DUCT SYMBOLS

DOUBLE LINE SYMBOL	DESCRIPTION	SINGLE LINE SYMBOL
20x16	DUCT- FIRST NUMBER IS VISIBLE DIMENSION.	20x16
R	RADIUS ELBOW W/VANE(S) (1.5=R/D STANDARD)	R
	DUCT SECTION, POSITIVE PRESSURE	
	DUCT SECTION, NEGATIVE PRESSURE	
	AIR DEVICE, RETURN/EXHAUST- SIDEWALL.	
	VOLUME DAMPER	
	FIRE DAMPER	
S D	SMOKE DETECTOR	
	MOTORIZED DAMPER	
T	THERMOSTAT	
H	HUMIDISTAT	
T S	TEMPERATURE SENSOR	
H S	HUMIDITY SENSOR	

MECHANICAL DRAWING LIST

CODE COMPLIANCE

ALL WORK AND MATERIAL SHALL BE PERFORMED AND INSTALLED IN COMPLIANCE WITH THE FOLLOWING CODES AS ADOPTED AND AMENDED BY THE INSPECTING AUTHORITY. NOTHING IN THESE DRAWINGS IS TO BE CONSTRUCTED TO PERMIT WORK NOT CONFORMING TO THESE CODES OR OTHERS APPLICABLE TO THESE PROJECT:

A. MICHIGAN BUILDING CODE 2012

B. MICHIGAN PLUMBING CODE 2015

C. MICHIGAN MECHANICAL CODE 2015

D. MICHIGAN UNIFORM ENERGY CODE 2015 (2013-ASHRAE 90.1)

MECHANICAL ABBREVIATIONS

FFU	FAN FILTER UNIT
RAG	RETURN AIR GRILLE
HEPA	HIGH EFFICIENCY PARTICULATE AIR
RTU	ROOF TOP UNT
VD	VOLUME DAMPER
SA	SUPPLY AIR
RA	RETURN AIR
OA	OUTSIDE AIR
EXFIL	EXFILTRATION
PA	PASCAL
DH	DEHUMIDIFIER
H	HUMIDIFIER
MD	MOTORIZED DAMPER
SAD	SUPPLY AIR DUCT
RAD	RETURN AIR DUCT

GENERAL MECHNANICAL NOTES AND SPECIFICATIONS

GENERAL

1. COORDINATE WORK AMONG ALL DISCIPLINES. IT IS NOT THE INTENT OF THESE DOCUMENTS TO DICTATE WHO MUST DO THE WORK. ALL WORK SHOWN IS THE RESPONSIBILITY OF THE (PRIME) CONTRACTOR.
2. FIELD VERIFY ALL CONDITIONS AND MEASURE DIMENSIONS WITHIN THE BUILDING PRIOR TO ORDERING EQUIPMENT AND/OR PROCEEDING WITH INSTALLATION.
3. ALL EQUIPMENT SHALL BE FACTORY TESTED, AND CONTRACTOR SHALL VERIFY THEIR CONDITION PRIOR TO INSTALLATION. CONTRACTOR IS RESPONSIBLE FOR EQUIPMENT DAMAGED DURING MOVING AND INSTALLATION.
4. EQUIPMENT FOUND DEFECTIVE PRIOR TO FINAL ACCEPTANCE SHALL BE REPLACED AT NO COST TO OWNER.
5. SUBMISSION OF BID PROPOSAL IS CONSIDERED AN ACKNOWLEDGEMENT THAT CONTRACTOR VISITED SITE, AND VERIFIED ALL EXISTING CONDITIONS, AND INCLUDED ANY MODIFICATIONS TO EXISTING AND NEW WORK REQUIRED FOR INSTALLATION OF A COMPLETE AND OPERATIONAL MECHANICAL SYSTEM.
6. COORDINATE WITH OWNER AND ENGINEER FOR ANY DISRUPTION IN UTILITY SERVICES, PARTICULARLY THOSE THAT MIGHT AFFECT OTHER BUILDINGS.
7. CONTRACTOR SHALL NOT PROCEED WITH ANY WORK INVOLVING A CHANGE IN PROJECT SCOPE OR COST WITHOUT FIRST HAVING OBTAINED ENGINEER'S APPROVAL IN WRITING. UNLESS ENGINEER HAS AGREED TO SUCH CHANGE PRIOR TO IT BEING DONE, AND HAS AGREED THAT AN INCREASE IN COST ASSOCIATED WITH SUCH CHANGE IS WARRANTED; CONTRACTOR WILL NOT BE REIMBURSED FOR SUCH CHANGE.
8. TESTING, ADJUSTING AND BALANCING (TAB) CONTRACTOR SHALL BE RETAINED BY THE PRIME CONTRACTOR TAB SHALL NOT BE A PART OF THE MECHANICAL CONTRACT.

CODES AND ORDINANCES

1. PERFORM ALL WORK PER LATEST VERSION OF INTERNATIONAL MECHANICAL CODE, AND APPLICABLE LOCAL CODES AND ORDINANCES, UNLESS DRAWINGS OR SPECIFICATIONS HAVE MORE STRINGENT REQUIREMENTS.
2. CONTRACTOR IS RESPONSIBLE FOR ALL PERMITS AND FEES ASSOCIATED WITH PROJECT, INCLUDING FEES FOR INSPECTIONS, APPLICATIONS, AND PROVISION OF NEW SERVICES.
3. NOTIFY ENGINEER OF ANY ASPECTS OF DESIGN WHICH ARE THOUGHT TO BE IN NONCOMPLIANCE WITH APPLICABLE CODES.

COORDINATION

1. REFER TO ARCHITECTURAL AND STRUCTURAL PLANS FOR DETAILS OF CONSTRUCTION, INCLUDING BEAMS, FLOOR AND WALL PENETRATIONS, CHASES, AND REFLECTED CEILING PLANS. VERIFY OPENING SIZES WITH EQUIPMENT FURNISHED.
2. COORDINATE ALL WORK WITH OTHER TRADES; COORDINATE SCHEDULE OF WORK WITH ALL SUB-CONTRACTORS TO ACHIEVE SMOOTH FLOW OF CONSTRUCTION.
3. CONTRACTOR SHALL REVIEW COMPLETE DOCUMENTS PRIOR TO SUBMITTAL OF PROPOSAL TO GAIN COMPLETE UNDERSTANDING OF PROJECT SCOPE, WORK BY OTHERS, AND MECHANICAL WORK ASSOCIATED WITH OTHER DISCIPLINES.
4. ENGINEER/ ARCHITECT MUST BE GIVEN AT LEAST A TEN (10) WORKING DAY NOTICE TO PERFORM ALL TYPES OF INSPECTIONS. COORDINATE WORK SCHEDULE WITH ARCHITECT AND ENGINEER TO PLAN ACCORDINGLY FOR APPROPRIATE INSPECTIONS.
5. COORDINATE LIGHT LOCATIONS WITH ELECTRICAL CONTRACTOR PRIOR TO INSTALLATION OF AIR DEVICES. LIGHT LOCATIONS TAKE PRECEDENCE OVER AIR DEVICES.

METAL AND FLEXIBLE DUCTS

1. DRAWINGS ARE DIAGRAMMATIC IN NATURE. FOR CLARITY SAKE, MOST DUCT OFFSETS/RISES/DROPS ARE NOT SHOWN.RECTANGULAR AND ROUND DUCTWORK SHALL BE GALVANIZED STEEL. SIZES SHOWN ARE INSIDE CLEAR DIMENSION.
2. PRIOR TO CONSTRUCTION, CONTRACTOR IS REQUIRED TO COORDINATE HEIGHTS OF DUCTWORK LAYOUT WITH EXISTING STRUCTURE, OTHER TRADES, AND PROPOSED CEILING HEIGHT TO CONFIRM ADEQUATE VERTICAL SPACE FOR STACKING.
3. CONSTRUCT AND LEAKAGE TEST ALL DUCTWORK BASED ON SMACNA REQUIREMENTS. COORDINATE PRESSURE CLASSES WITH EQUIPMENT SCHEDULES.
4. ALL GALVANIZED SHEET METAL DUCT WORK SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS--METAL AND FLEXIBLE".
5. USE 2" GLASS FIBER-REINFORCED FABRIC JOINT AND SEAM TAPE. USE WATER BASED JOINT AND SEAM SEALER. USE FIRE RESISTANT SEALER FOR FILLING OPENINGS AROUND DUCT PENETRATIONS THROUGH WALLS. ACCEPTABLE PRODUCTS ARE DOW CORNING, FIRE STOP FOAM AND FIRE STOP SEALER OR EQUAL.
6. USE SHEET METAL SCREWS OR BLIND RIVETS COMPATIBLE WITH DUCT MATERIALS WHEN SECURING ALL DUCTWORK TO STRUCTURE.
7. FLEXIBLE DUCT MAY BE USED TO CONNECT TO SUPPLY DIFFUSERS. MAXIMUM LENGTH OF FLEXIBLE DUCT LIMITED TO 5 FEET. PROVIDE FLEXMASTER TYPE 8M UL 181 CLASS I AIR DUCT OR EQUAL. FLEXIBLE DUCT SHALL HAVE MIN. R-8 INSULATING VALUE.
8. FLEXIBLE DUCT CLAMP SHALL BE OF STAINLESS STEEL BANDS WITH CADMIUM PLATED HEX SCREW TO TIGHTEN BAND WITH WORM GEAR ACTION.
9. PROVIDE TURNING VANES IN ALL SPLITS, TEES AND SWEPT 90 DEGREE ANGLE DUCT FITTINGS. MANUFACTURED TURNING VANES TO BE 1-1/2" WIDE, DOUBLE VANE, CURVED BLADES OF GALVANIZED SHEET STEEL SET ¾" O.C. ACCEPTABLE MANUFACTURER'S ARE DUCTMATE INDUSTRIES, METALAIRE, WARD INDUSTRIES OR EQUAL.

DOCUMENTATION

1. CONSTRUCTION "AS BUILT" DRAWINGS AND DOCUMENTS SHALL BE PROVIDED TO THE OWNER WITHIN 30 DAYS AFTER THE DATE OF ACCEPTANCE AND PROVIDE COPY TO LL.
2. OPERATION MANUALS AND MAINTENANCE MANUALS FOR ALL THE EQUIPMENTS SHALL BE PROVIDED TO THE BUILDING OWNER.

10. WHERE RECTANGULAR TEE FITTINGS ARE SHOWN, PROVIDE FITTING WITH ADJUSTABLE DIVIDER SHEET AND TURNING VANES.
11. WHERE RECTANGULAR MAIN AND BRANCH CONNECTIONS ARE SHOWN, PROVIDE EXTRACTOR VANES.
12. PROVIDE MANUAL VOLUME CONTROL DAMPERS WHERE SHOWN ON DRAWINGS. DAMPERS TO HAVE NEOPRENE BLADE SEALS AND GALVANIZED STEEL FRAMES, TIE BARS, DAMPER AND BRACKETS. ACCEPTABLE MANUFACTURER'S ARE RUSKIN CO., NAILOR INDUSTRIES, FLEXMASTER OR EQUAL.
13. ABOVE INACCESSIBLE CEILINGS AND WHERE DUCT CONFIGURATION DOES NOT ALLOW FOR INSTALLATION OF DAMPER IN DUCTWORK OR DIFFUSER, PROVIDE REMOTE MANUAL DAMPER BY YOUNG REGULATOR, (BOWDEN CABLE CONTROL SYSTEM). CONTRACTOR MAY PROVIDE OPPOSED BLADE DAMPER THAT IS INTEGRAL TO GRD WITH ENGINEER'S APPROVAL.

SCOPE OF WORK

PROVIDE 5.0 TON GAS HEAT ROOF TOP UNIT. PROVIDE HEPA FAN FILTER UNIT FOR THE CLEAN ROOM AND ANTE ROOM PER SCHEDULE.

PROVIDE NEW DUCTWORK AND WITH NECESSARY SUPPORTING ARRANGEMENTS FOR THE COMPLETE HVAC SYSTEM.

MICHIGAN BUILDING DEPARTMENT NOTES

ALL WORK SHALL COMPLY WITH APPLICABLE SECTIONS OF THE MICHIGAN BUILDING CODE 2015 5, AND ALL AMENDMENTS AND RULES AND REGULATIONS OF THE DEPARTMENT OF BUILDINGS TO DATE.

1. ALL HEATING AND COOLING LOADS CALCULATED PER ASHRAE/ACCA 183.
2. VENTILATION FOR ALL AREA SHALL COMPLY WITH MICHIGAN MECHANICAL CODE 2015 CHAPTER 4.
3. THE LICENSED PROFESSIONAL ENGINEER, ARCHITECT OR OTHER PERSON HAVING NOT LESS THAN FIVE (5) YEARS EXPERIENCE SUPERVISING THE INSTALLATION OF SUCH MECHANICAL SYSTEMS AND CONDUCTING SUCH TESTS WILL FILE DOCUMENTATION AND REPORTS OF TESTS THAT THE SYSTEM COMPLIES WITH THE CONSTRUCTION DOCUMENTS AND APPLICABLE LAWS.
4. TESTS OF MECHANICAL SYSTEMS SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING SECTIONS OF THE MICHIGAN MECHANICAL CODE 2015:
   A. VENTILATION SYSTEM BALANCING MICHIGAN MECHANICAL CODE 2015 – 403.7
6. THE FOLLOWING WORK ITEMS, COMPONENTS, MATERIALS, CAPACITIES, ETC. SHALL COMPLY WITH THE REFERENCED CODE OR STANDARD:
   B. STANDARDS OF HEATING – MICHIGAN MECHANICAL CODE 2015 – 309.1
   C. DUCT CONSTRUCTION AND INSTALLATION– MICHIGAN MECHANICAL CODE 2015 – 603
   D. AIR INTAKES, EXHAUSTS AND RELIEF – MICHIGAN MECHANICAL CODE 2015 – 401.5
   E. AIR FILTERS – MICHIGAN MECHANICAL CODE 2015 – 605
   F. MANUAL AND AUTOMATIC FIRE AND SMOKE CONTROLS FOR AIR DISTRIBUTION SYSTEMS – MICHIGAN MECHANICAL CODE 2015 – 606
7. MINIMUM TEMPERATURE TO BE MAINTAINED IN OCCUPIED SPACES DURING HEATING SEASON: 68 DEG. FAHRENHEIT.
8. A STATEMENT SHALL BE FILED BY THE OWNER OR TENANT IN POSSESSION THAT THE VENTILATION SYSTEM WILL BE KEPT IN CONTINUOUS OPERATION AT ALL TIMES DURING THE NORMAL OCCUPANCY OF THE STRUCTURE AS REQUIRED BY MICHIGAN MECHANICAL CODE 2015 – 403.3
9. SMOKE DETECTION SYSTEMS SHALL BE INSTALLED AND SEQUENCED TO FOLLOW CONTROLS OPERATIONS WITH THE REQUIREMENTS OF SECTION MICHIGAN MECHANICAL CODE 2015 – 606 TO CLOSE DAMPERS AND AUTOMATICALLY STOP THE FAN.
10. REFER TO ARCHITECTURAL DRAWINGS FOR REQUIRED FIRE-RATED WALL AND SMOKE WALL CONSTRUCTION AND LOCATION.
11. THESE PLANS ARE APPROVED ONLY FOR THE WORK INDICATED ON THE APPLICATION SPECIFICATION SHEET. ALL OTHER MATTERS SHOWN ARE NOT TO BE RELIED UPON OR TO BE CONSIDERED AS EITHER BEING APPROVED OR IN ACCORDANCE WITH APPLICABLE CODES.
12. CONTRACTOR TO PROVIDE AIR BALANCE REPORT FOR THE ENTIRE SYSTEM TO THE INSPECTOR OF THE RESPECTIVE BUILDING DEPARTMENT PRIOR TO FINAL INSPECTION.

SECTION 230713 – DUCT INSULATION

1.1 QUALITY ASSURANCE

SURFACE-BURNING CHARACTERISTICS: ALL INSULATION SHALL HAVE COMPOSITE (INSULATION JACKET OR FACING AND ADHESIVE USED TO ADHERE THE FACING OR JACKET TO THE INSULATION) A FLAME-SPREAD INDEX OF 25, AND SMOKE-DEVELOPED INDEX OF 50 FOR INSULATION INSTALLED INDOOR, 75, AND SMOKE-DEVELOPED INDEX OF 150 FOR INSULATION INSTALLED OUTDOORS; ACCORDING TO ASTME 84.

1.2 FIELD QUALITY CONTROL
- A. FIELD INSPECTIONS: BY OWNER-ENGAGED AGENCY.

1.3 INDOOR DUCT AND PLENUM INSULATION SCHEDULE;
- A. CONCEALED, RECTANGULAR, ROUND AND FLAT-OVAL, SUPPLY-RETURN, OUTDOOR-AND EXHAUST-AIR DUCT AND AIR PLENUM INSULATION:
- B. FLEXIBLE ELASTOMERIC, MINERAL-FIBER BLANKET, MINERAL-FIBER BOARD OR POLYOLEFIN WITH MINIMUM INSTALLED THERMAL RESISTANCE AS FOLLOWS:
  - UNVENTED ATTIC WITH ROOF INSULATION: R-3.5
  - EXTERIOR OF BUILDING: R-6
  - INDIRECTLY CONDITIONED SPACES: NONE
- C. ALL EXTERNAL EXPOSED INSULATION SHALL BE VAPOR RETARDANT.

1.4 ITEMS NOT INSULATED:
1. FIBROUS-GLASS DUCTS.
2. METAL DUCTS WITH DUCT LINER OR SUFFICIENT THICKNESS TO COMPLY WITH ENERGY CODE AND ASHRAE/IESNA 90.1.
3. FACTORY-INSULATED FLEXIBLE DUCTS.
4. FACTORY-INSULATED PLENUMS AND CASINGS.
5. FLEXIBLE CONNECTORS.
6. VIBRATION-CONTROL DEVICES.
7. FACTORY-INSULATED ACCESS PANELS AND DOORS.
8. DUCTS THAT HAVE INTERNAL ACOUSTICAL LINING.

1.5 PRODUCTS
- A. THE FOLLOWING INSULATION MANUFACTURERS WILL BE ACCEPTABLE:
1. JOHNS-MANVILLE
2. OWENS-CORNING

1.6 ACOUSTICAL TREATMENT
1. WHERE SHOWN ON THE DRAWINGS, LOW PRESSURE DUCTWORK SHALL BE LINED WITH 1.5" THICK R-6 AS MANUFACTURED BY DUCTMATE, 1-1/2 POUND MINIMUM DENSITY, NEOPRENE COATED, FLEXIBLE FIBERGLASS DUCT LINER. LINING SHALL COMPLY WITH NFPA 90A AND SHALL HAVE A FLAME SPREAD CLASSIFICATION OF NOT MORE THAN 25 AND A SMOKE DEVELOPED RATING NOT MORE THAN 50. DUCT SIZES WHERE LINING IS INDICATED ON PLANS ARE MINIMUM INSIDE CLEAR DIMENSIONS REQUIRED,

END OF SECTION 230713

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PROJECT NAME

PHYSICAL LOCATION

DRAWING TITLE

HVAC GENERAL NOTES, SYMBOL LISTS & ABBREVIATIONS

GRAPHIC SCALE 0 ¼" ½" ¾" 1"

SEAL

PROJECT NO.

SCALE AS NOTED

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CHECKED BY NYE

DATE 05/05/23

SHEET NUMBER M-1

Node:

Dwg File:

SECTION 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

1.1 SUMMARY

A. TESTING, ADJUSTING, AND BALANCING FOR THE FOLLOWING:

1. AIR SYSTEMS: CONSTANT–VOLUME.
2. MOTORS.

1.2 QUALITY ASSURANCE

A. THE CONTRACTOR SHALL PROCURE THE SERVICES OF A TESTING, ADJUSTING AND BALANCING (TAB) SPECIALIST WHO SPECIALIZES IN HEATING, VENTILATION AND AIR CONDITIONING SYSTEMS. THE TAB AGENT SHALL HAVE THE FOLLOWING QUALIFICATIONS: AABC, NEBB OR TABB CERTIFIED.

1.3 EXECUTION

A. THE TAB SPECIALIST SHALL PERFORM FLOW MEASUREMENTS OF ALL EXISTING AIR AND HYDRONIC SYSTEMS THAT ARE TO REMAIN OR TO BE INCORPORATED INTO THE STARTING OF WORK IN THE PROJECT SCOPE. A REPORT OF THESE MEASUREMENTS, INDICATING ANY AND ALL DEFICIENCIES SHALL BE SUBMITTED FOR OWNER REVIEW.

B. THE TAB SPECIALIST SHALL PERFORM FLOW MEASUREMENTS OF ALL NEW AIR AND HYDRONIC SYSTEMS AS LISTED ABOVE IN THE PROJECT SCOPE. A REPORT OF THESE MEASUREMENTS, INDICATING ANY AND ALL DEFICIENCIES SHALL BE SUBMITTED FOR OWNER REVIEW.

C. THE REPORT SHALL INDICATE A SCHEMATIC DIAGRAM INDICATING LOCATIONS OF ALL EQUIPMENT TESTED AND MEASUREMENT LOCATIONS.

D. PRIOR TO FINAL INSPECTION OF THE WORK, THE TAB SPECIALIST SHALL BALANCE ALL SYSTEMS AS INDICATED ABOVE TO THE REQUIREMENTS OF THE DESIGN.

E. THE CONTRACTOR SHALL HAVE FURNISH AND INSTALL ALL ADDITIONAL BALANCING EQUIPMENT, PRESSURE TAPS, GAUGES AND OTHER EQUIPMENT AS REQUIRED FOR A PROPERLY BALANCED SYSTEM AT NO ADDITIONAL COST TO THE OWNER. SUCH ADDITIONAL EQUIPMENT SHALL ADHERE IN STRICT ACCORDANCE WITH THE RESPECTIVE EQUIPMENT MANUFACTURER'S RECOMMENDATIONS.

F. THE CONTRACTOR SHALL HAVE THE TESTING AND BALANCING SPECIALIST COORDINATE ALL WORK OF THIS SECTION WITH THE BUILDING MANAGER. BALANCING WORK SHALL NOT CONFLICT WITH OTHER WORK SO AS TO MAINTAIN COMPLETION WITHIN THE SPECIFIED TIME.

G. ALL INSTRUMENTS USED FOR TAB SHALL BE MAINTAINED IN GOOD WORKING CONDITION AND ACCURATELY CALIBRATED.

H. TOLERANCES: PLUS OR MINUS 5 PERCENT OF DESIGN VALUES.

I. INSPECTIONS: RANDOM CHECKS BY OWNER OR ARCHITECT TO VERIFY FINAL TESTING, ADJUSTING, AND BALANCING REPORT.

J. ADDITIONAL TESTS: RANDOM TESTS WITHIN 90 DAYS OF COMPLETING TAB TO VERIFY BALANCE CONDITIONS AND SEASONAL TESTS.

END OF SECTION 230593

THERMOSTATIC CONTROLS:

6.4.3.1 ZONE THERMOSTATIC CONTROLS:

6.4.3.1.1 GENERAL.

THE SUPPLY OF HEATING AND COOLING ENERGY TO EACH ZONE SHALL BE INDIVIDUALLY CONTROLLED BY THERMOSTATIC CONTROLS RESPONDING TO TEMPERATURE WITHIN THE ZONE. FOR THE PURPOSES OF SECTION 6.4.3.1, A DWELLING UNIT SHALL BE PERMITTED TO BE CONSIDERED A SINGLE ZONE.
EXCEPTIONS: INDEPENDENT PERIMETER SYSTEMS THAT ARE DESIGNED TO OFFSET ONLY BUILDING ENVELOPE LOADS SHALL BE
PERMITTED TO SERVE ONE OR MORE ZONES ALSO SERVED BY AN INTERIOR SYSTEM PROVIDED.
A. THE PERIMETER SYSTEM INCLUDES AT LEAST ONE THERMOSTATIC CONTROL ZONE FOR EACH BUILDING EXPOSURE HAVING
EXTERIOR WALLS FACING ONLY ONE ORIENTATION FOR 50 CONTIGUOUS FEET OR MORE, AND
B. THE PERIMETER SYSTEM HEATING AND COOLING SUPPLY IS CONTROLLED BY A THERMOSTATIC CONTROL(S) LOCATED WITHIN
THE ZONES(S) SERVED BY THE SYSTEM. EXTERIOR WALLS ARE CONSIDERED TO HAVE DIFFERENT ORIENTATIONS IF THE DIRECTIONS THEY FACE DIFFER BY MORE THAN 45 DEGREES.

6.4.3.1.2 DEAD BAND.

WHERE USED TO CONTROL BOTH HEATING AND COOLING, ZONE THERMOSTATIC CONTROLS SHALL BE CAPABLE OF PROVIDING A TEMPERATURE RANGE OR DEAD BAND OF AT LEAST 5°F WITHIN WHICH THE SUPPLY OF HEATING AND COOLING ENERGY TO
THE ZONE IS SHUT OFF OR REDUCED TO A MINIMUM.
EXCEPTIONS:
A. THERMOSTATS THAT REQUIRE MANUAL CHANGEOVER BETWEEN HEATING AND COOLING MODES.
B. SPECIAL OCCUPANCY OR SPECIAL APPLICATIONS WHERE WIDE TEMPERATURE RANGES ARE NOT ACCEPTABLE (SUCH AS RETIREMENT HOMES, PROCESS APPLICATIONS, MUSEUMS, SOME AREAS OF HOSPITALS) AND ARE APPROVED BY THE AUTHORITY HAVING JURISDICTION.

6.4.3.2 SETPOINT OVERLAP RESTRICTION.

WHERE HEATING AND COOLING TO A ZONE ARE CONTROLLED BY SEPARATE ZONE THERMOSTATIC CONTROLS LOCATED WITHIN THE ZONE, MEANS (SUCH AS LIMIT SWITCHES, MECHANICAL STOPS, OR, FOR DDC SYSTEMS, SOFTWARE PROGRAMMING) SHALL BE PROVIDED TO PREVENT THE HEATING SETPOINT FROM EXCEEDING THE COOLING SETPOINT MINUS ANY APPLICABLE PROPORTIONAL BAND.

6.4.3.3 OFF–HOUR CONTROLS.

HVAC SYSTEMS SHALL HAVE THE OFF–HOUR CONTROLS REQUIRED BY SECTIONS 6.4.3.3.1 THROUGH 6.4.3.3.4.EXCEPTIONS:

A.HVAC SYSTEMS INTENDED TO OPERATE CONTINUOUSLY.
B. HVAC SYSTEMS HAVING A DESIGN HEATING CAPACITY AND COOLING CAPACITY LESS THAN 15,000 BTU/H THAT ARE EQUIPPED WITH READILY ACCESSIBLE MANUAL ON/ OFF CONTROLS.

6.4.3.3.1 AUTOMATIC SHUTDOWN.

HVAC SYSTEMS SHALL BE EQUIPPED WITH AT LEAST ONE OF THE FOLLOWING:
A. CONTROLS THAT CAN START AND STOP THE SYSTEM UNDER DIFFERENT TIME SCHEDULES FOR SEVEN DIFFERENT DAY–TYPES PER WEEK, ARE CAPABLE OF RETAINING PROGRAMMING AND TIME SETTING DURING LOSS OF POWER FOR A PERIOD OF AT LEAST TEN HOURS, AND
INCLUDE AN ACCESSIBLE MANUAL OVERRIDE, OR EQUIVALENT FUNCTION, THAT ALLOWS TEMPORARY OPERATION OF THE SYSTEM FOR UP
TO TWO HOURS.

A. AN OCCUPANT SENSOR THAT IS CAPABLE OF SHUTTING THE SYSTEM OFF WHEN NO OCCUPANT IS SENSED FOR A PERIOD OF UP TO 30 MINUTES.

B. A MANUALLY OPERATED TIMER CAPABLE OF BEING ADJUSTED TO OPERATE THE SYSTEM FOR UP TO TWO HOURS.

C. AN INTERLOCK TO A SECURITY SYSTEM THAT SHUTS THE SYSTEM OFF WHEN THE SECURITY SYSTEM IS ACTIVATED.

EXCEPTION: RESIDENTIAL OCCUPANCIES MAY USE CONTROLS THAT CAN START AND STOP THE SYSTEM UNDER TWO DIFFERENT TIME SCHEDULES PER WEEK.

6.4.3.3.2 SETBACK CONTROLS.

HEATING SYSTEMS LOCATED IN CLIMATE ZONES 2–8 SHALL BE EQUIPPED WITH CONTROLS THAT HAVE THE CAPABILITY TO AUTOMATICALLY RESTART AND TEMPORARILY OPERATE THE SYSTEM AS REQUIRED TO MAINTAIN ZONE TEMPERATURES ABOVE A HEATING SETPOINT ADJUSTABLE DOWN TO 55°F OR LOWER. COOLING SYSTEMS LOCATED IN CLIMATE ZONES 1B, 2B, AND 3B SHALL BE EQUIPPED WITH CONTROLS THAT HAVE THE CAPABILITY TO AUTOMATICALLY RESTART AND TEMPORARILY OPERATE THE SYSTEM AS REQUIRED TO MAINTAIN ZONE TEMPERATURES BELOW A COOLING SETPOINT ADJUSTABLE UP TO 90°F OR HIGHER OR TO PREVENT HIGH SPACE HUMIDITY LEVELS.
EXCEPTION: RADIANT FLOOR AND CEILING HEATING SYSTEMS.

6.4.3.3.3 OPTIMUM START CONTROLS.

INDIVIDUAL HEATING AND COOLING AIR DISTRIBUTION SYSTEMS WITH A TOTAL DESIGN SUPPLY AIR CAPACITY EXCEEDING 10,000 CFM, SERVED BY ONE OR MORE SUPPLY FANS, SHALL HAVE OPTIMUM START CONTROLS. THE CONTROL ALGORITHM SHALL, AS A MINIMUM, BE A FUNCTION OF THE DIFFERENCE BETWEEN SPACE TEMPERATURE AND OCCUPIED SETPOINT AND THE AMOUNT OF TIME PRIOR TO SCHEDULED OCCUPANCY.

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HVAC NOTES

GRAPHIC SCALE

0 ¼" ½" 1"

SEAL

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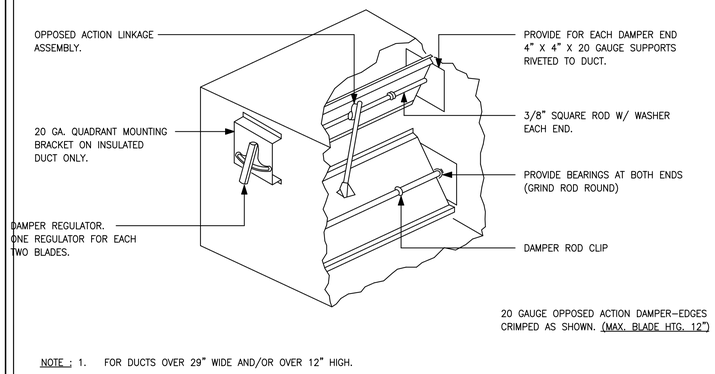
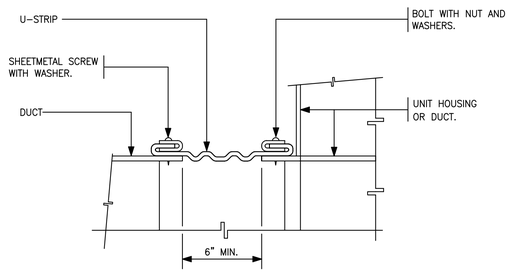
SHEET NUMBER M-2

Node:
Dwg File:

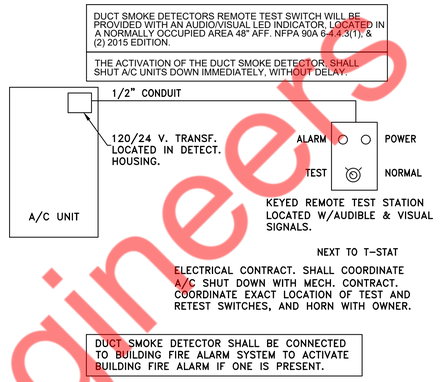


NOTE : 1. FOR DUCTS OVER 29" WIDE AND/OR OVER 12" HIGH.

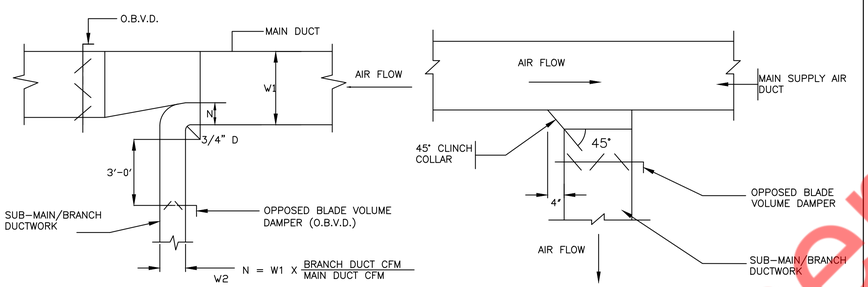
1 / M-3 LOW PRESSURE BALANCING DAMPER N.T.S



2 / M-3 FLEXIBLE CONNECTION (DUCT-EQUIPMENT) N.T.S

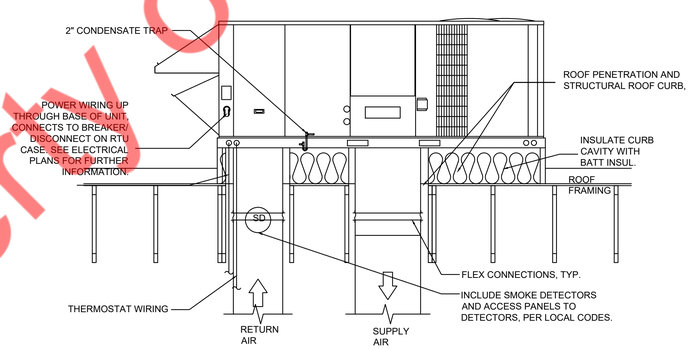


3 / M-3 DUCT SMOKE DETECTOR DETAIL N.T.S



NOTE:
FURNISH THIS TYPE CONNECTION WHEN SINGLE LINE DUCTWORK IS INDICATED AS THIS OR

4 / M-3 SUPPLY AIR DUCTWORK SUB-MAIN/BRANCH DUCT CONNECTION N.T.S



5 / M-3 ROOF TOP UNIT INSTALLATION N.T.S

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PROJECT NAME

PHYSICAL LOCATION

DRAWING TITLE

HVAC DETAILS
(01 OF 02)

GRAPHIC SCALE 0 ½" ½" ½" 1"

SEAL

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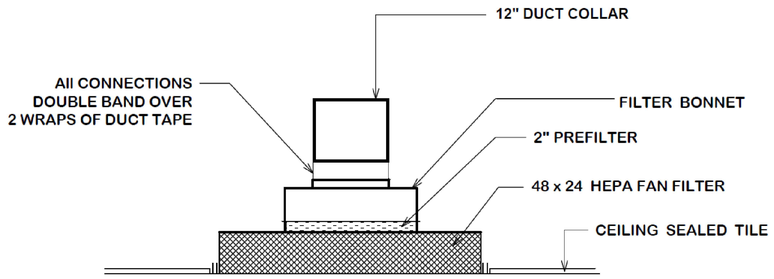
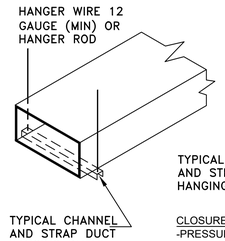
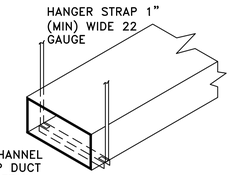


1 / M-4 FAN FILTER UNIT CONNECTION DETAIL
N.T.S

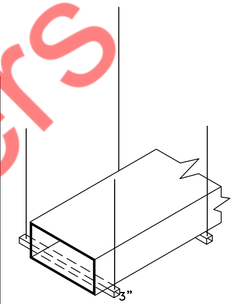
CHANNEL SELECTION		
DUCT WIDTH MIN.	CHANNEL GUAGE MIN.	CHANNEL PROFILE
LESS THAN 18"	22 3"x 2"	
LESS THAN 30"	18 3"x 2"	





CLOSURE:
-PRESSURE SENSITIVE ALUMINUM FOIL TAPES LSITED UNDER UL 181A, PART I (P)
- HEAT ACTIVATED ALUMINUM FOIL/SCRIM TAPES LISTED UNDER UL 181A, PART II (H)
- MASTIC AND GLASS FABRIC TAPE CLOSURE SYSTEMS LISTED UNDER UL 181A, PART III (M)

DUCT SIZE,IN.	MAXIMUM HANGER SPACING
① WIDTH 48" OR GREATER	4'-0"
② LESS THEN 48"W X 12"H	6'-0"
③ WIDTH BETWEEN 24" & 48" & HEIGHT OVER 24"	6'-0"
④ WIDTH BETWEEN 24" & 48" & HEIGHT BETWEEN 12" & 24"	8'-0"
⑤ WIDTH LESS THAN 24" & HEIGHT GREATER THAN 12"	8'-0"
DUCT REINFORCING PER SMACNA REQUIRED	



HANGER SPACING AND EXTENSION
3" WIDE CHANNELS

DUCT SUPPORTS
NOT TO SCALE

2 / M-4 DUCT SUPPORT DETAILS
N.T.S

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PROJECT NAME

PHYSICAL LOCATION

DRAWING TITLE
HVAC DETAILS
(02 OF 02)

GRAPHIC SCALE
0 ¼" ½" ¾" 1"

SEAL

PROJECT NO.

SCALE
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05/05/23

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M-4

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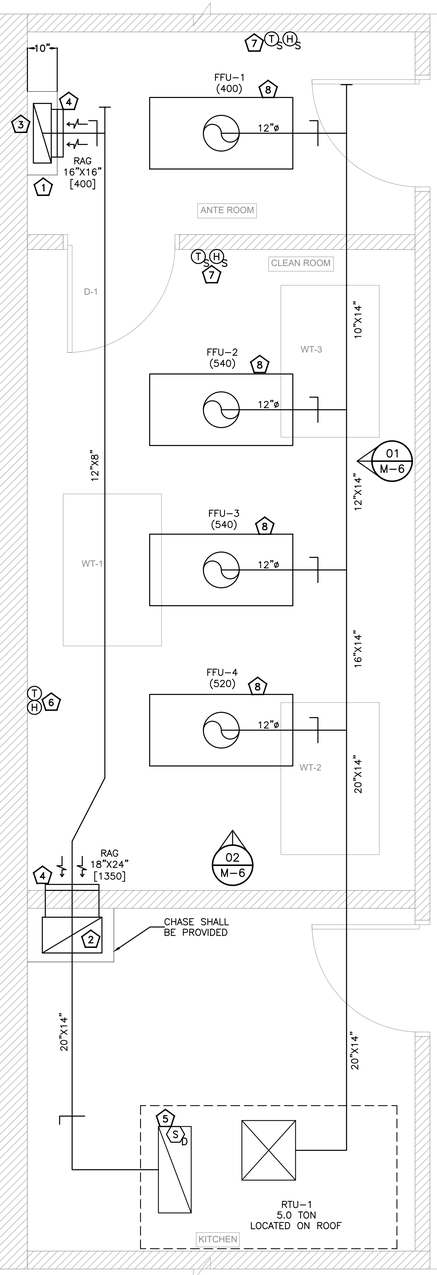

HVAC FLOOR PLAN

SCALE : 1/2" = 1'-0"

KEY NOTES – HVAC FLOOR PLAN

1. RETURN AIR WALL CHASE TILL CEILING 10" WIDTH
2. 18"X12" RETURN DUCT CONNECTING TO RAG
3. 20"X6" RETURN DUCT CONNECTING TO RAG
4. INSTALL RAG @+10" A.F.F
5. SMOKE DETECTOR MOUNTED AT RETURN AIR DUCT
6. THERMOSTAT & HUMIDISTAT FOR RTU-1. CONFIRM THE FINAL LOCATION WITH CLIENT/ARCHITECT PRIOR ROUGH-IN.
7. TEMPERATURE AND HUMIDITY SENSORS FOR SPACE TO MONITOR THE INSIDE CONDITIONS. CONFIRM THE FINAL LOCATION WITH CLIENT/ARCHITECT PRIOR ROUGH-IN.
8. FAN FILTER UNIT AIR QUANTITY SHALL BE ADJUSTED TO THE QUANTITY AS SHOWN IN THE PLAN.

MECHANICAL GENERAL NOTES

A. CONTRACTOR SHALL VISIT SITE TO VERIFY FIELD CONDITIONS ALONG WITH THE DRAWINGS & INFORM THE ENGINEER FOR ANY DISCREPANCIES FOUND BEFORE COMMENCING BIDS.
B. DUCTWORK SHOWN ON PLAN ARE SCHEMATIC ONLY. CONTRACTOR SHALL COORDINATE WITH OTHER TRADES FOR DUCTWORK ROUTING. OFFSET AND RUN DUCTWORK INSIDE THE STRUCTURE IF REQUIRED. PROVIDE ANY EXTRA DUCTWORK, FITTINGS, INSULATIONS AND OTHER ACCESSORIES IN ORDER TO COMPLETE THE INSTALLATION.
C. COORDINATE LOCATIONS AND SIZES OF ROOF OPENINGS WITH OWNER AND STRUCTURE ENGINEERS.
D. EQUIPMENT SIZES, DIMENSIONS AND REQUIRED CONNECTIONS SHALL BE VERIFIED WITH THE ACTUAL EQUIPMENT SELECTED VENDOR DRAWINGS BEFORE FABRICATION OF DUCTWORK ETC.
E. DUCT SIZES SHOWN ON PLANS ARE CLEAR INSIDE AIR STREAM DIMENSIONS.
F. CONTRACTOR SHALL COORDINATE ALL ELECTRICAL REQUIREMENTS FOR ALL HVAC BASED ON ACTUAL EQUIPMENT SELECTED PRIOR TO INSTALLATION.
G. CONTRACTOR SHALL COORDINATE EQUIPMENT WEIGHTS AND SUPPORTS BASED ON ACTUAL EQUIPMENT SELECTED.
H. ALL DUCT WORK SHALL BE METAL AND SHALL CONSTRUCTED AS SPECIFIED IN SMACNA HVAC DUCT CONSTRUCTION AND STANDARDS – METAL AND FLEXIBLE. ALL EXPOSED DUCTWORK SHALL BE INTERNALLY INSULATED, PRIMED FOR PAINTING. ALL CONCEALED DUCTWORK SHALL BE EXTERNALLY INSULATED METAL. COORDINATE FINAL FINISH WITH ARCHITECT.
I. COORDINATE WITH ALL TRADES FOR MATERIALS IN RATED AND PLENUM SPACES.
J. ALL SOURCE OF MECHANICAL INTAKE SHALL MAINTAIN 10 LINEAR FEET SEPARATION BETWEEN ANY SOURCE OF EXHAUST. CONTRACTOR IS RESPONSIBLE TO ADJUST DUCT LENGTH AS NEEDED.
K. MD TO INTERLOCK WITH RESPECTIVE INDOOR UNITS.
L. COORDINATE FINAL LOCATION OF EQUIPMENT WITH STRUCTURAL DRAWINGS.
M. TAKE NECESSARY PRECAUTIONS TO PREVENT DUST AND DIRT MIGRATING TO OCCUPIED AREAS OF THE BUILDING. THIS INCLUDES BLANKING OFF ANY RETURN AIR GRILLES/ DUCTS IN THE WORK AREA. PROVIDE TEMPORARY EXHAUST FANS, DUCTED DIRECTLY TO OUTDOORS, TO MAINTAIN NEGATIVE PRESSURE WITHIN THE WORK AREA.
N. KEEP ALL ADJOINING AREAS ADJACENT TO THE WORK AREAS CLEAN AND FREE OF DEBRIS.
O. MECHANICAL CONTRACTOR TO COORDINATE ALL DUCT WORK, CROSSINGS, OVERLAPPING AND PENETRATIONS WITH SITE CONDITIONS AND AS PER EXISTING JOIST LAYOUT AND SKYLIGHT IN FIELD. MODIFY DUCT WORK WHEREVER REQUIRED.
P. PROVIDE FIRE OR FIRE+SMOKE DAMPER WHEREVER DUCTS ARE CROSSING FIRE/SMOKE RATED WALLS/BARRIERS/SLABS. COORDINATE WITH ARCHITECTURAL DRAWING FOR FIRE RATING OF THE WALLS.
Q. CONTRACTOR SHALL COORDINATE WITH THE OWNER/GENERAL CONTRACTOR FOR THE ELECTRICAL POWER PROVISION FOR THE MECHANICAL UNITS BEFORE COMMENCING ANY WORK.
R. FOR SYSTEM OVER 2,000 CFM CHECK FOR DUCT MOUNTED AIR SMOKE DETECTORS AND THAT MEET THE REQUIREMENTS OF U.L. 268A, INTERLOCKED TO SHUTDOWN A/C UNIT UPON DETECTION OF SMOKE. IF NECESSARY PROVIDE SMOKE DETECTOR WITH AN ANNUNCIATOR, ALARM AND POWER L.E.D'S FOR VISIBLE AND AUDIBLE ALARM SIGNAL, AND VISIBLE TROUBLE SIGNAL MOUNT ANNUNCIATOR ON ROOM SIDE OF CEILING.
S. CONTRACTOR SHALL PROVIDE NECESSARY TEMPERATURE AND HUMIDITY SENSORS AND CONTROLS INCLUDING THERMOSTAT AND HUMIDISTAT AS REQUIRED PER THE SEQUENCE OF THE OPERATION.
T. ALL EQUIPMENT SHALL BE CLEAN ROOM RATED AND SHALL MEET CLEAN ROOM REQUIREMENTS.

HVAC ROOF PLAN

SCALE : N.T.S

KEY NOTES – HVAC ROOF PLAN

12. NEW ROOFTOP UNIT SHALL BE PROVIDED. PROVIDE FLEXIBLE CONNECTORS ON SUPPLY AND RETURN DUCT CONNECTIONS. SET OUTSIDE AIR AS INDICATED ON ROOFTOP UNIT SCHEDULES. MECHANICAL CONTRACTOR SHALL SCRIBE INTO UNIT POSITION OF OUTSIDE AIR DAMPER AND LABEL OUTSIDE AIR VOLUME AND PERCENT OF OUTSIDE AIR. TRANSITION AND CONNECT SUPPLY AND RETURN DUCTWORK FROM FLOOR BELOW. COORDINATE ROUTING THROUGH STRUCTURAL TRUSSES AND OFFSET AS REQUIRED IN CURB SPACE.
13. COORDINATE/SUBMIT FINAL LOCATION OF MECHANICAL UNITS, SUPPORT DETAILS WITH STRUCTURAL DRAWINGS. TAKE STRUCTURAL ENGINEER'S APPROVAL ON RTU WEIGHTS AND CALCULATIONS PRIOR COMMENCING ANY CONSTRUCTION WORK.
14. CONTRACTOR TO PROVIDE ROOF WALK PADS & CONFIRM TYPE & REQUIREMENTS WITH LANDLORD/OWNER.
15. GUARDS SHALL BE PROVIDED WHERE VARIOUS COMPONENTS THAT REQUIRE SERVICE ARE LOCATED WITHIN 10 FEET OF A ROOF EDGE OR OPEN SIDE OF A WALKING SURFACE AND SUCH EDGE OR OPEN SIDE IS LOCATED MORE THAN 30 INCHES ABOVE THE FLOOR, ROOF OR GRADE BELOW. THE GUARD SHALL EXTEND NOT LESS THAN 30 INCHES BEYOND EACH END OF SUCH COMPONENTS. THE GUARD SHALL BE CONSTRUCTED SO AS TO PREVENT THE PASSAGE OF A SPHERE 21 INCHES IN DIAMETER.

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PROJECT NAME

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DRAWING TITLE

HVAC FLOOR &
ROOF PLANS

GRAPHIC SCALE

0 ½" ½" ½" 1"

SEAL

PROJECT NO.

SCALE: AS NOTED

DRAWN BY: NYE

CHECKED BY: NYE

DATE: 05/05/23

SHEET NUMBER: M-5

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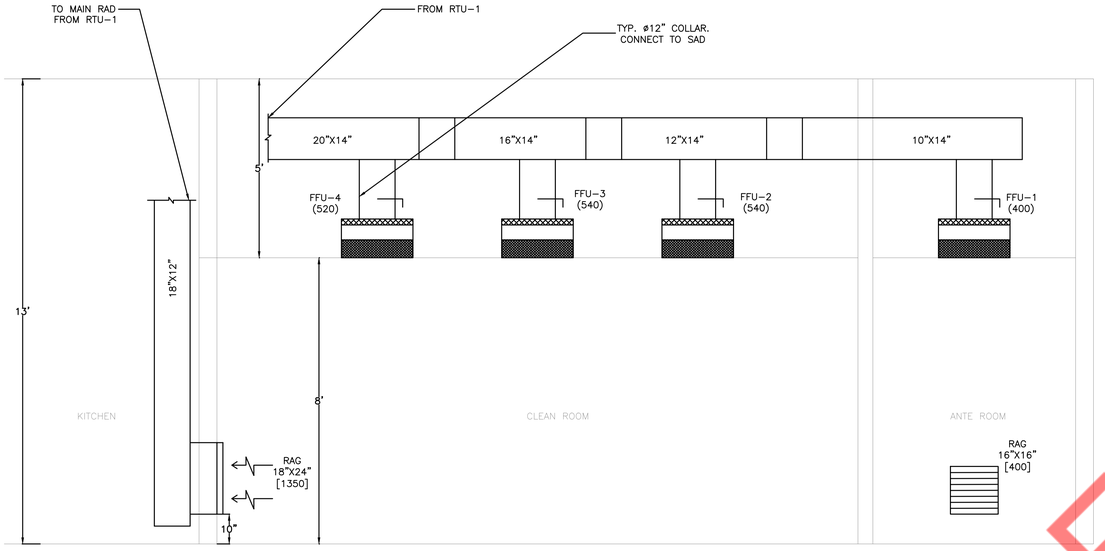
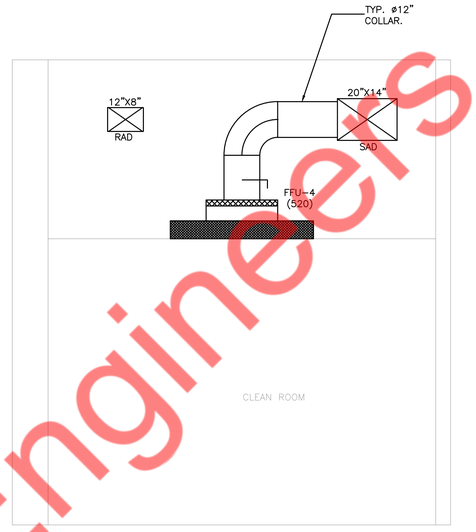
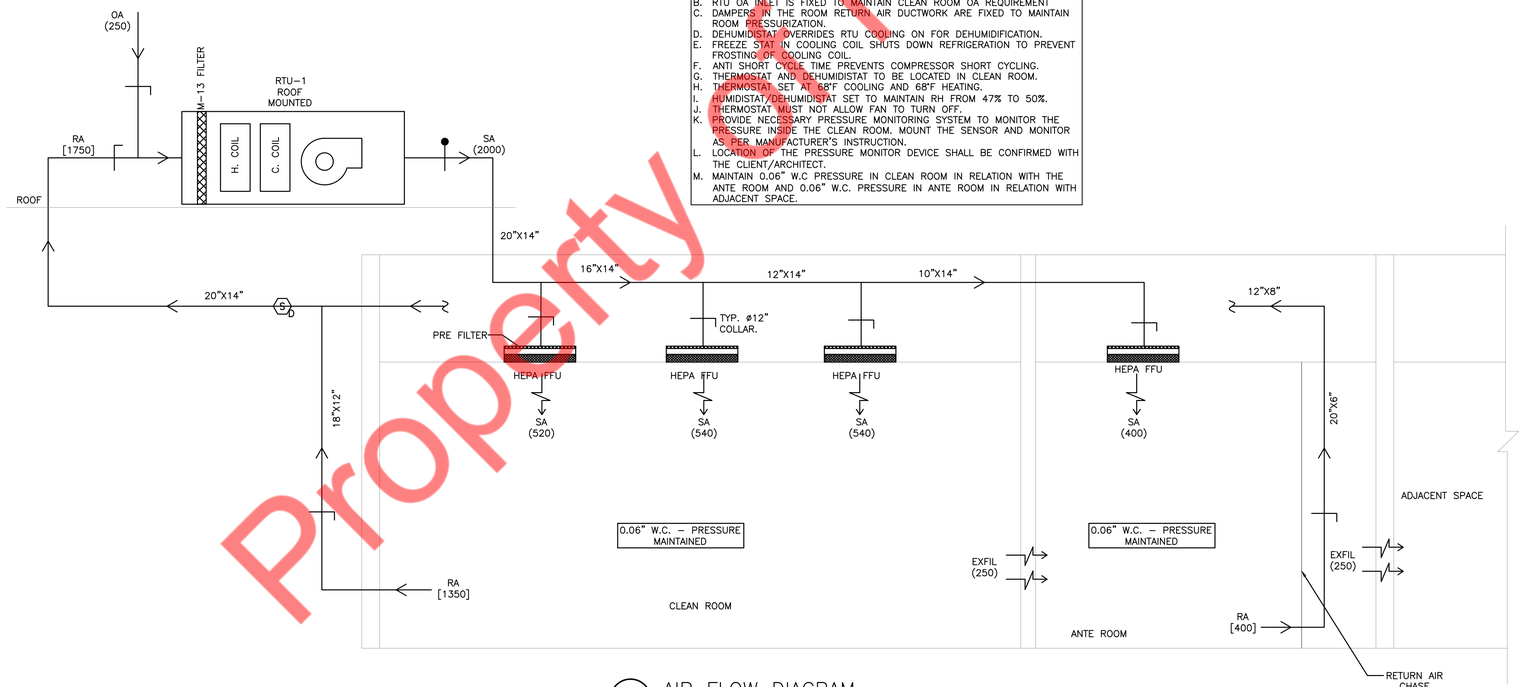


01 M-6 SECTION A
SCALE : 1/2"=1'0"



02 M-6 SECTION B
SCALE : 1/2"=1'0"



03 M-6 AIR FLOW DIAGRAM
SCALE : 1/2"=1'-0"

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HVAC SECTIONS &
AIR FLOW DIAGRAM

GRAPHIC SCALE 0 ½" ½" ½" 1"

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FAN FILTER UNIT SCHEDULE

UNIT ID	MANUFACTURER	MODEL	AREA SERVED	AIR FLOW (CFM)	ELECTRICAL				FILTER TYPE	DUCT COLLAR (IN)	DIMENSION (L X W) FT	OPERATING WEIGHT (LBS.)	REMARKS
					VOLTS	PHASE	HZ	FLA (A)					
FFU-1	ENVIRCO	MAC 10 ORIGINAL	ANTE ROOM	400	115	1	60	3	HEPA 99.99% @ 0.3 MICRON	Ø12	2 X 4	70	NEW
FFU-2	ENVIRCO	MAC 10 ORIGINAL	CLEAN ROOM	540	115	1	60	3	HEPA 99.99% @ 0.3 MICRON	Ø12	2 X 4	70	NEW
FFU-3	ENVIRCO	MAC 10 ORIGINAL	CLEAN ROOM	540	115	1	60	3	HEPA 99.99% @ 0.3 MICRON	Ø12	2 X 4	70	NEW
FFU-4	ENVIRCO	MAC 10 ORIGINAL	CLEAN ROOM	520	115	1	60	3	HEPA 99.99% @ 0.3 MICRON	Ø12	2 X 4	70	NEW

NOTES:

1. CONTRACTOR SHALL PROVIDE FAN FILTER UNIT WITH SPEED CONTROL.
2. AIR QUANTITY OF FFU SHALL BE ADJUSTED TO DELIVER AS SHOWN IN SCHEDULE.
3. PROVIDE ALL NECESSARY SUPPORT ARRANGMENTS FOR STURDY FITTING OF THE FFU
4. COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL POWER REQUIREMENT

MECHANICAL AIR TERMINAL DEVICES SCHEDULE

TAG	SIZE	DESCRIPTION	CONSTRUCTION	FINISH	BASIS OF DESIGN		NOTES
					MANUFACTURER	MODEL	
RAG	SEE PLAN	RETURN GRILLE, 3/4" BLADE SPACING, 0-DEGREE DEFLECTION	STAINLESS STEEL	-	TITUS	350RL-SS	-

NOTES:

1. PROVIDE STANDARD WHITE FINISH FOR ALL AIR DEVICES UNLESS NOTED OTHERWISE ON PLAN.
2. PAINT ALL SURFACES VISIBLE THROUGH FACE OF RETURN AIR GRILLE FLAT BLACK. THIS SHALL INCLUDE PIPING, CONDUIT, DUCTWORK AND STRUCTURAL MEMBERS.
3. PROVIDE FRAMES FOR SURFACE MOUNTING.
4. AIR DEVICE SHALL BE OF CLEAN ROOM STANDARD. ANY NECESSARY COATING SHALL BE PROVIDED

ROOF TOP UNIT SCHEDULE — **MAKE : CARRIER (OR EQUIVALENT)**

TAG	AREA SERVED	TON	TOTAL COOLING CAP. (MBH)	TOTAL SENSIBLE COOLING CAP. (MBH)	SUPPLY AIRFLOW (CFM)	OUTDOOR AIR (CFM)	HEATING CAPACITY (MBH)		THERMAL EFFICIENCY	E.S.P (IN. W.C.)	ELECTRICAL DATA			SEER	WEIGHT (LBS.)	MODEL NO.	REMARK
							INPUT	OUTPUT			VOLT/PH/HZ	MCA (A)	MOCP (A)				
RTU-1	SEE PLAN	5	58.57	29.25	2000	250	150	120	80%	1.5"	208-230/3/60	31	45	14	900	48FCA06A2A5 (OR EQUIVALENT)	NEW

NOTES :-

A. PROVIDE FULL PERIMETER 14" HIGH ROOF CURB.
B. PROVIDE 2" MERV-13 FILTERS AT THE RETURN SIDE. CONSIDER NECESSARY STATIC FOR THE FILTER ARRANGEMENT IN THE FAN.
C. PROVIDE HINGED PANELS FOR FILTER ACCESS, FAN MOTOR ACCESS, COMPRESSOR ACCESS AND CONTROL COMPARTMENT ACCESS.
D. CONTRACTOR TO PROVIDE 7-DAY PROGRAMMABLE THERMOSTAT/HUMIDISTAT FOR RTU WITH HUMIDITY CONTROL.
E. PROVIDE HAIL GUARD.
F. PROVIDE NON FUSED DISCONNECT SWITCH.
G. PROVIDE WITH TUBE & FIN COIL SYSTEM.
H. PROVIDE WITH STANDARD CAP AND PHASE MONITOR SYSTEM.
I. PROVIDE WITH GFCI FLD WIRED.
J. PROVIDE HIGH STATIC BELT DRIVE
K. UNIT TO BE PROVIDED WITH LOW AMBIENT OPERATION CAPABILITIES. PROVIDE FROST STAT AND ANTI-CYCLE TIMER.
L. PROVIDE HOT GAS BYPASS SYSTEM, THEN CAPACITY OF HOT GAS BYPASS SHALL BE LIMITED TO 50% OF TOTAL UNIT CAPACITY.
M. PROVIDE RETURN AIR DUCT MOUNTED SMOKE DETECTOR.
N. PROVIDE ULTRA LOW LEAK ECONOMIZER WITH FDD AND BAROMETRIC RELIEF COMPLYING WITH LOCAL ENERGY CODE

RTU NOTES-

1. INSTALL AS PER MANUFACTURERS SPECIFICATIONS AND MAINTAIN ALL SERVICES CLEARANCES.
2. PROVIDE CONDENSATE DRAIN 'P' TRAP MINIMUM 3" DEEP OR TWICE THE TOTAL STATIC PRESSURE WHICHEVER IS GREATER.
3. COMPRESSOR SHALL HAVE A MINIMUM 5 YEAR WARRANTY ALL OTHER EQUIPMENTS SHALL HAVE MINIMUM 1 YEAR WARRANTY.
4. RTU IS BASED ON AHRI STANDARD CONDITIONS OF 80°F DB,67°F INDOOR ENTERING AIR TEMPERATURE AND 95°F DB ENTERING AIR FOR OUTDOOR UNIT.
5. MUST MEET THE EER'S MINIMUM EFFICIENCY CODE REQUIREMENTS.

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