DIGITAL INPUT

**DUCTLESS MINI-SPLIT SYSTEM** 

DIAMETER

DIA

DMSS

KW

**KILOWATT** 

LEAVING AIR TEMPERATURE

LOUVER

SCH

SEC

SCHEDULE

SUPPLY FAN OR SQUARE FOOT

SECONDS

STATE BUILDING OFFICIAL

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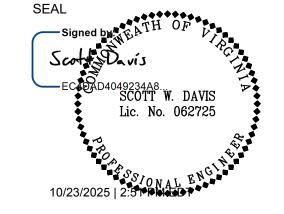
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DEB APROVAL





KEY PLAN:

SCALE:

DRAWN BY SMF

APPROVED BY SWD

CHECKED BY JMT

DATE JULY 25, 2025

MECHANICAL SYMBOLS & ABBREVIATIONS

DEI PROJECT NO: 50188025
RADFORD PROJECT NO: 217-B5217-004
SHEET NO.

M0.01

TOTAL: 24

#### MECHANICAL GENERAL NEW **WORK NOTES**

- 1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH APPLICABLE STATE CODES AND REGULATIONS. MECHANICAL EQUIPMENT SHALL BE SELECTED TO MEET OR EXCEED THE REQUIREMENTS OF THE STATE ENERGY CONSERVATION CODE. MECHANICAL WORK SHALL COMPLY WITH PROJECT SPECIFICATIONS.
- 2. FURNISH AND INSTALL ALL INCIDENTAL ACCESSORIES REQUIRED TO MAKE THE MECHANICAL WORK COMPLETE AND OPERATIONAL.
- CONTRACTOR SHALL BE RESPONSIBLE FOR INSPECTING, TESTING AND VERIFYING CONTROL SEQUENCES, LINE BY LINE, AND VERIFYING OPERATION OF THE EQUIPMENT. ALL EQUIPMENT, VALVES, DAMPERS ACTUATORS, ETC. SHALL BE FUNCTIONAL PRIOR TO FINAL COMMISSIONING. COORDINATE WITH ELECTRICAL AND TAB CONTRACTORS. REFER TO SECTION 239000 FOR MORE DETAIL.
- THESE DRAWINGS ARE DIAGRAMMATIC. EXACT EQUIPMENT LOCATIONS AND DUCT AND PIPING ROUTING SHALL BE COORDINATED WITH THE BUILDING AND SITE CONDITIONS. THE ACTUAL EQUIPMENT AND MINIMUM CLEARANCE DIMENSIONS SHALL BE VERIFIED WITH THE SUPPLIERS. FITTINGS NOT SHOWN ON THE DRAWINGS MIGHT BE REQUIRED.
- EQUIPMENT, DUCTWORK, PIPING AND CONDUIT LAYOUT SHALL BE COORDINATED WITH BUILDING COMPONENTS AND OTHER TRADES PRIOR TO INSTALLATION. THE SYSTEM SHALL BE NEATLY ARRANGED TO MAXIMIZE SPACE ABOVE CEILINGS AND WITHIN CHASES. MAINTAIN MINIMUM EQUIPMENT AND DEVICE MAINTENANCE CLEARANCES. DEVICES SHALL BE READILY MAINTAINABLE. METERS AND GAGES SHALL BE ORIENTED FOR BEST VIEW. INSTALLED MATERIALS NOT COORDINATED SHALL BE REMOVED AND REINSTALLED AT NO ADDITIONAL COST.
- DUCT OFFSETS SHALL BE MADE AT 15 OR 30-DEGREE ANGLES WHERE POSSIBLE BUT AT NEVER MORE THAN 45-DEGREES.
- 7. WALL-MOUNTED CONTROL SENSORS SHALL BE INSTALLED AT 48-INCHES ABOVE THE FLOOR TO THE TOP OF SENSOR. COORDINATE EXACT LOCATIONS WITH LIGHT SWITCHES. WHEN BOTH ARE INDICATED ADJACENT TO A DOOR, LOCATE THE SWITCH CLOSEST TO THE DOOR AND THE SENSOR WITHIN 12-INCHES OF THE SWITCH.
- CONTROL AND ALARM DEVICES SHALL BE INSTALLED IN BACK-BOXES WITHIN NEW AND EXISTING WALLS. SURFACE-MOUNTED CONDUIT AND RACEWAY WILL NOT BE ACCEPTED EXCEPT FOR EXISTING SOLID CONCRETE WALLS. DEVICE BACK-BOXES IN FIRE-RATED WALLS SHALL HAVE FIRESTOP PUTTY PADS OR EQUIVALENT UL-LISTED INSTALLATION.
- 9. INSTALL PENETRATIONS OF LIFE-SAFETY RATED ASSEMBLIES PER APPROVED UL-LISTED DETAIL IN ACCORDANCE WITH THE BUILDING CODE.
- 10. INSTALL LIFE-SAFETY (FIRE, SMOKE AND COMBINATION FIRE AND SMOKE) DAMPERS IN RATED ASSEMBLIES PER UL-LISTED DETAIL IN ACCORDANCE WITH THE BUILDING CODE AND MANUFACTURERS LISTING REQUIREMENTS.
- 11. PROVIDE A DUCT ACCESS DOOR FOR EACH DUCT-MOUNTED DEVICE REQUIRING MAINTENANCE OR INSPECTION. REFER TO SECTION 23 33 00 FOR DOOR SIZING REQUIREMENTS. COORDINATE CEILING AND WALL ACCESS DOORS WITH DUCT ACCESS DOORS.
- 12. HVAC PIPING SHALL BE NO LESS THAN 3/4-INCH, EXCEPT REFRIGERANT
- 13. ALL MOTORIZED EQUIPMENT SHALL BE CONNECTED TO DUCTWORK OR PIPING WITH FLEXIBLE CONNECTIONS.
- 14. ROOF MODIFICATIONS AND REPAIRS SHALL MEET THE REQUIREMENTS OF THE ROOF WARRANTY.
- 15. EXTEND POWER CONDUIT AND WIRING FROM DEDICATED POWER SOURCES TO CONTROL EQUIPMENT AND DEVICES. COORDINATE POWER SOURCES WITH ELECTRICAL CONTRACTOR.
- 16. PIPING BRANCHES FROM MAINS TO HEATING AND COOLING COILS SHALL MATCH SCHEDULED SIZES UNLESS OTHERWISE NOTED.
- 17. MAINTAIN MINIMUM 36-INCH CLEARANCE FOR 120/208V POWER OR 42-INCH CLEARANCE FOR 277/480V POWER AS REQUIRED BY THE NATIONAL ELECTRIC CODE FOR ELECTRICAL EQUIPMENT AND TO PROVIDE MAINTENANCE ACCESS.
- 18. FIELD VERIFY EXACT PIPING SIZES AND FLOW DIRECTIONS PRIOR TO CONNECTING TO PIPING SYSTEM.
- 19. EXPOSED DUCT, PIPING AND CONDUIT SHALL BE PRIMED AND PAINTED TO MATCH ADJACENT SURFACES. REFER TO SPECIFICATIONS FOR DETAILED REQUIREMENTS.
- 20. SCHEDULE ALL SERVICE DISRUPTIONS AND SHUTDOWNS WITH THE OWNER NO LESS THAN 2 WEEKS PRIOR.
- 21. AIR HANDLING UNIT INTAKES SHALL BE SEPARATED BY MINIMUM 10 FEET FROM EXHAUST FANS, EXHAUST VENTS, FLUES, PLUMBING VENTS, ETC.
- 22. EXISTING DUCTWORK AND PIPING SHOWN ARE BASED ON AS-BUILT DRAWINGS AND EXISTING CONDITIONS NOTED TO THE BEST OF ENGINEER'S ABILITY DURING DESIGN. CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD-VERIFYING ALL EXISTING MECHANICAL ITEMS SHOWN PRIOR TO COMMENCING WORK.

MECHANICAL GENERAL DEMOLITION

# **WORK NOTES**

- VERIFY PROJECT SITE EXISTING CONDITIONS PRIOR TO BID. EXISTING CONDITIONS INDICATED IN THESE DOCUMENTS ARE APPROXIMATE AND DO NOT INCLUDE EVERY COMPONENT.
- RECORD EXISTING CONDITIONS PRIOR TO THE START OF WORK. REPAIR DAMAGES RESULTING FROM PROJECT WORK.
- COORDINATE MATERIALS TO BE RETAINED BY THE OWNER PRIOR TO THE START OF DEMOLITION WORK. RETAINED MATERIALS SHALL BE DELIVERED TO A POINT DESIGNATED BY THE OWNER WITHIN A 10-MILE RADIUS OF THE PROJECT SITE. PROPERLY DISPOSE OF ALL REMAINING DEMOLITION MATERIALS. COMPLY WITH MATERIAL RECYCLING REQUIREMENTS. DO NOT ABANDON IN PLACE ANY ITEMS IDENTIFIED TO BE REMOVED UNLESS OTHERWISE NOTED.
- 4. THE SCOPE OF DEMOLITION FOR ITEMS TO BE REMOVED INCLUDES ASSOCIATED SUPPORTS, POWER CONNECTIONS, CONTROLS, CONDUIT,
- PERFORM ALL DEMOLITION INDICATED INCLUDING THAT REQUIRED TO INSTALL NEW WORK. REMOVE AND REINSTALL MATERIALS TO REMAIN AS NEEDED WHERE REQUIRED TO PERFORM DEMOLITION OR TO INSTALL NEW WORK. REPAIR DAMAGED SURFACES TO MATCH EXISTING ADJACENT SURFACES.
- REMOVE DUCT, PIPING AND CONDUIT BACK TO POINTS INDICATED. PREPARE OPEN ENDS FOR CONNECTION TO NEW WORK INDICATED OR
- 7. REPAIR DAMAGE TO ANY OPENINGS IN LIFE-SAFETY RATED ASSEMBLIES CREATED BY THE DEMOLITION WORK PER APPROVED UL-LISTED DETAIL IN ACCORDANCE WITH THE BUILDING CODE.
- PIPING AND CONDUIT TO BE REMOVED THAT IS LOCATED BELOW CONCRETE SLAB-ON-GRADE FLOORS OR WITHIN CONCRETE SOLID OR BLOCK WALLS MAY BE ABANDONED IN PLACE UNLESS NECESSARY TO INSTALL NEW WORK OR NOTED OTHERWISE. WHEN ABANDONING CUT PIPING OR CONDUIT BACK AT LEAST 1-INCH BEHIND THE SURFACE, PLUG THE ENDS AND PATCH THE SURFACE WITH SIMILAR MATERIAL.
- 9. CAPTURE AND RECYCLE REFRIGERANT FROM HVAC EQUIPMENT. COMPLY WITH THE EPA REFRIGERANT RECYCLING REQUIREMENTS.
- 10. REMOVE AND REINSTALL LAY-IN CEILING TILES AND GRID AS NEEDED TO PERFORM CONTRACT WORK. STORE CEILING MATERIALS IN A CLEAN DRY PLACE. REPLACE DAMAGED TILES WITH NEW TO MATCH. SELECT ONE ROOM TO INSTALL ALL NEW TILE AND GRID TO PROVIDE THE TILES NEEDED TO REPLACE DAMAGED TILES IN OTHER SPACES.
- 11. DURING RENOVATION, MAINTAIN OPERATION OF EXISTING CONTROL SYSTEMS AND COMPONENTS OUTLINED ON CONTROLS DRAWINGS AND IN THE SEQUENCE OF CONSTRUCTION NOTES ON THIS DRAWING. AT EACH PHASE RE-VERIFY OPERATION OF REMAINING CONTROLLED DEVICES AFTER REMOVAL WORK IS COMPLETE.
- 12. EXISTING SYSTEMS SERVING AREAS OCCUPIED DURING CONSTRUCTION AND SYSTEMS EXPLICITLY INDICATED SHALL BE KEPT IN OPERATION BY TEMPORARY MEANS. TEMPORARY MEANS INCLUDES TEMPORARY BYPASSES OR CONNECTIONS TO BUILDING SYSTEMS AND / OR CONNECTIONS TO TEMPORARY EQUIPMENT. ALL TEMPORARY MEANS, MATERIALS AND EQUIPMENT SHALL BE INCLUDED IN THE CONTRACT UNLESS OTHERWISE NOTED.
- 13. CONTRACTOR SHALL PERFORM PRE-READ TAB AND SUBMIT TAB REPORT TO ENGINEER PRIOR TO COMMENCING DEMOLITION THIS IS A CRITICAL, NON-NEGOTIABLE STEP OF THE WORK SCOPE THAT SHALL NOT BE OVERLOOKED. REFER TO TEST AND BALANCE (TAB) DESCRIPTION ON M0.03 AND SECTION 230593 "TESTING ADJUSTING AND BALANCING".

# HAZARDOUS MATERIAL NOTES

HAZARDOUS MATERIALS WARNING HAZARDOUS MATERIALS ARE ANTICIPATED TO BE ON SITE. REFER TO THE HAZARDOUS MATERIALS TESTING REPORT PROVIDED BY THE OWNER PRIOR TO THE START OF WORK. IF UNCOVERED MATERIALS ARE SUSPECTED OF CONTAINING ASBESTOS, LEAD-BASED PAINT, PCB'S OR ANY OTHER HAZARDOUS MATERIAL, STOP WORK IN THAT AREA AND REPORT THE CONCERN TO THE CONSTRUCTION MANAGER, OWNER, ARCHITECT AND ENGINEER IMMEDIATELY.

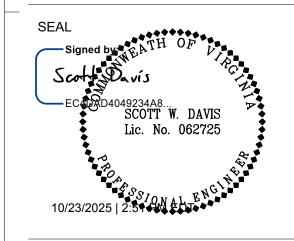
STATE BUILDING OFFICIAL



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DEB APROVAL





KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY APPROVED BY CHECKED BY JULY 25, 2025

**MECHANICAL** 

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

# GENERAL PROJECT INFORMATION AND CRITICAL SYSTEMS REQUIREMENTS

RADFORD UNIVERSITY PLANS TO FULLY RENOVATE THE ALLEN BUILDING HVAC SYSTEMS. THIS WORK WILL BE PERFORMED IN TWO CONSECUTIVE PROJECT PHASES UNDER SEPARATE CONTRACTS. THIS PROJECT, THE "ALLEN BUILDING ELECTRICAL IMPROVEMENTS" IS THE FIRST PROJECT PHASE AND CONSISTS OF UPGRADES TO THE BUILDING ELECTRICAL SYSTEMS TO SUPPORT THE HVAC RENOVATION, AND THE DEMOLITION AND REPLACEMENT OF THE CENTRAL CHILLED WATER AND HEATING HOT WATER SYSTEMS AND ASSOCIATED EQUIPMENT AND CONTROLS. PHASE 1 PROJECT SCOPE IS GENERALLY LOCATED IN GROUND FLOOR MECHANICAL ROOM 002 AND ON THE BUILDING EXTERIOR.

THE SECOND PHASE RENOVATION PROJECT WILL BE PERFORMED BY OTHERS IN THE FUTURE, UNDER A SEPARATE CONTRACT. FUTURE PHASE 2 PROJECT SCOPE WILL INCLUDE DEMOLITION AND REPLACEMENT OF THE REMAINING BUILDING HVAC SYSTEMS NOT INCLUDED UNDER THIS PHASE 1 PROJECT.

#### **CRITICAL SYSTEMS REQUIREMENTS**

THE ALLEN BUILDING IS A FULL-SERVICE EMERGENCY FIRST-RESPONSE POLICE DEPARTMENT SERVING THE RADFORD UNIVERSITY COMMUNITY. AS SUCH, PORTIONS OF THE BUILDING AND ASSOCIATED SYSTEMS MUST REMAIN OPERATIONAL AT ALL TIMES. THIS INCLUDES THE FOLLOWING:

- EMERGENCY COMMUNICATIONS ROOM 132 THIS DISPATCH ROOM WILL BE OCCUPIED AT ALL TIMES DURING CONSTRUCTION. ROOM CONTAINS CRITICAL EMERGENCY COMMUNICATION, FIRE, DATA, AND SECURITY EQUIPMENT WHICH REQUIRES CONTINUOUS POWER AND HVAC. CONTINUOUS HVAC TO THE ROOM SHALL BE MAINTAINED VIA EXISTING FAN COIL UNIT FC2215 AND DUCTLESS MINI-SPLIT SYSTEM DMSS-2(E)/CU-2(E).
- RADIO ROOM 016: RADIO ROOM CONTAINS CRITICAL EMERGENCY COMMUNICATION, FIRE, DATA, AND SECURITY EQUIPMENT WHICH REQUIRES CONTINUOUS POWER AND HVAC. CONTINUOUS HVAC TO THE ROOM SHALL BE MAINTAINED BY EXISTING DUCTLESS MINI-SPLIT SYSTEM, DMSS-1(E)/CU-1(E).
- BUILDING AUTOMATION SYSTEM (BAS) EXISTING BAS FUNCTIONALITY FOR CONTROL AND MONITORING OF EQUIPMENT AND DEVICES UNRELATED TO THE HVAC REPLACEMENT WORK SCOPE SHALL BE KEPT IN CONTINUOUS OPERATION BY TEMPORARY MEANS. ALL TEMPORARY MEANS, MATERIALS AND EQUIPMENT SHALL BE INCLUDED IN THE CONTRACT UNLESS OTHERWISE NOTED.
- BAS CONNECTION TO CAMPUS SERVER THE EXISTING NETWORK INTERFACE BETWEEN THE BUILDING AUTOMATION SYSTEM AND THE CAMPUS SUPERVISORY SERVER SYSTEM SHALL BE MAINTAINED TO SUPPORT CRITICAL COMMUNICATIONS UNTIL WORK IS COMPLETE AND ALL COMMUNICATIONS HAVE BEEN RELOCATED TO THE NEW BUILDING AUTOMATION SYSTEM/HEAD END. REFER TO KEYNOTE 4 ON THIS DRAWING FOR EXISTING SUPERVISORY NETWORK INTERFACE LOCATION IN MECHANICAL ROOM 002.
- EMERGENCY OUTDOOR AIR ISOLATION SWITCH BAS INTERFACE AND FUNCTIONALITY OF THE CAMPUS-WIDE EMERGENCY OUTDOOR AIR INTAKE ISOLATION SWITCH LOCATED IN EMERGENCY COMMUNICATIONS 132 SHALL BE MAINTAINED THROUGHOUT CONSTRUCTION. REFER TO KEYNOTE 2 ON M1.21 FOR OA SHUTDOWN SWITCH LOCATION.
- CAMPUS ELECTRIC METER INTERFACE THE CAMPUS-WIDE ELECTRIC SERVICE UTILITY METER IS LOCATED IN THE RADFORD CITY ELECTRIC SUBSTATION, DIRECTLY ADJACENT TO THE ALLEN BUILDING. EXISTING ELECTRIC METER CONNECTIONS TO THE SUBSTATION MUST BE MAINTAINED. THIS IS WHAT CONTROLS THE ENERGY SAVINGS/DEMAND LIMITING CONTROLS ON CAMPUS. THE EXISTING CONNECTION TO THE DEMAND RESPONSE VENDOR (CURRENTLY VOLTUS ENERGY) MUST ALSO BE MAINTAINED. THIS IS HOW RADFORD UNIVERSITY PROVIDES DATA FOR DEMAND RESPONSE PARTICIPATION IN THE VIRGINIA ENERGY DEPARTMENT PROGRAM. REFER TO KEYNOTES 3 AND 10 ON THIS SHEET FOR ADDITIONAL INFORMATION.
- BUILDING ELECTRIC METER INTERFACE ALLEN BUILDING ELECTRIC METER INTERFACE FROM PANEL MDP TO BAS MUST BE MAINTAINED. REFER TO KEYNOTE 12 ON THIS SHEET.
- OWNER COORDINATION: CONTRACTOR SHALL COORDINATE THE SEQUENCE OF ALL WORK WITH THE OWNER/OCCUPANTS TO MINIMIZE DISRUPTION. REFER TO GENERAL MECHANICAL NOTES ON M0.02 FOR ADDITIONAL REQUIREMENTS

# **PIPING SYSTEM FLUSHING NOTES**

THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR CHILLED WATER AND HOT WATER HYDRONIC PIPING SYSTEMS FLUSHING AND TESTING, SUBJECT TO THE CRITERIA OUTLINED HEREIN AND THE REQUIREMENTS OF SECTION "230555 - HVAC PIPING SYSTEMS FLUSHING AND TESTING."

EACH BUILDING HYDRONIC SYSTEM LOOP PIPING SHALL BE CLEANED AND FLUSHED PRIOR TO STARTING WORK ON THE RESPECTIVE SYSTEM. REFER TO SEQUENCE OF CONSTRUCTION NOTES ON THIS DRAWING FOR FLUSHING PROCEDURE CONSTRUCTION SEQUENCE. CONTRACTOR SHALL SUBMIT A DELEGATED-DESIGN SUBMITTAL WITH DETAILED FLUSHING AND TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER AND OWNER.

GENERAL PROCEDURES FOR PRELIMINARY AND FINAL FLUSHING SHALL INCLUDE AN INITIAL SYSTEM CLEANING PERIOD, OPERATING THE SYSTEM PUMPS WITH A PRE-CLEANING CHEMICAL AGENT TO REMOVE SYSTEM DEPOSITS, AND CONCURRENT BLOWDOWN OF ALL SYSTEM AND EQUIPMENT STRAINERS. FOLLOWING CLEANING AND BLOWDOWN, THE SYSTEM SHALL BE DRAINED, REFILLED, AND RE-FLUSHED UNTIL WATER IS WITHIN TOLERANCES SPECIFIED IN SECTION 230555.

# THE FOLLOWING CRITERIA SHALL APPLY:

- THE PROCESS OF CLEANING SHALL BE PERFORMED AND MONITORED BY A QUALIFIED COMMERCIAL WATER TREATMENT COMPANY. A FULL REPORT OF CLEANING WITH ANALYSIS SHALL BE SUBMITTED.
- EXISTING BASE MOUNTED CONSTANT VOLUME PUMPS SERVING THE HYDRONIC SYSTEMS MAY BE USED FOR CLEANING AND FLUSHING. STRAINER BLOW-DOWN PROCESS SHALL INCLUDE STRAINERS AT ALL FAN COIL
- UNITS, OUTDOOR AIR UNIT OAU-1, SYSTEM PUMPS, CHILLER, AND HW HEAT EXCHANGER. FINE MESH STRAINERS SHALL BE INSTALLED AT THE SYSTEM PUMP SUCTION DIFFUSERS FOR THE DURATION OF THE FLUSHING PROCESS. ALL EXISTING EQUIPMENT COILS ARE EQUIPPED WITH A 3-WAY CONTROL
- VALVE. CONTROL VALVES SHALL BE MODULATED TO FULLY BYPASS THE COIL FOR THE DURATION OF THE FLUSHING PROCESS. ALL SYSTEM WATER AND CHEMICAL CLEANERS SHALL BE DRAINED TO THE
- SANITARY SEWER SYSTEM. ALL CHEMICALS SHALL BE APPROVED BY THE OWNER IN WRITING PRIOR TO USE AND SHALL BE COMPATIBLE WITH OWNER'S PRESENT PROGRAM AND WITH EXISTING SYSTEM PIPING, EQUIPMENT, SENSORS, AND OTHER COMPONENTS.

NO HAZARDOUS CHEMICALS SHALL BE USED. MSDS FOR ALL CHEMICALS TO BE

USED SHALL BE SUBMITTED FOR REVIEW AND APPROVAL, PRIOR TO DELIVERY

OF CHEMICALS TO SITE. 8. ALL EMPTY CHEMICAL DRUMS, TEMPORARY EQUIPMENT, AND ASSOCIATED DEBRIS SHALL BE REMOVED AT COMPLETION OF JOB.

### **CENTRAL PLANT REPLACEMENT - SEQUENCE OF CONSTRUCTION**

THE ALLEN BUILDING WILL REMAIN OCCUPIED DURING CONSTRUCTION. THE BUILDING'S CENTRAL HEATING AND COOLING SYSTEMS WILL BE CONSECUTIVELY REPLACED IN THE RESPECTIVE SUMMER AND WINTER PERIODS WHEN EACH SYSTEM IS NOT REQUIRED FOR OCCUPANT COMFORT.

A GENERAL GUIDE FOR THE CONTRACTORS USE IN MAINTAINING CONTINUOUS HEATING AND COOLING TO THE BUILDING AS SEASONALLY REQUIRED THROUGHOUT THE DURATION OF THE CONSTRUCTION PROCESS. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE MECHANICAL WORK

PLEASE NOTE THAT THE FOLLOWING SEQUENCE IS NOT MEANT TO SERVE AS STEP-

BY-STEP INSTRUCTIONS FOR THE CONTRACTOR. INSTEAD. IT IS MEANT TO SERVE AS

WITH THE ELECTRICAL WORK. ANY REQUIRED SHUTDOWN WORK SHALL BE COORDINATED WITH THE OWNER A MINIMUM OF 2-WEEKS PRIOR TO THE PLANNED

#### **HEATING PLANT REPLACEMENT – SUMMER 2026**

- PERFORM AIR AND WATER SYSTEM PRE-TAB OF EXISTING HEATING WATER SYSTEM EQUIPMENT AND COILS TO ESTABLISH BASELINE PERFORMANCE OF
- EXISTING HW SYSTEMS PRIOR TO START OF WORK. ENLARGE MECHANICAL ROOM 002 SPACE INTO SAFETY STORAGE ROOM 001 AS INDICATED ON ARCHITECTURAL DRAWINGS. DEMOLISH EXISTING PARTITION WALL AND INSTALL NEW FIRE-RATED PARTITION WALL. UPGRADE EXISTING MECHANICAL ROOM 002 WALLS TO FIRE-RATED CONSTRUCTION.
- IN THE SPRING, WHEN BUILDING HEATING IS NO LONGER REQUIRED: A. FLUSH EXISTING BUILDING HW PIPING SYSTEMS. REFER TO PIPING SYSTEMS FLUSHING NOTES ON THIS DRAWING AND SPECIFICATION SECTION "230555 - HVAC SYSTEMS FLUSHING AND TESTING" FOR REQUIREMENTS.
  - TAKE STEAM AND HEATING WATER SYSTEMS OFFLINE, DISCONNECT BUILDING HW PIPING SERVICE MAINS AT MECHANICAL ROOM 002 WALL AND DEMOLISH ALL HOT WATER PIPING AND ASSOCIATED EQUIPMENT IN MECHANICAL ROOM 002 UP TO THE POINTS OF DISCONNECTION AT THE **ROOM WALL**
  - DISCONNECT BUILDING STEAM AND STEAM CONDENSATE SERVICE PIPING AT ISOLATION VALVES LOCATED AT THE CENTRAL PLANT, AND DEMOLISH ALL ABOVE GROUND STEAM AND STEAM CONDENSATE SYSTEMS THROUGHOUT THE ALLEN BUILDING, COMPLETE WITH STEAM TO HW EXCHANGER, HOT WATER PUMPS, CONDENSATE PUMPS, UNIT HEATERS MAKEUP AIR UNIT STEAM COIL, AND ALL ASSOCIATED PIPING AND CONTROLS. RETURN STEAM PRV AND STEAM METER TO OWNER FOR
  - INFILL BELOW GROUND CONDENSATE BASIN IN MECH RM 002 AS INDICATED ON STRUCTURAL DRAWINGS.
- INSTALL TEMPORARY ELECTRIC HEATERS (UH-A TO UH-E AND RHC-1) TO REPLACE DEMOLISHED STEAM HEATERS. TEMPORARY HEATERS TO REMAIN IN SERVICE UNTIL CONSTRUCTION OF FUTURE PHASE 2 PROJECT (BY OTHERS).
- INSTALL NEW HW PLANT, COMPLETE WITH BOILER(S), PROPANE STORAGE AND SUPPLY PIPING, PRIMARY AND SECONDARY PUMPS, EXPANSION TANK, PIPING, UNIT HEATERS, AND CONTROLS. CONNECT PLANT PIPING TO EXISTING BUILDING HW SERVICE MAINS, FLUSH NEW PIPING, START PLANT, AND TAB NEW AND EXISTING SYSTEM EQUIPMENT AND COILS.

#### COOLING PLANT REPLACEMENT- WINTER '26-'27

- PERFORM AIR AND WATER SYSTEMS PRE-TAB OF EXISTING CHILLED WATER SYSTEM EQUIPMENT AND COILS TO ESTABLISH BASELINE PERFORMANCE OF EXISTING CHW SYSTEMS PRIOR TO START OF WORK.
- IN THE FALL, WHEN BUILDING COOLING IS NO LONGER REQUIRED: FLUSH EXISTING BUILDING CHW PIPING SYSTEMS. REFER TO PIPING SYSTEMS FLUSHING NOTES ON THIS DRAWING AND SPECIFICATION SECTION "230555 - HVAC SYSTEMS FLUSHING AND TESTING" FOR REQUIREMENTS.
- TAKE CHILLED WATER PLANT OFFLINE, DISCONNECT BUILDING CHW PIPING SERVICE MAINS AT MECHANICAL ROOM 002 WALL AND DEMOLISH ALL CHILLED WATER PIPING AND ASSOCIATED EQUIPMENT AND CONTROLS IN MECHANICAL ROOM 002 AND OUTSIDE, UP TO THE POINTS OF DISCONNECTION AT THE MECHANICAL ROOM WALL.
- INSTALL NEW CHW PLANT, COMPLETE WITH CHILLER, PUMPS, BUFFER TANK PIPING, AND CONTROLS. CONNECT PLANT PIPING TO BUILDING CHW SERVICE MAINS, FLUSH NEW PIPING, START PLANT, AND TAB NEW AND EXISTING EQUIPMENT AND COILS.

# **TEST AND BALANCE (TAB) DESCRIPTION**

# PRE-CONSTRUCTION TAB:

- PRE-READ TAB OF THE EXISTING CHILLED WATER AND HOT WATER SYSTEMS SHALL BE PERFORMED PRIOR TO THE START OF CONSTRUCTION TO ESTABLISH BASELINE PERFORMANCE. THIS INCLUDES READING CHW AND HW FLOWRATES AT ALL EXISTING FAN COIL UNITS, AIR HANDLING UNITS, OUTDOOR AIR UNIT OAU-1. HW/CHW PUMPS. HW HEAT EXCHANGER. AND CHILLER.
- PRE-READ TAB OF ALL EXISTING AIR SYSTEMS SHALL BE PERFORMED PRIOR TO START OF CONSTRUCTION TO ESTABLISH BASELINE PERFORMANCE. THIS INCLUDES READING OUTLET AND EQUIPMENT AIRFLOWS AT ALL EXISTING FAN COIL UNITS. AIR HANDLING UNITS. EXHAUST FANS, AND OUTDOOR AIR UNIT
- CONTRACTOR SHALL SUBMIT PRE-READ TAB REPORTS FOR ENGINEER APPROVAL PRIOR TO COMMENCING DEMOLITION.

FINAL TAB OF ALL HYDRONIC AND AIR SYSTEMS SHALL BE PERFORMED AT THE END OF CONSTRUCTION TO CONFIRM CENTRAL PLANT PERFORMANCE AND TO VERIFY BASELINE PERFORMANCE HAS BEEN RESTORED TO THE EXISTING SYSTEMS AND

REFER TO SECTION 230593 "TESTING ADJUSTING AND BALANCING" FOR DETAILED REQUIREMENTS.

# **BULDING STEAM SERVICE DISCONNECTION SCOPE**

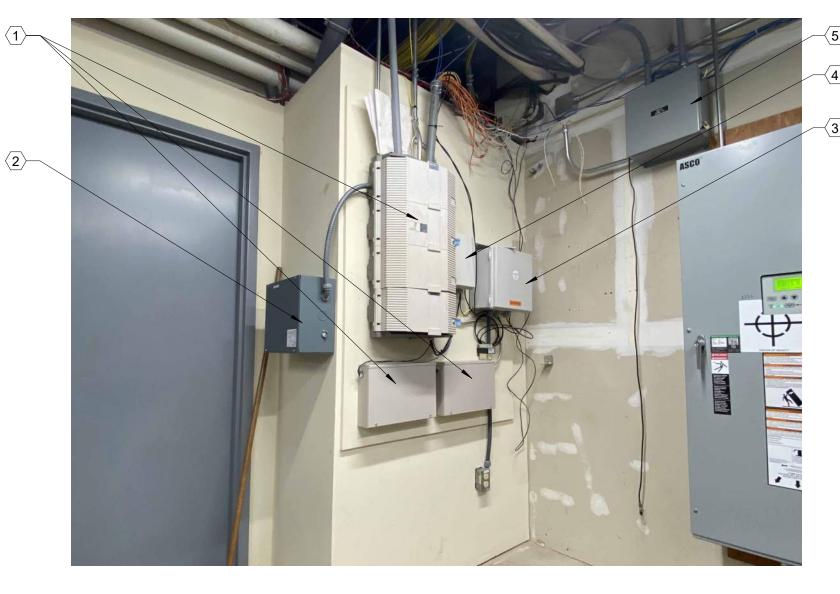
ALL EXISTING STEAM AND CONDENSATE SYSTEM EQUIPMENT, PIPING AND COMPONENTS IN THE ALLEN BUILDING WILL BE DEMOLISHED. BUILDING STEAM SERVICE PIPING AND AND STEAM TUNNEL BETWEEN THE CAMPUS BOILER PLANT AND ALLEN BUILDING WILL BE ABANDONED IN PLACE.

ALLEN BUILDING STEAM AND PUMPED CONDENSATE RETURN SERVICE PIPING IS ROUTED IN A BELOW-GROUND STEAM TUNNEL WITH CRAWL ACCESS FROM THE CAMPUS BOILER PLANT TO THE ALLEN BUILDING. THE BOILER PLANT IS LOCATED APPROXIMATELY 350 FEET WEST OF THE ALLEN BUILDING AT THE WEST END OF EAST MAIN STREET ACCESS ROAD. THE STEAM TUNNEL IS ROUTED BELOW THE ACCESS ROAD FROM THE BOILER PLANT TO THE ALLEN BUILDING SERVICE ENTRANCE LOCATED IN SAFETY STORAGE ROOM 001. EACH SERVICE LINE IS EQUIPPED WITH AN ISOLATION VALVE AT THE STEAM TUNNEL ENTRANCE IN THE BOILER HOUSE.

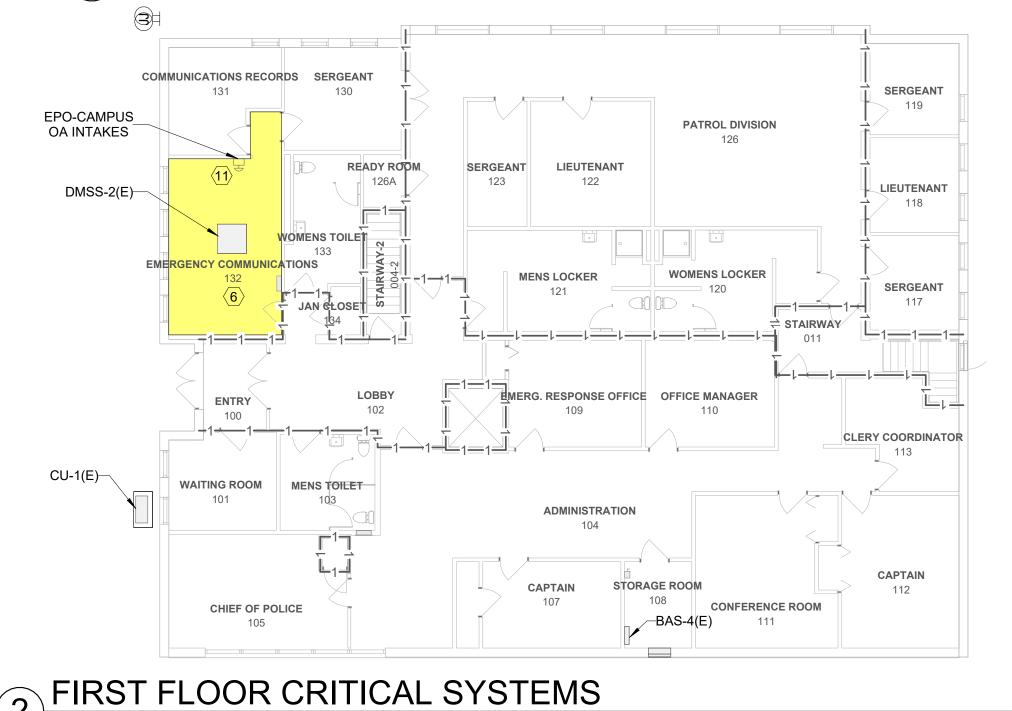
PRIOR TO DEMOLITION OF THE ALLEN BUILDING STEAM SYSTEMS, THE EXISTING HIGH PRESSURE STEAM AND PUMPED CONDENSATE RETURN SERVICE LINES SHALL BE DISCONNECTED FROM THE PLANT MAINS AT THEIR RESPECTIVE BRANCH ISOLATION VALVES AT THE BOILER PLANT SERVICE TUNNEL ENTRANCE. CONTRACTOR SHALL PERMANENTLY CAP EACH ISOLATION VALVE AFTER DISCONNECTING THE BUILDING SERVICE LINES.

CONTRACTOR IS ADVISED THAT ACCESS TO THE ISOLATION VALVES IN THE PLANT TUNNEL ENTRANCE IS LIMITED AND WORK SCOPE ASSOCIATED WITH DISCONNECTION AND CAPPING OF THE BUILDING BRANCH LINES REQUIRES CONFINED SPACE WORK. ALL PERSONNEL SHALL BE PROPERLY TRAINED FOR CONFINED SPACE WORK AND CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING A "CONFINED SPACE ENTRY PERMIT" FROM THE UNIVERSITY PRIOR TO COMMENCING

FOLLOWING SERVICE LINE ISOLATION AND CAPPING AT THE BOILER HOUSE. CONTRACTOR SHALL DISCONNECT AND CAP THE LINES IN THE STEAM TUNNEL AT THE ALLEN BUILDING, DIRECTLY OUTSIDE SAFETY STORAGE ROOM 001 WHERE INDICATED ON DRAWING 1/M1.12. ALL STEAM AND CONDENATE PIPING WITHIN THE BUILDING SHALL THEN BE DEMOLISHED FROM THE POINT OF DISCONNECTION AS INDICATED ON THE DRAWINGS.



# CRITICAL COMPONENTS IN MECHANICAL ROOM 002



P.D. STORAGE

**CORRIDOR** 

DETECTIVE

CORRIDOR

POLICE RECORDS

ELECTRICAL ROOM

**EVIDENCE** 

INTERVIEW

023

STORAGE

026

BAS-3(E)-

EMS EXECUTIVE OFFICE

EMS BEDROOM

DETECTIVE ADMIN OFFICE TOILET SHOWER

ARMORY

LOCKER STORAGE

CORRIDOR

**BREAK ROOM** 

VESTIBULE

SITUATION ROOM

019

SAFETY STORAGE

### **# KEY NOTES**

- EXISTING BAS PANELS TO REMAIN. CONTRACTOR TO PROTECT PANEL AND MAINTAIN POWER AND CRITICAL DATA CONNECTIONS THROUGHOUT CONSTRUCTION.
- EXISTING BAS UPS PANEL TO BE RELOCATED. CONTRACTOR TO PROTECT PANEL AND MAINTAIN POWER AND DATA CONNECTIONS THROUGHOUT CONSTRUCTION. EXTEND CONDUIT AND WIRING AND MOUNT UPS PANEL ON WALL BELOW EXISTING BAS PANEL NOTED IN KEYNOTE #1 ON THIS SHEET. CONTRACTOR TO TEST UPS BATTERY AND REPLACE OR UPGRADE UPS AS REQUIRED TO MAINTAIN POWER TO BAS EQUIPMENT FOR A POWER LOSS DURATION OF 30 MINUTES OR GREATER.
- EXISTING CAMPUS-WIDE ELECTRIC UTILITY DEMAND RESPONSE CONTROL PANEL TO REMAIN ("VOLTUS" IS THE CURRENT CAMPUS DEMAND RESPONSE VENDOR). CONTRACTOR TO PROTECT PANEL AND MAINTAIN POWER AND DATA CONNECTIONS THROUGHOUT CONSTRUCTION. FIELD-VERIFY DATA CABLE ROUTING PRIOR TO START OF CONSTRUCTION. REFER TO "CRITICAL SYSTEMS REQUIREMENTS" NOTES ON THIS SHEET FOR ADDITIONAL INFORMATION.
- EXISTING SSI NETWORK INTERFACE PANEL TO CAMPUS SUPERVISORY SERVER. CONTRACTOR TO PROTECT PANEL AND MAINTAIN POWER AND DATA CONNECTIONS THROUGHOUT CONSTRUCTION. DISCONNECT POWER AND DEMOLISH FOLLOWING INSTALLATION AND FINAL COMMISSIONING OF NEW BUILDING AUTOMATION SYSTEM AND NETWORK INTERFACE TO CAMPUS SUPERVISORY SERVER. COORDINATE DEMOLITION WITH WORK SEQUENCE.
- EXISTING EXTERIOR LIGHTING RELAY PANEL 'FC' TO REMAIN. CONTRACTOR TO PROTECT PANEL AND MAINTAIN POWER AND CONTROL CONNECTIONS THROUGHOUT CONSTRUCTION. COORDINATE RECONNECTION OF EXISTING CONTROL POINTS TO NEW BAS WITH CONSTRUCTION SEQUENCE. REFER TO M7.03.
- THIS ROOM TO REMAIN FULLY OPERATIONAL AT ALL TIMES DURING CONSTRUCTION. REFER TO "CRITICAL SYSTEMS REQUIREMENTS" NOTES ON THIS SHEET FOR ADDITIONAL INFORMATION.
- REFER TO PHOTOGRAPH 1 ON THIS SHEET FOR EXISTING CRITICAL COMPONENTS IN THIS CORNER OF MECHANICAL ROOM 002 THAT REQUIRE PROTECTION AND CONTINUOUS POWER AND DATA CONNECTIONS THROUGHOUT CONSTRUCTION.
- EXISTING BAS PANEL.
- NEW BAS PANEL
- APPROXIMATE ROUTING OF EXISTING ELECTRIC METER CONNECTION TO THE RADFORD CITY ELECTRIC SUBSTATION. CONTRACTOR TO VERIFY EXACT LOCATION WITH OWNER PRIOR TO STARTING DEMOLITION AND PROTECT ROUTING AND CONNECTIVITY THROUGHOUT CONSTRUCTION. REFER TO "CRITICAL SYSTEMS REQUIREMENTS" NOTES ON THIS SHEET FOR ADDITIONAL INFORMATION.
- CAMPUS OA INTAKE EMERGENCY CLOSURE/RESET SWITCH. CONTRACTOR TO PROTECT SWITCH PRIOR TO STARTING DEMOLITION AND MAINTAIN SWITCH ACCESS, FUNCTIONALITY AND BAS INTERFACE THROUGHOUT CONSTRUCTION.

12 ALLEN BUILDING ELECTRIC METER IN EXISTING PANEL MDP.

WALL RATING LEGEND

\_\_\_1\_\_\_1\_\_

<del>\_\_2</del>\_\_2 -SB-SB-

1-HR FIRE RATED WALL

SMOKE PARTITIONS

2-HR FIRE WALL

Dewberry Dewberry Engineers Inc.

Suite 220

704.509.9918

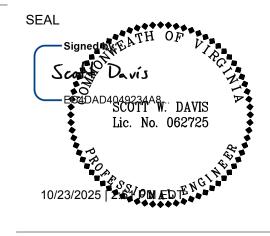
9300 Harris Corners Parkway

Charlotte, NC 28269-3797

NC License No. F-0929

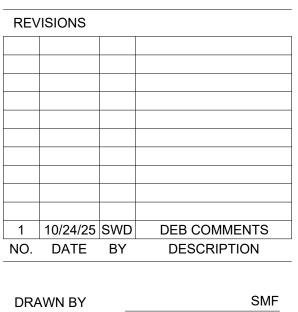
**DEB APROVAL** 





KEY PLAN:

SCALE:



SWD APPROVED BY JMT CHECKED BY JULY 25, 2025

**MECHANICAL** 

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.



RADIO ROOM

SAFETY STORAGE STORAGE

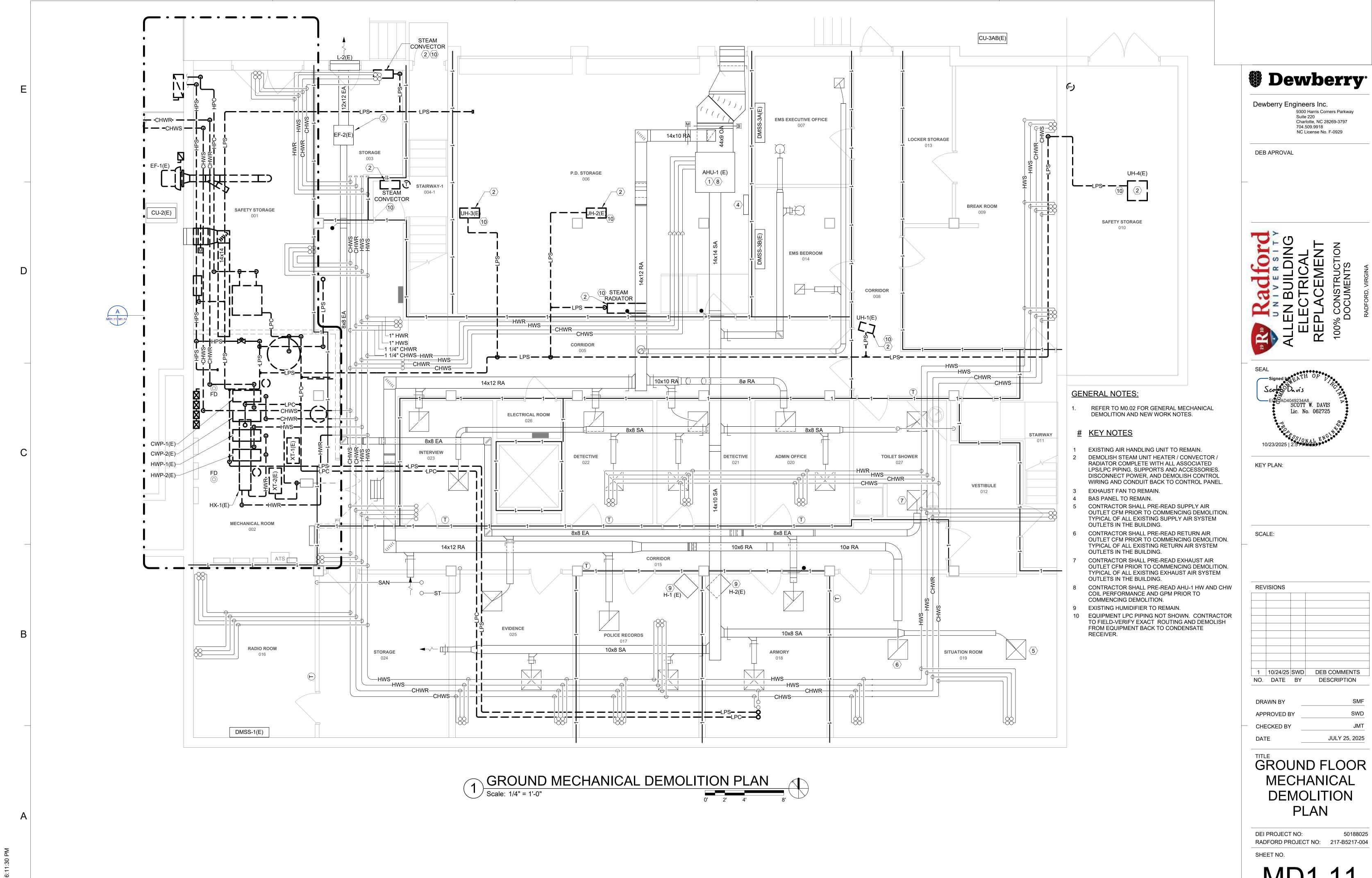
MECHANICAL ROOM

CU-2(E)-

DMSS-1(E)—

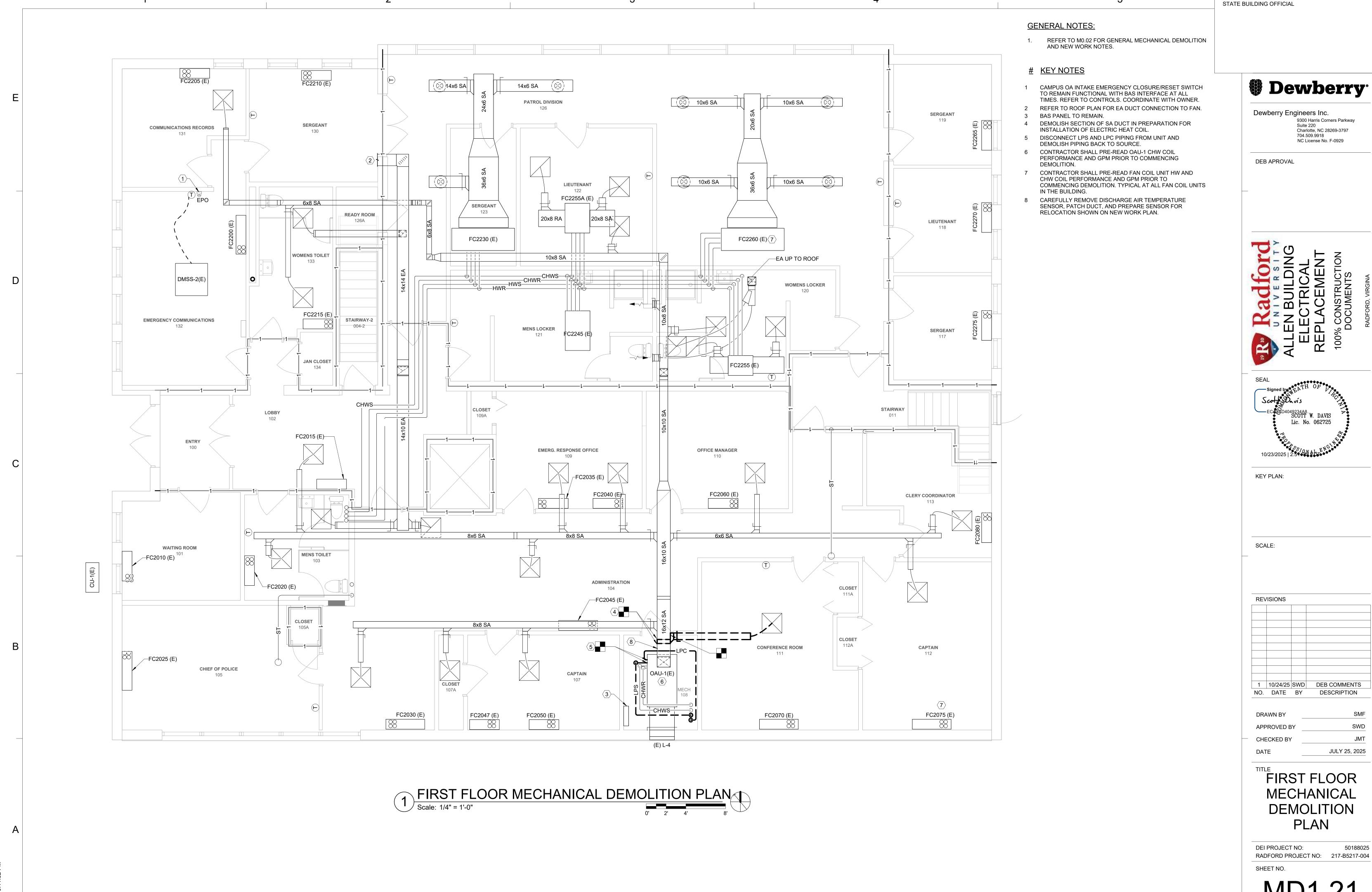
STAIRWAY-1

004-1

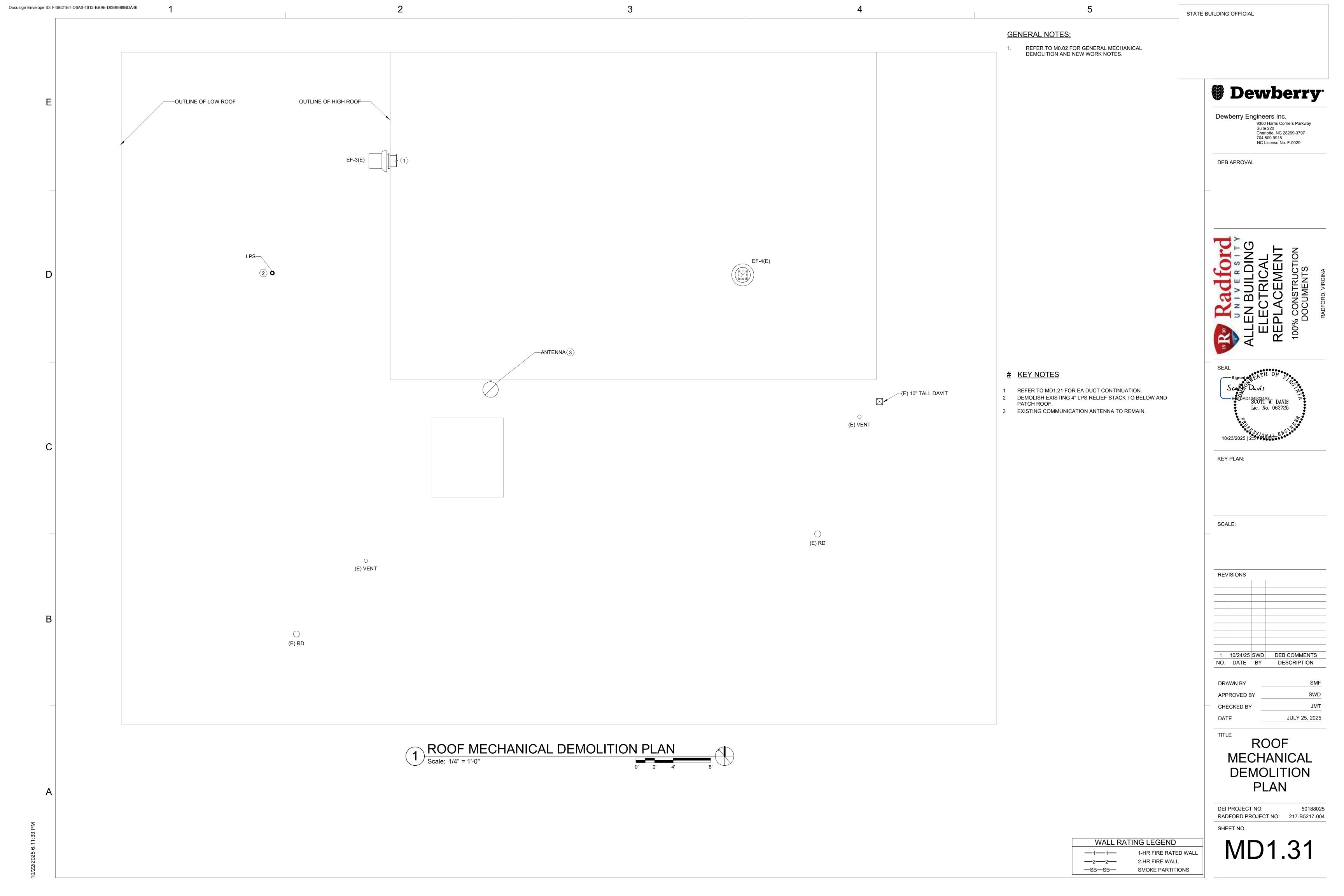


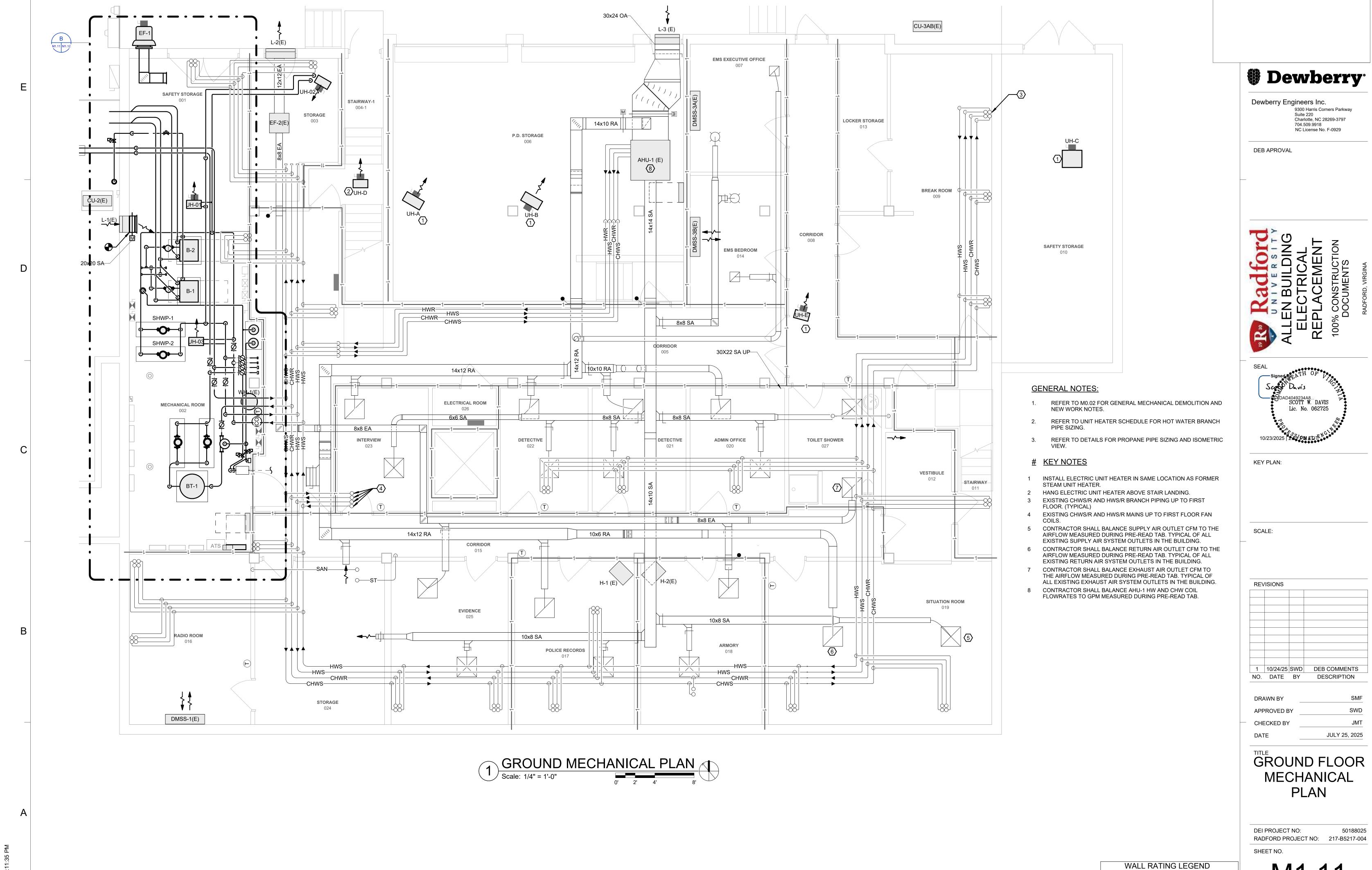
MD1.11

STATE BUILDING OFFICIAL



MD1.21





STATE BUILDING OFFICIAL

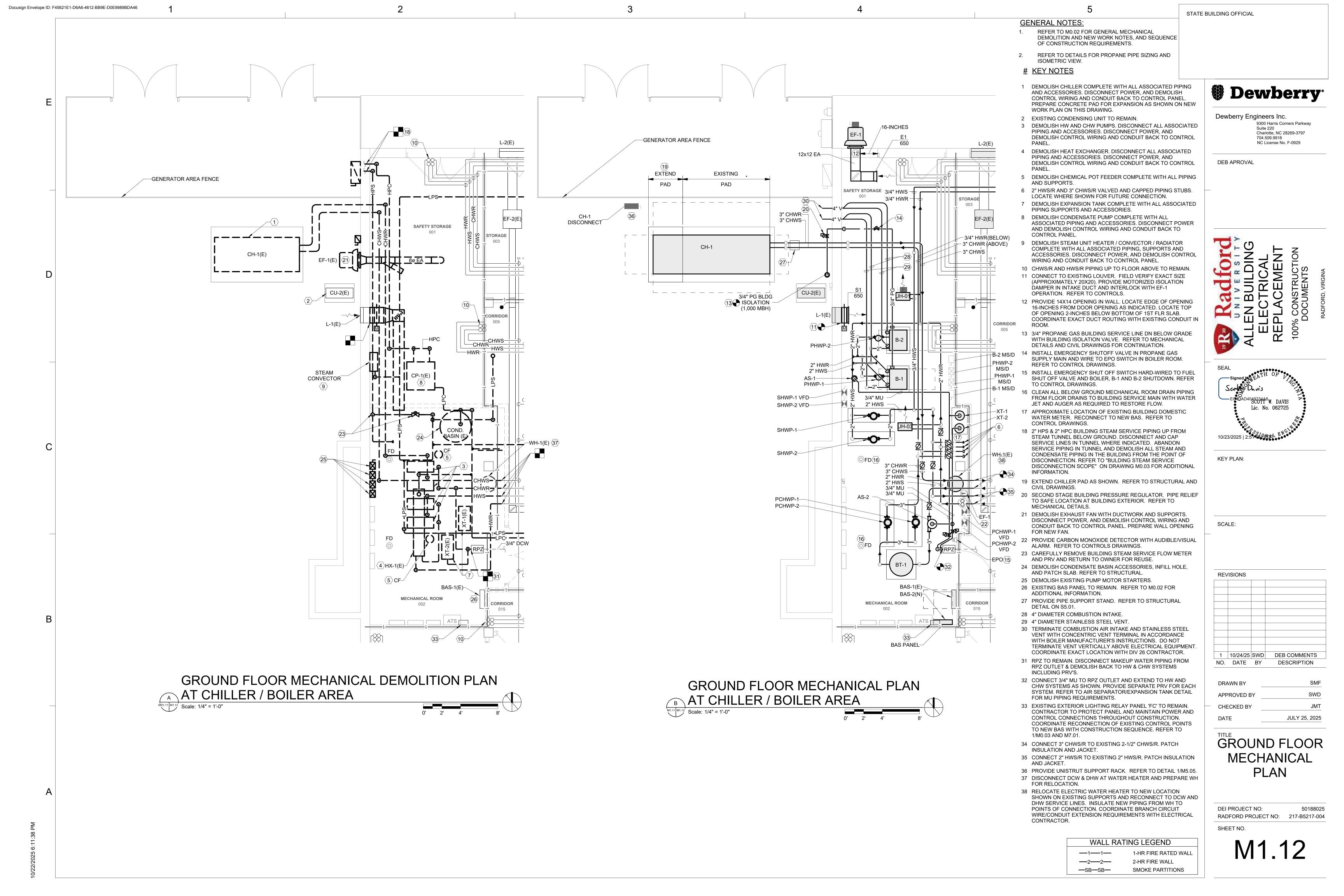
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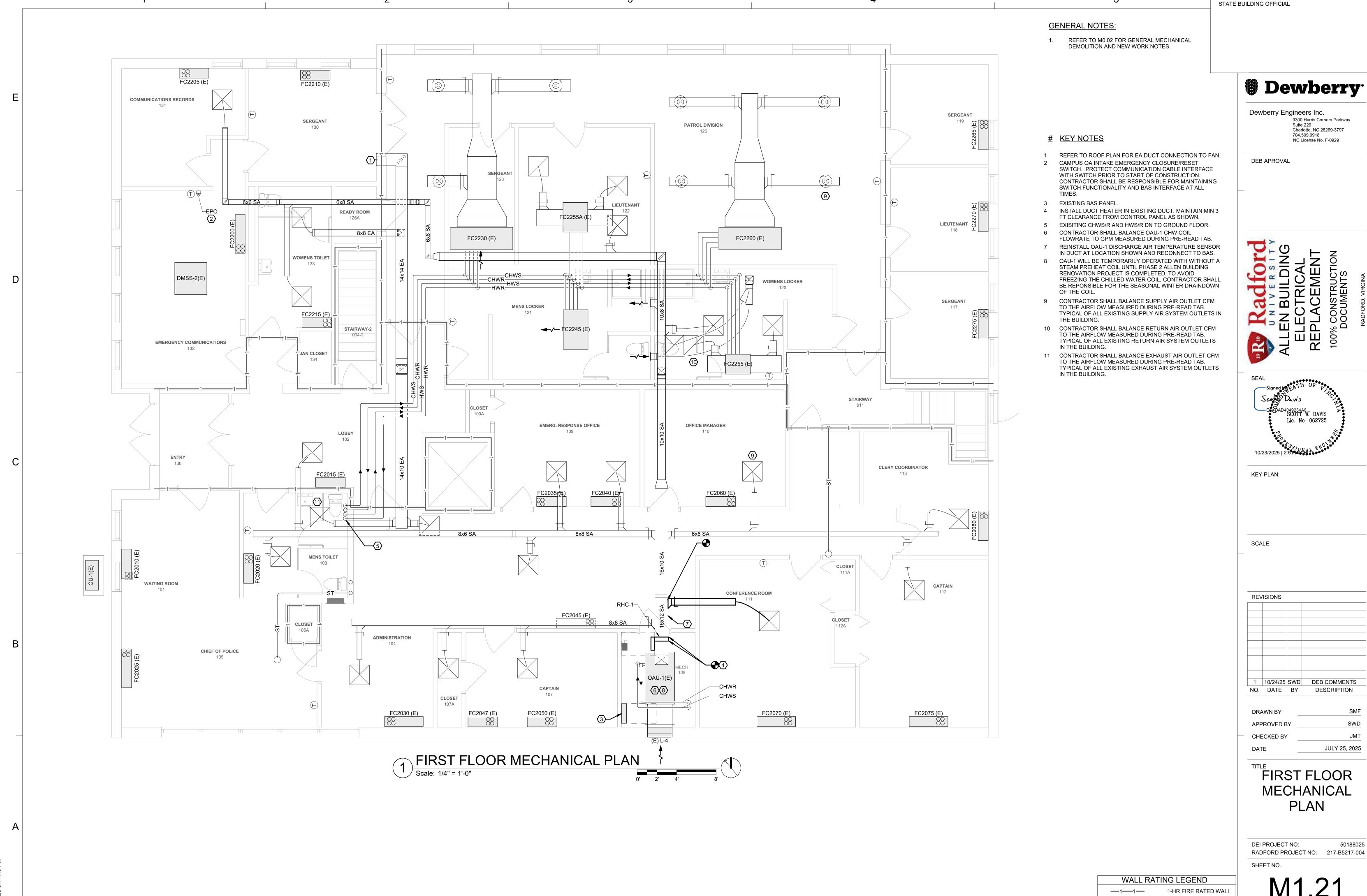
1-HR FIRE RATED WALL

SMOKE PARTITIONS

2-HR FIRE WALL

<del>\_\_\_2\_\_2\_\_</del>



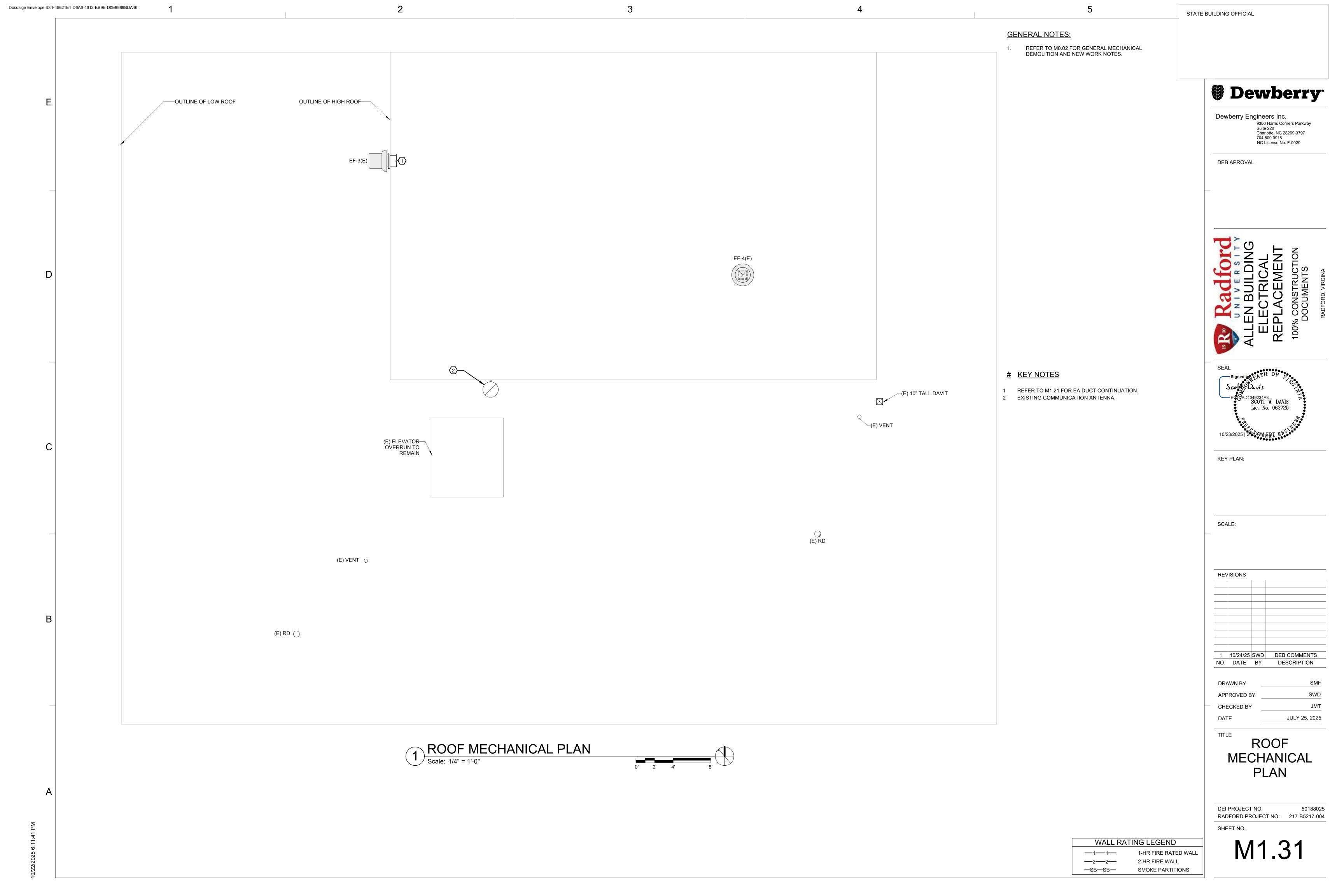


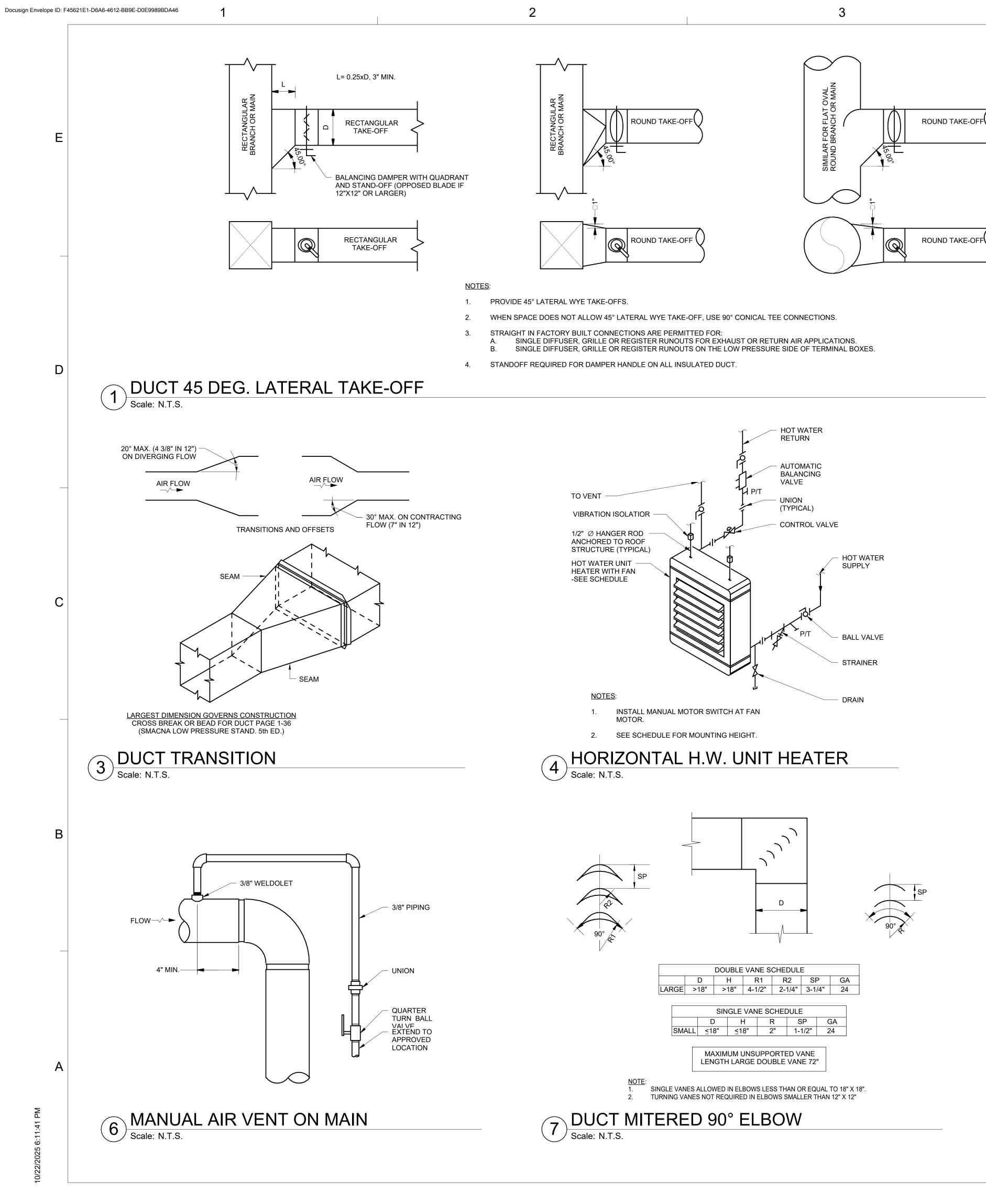
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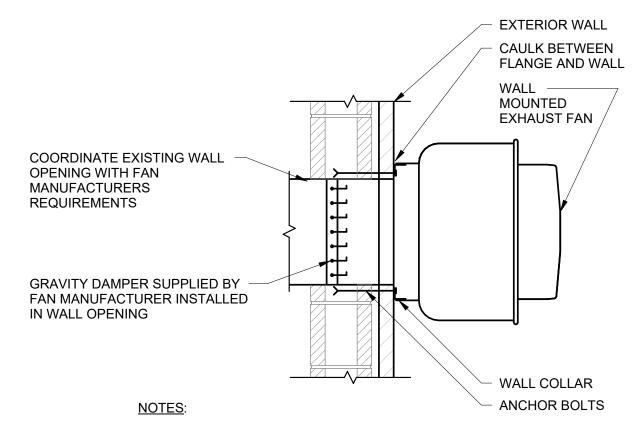
2-HR FIRE WALL

SMOKE PARTITIONS

<del>\_\_\_2\_\_\_2\_\_\_</del>

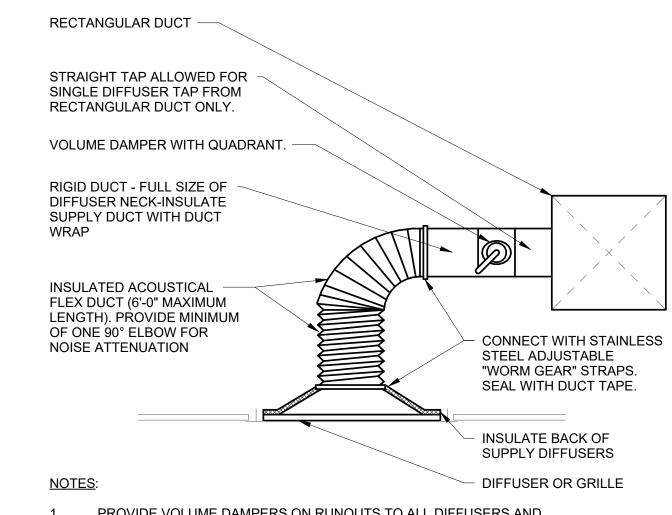






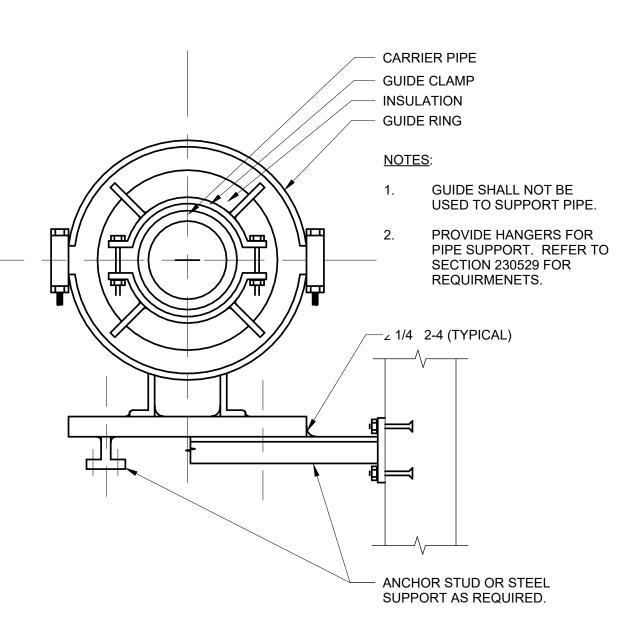
- 1. FOR INSTALLATION ON SPLIT FACE BLOCK, GRIND AREA ON BLOCK SMOOTH WHERE WALL COLLAR SEATS, SHIM AND CAULK AS REQUIRED.
- 2. ALL CAVITIES AROUND WALL OPENING SHALL BE FILLED SOLID WITH MORTAR.
- 3. WHERE EXHAUST FAN IS INSTALLED ON CAVITY WALL CONSTRUCTION, CAVITY SHALL BE FILLED SOLID WITH MORTAR ALL AROUND OPENING.

# 2 WALL MOUNTED EXHAUST FAN Scale: N.T.S.



- 1. PROVIDE VOLUME DAMPERS ON RUNOUTS TO ALL DIFFUSERS AND GRILLES EXCEPT DO NOT INSTALL A VOLUME DAMPER ON A SUPPLY WHEN THERE IS ONLY ONE SUPPLY OUTLET ON TERMINAL BOX.
- 2. LOCATE DAMPER WHERE ACCESSIBLE.
- 3. STANDOFF REQUIRED FOR DAMPER HANDLE ON ALL INSULATED DUCT.

# GRILLE AND DIFFUSER ASSEMBLY Scale: N.T.S.







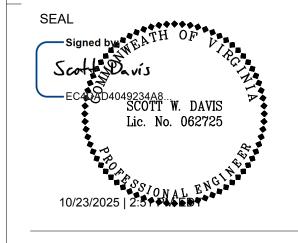
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Suite 220
Charlotte, NC 28269-3797
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DEB APROVAL

STATE BUILDING OFFICIAL





SCALE:

KEY PLAN:

REVISIONS

1 10/24/25 SWD DEB COMMENTS

NO. DATE BY DESCRIPTION

DRAWN BY SMF

APPROVED BY SWD

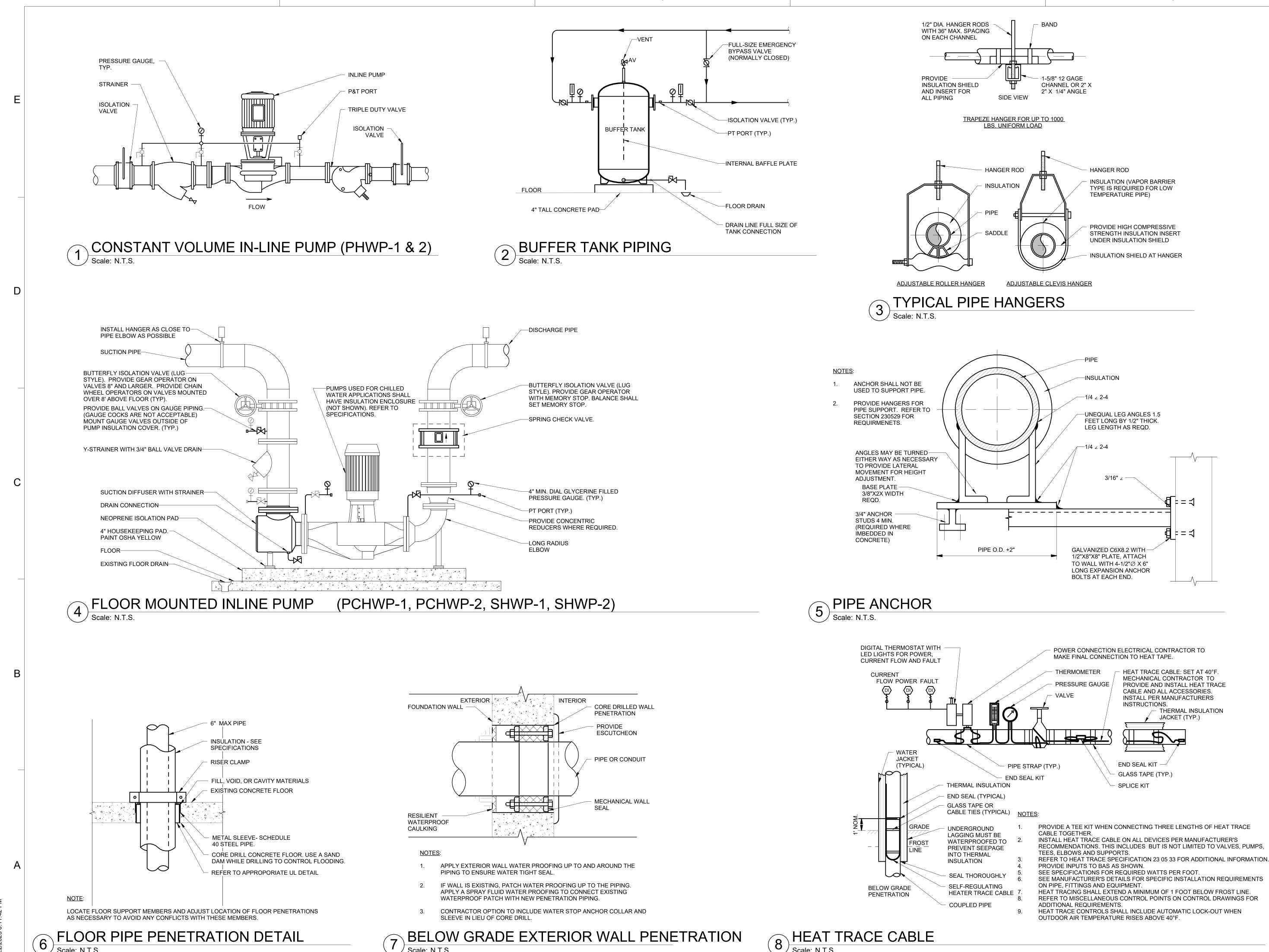
CHECKED BY JMT

DATE JULY 25, 2025

**DETAILS** 

DEI PROJECT NO: 50188025
RADFORD PROJECT NO: 217-B5217-004
SHEET NO.

M5.01



Scale: N.T.S.

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DEB APROVAL

SCOTT W. DAVIS Lic. No. 062725

KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY CHECKED BY JULY 25, 2025

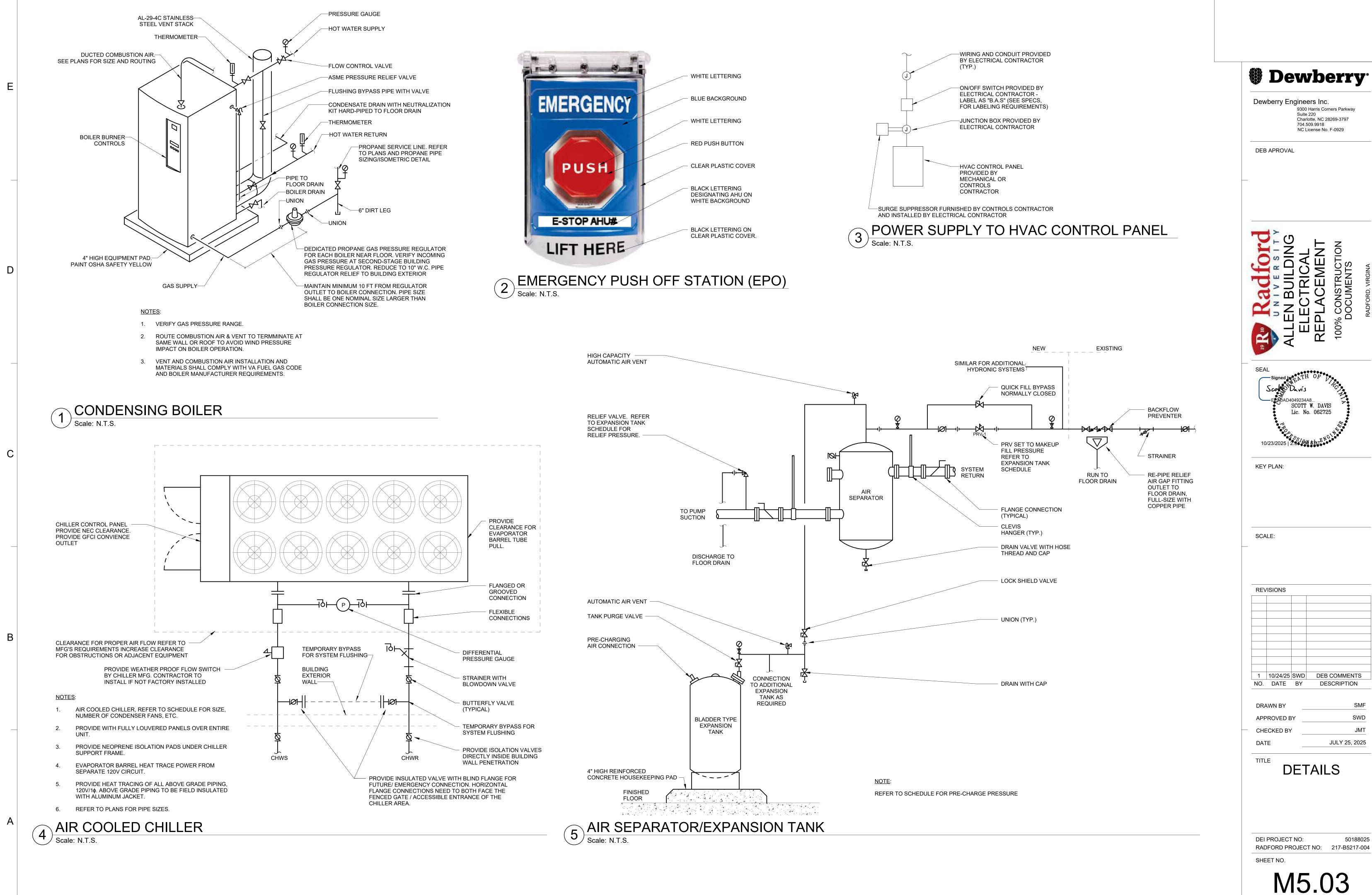
**DETAILS** 

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SHEET NO.

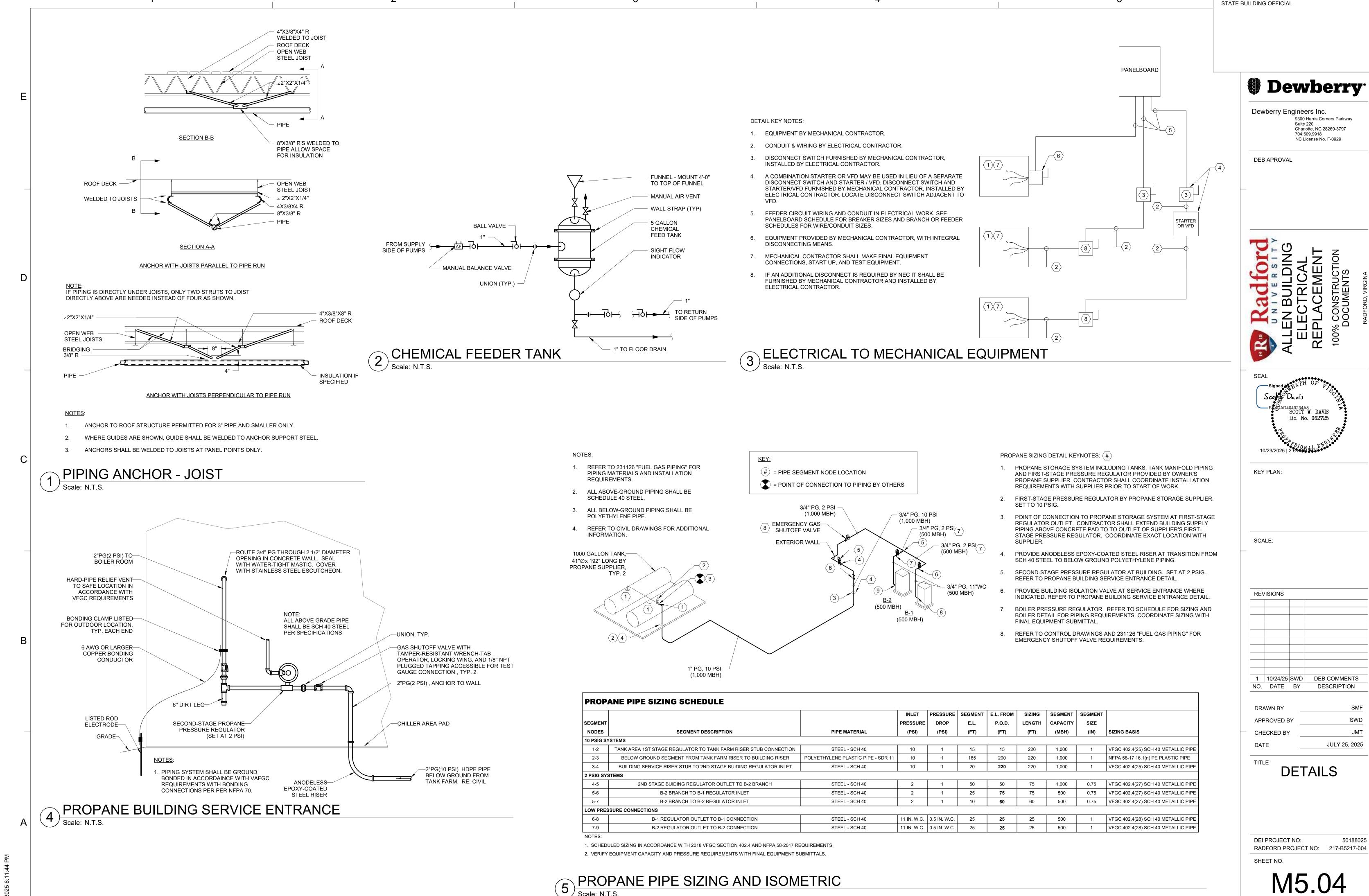
M5.02

8 HEAT TRACE CABLE Scale: N.T.S. BELOW GRADE EXTERIOR WALL PENETRATION



STATE BUILDING OFFICIAL

JULY 25, 2025

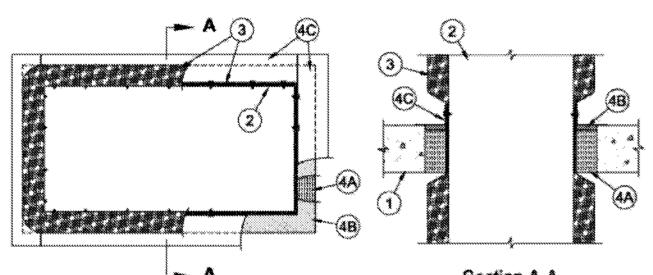


# System No. C-AJ-7145

CHILLER DISCONNECT SUPPORT RACK

January 13, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115					
F Rating — 2 Hr	F Rating — 2 Hr					
T Rating — 1-3/4 Hr	FT Rating — 1-3/4 Hr					
	FH Rating — 2 Hr					
	FTH Rating 1-3/4 Hr					



Section A-A 1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any UL Classified Concrete Blocks\*. Max area of opening is 17.8 ft² (1.65 m²)

with max dimension of 64 in. (1.6 m). See Concrete Blocks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Steel Duct - Max 60 by 36 in. (1524 by 914 mm) steel duct. Steel gauge of duct shall conform with SMACNA requirements. One duct to be installed concentrically or eccentrically within the firestop system. The annular space between steel duct and edges of opening shall be min 2 in. (51 mm) to max 6 in. (152 mm) when max duct dimension is 28 in. (711 mm). Otherwise, max annular space is 2-1/2 in. (64 mm). Steel duct to be rigidly supported on both sides of floor or wall assembly:

3. Batts and Blankets\* — Nom 2 in. (51 mm) thick light density (min:3/4 pcf or 12 kg/m³) glass fiber blanket insulation jacketed on the outside with a foll-scrim-kraft facing, Longitudinal and transverse joints sealed with foll-scrim-kraft tape, Nom annular space between insulated steel duct and periphery of opening to be point contact to max 1/2 in. (13 mm) prior to installation of packing material (Item 4A). When max duct dimension is 28 in. (711 mm), max annular space between insulated steel duct and periphery of opening is 4 in. (102 mm) prior to installation of packing material (Item 4A).

See Batts and Blankets (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket meeting the above specifications and bearing the UL Classification Marking with a Fiame Spread value of 25 or less and a Smoke Developed value of 50 or less may be used.

# 4. Firestop System — The firestop system shall consist of the following:

A. Packing Material -- Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into annular space such that glass fiber blanket insulation on steel duct is compressed to a maximum overall thickness of 1/2 in. (13 mm). Packing material to be recessed from top surface of floor and from both surfaces of wall to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material\* -- Sealant -- Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, flush with top surface of floor and both surfaces of wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC - FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

C. Retaining Angles — Min 2 by 2 in. (51 by 51 mm) No. 16 ga (or heavier) galv steel angles. Angles attached to all four sides of steel duct; through glass fiber blanket insulation, on top surface of floor or on both surfaces of wall with No. 10 (or larger) steel sheet metal screws spaced 1 in. (25 mm) from each end and max 4 in. (102 mm) OC.

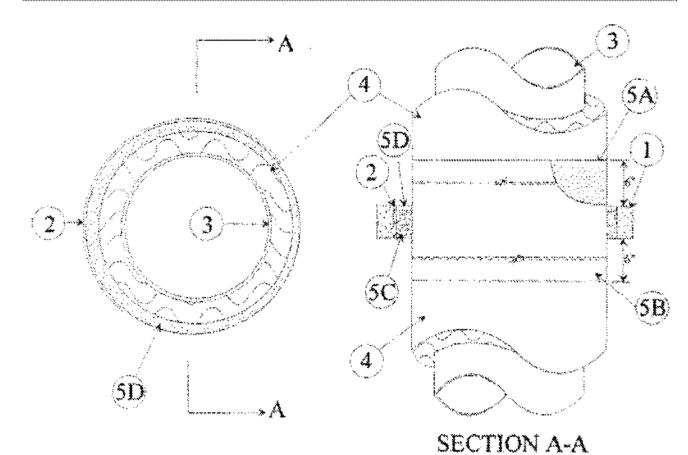
\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Last Updated on 2015-01-13

#### System No. C-AJ-5061

March 14, 2017

ANSI/UL1479 (ASTM E814)	CAN/ULC \$115
F Rating 3 Hr	F Bating 3 Hr
T Rating — 1/2Hr	FT Rating 1/2 Hr
	FH Rating 3 Hr
	FTH Rating — 1/2 Hr



1. Floor or Wall Assembly --- Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (189-190 pcf or 1800-2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any Ut. Classified Concrete Blocks\*. Max diam of opening is 30 in. (762 mm). See Concrete Blacks (CAZT) category in the Fire Resistance Directory for names of manufacturers.

2. Metallic Steeve — (Optional) --- Nom 30 in (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe, conduit or EMT cast or grouted into floor or wall assembly, flush with floor or wall surfaces.

3. Through Penetrants -- One metallic pipe or tubing to be either concentrically or eccentrically within the firestop system. Pipe or tube to be rigidly supported on both sides of floor or wall assembly. The following types and sizes of metallic pipes or rubing

A. Steel Pipe — Norm 20 in. (508 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Iron Pipe -- Nom 20 in. (508 mm) diam (or smaller) cast or ductile iron pipe

C. Copper Tubing - Nom 6 in (152 mm) diam (or smaller) Type I (or beavier) copper taking.

D. Copper Pipe -- Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

4. Pipe Covering — Max 3 in. (76 mm) thick hollow cylindrical heavy density (min 3.5 pcf or 56 kg/m³) glass fiber units jacketed on the outside with an all service jacket. Longitudinal joints sealed with metal fasteners or factory-applied self-sealing lap tape. Transverse joints secured with metal fasteners or with butt tape supplied with the product. Pipe covering to terminate 6 in. (152) mm)from each side of floor or wall assembly.

See Pipe and Equipment Covering --- Materials (8850) category in the Eurlding Materials Directory for names of manufacturers. Any pipe covering material meeting the above specifications and bearing the Ut. Classification Marking with a Flame Spread Index of 25 or less and a Smake Developed tadex of 50 or less may be used

5 Firestop System --- The firestop system shall consist of the following:

A. Pipe Covering Materials\* -- Norm 3 in. (76 mm) thick unfaced mineral fiber pipe insulation having a norm density of 5 pcf (80 kg/m²) (or heavier) sized to the outside diam of pipe or tube and extending min 6 in. (152 mm) beyond each surface of floor or wall. Pipe insulation secured with min 18 AWG steel wire 3 in, (76 mm) beyond each surface of floor or wall. The annular space shall be min 1/4 in. (6 mm) to max of 3 in. (76 mm), or when steel steeve is used, min 1 in. (25 mm)

See Pipe and Equipment Covering --- Materials (8RGU) caregory in the Building Materials Directory for names of manufacturers. Any pipe covering material meeting the above specification and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed index of S0 or less may be used.

B. Sheathing Material\* ---- All service jacket material shall be wrapped around the outer cucumference of the pipe covering material (Item SA) with kraft facing exposed. Longitudinal joints sealed with metal fasteners. See Sheathing Material (8VDV) category in the Building Materials Directory for names of manufacturers, Any sheathing material meeting the above specifications and bearing the Ut. Classification Marking with a Filme Spread Index of 25 or less and a Smoke Developed index of 50 or less may be used.

C. Packing Material — Min 3 in. (76 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form. Packing material to be recessed from top surface of floor or from both surfaces of wall as required to accommodate the required thickness of fill material.

D. Fill, Void or Cavity Material\* - Sealant - Min 3/4 in. (19 mm) thickness of fill material applied within the annulus, Bush with top surface of floor or with both surfaces of wall. HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC -- PS-One Septent or PS-ONE MAX interpresent Septent

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

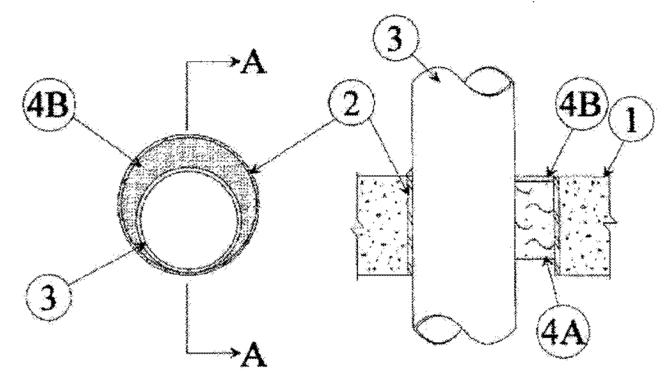
Last Updated on 2017-03-14

# 3 THROUGH-PENETRATION FIRESTOP (C-AJ-5061) Scale: N.T.S.

System No. C-AJ-1226

January 07, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115
F Rating — 3 Hr	F Rating — 3 Hr
T Rating — Ö Hr	FT Rating — 0 Hr
L Rating At Ambient — Less Than 1 CFM/sq ft	FH Rating — 3 Hr
L Rating At 400 F 4 CFM/sq ft	FTH Rating — 0 Hr
	L Rating At Ambient — Less Than 1 CFM/sq ft
	L Rating At 400 F — 4 CFM/sq ft



# **SECTION A-A**

1. Floor or Wall Assembly — Min.4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m³) concrete. Wall may also be constructed of any Ut. Classified Concrete Blocks\*. Max diam of opening is 32 in. (813 mm).

2. Metallic Sleeve — (Optional) Nom 32 in. (813 mm) diam (or smaller) Schedule 40 (or heavier) steel sleeve cast or grouted into floor or wall assembly, flush with floor or wall surfaces or extending a max of 3 in. (76 mm) above floor or beyond both surfaces

ZA, Sheet Metal Sleeve — (Optional) Max 6 in. (152 mm) diam, min 26 ga, galv steel provided with a 26 ga galv steel square. flange spot welded to the sleeve at approximid-height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51 mm) larger than the sleeve diam. The sleeve is to be cast in place and may extend a max of 4 in. (102 mm) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete floor.

28. Sheet Metal Sleeve -- (Optional) - Max 12 in. (305 mm) diam, min 24 ga galv steel provided with a 24 ga galv steel square flange spot welded to the sleeve at approx mid-height, or flush with bottom of sleeve in floors, and sized to be a min of 2 in. (51

mm) larger than the sleeve diam. The sleeve is to be cast in place and may extend a max of 4 in. (102 min) below the bottom of the deck and a max of 1 in. (25 mm) above the top surface of the concrete floor.

3. Through-Penetrant — One metallic pipe, tube or conduit to be installed either concentrically or eccentrically within the firestop system. The annular space between penetrant and periphery of opening shall be min 0 in. (point contact) to max 1-7/8 in. (48 mm). Penetrant may be installed with continuous point contact. Penetrant to be rigidly supported on both sides of floor or

wall assembly. The following types and sizes of metallic penetrants may be used: A. Steel Pipe -- Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Iron Pipe -- Nom 30 in. (762 mm) diam (or smaller) cast or ductile iron pipe.

C. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

D. Copper Tubing -- Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.

E. Conduit - Nom 6 in. (152 mm) diam (or smaller) steel conduit.

F. Conduit -- Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing (EMT).

4. Firestop System — The firestop system shall consist of the following: A. Packing Material -- Min 4 in. (102 mm) thickness of min 4 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form, Packing material to be recessed from top surface of floor or sleeve or from both

surfaces of wall or sleeve as required to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material\* - Sealant - Min 1/4 in. (6 mm) thickness of fill material applied within the annulus, flush with top surface of floor or sleeve or with both surfaces of wall or sleeve. At the point or continuous contact locations between penetrant and concrete or sleeve, a min 1/4 in. (6 mm) diam bead of fill material shall be applied at the concrete or sleeve/ pipe penetrant interface on the top surface of floor and on both surfaces of wall.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC --- FS-One Sealant or FS-ONE MAX intumescent Sealant

Last Updated on 2015-01-07

THROUGH - PENETRATION FIRESTOP (C-AJ-1226)

Scale: N.T.S.

**Dewberry** 

Dewberry Engineers Inc.

9300 Harris Corners Parkway

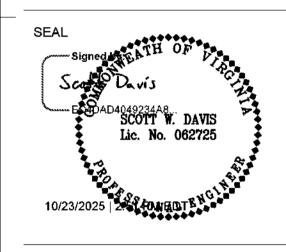
Charlotte, NC 28269-3797

NC License No. F-0929

Suite 220

704,509,9918

DEB APROVAL



KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY CHECKED BY JULY 25, 2025

**DETAILS** 

50188025

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

2 THROUGH-PENETRATION FIRESTOP (C-AJ-7145)
Scale: N.T.S.

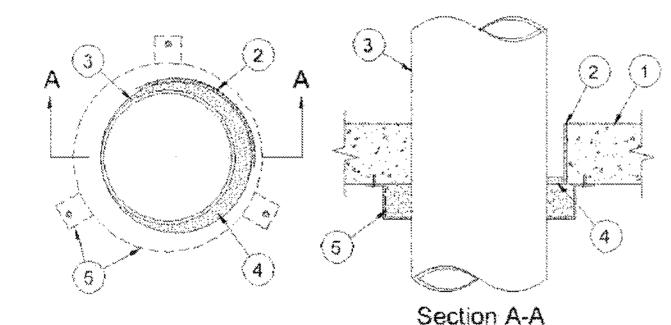
July 31, 2018

F Ratings — 2 and 3 Hr (See Item 3)

T Ratings — 0, 2 and 3 Hr (See Items 2 and 3)

W Rating - Class 1 (See Items 2, 3 and 4)

L Rating at Ambient — Less Than 1 CFM/sq ft (See Item 4) L Rating at 400 F — Less Than 1 CFM/sq ft (See Item 4)



1. Floor or Wall Assembly --- Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1600-2400 kg/m<sup>3</sup>) concrete. Wall may also be constructed of any Ut. Classified Concrete Blocks\*. Max diam of opening is 12 in (305 mm). See Concrete Blocks (CAZT) category in the Fire Resistance Objectory for names of manufactures.

2. Steel Sleeve — (Optional) — Nom 12 in. (305 mm) dram (or smaller) Schedule 40 (or heavier) steel pipe cast or grouted into floor or wall assembly, flush with floor or wall surfaces a max of 3 in. (76 mm) above the floor. If the steel sleeve extends above the floor, the T Rating of the firestop system is 0 Hr and a min 1/2 in. (13 mm) annular space is required between the through penetrant (item 3) and the periphery of the opening. The W Rating does not apply when the steel sleeve is used.

3. Through Penetrants - One nonmetallic pipe to be installed either concentrically or eccentrically within the firestop system. For max 6 in. (152 mm) diam pipes, the annular space between the pipe and the periphery of opening shall be min 0 in. (0 mm, point contact) to max 1/2 in. (13 mm), For nom 8 in. (203 mm) and 10 in. (254 mm) diam pipes, the annular space between the pipe and the periphery of opening shall be min 0 in, (0 mm, point contact) to max 1-1/4 in, (32 mm). If the steel sleeve extends above the floor (frem 2), a min 1/2 in, (13 mm) annular space is required between the through penetrant (Item 3) and the periphery of the opening. Pipe to be rigidly supported on both sides of floor or wall assembly. For systems with a W Rating, the max annular space is 1/2 in. (13 mm). The T Ratings are dependent on the size and/or type of pipe as shown in the table below. The following types and sizes of nonmetailic pipes may be used:

A. Polyvinyl Chloride (PVC) Pipe — Nom 10 in. (254 mm) diam (or smaller) Schedule 40 solid core or cellular core PVC pipe for use in closed (process or supply ) or vented (drain, waste or vent) piping systems. For systems with a W Rating, the nom diam of pipe shall not exceed 6 ip. (152 mm),

8. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 10 in, (254 mm) diam (or smaller) SDR13.5 CPVC pipe for use in closed (process or supply) piping systems. For systems with a WiRating, the riom diam of pipe shall not exceed 6 in. (152 mm).

C. Acrylonitrile Butadiene Styrene (ABS) Pipe — Nom 6 in. (152 mm) diam (or smaller) Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

D. Flame Retardant Polypropylene (FRPP) Pipe -- Norn 6 in. (152 mm) diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems

Pipe Type	Nom Pipe Diam, In. (mm)	F Rating Hr	
PVC, CPVC	Greater than 6 (152)	2	
PVC, CPVC, ABS, FRPP	6 (152) or smaller	3	

Pipe Type	Nom Pipe Diam, In. (mm)	T Rating Hr	
PVC, CPVC, ABS, FRPP	1-1/2, 2, 3 (38, 51, 76)	2	
PVC, CPVC, ABS, FRPP	4 (102)	3	
PVC, CPVC, ABS+, FRPP	6 (152)	3	
PVC, CPVC	Greater than 6 (152)	0	
ABS++	6 (152)	0	

Indicates solid core ABS only

++ indicates cellular core ABS only.

4. Fill, Void or Cavity Material\* — Sealant — Min 1/2 in. (13 mm) thickness of fill material applied within the annulus, itush with top or bottom surface of floor or both surfaces of wall. Sealant is optional for pipes having a max diam of 6 in. (152 mm) in unsleeved openings. For systems with W Rating and/or L Rating, min 1/2 in. (13 mm) thickness of CP 601S, CFS-S SIL GG, CFS-S SIL SL (floors only) Sealant shall be applied within the annulus, flush with top or bottom surface of floor.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE MAX Interrescent Sealant, CP 6015 Sealant, CFS-5 Sit, GG, CFS-5 Sit, St (floors only)

4A. Packing Material - (Not Shown) - Min 1/2 in. (15 mm) thickness of 4 pcf (64 kg/m²) mineral wool balt insulation firmly packed into annular space and recessed from the top surface of floor to accommodate the required thickness of fill material. Required only when CP 604 Sealant is used.

5. Firestop Device\* — Firestop Collar — Firestop collar shall be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the pipe and secured to underside of floor or both sides of wall using the anchor hooks provided with the collar. Minimum two anchor books for nom 1-1/2 and 2 in. (38 and 51 mm) diam pipes. Minimum three anchor books required for nom 3 and 4 in, (76 and 102 mm) diam pipes. Minimum four anchor hooks required for nom 6 in, (152 mm) diam pipes. Minimum ten anchor hooks required for riom 8 in (203 mm) diam pipes. Minimum twelve anchor hooks required for nom 10 in. (254 mm) diam pipes. The anchor hooks are to be secured with min 1/4 in, (6 mm) diam by min 1-1/4 in, (32 mm) long steel expansion bolts or min 0.145 in, (3.7 mm) diam by 1-1/4 in, (32 mm) long powder actuated fasteriers utilizing a 1-7/16 in (37 mm) diam by 1/16 in. (1.6 mm) thick steel washer. As alternates to the anchors specified above, Hilti 1/4 in, (6 mm) diam by 1-1/4 in, (32 mm) long KWIK-CON (I+ concrete screw anchor, Hilti 1/4 in, (6 mm) diam by 1-3/4 in, (45 mm) long KWIK-BOLT 3 steel expansion anchor or Hilb X-DNI 27 P8 S15 powder actuated floor pie with integral nom 9/16 in. (15 mm) diam washer may be used.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC --- CP 643N 50/1.5", CP 643N 63/2", CP 643N 90/3", CP 643N 110/4", CP 643 160/6", CP 644-200/8" US or CP 644-250/10" US Firestop Collar

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

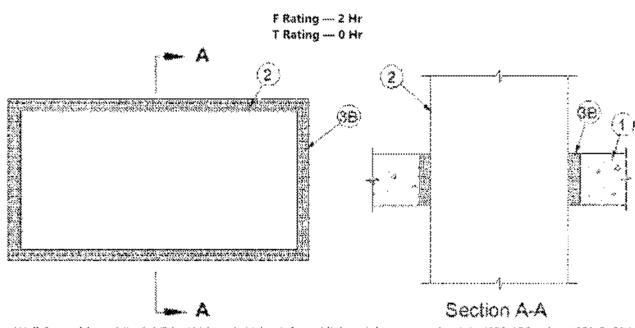
THROUGH-PENETRATION FIRESTOP (C-AJ-2109)
Scale: N.T.S.

Last Wodated on 2018-07-31

2 THROUGH-PENETRATION FIRESTOP (C-AJ-7029)
Scale: N.T.S.

System No. C-AJ-7029

June 16, 2022



1. Floor or Wall Assembly — Min 4-1/2 in. (114 mm) thick reinforced lightweight or normal weight (100-150 pcf or 1680-2400 kg/m²) concrete. Wall may also be constructed of any Ut. Classified Concrete Blocks\*. For rectangular ducts, max area of opening shall be 13.4 ft? (1.25 m²) with max dimension of 44 in. (1.11 m). For round ducts, max diam of opening shall be 44 in. (1.11 m). For oval shaped ducts, max dimension of opening shall be 44 in. (1,11 m) by 14 in.(0.37 m).

See Concrete Blocks (CAZT) category in the Fire Resistance Cirectory for names of manufacturers.

2. Through-Penetrants — Coated Ducts\* — Reclangular, round or flat oval coated steel air duct. For rectangular duct, max perimeter dimension shall be 13.3 ft.(4.06 m) with a max individual dimension of 40 in. (1.02 m). For round ducts, max diam shall be 40 in. (1.02 m) and for oval shaped docts, max size of oval shall be 40 in. (1.02 m) by 10 in. (254 mm). Duct supplied coated with 6W11 coating material. One duct to be centered within the firestop system with an annular space of 2 in. (\$1 mm). Reinforcement stiffener or transverse joint with bolited flanges shall be located approximately at the mid depth of the annular space. Duct to be notify supported on both sides of the floor or wall assembly. Duct sections shall be assembled using bolted flanges or SMACNA approved Transverse Joint Reinforcements. FIRESPRAY INTERNATIONAL LTD --- FLAMEBAR BW11 FIRE RATED DUCTWORK

3. Firestop System — The firestop system shall consist of the following:

A. Forms — (Not Shows) — Used as a form to prevent leakage of fill material during installation. Forms to be a rigid sheet material, cut to fit the contour of the penetrating item and fastened to the underside of the floor or both sides of wall. Forms to be removed after fill

B. Fill, Void or Cavity Material\* -- Mortar -- Fill material applied within the annulus, flush with top and bottom surfaces of floor or with both surfaces of wall. Mortar is mixed with water in accordance with the mortar manufacturer's installation instructions. A/D FIRE PROTECTION SYSTEMS INC --- A/O Firebarrier Moriar

HIETI CONSTRUCTION CHEMICALS, DIV OF HILTI INC --- CP637 Mortar

ISOLATEK INTERNATIONAL --- Cafco TPS Mortar

RECTORSEAL --- 850 K10+ Morear

HOBEN INTERNATIONAL LTD --- Firecrete Mortar

SPECIFIED TECHNOLOGIES INC — SpecSeal Mortar

TREMCO CPG INC. — TREMstop M mortar

GCP APPLIED TECHNOLOGIES INC -- Type KBS Mortan

3M COMPANY - 3M Fire Barner Mortan

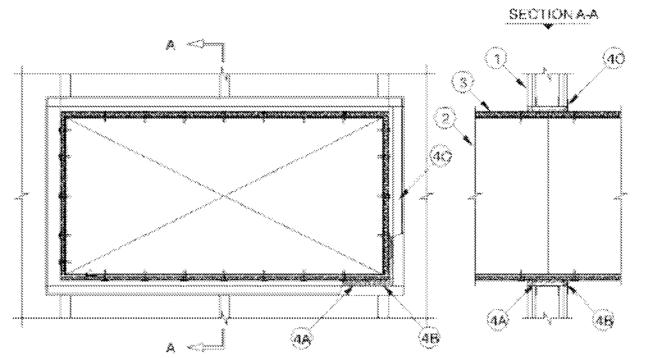
C. Steel Angles ---- (Optional, Not Shown) - Nom 4 by 4 by 1/4 in. (102 by 102 by 6 mm) thick steel angles installed around perimeter of opening on top surface of floor or both surfaces of wall. Steel angles shall lap a min of 2 in. (51 mm) onto the concrete on all sides of the opening. Steel angles shall be attached to through penetrant (Item 2) by means of nom 3/8 in. (9.5 mm) diam by 1-1/4 in. (3.2 mm) long steel boits in conjunction with nom 3/6 in. (9.5 mm) by 1-1/2 in. (38 mm) diam steel fender washers spaced max 6 in. (152 mm) OC. Steel angles attached to concrete floor on all sides of the opening by means of nom 5/16 in. (8 mm) diam by 1-3/4 in. (45 mm) long concrete. screws in conjunction with 3/8 in. (10 mm) by 1-1/2 in. (38 mm) diam steel fender washers spaced max 6 in. (152 mm) QC.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Last Updated on 2022-06-16

System No. W-L-7151

August 22, 2018 ANSI/UL1479 (ASTM E814) CAN/ULC S115 Ratings - 1 and 2 Ht (See them 1) F Ratings - 1 and 2 Hr (See Item 1) T Bating - 0, 1, and 2 Hr (See Item 4C) FT Rating - 0, 1, and 2 Hr (See Item 4C) FH Ratings - 1 and 2 Hr (See Item 1) FTH Ratings - 0, 1, and 2 Hr (See Item 4C)



1. Wall Assembly — The fice-cated gypsum board/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 3-1/2 in. (89 mm) wide and spaced max 24 in. (610 rsm). Additional framing members shall be used to completely frame around opening.

B Gypsum Board\* -- Nom 5/8 in. (16 mm) thick with square or tapered edges. The gypsum wallboard type, number of layers and sheet orientation shall be as specified in the individual Wall and Partition Design Number. Max area of opening is 210 sq in. (1355 cm²) with a max width of 14-1/2 in. (368 mm) for wood studs. Max area of opening is 2457 in² (1.58 m²) with the max length or width dimension of 63 in. (1600 mm) for steel studs. The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Steel Duct — Nom 36 in, by 60 in. (914 mm by 1524 mm or smaller) galv steel duct to be installed within the firestop system. The duct shall be constructed and reinforced in accordance with SMACNA construction standards. Duct to be rigidly supported on both sides of the wall assembly.

3. Batts and Blankets\* — Max 2 in: (\$1 mm) thick min 3/4 pcf (12 kg/m³) glass fiber batt or blanket jacketed on the outside with a foil-scrim-kraft facing. Longitudinal and transverse joints sealed with aluminum foil tape. During the installation of the fill material, the batt or blanket shall be compressed minimum 50% such that the annular space within the firestop system shall be

min 1/4 in. (6 mm) to a max 3-1/2 in. (89mm); refer to the table below.

See Batts and Blankets - (BKNV) category in the Building Materials Directory for names of manufacturers. Any batt or blanket. meeting the above specifications and bearing the UL Classification Marking with a Flame Spread Index of 25 or less and a Smoke Developed Index 50 or less may be used.

4. Firestop System - The firestop system shall consist of the following:

A, Packing Material — Min 3-1/2 in, (89 mm) thickness of min 4.0 pcf (64 kg/m³) mineral wool batt insulation firmly packed into the opening as a permanent form. Packing material to be recessed from both sides of the wall to accommodate the required thickness of fill material.

8, Fill, Void or Cavity Material\*—Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within annulus flush

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC --- FS-ONE MAX Intumescent Sessiont

C. Steel Retaining Angle - No. 18 MSG (or heavier) galv steel angles. When duct dimension exceeds 48 in. (1219 mm), angles shall be No. 16 MSG (or heavier). Angles cut to fit contour of duct with a Z in. (51 mm) overlap on the duct and a min 1 in. (25 mm) averlap on the gypsum board assembly on both surfaces of wall. 2 in. (51 mm) leg of angle secured to duct with min No. 8 by 3/4 in. (19 mm) long sheet metal screws, spaced a max of 6 in. (152 mm) OC. Angles are optional for ducts 30 in. (762 mm) by 24 in. (610 mm) and smaller. In addition, see table below for additional conditions and options regarding retaining angles.

Max Duct Dimension		Max Insulation Thickness (Item 3)		-	(Item 4C)	T- Rating Hr
**24 in. (610 mm)	3 ~		1/4 in. min to 1 in. max (6 to 25 mm)	Na	No	0
25 in. (635mm) wide by 45 in. (1143 mm) high	-	2 in. (51mm)	1/4 in. min to 3-1/2 in. max (6 to 89 mm)	Yes	No	1 and 2 (Same as wall rating)

\*\* Indicates that when max 1-1/2 in, (38 mm) thick insulation is used, steel angles are optional for those sides of the duca that do not exceed the dimension specified.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

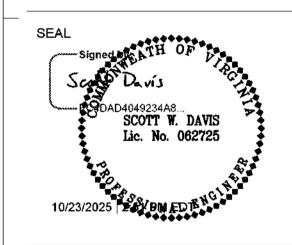
<u>Last Updated</u> on 2018-08-22

THROUGH-PENETRATION FIRESTOP (W-L-7151)
Scale: N.T.S.

**Dewberry** 

Dewberry Engineers Inc. 9300 Harris Comers Parkway Suite 220 Charlotte, NC 28269-3797 704,509,9918 NC License No. F-0929

DEB APROVAL



KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY CHECKED BY JULY 25, 2025

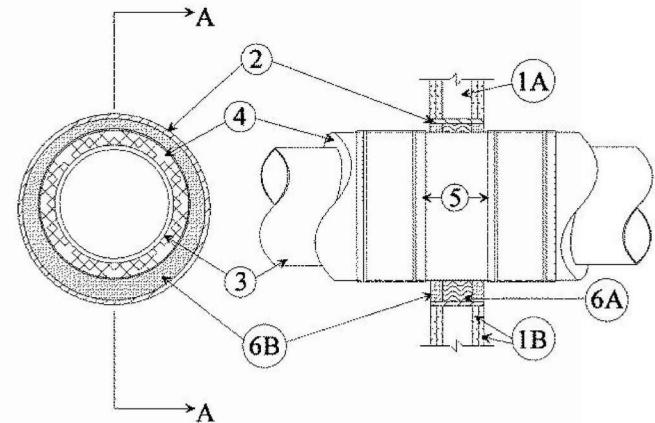
**DETAILS** 

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

50188025

SHEET NO.

	December 11, 2017	
ANSI/UL1479 (ASTM E814)	CAN/ULC S115	
F Rating — 1 & 2 Hr (See Item 6)	F Rating — 1 & 2 Hr (See Item 6)	
T Rating — 0 & 1 Hr (See Item 4)	FT Rating — 0 & 1 Hr (See Item 4)	
	FH Rating — 1 & 2 Hr (See Item 6)	
	FTH Rating — 0 & 1 Hr (See Item 4)	



1. Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300, U400, V400 or W400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC.

B. Gypsum Board\* — Nom 5/8 in. (16 mm) thick gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 14-1/2 in. (368 mm) for wood stud walls and 22 in. (559 mm) for steel stud walls.

2. Metallic Sleeve — Nom 22 in. (559 mm) diam (or smaller) Schedule 40 (or thinner) steel pipe cast into wall assembly with joint compound and installed flush with wall surfaces.

3. Through Penetrants — One metallic pipe or tubing to be positioned within the firestop system. Pipe or tubing to be rigidly supported on both sides of wall assembly. The annular space shall be min 3/4 in. (19 mm) to max 3 in. (76 mm). The following types and sizes of metallic pipes or tubing may be used:

A. Steel Pipe — Nom 12 in. (305 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe.

B. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.

C. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

4. Pipe Covering Materials\* — Cellular Glass Insulation — Nom 1-1/2 in. (38 mm) or 3 in. (76 mm) thick cellular glass pipe insulation sized to the outside diam of the steel pipe or tube and installed in accordance with the manufacturer's instructions. T Rating is 0 hr when nom 1-1/2 in. (38 mm) thick pipe insulation is used in 1 hr and 2 hr fire-rated wall assembly. T Rating is 0 hr when nom 3 in. (76 mm) thick pipe insulation is used in 1 hr fire-rated wall assembly. T Rating is 1 hr when nom 3 in. (76 mm) thick pipe insulation is used in 2 hr fire-rated wall assembly.

5. Metal Jacket (Optional) — Min 12 in. (305 mm) long jacket formed of min 0.010 in. (.254 mm) thick steel or aluminum sheet cut to wrap tightly around the pipe insulation with a min 2 in. (51 mm) lap. Jacket secured with min 1/2 in. (13 mm) wide stainless steel hose clamps or bands located within 2 in. (51 mm) of each end of the jacket and spaced a max of 10 in. (254 mm) OC. Jacket to be installed with abutting surface of sealant (Item 6B) on both surfaces of wall. Metal jacket to be used in addition to any other jacketing material which may be required or desired on the pipe insulation.

6. Firestop System — Installed symmetrically on both sides of the wall. The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed.

A. Packing Material — Min 2-1/4 or 3-1/2 in. (57 to 89 mm) thickness of min 4.0 pcf (64 kg/m<sup>3</sup>) mineral wool batt insulation firmly packed into opening as a permanent form for 1 or 2 hr walls, respectively. Packing material to be recessed from both surfaces of wall as required to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material\* — Sealant — Min 3/4 in. (19 mm) thickness of fill material applied within the annulus, flush with both surfaces of the wall.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE MAX Intumescent Sealant

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

THROUGH-PENETRATION FIRESTOP (W-L-5046)
Scale: N.T.S.

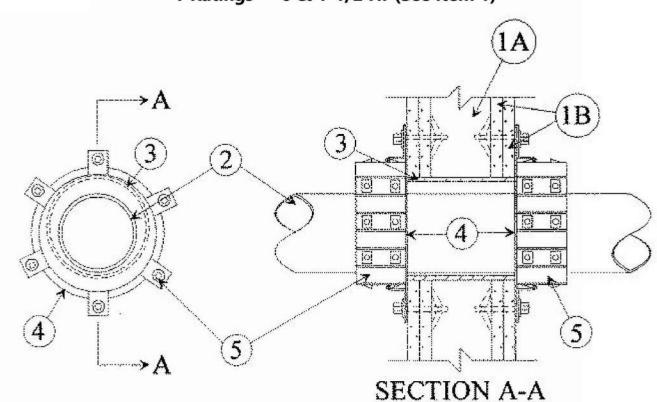
Last Updated on 2017-12-21

System No. W-L-2084

F Ratings — 1 & 2 Hr (See Item 1)

T Ratings — 0 & 1-1/2 Hr (See Item 1)

November 29, 2005



1. Wall Assembly — The fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner specified in the individual U300 or U400 Series Wall and Partition Designs in the UL Fire Resistance Directory and shall include the construction features noted below. The hourly F Rating of the firestop system is equal to the hourly fire rating of the wall assembly in which it is installed. The hourly T Rating is 1-1/2 Hr when installed in 2 hr fire-rated wall, 0 hr when installed in 1 hr fire-rated wall.

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. lumber spaced 16 in. OC. Steel studs to be min 2-1/2 in. wide and spaced max 24 in. OC.

B. Gypsum Board\* — Nom 5/8 in. thick gypsum wallboard, as specified in the individual Wall and Partition Design. Max diam of opening is 8 in.

2. Through-Penetrants — One nonmetallic pipe, conduit or tubing to be installed within the firestop system. The annular space between pipe and periphery of opening shall be min 1/4 in. to max 1-1/4 in. Pipe or conduit to be rigidly supported on both

in closed (process or supply) or vented (drain, waste or vent) piping system.

sides of the wall assembly. The following types and sizes of nonmetallic pipes may be used: A. Polyvinyl Chloride (PVC) Pipe — Nom 6 in. diam (or smaller) Schedule 40 solid-core or cellular core PVC pipe for use

B. Chlorinated Polyvinyl Chloride (CPVC) Pipe — Nom 6 in. diam (or smaller) SDR17 CPVC pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

C. Acrylonitrile Butadiene Styrene (ABS) Pipe — Nom 6 in. diam (or smaller) Schedule 40 solid-core or cellular core ABS pipe for use in closed (process or supply) or vented (drain, waste or vent) piping systems.

D. Flame Retardant Polypropylene (FRPP) Pipe — Nom 6 in. diam (or smaller) Schedule 40 FRPP pipe for use in closed (process or supply) or vented (drain, waste or vent) piping system.

3. Metallic Sleeve — Nom 8 in. diam (or smaller) Schedule 40 (or thinner) steel pipe cast into wall assembly with joint compound and installed flush with wall surfaces

4. Metal Cover Plate — Min. 18 ga. steel with max I.D. 1/4 in. larger than O.D. of pipe. Min. O.D. of cover plate to be 2-1/2 in. larger than O.D. of pipe. Installed between collar and wall surfaces.

5. Firestop Device\* — Firestop Collar — Firestop collar shall be installed in accordance with the accompanying installation instructions. Collar to be installed and latched around the pipe and secured to both sides of the wall using the anchor hooks provided with the collar. (Minimum 2 anchor hooks for 1-1/2 and 2 in. diam pipes, 3 anchor hooks for 3 and 4 in. diam pipes, and 4 anchor hooks for 6 in. diam pipes). The anchor hooks are to be secured to the surface of wall with 3/16 by 2-1/2 in. long toggle bolts along with washers. As an alternate for pipe sizes of nom 4 in. diam or less, min No. 10 by 1-1/2 in. long drywall or laminate screws with min 3/4 in. steel washers may be used.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CP 643 50/1.5"N, CP 643 63/2"N, CP 643 90/3"N, CP 643 110/4"N or CP 643 160/6"N Firestop Collar

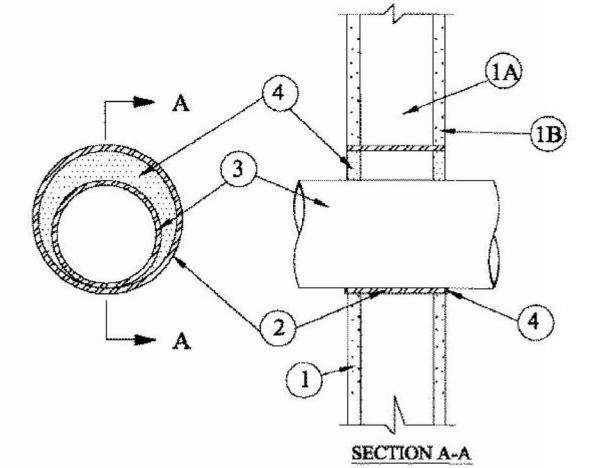
\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

<u>Last Updated</u> on 2005-11-29

### System No. W-L-1164

January 22, 2015

ANSI/UL1479 (ASTM E814)	CAN/ULC S115				
F Ratings — 1 and 2 Hr (See Item 1and 4)	F Ratings — 1 and 2 Hr (See Items 1 and 4)				
T Rating — 0 Hr	FT Rating — 0 Hr				
	FH Ratings — 1 and 2 Hr (See Items 1 and 4)				
	FTH Rating — 0 Hr				



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U300, U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction features:

A. Studs — Wall framing may consist of either wood studs or steel channel studs. Wood studs to consist of nom 2 by 4 in. (51 by 102 mm) lumber spaced 16 in. (406 mm) OC. Steel studs to be min 2-1/2 in. (64 mm) wide and spaced max 24 in. (610 mm) OC. When steel studs are used and the diam of opening exceeds the width of stud cavity, the opening shall be framed on all sides using lengths of steel stud installed between the vertical studs and screw-attached to the steel studs at each end. The framed opening in the wall shall be 4 to 6 in. (102 to 152 mm) wider and 4 to 6 in. (102 to 152 mm) higher than the diam of the penetrating item such that, when the penetrating item is installed in the opening, a 2 to 3 in. (51 to 76 mm) clearance is present between the penetrating item and the framing on all four sides.

B. Gypsum Board\* — The gypsum wallboard type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design. Max diam of opening in steel stud walls is 32 in. (813 mm). Max diam of openings in wood stud walls is 14-1/2 in. (368 mm).

2. Steel Sleeve — Nom 32 in. (813 mm) diam (or smaller) Schedule 40 (or heavier) steel pipe sleeve friction fit in nom 32 in. (813 mm) diam circular opening cut through gypsum board layers. Length of steel sleeve to be equal to thickness of wall.

3. Through-Penetrant — One metallic pipe, conduit or tubing installed either concentrically or eccentrically within the firestop system. The annular space between pipe, conduit or tubing and the steel sleeve shall be min of 0 in. (point contact) to max 1-7/8 in. (48 mm) Pipe, conduit or tubing to be rigidly supported on both sides of wall assembly. The following types and sizes of

A. Steel Pipe — Nom 30 in. (762 mm) diam (or smaller) Schedule 10 (or heavier) steel pipe.

B. Iron Pipe — Nom 30 in. (762 mm) diam (or smaller) service weight (or heavier) cast iron soil pipe or Class 50 (or heavier) ductile iron pressure pipe.

C. **Conduit** — Nom 4 in. (102 mm) diam (or smaller) steel electrical metallic tubing.

D. Copper Tubing — Nom 6 in. (152 mm) diam (or smaller) Type L (or heavier) copper tubing.

E. Copper Pipe — Nom 6 in. (152 mm) diam (or smaller) Regular (or heavier) copper pipe.

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — FS-ONE Sealant or FS-ONE MAX Intumescent Sealant

4. Fill, Void or Cavity Material\*-Sealant — Min 5/8 in. (16 mm) and 1-1/4 in. (32 mm) thickness of fill material applied within annulus, flush with both surfaces of wall assembly for 1 or 2 hr rated walls, respectively. Min 1/2 in. (13 mm) diam bead of caulk applied to the penetrant/gypsumboard interface at the point contact location on both sides of wall.

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.

Last Updated on 2015-01-22

# THROUGH-PENETRATION FIRESTOP (W-L-2084) Scale: N.T.S.

# THROUGH - PENETRATION FIRESTOP (W-L-1164) Scale: N.T.S.

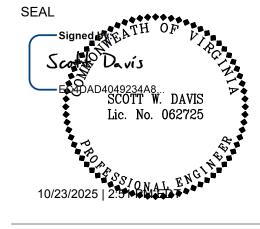
Dewberry

Dewberry Engineers Inc.

9300 Harris Corners Parkway Suite 220 Charlotte, NC 28269-3797 704.509.9918 NC License No. F-0929

DEB APROVAL





KEY PLAN:

SCALE:

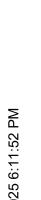
REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY APPROVED BY CHECKED BY JULY 25, 2025

**DETAILS** 

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.



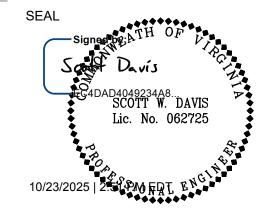
В

# Dewberry

Dewberry Engineers Inc. 9300 Harris Corners Parkway Suite 220 Charlotte, NC 28269-3797 704.509.9918 NC License No. F-0929

DEB APROVAL





KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY	SMF
APPROVED BY	SWD
CHECKED BY	JMT
DATE	JULY 25, 2025

**DETAILS** 

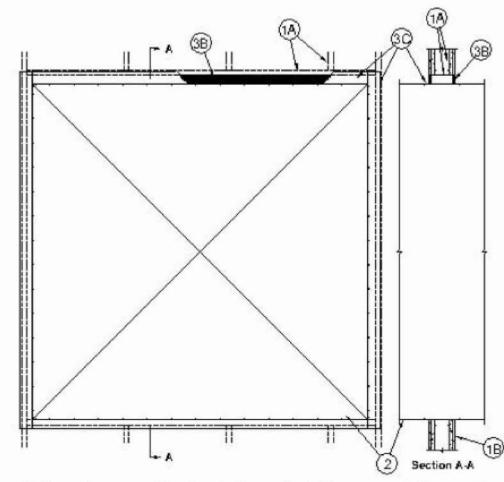
DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

System No. **W-L-7155** 

October 28, 2024

ANSI/UL1479 (ASTM E814) CAN/ULC S115 F Ratings — 1 and 2 Hr (See Item 1) F Ratings — 1 and 2 Hr (See Item 1) FT Ratings — 0 Hr T Ratings — 0 Hr L Rating at Ambient — Less Than 1 CFM/sq ft FH Ratings — 1 and 2 Hr (See Item 1) FTH Ratings — 0 Hr L Rating at 400 F — Less Than 1 CFM/sq ft L Rating at Ambient — Less Than 1 CFM/sq ft L Rating at 400 F — Less Than 1 CFM/sq ft



1. Wall Assembly — The 1 or 2 hr fire-rated gypsum wallboard/stud wall assembly shall be constructed of the materials and in the manner described in the individual U400, V400 or W400 Series Wall or Partition Design in the UL Fire Resistance Directory and shall include the following construction

A. Studs — Wall framing shall consist of min 3-1/2 in. (89 mm) wide steel channel studs spaced max 24 in. (610 mm) OC. Additional steel studs shall be used to completely frame the opening.

B. Gypsum Board\* — 5/8 in. (16 mm) thick, 4 ft (1.22 m) wide with square or tapered edges. The gypsum board type, thickness, number of layers, fastener type and sheet orientation shall be as specified in the individual Wall and Partition Design in the UL Fire Resistance Directory. Max area of opening is 73.7 sq ft (6.85 m<sup>2</sup>) with a max dimension of 104 in. (2.64 m).

### The hourly F and FH Ratings of the firestop system are equal to the hourly fire rating of the wall assembly in which it is installed.

2. Steel Duct — Max 100 in. by 100 in. (2.5 by 2.5 m) galv steel duct to be installed either concentrically or eccentrically within the firestop system. The duct shall be constructed and reinforced in accordance with SMACNA construction standards. The space between the steel duct and periphery of opening shall be min 0 in. (point contact) to max 2 in. (51 mm). Steel duct to be rigidly supported on both sides of the wall assembly.

duct, with a max cross-sectional area of 43.0 sq ft, (4 m²) and a max individual dimension of 78 3/4 in. (2 m). Duct to be installed either concentrically or eccentrically within the firestop system such that the annular space is min 0 in. (point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides of wall assembly. Refer to Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory. VAUGHANAIR CANADA ULC — Type DuraDuct HP.

2A3. Through-Pentrating Product\* — As an alternate to Item 2. Galvanized steel faced duct panel, with a max cross-sectional area of 2450 sq in. (1.58 m<sup>2</sup>), and a max individual dimension of 49-1/2 in. (1258 mm) Duct to be installed either concentrically or eccentrically within the firestop system such that the annular space is min 0 in. (point contact) to max 2 in. (51 mm). Duct to be rigidly supported on both sides wall assembly. Refer to Ventilation Duct Assemblies in Vol. 2 of the Fire Resistance Directory.

2A4. Through-Penetrants — Coated Ducts\* — As an alternate to Item 2, rectangular steel air duct supplied coated with BW11 coating material. Max 40 by 40 in. (1.02 by 1.02 m) duct size. One duct to be installed within the firestop system with an annular space of min 0 in. (point contact) to max 2 in. (51 mm). Reinforcement stiffener or transverse joint with bolted flanges shall be located approximately at the mid depth of the annular space. Duct to be rigidly supported on both sides of the wall assembly. Duct sections shall be assembled using bolted flanges or SMACNA approved Transverse Joint Reinforcements.

FIRESPRAY INTERNATIONAL LTD — FLAMEBAR BW11 FIRE RATED DUCTWORK

VAUGHANAIR CANADA ULC — Type DuraDuct GNX.

3 **Firestop System** — The firestop system shall consist of the following:

A. Packing Material — (Optional, Not Shown) — Polyethylene backer rod, mineral wool batt insulation or fiberglass batt insulation friction fitted into annular space. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.

A1. Packing Material — Required as specified in Table below. Min 3-3/4 in. (95 mm) or 5 in. (127 mm) thickness of min 4 pcf (64 kg/m³) mineral wool batt insulation firmly packed into opening as a permanent form for 1 and 2 hr rated assemblies, respectively. Packing material to be recessed from both surfaces of wall to accommodate the required thickness of fill material.

B. Fill, Void or Cavity Material\* — Sealant — Min 5/8 in. (16 mm) thickness of fill material applied within the annulus, flush with both surfaces of wall. Min 1/4 in. (6 mm) diam bead of fill material shall be applied at the point contact location between the steel duct or coated duct and the gypsum

HILTI CONSTRUCTION CHEMICALS, DIV OF HILTI INC — CFS-S SIL GG Sealant, FS-ONE Sealant, FS-ONE MAX Intumescent Sealant or CP606 Flexible Firestop

C. Steel Retaining Angles — Min No. 16 gauge galv steel angles sized to lap steel duct a min of 2 in. (51 mm) and to lap wall surfaces a min of 1 in. (25 mm). When max duct dimension does not exceed 48 in. (122 cm) and duct area does not exceed 1300 in<sup>2</sup> (8387 cm<sup>2</sup>), angles may be min No. 18 gauge galv steel. Angles attached to steel duct or coated duct on both sides of wall with min No. 10 by 1/2 in. (13 mm) long steel sheet metal screws located a max of 1 in. (25 mm) from each end of steel duct and spaced a max of 6 in. (152 mm) OC. Steel angles are optional for those sides of duct that do not exceed the dimension specified in Table below, dependent on packing material, sealant and annular space as specified.

Max Duct Dimension	Duct Thickness	Annular Space	Sealant	Packing Material	Angle (Item 3C) Required
24 in. (610 mm)	24 ga or heavier	1/2 in. min to 1 in. max (13 to 25 mm)	FS-ONE Sealant or CP606 Flexible Firestop Sealant	Item 3A1	No

\* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada),

Last Updated on 2024-10-28

# THROUGH-PENETRATION FIRESTOP (W-L-7155) Scale: N.T.S.

449.6 125.3

33.5

20.4

7.9

Dewberry

704.509.9918

9300 Harris Corners Parkway Suite 220 Charlotte, NC 28269-3797

NC License No. F-0929

Dewberry Engineers Inc.

DEB APROVAL

KEY PLAN:

SCALE:

AIR DI	AIR DISTRIBUTION SCHEDULE								BUILDING LOADS SCHEDULE			
						MAX.	FACE	NECK		MAX.		DOILDING LOADS COILLD CL
						AIR FLOW	SIZE	SIZE	APD	SOUND		BUILDING HEATING, MBH
MARK	SERVICE	TYPE	MATERIAL	COLOR	PATTERN	(CFM)	(IN x IN)	(IN x IN)	(IN WG)	(NC)	NOTES	OUTSIDE AIR COMPONENT, MBH
IVIANN	_					(- /	, ,	, ,	<u> </u>	· , ,		TOTAL COOLING, TONS
S1	SUPPLY	STANDARD BLADE GRILLE	ALUMINUM	WHITE	90 DEG.	1,600	22 x 22	20 x 20	0.10	20	1,2,3,4,5,6,7	,
R1 / E1	RETURN/EXHAUST	STANDARD BLADE GRILLE	ALUMINUM	WHITE	N/A	650	14 x 14	12 x 12	0.10	20	1,2,3,4,5,6,7	SENSIBLE COOLING, TONS
NOTES:		S. H. S. H. S. B. S. G. W. E. E.	1, 120,111,10,111		1,, .	1 300		1 .2 × 12	5.10	1 -0	.,=,0,.,0,0,.	TOTAL OUTSIDE AIR COOLING COMPONENT, TONS

- 1. REFER TO SECTION 233713 FOR ADDITIONAL REQUIREMENTS.
- 2. SOUND LEVELS SHALL BE BASED ON ASHRAE 70.
- 3. VERIFY MOUNTING FRAME STYLE WITH ARCHITECTURAL REFLECTED CEILING PLANS, FINISH SCHEDULES AND EXISTING CEILINGS. 4. DUCT BRANCH FROM MAIN TAKEOFF TO AIR INLET / OUTLET SHALL MATCH SCHEDULED NECK SIZE UNLESS OTHERWISE NOTED.
- 5. PROVIDE INTEGRAL DAMPERS ADJUSTABLE AT THE DEVICE FACE ONLY AT LOCATIONS NOTED ON PLANS.
- 6. PROVIDE PRIMED-FOR-PAINT FINISH FOR DIFFUSERS AND GRILLES IN SPACES WITH EXPOSED STRUCTURE CEILINGS AND/OR MOUNTED TO EXPOSED DUCT.
- 7. PROVIDE ALUMINUM CONSTRUCTION FOR HUMID AREAS SUCH AS KITCHENS, TOILET ROOMS, LOCKER ROOMS, AND MECHANICAL SPACES.

LP STORAGE VOLUME ESTIMATE - BASED ON PEAK MONTHLY O	CONSUMPTION (N	NOTE 1)
BUILDING GAS CONSUMPTION - PEAK MONTH	472	THERMS/MONTH (NOTE 4; JANUARY IS PEAK MONTH)
BUILDING GAS CONSUMPTION - PEAK MONTH	47,200,000	BTU/MONTH (PEAK MONTH - JANUARY)
LP HEAT CONTENT	90,500	BTU/GALLON (LP @ 60F)
ESTIMATED GALLONS	522	GALLONS/MONTH (PEAK MONTH - JANUARY)
DESIGN TANK SIZE	1,000	GALLONS
TANK QTY REQUIRED - PEAK MONTH CONSUMPTION BASIS	1	TANK(S)
TANK FULL VOLUME	80%	OF DESIGN TANK SIZE (MAX LIQUID FILL VOLUME)
REFILL WHEN TANK(S) ARE	25%	OF DESIGN TANK SIZE
AVAILABLE VOLUME	550	GALLONS PER REFILL
DAYS BETWEEN REFILLS	32	DAYS (FOR PEAK MONTH)
LP STORAGE VOLUME ESTIMATE - BASED ON PEAK TANK DEMA	AND WITHOUT VA	APORIZER (NOTE 2)
BOILER INPUT	500,000	BTU/HOUR INPUT
BOILER QTY	1	(SECOND BOILER IS 100% REDUNDANT)
TOTAL CONNECTED LOAD (PEAK INSTANTANEOUS DEMAND)	500,000	BTU/HOUR
LOAD FACTOR	85%	DEMAND DIVERSITY OVER 8 HOUR PERIOD
DIVERSIFIED DEMAND	425,000	BTU/HOUR (CONTINUOUS)
DESIGN TEMPERATURE	10°F	ASHRAE 99% = 17.6°F (NEW RIVER VALLEY, VA)
DESIGN RELATIVE HUMIDITY	40%	ASHRAE EXTREME ANNUAL MIN = 71.8% RH @ 6.2 °FDB / 4.9 °FWB
DESIGN TANK SIZE	1,000	GALLONS
DESIGN TANK FILL LEVEL	25%	OF DESIGN TANK SIZE
SINGLE TANK VAPORIZATION RATE @ DESIGN CONDITIONS	279,720	BTU/HOUR (@ CONDITIONS ABOVE; FISHER BULLETIN LP-27)
TANK QTY REQUIRED - PEAK DRAW BASIS (NOTE 3)	2	TANK(S) (= DIVERSIFIED DEMAND ÷ SINGLE TANK VAPORIZATION RATE)

- 1. PEAK CONSUMPTION SIZING BASED ON MIN STORAGE VOLUME REQUIRED FOR PEAK MONTH,
- ALLOWING FOR ROUTINE MONTHLY DELIVERIES.
- 2. PEAK TANK DEMAND SIZING BASED ON CONTINUOUS DEMAND, DRAWN OVER 8-HOUR PERIOD
- WITHOUT FROSTING.
- 3. PEAK TANK DEMAND IS STORAGE DESIGN BASIS; PROVIDE TWO (2) 1,000 GALLON TANKS.
- 4. TRANE TRACE 700 USED TO DETERMINE BUILDING PEAK MONTHLY HEATING CONSUMPTION.

PROP/	ANE PIPE SIZING SCHEDULE									
			INLET	PRESSURE	SEGMENT	E.L. FROM	SIZING	SEGMENT	SEGMENT	
SEGMENT			PRESSURE	DROP	E.L.	P.O.D.	LENGTH	CAPACITY	SIZE	
NODES	SEGMENT DESCRIPTION	PIPE MATERIAL	(PSI)	(PSI)	(FT)	(FT)	(FT)	(MBH)	(IN)	SIZING BASIS
10 PSIG SY	STEMS							•		
1-2	TANK AREA 1ST STAGE REGULATOR TO TANK FARM RISER STUB CONNECTION	STEEL - SCH 40	10	1	15	15	220	1,949	1	VFGC 402.4(25) SCH 40 METALLIC PIPE
2-3	TANK FARM RISER TO BELOW GROUND BRANCH	POLYETHYLENE PLASTIC PIPE - SDR 11	10	1	25	40	220	1,949	1	NFPA 58-17 16.1(n) PE PLASTIC PIPE
3-4	BELOW GROUND BRANCH TO BUILDING SERVICE RISER STUB	POLYETHYLENE PLASTIC PIPE - SDR 11	10	1	160	200	220	1,000	1	NFPA 58-17 16.1(n) PE PLASTIC PIPE
4-5	BUILDING SERVICE RISER STUB TO 2ND STAGE BUIDING REGULATOR INLET	STEEL - SCH 40	10	1	20	220	220	1,000	0.75	VFGC 402.4(25) SCH 40 METALLIC PIPE
3-9	BELOW GROUND BRANCH TO GENERATOR RISER STUB (EXISTING)	POLYETHYLENE PLASTIC PIPE - SDR 11	10	1	80	120	130	949	0.75	NFPA 58-17 16.1(n) PE PLASTIC PIPE
9-10	GENERATOR RISER STUB TO 2ND STAGE GENERATOR REGULATOR INLET	STEEL - SCH 40	10	1	10	130	130	949	0.75	VFGC 402.4(25) SCH 40 METALLIC PIPE
2 PSIG SYS	TEMS									
5-6	2ND STAGE BUIDING REGULATOR OUTLET TO B-2 BRANCH	STEEL - SCH 40	2	1	50	50	75	1,000	0.75	VFGC 402.4(27) SCH 40 METALLIC PIPE
6-7	B-2 BRANCH TO B-1 REGULATOR INLET	STEEL - SCH 40	2	1	25	75	75	500	0.75	VFGC 402.4(27) SCH 40 METALLIC PIPE
6-8	B-2 BRANCH TO B-2 REGULATOR INLET	STEEL - SCH 40	2	1	10	60	60	500	0.75	VFGC 402.4(27) SCH 40 METALLIC PIPE
LOW PRES	SURE CONNECTIONS									
7-12	B-1 REGULATOR OUTLET TO B-1 CONNECTION	STEEL - SCH 40	11 IN. W.C.	0.5 IN. W.C.	25	25	25	500	1	VFGC 402.4(28) SCH 40 METALLIC PIPE
8-13	B-2 REGULATOR OUTLET TO B-2 CONNECTION	STEEL - SCH 40	11 IN. W.C.	0.5 IN. W.C.	25	25	25	500	1	VFGC 402.4(28) SCH 40 METALLIC PIPE
10-11	2ND STAGE GENERATOR REGULATOR OUTLET TO GENERATOR CONNECTION	STEEL - SCH 40	11 IN. W.C.	0.5 IN. W.C.	15	15	15	949	1.25	VFGC 402.4(28) SCH 40 METALLIC PIPE

	ASSEMBLY AND PENETRATION TYPE	RATING	U. L. DETAIL SYSTEM NUMBER
		(HR)	
	INSULATED METAL PIPES	1 or 2	CAJ-5061, CAJ-5090, CAJ-5091, CAJ-5096, CAJ-5277
CONCRETE FLOORS	UNINSULATED METAL PIPES OR CONDUITS	1 or 2	CAJ-1226, CAJ-1155, CAJ-1380, CAJ-1575, FA-1028
	UNINSULATED NON-METAL PIPES OR CONDUITS	1 or 2	CAJ-2109, CAJ-2407, CAJ-2567, CAJ-2831
	INSULATED METAL PIPES	1 or 2	CAJ-5061, CAJ-5090, CAJ-5091, CAJ-5096, CAJ-5277
CONCRETE /	UNINSULATED METAL PIPES OR CONDUITS	1 or 2	CAJ-1226, CAJ-1155, CAJ-1380, CAJ-1575
	UNINSULATED NON-METAL PIPES OR CONDUITS	1 or 2	CAJ-2109, CAJ-2407, CAJ-2567, CAJ-2831
	INSULATED METAL DUCTWORK WITHOUT DAMPERS	1 or 2	CAJ-7145, WJ-7091, WJ-7112
	UNINSULATED METAL DUCTWORK WITHOUT DAMPERS	1 or 2	CAJ-7029, WJ-7109, WJ-7021
	INSULATED METAL PIPES	1 or 2	WL-5046, WL-5047, WL-5096
	UNINSULATED METAL PIPES OR CONDUITS	1 or 2	WL-1164, WL-1205, WL-1465
GYPSUM WALLBOARD	UNINSULATED NON-METAL PIPES OR CONDUITS	1 or 2	WL-2084, WL-2341, WL-2649
	INSULATED METAL DUCTWORK WITHOUT DAMPERS	1 or 2	WL-7151, WL-7156
	UNINSULATED METAL DUCTWORK WITHOUT DAMPERS	1 or 2	WL-7155, WL-7213, WL-7250

1. REFER TO MECHANICAL DETAILS AND SECTION 230500 FOR MORE INFORMATION.

LIFE-SAFETY PENETRATION SCHEDULE

2. CONTRACTOR SHALL SELECT UL LISTED PENETRATION DETAIL MATCHING THE PENETRATION CONDITIONS. 3. SUBMIT AN APROPRIATE DETAIL FOR ENGINEER REVIEW IF THE PROJECT CONDITIONS ENCOUNTERED ARE NOT REPRESENTED ABOVE.

EXP	ANSION AND B	UFFER TANK SCHEI	DULE									
				EX	(PANSION TA	NK	HYDRONI	C SYSTEM	DIM	ENSIONS AND WEI	GHT	
				TOTAL	ACCEPT.	CHARGE	MAKEUP	RELIEF	INLET			
				VOLUME	VOLUME	PRESSURE	PRESSURE	PRESSURE	SIZE	DIMENSIONS	WEIGHT	
MARI	SERVICE	TYPE	MANUFACTURER / MODEL	(GALLONS)	(GALLONS)	(PSIG)	(PSIG)	(PSIG)	(IN DIA)	(IN DIA x IN)	(LBS)	NOTES
XT-1	HEATING WATER	BLADDER EXPANSION	BELL & GOSSETT / B35	10	10	18	19	30	0.75	12"ø x 24"	125	1,2
XT-2	CHILLED WATER	BLADDER EXPANSION	BELL & GOSSETT / B35	10	10	18	19	30	0.75	12"ø x 24"	125	1,2
BT-1	CHILLED WATER	VERTICAL BUFFER	CEMLINE / CWB SERIES	200	-	-	-	-	3	30"ø x 72" TALL	2,100	1,2

- NOTES: 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION,
- LOCATION, CONNECTIONS AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER BUILDING SYSTEMS. SEE SPECIFICATION SECTION
- 232116 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT.
- 2. PROVIDE 4-INCH DEEP CONCRETE PAD.

FAN S	CHEDULE														
						EC			BRAKE	NOMINAL	MAX.			STARTER/	
				AIR FLOW	ESP	MOTOR	DRIVE	SPEED	MOTOR	MOTOR	SOUND	DAMPER	VOLTAGE/	DSCNNCT	
MARK	SERVICE / LOCATION	TYPE	MANUFACTURER / MODEL	(CFM)	(IN WG)	(Y or N)	TYPE	(RPM)	(HP)	(HP)	(SONES)	TYPE	PHASE	MEANS	NOTES
EF-1	BOILER RM / EXTERIOR	UPBLAST DOME, SIDEWALL MOUNT	GREENHECK / CUE-099-VG	650	0.5	YES	DIRECT	1320	0.1	0.25	8.0	GRAVITY	120/1	MS/D	1,2,3,4

- 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION, LOCATION, CONNECTIONS
- AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER BUILDING SYSTEMS. SEE SPECIFICATION SECTION 233400 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT. 2. PROVIDE STARTING AND DISCONNECTING MEANS AS SCHEDULED. (MRS = MOTOR RATED SWITCH; MS/D = COMBINATION MOTOR-STARTER AND DISCONNECT; VFD = VARIABLE FREQUENCY DRIVE; AND DISC = DISCONNECT)
- 3. PROVIDE LOCAL SPEED CONTROL ADJUSTMENT AT EC FAN MOTOR FOR BALANCING.
- 4. PROVIDE FACTORY-FABRICATED WALL-MOUNT CURB. COORDINATE EXACT LOCATION WITH EXISTING WALL OPENING.

AIR SE	EPARATOR SO	HEDULE								
				WATER	MAX.		INLET			
				FLOW	WPD	DIMENSIONS	SIZE	WEIGHT		
MARK	SERVICE	TYPE	MANUFACTURER / MODEL	(GPM)	(FT H2O)	(IN DIA x IN)	(IN DIA)	(LBS)		NOTES
AS-1	HEATING WATER	TANGENTIAL	BELL & GOSSETT / RL-2N	43	1	7"ø x 16"	2	65	1,2,3	
AS-2	CHILLED WATER	TANGENTIAL	BELL & GOSSETT / R-3F	65	2	12"ø x 24"	3	190	1,2,3	

- 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW
- THE GENERAL SIZE, CONFIGURATION, LOCATION, CONNECTIONS AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER
- BUILDING SYSTEMS. SEE SPECIFICATION SECTION 232116 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT.
- 2. PROVIDE MANUAL BLOWDOWN VALVE.
- PROVIDE AUTOMATIC AIR VENT.

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY APPROVED BY CHECKED BY JULY 25, 2025

MECHANICAL

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

ΙĿ	ROIL	DING	OFFI	JIAL	

AIR-CC	OOLED CHILLEI	R SCHEDULE																							
				REFRIGERANT	CHILLED WA	ATER					PERFORMA	ANCE			ELECTRICA	<b>\L</b>		EVAPORAT	OR HEATER	PIPING HI	EAT TRACE	DIMENSIONS AN	D WEIGHT		
					CAPACITY	FLOW	MIN FLOW	EWT I	LWT M	MAX. WPD	MIN. EER	MIN. IPLV	AMB.	MAX. SOUND	MCA	MOCP	VOLTAGE/	REQ'D	VOLTAGE/	REQ'D	VOLTAGE/	FOOTPRINT	HEIGHT	WEIGHT	
MARK	SERVICE	TYPE	MANUFACTURER / MODEL	TYPE	(TONS)	(GPM)	(GPM)	(F)	(F) (	(FT H2O)	(BTU/W)	(BTU/W)	(F)	(dBA)	(A)	(A)	PHASE	(Y OR N)	PHASE	(Y OR N)	PHASE	(IN X IN)	(IN)	(LBS)	NOTES
CH-1	ALLEN BUILDING	AIR-COOLED SCROLL	TRANE / CGAM035	R-454B	33	65	39	44	56	11	10.10	13.70	95	65	167	250	208/3	YES	120/1	YES	120/1	150 x 50	85	3,100	1,2,3,4,5,6,7,8

94%

94%

93%

93%

500.0

500.0

465

465

12.0

12.0

4

560 1,2,3,4,5,6

120/1 30.5 x 26.25 53.5

120/1

- 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION, LOCATION, CONNECTIONS
- AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER BUILDING SYSTEMS. SEE SPECIFICATION SECTION 236426 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT.
- 2. SOUND PERFORMANCE IS BASED ON SOUND PRESSURE LEVELS MEASURED AT 30 FEET FROM UNIT AT FULL CAPACITY IN ACCORDANCE WITH AHRI 370.
- 3. PROVIDE 20A DEDICATED CIRCUIT FOR EVAPORATOR HEATER FOR EACH CHILLER.
- 4. PROVIDE 20A DEDICATED CIRCUIT FOR PIPING HEAT TAPE FOR EACH CHILLER.
- 5. CAPACITIES ARE BASED ON 0.00025 FOULING FACTORS FOR AIR-COOLED CHILLERS.
- 6. PROVIDE CONCRETE PAD FOR OUTDOOR CHILLERS THAT IS 6-INCHES LONGER AND WIDER THAN UNIT FOOTPRINT AND 6-INCHES DEEP WITH 4-INCHES DEEP CRUSHED STONE BASE.
- PROVIDE LOW AMBIENT CONTROLS AND ACCESSORIES.
- 8. SCHEDULED CAPACITIES ARE ARE SITE ELEVATION OF 2,100 FT.

COND	ENSING WATE	ER BOILER SCHEDU	LE																			
				HEATI	NG WAT	ER			BURNER									DIMENSION	S AND WEIG	SHT		
						DESIGN	MINIMUM		PRIMARY	FUEL	FULL FIRE	MIN. FIRE		DESIGN		ELECTRICAL				EXHAUST	COMBUST.	WET
				EWT	LWT	FLOW	FLOW	WPD	PRIMARY	PRESSURE	MIN. EFF.	MIN. EFF.	INPUT	OUTPUT	FLA	MOCP	VOLTAGE/	FOOTPRIN T	HEIGHT	FLUE VENT	AIR DUCT	WEIGHT
MARK	SERVICE	TYPE	MANUFACTURER / MODEL	(F)	(F)	(GPM)	(GPM)	(FT H2O)	FUEL TYPE	(IN WC)	(%)	(%)	(MBH)	(MBH)	(A)	(A)	PHASE	(IN x IN)	(IN)	(IN DIA)	(IN DIA)	(LBS)

# B-2

1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION, CONNECTIONS AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER BUILDING SYSTEMS.

PROPANE

SEE SPECIFICATION SECTION 235216 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT. 2. PROVIDE MOTOR-RATED DISCONNECT SWITCH.

**HW SYSTEM** 

HW SYSTEM

- 3. EFFICIENCIES ARE BASED ON DESIGN CONDITIONS AT FULL FIRE AND MINIMUM FIRE RATE.
- 4. CAPACITY AND PRESSURE DROP IS BASED ON DESIGN FLOW RATE. CONTROL / TAB SHALL NOT ALLOW FLOW BELOW MINIMUM FLOW RATE PLUS A 15% SAFETY FACTOR.

LOCHINVAR / FTXL500

LOCHINVAR / FTXL500

5. PROVIDE 4-INCH DEEP CONCRETE PAD THAT IS 4-INCHES LONGER AND WIDER THAN UNIT FOOTPRINT

S.S. HEAT EXCHANGER

S.S. HEAT EXCHANGER

6. PROVIDE LP GAS REGULATOR AS REQUIRED FOR BOILER UTILIZATION PRESSURE. REGULATORS SHALL BE VENTED TO A SAFE LOCATION EXTERIOR TO THE BUILDING. VENTLESS REGULATORS WITH VENT LIMITERS ARE NOT ACCEPTABLE.

35.0

35.0

15.0

15.0

PUMP	SCHEDULE														
											BRAKE	NOMINAL		STARTER/	
				SUCTION	DISCHARGE	IMPELLER	FLOW	HEAD	EFF.	SPEED	MOTOR	MOTOR	VOLTAGE/	DSCNNCT	
MARK	SERVICE	TYPE	MANUFACTURER / MODEL	(IN DIA)	(IN DIA)	(IN DIA)	(GPM)	(FT H2O)	(%)	(RPM)	(HP)	(HP)	PHASE	MEANS	NOTES
PCHWP-1	PRIMARY CHW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E80-1.5x1.5x9.5B	1.5	1.5	9.5	65	67	55%	1800	2.1	3.0	208/3	VFD	1,2,3,4,5,6
PCHWP-2	PRIMARY CHW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E80-1.5x1.5x9.5B	1.5	1.5	9.5	65	67	55%	1800	2.1	3.0	208/3	VFD	1,2,3,4,5,6
PHWP-1	PRIMARY HW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E90-1.25AAB	1.25	1.25	4.25	35	15	65%	1800	0.2	0.33	120/1	MS/D	1,2,3,4
PHWP-2	PRIMARY HW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E90-1.25AAB	1.25	1.25	4.25	35	15	65%	1800	0.2	0.33	120/1	MS/D	1,2,3,4
SHWP-1	SECONDARY HW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E80-1.5x1.5x7C	1.5	1.5	7.0	43	47	60%	1800	0.8	1.5	208/3	VFD	1,2,3,4,5,6
SHWP-2	SECONDARY HW	SEPARATELY-COUPLED IN-LINE	BELL & GOSSETT / E80-1.5x1.5x7C	1.5	1.5	7.0	43	47	60%	1800	0.8	1.5	208/3	VFD	1.2.3.4.5.6

### NOTES:

- 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION,
- LOCATION, CONNECTIONS AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED WITH RELATION TO THE OTHER BUILDING SYSTEMS. SEE SPECIFICATION SECTION 232123 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT.
- 2. PUMPS OPERATING IN PARALLEL SHALL BE SELECTED FOR PARALLEL OPERATION.
- 3. PROVIDE STARTING AND DISCONNECTING MEANS AS SCHEDULED. (MRS = MOTOR RATED SWITCH; MS/D = COMBINATION MOTOR-STARTER AND DISCONNECT; AND VFD = VARIABLE FREQUENCY DRIVE) 4. PUMPS MOTOR SELECTION SHALL BE BASED ON NON-OVERLOADING SERVICE.
- 5. PROVIDE 4-INCH DEEP CONCRETE PAD.
- 6. CONSTANT VOLUME PUMP. VFD PROVIDED FOR BALANCING.

				FAN			AIR		MOUNTING	HEATING W	/ATER						ELECTRIC		
				AIR FLOW	MOTOR	VOLTAGE/	EAT	LAT	HEIGHT	CAPACITY	EWT	LWT	FLOW	MAX. WPD	PIPE SIZE	CONTROL	DESIGN	VOLTAGE/	
MARK	SERVICE	TYPE	MANUFACTURER / MODEL	(CFM)	(HP)	PHASE	(F)	(F)	(FT)	(MBH)	(F)	(F)	(GPM)	(FT H2O)	(INCHES)	VALVE	(KW)	PHASE	NOTES
UH-01	SAFETY STORAGE 001	HORIZONTAL UNIT HEATER	TRANE / S-A18	500	16 WATTS	120/1	65	95	7	16.3	140	110	1.25	5	0.75	2-WAY PD	-	-	1,2,3,4
UH-02	STORAGE 003	HORIZONTAL UNIT HEATER	TRANE / S-A08	245	16 WATTS	120/1	65	95	8	8.0	140	110	0.75	5	0.75	2-WAY PD	-	-	1,2,3,4
UH-03	MECHANICAL 002	HORIZONTAL UNIT HEATER	TRANE / S-A25	580	25 WATTS	120/1	65	95	9	18.9	140	110	1.50	5	0.75	2-WAY PD	-	-	1,2,3,4
UH-A	P.D. STORAGE 006	HORIZONTAL UNIT HEATER	TRANE / UHEC07	700	1/50	-	60	94	9	-	-	-	-	-	-	-	7.5	208/3	1,2,3,4
UH-B	P.D. STORAGE 006	HORIZONTAL UNIT HEATER	TRANE / UHEC07	700	1/50	-	60	94	9	-	-	-	-	-	-	-	7.5	208/3	1,2,3,4
UH-C	SAFETY STORAGE 010	VERTICAL UNIT HEATER	TRANE / UHEC10	700	1/50	-	60	105	8	-	-	-	-	-	-	-	10.0	208/3	1,2,3,4
UH-D	STAIRWAY 004	HORIZONTAL UNIT HEATER	TRANE / UHEC05	400	1/125	-	60	99	8	-	-	-	-	-	-	-	5.0	208/3	1,2,3,4
UH-E	CORRIDOR 008	HORIZONTAL UNIT HEATER	TRANE / UHEC03	400	1/125	-	70	96	8	-	-	_	-	-	-	-	3.3	208/3	1,2,3,4

- 1. THE DESIGN SHOWN ON THE DRAWINGS IS BASED ON THE EQUIPMENT MANUFACTURER AND MODEL SCHEDULED AND IS INTENDED ONLY TO SHOW THE GENERAL SIZE, CONFIGURATION, LOCATION, CONNECTIONS AND SUPPORT FOR EQUIPMENT OR SYSTEMS SPECIFIED
- WITH RELATION TO THE OTHER BUILDING SYSTEMS. SEE SPECIFICATION SECTION 238239 FOR TECHNICAL REQUIREMENTS PERTAINING TO THE EQUIPMENT.
- 2. PROVIDE MOTOR-RATED DISCONNECT SWITCH.
- 3. PROVIDE FACTORY-FABRICATED WALL/CEILING SUPPORT. MOUNT AT SCHEDULED HEIGHT AFF TO BOTTOM OF HEATER UNLESS OTHERWISE NOTED ON PLANS.
- 4. UNIT-MOUNTED THERMOSTAT.

	COIL SCHED	ULE										
Γ			DIMENSION	NS	HEATING CC	IL						
			NOMINAL	NOMINAL	AIR				ELECTRIC			
			WIDTH	HEIGHT	COIL FLOW	EAT	LAT	MAX. APD	MIN. CAP.	DESIGN	VOLTAGE/	
	MARK	SERVICE	(IN)	(IN)	(CFM)	(F)	(F)	(IN WG)	(KW)	(KW)	PHASE	NOTES
	RHC-1	(E) OAU-1	16	12	1,250	5.0	68.0	0.10	25.0	25.0	208/3	1,2,3,4

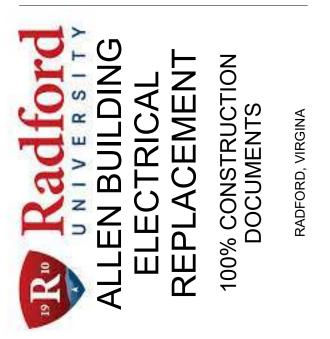
# NOTES:

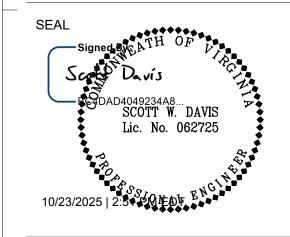
- 1. REFER TO SECTION 238216 FOR ADDITIONAL REQUIREMENTS.
- 2. COORDINATE COIL DIMENSIONS TO MATCH EQUIPMENT CASING OR DUCTWORK DIMENSIONS.
- 3. PROVIDE SCR CONTROLLER AND DISCONNECT FOR ELECTRIC HEATING COILS. COIL CAPACITIES SHALL BE NO LESS THAN MINIMUM AND NO MORE THAN THE
- ELECTRICAL DESIGN BASIS SCHEDULED.
- 4. FIELD VERIFY DUCT DIMENSIONS AND INTERNAL INSULATION THICKNESS.

# Dewberry

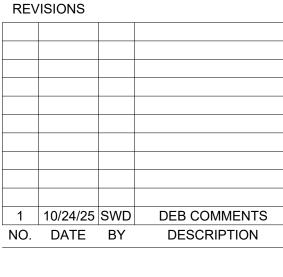
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DEB APROVAL





SCALE:



DRAWN BY	SMF
APPROVED BY	SWD
CHECKED BY	JMT
DATE	JULY 25, 2025

MECHANICAL

DEI PROJECT NO:
RADFORD PROJECT NO:

SHEET NO.

217-B5217-004

STEAM SYSTEM HEATING EQUIPMENT THAT WAS DEMOLISHED WILL BE REPLACED WITH TEMPORARY ELECTRIC HEATERS. THIS INCLUDES FIVE UNIT HEATERS AND ONE HEATING COIL LOCATED IN EXISTING OUTDOOR AIR UNIT, OAU-1. ELECTRIC HEATERS WILL BE REPLACED BY OTHERS AS PART OF THE FUTURE, PHASE 2 BUILDING RENOVATION PROJECT.

LEVEL CONTROLLERS ARE LOCATED THROUGHOUT THE BUILDING, INCLUDING THE FOLLOWING:

MECH RM 108 (METASYS FEC-2611; SERVES EXISTING OAU-1).

EXISTING FIELD CONTROLLERS ARE INTEGRATED WITH THE CENTRAL CAMPUS JCI SYSTEM VIA A SUPERVISORY CONTROLLER (METASYS SNE10501) LOCATED IN MECHANICAL ROOM 002.

CONTROLS SERVING EXISTING-TO-REMAIN EQUIPMENT AND SYSTEMS SHALL REMAIN IN SERVICE. REFER TO M0.03 FOR CRITICAL SYSTEMS AND COMPONENTS REQUIRING CONTINUOUS OPERATION AT

4. A NEW BAS SYSTEM COMPLYING WITH SECTION 239000 REQUIREMENTS SHALL BE PROVIDED TO SERVE THE NEW CENTRAL PLANT SYSTEMS AND EQUIPMENT. THE NEW SYSTEM SHALL INCLUDE A NEW SUPERVISORY LEVEL NETWORK CONTROLLER TO REPLACE THE EXISTING SNE10501 CONTROLLER. ALL EXISTING BUILDING CONTROLS, INCLUDING FIELD CONTROLLERS, DEVICES, AND SENSORS SHALL BE RECONNECTED AND FULLY INTEGRATED WITH THE EXISTING CAMPUS NETWORK. THE BAS SHALL INCLUDE ALL REQUIRED SENSORS, DEVICES, FIELD CONTROLLERS AND PANELS, NETWORK CONTROLLERS AND SERVERS, INTEGRATION WITH ALL EXISTING BUILDING SENSORS, DEVICES, AND FIELD CONTROLLERS, INTEGRATION WITH THE CAMPUS FRONT END OPERATOR INTERFACE, SOFTWARE AND ANY OTHER HARDWARE OR SOFTWARE COMPONENTS FOR A FULLY FUNCTIONING BAS SYSTEM.

ALL COMMISSIONING AND FUNCTIONAL TESTING WITH THE UNIVERSITY COMMISSIONING TEAM SHALL BE INCLUDED IN THIS CONTRACT AND CONSIST OF ALL PROCEDURES OUTLINED IN THE COMMISSIONING PROCEDURES.

### **BAS CONTROL SYSTEM GENERAL NOTES**

DEVICES OVER ETHERNET OR IP. REFER TO SECTION 239000 SPECIFICATIONS FOR DETAILED INFORMATION.

TIME DELAYS: TIME DELAYS NOTED IN THE SEQUENCES OF OPERATION ARE INTENDED TO ALLOW FOR FOR AN ASSOCIATED DAMPER TO OPEN. TIME DELAY DURATIONS SHALL BE DETERMINED WITH THE

SHALL START AT MINIMUM SPEED AND SLOWLY INCREASE UNTIL REACHING THE REQUIRED SPEED TO SATISFY THE REFERENCE SIGNAL. STARTING AT FULL SPEED AND SLOWING TO MEET SET POINT IS NOT

INSTALLED PACKAGED CONTROLS SHALL COME WITH BACNET INTERFACE CARDS THAT ALLOW FULL VISIBILITY OF INTERNAL CONTROL AND MONITORING POINTS. THIS REQUIREMENT SHALL INCLUDE CHILLERS AND BOILERS. ELECTRICAL OR INDUSTRIAL EQUIPMENT THAT IS NOT AVAILABLE WITH A DIRECT BACNET INTERFACE SHALL BE MODBUS.

REGAIN POWER CONTROL: ENABLE CHILLER AND BOILER AUTOMATIC RESTART 5 MINUTES (ADJ.) AFTER RESUMPTION OF POWER FROM AN OUTAGE. AUTOMATICALLY RESTART ALL OTHER EQUIPMENT BASED ON

POWER SUPPLY: POWER TO THE BAS SYSTEM SHALL BE MAINTAINED BY UPS FOR A POWER LOSS DURATION

SCHEDULING FUNCTIONS: PROVIDE A REAL TIME CLOCK AND SCHEDULE CONTROLLER WITH SUFFICIENT SCHEDULING CAPABILITY TO SCHEDULE ALL REQUIRED CONTROLLERS AND SEQUENCES. SET UP INITIAL

USER-ADJUSTABLE SCHEDULE. MINIMUM OF 10 SCHEDULES SHALL BE AVAILABLE FOR CURRENT AND FUTURE USE. UNLESS OTHERWISE DIRECTED BY THE OWNER / ENGINEER, USE THE FOLLOWING PRELIMINARY SCHEDULE:

SPACE SENSORS SHALL BE EQUIPPED WITH SETPOINT ADJUSTMENT AND OVERRIDE PUSH BUTTON STAINLESS STEEL FLAT PLATE SENSORS AND FLAT PLATE SENSORS WITH OVERRIDE.

#### MISCELLANEOUS CONTROL POINTS

OA TEMPERATURE, HUMIDITY & CARBON DIOXIDE PROVIDE BUILDING OUTDOOR AMBIENT REFERENCE SENSORS FOR TEMPERATURE, HUMIDITY AND CARBON DIOXIDE TO BE USED BY ALL HVAC BUILDING CONTROLLERS TO DETERMINE OUTSIDE AIR TEMPERATURE, HUMIDITY AND CARBON DIOXIDE LEVEL. COORDINATE SENSOR LOCATION WITH OWNER.

<u>LIGHTING CONTROLS:</u> RECONNECT ANY EXISTING LIGHTING CONTROL ZONES AND RELAYS. REFER TO 1/M0.03 FOR REQUIREMENTS FOR EXTERIOR LIGHTING RELAY PANEL 'FC'. CONFIRM DETAILED REQUIREMENTS WITH OWNER

<u>FIRE ALARM SYSTEM</u> BAS SHALL SEND THE APPROPRIATE HVAC SHUTDOWN SIGNALS IN THE EVENT

THE FIRE ALARM PANEL IS IN ALARM. PROPANE STORAGE TANK FILL LEVEL: PROVIDE PROPANE STORAGE TANK LEVEL SENSOR AT A MINIMUM OF ONE PROPANE TANK. COORDINATE INSTALLTION WITH OWNERS TANK SUPPLIER.

MONITOR FILL LEVEL ON 15 MIN. (ADJ) INTERVALS AND ALARM BAS WHEN WHEN TANK LEVEL FALLS BELOW 25%. REFER TO CIVIL DRAWINGS FOR TANK FARM LOCATION.

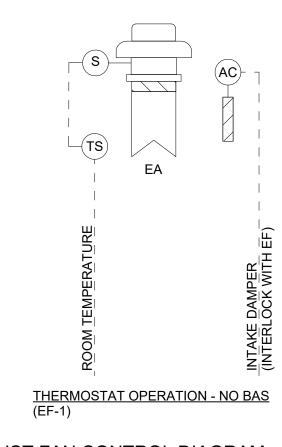
EXISTING DOMESTIC WATER METER: RECONNECT EXISTING DOMESTIC WATER METER IN MECHANICAL ROOM 002 TO THE BAS. REFER TO 2/M1.12 FOR APPROXIMATE METER LOCATION.

**EXISTING ELECTRIC METER DEMAND & CONSUMPTION CONNECTIONS TO THE EXISTING ELECTRIC** METER MUST BE MAINTAINED DURING CONSTRUCTION AND TRANSFERRED TO THE NEW BAS PRIOR TO PROJECT COMPLETION. THIS INCLUDES MONITORING AND CONTROL CONNECTIONS TO RADFORD CITY ELECTRIC SUBSTATION AS REQUIRED FOR THE ENERGY SAVINGS/DEMAND LIMITING CONTROLS ON CAMPUS. THE EXISTING CONNECTION TO THE DEMAND RESPONSE VENDOR (VOLTUS ENERGY) MUST ALSO BE MAINTAINED. THIS IS USED TO PROVIDE RADFORD UNIVERSITY DATA FOR DEMAND RESPONSE PARTICIPATION IN THE VIRGINIA ENERGY DEPARTMENT PROGRAM. FIELD VERIFY CONNECTION REQUIREMENTS SHOWN WITH OWNER. REFER TO CRITICAL SYSTEM NOTES AND PHOTOGRAPH ON DRAWING MO.03 FOR ADDITIONAL INFORMATION.

HEAT TRACE CONTROLS: BAS SHALL ALARM ON HEAT TRACE SYSTEM FAULT OR WHEN SYSTEM POWER IS TURNED OFF AND OUTSIDE AIR TEMPERATURE FALLS BELOW 45 DEF. F. HEAT TRACE OPERATION SHALL BE LOCKED OUT WHEN OUTDOOR AIR TEMPERATURE RISES ABOVE 40°F. REFER TO MECHANICAL DETAILS AND HEAT TRACING SPECIFICATION 230533.

CAMPUS OA INTAKE EMERGENCY CLOSURE/RESET SWITCH BAS INTERFACE AND FUNCTIONALITY OF THE EMERGENCY OUTDOOR AIR INTAKE SHUTDOWN SWITCH LOCATED IN EMERGENCY COMMUNICATIONS 132 SHALL BE MAINTAINED DURING CONSTRUCTION AND TRANSFERRED TO THE NEW BAS PRIOR TO PROJECT COMPLETION. FIELD VERIFY CONNECTION REQUIREMENTS SHOWN WITH OWNER. REFER TO CRTICAL SYSTEMS REQUIREMENTS ON M0.03 FOR ADDITIONAL

TREND LOGS: PROVIDE TREND LOGS FOR BOILER OPERATION, CHILLER OPERATION, PUMP OPERATION, AIR HANDLING UNIT OPERATION AND ENERGY RECOVERY UNIT OPERATION AT OWNER'S DISCRETION. COORDINATE WITH OWNER FOR EXACT REQUIREMENTS OF TREND LOG REQUIREMENTS.



### **EXHAUST FAN CONTROL DIAGRAM**

#### **EXHAUST FAN CONTROL**

THERMOSTAT FAN CONTROL: OPEN MOTOR-OPERATED INTAKE DAMPER (WHERE APPLICABLE) AND START FAN (TIME DELAY) BASED ON A RISE IN SPACE TEMPERATURE ABOVE THE SPACE TEMPERATURE SET POINT. STOP FAN AND CLOSE MOTOR-OPERATED INTAKE DAMPER (WHERE APPLICABLE) (TIME DELAY) WHEN SPACE TEMPERATURE DROPS 1F BELOW SET POINT.

SPACE SET POINTS: MECHANICAL/ELECTRICAL ROOMS = 85F

#### **HW UNIT HEATER CONTROL**

GENERAL: PROVIDE UNIT-MOUNTED ADJUSTABLE THERMOSTAT. CYCLE FAN ON AND OPEN HW CONTROL VALVE TO MAINTAIN SETPOINT AS TEMPERATURE DROPS BELOW THERMOSTAT SETPOINT. PROVIDE AQUASTAT TO PREVENT FAN OPERATION IF HOT WATER SUPPLY DROPS BELOW 90F. DEENERGIZE FAN AND CLOSE HW VALVE WHEN OUTSIDE AIR TEMP RISES ABOVE 60F ADJUSTABLE

**SPACE SET POINTS**: MECHANICAL/ELECTRICAL ROOMS = 60F STAIRWELLS = 60F STORAGE ROOMS = 60F

MONITOR AND TREND: SPACE TEMPERATURE (15 MINUTE INTERVALS)

ALARM BAS: SPACE TEMPERATURE FALLS 10F (ADJ.) BELOW SETPOINT



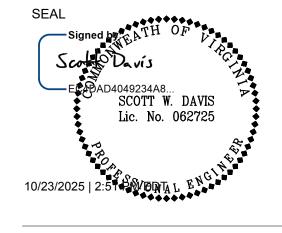
# Dewberry Dewberry Engineers Inc.

9300 Harris Corners Parkway Suite 220 Charlotte, NC 28269-3797 704.509.9918 NC License No. F-0929

DEB APROVAL

STATE BUILDING OFFICIAL





KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

DRAWN BY APPROVED BY CHECKED BY JULY 25, 2025

**MECHANICAL** CONTROLS

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

# **CONTROLS SCOPE:**

#### 1. GENERAL PROJECT DESCRIPTION:

A. THIS PROJECT CONSISTS OF A FULL REPLACEMENT OF THE ALLEN BUILDING CENTRAL HEATING AND COOLING PLANT LOCATED IN AND DIRECTLY OUTSIDE OF MECHANICAL ROOM 002 LOCATED ON THE GROUND FLOOR OF THE BUILDING. EXISTING HOT WATER AND CHILLED WATER PIPING MAINS FROM THE PLANT WILL BE DISCONNECTED FROM BUILDING DISTRIBUTION MAINS AT MECHANICAL ROOM 002 WALL. HEATING AND COOLING SYSTEM EQUIPMENT AND PIPING WITHIN MECHANICAL ROOM 002 WILL BE FULLY DEMOLISHED, INCLUDING STEAM TO HOT WATER EXCHANGER, DUPLEX STEAM CONDENSATE PUMP, CHILLED AND HOT WATER PUMPS, ASSOCIATED PIPING ACCESSORIES, AND AIR-COOLED CHILLER LOCATED OUTSIDE.

EXISTING STEAM AND STEAM CONDENSATE SYSTEMS WILL BE DEMOLISHED THROUGHOUT THE ENTIRE BUILDING, COMPLETE WITH ASSOCIATED EQUIPMENT, PIPING AND ACCESSORIES.

ALL EXISTING HVAC SYSTEMS IN THE BUILDING THAT ARE LOCATED OUTSIDE OF MECHANICAL ROOM 002 WILL REMAIN FOR CONTINUED SERVICE WITH THE EXCEPTION OF THE EXISTING STEAM SYSTEMS AND ITEMS SPECIFICALLY NOTED ON THE DEMOLITION DRAWINGS.

D. NEW CHILLED WATER AND HEATING HOT WATER EQUIPMENT AND RELATED COMPONENTS WILL BE INSTALLED IN AND DIRECTLY OUTSIDE OF MECHANICAL ROOM 002. THE NEW CHW PLANT WILL CONSIST OF ONE AIR-COOLED CHILLER, TWO CHILLED WATER PUMPS, PIPING, ACCESSORIES, AND CONTROLS. THE NEW HW PLANT WILL CONSIST OF TWO GAS-FIRED BOILERS, PROPANE STORAGE SYSTEM WITH FUEL SUPPLY PIPING, TWO PRIMARY AND TWO SECONDARY PUMPS, PIPING, HYRDONIC ACCESSORIES, THREE HW UNIT HEATERS, AND HEATING SYSTEM CONTROLS. SUPPLY AND RETURN PIPING FROM THE NEW HOT AND CHILLED WATER SYSTEMS WILL BE CONNECTED TO THE EXISTING BUILDING CHILLED AND HOT WATER DISTRIBUTION MAINS IN THE CORRIDOR DIRECTLY OUTSIDE MECHANICAL ROOM 002.

2. EXISTING BUILDING CONTROLS CONSIST OF OLDER GENERATION JCI METASYS COMPONENTS. FIELD

MECHANICAL ROOM 002 (METASYS DX-9100; SERVES CENTRAL PLANT) P.D. STORAGE 006 (METASYS DX-9100; SERVES EXISTING AHU-1), AND

DESCRIPTION: OPEN ARCHITECTURE SYSTEM SHALL VIEW, MONITOR AND CONTROL BACNET PROTOCOL

SET POINTS: ALL SET POINTS AND NUMERIC VALUES SHALL BE ADJUSTABLE

OTHER DEVICES TO ACT IN ADVANCE. FOR EXAMPLE, A FAN NOTED TO START ON A TIME DELAY IS WAITING ENGINEER ONCE THE ACTUATORS HAVE BEEN SELECTED.

VARIABLE SPEED DRIVE OPERATION WHEN A FAN OR PUMP IS STARTED, THE VARIABLE FREQUENCY DRIVE

EQUIPMENT WITH PACKAGED CONTROLS: HVAC EQUIPMENT THAT COMES EQUIPPED WITH FACTORY-

THE OCCUPANCY SCHEDULE.

OF UP TO 30 MINUTES.

OCCUPANCY AND SYSTEM CONTROL SCHEDULES IN COORDINATION WITH THE OWNER. OCCUPANCY SCHEDULE EACH TEMPERATURE CONTROL ZONE SHALL REFERENCE A USER-DEFINED AND

OCCUPIED: MON. – SUN. 12:00 AM – 12:00 AM

SPACE SENSORS: ALL SPACE SENSORS SHALL BE COMBINATION TEMPERATURE / HUMIDITY SENSORS. ALL (ASSOCIATED SYSTEM SHALL OPERATE FOR 90 MINUTE PERIOD (ADJ.)). REFER TO PLANS FOR LOCATIONS OF

NOTES AND CONTROLS LEGEND.

PROVIDE PROPANE STORAGE TANK FARM SUPPLY PRESSURE SENSOR. LOCATE BETWEEN 1ST STAGE SUPPLY REGULATOR AND 2ND STAGE MAIN BUILDING REGULATOR. MONITOR LINE PRESSURE AT BAS AND SEND NOTIFICATION IF PRESSURE DROPS BELOW 6 PSI, AND ALARM IF PRESSURE DROPS BELOW 4 PSI. COORDINATE SENSOR INSTALLATION REQUIREMENTS WITH PROPANE STORAGE SYSTEM SUPPLIER.

CARBON MONOXIDE DETECTOR WITH AUDIBLE ANNUNCIATION & AUXILIARY CONTACTS IN BOILER ROOM. WIRE AUX. CONTACTS TO BAS AS INDICATED. REFER TO 2/M1.12 FOR LOCATION(S) AND SECTION 239010 FOR SENSOR REQUIREMENTS.

EMERGENCY POWER-OFF PUSHBUTTON AT BOILER ROOM EXIT DOOR. RE: BOILER ROOM ENLARGED PLAN 2/M1.12 FOR LOCATION.

DP SENSOR IS FUTURE TO BE INSTALLED IN PHASE II, BY OTHERS. PROVIDE SPARE I/O POINT FOR FUTURE DP SENSOR. PROVIDE PROGRAMMING THAT CAN BE TURN ON IN PHASE II TO ALLOW FOR THE SECONDARY HOT WATER PUMPS TO MODULATE TO MAINTAIN A SET DP.

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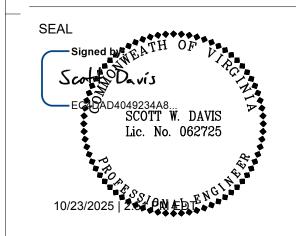
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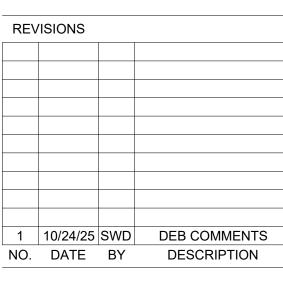
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KEY PLAN:

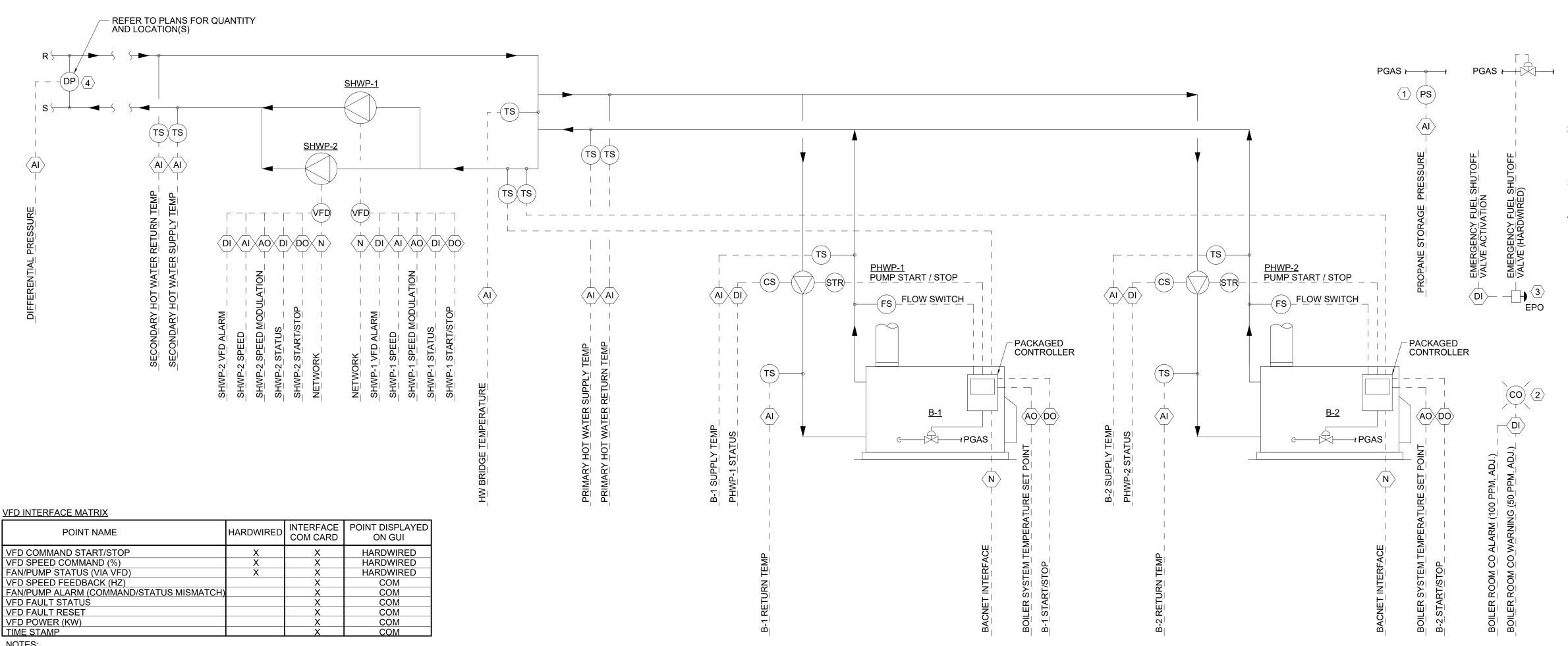
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DRAWN BY	SMF
APPROVED BY	SWE
CHECKED BY	JMT
DATE	JULY 25, 2029

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.



# SECONDARY PUMPING CONTROL

<u>DESCRIPTION</u>: ACTIVE / STANDBY SECONDARY PUMPING CONFIGURATION AS PART OF THE HEATING WATER SYSTEM. ACTIVE AND STANDBY PUMPS ARE EACH SIZED FOR 100% OF SYSTEM CAPACITY TO PROVIDE N+1 REDUNDANCY.

PROVIDE DIRECT INTERFACE TO VFD. MAP ALL AVAILABLE POINTS TO THE BAS HARDWIRE INDICATED POINTS. DISPLAY HARDWIRED POINTS AND VFD ALARM ON

SEPARATE VFD GRAPHIC (LINKED TO THE EQUIPMEMT GRAPHIC).

EQUIPMENT GRAPHIC. ALL OTHER (INTERFACE) POINTS MAY BE DISPLAYED ON A

# OPERATIONAL MODES

ENABLE / DISABLE MODES ENABLE / DISABLE SECONDARY PUMPS BASED ON SYSTEM STATUS.

SHUTDOWN MODE: SWITCH TO SHUTDOWN MODE BASED ON AUTOMATIC SAFETY FUNCTION, REMOTE OVERRIDE, OR MANUAL OVERRIDE CONTROL.

# OVERRIDE MODES

EMERGENCY OVERRIDE MODE SWITCH TO SHUTDOWN MODE BASED ON EMERGENCY SHUTDOWN SIGNAL

REMOTE OVERRIDE MODE: SWITCH TO ENABLED OR DISABLED MODE BASED ON BAS OPERATOR COMMAND. SWITCH BACK TO ENABLED OR DISABLED MODE WHEN OVERRIDE IS REMOVED.

VARIABLE FREQUENCY DRIVE CONTROL: VFD WILL OPERATE AT A CONSTANT SPEED AS DETERMINED DURING FINAL TAB TO SERVE THE EXISTING BUILDING PIPING SYSTEM WITH 3-WAY EQUIPMENT CONTROL VALVES.

SECONDARY PUMP CONTROL - ACTIVE / STANDBY: ASSIGN ONE SECONDARY PUMP 'ACTIVE' AND ONE PUMP 'STANDBY' STATUS. OPERATE SECONDARY PUMPS IN ACTIVE / STANDBY DUTY. ROTATE SECONDARY PUMPS ACTIVE / STANDBY ORDER BASED ON RUNTIME WEEKLY AT A SET TIME ON A SET DAY OF THE WEEK. START STANDBY PUMP IF ACTIVE PUMP FAILS.

# PUMP ROTATION DEFAULT SCHEDULE

HEATING WATER 12:00 PM TUESDAYS

PUMP START / STOP: START ACTIVE SECONDARY PUMP BASED ON SYSTEM ENABLE / DISABLE STATUS. SECONDARY PUMP SHALL RUN ANYTIME A BOILER PRIMARY PUMP IS RUNNING.

# PUMP SPEED CONTROL: ACTIVE PUMP SHALL OPERATE AT A CONSTANT SPEED.

PUMP ACTIVE / STANDBY TRANSITION: WHEN A TRANSITION IS COMMANDED, THE STANDBY PUMP SHALL START AND RUN AT MINIMUM SPEED (20%). THE STANDBY PUMP SHALL SLOWLY MODULATE ITS SPEED UP AND THE ACTIVE PUMP INVERSELY MODULATE DOWN UNTIL THE ACTIVE PUMP IS AT MINIMUM SPEED (20%) AND THE STANDBY PUMP REACHES IT'S PREDETERMINED OPERATING SPEED. THE STANDBY PUMP SHALL BE ASSIGNED AS 'ACTIVE' AND THE ACTIVE PUMP SHALL BE 'STANDBY'. THE NEWLY ASSIGNED STANDBY PUMP SHALL SHUTDOWN.

# HEATING WATER SYSTEM GRAPHICAL DISPLAY. MINIMUM REQUIREMENTS INCLUDE:

COMPLETE SYSTEM GRAPHIC INCLUDING ALL CONTROL COMPONENTS BUILDING PLAN GRAPHIC WITH BOILER AND PUMP LOCATIONS OPERATIONAL MODE STATUS, INCLUDING TIME OF DAY OVERRIDE MODE STATUS ENTERING AND LEAVING HEATING WATER TEMPERATURES OF EACH BOILER PRIMARY AND SECONDARY LOOP HEATING WATER SUPPLY AND RETURN TEMPERATURES SECONDARY HEATING WATER SUPPLY TEMPERATURE SET POINT PRIMARY HEATING WATER PUMP STATUS AND RUN TIMES SECONDARY HEATING WATER PUMP STATUS AND RUN TIMES SECONDARY PUMP OPERATING SPEEDS BOILER STATUS AND FIRING RATES ALL ALARMS

# **HEATING WATER SYSTEM CONTROL**

<u>DESCRIPTION</u>: TWO EQUAL-CAPACITY CONDENSING-TYPE WATER BOILERS WITH PRIMARY-SECONDARY PUMPING. **OPERATIONAL MODES** 

# HEATING PLANT ENABLE: HEATING PLANT SHALL BE ENABLED WHENEVER

- MANUALLY SELECTED TO RUN BY BAS REMOTE OVERRIDE
- OR, OAT IS LESS THAN 50F (ADJ.) OR, THERE IS A CALL FOR THE HEATING SYSTEM TO RUN FROM ANY AHU, TERMINAL UNIT, OR UNIT
- HEATER FOR 10 MINUTES (ADJ.) OR, AHU IS TRIPPED DUE TO A FREEZE CONDITION

CONDENSING BOILER WITH PRIMARY SECONDARY PUMPING CONTROL DIAGRAM

AND, EMERGENCY STOP BUTTON IS NOT ENABLED 6. AND, HEATING SYSTEM IS NOT MANUALLY DISABLED BY BAS REMOTE OVERRIDE

# HEATING PLANT DISABLE: HEATING PLANT SHALL BE DISABLED WHENEVER

- MANUALLY DISABLED BY BAS REMOTE OVERRIDE OR, EMERGENCY STOP BUTTON IS ENABLED
- OR, OAT IS LESS THAN 50F (ADJ.) AND THERE IS NO CALL FOR THE HEATING SYSTEM TO RUN FROM ANY AHU OR TERMINAL UNIT FOR 5 MINUTES (ADJ.)
- SHUTDOWN MODE: SWITCH TO SHUTDOWN MODE BASED ON AUTOMATIC SAFETY FUNCTION, REMOTE OVERRIDE, OR MANUAL OVERRIDE CONTROL.

# **OVERRIDE MODES**

EMERGENCY OVERRIDE MODE SWITCH TO SHUTDOWN MODE BASED ON MANUAL ACTIVATION OF ANY ONE EMERGENCY SHUTDOWN SWITCH LOCATED AT EACH BOILER ROOM EXIT DOOR. SWITCH BACK TO ENABLED / DISABLED MODE WHEN SHUTDOWN SWITCH HAS BEEN MANUALLY RESET.

REMOTE OVERRIDE MODE: SWITCH TO ENABLED OR DISABLED MODE BASED ON BAS OPERATOR COMMAND. SWITCH BACK TO ENABLED / DISABLED MODE WHEN OVERRIDE IS REMOVED.

# TEMPERATURE CONTROL

<u>LEAVING WATER TEMPERATURE (LWT) SET POINT CONTROL</u>: RESET HEATING WATER SUPPLY SET POINT **BASED ON OA TEMPERATURE:** 

LWT = 180F (ADJ) WHEN OAT < 35F

LWT = 180F (ADJ) TO 120F LINEARLY WHEN OAT = 35F TO 75F LWT = 120F (ADJ) WHEN OAT > 75F

BOILER AND PRIMARY PUMP CONTROL: THE BOILER SHALL START THE ASSOCIATED PRIMARY PUMP. WITH PROOF OF PRIMARY WATER FLOW AND COMBUSTION AIR, START BOILER AT MINIMUM FIRING RATE. MODULATE BURNER TO MAINTAIN BOILER SUPPLY TEMPERATURE SET POINT. BOILER SUPPLY TEMPERATURE SET POINT SHALL BE EQUAL TO SECONDARY HEATING WATER TEMPERATURE SET POINT. WHEN COMMANDED OFF, STOP BOILER, STOP PRIMARY PUMP (2 MINUTE TIME DELAYOR GREATER AS RECOMMENDED BY BOILER MFG.

BOILER MINIMUM RUN-TIMES EACH BOILER SHALL RUN FOR MINIMUM 15 MINUTES ONCE COMMANDED ON. OVERRIDE MINIMUM RUN-TIME IF COMMANDED OFF BY OPERATOR OR EMERGENCY OVERRIDES.

BOILER BAS INTERFACE: PACKAGED BOILER CONTROLS SHALL PROVIDE BACNET COMPATIBLE MONITORING POINTS INCLUDING BOILER STATUS AND ALARMS.

# HEATING WATER SYSTEM CONTROL(CONTINUED)

BOILER STAGING & RUN TIME: ASSIGN EACH BOILER A LEAD / LAG ORDER FROM 1 TO 2. ROTATE BOILERS LEAD / LAG ORDER WEEKLY BASED ON RUNTIME AT A SET TIME ON A SET DAY OF THE WEEK (DEFAULT AT 12:00 PM

HEATING WATER TEMPERATURE: IF LEAD BOILER IS OPERATING ABOVE 95% AND SECONDARY HHW TEMPERATURE REMAINS MORE THAN 5F (ADJ) BELOW SET POINT FOR 5 MINUTES (ADJ), START LAG BOILER. MODULATE THE FIRING RATE OF THE LAG BOILER TO MAINTAIN SUPPLY HOT WATER SETPOINT. DISABLE LAG BOILER IF HHW TEMPERATURE REMAINS 5F (ADJ) ABOVE SET POINT FOR 10 MINUTES (ADJ) OR HHW SYSTEM IS NO LONGER BEING REQUESTED.

BOILER FAILURES: START LAG BOILER IF AN ACTIVE BOILER OR ASSOCIATED PRIMARY PUMP FAILS AS DETERMINED BY THE BOILER CONTROL PANEL. STOP ALL ASSOCIATED HHW PUMPS IF BOILER SAFETY SHUTDOWN CONTACT CLOSES.

# FUEL SERVICE SUPPLY VALVE CONTROL

FUEL SERVICE EMERGENCY SHUTOFF. CLOSE VALVE UPON EMERGENCY OR REMOTE OVERRIDE SIGNAL OTHERWISE REMAIN OPEN.

# SAFETY AND ALARM CONTROLS

EMERGENCY SHUTDOWN CONTROL: IMMEDIATELY CLOSE MAIN BOILER SYSTEM FUEL VALVE AND SHUT DOWN HEATING WATER SYSTEM TO AVOID DAMAGE WHEN AN EMERGENCY SHUTDOWN BUTTON IS MANUALLY ACTIVATED OR A GENERAL ALARM SIGNAL IS RECEIVED FROM THE FIRE ALARM PANEL.

GENERAL ALARMS CONTROL: ALARM BAS OF THE FOLLOWING CONDITIONS:

ACTIVATION OF EMERGENCY SHUTDOWN CONTROL BOILER ROOM CARBON MONOXIDE DETECTION BOILER ALARMS AND FAILURES PRIMARY HEATING WATER PUMP FAILURES SECONDARY HEATING WATER PUMP FAILURES

# **FUEL SERVICE SUPPLY VALVE NOTES**

PROVIDE FULL LINE SIZE TWO-WAY TWO-POSITION MOTORIZED GAS VALVE TO SHUTOFF AND ISOLATE FUEL SOURCE FROM THE BOILER ROOM. THE VALVE SHALL FAIL IN POSITION. REFER TO SECTION 231126 FOR VALVE INFORMATION.

SHUTDOWN MODE: SWITCH TO SHUTDOWN MODE BASED ON AUTOMATIC SAFETY FUNCTION OR REMOTE OVERRIDE

# OVERRIDE MODES

REMOTE OVERRIDE MODE SWITCH TO ENABLED OR DISABLED MODE BASED ON BAS OPERATOR COMMAND. SWITCH BACK TO ENABLED / DISABLED MODE WHEN OVERRIDE IS REMOVED.

CHILLER AND PRIMARY PUMP CONTROL: START ACTIVE PRIMARY CHILLED WATER PUMP. START CHILLER WITH PROOF OF PRIMARY WATER FLOW. PACKAGED CHILLER CONTROLS SHALL OPERATE CHILLER TO MAINTAIN CHILLED WATER SUPPLY TEMPERATURE SET POINT. IF CHILLER IS OPERATING BELOW 50% OF IT'S RLA CAPACITY FOR 15 MINUTES THEN STOP CHILLER AND ACTIVE PRIMARY PUMP.

TEMPERATURE SETPOINT: CHILLER SUPPLY TEMPERATURE SHALL BE CONTROLLED BY ITS CHILLER CONTROL PANEL. THE BAS SHALL SEND A CHILLED WATER SUPPLY TEMPERATURE SETPOINT COMMAND TO THE CHILLER CONTROL PANEL. THE SETPOINT SHALL BE CAPABLE OF BEING RESET LINEARLY FROM 44°F CHILLED WATER SUPPLY TEMPERATURE, AT 85°F OUTSIDE AIR TEMPERATURE TO 50°F CHILLED WATER SUPPLY TEMPERATURE, AT 60°F OUTSIDE AIR TEMPERATURE. THE INITIAL SET POINT FOR THE CHILLED WATER SUPPLY TEMPERATURE SHALL BE 44°F (ADJ.).

CHILLER FREEZE PROTECTION: PACKAGED CHILLER CONTROL PANEL SHALL COMMAND ACTIVE PRIMARY PUMP TO START TO PREVENT FREEZING DUE TO REFRIGERANT MIGRATION. CONTROL SHALL BE DIRECT FROM THE CHILLER PANEL TO THE PUMP MOTOR-STARTER AND PARALLEL TO THE BAS START / STOP SIGNAL SUCH THAT EITHER SIGNAL WILL START THE PUMPS.

CHILLER FAILURES: START LAG ACTIVE PUMP AND CHILLER IF CHILLER / PUMP FAILS AS DETERMINED BY THE CHILLER CONTROL PANEL.

STOP PRIMARY PUMP IF CHILLER SAFETY SHUTDOWN CONTACT CLOSES. STOP PRIMARY PUMP IF CHILLER HAS BEEN COMMANDED TO START BUT INTERNAL SENSORS OF THE CHILLER INDICATE NO MOTOR AMPERAGE WITHIN 5 MINUTES.

CHILLER BAS INTERFACE: PACKAGED CHILLER CONTROLS SHALL PROVIDE BACNET COMPATIBLE MONITORING POINTS INCLUDING CHILLER STATUS AND ALARMS. BACNET CONTROLLER SHALL BE FULLY OPEN PROTOCOL, COMPATIBLE WITH THE CAMPUS-WIDE JCI BAS SYSTEM, CERTIFIED IN COMPLIANCE WITH BACNET TESTING LABORATORY REQUIREMENTS (V12 OR LATER).

MONITOR AND TREND (INCLUDED ON CHILLED WATER SYSTEM GRAPHIC) ENTERING AND LEAVING CHILLED WATER TEMPERATURES AT CHILLER (15 MINUTE INTERVALS) PRIMARY CHILLED WATER SUPPLY TEMPERATURE SET POINT PRIMARY CHILLED WATER PUMP STATUS (5 MINUTE INTERVALS) BY CURRENT SENSING RELAY PRIMARY CHILLED WATER PUMP RUN TIMES

CHILLER ALARMS AND FAILURES PRIMARY CHILLED WATER PUMP FAILURES

CHILLER STATUS

OVERRIDE MODE STATUS PUMP STATUS AND RUN TIMES

EMERGENCY SHUTDOWN SIGNAL FROM SYSTEM.

FREEZE PROTECTION: SWITCH TO ENABLED MODE BASED ON A CALL FROM THE BAS FOR COIL FREEZE PROTECTION.

REMOTE OVERRIDE MODE SWITCH TO ENABLED OR DISABLED MODE BASED ON BAS

OVERRIDE IS REMOVED. PRIMARY PUMP CONTROL - ACTIVE / STANDBY: ASSIGN ONE PUMP 'ACTIVE' AND ONE PUMP 'STANDBY' STATUS. OPERATE PUMPS IN ACTIVE / STANDBY DUTY. ROTATE PUMPS

OPERATOR COMMAND. SWITCH BACK TO ENABLED OR DISABLED MODE WHEN

ACTIVE / STANDBY ORDER BASED ON RUNTIME WEEKLY AT A SET TIME ON A SET DAY OF THE WEEK. IF ACTIVE PUMP IS OPERATING WHEN ROTATION IS COMMANDED, DELAY ROTATION UNITIL ACTIVE PUMP STOPS. START STANDBY PUMP IF ACTIVE PUMP FAILS.

#### PUMP ROTATION DEFAULT SCHEDULE CHILLED WATER 12:00 PM TUESDAYS

PUMP START / STOP: START ACTIVE PRIMARY PUMP BASED ON SYSTEM ENABLE / DISABLE STATUS. IF BAS LOSES COMMUNICATION WITH BUILDING, MAINTAIN PUMP OPERATION UNTIL COMMUNICATION IS RE-ESTABLISHED.

CHILLED WATER SYSTEM GRAPHICAL DISPLAY. MINIMUM REQUIREMENTS INCLUDE:

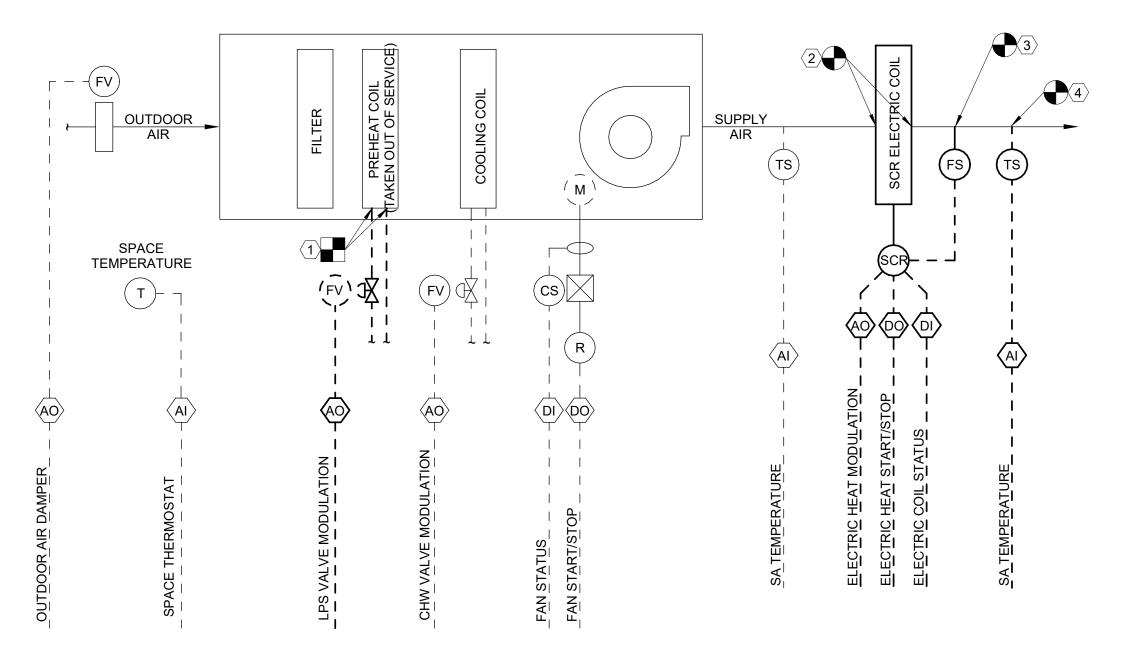
COMPLETE SYSTEM GRAPHIC INCLUDING ALL CONTROL COMPONENTS BUILDING PLAN GRAPHIC WITH CHILLER AND PUMP LOCATIONS OPERATIONAL MODE STATUS, INCLUDING TIME OF DAY

**GENERAL NOTES:** 

REFER TO M7.01 FOR BAS CONTROL SYSTEM GENERAL NOTES AND CONTROLS LEGEND.

### **#** KEY NOTES

- 1 STEAM PREHEAT COIL TAKEN OUT OF SERVICE. REFER TO PLANS FOR PIPING CHANGES. REMOVE STEAM CONTROL VALVE
- 2 NEW ELECTRIC HEAT COIL. PROVIDE BAS INTERFACE AS
- INDICATED. 3 PROVIDE AIRFLOW PROVING SWITCH AND WIRE TO COIL
- CONTROLLER AS INDICATED.
- 4 PROVIDE SA TEMPERATURE SENSOR AS INDICATED.



EXISTING OUTDOOR AIR UNIT CONTROL DIAGRAM (OAU-1)

# **EXISTING OAU-1 CONTROL**

- A. SUPPLY FAN: BAS SHALL CONTROL THE STARTING AND STOPPING OF THE FAN AS FOLLOWS:
  - START/STOP: BAS SHALL COMMAND THE OPERATION OF THE CONSTANT VOLUME SUPPLY FAN BASED ON THE OCCUPANCY SCHEDULE. OA DAMPER SHALL OPEN. FAN SHALL START AND RUN CONTINUOUSLY DURING OCCUPIED
  - PROOF: BAS SHALL PROVE FAN OPERATION AND USE THE STATUS INDICATION TO ACCUMULATE RUNTIME. UPON FAILURE OF THE FAN, BAS SHALL ENUNCIATE AN ALARM.
- B. SUPPLY AIR TEMPERATURE CONTROL:
  - COOLING OPERATION: WHEN OAT RISES ABOVE 75F, BAS SHALL MODULATE THE CHW COOLING COIL CONTROL VALVE TO MAINTAIN COOLING SUPPLY AIR TEMPERATURE SETPOINT OF 75F.
  - 2. HEATING OPERATION: WHEN OAT FALLS BELOW 60F, BAS SHALL MODULATE THE ELECTRIC HEATING COIL TO MAINTAIN HEATING SUPPLY AIR TEMPERATURE SETPOINT OF 70F.
  - 3. DEADBAND OPERATION: WHEN OAT IS BETWEEN 60F AND 75F, HEATING AND COOLING SHALL BE DISABLED.

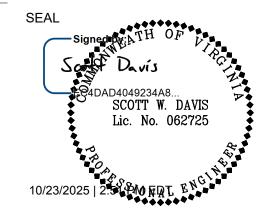
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DEB APROVAL

STATE BUILDING OFFICIAL





KEY PLAN:

SCALE:

REVISIONS 1 10/24/25 SWD DEB COMMENTS NO. DATE BY DESCRIPTION

SWD APPROVED BY CHECKED BY JULY 25, 2025

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004

SHEET NO.

DRAWN BY

# KEY NOTES

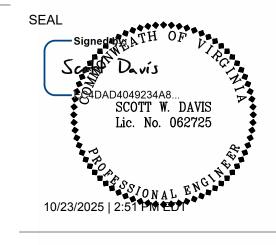
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KEY PLAN:

SCALE:

REVISIONS						
1	10/24/25	SWD	DEB COMMENTS			
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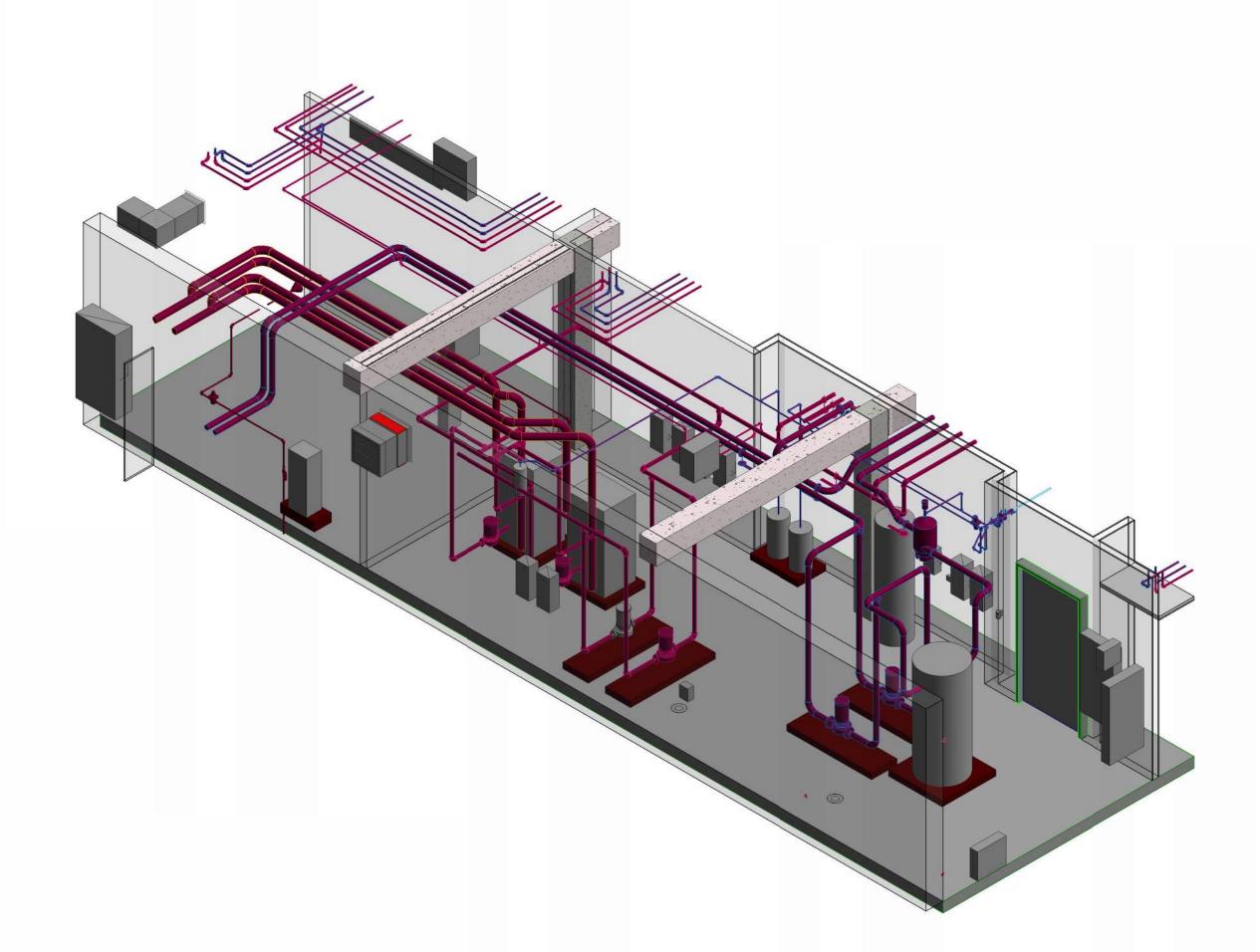
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ISOMETRICS, PERSPECTIVES

DEI PROJECT NO: RADFORD PROJECT NO: 217-B5217-004 SHEET NO.

M9.01

1 ISOMETRIC VIEW OF BOILER ROOM LOOKING WEST Scale: N.T.S.



2 ISOMETRIC VIEW OF BOILER ROOM LOOKING NORTH Scale: N.T.S.