

HVAC SEQUENCE OF OPERATION

THE ENTIRE HVAC AND PLUMBING CONTROL SYSTEM SHALL BE BY THE CONTROLS CONTRACTOR. ALL 120V WIRING TO ALL EQUIPMENT CONTROLLERS, DAMPERS, VALVES, ACTUATORS, TRANSFORMERS, PANELS SHALL BE FURNISHED BY THE CONTROLS CONTRACTOR HOWEVER DIVISION 26 PROVIDED LIMITED 120V CIRCUITRY FOR CONTROLS.

ALL EXPOSED POWER AND CONTROL WIRING SHALL BE IN CONDUIT. REFER TO ELECTRICAL SPECIFICATION FOR REQUIREMENTS. ALL CONTROLS SHALL HAVE FACTORY START-UP AND COMMISSIONING. REFER TO SECTION 23 0900 FOR ADDITIONAL REQUIREMENTS.

THE CONTROL CONTRACTOR SHALL INTERLOCK ANY AND ALL FIELD INSTALLED CONTROLS ASSOCIATED WITH DIVISION 23 INCLUDING, BUT NOT LIMITED TO, EQUIPMENT CONTROL PANELS, REMOTE PANELS, SENSORS, VAV TERMINAL UNITS, BLOWER COIL UNITS, FAN COIL UNITS, ETC.

THE CONTROL CONTRACTOR SHALL PROVIDE A COLOR CODED WIRING DIAGRAM AND A QUICK REFERENCE SETPOINT GUIDE AT EACH CONTROL PANEL. THIS SHALL BE LAMINATED TO THE INSIDE COVER OF THE DOOR.

THE CONTROL CONTRACTOR SHALL PROVIDE THE BALANCING CONTRACTOR ALL NECESSARY HARDWARE AND/OR SOFTWARE FOR BALANCING.

THE CONTROL CONTRACTOR SHALL PROVIDE ALL NECESSARY GATEWAYS TO INTERFACE WITH ANY AND ALL EQUIPMENT AS SPECIFIED BELOW. COORDINATE WITH THE RESPECTIVE MANUFACTURER FOR PROPER AND RELIABLE INTEGRATION.

PROVIDE AN OPEN PROTOCOL WEB BASED, STAND-ALONE DDC CONTROL SYSTEM. THE STAND-ALONE DDC CONTROL SYSTEM SHALL HAVE A UPS CAPABLE OF STANDBY POWER FOR THE ENTIRE CONTROL SYSTEM (INCLUDING MONITORING) FOR A MINIMUM OF 30 MINUTES. THE STAND-ALONE DDC CONTROLS SHALL BE CAPABLE OF INTEGRATION WITH FUTURE BAS DDC CONTROLS FOR A COMPLETE AND FULLY FUNCTIONAL SYSTEM. NEW DDC SYSTEMS SHALL INTEGRATE WITH THE FUTURE BAS INTERFACE WITHOUT HAVING TO GO THROUGH A SEPARATE PLATFORM.

PROVIDE AN ADDITIONAL 10% AVAILABLE POINTS AT EACH LOCAL CONTROLLER, AND AT THE MAIN HEAD END.

ALL CONTROL SET-POINTS SHALL BE ADJUSTABLE.

AIR HANDLING UNIT - VAV AHU'S WITHOUT PRE-HEAT COILS

SUPPLY FAN START/STOP: THE SUPPLY FAN WILL BE STARTED ACCORDING TO THE TIME SCHEDULE. IF THE SUPPLY FAN STATUS DOES NOT MATCH THE COMMANDED VALUE, AN ALARM WILL BE GENERATED. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN STARTED, THE CONTROL SEQUENCE WILL BE ENABLED.

INTERLOCK ALL HOOD EXHAUST FANS WITH THE RESPECTIVE AHU.

STATIC PRESSURE CONTROL: THE SUPPLY FAN WILL MODULATE TO MAINTAIN THE LARGEST DEMAND FROM ALL OF THE VAV TERMINAL BOXES.

DISCHARGE AIR CONTROL: THE COOLING VALVE WILL MODULATE IN SEQUENCE TO MAINTAIN THE DISCHARGE AIR TEMPERATURE AT SET POINT (55°F ADJ.).

MIXED AIR LOW LIMIT OVERRIDE: THE MIXED AIR TEMPERATURE WILL OVERRIDE THE MINIMUM POSITION AND CLOSE THE OUTSIDE AIR DAMPER IF A TEMPERATURE IS SENSED BELOW THE SET POINT (38°F ADJ.).

OUTSIDE AIR DAMPER CONTROL: OUTSIDE AIR DAMPER SHALL MODULATE TO MAINTAIN DESIGN VENTILATION AIRFLOW. AS THE CO2 CONCENTRATION INCREASES ABOVE THE CO2 RESET START VALUE, THE VENTILATION CONTROL MODULE SHALL MODIFY THE MINIMUM OUTDOOR AIR CFM SETPOINT AND MODULATE OPEN THE OUTSIDE AIR DAMPER TO INCREASE THE AMOUNT OF OUTSIDE AIR ENTERING THE UNIT. THE SET POINT SHALL BE ADJUSTED UPWARD UNTIL THE CO2 MAXIMUM RESET VALUE IS REACHED. THE MAXIMUM EFFECTIVE RESET SET POINT VALUE FOR OUTSIDE AIR ENTERING THE UNIT IS LIMITED TO THE MAXIMUM RATED AIR FLOW FOR THE UNIT. AS THE CO2 CONCENTRATION DECREASES, THE EFFECTIVE RESET SET POINT VALUE SHALL BE ADJUSTED DOWNWARD TOWARD THE MINIMUM OUTDOOR AIR CFM SETPOINT AND THE OUTSIDE AIR DAMPER/RETURN AIR DAMPER INDEPENDENTLY MODULATED AS REQUIRED TO MEET THE CO2 DEMAND. (DAMPER IS NEVER CLOSED DURING THE OCCUPIED MODE). THE ACCEPTABLE INDOOR CO2 CONCENTRATION RANGE SHALL BE BETWEEN 400-700 PPM ABOVE OUTDOOR AIR CONCENTRATION. TYPICAL OUTDOOR AIR CO2 CONCENTRATION IS 400 PPM. PROVIDE ALARM THROUGH BAS IF THE MEASURED INDOOR CO2 CONCENTRATION FALLS OUTSIDE THE ALLOWABLE RANGE FOR LONGER THAN 30 MINUTES.

NIGHT SETBACK/NIGHT SETUP: WHEN IN "UNOCCUPIED" MODE, THE UNIT WILL CYCLE AS NECESSARY TO MAINTAIN THE SHARED NIGHT SETBACK ZONE TEMPERATURE AT SET POINT. A DIFFERENTIAL PREVENTS THE UNIT FROM CYCLING EXCESSIVELY.

SPACE HUMIDITY: THE SPACE HUMIDITY SENSOR WILL BE USED TO MONITOR AND CONTROL THE SPACE HUMIDITY. UPON A RISE IN RH ABOVE 60% RH FOR CONTINUOUS 15 MINUTES WHEN OPERATING THE COOLING VALVE SHALL BE FORCED ON TO MAINTAIN DISCHARGE AIR TEMPERATURE SET POINT (55°F) AND THE REHEAT VALVE SHALL MODULATE SIMULTANEOUSLY TO MAINTAIN SPACE TEMPERATURE SETPOINT. ALSO AN ALARM WILL BE GENERATED BY THE BAS AND A RED LIGHT LOCATED BY ENGINEER AND BY OWNER. THE CAUSE OF THE HIGH RH MUST BE CORRECTED IMMEDIATELY TO PREVENT BUILDING DAMAGE.

SHUTDOWN:

WHEN THE UNIT IS SHUTDOWN BY EITHER A STOP COMMAND OR SYSTEM SAFETY THE UNIT WILL BE SET AS FOLLOWS:

- SUPPLY FAN WILL BE OFF AND VFD BE COMMANDED TO 0%
- OUTSIDE AIR DAMPER WILL CLOSE, RETURN AIR DAMPER WILL OPEN AND COOLING VALVE WILL CLOSE (EXCEPT LOW LIMIT).

IF A FIRE ALARM SHUTDOWN CONTACT IS PROVIDED, THE SUPPLY FAN WILL BE SHUTDOWN WHEN TRIGGERED.

IF A HIGH STATIC PRESSURE SWITCH (ADJ. 1"-3" W.G.) LOCATED AFTER THE SUPPLY FAN SENSES A DISCHARGE PRESSURE THAT IS GREATER THAN SET POINT, THE SUPPLY FAN WILL BE SHUTDOWN.

VAV TERMINAL UNIT(S) WITH ELECTRIC REHEAT

NOTE ALL BOXES SHALL BE INTERLOCKED WITH THE BAS

DISCHARGE AIR TEMP SENSOR: A DISCHARGE AIR TEMP SENSOR IS PROVIDED ON EACH BOX FOR MONITORING PURPOSES.

OCCUPIED MODE: WHEN THE ZONE TEMPERATURE IS BETWEEN THE OCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BAS), THE PRIMARY AIR DAMPER WILL BE AT THE MINIMUM CFM AND THE REHEAT COIL SHALL BE DISABLED. ONCE THE ZONE TEMPERATURE RISES ABOVE THE COOLING SETPOINT, THE PRIMARY AIR DAMPER SHALL INCREASE THE CFM AND THE REHEAT COIL REMAINS DISABLED. ON A DROP IN ZONE TEMPERATURE BELOW THE HEATING SETPOINT, THE REHEAT COIL IS ENABLED AND THE DAMPER IS CONTROLLED TO PROVIDE MINIMUM CFM.

UNOCCUPIED (NIGHT SETBACK) MODE: WHEN THE AIR HANDLING UNIT SHUTS DOWN, ALL BOX CONTROLLERS ARE INDEXED TO UNOCCUPIED MODE. WHEN THE ZONE TEMPERATURE IS BETWEEN THE UNOCCUPIED HEATING AND COOLING SETPOINTS (INSIDE OF THE BAS), THE PRIMARY AIR DAMPER SHALL BE AT THE MINIMUM CFM AND THE REHEAT COIL SHALL BE DISABLED. ONCE THE ZONE TEMPERATURE RISES ABOVE THE UNOCCUPIED COOLING SETPOINT, THE PRIMARY AIR DAMPER SHALL INCREASE THE CFM (IF AVAILABLE), AND THE REHEAT COIL REMAINS DISABLED. ON A DROP IN ZONE TEMPERATURE BELOW THE UNOCCUPIED HEATING SETPOINT, THE REHEAT COIL IS ENABLED, AND THE DAMPER IS CONTROLLED TO PROVIDE MINIMUM CFM.

ADJUSTABLE FREQUENCY DRIVES

INTERLOCK ALL ADJUSTABLE FREQUENCY DRIVES (AFD) WITH THE BAS SYSTEM. BAS SHALL MONITOR ALL STATUS AND ALARMS FROM THE AFD MANUFACTURER.

GRAPHICAL USER INTERFACE

- THE GUI SHALL HAVE INPUT/OUTPUT CAPABILITY FROM ANY OPERATOR STATION OR GUI INTERFACE FOR MONITORING AND CONTROLLING ALL OF THE POINTS.
- THE OPERATOR SHALL BE ABLE TO MONITOR AND ACCESS ALL POINTS BY MEANS OF CLEAR CONCISE ENGLISH NAMES WITHOUT HAVING TO UNDERSTAND OR REFERENCE HARDWARE POINT LOCATIONS OR CONTROLLER PROGRAMS.
- ALL DEVICES SHALL HAVE A UNIQUE TAG AS DESIGNATED BY THE CONTRACT DOCUMENTS.
- PROVIDE LOCAL GRAPHICAL USER INTERFACE (GUI) FOR ALL AHU'S, BOILERS, CHILLERS, BLOWER COILS, PUMPS, ETC.
- PROVIDE A SEPARATE SUBMITTAL FOR GUI AFTER THE CONTROL SUBMITTAL HAS BEEN SUBMITTED AND REVIEWED BY THE ENGINEER.
- REFER TO HVAC CONTROLS AND INSTRUMENT SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS

DATA/TREND LOGGING

THE BAS SHALL RECORD, STORE AND PROVIDE TREND LOGGING FOR ANY AND ALL POINTS AS STATED ABOVE. TRENDING SHALL NOT IMPAIR OR SLOWDOWN THE BAS. TRENDING TIMES SHALL BE FULLY ADJUSTABLE AND SHALL BE EASILY ACCESSIBLE FOR REVIEW OF DATA. PROVIDE GRAPHS AND RAW DATA OUTPUTS. GRAPHS SHALL BE ABLE TO BE SCALED. ALL DATA SHALL BE ABLE TO BE EXPORTED TO A SPREADSHEET OR TEXT DOCUMENT.

THE BAS SHALL RECORD, STORE AND PROVIDE TREND LOGGING FOR THE FOLLOWING ITEMS:

- AIR HANDLING EQUIPMENT (AHUs, BCUs, FCUs, VAV TERMINAL UNITS, ETC.)

SUPPLY AIR TEMPERATURES (AS APPLICABLE)
ROOM TEMPERATURE (AS APPLICABLE)
FAN ON/OFF STATUS
CHILLED WATER VALVE POSITION
OUTSIDE AIR DAMPER POSITION
DUCT STATIC PRESSURE
HIGH LIMIT DUCT PRESSURE
SPACE HUMIDITY
OUTSIDE AIR TEMPERATURE
AIRFLOW MEASURING STATION (AS APPLICABLE)

- EXHAUST FANS

FAN ON/OFF STATUS

- GENERAL/MISC.

RECORD ANY AND ALL FAULT AND ALARMS
PROVIDE HARD DRIVE FOR AT LEAST 2 FULL YEARS OF DATA STORAGE.
PROVIDE AN ADDITIONAL 15% FOR TRENDING POINTS.

- CHILLED WATER

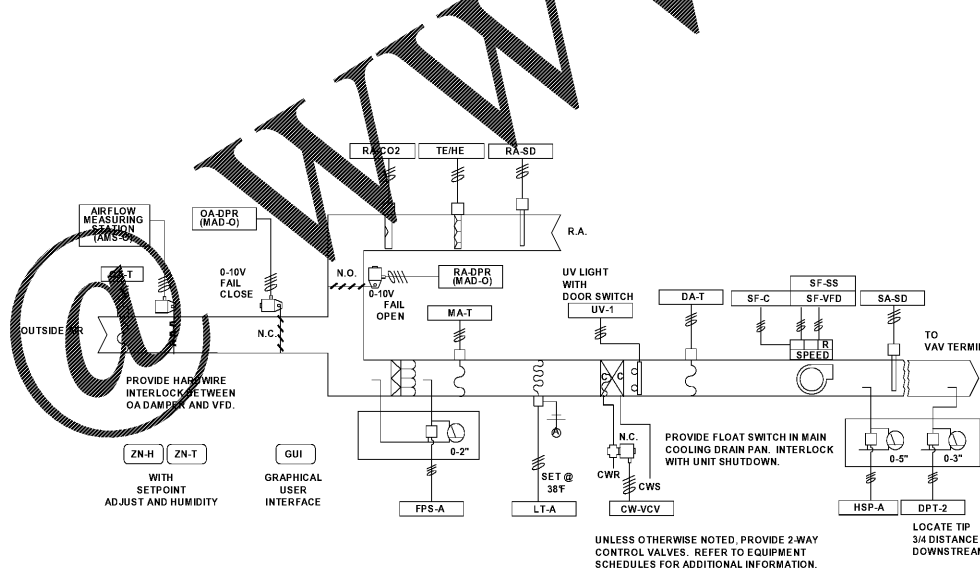
RECORD BLDG CHILLED WATER FLOW & SUPPLY AND RETURN TONNAGE AS MONTHLY REPORT IN EXCEL SPREADSHEET.

- DOMESTIC HOT WATER

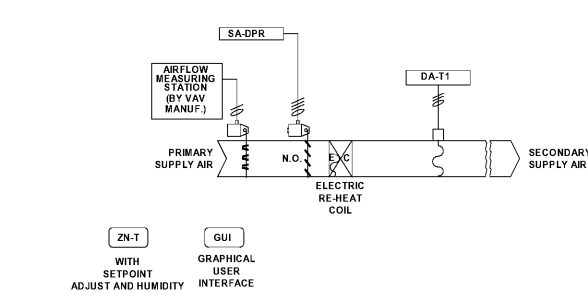
RECORD BLDG DOMESTIC HOT WATER FLOW (GALLONS PER HOUR) AS MONTHLY REPORT IN EXCEL SPREADSHEET.

AHU CONTROL SCHEMATIC SYMBOL LEGEND:

AFMS	AIRFLOW MEASURING STATION
BTUM-CHW	BTU METER - CHILLED WATER
CC	CHILLED WATER COOLING COIL
CW-FM	CHILLED WATER FLOW METER
CW-VLV	CHILLED WATER CONTROL VALVE
DA-T	DISCHARGE AIR TEMPERATURE SENSOR
DPT-1,2	DIFFERENTIAL PRESSURE SENSOR
EDH	ELECTRIC DUCT HEATER
ES	END-SWITCH
FPS-A	FILTER PRESSURE SENSOR - ALARM
HSP-A	HIGH PRESSURE SENSOR - ALARM
HW-VLV	HOT WATER CONTROL VALVE
LT-A	LOW TEMPERATURE SENSOR SET @ 38°F (ADJ.)
LPS-VLV	LOW PRESSURE STATIC CONTROL VALVE
MA-T	MIXED AIR TEMPERATURE SENSOR
NC	NORMALLY CLOSED VALVE/DAMPER
NO	NORMALLY OPEN VALVE/DAMPER
OA-DPR	OUTSIDE AIR MODULATED DAMPER
OA-S	OUTSIDE AIR SMOKE DETECTOR
OUT	OUTSIDE AIR TEMPERATURE
PH-S1	ELECTRIC RESISTANCE HEATER PRE-HEATER
HMI	HUMAN MACHINE INTERFACE
RA	RETURN AIR
RA-CO2	RETURN AIR CO2 DETECTOR
RA-DPR	RETURN AIR MODULATED DAMPER
RA-S	RETURN AIR SMOKE DETECTOR (OVER 2000 CFM ONLY)
SCR	ELECTRIC RESISTANCE HEATER SCR TYPE
TE/H	TEMPERATURE & HUMIDITY SENSOR
SA-S	SUPPLY AIR SMOKE DETECTOR (OVER 2000 CFM ONLY)
SF-C	SUPPLY FAN MOTOR CURRENT
SF-SS	SUPPLY FAN DRIVER START/STOP
SF-ECM	SUPPLY FAN VARIABLE SPEED ECM MOTOR
SF-VFD	SUPPLY FAN VARIABLE FREQUENCY DRIVE
ZN-H	ZONE HUMIDITY SENSOR
ZN-T	ZONE TEMPERATURE SENSOR



HVAC CONTROL SCHEMATIC DIAGRAM - AHU COOLING ONLY
2 NOT TO SCALE



HVAC CONTROL SCHEMATIC DIAGRAM - VAV TERMINAL UNIT (ERH)
1 NOT TO SCALE

NANO ARCHITECTURE
RESILIENT ARCHITECTURE FOR THE FUTURE

REV. DATE. DESCRIPTION. BY.

SEWERAGE AND WATER BOARD OF NEW ORLEANS

CONTRACT 8155
ELECTRICAL STORAGE ROOM OFFICE RENOVATION

HVAC SEQUENCE OF OPERATIONS **M6.1**

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