NOTE: NOT ALL ABBREVIATIONS, SYMBOLS OR CRITERIA SHOWN ON THIS SHEET MAY APPLY TO THIS PROJECT

DUCT SIZING CRITERIA

MEDIUM PRESSURE SUPPLY	MAX. 2300 FPM OR 0.22"/100'
LOW PRESSURE SUPPLY	MAX. 1000 FPM OR 0.07"-0.1"/100'
LOW PRESSURE RETURN/EXHAUST	MAX. 1200 FPM 0.05" - 0.08"/100'

DUCT CONSTRUCTION CLASSIFICATION

DUCT SECTION	PRESSURE CLASS / SEAL CLASS
SUPPLY-UNIT DISCHARGE TO TERMINAL	+6", SEAL CLASS A
SUPPLY-TERMINAL UNIT TO DIFFUSER	+1", SEAL CLASS A
RETURN - ALL	-2", SEAL CLASS A - INLET SIDE OF FAN +2", SEAL CLASS A - OUTLET SIDE OF FAN
EXHAUST - GENERAL	-2", SEAL CLASS A - INLET SIDE OF FAN +2", SEAL CLASS A - OUTLET SIDE OF FAN
EXHAUST - SPECIALTY	AS REQUIRED
OUTDOOR - ALL	-2", SEAL CLASS A

GENERAL NOTES

1. ALL DUCT DIMENSIONS SHOWN ARE INSIDE CLEAR MEASUREMENTS.
2. ALL DUCTS AND PIPING SHALL BE INSULATED AS INDICATED.
3. EXTERIOR INSULATED DUCT AND PIPING SHALL BE RECOVERED AS INDICATED.
4. INSULATION AND VAPOR BARRIER SHALL BE CONTINUOUS WITHOUT BREAKS OR INTERRUPTION AT HANGERS AND WALL PENETRATIONS
   1. PIPING PENETRATIONS OF RATED WALLS SHALL BE INSTALLED PER A TESTED UL-ASSEMBLY.
   2. DUCT PENETRATIONS WITH FIRE OR FIRE/SMOKE DAMPERS SHALL BE INSTALLED AND INSULATED PER MANUFACTURER'S LISTING AND AS DETAILED.
   3. PROVIDE RIGID INSULATION AT HANGERS TO AVOID CRUSHING INSULATION.
5. DUCT SYSTEMS SHALL BE CONSTRUCTED PER THE REQUIREMENTS OF SMACNA "HVAC DUCT CONSTRUCTION STANDARDS-METAL AND FLEXIBLE" CURRENT EDITION AND AS NOTED:
   - A. ALL LOW PRESSURE DUCT TRANSITIONS ARE FLAT ON TOP (FOT) UNLESS OTHERWISE NOTED.
   - B. ALL RECTANGULAR ELBOWS SHALL HAVE DOUBLE THICKNESS TURNING VANES EXCEPT AS INDICATED. DO NOT INSTALL TURNING VANES IN TYPE-1 KITCHEN HOOD EXHAUST DUCT OR TYPE-2 HOOD EXHAUST DUCT.
   - C. ALL SUPPLY, RETURN, AND EXHAUST DUCTS ARE TO BE CONSTRUCTED TO SEAL CLASS A: SEALED AT ALL LONGITUDINAL SEAMS AND ALL TRANSVERSE JOINTS AND ANY FITTINGS . TEST ALL DUCTS AS INDICATED.
   - D. PROVIDE VOLUME DAMPERS ON ALL BRANCH DUCTWORK WHETHER INDICATED OR NOT EXCEPT SUPPLY UPSTREAM OF AIR TERMINAL UNITS.
   - E. EXTRACTORS AND AIR SCOOPS ARE NOT ALLOWED.
   - F. BUTTON-PUNCH SEAMS ARE NOT ALLOWED IN ANY DUCT CLASS.
   - G. ALL TRANSITIONS SHALL BE 30 DEGREES MAX. ON CONTRACTING FLOW (7" IN 12"); 20 DEGREES MAX. ON DIVERGING FLOW (4-3/8" IN 12") PER SMACNA DUCT STANDARDS.
6. EQUIPMENT, VALVES, TRAPS, DAMPERS, CLEANOUTS, CONTROLS, ETC. SHALL BE ACCESSIBLE. PROVIDE ACCESS PANELS OR DOORS AS REQUIRED AND INDICATED.
7. DRAWINGS ARE DIAGRAMMATIC. NOT ALL OFFSETS AND CHANGES IN ELEVATIONS ARE SHOWN. TRADES ARE TO COORDINATE THEIR WORK TO AVOID CONFLICTS.
8. LOCATION OF CONCEALED EQUIPMENT, HYDRONIC VALVES, FIRE DAMPERS, SMOKE DAMPERS, COMBINATION FIRE/SMOKE DAMPERS, ETC. SHALL BE PERMANENTLY VISIBLE FROM THE SPACE BELOW BY LABEL HAVING LETTERS NOT LESS THAN 1/2" IN HEIGHT IDENTIFYING COMPONENT AND DESIGNATION.
9. LOCATE ANY EXHAUST FAN DISCHARGE AT MINIMUM 10' - 0" FROM OUTSIDE AIR INTAKES OR BUILDING OPENINGS.
10. MECHANICAL SYSTEMS INCLUDING DUCTWORK, PIPING AND EQUIPMENT SHALL BE SUPPORTED INDEPENDENTLY OF ONE ANOTHER AND ALL OTHER SYSTEMS.

DEMOLITION NOTES

DM-1 THESE DRAWINGS HAVE BEEN DEVELOPED FROM EXISTING DRAWINGS WHICH MAY NOT REFLECT ACTUAL FIELD CONDITIONS. THE CONTRACTOR SHALL VERIFY THESE DRAWINGS WITH EXISTING FIELD CONDITIONS AND NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY OF ANY INCONSISTENCIES PRIOR TO COMMENCEMENT OF WORK.

DM-2 THE CONTRACTOR SHALL NOTIFY THE ARCHITECT/ENGINEER IMMEDIATELY IF ANY WORK INDICATED IN THE CONTRACT DOCUMENT CANNOT BE PERFORMED DUE TO EXISTING FIELD CONDITIONS OR, IF PERFORMING SUCH WORK WILL JEOPARDIZE THE INTENT OF THE CONTRACT DOCUMENT.

DM-3 PIPING REMOVAL SHALL TERMINATE AT THE MAIN OR AT LOCATION INDICATED. VALVE AND CAP PIPES AT TERMINATION LOCATION.

DM-4 COORDINATE DEMOLITION WORK WITH OTHER TRADES. REFER TO ARCHITECTURAL DRAWINGS FOR PHASING OF WORK.

DM-5 ANY EXISTING ITEM(S) WHICH ARE TO REMAIN SHALL BE PROTECTED FROM DAMAGE BY THE CONTRACTOR THROUGHOUT THE CONSTRUCTION PERIOD. DAMAGE TO EXISTING ITEMS WHICH ARE TO REMAIN SHALL BE REPAIRED OR REPLACED TO CONFORM TO ITS ORIGINAL WORKING CONDITION PRIOR TO EVENT.

DM-6 CONTRACTOR SHALL COORDINATE AND SCHEDULE ANY ANTICIPATED HVAC SYSTEM(S) SHUTDOWN/INTERRUPTION WITH THE FACILITY'S MANAGEMENT DEPARTMENT. ANY SUCH SERVICE INTERRUPTION SHALL NOT BE MADE WITH OUT PRIOR WRITTEN CONSENT/APPROVAL FROM THE OWNER AND PROPER COORDINATION WITH THE FACILITY. FURNISH THE ARCHITECT/ ENGINEER WITH A COPY OF THE WRITTEN APPROVAL PRIOR TO THE SCHEDULED ACTIVITY DATE.

DM-7 PATCH, REPAIR AND SEAL ALL AREAS OF DEMOLITION TO MATCH EXISTING ADJACENT AREAS. THIS INCLUDES WALLS, CEILINGS, FLOORS AND ROOFS. REFER TO DOCUMENTS FOR ADDITIONAL INFORMATION.

DM-8 IT IS THE CONTRACTOR'S RESPONSIBILITY TO SHUT DOWN AND MAKE SAFE EQUIPMENT AND SERVICES EITHER BEING DEMOLISHED OR DE-COMMISSIONED IN PLACE.

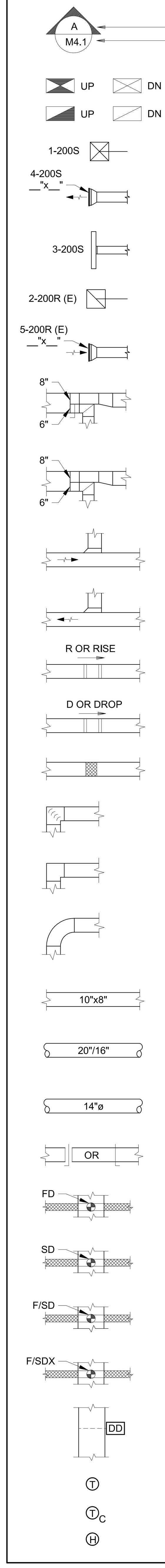
DM-9 CONTRACTOR SHALL COORDINATE THE RECOVERY OR DISPOSAL OF EQUIPMENT AND FLUIDS REMOVED AND NOT REUSED ON THIS PROJECT. IF THE OWNER CHOOSES TO RECOVER EQUIPMENT THE CONTRACTOR SHALL COORDINATE THE STORAGE OF EQUIPMENT WITH THE OWNER.

DM-10 CONTRACTOR SHALL PATCH EXISTING TO REMAIN DUCTWORK WHERE TAPS/TAKE-OFFS ARE REMOVED; PATCH SHALL BE OF SIMILAR MATERIAL AND PRESSURE CLASS AS THE DUCTWORK BEING PATCHED. PATCH SHALL BE SEALED PER SMACNA SEAL CLASS "A".

ABBREVATIONS

AC	AIR CONDITIONING UNIT	FLA	FULL LOAD AMPS
AD	ACCESS DOOR	FT	FINNED TUBE
AF	AIR FOIL	GPM	GALLONS PER MINUTE
AFF	ABOVE FINISHED FLOOR	H	HUMIDIFIER
AFM	AIR FLOW MEASURING MONITOR	HC	HEATING COIL
AH	AIR HANDLING UNIT	HP	HORSEPOWER
AP	ACCESS PANEL	HPC	HIGH PRESSURE STEAM CONDENSATE RETURN
APD	AIR PRESSURE DROP (INCHES OF WATER)	HPS	HIGH PRESSURE STEAM
ATC	AUTOMATIC TEMPERATURE CONTROL PANEL	HV	HEATING AND VENTILATING UNIT
B	BOILER	HX	HEAT EXCHANGER
BAS	BUILDING AUTOMATION SYSTEM	KW	KILOWATT
BHP	BREAK HORSEPOWER	LAT	LEAVING AIR TEMPERATURE
BI	BACKWARD INCLINED	LBS/HR	POUNDS PER HOUR
BOJ	BOTTOM OF JOIST	LPC	LOW PRESSURE STEAM CONDENSATE RETURN
BOD	BOTTOM OF DUCT (ELEVATION)	LPS	LOW PRESSURE STEAM
BOP	BOTTOM OF PIPE (ELEVATION)	LWT	LEAVING WATER TEMPERATURE
BOS	BOTTOM OF STRUCTURE	MAX	MAXIMUM
BTUH	BTU PER HOUR	MBH	1000 BTU PER HOUR
BVS	BELTED-VENT SET (CENTRIFUGAL FAN)	MCC	MOTOR CONTROL CENTER
CC	COOLING COIL	MIN	MINIMUM
CD	CEILING DIFFUSER	MPC	MEDIUM PRESSURE STEAM CONDENSATE RETURN
CFM	CUBIC FEET PER MINUTE	MPS	MEDIUM PRESSURE STEAM
CG	CEILING GRILLE	MVD	MANUAL VOLUME DAMPER
CH	CHILLER	NC	NORMALLY CLOSED
CLG	CEILING	NO	NORMALLY OPEN
CO	CLEAN OUT	NOM	NORMAL
CP	CONDENSATE PUMP	OA	OUTSIDE AIR
CR	CONDENSATE RETURN	P	PUMP
CRU	CONDENSATE RETURN UNIT	PC	PUMP CONDENSATE
CT	COOLING TOWER	PD	PRESSURE DROP (FEET OF WATER)
CU	CONDENSING UNIT	PF	PRE-FILTER
DB	DRY BULB TEMPERATURE ºF	PH	PREHEAT
dB	DECIBELS	PRV	PRESSURE REDUCING VALVE
DDC	DIRECT DIGITAL CONTROLS	PTAC	PACKAGED TERMINAL AIR CONDITIONER
Dp	DEW POINT TEMPERATURE ºF	RA	RETURN AIR
DPS	DIFFERENTIAL PRESSURE SENSOR	RAG	RETURN AIR GRILLE
DX	DIRECT EXPANSION	RAR	RETURN AIR REGISTER
EA	EXHAUST AIR	RF	RETURN FAN
EAG	EXHAUST AIR GRILLE	RH	REHEAT COIL
EAR	EXHAUST AIR REGISTER	RH	RELATIVE HUMIDITY
EAT	ENTERING AIR TEMPERATURE ºF	RTU	ROOFTOP UNIT
ECM	ELECTRICALLY COMMUNICATED MOTOR	SA	SUPPLY AIR
EDH	ELECTRIC DUCT HEATER	SA	SOUND ATTENUATING
EER	ENERGY EFFICIENCY RATIO	SAG	SUPPLY AIR GRILLE
EF	EXHAUST FAN	SAR	SUPPLY AIR REGISTER
EOM	END OF MAIN DRIP (STEAM)	SD	SMOKE DAMPER
ERC	ENERGY RECOVERY COIL	SF	SUPLPLY FAN
ET	EXPANSION TANK	SH	STEAM HUMIDIFER
EUH	ELECTRIC UNIT HEATER	SP	STATIC PRESSURE (INCHES OF WATER)
EWB	ENTERING WET BULB TEMPERATURE ºF	TDH	TOTAL DYNAMIC HEAD
EWT	ENTERING WATER TEMPERATURE ºF	TOS	TOP OF STRUCTURE
ETR	EXISTING TO REMAIN	UH	UNIT HEATER
FA	FIRE ALARM	V	VALVE
FACP	FIRE ALARM CONTROL PANEL	VFD	VARIABLE FREQUENCY DRIVE
FCU	FAN COIL UNIT	VSC	VARIABLE SPEED CONTROLLER
FF	FINAL FILTER	VSD	VARIABLE SPEED DRIVE
FLR	FLOOR	WB	WET BULB TEMPERATURE ºF
FD	FLOOR DRAIN	WF	WATER FILTER
FD	FIRE DAMPER	WFM	WATER FLOW MEASURING DEVICE
F/SD	COMBINATION FIRE/SMOKE DAMPER	WSHP	WATER SOURCE HEAT PUMP
FOB	FLAT ON BOTTOM	WSF	WATER SAND FILTER
FOT	FLAT ON TOP		

DRAWING SYMBOLS



SECTION LETTER / NUMBER
DRAWING NUMBER WHERE SHOWN

SUPPLY DUCT (UP & DOWN)

RETURN/EXHAUST DUCT (UP & DOWN)

CEILING DIFFUSERS (TYPE 1 - 200 CFM)

SIDEWALL SUPPLY GRILLE OR REGISTER (TYPE 4 - 200 CFM)

LINEAR SLOT DIFFUSERS (TYPE 3 - 200 CFM)

CEILING RETURN (OR EXHAUST) GRILLE OR REGISTER (TYPE 2 - 200 CFM)

SIDEWALL RETURN (OR EXHAUST) GRILLE OR REGISTER (TYPE 5 - 200 CFM)

VANE TURN ELBOW & PROPORTIONAL AIR SPLIT TYPE DUCT TAKE-OFF W/ SPLITTER DAMPER

VANE TURN ELBOW & PROPORTIONAL AIR SPLIT TYPE DUCT TAKE-OFF

45° BRANCH DUCT TAKE-OFF (SUPPLY)

45° BRANCH DUCT TAKE-OFF (RETURN OR EXHAUST)

INCLINED RISE, IN DIRECTION OF AIR FLOW

INCLINED DROP, IN DIRECTION OF AIR FLOW

FLEXIBLE CONNECTION

RECTANGULAR WITH TURNING VANES

RECTANGULAR WITH TURNING VANES

STANDARD RADIUS ELBOW (CENTERLINE RADIUS EQUAL 1.5 TIMES DUCT WIDTH)

RECTANGULAR DUCT-WIDTH x DEPTH (FIRST FIGURE INDICATES SIDE SHOWN)

FLAT OVAL DUCT-WIDTH x DEPTH (FIRST FIGURE INDICATES SIDE SHOWN)

ROUND DUCT - DIAMETER

MANUAL VOLUME DAMPER

FIRE DAMPER

SMOKE DAMPER WITH DUCT MOUNTED SMOKE DETECTOR WITHIN 5'-0" OF DAMPER

COMBINATION FIRE/SMOKE DAMPER WITH DUCT MOUNTED SMOKE DETECTOR WITHIN 5'-0" OF DAMPER

COMBINATION FIRE/SMOKE DAMPER WITHOUT DUCT MOUNTED SMOKE DETECTOR

DUCT MOUNTED SMOKE DETECTOR

ROOM CONTROL: THERMOSTAT

ROOM CONTROL: CONCEALED THERMOSTAT

ROOM CONTROL: HUMIDISTAT

amazon
KCVG HUB
470 DAY ONE DRIVE
FLORENCE, KY 41042

Gresham Smith

CONSULTANT

ISSUANCE SCHEDULE

NUMBER	DESCRIPTION	DATE

SEAL

STATE OF KENTUCKY
TRACY A. WORLEY
35085
LICENSED
PROFESSIONAL ENGINEER
[illegible]
Digitally signed by Tracy Worley
Date: 2023.04.28 16:31:15-05'00'

PACKAGE DESCRIPTION

KENTON COUNTY AIRPORT BOARD
CVG
CINCINNATI/NORTHERN KENTUCKY INTERNATIONAL AIRPORT

SHEET TITLE
HVAC LEGENDS AND NOTES

SHEET MANAGEMENT

PROJECT NO.:	47000.19
DATE ISSUED:	04/28/2023
DRAWN BY:	Author
REVIEWED BY:	Checker

SHEET NUMBER
M001

SUBMITTAL TYPE - Conform Set - 20210331

4/28/2023 4:23:25 PM Autodesk Docs://47000.MP Amazon Air R22/47000.19 MechCentralR22.rvt

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1. GENERAL CONDITIONS:
   A. ALL WORK SHALL BE COORDINATED WITH THE OWNERS REPRESENTATIVE
   B. PERFORM ALL WORK IN ACCORDANCE WITH ASHRAE, SMACNA, O.S.H.A. PERTINENT NFPA CODES AND THE RULES AND REGULATIONS OF ALL CITY, STATE FEDERAL AUTHORITIES HAVING JURISDICTION. PROVIDE WITH CERTIFICATES OF INSPECTION.
   C. ALL PROPOSED PHASING SHALL BE COORDINATED WITH OWNER AND APPROVED PRIOR TO START OF WORK
   D. THESE DRAWINGS INDICATE THE SIZE AND GENERAL LOCATION OF WORK. SCALED DIMENSIONS SHALL NOT BE USED.
   E. PRIOR TO STARTING ANY WORK, PURCHASING OF EQUIPMENT, ETC., COORDINATE THE WORK WITH OTHER TRADES. CONFER WITH OTHER CONTRACTORS WHOSE WORK MIGHT AFFECT THIS INSTALLATION AND ARRANGE ALL PARTS OF THIS WORK AND EQUIPMENT WITH THE BUILDING CONSTRUCTION AND WITH ARCHITECTURAL FINISH SO THAT IT WILL HARMONIZE IN SERVICE AND APPEARANCE. IN THE EVENT THERE IS A CONFLICT IN COORDINATION BETWEEN TRADES, THE OWNER WILL RESOLVE IT.
   F. SUBMIT TO THE OWNER RECORD DRAWINGS AND SHOP DRAWINGS FOR ALL WORK INSTALLED.
   G. ALL PARTS OF THE WORK AND ASSOCIATED EQUIPMENT SHALL BE TESTED AND ADJUSTED TO WORK PROPERLY AND BE LEFT IN PERFECT OPERATING CONDITION.

2. NOTICE TO BIDDERS:
   A. THE SPECIFICATIONS AND DRAWINGS ARE INTENDED TO SERVE THIS CONTRACTOR JOINTLY AS A BASIS UPON WHICH CONTRACTOR SHALL SUBMIT A CONTRACT PRICE FOR THE MATERIAL AND LABOR PROVISION.
   B. WHEN CONFLICTS OCCUR IN THE SPECIFICATIONS, OR ON THE DRAWINGS EITHER THE ITEMS OF GREATER QUANTITY OR HIGHER COST SHALL BE PROVIDED.
   C. THE CONTRACTOR SHALL PROVIDE ALL ITEMS OF LABOR OR MATERIALS NOT SPECIFICALLY INDICATED, BUT REQUIRED TO COMPLETE THE INTENDED INSTALLATION.
   D. THE CONTRACTOR SHALL COORDINATE HIS WORK OR ADJUST SAME TO THAT OF OTHER TRADES IN ORDER THAT CONFLICTS IN SPACE LOCATION DO NOT OCCUR.
   E. THE WORK UNDER THIS CONTRACT SHALL BE PERFORMED AND COORDINATED SIMULTANEOUSLY WITH WORK OF OTHER TRADES SO AS NOT TO DELAY THE OVERALL PROGRESS OF WORK.
   F. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR HIS WORK, FOR ITS COMPLETION AND FINAL ACCEPTANCE, AND SHALL REPLACE ANY OF SAME WHICH MAY BE DAMAGED, LOST OR STOLEN, WITHOUT ADDITIONAL COSTS TO THE OWNER.

3. OPERATING AND MAINTENANCE INSTRUCTIONS:
   A. AFTER FINAL TEST AND ADJUSTMENTS, FULLY INSTRUCT OWNER'S OPERATING PERSONNEL IN ALL DETAILS OF OPERATION FOR EQUIPMENT INSTALLED. A SIGNED RECEIPT SHALL BE OBTAINED FROM THE OPERATOR AND CONSTRUED AS EVIDENCE THAT INSTRUCTIONS WERE SATISFACTORY.
   B. FURNISH THREE (3) COPIES OF WRITTEN DESCRIPTIONS OF ALL SYSTEMS COVERING ALL MANUAL OPERATING PROCEDURES, AUTOMATIC CONTROL DESCRIPTIONS AND AUTOMATIC CONTROL TEMPERATURE AND PRESSURE SETTINGS. WRITTEN DESCRIPTIONS SHALL INCLUDE LUBRICATION SCHEDULES, PARTS LIST, PERFORMANCE SERVICES FOR EQUIPMENT, AND FILTER SIZE/QUANTITY. INSTRUCTIONS WHICH ARE USED, SHALL BE CLEARLY MARKED TO INDICATED APPLICABILITY.

4. TESTING AND BALANCING:
   A. A. THE CONTRACTOR SHALL OBTAIN THE SERVICES OF AN INDEPENDENT AABC OR NEBB APPROVED TESTING AND BALANCING AGENCY.
   B. THE T&B AGENCY SHALL PROVIDE ALL LABOR, MATERIALS, SUPERVISION, PROFESSIONAL SERVICES, TOOLS, TEST EQUIPMENT AND INSTRUMENTS NECESSARY TO TEST AND BALANCE MECHANICAL SYSTEMS DESCRIBED HEREIN.
   C. PRECONSTRUCTION REVIEW OF CONTRACT DOCUMENTS:
      1. REVIEW DRAWINGS FOR ANY CONDITIONS DEEMED TO BE DETRIMENTAL TO SYSTEM PERFORMANCE.
      2. REVIEW DRAWINGS FOR ANY CONDITIONS THAT WOULD HINDER OR IMPAIR THE BALANCING PROCEDURE,I.E., LACK OF BALANCING DAMPERS, ACCESSIBILITY, OR IMPROPER LOCATION OF SUCH ITEMS.
      3. PROVIDE WRITTEN REPORT TO THE ARCHITECT, THE RESULTS OF THE REVIEW AND RECOMMENDED CORRECTIVE ACTION, IF ANY.
      4. A PRE-CONSTRUCTION TEST, ADJUST, AND BALANCE REPORT IS REQUIRED TO DETERMINE EXISTING AIRFLOWS AND WATER FLOWS OF SYSTEMS WITHIN AND SERVING THE PROJECT SCOPE AND SERVING AREAS OUTSIDE OF THE PROJECT SCOPE. AIRFLOWS AND WATER FLOWS TO AREAS OUTSIDE OF THE PROJECT SCOPE SHALL BE REBALANCED TO MEET PRE-CONSTRUCTION AIRFLOW AND WATERFLOW MEASUREMENTS.
   D. PRE-INSTALLATION REVIEW:
      1. REVIEW CONTRACTORS SHOP DRAWINGS AND CONTROL SYSTEM DOCUMENTS PRIOR TO INSTALLATION OF SYSTEMS TO ENSURE BALANCING PROCEDURES ARE NOT COMPROMISED.
      2. REPORT DEFICIENCIES TO CONTRACTOR AND ARCHITECT.
   E. REVIEW OF CONSTRUCTION:
      1. REVIEW CONSTRUCTION TO VERIFY THAT DUCTS ARE SEALED PROPERLY, BALANCING DAMPERS ARE INSTALLED AND ACCESSIBLE, FITTINGS ARE APPROPRIATE AND WILL NOT RESULT IN HIGH LOSSES, FLEX DUCT IS NOT CRIMPED, AND ALL FANS ARE OPERATING AND ROTATING IN THE CORRECT DIRECTION.
      2. NOTE DEFICIENCIES AND FILE REPORT TO ARCHITECT AND CONTRACTOR.
   F. SYSTEMS CLEANING AND START-UP:
      1. OBSERVE CONTRACTORS CLEANING AND START-UP OF HVAC SYSTEMS.
      2. REPORT DEFICIENCIES TO CONTRACTOR AND ARCHITECTS.
   G. AHU CONTROL SYSTEM TESTING:
      1. CHECK TEMPERATURE CONTROLS FOR PROPER CALIBRATION AND SETPOINT.
      2. CHECK ECONOMIZER CONTROLS FOR PROPER DAMPER OPERATION AND CONTROL CALIBRATION (OUTSIDE AIR CONDITIONS MAY PRECLUDE ACTUAL CALIBRATION TEST).
      3. CHECK AND TEST FOR CALIBRATION THE SUPPLY/RETURN VOLUMETRIC SYSTEM FOR VARIABLE VOLUME SYSTEM CONTROL.
   H. THERMOSTATS AND CONTROLLER TESTING:
      1. CHECK FOR PROPER CONTROL OF AIR TERMINAL UNITS, EXHAUST FANS, ETC.
      2. SET AT DESIGN SETPOINT.
   I. THERMOSTATS CALIBRATION:
      1. MEASURE AND RECORD DRY AND WET BULB TEMPERATURES AT EACH THERMOSTAT.
      2. NOTE ANY THERMOSTAT WHICH IS NOT CONTROLLING WITH PLUS/MINUS 1.5°F
   J. CONTROL TEMPERATURE READOUTS:
      1. TEST ACTUAL TEMPERATURE NEXT TO SENSING BULB (IF POSSIBLE) AND COMPARE TO READ-OUT GAGE.
      2. REPORT ANY GAGE OUT OF CALIBRATION.
   K. EXISTING CONDITION VERIFICATION:
      1. THE FOLLOWING EXISTING CONDITION VERIFICATION SHALL OCCUR PRIOR TO THE START OF ANY DEMOLITION OPR MODICIATION OF SYSTEMS.
      2. PERFORM STATIC PRESSURE PROFILES OF ALL ASSOCIATED EXISTING AIR HANDLING UNITS, RETURN/RELIEF FANS, AND EXHAUST FANS, AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS.
      3. RECORD ALL ASSOCIATED EXISTING AIR HANDLING UNITS PRE-FILTER AND FINAL-FILTER MERV RATINGS.
      4. PERFORM DUCT TRAVERSES OF EXISTING SUPPLY, RETURN, AND OUTSIDE AIR TO ALL ASSOCIATED AIR HANDLING UNITS AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS.
      5. PERFORM DUCT TRAVERSES OF EXISTING SUPPLY, RETURN, AND EXHAUST DUCTS SERVING SPACES WITHIN THE PROJECT SCOPE AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS.
      6. PERFORM DUCT TRAVERSES OF EXISTING SUPPLY, RETURN, AND EXHAUST DUCTS SERVING AREAS OUTSIDE OF THE PROJECT SCOPE AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS. REBALANCE AIRFLOWS TO SPACES OUTSIDE OF THE PROJECT SCOPE TO PRE-CONSTRUCTION VALUES.
      7. PERFORM AIRFLOW MEASUREMENTS (VIA CAPTURE HOOD OR DUCT TRAVERSE) OF ALL ASOCIATED EXISTING SUPPLY AIR DIFFUSERS AND RETURN AIR AND EXHAUST AIR GRILLES IN THE PROJECT SCOPE AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS.
      8. RECORD HEATING HOT WATER FLOW RATES TO ALL EXISTING AIR TERMINAL UNITS VIA BRANCH BALANCE VALVE, AS WELL AS BALANCE VALVE POSITION (% OPEN) WITH TERMINAL UNITS IN FULL HEATING MODE AND RECORD RESULTS PRIOR TO MODIFICATIONS TO EXISTING SYSTEMS.
      9. NOTE ANY DEFICIENT OR UNUSUAL CONDITIONS IN THE PRE-EXISTING SYSTEM AS PART OF THE PRE-CONSTRUCTION TEST, ADJUST, AND BALANCE REPORT.

5. TESTING AND BALANCING AIR SYSTEMS:
   A. DUCT SYSTEMS (SUPPLY, RETURN AND EXHAUST) SHALL BE PRESSURE TESTED IN ACCORDANCE WITH SMACNA PROCEDURES. SEAL ALL JOINTS AND SEAMS. REPAIR OR REPLACE DUCT SECTIONS TO ELIMINATE AUDIBLE DUCT LEAKAGE WITH THE DUCT SYSTEM PRESSURIZED TO 150% OF DESIGN DUCT STATIC PRESSURE. IN NO CASE SHALL TOTAL LEAKAGE EXCEED (1) ONE PERCENT OF DESIGN AIRFLOW. TESTING SHALL BE COMPLETED AND CERTIFICATION OF TESTING SUBMITTED TO AND APPROVED BY ARCHITECT BEFORE INSULATION OR CONCEALMENT IS STARTED.
   B. SUPPLY AIR:
      1. FANS CHECKED FOR SPEED, ROTATION, AMPERAGE, STATIC PRESSURE, ETC.
      2. VAV BOXES SET TO MAXIMUM, MINIMUM AND OUTLETS BALANCED TO DESIGN WITHIN +10%, -5%
      3. TOTAL SUPPLY PITOT TUBE TRAVERSE AND ADJUSTMENT OF FAN SPEED TO PRODUCE DESIGN CFM WHILE MAINTAINING MINIMUM SYSTEM STATIC PRESSURE FOR PROPER ATU OPERATION.
   C. RELIEF / RETURN AIR:
      1. FANS CHECKED FOR SPEED, ROTATION, AMPERAGE, STATIC PRESSURE, ETC.
      2. WITH SUPPLY SYSTEM IN THE MAXIMUM MODE, PROPORTION RETURN INLETS.
      3. WITH SUPPLY SYSTEM IN THE MAXIMUM MODE, TRAVERSE AND ADJUST RETURN FAN TO PRODUCE DESIGN CFM WHILE MAINTAINING MINIMUM SYSTEM STATIC PRESSURE.
   D. OUTSIDE AIR:
      1. WITH SUPPLY SYSTEM IN THE MAXIMUM MODE, ADJUST MINIMUM OUTSIDE AIR DAMPER TO DESIGN.
      2. AFTER COMPLETION, TAKE TOTAL UNIT STATIC PROFILE AND RECORD ALL FINAL STATICS, AMPERAGES, RPM, CFM, ETC.
      3. REPEAT PROCEDURE FOR OUTSIDE AIR DAMPER SET FOR MAXIMUM DESIGN FLOW.
   E. STATIC PRESSURE PROFILE:
      1. FOR EACH AIR HANDLING SYSTEM, MEASURE AND RECORD THE INDIVIDUAL COMPONENT PRESSURE LOSSES THROUGH THE UNIT FROM INLET TO OUTLET INCLUDING ANY DAMPERS,FILTERS, MIXING DEVICES, COILS, AND FANS.
   F. VENTILATION AND PRESSURIZATION VERIFICATIONS:
      1. BALANCE EACH SUPPLY AND RETURN AIR OUTLET WITHIN +10%, -5% OF DESIGN.BALANCE EACH EXHAUST AIR OUTLET WITHIN +10%, -0% OF DESIGN. CHECK AND/OR ADJUST PRESSURE RELATIONSHIPS SO THAT EACH POSITIVE PRESSURE AND EACH NEGATIVE PRESSURE AREA IS AT LEAST 10% POSITIVE OR NEGATIVE AS APPROPRIATE, UNLESS SHOWN OTHERWISE ON THE DRAWINGS.

6. TESTING AND BALANCING REPORT:
   A. A PRE-CONSTRUCTION AND POST-CONSTRUCTION TEST, ADJUST, AND BALANCE REPOERT IS REQUIRED. SEE 6.K. FOR EXISTING CONDITIONS REQUIRED TO BE RECORDED IN PRE-CONSTRUCTION TEST, ADJUST, AND BALANCE REPORT. SEE ADDITIONAL REQUIREMENTS OF PART 6 AND PART 6.1 FOR POST-CONSTRUCTION TEST, ADJUST, AND BALANCE REPORT.
   B. PROVIDE AN ELECTRONIC COPY OF CONTRACT DOCUMENTS REVIEW TO ARCHITECT NOTING ANY CONDITIONS DEEMED DETRIMENTAL TO SYSTEM PERFORMANCE, LACK OF BALANCING DAMPERS, ETC.
   C. PROVIDE A COPY OF CONSTRUCTION REVIEW REPORT NOTING ALL DEFICIENCIES.
   D. THE CONTRACTOR SHALL SUBMIT TO THE ARCHITECT AN ELECTRONIC COPY OF A TYPED, WRITTEN REPORT TO INCLUDE THE FOLLOWING:
      1. OUTSIDE AIR CFM
      2. RETURN AIR CFM
      3. SUPPLY AIR CFM
      4. FAN RPM
      5. TOTAL STATIC PRESSURE
      6. PRESSURE DROP ACCESS COMPONENTS (STATIC PROFILE)
      7. MOTOR VOLTAGE AND AMPS
      8. CFM AT EACH SUPPLY, RETURN, RELIEF AND EXHAUST OUTLETS IN RENOVATED AREA
      9. INLET STATIC PRESSURE AND PRESSURE DROP AT EACH AIR TERMINAL UNIT.
   E. ACTUAL VOLTS AND AMPS, NAMEPLATE VOLTS AND AMPS ON MOTORS ALL REPORTS BY THE T&B AGENCY SHALL INCLUDE BOTH THE DATE OF THE TEST AND THE NAMES OF ALL PERSONS PERFORMING AND WITNESSING THE TESTS.

7. RECORD DRAWINGS:
   A. REPRODUCIBLE RECORD DRAWINGS SHALL BE SUPPLIED UPON WHICH CORRECTIONS SHALL BE MADE TO PROVIDED AN ACCURATE AND COMPLETE RECORD OF THE WORK AS INSTALLED.

8. APPROVALS AND SUBSTITUTIONS:
   A. IT IS THE INTENT OF THESE SPECIFICATIONS THAT WHENEVER A MANUFACTURER IS SPECIFIED AND SUBSTITUTIONS ARE MADE, THEY SHALL CONFORM IN ALL ASPECTS TO THE SPECIFIED ITEM. CRITERIA AS DELINEATED FOR EQUIPMENT SHALL BE INTERPRETED AS MINIMUM PERFORMANCE REQUIREMENTS.
   B. SUBSTITUTED EQUIPMENT, WHERE PERMITTED, MUST CONFORM TO SPACE REQUIREMENTS. ANY SUBSTITUTED EQUIPMENT THAT CANNOT MEET SPACE REQUIREMENTS, WHETHER APPROVAL OR NOT, SHALL BE REPLACED AT THE CONTRACTOR'S EXPENSE. ANY MODIFICATION OF RELATED SYSTEMS OR ADDITIONAL COSTS THAT RESULT FROM SUBSTITUTED EQUIPMENT SHALL BE BORNE BY THIS CONTRACTOR.
   C. IT SHALL BE MANDATORY FOR THIS CONTRACTOR TO SUBMIT HIS PROPOSAL PRICE BASED ON SPECIFIED MANUFACTURER OR SUPPLIER OF MATERIALS OR SERVICES. IF THE CONTRACTOR DESIRES TO SUBMIT OTHER THAN SPECIFIED, HE SHALL SUBMIT SEPARATE PRICES FOR EACH OF THESE ITEMS, ADDITIONS OR DEDUCTION TO CONTRACT PROPOSAL PRICE FOR ACCEPTANCE OR REJECTIONS AT THE TIME WHEN BIDS ARE DUE. SHOULD THESE SUBSTITUTES BE REJECTED, THE CONTRACTOR SHALL PROVIDE SPECIFIED MATERIALS AND SERVICES.

9. CODES, PERMITS AND INSPECTIONS:
   A. ALL WORK SHALL MEET OR EXCEED LATEST REQUIREMENTS OF NATIONAL, STATE, COUNTY, MUNICIPAL AND OTHER AUTHORITIES EXERCISING JURISDICTION OF THE WORK OF THIS PROJECT.
   B. ANY PORTION OF WORK WHICH IS NOT SUBJECT TO THE APPROVAL OF AN AUTHORITY MAKING JURISDICTION SHALL BE PROVIDED IN ACCORDANCE WITH NFPA REQUIREMENTS.
   C. SECURE PERMITS AND INSPECTION CERTIFICATES AND TRANSMIT SAME TO THE OWNER AT THE COMPLETION OF THE WORK.
   D. THIS CONTRACTOR SHALL PERFORM ALL CONTROLLED INSPECTORS IN ACCORDANCE WITH THE LOCAL AUTHORITIES HAVING JURISDICTION.

10. GUARANTEES:
   A. A. ALL WORK SHALL BE GUARANTEED TO BE FREE FROM LEAKS OR OTHER DEFECTS. ALL DEFECTIVE MATERIALS OR WORKMANSHIP AS WELL AS DAMAGES TO THE WORK SHALL BE REPLACED AND REPAIRED. ALL TRADES RESULTING FROM SAME SHALL BE REPLACED OR REPAIRED FOR THE DURATION OF THE GUARANTEE PERIOD.
   B. B. THE GUARANTEE PERIOD SHALL BE FOR ONE (1) YEAR FROM THE DATE OF ACCEPTANCE, WHICH SHALL BE THE DATE OF FINAL PAYMENT OR THE DATE OF FORMAL NOTICE OF ACCEPTANCE, WHICH EVER IS EARLIER.
   C. C. ALL WORK SHALL BE GUARANTEED AGAINST DEFECTS FOR A PERIOD OF ONE YEAR FROM THE DATE OF ACCEPTANCE OF THE INSTALLATION, AND ANY PORTIONS OF THE WORK WHICH DEVELOP DEFECTS DURING THAT TIME SHALL BE REPLACED OR REPAIRED IN A MANNER SATISFACTORY TO THE ARCHITECT.
   D. D. CERTIFICATION SHALL BE FOR ONE (1) YEAR FROM THE DATE OF ACCEPTANCE WHICH SHALL BE THE DATE FINAL PAYMENT OR THE DATE OF FORMAL NOTICE OF ACCEPTANCE, WHICHEVER IS EARLIER.

11. INSTALLATION OF AIR CONDITIONING UNIT
   A. GENERAL
   INSTALL AIR CONDITIONING UNIT IN ACCORDANCE WITH MANUFACTURER'S INSTALLATION INSTRUCTIONS. INSTALL UNIT PLUMB AND LEVEL, FIRMLY ANCHORED TO SUPPORT THE UNIT'S WEIGHT IN LOCATION INDICATED AND MAINTAIN MANUFACTURER'S RECOMMENDED CLEARANCES. DO NOT MOUNT UNITS ABOVE SENSITIVE ELECTRONIC EQUIPMENT TO MINIMIZE RISK OF WATER OVERFLOW/LEAKAGE DAMAGE AND IMPROVE MAINTENANCE/SERVICE ACCESS.

   B. ELECTRICAL WIRING
   INSTALL AND CONNECT ELECTRICAL DEVICES FURNISHED BY MANUFACTURER BUT NOT SPECIFIED TO BE FACTORY MOUNTED. FURNISH COPY OF MANUFACTURER'S ELECTRICAL CONNECTION DIAGRAM SUBMITTAL TO ELECTRICAL CONTRACTOR.

   C. PIPING CONNECTIONS
   INSTALL AND CONNECT DEVICES FURNISHED BY MANUFACTURER BUT NOT SPECIFIED TO BE FACTORY MOUNTED. FURNISH COPY OF MANUFACTURER'S PIPING CONNECTION DIAGRAM SUBMITTAL TO PIPING CONTRACTOR.

   D. SUPPLY AND DRAIN WATER PIPING
   CONNECT WATER SUPPLY AND DRAINS TO AIR CONDITIONING UNIT. UNIT DRAIN SHALL BE TRAPPED INTERNALLY AND SHALL NOT BE TRAPPED EXTERNALLY.

   E. FIELD SUPPLIED PAN
   A FIELD SUPPLIED PAN WITH DRAIN SHALL BE INSTALLED BENEATH COOLING UNITS AND WATER/GLYCOL CONDENSING UNITS.

   F. STARTUP AIR CONDITIONING UNIT IN ACCORDANCE WITH MANUFACTURER'S STARTUP INSTRUCTIONS. TEST CONTROLS AND DEMONSTRATE COMPLIANCE WITH REQUIREMENTS.

12. SHEET METAL DUCTWORK:
   A. ALL DUCTWORK AIR CHAMBERS, CASINGS, ENCLOSURES, DAMPERS AND ALL AUXILIARY DEVICES AND WORK NECESSARY TO MAKE THE VARIOUS AIR CONDITIONING AND VENTILATING SYSTEMS COMPLETE AND READY FOR SATISFACTORY OPERATION, SHALL BE FURNISHED AND INSTALLED.
   B. STEEL DUCTS: ASTM A525 GALVANIZED STEEL SHEET, LOCK-FORMING QUALITY HAVING ZINC COATING OF 125 OZ. PER SQ. FT FOR EACH SIDE IN CONFORMANCE WITH ASTM A90.
   C. FABRICATE AND SUPPORT ALL DUCTWORK IN ACCORDANCE WITH SMACNA DUCT CONSTRUCTION STANDARDS.
   D. ALL LOW PRESSURE DUCTWORK SHALL BE GALVANIZED STEEL, EXCEPT WHERE OTHERWISE SPECIFIED WITH GAUGES, BRACING AND CONSTRUCTION IN ACCORDANCE WITH THE LATEST SMACNA DUCT MANUAL STANDARDS. TOTAL AIR VOLUME FOR LOW PRESSURE DUCT SYSTEMS SHALL BE AT LEAST 95% OF SUPPLY VOLUME WHEN MEASURED BY DUCT TRAVERSES WITH A PITOT TUBE AND WATER MANOMETER.
      1. SUPPLY DUCT FROM UNIT DISCHARGE TO FILTER SECTION OR AIR TERMINAL UNIT: +4" PRESSURE CLASS, SEAL CLASS A.
      2. SUPPLY DUCT UPSTRREAM OF AIR TERMINAL UNIT: +6" PRESSURE CLASS, SEAL CLASS A.
      3. SUPPLY DUCT DOWN STREAM OF AIR TERMINAL UNIT: +1" PRESSURE CLASS, SEAL CLASS A.
      4. RETURN AND EXHAUST DUCT: -2" PRESSURE CLASS, SEAL CLASS A.
      5. BUTTON PUNCH LONGITUDINAL SEAMS SHALL NOT BE ALLOWED AT ANY PRESSURE CLASS.
   E. IN ACCORDANCE WITH SMACNA STANDARD, PROVIDE DUCT WORK CASING ACCESS DOORS TO ALL CONCEALED CONTROLS, FUSIBLE LINKS OF DAMPERS, ETC.
   F. PROVIDE MANUAL DAMPERS IN EACH SPLIT OR TAP CONNECTION TO AIR DISTRUBTION DEVICES FOR BALANCING PURPOSES, EACH PROVIDED WITH OPERATOR AND LOCKING DEVICE LOCATIONS TO BE AS INDICATED ON PLANS. WHERE MANUAL VOLUME DAMPERS ARE LOCATED ABOVE HARD CEILINGS, PROVIDE REMOTE OPERATING DAMPERS AND COORDINATE CABLE LENGTH AND CEILING MOUNTED ADJUSTMENT BOX WITH ALL TRADES AND LABEL APPRORIATELY.
   G. ANGLES AND OTHER STRUCTURAL SHAPES USED IN CONNECTION WITH BOTH STEEL AND ALUMINUM SHEETS SHALL BE ZINC-COATED STEEL. HANGER SHALL BE 3/8" MINIMUM DIAMETER ROLLED MILL STEEL.
   H. INSULATED FLEXIBLE DUCTWORK WITH VAPOR BARRIER MAY BE USED TO CONNECT LOW PRESSURE DUCTWORK TO CEILING DIFFUSERS.
   I. FLEXIBLE DUCT SHALL NOT EXCEED 5 FEET IN LENGTH AND CONSTRUCTION CONFORMING TO NFPA 90A AND UL.
   J. FLEXIBLE DUCTS SHALL BE PLENUM RATED VINYL IMPREGNATED FIBERGLASS FABRIC SUPPORTED BY HELICALLY WOUND SPRING STEEL WIRE OR FLAT STEEL BANDS RATED TO 3 INCHES WG POSITIVE AND 15 INCHES WG NEGATIVE, WRAPPED WITH FLEXIBLE GLASS FIBER INSULATION, ENCLOSED BY SEAMLESS ALUMINUM PIGMENTED PLASTIC VAPOR BARRIER JACKET MAXIMUM 023K VALUE AT 75 DEGREES F.
   K. SPIN-IN FITTINGS - SHALL BE CONICAL TYPE WITH BALANCING DAMPER, WITHOUT SCOOP
   L. ALL HVAC DUCTWORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH SMACNA EXCEPT THAT BUTTON PUNCH SEAMS SHALL NOT BE ACCEPTED.
   M. CONTROL DAMPERS SHALL BE OPPOSED BLADE TYPE W/ BLADE EDGE JAM SEALS.

13. GRILLES, REGISTERS AND DIFFUSERS:
   A. FURNISH AND INSTALL ALL METAL DIFFUSERS, GRILLES AND REGISTERS WITH MANUFACTURERS MODELS, SIZES, ACCESSORIES, FINISHES, ETC.
   B. A SCHEDULE OF DIFFUSERS, GRILLES AND REGISTERS WITH MANUFACTURERS MODELS, SIZES ACCESSORIES, FINISHES, ETC. SHALL BE SUBMITTED FOR APPROVAL PRIOR TO RELEASE FOR FABRICATION AND DELIVERY.
   C. DUCTWORK LAYOUTS AND ROUTES AS SHOWN ON THE DRAWINGS ARE SCHEMATIC. THEREFORE, CHANGES IN DUCT SIZES AND/OR LOCATIONS SHALL BE MADE WHERE NECESSARY TO CONFORM TO SPACE CONDITIONS OR OBTAIN MAXIMUM HEADROOM CONDITIONS WITHOUT ADDITIONAL COSTS TO THE OWNER.
   D. AIR DIFFUSERS AND GRILLES SHALL BE LOCATED IN CONFORMANCE TO ARCHITECTURAL REFLECTED CEILING PLANS.
   E. FRAMING FOR ALL AIR DISTRIBUTION DEVICES SHALL CONFORM TO AND ACCOMMODATE THE CEILING CONSTRUCTION.

14. PIPING AND FITTINGS:
   A. REFRIGERANT PIPING:
      1. TYPE "L" (ACR) COPPER TUBING, ASTM B280, HARD DRAWN.
      2. FITTINGS: WROUGHT COPPER SOLDER JOINT FITTINGS, ANSI/ASME B16.22.
      3. JOINTS: CLASSIFICATION BAG-1 (SILVER) AWS A5.8 BRAZED-SILVER ALLOY BRAZING. DO NOT USE AN ACID FLUX.
   B. AC CONDENSATE DRAIN PIPING:
      1. TYPE "L" COPPER, ASTM B88, DWV FITTINGS.

15. INSTALLATION:
   A. COORDINATE WITH ALL AFFECTED TRADES TO INSURE THAT NO CEILINGS, EQUIPMENT, OR OTHER MATERIALS OTHER THAN SPECIFICALLY PROVIDED HEREIN ARE SUPPORTED FROM DUCTWORK OR THE DUCTWORK HANGER SYSTEM.
   B. TOTAL SYSTEM LEAKAGE SHALL NOT EXCEED 5 PERCENT OF THE SCHEDULED DESIGN CAPACITY OF THE SYSTEM WHEN TESTED BY FULLY OPENING UP ALL BOXES AND DIFFUSERS AND READING THESE AIR QUANTITIES COMPARED TO DUCT TRAVERSE AND FAN CURVE COMPARISON.

16. INSULATION REQUIREMENTS:
   A. ALL DUCTWORK AND EQUIPMENT THAT TRANSMITS OR RECEIVES HEAT, SHALL BE INSULATED UNLESS IT IS SPECIFICALLY STATED OTHERWISE. INSULATION SHALL CONFORM TO RECOMMENDATIONS OF THE NFPA AND SHALL HAVE COMPOSITE FIRE AND SMOKE HAZARD RATINGS AS TESTED BY PROCEDURE ASTM-E-84, NFPA 255, OR UL-723, NOT EXCEEDING FLAME SPREAD 25 AND SMOKE DEVELOPED 50.
   B. DUCTWORK INSULATION:
      1. CONDITIONED SUPPLY, RETURN AND EXHAUST AIR DUCTS FOR AIR CONDITIONED SPACES TO HAVE A MINIMUM INSTALLED INSULATING VALUE OF R-6, TO BE FIBERGLASS WITH VAPOR SEAL FOIL FACED BLANKET TYPE 75, OWENS CORNING. THE K VALUE SHALL BE 0.30 AT 75 DEGREES F. MEAN TEMPERATURE. SEAL WITH GLASS FABRIC TAPE AND MASTIC. NO PRESSURE SENSITIVE TAPE TO BE ALLOWED.
   C. PERFORM ALL WORK IN STRICT ACCORDANCE WITH MANUFACTURERS' RECOMMENDATIONS.
   D. SEAL ALL VAPOR BARRIERS CONTINUOUS AND THROUGHOUT AGAINST MOISTURE PENETRATIONS.
   E. REFRIGERANT PIPING, LIQUID AND GAS, 1-1/2 INCHES AND SMALLER:
      1. 0.5" FLEXIBLE ELASTOMERIC. LABEL APPROPRIATELY. WHERE INSULATION IS EXPOSED OUTDOORS TO THE WEATHER, COVER WITH POLYGUARD ALUMAGUARD ALL-WEATEHR COOL-WRAP, A COMPOSITE MEMBRANE CONSISTING OF MULTI-PLY EMBOSSED UV-RESISTANT ALUMINUM FOIL/POLYMER LAMINATE WITH APPLIED RUBBERIZED ASPHALT LAYER AND METALIZED POLYESTER FILM COATED WITH A LOW TEMPERATURE ACRYLIC ADHESIVE.
   F. AC CONDENSATE DRAIN PIPING:
      1. 0.5 FLEXIBLE ELASTOMERIC. LABEL APPROPRIATELY.

17. EXECUTION:
   A. ADHERE TO DRAWINGS AS CLOSELY AS POSSIBLE. THE RIGHT IS RESERVED TO VARY THE RUNS AND SIZES OF DUCTWORK AND TO MAKE OFFSETS, WHERE NECESSARY TO ACCOMMODATE CONDITIONS ARISING AT THE BUILDING.
   B. MAKE JOINTS AND SEAMS SMOOTH ON THE INSIDE AND A NEAT FINISH ON THE OUTSIDE. DUCT JOINTS SHALL BE AIRTIGHT.
   C. SHAPE ALL CHANGES IN DIRECTION, BOTH HORIZONTAL AND VERTICAL, TO PERMIT THE EASIEST POSSIBLE AIR FLOW OR USE SQUARE VANED ELBOWS.
   D. EXACT DIMENSIONS OF OPENINGS MUST AWAIT REVIEW OF REGISTERS AND DIFFUSERS AND EXACT LOCATIONS SHALL BE SUBMITTED FOR REVIEW. EGISTER BOXES AND OTHER OPENINGS OF THE DUCTWORK MUST BE TIGHTLY CLOSED DURING CONSTRUCTION TO KEEP DIRT, DUST AND OTHER FORMS OF RUBBISH OUT OF THE DUCTWORK.
   E. PROVIDE GALVANIZED ANGLE IRON AND BANDS REQUIRED FOR DUCTWORK BRACING AND SUPPORT. PROVIDE HANGER INSERTS OF THE TYPE REQUIRED.
   F. FOR LOW PRESSURE DUCTWORK, PROVIDE AIR EXTRACTORS IN BRANCH DUCTS AT CONNECTION TO MAIN DUCTS.
   G. PROVIDE DUCT TURNS, OR OTHER TURNING VANES, IN ALL CASES WHERE 90 DEGREE SQUARE ELBOWS ARE USED.

18. HVAC CONTROLS:
   A. PROVIDE BASE BID PRICING FOR ADDING BACNET CONTROL SYSTEM CONTROL COMPONENTS TO NEW EQUIPMENT.

AIR DISTRIBUTION DEVICE SCHEDULE

TYPE	MANUFACTURER	MODEL	COMMENTS	SERVICE	CFM RANGE	FACE SIZE	NECK	RUNOUT	THROW (FT @ 50 FPM & 20°F)	MAX. NC	TOTAL PRESSURE (IN WC)	NOTES
1	TITUS	TDCAA	N/A	SUPPLY SQUARE CEILING DIFFUSER	0-50 55-110 115-220 225-340 345-645	12"x12" 24"x24" 24"x24" 24"x24" 24"x24"	6"ø 6"ø 8"ø 10"ø 12"ø	6"ø / 8"x4" 6"ø / 8"x4" 8"ø / 10"x6" 10"ø / 12"x8" 12"ø / 16"x8"				A,B,C,D
2	TITUS	50R AND 50F	N/A	RETURN/EXHAUST CEILING REGISTER	0-150 155-200 205-400 405-550 555-650 655-950 955-1300 1305-1700 1705-2000 2005-2300 2305-2700 2705-3200 3205-3800	6"x6" 12"x12" 12"x12" 12"x12" 24"x24" 24"x24" 24"x24" 24"x24" 24"x24" 24"x48" 24"x48" 24"x48" 24"x48"	--- --- --- --- --- --- --- --- --- --- --- --- ---	8"ø / 10"x6" 10"ø / 14"x6" 12"ø / 14"x8" 14"ø / 18"x8" 14"ø / 28"x6" 16"ø / 28"x8" 18"ø / 28"x10" 20"ø / 28"x12" 22"ø / 28"x14" 24"ø / 28"x16" 24"ø / 32"x16" 26"ø / 36"x16" 26"ø / 36"x18"				A,B,C,D

NOTES:
A. REFER TO MECHANICAL FLOOR PLANS FOR LOCATIONS AND QUANTITIES.
B. RUNOUT SIZES ARE AS NOTED IN SCHEDULE UNLESS OTHERWISE NOTED ON PLANS OR DETAILS.
C. NOT ALL SIZES SHOWN MAY BE USED ON THIS PROJECT.
D. PAINT INSIDE OF DUCTWORK FLAT BLACK BEHIND REGISTERS AND GRILLES WHEN SHEET METAL IS VISIBLE.

DUCTED MINI SPLIT SYSTEM - INDOOR UNIT SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL NO.	TYPE	PAIRED WITH	WEIGHT (LBS.)	NOMINAL TONNAGE	AIRFLOW CFM	HEATING			COOLING			ELECTRICAL		NOTES
									CAPACITY (BTU/H)	EAT DB/WB (°F)	HPSF	TOTAL CAPACITY (BTU/H)	SENSIBLE CAPACITY (BTU/H)	EAT DB/WB (°F)	MCA (A)	V/Ph/Hz	
IDU-1	1ST FLOOR	DAIKIN	FBQ18PVJU	HORIZONTAL DUCTED	CU-1	80	1.5	635	20,000	70/60	9.5	18,000	14,800	80/67	1.6	208/1/60	A,B,C,D
IDU-2	1ST FLOOR	DAIKIN	FBQ18PVJU	HORIZONTAL DUCTED	CU-2	80	1.5	530	20,000	70/60	9.5	18,000	14,800	80/67	1.6	208/1/60	A,B,C,D

NOTES:
A. PROVIDE AND INSTALL WITH A WIRED CONTROLLER.
B. PROVIDE AND INSTALL WITH INLINE CONDENSATE PUMP POWERED THRU UNIT WITH MINIMUM 30' LIFT.
C. PROVIDE AND INSTALL WITH DISCONNECT SWITCH
D. BACNET ADD-ON CARD TO INTEGRATE INTO BUILDING AUTOMATION SYSTEM. SEE CONTROLS SECTION FOR ALL REQUIRED OEM CONTROLLERS, SENSORS, AND DEVICES NECESSARY TO PERFORM THE SEQUENCE OF OPERATIONS.

DUCTED MINI SPLIT SYSTEM - OUTDOOR UNIT SCHEDULE

TAG	LOCATION	MANUFACTURER	MODEL NO.	TYPE	PAIRED WITH	WEIGHT (LBS.)	NOMINAL TONNAGE	EFFICIENCY		CONDENSER COIL		ELECTRICAL			NOTES
								SEER	EER	REFRIGERANT TYPE	AMBIENT RANGE (°F)	MCA (A)	MOP (A)	V/PH/HZ	
CU-1	LOWER ROOF	DAIKIN	RZQ18TAVJUA	HEAT PUMP	IDU-1	172	1.5	16.7	13.0	R-410A	-4 - 122	16.5	20	208/1/60	A,B,C,D,E,F
CU-2	LOWER ROOF	DAIKIN	RZQ18TAVJUA	HEAT PUMP	IDU-2	172	1.5	16.7	13.0	R-410A	-4 - 122	16.5	20	208/1/60	A,B,C,D,E,F

NOTES:
A. PROVIDE AND INSTALL ON EQUIPMENT RAILS.
B. PROVIDE AND INSTALL WIND BAFFLE FOR LOW AMBIENT COOLING DOWN TO 0°F.
C. VARIABLE SPEED INVERTER-DRIVE COMPRESSORS FOR MODULATING DX COOLING.
D. DISCONNECT PROVIDED BY DIVISION 26.
E. PROVIDE AND INSTALL MANUFACTURER SIZED REFRIGERANT PIPING OR LINE SET. COORDINATE DISTANCES BETWEEN INDOOR UNITS AND OUTDOOR UNITS FOR PROPER OPERATION WITH MANUFACTURER.
F. SEE CONTROL SECTION FOR ALL REQUIRED OEM CONTROLLERS, SENSORS, AND DEVICES NECESSARY TO PERFORM THE SEQUENCE OF OPERATIONS.

MINI-SPLIT SYSTEM HEAT PUMPS

MINI-SPLIT SYSTEMS SHALL COME WITH BACNET ADD-ON CARDS

RUN CONDITIONS - CONTINUOUS
THE UNIT SHALL RUN CONTINUOUSLY AND SHALL MAINTAIN A 75°F (ADJ.) COOLING SETPOINT AND A 50°F HEATING SETPOINT (ADJ.) AS SENSED BY A WALL MOUNTED THERMOSTAT OR AN AUXILIARY INPUT RETURN DUCT MOUNTED TEMPERATURE SENSOR DEPENDING ON APPLICATION.

SUPPLY FAN
THE FAN SHALL CYCLE WITH A CALL FOR COOLING OR HEATING.

DX COOLING
THE BUILT IN CONTROLLER SHALL MONITOR THE ZONE THERMOSTAT AND CYCLE ITS STAGES OF DX COOLING AS REQUIRED TO MAINTAIN
THE ZONE COOLING SETPOINT.

REVERSE DX HEATING
THE BUILT IN CONTROLLER SHALL MONITOR THE ZONE THERMOSTAT AND CYCLE ITS STAGES OF DX HEATING AS REQUIRED TO MAINTAIN THE ZONE HEATING SETPOINT.

SYSTEM CONTROL
THE CONTROLLER SHALL PROVIDE CONTROL OF THE FOLLOWING PARAMETERS THROUGH THE BUILDING AUTOMATION SYSTEM:

1. TEMPERATURE SETPOINT

SYSTEM MONITORING
THE CONTROLLER SHALL PROVIDE MONITORING OF THE FOLLOWING PARAMETERS THROUGH THE BUILDING AUTOMATION SYSTEM:

1. MODE STATE
2. FAN SPEED STATE
3. INLET TEMPERATURE
4. FAULT CODE

AUXILIARY DRAIN PAN WATER LEVEL SWITCHES
FOR UNITS IN ELETRICAL ROOMS, TDR/TER ROOMS, DATA ROOMS, IT CLOSETS, AND ABOVE HARD CEILINGS, THE CONTRACTOR SHALL PROVIDE AN AUXILIARY DRAIN PAN BELOW THE UNIT CONSTRUCTED OF NON-CORRODING MATERIALS. PLACE A WATER LEVEL SWITCH IN AUXILIARY DRAIN PANS. UPON DETECTION OF WATER, DE-ENERGIZE UNIT AND SEND AN ALARM TO THE BUILDING AUTOMATION SYSTEM.

ALARMS
ALARMS SHALL BE PROVIDED AS FOLLOWS

1. UNIT MALFUNCTION - THE CONTROLLER SENDS AN ERROR STATUS.
2. HIGH SPACE TEMPERATURE - THE SPACE TEMPERATURE IS 5°F (ADJ.) ABOVE THE COOLING SETPOINT.
3. IMPROPER CONDENSATE DRAINING - WATER LEVEL SWITCH IS TRIPPED.

MINI-SPLIT SYSTEMS	DIRECT DIGITAL CONTROL POINTS LIST SUMMARY TABLE																	
								ALARMS										
POINT DESCRIPTION	Electric	Pneumatic	Analog	Binary	Input	Output	Set Point Adjust	General Alarm	Critical Alarm	High Limit	Low Limit	Failure	Trend	Event History	Archive	Totalization	Graphical Point	Units
MODE STATE	X			X	X								X				X	SYSTEM STATUS
FAN SPEED STATE	X			X	X								X				X	SYSTEM STATUS
INLET TEMPERATURE	X		X		X			X		X			X				X	DEGREES F
FAULT CODE / UNIT MALFUNCTION	X			X	X			X				X	X	X			X	SYSTEM STATUS
CONDENSATE DRAIN ALARM	X			X	X			X				X	X	X			X	SYSTEM STATUS

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KCVG HUB
470 DAY ONE DRIVE
FLORENCE, KY 41042

Gresham Smith

CONSULTANT

ISSUANCE SCHEDULE

NUMBER	DESCRIPTION	DATE

SEAL

STATE OF KENTUCKY
TRACY A. WORLEY
35085
PROFESSIONAL ENGINEER

Digitally signed by Tracy Worley
Date: 2023.04.28 16:31:23-05'00'

PACKAGE DESCRIPTION

KENTON COUNTY AIRPORT BOARD

CVG
CINCINNATI/NORTHERN KENTUCKY INTERNATIONAL AIRPORT

SHEET TITLE

HVAC SCHEDULES, CONTROLS AND SPECIFICATIONS

SHEET MANAGEMENT

PROJECT NO.:	47000.19
DATE ISSUED:	04/28/2023
DRAWN BY:	Author
REVIEWED BY:	Checker

SHEET NUMBER

M002

SUBMITTAL TYPE - Conform Set - 20210331

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1 FIRST FLOOR NEW CONSTRUCTION HVAC PLAN

16' 8' 0' 16' 32'

NEW CONSTRUCTION PLAN LEGEND

- TYPE A - 1 HOUR FIRE BARRIERS TO REMAIN
- TYPE B - 1 HOUR SMOKE BARRIERS TO REMAIN
- TYPE C - 2 HOUR FIRE BARRIERS TO REMAIN
- TYPE D - 2 HOUR SMOKE BARRIERS TO REMAIN
- TYPE N - NON-RATED PARTITION TO REMAIN
- TYPE N - NON-RATED PARTITION
- 10909 OWNER FURNISHED EQUIPMENT
- GXXX SEE "GENERAL NOTES"
- 501 SEE "KEYNOTES"
- 101A DOOR DESIGNATION
- A EXTERIOR WINDOW DESIGNATION
- 01 INTERIOR WINDOW DESIGNATION
- B1 TOILET ACCESSORY
- WALL DESIGNATION

GENERAL NOTES

1 EXISTING INDOOR VRV UNITS TO REMAIN AS-IS. REBALANCE AIR DISTRIBUTION AS SHOWN.

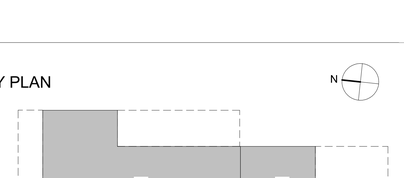
KEYNOTES

1 REBALANCE EXISTING SUPPLY AIR DIFFUSER TO 90 CFM
2 REBALANCE EXISTING RETURN AIR REGISTER TO 75 CFM
3 REBALANCE EXISTING OUTDOOR AIR SUPPLY TO 80 CFM
4 REBALANCE EXISTING OUTDOOR AIR SUPPLY TO 90 CFM
5 REBALANCE EXISTING OUTDOOR AIR SUPPLY TO 60 CFM
6 BALANCE OUTDOOR AIR SUPPLY TO 90 CFM
7 BALANCE OUTDOOR AIR SUPPLY TO 65 CFM
8 PROVIDE MINIMUM3/4" AC DRAIN AND ROUTE AS REQUIRED TO CONNECT TO EXISTING AC DRAINS.

NEW CONSTRUCTION KEYNOTES

Key Value	Keynote Text

KEY PLAN



BUILDINGS:
A - GSE/CARRIER MAINTENANCE/STORAGE FACILITY
B - GSE MAINTENANCE BAYS

BOUNDARY OF THE FUTURE EXPANSION

amazon

KCVG HUB
470 DAY ONE DRIVE
FLORENCE, KY 41042

Gresham Smith

CONSULTANT

ISSUANCE SCHEDULE

NUMBER	DESCRIPTION	DATE

SEAL

STATE OF KENTUCKY
TRACY A. WORLEY
29055
LICENSED PROFESSIONAL ENGINEER

Digitally signed by Tracy Worley
Date: 2023.04.28 16:31:32-05'00'

PACKAGE DESCRIPTION

KENTON COUNTY AIRPORT BOARD

CVG CINCINNATI/NORTHERN KENTUCKY INTERNATIONAL AIRPORT

SHEET TITLE

FIRST FLOOR HVAC PLAN

SHEET MANAGEMENT

PROJECT NO.:	47000.19
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REVIEWED BY:	Checker

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M201

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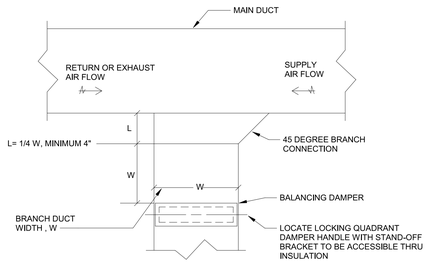
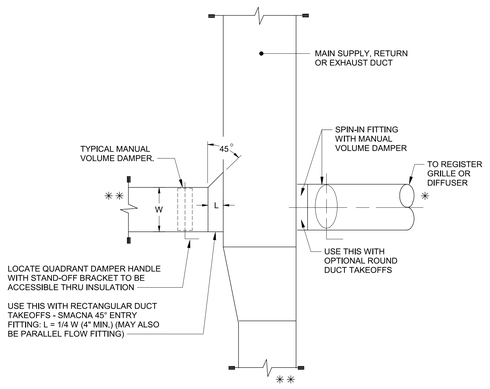


1 **LOW PRESSURE BRANCH TAKE-OFF**

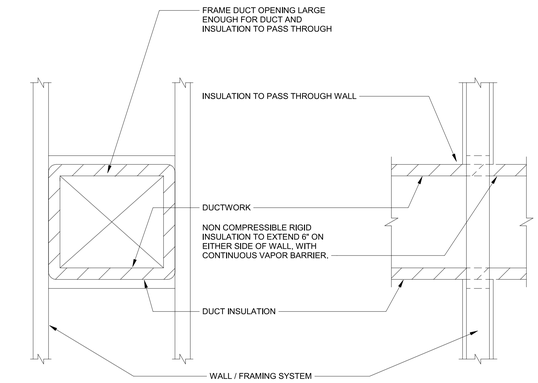
NO SCALE A-DUCT008



✳ = BRANCH TO INDIVIDUAL DIFFUSER OR GRILLE
✳✳ = SUBMAIN, BRANCHMAIN, OR BRANCH.

2 **LOW PRESSURE DUCT VOLUME DAMPER REQUIREMENTS**

NO SCALE

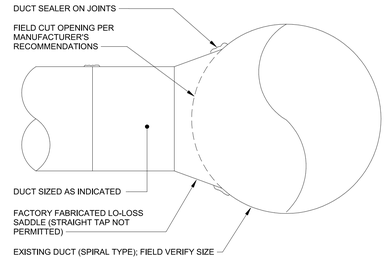


NOTES:

1. SUPPORT DUCT ON BOTH SIDES OF THE WALL WITHOUT PERMITTING CONTACT WITH THE WALL OR ITS FRAMING
2. PENETRATION TO MATCH STC RATING OF WALL

3 **DUCT SUPPORT AT PARTITION**

NO SCALE A-DUCT001

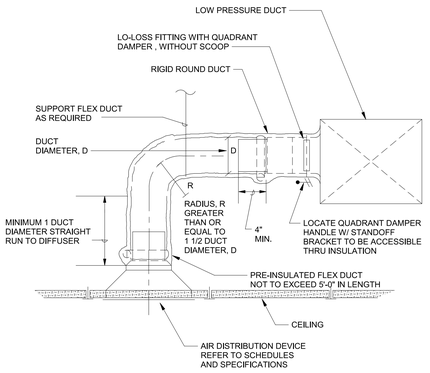


4 **FIELD TAP IN EXISTING SPIRAL DUCT**

NO SCALE A-DUCT004

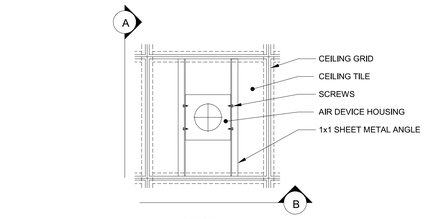
NOTE:

1. REFER TO SPECIFICATIONS FOR LOW PRESSURE AIR DUCT INSULATION REQUIREMENTS



5 **AIR DISTRIBUTION DEVICE CONNECTION**

NO SCALE A-DUCT006

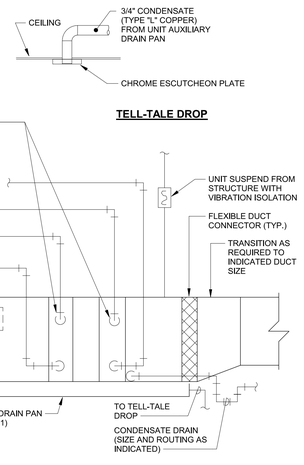


PLAN

SECTION A SECTION B

6 **AIR DEVICE SUPPORT**

NO SCALE A-DUCT011



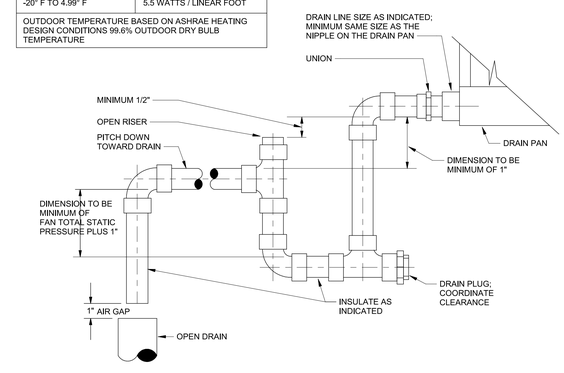
NOTES:

1. IN LIEU OF TELL-TALE DROP, CONTRACTOR MAY PROVIDE A WATER LEVEL DETECTION DEVICE CONFORMING TO UL-508 THAT WILL SHUT OFF THE EQUIPMENT SERVED PRIOR TO THE OVERFLOW OF THE PAN.

7 **ABOVE CEILING UNIT**

NO SCALE P-MISC023

EXTERNAL INSTALLATION HEAT TRACE REQUIREMENTS	
OUTDOOR TEMPERATURE	HEAT TRACE REQUIREMENTS
36° F AND ABOVE	NONE
5° F TO 35.99° F	3.3 WATTS / LINEAR FOOT
-20° F TO 4.99° F	5.5 WATTS / LINEAR FOOT
OUTDOOR TEMPERATURE BASED ON ASHRAE HEATING DESIGN CONDITIONS 99.6% OUTDOOR DRY BULB TEMPERATURE	

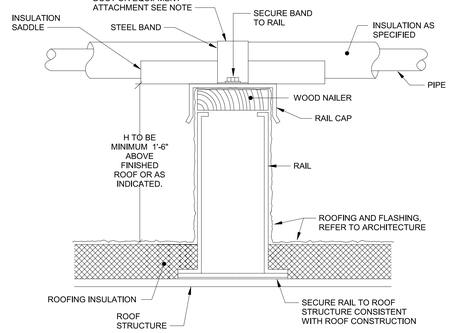


8 **BLOW-THRU AIR HANDLING UNIT CONDENSATE DRAIN TRAP**

NO SCALE P-MISC014

WIDTH OF EQUIPMENT	HEIGHT "H"
0" TO 36"	18"
37" TO 48"	24"
49" TO 60"	30"
61" AND WIDER	48"

"H" CLEARANCE FOR ROOF MAINTENANCE IS RECOMMENDED FOR EQUIPMENT AND DUCTS

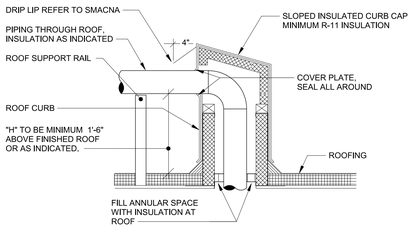


NOTES:

1. ROOFING AND COUNTER FLASHING PER ROOFING MANUFACTURER'S REQUIREMENTS.
2. DUCTWORK ATTACHMENT PER SMACNA
3. EQUIPMENT ATTACHMENT PER MANUFACTURER'S RECOMMENDATION.

9 **ROOF SUPPORT RAIL**

NO SCALE A-EQUIP007

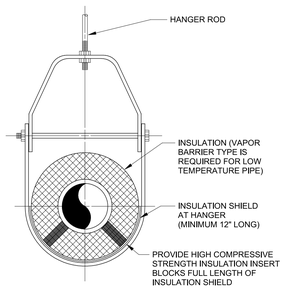


TOTAL WIDTH OF PIPING	HEIGHT "H"
0" TO 36"	18"
37" TO 48"	24"
49" TO 60"	30"
61" AND WIDER	48"

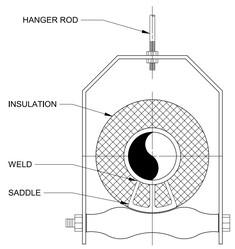
"H" CLEARANCE FOR ROOF MAINTENANCE IS RECOMMENDED FOR PIPING, EQUIPMENT AND DUCTS

10 **PIPE THRU ROOF**

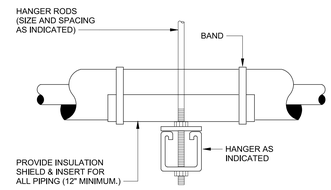
NO SCALE P-MISC001



ADJUSTABLE CLEVIS HANGER



ADJUSTABLE ROLLER HANGER



TRAPEZE HANGER

NOTES:

1. CLEVIS HANGER SIZED FOR FULL INSULATION THICKNESS OF THE PIPING SYSTEM.
2. INSULATION INSERT BLOCKS MAY BE OMITTED IF INSULATION WILL NOT BE COMPRESSED BY WEIGHT OF FILLED PIPING SYSTEM.
3. PROVIDE DIELECTRIC ISOLATION WHERE DISSIMILAR METALS ARE IN CONTACT.
4. PROVIDE VIBRATION ISOLATION AS INDICATED.

MAXIMUM METALLIC PIPE / TUBING SUPPORT SPACING, FEET

NOM. SIZE	THRU 3/4"	1	1 1/4	1 1/2	2	2 1/2	3	4	5	6	8	10	12	14	16	18	20	24
PIPE	7 FT.	8	8	10	10	10	12	12	12	12	12	12	12	12	12	12	12	12
TUBING	5 FT.	6	6	8	8	8	8	8	8	8	8	——	——	——	——	——	——	——

NOTES:
1. FOR TRAPEZE HANGER TAKE SPACING OF SMALLEST SIZE ON TRAPEZE
2. NOT APPLICABLE FOR NON-METALLIC OR MEDICAL GAS SYSTEMS

11 **TYPICAL PIPE HANGERS**

NO SCALE P-MISC017

amazon

KCVG HUB
470 DAY ONE DRIVE
FLORENCE, KY 41042

Gresham Smith

CONSULTANT

ISSUANCE SCHEDULE

NUMBER	DESCRIPTION	DATE

SEAL

STATE OF KENTUCKY
TRACY K. WORLEY
LICENSED PROFESSIONAL ENGINEER

Digitally signed by Tracy Worley
Date: 2023-04.28 16:31:41-05'00'

PACKAGE DESCRIPTION

KENTON COUNTY AIRPORT BOARD

CVG CINCINNATI NORTHERN KENTUCKY INTERNATIONAL AIRPORT

SHEET TITLE

HVAC DETAILS

SHEET MANAGEMENT

PROJECT NO.:	47000.19
DATE ISSUED:	04/28/2023
DRAWN BY:	Author
REVIEWED BY:	Checker

SHEET NUMBER

M601

SUBMITTAL TYPE - Conform Set - 20210331

Autodesk Docs://47000.MP Amazon Air P22/47000.19 MechCentralR22.rvt

4/28/2023 4:23:29 PM

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