Powered Induction Unit
RA - Return Air
RF - Return Fan
RH - Relative Humidity
RTU - Roof-top Unit
SA - Supply Air
SF - Supply Fan
SP - Static Pressure
TEMP - Temperature
UH - Unit Heater
UV - Unit Ventilator
VAV - Variable Air Volume
VVTU - Variable Volume Terminal Unit
W/ - with

W/O - without
WSHP - Water Source Heat Pump

END OF SECTION