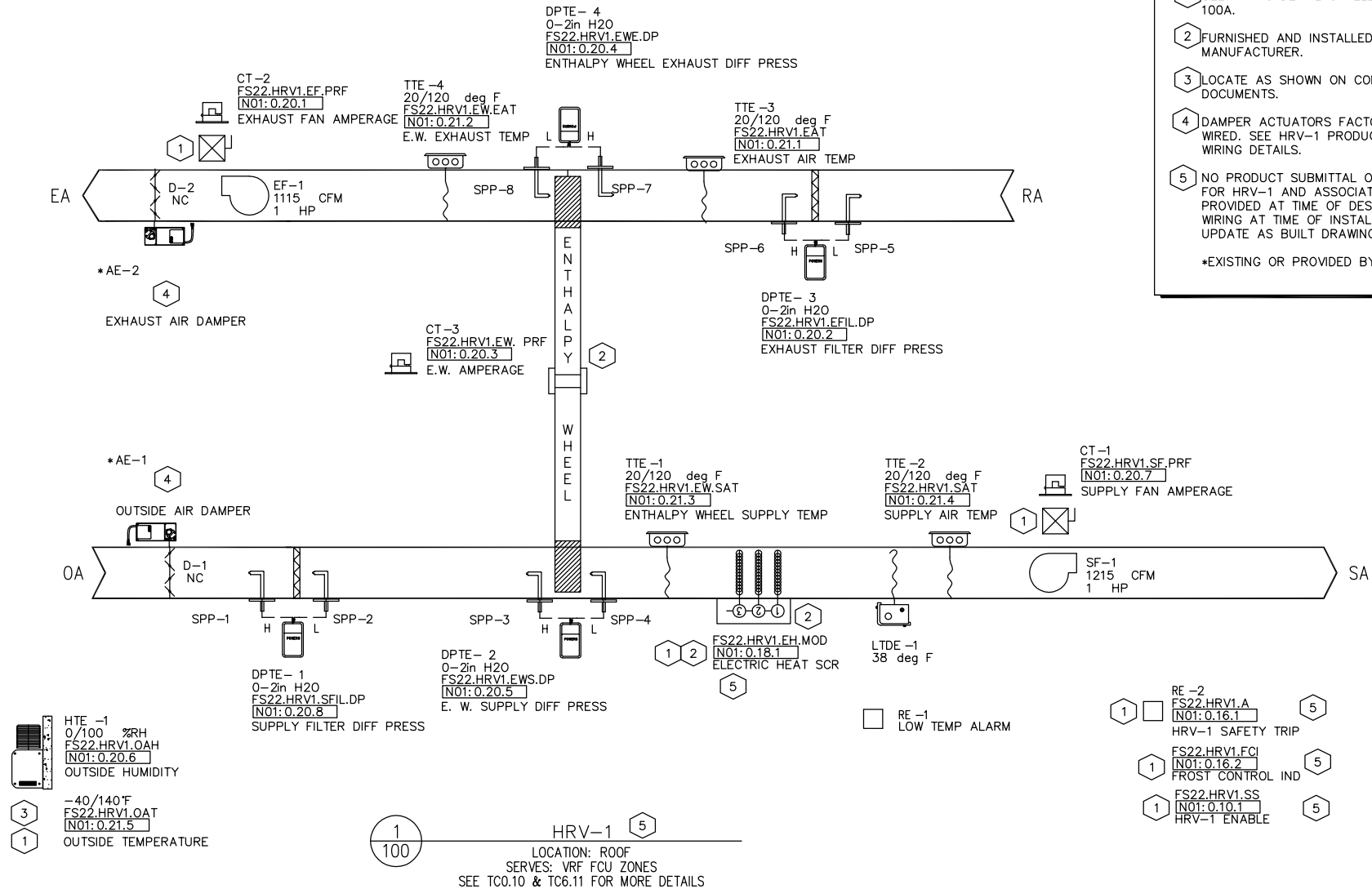


# INSTALLATION NOTES:

- SEE WIRING DETAIL ON ELECTRICAL DRAWING 100A.
  - FURNISHED AND INSTALLED WITH UNIT BY MANUFACTURER.
  - LOCATE AS SHOWN ON CONTRACT DOCUMENTS.
  - DAMPER ACTUATORS FACTORY MOUNTED AND WIRED. SEE HRV-1 PRODUCT SUBMITTAL FOR WIRING DETAILS.
  - NO PRODUCT SUBMITTAL OR WIRING DIAGRAM FOR HRV-1 AND ASSOCIATED COMPONENTS PROVIDED AT TIME OF DESIGN. FIELD VERIFY WIRING AT TIME OF INSTALLATION AND UPDATE AS BUILT DRAWINGS ACCORDINGLY.
- \*EXISTING OR PROVIDED BY OTHERS



REF#	FIELD PANEL NAME	FIELD PANEL NODE NAME
N01	FS22N01	N01

## REVISION HISTORY

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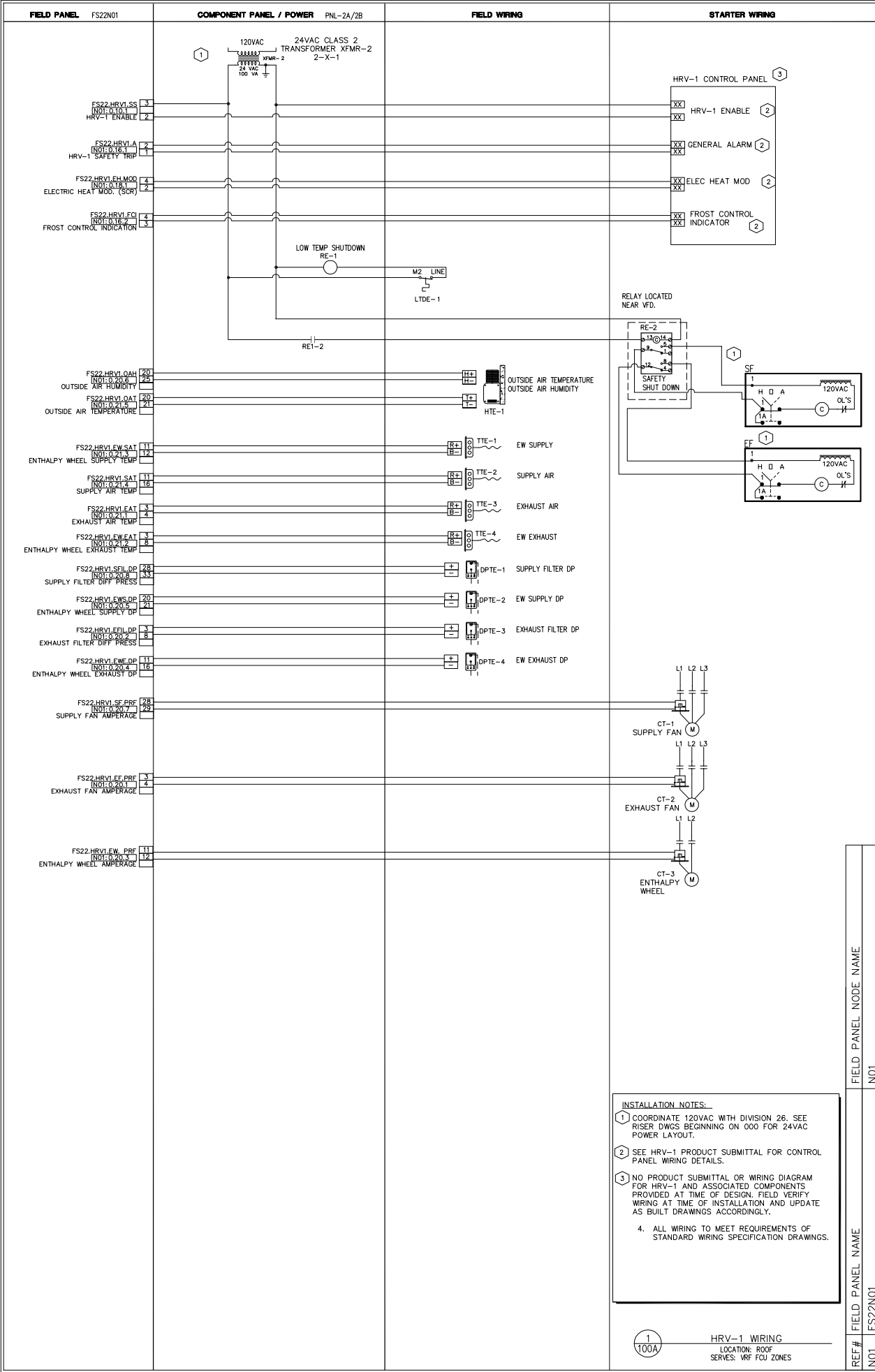
**FIRESTATION 22**  
Seattle, WA

ENGINEER	DRAFTER	CHECKED BY	INITIAL RELEASE	LAST EDIT DATE
SK	SK		11/11/16	12/21/16

**HEAT RECOVERY VENTILATOR 1**

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**100**



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100A

FIRESTATION 22

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REVISION HISTORY

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INITIAL RELEASE

11/11/16

LAST EDIT DATE

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HEAT RECOVERY VENTILATOR 1

Control Device	Qty	Product Number	Manufacturer	Document Number	Description
Field Mounted Devices					
CT 1-3	3	H921	VERIS	1006cut007	LOOP-POWRED 4-20MA CURR SNSR
DPTE 1-4	4	QBM3100U2.5	SIEMENS	149930	SIEMENS AIR DP SNSR, 1%, 0-2.5", 4-20MA
HTE 1	1	H01NMSTA12	N/A	N/A	N/A
LTDE 1	1	134-1504	SIEMENS	155 016	T'STAT, LOW TEMP,15/55,MANUAL
RE 1	1	RH2B-U-AC24V-KIT	IDEC	1202cut016	RELAY&SOC,GP DPDT AC24V 10A
RE 2	1	RIB2401D	FUNCTIONAL DEVICES	1208cut002	RIB 24VAC 24VAC/DC DPDT
SPP 1-8	8	269-062	SIEMENS	N/A	PR269 ACCESSORY, SENSING TUBE
TTE 1-4	4	533-380-8	SIEMENS	149263	FLEX AVER SNSR, 20-120#F, 8FT PROBE

**HEAT RECOVERY VENTILATOR 1 (HRV-1)**

**OVERVIEW**

THE SYSTEM INCLUDES HRV-1 AND THE RELATED INDOOR VRF UNITS (VRF-1 THROUGH 13) THAT IT PROVIDES MAKE-UP AIR FOR. THE KITCHEN MAKE-UP AIR UNIT (MAU-1) IS ALSO VERY INTERACTIVE WITH THIS SYSTEM SO PLEASE REFER TO THAT SEQUENCE OF OPERATION FOR ADDITIONAL INFORMATION.

THE SYSTEM INCLUDES THE FOLLOWING COMPONENTS:

- MOTORIZED POWER OPEN/SPRING RETURN CLOSED INTAKE DAMPERS
- MERV13 SUPPLY AIR (OUTDOOR AIR) FILTERS
- A CONSTANT SPEED ENTHALPY WHEEL
- A SUPPLEMENTAL ELECTRIC HEATING COIL WITH A SILICON CONTROLLED RECTIFIER TO ALLOW MODULATING CAPACITY CONTROL
- A CONSTANT SPEED SUPPLY FAN
- VARIABLE FLOW REFRIGERATION INDOOR UNITS WHICH INCLUDE:
  - 1. MERV8 FILTERS
  - 2. DIRECT EXPANSION REFRIGERANT COILS CAPABLE OF HEATING OR COOLING
  - 3. VARIABLE SPEED SUPPLY FANS
- MERV8 EXHAUST FILTERS
- A CONSTANT SPEED EXHAUST FAN
- MOTORIZED POWER OPEN/SPRING RETURN CLOSED EXHAUST DAMPERS

THE MAJORITY OF THE INDOOR UNITS WILL RUN CONTINUOUSLY BUT WILL HAVE SCHEDULING CAPABILITIES PROVIDED IN THE SOFTWARE IF SCHEDULES ARE DESIRED AT SOME POINT IN THE FUTURE. ADDITIONAL INFORMATION REGARDING THE INDOOR UNITS CAN BE FOUND IN THE VARIABLE FLOW REFRIGERATION SYSTEM (VRF) SEQUENCE OF OPERATION.

THE FOLLOWING 3 ZONES WILL HAVE THEIR INDOOR UNITS CYCLED BY AN OCCUPANCY SENSOR DUE TO THE HIGHLY VARIABLE OCCUPANCY.

1. DAY ROOM
2. BEANERY
3. FITNESS CENTER (PHYSICAL TRAINING)

THESE ZONES WILL ALSO HAVE THEIR CO2 LEVELS MONITORED FOR LEED PURPOSES. THE CO2 SENSORS WILL PROVIDE NO ACTIVE CONTROL FUNCTION AND ARE FOR MONITORING ONLY. OUTDOOR AIR FROM THE HRV WILL BE DELIVERED TO THESE ZONES EVEN WHEN THE INDOOR UNIT IS SHUT DOWN.

**DAMPER INTERLOCKS**

THE HRV SUPPLY AND EXHAUST DAMPERS WILL BE COMMANDED OPEN ANY TIME THE UNIT IS COMMANDED ON VIA FACTORY INTERLOCK WIRING.

**START/STOP CONTROL**

HRV-1 WILL INCLUDE A SCHEDULING FEATURE TO ALLOW SCHEDULED OPERATION TO BE IMPLEMENTED IF SO DESIRED. HOWEVER, THE SCHEDULE WILL BE SET INITIALLY TO PROVIDE ROUND-THE-CLOCK OPERATION.

**POWER FAILURE RECOVERY**

IN THE EVENT OF A POWER FAILURE, THE HRV-1 LOGIC WILL BE ARRANGED TO PROVIDE FOR AN ORDERLY RESTART OF THE SYSTEM IN CONJUNCTION WITH THE OTHER SYSTEMS IN THE FACILITY, INCLUDING THE UTILITY SYSTEMS SERVING IT. THE DETAILS OF THE SPECIFIC RESTART SEQUENCE WILL BE COORDINATED WITH THE DESIGN TEAM AND FACILITY OPERATIONS DURING SUBMITTAL REVIEW AND THE START-UP AND COMMISSIONING PROCESS.

**START-UP SEQUENCING**

- AN ENABLE COMMAND FROM THE SIEMENS CONTROL SYSTEM TO HRV-1, ISSUED FOR ANY PURPOSE WILL:
- IMMEDIATELY START THE EXHAUST FAN AND OPEN THE EXHAUST DAMPER VIA THE FACTORY INTERLOCK WIRING.
  - IMMEDIATELY START THE ENTHALPY WHEEL VIA AN EXHAUST FAN STARTER AUXILIARY CONTACT AND THE FACTORY INTERLOCK WIRING.
  - IMMEDIATELY START THE SUPPLY FAN AND OPEN THE SUPPLY DAMPER IF THE FROST CONTROL CYCLE IS NOT ACTIVE VIA AN EXHAUST FAN STARTER AUXILIARY CONTACT AND THE FACTORY INTERLOCK WIRING (THE FROST CONTROL CYCLE IS DESCRIBED IN THE NEXT SECTION).

ON START-UP OF HRV-1, THE OPERATION OF THE VRF SYSTEMS ASSOCIATED WITH THE SYSTEM WILL BE DELAYED FOR 15 MINUTES (ADJ.) TO ALLOW THE SUPPLY SYSTEM CONDITIONS TO STABILIZE.

**SHUT DOWN SEQUENCING**

A SHUT DOWN COMMAND TO HRV-1, ISSUED FOR ANY PURPOSE, WILL IMMEDIATELY DISABLE THE ELECTRIC REHEAT COIL AND THE VRF SYSTEMS ASSOCIATED WITH HRV-1. THE COMMAND WILL ALSO TRIGGER A SHUTDOWN TIMER THAT WILL DISABLE THE HRV-1 SYSTEM AFTER 5 MINUTES (ADJ.) TO ENSURE THAT ANY RESIDUAL HEAT IN THE ELECTRIC HEATING COILS IS DISSIPATED PRIOR TO SHUT DOWN IN AN EFFORT TO PREVENT NUISANCE HIGH TEMPERATURE SAFETY TRIPS AT THE ELECTRIC RESISTANCE HEATER. WHEN THE DISABLE COMMAND IS ISSUED BY THE SIEMENS SYSTEM, THE FACTORY INTERLOCK WIRING IN HRV-1 WILL SHUT DOWN THE EXHAUST FAN, SUPPLY FAN, AND ENTHALPY WHEEL AND RETURN THE DAMPERS TO THE FULLY CLOSED POSITION.

**DISCHARGE TEMPERATURE CONTROL**

**ENTHALPY WHEEL CONTROL**

HRV-1 INCORPORATES AN ENTHALPY WHEEL TO RECOVER ENERGY FROM THE EXHAUST AIR STREAM AND MOVE IT TO THE SUPPLY AIR STREAM. SUPPLEMENTAL COOLING IS NOT PROVIDED. SUPPLEMENTAL HEATING IS PROVIDED AND CONTROLLED AS DESCRIBED BELOW.

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		HEAT RECOVERY VENTILATOR 1																

THE ENTHALPY WHEEL IS A CONSTANT SPEED WHEEL WITH NO ACTIVE CONTROL OF THE LEAVING AIR TEMPERATURE. IT IS STARTED VIA THE SAME FACTORY INTERLOCK WIRING THAT OPENS THE DAMPERS AND STARTS THE FANS VIA THE HRV-1 ENABLE COMMAND FROM THE SIEMENS SYSTEM AS DESCRIBED ABOVE.

FROST CONTROL CYCLE

A FACTORY WIRED FROST CONTROL CYCLE IS INITIATED BASED ON THE PRESSURE DROP ACROSS THE SUPPLY AIR SIDE OF THE ENTHALPY WHEEL WHEN THE OUTDOOR AIR TEMPERATURE AT THE INTAKE TO THE UNIT IS BELOW 5 DEG F AS SENSED BY A FACTORY FURNISHED AND WIRED THERMOSTAT.

WHEN THE PRESSURE DROP EXCEEDS THE SETTING OF THE FACTORY FURNISHED AND WIRED PRESSURE SWITCH, A TIME DELAY RELAY CYCLES THE SUPPLY FAN OFF FOR 5 MINUTES AND THEN ON FOR 30 MINUTES (FACTORY SET, ADJ.). DURING THIS PERIOD OF TIME, THE ENTHALPY WHEEL CONTINUES TO ROTATE, ALLOWING THE HEAT IN THE EXHAUST AIR STREAM TO DEFROST THE WHEEL.

WHEN THE OUTDOOR TEMPERATURE RISES ABOVE 5 DEG F PLUS THE FIXED DIFFERENTIAL OF THE FACTORY OUTDOOR AIR TEMPERATURE SENSOR, THE FROST CONTROL CYCLE IS DISABLED.

AN ISOLATED CONTACT FACTORY FURNISHED CONTACT CLOSSES WHEN THE FROST CONTROL CYCLE IS OCCURRING. THE DDC SYSTEM MONITORS THIS CONTACT TO PROVIDE ANNUNCIATION OF THE FROST CONTROL CYCLE.

SUPPLEMENTAL HEAT CONTROL

SUPPLEMENTAL HEATING IS PROVIDED BY AN ELECTRIC REHEAT COIL WHICH IS CONTROLLED BY A FACTORY FURNISHED AND INSTALLED SILICON CONTROLLED RECTIFIER (SCR) WITH A REMOTE SET POINT ADJUSTMENT CAPABILITY FROM THE SIEMENS SYSTEM. THE SIEMENS SYSTEM INDEPENDENTLY MONITORS THE LEAVING AIR TEMPERATURE FROM THE ELECTRIC HEATING COIL (ALONG WITH OTHER UNIT PARAMETERS, SEE THE POINTS LIST FOR DETAILS) BUT THE ELECTRIC RESISTANCE COIL USES A FACTORY FURNISHED AND WIRED TEMPERATURE SENSOR TO DIRECTLY CONTROL THE ELECTRIC RESISTANCE HEATER VIA THE FACTORY FURNISHED AND INSTALLED SCR.

THE SIEMENS SYSTEM ENABLES THE SUPPLEMENTAL ELECTRIC HEAT WHEN THE OUTDOOR TEMPERATURE DROPS BELOW THE DISCHARGE AIR TEMPERATURE SET POINT FOR 30 MINUTES OR MORE (ADJ.). WHEN THE OUTDOOR AIR TEMPERATURE RISES ABOVE THE ENABLE SET POINT, THE SUPPLEMENTAL HEATER IS DISABLED.

ONCE ENABLED, THE FACTORY FURNISHED SCR MODULATES THE CAPACITY OF THE ELECTRIC HEATER TO MAINTAIN THE DESIRED DISCHARGE AIR TEMPERATURE ("NEUTRAL AIR" 70 DEG F INITIAL SET POINT, ADJUSTABLE VIA THE SIEMENS SYSTEM). VIA THE PHYSICAL CONFIGURATION OF THE SYSTEM, THE FIRST STAGE OF HEATING WILL BE PROVIDED BY THE ENTHALPY WHEEL TRANSFERRING ENERGY FROM THE EXHAUST STREAM TO THE OUTDOOR AIR STREAM. THIS IS A PASSIVE PROCESS WITH NO DIRECT CONTROL OVER THE TEMPERATURE AND HUMIDITY PROVIDED IN THE SUPPLY AIR STREAM.

IF THE SUPPLY TEMPERATURE DOWNSTREAM OF THE ENERGY RECOVERY WHEEL DEVIATES BELOW THE SUPPLY AIR TEMPERATURE SET POINT BECAUSE THE RECOVERED ENERGY IS INSUFFICIENT TO MEET IT, THEN THE ELECTRIC HEAT IS MODULATED FROM MINIMUM TOWARDS MAXIMUM CAPACITY BY THE SCR. A DEVIATION ABOVE SET POINT REVERSES THE SEQUENCE.

FACTORY FURNISHED, HARDWIRED SAFETY INTERLOCKS WILL SHUT DOWN THE ELECTRIC RESISTANCE HEATER IRRESPECTIVE OF ANY COMMANDS FROM SIEMENS OR THE SCR IF:

- THE SUPPLY FAN STOPS OPERATING AS SENSED BY A DIFFERENTIAL PRESSURE SWITCH MONITORING THE PRESSURE DROP ACROSS THE ELECTRIC HEATING ELEMENT.
- AN AUTOMATIC RESET THERMAL LIMIT SWITCH SENSES A TEMPERATURE IN THE DUCT HEATER THAT EXCEEDS ITS SET POINT.
- A MANUAL RESET THERMAL LIMIT SWITCH SENSES A TEMPERATURE IN THE DUCT HEATER THAT EXCEEDS ITS SET POINT, WHICH IS HIGHER THAN THE AUTOMATIC RESET THERMAL SWITCH.

VENTILATION OPERATION

HRV-1 OPERATES AT A CONSTANT VOLUME. CARBON DIOXIDE (CO2) SENSORS MONITOR CO2 LEVELS IN THE DAY ROOM, BEANERY, AND THE FITNESS CENTER AND INITIATE ALARMS IF THE LEVELS EXCEED SAFE THRESHOLDS FOR 5 MINUTES OR MORE (1000 PPM, ADJ.).

NITROUS OXIDE AND CARBON MONOXIDE SENSORS MONITOR THE LEVELS OF THOSE GASES IN THE CORRIDORS WITH ACCESS TO THE APPARATUS BAY ON THE FIRST FLOOR AND BASEMENT LEVELS AND INITIATE ALARMS IF THE HARD CODED THRESHOLD LEVELS IN THE SENSORS ARE EXCEEDED (100 PPM FOR CO AND 5 PPM FOR NO2).

INDOOR FAN COIL UNIT CONTROLS

SEE THE NARRATIVE SEQUENCE OF OPERATIONS FOR THE VRF SYSTEMS FOR THE DETAILS OF THE SEQUENCE OF OPERATION ASSOCIATED WITH THE INDOOR FAN COIL UNITS. NOTE THAT HRV-1 WILL CONTINUE TO SUPPLY VENTILATION AIR TO AN INDOOR FAN COIL UNIT EVEN IF IT IS IN THE UNOCCUPIED CYCLE.

SAFETY INTERLOCKS

THE HRV-1 FIRE ALARM INTERFACE AND SUPPLY DUCT FREEZESTAT WILL SHUT DOWN THE SYSTEM, NO MATTER WHAT THE POSITION THE ANY STARTER HAND-OFF-AUTO SWITCHES ARE IN IF AN UNSAFE OPERATING CONDITION IS DETECTED. NOTE THAT THE FIRE ALARM SHUT DOWN IS PROVIDED VIA SOFTWARE LOGIC IN THE DDC SYSTEM BASED ON ONE HARD WIRED INPUT FROM THE FIRE ALARM CONTROL PANEL. THIS FEATURE IS NOT REQUIRED BY CODE AND IS BEING PROVIDED AS AN ADDED MEASURE OF SAFETY IN THE EVENT OF AN ALARM.

FACTORY FURNISHED AND WIRED MOTOR OVERLOADS WILL SHUT DOWN AND LOCK OUT EITHER FAN NO MATTER WHAT POSITION THEIR STARTER HAND-OFF-AUTO SELECTOR SWITCHES ARE IN.

FIELD WIRING INFORMATION

THE WIRING DIAGRAM FOR THE BASIS OF DESIGN UNIT HAS BEEN INCLUDED FOR BIDDING PURPOSES ON SHEET TC5.12.

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