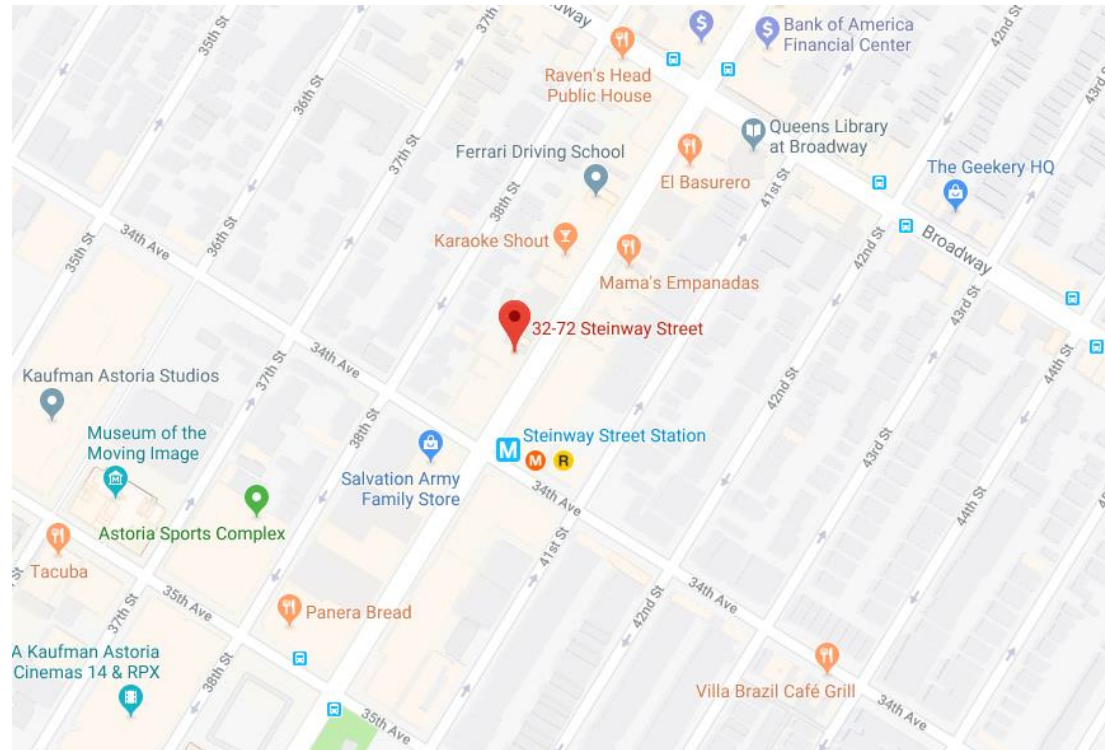


TITLE PAGE

SAMPLE PROJECT – JOHNSON CONTROLS

BUILDING AUTOMATION SYSTEM

MAP TO SITE



GENERAL NOTES

1. ALL POWER WIRING 120 VAC AND ABOVE BY ELECTRICAL CONTRACTOR.

TEMPERATURE CONTROL LEGEND:

- MOUNTED ON PANEL FACE
- MOUNTED INSIDE PANEL
- ③ CONTROL TUBE #3
- PNEUMATIC TUBING
- - - WIRING
- 6 TERMINAL BLOCK #6
- SV SOLENOID VALVE
- CONTROL VALVE, 2-WAY
- CONTROL VALVE, 3-WAY
- ↔ PARALLEL BLADED DAMPER
- ↔ OPPOSED BLADED DAMPER
- ◇ AB SIGNAL LINE INSIDE PANEL

ABBREVIATIONS:

- AFMS- AIR FLOW MEASURING STATION
- C- COMMON PORT
- CCP- CENTRAL CONTROL PANEL
- CR- CONTROL RELAY
- CS- CURRENT SWITCH
- DA- DAMPER ACTUATOR
- DPRO- DAMPER OUTPUT
- DPRS- DAMPER STATUS
- DPS- DIFFERENTIAL PRESSURE SWITCH
- DPT- DIFFERENTIAL PRESSURE TRANS
- EA- EXHAUST AIR
- ES- END SWITCH, POSITION SWITCH
- FS- FLOW SWITCH
- FSD- FIRE & SMOKE DAMPER
- H- HUMIDISTAT
- HC- MOTOR STARTER HOLDING COIL
- HI- HUMIDITY INDICATOR
- HL- HIGH LIMIT HUMIDISTAT
- HS- HIGH SIGNAL SELECTOR
- HT- HUMIDITY TRANSMITTER
- LCP- LOCAL CONTROL PANEL
- LS- LOW SIGNAL SELECTOR
- MA- MIXED AIR
- MOD- MOTOR OPERATED DAMPER
- NC- NORMALLY CLOSED
- NCP- NETWORK CONTROL PANEL
- NO- NORMALLY OPEN
- OA- OUTSIDE AIR
- OL'S- MOTOR STARTER OVERLOADS
- PC- PRESSURE CONTROLLER
- PE- PRESSURE TOGGLE SWITCH
- PI- PRESSURE INDICATOR
- PL- PILOT LIGHT
- PR- PNEUMATIC RELAY
- PT- PRESSURE TRANSMITTER
- RC- RECEIVER CONTROLLER
- RR- REVERSING RELAY
- RT- ROOM THERMOSTAT
- S- SWITCH
- SD- SMOKE DETECTOR
- S/W- SUMMER/ WINTER SIGNAL
- T- THERMOSTAT
- TS- TEMPERATURE SENSOR
- TC- TIME CLOCK
- TDR- TIME DELAY RELAY
- THL- TEMPERATURE HIGH LIMIT THERMOSTAT
- TI- TEMPERATURE INDICATOR
- TLL- TEMPERATURE LOW LIMIT THERMOSTAT
- TR- TRANSDUCER
- TT- TEMPERATURE TRANSMITTER
- TX- TRANSFORMER
- V- VALVE
- WB- WET BULB
- WU- WARM-UP SIGNAL

HVAC SYSTEM LEGEND:

- MOTOR OPERATED DAMPER
- PREHEAT COIL
- COOLING COIL
- REHEAT COIL
- HEATING COIL
- DIRECT EXPANSION COIL
- FAN
- MANUAL VALVE
- DUCT MOUNTED TEMPERATURE & HUMIDITY COMBINED SENSOR
- WATER FLOW SWITCH
- AVERAGING TYPE TEMPERATURE SENSOR
- FILTER
- FIRE & SMOKE DAMPER (BY OTHERS)
- FREESTAT
- DUCT MOUNTED TEMPERATURE SENSOR
- IMMERSION TYPE TEMPERATURE SENSOR
- DUCT MOUNTED SMOKE DETECTOR
- STATIC PRESSURE TRANSMITTER
- PUMP
- DUCT MOUNTED HUMIDITY SENSOR
- ROOM TEMPERATURE
- AIR FLOW MEASURING STATION
- CONTROL RELAY

ENGINEER:-

CONTRACTOR: -

SUBMISSION: MM/DD/YYYY

LEGEND

- Low Voltage, 18 AWG, Copper Wire
- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
- Line Voltage, THHN Field Wiring

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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**

TITLE PAGE

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29	EXISTING FAN COIL UNIT SCHEMATIC DIAGRAM
30	EXISTING FAN COIL UNIT SEQUENCE OF OPERATION
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32	DUCTLESS SPLIT HEAT PUMPS HP-1,2,3/ ACCU-1,2,3 SCHEMATIC & WIRING DIAGRAM
33	VALVE SCHEDULE
34	MASTER BILL OF MATERIAL

LEGEND	----- Low Voltage, 18 AWG, Copper Wire
	----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
	_____ Line Voltage, THHN Field Wiring

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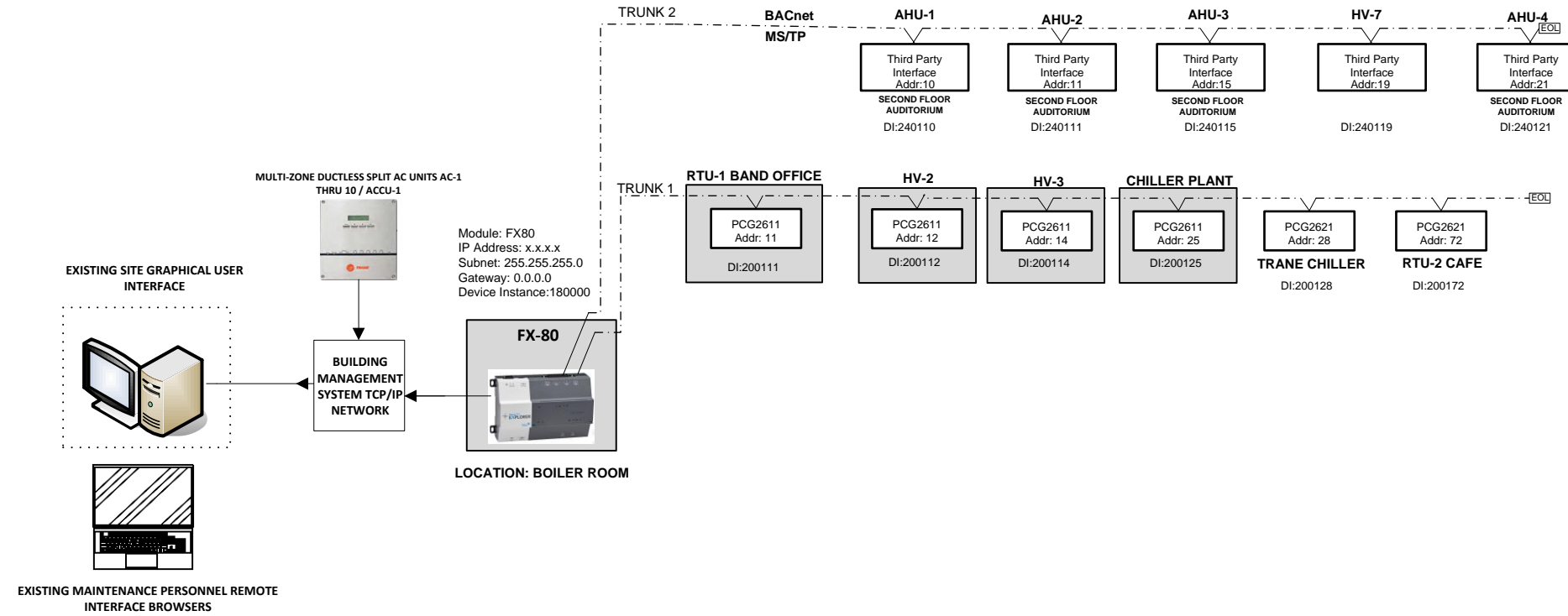
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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**

TABLE OF CONTENT

NETWORK RISER



BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Description	Manufacturer
1	JACE	FX-80	FX-80	1	FX80 Supervisory Controller is a web-based supervisory-class controller	Johnson
2	Device	Device	LP-FXWS-3	1	3-device FX Server license, integration of up to three FX Supervisory Controllers	Johnson
3	Device	Device	FX-SC8CL025-0	1	FX80 Supervisory Controller core device license, 25 field devices, 1,250 points	Johnson
4	Device	Device	FX-SC8DL50-0	1	License enabling an additional 50 field devices, 2,500 points for one FX80	Johnson
5	Device	Device	FX-SC8D100M1-0	1	Initial 1 year software maintenance for FX80 Supervisory Controller with 100-199 field device capacity	Johnson
6	Power Module	PWR	FX-SC8XPS-0	1	FX80 universal wall mount power supply 100-240 VAC/24 V	Johnson
7	Panel	CP-1	SCE-24N2406LP	1	Saginaw, 24"H X 24"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
8	Perforated Subpanel	CP-1	SCE-24N24MP	1	Enclosure, Nema-1	Saginaw

LEGEND

- Low Voltage, 18 AWG, Copper Wire
- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
- Line Voltage, THHN Field Wiring

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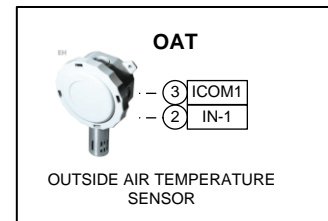
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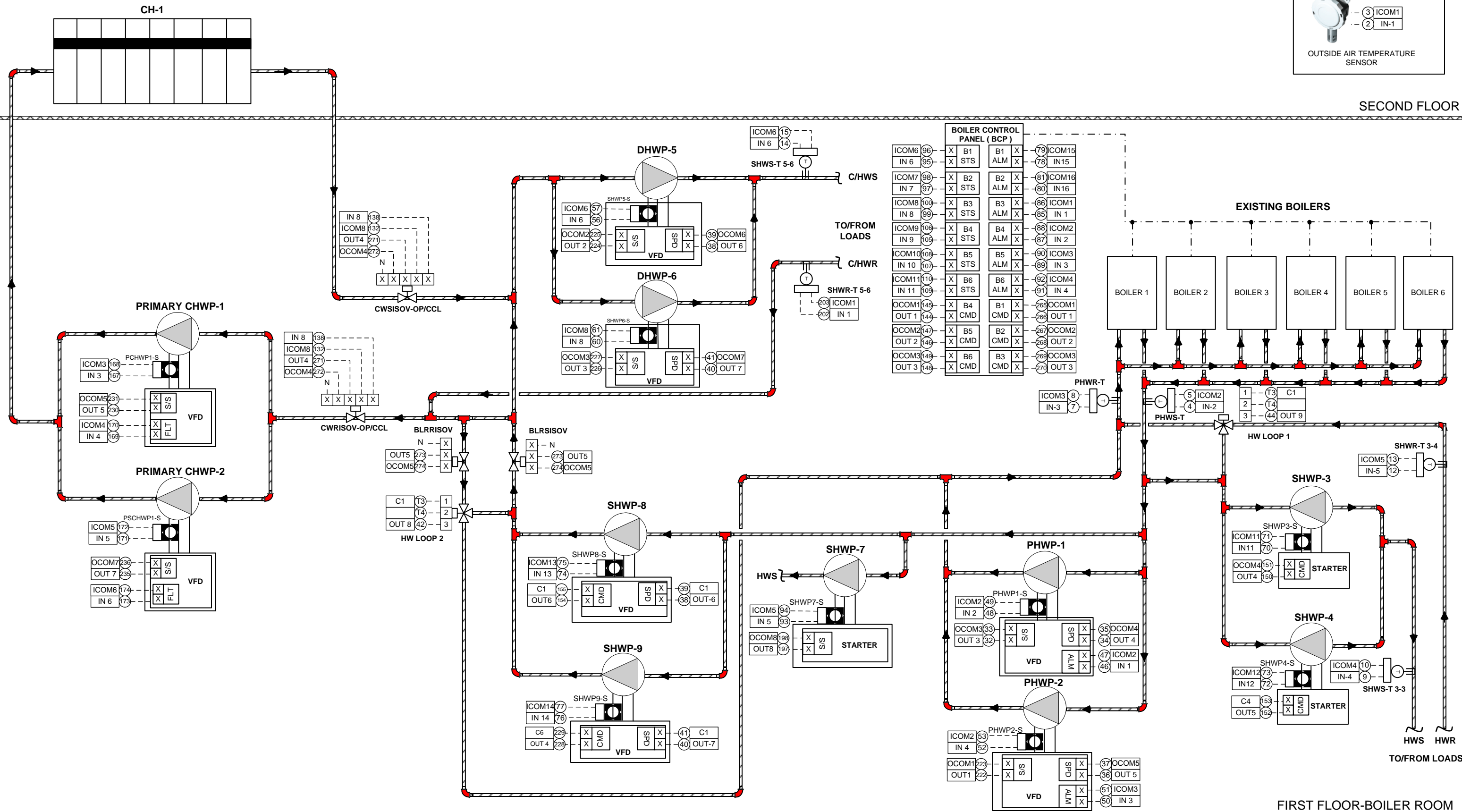
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
NETWORK RISER	
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EAST PLANT SYSTEM CONTROL SCHEMATIC DIAGRAM



SECOND FLOOR



FIRST FLOOR-BOILER ROOM

LEGEND

---	Low Voltage, 18 AWG, Copper Wire
---	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
---	Line Voltage, THHN Field Wiring

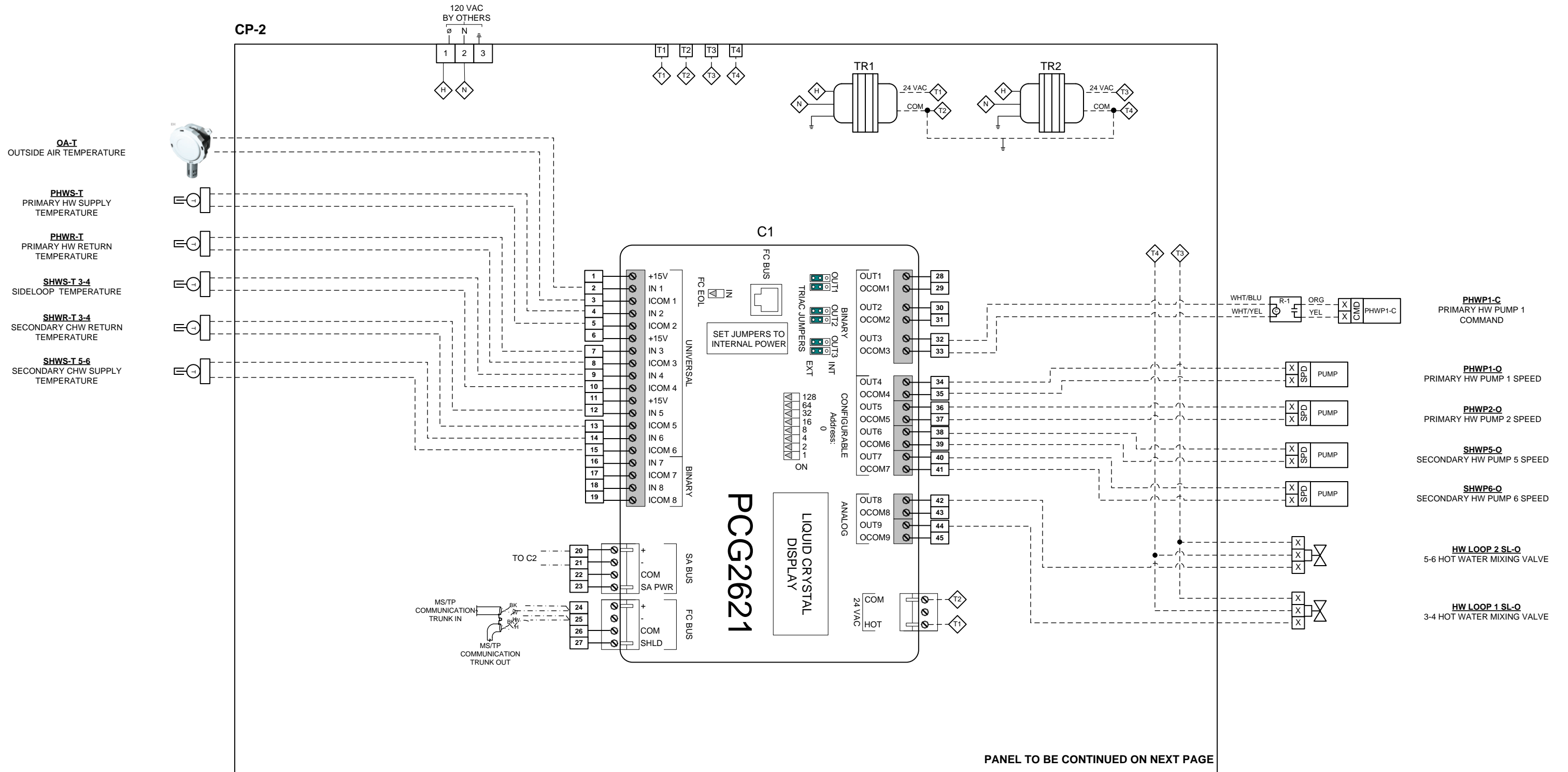
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 1



PANEL LOCATION: BOILER ROOM

LEGEND	Description
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

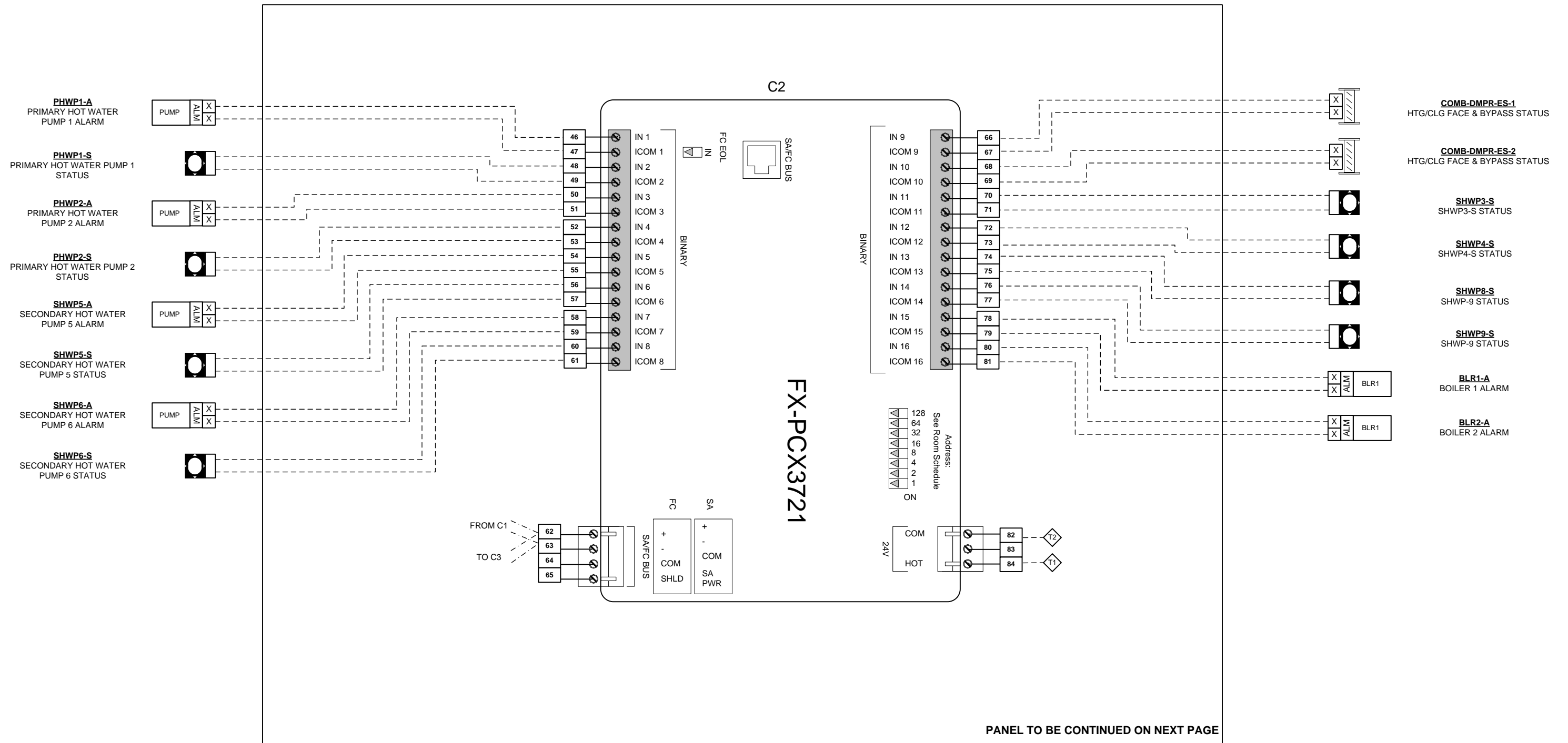
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 2



PANEL LOCATION: BOILER ROOM

LEGEND	-----	Low Voltage, 18 AWG, Copper Wire
	-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring	

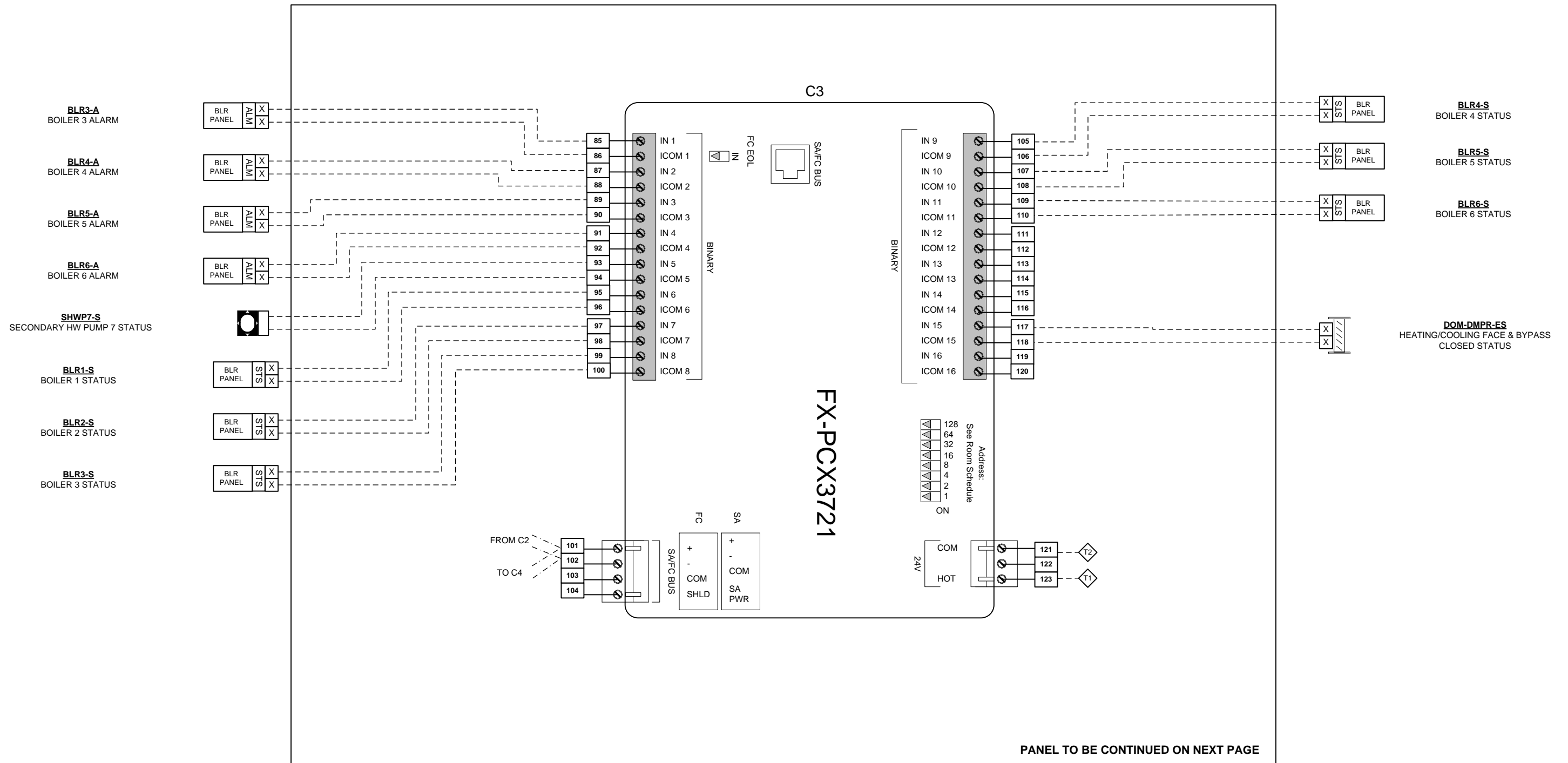
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 3



LEGEND	DESCRIPTION
-----	Low Voltage, 18 AWG, Copper Wire
-.-.-.-.-	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
_____	Line Voltage, THHN Field Wiring

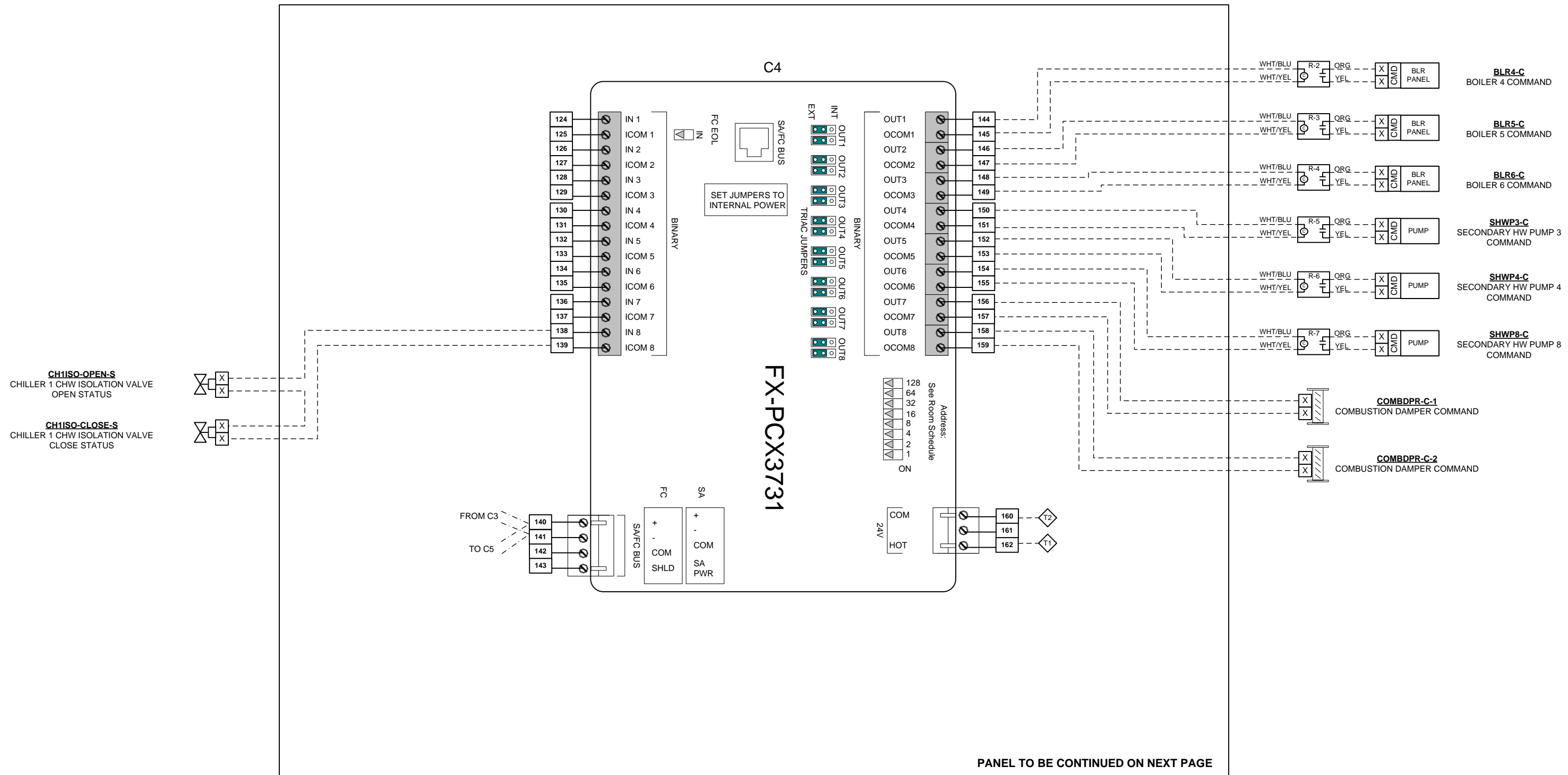
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 4



PANEL LOCATION: BOILER ROOM

LEGEND	---	
	Low Voltage, 18 AWG, Copper Wire	
---	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance	
---	Line Voltage, THHN Field Wiring	

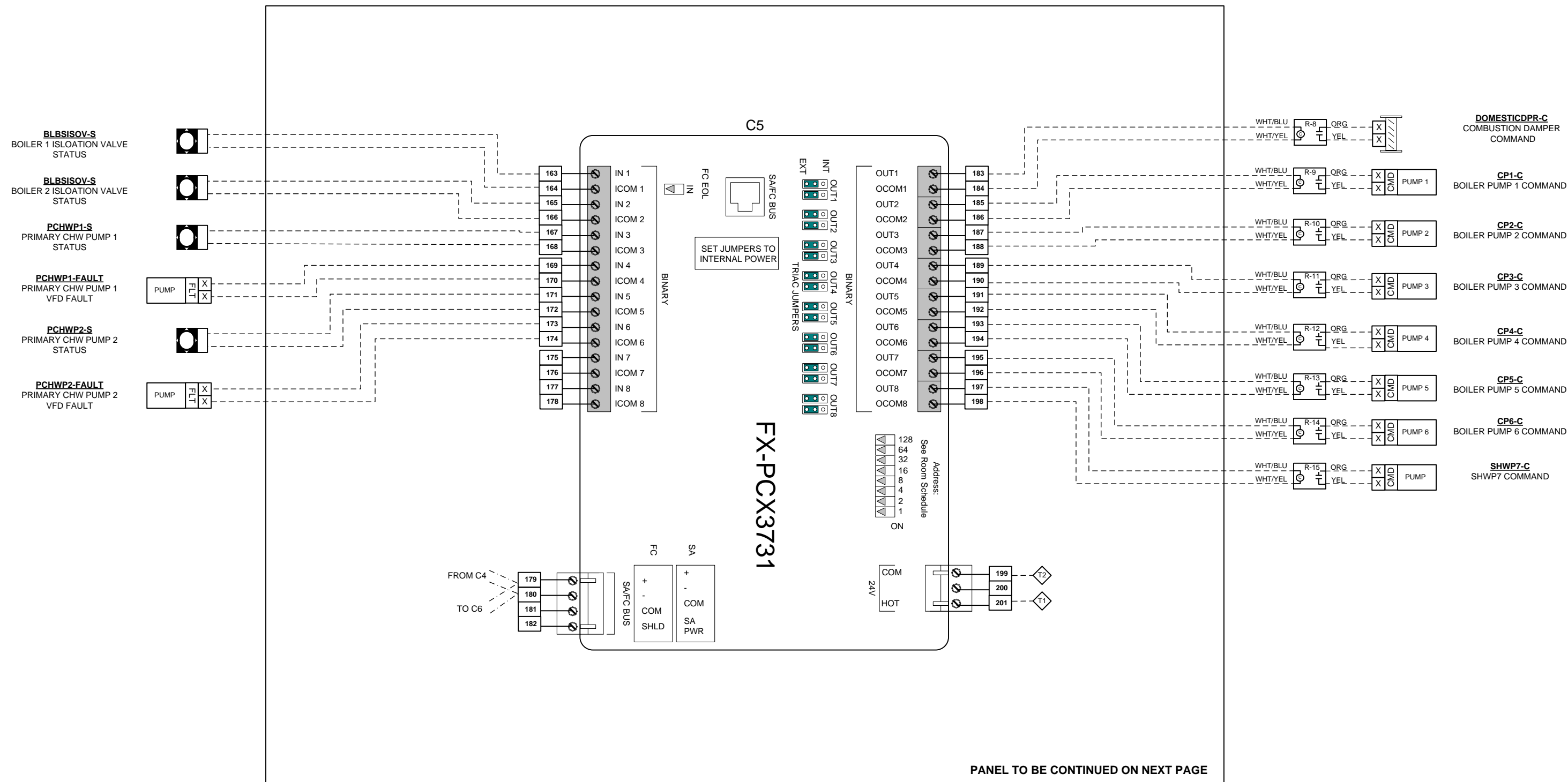
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 5



PANEL LOCATION: BOILER ROOM

PANEL TO BE CONTINUED ON NEXT PAGE

LEGEND	DESCRIPTION
---	Low Voltage, 18 AWG, Copper Wire
---	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
---	Line Voltage, THHN Field Wiring

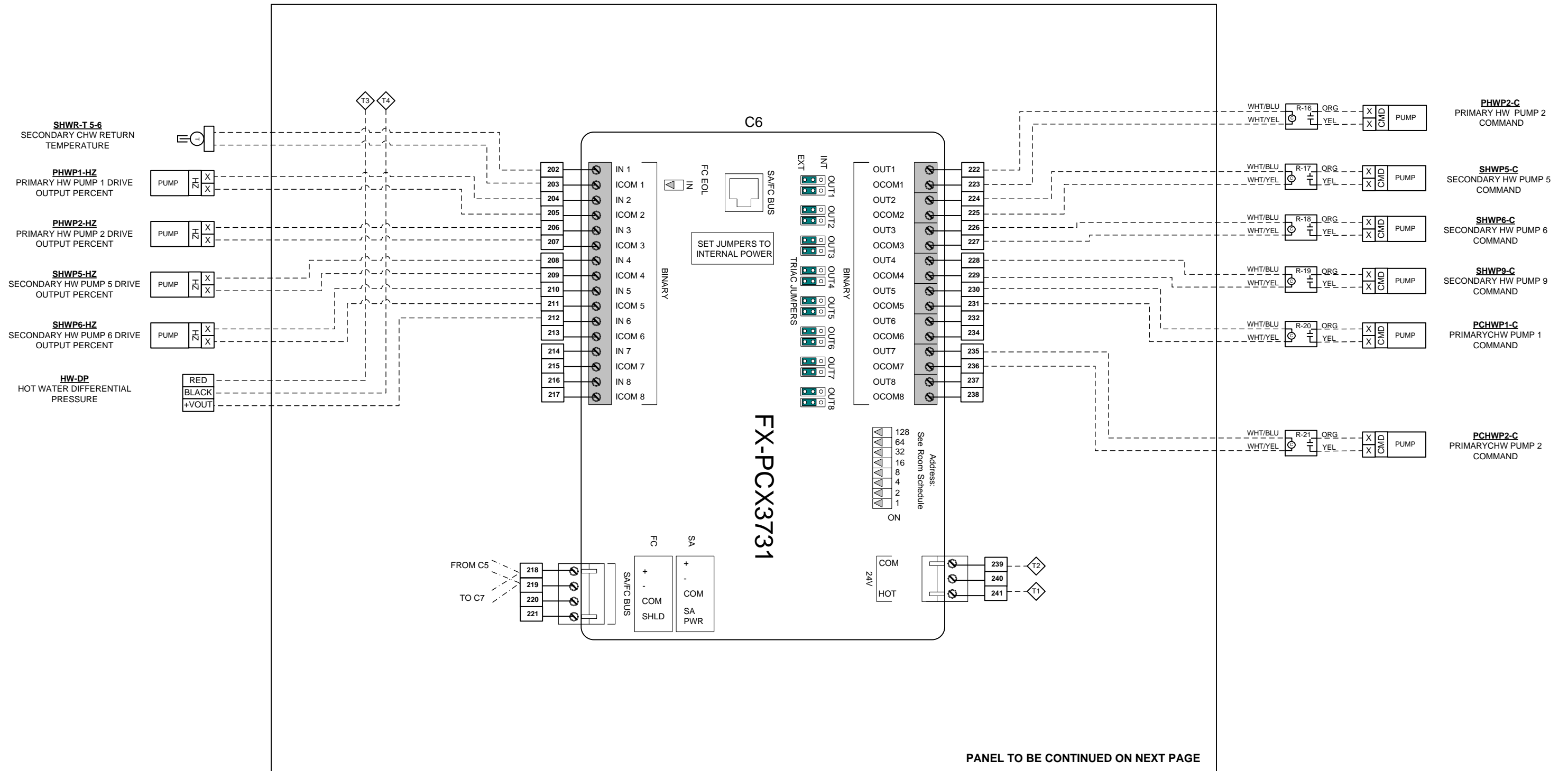
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 6



PANEL LOCATION: BOILER ROOM

PANEL TO BE CONTINUED ON NEXT PAGE

LEGEND	-----	Low Voltage, 18 AWG, Copper Wire
	-.-.-.-.-	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
	_____	Line Voltage, THHN Field Wiring

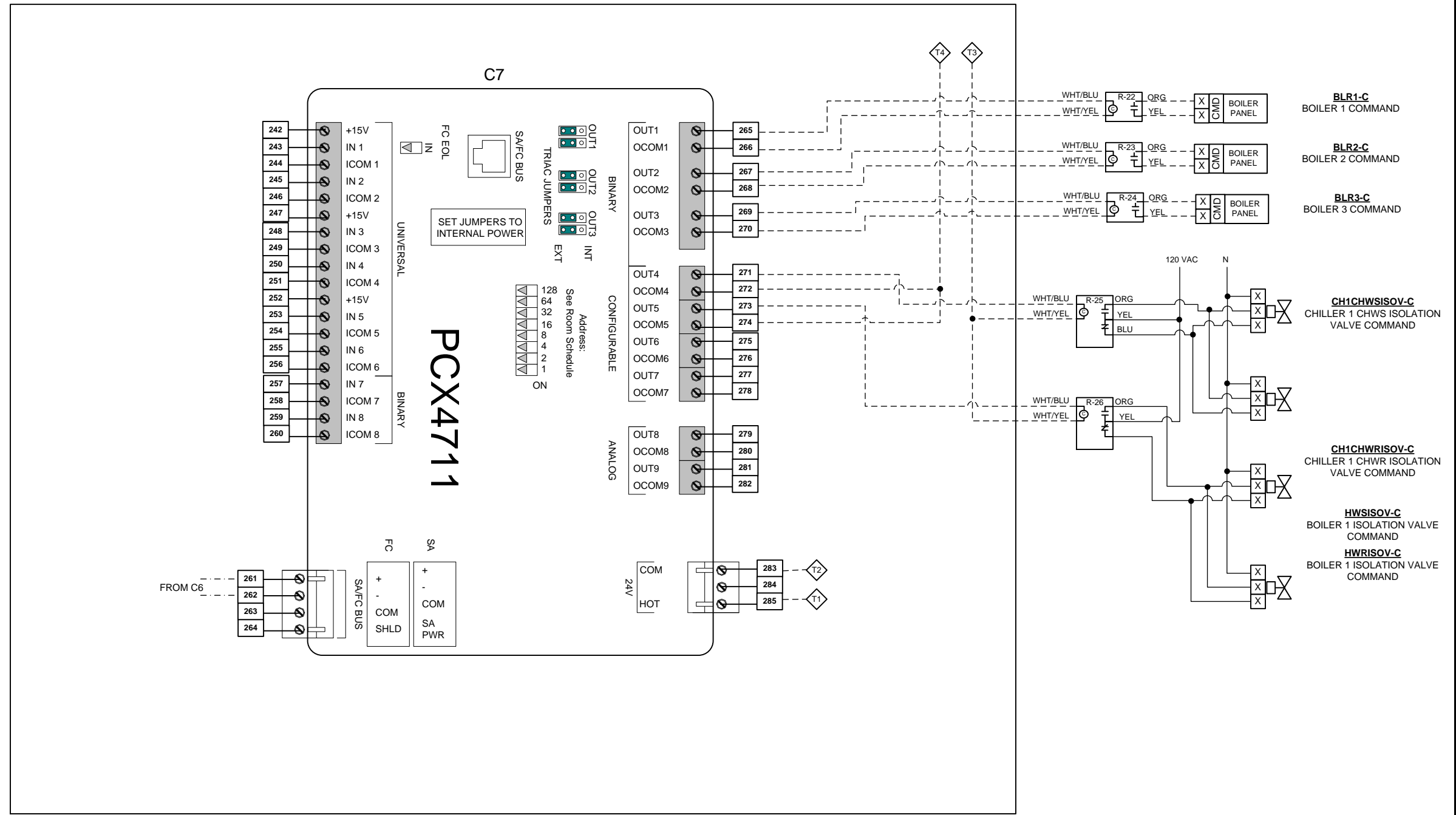
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EAST PLANT SYSTEM WIRING DIAGRAM PAGE 7



LEGEND	---	
	Low Voltage, 18 AWG, Copper Wire	
---	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance	
---	Line Voltage, THHN Field Wiring	

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EAST PLANT SYSTEM SEQUENCE OF OPERATION

SEQUENCE OF OPERATION : DUAL TEMPERATURE - CENTRAL PLANT CONTROL

A. CENTRAL PLANT - HEATING / COOLING MODE SELECTION:

1. THE SYSTEM SHALL BE PLACED IN THE HEATING OR COOLING MODE THROUGH:
 - A. THE SUPERVISORY NETWORK CONTROLLER (SNC) OR
 - B. A MODE OF OPERATION SELECTOR SWITCH (WINTER-AUTO-SUMMER) MOUNTED ON THE DUAL TEMPERATURE CONTROL PANEL DOOR.

B. DUAL TEMPERATURE WATER PUMP CONTROL

1. START AND STOP COMMANDS
 - A. THE DUAL TEMPERATURE WATER PUMP (DTWP) SHALL START WHEN THE SYSTEM IS ENABLED IN EITHER THE COOLING MODE OR THE HEATING MODE.
 - B. THE DUAL TEMPERATURE WATER PUMP (DTWP) SHALL NOT OPERATE UNTIL THE ISOLATION VALVES ARE IN THE ASSOCIATED MODE POSITION, AS PROVEN OPEN BY THEIR END-SWITCH (ISOES).
 - C. THE DUAL TEMPERATURE WATER PUMP (DTWP) SHALL STOP DURING A SYSTEM CHANGEOVER EVENT, OR 30 MINUTES AFTER THE DUAL TEMPERATURE SYSTEM IS COMMANDED OFF.

2. PUMP LEAD / LAG CONTROL:

- A. IF THE DUAL TEMPERATURE WATER PUMP (DTWP) FAILS TO OPERATE AFTER A DELAY OF 30 SECONDS; THE LAG DUAL TEMPERATURE WATER PUMP (DTWP) SHALL BE COMMANDED TO START; THE LEAD DUAL TEMPERATURE WATER PUMP (DTWP) SHALL BE COMMANDED TO STOP.

B. ALARMING:

- 1) WHEN A DUAL TEMPERATURE WATER PUMP FAILS TO OPERATE, AN ALARM SHALL BE SENT TO THE GUI & LOCALLY (BOILER SPACE) AUDIBLE/VISUAL ALARM SHALL INDICATE A PUMP FAILURE.

3. PUMP ROTATION:

- A. THE LEAD DUAL TEMPERATURE WATER PUMP (DTWP) SHALL BE ROTATED: EVERY 168 HOURS OF ACCUMULATED RUN TIME OR FROM A MANUAL SELECTION SWITCH ON THE GUI.
- B. THE ATC CONTRACTOR SHALL ALSO PROVIDE THE FOLLOWING HARDWIRE WIRING CONTROL:
 - 1) START/STOP COMMAND (DTWPSS)
 - 2) PUMP STATUS (DTPCS)

C. CHILLED WATER PUMP CONTROL (P-10 & P-11)

1. START AND STOP COMMANDS

- A. THE CHILLED WATER PUMP SHALL START WHEN THE SYSTEM IS ENABLED IN THE COOLING MODE.
- B. THE CHILLED WATER PUMP (CHWP) SHALL NOT OPERATE UNTIL THE ISOLATION VALVES ARE IN THE ASSOCIATED MODE POSITION, AS PROVEN OPEN BY THEIR END-SWITCH (ISOES).
- C. THE CHILLED WATER PUMP (CHWP) SHALL STOP DURING A SYSTEM CHANGEOVER EVENT, OR 30 MINUTES AFTER THE CHILLED WATER SYSTEM IS COMMANDED OFF.

2. PUMP LEAD / LAG CONTROL:

- A. IF THE CHILLED WATER PUMP (CHWP) FAILS TO OPERATE AFTER A DELAY OF 30 SECONDS; THE LAG CHILLED WATER PUMP (CHWP) SHALL BE COMMANDED TO START; THE LEAD CHILLED WATER PUMP (CHWP) SHALL BE COMMANDED TO STOP.

B. ALARMING:

- 1) WHEN A CHILLED WATER PUMP (CHWP) FAILS TO OPERATE, AN ALARM SHALL BE SENT TO THE GUI & LOCALLY (INBOILER SPACE) AUDIBLE/VISUAL ALARM SHALL INDICATE A PUMP FAILURE.

3. PUMP ROTATION:

- A. THE LEAD CHILLED WATER PUMP (CHWP) SHALL BE ROTATED: EVERY 168 HOURS OF ACCUMULATED RUN TIME OR FROM A MANUAL SELECTION SWITCH ON THE GUI.
- B. THE ATC CONTRACTOR SHALL ALSO PROVIDE THE FOLLOWING HARDWIRE WIRING CONTROL:
 - 1) START/STOP COMMAND (CHWPSS)
 - 2) PUMP STATUS (CHWPCS)

E. MODE SELECTION:

1. HEATING MODE ENABLE:

- A. THE HEATING MODE WILL BE ENABLED WHEN:
 - 1) THE OUTSIDE AIR TEMPERATURE (OAT) IS < 58 °F (ADJ.) (HWENBSP) OR
 - 2) THE OUTSIDE AIR TEMPERATURE (OAT) IS < 72 °F (ADJ.) & THE BUILDING IS "OCCUPIED".
- B. THE HEATING MODE WILL BE NOT BE ENABLED WHEN:
 - 1) THE OUTSIDE AIR TEMPERATURE (OAT) IS >60°F(ADJ.)(HWENBSP) & THE BUILDING IS "UNOCCUPIED" OR
 - 2) THE OUTSIDE AIR TEMPERATURE (OAT) IS > 65 °F (ADJ.).

C. WHEN THE SYSTEM IS IN THE HEATING MODE:

- 1) THE BOILER CONTROL PANEL SHALL BE ENABLED AND OPERATE THROUGH ITS INTEGRAL OPERATING & SAFETY CONTROLS.
- 2) THE SELECTED LEAD DTWP SHALL START & RUN CONTINUOUSLY

2. COOLING MODE ENABLE:

- A. THE COOLING MODE WILL BE ENABLED WHEN:
 - 1) THE OUTSIDE AIR TEMPERATURE IS >70°F(ADJ.)(CHENBSP) & THE BUILDING IS "OCCUPIED".
- B. THE COOLING MODE WILL BE NOT BE ENABLED WHEN:
 - 1) THE BUILDING IS "UNOCCUPIED" OR
 - 2) THE OUTSIDE AIR TEMPERATURE (OAT) IS < 65 °F (ADJ.).

C. WHEN THE SYSTEM IS IN THE COOLING MODE:

- 1) THE CHILLER SHALL BE ENABLED AND OPERATE THROUGH ITS INTEGRAL OPERATING & SAFETY CONTROLS.
- 2) THE SELECTED LEAD CHWP SHALL START & RUN CONTINUOUSLY

F. SYSTEM CHANGE OVER:

1. COOLING TO HEATING:

- A. WHEN THE SYSTEM IS PLACED IN THE HEATING MODE:
 - 1) THE CHILLER SHALL NOT BE "ENABLED":
 - 2) THE DUAL TEMPERATURE WATER PUMP SHALL CONTINUE TO RUN.
 - 3) AFTER 30 MINUTES:
 - A) THE DUAL TEMPERATURE WATER PUMP (DTWP) SHALL STOP.
 - B) THE SYSTEM ISOLATION VALVES SHALL POSITION TO CLOSE THE SYSTEM TO CHILLER & OPEN THE SYSTEM ISOLATION VALVES PROVIDE FLOW TO THE HOT WATER BOILERS.
 - 4) WHEN THE BOILER ISOLATION VALVES ARE PROVEN OPEN & CHILLER ISOLATION VALVES ARE PROVEN CLOSED, VIA END-SWITCHES, THE DUAL TEMPERATURE WATER PUMP SHALL START.

2. HEATING TO COOLING:

- A. WHEN THE SYSTEM IS PLACED IN THE COOLING MODE:
 - 1) THE BOILER CONTROL PANEL SHALL NOT BE "ENABLED":
 - 2) THE CHILLED WATER PUMP (CHWP) SHALL CONTINUE TO RUN.
 - 3) THE RETURN WATER SAFETY THERMOSTAT LOCATED IN THE COMMON DUAL TEMPERATURE WATER RETURN SYSTEM PIPING SHALL PREVENT THE SYSTEM FROM CHANGING OVER TO THE COOLING MODE UNTIL THE RETURN WATER TEMPERATURE IS < ITS SETTING OF 80 °F.
 - 4) ONCE THIS CONDITION IS MET:
 - A) THE CHILLED WATER PUMP (CHWP) SHALL STOP.
 - B) THE SYSTEM ISOLATION VALVES SHALL POSITION TO CLOSE THE SYSTEM TO THE HOT WATER BOILERS & OPEN THE SYSTEM ISOLATION VALVES PROVIDE FLOW TO THE CHILLER.
 - 5) WHEN THE CHILLER ISOLATION VALVES ARE PROVEN OPEN AND THE BOILER ISOLATION VALVES AND PROVEN CLOSED, VIA THEIR END-SWITCHES, THE CHILLED WATER PUMP SHALL START.

G. TEMPERATURE CONTROL

1. HEATING MODE:

- A. THE TEMPERATURE SETPOINT OF THE HOT WATER BEING SUPPLIED TO THE DUAL TEMPERATURE SYSTEM SHALL BE VARIED INVERSELY WITH THE OUTSIDE AIR TEMPERATURE BY A FULLY ADJUSTABLE BACNET DDC CONTROLLER LOCATED IN THE BOILER ROOM CONTROL CENTER.
- B. THE TEMPERATURE SETPOINT OF THE SYSTEM SHALL BE INITIALLY SCHEDULED TO BE 180 °F AT 0 °F OUTSIDE AIR TEMPERATURE & 100 °F AT 65 °F OUTSIDE AIR TEMPERATURE.
- C. THE BOILER CONTROL PANEL DDC CONTROLLER SHALL STAGE THE INDIVIDUAL BOILERS TO MAINTAIN DESIRED HOT WATER TEMPERATURE.
- D. THE BMS SHALL ALSO HAVE HARDWIRED CONTROL POINTS FOR ENABLE, SETPOINT AND STATUS.

2. COOLING MODE:

- A. THE TEMPERATURE SETPOINT OF THE SYSTEM SHALL BE INITIALLY SCHEDULED TO BE 50 °F (ADJ).
- B. THE CHILLER'S CONTROLLER SHALL CONTROL TO THE DESIRED SUPPLY TEMPERATURE UNDER ITS INTEGRAL OPERATING CONTROLS.
- C. THE BMS SHALL BE INTEGRATED TO SEND/RECEIVE CONTROL, ALARM AND TRENDING I/O POINTS AND PARAMETERS.
- D. THE BMS SHALL ALSO HAVE HARDWIRED CONTROL POINTS FOR ENABLE, CHILLER SETPOINT AND STATUS.

LEGEND

-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
_____	Line Voltage, THHN Field Wiring

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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**

EAST PLANT SYSTEM SEQUENCE OF OPERATION

Job No. ##

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EAST PLANT SYSTEM BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Description	Manufacturer
1	Programmable Controller	C1	FX-PCG2611-0	1	17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC	Johnson
2	Expansion IO module	IO-#	FX-PCX3721-0	2	16-Point Expansion I/O Module with 16 BI, FC, and SA Bus Support	Johnson
3	Expansion IO module	IO-#	FX-PCX3731-0	2	16-Point Expansion I/O Module with 8 BI, 8 BO, FC, and SA Bus Support	Johnson
4	Expansion IO module	IO-#	FX-PCX4711-0	2	17-Point Expansion I/O Module with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, FC, and SA Bus Support	Johnson
5	Outside Air Temperature	OAT/H	A/CP-O-EH	1	10K Type II , CP Outside Air Sensor, 14" Leads, Euro Housing	ACI
6	Immersion Temperature Sensor	TS-1 THRU 6	A/CP-I-6"-PB	6	Immersion 10 kΩ type II thermistor with stainless well and 6" insertion	ACI
7	Wet differential pressure sensor	DPT-1	629-05-CH-P2-E5-S3	1	Wet/wet differential pressure transmitter, range 100 psid, working pressure 200 psi	Dwyer
8	Current Switch	CS-1 THRU 13	RIBXGF	13	Split Core Current Switch- .35 to 150 Amperes	Functional Devices
9	Field Mounted Relay	R-1 THRU 26	RIBU1C	26	Universal RIB Relay	Functional Devices
10	Transformer	TR1	APT-100-5SB	2	MULTI-TAP 24 Vac Control Transformer - 100VA	Dwyer
11	Panel	CP-2	SCE-30N2406LP	1	Saginaw, 30"H X 24"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
12	Perforated Subpanel	CP-2	SCE-30N24MP	1	Enclosure, Nema-1	Saginaw

LEGEND

-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
_____	Line Voltage, THHN Field Wiring

0	MM/DD/YYYY	Submitted for Approval	ICT
NO.	DATE	REVISION	BY

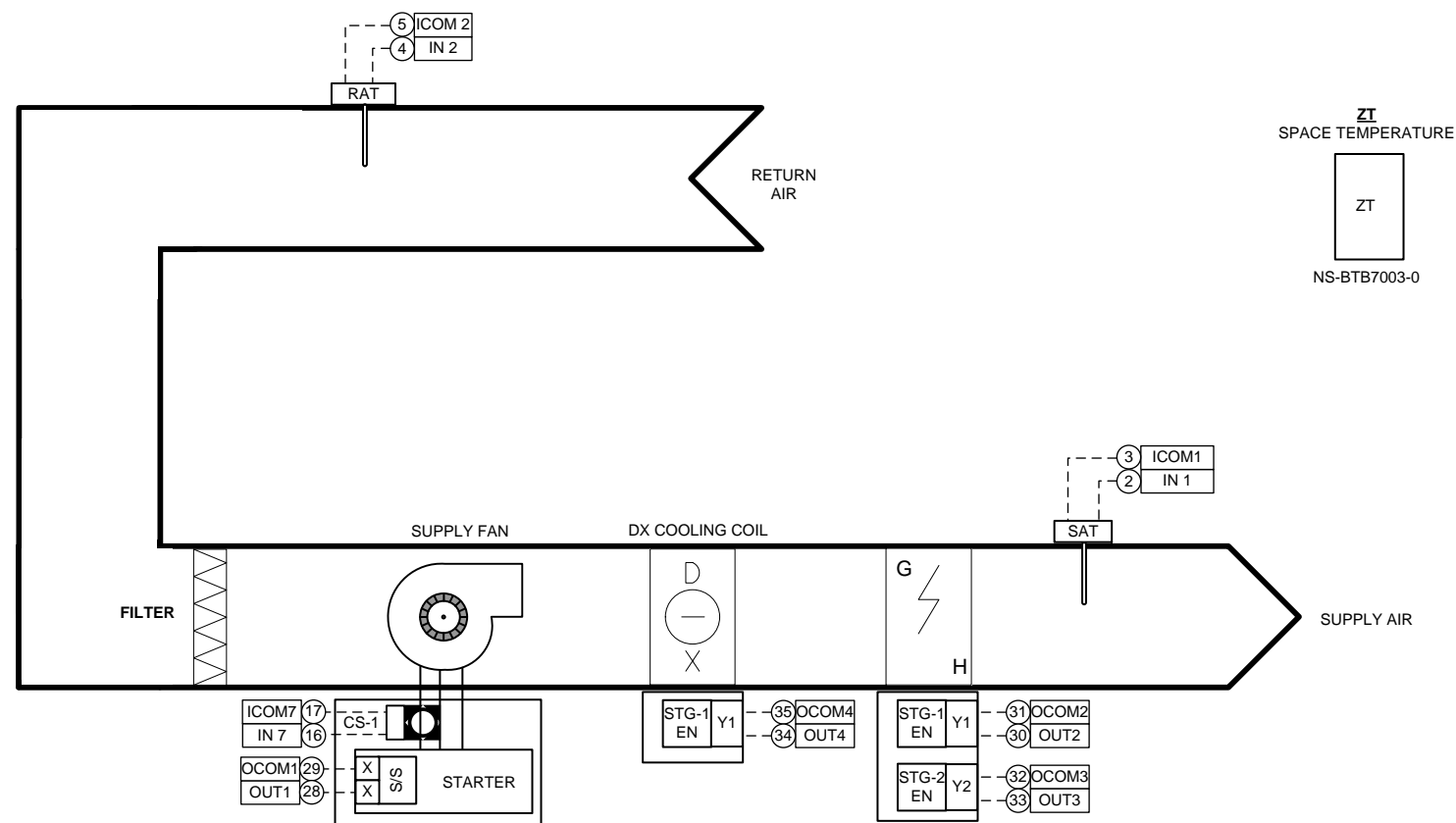


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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EAST PLANT SYSTEM BILL OF MATERIAL	
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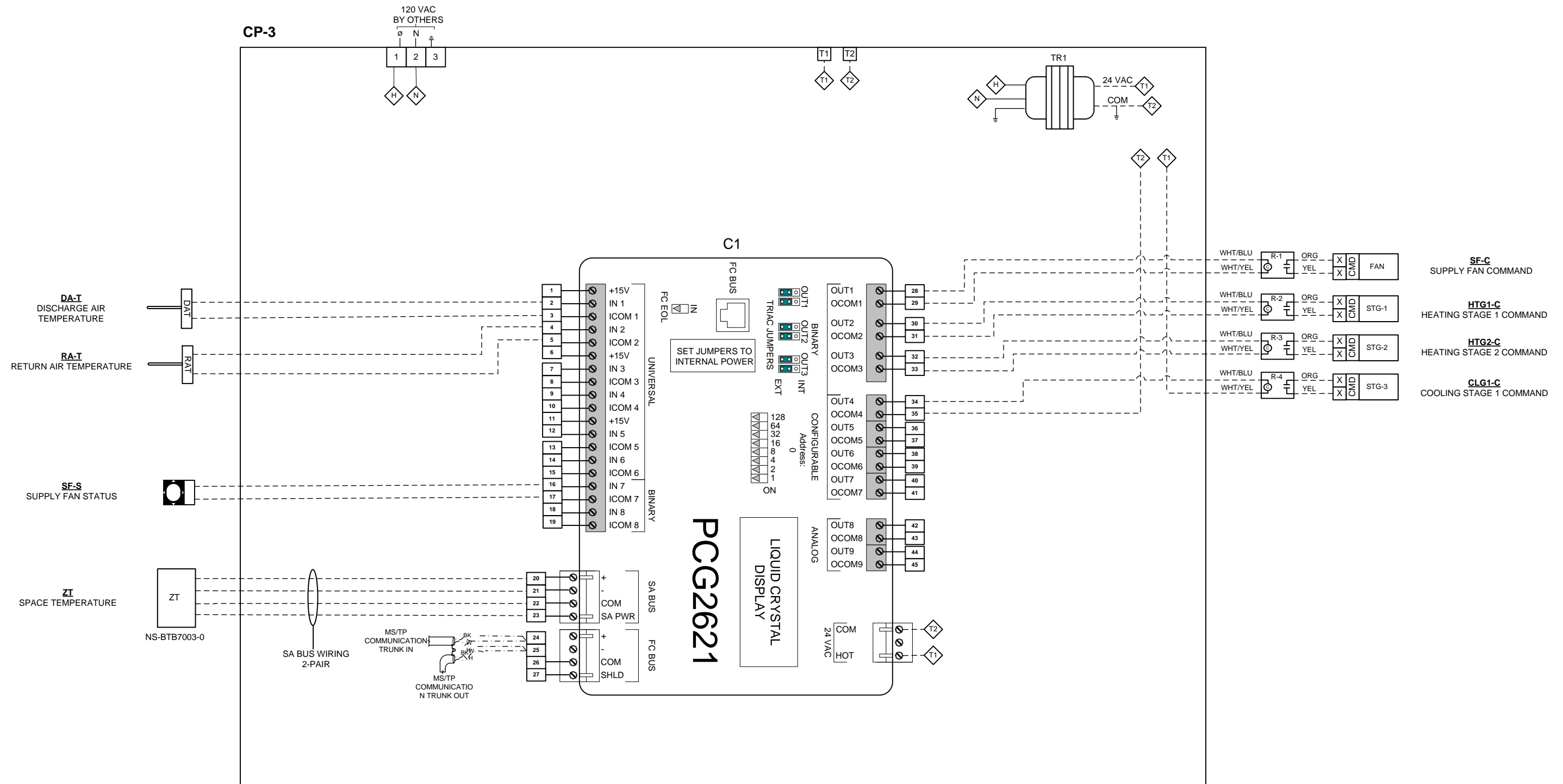
RTU-1 BAND OFFICE SCHEMATIC DIAGRAM



**SEQUENCE OF OPERATION:
ROOF TOP UNIT - 1 - NATURAL GAS HEATING & DIRECT EXPANSION COOLING**

1. THE UNIT SHALL BE CONTROL AS DETAILED IN THE UNIT MANUFACTURERS EQUIPMENT CONTROL SUBMITTAL.
2. THE ATC CONTRACTOR SHALL INTEGRATE WITH THE UNIT AND PROVIDE CONTROL, MONITORING AND ALARMING TO THE BMS SYSTEM.

RTU-1 BAND OFFICE WIRING DIAGRAM



LEGEND	DESCRIPTION
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
RTU-1 BAND OFFICE WIRING DIAGRAM	
Job No. ##	Page 15 of 34


RTU-1 BAND OFFICE BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Description	Manufacturer
1	Programmable Controller	C1	FX-PCG2611-0	1	17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC	Johnson
2	Discharge Air Temperature Sensor	DAT, RAT	A/CP-D-12-PB	2	Thermistor, Duct, 10K Ω (Type II), 12", Plastic Box	ACI
3	Space Temperature Sensor	ZT	NS-BTB7003-0	1	NS Series network sensor with LCD	Johnson
4	Guard		BA/BG	1	Larger BAPI-Guard Thermostat Protector	Bapi
5	Current Switch	CS-1	RIBXGF	1	Split Core Current Switch- .35 to 150 Amperes	Functional Devices
6	Field Mounted Relay	R-1	RIBU1C	1	Universal RIB Relay	Functional Devices
7	Transformer	TR1	APT-75-5SB	1	MULTI-TAP 24 Vac Control Transformer - 75VA	Dwyer
8	Panel	CP-3	SCE-16N1606LP	1	Saginaw, 16"H X 16"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
9	Perforated Subpanel	CP-3	SCE-16N16MP	1	Enclosure, Nema-1	Saginaw

LEGEND

----- Low Voltage, 18 AWG, Copper Wire
 - - - - - Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
 _____ Line Voltage, THHN Field Wiring

0	MM/DD/YYYY	Submitted for Approval	ICT
NO.	DATE	REVISION	BY

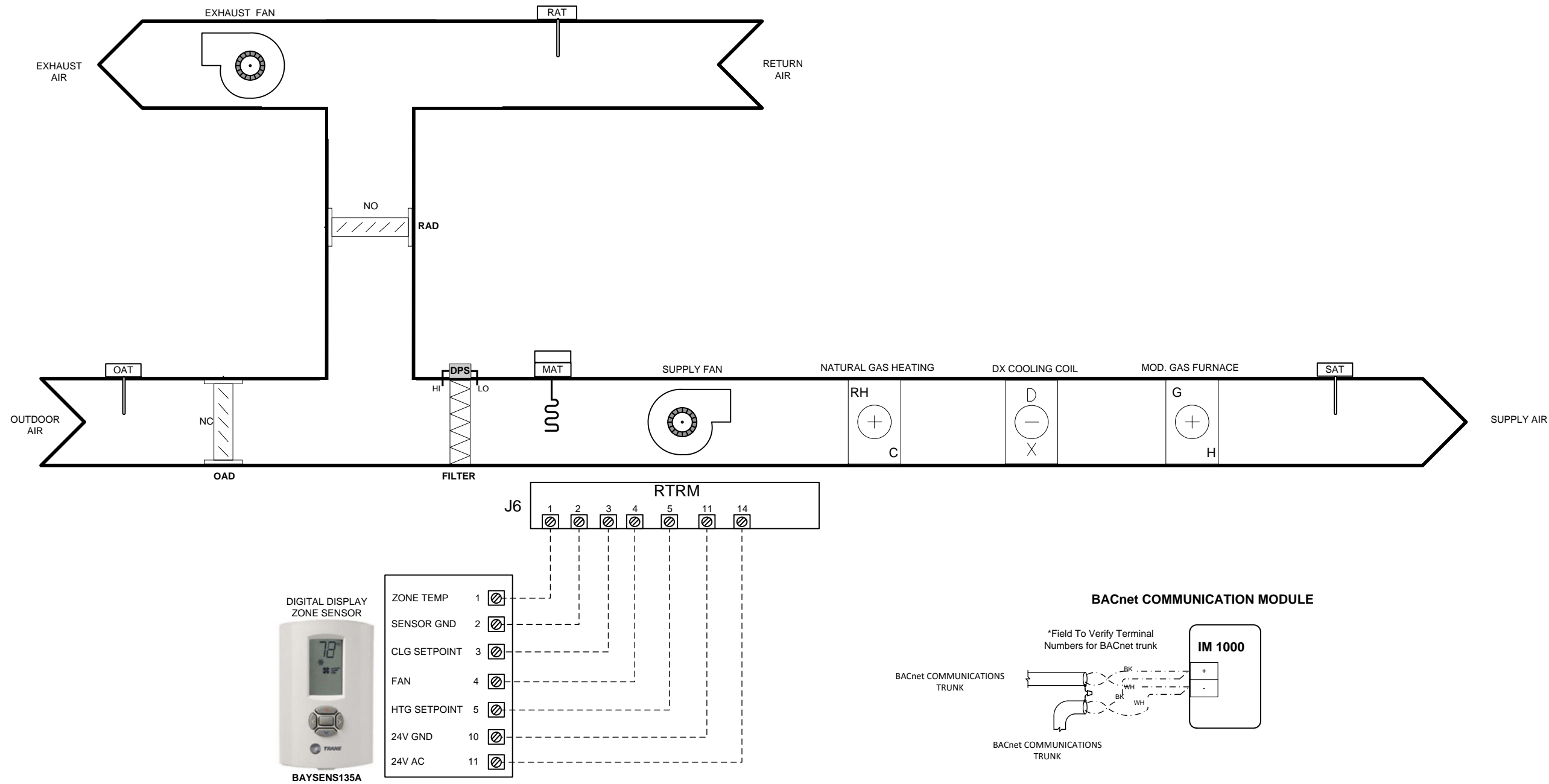


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RTU-1 BAND OFFICE BILL OF MATERIAL

PACKAGED RTU-2 SCHEMATIC & WIRING DIAGRAM



LEGEND	DESCRIPTION
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

NO.	DATE	REVISION	BY
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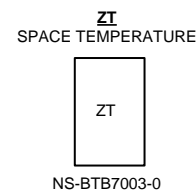
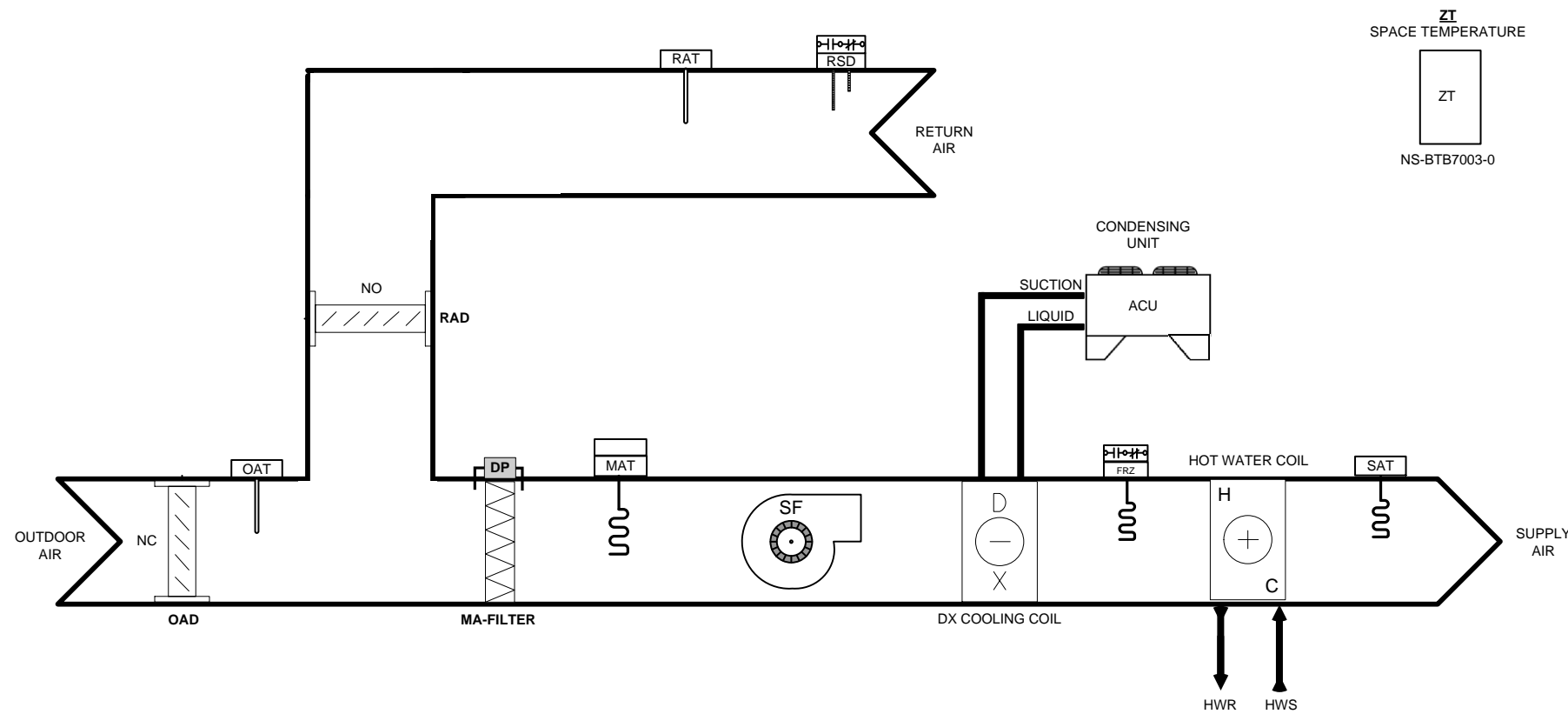
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
PACKAGED RTU-2 SCHEMATIC & WIRING DIAGRAM	
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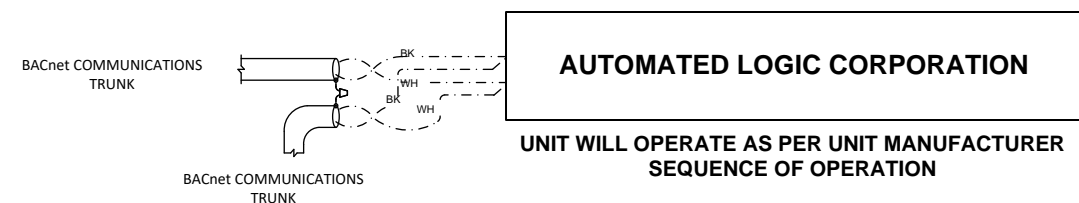
PACKAGED AHU-1 THRU 4 & ACU-1 THRU 4 SCHEMATIC & FIELD WIRING DIAGRAM

TYPICAL OF 4



SCHEDULE

ITEM #	TAG	LOCATION	SERVICE LOCATION	MECH. DWG
1	AHU-1	SECOND FLOOR	AUDITORIUM	M204
2	AHU-2	SECOND FLOOR	AUDITORIUM	M204
3	AHU-3	SECOND FLOOR	AUDITORIUM	M204
4	AHU-4	SECOND FLOOR	AUDITORIUM	M204



BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Description	Manufacturer
1	Discharge Air Temperature Sensor	DAT, RAT	A/CP-D-12-PB	8	Thermistor, Duct, 10K Ω (Type II), 12", Plastic Box	ACI
2	Space Temperature Sensor	ZT	NS-BTB7003-0	4	NS Series network sensor with LCD	Johnson
3	Guard		BA/BG	4	Larger BAPI-Guard Thermostat Protector	Bapi
4	Freezestat	FRZ	A11D	4	SPST,Open Low ,Manual Reset	Johnson

LEGEND	
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
PACKAGED AHU-1 THRU 4 & ACU-1 THRU 4 SCHEMATIC & FIELD WIRING DIAGRAM	
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PACKAGED AHU-1 THRU 4 & ACU-1 THRU 4 SEQUENCE OF OPERATION PAGE 1

SEQUENCE OF OPERATION :

AIR HANDLING UNIT 1 THRU 4 – HOT WATER & DIRECT EXPANSION COOLING (DX)

A. REFERENCE THE PROJECT DRAWINGS, ATC DIAGRAMS FOR AIR HANDLING UNIT CONFIGURATION, ATC DEVICES, POINT TYPES & LOCATIONS

B. COORDINATION:

1. THE MECHANICAL CONTRACTOR (MC) SHALL PROVIDE COORDINATION BETWEEN THE AIR HANDLING UNIT MANUFACTURER (UM) & THE ATC CONTRACTOR (ATC) FOR A COMPLETE INTEGRATED SYSTEM
2. THE ATC CONTRACTOR (ATC) SHALL PROVIDE, FIELD INSTALL & WIRE A BACNET DDC CONTROLLER, CONTROL VALVES, SENSORS, RELAYS, STATUS SENSORS & DAMPERS ACTUATORS.

C. SCHEDULING

1. THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT'S BACNET MS/TP DDC CONTROLLER AS ESTABLISHED IN THE GUI.
2. THE AIR HANDLING UNIT SHALL REMAIN IN THE "UNOCCUPIED" MODE UNTIL THE SUPPLY FANS STATUS HAS BEEN PROVEN TO BE ON BY THE SUPPLY FAN CURRENT SWITCH (CS).

D. SPACE TEMPERATURE SENSOR (TS)

1. THE SPACE TEMPERATURE SENSORS (TS) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (TS) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE LED SHALL LIGHT & THE UNIT SHALL BE SCHEDULED INTO THE "OCCUPIED" MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE
2. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 74 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

E. "UNOCCUPIED" MODE:


1. WHEN THE AIR HANDLING UNIT IS SCHEDULED IN THE "UNOCCUPIED" MODE; THE AIR HANDLING UNIT'S SUPPLY FAN AND ANY ASSOCIATED EXHAUST FANS SHALL BE OFF; THE OUTSIDE DAMPERS (OAD) SHALL BE CLOSED & THE RETURN DAMPER (RAD) SHALL BE OPEN; THE DIRECT EXPANSION COOLING (DX) SHALL BE OFF.
 - A. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS > 45 °F, THE HOT WATER COIL CONTROL VALVE (HWV) BE CLOSED TO THE COIL.
 - B. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS < 48 °F, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL MODULATE TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F.
2. "UNOCCUPIED COOLING" MODE:
 - A. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS > THE "UNOCCUPIED COOLING" SETPOINT (UCSP) OF 85 °F (ADJ.) & CONDITIONAL USE OF MECHANICAL COOLING AIR CONDITIONS IS ALLOWED, THE AIR HANDLING UNIT'S SUPPLY FAN SHALL START. ANY ASSOCIATED EXHAUST FANS SHALL REMAIN OFF.
 - B. WHEN THE SUPPLY FAN HAS BEEN PROVEN ON BY THE SUPPLY FAN CURRENT SWITCH (CS), THE DIRECT EXPANSION COOLING (DX) SHALL BE SEQUENCED ON TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 55 °F.
 - C. WHEN THE SPACE TEMPERATURE (TS) IS < THE "UNOCCUPIED COOLING" SETPOINT (UCSP) HYSTERESIS, THE DIRECT EXPANSION COOLING (DX) SHALL BE SEQUENCED OFF, THE AIR HANDLING UNIT'S SUPPLY FAN SHALL STOP.
 - D. THE OWNER SHALL HAVE THE ABILITY TO DISABLE THIS FEATURE VIA SOFTWARE.
3. "UNOCCUPIED HEATING" MODE:
 - A. WHEN ANY SPACE TEMPERATURE SENSOR (TS) IS < THE "UNOCCUPIED HEATING" SETPOINT (UHSP) OF 60 °F (ADJ.), THE AIR HANDLING UNIT'S SUPPLY FAN SHALL START. ANY ASSOCIATED EXHAUST FANS SHALL REMAIN OFF.
 - B. WHEN THE SPACE TEMPERATURE (TS) IS > THE "UNOCCUPIED HEATING" SETPOINT (UHSP) HYSTERESIS, THE AIR HANDLING UNIT'S SUPPLY FAN SHALL STOP.

F. "OCCUPIED" CONTROL MODE:

1. WHEN THE AIR HANDLING UNIT IS SCHEDULED IN THE "OCCUPIED" MODE THE AIR HANDLING UNIT SUPPLY FAN AND ANY ASSOCIATED EXHAUST FANS SHALL START & RUN CONTINUOUSLY. THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL OPEN TO THE MINIMUM OUTSIDE AIR SETTING (ADJ.) (OAMINSP).
 - A. UPON THE TRANSITION OF THE AIR HANDLING UNIT TO "OCCUPIED" MODE, A 10 MINUTE RAMP SHALL BE IMPLEMENTED BEFORE THE OUTSIDE DAMPERS (OAD) CAN GO FULLY OPEN.
2. MORNING "WARM-UP" MODE:
 - A. THE AIR HANDLING UNIT SHALL BE PLACED IN "WARM-UP" MODE WHEN THE SPACE TEMPERATURE (TS) IS > 5 °F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP) OR THE RETURN AIR TEMPERATURE (RAT) IS < THE "WARM-UP" SETPOINT (WUSP) OF 66 °F (ADJ.) (WUSP).
 - B. WHEN THE AIR HANDLING UNIT IS PLACED IN WARM-UP MODE ALL ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE (OAD) DAMPERS SHALL BE CLOSED. THE RETURN DAMPER (RAD) SHALL BE OPENED, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE MODULATED OPEN TO THE COIL TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F (ADJ.)
 - C. THE AIR HANDLING UNIT SHALL BE RELEASED FROM "WARM-UP" MODE WHEN THE RETURN AIR TEMPERATURE (RAT) > THE "WARM-UP" SETPOINT (WASP) HYSTERESIS OR THE SPACE TEMPERATURE (TS) IS < 2 °F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP)
 - D. WHEN THE AIR HANDLING UNIT IS RELEASED FROM WARM-UP MODE THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT TO THEIR SCHEDULED MODE.
3. MINIMUM OUTSIDE AIR CONTROL:
 - A. THE TESTING & BALANCING CONTRACTOR (TAB) SHALL ADJUST & SET THE OUTSIDE AIR MINIMUM SETTING (OAMINSP).
 - B. THE BACNET DDC CONTROLLER SHALL POSITION THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS TO THIS POSITION ACCORDING TO THE SEQUENCE OF OPERATIONS.
 - C. THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL BE POSITIONED TO THE MINIMUM OUTSIDE AIR SETTING (OAMINSP) IN CONJUNCTION WITH THE CO2 RESET STRATAGEM.
4. HEATING MODE:
 - A. THE SPACE TEMPERATURE (TS) SENSOR, THROUGH THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN THE SPACE HEATING SETPOINTS. (HSP).
 - B. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE TEMPERATURE (HSP) HEATING SETPOINT, THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) OPEN TO THE COIL.
 - C. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE HEATING SETPOINT (HSP), THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) CLOSED TO THE COIL.
5. COOLING MODE SELECTION:
 - A. FREE COOLING ECONOMIZER: WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS < THE SPACE TEMPERATURE (TS) BY > 8 °F (ADJ.).
 - B. MECHANICAL COOLING: WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS > 45 °F (ADJ.) & IS < 8°F BELOW THE SPACE TEMPERATURE (TS).
6. FREE COOLING ECONOMIZER MODE:
 - A. THE USE OF THE FREE COOLING ECONOMIZER SHALL BE USED TO COOL THE SPACE TEMPERATURE (TS) AS REQUIRED.
 - B. A MIXED AIR TEMPERATURE SENSOR (MAT) SHALL, THROUGH THE AIR HANDLING UNIT BACNET DDC CONTROLLER, MODULATE THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS TO MAINTAIN MIXED AIR TEMPERATURE SETPOINT (MASP) - 10°F TO THE SPACE COOLING SETPOINT (CSP)
 - C. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) SHALL BE MODULATED OPEN; THE RETURN (RAD) DAMPERS MODULATED CLOSED.
 - D. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) DAMPERS SHALL BE MODULATED CLOSED; THE RETURN (RAD) DAMPER MODULATED OPEN.
7. LACK OF ADEQUATE FREE COOLING OPERATION
 - A. WHEN THE SPACE TEMPERATURE (TS) REMAINS ABOVE THE SPACE COOLING SETPOINT (CSP) FOR > 15 MINUTES, THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL RETURN TO THE MINIMUM OUTSIDE AIR SETTING (OAMINSP) & THE MECHANICAL COOLING SHALL BE UTILIZED.

LEGEND	----- Low Voltage, 18 AWG, Copper Wire			
	----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance			
	_____ Line Voltage, THHN Field Wiring			

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NO.	DATE	REVISION	BY

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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
PACKAGED AHU-1 THRU 4 & ACU-1 THRU 4 SEQUENCE OF OPERATION PAGE 1	
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PACKAGED AHU-1 THRU 4 & ACU-1 THRU 4 SEQUENCE OF OPERATION PAGE 2

8. MECHANICAL COOLING MODE:

A. THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL BE FIXED AT THE MINIMUM OUTSIDE AIR SETTING (OAMINSP). THE DIRECT EXPANSION COOLING SHALL BE SEQUENCED TO MAINTAIN THE SPACE COOLING SETPOINT (CSP). WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE COOLING SETPOINT (CSP) THE DIRECT EXPANSION COOLING SHALL SEQUENCE ON. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE COOLING SETPOINT (CSP) THE DIRECT EXPANSION COOLING SHALL SEQUENCE OFF.

B. DURING THE MECHANICAL COOLING MODE THE HEATING MODE SHALL BE DISABLED.

9. DEMAND CONTROL VENTILATION

A. THE CO2 (CO2) LEVELS SHALL, THROUGH THE BACNET DDC CONTROLLER, ADJUST THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS POSITION IN ORDER TO MAINTAIN A CO2 SETPOINT (CO2SP) OF 900 PPM. WHEN THE CO2 (CO2) IS > THE CO2 SETPOINT (CO2SP), THE OUTSIDE (OAD) DAMPERS SHALL MODULATE OPEN AND THE RETURN (RAD) DAMPER SHALL MODULATE CLOSED. WHEN THE CO2 (CO2) IS < THE CO2 SETPOINT (CO2SP), THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL REVERT BACK TO SCHEDULE MODE.

10. DISCHARGE AIR TEMPERATURE LOW-LIMIT:

A. THE DISCHARGE AIR TEMPERATURE SENSOR (DAT) SHALL, THROUGH THE BACNET DDC CONTROLLER OVERRIDE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN A THE DISCHARGE AIR LOW LIMIT (DALL) OF 60 °F (ADJ.). WHEN THE DISCHARGE AIR TEMPERATURE (DAT) FAILS TO INCREASE ABOVE 60 °F AFTER THE HOT WATER COIL CONTROL VALVE (HWV) IS FULLY OPEN, THE OUTSIDE DAMPER (OAD) SHALL BE MODULATED CLOSED & AN ALARM SHALL BE GENERATED. (DATLO).

B. THIS SEQUENCE SHALL BE INHIBITED WHEN THE AIR HANDLING UNIT IS IN MECHANICAL COOLING.

G. AIR FILTER MONITORING

1. A DIFFERENTIAL PRESSURE SWITCH (FLTR) AT EACH FILTER BANK SHALL BE SET AS PER THE MANUFACTURERS RATING FOR A DIRTY FILTER. WHEN THE FILTER EXCEEDS THIS RATING, THE FILTER SWITCH SHALL INDICATE A DIRTY FILTER ALARM AT THE GUI.

H. LOW LIMIT SWITCH:

1. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE LOCATED ON THE LEAVING AIRSIDE OF THE HEATING COIL. IF THE LOW TEMPERATURE LIMIT SWITCH (LLS) SENSES S COIL DISCHARGE BELOW THE LOCAL DEVICE SETTING OF 38 °F; THE AIR HANDLING UNIT'S SUPPLY FAN, RETURN FAN AND ANY ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE DAMPERS (OAD) SHALL CLOSE; THE RETURN DAMPER (RAD) SHALL OPEN; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL OPEN TO THE COIL.

2. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE RESET FROM THE GUI.

I. LIQUID DETECTION SENSOR (LDS):

1. WHEN THE LIQUID DETECTOR SENSOR (LDS) SWITCH DETECTS ACCUMULATED LIQUIDS IN THE DRIP PAN THE AIR HANDLING UNIT'S COOLING SEQUENCES SHALL BE DISABLED.

J. DUCT SMOKE DETECTION

1. THE DIVISION 26 ELECTRICAL CONTRACTOR (EC) SHALL PROVIDE THE INTERLOCK WIRING FOR THE AIR HANDLING UNIT SHUT DOWN; PROVIDE THE SMOKE DETECTORS WITH A SPARE CONTACT FOR USE BY THE ATC SYSTEM; PROVIDE, FIELD INSTALL & WIRE THE FIRE ALARM SYSTEM SHUTDOWN/PURGE FROM THE FACP PANEL.

2. THE DIVISION 23 MECHANICAL CONTRACTOR SHALL INSTALL THE SMOKE DETECTORS

3. THE ATC CONTRACTOR (ATC) SHALL PROVIDE WIRING OF THE SPARE CONTACT ON THE SMOKE DETECTORS TO AIR HANDLING UNITS ATC BACNET DDC CONTROLLER TO DISABLE CONTROL LOOPS DURING A SMOKE CONDITION.

K. ALARMS & SAFETIES MONITORING:

1. FAN FAILURE (FANFAIL): COMMANDED ON, BUT THE STATUS (CS) IS OFF.

2. FAN IN HAND (FANHAND): COMMANDED OFF, BUT THE STATUS (CS) IS ON.

3. HI/LOW SPACE AIR TEMP: WHEN THE SPACE TEMPERATURE (TS) IS > 85 °F (ADJ.) < 55 °F (ADJ.).

4. HI/LOW DISCHARGE AIR TEMP: WHEN THE DISCHARGE AIR TEMPERATURE (DAT) IS > 120 °F (ADJ.) < 50 °F (ADJ.).

5. HI/LO MIXED AIR TEMP: WHEN THE MIXED AIR TEMPERATURE IS > 85°F (ADJ.) < 45°F (ADJ.).

6. HIGH FILTER DIFFERENTIAL PRESSURE: WHEN THE PRESSURE EXCEEDS THE SET LIMIT (ADJ.).

7. HIGH CO2 (CO2HI): WHEN THE CO2 IS > 900 PPM (ADJ.).

8. SMOKE DETECTOR: (SMOKE) WHEN THE SMOKE DETECTOR SENSING SMOKE.

9. DRIP PAN LIQUID (LEAK): WHEN THE DRIP PAN LIQUID DETECTOR SENSES LIQUID LEVEL IN THE PAN.

10. LOW TEMPERATURE LIMIT SWITCH (LLSTRIP): WHEN THE SENSOR TRIPS, UPON THE TEMPERATURE BELOW THE SETTING.

11. COOLING FAILURE (COOLFAIL): AN ALARM SHALL BE GENERATED WHEN THE DISCHARGE AIR TEMPERATURE (DAT) REMAINS WITHIN 4°F (ADJ.) OF THE MIXED AIR TEMPERATURE, WITH THE MECHANICAL COOLING UTILIZED (FOR > 5 MINUTES). THIS LARM SHALL NOT BE ENABLED UNTIL THE ZONE HAS BEEN ON FOR 10 MINUTES (ADJ.).

12. HEATING FAILURE (HEATFAIL): AN ALARM SHALL BE GENERATED WHEN THE DISCHARGE AIR TEMPERATURE (DAT) REMAINS WITHIN 4°F (ADJ.) OF THE HEATING SETPOINT (HSP) & THE HEATING SIGNAL IS > 10% OPEN (FOR > 5 MINUTES) THIS ALARM SHALL NOT BE ENABLED UNTIL THE ZONE HAS BEEN ON FOR 10 MINUTES (ADJ.).

LEGEND	----- Low Voltage, 18 AWG, Copper Wire			
	----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance			
	_____ Line Voltage, THHN Field Wiring			
		0	MM/DD/YYYY	Submitted for Approval
	NO.	DATE	REVISION	BY

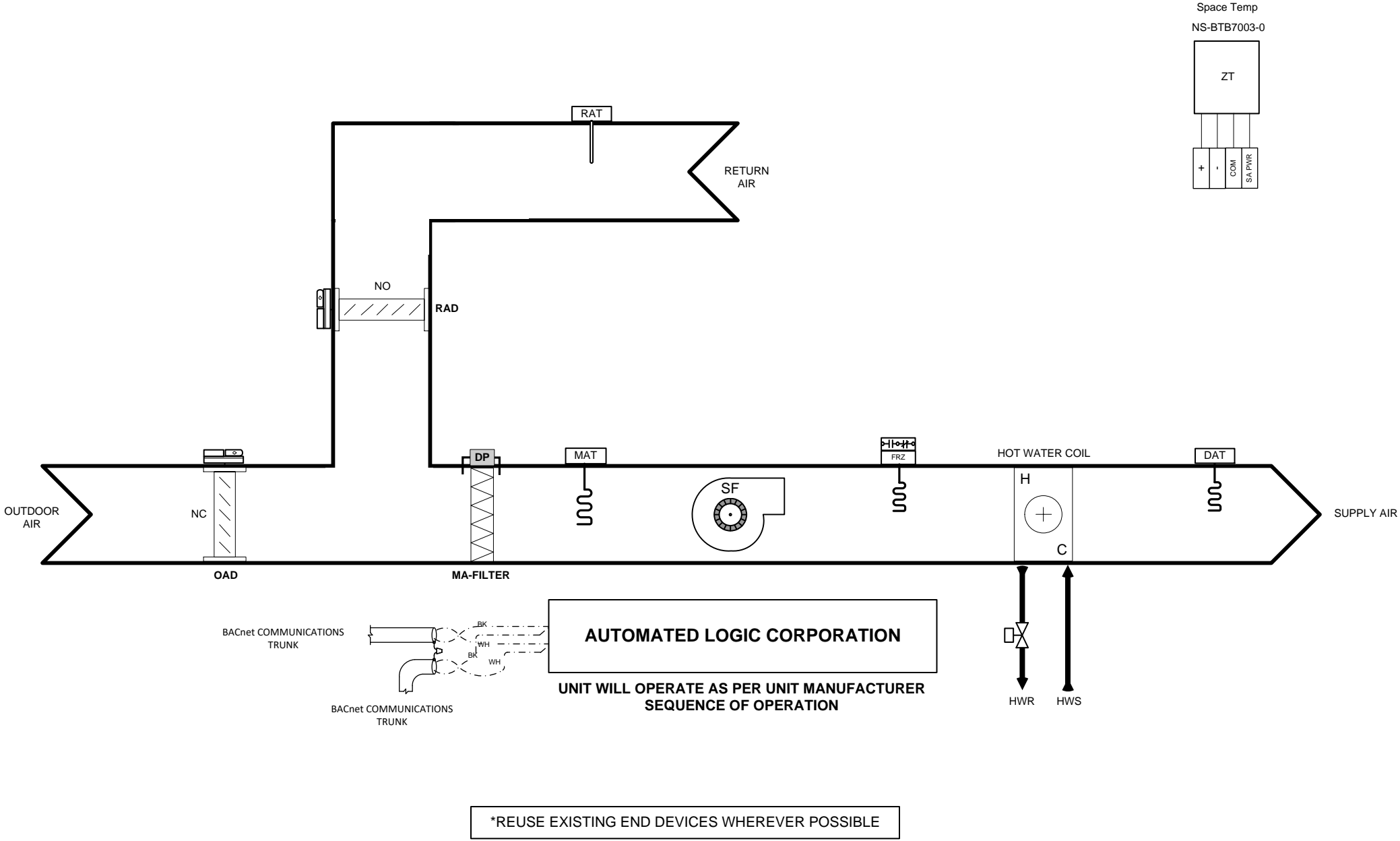
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EXISTING HEATING AND VENTILATION UNIT HV-7 SCHEMATIC DIAGRAM



*REUSE EXISTING END DEVICES WHEREVER POSSIBLE

LEGEND	-----	Low Voltage, 18 AWG, Copper Wire
	-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
	_____	Line Voltage, THHN Field Wiring

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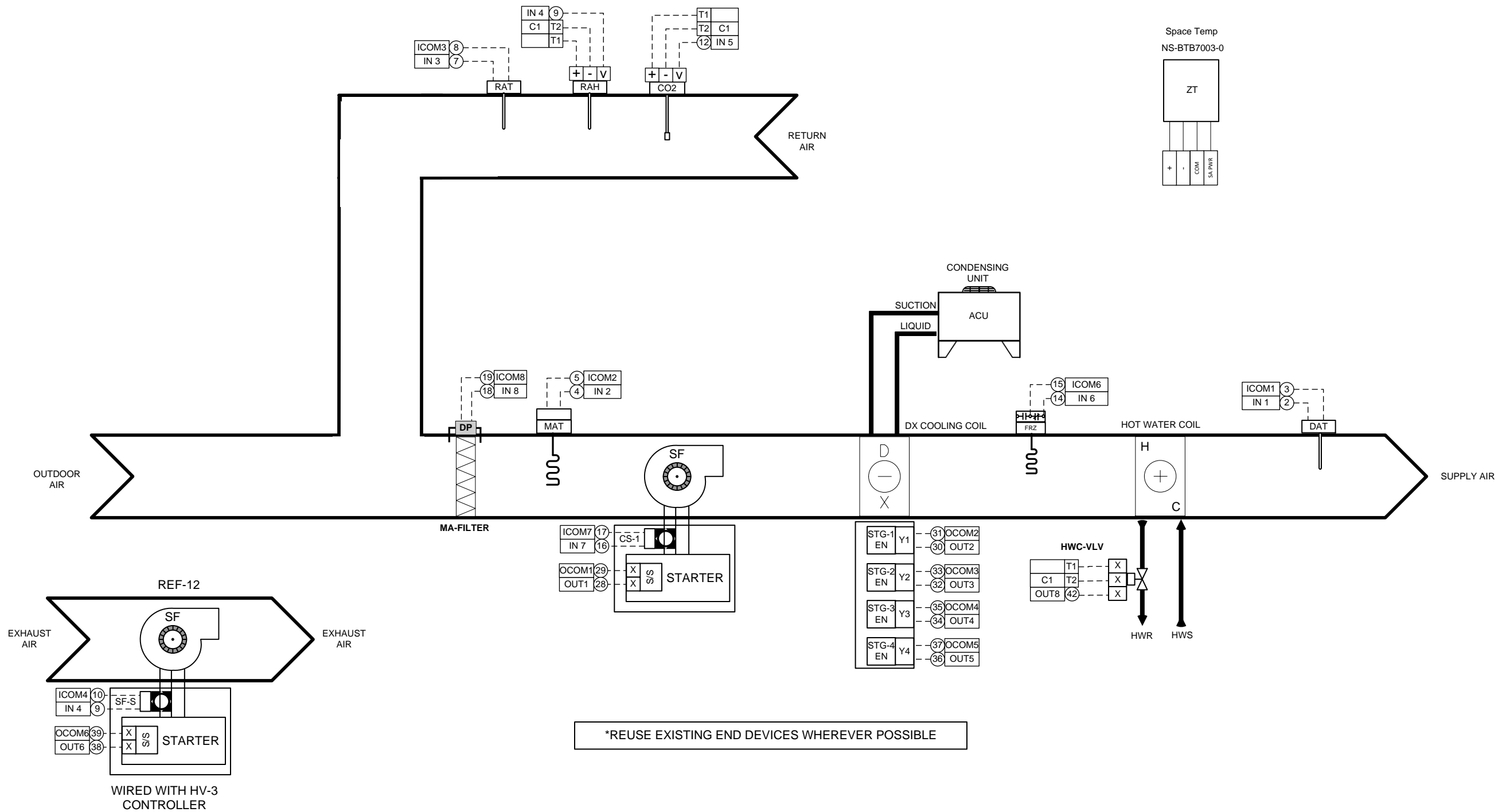
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EXISTING HEATING AND VENTILATION UNIT HV-7 SCHEMATIC DIAGRAM	
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EXISTING HEATING AND VENTILATION UNIT HV-2.3 & ACU-5.6 SCHEMATIC DIAGRAM

TYPICAL OF 2



SCHEDULE

ITEM #	TAG	LOCATION	MECH. DWG
1	HV-2	SECOND FLOOR-MEZANNINE	M205
2	HV-3	SECOND FLOOR-MEZANNINE	M205

LEGEND	Description
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

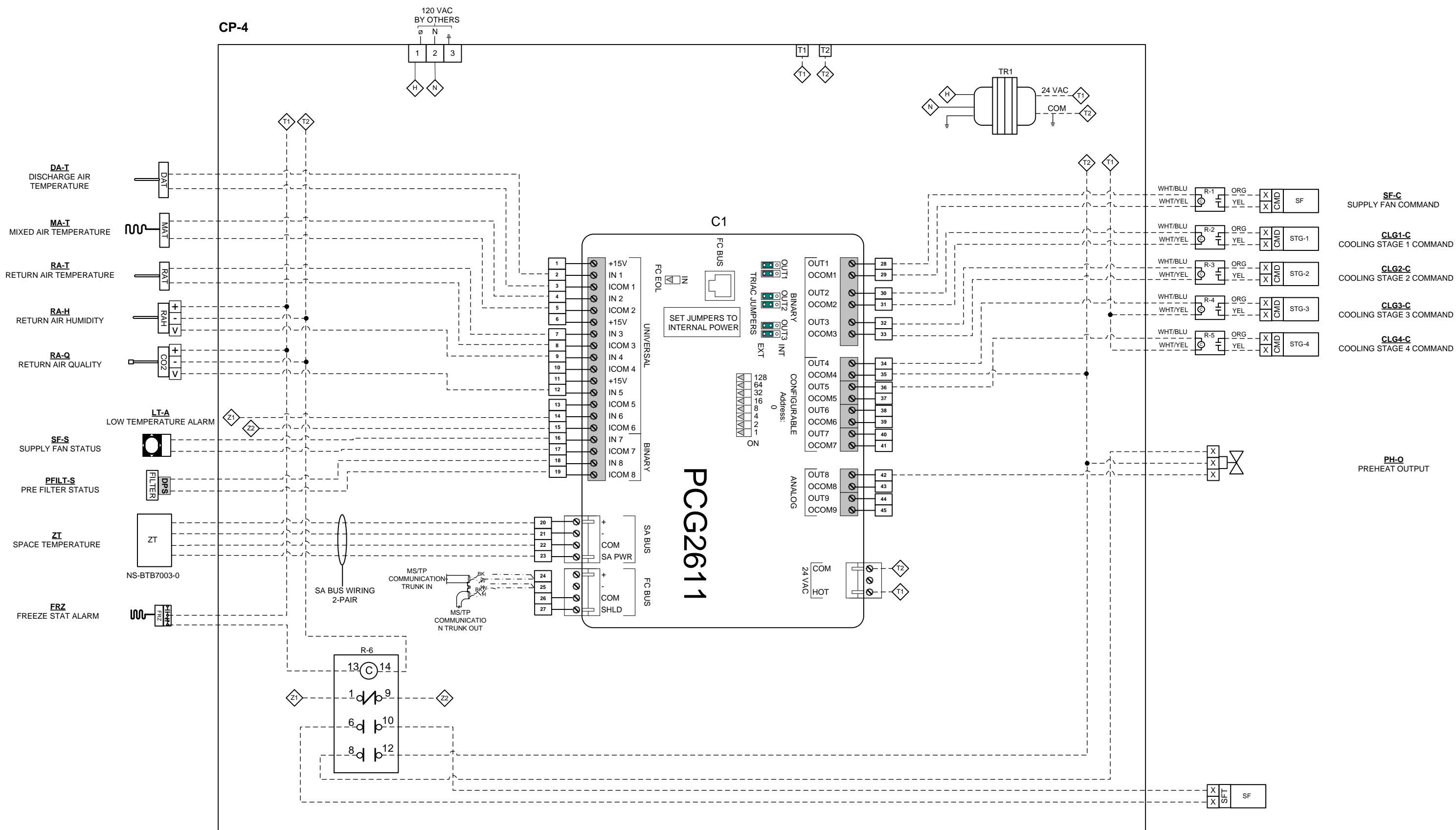
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING HEATING AND VENTILATION UNIT HV-2,3 & ACU-5,6 SCHEMATIC DIAGRAM	
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EXISTING HEATING AND VENTILATION UNIT HV-2 WIRING DIAGRAM



LEGEND

- Low Voltage, 18 AWG, Copper Wire
- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
- Line Voltage, THHN Field Wiring

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NO.	DATE	REVISION	BY		

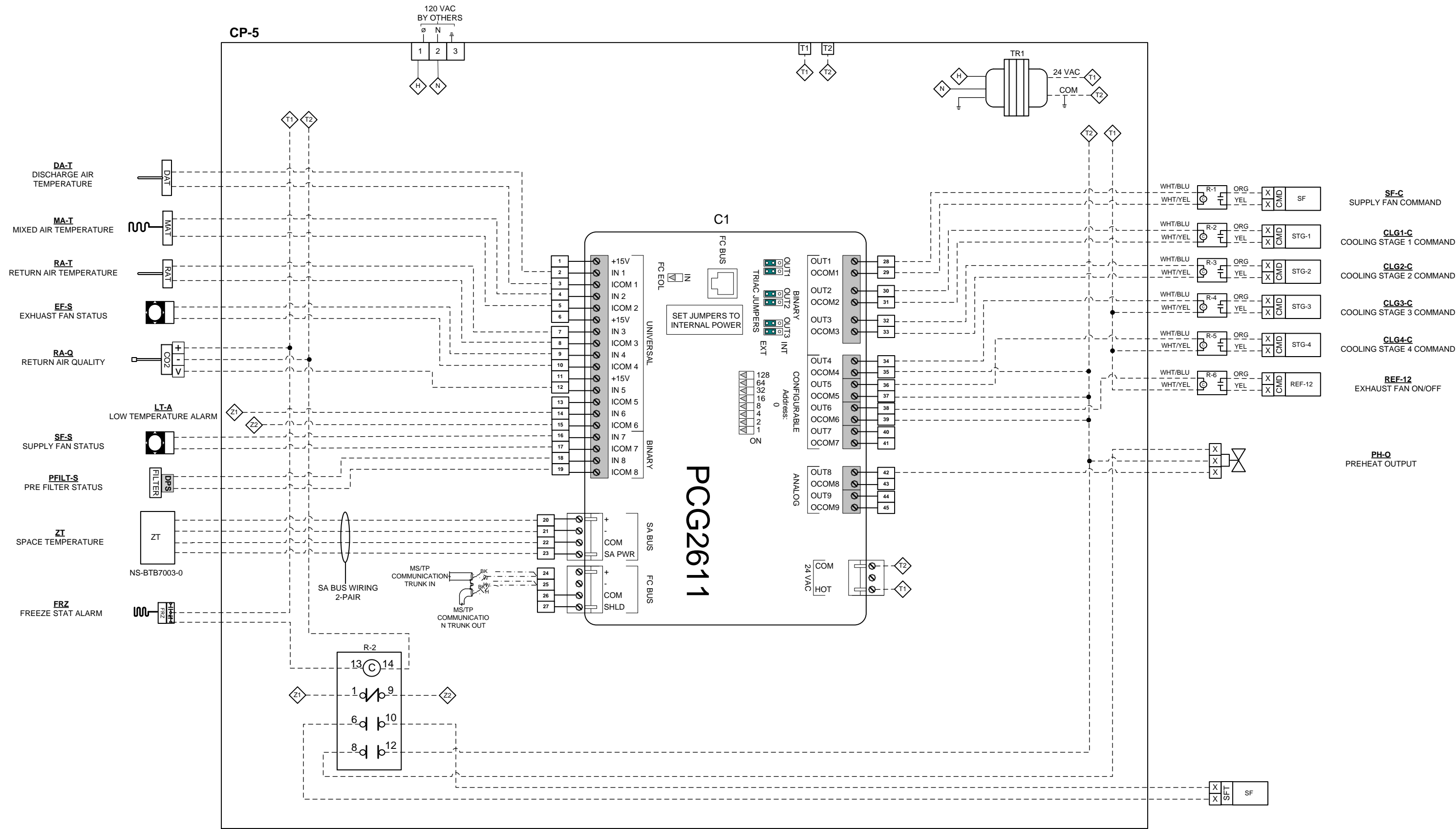


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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING HEATING AND VENTILATION UNIT HV-2 WIRING DIAGRAM	
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EXISTING HEATING AND VENTILATION UNIT HV-3 WIRING DIAGRAM



LEGEND	DESCRIPTION
---	Low Voltage, 18 AWG, Copper Wire
---	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
---	Line Voltage, THHN Field Wiring

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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING HEATING AND VENTILATION UNIT HV-3 WIRING DIAGRAM	
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EXISTING HEATING AND VENTILATION UNIT HV-2,3 & ACU-5,6 BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Description	Manufacturer
1	Programmable Controller	C1	FX-PCG2611-0	2	17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC	Johnson
2	Discharge Air Temperature Sensor	DAT, RAT	A/CP-D-12-PB	10	Thermistor, Duct, 10K Ω (Type II), 12", Plastic Box	ACI
3	Space Temperature Sensor	ZT	NS-BTB7003-0	2	NS Series network sensor with LCD	Johnson
4	Guard		BA/BG	2	Larger BAPI-Guard Thermostat Protector	Bapi
5	Return Air Humidity	RAH	A/RH2-D-010	1	Relative Humidity, +/-2% Accuracy, Duct mounted, 0 to 10 VDC	AC1
6	CO2 Sensor	RA-CO2	A/CO2-DUCT	2	Duct Mount CO2 Sensor, 0 to 2,000 ppm, 0-5 VDC or 0-10 VDC	AC1
7	Freezestat	FRZ	A11D	2	SPST,Open Low ,Manual Reset	Johnson
8	Current Switch	CS-1	RIBXGF	3	Split Core Current Switch- .35 to 150 Amperes	Functional Devices
9	Field Mounted Relay	R-1	RIBU1C	11	Universal RIB Relay	Functional Devices
10	Panel Mounted Relay	R-2	RH3B-ULAC24V	2	3PDT Relay w/ light 24VAC	IDEC
11	Base	R-2	SH3B-05	2	Relay Socket DIN Rail Mounted	IDEC
12	Transformer	TR1	APT-100-5SB	2	MULTI-TAP 24 Vac Control Transformer - 100VA	Dwyer
13	Panel	CP-4,5	SCE-16N1606LP	2	Saginaw, 16"H X 16"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
14	Perforated Subpanel	CP-4,5	SCE-16N16MP	2	Enclosure, Nema-1	Saginaw

*REUSE EXISTING END DEVICES WHEREVER POSSIBLE

LEGEND	----- Low Voltage, 18 AWG, Copper Wire					 32-72 Steinway St, Astoria, NY 11103 (M) 718-350-8716 Project: SAMPLE PROJECT - JOHNSON CONTROLS EXISTING HEATING AND VENTILATION UNIT HV-2,3 & ACU-5,6 BILL OF MATERIAL	
	----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance						Job No. ##
	----- Line Voltage, THHN Field Wiring						Page 25 of 34
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	NO. DATE REVISION BY						

EXISTING HEATING AND VENTILATION UNIT SEQUENCE OF OPERATION

SEQUENCE OF OPERATION:

HEATING AND VENTILATING UNIT – HOT WATER HEATING

A. COORDINATION:

1. REFERENCE THE ATC DIAGRAMS FOR UNIT CONFIGURATION, ATC DEVICES, POINT TYPES & LOCATIONS.
2. THE ATC CONTRACTOR (ATC) SHALL PROVIDE, FIELD INSTALL & WIRE A BACNET DDC CONTROLLER, CONTROL VALVES, SENSORS, RELAYS, STATUS SENSORS; PROVIDE & FIELD WIRE CONTROL VALVES & DAMPERS AND THEIR ACTUATORS.

B. SCHEDULING

1. THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT'S BACNET MS/TP DDC CONTROLLER AS ESTABLISHED IN THE GUI.
2. THE UNIT SHALL REMAIN IN THE "UNOCCUPIED" MODE UNTIL THE SUPPLY FANS STATUS HAS BEEN PROVEN TO BE ON BY THE SUPPLY FAN CURRENT SWITCH (CS).

C. SPACE TEMPERATURE SENSOR (TS)

1. THE SPACE TEMPERATURE SENSORS (TS) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (TS) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE LED SHALL LIGHT & THE UNIT SHALL BE SCHEDULED INTO THE "OCCUPIED" MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE
2. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 74 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

D. "UNOCCUPIED" MODE:

1. THE UNIT'S SUPPLY FAN AND ASSOCIATED EXHAUST FANS SHALL BE OFF; THE OUTSIDE DAMPERS (OAD) SHALL BE CLOSED & THE RETURN DAMPER (RAD) SHALL BE OPEN.
2. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS > 45 °F, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE CLOSED TO THE COIL
3. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS < 48 °F, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL MODULATE TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F.
4. "UNOCCUPIED COOLING" MODE:
 - A. NONE
5. "UNOCCUPIED HEATING" MODE:
 - A. WHEN ANY SPACE TEMPERATURE SENSOR (TS) IS < THE "UNOCCUPIED HEATING" SETPOINT (UHSP) OF 60 °F (ADJ.) THE HEATING & VENTILATING UNIT'S SUPPLY FAN SHALL START;
 - B. WHEN THE SPACE TEMPERATURE (TS) RISES ABOVE THE "UNOCCUPIED HEATING" SETPOINT (UHSP) HYSTERESIS, THE HEATING & VENTILATING UNIT'S SUPPLY FAN SHALL STOP.

E. "OCCUPIED" MODE:

1. THE UNIT'S SUPPLY FAN SHALL START & RUN CONTINUOUSLY; THE OUTSIDE (OAD & RETURN (RAD) DAMPERS SHALL OPEN TO THE MINIMUM OUTSIDE AIR SETTING (ADJ.) (OAMINSP). UPON THE TRANSITION OF THE HEATING & VENTILATING UNIT TO "OCCUPIED" MODE, A 10 MINUTE RAMP SHALL BE IMPLEMENTED BEFORE THE OUTSIDE DAMPERS (OAD) CAN GO FULLY OPEN.
2. "WARM-UP" MODE:
 - A. THE UNIT SHALL BE PLACED IN "WARM-UP" MODE WHEN THE SPACE TEMPERATURE (TS) IS >5°F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP) OR THE RETURN AIR TEMPERATURE (RAT) IS < THE "WARM-UP" SETPOINT (WUSP) OF 66 °F (ADJ.) (WUSP). WHEN THE UNIT IS PLACED IN WARM-UP MODE THE OUTSIDE (OAD) DAMPERS SHALL BE CLOSED & THE RETURN DAMPER (RAD) SHALL BE OPENED; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE MODULATED OPEN TO THE COIL TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F (ADJ.). THE UNIT SHALL BE RELEASED FROM "WARM-UP" MODE WHEN THE RETURN AIR TEMPERATURE (RAT) > THE "WARM-UP" SETPOINT (WASP) HYSTERESIS OR THE SPACE TEMPERATURE (TS) IS <2°F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP); WHEN THE UNIT IS RELEASED FROM WARM-UP MODE THE OUTSIDE (OAD & RETURN (RAD) DAMPERS, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT TO THEIR SCHEDULED MODE.
3. MINIMUM OUTSIDE AIR CONTROL:
 - A. THE TESTING & BALANCING CONTRACTOR (TAB) SHALL ADJUST & SET THE OUTSIDE AIR MINIMUM SETTING (OAMINSP). THE BACNET DDC CONTROLLER SHALL POSITION THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS TO THIS POSITION AS REQUIRED PER THE SEQUENCE OF OPERATIONS.
 - B. THE OUTSIDE (OAD) & RETURN (RAD) SHALL BE POSITIONED TO THE MINIMUM OUTSIDE AIR SETTING (OAMINSPP).

4. HEATING MODE:

- A. THE SPACE TEMPERATURE (TS) SENSOR, THROUGH THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN THE SPACE HEATING SETPOINTS. (HSP)
- B. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE TEMPERATURE (HSP) HEATING SETPOINT, THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) OPEN TO THE COIL.
- C. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE HEATING SETPOINT (HSP), THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) CLOSED TO THE COIL.

5. FREE COOLING ECONOMIZER MODE:

- A. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS < THE SPACE TEMPERATURE (TS) BY > 8 °F (ADJ.) THE USE OF THE FREE COOLING ECONOMIZER SHALL BE USED TO COOL THE SPACE TEMPERATURE (TS) AS REQUIRED.
- B. A MIXED AIR TEMPERATURE SENSOR (MAT) SHALL, THROUGH THE UNIT'S BACNET DDC CONTROLLER, MODULATE THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS TO MAINTAIN MIXED AIR TEMPERATURE SETPOINT (MASP) - 10°F TO THE SPACE COOLING SETPOINT (CSP).
- C. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL BE MODULATED OPEN.
- D. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS SHALL BE MODULATED CLOSED.

6. DISCHARGE AIR TEMPERATURE LOW-LIMIT:

- A. THE DISCHARGE AIR TEMPERATURE SENSOR (DAT) SHALL, THROUGH THE BACNET DDC CONTROLLER OVERRIDE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN A THE DISCHARGE AIR LOW LIMIT SETPOINT (DALL) OF 60 °F (ADJ.); WHEN THE DISCHARGE AIR TEMPERATURE (DAT) FAILS TO INCREASE ABOVE 60 °F AFTER THE HOT WATER COIL CONTROL VALVE (HWV) IS FULLY OPEN TO THE COIL, THE OUTSIDE DAMPER (OAD) SHALL BE MODULATED CLOSED & AN ALARM SHALL BE GENERATED. (DATLO)

F. AIR FILTER MONITORING

1. A DIFFERENTIAL PRESSURE SWITCH (DPS) AT EACH FILTER BANK SHALL BE SET AS PER THE MANUFACTURERS RATING FOR A DIRTY FILTER. WHEN THE FILTER EXCEEDS THIS RATING, THE FILTER SWITCH SHALL INDICATE A DIRTY FILTER ALARM AT THE GUI.

G. LOW LIMIT SWITCH:


1. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE LOCATED ON THE LEAVING AIRSIDE OF THE HEATING COIL. IF THE LOW TEMPERATURE LIMIT SWITCH (LLS) SENSES A COIL DISCHARGE BELOW THE LOCAL DEVICE SETTING OF 38 °F; THE UNIT'S SUPPLY FAN AND ALL ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE DAMPERS (OAD) SHALL CLOSE & THE RETURN DAMPER (RAD) SHALL OPEN; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL OPEN FULLY TO THE COIL. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE RESET FROM THE GUI.

H. ALARMS & SAFETIES MONITORING:

1. FAN FAILURE (FANFAIL): COMMANDED ON, BUT THE STATUS (CS) IS OFF.
2. FAN IN HAND (FANHAND): COMMANDED OFF, BUT THE STATUS (CS) IS ON.
3. HI/LOW SPACE AIR TEMP: WHEN THE SPACE TEMPERATURE (TS) IS > 85 °F (ADJ.) < 55 °F (ADJ.).
4. HI/LOW DISCHARGE AIR TEMP: WHEN THE DISCHARGE AIR TEMPERATURE (DAT) IS > 120 °F (ADJ.) < 50 °F (ADJ.).
5. HI/LO MIXED AIR TEMP: WHEN THE MIXED AIR TEMPERATURE IS > 85°F (ADJ.) < 45°F (ADJ.).
6. HIGH FILTER DIFFERENTIAL PRESSURE: WHEN THE PRESSURE EXCEEDS THE SET LIMIT (ADJ.).
7. LOW TEMPERATURE LIMIT SWITCH (LLSTRIP): WHEN THE SENSOR TRIPS, UPON THE TEMPERATURE BELOW THE SETTING.
8. HEATING FAILURE: (HEATFAIL) AN ALARM SHALL BE GENERATED WHEN THE DISCHARGE AIR TEMPERATURE (DAT) REMAINS WITHIN 4°F (ADJ.) OF THE HEATING SETPOINT (HSP) & THE HEATING SIGNAL IS > 10% OPEN (FOR > 5 MINUTES) THIS ALARM SHALL NOT BE ENABLED UNTIL THE ZONE HAS BEEN ON FOR 10 MINUTES (ADJ.).

LEGEND	-----	Low Voltage, 18 AWG, Copper Wire
	-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
	-----	Line Voltage, THHN Field Wiring

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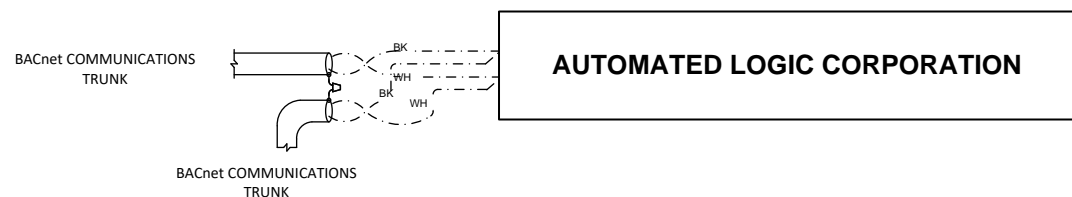
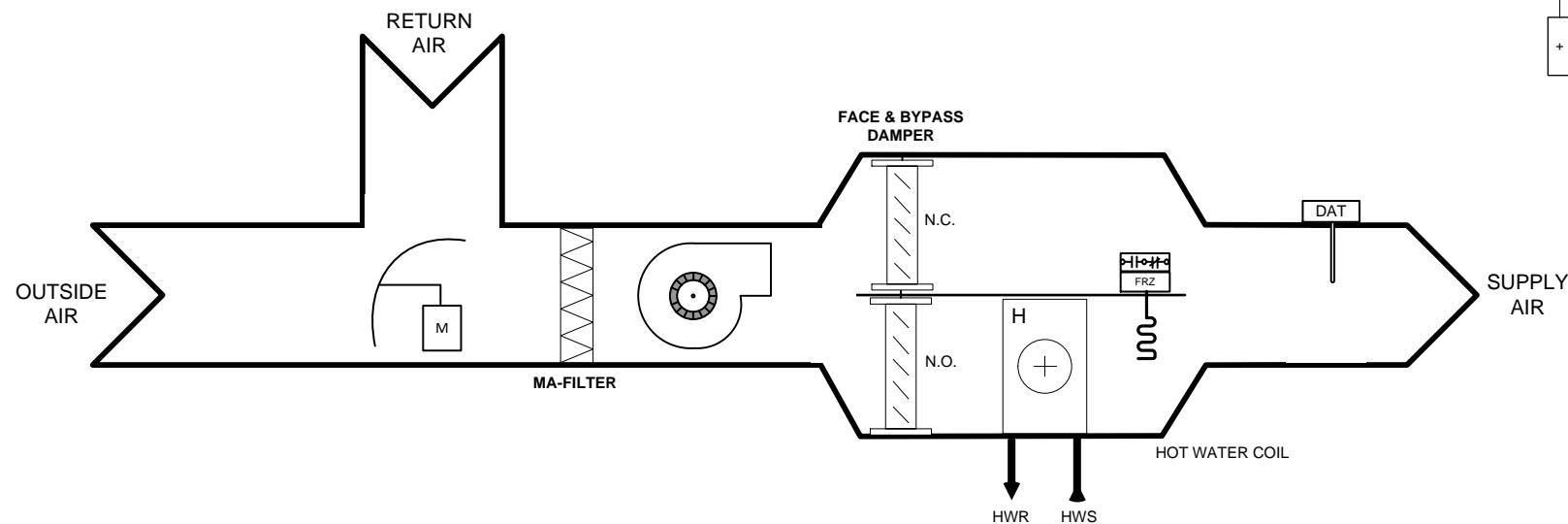
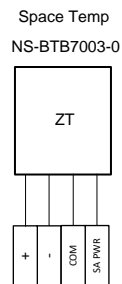
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING HEATING AND VENTILATION UNIT SEQUENCE OF OPERATION	
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EXISTING UNIT VENTILATOR SCHEMATIC DIAGRAM

TYPICAL OF 37

*REUSE EXISTING END DEVICES WHEREVER POSSIBLE



SCHEDULE

ITEM #	TAG	FLOOR LOCATION	SERVICE LOCATION	MECH. DWG
1	UV-1	FIRST FLOOR	109-SELF CONT SPECIAL ED	M101
2	UV-2	FIRST FLOOR	110-LIFE SKILLS LAB	M101
3	UV-3	FIRST FLOOR	111-LIFE SKILLS LAB	M101
4	UV-4	FIRST FLOOR	112-FOODS/CULTINARY ARTS LAB	M101
5	UV-5	FIRST FLOOR	107-CLASSROOM	M101
6	UV-6	FIRST FLOOR	106-CLASSROOM	M101
7	UV-7	FIRST FLOOR	105-CLASSROOM	M101
8	UV-8	FIRST FLOOR	104-CLASSROOM	M101
9	UV-9	FIRST FLOOR	103-CLASSROOM	M101
10	UV-10	FIRST FLOOR	102-SELF CONT SPECIAL ED	M101
11	UV-11	FIRST FLOOR	101-CLASSROOM	M101
12	UV-12	FIRST FLOOR	113-ERASE ROOM	M101
13	UV-13	FIRST FLOOR	FACULTY ROOM	M101
14	UV-14	FIRST FLOOR	1-CLASSROOM	M101
15	UV-15	FIRST FLOOR	2-CLASSROOM	M101
16	UV-16	FIRST FLOOR	3-CLASSROOM	M101
17	UV-17	FIRST FLOOR	4-CLASSROOM	M101
18	UV-18	FIRST FLOOR	5-CLASSROOM	M101
19	UV-19	FIRST FLOOR	108-SELF CONT SPECIAL ED	M101
20	UV-20	SECOND FLOOR	208-SELF CONT SPECIAL ED DEMO	M103
21	UV-21	SECOND FLOOR	209-SELF CONT SPECIAL ED DEMO	M103
22	UV-22	SECOND FLOOR	210-SCIENCE DEMO	M103
23	UV-23	SECOND FLOOR	211-SCIENCE LAB	M103
24	UV-24	SECOND FLOOR	212-BIOLOGY LAB	M103
25	UV-25	SECOND FLOOR	207-CLASSROOM	M103
26	UV-26	SECOND FLOOR	206-CLASSROOM	M103
27	UV-27	SECOND FLOOR	205-CLASSROOM	M103
28	UV-28	SECOND FLOOR	204-SCIENCE DEMO	M103
29	UV-29	SECOND FLOOR	203-CLASSROOM	M103
30	UV-30	SECOND FLOOR	202-SMALL GROUP INSTRUCTION	M103
31	UV-31	SECOND FLOOR	201-SMALL GROUP INSTRUCTION	M103
32	UV-32	SECOND FLOOR	200-SMALL GROUP INSTRUCTION	M103
33	UV-33	SECOND FLOOR	6-CLASSROOM	M103
34	UV-34	SECOND FLOOR	7-CLASSROOM	M103
35	UV-35	SECOND FLOOR	8-CLASSROOM	M103
36	UV-36	SECOND FLOOR	9-CLASSROOM	M103
37	UV-37	SECOND FLOOR	10-CLASSROOM	M103

LEGEND	Wiring	
	-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance	
-----	Line Voltage, THHN Field Wiring	

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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**
EXISTING UNIT VENTILATOR SCHEMATIC DIAGRAM
 Job No. ## Page 27 of 34

EXISTING UNIT VENTILATOR SEQUENCE OF OPERATION

UNIT VENTILATOR – HOT WATER HEATING

A. SCHEDULING

1. THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT'S BACNET MS/TP DDC CONTROLLER AS ESTABLISHED IN THE GUI.
2. THE UNIT SHALL REMAIN IN THE "UNOCCUPIED" MODE UNTIL THE SUPPLY FANS STATUS HAS BEEN PROVEN TO BE ON BY THE SUPPLY FAN CURRENT SWITCH (CS).

B. SPACE TEMPERATURE SENSOR (TS)

1. THE SPACE TEMPERATURE SENSORS (TS) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (TS) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE LED SHALL LIGHT & THE UNIT SHALL BE SCHEDULED INTO THE "OCCUPIED" MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE.
2. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 74 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

C. "UNOCCUPIED" MODE:

1. WHEN THE UNIT IS SCHEDULED IN THE "UNOCCUPIED" MODE THE UNIT'S SUPPLY AND ANY ASSOCIATED EXHAUST FANS SHALL BE OFF; THE OUTSIDE (OAD) DAMPERS SHALL BE CLOSED; THE RETURN DAMPERS (RAD) SHALL BE OPEN.
2. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS > 45 °F, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE CLOSED TO THE COIL.
3. WHEN THE OUTSIDE AIR TEMPERATURE (OAT) IS < 48 °F, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL MODULATE TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F.
4. "UNOCCUPIED COOLING" MODE:
 - A. NONE
5. "UNOCCUPIED HEATING" MODE:
 - A. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS < THE "UNOCCUPIED HEATING" SETPOINT (UHSP) OF 60 °F (ADJ.), THE UNIT'S SUPPLY FANS SHALL START. ANY ASSOCIATED EXHAUST FANS SHALL REMAIN OFF.
 - B. WHEN THE SPACE TEMPERATURE (TS) IS > THE "UNOCCUPIED HEATING" SETPOINT (UHSP) HYSTERESIS, THE UNIT'S SUPPLY FAN SHALL STOP.

D. "OCCUPIED" MODE:

1. UPON THE TRANSITION OF THE UNIT TO "OCCUPIED" MODE, A 10 MINUTE RAMP SHALL BE IMPLEMENTED BEFORE THE OUTSIDE DAMPERS (OAD) CAN GO FULLY OPEN.
2. MORNING "WARM-UP" MODE:
 - A. THE UNIT SHALL BE PLACED IN "WARM-UP" MODE WHEN THE SPACE TEMPERATURE (TS) IS > 5 °F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP).
 - B. WHEN THE UNIT IS IN THE WARM-UP MODE ALL ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE (OAD) DAMPERS SHALL BE CLOSED. THE RETURN DAMPER (RAD) SHALL BE OPENED & THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE MODULATED OPEN TO THE COIL TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F (ADJ.).
 - C. THE UNIT SHALL BE RELEASED FROM "WARM-UP" MODE WHEN THE SPACE TEMPERATURE (TS) IS < 2 °F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP).
 - D. WHEN THE UNIT IS RELEASED FROM WARM-UP MODE THE OUTSIDE (OAD), & RETURN (RAD) DAMPERS, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT TO THEIR SCHEDULED MODE.
3. MINIMUM OUTSIDE AIR CONTROL:
 - A. THE TESTING & BALANCING CONTRACTOR (TAB) SHALL ADJUST & SET THE OUTSIDE AIR MINIMUM SETTING (OAMINSP). THE BACNET DDC CONTROLLER SHALL POSITION THE OUTSIDE (OAD) & RETURN (RAD) DAMPERS TO THIS POSITION AS REQUIRED PER THE SEQUENCE OF OPERATIONS.
 - B. THE OUTSIDE (OAD) & RETURN (RAD) SHALL BE POSITIONED TO THE MINIMUM OUTSIDE AIR SETTING (OAMINSP)

4. HEATING MODE:

- A. THE SPACE TEMPERATURE (TS) SENSOR, THROUGH THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN THE SPACE HEATING SETPOINTS. (HSP). WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE TEMPERATURE (HSP) HEATING SETPOINT, THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) OPEN. WHEN THE SPACE TEMPERATURE (TS) IS> THE SPACE HEATING SETPOINT (HSP), THE BACNET DDC CONTROLLER SHALL MODULATED THE HOT WATER COIL CONTROL VALVE (HWV) CLOSED.

5. FREE COOLING ECONOMIZER MODE:

- A. THE USE OF THE FREE COOLING ECONOMIZER SHALL BE USED TO COOL THE SPACE TEMPERATURE (TS) AS REQUIRED. A SPACE TEMPERATURE SENSOR (TS) SHALL MODULATE THE OUTSIDE (OAD) DAMPERS TO MAINTAIN THE SPACE COOLING SETPOINT (CSP). WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) DAMPERS SHALL BE MODULATED OPEN. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE COOLING SETPOINT (CSP) THE OUTSIDE (OAD) DAMPERS SHALL BE MODULATED CLOSED.

6. MECHANICAL COOLING MODE:

- A. NONE

7. DISCHARGE AIR TEMPERATURE LOW-LIMIT:

- A. THE DISCHARGE AIR TEMPERATURE SENSOR (DAT) SHALL, THROUGH THE BACNET DDC CONTROLLER OVERRIDE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN A THE DISCHARGE AIR LOW LIMIT SETPOINT (DALL) OF 45 °F (ADJ.). WHEN THE DISCHARGE AIR TEMPERATURE (DAT) FAILS TO INCREASE ABOVE 45 °F AFTER THE HOT WATER COIL CONTROL VALVE (HWV) IS FULLY OPEN TO THE COIL, THE OUTSIDE DAMPER (OAD) SHALL BE MODULATED CLOSED & AN ALARM SHALL BE GENERATED. (DATLO).

E. AIR FILTER MONITORING

1. THE BACNET DDC CONTROLLER SHALL MONITOR THE FAN POWERED VARIABLE AIR VOLUME BOX'S FAN RUN TIME (CS) & SHALL PROVIDE A MAINTENANCE REMINDER (FILTER) AT THE GUI WHEN THE FILTER REPLACEMENT TIMER SETTING (FILTERSP) HAS BEEN REACHED. A SOFTWARE RESET SHALL BE REQUIRED TO SILENCE/RESET THE TIMER FUNCTION.

F. LOW LIMIT SWITCH:


1. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE LOCATED ON THE LEAVING AIRSIDE OF THE HEATING COIL. IF THE LOW TEMPERATURE LIMIT SWITCH (LLS) SENSES A COIL DISCHARGE BELOW THE LOCAL DEVICE SETTING OF 38 °F; THE UNIT'S SUPPLY FAN AND ANY ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE DAMPERS (OAD) SHALL CLOSE; THE RETURN DAMPER (RAD) SHALL OPEN; THE HOT WATER COIL CONTROL VALVE (HWV) OPEN TO THE COIL. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE RESET FROM THE GUI.

G. ALARMS & UNIT SAFETIES MONITORING

1. FAN FAILURE (FANFAIL): COMMANDED ON, BUT THE STATUS (CS) IS OFF.
2. FAN IN HAND (FANHAND): COMMANDED OFF, BUT THE STATUS (CS) IS ON.
3. HI/LOW SPACE AIR TEMP: WHEN THE SPACE TEMPERATURE (TS) IS > 85 °F (ADJ.) < 55 °F (ADJ.).
4. HI/LOW DISCHARGE AIR TEMP: WHEN THE DISCHARGE AIR TEMPERATURE (DAT) IS > 120 °F (ADJ.) < 50 °F (ADJ.).
5. HI/LO MIXED AIR TEMP: WHEN THE MIXED AIR TEMPERATURE IS > 85°F (ADJ.) < 45°F (ADJ.).
6. HIGH FILTER DIFFERENTIAL PRESSURE: WHEN THE PRESSURE EXCEEDS THE SET LIMIT (ADJ.).
7. LOW TEMPERATURE LIMIT SWITCH (LLSTRIP): WHEN THE SENSOR TRIPS BELOW SETPOINT.
8. HEATING FAILURE (HEATFAIL): AN ALARM SHALL BE GENERATED WHEN THE DISCHARGE AIR TEMPERATURE (DAT) REMAINS WITHIN 4°F (ADJ.) OF THE HEATING SETPOINT (HSP) & THE HEATING SIGNAL IS > 10% OPEN (FOR > 5 MINUTES) THIS ALARM SHALL NOT BE ENABLED UNTIL THE ZONE HAS BEEN ON FOR 10 MINUTES (ADJ.).

LEGEND	----- Low Voltage, 18 AWG, Copper Wire			
	----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance			
	_____ Line Voltage, THHN Field Wiring			

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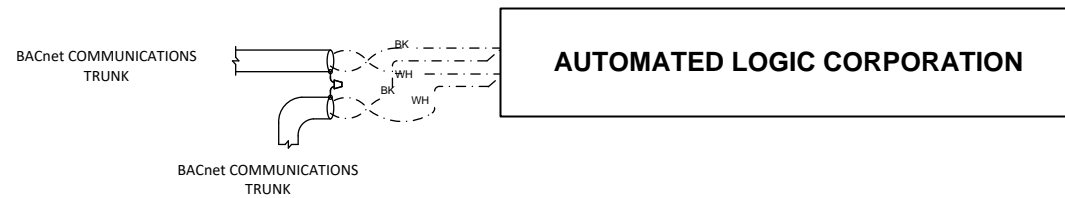
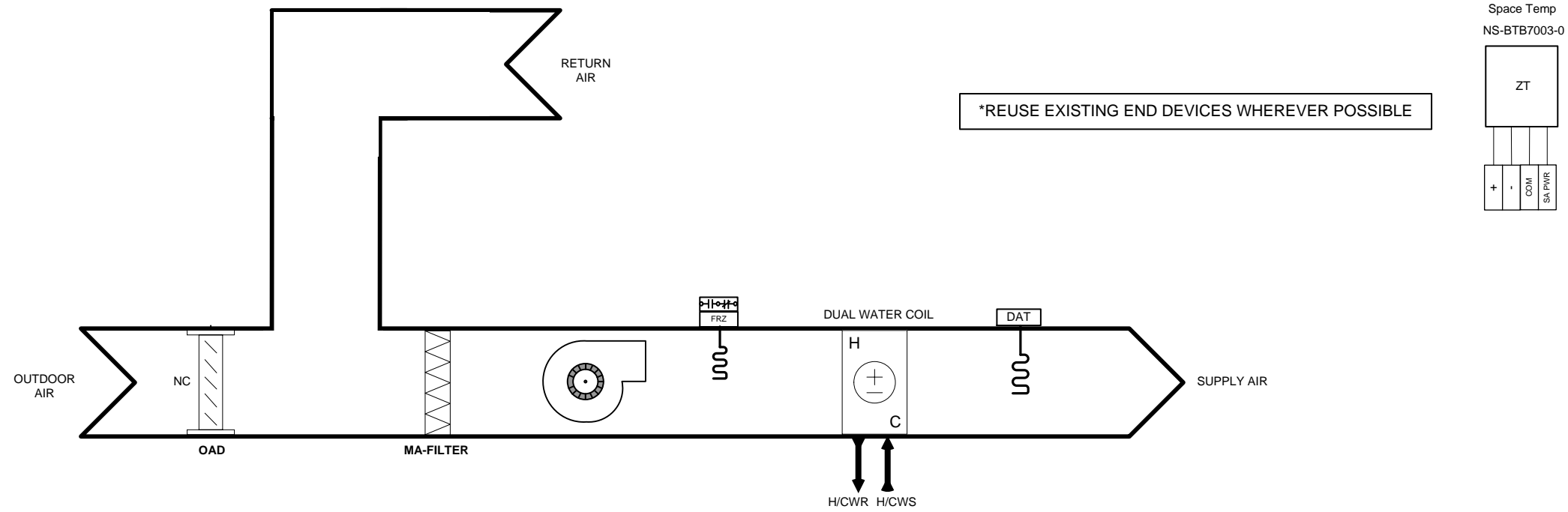
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING UNIT VENTILATOR SEQUENCE OF OPERATION	
Job No. ##	Page 28 of 34

EXISTING FAN COIL UNIT SCHEMATIC DIAGRAM

TYPICAL OF 5



SCHEDULE

ITEM #	TAG	FLOOR LOCATION	ROOM LOCATION	MECH. DWG
1	FCU-1	FIRST FLOOR	OFFICE	M101
2	FCU-2	SECOND FLOOR	210-OFFICE	M103
3	FCU-3	SECOND FLOOR	204A-OFFICE	M103
4	FCU-4	SECOND FLOOR	214A-OFFICE	M103
5	FCU-5	SECOND FLOOR	11-IDF	M103

LEGEND	Description
-----	Low Voltage, 18 AWG, Copper Wire
-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
-----	Line Voltage, THHN Field Wiring

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NO.	DATE	REVISION	BY


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 Astoria, NY 11103
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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**

EXISTING FAN COIL UNIT SCHEMATIC DIAGRAM

Job No. ##

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SEQUENCE OF OPERATION:

EXISTING FAN COIL UNIT SEQUENCE OF OPERATION

FAN COIL UNIT – HOT WATER HEATING & DIRECT EXPANSION COOLING (DX)

A. COORDINATION:

1. THE ATC CONTRACTOR (ATC) SHALL PROVIDE, FIELD INSTALL AND WIRE A BACNET DDC CONTROLLER, TEMPERATURE SENSORS, RELAYS, STATUS SENSORS, & ALL NECESSARY EQUIPMENT REQUIRED TO MEET THIS SPECIFICATION & MECHANICAL SYSTEM CONTROL SEQUENCE REQUIREMENTS.

B. SCHEDULING:

1. THE SCHEDULE SHALL BE COMMUNICATED TO THE UNIT’S BACNET MS/TP DDC CONTROLLER.

C. SPACE TEMPERATURE SENSOR (TS)

1. THE SPACE TEMPERATURE SENSORS (TS) SHALL HAVE A LCD SCREEN DEPICTING THE TEMPERATURE & SETPOINTS. THE SPACE TEMPERATURE SENSOR (TS) SHALL HAVE A LOCALLY ADJUSTABLE HEATING AND COOLING SETPOINT WITH AN OVERRIDE PUSHBUTTON; WHEN THE BUTTON IS DEPRESSED, THE LED SHALL LIGHT & THE UNIT SHALL BE SCHEDULED INTO THE “OCCUPIED” MODE FOR UP TO 3 HOURS (ADJ.); UPON THE EXPIRATION OF THE OVERRIDE, THE UNIT SHALL REVERT TO ITS SCHEDULED MODE

2. THE SETPOINTS SHALL BE INITIALLY SET AT 72 °F (ADJ.) FOR HEATING (HSP) & 74 °F (ADJ.) FOR COOLING (CSP) WITH A SETPOINT ADJUSTMENT SPAN SETTING OF ± 4 °F (ADJ.).

D. “UNOCCUPIED” MODE:

1. THE FAN COIL UNIT’S FAN AND ANY ASSOCIATED EXHAUST FANS SHALL BE OFF; THE OUTSIDE DAMPERS SHALL BE CLOSED; THE DIRECT EXPANSION COOLING STAGES (DX) SHALL BE OFF; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL MODULATE TO MAINTAIN A DISCHARGE AIR SETPOINT OF 85°F.

2. “UNOCCUPIED COOLING” MODE:

A. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS > THE “UNOCCUPIED COOLING” SETPOINT (UCSP) OF 85 °F (ADJ.), THE FAN COIL UNIT’S FAN SHALL START; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL CLOSE.; WHEN THE FAN COIL UNIT’S FAN HAS BEEN PROVEN ON BY THE FAN CURRENT SWITCH (CS), THE DIRECT EXPANSION COOLING STAGES (DX) SHALL BE SEQUENCED ON.

B. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS < THE “UNOCCUPIED COOLING” SETPOINT (UCSP) HYSTERESIS, THE DIRECT EXPANSION COOLING STAGES (DX) SHALL BE SEQUENCED OFF; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT BACK TO THE SCHEDULED SEQUENCE; THE FAN COIL UNIT’S FAN SHALL STOP.

C. THE OWNER SHALL HAVE THE ABILITY TO DISABLE THIS FEATURE VIA SOFTWARE.

3. “UNOCCUPIED HEATING” MODE:

A. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS < THE “UNOCCUPIED HEATING” SETPOINT (UHSP) OF 60 °F (ADJ.), THE FAN COIL UNIT’S FAN SHALL START; WHEN THE FAN COIL UNIT’S FAN HAS BEEN PROVEN ON BY THE FAN CURRENT SWITCH (CS), THE HOT WATER COIL CONTROL VALVE (HWV) SHALL OPEN TO THE COIL.

B. WHEN THE SPACE TEMPERATURE SENSOR (TS) IS > THE “UNOCCUPIED HEATING” SETPOINT (UHSP) HYSTERESIS, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT BACK TO THE SCHEDULED SEQUENCE. THE FAN COIL UNIT’S FAN SHALL STOP. THE OWNER SHALL HAVE THE ABILITY TO DISABLE THIS FEATURE VIA SOFTWARE.

E. “OCCUPIED” MODE:

1. THE FAN COIL UNIT’S FAN SHALL START AND RUN CONTINUOUSLY; THE OUTSIDE DAMPER SHALL OPEN.

2. “WARM-UP” MODE:

A. WHEN THE SPACE TEMPERATURE (TS) IS > 5 °F (ADJ.) BELOW THE SPACE HEATING SETPOINT (HSP), THE FAN COIL UNIT SHALL GO TO A WARM-UP MODE. THE OUTSIDE DAMPERS (OAD) SHALL REMAIN CLOSED, THE HOT WATER COIL CONTROL VALVE (HWV) SHALL BE MODULATED OPEN TO THE COIL TO MAINTAIN A DISCHARGE AIR SETPOINT (DASP) OF 85 °F (ADJ.).

B. WHEN THE SPACE TEMPERATURE (TS) RETURNS WITHIN 2 °F OF THE SPACE HEATING SETPOINT (HSP) THE FAN COIL UNIT SHALL RETURN TO NORMAL SCHEDULED OPERATION.

3. HEATING MODE: (HOT WATER)

A. THE SPACE TEMPERATURE (TS) SENSOR, THROUGH THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) TO MAINTAIN THE SPACE HEATING SETPOINTS (HSP).

B. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE HEATING SETPOINT (HSP), THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) OPEN TO THE COIL.

C. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE HEATING SETPOINT (HSP), THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) CLOSED TO THE COIL.

4. DIRECT EXPANSION COOLING ENABLE:

A. THE FAN COIL UNIT SHALL BE INDEXED FOR SUMMER/COOLING OPERATION FROM THE GUI OR WHEN THE OUTSIDE AIR TEMPERATURE (OAT) GOES ABOVE 45 °F (ADJ.).

5. DIRECT EXPANSION COOLING (DX) MODE:

A. THE SPACE TEMPERATURE SENSOR (TS) SHALL, THROUGH THE BACNET DDC CONTROLLER, SEQUENCE THE DIRECT EXPANSION COOLING STAGES (DX) TO MAINTAIN THE SPACE COOLING SETPOINTS (CSP).

B. WHEN THE SPACE TEMPERATURE (TS) IS > THE SPACE COOLING SETPOINT (CSP), THE BACNET DDC CONTROLLER SHALL SEQUENCE THE DIRECT EXPANSION COOLING STAGES (DX) ON.

C. WHEN THE SPACE TEMPERATURE (TS) IS < THE SPACE COOLING SETPOINT (CSP), THE BACNET DDC CONTROLLER SHALL SEQUENCE THE DIRECT EXPANSION COOLING STAGES (DX) OFF.

D. DURING THE MECHANICAL COOLING MODE THE HEATING MODE SHALL BE DISABLED.

6. DISCHARGE AIR TEMPERATURE LOW LIMIT CONTROL:

A. THE DISCHARGE AIR TEMPERATURE SENSOR (DAT), THROUGH THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) & OUTSIDE DAMPERS (OAD) IN SEQUENTIAL SERIES TO MAINTAIN THE DISCHARGE AIR TEMPERATURE LOW LIMIT SETPOINT (DALL). WHEN THE DISCHARGE AIR TEMPERATURE (DAT) IS < THE DISCHARGE AIR TEMPERATURE LOW LIMIT SETPOINT (DALL), THE BACNET DDC CONTROLLER, SHALL MODULATE THE HOT WATER COIL CONTROL VALVE (HWV) OPEN TO THE COILS. IF THE DISCHARGE AIR TEMPERATURE (DAT) CONTINUES TO LOWER BELOW THE DISCHARGE AIR TEMPERATURE LOW LIMIT SETPOINT (DALL), THE OUTSIDE AIR DAMPER SHALL BE CLOSED. A FURTHER DECREASE IN THE DISCHARGE AIR TEMPERATURE (DAT) BELOW 45°F AN ALARM (DATLO) SHALL BE SENT TO THE GUI. WHEN THE DISCHARGE AIR TEMPERATURE (DAT) HAS RISEN ABOVE THE DISCHARGE AIR TEMPERATURE LOW LIMIT SETPOINT (DALL), THE CONTROL OF THE OUTSIDE DAMPER (OAD) & HOT WATER COIL CONTROL VALVE (HWV) SHALL REVERT BACK TO THE SCHEDULED MODE OF OPERATION. THE DISCHARGE AIR TEMPERATURE LOW LIMIT SEQUENCE SHALL BE DISABLED WHEN THE DIRECT EXPANSION COOLING (DX) IS IN OPERATION.

F. AIR FILTER MONITORING

1. THE BACNET DDC CONTROLLER SHALL MONITOR THE FAN COIL UNIT’S FAN RUN TIME (CS) & SHALL PROVIDE A MAINTENANCE REMINDER (FILTER) AT THE GUI WHEN THE FILTER REPLACEMENT TIMER SETTING (FILTERSP) HAS BEEN REACHED.

2. A SOFTWARE RESET SHALL BE REQUIRED TO SILENCE/RESET THE TIMER FUNCTION.

G. LOW LIMIT SWITCH:

1. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE LOCATED ON THE LEAVING AIRSIDE OF THE HEATING COIL. IF THE LOW TEMPERATURE LIMIT SWITCH (LLS) SENSES S COIL DISCHARGE BELOW THE LOCAL DEVICE SETTING OF 38 °F; THE FAN COIL UNIT’S FAN AND ANY ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE DAMPERS (OAD) SHALL

CLOSE; THE DIRECT EXPANSION COOLING STAGES (DX) SHALL BE OFF; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL OPEN TO THE COIL.

2. THE LOW TEMPERATURE LIMIT SWITCH (LLS) SHALL BE RESET FROM THE GUI.

H. LIQUID DETECTION SENSOR (LDS):

1. WHEN THE LIQUID DETECTOR SENSOR (LDS) SWITCH DETECTS ACCUMULATED LIQUIDS IN THE DRIP PAN THE AIR HANDLING UNIT’S COOLING SEQUENCES SHALL BE DISABLED. A

DRIP PAN LIQUID DETECTION SWITCH SHALL BE LOCATED BELOW THE FAN COIL UNIT. IF LIQUID IS DETECTED IN THE PAN, THE FAN COIL UNIT’S SUPPLY AND ANY ASSOCIATED EXHAUST FANS SHALL STOP; THE OUTSIDE DAMPERS (OAD) SHALL CLOSE; THE DIRECT EXPANSION COOLING STAGES (DX) SHALL BE OFF; THE HOT WATER COIL CONTROL VALVE (HWV) SHALL OPEN TO THE COIL. A DRIP PAN LIQUID DETECTION (LEAK) ALARM SHALL BE SENT TO THE GUI. THE ALARM SHALL BE RESET THROUGH A SOFTWARE SWITCH FROM THE GUI.

I. ALARMS:

1. MONITORED VALUES SHALL GENERATE ALARMS AT THE GUI & NOTIFY PERSONNEL WHEN ANY OF THE BELOW OCCUR.

2. FAN FAILURE (FANFAIL): COMMANDED ON, BUT THE STATUS (CS) IS OFF.

3. FAN IN HAND (FANHAND): COMMANDED OFF, BUT THE STATUS (CS) IS ON.

4. HI/LOW SPACE AIR TEMP: WHEN THE SPACE TEMPERATURE (TS) IS > 85 °F (ADJ.) < 55 °F (ADJ.).

5. HI/LOW DISCHARGE AIR TEMP: WHEN THE DISCHARGE AIR TEMPERATURE (DAT) IS>120°F(ADJ.)< 50°F (ADJ.).

6. FILTER (FILTER): WHEN THE FILTER REPLACEMENT TIMER SETTING IS REACHED.

7. DRIP PAN LIQUID (LEAK): WHEN THE DRIP PAN LIQUID DETECTOR SENSES LIQUID LEVEL IN THE PAN.

8. LOW TEMPERATURE LIMIT SWITCH: WHEN THE SENSOR TRIPS, UPON THE TEMPERATURE BELOW THE SETTING.

LEGEND	-----	Low Voltage, 18 AWG, Copper Wire
	-----	Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
	_____	Line Voltage, THHN Field Wiring

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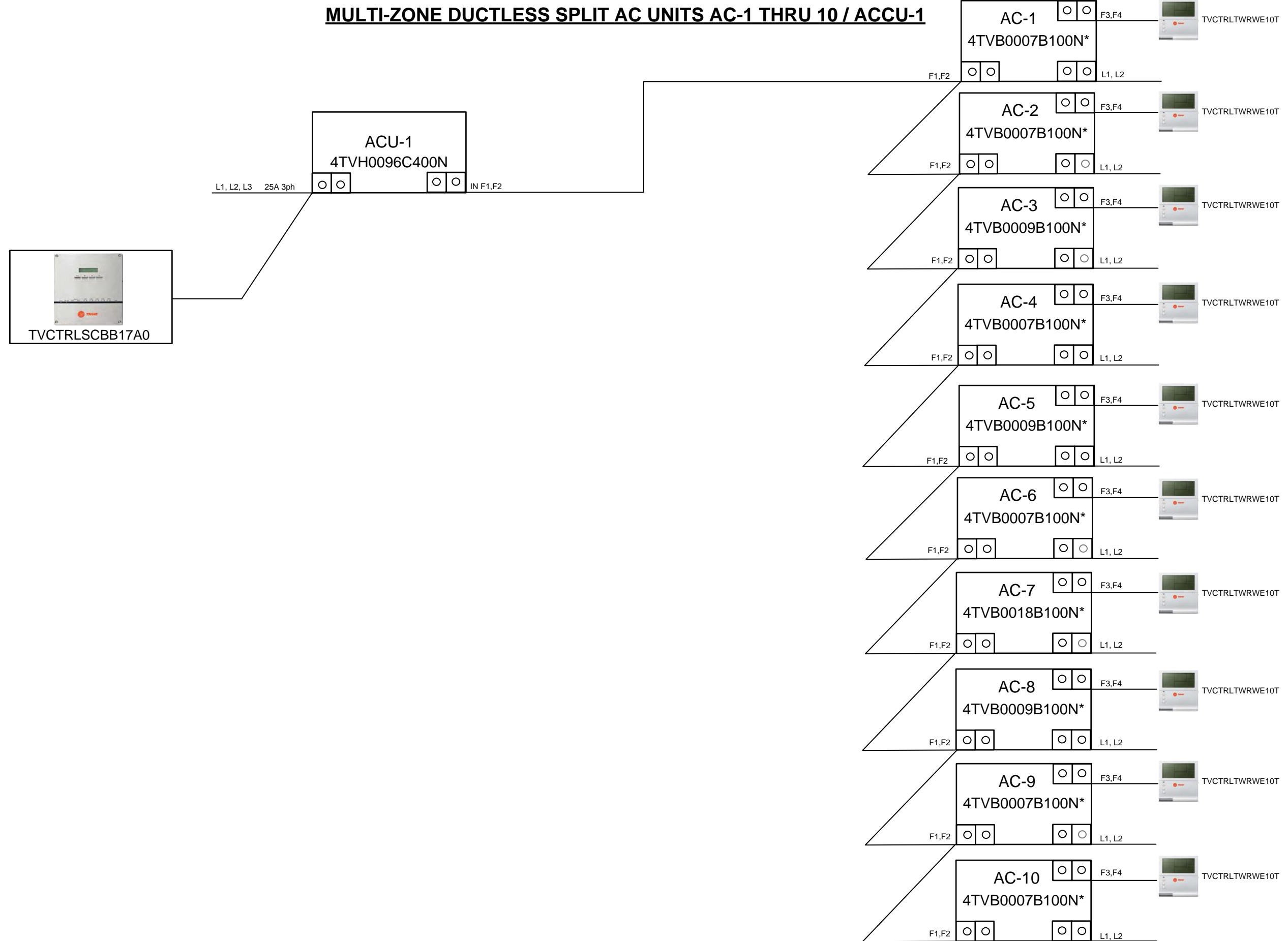
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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
EXISTING FAN COIL UNIT SEQUENCE OF OPERATION	
Job No. ##	Page 30 of 34

MULTI-ZONE DUCTLESS SPLIT AC UNITS AC-1 THRU 10 / ACCU-1



LEGEND	---	
	Low Voltage, 18 AWG, Copper Wire	
Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance		
Line Voltage, THHN Field Wiring		

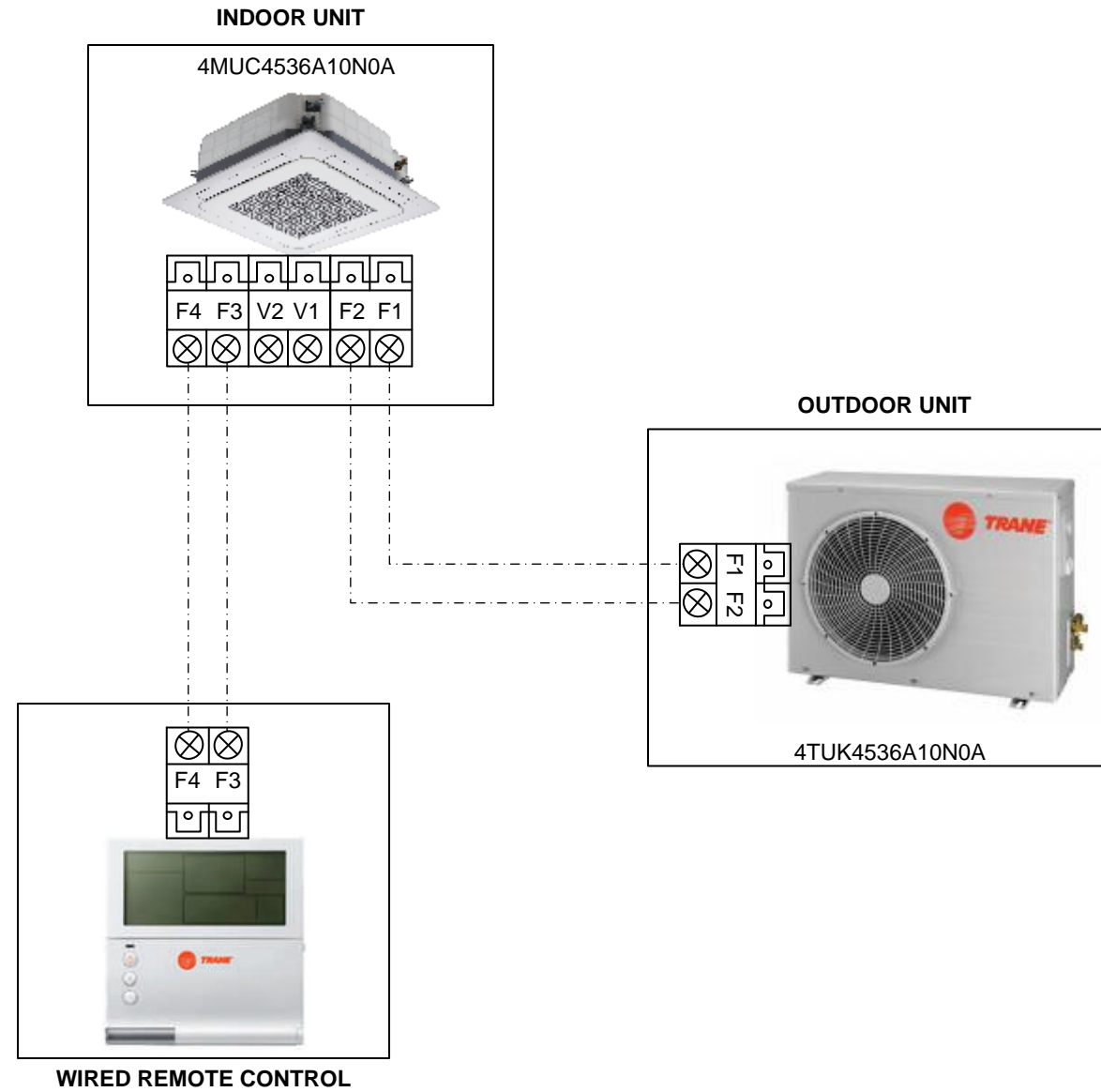
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DUCTLESS SPLIT HEAT PUMPS HP-1,2,3/ ACCU-1,2,3 SCHEMATIC & WIRING DIAGRAM

TYPICAL OF 3



LEGEND

- Low Voltage, 18 AWG, Copper Wire
- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
- Line Voltage, THHN Field Wiring

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Project: SAMPLE PROJECT - JOHNSON CONTROLS	
DUCTLESS SPLIT HEAT PUMPS HP-1,2,3/ ACCU-1,2,3	
SCHEMATIC & WIRING DIAGRAM	
Job No. ##	Page 32 of 34

VALVE SCHEDULE

ITEM #	EQUIPMENT NAME	VALVE TAG	SYSTEM DATA			Water Data		VALVE BODY DATA										ACTUATOR DATA		DESCRIPTION	
			Qty	EQUIPMENT LOCATION	SERVICE OR APPLICATION	Line Size (INCH)	Design Flow (gpm)	Design Pressure Drop (psi)	Size (IN)	Pressure Drop	Calculated CV	VALVE CV	PATTERN	TYPE	CONN.	PART NUMBER	TRIM	MANUFACTURER	PART NUMBER		MANUFACTURER
1	Chiller	V-1	1	First Floor	Chilled Water	6	343	5	6	0.11	153.39	1025	2-WAY	On-Off	Flanged	VFC-060LB-722D	Stainless Steel	Johnson		Johnson	Butterfly Valve, NSR 120Vac Actuator
2	Chiller	V-2	1	First Floor	Chilled Water	6	343	5	6	0.11	153.39	1025	2-WAY	On-Off	Flanged	VFC-060LB-722D	Stainless Steel	Johnson		Johnson	Butterfly Valve, NSR 120Vac Actuator
3	Boiler	V-3	1	First Floor	Hot Water	4	343	5	4	0.48	153.39	496	2-WAY	On-Off	Flanged	VFC-040LB-722D	Stainless Steel	Johnson		Johnson	Butterfly Valve, NSR 120Vac Actuator
4	Boiler	V-4	1	First Floor	Hot Water	4	343	5	4	0.48	153.39	496	2-WAY	On-Off	Flanged	VFC-040LB-722D	Stainless Steel	Johnson		Johnson	Butterfly Valve, NSR 120Vac Actuator
5	AHU-1	V-5	1	Second Floor	Hot Water	2 1/2	54	5	2	3.24	24.15	30	2-WAY	Modulating	NPT	VG1245FR	Stainless Steel	Johnson	928GGA	Johnson	Ball Valve, SR 24Vac Actuator
6	AHU-2	V-6	1	Second Floor	Hot Water	2 1/2	54	5	2	3.24	24.15	30	2-WAY	Modulating	NPT	VG1245FR	Stainless Steel	Johnson	928GGA	Johnson	Ball Valve, SR 24Vac Actuator
7	AHU-3	V-7	1	Second Floor	Hot Water	2 1/2	54	5	2	3.24	24.15	30	2-WAY	Modulating	NPT	VG1245FR	Stainless Steel	Johnson	928GGA	Johnson	Ball Valve, SR 24Vac Actuator
8	AHU-4	V-8	1	Second Floor	Hot Water	2 1/2	54	5	2	3.24	24.15	30	2-WAY	Modulating	NPT	VG1245FR	Stainless Steel	Johnson	928GGA	Johnson	Ball Valve, SR 24Vac Actuator

LEGEND

- Low Voltage, 18 AWG, Copper Wire
- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
- Line Voltage, THHN Field Wiring

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NO.	DATE	REVISION		BY					



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Project: **SAMPLE PROJECT - JOHNSON CONTROLS**

VALVE SCHEDULE

MASTER BILL OF MATERIAL

Item #	Application	Tag	Part no	Quantity	Shipped	Description	Manufacturer
1	JACE	FX-80	FX-80	1		FX80 Supervisory Controller is a web-based supervisory-class controller	Johnson
2	Device	Device	LP-FXWS-3	1		3-device FX Server license, integration of up to three FX Supervisory Controllers	Johnson
3	Device	Device	FX-SC8CL025-0	1		FX80 Supervisory Controller core device license, 25 field devices, 1,250 points	Johnson
4	Device	Device	FX-SC8DL50-0	1		License enabling an additional 50 field devices, 2,500 points for one FX80	Johnson
5	Device	Device	FX-SC8D100M1-0	1		Initial 1 year software maintenance for FX80 Supervisory Controller with 100-199 field device capacity	Johnson
6	Power Module	PWR	FX-SC8XPS-0	1		FX80 universal wall mount power supply 100-240 VAC/24 V	Johnson
7	Programmable Controller	C1	FX-PCG2611-0	4		17-Point General Purpose Programmable Controller with 6 UI, 2 BI, 3 BO, 2 AO, and 4 CO; 24 VAC	Johnson
8	Expansion IO module	IO-#	FX-PCX3721-0	2		16-Point Expansion I/O Module with 16 BI, FC, and SA Bus Support	Johnson
9	Expansion IO module	IO-#	FX-PCX3731-0	2		16-Point Expansion I/O Module with 8 BI, 8 BO, FC, and SA Bus Support	Johnson
10	Expansion IO module	IO-#	FX-PCX4711-0	2		17-Point Expansion I/O Module with 6 UI, 2 BI, 3 BO, 2 AO, 4 CO, 24 VAC, FC, and SA Bus Support	Johnson
11	Outside Air Temperature	OAT/H	A/CP-O-EH	1		10K Type II , CP Outside Air Sensor, 14" Leads, Euro Housing	ACI
12	Immersion Temperature Sensor	TS-1 THRU 6	A/CP-I-6"-PB	6		Immersion 10 kΩ type II thermistor with stainless well and 6" insertion	ACI
13	Discharge Air Temperature Sensor	DAT, RAT	A/CP-D-12-PB	20		Thermistor, Duct, 10K Ω (Type II), 12", Plastic Box	ACI
14	Space Temperature Sensor	ZT	NS-BTB7003-0	7		NS Series network sensor with LCD	Johnson
15	Guard		BA/BG	7		Larger BAPI-Guard Thermostat Protector	Bapi
16	Return Air Humidity	RAH	A/RH2-D-010	1		Relative Humidity, +/-2% Accuracy, Duct mounted, 0 to 10 VDC	AC1
17	CO2 Sensor	RA-CO2	A/CO2-DUCT	2		Duct Mount CO2 Sensor, 0 to 2,000 ppm, 0-5 VDC or 0-10 VDC	AC1
18	Wet differential pressure sensor	DPT-1	629-05-CH-P2-E5-S3	1		Wet/wet differential pressure transmitter, range 100 psid, working pressure 200 psi	Dwyer
19	Freezestat	FRZ	A11D	6		SPST,Open Low ,Manual Reset	Johnson
20	Current Switch	CS-1 THRU 13	RIBXGF	17		Split Core Current Switch- .35 to 150 Amperes	Functional Devices
21	Field Mounted Relay	R-1 THRU 26	RIBU1C	38		Universal RIB Relay	Functional Devices
22	Transformer	TR1	APT-75-5SB	1		MULTI-TAP 24 Vac Control Transformer - 75VA	Dwyer
23	Transformer	TR1	APT-100-5SB	4		MULTI-TAP 24 Vac Control Transformer - 100VA	Dwyer
24	Panel Mounted Relay	R-2	RH3B-ULAC24V	2		3PDT Relay w/ light 24VAC	IDEC
25	Base	R-2	SH3B-05	2		Relay Socket DIN Rail Mounted	IDEC
26	Panel	CP-1	SCE-16N1606LP	3		Saginaw, 16"H X 16"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
27	Perforated Subpanel	CP-1	SCE-16N16MP	3		Enclosure, Nema-1	Saginaw
28	Panel	CP-1	SCE-30N2406LP	1		Saginaw, 30"H X 24"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
29	Perforated Subpanel	CP-1	SCE-30N24MP	1		Enclosure, Nema-1	Saginaw
30	Panel	CP-1	SCE-24N2406LP	1		Saginaw, 24"H X 24"W X 6" Depth Nema1 enclosure, steel ANSI61-Grey	Saginaw
31	Perforated Subpanel	CP-1	SCE-24N24MP	1		Enclosure, Nema-1	Saginaw

LEGEND

----- Low Voltage, 18 AWG, Copper Wire
 ----- Low Voltage Communication Wiring 22/2 AWG, CL2P, Shielded Copper Wire, Low Capacitance
 _____ Line Voltage, THHN Field Wiring

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