ATC GENERAL NOTES (APPLIES TO ALL ATC WORK)

1. ALL AUTOMATIC TEMPERATURE CONTROLS (ATC) SHALL BE DIRECT DIGITAL CONTROLS (DDC) AND SHALL BE INTEGRATED INTO THE EXISTING JCI METASYS BUILDING AUTOMATION SYSTEM (BAS) FOR THE FOLLOWING SCHOOLS: DOES, FES, GHS, HCMS, OMHS, AND RHHS. THE DIRECT DIGITAL CONTROLS SHALL BE INTEGRATED INTO THE EXISTING HONEYWELL TRIDIUM BAS FOR THE FOLLOWING SCHOOLS: ELMS, GCES, HSES, MWMS, AND VES. ALL ATC WORK SHALL BE PERFORMED BY INSTALLERS AUTHORIZED BY THE BAS MANUFACTURER.
2. THE BAS CONTROLS SHALL UTILIZE ELECTRONIC SENSING, MICROPROCESSOR-BASED DIGITAL CONTROL, AND ELECTRONIC ACTUATION OF DAMPERS AND VALVES OR PROVIDE ANALOG PRESSURE TRANDUCER TO CONVERT DDC VOLTAGE INTO PNEUMATIC SIGNAL PRESSURE FOR ALL EXISTING PNEUMATIC HEATING OR COOLING WATER VALVE ACTUATORS, EQUAL TO VERIS EP2100S.
3. THE ATC CONTRACTOR SHALL PROVIDE ALL CONTROLLERS; CONTROL DEVICES; CONTROL PANELS; SOFTWARE; PROGRAMMING; AND INPUT/OUTPUT, POWER, AND NETWORK WIRING REQUIRED TO CONTROL THE HVAC EQUIPMENT AND CONNECT THE HVAC EQUIPMENT TO THE BAS. NETWORK INTERFACE COMMUNICATION SHOULD MATCH THE EXISTING BUILDING BAS NETWORK PROTOCOL.
4. IF COMMUNICATION IS LOST BETWEEN THE UNIT CONTROLLER AND THE BAS, THE UNIT CONTROLLER SHALL OPERATE USING DEFAULT MODES AND SETPOINTS.
5. EXCEPT AS OTHERWISE INDICATED, PROVIDE MANUFACTURER'S STANDARD MATERIALS AND COMPONENTS AS PUBLISHED IN THEIR PRODUCT INFORMATION, DESIGNED AND CONSTRUCTED AS RECOMMENDED BY THE MANUFACTURER, AND AS REQUIRED FOR THE APPLICATION INDICATED.
6. ALL INPUT/OUTPUT POINTS SHOWN IN THE DDC POINT LISTS SHALL BE HARDWIRED TO THE BAS.
7. GRAPHICS SHALL BE PROVIDED ON THE BAS FOR ALL EXISTING AND NEW INPUT/OUTPUT POINTS SHOWN IN THE DDC POINT LISTS. GRAPHICS SHALL IDENTIFY THE CURRENT MODE OF OPERATION, SETPOINTS, AND CURRENT VALUES OF ALL POINTS. ALL SETPOINTS SHALL BE ADJUSTABLE.
8. OCCUPIED/UNOCCUPIED MODES OF OPERATION SHALL BE DETERMINED BY THE TIME SCHEDULE OF THE BAS.
9. ALL WIRING SHALL BE INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND SHALL BE INSTALLED WITHIN CONDUIT (EMT - INDOORS, RIGID STEEL - OUTDOORS) IN EXPOSED OR CONCEALED, INACCESSIBLE LOCATIONS. UL PLENUM RATED CABLE INSTALLED ON J-HOOKS IS ACCEPTABLE FOR CONCEALED, ACCESSIBLE LOCATIONS FOR COMMUNICATIONS AND SIGNAL WIRING. J-HOOKS SHALL BE PROVIDED AT INTERVALS NOT EXCEEDING 60 INCHES. CABLES SHALL BE SECURED WITH VELCRO CABLE STRAPS (PLASTIC CABLE TIES ARE NOT ACCEPTABLE). 24VAC POWER WIRING SHALL BE METAL CLAD (MC) CABLE AND SECURELY FASTENED.
10. COMMUNICATION WIRING:
    - A. LOCAL SUPERVISORY LAN: CATEGORY 6 OF STANDARD TIA/EIA (100/1000BASET). NETWORK SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 30 VOLTS.
    - B. PRIMARY AND SECONDARY CONTROLLER LANS: INDIVIDUALLY 100% SHIELDED PAIRS PER MANUFACTURER'S RECOMMENDATIONS FOR DISTANCES INSTALLED, WITH OVERALL PVC COVER, CLASS 2, PLENUM-RATED. COMMUNICATION WIRING SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 10 VOLTS. SHIELD SHALL BE TERMINATED AND WIRING SHALL BE GROUNDED AS RECOMMENDED BY BAS MANUFACTURER.
11. SIGNAL WIRING TO ALL FIELD DEVICES INCLUDING, BUT NOT LIMITED TO, ALL SENSORS, TRANSDUCERS, TRANSMITTERS, SWITCHES, ETC. SHALL BE TWISTED, 100% SHIELDED PAIR, MINIMUM 18-GAUGE WIRE, WITH PVC COVER. SIGNAL WIRING SHALL BE RUN WITH NO SPLICES AND SEPARATE FROM ANY WIRING OVER 30 VOLTS. SHIELD SHALL BE GROUNDED AT CONTROLLER END ONLY UNLESS OTHERWISE RECOMMENDED BY THE CONTROLLER MANUFACTURER.
12. FUNCTION OF CONTROLS SHALL BE AUTOMATICALLY RESTORED TO NORMAL OPERATION WITHOUT OPERATOR INTERVENTION WHEN SAFETIES ARE MANUALLY RESET OR WHEN POWER IS RESTORED AFTER AN OUTAGE. LOW LIIMIT TEMPERATURE SENSORS AND HIGH LIMIT PRESSURE SWITCHES SHALL REQUIRE MANUAL RESET AT THEIR RESPECTIVE UNIT. EMERGENCY FAN SHUTDOWN SHALL BE RESET WHEN THE EMERGENCY POWER OFF SWITCH IS RESET. SMOKE DETECTOR TRIPPING SHALL BE RESET WHEN THE ALARM IS NO LONGER PRESENT IN THE FIRE ALARM SYSTEM.
13. PROVIDE AN UNITERRUPTIBLE POWER SUPPLY (UPS) FOR ALL SERVER-LEVEL BAS COMPONENTS.

EXISTING:

- T-1 OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
- BAS BUILDING AUTOMATION SYSTEM

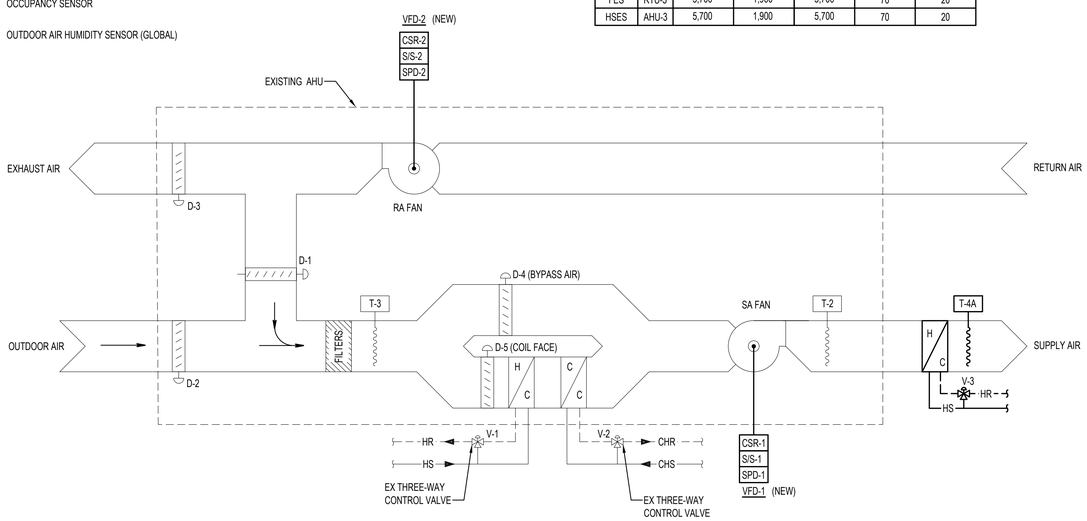
NEW SENSORS:

- CS-1 COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
- OS OCCUPANCY SENSOR
- H-1 OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN AND RA FAN ARE EXISTING. MOTORS SHALL BE REPLACED WITH INVERTER DUTY MOTORS AND NEW VFDS SHALL BE PROVIDED.

EXISTING AIR AND WATER FLOW SCHEDULES

SCHOOL	UNIT	SA FAN CFM	OA CFM	RA FAN CFM	CC GPM	HC GPM
FES	RTU-3	5,700	1,900	5,700	70	20
HSES	AHU-3	5,700	1,900	5,700	70	20



CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT:
FULTON ELEMENTARY SCHOOL (RTU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (AHU-3)

DDC POINT LIST

FULTON ELEMENTARY SCHOOL (RTU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (AHU-3)

POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEWEXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	EXISTING
	H-1	**OUTDOOR RELATIVE HUMIDITY**	**TREND**	**NEW**
	H-2	**SPACE RELATIVE HUMIDITY**	**TREND**	**NEW**
	CO2-2	**SPACE CO2 CONCENTRATION**	**TREND**	**NEW**
	T-5	**SPACE TEMPERATURE**	**TREND**	**NEW**
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-4A	**RHC TEMPERATURE - DOWNSTREAM**	**TREND**	**NEW**
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	RF-1	RETURN FAN STATUS	ALARM	EXISTING
	LT-1	LOW LIMIT TEMPERATURE	ALARM	EXISTING
	CSR-1	**SUPPLY FAN STATUS**	**ALARM**	**NEW**
	CSR-2	**RETURN FAN STATUS**	**ALARM**	**NEW**
	OS	**SPACE OCCUPANCY**	**TREND**	**NEW**
ANALOG OUTPUT	**SPD-1**	**SUPPLY FAN SPEED (VFD-1)**	**TREND**	**NEW**
	SPD-2	**RETURN FAN SPEED (VFD-2)**	**TREND**	**NEW**
	V-1	HEATING COIL VALVE	TREND	EXISTING
	V-2	COOLING COIL VALVE	TREND	EXISTING
	V-3	**REHEAT COIL VALVE**	**TREND**	**NEW**
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-3	RELIEF AIR DAMPER	TREND	EXISTING
	D-4	BYPASS AIR DAMPER	TREND	EXISTING
	D-5	COIL FACE DAMPER	TREND	EXISTING
DIGITAL OUTPUT	**S/S-1**	**SUPPLY FAN START/STOP (VFD-1)**	**TREND**	**NEW**
	S/S-2	**RETURN FAN START/STOP (VFD-2)**	**TREND**	**NEW**

INPUT/OUTPUT SUMMARY FOR:
FULTON ELEMENTARY SCHOOL (RTU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (AHU-3)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.

STARTING AND STOPPING:
1. WHEN THE UNIT SUPPLY AIR FAN AND RETURN AIR FAN ARE ENERGIZED TO OPERATE, THE FANS SHALL BE SOFT STARTED THROUGH THEIR ASSOCIATED VARIABLE FREQUENCY DRIVES.

SUPPLY FAN AND RETURN FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN AND RETURN FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN AND RETURN FAN STATUS INDICATES THE FANS HAVE STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:
1. WHEN HEATING IS REQUIRED, BYPASS DAMPER D-4 SHALL BE CLOSED AND COIL FACE DAMPER D-5 SHALL BE FULLY OPENED.
2. THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY AND RETURN FANS SHALL BE AT THEIR MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AND RETURN AIRFLOWS (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE REHEAT COIL VALVE SHALL BE CLOSED.
3. DEHUMIDIFICATION MODE:
   - 3.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 3.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. WHEN MECHANICAL COOLING IS REQUIRED, THE CHILLED WATER CONTOL VALVE V-2 SHALL BE FULLY OPEN TO THE COOLING COIL.
   - 1.2. MINIMUM OUTDOOR AIR MODE:
     THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE COIL FACE DAMPER, D-5, AND BYPASS DAMPER, D-4, SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.3. ENTHALPY ECONOMIZER MODE:
     WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE COIL FACE DAMPER, D-5, AND BYPASS DAMPER, D-4, SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.4. FREE COOLING MODE:
     WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR, RELIEF AIR, AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   - 2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). THE RETURN FAN VFD SHALL MODULATE THE RETURN FAN SPEED TO LAG THE SUPPLY FAN SPEED BY AN ADJUSTABLE PERCENTAGE DIFFERENTIAL. WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, THE REHEAT COIL CONTROL VALVE SHALL MODULATE OPEN TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SHALL BE SET TO ZERO. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR AND RELIEF AIR DAMPERS CLOSED, THE RETURN AIR DAMPER OPENED, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SET TO ZERO TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:
1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR:
FULTON ELEMENTARY SCHOOL (RTU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (AHU-3)

Howard County Public School System

HENRY ADAMS
Consulting Engineers
MECHANICAL ELECTRICAL & PLUMBING ENGINEERS

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600 BALTIMORE AVENUE
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M701

5/21/2023 3:54 PM

EXISTING:

BAS	BUILDING AUTOMATION SYSTEM

NEW SENSORS:

CS-1	COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
OS	OCCUPANCY SENSOR
T-1	OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
H-1	OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN IS EXISTING. MOTOR SHALL BE REPLACED WITH AN INVERTER DUTY MOTOR AND A NEW VFD SHALL BE PROVIDED.

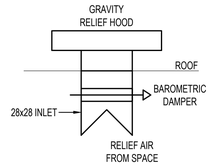
EXISTING AIR AND WATER FLOW SCHEDULE

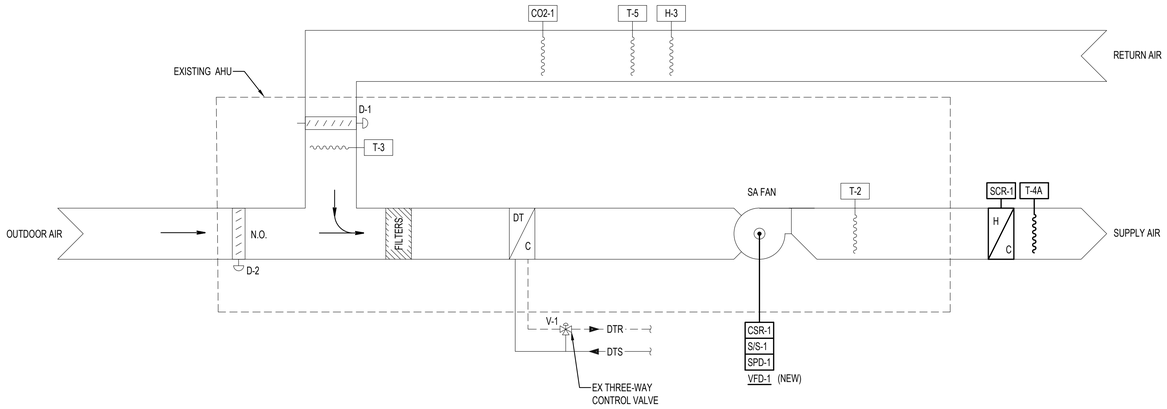
SCHOOL	UNIT	SA CFM	OA CFM	RA CFM	DTC CLG GPM	DTC HTG GPM
GHS	AHU-2	NOTE 1	NOTE 1	NOTE 1	NOTE 1	NOTE 1

NOTES FOR EXISTING AIR FLOW SCHEDULE:
1. CONTRACTOR SHALL TAKE SUPPLY AIR, OUTDOOR AIR, AND RETURN AIR FLOW MEASUREMENTS PRIOR TO ANY DEMOLITION OR NEW WORK.

RELIEF HOOD SCHEDULE

SCHOOL	EA CFM	APD
GHS	3,000	0.05





CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT: GLENELG HIGH SCHOOL (AHU-2)

DDC POINT LIST

GLENELG HIGH SCHOOL (AHU-2)

POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEWEXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	NEW
	H-1	OUTDOOR RELATIVE HUMIDITY	TREND	NEW
	H-3	RETURN DUCT RELATIVE HUMIDITY	TREND	EXISTING
	T-5	RETURN DUCT TEMPERATURE	TREND	EXISTING
	CO2-1	RETURN DUCT CO2 CONCENTRATION	TREND	EXISTING
	H-2	SPACE RELATIVE HUMIDITY	TREND	NEW
	CO2-2	SPACE CO2 CONCENTRATION	TREND	NEW
	T-6	SPACE TEMPERATURE	TREND	NEW
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-4A	RHC TEMPERATURE - DOWNSTREAM	TREND	NEW
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	CSR-1	SUPPLY FAN STATUS	ALARM	NEW
	OS	SPACE OCCUPANCY	TREND	NEW
ANALOG OUTPUT	SPD-1	SUPPLY FAN SPEED (VFD-1)	TREND	NEW
	V-1	DUAL TEMPERATURE COIL VALVE	TREND	NEW
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	SCR-1	SCR HEAT	TREND	NEW
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP (VFD-1)	TREND	NEW

INPUT / OUTPUT SUMMARY FOR: GLENELG HIGH SCHOOL (AHU-2)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.

STARTING AND STOPPING:
1. WHEN THE UNIT SUPPLY AIR FAN IS ENERGIZED TO OPERATE, THE FAN SHALL BE SOFT STARTED THROUGH IT'S ASSOCIATED VARIABLE FREQUENCY DRIVE.

SUPPLY FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN HAS STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:
1. THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITION, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY FAN SHALL BE AT IT'S MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AIRFLOW (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE ELECTRIC REHEAT COIL SHALL BE OFF.
2. DEHUMIDIFICATION MODE:
   - 2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. MINIMUM OUTDOOR AIR MODE:
     THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITIONS AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.2. ENTHALPY ECONOMIZER MODE:
     WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR DAMPER SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.3. FREE COOLING MODE:
     WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   - 2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, THE ELECTRIC REHEAT COIL SHALL MODULATE ITS OUTPUT TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR DAMPER SHALL CLOSE, AND THE RETURN AIR DAMPER SHALL OPEN. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR DAMPER SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR DAMPER CLOSED AND THE RETURN AIR DAMPER OPENED TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:
1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR: GLENELG HIGH SCHOOL (AHU-2)

Howard County Public School System

HENRY ADAMS
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M702

5/25/2023 3:54 PM

EXISTING:

BAS	BUILDING AUTOMATION SYSTEM
KS	KITCHEN HOOD/FAN STATUS

NEW SENSORS:

CS-1	COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
OS	OCCUPANCY SENSOR
T-1	OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
H-1	OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN IS EXISTING. MOTOR SHALL BE REPLACED WITH A INVERTER DUTY MOTOR AND A NEW VFD SHALL BE PROVIDED.

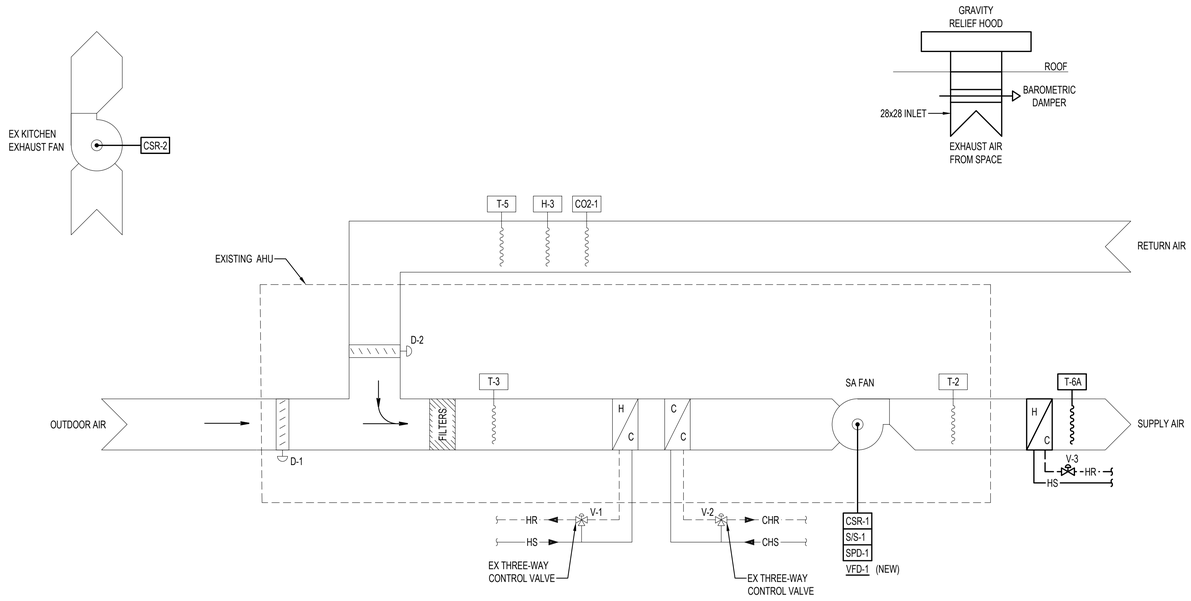
EXISTING AIR AND WATER FLOW SCHEDULE						
SCHOOL	UNIT	SA CFM	MIN OA CFM	RA CFM	CC GPM	HC GPM
OMHS	AHU-4	11,000	11,000	0	145	105

NOTES:
1. THE AIRFLOWS INDICATED IN THIS SCHEDULE SHALL BE MAINTAINED WHEN THE KITCHEN HOOD/EXHAUST IS ON.

NEW AIR FLOW SCHEDULE				
SCHOOL	UNIT	SA CFM	MIN OA CFM	RA CFM
OMHS	AHU-4	11,000	2,900	8,100

NOTES:
1. THE MIN OA AIRFLOW INDICATED IN THIS SCHEDULE SHALL BE PROVIDED WHEN THE KITCHEN HOOD/EXHAUST IS OFF.

RELIEF HOOD SCHEDULE		
SCHOOL	EA CFM	APD
OMHS	3,000	0.05



CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT: OAKLAND MILLS HIGH SCHOOL (AHU-4)

DDC POINT LIST				
OAKLAND MILLS HIGH SCHOOL (AHU-4)				
POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEW/EXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	NEW
	H-1	OUTDOOR RELATIVE HUMIDITY	TREND	NEW
	H-3	RETURN DUCT RELATIVE HUMIDITY	TREND	EXISTING
	T-5	RETURN DUCT TEMPERATURE	TREND	EXISTING
	CO2-1	RETURN DUCT CO2 CONCENTRATION	TREND	EXISTING
	H-2	SPACE RELATIVE HUMIDITY	TREND	NEW
	CO2-2	SPACE CO2 CONCENTRATION	TREND	NEW
	T-6	SPACE TEMPERATURE	TREND	NEW
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-6A	RHC TEMPERATURE - DOWNSTREAM	TREND	NEW
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	KS	KITCHEN HOOD/FAN STATUS	ALARM	EXISTING
	CSR-1	SUPPLY FAN STATUS	ALARM	NEW
	CSR-2	KITCHEN EXHAUST FAN STATUS	ALARM	NEW
	OS	SPACE OCCUPANCY	TREND	NEW
ANALOG OUTPUT	SPD-1	SUPPLY FAN SPEED (VFD-1)	TREND	NEW
	V-1	HEATING COIL VALVE	TREND	EXISTING
	V-2	COOLING COIL VALVE	TREND	EXISTING
	V-3	REHEAT COIL VALVE	TREND	NEW
	D-1	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-2	RETURN AIR DAMPER	TREND	EXISTING
	SCR-1	SCR HEAT	TREND	NEW
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP (VFD-1)	TREND	NEW

INPUT / OUTPUT SUMMARY FOR: OAKLAND MILLS HIGH SCHOOL (AHU-4)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.
3. WHEN THE KITCHEN HOOD/FAN IS ON, THE EXISTING AHU AIRFLOWS INDICATED ON THIS SHEET AND THE EXISTING CONTROL SEQUENCE SHALL OCCUR. WHEN THE KITCHEN HOOD/FAN IS OFF THE NEW AIRFLOWS INDICATED ON THIS SHEET AND THE NEW SEQUENCE INDICATED BELOW SHALL OCCUR.

STARTING AND STOPPING:
1. WHEN THE UNIT SUPPLY AIR FAN IS ENERGIZED TO OPERATE, THE FAN SHALL BE SOFT STARTED THROUGH IT'S ASSOCIATED VARIABLE FREQUENCY DRIVE.

SUPPLY FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN HAS STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:
1. THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITION, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY FAN SHALL BE AT IT'S MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AIRFLOW (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE REHEAT COIL CONTROL VALVE SHALL BE CLOSED.
2. DEHUMIDIFICATION MODE:
   - 2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. MINIMUM OUTDOOR AIR MODE:
     THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITIONS AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.2. ENTHALPY ECONOMIZER MODE:
     WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR DAMPER SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.3. FREE COOLING MODE:
     WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   - 2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, THE REHEAT COIL CONTROL VALVE SHALL MODULATE OPEN TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR DAMPER SHALL CLOSE, AND THE RETURN AIR DAMPER SHALL OPEN. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR DAMPER SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR DAMPER CLOSED AND THE RETURN AIR DAMPER OPENED TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:
1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR: OAKLAND MILLS HIGH SCHOOL (AHU-4)

Howard County Public School System

HENRY ADAMS
Consulting Engineers
MECHANICAL ELECTRICAL & PLUMBING ENGINEERS
MEP ENGINEERING
HENRY ADAMS,LLC
600 BALTIMORE AVENUE
SUITE 400
BALTIMORE, MD 21204
(410) 296-6500

PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M703

5/21/2023 3:54 PM

EXISTING:

- BAS — BUILDING AUTOMATION SYSTEM
- HOA — HAND-OFF-AUTO SWITCH
- T-1 — OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)

NEW SENSORS:

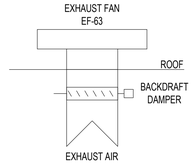
- CS-1 — COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
- OS — OCCUPANCY SENSOR
- H-1 — OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

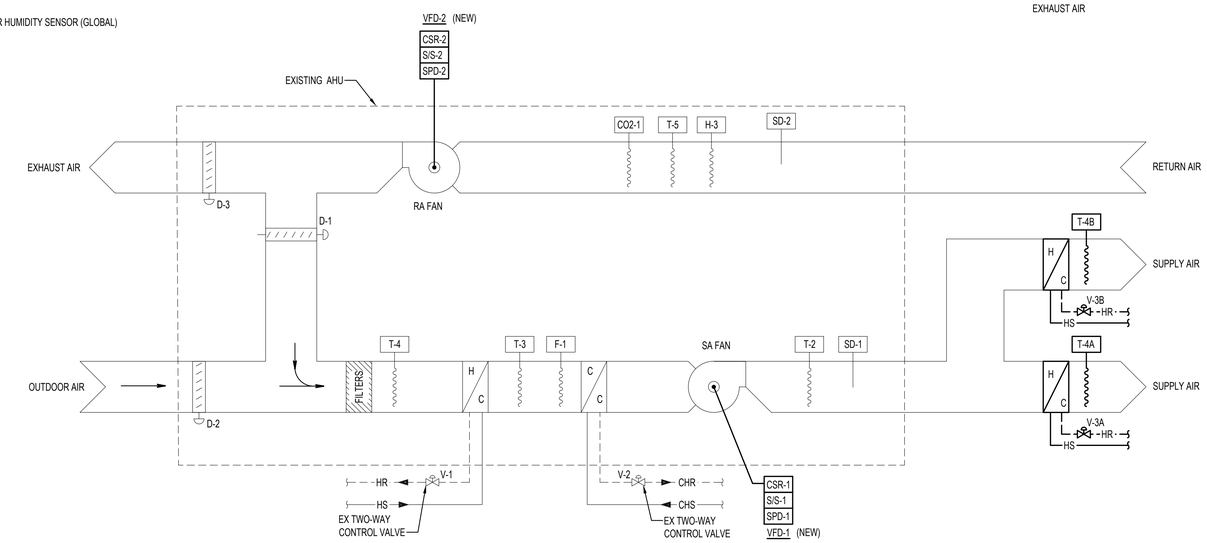
NOTES:

1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN AND RA FAN ARE EXISTING. MOTORS SHALL BE REPLACED WITH INVERTER DUTY MOTORS AND NEW VFD'S SHALL BE PROVIDED.

EXISTING AIR AND WATER FLOW SCHEDULE

SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM	CC GPM	HC GPM
RHHS	AHU-12	13,000	5,200	10,400	102	49





CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT: RIVER HILL (AHU-12)

DDC POINT LIST

RIVER HILL (AHU-12)

POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEWEXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	EXISTING
	H-1	**OUTDOOR RELATIVE HUMIDITY**	**TREND**	**NEW**
	H-3	RETURN DUCT RELATIVE HUMIDITY	TREND	EXISTING
	T-5	RETURN DUCT TEMPERATURE	TREND	EXISTING
	CO2-1	RETURN DUCT CO2 CONCENTRATION	TREND	EXISTING
	H-2	**SPACE RELATIVE HUMIDITY**	**TREND**	**NEW**
	CO2-2	**SPACE CO2 CONCENTRATION**	**TREND**	**NEW**
	T-6	**SPACE TEMPERATURE**	**TREND**	**NEW**
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-8	HEATING COIL DISCHARGE TEMPERATURE	TREND	EXISTING
	T-4A	**RHC TEMPERATURE - DOWNSTREAM**	**TREND**	**NEW**
	T-4B	**RHC TEMPERATURE - DOWNSTREAM**	**TREND**	**NEW**
	HOA	HAND-OFF-AUTO	TREND	EXISTING
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	SD-1	SUPPLY SMOKE DETECTOR	ALARM	EXISTING
	SD-2	RETURN SMOKE DETECTOR	ALARM	EXISTING
	CSR-1	**SUPPLY FAN STATUS**	**ALARM**	**NEW**
	CSR-2	**RETURN FAN STATUS**	**ALARM**	**NEW**
	OS	**SPACE OCCUPANCY**	**TREND**	**NEW**
ANALOG OUTPUT	**SPD-1**	**SUPPLY FAN SPEED (VFD-1)**	**TREND**	**NEW**
	SPD-2	**RETURN FAN SPEED (VFD-2)**	**TREND**	**NEW**
	V-1	HEATING COIL VALVE	TREND	EXISTING
	V-2	COOLING COIL VALVE	TREND	EXISTING
	V-3A	**REHEAT COIL VALVE**	**TREND**	**NEW**
	V-3B	**REHEAT COIL VALVE**	**TREND**	**NEW**
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-3	RELIEF AIR DAMPER	TREND	EXISTING
DIGITAL OUTPUT	**S/S-1**	**SUPPLY FAN START/STOP (VFD-1)**	**TREND**	**NEW**
	S/S-2	**RETURN FAN START/STOP (VFD-2)**	**TREND**	**NEW**

INPUT / OUTPUT SUMMARY FOR: RIVER HILL (AHU-12)

GENERAL:

1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.

STARTING AND STOPPING:

1. WHEN THE UNIT SUPPLY AIR FAN AND RETURN AIR FAN ARE ENERGIZED TO OPERATE, THE FANS SHALL BE SOFT STARTED THROUGH THEIR ASSOCIATED VARIABLE FREQUENCY DRIVES.

SUPPLY FAN AND RETURN FAN CONTROL:

THE VARIABLE SPEED SUPPLY FAN AND RETURN FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN AND RETURN FAN STATUS INDICATES THE FANS HAVE STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:

1. THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY AND RETURN FANS SHALL BE AT THEIR MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AND RETURN AIRFLOWS (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE REHEAT COIL VALVE SHALL BE CLOSED.
2. DEHUMIDIFICATION MODE:
   - 2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:

1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. MINIMUM OUTDOOR AIR MODE:
     THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.2. ENTHALPY ECONOMIZER MODE:
     WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.3. FREE COOLING MODE:
     WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR, RELIEF AIR, AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   - 2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). THE RETURN FAN VFD SHALL MODULATE THE RETURN FAN SPEED TO LAG THE SUPPLY FAN SPEED BY AN ADJUSTABLE PERCENTAGE DIFFERENTIAL. WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, BOTH REHEAT COIL CONTROL VALVES SHALL RECEIVE THE SAME SIGNAL AND MODULATE OPEN TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:

1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SHALL BE SET TO ZERO. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):

1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:

1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR AND RELIEF AIR DAMPERS CLOSED, THE RETURN AIR DAMPER OPENED, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SET TO ZERO TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:

1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR: RIVER HILL (AHU-12)

Howard County Public School System

HENRY ADAMS
Consulting Engineers
MECHANICAL ELECTRICAL & PLUMBING ENGINEERS
MEP ENGINEERING
HENRY ADAMS,LLC
600 BALTIMORE AVENUE
SUITE 400
BALTIMORE, MD 21204
(410) 296-6500

PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M704

5/21/2018 3:34 PM

EXISTING:

T-1	OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
BAS	BUILDING AUTOMATION SYSTEM

NEW SENSORS:

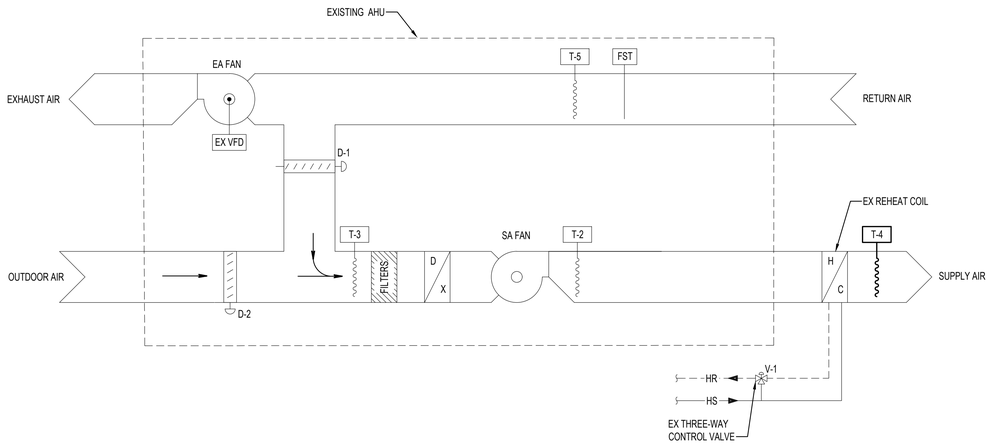
CS-1	COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
OS	OCCUPANCY SENSOR
H-1	OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN AND RA FAN ARE EXISTING. MOTORS SHALL BE REPLACED WITH INVERTER DUTY MOTORS AND NEW VFDS SHALL BE PROVIDED.

EXISTING AIR AND WATER FLOW SCHEDULE

SCHOOL	UNIT	SA CFM	MIN OA CFM	EA CFM	HC GPM
GCES	ACU-3	2,400	NOTE 1	NOTE 1	NOTE 1
HSES	ACU-2	2,400	NOTE 1	NOTE 1	NOTE 1

NOTES FOR EXISTING AIR FLOW SCHEDULE:
1. CONTRACTOR SHALL TAKE HEATING WATER, OUTDOOR AIR, AND RETURN AIR FLOW MEASUREMENTS PRIOR TO ANY DEMOLITION OR NEW WORK.



CONTROL DIAGRAM FOR CONSTANT VOLUME AIR HANDLING UNIT AT:
GORMAN CROSSING ELEMENTARY SCHOOL (ACU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (ACU-2)

DDC POINT LIST
GORMAN CROSSING ELEMENTARY SCHOOL (ACU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (ACU-2)

POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEW/EXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	EXISTING
	H-1	**OUTDOOR RELATIVE HUMIDITY**	**TREND**	**NEW**
	H-2	**SPACE RELATIVE HUMIDITY**	**TREND**	**NEW**
	CO2-2	**SPACE CO2 CONCENTRATION**	**TREND**	**NEW**
	T-6	**SPACE TEMPERATURE**	**TREND**	**NEW**
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	RETURN AIR TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-4	**SUPPLY AIR TEMPERATURE**	**TREND**	**NEW (NOTE 1)**
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	RF-1	RETURN FAN STATUS	ALARM	EXISTING
	LT-1	LOW LIMIT TEMPERATURE	ALARM	EXISTING
	FST	FIRESTAT	ALARM	EXISTING
	FLT-1	FILTER ALARM	ALARM	EXISTING
	OS	**SPACE OCCUPANCY**	**TREND**	**NEW**
ANALOG OUTPUT	**SPD-1**	**EXHAUST FAN SPEED (EX VFD)**	**TREND**	**NEW**
	V-1	REHEAT COIL VALVE	TREND	EXISTING
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP	TREND	EXISTING
	S/S-2	RETURN FAN START/STOP (VFD-1)	TREND	EXISTING

NOTE 1: T-4 IS NEW FOR HOLLIFIELD STATION ES. T-4 IS EXISTING FOR GORMAN CROSSING ES.

INPUT / OUTPUT SUMMARY FOR:
GORMAN CROSSING ELEMENTARY SCHOOL (ACU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (ACU-2)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.

STARTING AND STOPPING:
EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.

SUPPLY FAN AND EXHAUST FAN CONTROL:
EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.

OCCUPIED HEATING MODE:
1. THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY FAN SHALL BE AT IT'S MAXIMUM SPEED AND THE EXHAUST FAN SPEED SHALL BE SET TO DELIVER THE DESIGN SUPPLY AND RETURN AIRFLOWS (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE MANUFACTURER'S CONTROLS SHALL MODULATE COMPRESSORS TO MAINTAIN THE SPACE TEMPERATURE SENSOR OCCUPIED SPACE HEATING SETPOINT (70°F). THE REHEAT COIL VALVE SHALL BE CLOSED.
2. DEHUMIDIFICATION MODE:
   2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
      a. IF ENTHALPY ECONOMIZER OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
      b. IF ENTHALPY ECONOMIZER OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   1.1. MINIMUM OUTDOOR AIR MODE:
      EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
   1.2. ENTHALPY ECONOMIZER MODE:
      EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
   1.3. FREE COOLING MODE:
      EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
2. FAN SPEED CONTROL:
   2.1. EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
3. DEHUMIDIFICATION MODE:
   3.1. IF DURING THE OCCUPIED COOLING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE MANUFACTURER'S CONTROLS SHALL MODULATE COMPRESSORS TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE AND THE REHEAT COIL SHALL MODULATE ITS OUTPUT TO MAINTAIN THE SPACE COOLING SETPOINT UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE EXISTING OCCUPIED COOLING MODE WITH THE NORMAL SPACE COOLING SETPOINT OF 76°F.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR DAMPERS SHALL CLOSE AND THE EXHAUST AIR FAN SHALL BE OFF. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR DAMPER SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. THE EXHAUST FAN SPEED SHALL MODULATE PROPORTIONALLY TO THE INCREASE IN OUTDOOR AIR DAMPER POSITION (AS DETERMINED DURING AIR BALANCING OF THE UNIT). UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR DAMPER CLOSED, THE RETURN AIR DAMPER OPENED, AND THE EXHAUST FAN SHALL BE OFF TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:
1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR:
GORMAN CROSSING ELEMENTARY SCHOOL (ACU-3)
HOLLIFIELD STATION ELEMENTARY SCHOOL (ACU-2)

Howard County Public School System

HENRY ADAMS
Consulting Engineers
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M705

5/21/2023 3:54 PM

EXISTING:

BAS BUILDING AUTOMATION SYSTEM

NEW SENSORS:

CS-1 COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR

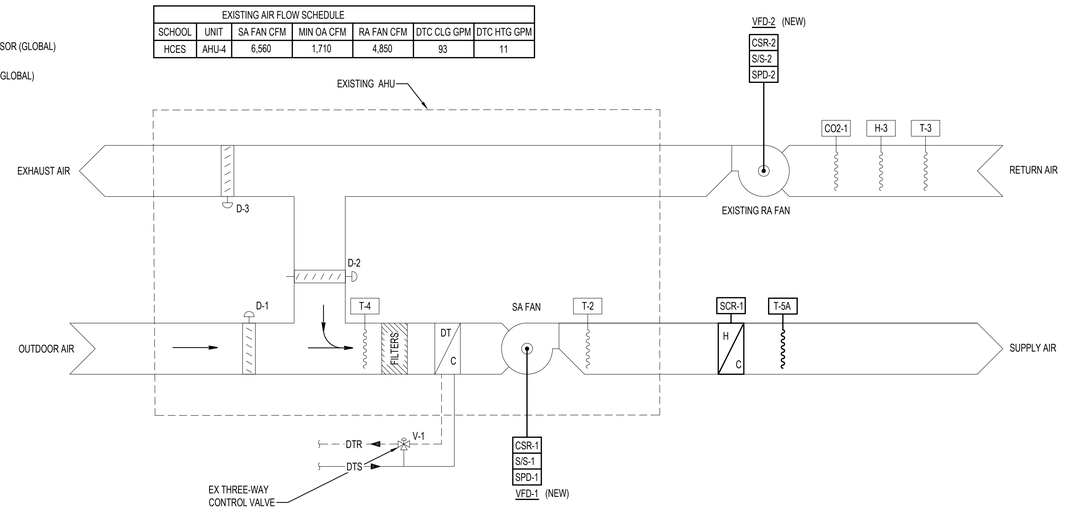
OS OCCUPANCY SENSOR

T-1 OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)

H-1 OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN AND RA FAN ARE EXISTING. MOTORS SHALL BE REPLACED WITH INVERTER DUTY MOTORS AND NEW VFDS SHALL BE PROVIDED.

EXISTING AIR FLOW SCHEDULE						
SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM	DTC CLG GPM	DTC HTG GPM
HCES	AHU-4	6,560	1,710	4,850	93	11



CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT: HARPER'S CHOICE MIDDLE SCHOOL (AHU-4)

DDC POINT LIST				
HARPER'S CHOICE MIDDLE SCHOOL (AHU-4)				
POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEWEXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	NEW
	H-1	OUTDOOR RELATIVE HUMIDITY	TREND	NEW
	H-2	SPACE RELATIVE HUMIDITY	TREND	NEW
	CO2-2	SPACE CO2 CONCENTRATION	TREND	NEW
	T-6	SPACE TEMPERATURE	TREND	NEW
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	RETURN AIR TEMPERATURE	TREND	EXISTING
	H-3	RETURN AIR RELATIVE HUMIDITY	TREND	EXISTING
	CO2-1	SPACE CO2 CONCENTRATION	TREND	EXISTING
	T-4	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-5A	RHC TEMPERATURE - DOWNSTREAM	TREND	NEW
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	RF-1	RETURN FAN STATUS	ALARM	EXISTING
	CSR-1	SUPPLY FAN STATUS	ALARM	NEW
	CSR-2	RETURN FAN STATUS	ALARM	NEW
	OS	SPACE OCCUPANCY	TREND	NEW
ANALOG OUTPUT	SPD-1	SUPPLY FAN SPEED (VFD-1)	TREND	NEW
	SPD-2	RETURN FAN SPEED (VFD-2)	TREND	NEW
	V-1	DUAL TEMPERATURE COIL VALVE	TREND	EXISTING
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-3	RELIEF AIR DAMPER	TREND	EXISTING
	SCR-1	SCR HEAT	TREND	NEW
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP (VFD-1)	TREND	NEW
	S/S-2	RETURN FAN START/STOP (VFD-2)	TREND	NEW

INPUT / OUTPUT SUMMARY FOR: HARPER'S CHOICE MIDDLE SCHOOL (AHU-4)

GENERAL:

1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.

STARTING AND STOPPING:

1. WHEN THE UNIT SUPPLY AIR FAN AND RETURN AIR FAN ARE ENERGIZED TO OPERATE, THE FANS SHALL BE SOFT STARTED THROUGH THEIR ASSOCIATED VARIABLE FREQUENCY DRIVES.

SUPPLY FAN AND RETURN FAN CONTROL:

THE VARIABLE SPEED SUPPLY FAN AND RETURN FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN AND RETURN FAN STATUS INDICATES THE FANS HAVE STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:

1. THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY AND RETURN FANS SHALL BE AT THEIR MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AND RETURN AIRFLOWS (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE ELECTRIC REHEAT COIL SHALL BE OFF.
2. DEHUMIDIFICATION MODE:
   - 2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:

1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. MINIMUM OUTDOOR AIR MODE:
     THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.2. ENTHALPY ECONOMIZER MODE:
     WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   - 1.3. FREE COOLING MODE:
     WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR, RELIEF AIR, AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   - 2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). THE RETURN FAN VFD SHALL MODULATE THE RETURN FAN SPEED TO LAG THE SUPPLY FAN SPEED BY AN ADJUSTABLE PERCENTAGE DIFFERENTIAL. WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, THE ELECTRIC REHEAT COIL SHALL MODULATE ITS OUTPUT TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:

1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL CLOSE, THE RETURN AIR DAMPER SHALL OPEN, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SHALL BE SET TO ZERO. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):

1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:

1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR AND RELIEF AIR DAMPERS CLOSED, THE RETURN AIR DAMPER OPENED, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SET TO ZERO TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:

1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR: HARPER'S CHOICE MIDDLE SCHOOL (AHU-4)

Howard County Public School System

HENRY ADAMS
Consulting Engineers
MECHANICAL ELECTRICAL & PLUMBING ENGINEERS
MEP ENGINEERING
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600 BALTIMORE AVENUE
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

M706

5/21/2023 3:34 PM

EXISTING:

- T-1 OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
- BAS BUILDING AUTOMATION SYSTEM
- KS KITCHEN HOOD/FAN STATUS

NEW SENSORS:

- CS-1 COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
- OS OCCUPANCY SENSOR
- H-1 OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN AND RA FAN ARE EXISTING.

EXISTING AIR AND WATER FLOW SCHEDULES						
SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM	CC GPM	HC GPM
DOES	AHU-5	7,600	7,800/3,300	7,450/3,125	90	39
VES	AHU-5	7,800	7,800/3,300	7,675/3,325	93	40

NEW AIR FLOW SCHEDULE (NOTE 1) - DISHWASHER HOOD ON				
SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM
DOES	AHU-5	7,600	2,200	5,400
VES	AHU-5	7,800	2,200	5,600

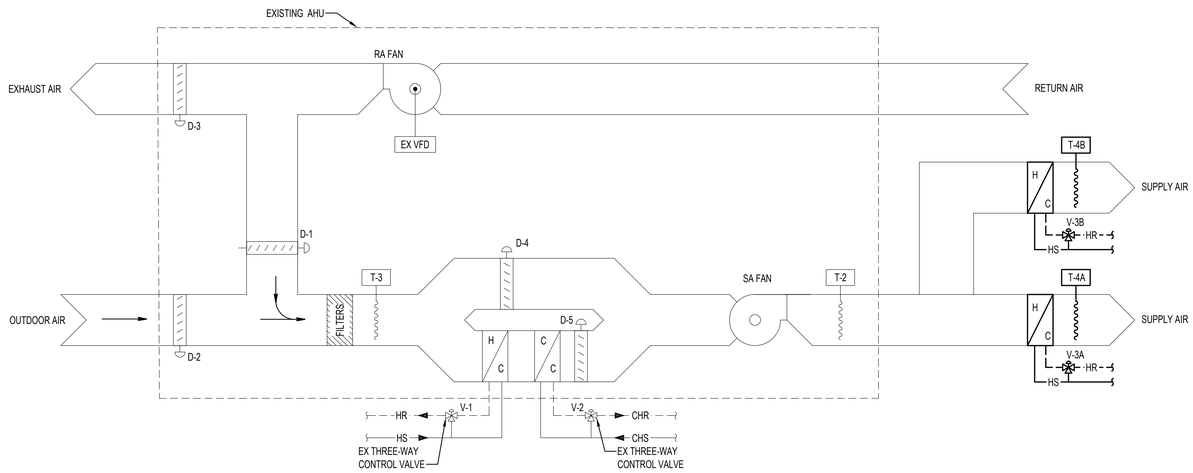
NOTES:
1. THE AIRFLOWS INDICATED IN THIS SCHEDULE SHALL BE MAINTAINED WHEN THE DISHWASHER HOOD IS ON AND THE KITCHEN RANGE HOOD IS OFF. THE AIRFLOWS INDICATED IN THIS SCHEDULE ARE BASED ON THE ASSUMPTION THAT THE KITCHEN HOOD IS OFF AND THE EXHAUST FANS SERVING DRY STORAGE A34 (110 CFM), TOILET ROOM A32 (110 CFM), AND CHAIR STORAGE A50 (150 CFM) ARE OPERATING.

NEW AIR FLOW SCHEDULE (NOTE 1) - KITCHEN HOOD ON				
SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM
DOES	AHU-5	7,600	4,250	3,350
VES	AHU-5	7,800	4,250	3,550

NOTES:
1. THE AIRFLOWS INDICATED IN THIS SCHEDULE SHALL BE MAINTAINED WHEN THE KITCHEN RANGE HOOD IS ON AND THE DISHWASHER HOOD IS OFF. THE AIRFLOWS INDICATED IN THIS SCHEDULE ARE BASED ON THE ASSUMPTION THAT THE DISHWASHER HOOD IS OFF AND THE EXHAUST FANS SERVING DRY STORAGE A34 (110 CFM), TOILET ROOM A32 (110 CFM), AND CHAIR STORAGE A50 (150 CFM) ARE OPERATING.

NEW AIR FLOW SCHEDULE (NOTE 1) - HOODS OFF				
SCHOOL	UNIT	SA FAN CFM	MIN OA CFM	RA FAN CFM
DOES	AHU-5	7,600	1,900	6,600
VES	AHU-5	7,800	2,000	6,800

NOTES:
1. THE AIRFLOWS INDICATED IN THIS SCHEDULE SHALL BE MAINTAINED WHEN THE KITCHEN RANGE HOOD AND DISHWASHER HOOD ARE OFF. THE AIRFLOWS INDICATED IN THIS SCHEDULE ARE BASED ON THE ASSUMPTION THAT THE KITCHEN AND DISHWASHER HOODS ARE OFF AND THE EXHAUST FANS SERVING DRY STORAGE A34 (110 CFM), TOILET ROOM A32 (110 CFM), AND CHAIR STORAGE A50 (150 CFM) ARE OPERATING.



CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT:
DAYTON OAKS ELEMENTARY SCHOOL (AHU-5)
VETERANS ELEMENTARY SCHOOL (AHU-5)

DDC POINT LIST DAYTON ELEMENTARY SCHOOL (AHU-5) VETERANS ELEMENTARY SCHOOL (AHU-5)				
POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEWEXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	EXISTING
	H-1	**OUTDOOR RELATIVE HUMIDITY**	**TREND**	**NEW**
	H-2	**SPACE RELATIVE HUMIDITY**	**TREND**	**NEW**
	CO2-2	**SPACE CO2 CONCENTRATION**	**TREND**	**NEW**
	T-5	**SPACE TEMPERATURE**	**TREND**	**NEW**
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-4A	**RHC TEMPERATURE - DOWNSTREAM**	**TREND**	**NEW**
	T-4B	**RHC TEMPERATURE - DOWNSTREAM**	**TREND**	**NEW**
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	RF-1	RETURN FAN STATUS	ALARM	EXISTING
	KS	KITCHEN HOOD/FAN STATUS	ALARM	EXISTING
	LT-1	LOW LIMIT TEMPERATURE	ALARM	EXISTING
	OS	**SPACE OCCUPANCY**	**TREND**	**NEW**
ANALOG OUTPUT	**SPD-1**	**RETURN FAN SPEED (EX VFD, NOTE 1)**	**TREND**	**NEW**
	V-1	HEATING COIL VALVE	TREND	EXISTING
	V-2	COOLING COIL VALVE	TREND	EXISTING
	V-3A	**REHEAT COIL VALVE**	**TREND**	**NEW**
	V-3B	**REHEAT COIL VALVE**	**TREND**	**NEW**
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-3	RELIEF AIR DAMPER	TREND	EXISTING
	D-4	BYPASS AIR DAMPER	TREND	EXISTING
	D-5	COIL FACE DAMPER	TREND	EXISTING
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP	TREND	EXISTING
	S/S-2	RETURN FAN START/STOP (EX VFD)	TREND	EXISTING

NOTE 1: RETURN FAN SPEED IS EXISTING FOR DAYTON OAKS ELEMENTARY SCHOOL

INPUT / OUTPUT SUMMARY FOR:
DAYTON ELEMENTARY SCHOOL (AHU-5)
VETERANS ELEMENTARY SCHOOL (AHU-5)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. EXISTING COIL ISOLATION DAMPER AND BYPASS DAMPER OPERATION SHALL BE MAINTAINED.
3. UNDER NORMAL OPERATION, COIL BYPASS DAMPER SHALL BE CLOSED AND COIL ISOLATION DAMPER SHALL BE OPEN. UNDER ECONOMIZER OPERATION, COIL BYPASS DAMPER SHALL BE OPEN AND COIL ISOLATION DAMPER SHALL BE CLOSED
4. WHEN THE KITCHEN HOOD/FAN IS ON, THE EXISTING AHU AIRFLOWS INDICATED ON THIS SHEET AND THE EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED. WHEN THE KITCHEN HOOD/FAN IS OFF THE NEW AIRFLOWS INDICATED ON THIS SHEET AND THE NEW SEQUENCE INDICATED BELOW SHALL BE MAINTAINED.

STARTING AND STOPPING:
EXISTING SEQUENCE TO REMAIN.

SUPPLY FAN AND RETURN FAN CONTROL:
EXISTING SEQUENCE SHALL BE MAINTAINED. REFER TO AHU AIRFLOW SCHEDULE ON THIS SHEET FOR MIN OA AIRFLOW AND RA AIRFLOW TO BE MAINTAINED. THE RETURN FAN SHALL BE SET TO THREE SPEEDS THROUGH THE EXISTING VFD (LOW SPEED - KITCHEN HOOD IS ON, MEDIUM SPEED - DISHWASHER HOOD IS ON, HIGH SPEED BOTH HOOD FANS ARE OFF). THE RETURN FAN SPEEDS AND THE OUTDOOR, RETURN AND RELIEF AIR DAMPER POSITIONS SHALL BE ESTABLISHED DURING THE AIR BALANCING OF THE UNIT TO ACHIEVE THE SCHEDULED SUPPLY, MINIMUM OUTDOOR AND RETURN AIRFLOWS.

OCCUPIED HEATING MODE:
1. THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL BE AT THEIR MINIMUM POSITIONS, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY AND RETURN FANS SHALL BE AT THEIR MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AND RETURN AIRFLOWS (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE REHEAT COIL VALVE SHALL BE CLOSED.
2. DEHUMIDIFICATION MODE:
   - 2.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   - 2.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
     - a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
     - b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   - 1.1. MINIMUM OUTDOOR AIR MODE:
     EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED. REFER TO AHU AIRFLOW SCHEDULE ON THIS SHEET FOR MIN OA AIRFLOW TO BE MAINTAINED.
   - 1.2. ENTHALPY ECONOMIZER MODE:
     EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
   - 1.3. FREE COOLING MODE:
     EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
2. FAN SPEED CONTROL:
   - 2.1. EXISTING CONTROL SEQUENCE SHALL BE MAINTAINED.
3. DEHUMIDIFICATION MODE:
   - 3.1. IF DURING THE OCCUPIED COOLING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE COOLING COIL CONTROL VALVE SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE AND THE REHEAT COIL SHALL MODULATE TO MAINTAIN SPACE COOLING SETPOINT UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE EXISTING OCCUPIED COOLING MODE WITH THE NORMAL SPACE COOLING SETPOINT OF 76°F.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL CLOSE AND THE RETURN AIR DAMPER SHALL OPEN. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR AND RELIEF AIR DAMPERS SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR AND RELIEF AIR DAMPERS CLOSED, THE RETURN AIR DAMPER OPENED, AND THE SUPPLY AND RETURN AIR FAN PERCENTAGE DIFFERENTIAL SET TO ZERO TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

EXHAUST FAN CONTROL:
1. INTERLOCKED EXHAUST FANS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR:
DAYTON ELEMENTARY SCHOOL (AHU-5)
VETERANS ELEMENTARY SCHOOL (AHU-5)

Howard County Public School System

HENRY ADAMS
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
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CHECKED BY	SRH

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EXISTING:

BAS	BUILDING AUTOMATION SYSTEM

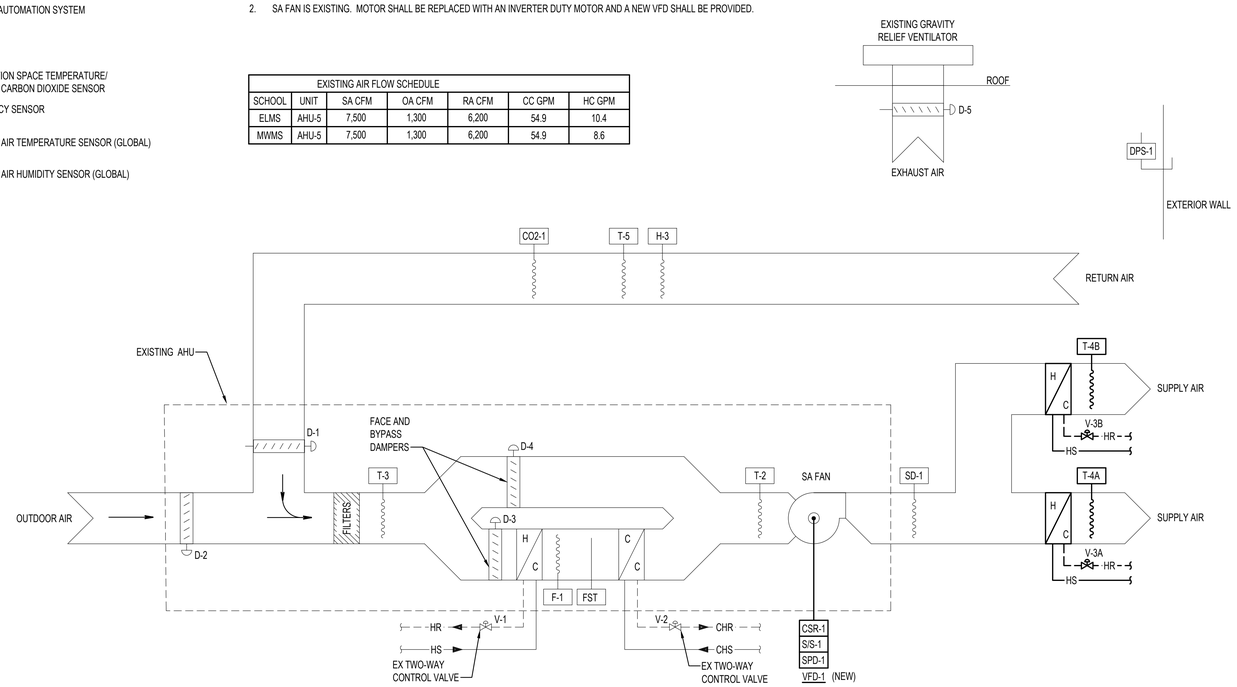
NEW SENSORS:

CS-1	COMBINATION SPACE TEMPERATURE/ HUMIDITY/ CARBON DIOXIDE SENSOR
OS	OCCUPANCY SENSOR
T-1	OUTDOOR AIR TEMPERATURE SENSOR (GLOBAL)
H-1	OUTDOOR AIR HUMIDITY SENSOR (GLOBAL)

NOTES:
1. AIR HANDLING UNITS ARE EXISTING. COMPONENTS SHOWN WITHIN THE EXISTING AHU BOUNDARY ARE EXISTING.
2. SA FAN IS EXISTING. MOTOR SHALL BE REPLACED WITH AN INVERTER DUTY MOTOR AND A NEW VFD SHALL BE PROVIDED.

EXISTING AIR FLOW SCHEDULE

SCHOOL	UNIT	SA CFM	OA CFM	RA CFM	CC GPM	HC GPM
ELMS	AHU-5	7,500	1,300	6,200	54.9	10.4
MWMS	AHU-5	7,500	1,300	6,200	54.9	8.6



CONTROL DIAGRAM FOR VARIABLE VOLUME AIR HANDLING UNIT AT:
ELKRIDGE LANDING MIDDLE SCHOOL SCHOOL (AHU-5)
MAYFIELD WOODS MIDDLE SCHOOL SCHOOL (AHU-5)

DDC POINT LIST

ELKRIDGE LANDING MIDDLE SCHOOL (AHU-5)
MAYFIELD WOODS MIDDLE SCHOOL (AHU-5)

POINT TYPE	TAG	DESCRIPTION	FUNCTIONS	NEW/EXISTING
ANALOG INPUT	T-1	OUTDOOR TEMPERATURE	TREND	NEW
	H-1	OUTDOOR RELATIVE HUMIDITY	TREND	NEW
	H-3	RETURN DUCT RELATIVE HUMIDITY	TREND	EXISTING
	T-5	RETURN DUCT TEMPERATURE	TREND	EXISTING
	CO2-1	RETURN DUCT CO2 CONCENTRATION	TREND	EXISTING
	H-2	SPACE RELATIVE HUMIDITY	TREND	NEW
	CO2-2	SPACE CO2 CONCENTRATION	TREND	NEW
	T-6	SPACE TEMPERATURE	TREND	NEW
	T-2	SUPPLY LEAVING TEMPERATURE	TREND	EXISTING
	T-3	MIXED AIR TEMPERATURE	TREND	EXISTING
	T-4A	RHC TEMPERATURE - DOWNSTREAM	TREND	NEW
	T-4B	RHC TEMPERATURE - DOWNSTREAM	TREND	NEW
	DPS-1	SPACE DIFFERENTIAL PRESSURE	TREND	EXISTING
DIGITAL INPUT	SF-1	SUPPLY FAN STATUS	ALARM	EXISTING
	SD-1	SUPPLY SMOKE DETECTOR	ALARM	EXISTING
	CSR-1	SUPPLY FAN STATUS	ALARM	NEW
	OS	SPACE OCCUPANCY	TREND	NEW
ANALOG OUTPUT	SPD-1	SUPPLY FAN SPEED (VFD-1)	TREND	NEW
	V-1	HEATING COIL VALVE	TREND	EXISTING
	V-2	COOLING COIL VALVE	TREND	EXISTING
	V-3A	REHEAT COIL VALVE	TREND	NEW
	V-3B	REHEAT COIL VALVE	TREND	NEW
	D-1	RETURN AIR DAMPER	TREND	EXISTING
	D-2	OUTDOOR AIR DAMPER	TREND	EXISTING
	D-3	COIL FACE DAMPER	TREND	EXISTING
	D-4	BYPASS AIR DAMPER	TREND	EXISTING
	D-5	RELIEF DAMPER	TREND	EXISTING
DIGITAL OUTPUT	S/S-1	SUPPLY FAN START/STOP (VFD-1)	TREND	NEW

INPUT / OUTPUT SUMMARY FOR:
ELKRIDGE LANDING MIDDLE SCHOOL (AHU-5)
MAYFIELD WOODS MIDDLE SCHOOL (AHU-5)

GENERAL:
1. ALL GENERAL FUNCTIONS OF THE EXISTING SEQUENCE OF OPERATION, SUCH AS UNIT SCHEDULING, UNOCCUPIED OPERATION, MORNING WARM-UP/COOL-DOWN, AND SAFETIES SHALL BE THE SAME AS EXISTING.
2. COORDINATE VARIABLE FREQUENCY DRIVE (VFD) INTERFACE REQUIREMENTS WITH VFD MANUFACTURER.

STARTING AND STOPPING:
1. WHEN THE UNIT SUPPLY AIR FAN IS ENERGIZED TO OPERATE, THE FAN SHALL BE SOFT STARTED THROUGH IT'S ASSOCIATED VARIABLE FREQUENCY DRIVE.

SUPPLY FAN CONTROL:
THE VARIABLE SPEED SUPPLY FAN WILL BE STARTED BASED ON OCCUPANCY SCHEDULE. WHEN THE SUPPLY FAN STATUS INDICATES THE FAN HAS STARTED, THE CONTROL SEQUENCE SHALL BE ENABLED.

OCCUPIED HEATING MODE:
1. WHEN HEATING IS REQUIRED, THE FACE AND BYPASS DAMPERS SHALL BE POSITIONED FULLY OPENED TO THE COIL FACE.
2. THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITION, AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION. THE SUPPLY FAN SHALL BE AT IT'S MAXIMUM SPEED DELIVERING THE DESIGN SUPPLY AIRFLOW (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE SPACE TEMPERATURE SENSOR SHALL MODULATE THE HVAC UNIT'S HEATING WATER COIL CONTROL VALVE TO MAINTAIN THE OCCUPIED SPACE HEATING SETPOINT (70°F). THE ELECTRIC REHEAT COIL SHALL BE OFF.
3. DEHUMIDIFICATION MODE:
   3.1. IF, DURING THE OCCUPIED HEATING MODE OF OPERATION, THE SPACE RELATIVE HUMIDITY RISES ABOVE 60%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 73°F.
   3.2. IF, AFTER A 30-MINUTE TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60%, THE FOLLOWING SHALL OCCUR:
      a. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE AVAILABLE, THE UNIT SHALL CHANGE ITS MODE OF OPERATION TO OCCUPIED COOLING WITH A SPACE COOLING SETPOINT OF 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE UNIT SHALL REVERT TO THE OCCUPIED HEATING MODE WITH THE NORMAL SPACE HEATING SETPOINT OF 70°F.
      b. IF CHILLED WATER, ENTHALPY ECONOMIZER, OR FREE COOLING ARE NOT AVAILABLE, THE UNIT SHALL REMAIN IN THE OCCUPIED HEATING MODE AND THE SPACE HEATING SETPOINT SHALL REMAIN AT 73°F UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%. UPON A DROP IN SPACE RELATIVE HUMIDITY BELOW 50%, THE SPACE HEATING SETPOINT SHALL BE RESET TO 70°F.

OCCUPIED COOLING MODE:
1. DISCHARGE AIR TEMPERATURE CONTROL:
   1.1. WHEN MECHANICAL COOLING IS REQUIRED, THE CHILLED WATER COIL CONTROL VALVE SHALL BE OPENED FULLY TO THE COIL.
   1.2. MINIMUM OUTDOOR AIR MODE:
      THE OUTDOOR AIR DAMPER SHALL BE AT IT'S MINIMUM POSITIONS AND THE RETURN AIR DAMPER SHALL BE AT ITS MAXIMUM POSITION (AS DETERMINED DURING AIR BALANCING OF THE UNIT). THE FACE AND BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   1.3. ENTHALPY ECONOMIZER MODE:
      WHEN THE OUTDOOR AIR ENTHALPY IS LESS THAN THE RETURN AIR ENTHALPY AND CONTINUES WITH A DEADBAND OF 3 BTU/LB OR UNTIL THE OUTDOOR AIR TEMPERATURE RISES ABOVE 80°F, THE OUTDOOR AIR DAMPER SHALL BE FULLY OPENED AND THE RETURN AIR DAMPER SHALL BE FULLY CLOSED. THE FACE AND BYPASS DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
   1.4. FREE COOLING MODE:
      WHEN THE OUTDOOR AIR TEMPERATURE IS MORE THAN 5°F BELOW THE DISCHARGE AIR TEMPERATURE SETPOINT, MECHANICAL COOLING SHALL BE LOCKED OUT AND THE OUTDOOR AIR AND RETURN AIR DAMPERS SHALL MODULATE TO MAINTAIN A 55°F DISCHARGE AIR TEMPERATURE.
2. FAN SPEED CONTROL:
   2.1. THE SUPPLY FAN VFD SHALL MODULATE THE SUPPLY FAN SPEED TO MAINTAIN THE OCCUPIED SPACE COOLING SETPOINT (76°F). WHEN THE SUPPLY FAN IS AT ITS MINIMUM 50% SPEED, UPON A FURTHER DROP IN SPACE TEMPERATURE BELOW THE COOLING SETPOINT, BOTH REHEAT COIL CONTROL VALVES SHALL RECEIVE THE SAME SIGNAL AND MODULATE OPEN TO MAINTAIN THE SPACE COOLING SETPOINT.

REDUCED OCCUPANCY MODE:
1. WHEN ALL OCCUPANCY SENSORS INDICATE A LACK OF OCCUPANCY IN THE CAFETERIA, THE OUTDOOR AIR DAMPER SHALL CLOSE, AND THE RETURN AIR DAMPER SHALL OPEN. THE UNIT SHALL REVERT TO ITS NORMAL MODE OF OPERATION ONCE OCCUPANCY IS DETECTED CONTINUOUSLY BY ANY OCCUPANCY SENSOR FOR 5 MINUTES.

DEMAND-CONTROLLED VENTILATION (DCV):
1. UPON A RISE IN SPACE CO_2 CONCENTRATION ABOVE 1,000 PPM, THE OUTDOOR AIR DAMPER SHALL MODULATE OPEN AND THE RETURN AIR DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE 1,000 PPM CO_2 SETPOINT. UPON A DROP IN SPACE CO_2 CONCENTRATION BELOW 800 PPM, THE UNIT SHALL REVERT TO NORMAL OPERATION.

UNOCCUPIED DEHUMIDIFICATION MODE:
1. IF, AFTER A 4-HOUR TIME DELAY, THE SPACE RELATIVE HUMIDITY REMAINS ABOVE 60% DURING THE UNOCCUPIED MODE OF OPERATION, THE UNIT SHALL BE ENERGIZED, THE HEATING WATER PLANT SHALL BE ENABLED, THE CHILLED WATER PLANT SHALL BE ENABLED IF FREE COOLING IS NOT AVAILABLE, AND THE UNIT SHALL OPERATE WITH THE OUTDOOR AIR DAMPER CLOSED AND THE RETURN AIR DAMPER OPENED TO MAINTAIN THE UNOCCUPIED SPACE COOLING SETPOINT (82°F) UNTIL THE SPACE RELATIVE HUMIDITY DROPS BELOW 50%.

GRAVITY RELIEF VENTILATOR CONTROL:
1. INTERLOCKED GRAVITY RELIEF VENTILATOR CONTROLS SHALL BE THE SAME AS EXISTING.

SEQUENCE OF OPERATION FOR:
ELKRIDGE LANDING MIDDLE SCHOOL (AHU-5)
MAYFIELD WOODS MIDDLE SCHOOL (AHU-5)

Howard County Public School System

HENRY ADAMS
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO: 37247

EXPIRATION DATE: 01/09/2024

NO.	DESCRIPTION	DATE

KEY PLAN

AUTOMATIC CONTROLS

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	BMB
CHECKED BY	SRH

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GENERAL NOTES: (APPLICABLE TO ALL MECHANICAL SCHEDULES)

1. UNIT NUMBERS ARE INDICATED WHERE ALL UNITS ARE LISTED AND NUMBERED INDIVIDUALLY.
2. UNIT TYPES ARE DESCRIBED IN THE SPECIFICATIONS.
3. TEMPERATURE VALUES ARE LISTED IN DEGREES FAHRENHEIT.
4. AIR PRESSURE VALUES ARE LISTED IN INCHES OF WATER COLUMN.
5. AIR VELOCITY VALUES ARE LISTED IN FEET PER MINUTE.
6. DUCT SIZES ARE LISTED IN SINGLE-NUMBER INCHES OF NOMINAL DIAMETER OR MULTIPLE NUMBER INCHES OF INDICATED PARAMETER. CONNECTION SIZES ARE BRANCH SIZES FROM MAINS TO UNIT INLETS. SINGLE PIPE SIZE IS TYPICAL FOR SUPPLY AND RETURN.

HOT WATER DUCT HEATERS

UNIT NO	SERVICE	LOCATION	COIL SIZE (WxH)	MBH	AIR FLOW			APD	BRANCH PIPE SIZE	WATER DATA				BASIS OF DESIGN	NOTES
					CFM	EAT	LAT			EWT	LWT	GPM	WPD		
HWC-1	AHU-5	DAYTON OAKS ES	38 x 24	36	1600	55	76	0.04	3/4	140	120	3.5	0.4	DAIKIN 5WQ1001A	
HWC-2	AHU-5	DAYTON OAKS ES	79 x 33	139	6000	55	76	0.04	1-1/2	140	120	13.1	2.6	DAIKIN 5WQ1001A	
HWC-3	AHU-5	ELKRIDGE LANDING MS	40 x 16	30.2	1350	55	75	0.04	3/4	140	120	3.0	2	DAIKIN 5BB1401A	
HWC-4	AHU-5	ELKRIDGE LANDING MS	52 x 27	53.1	2,400	55	75	0.04	1	140	120	5.2	0.4	DAIKIN 5WB1301A	
HWC-5	AHU-3	FULTON ES	62 x 24	65.3	2,850	55	75	0.04	1	140	120	6.2	1	DAIKIN 5WQ1001A	
HWC-6	AHU-3	HOLLIFIELD STATION ES	62 x 24	65.3	2,850	55	75	0.04	1	140	120	6.2	1	DAIKIN 5WQ1001A	
HWC-7	AHU-5	MAYFIELD WOODS MS	40 x 16	30.2	1350	55	75	0.04	3/4	140	120	3.0	2	DAIKIN 5BB1401A	
HWC-8	AHU-5	MAYFIELD WOODS MS	52 x 27	53.1	2,400	55	75	0.04	1	140	120	5.2	0.4	DAIKIN 5WB1301A	
HWC-9	AHU-4	OAKLAND MILLS HS	74 x 33	127	5,500	55	76	0.04	1-1/2	140	120	12	2.1	DAIKIN 5WQ1001A	
HWC-10	AHU-12	RIVER HILL HS	56 x 24	60	2,730	55	75	0.04	1	140	120	6	0.8	DAIKIN 5WQ1001A	
HWC-11	AHU-12	RIVER HILL HS	63 x 27	83.8	3,770	55	75	0.04	1-1/4	140	120	8.2	2.3	DAIKIN 5WQ0901A	
HWC-12	AHU-5	VETERANS ES	39 x 24	38.5	1,700	55	75	0.04	3/4	140	120	3.7	0.4	DAIKIN 5WQ1001A	
HWC-13	AHU-5	VETERANS ES	80 x 33	141	6,100	55	75	0.04	1-1/2	140	120	13.3	2.7	DAIKIN 5WQ1001A	

NOTES FOR ELECTRIC DUCT HEATERS:
1. CONTRACTOR SHALL BALANCE HEATING WATER FLOW THROUGH THE DUCT MOUNTED HOT WATER REHEAT COIL WHEN THE OUTDOOR TEMPERATURE IS ABOVE 60 DEGREES F.

ELECTRIC DUCT HEATERS

UNIT NO	SERVICE	LOCATION	DUCT SIZE (WxH)	AIR FLOW (NOTE 2)			MAX APD	ELECTRIC				BASIS OF DESIGN	NOTES
				CFM	EAT	LAT		KW	V	PH	CONTROL		
EDH-1	AHU-2	GLENELG HS	32x32	3,550	55	75	0.04	22.5	480	3	SCR	MARKEL HF	1
EDH-2	AHU-4	HARPERS CHOICE MS	30x21	3,300	55	75	0.04	20.9	480	3	SCR	MARKEL HF	

NOTES FOR ELECTRIC DUCT HEATERS:
1. PROVIDE NEMA 4X -SS, WATERTIGHT ENCLOSURE.
2. CONTRACTOR SHALL OBTAIN EXISTING SUPPLY AIRFLOW PRIOR TO SUBMITTING EDH TO ENSURE SCHEDULED AIRFLOW IS CORRECT.

VARIABLE FREQUENCY DRIVES

UNIT NO	SERVICE	SCHOOL	HP	ELECTRICAL		NOTES
				V	PH	
VFD-ELMS-SF-5	AHU-3, SUPPLY	ELKRIDGE LANDING ES	7.5	480	3	
VFD-FES-RF-3	AHU-3, RETURN	FULTON ES	1.0	480	3	
VFD-FES-SF-3	AHU-3, SUPPLY	FULTON ES	5.0	480	3	
VFD-GHS-SF-2	AHU-2, SUPPLY	GLENELG HS	5.0	480	3	
VFD-HCMS-RF-4	RF-4, RETURN	HARPER'S CHOICE MS	5.0	480	3	
VFD-HCMS-SF-4	AHU-4, SUPPLY	HARPER'S CHOICE MS	10.0	480	3	
VFD-HSES-RF-3	AHU-3, RETURN	HOLLIFIELD STATION ES	1.0	480	3	
VFD-HSES-SF-3	AHU-3, SUPPLY	HOLLIFIELD STATION ES	5.0	480	3	
VFD-MWMS-SF-5	AHU-5, SUPPLY	MAYFIELD WOODS MS	5.0	480	3	
VFD-OMHS-SF-4	AHU-4, SUPPLY	OAKLAND MILLS HS	10.0	480	3	
VFD-RHHS-RF-12	AHU-12, RETURN	RIVER HILL HS	5.0	480	3	
VFD-RHHS-SF-12	AHU-12, SUPPLY	RIVER HILL HS	15.0	480	3	

FAN MOTORS

UNIT NO	SERVICE	SCHOOL	HP	ELECTRICAL		NOTES
				V	PH	
ELMS-SF-5	AHU-3, SUPPLY	ELKRIDGE LANDING ES	7.5	480	3	
FES-RF-3	AHU-3, RETURN	FULTON ES	1.0	480	3	
FES-SF-3	AHU-3, SUPPLY	FULTON ES	5.0	480	3	
GHS-SF-2	AHU-2, SUPPLY	GLENELG HS	5.0	480	3	
HCMS-RF-4	RF-4, RETURN	HARPER'S CHOICE MS	5.0	480	3	
HCMS-SF-4	AHU-4, SUPPLY	HARPER'S CHOICE MS	10.0	480	2	
HSES-RF-3	AHU-3, RETURN	HOLLIFIELD STATION ES	1.0	480	3	
HSES-SF-3	AHU-3, SUPPLY	HOLLIFIELD STATION ES	5.0	480	2	
MWMS-SF-5	AHU-5, SUPPLY	MAYFIELD WOODS MS	5.0	480	2	
OMHS-SF-4	AHU-4, SUPPLY	OAKLAND MILLS HS	10.0	480	3	
RHHS-RF-12	AHU-12, RETURN	RIVER HILL HS	5.0	480	2	
RHHS-SF-12	AHU-12, SUPPLY	RIVER HILL HS	15.0	480	3	

NOTES FOR FAN MOTORS:
1. MOTOR SHALL BE INVERTER DUTY MOTOR CAPABLE OF OPERATING WITH VARIABLE FREQUENCY DRIVE.

Howard County Public School System

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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
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KEY PLAN

MECHANICAL SCHEDULES

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
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CHECKED BY	SRH

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GENERAL ELECTRICAL NOTES

1. PROVIDE LABOR, MATERIALS, TOOLS, EQUIPMENT, COORDINATION, DELEGATED DESIGN AND INCIDENTALS NECESSARY TO PROVIDE A COMPLETE AND OPERABLE SYSTEM.
2. PERFORM WORK AS REQUIRED BY APPLICABLE CODES, REGULATIONS AND LAWS OF LOCAL, STATE AND FEDERAL GOVERNMENTS AND OTHER AUTHORITIES WITH LAWFUL JURISDICTION.
3. MATERIAL AND EQUIPMENT SHALL BE LISTED AND LABELED BY NATIONALLY RECOGNIZED TESTING LABORATORIES FOR INTENDED SERVICE.
4. GIVE NOTICES, FILE PLANS, OBTAIN PERMITS AND LICENSES, PAY FEES AND BACK CHARGES, AND OBTAIN NECESSARY APPROVALS FROM AUTHORITIES THAT HAVE JURISDICTION.
5. MAINTAIN RECORD DRAWINGS ON SITE. RECORD SET SHALL BE COMPLETE, CURRENT, AND AVAILABLE UPON REQUEST.
6. SUBMIT FOR APPROVAL, SHOP DRAWINGS FOR EQUIPMENT AND MATERIALS USED ON PROJECT. OBTAIN APPROVAL BY ENGINEER PRIOR TO PURCHASE OF EQUIPMENT AND MATERIALS.
7. REPAIR OR REPLACE DAMAGE TO FACILITIES AND EQUIPMENT AT NO ADDITIONAL EXPENSE TO OWNER.
8. PATCH AND REPAIR DISTURBED AREAS TO MATCH ADJACENT SURFACES AND FINISHES.
9. PROVIDE TEMPORARY POWER AND LIGHTING FOR OTHER TRADES AS REQUIRED TO COMPLETE PROJECT IN ACCORDANCE WITH APPLICABLE CODES AND STANDARDS.
10. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS. PROVIDE COMPONENTS INDICATED ON RISER DIAGRAMS WHETHER OR NOT INDICATED ON PLANS, AND VICE VERSA.
11. LOCATIONS SHOWN ON PLANS ARE APPROXIMATE AND REQUIRE COORDINATION WITH OTHER TRADES. ROUTING OF CONDUIT IS DIAGRAMMATIC IN NATURE AND NOT INTENDED TO SHOW REQUIRED OFFSETS AND DETAILS. OBTAIN DRAWINGS AND SPECIFICATIONS FROM OTHER TRADES AND COORDINATE WITH OTHER TRADES.
12. COORDINATE ELECTRICAL INSTALLATION WITH FIELD CONDITIONS. LOCATIONS SHOWN ARE DIAGRAMMATIC AND MAY REQUIRE ADJUSTMENT IN FIELD.
13. REFER TO MECHANICAL DRAWINGS FOR EXACT LOCATION OF MECHANICAL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS.
14. PERMANENTLY LABEL NEW ELECTRICAL EQUIPMENT, INCLUDING BUT NOT LIMITED TO, DEVICE DESIGNATION AND SUPPLY CIRCUIT DESIGNATION.
15. CORE DRILL CONCRETE WALLS AND FLOORS TO PROVIDE OPENINGS FOR CONDUIT INSTALLATION. MAXIMUM CORE DRILL SIZE SHALL BE 5-INCH DIAMETER. SPACE CORE DRILL LOCATIONS A MINIMUM OF 6" FROM EACH OTHER, MEASURED FROM CORE DRILL OPENINGS. PROPERLY SEAL OPENINGS ACCORDING TO LOCATION AND APPLICATION.
16. PROVIDE EACH CIRCUIT WITH A DEDICATED NEUTRAL UNLESS NOTED OTHERWISE.
17. CONDUIT HOMERUNS SHOWN ON DRAWINGS WITH MORE THAN 3 CURRENT CARRYING CONDUCTORS ARE SHOWN DIAGRAMMATICALLY. DO NOT INSTALL MORE THAN 3 CURRENT CARRYING CONDUCTORS IN A SINGLE RACEWAY UNLESS INSTALLED IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.
18. PROVIDE FIRESTOPPING FOR ELECTRICAL PENETRATIONS IN FIRE RATED ASSEMBLIES.
19. INSTALL ELECTRICAL WORK IN A NEAT AND WORKMANLIKE MANNER, RECTILINEAR TO BUILDING STRUCTURE. INSTALL RACEWAYS TIGHT TO STRUCTURAL CEILING AND AS HIGH AS POSSIBLE WITHIN CEILING SPACES TO MAINTAIN MAXIMUM AMOUNT OF CLEAR SPACE BELOW RACEWAY.
20. INSTALL RACEWAYS CONCEALED IN BUILDING FINISHES FOR ALL EXTERIOR MOUNTED DEVICES. DO NOT ROUTE EXPOSED ON BUILDING EXTERIOR.
21. INSTALL RACEWAYS CONCEALED IN WALLS, UNDER FLOORS, ABOVE CEILINGS, ETC., EXCEPT AS FOLLOWS:
    A. WHERE SUSPENDED CEILINGS ARE NOT PROVIDED.
    B. IN VERTICAL SHAFTS, ELECTRICAL CLOSETS, ETC., MECHANICAL AND ELECTRICAL EQUIPMENT SPACES WHERE CONCEALMENT IS NOT PRACTICAL.
    C. AT SURFACE-MOUNT PANELBOARDS IN OTHERWISE FINISHED SPACES LIMITED TO VERTICAL RUNS ABOVE AND BELOW PANEL.
    D. WHERE REQUIRED FOR EQUIPMENT CONNECTIONS.
    E. WHERE SPECIFICALLY INDICATED ON DRAWINGS.
22. WHERE SUBMITTED EQUIPMENT REQUIRES REVISION TO OVERCURRENT PROTECTION, CONDUIT, AND WIRING, COORDINATE AND MAKE CHANGE TO PROVIDE A COMPLETE INSTALLATION IN ACCORDANCE WITH APPLICABLE CODES.
23. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. COORDINATE EXACT LOCATION IN FIELD. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURER'S RECOMMENDED MAINTENANCE CLEARANCES.

GENERAL ELECTRICAL DEMOLITION/RENOVATION NOTES

1. THE FACILITY WILL REMAIN OCCUPIED DURING RENOVATIONS.
2. MINIMIZE OUTAGES. COORDINATE OUTAGES WITH OWNER. PERFORM WORK REQUIRING SUSTAINED EQUIPMENT OUTAGE CONTINUOUSLY AROUND THE CLOCK UNTIL WORK IS COMPLETE, UNLESS NOTED OTHERWISE.
3. PRIOR TO DEMOLITION, FIELD VERIFY CONDUITS, CONDUCTORS, AND CABLES THAT PASS THROUGH AND SERVE AREAS OUTSIDE THE SCOPE OF WORK. MAINTAIN CONTINUITY OF SYSTEMS. PROTECT OR RELOCATE SYSTEMS TO PREVENT DAMAGE. RESTORE SYSTEMS TO NORMAL OPERATION. COORDINATE SYSTEM OUTAGES WITH OWNER.
4. IDENTIFY NONFUNCTIONING EQUIPMENT AND DEVICES TO REMAIN AFTER DEMOLITION. NOTIFY OWNER IN WRITING PRIOR TO DEMOLITION. UPON COMPLETION OF WORK, ENSURE THAT EXISTING EQUIPMENT AND DEVICES OPERATE PROPERLY.
5. IN AREAS REQUIRING THE PERFORMANCE OF WORK OF OTHER TRADES, CAREFULLY DISCONNECT, MAKE SAFE, REMOVE AND STORE ELECTRICAL ITEMS IN PATH OF WORK. REINSTALL AND RECONNECT SAME AFTER COMPLETION OF OTHER TRADE'S WORK. COORDINATE REMOVAL OF EQUIPMENT WITH OTHER TRADES PRIOR TO DEMOLITION.
6. AFTER DEMOLITION VERIFY AND SUPPORT REMAINING CABLES, WIRES, AND CONDUIT IN ACCORDANCE WITH THE APPLICABLE VERSION OF THE NEC. DISCONNECT, MAKE SAFE AND REMOVE ABANDONED AND TEMPORARY WIRE WITHIN SPACE.
7. EXISTING CONDITIONS REFLECT GENERAL OBSERVATIONS AND ARE NOT INTENDED TO INDICATE DETAILS OR DIMENSIONS. NO ATTEMPT HAS BEEN MADE TO SHOW ALL ELECTRICAL EQUIPMENT. VERIFY EXISTING CONDITIONS PRIOR TO PERFORMING WORK. NOTIFY ENGINEER IN WRITING IF CONDITIONS ARE DISCOVERED THAT PREVENT EXECUTION OF WORK.
8. PROTECT REMAINING ELECTRICAL SYSTEMS AND COMPONENTS FROM DAMAGE. REMOVE PROTECTIVE MATERIALS UPON COMPLETION OF WORK.
9. IN AREAS NOTED TO REMOVE ELECTRICAL WORK, REMOVE CONDUITS AND ASSOCIATED SUPPORTS BACK TO POINT OF CONCEALMENT AND REMOVE WIRING BACK TO REMAINING ACTIVE DEVICES OR SOURCE.
10. DISPOSE OF LIGHTING BALLASTS AND CAPACITORS CONTAINING PCB'S, AS DEFINED BY THE ENVIRONMENTAL PROTECTION AGENCY (EPA), IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, FEDERAL AND EPA REGULATIONS.
11. PROVIDE OWNER WITH INVENTORY OF MAJOR ELECTRICAL ITEMS TO BE REMOVED. OWNER WILL SELECT ITEMS TO BE SALVAGED. TURN SALVAGED ITEMS OVER TO OWNER. ITEMS REJECTED BY THE OWNER SHALL BECOME THE PROPERTY OF THE CONTRACTOR. REMOVE DEMOLISHED ITEMS FROM SITE.
12. UPDATE PANELBOARD DIRECTORIES TO INCLUDE MODIFICATIONS BY THIS PROJECT. TRACE CIRCUITS TO IDENTIFY UNLABELED LOADS.
13. REPAIR DISTURBED AREAS TO MATCH EXISTING CONDITIONS.
14. PROVIDE BLANK COVER PLATES FOR DEVICES REMOVED WHEN A REPLACEMENT DEVICE IS NOT INDICATED.
15. MAINTAIN CONTINUITY OF CIRCUITS AND FEEDERS REMAINING AFTER DEMOLITION IN PANELS INDICATED TO BE DEMOLISHED OR REPLACED. EXTEND EXISTING CIRCUITS AND FEEDERS REMAINING AFTER DEMOLITION TO NEW PANELS. CIRCUIT BREAKER, CONDUIT, AND WIRE SHALL MATCH EXISTING TYPES AND SIZES.
16. WHERE CIRCUITS ARE REMOVED BACK TO PANELS, TURN OFF ASSOCIATED CIRCUIT BREAKERS AND RELABEL AS "SPARE".

ELECTRICAL ABBREVIATIONS

A	AMPERE
ACCU	AIR COOLED CONDENSING UNIT
ACU	AIR CONDITIONING UNIT
ADA	AMERICANS WITH DISABILITIES ACT
AF	AMPERE FRAME, AMPERE FUSE
AFCI	ARC FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AIC	AMPERE INTERRUPTING CAPACITY
AL	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ASYM	ASYMMETRICAL
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BF	BALLAST FACTOR
BGE	BALTIMORE GAS & ELECTRIC
BOD	BASIS OF DESIGN
BS	BRANCH SELECTOR
C	CONDUIT
CB	CIRCUIT BREAKER
CCT	CORRELATED COLOR TEMPERATURE
CCTV	CLOSED CIRCUIT TELEVISION
CH	CHILLER
CKT	CIRCUIT
CMS	COMBINATION MOTOR STARTER
COMM	COMMUNICATION
CRI	COLOR RENDERING INDEX
CT	CURRENT TRANSFORMER
CU	COPPER
CX	CONNECT TO EXISTING
DOAS	DEDICATED OUTDOOR AIR SYSTEM
DS	DISCONNECT SWITCH
DWC	DRINKING WATER COOLER
DWG	DRAWING
E	EMERGENCY
EBH	ELECTRIC BASEBOARD HEATER
EBU	EMERGENCY BATTERY UNIT
ECB	ENCLOSED CIRCUIT BREAKER
EF	EXHAUST FAN
EMT	ELECTRICAL METALLIC TUBING
ENCL	ENCLOSURE
ENT	ELECTRICAL NONMETALLIC TUBING
EQUIP	EQUIPMENT
ETR	EXISTING TO REMAIN
EWH	ELECTRIC WATER HEATER
EX	EXISTING
F	FUSED, FUSIBLE, FAHRENHEIT
FA	FIRE ALARM
FAAP	FIRE ALARM ANNUNCIATOR PANEL
FACP	FIRE ALARM CONTROL PANEL
FCU	FAN COIL UNIT
FDR	FEEDER
FLA	FULL LOAD AMPERAGE
FMC	FLEXIBLE METAL CONDUIT
FP	FAN POWERED, FIRE PUMP
FSS	FUSED SAFETY SWITCH
FT	FEET
FVNR	FULL VOLTAGE NON-REVERSING
G	GROUND
GB	GROUND BAR
GD	GENERAL DUTY
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFEP	GROUND FAULT EQUIPMENT PROTECTOR
GFI	GROUND FAULT INTERRUPTER
GND	GROUND
GRC	GALVANIZED RIGID STEEL
GW	GROUND WIRE
HD	HEAVY DUTY
HDPE	HIGH-DENSITY POLYETHYLENE
HOA	HAND-OFF-AUTOMATIC
HP	HORSEPOWER
HPU	HEAT PUMP UNIT
HV	HIGH VOLTAGE
HVAC	HEATING VENTILATING AIR CONDITIONING
HZ	HERTZ
IBC	INTERNATIONAL BUILDING CODE
ICCB	INSULATED CASE CIRCUIT BREAKER
IEBC	INTERNATIONAL EXISTING BUILDING CODE
IECC	INTERNATIONAL ENERGY CONSERVATION CODE
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IG	ISOLATED GROUND
IGCC	INTERNATIONAL GREEN CONSTRUCTION CODE
IMC	INTERMEDIATE METALLIC CONDUIT
IN	INCH
IT	INFORMATION TECHNOLOGY
JB	JUNCTION BOX
K	ONE THOUSAND, KELVIN
KAIC	THOUSAND AMPERE INTERRUPTING CAPACITY
KCMIL	THOUSAND CIRCULAR MILS
KV	KILOVOLTS
KVA	KILOVOLT-AMPERES
KW	KILOWATTS
LC	LOAD CENTER
LED	LIGHT EMITTING DIODE
LF	LINEAR FEET
LFMC	LIQUID TIGHT FLEXIBLE METALLIC CONDUIT
LFNC	LIQUID TIGHT FLEXIBLE NON-METALLIC CONDUIT
LRA	LOCKED ROTOR AMPS
LS	LIMIT SWITCH, LONG TIME-SHORT TIME
LSI	LONG TIME-SHORT TIME-INSTANTANEOUS
LSIG	LONG TIME-SHORT TIME-INSTANTANEOUS GROUND FAULT
LTG	LIGHTING
LTS	LIGHTS
LV	LOW VOLTAGE
MAX	MAXIMUM
MC	METAL CLAD, METER CENTER
MCA	MINIMUM CIRCUIT AMPACITY
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCCB	MOLDED CASE CIRCUIT BREAKER
MCP	MOTOR CIRCUIT PROTECTOR
MDP	MAIN DISTRIBUTION PANEL
MGB	MAIN GROUND BAR
MH	MANHOLE, METAL HALIDE, MOUNTING HEIGHT
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MMS	MANUAL MOTOR STARTER
MOCP	MAXIMUM OVERCURRENT PROTECTION
MOD	MOTOR OPERATED DAMPER
MTD	MOUNTED
MV	MEDIUM VOLTAGE
N	NEUTRAL
NAC	NOTIFICATION APPLIANCE CIRCUIT
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NON-FUSED
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NFSS	NON-FUSED SAFETY SWITCH
NM	NON-METALLIC
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OCP	OVERCURRENT PROTECTION
OH	OVERHEAD
OHE	OVERHEAD ELECTRIC
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
P	POLE(1P, 2P, 3P)
PA	PUBLIC ADDRESS
PEPCO	POTOMAC ELECTRIC POWER COMPANY
PF	POWER FACTOR
PH	PHASE
PIR	PASSIVE INFRARED
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
R	RACEWAY
REC	RECEPTACLE
RGS	RIGID GALVANIZED STEEL
RLA	RATED LOAD AMPERES
RM	ROOM
RMS	ROOT MEAN SQUARE
RNC	RIGID NONMETALLIC CONDUIT
RTU	ROOF TOP UNIT
RX	REMOVE EXISTING
SCTE	SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS
SE	SERVICE ENTRANCE
SF	SQUARE FEET
SN	SOLID NEUTRAL
SPD	SURGE PROTECTION DEVICE
SS	SAFETY SWITCH
ST	SINGLE-THROW
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMMETRICAL
T	TRANSFORMER
TA	TRIP AMPERES
TECH	TECHNOLOGY
TGB	TELECOMMUNICATIONS GROUND BAR
THD	TOTAL HARMONIC DISTORTION
TIA	TELECOMMUNICATIONS INDUSTRY ASSOCIATION
TMGB	TELECOMMUNICATIONS MAIN GROUND BAR
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UG	UNDERGROUND
UGE	UNDERGROUND ELECTRIC
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORY
UON	UNLESS OTHERWISE NOTED
UTP	UNSHIELDED TWISTED PAIR
V	VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE
VRF	VARIABLE REFRIGERANT FLOW
VSD	VARIABLE SPEED DRIVE
W	WIRE, WATTS
W/	WITH
WP	WEATHERPROOF
WR	WEATHER RESISTANT
XFMR	TRANSFORMER
Y	WYE

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION	MOUNTING HEIGHT
	MOTOR	- -
VFD	VARIABLE FREQUENCY DRIVE	60" TO TOP
	SAFETY SWITCH	60" TO TOP
	MAGNETIC MOTOR STARTER	60" TO TOP
	COMBINATION MAGNETIC MOTOR STARTER AND SAFETY SWITCH	60" TO TOP
	EQUIPMENT, AS NOTED	- -
	PANELBOARD, SURFACE AND FLUSH MOUNTED	78" TO TOP

NOTES: (APPLICABLE TO ELECTRICAL LEGEND ONLY)

1. THE MOUNTING HEIGHTS GIVEN ON THIS SHEET IN THE ELECTRICAL LEGEND ARE GENERAL AND SHALL BE USED ONLY WHEN MOUNTING HEIGHTS CANNOT BE ESTABLISHED BY REFERENCE TO DETAILS, ELEVATIONS, AND NOTES ON THE DRAWINGS.
2. ALL MOUNTING HEIGHTS, UNLESS OTHERWISE NOTED, SHALL BE MEASURED FROM THE FINISHED FLOOR TO THE CENTERLINE OF THE OUTLET OR DEVICE.
3. HEIGHTS OF ALL ITEMS NOT COVERED BY THE ELECTRICAL LEGEND AND NOT SHOWN ON THE DRAWINGS SHALL BE AS DIRECTED BY THE ARCHITECT OR ENGINEER.
4. WHERE PLACING ANY ITEM AT THE HEIGHTS LISTED OR NOTED WILL CAUSE INTERFERENCE WITH THE WORK OF OTHER TRADES, OR IS NOT PHYSICALLY POSSIBLE OR DESIRABLE FOR ONE REASON OR ANOTHER, THE ITEM SHALL BE INSTALLED AT A LOCATION APPROVED BY THE ARCHITECT OR ENGINEER.

ELECTRICAL CONVENTIONS

REFERENCE

1 — SPECIAL NOTE (APPLIES WHERE INDICATED ON THE DRAWING)

WIRING

1,3,5(LP-1) — BRANCH CIRCUIT HOMERUN TO PANEL "LP-1", CIRCUITS #1,3,5

GENERAL NOTE: WHERE WIRE SIZE IS INDICATED AT THE HOMERUN OR ON THE SCHEDULE TO BE LARGER THAN THE SPECIFIED MINIMUM PROVIDE THE INDICATED WIRE SIZE THROUGHOUT THE ENTIRE BRANCH CIRCUIT.

PRESENTATION

ELECTRICAL EQUIPMENT DESIGNATED BY SOLID HEAVY LINEWEIGHT INDICATES NEW WORK TO BE PROVIDED.

ELECTRICAL EQUIPMENT DESIGNATED BY SOLID LIGHT LINEWEIGHT INDICATES EXISTING EQUIPMENT TO REMAIN, UNLESS OTHERWISE INDICATED.

ELECTRICAL EQUIPMENT DESIGNATED BY DASHED HEAVY LINEWEIGHT REPRESENTS EXISTING EQUIPMENT TO BE REMOVED AND DISPOSED, UNLESS INDICATED TO BE REMOUNTED, RELOCATED, OR TURNED OVER TO OWNER.

Howard County Public School System

HENRY ADAMS
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MECHANICAL ELECTRICAL & PLUMBING ENGINEERS

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600 BALTIMORE AVENUE
SUITE 400
BALTIMORE, MD 21204
(410) 296-6500

PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN

ELECTRICAL COVER SHEET

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E001

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

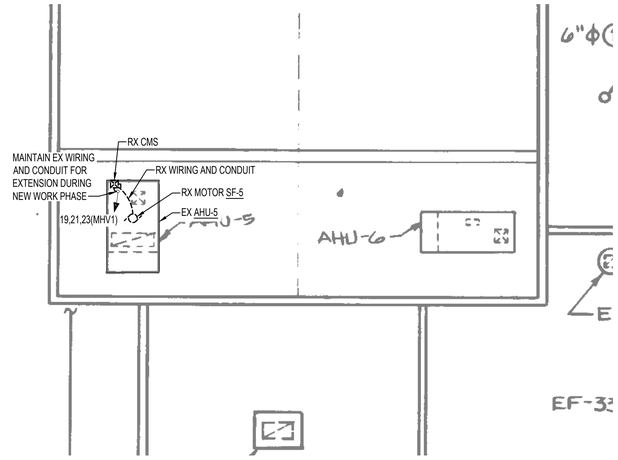
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
ELMS-SF-5	-	7-1/2	-	-	11	480	3	9.15	3#12+#12GW IN 3/4"C	VFD-ELMS-SF-5	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

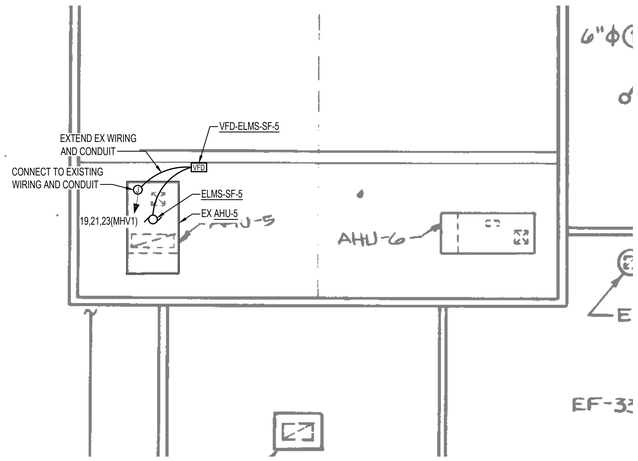
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

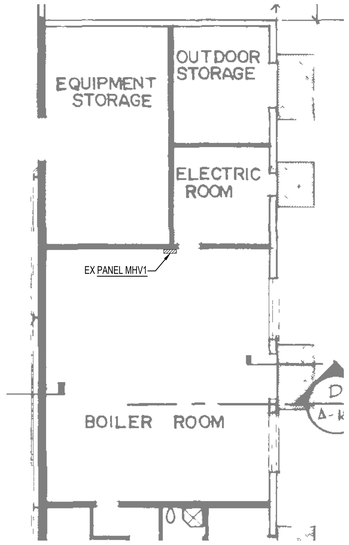
1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (———) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (———) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



1 E101 ELKRIDGE LANDING MS - PARTIAL ROOF PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 E101 ELKRIDGE LANDING MS - PARTIAL ROOF PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"



3 E101 ELKRIDGE LANDING MS - PARTIAL FIRST FLOOR PLAN - ELECTRICAL - EXISTING
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

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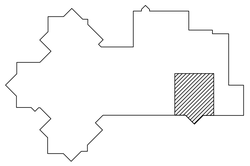
KEY PLAN



ELKRIDGE LANDING MS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E101

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
FES-RF-3	-	1	-	-	2.1	480	3	1.75	3#12+#12GW IN 3/4"C	VFD-FES-RF-3	1, 2
FES-SF-3	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-FES-SF-3	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

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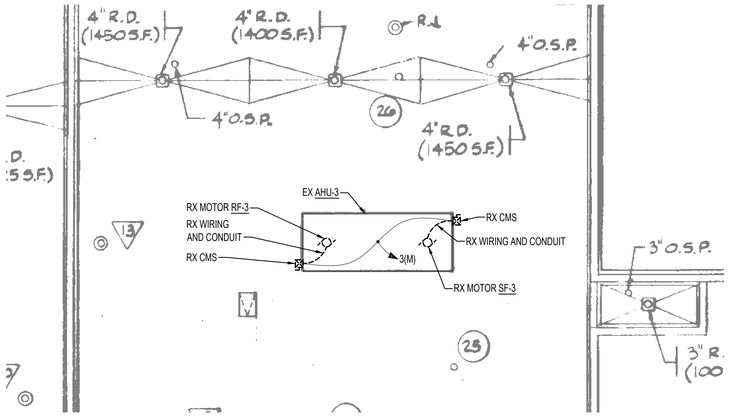
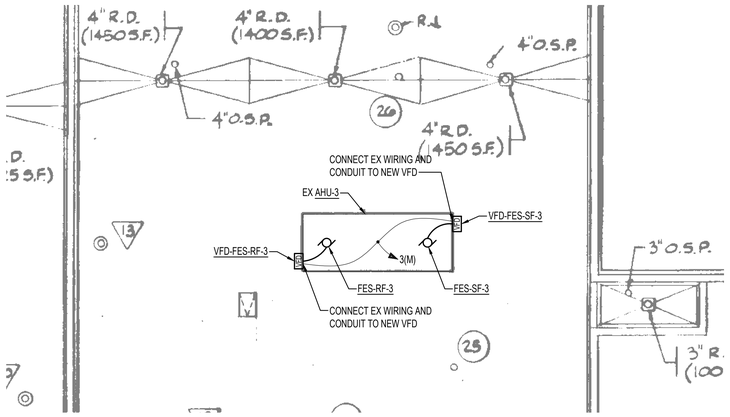
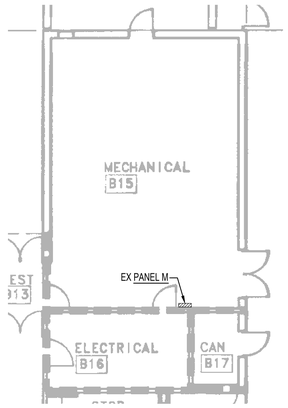


1 E102 FULTON ES - PARTIAL ROOF PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 E102 FULTON ES - PARTIAL ROOF PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"



3 E102 FULTON ES - PARTIAL FIRST FLOOR PLAN - ELECTRICAL - EXISTING
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

Howard County Public School System

HENRY ADAMS
Consulting Engineers
MECHANICAL ELECTRICAL & PLUMBING ENGINEERS

MEP ENGINEERING
HENRY ADAMS,LLC
600 BALTIMORE AVENUE
SUITE 400
BALTIMORE, MD 21204
(410) 296-6500

PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

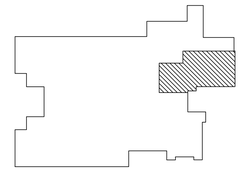
PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN



FULTON ES - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E102

EX PANELBOARD MP2B

SERVICE TYPE: NORMAL
MANUFACTURER: SIEMENS
TYPE: P3

BUS AMPACITY: 250A
MAIN TYPE: 150A MCB
SERVICE: 480Y/277 VOLTS, 3 PHASE, 4 WIRE
MIN. RATING: 65K AIC RMS SYMMETRICAL AMPS

MOUNTING: SURFACE
SECTIONS: 1
ENCLOSURE: NEMA 1
LOCATION: MECH 200

CKT	LOAD DESCRIPTION	NOTE	CKT BREAKER P	CKT BREAKER TA	CKT BREAKER AUX	KVA PER PHASE PHASE A		PHASE B		PHASE C		CKT BREAKER AUX	CKT BREAKER TA	CKT BREAKER P	NOTE	LOAD DESCRIPTION	CKT
1	SPACE	-	-	-	-	-	-					-	-	-	-	SPACE	2
3	EX LOAD: FCU 209, 211-213	-	1	15	-			-	-			-	15	1	-	SPARE	4
5	EX LOAD: FCU 205-207	-	1	15	-					-	-	-	15	1	-	SPARE	6
7	EX LOAD: FCU 202-203	-	1	15	-	-	-					-	15	1	-	SPARE	8
9	EX LOAD: FCU 201- STOR 47	-	1	15	-			-	-			-	15	1	-	SPARE	10
11	SPARE	-	1	20	-					-	-	-	20	1	-	SPARE	12
13	SPARE	-	1	20	-	-	-					-	20	1	-	SPARE	14
15	**EDH-1**	**1**	**3**	**40**	**-**			**7.50**	-			-	20	1	-	SPARE	16
17	**{ }**	**-**	**-**	**-**	**-**					**7.50**	-	-	-	-	-	SPACE	18
19	**{ }**	**-**	**-**	**-**	**-**	**7.50**	-					-	-	-	-	SPACE	20
21	SPACE	-	-	-	-			-	-			-	-	-	-	SPACE	22
23	SPACE	-	-	-	-					-	-	-	-	-	-	SPACE	24
25	SPACE	-	-	-	-	-	-					-	-	-	-	SPACE	26
27	SPACE	-	-	-	-			-	-			-	-	-	-	SPACE	28
29	SPACE	-	-	-	-					-	-	-	-	-	-	SPACE	30
31	SPACE	-	-	-	-	-	-					-	20	3	-	EX LOAD: AHU #6	32
33	SPACE	-	-	-	-			-	-			-	-	-	-	{ }	34
35	SPACE	-	-	-	-					-	-	-	-	-	-	{ }	36
37	EX LOAD: AHU #5	-	3	60	-	-	-					-	20	3	-	EX LOAD: AHU #7	38
39	{ }	-	-	-	-			-	-			-	-	-	-	{ }	40
41	{ }	-	-	-	-					-	-	-	-	-	-	{ }	42
						7.50	-	7.50	-	7.50	-						
						7.50		7.50		7.50							
						27.1A		27.1A		27.1A							

AUXILIARIES
- a AFCI BREAKER
- b GFCI BREAKER (5mA)
- c GFEP BREAKER (30mA)
- d SHUNT TRIP BREAKER
- e HANDLE PADLOCK
- f HANDLE CLAMP
- g RED CB HANDLE

- [X] GROUND BUS
- [ ] SERVICE ENTRANCE LABEL
- [ ] INTEGRAL SPD/TVSS
- [ ] 200% NEUTRAL BUS & LUGS
- [ ] ISOLATED GROUND BUS
- [ ] SPLIT BUS
- [ ] FEED THRU LUGS
- [ ] SUB FEED LUGS

TOTAL CONNECTED LOAD	22.50
TOTAL DEMAND LOAD	22.50
DEMAND AMPS	27.1

LOAD SUMMARY NOTES

NOTE 1: FIRST 10KVA AT 100% AND REMAINDER AT 50%.
NOTE 2: HEATING CYCLE IS GREATER THAN COOLING CYCLE, THEREFORE HEATING CYCLE IS USED.
NOTE 3: DEMAND FACTOR FROM NEC TABLE FOR KITCHEN EQUIPMENT OTHER THAN DWELLING UNIT.
NOTE 4: DEMAND FACTOR FROM NEC TABLE FOR ELEVATORS.

LOAD SUMMARY (KVA)

LOAD TYPE	CONNECTED	DF	DEMAND
LIGHTING	0.00	100%	0.00
RECEPTACLE (SEE NOTE 1)	0.00	--	0.00
EQUIPMENT: CONTINUOUS	0.00	100%	0.00
EQUIPMENT: NON-CONTINUOUS	0.00	100%	0.00
MOTOR	0.00	100%	0.00
COOLING (SEE NOTE 2)	0.00	0%	0.00
HEATING (SEE NOTE 2)	22.50	100%	22.50
STANDBY	0.00	0%	0.00
OTHER	0.00	100%	0.00
KITCHEN (SEE NOTE 3)	0.00	100%	0.00
ELEVATOR (SEE NOTE 4)	0.00	100%	0.00

NOTES: (APPLICABLE TO PANEL SCHEDULE'S NOTE COLUMN)

1. PROVIDE NEW CIRCUIT BREAKER IN EXISTING AVAILABLE SPACE. MATCH PANELBOARD MANUFACTURER, TYPE, AND AIC RATING.

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

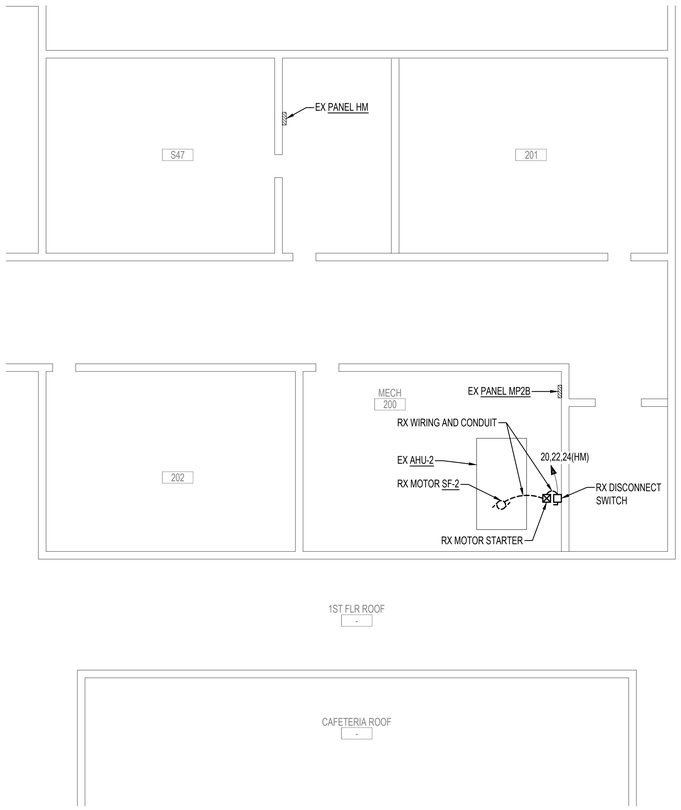
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
EDH-1	22.5	-	33.87	40	27.1	480	3	22.5	3#8+#10GW IN 3/4"C	INTEGRAL	1, 2
GHS-SF-2	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-GHS-SF-2	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

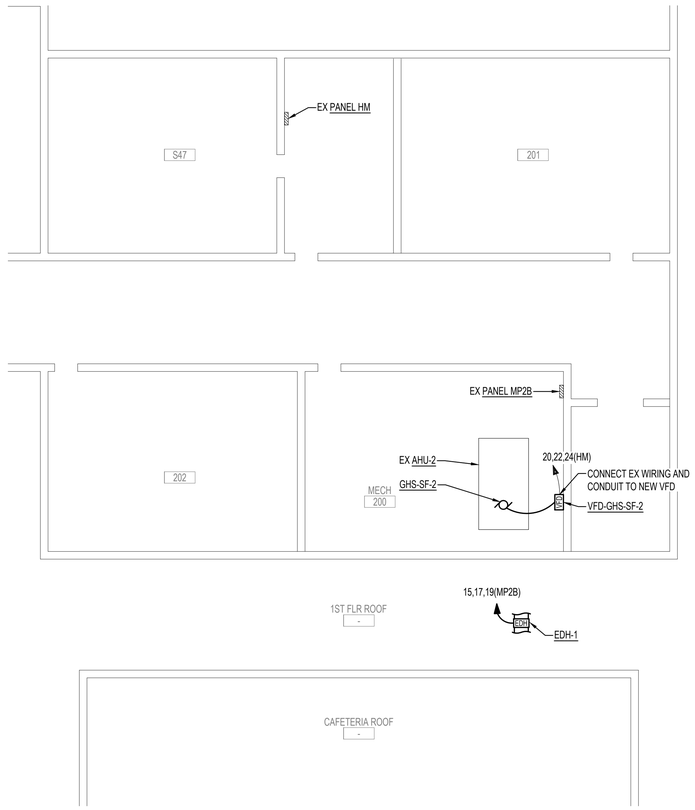
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (——) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (——) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



1 E103 GLENELG HS - PARTIAL ROOF PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 E103 GLENELG HS - PARTIAL ROOF PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

Howard County Public School System

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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

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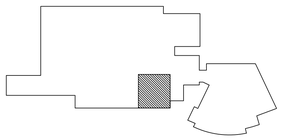
LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN



GLENELG HS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E103

EX PANELBOARD AH3-R

SERVICE TYPE: NORMAL
MANUFACTURER: FEDERAL PACIFIC
TYPE: NH1B

BUS AMPACITY: 225A
MAIN TYPE: MLO
SERVICE: 480Y/277 VOLTS, 3 PHASE, 4 WIRE
MIN. RATING: 14K AIC RMS SYMMETRICAL AMPS

MOUNTING: SURFACE
SECTIONS: 1
ENCLOSURE: NEMA 1
LOCATION: PENTHOUSE

CKT	LOAD DESCRIPTION	NOTE	CKT BREAKER P	CKT BREAKER TA	CKT BREAKER AUX	KVA PER PHASE PHASE A	PHASE B	PHASE C	CKT BREAKER AUX	CKT BREAKER TA	CKT BREAKER P	NOTE	LOAD DESCRIPTION	CKT
1	SPARE	-	3	20	-	- **6.97**			-	**3.5**	**3**	**1**	**EDH-2**	2
3	{ }	-	-	-	-		- **6.97**		-	-	-	-	**{ }**	4
5	{ }	-	-	-	-			- **6.97**	-	-	-	-	**{ }**	6
7	EX LOAD: RF-4	-	3	20	-	- -			-	20	3	-	SPARE	8
9	{ }	-	-	-	-		- -		-	-	-	-	{ }	10
11	{ }	-	-	-	-			- -	-	-	-	-	{ }	12
13	EX LOAD: RF-3	-	3	30	-	- -			-	30	3	-	EX LOAD: RF-1	14
15	{ }	-	-	-	-		- -		-	-	-	-	{ }	16
17	{ }	-	-	-	-			- -	-	-	-	-	{ }	18
19	EX LOAD: SF-3	-	3	40	-	- -			-	20	3	-	EX LOAD: EF-4	20
21	{ }	-	-	-	-		- -		-	-	-	-	{ }	22
23	{ }	-	-	-	-			- -	-	-	-	-	{ }	24
						- 6.97	- 6.97	- 6.97						
						6.97	6.97	6.97						
						25.2A	25.2A	25.2A						

AUXILIARIES
- a AFCI BREAKER
- b GFCI BREAKER (5mA)
- c GFEP BREAKER (30mA)
- d SHUNT TRIP BREAKER
- e HANDLE PADLOCK
- f HANDLE CLAMP
- g RED CB HANDLE

- [X] GROUND BUS
- [ ] SERVICE ENTRANCE LABEL
- [ ] INTEGRAL SPD/TVSS
- [ ] 200% NEUTRAL BUS & LUGS
- [ ] ISOLATED GROUND BUS
- [ ] SPLIT BUS
- [ ] FEED THRU LUGS
- [ ] SUB FEED LUGS

TOTAL CONNECTED LOAD	20.90
TOTAL DEMAND LOAD	20.90
DEMAND AMPS	25.1

LOAD SUMMARY NOTES

NOTE 1: FIRST 10KVA AT 100% AND REMAINDER AT 50%.
NOTE 2: HEATING CYCLE IS GREATER THAN COOLING CYCLE, THEREFORE HEATING CYCLE IS USED.
NOTE 3: DEMAND FACTOR FROM NEC TABLE FOR KITCHEN EQUIPMENT OTHER THAN DWELLING UNIT.
NOTE 4: DEMAND FACTOR FROM NEC TABLE FOR ELEVATORS.

LOAD SUMMARY (KVA)

LOAD TYPE	CONNECTED	DF	DEMAND
LIGHTING	0.00	100%	0.00
RECEPTACLE (SEE NOTE 1)	0.00	--	0.00
EQUIPMENT: CONTINUOUS	0.00	100%	0.00
EQUIPMENT: NON-CONTINUOUS	0.00	100%	0.00
MOTOR	0.00	100%	0.00
COOLING (SEE NOTE 2)	0.00	0%	0.00
HEATING (SEE NOTE 2)	20.90	100%	20.90
STANDBY	0.00	0%	0.00
OTHER	0.00	100%	0.00
KITCHEN (SEE NOTE 3)	0.00	100%	0.00
ELEVATOR (SEE NOTE 4)	0.00	100%	0.00

NOTES: (APPLICABLE TO PANEL SCHEDULE'S NOTE COLUMN)

1. PROVIDE NEW CIRCUIT BREAKER IN EXISTING AVAILABLE SPACE. EXISTING PANEL IS MANUFACTURED BY FEDERAL PACIFIC. PROVIDE THIRD PARTY CIRCUIT BREAKER CERTIFIED TO BE COMPATIBLE WITH EXISTING PANEL IN EXISTING AVAILABLE SPACE. OEM FEDERAL PACIFIC CIRCUIT BREAKER ARE NOT ACCEPTABLE. MATCH PANELBOARD AIC RATING.

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

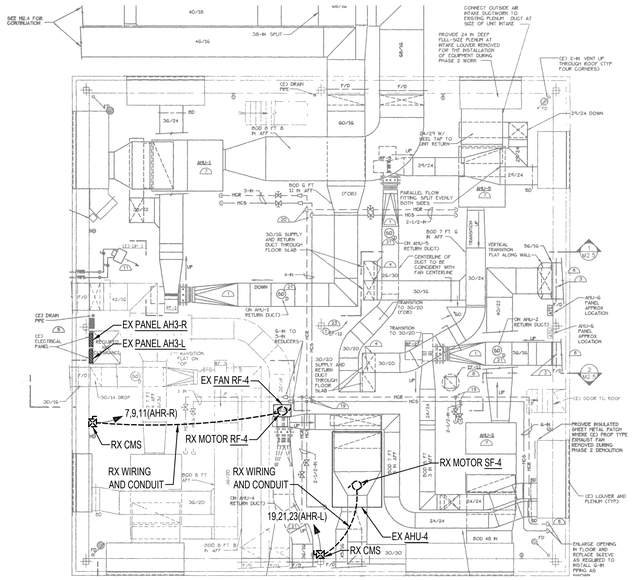
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
EDH-2	20.9	-	31.46	35	25.17	480	3	20.9	3#8+#10GW IN 3/4"C	INTEGRAL	1, 2
HCMS-RF-4	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-HCMS-RF-4	1, 2
HCMS-SF-4	-	10	-	-	14	480	3	11.6	3#12+#12GW IN 3/4"C	VFD-HCMS-SF-4	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

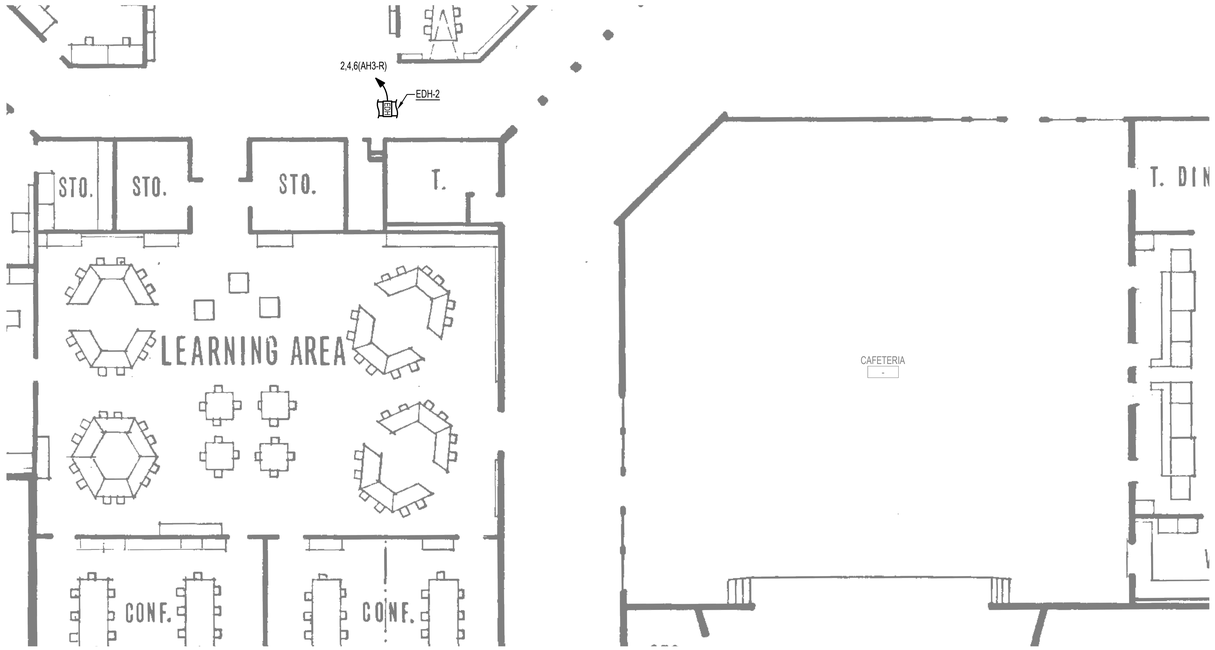
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

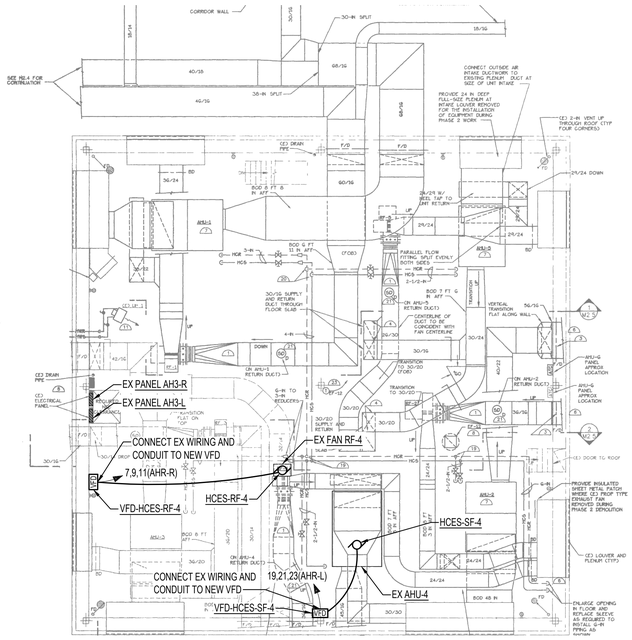
1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (———) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (———) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



2 E104 HARPERS CHOICE MS - PARTIAL PENTHOUSE PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



3 E104 HARPERS CHOICE MS - PARTIAL FIRST FLOOR PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"



3 E104 HARPERS CHOICE MS - PARTIAL PENTHOUSE PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

Howard County Public School System

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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

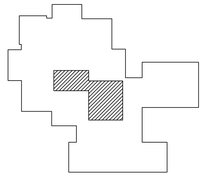
PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN



HARPERS CHOICE MS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E104

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

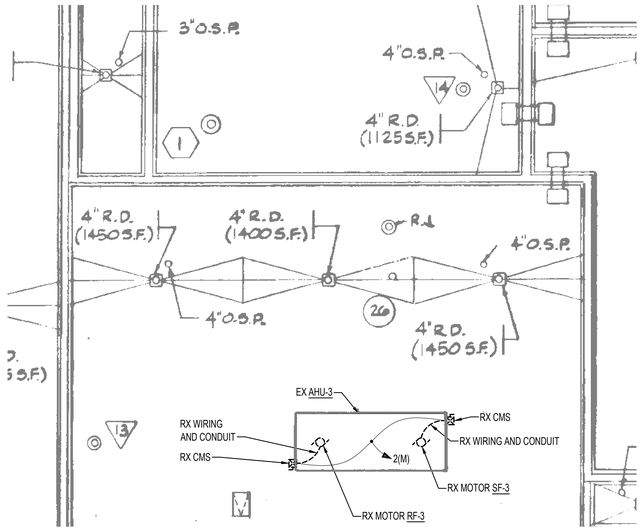
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
HSES-RF-3	-	1	-	-	2.1	480	3	1.75	3#12+#12GW IN 3/4"C	VFD-HSES-RF-3	1, 2
HSES-SF-3	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-HSES-SF-3	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

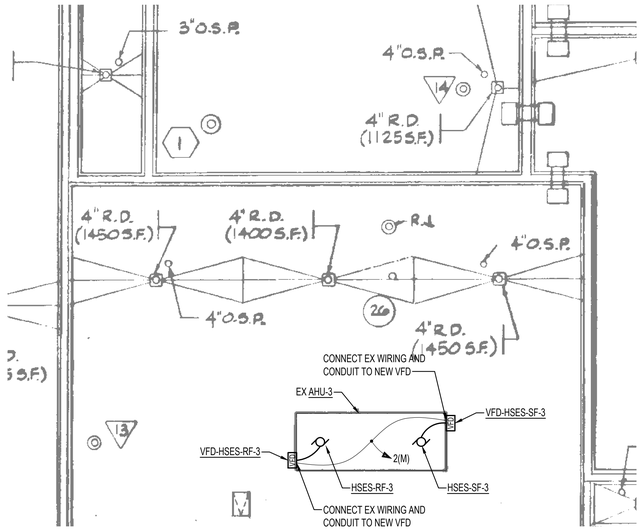
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

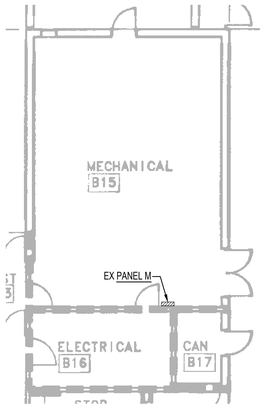
1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (———) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (———) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



1 E105 HOLLIFIELD STATION ES - PARTIAL ROOF PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 E105 HOLLIFIELD STATION ES - PARTIAL ROOF PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"



3 E105 HOLLIFIELD STATION ES - PARTIAL FIRST FLOOR PLAN - ELECTRICAL - EXISTING
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

Howard County Public School System

HENRY ADAMS
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MEP ENGINEERING
HENRY ADAMS,LLC
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BALTIMORE, MD 21204
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PROJECT

HOWARD COUNTY PUBLIC SCHOOLS

CAFETERIA HVAC UNIT CONVERSIONS

CONSTRUCTION DOCUMENTS
05/25/2023

SEAL

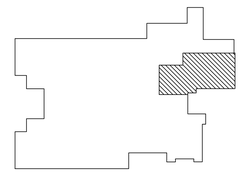
PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND.

LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN



HOLLIFIELD STATION ES - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E105

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

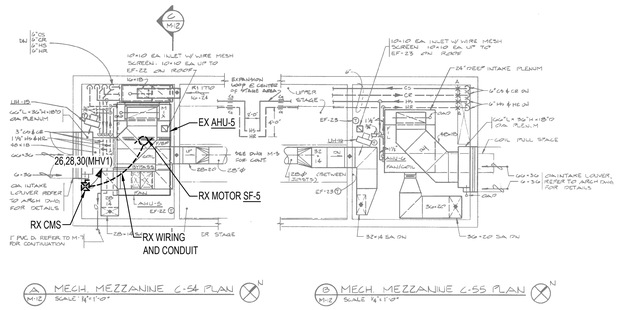
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
MWMS-SF-5	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-MWMS-SF-5	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

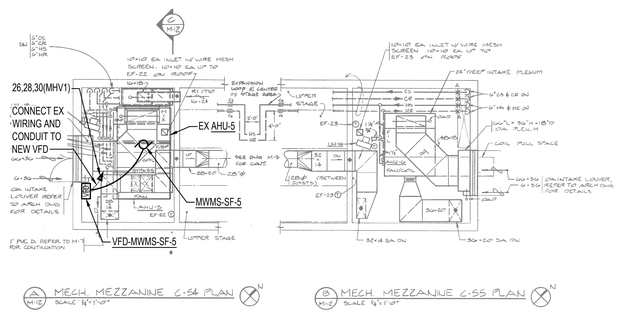
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

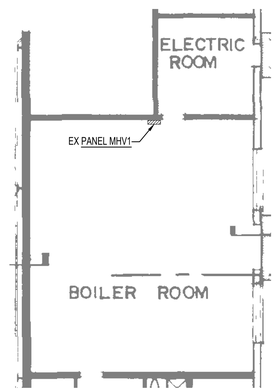
1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (———) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (———) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



1 E106 MAYFIELD WOODS MS - MEZZANINE PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 E106 MAYFIELD WOODS MS - MEZZANINE PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"



3 E106 MAYFIELD WOODS MS - PARTIAL FIRST FLOOR PLAN - ELECTRICAL - EXISTING
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

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PROJECT

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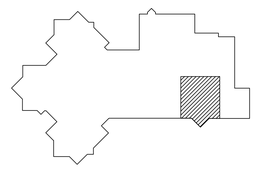


MAYFIELD WOODS MS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E106

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

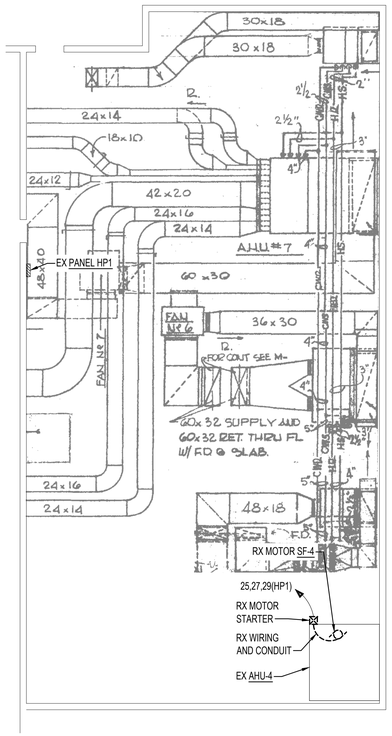
EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
OMHS-SF-4	-	10	-	-	14	480	3	11.6	3#12+#12GW IN 3/4"C	VFD-OMHS-SF-4	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

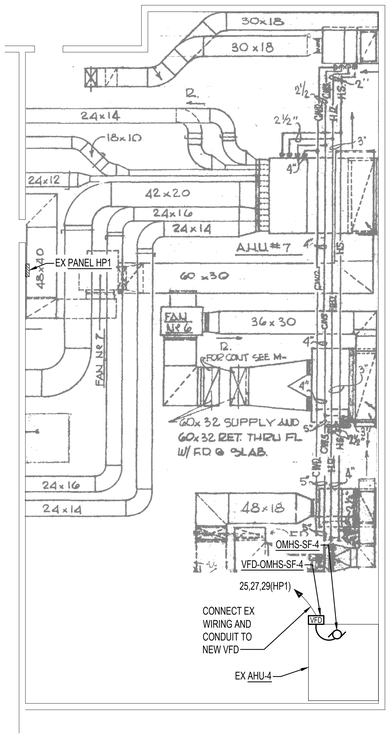
1. REVIEW EQUIPMENT SUBMITTALS FROM OTHER TRADES PRIOR TO ORDERING OR INSTALLING ASSOCIATED ELECTRICAL WORK. ELECTRICAL CONTRACTOR SHALL MODIFY COMPONENTS OF THE ELECTRICAL CONNECTIONS AS NECESSARY TO MATCH NAMEPLATE DATA OF APPROVED EQUIPMENT AND PROVIDE A CODE COMPLIANT INSTALLATION, INCLUDING BUT NOT LIMITED TO CIRCUIT BREAKERS, WIRE, CONDUITS, CONNECTION TYPES, SWITCHES, AND FUSES. CHANGE ORDERS AND EXTRAS WILL NOT BE AWARDED FOR FAILURE TO COORDINATE WITH OTHER TRADES' EQUIPMENT SUBMITTALS.
2. PROVIDE NECESSARY SUPPORTING STRUT CHANNEL AND ALL MISCELLANEOUS HARDWARE FOR MOUNTING ELECTRICAL EQUIPMENT. MAINTAIN NEC WORKING CLEARANCES. FIELD COORDINATE EXACT LOCATIONS. DO NOT MOUNT ON EQUIPMENT ACCESS PANELS OR IN EQUIPMENT MANUFACTURERS' RECOMMENDED MAINTENANCE CLEARANCES. COORDINATE EXACT LOCATION OF SAFETY SWITCHES WITH MECHANICAL EQUIPMENT/CONTRACTOR.

DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

1. UNLESS OTHERWISE NOTED, ELECTRICAL ITEMS SHOWN BY DASHED HEAVY LINEWEIGHT (– – –) INDICATE EXISTING ITEMS TO BE REMOVED. ELECTRICAL ITEMS SHOWN BY SOLID LIGHT LINEWEIGHT (———) INDICATE EXISTING ITEMS TO REMAIN. ELECTRICAL ITEMS SHOWN BY SOLID HEAVY LINEWEIGHT (———) INDICATE NEW WORK TO BE PROVIDED.
2. INFORMATION SHOWN ON THIS DRAWING PERTAINING TO EXISTING CONDITIONS HAS BEEN OBTAINED FROM AVAILABLE BUILDING DRAWINGS OR GENERAL FIELD OBSERVATIONS AND MAY NOT INDICATE ACTUAL EXISTING CONDITIONS IN DETAIL OR DIMENSION. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE ACTUAL EXISTING CONDITIONS PRIOR TO FABRICATION OR PERFORMANCE OF ANY WORK. SHOULD CONDITIONS BE DISCOVERED THAT PREVENT EXECUTION OF THE WORK AS INDICATED, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING AND AWAIT WRITTEN DIRECTION BEFORE PROCEEDING WITH THE WORK.



2 E107 OAKLAND MILLS HS - PENTHOUSE NO 1 FLOOR PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



4 E107 OAKLAND MILLS HS - PENTHOUSE NO 1 FLOOR PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

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HOWARD COUNTY PUBLIC SCHOOLS

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LICENSE NO:

EXPIRATION DATE:

NO.	DESCRIPTION	DATE

KEY PLAN

OAKLAND MILLS HS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E107

MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE

EQUIPMENT DESIGNATION	KW	HP	MCA	MOCP	FLA	VOLTAGE	PHASE	LOAD (kVA)	WIRING & CONDUIT	DISCONNECTING MEANS	NOTES
RHHS-RF-12	-	5	-	-	7.6	480	3	6.32	3#12+#12GW IN 3/4"C	VFD-RHHS-RF-12	1, 2
RHHS-SF-12	-	15	-	-	21	480	3	17.5	3#10+#10GW IN 3/4"C	VFD-RHHS-SF-12	1, 2

NOTES: (APPLICABLE TO MECHANICAL EQUIPMENT ELECTRICAL CONNECTION SCHEDULE ONLY)

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DRAWING NOTES: (APPLICABLE TO THIS SHEET ONLY)

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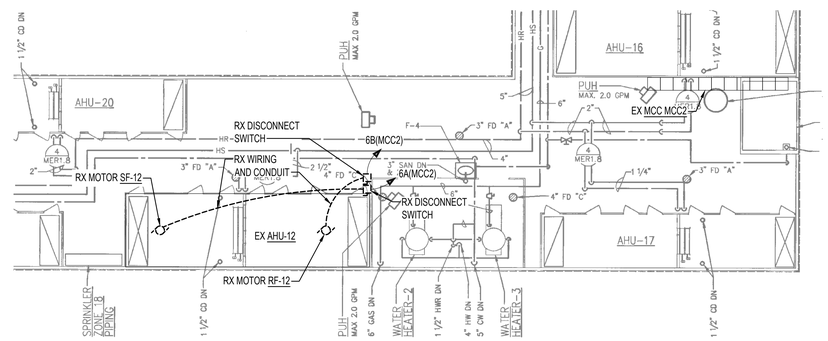
REPLACE EXISTING ACROSS-THE-LINE MAGNETIC MOTOR STARTER MCC BUCKET WITH A NEW 50A 3PH 480V CIRCUIT BREAKER FEEDER BUCKET. MATCH MCC MANUFACTURER, TYPE, AND AIC RATING.

REPLACE EXISTING ACROSS-THE-LINE MAGNETIC MOTOR STARTER MCC BUCKET WITH A NEW 15A 3PH 480V CIRCUIT BREAKER FEEDER BUCKET. MATCH MCC MANUFACTURER, TYPE, AND AIC RATING.

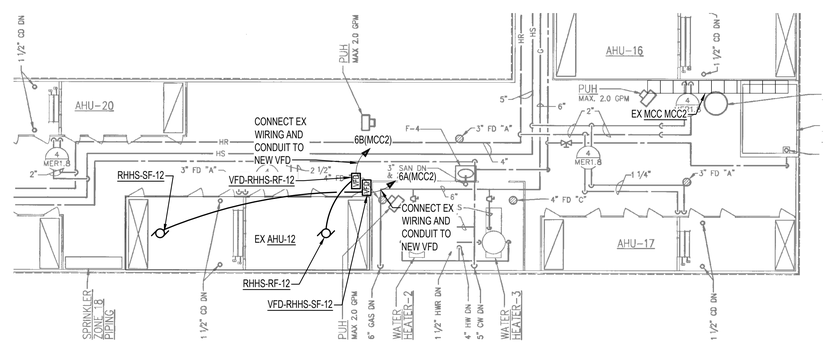
MCC2 SECTION 1	MCC2 SECTION 2	MCC2 SECTION 3	MCC2 SECTION 4	MCC2 SECTION 5	MCC2 SECTION 6	MCC2 SECTION 7	MCC2 SECTION 8	MCC2 SECTION 9	MCC2 SECTION 10	MCC2 SECTION 11
1A	2A	3A	4A	5A	6A	7A	8A	9A	10A	11A
	2B	3B	4B	5B	6B	7B	8B	9B	10B	11B
			4C	5C	6C	7C	8C	9C	10C	11C
1B	2C		4D		6D	7D	8D	9D	10D	11D
		3C	4E	5D	6E	7E	8E	9E	10E	11E
					6F	7F	8F	9F	10F	11F

MANUFACTURER: SIEMENS
MODEL: 95
NEMA ENCLOSURE TYPE: 1
VOLTS: 480V
PHASE: 3
HORIZONTAL BUS RATING: 1200A

3 / E108 RIVER HILL HS - MOTOR CONTROL CENTER MCC2 - NEW WORK
NOT TO SCALE



1 / E108 RIVER HILL HS - PENTHOUSE NO. 2 PART PLAN - ELECTRICAL - DEMOLITION
1/8" = 1'-0"



2 / E108 RIVER HILL HS - PENTHOUSE NO. 2 PART PLAN - ELECTRICAL - NEW WORK
1/8" = 1'-0"

1/8" = 1'-0" 0 4 8 16 24 FT

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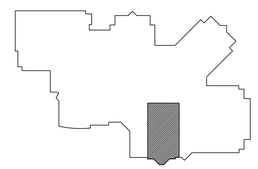

RIVER HILL HS - ELECTRICAL WORK

PROJECT NUMBER	PO-10028674
DATE	05/25/2023
DRAWN BY	MWL
CHECKED BY	ADP

E108