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INPUT/OUTPUT SUMMARY FOR AIR HANDLING UNIT AH-01 (TYP 2 SYSTEMS)

SYSTEM, APPARATUS, OR AREA POINT DESCRIPTION	INPUTS – ANALOG – MEASURED							INPUTS – ANALOG – CALCULATED					INPUTS – BINARY							OUTPUTS – DIGITAL				OUTPUTS – ANALOG					SYSTEM FEATURES – ALARMS							SYSTEM FEATURES – PROGRAMS								GENERAL						SUPPLEMENTARY NOTES
	TEMPERATURE	PRESSURE	RH	KW	AIR FLOW	LEVEL	GALLONS	VIBRATIONS	KWH	ENTHALPY	RUN TIME	EFFICIENCY	WET BULB TEMP	STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	METER	OFF-ON	OFF-AUTO-ON	OFF-HI-LO	OPEN-CLOSE	MULTI-STAGE	DAMPER POSITION	VALVE POSITION	SET POINT ADJUSTMENT	VANE POSITION	SCR CONTROL	HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF		TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPTION	ENTHALPY OPTION	SMOKE CNT	TREND	ALARM INSTRUCT	MAINT WK ORD		COLOR GRAPHIC					
OUTSIDE TEMERATURE	●																																																	
OUTSIDE RELATIVE HUMIDITY		●																																																	
PREHEAT COIL, HC-14	●													●									●				●			●								●				●	●							
PREHEAT COIL, HC-15	●													●									●				●			●								●				●	●							
AIR FILTER AF-01 (TYP 2)		●																												●													●							2 SENSORS
AIR FILTER AF-02 (TYP 2)		●																												●													●							2 SENSORS
MIXING AIR DAMPER 01																									●																		●	●							
MIXING AIR DAMPER 02																									●																		●	●							
COOLING COIL CC-01	●																									●				●													●	●							
COOLING COIL CC-02	●																									●				●													●	●							
SUPPLY FAN SF-01				●		●			●				●			●				●								●		●			●			●		●				●	●							
SUPPLY FAN SF-02				●		●			●				●			●				●								●		●			●			●		●				●	●							
SUPPLY AIR TEMP (TYP 2)	●																													●	●												●								
SUPPLY AIR RELATIVE HUMIDITY		●																												●													●								
ROOM TEMPERATURE (TYPICAL 5 ZONES)	●																													●	●												●								
SPACE AVERAGE RELATIVE HUMIDITY		●																												●	●												●								
ZONE DUCT HEATER (VEA)	●													●															●	●								●				●	●							
ZONE DUCT HEATERS (TYPICAL 5 ZONES)	●													●									●							●								●				●	●							
SMOKE DETECTOR (SD-01)																●																								●		●								
MIXING AIR TEMP	●																																																		
AIR COMPRESSORS (TYP 2)		●												●																●	●								●												
TOILET EXHAUST FAN, EF-01										●				●						●													●			●		●					●								
AIR FLOW DIAGRAM																																															●				
HEPA FILTERS		●																												●													●								
FLOOR PLANS																																															●				

INPUT/OUTPUT SUMMARY FOR WATER CHILLERS CH-01 & CH-02 (TYP 2 SYSTEMS)

SYSTEM, APPARATUS, OR AREA POINT DESCRIPTION	INPUTS – ANALOG – MEASURED							INPUTS – ANALOG – CALCULATED					INPUTS – BINARY							OUTPUTS – DIGITAL				OUTPUTS – ANALOG					SYSTEM FEATURES – ALARMS							SYSTEM FEATURES – PROGRAMS								GENERAL						SUPPLEMENTARY NOTES
	TEMPERATURE	PRESSURE	RH	KW	AIR FLOW	LEVEL	VIBRATIONS	GPM	KWH	ENTHALPY	RUN TIME	EFFICIENCY	WET BULB TEMP	STATUS	FILTER	SMOKE	FREEZE	AIR FLOW	METER	OFF-ON	OFF-AUTO-ON	OFF-HI-LO	OPEN-CLOSE	MULTI-STAGE	DAMPER POSITION	VALVE POSITION	SET POINT ADJUSTMENT	VANE POSITION	SCR CONTROL	HI ANALOG	LOW ANALOG	HI BINARY	LOW BINARY	PROOF		TIME SCHEDULING	DEMAND LIMITING	DUTY CYCLE	START/STOP OPTION	ENTHALPY OPTION	SMOKE CNT	TREND	ALARM INSTRUCT	MAINT WK ORD		COLOR GRAPHIC					
WATER CHILLER, CH-01	●						●			●				●						●							●			●	●					●			●			●	●							
WATER CHILLER, CH-02	●						●			●				●						●							●			●	●					●			●			●	●							
CHILLED WATER PUMP, WP-01		●					●	●		●				●						●										●			●			●			●				●								
CHILLED WATER PUMP, WP-02		●					●	●		●				●						●										●			●			●			●				●								
CHILLED WATER RETURN TEMP	●																																									●								
CHILLED WATER SUPPLY TEMP	●																																									●								
CHILLED WATER BOOSTER PUMP		●									●			●						●																			●			●	●							PUMP BY VE CONTRACTOR
CHILLED WATER FLOW DIAGRAM																																															●				
FLOOR PLANS																																															●				

NOTES:

1. FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES SEE SHEETS LA-H-001 AND LA-H-002.
2. SMOKE DETECTORS WILL BE HARD WIRED TO THE SUPPLY FANS SF-01 & SF-02 MOTOR STARTER TO STOP FANS WHEN SMOKE DETECTED IN THE RETURN AIR STREAM. ALSO SMOKE DETECTORS WILL BE SOFTWARE CONNECTED TO DDC CONTROL PANEL AND THE FACILITY CONTROL ROOM.
3. CONTROL SYSTEM SHALL BE STAND ALONE TYPE AND CONNECTED TO THE MAIN CONTROL AND MONITORING SYSTEM AT THE FACILITY CONTROL ROOM IN THE CORNER STATION BUILDING.
4. VACUUM EQUIPMENT ROOM WILL BE PROVIDED WITH FOUR TEMPERATURE SENSORS TO CONTROL THE RESPECTIVE DUCT HEATER. SYSTEM MAY AVERAGE THE READING OF THE FOUR ROOM TEMPERATURE SENSORS OR SELECT ANY SENSOR TO CONTROL THE DUCT HEATER.

SEQUENCE OF OPERATION:

I. CHILLED WATER PLANT:

UPON A SIGNAL FROM THE CENTRAL CONTROL SYSTEM THE PACKAGED CONTROLS PROVIDED WITH THE WATER CHILLER WILL PERFORM THE FOLLOWING:

A. THE LEAD CHILLED WATER PUMP (WP-01) WILL START TO ESTABLISH STEADY WATER FLOW THROUGH THE SYSTEM.

B. UPON PROOF OF ESTABLISHED WATER FLOW THE LEAD CHILLER (CH-01) WILL START TO MAINTAIN THE LEAVING CHILLED WATER TEMPERATURE SETPOINT (42°F).

C. THE PACKAGED DDC CONTROLS ON THE WATER CHILLER WILL CYCLE THE REFRIGERATION COMPRESSORS IN SEQUENCE TO MATCH THE SYSTEM THERMAL LOAD.

D. WHEN THE THERMAL LOAD DROPS BELOW THE MINIMUM OPERATING CAPACITY OF THE WATER CHILLER, THE PACKAGED CONTROL WILL ACTIVATE THE HOT GAS BYPASS CYCLE.

E. PACKAGED CONTROLS WILL RUN SELF DIAGNOSTICS TEST BEFORE STARTING THE REFRIGERATION COMPRESSORS TO PROVE THAT ALL OPERATING CONDITIONS ARE WITHIN THE NORMAL LIMITS.

F. PACKAGED CONTROLS WILL CONTINUOUSLY MONITOR THE CHILLER OPERATION AND REPORT ANY OPERATIONAL OR SAFETY ALARMS TO THE OPERATOR COMPUTER IN THE FACILITY CONTROL ROOM. PACKAGED CONTROLS WILL AUTOMATICALLY STOP THE MALFUNCTIONING WATER CHILLER AND START THE STANDBY CHILLER.

G. CENTRAL CONTROL SYSTEM WILL ALTERNATE THE LEAD AND STANDBY WATER CHILLERS TO MAINTAIN EQUAL OPERATING PERIODS ON BOTH WATER CHILLERS.

II. AIR HANDLING SYSTEM:

UPON A SIGNAL FROM THE CENTRAL CONTROL SYSTEM THE LEAD SUPPLY AIR FAN (SF-01) WILL START TO ESTABLISH A STEADY AIR FLOW THROUGH THE SYSTEM. THE DDC CONTROLS WILL PERFORM THE FOLLWING:

A. MODULATE THE CONTROLLABLE PITCH VANES ON THE SUPPLY AIR FANS TO MAINTAIN THE DESIRED CONSTANT AIR VOLUME FLOW RATE REGARDLESS OF THE SYSTEM STATIC PRESSURE.

B. THE TEMPERATURE SENSORS LOCATED DOWN STREAM OF THE OUTSIDE AIR PREHEAT COILS WILL BE USED TO CONTROL THE CAPACITY OF THE DUCT ELECTRIC HEATERS TO MAINTAIN THE OUTSIDE AIR DRY BULB TEMPERATURE AT 50°F.

C. THE TEMPERATURE SENSOR LOCATED DOWN STREAM OF THE COOLING COIL WILL BE USED TO MODULATE THE 3-WAY CONTROL VALVE ON THE CHILLED WATER LOOP TO MAINTAIN THE LEAVING AIR DRY BULB TEMPERATURE AT THE SET POINT (50°F).

D. THE DDC CONTROLS WILL COMPARE THE SPACE ROOM TEMPERATURE SENSORS AND MODULATE THE FACE AND BYPASS DAMPER BASED ON THE MOST DEMANDING ZONE.

E. THE ROOM TEMPERATURE SENSORS (TOTAL 4) OF VACUUM EQUIPMENT AREA SHALL BE USED TO MODULATE THE SCR CONTROLS ON THE RESPECTIVE ELECTRIC DUCT HEATER TO MAINTAIN THE ROOM TEMPERATURE SETPOINT (72°F)

F. THE ROOM TEMPERATURE SENSORS FOR OTHER ROOMS SHALL BE USED TO SEQUENCE THE CAPACITY CONTROL STAGES OF THEIR RESPECTIVE DUCT HEATERS TO MAINTAIN THE ROOM TEMPERATURE SET POINT.

G. WHEN THE ROOM TEMPERATURE RISES 5 DEGREES F ABOVE THE SETPOINT, THE CONTROL SYSTEM SHALL REPORT AN ALARM SIGNAL TO THE FACILITY CONTROL ROOM.

H. THE RELATIVE HUMIDITY SENSOR LOCATED IN VACUUM EQUIPMENT ROOM SHALL BE USED TO MONITOR THE SPACE RELATIVE HUMIDITY.

I. THE SMOKE DUCT DETECTOR IN THE RETURN AIR DUCTS SHALL STOP THE SUPPLY AIR FANS WHEN SMOKE IS DETECTED IN THE RETURN AIR STREAM AND REPORT AN ALARM SIGNAL (AUDIO AND VISUAL) AT THE FACILITY CONTROL ROOM AND LOCAL CONTROL PANEL.
THE SPACE DIFFERENTIAL PRESSURE SENSORS SHALL BE USED TO MODULATE THE MOTORIZED CONTROL DAMPERS ON THE RETURN AIR DUCTS AND THE OUTSIDE AIR DUCTS TO MAINTAIN THE SPACE PRESSURIZATION AT THE SETPOINT.

III. EQUIPMENT START UP:

A. ALL WATER CHILLER SHALL BE SOFT START

B. THE SUPPLY AIR FANS SF-01 & SF-02 SHALL START AT THE MINIMUM STATIC PRESSURE AND GRADUALLY INCREASE THE SYSTEM STATIC PRESSURE TO MAINTAIN THE DESIRED AIR FLOW RATE.

C. THE BUILDING PRESSURIZATION SENSORS FOR LVEA AND OSB (LAB AREA) SHALL MODULATE THE MOTORIZED DAMPERS LOCATED ON THE RETURN AIR & OUTSIDE AIR DAMPERS TO START AT 100% RETURN AIR AND GRADUALLY MODULATE THE DAMPERS TO MAINTAIN THE BUILDING PRESSURIZATION SETPOINT.

IV. TOILET EXHAUST FAN:

A. THE TOILET EXHAUST FAN WILL RUN CONTINUOUSLY.

LIGO-D960989-01-O

REFERENCES	
DRAWING NO.	DESCRIPTION

REVISIONS						
NO.	DATE	BY	CHKD	ENGR	PROJ	DESCRIPTION
1	8-7-98	DJB	AA	AA		ISSUED FOR AS-BUILT

ISSUED FOR CONSTRUCTION		
DRAWN	CLP	11-15-96
CHECKED	MN	10-25-96
ENGINEER	AA	1-23-96
PROJ	TDM	11-15-96

AS-BUILT DRAWINGS

PARSONS
100 WEST WALNUT STREET
PASADENA, CALIFORNIA

LIGO
CALIFORNIA INSTITUTE OF TECHNOLOGY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LASER INTERFEROMETER
GRAVITATIONAL-WAVE OBSERVATORY
SITE NO. 2 - LIVINGSTON, LOUISIANA

TITLE: HVAC END STATION SEQUENCES OF OPERATION & I/O SUMMARY SHEET

SCALE	CONTRACT NUMBER	PROJECT NUMBER
NONE	PP150969	8094

SHEET NUMBER: LA-H-231
REVISIONS: 1

LIGOLAF.BDR