HVAC LEGEND

SYMBOL	DESCRIPTION	ABBREVIATION
D 20 / 10	AIR DEVICE TAG, TYPE "A", BALANCE FOR 100 CFM, 6"Ø NECK	---
12x10	DUCT SIZE - RECTANGULAR (OR 12/10)	---
Ø 30	DUCT SIZE - ROUND	---
	DUCT SMOKE DETECTOR	---
	DUCT TRANSITION	---
FPB 3-7 / D - 1230 / E - 380	1230 MAX CFM, 6 KW, 380 MIN CFM	---
AHU 1	EQUIPMENT DESIGNATION	---
	FLEXIBLE DUCT	---
	FLEXIBLE DUCT CONNECTOR	---
	MANUAL VOLUME DAMPER (RECTANGULAR DUCT)	MVD
	MANUAL VOLUME DAMPER (ROUND DUCT)	MVD
M	MOTORIZED DAMPER	MD
	RETURN / EXHAUST AIR DUCT TURNED DOWN	---
	RETURN / EXHAUST AIR DUCT TURNED UP	---
	RETURN / EXHAUST AIR GRILLE (CEILING)	---
	SUPPLY AIR DIFFUSER WITH SECTORIZING BAFFLE (CEILING)	---
	SIDEWALL SUPPLY REGISTER OR GRILLE	---
	SIDEWALL RETURN AIR REGISTER OR GRILLE	---
	SLOT DIFFUSER	---
	SQUARE CEILING DIFFUSER	---
	SUPPLY AIR DUCT TURNED DOWN	---
	SUPPLY AIR DUCT TURNED UP	---
T S	THERMOSTAT/TEMPERATURE SENSOR	TSTAT
	TURNING VANES	---
	MECHANICAL EQUIPMENT WITH SERVICE AND AIRFLOW CLEARANCES (AS REQUIRED BY THE MANUFACTURER)	---
---	1000 BTU/HR	MBH
---	ABOVE CEILING	A/C
---	ABOVE FINISHED FLOOR	AFF
---	ABOVE FINISHED GRADE	AFG
---	ACCESS DOOR	AD
---	ACCESS PANEL (REFER TO ARCHITECTURAL DWGS.)	AP
---	AIR COOLED CONDENSING UNIT	CU
---	AIR HANDLER	AH
---	AUTHORITY HAVING JURISDICTION	AHJ
---	CONDENSATE DRAIN	CD
---	DRY BULB	DB
---	ENTERING AIR TEMPERATURE	EAT
---	EXHAUST AIR (ENVIRONMENTAL AIR)	EA
---	EXHAUST FAN	EF
---	EXTERNAL STATIC PRESSURE	ESP
---	INCHES OF WATER COLUMN	IN WC
---	LEAVING AIR TEMPERATURE	LAT
---	OPPOSED BLADE DAMPER	OBD
---	OUTSIDE AIR	OA
---	PRESSURE DROP	PD
---	RETURN AIR	RA
---	SEASONAL ENERGY EFFICIENCY RATIO	SEER
---	SENSIBLE	SENS
---	STATIC PRESSURE (IN WC)	SP
---	SUPPLY AIR	SA
---	TRANSFER DUCT	TD
---	TYPICAL	TYP
---	UNLESS NOTED OTHERWISE	UNO
---	WET BULB	WB
---	WIRE MESH SCREEN	WMS
---	CLEANOUT	CO

SHEET LIST

M-0001	MECHANICAL GENERAL NOTES & LEGEND
M-0002	MECHANICAL SCHEDULES
M-0003	MECHANICAL DETAILS
M-0004	MECHANICAL SPECIFICATION
M-0005	MECHANICAL SPECIFICATION
M-0006	MECHANICAL SPECIFICATION
M-1102A.1	DEMOLITION PLAN - LEVEL 02A - SUITE 225
M-1102A.2	DEMOLITION PLAN - LEVEL 02A - SUITE 250
M-1102B	DEMOLITION PLAN - LEVEL 02B - SUITE 200
M-1104A.1	FLOOR PLAN - LEVEL 02A - SUITE 225
M-1104A.2	FLOOR PLAN - LEVEL 02A - SUITE 250
M-1104B	FLOOR PLAN - LEVEL 02B - SUITE 200
M-1105A.2	ROOF PLAN - BUILDING A - SUITE 250
M-1105B	ROOF PLAN - BUILDING B - SUITE 200

HVAC GENERAL NOTES

1. ALL MECHANICAL EQUIPMENT AND INSTALLATIONS SHALL CONFORM WITH THE REQUIREMENTS OF THE 2015 INTERNATIONAL MECHANICAL CODE, THE 2015 INTERNATIONAL BUILDING CODE, 2015 INTERNATIONAL ENERGY CONSERVATION CODE, STATE AND LOCAL AMENDMENTS, NFPA 90A, 101, UNDERWRITERS LABORATORIES (OR ETL) AND ALL APPLICABLE LOCAL CODES AND ORDINANCES.

2. THIS PROJECT HAS BEEN DESIGNED TO COMPLY WITH THE 2015 INTERNATIONAL ENERGY CONSERVATION CODE PRESCRIPTIVE COMPLIANCE PATH. THE OWNER/ARCHITECT/CONTRACTOR SHALL REFER TO THE APPLICABLE PROJECT DOCUMENTATION (SCORECARD/ CHECKLIST/ CODE) PRIOR TO PRESENTING VALUE ENGINEERING ALTERNATIVES OR OWNER/ARCHITECT REQUESTED REVISIONS THAT MAY IMPACT COMPLIANCE WITH THE APPLICABLE GREEN BUILDING PROGRAM OR ENERGY CODE.

3. THE LOCATIONS, ARRANGEMENT AND EXTENT OF EQUIPMENT, PIPING, SUPPORTS, DEVICES, CONDUIT, AND OTHER APPURTENANCES RELATED TO THE INSTALLATION OF THE MECHANICAL AND ELECTRICAL WORK SHOWN ARE APPROXIMATE. THE DRAWINGS ARE DIAGRAMMATIC. DO NOT SCALE THE DRAWINGS, BUT REFER TO THE ARCHITECTURAL DRAWINGS FOR EXACT DIMENSIONS OF BUILDING COMPONENTS. SHOULD A CONFLICT EXIST BETWEEN THE ARCHITECTURAL AND ENGINEERING DRAWINGS REGARDING DIMENSIONS, SCALE, ETC., NOTIFY THE ARCHITECT IMMEDIATELY.

4. MATERIALS, EQUIPMENT OR LABOR NOT INDICATED, BUT WHICH CAN BE REASONABLY INFERRED TO BE NECESSARY FOR A COMPLETE INSTALLATION SHALL BE PROVIDED. THE DRAWINGS AND SPECIFICATIONS DO NOT UNDERTAKE TO INDICATE EVERY ITEM OF MATERIAL, EQUIPMENT OR LABOR REQUIRED TO PRODUCE A SAFE, COMPLETE AND PROPERLY OPERATING SYSTEM.

5. PRIOR TO PURCHASING ANY MATERIALS OR STARTING ANY WORK, CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS, DUCTWORK SIZES AND LOCATIONS, EQUIPMENT, ETC. SHOWN ON THE DRAWINGS OR AFFECTING THIS WORK AND SHALL REPORT ANY DEVIATIONS TO THE ARCHITECT.

6. SHOP DRAWINGS SHALL BE SUBMITTED TO AND APPROVED BY THE ARCHITECT/ENGINEER PRIOR TO ORDERING, PURCHASING, OR FABRICATING ANY MECHANICAL EQUIPMENT. SHOP DRAWINGS SHALL INCLUDE: ALL EQUIPMENT SCHEDULED OR SPECIFIED ON THE DRAWINGS; DUCTWORK DRAWN TO 1/4" SCALE OR THE SCALE SHOWN ON THE DRAWINGS; SENSOR LOCATIONS; REFRIGERANT PIPING AND CONTROL WIRING SCHEMATICS CERTIFIED BY THE AIR CONDITIONING EQUIPMENT MANUFACTURER.
   a. WHERE SPLIT SYSTEMS ARE USED IN A "LONG LINE APPLICATION," SUBMIT MANUFACTURER'S REFRIGERANT LINE SET ROUTING DRAWINGS AND ENGINEERED CALCULATIONS SUPPORTING INSTALLED LINE LENGTHS AND RECOMMENDED SUCTION AND LIQUID LINE SIZES (DEVIATIONS IN THE INSTALLED LENGTHS AND SIZES SHALL BE RECORDED ON THE AS-BUILT DRAWINGS AND COORDINATED WITH THE MANUFACTURER TO RECONFIRM THAT LONG LINE GUIDELINES ARE BEING MET). IDENTIFY AND PROVIDE CUT SHEETS OF ANY AND ALL ACCESSORIES REQUIRED TO MAKE THE SYSTEM COMPLETE, FUNCTIONAL AND RELIABLE.
   b. FAILURE TO SUBMIT CERTIFIED REFRIGERANT PIPING DRAWINGS SHALL BE CAUSE FOR REJECTION OF THE ENTIRE SUBMITTAL AND DOES NOT RELIEVE THE CONTRACTOR OF COMPLYING WITH MANUFACTURER'S RECOMMENDATIONS.
   c. LONG LINE REFRIGERANT PIPING APPLICATIONS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S CURRENT SPLIT SYSTEM LONG LINE APPLICATION GUIDELINE.
   d. ANY SPLIT SYSTEM WITH 75 FEET OF SEPARATION BETWEEN THE OUTDOOR UNIT AND INDOOR UNIT REQUIRES THAT THE CONTRACTOR OBTAIN A WARRANTY APPROVAL LETTER FROM THE EQUIPMENT MANUFACTURER CERTIFYING THE LONG LINE LENGTH DISTANCES SHOWN ON THE SUBMITTED SHOP DRAWINGS ARE ACCEPTABLE.
   e. HVAC EQUIPMENT SUBMITTALS SHALL INCLUDE, BUT NOT BE LIMITED TO, DATA SHEETS FOR ALL SYSTEM COMPONENTS, FAN SELECTIONS WITH PERFORMANCE CURVES AT SITE CONDITIONS, ELECTRICAL CHARACTERISTICS (COORDINATED WITH ELECTRICAL SUBCONTRACTOR), WIRING DIAGRAMS, INSTALLATION, OPERATION AND MAINTENANCE MANUALS, AHRI RATING CERTIFICATES FOR ACTUAL EQUIPMENT TO BE INSTALLED. FAILURE TO SUBMIT AHRI CERTIFICATES IS CAUSE FOR REJECTION OF THE SUBMITTAL.

   SHOP DRAWINGS SHALL BE SUBMITTED SIMULTANEOUSLY IN ONE PACKAGE WITH EACH ITEM CLEARLY NOTED BY THE TAG USED ON THE DRAWINGS AND SPECIFICATION SECTION PERTAINING TO THE ITEM.

7. ALL MECHANICAL EQUIPMENT SHALL BE INSTALLED AND MAINTAINED PER MANUFACTURER'S RECOMMENDATIONS AND INSTALLATION INSTRUCTIONS.

8. ALL MECHANICAL EQUIPMENT AND SYSTEMS SHALL BE GUARANTEED FOR A PERIOD OF ONE YEAR AFTER ACCEPTANCE BY OWNER.

9. ALL HVAC COMPRESSORS SHALL HAVE EXTENDED 4_YEAR MANUFACTURER'S WARRANTY FOR A 5-YEAR TOTAL WARRANTY.

10. FOR EXACT LOCATION OF OUTDOOR AIR CONDITIONING UNITS, SEE ARCHITECTURAL DRAWINGS.

11. INSTALL ROOF MOUNTED OUTDOOR AIR CONDITIONING EQUIPMENT LEVEL ON SUPPORTS AS INDICATED ON THE DETAIL SHEETS. MOUNT ALL EQUIPMENT ON 3/8" THICK NEOPRENE PADS (MINIMUM OF 4 PADS PER UNIT). ALL ROOFTOP MOUNTED EQUIPMENT SHALL BE INSTALLED PER DETAILS AND AS RECOMMENDED BY THE MANUFACTURER.

12. SPLIT SYSTEM OUTDOOR UNIT EQUIPMENT HAS BEEN SHOWN ON ROOF INDICATING MATCHED SYSTEMS OF THE INDOOR UNIT WITH ITS ASSOCIATED OUTDOOR UNIT. WHILE THE LOCATION OF THE OUTDOOR UNITS ARE APPROXIMATE, THE IMPORTANCE OF UNIT LOCATIONS IN RELATION TO THE REFRIGERANT LINE SET ROOF JACKHOOD (PENETRATION THROUGH THE ROOF) IS CRITICAL FOR THE PROJECT. THE CONTRACTOR SHALL COORDINATE THE INSTALLATION AND OBSERVE THE MANUFACTURER'S INSTALLATION INSTRUCTIONS FOR LONG LINE APPLICATIONS. REFRIGERANT LINE SETS SHALL BE INSTALLED TO REDUCE THE SYSTEM TOTAL EQUIVALENT LENGTH AND MINIMIZE SYSTEM CAPACITY LOSSES DUE TO ELBOWS, FITTINGS, VALVES, ETC. THAT COMPRISE THE ENTIRE REFRIGERANT PIPING SYSTEM. AFTER RECEIPT OF THE APPROVED SUBMITTALS, THE CONTRACTOR IS RESPONSIBLE TO COORDINATE THE REFRIGERANT PIPING SCHEMATICS CERTIFIED BY THE EQUIPMENT MANUFACTURER AND SUBMITTING THE REFRIGERANT PIPING DRAWINGS AS OUTLINED IN THE SHOP DRAWING NOTE ABOVE.

13. PORTIONS OF DUCTWORK AND PIPE INSULATION VISIBLE THROUGH AIR DISTRIBUTION DEVICES IN FINISHED AREAS SHALL BE PAINTED FLAT BLACK.

14. MOUNT TOP OF THERMOSTATS AND SONSORS AT 48" AFF UNLESS NOTED OTHERWISE. PROVIDE CLEAR LOCKING GUARD ASSEMBLIES FOR ALL PUBLIC AREA THERMOSTATS. COORDINATE THERMOSTAT LOCATIONS WITH ALL TRADES. COORDINATE FINAL LOCATIONS WITH THE GENERAL CONTRACTOR, INTERIOR DESIGNER AND THE OWNER PRIOR TO INSTALLATION. LOCATE ADJACENT TO LIGHT SWITCHES WHERE POSSIBLE. DO NOT LOCATE THERMOSTATS AT THE CENTER OR NEAR CENTER OF A WALL. THERMOSTATS SHALL BE MOUNTED NO CLOSER THAN 8" FROM THE CORNER OR END OF A WALL OR DOOR. ALL THERMOSTATS SHALL BE ADA COMPLIANT.

15. CAREFULLY COORDINATE ALL PENETRATIONS THROUGH EXTERIOR WALLS WITH ARCHITECTURAL DRAWINGS AND FINISHES. THE PENETRATIONS SHALL NOT BE LOCATED WHERE THEY WILL CONFLICT WITH ARCHITECTURAL FEATURES, TRANSITIONS IN MATERIALS, OR COLOR CHANGES IN MATERIALS. HORIZONTALLY ALIGN PENETRATIONS WHEREVER POSSIBLE UNLESS NOTED OTHERWISE. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO ANY WORK BEING DONE.

16. CAREFULLY COORDINATE ALL PENETRATIONS THROUGH THE ROOF WITH ARCHITECTURAL DRAWING. THE PENETRATIONS SHALL NOT BE LOCATED WHERE THEY WILL CONFLICT WITH ARCHITECTURAL FEATURES, EXPANSION JOINTS OR STRUCTURE. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT PRIOR TO ANY WORK BEING DONE.

17. CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL MECHANICAL EQUIPMENT, DUCTWORK, PIPING, ETC. TO FIT WITHIN THE SPACE ALLOWED BY THE ARCHITECTURAL AND STRUCTURAL CONDITIONS. CUTTING OR OTHERWISE ALTERING ANY STRUCTURAL MEMBERS SHALL NOT BE PERMITTED WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT.

18. SEAL THE ANNULAR SPACE AROUND ALL DUCT, PIPE, GRILLE, REGISTER, DIFFUSER, ETC. PENETRATIONS THROUGH WALLS, FLOORS AND CEILINGS AIRTIGHT WITH AN APPROVED MATERIAL (RE: ARCHITECTURAL DOCUMENTS FOR APPROVED MATERIALS).

19. THE GENERAL CONTRACTOR SHALL COORDINATE SERVICE ACCESS PATHS FOR ROOF MOUNTED EQUIPMENT REQUIRING ROUTINE MAINTENANCE. PROVIDE CODE COMPLIANT GALVANIZED STEEL CROSSING STRUCTURE (E.G. STAIRS WITH HANDRAILS, LADDERS, ETC.) FOR ANY OBSTRUCTION (DUCTWORK, PIPING, ETC.) THAT EXCEEDS 1'-6" IN HEIGHT X 1'-6" IN WIDTH. ALL DUCTWORK, PIPING AND EQUIPMENT INSTALLATION SHALL COMPLY WITH THE FOLLOWING:
   a. FOR ROOF MOUNTED EQUIPMENT REQUIRING ROUTINE MAINTENANCE, ALLOW FOR AN UNOBSTRUCTED PATH FROM THE ROOF SERVICE ENTRY POINT TO THE EQUIPMENT. THE PATH AREA SHALL BE A MINIMUM OF 6'-0" HIGH BY 3'-0" WIDE.

21. ACCESS PANELS IN NON-ACCESSIBLE CEILINGS AND IN WALLS TO ALLOW ADEQUATE ROOM FOR MAINTENANCE OF EQUIPMENT AND BALANCING OF SYSTEMS SHALL BE INSTALLED UNDER THE ARCHITECTURAL DIVISION. ACCESS PANELS IN CEILING AND WALLS SHALL BE PROVIDED WHERE SHOWN ON THE DRAWINGS OR WHERE NECESSARY TO ACCESS DAMPERS, VALVES, ETC. COORDINATE EXACT LOCATION OF ALL ACCESS PANELS WITH THE ARCHITECT DURING THE SHOP DRAWING PROCESS.

22. ALL MECHANICAL EQUIPMENT SHALL BE LABELED WITH A 2" HIGH PLASTIC ENGRAVED NAMEPLATE WITH 1" HIGH WHITE LETTERS ON A BLACK BACKGROUND SECURELY AFFIXED TO THE EQUIPMENT. THE NAMEPLATE SHALL SHOW THE EQUIPMENT TAG USED ON THESE DRAWINGS.

23. THE FIRE SPRINKLER CONTRACTOR SHALL INSTALL AND LOCATE ALL FIRE SPRINKLER PIPING TO PREVENT PIPING FROM THE POTENTIAL OF FREEZING. THE FIRE SPRINKLER CONTRACTOR IS REQUIRED TO NOTIFY THE ARCHITECT AND COORDINATE WITH THE MECHANICAL AND ELECTRICAL CONTRACTORS IF HEATING IS REQUIRED.

24. DUCTWORK AND PIPING SHALL NOT BE INSTALLED IN ELECTRICAL ROOMS EXCEPT FOR DUCTWORK AND PIPING SERVING THAT SPECIFIC ROOM. DUCTWORK AND PIPING SHALL NOT BE ROUTED ABOVE ELECTRICAL EQUIPMENT PER THE NATIONAL ELECTRICAL CODE ARTICLE 110.

25. ROOFING: ROOF OPENINGS, PENETRATIONS AND CURBS SHALL BE AT LEAST 12 INCHES APART FROM OTHER ROOF PENETRATIONS, CURBS, WALL, AND DRAIN SUMP TO ALLOW FOR PROPER ROOFING SYSTEM FLASHING AND DETAILING.

26. ROOFTOP EQUIPMENT WIND RESISTANCE: CONTRACTOR SHALL PROVIDE SUPPORT FOR MECHANICAL ROOFTOP EQUIPMENT IN ORDER TO MEET CODE REQUIRED WIND RESISTANCE (RE: 2015 IMC "301.15 WIND RESISTANCE. MECHANICAL EQUIPMENT, APPLIANCES AND SUPPORTS THAT ARE EXPOSED TO WIND SHALL BE DESIGNED AND INSTALLED TO RESIST THE WIND PRESSURE DETERMINED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE."

TESTING, ADJUSTING AND BALANCING

1. AFTER CONSTRUCTION, THE ENTIRE HVAC SYSTEM SHALL BE TESTED, ADJUSTED, AND BALANCED TO DELIVER THE AIR QUANTITIES SHOWN ON THE DRAWINGS.

2. SUBMIT THE CERTIFIED TEST AND BALANCE REPORT TO THE ARCHITECT FOR APPROVAL. BALANCING CONTRACTOR SHALL BE NATIONAL TAB.

3. VENTILATION AIR DISTRIBUTION SYSTEMS FOR ALL AIR SYSTEMS SHALL BE BALANCED TO ACHIEVE THE AIRFLOW RATES INDICATED ON THE DRAWINGS. THESE AIRFLOW RATES SHALL BE CONSIDERED MINIMUM RATES. THE MEASURED AIR BALANCE TOLERANCE FOR ALL AIR RATES SHALL BE 0% TO +5%.

MECHANICAL/ELECTRICAL COORDINATION:

1. CONTRACTOR SHALL COORDINATE ELECTRICAL CHARACTERISTICS AND REQUIREMENTS OF ALL MECHANICAL EQUIPMENT WITH ELECTRICAL DRAWINGS PRIOR TO ORDERING EQUIPMENT OR SUBMITTING SHOP DRAWINGS AND SHALL FURNISH EQUIPMENT WIRED FOR THE VOLTAGES SHOWN THEREIN. SHOP DRAWING SUBMITTALS SHALL CLEARLY STATE THAT THE ELECTRICAL CHARACTERISTICS OF ALL EQUIPMENT HAS BEEN COORDINATED WITH THE ELECTRICAL CONTRACT DOCUMENTS AND THE ELECTRICAL CONTRACTOR.

2. ALL MECHANICAL EQUIPMENT REQUIRING ELECTRICAL POWER SHALL BE INSTALLED WITH A DISCONNECT SWITCH AT EACH PIECE OF EQUIPMENT. COORDINATE SWITCH TYPE (FUSED OR NON-FUSED) WITH EQUIPMENT CHARACTERISTICS, MANUFACTURER'S RECOMMENDATIONS AND THE ELECTRICAL DRAWINGS. DISCONNECT SWITCH SHALL BE FURNISHED BY MECHANICAL FOR INSTALLATION BY ELECTRICAL. DISCONNECT SWITCHES SHALL NOT BE MOUNTED ON THE EQUIPMENT IT SERVES UNLESS INTEGRAL TO THE UNIT.

3. PROVIDE ALL SYSTEM CONTROLS AND ASSOCIATED CONTROL AND INTERLOCK WIRING FOR COMPLETE AND OPERABLE SYSTEMS. 120 VOLT AND HIGHER WIRING SHALL BE MC CABLE OR IN CONDUIT IN ACCORDANCE WITH LOCAL CODES AND THE MATERIALS AND INSTALLATION REQUIREMENTS OF DIVISION 26 - ELECTRICAL.

4. ALL REQUIRED CONTROL WIRING (INCLUDING POWER WIRING REQUIRED FOR CONTROL PANELS, DEVICES, ETC.) NOT INDICATED ON WIRING IN HVAC PLENUM SPACES SHALL BE INSTALLED ACCORDING TO CODE REQUIREMENTS.

5. UNLESS NOTED OTHERWISE, TRANSFORMERS, CONTROLS AND CONTROL WIRING REQUIRED FOR ALL MECHANICAL SYSTEMS SHALL BE FURNISHED WITH THE EQUIPMENT IT SERVES AND INSTALLED BY THE MECHANICAL CONTRACTOR. MOTOR STARTERS FOR HVAC EQUIPMENT SHALL BE FURNISHED WITH THE MOTOR OR APPARATUS WHICH IT OPERATES. MOTOR STARTER INSTALLATION SHALL BE BY THE DIVISION 26 CONTRACTOR.

6. MAINTAIN REQUIRED NEC CLEARANCES FOR ALL FUTURE ELECTRICAL EQUIPMENT. THE CLEAR WIDTH SHALL BE THE WIDTH OF THE EQUIPMENT OR 2'-6" (MINIMUM). THE FOLLOWING CLEARANCE IN FRONT OF THE EQUIPMENT SHALL BE:
   a. FOR 208/240V EQUIPMENT: 3'-0" CLEARANCE

7. CLEARANCES FOR ELECTRIC DUCT HEATERS AND LOW VOLTAGE CONTROL PANELS LOCATED ABOVE CEILINGS: THE CONTRACTOR SHALL COORDINATE AND PLAN THE WORK TO ALLOW FOR A CLEAR SPACE IN FRONT OF ALL ELECTRIC DUCT HEATER CONTROL PANELS (INCLUDING, BUT NOT LIMITED TO AHUS, FCUS, VAVs, PIUs, UHs, ETC.) OF 42" X 30" WIDE (OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER). THE CONTROL PANEL DOOR SHALL BE ALLOWED TO OPEN AT LEAST 90 DEGREES. EQUIPMENT WITHOUT DUCT HEATERS THAT HAVE LOW VOLTAGE CONTROL PANELS SHALL HAVE A MINIMUM CLEAR SPACE IN FRONT OF THE PANEL OF 34" X 24" WIDE (OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER).

8. ROUTING OF PIPING AND DUCTWORK SHALL BE COORDINATED WITH THE ELECTRICAL CONTRACTOR AND ALL OTHER TRADES DURING THE SUBMITTAL AND LAYOUT PHASE. PIPING AND DUCTWORK SHALL NOT BE ROUTED THROUGH THE DEDICATED ELECTRICAL SPACE ABOVE EACH LOAD CENTER.

9. COORDINATE WITH THE ELECTRICAL DRAWINGS FOR THE REQUIRED SHORT CIRCUIT CURRENT RATING OF THE PANELBOARD SERVING THE EQUIPMENT. THE EQUIPMENT NAMEPLATE SHALL BEAR A RATING OF NO LESS THAN THE PANELBOARD RATING.

DUCT SMOKE DETECTORS:

1. ALL FANS SUPPLYING MORE THAN 2000 CFM OF AIR TO ANY SPACE SHALL BE INSTALLED WITH A SMOKE DETECTOR IN THE RETURN DUCTWORK. DUCT SMOKE DETECTORS SHALL BE INSTALLED IN THE RETURN AIR PATH OF AIR DISTRIBUTION SYSTEMS UTILIZING A COMMON SUPPLY AND/OR RETURN AIR PLENUM WITH A COMBINED DESIGN CAPACITY GREATER THAN 2000 CFM.

2. THE SMOKE DETECTOR SHALL BE WIRED TO STOP THE FAN UPON DETECTION OF SMOKE AND CAUSE A VISIBLE AND AUDIBLE ALARM SIGNAL IN A NORMALLY OCCUPIED AREA. SMOKE DETECTOR TROUBLE CONDITIONS SHALL BE IDENTIFIED AS AIR DUCT DETECTOR TROUBLE. THE SMOKE DETECTOR AND AUDIBLE/VISIBLE ALARM SHALL BE FURNISHED AND INSTALLED BY THE MECHANICAL CONTRACTOR.

AIR DISTRIBUTION:

1. SUPPLY, RETURN AND O.A. DUCTWORK SHALL BE CONSTRUCTED OF GALVANIZED SHEETMETAL IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS-METAL AND FLEXIBLE, LATEST EDITION.
   a. SNAP-LOCK LONGITUDINAL SEAMS ARE NOT ALLOWED UNLESS SECURED WITH SHEET METAL FASTENING SCREWS AS RECOMMENDED BY SMACNA.

2. TAPES, SEALANTS AND MASTICS USED TO SEAL METALLIC AND FLEXIBLE AIR DUCTS AND FLEXIBLE AIR CONNECTORS SHALL COMPLY WITH UL 181B AND SHALL BE MARKED "181 B-FX" FOR PRESSURE-SENSITIVE TAPE OR "181 B-M" FOR MASTIC/SEALANT.

3. SEAL THE ANNULAR SPACE AROUND ALL DUCT PENETRATIONS THROUGH WALLS, CEILINGS AND FLOORS AIRTIGHT WITH AN APPROVED MATERIAL (RE: ARCHITECTURAL DRAWINGS FOR APPROVED MATERIALS).

4. MECHANICAL FASTENERS FOR USE WITH FLEXIBLE NONMETALLIC AIR DUCTS SHALL COMPLY WITH UL 181B AND SHALL BE MARKED "181 B-C".

5. SHEETMETAL DUCT SEALING:
   a. ALL JOINTS AND SEAMS IN ALL SHEETMETAL DUCTWORK SHALL BE SEALED WITH DUCT SEALER.
   b. SEAL, INSPECT AND TEST SHEETMETAL DUCTWORK PRIOR TO INSULATING OR CONCEALING. SEAL ALL DUCTWORK AND PLENUMS TO MEET SMACNA SEAL CLASS A.
   c. SEAL ALL TRANSVERSE JOINTS, LONGITUDINAL SEAMS, AND DUCT WALL PENETRATIONS.
   d. PRESSURE-SENSITIVE TAPE SHALL NOT BE USED AS THE PRIMARY SEALANT, UNLESS IT HAS BEEN CERTIFIED TO COMPLY WITH UL-181A OR UL-181B BY AN INDEPENDENT TESTING LABORATORY AND THE TAPE IS USED IN ACCORDANCE WITH THAT CERTIFICATION.
   e. ALL CONNECTIONS SHALL BE SEALED, INCLUDING BUT NOT LIMITED TO SPIN-IN FITTINGS, TAPS, OTHER BRANCH CONNECTIONS, ACCESS DOORS, AND DUCT CONNECTIONS TO EQUIPMENT.
   f. SEALING THAT WOULD VOID PRODUCT LISTINGS IS NOT REQUIRED.
   g. SPIRAL LOCK SEAMS NEED NOT BE SEALED.

6. EXHAUST DUCTWORK SHALL BE GALVANIZED SHEET METAL (G 90 MINIMUM) CONSTRUCTED TO SMACNA STANDARDS AND SHALL NOT BE INSULATED UNLESS NOTED OTHERWISE.

7. ALL DUCTWORK SHALL BE SUPPORTED BY THE BUILDING STRUCTURE AND SHALL NOT REST ON CEILING TILES OR CEILING STRUCTURE. DUCT SUPPORTS AND ATTACHMENT TO STRUCTURE SHALL BE PER SMACNA STANDARDS.

8. FLEXIBLE DUCTWORK SHALL BE THERMAFLEX M-KE (U.L. 181 LISTED, CLASS 1 FLEXIBLE AIR DUCT) OR EQUAL. PROVIDE MINIMUM INSULATION VALUE OF R-6; R-8 WHEN LOCATED OUTSIDE THE THERMAL ENVELOPE OF THE BUILDING, OR GREATER WHERE REQUIRED BY APPLICABLE ENERGY CODE. AIR CONNECTORS ARE NOT ACCEPTABLE. FLEX DUCT DIAMETER SHALL MATCH DEVICE NECK DIAMETER. PROVIDE ROUND GALVANIZED STEEL DUCT RUNOUTS TO MAINTAIN A MAXIMUM FLEXIBLE DUCT LENGTH OF 8'_0". FLEXIBLE DUCTWORK SHALL BE INSTALLED AS STRAIGHT AS POSSIBLE AND SHALL BE ROUTED AND SUPPORTED WITHOUT FORMING CRIMPS OR OTHER AIR FLOW RESTRICTIONS. PROVIDE SQUARE TO ROUND ADAPTERS OR BOOTS TO CONNECT TO AIR DEVICE NECK WHEN REQUIRED.

9. ROUND AND FLEXIBLE SUPPLY AIR DUCTWORK SHALL BE CONNECTED TO MAIN DUCTS WITH A CONICAL TYPE SPIN_IN FITTING WITH MANUAL VOLUME DAMPER (EXCEPT WHERE INSTALLED ABOVE INACCESSIBLE CEILINGS). THE DAMPER SHALL BE OMITTED AND PROVIDED IN THE AIR DEVICE NECK).

10. TAPE, BED AND SEAL AIR-TIGHT ALL PENETRATIONS FROM RETURN AIR PLENUMS TO NON-RETURN AIR PLENUMS THAT ARE REQUIRED DUE TO DUCTWORK, PIPING OR OTHER ITEMS.

11. DUCTWORK DIMENSIONS SHOWN ON THE DRAWINGS ARE INSIDE CLEAR DIMENSIONS.

12. EXTERNAL STATIC PRESSURE (ESP) DOES NOT INCLUDE COIL, CASING OR FILTER PRESSURE DROP.

13. PROVIDE ALL OUTDOOR AIR INTAKES AND EXHAUST OPENINGS WITH MOTORIZED OR GRAVITY DAMPERS IN ACCORDANCE WITH THE LOCAL ENERGY CODE. DAMPERS SHALL CLOSE WHEN THE VENTILATION SYSTEM IS NOT OPERATING.

14. LOCATIONS OF GRILLES, REGISTERS, AND DIFFUSERS SHOWN ON THE DRAWINGS ARE APPROXIMATE. COORDINATE EXACT LOCATIONS WITH LIGHTS, CEILING GRID, ETC. AND ARCHITECTURAL REFLECTED CEILING PLAN.

15. WHERE BALANCING DAMPERS CANNOT BE ACCESSED FROM BELOW THE CEILING, PROVIDE A REMOTE OPERATED DAMPER; YOUNG REGULATOR OR EQUAL.

16. FLEXIBLE DUCT CONNECTORS SHALL BE USED TO CONNECT DUCTWORK AND PLENUMS TO FAN-ROTATING EQUIPMENT; PROFLEX BY DUCTMATE OR APPROVED EQUAL. INDOOR FLEXIBLE CONNECTORS SHALL BE 26 OZ/SQ. YD. GLASS FABRIC DOUBLE COATED WITH NEOPRENE. OUTDOOR FLEXIBLE CONNECTORS SHALL BE 24 OZ/SQ. YD. GLASS FABRIC DOUBLE COATED WITH WEATHERPROOF SYNTHETIC RUBBER RESISTANT TO UV RAYS AND OZONE. FABRICS, COATINGS AND ADHESIVES SHALL BE TESTED IN ACCORDANCE WITH UL 701 AND HAVE A FLAME SPREAD/ SMOKE DEVELOPED RATING OF 25/50. FLEXIBLE DUCT CONNECTORS SHALL ALSO BE PROVIDED WHERE DUCTWORK CROSSES BUILDING EXPANSION JOINTS.

17. INSTALL DUCTWORK SUCH THAT LINE-OF-SIGHT IS ELIMINATED BETWEEN RETURN AIR REGISTERS/GRILLES AND AIR HANDLING UNITS, AND ROOFTOP UNITS.

INSULATION:

1. DUCT INSULATION:
   a. DUCT WRAP SHALL BE UL LISTED FIBERGLASS BLANKET INSULATION WITH FOIL VAPOR BARRIER, JOHNS MANVILLE MICROLITE EQ FSK OR APPROVED EQUAL. PUNCTURES AND TEARS IN THE FOIL JACKET SHALL BE PATCHED WITH FOIL TAPE TO MAINTAIN THE INTEGRITY OF THE VAPOR BARRIER. INSULATE SHEET METAL DUCTWORK IN THE THICKNESSES AND DENSITIES LISTED BELOW:
      i. SHEET METAL SUPPLY, RETURN AND OUTSIDE AIR DUCTWORK: 2" THICK, 1 LB/FT^3 DENSITY, R-6 MINIMUM INSTALLED.
   b. DUCT LINER FOR ACOUSTICS: LINE ALL SUPPLY AND RETURN SHEETMETAL DUCTWORK A MINIMUM OF 15'_0" (OR AS INDICATED OR SPECIFIED HEREIN) UPSTREAM AND DOWNSTREAM OF ALL AIR HANDLING UNITS, ROOFTOP UNITS, AND TERMINAL UNITS. DUCT LINER FOR RECTANGULAR DUCTS SHALL BE 1½" THICK, (MINIMUM R-6 OR GREATER WHERE REQUIRED BY APPLICABLE ENERGY CODE); JOHNS MANVILLE LINACOUSTIC RC OR EQUAL.
      1) THE LEADING EDGE OF THE DUCT LINER SHALL HAVE A SHEETMETAL NOSING.
      2) EXPOSED EDGES AND BUTT JOINTS SHALL BE "BUTTERED" WITH DUCT SEALER.
      3) LINED DUCTWORK DOES NOT REQUIRE ADDITIONAL EXTERIOR INSULATION WHERE LINER MEETS REQUIRED R-VALUES.
      4) RETURN AIR TRANSFER DUCTS, ELBOWS AND SOUND BOOTS SHALL BE LINED WITH 1" THICK LINER UNLESS OTHERWISE NOTED.
      5) DUCT LINER SHALL BE INTERRUPTED AT ALL FIRE, SMOKE, COMBINATION FIRE/SMOKE AND RADIATION DAMPERS.
      6) DUCT LINER SHALL BE INTERRUPTED NOT LESS THAN 8" UPSTREAM AND 6" DOWNSTREAM OF ELECTRIC-RESISTANCE AND FUEL-BURNING HEATERS IN A DUCT SYSTEM.

2. PIPE INSULATION:
   a. CONVENTIONAL SPLIT SYSTEMS - PIPING INSULATION SHAL

DUCTLESS SPLIT SYSTEM (COOLING ONLY)

TAG	SERIES FAN COIL UNIT/CONDENSING UNIT	AREA SERVED	FAN COIL UNIT		CAPACITY		SEER	APPROX. WEIGHT (LBS) FCU/CU	ACCESSORIES
			TYPE	TOTAL CFM	TOTAL COOLING (MBH)	SENSIBLE COOLING (MBH)			
DFC A226/DCU A226	TPKA5A036KA70A/TRUYA036KA70NA	IDF ROOM A226	W	810	36.0	25.2	18	50/250	ALL
DFC B262/DCU B262	TPKA5A036KA70A/TRUYA036KA70NA	IDF ROOM B262	W	810	36.0	25.2	18	50/250	ALL
-	-	-		-	-	-	-	-	-

NOTES (APPLY TO ALL UNITS):
A. COOLING CAPACITIES ARE BASED ON AN INDOOR EAT OF 80°F DB/67°F WB AND 95°F AMBIENT.
C. 18 SEER MINIMUM UNITS WITH R-410A. SUBMIT AHRI CERTIFIED CAPACITIES FOR ACTUAL EQUIPMENT TO BE INSTALLED.
D. REFER TO HVAC GENERAL NOTES AND DETAILS FOR ADDITIONAL INFORMATION.
E. INDOOR AND OUTDOOR UNITS SHALL BE INSTALLED PER PLANS, MANUFACTURER'S RECOMMENDATIONS AND LOCAL CODE REQUIREMENTS.
F. DISCONNECT SWITCH FOR OUTDOOR UNIT FURNISHED BY DIV 23, INSTALLED BY DIV 26.
G. UNITS SHALL BE EQUIPPED WITH AN INTERNAL CONDENSATE TRAP OR CHECK VALVE.
H. VERIFY MAXIMUM COMPRESSOR LIFT COMPATIBILITY WITH MANUFACTURER AND OUTDOOR UNIT LOCATION.

ACCESSORIES (THIS LIST IS NOT ALL INCLUSIVE, IN ADDITION, PROVIDE MANUFACTURER RECOMMEND ACCESSORIES FOR SAFE AND PROPER OPERATION):
1. WIRED WALL MOUNT UNIT CONTROLLER
2. CONDENSATE PUMP AND SAFETY SWITCH
3. COMPRESSOR ANTI-RECYCLE CONTROLS
4. REFRIGERANT LINE-SET (VERIFY LENGTH WITH EXISTING CONDITIONS PRIOR TO ORDERING)
5. LOW AMBIENT WIND BAFFLE
6. PROVIDE FACTORY STARTUP
7. PROVIDE BACNET CONNECTION CAPABILITIES FOR BUILDING AUTOMATION SYSTEM MONITORING

SELECTIONS BASED ON PRODUCTS BY MITSUBISHI, NO SUBSTITUTIONS.

LEGEND
FAN COIL UNIT TYPE:
C - CEILING CASSETTE
W - WALL HUNG

GRILLE, REGISTERS & DIFFUSERS

TAG	SERIES	CFM	DUTY	NECK SIZE	FACE SIZE	DAMPER	MATERIAL	TYPE	NOTES/ACCESSORIES
A	OMNI	SEE DWGS	SUPPLY	SEE DWGS	24X24	YES	ALUMINUM	PLAQUE	1,3
B	FTI-10	SEE DWGS	LINEAR SLOT	SEE DWGS	SEE DWGS	YES	ALUMINUM	48", 2-SLOT	2,3
BR	FTI-10	SEE DWGS	LINEAR SLOT	SEE DWGS	SEE DWGS	YES	ALUMINUM	48", 2-SLOT	2,3,4
C	ML-38	SEE DWGS	LINEAR SLOT	SEE DWGS	SEE DWGS	YES	ALUMINUM	48", 2-SLOT	2,3
D	PXP-AA	SEE DWGS	RETURN	SEE DWGS	24X24	YES	ALUMINUM	PERFORATED	3
E			EXHAUST					EXISTING	5
R			RETURN					EXISTING	5
S			SUPPLY					EXISTING	5

NOTES (APPLY TO ALL DEVICES):
A. REFER TO ARCHITECTURAL DRAWINGS FOR TYPE OF CEILING, SUSPENSION SYSTEM AND FINISHES WHERE DEVICE WILL BE MOUNTED. FRAME AND BORDER TYPE SHALL BE COMPATIBLE WITH ADJACENT SURFACES AND FINISHES.
B. FINISH SHALL BE MANUFACTURER'S STANDARD. REFER TO ACCESSORIES/NOTES FOR CUSTOM FINISHES, IF ANY. SUBMIT COLOR CHART WITH SHOP DRAWINGS.
C. WHEN A DAMPER IS CALLED FOR ABOVE AND THE DEVICE IS TO BE MOUNTED IN AN INACCESSIBLE CEILING PROVIDE A FACE ADJUSTABLE BALANCING DAMPER SHALL BE INCLUDED.
D. FOR DRYWALL OR PLASTER CEILING INSTALLATION, PROVIDE PLASTER FRAME.

ACCESSORIES:
1. MOLDED INSULATION (R-4) BLANKET ON BACK PAN
2. FACTORY INTERNALY INSULATED PLENUM.
3. PROVIDE ALL AIR DEVICES TO MATCH BUILDING CEILING GRID T-BAR CONSTRUCTION.
4. PROVIDE FACTORY LIGHT SHIELD.
5. CLEAN EXISTING TO REMAIN AIR DEVICE AND REPAIR TO NEW LIKE CONDITION.

SELECTIONS ARE BASED ON PRODUCTS BY: TITUS.

WALL LOUVERS

TAG	MODEL NUMBER	TYPE	DUTY	DEPTH (INCHES)	FACE AREA WxH (INCHES)	MIN FREE AREA (SF)	CFM	MAX PRESSURE DROP (IN WC)	INTERLOCKED WITH	ACTUATOR TYPE	MATERIAL	ACCESSORIES/ REMARKS
WL 1	ESD-635	STATIONARY	-	6	108X96	46.40	-	-	N/A	N/A	ALUMINUM	-

NOTES (APPLY TO ALL LOUVERS):
A. FINAL COLOR SELECTION SHALL BE MADE BY ARCHITECT AT TIME OF SHOP DRAWINGS APPROVAL.
B. ALL LOUVERS SHALL BE AMCA CERTIFIED FOR AIR PERFORMANCE AND WATER PENETRATION.

ACCESSORIES/REMARKS:
1. KYNAR 500 FINISH, COORDINATE COLOR WITH ARCHITECT

SELECTIONS ARE BASED ON GREENHECK
EQUAL PRODUCTS: POTTORFF, RUSKIN

MECH/ELEC COORDINATION

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE ELECTRICAL CHARACTERISTICS OF ALL HVAC EQUIPMENT (VOLTAGE, PHASE, MCA, MOCP, ETC.) WITH THE ELECTRICAL CONTRACTOR AND THE ELECTRICAL PLANS PRIOR TO SUBMITTING OR ORDERING ANY MECHANICAL EQUIPMENT. ANY SUBSEQUENT MISMATCH BETWEEN THE MECHANICAL EQUIPMENT ELECTRICAL REQUIREMENTS AND THE ELECTRICAL SERVICE, AS DESIGNED AND PROVIDED, SHALL BE THE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR WITH NO ADDITIONS TO THE CONTRACT.

MECHANICAL/ELECTRICAL COORDINATION STATEMENTS REQUIRED BY HVAC GENERAL NOTES [AND SPECIFICATION SECTION 230000 , PARAGRAPH 1.06.E] SHALL BE INCLUDED WITH HVAC EQUIPMENT SUBMITTALS/SHOP DRAWINGS.

BMS HVAC NOTES

- CONTROLS SHALL BE INSTALLED IN ACCORDANCE TO THE OWNERS (BILLINGSLEY) BUILDING STANDARDS. OWNERS CONTROL CONTRACTOR CLIMATEC.
- ALL CONTROLS SHALL BE PROVIDED BY THE MECHANICAL CONTRACTOR. MECHANICAL CONTRACTOR SHALL CONTRACT INSTALLATION OF ALL CONTROLS WITH THE OWNERS CONTROL CONTRACTOR.
- ALL SENSORS, EQUIPMENT AND TERMINAL BOXES SHALL BE LABELED PER OWNERS STANDARDS.

FAN POWERED BOX SCHEULE

TAG	NEW OR EXISTING	MODEL NO.	ARRANGEMENT	AREA SERVED	INLET SIZE (INCHES)	PRIMARY AIR VALVE		FAN			HEATING		ACCESSORIES
						AIRFLOW (CFM)		AIRFLOW (CFM)	HP	CFM	CAPACITY (KW)	STAGES	
						MAX	MIN						
(E)FPB 3-4	EXISTING	DTOP	PARALLEL	TRAINING AREA C00R	10	1025	305	210	.5	515	5.0	SCR	-
(E)FPB 3-7	EXISTING	DTOP	PARALLEL	BOARDROOM	12	1230	380	260	.5	640	6.0	SCR	
(E)FPB 3-8	ABANDONED	DTOP	PARALLEL	RECEPTION	14	0	0	0	.5	.02	10.5	SCR	-
FPB 3-10	NEW	DTOP-03	PARALLEL	ADMIN AREA	12	1525	460	450	.5	910	7.0	SCR	ALL
(E)FPB 3-1	EXISTING	DTOP	PARALLEL	MEETING AREA A2400	12	1275	380	260	.5	.02	10.5	SCR	-

NOTES:
1. UNITS SHALL BE ANSI/AHRI STANDARD 880 CERTIFIED FOR AIFLOW AND SOUND PERFORMANCE.
2. UNITS SHALL BE COMPLETE WITH SINGLE SPEED FAN WITH SCR CONTROL (UNO), SINGLE POINT POWER CONNECTION, AND INTEGRAL STEP DOWN TRANSFORMER.
3. MAXIMUM NC LEVEL SHALL BE 35 UNLESS NOTED OTHERWISE.
4. FANS SHALL BE SELECTED BASED ON MEDIUM OR LOW SPEED.
5. HOUSING SHALL BE CONSTRUCTED WITH 1/2" THICK MATFACED FIBERGLASS INSULATION.
6. PROVIDE ALL CONTROLS TO MATCH BUILDING STANDARDS. CONTROLS TO BE INSTALLED IN ACCORDANCE TO BILLINGSLEY STANDARDS.

ACCESSORIES:
1. SAFETY SWITCH, CONTACTORS, AND MANUAL RESET THERMAL CUTOUTS
2. PRESSURE INDEPENDENT DDC CONTROLS
3. INTEGRAL DISCONNECT SWITCH
4. UNIT SIZE 3
5. PROVIDE 2" HIGH PLASTIC ENGRAVED NAMEPLATE WITH 1" HIGH WHITE LETTERS ON A BLACK BACKGROUND.
6. PROVIDE TERMINAL BOX CONTROLLER BY BILLINGSLEY CONTROL VENDOR. CONTROLS SHALL BE SHIPPED TO THE TERMINAL BOX MANUFACTURER FOR INSTALLATION AND TERMINAL BOX CALIBRATION.

VARIABLE AIR VOLUME UNITS (ELEC HEAT)

TAG	NEW OR EXISTING	MODEL NO.	AREA SERVED	INLET SIZE (IN.)	PRIMARY AIR VALVE			PRESS. LOSS (IN WG)	HEATING		ACCESSORIES
					COOLING CFM		HEATING CFM		CAPACITY (KW)	STAGES	
					MAX	MIN					
(E)VAV-3-7	EXISTING	DESV	TRAINING ROOM A216	6	400	120	-	-	-	-	
VAV-3-23	NEW	DESV	TRAINING ROOM A216	8	500	385	385	0.3	4.0	SCR	All
VAV-3-27	NEW	DESV	WEST OPEN OFFICE	8	800	240	-	0.3	-	-	ALL
(E)VAV-3-3	EXISTING	DESV	MEETING A2400	6	300	150	150	-	1.0	SCR	-
(E)VAV-3-12	EXISTING	DESV	MEETING A203,A202	6	350	125	0	-	-	-	-
(E)VAV-3-6	EXISTING	DESV	OPEN AREA A2600	6	400	120	-	-	-	-	-
(E)VAV-3-5	EXISTING	DESV	OPEN AREA A2600	6	400	120	-	-	-	-	-
VAV-3-24	NEW	DESV	OPEN AREA A2600	6	400	200	200	0.3	2.5	SCR	ALL
(E)VAV-3-20	EXISTING	DESV	MEETING ROOM A282	6	150	45	-	-	-	-	-
VAV-3-25	NEW	DESV	VENDING A276	6	375	115	-	-	-	-	ALL
(E)VAV-3-15	EXISTING	DESV	MEETING/OFFA262,A263	6	375	100	-	-	-	-	-
(E)VAV-3-8	EXISTING	DESV	OPEN OFFICE A266	8	800	225	225		1.5	SCR	-
(E)VAV-3-17	EXISTING	DESV	PRINTER A233,A232	6	400	120	-	-	-	-	-
		-	-	-							
(E)VAV-8-8	ABANDONED	DESV	TRAINING ROOM B222	6	0	0	-	-	-	-	-
(E)VAV-8-9	EXISTING	DESV	TRAINING ROOM B222	8	500	150	150	-	1.5	SCR	-
VAV-8-22	NEW	DESV	TRAINING ROOM B222	8	500	385	385	-	4.0	SCR	ALL
		-	-	-							
(E)VAV-8-12	EXISTING	DESV	OFFICE B275,B285	6	300	100	-	-	-	-	-
		-	-	-							
(E)VAV-8-3	EXISTING	DESV	OFFICE B212,B211	6	200	60	-	-	-	-	-
(E)VAV-8-20	EXISTING	DESV	WELLNESS B265	8	500	75	75	-	0.75	SCR	-
VAV-3-26	NEW	DESV	ADMIN /CATERING	8	510	200	200	-	3.0	SCR	ALL

NOTES (APPLIES TO ALL):
1. MAXIMUM NC LEVEL SHALL BE 30 UNLESS NOTED OTHERWISE.
2. VAV HOUSING SHALL BE CONSTRUCTED WITH 1/2" THICK FIBERGLASS INSULATION.
3. PROVIDE ALL CONTROLS TO MATCH BUILDING STANDARDS. CONTROLS TO BE INSTALLED IN ACCORDANCE TO BILLINGSLEY STANDARDS.

ACCESSORIES:
1. SAFETY SWITCH, CONTACTORS, AND MANUAL RESET THERMAL CUTOUTS
2. PRESSURE INDEPENDENT DDC CONTROLS WITH 24 VOLT TRANSFORMER TO MATCH BUILDING SYSTEM.
3. EACH VAV SHALL HAVE A WALL MOUNTED SENSOR WITH OVERRIDE CONTROLS
4. INTEGRAL DISCONNECT SWITCH
5. PROVIDE 2" HIGH PLASTIC ENGRAVED NAMEPLATE WITH 1" HIGH WHITE LETTERS ON A BLACK BACKGROUND.
6. PROVIDE TERMINAL BOX CONTROLLER BY BILLINGSLEY CONTROL VENDOR. CONTROLS SHALL BE SHIPPED TO THE TERMINAL BOX MANUFACTURER FOR INSTALLATION AND TERMINAL BOX CALIBRATION.

SELECTIONS BASED ON THE PRODUCTS OF: TITUS, NO SUBSTITUTIONS.

CALLISONRTKL
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CallisonRTKL Project No: 010-210033.00

Consultant

STATE OF TEXAS
JOHN R. MAYEDA
82134
LICENSED PROFESSIONAL ENGINEER
08/13/21

3100 OLYMPUS FIRSTSOURCE

ISSUE FOR CONSTRUCTION AND PERMIT

Client/Owner/Project Address

FIRSTSOURCE
3100 Olympus Blvd
2ND FLOOR
Dallas, TX 75063

firstsource

Issue Drawing Log

#	DATE MM.DD.YYYY	ISSUE NAME
0	07.30.2021	ISSUE FOR PERMIT & CONSTRUCTION
1	08.13.2021	ADDENDUM 01

Seal

Sheet Identification

MECHANICAL SCHEDULES

M-0002

JSE Jordan & Skala Engineers
17850 North Dallas Parkway, Suite 320 • Dallas, TX, 75287
Tel: 214.368.1672 Fax: 214.368.1673
Texas Registered Engineering Firm F-4950
Project Number: 213011S Drawn By: BW Checked By: DW

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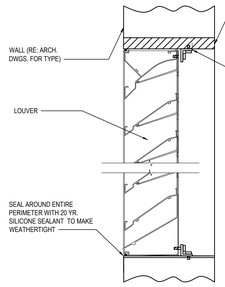
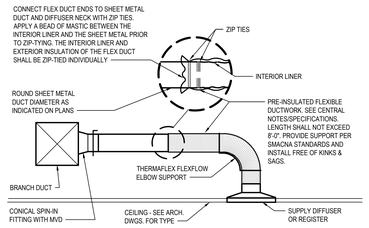


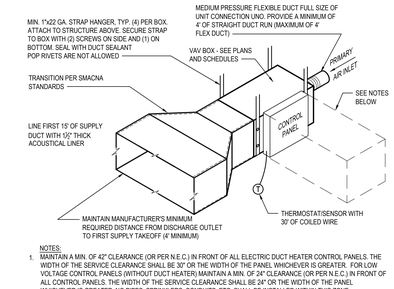
NOTES:
1. ARCH. DWGS. AND MANUFACTURER'S INSTALLATION INSTRUCTIONS SUPERCEDE THIS DETAIL.

WALL LOUVER DETAIL
NOT TO SCALE



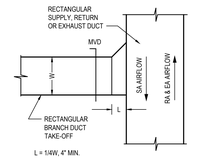
NOTES:
1. TAPES AND MASTICS USED TO SEAL FIBROUS GLASS DUCTWORK SHALL BE LISTED AND LABELED IN ACCORDANCE WITH UL 181A AND SHALL BE MARKED "181 A-P" FOR PRESSURE-SENSITIVE TAPE, "181 A-M" FOR MASTIC OR "181 A-H" FOR HEAT-SENSITIVE TAPE.
2. TAPES AND MASTICS USED TO SEAL METALLIC AND FLEXIBLE AIR DUCTS AND FLEXIBLE AIR CONNECTORS SHALL COMPLY WITH UL 181B AND SHALL BE MARKED "181 B-FX" FOR PRESSURE-SENSITIVE TAPE OR "181 B-M" FOR MASTIC.
3. MECHANICAL FASTENERS FOR USE WITH FLEXIBLE NONMETALLIC AIR DUCTS SHALL COMPLY WITH UL 181B AND SHALL BE MARKED "181 B-C".
4. ZIP TIES SHALL BE PLENUM RATED. INSTALL ZIP TIES USING A TENSIONING TOOL PER MANUFACTURER'S RECOMMENDATIONS.

COMMERCIAL FLEXIBLE DUCT TAKE-OFF DETAIL
NOT TO SCALE



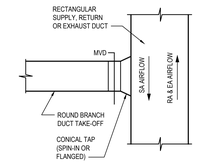
NOTES:
1. MAINTAIN A MIN. OF 42" CLEARANCE (OR PER N.E.C.) IN FRONT OF ALL ELECTRIC DUCT HEATER CONTROL PANELS. THE WIDTH OF THE SERVICE CLEARANCE SHALL BE 30" OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER. FOR LOW VOLTAGE CONTROL PANELS (WITHOUT DUCT HEATER) MAINTAIN A MIN. OF 24" CLEARANCE (OR PER N.E.C.) IN FRONT OF ALL CONTROL PANELS. THE WIDTH OF THE SERVICE CLEARANCE SHALL BE 24" OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER. NO PIPES, SPRINKLERS, CONDUITS, ETC. SHALL BE INSTALLED WITHIN THIS ZONE. COORDINATE CAREFULLY WITH ALL OTHER TRADES.
2. WHERE VAVs OR THEIR WORKING CLEARANCE ARE LOCATED ABOVE LIGHT FIXTURES, THE FIXTURE SHALL HAVE A FLEXIBLE WHIP TO ALLOW TEMPORARY RELOCATION OF THE FIXTURE FOR ACCESS TO THE VAV. COORDINATE WITH ELECTRICAL CONTRACTOR.

TYPICAL VAV BOX DETAIL
NOT TO SCALE



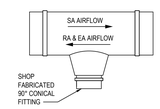
NOTE:
1. APPLIES TO COMMERCIAL SPACES AND MULTIFAMILY AMENITY AND COMMON SPACES.

LOW PRESSURE BRANCH DUCT TAKE-OFF (RECTANGULAR 45° ENTRY)
NOT TO SCALE



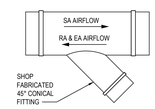
NOTE:
1. APPLIES TO COMMERCIAL SPACES AND MULTIFAMILY AMENITY AND COMMON SPACES.

LOW PRESSURE BRANCH DUCT TAKE-OFF (ROUND BRANCH ENTRY)
NOT TO SCALE



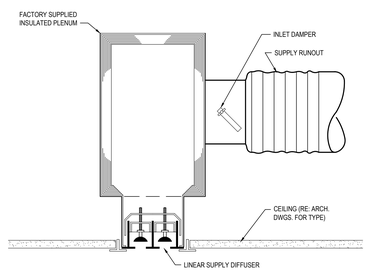
NOTE:
1. ACCEPTABLE ALTERNATES ARE CONICAL TAPS AND CONICAL SADDLE TAPS PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

LOW PRESSURE BRANCH DUCT TAKE-OFF (ALTERNATIVE ROUND 90° BRANCH)
NOT TO SCALE



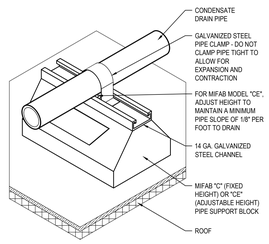
NOTE:
1. ACCEPTABLE ALTERNATES ARE CONICAL TAPS AND CONICAL SADDLE TAPS PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

LOW PRESSURE BRANCH DUCT TAKE-OFF (ALTERNATIVE ROUND 45° BRANCH)
NOT TO SCALE



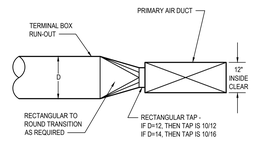
NOTES:
1. IF THE DIFFUSER IS INSTALLED IN AN INACCESSIBLE CEILING, DELETE INLET DAMPER & PROVIDE A REMOTE CONTROLLED (OR FACE OPERATED) DAMPER ASSEMBLY.

LINEAR DIFFUSER DETAIL
NOT TO SCALE

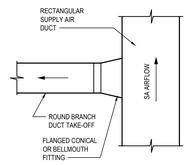


NOTES:
1. SUPPORTS SHALL BE SPACED 6' ON CENTER (BASED ON SCHEDULE 40 PVC).
2. PLACE WALKPAD MATERIAL SHEETS BENEATH SUPPORTS (MIN. 1" LARGER THAN SUPPORT ALL AROUND).

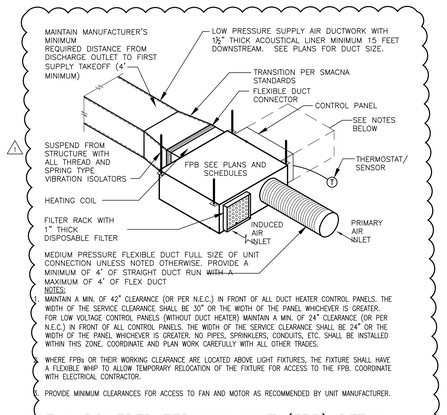
LINESET PIPING SUPPORT DETAIL
NOT TO SCALE



MEDIUM PRESSURE EQUIVALENT TAP SIZE FOR TERMINAL UNIT RUN-OUT
NOT TO SCALE

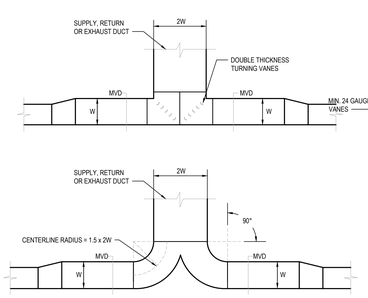


MEDIUM PRESSURE BRANCH DUCT TAKE-OFF (ROUND BRANCH ENTRY)
NOT TO SCALE

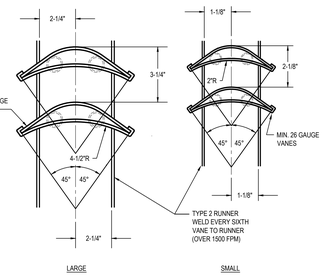


NOTES:
1. MAINTAIN A MIN. OF 42" CLEARANCE (OR PER N.E.C.) IN FRONT OF ALL DUCT HEATER CONTROL PANELS. THE WIDTH OF THE SERVICE CLEARANCE SHALL BE 30" OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER. FOR LOW VOLTAGE CONTROL PANELS (WITHOUT DUCT HEATER) MAINTAIN A MIN. OF 24" CLEARANCE (OR PER N.E.C.) IN FRONT OF ALL CONTROL PANELS. THE WIDTH OF THE SERVICE CLEARANCE SHALL BE 24" OR THE WIDTH OF THE PANEL WHICHEVER IS GREATER. NO PIPES, SPRINKLERS, CONDUITS, ETC. SHALL BE INSTALLED WITHIN THIS ZONE. COORDINATE AND PLAN WORK CAREFULLY WITH ALL OTHER TRADES.
2. WHERE FPBs OR THEIR WORKING CLEARANCE ARE LOCATED ABOVE LIGHT FIXTURES, THE FIXTURE SHALL HAVE A FLEXIBLE WHIP TO ALLOW TEMPORARY RELOCATION OF THE FIXTURE FOR ACCESS TO THE FPB. COORDINATE WITH ELECTRICAL CONTRACTOR.
3. PROVIDE MINIMUM CLEARANCES FOR ACCESS TO FAN AND MOTOR AS RECOMMENDED BY UNIT MANUFACTURER.

FAN POWERED TERMINAL UNIT (FPB) DETAIL
NOT TO SCALE



DIVIDED FLOW FITTING DETAILS
NOT TO SCALE



NOTE:
TURNING VANES SHALL BE CONSTRUCTED PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS (2005 EDITION FIGURE 4-3).

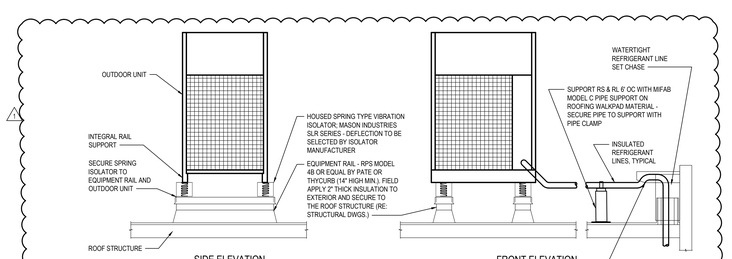
TURNING VANE DETAILS
NOT TO SCALE

NOTE:
1. ACCEPTABLE ALTERNATES ARE 90° CONICAL TAPS AND 90° CONICAL SADDLE TAPS PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

MEDIUM PRESSURE BRANCH DUCT TAKE-OFF (ROUND 90° BRANCH)
NOT TO SCALE

NOTE:
1. ACCEPTABLE ALTERNATES ARE 45° LATERAL TAPS AND 45° LATERAL SADDLE TAPS PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS.

MEDIUM PRESSURE BRANCH DUCT TAKE-OFF (ROUND 45° BRANCH)
NOT TO SCALE

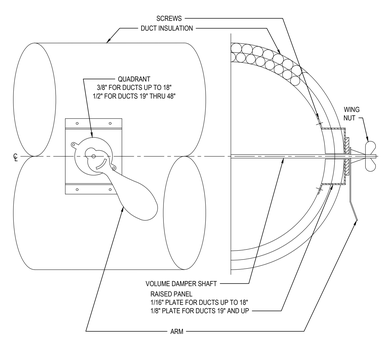


SIDE ELEVATION

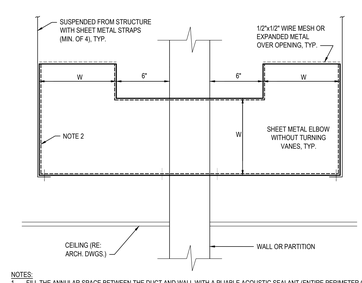
FRONT ELEVATION

NOTES:
1. MIFAB PIPE SUPPORT TO HAVE 14 GA. X 3/16" WIDE GALVANIZED CHANNEL. LENGTH TO SUIT QUANTITY OF PIPING SUPPORTED. PROVIDE INSULATION SHIELD WHERE STRUT CLAMP COMES IN CONTACT WITH INSULATION.
2. MAINTAIN ALL CODE ACCESS AND MANUFACTURER CLEARANCES AROUND UNITS. REFER TO GENERAL NOTES FOR REQUIRED NEC CLEARANCES.
3. INSTALL ELECTRICAL DISCONNECT ON UNISTRUT SO AS TO NOT OBSTRUCT EQUIPMENT ACCESS OR CLEARANCES.

ROOF MOUNTING DETAIL (SPRING ISOLATORS)
NOT TO SCALE



MANUAL VOLUME DAMPER DETAIL
NOT TO SCALE



NOTES:
1. FILL THE ANNULAR SPACE BETWEEN THE DUCT AND WALL WITH A PLIABLE ACOUSTIC SEALANT (ENTIRE PERIMETER OF PENETRATION).
2. INTERIOR OF RETURN AIR BOOT SHALL BE COVERED WITH 1" THICK ELASTOMERIC DUCT LINER WITH MICROBIAN ANTIMICROBIAL PROTECTION (ARMAFLEX AP OR EQUAL).
3. INSTALL RA BOOT AS HIGH AS POSSIBLE. MAINTAIN A MINIMUM OF 6" CLEAR FROM THE TOP OF THE OPENINGS TO ANY OBSTRUCTION.

CALLISONRTKL
A DESIGN CONSULTANCY OF ARCADIS

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STATE OF TEXAS
JOHN R. MAYEDA
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LICENSED PROFESSIONAL ENGINEER
08/13/21

3100 OLYMPUS FIRSTSOURCE

ISSUE FOR CONSTRUCTION AND PERMIT

Client/Owner/Project Address

FIRSTSOURCE
3100 Olympus Blvd
2ND FLOOR
Dallas, TX 75063

firstsource

Issue Drawing Log

#	DATE MM.DD.YYYY	ISSUE NAME
0	07.30.2021	ISSUE FOR PERMIT & CONSTRUCTION
1	08.13.2021	ADDENDUM 01

Seal

Sheet Identification

MECHANICAL DETAILS

M-0003

Jordan & Skala Engineers
17855 North Dallas Parkway, Suite 320 • Dallas, TX 75287
p. 469.385.1414 • f. 469.385.1413
Texas Registered Engineering Firm F-4990

Project Number: 213011S Drawn By: RW Checked By: DW

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SECTION 23 00 00

HVAC GENERAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Refer to Division 1 - General Requirements and any and all Supplementary or Special Requirements, all of which apply to work described in Division 23 - HVAC as if written in full herein.

B. The scope of work described in these Specifications and/or indicated on the Drawings shall include the furnishing of all materials, equipment, appurtenances, accessories, connections, labor, etc. required and/or necessary to completely install, clean, inspect, adjust, test, balance and leave in safe and proper operating condition all HVAC systems. All HVAC work shall be accomplished by workmen skilled in the various trades involved.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawings and Specifications, the higher implied cost shall be included in the bid, and the Architect shall be notified of the discrepancy in writing.

1.02 CODES AND STANDARDS

A. All HVAC work shall conform to all ordinances and regulations of the City, County and State where the work will take place, including the requirements of all authorities having jurisdiction. The following codes, standards and references shall be observed as a minimum:
1. The 2015 International Codes
2. State Amendments to the Code
3. National Fire Protection Association (NFPA) Standards and Guidelines
4. Local and State Fire Marshal requirements
5. Local Building and Inspection Department requirements
6. Local adopted codes, standards, ordinances (including noise ordinances), or amendments
7. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE)
a. Standard 90.1-2010 - Energy Standard for Buildings Except Low-Rise Residential Buildings
b. Standard 90.2-2018 Energy-Efficient Design of Low-Rise Buildings
c. Standard 62.1-2010 - Ventilation for Acceptable Indoor Air Quality
d. Standard 55-2010 - Thermal Environmental Conditions for Human Occupancy
e. Other Standards and Guidelines as applicable
8. Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Manuals
9. Air Conditioning, Heating, and Refrigeration Institute (AHRI)
10. Air Conditioning Contractors of America (ACCA)
11. American Society of Mechanical Engineers (ASME)
12. Underwriters Laboratories Inc. (UL)
13. Americans with Disabilities Act (ADA)

B. If Code or other requirements exceed the provisions shown on the Contract Documents, the Engineer shall be notified in writing. Where requirements of the Contract Documents exceed Code requirements, work shall be furnished and installed in accordance with the Contract Documents. Any work done contrary to these requirements shall be removed and replaced at the Contractor's expense.

1.03 NOISE CRITERIA DESIGN GOALS

A. Mechanical equipment, air distribution systems and devices shall be designed to not exceed the following noise criteria (NC) levels:
1. Public Space Areas: NC <35
2. Utility/All Other Areas: NC <40
3. Open Office areas: NC<40

1.04 MISCELLANEOUS DEFINITIONS

A. Terms: The following definitions of terms supplement those of the Division 01-General Requirements and are applicable to Division 23 - Heating, Ventilation, and Air Conditioning (HVAC):
1. Contractor: As used herein the term shall mean "the person or entity referred to throughout the Contract Documents as if singular in number. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative."
2. Furnish: As used herein shall mean "supply and deliver to Project site, unload and inspect for damage."
3. Install: As used herein the term shall mean "to place in position for service, temporarily store, unpack, assemble, erect, apply, place, protect, clean, start up, and make ready for use."
4. Owner: As used herein the term shall mean "the person or entity identified as such and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative."
5. Product: As used herein shall include materials, systems, and/or equipment, machinery, components, and fixtures forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
6. Provide: As used herein shall mean "furnish and install, complete and ready for the intended use."
7. The Work: As used herein the term shall mean "the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.
8. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.05 WORK INCLUDED

The HVAC Systems installed and work performed under this Division of the Specifications shall include, but not necessarily be limited to:

A. Airside Systems
1. Equipment: including fans, unitary air conditioners, air handling units, fan-coil units, make-up air units, dedicated outdoor air units, furnaces, split systems, etc.
2. Ductwork and Accessories: including sheet metal, duct-board, kitchen hood and dishwasher exhausts, flexible ductwork, fire and smoke dampers, access doors, etc.
3. Air Terminal Devices: including powered induction units, variable air volume valves, etc.
4. Air Distribution Devices: registers, grilles, diffusers, etc.

B. Refrigerant Systems
1. Equipment: condensing units, etc.
2. Piping, Tubing and Accessories: including pipe, refrigerant tubing, valves, solenoids, thermal expansion valves, pipe and equipment drains, condensate drains, expansion devices, etc.

C. Equipment, Ductwork and Piping Supports
1. Equipment Mounts: including roof curbs, equipment rails, miscellaneous steel, etc.
2. Hangers and Support Devices: including inserts, hanger rods, strut channel, cross-bracing, anchor bolts, pipe anchors, restraints, etc.

D. Insulation
1. Ductwork Insulation: including exterior duct wrap, internal duct liner, etc.
2. Piping and Equipment Insulation: including preformed, board and wrap.

E. Automatic Temperature Controls
1. Building Automation System (BAS)/Facility Management System (FMS): same as above but networked to a central human-machine computer interface, including all software and programming, display graphics, etc.

F. Labor and Equipment: including project management, supervision, trademen, lifts, fork-trucks, cranes, scaffolding, saws, wrenches, etc.

G. Equipment and Valve Identification

H. Start-up and Commissioning

I. Demonstration and Owner Training

J. Testing, Adjusting and Balancing

1.06 ENGINEER'S DRAWINGS

A. The locations, arrangement and extent of equipment, devices, ductwork, piping, and other appurtenances related to the installation of the HVAC work shown on the Drawings are approximate and define the intent of the design. The Contractor shall not scale Engineer's Drawings, but shall refer to the architectural drawings for exact dimensions of building components. Should a conflict exist between the architectural and engineering drawings regarding dimensions and scale, the Contractor shall notify the Architect of the discrepancy.

B. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

1.07 EQUIPMENT, MATERIALS AND BID BASIS

A. Manufacturers' names, model numbers, etc. cited on the Drawings and in the Specifications are for the purpose of describing type, capacity, function and quality of equipment and materials required. All project design and coordination between disciplines has been performed as if the named manufacturer and specific piece of equipment will be provided to the project by the Contractor.

B. Alternate equipment and/or materials other than that named on the Drawings and in the Specifications may be proposed for use, but all equipment and materials shall conform entirely to the specified base items. Proposed alternate equipment shall be substantially equal in size, weight, construction and capacity. Alternate equipment and materials shall be submitted only as full equivalent to the equipment and materials specified, with sufficient supportive documentation and technical literature to demonstrate quality, performance, and workmanship without doubt or question. Requests for prior approval of alternate products shall be made at least ten (10) days prior to the bid date and as required by Division 1 - General Requirements. The Engineer shall consider the use of the alternate equipment based on the supportive documentation made available to him, and shall approve or disapprove any proposed alternates. Major exceptions to these specifications will be considered sufficient cause for rejection of the submittal. The decision of the Engineer shall, in all cases, be final.
1. The ten (10) day prior approval submittal shall include a Compliance Review of the Specifications and Addenda (if any). The Compliance Review shall be paragraph-by-paragraph review of the Specifications with the following information; "C", "D" or "E" marked in the margin of the original Specifications and any subsequent Addenda.
2. "C": Comply with no exceptions.
3. "D": Comply with no deviations. For each and every deviation, provide a numbered footnote with reasons for the proposed deviation and how the intent of the Specification can be satisfied.
4. "E": Exception, does not comply. For each and every exception, provide a numbered footnote with reasons and possible alternatives.
5. Manufacturer shall provide complete paragraph-by-paragraph compliance document detailing unit conformance to the specification. The Engineer will not review the proposal for equipment compliance.

Unless a deviation or exception is specifically noted in the Compliance Review, it is assumed that the bidder is in complete compliance with the plans and specifications. Deviations or exceptions taken in cover letters, subsidiary documents, by omission or by contradiction do not release the bidder from being in complete compliance, unless the exception or deviation has been specifically noted in the Compliance Review. The bidder may submit the latest state-of-the-art components in lieu of specified components at no additional cost, where latest state-of-the-art components perform better than what is specified. All deviations from the specifications must be approved by the Architect/Engineer and the Owner.

C. The Contractor shall coordinate the installation of all HVAC equipment proposed for use in this project with all building trades (architectural, structural, electrical, etc.). Coordination shall be accomplished prior to, and shall be reflected in, the equipment submittals for approval. When the Contractor requests substitution of alternate equipment, it is with the knowledge that he shall be responsible for any and all costs required by the substitution, including necessary engineering and construction revisions in his or any other contract or trade to satisfy the design intent shown on the Plans and described in the Specifications.

D. All materials exposed within HVAC plenums shall have a flame-spread index of not more than 25 and a smoke-developed rating index of not more than 50 unless otherwise allowed by code.

1.08 SUBMITTALS

A. The Contractor shall prepare, submit and obtain Engineer's review of all manufacturers' data on the HVAC equipment and systems prior to ordering, purchasing or installing any equipment or materials. Shop drawings shall be submitted electronically in a portable document format (pdf). An acceptable alternate would be to submit six (6) hard copies of the complete submittal, five of which will be reviewed and returned. Submittals shall be as described in Division 01 - General Requirements. Prior to submitting to the engineer, the contractor shall review and subsequently place his approval stamp on the shop drawings. Submittals shall be transmitted simultaneously in a single .zip file or, in the case of hard copies, three-ring ring binders with the associated specification sections cited and the items submitted clearly identified. Submittals lacking the contractor's approval stamp and partial submittals will be returned without review. Submittals, as a minimum, shall include:
1. All HVAC items scheduled on the Drawings
2. Equipment arrangement, ductwork and piping drawings. Contractor drawings shall be prepared at a minimum scale of 1/8" = 1'-0". A scale of 1/4" = 1'-0" scale is preferred. Drawings shall be indicative of actual equipment purchased and shall show all offsets, transitions, fittings, dampers, valves, hanger locations, etc. Sections are required in spatially tight The following will guide the Contractor as to minimum drawing detail required:
a. Clearly indicate top and bottom of duct and pipe elevations. All elevations shall be coordinated as to not conflict with structural, plumbing, electrical and architectural trades.
b. Indicate all offsets (both vertical and horizontal).
c. Indicate graphically all duct and pipe joints and their lengths.
d. Submit duct and pipe-work fabrication schedule indicating duct size range with minimum duct material gauges, pipe schedule being used, duct and pipe connection joint types, section lengths, duct reinforcement type and spacing, etc.
e. Indicate graphically all ductwork to be fabricated with internal duct liner.
f. Indicate all insulation for ductwork and piping.
g. Indicate all dampers and valves as shown on design documents and called for in the specifications.
h. Indicate all flexible connectors where required by specifications and notes.
3. Flexible ductwork, insulation and linings
4. Ventilation controllers, dampers, air distribution devices.etc.)
5. Manufacturer's cut sheets of all piping and tubing materials
6. Where split systems are used in a "long line application," submit manufacturer's refrigerant line set routing drawings and engineered calculations supporting installed line lengths and recommended suction and liquid line sizes (deviations in the installed lengths and sizes shall be recorded on the as-built drawings and coordinated with the manufacturer to reconfirm that long line guidelines are being met).
a. Identify and provide cut sheets of any and all accessories required to make the system complete, functional and reliable.
b. Any split system with 75 feet of separation between the outdoor unit and the indoor unit requires that the contractor obtain a warranty approval letter from the equipment manufacturer certifying the long line length distances shown on the submitted shop drawings are acceptable.
c. Refer to the EQUIPMENT INSTALLATION - COMMON REQUIREMENTS paragraph below.
7. Refrigerant type and charge (lbs.) for each item of equipment utilizing refrigerant.
8. AHRI Certificates
9. Roof curbs, equipment supports.
10. Control equipment, systems and diagrams
11. Test and balance reports

B. All submittal approvals required by any code or enforcement authority, insurance underwriter, etc. shall be obtained prior to being submitted to the Engineer.

C. Review of submittals by the Engineer does not relieve the Contractor from responsibility for complying with all requirements of the Contract Documents. Furthermore, it shall be the responsibility of the Contractor to coordinate the requirements (roof penetrations, wall penetrations, floor penetrations, curbs, electrical, etc.) of all approved equipment with the other trades and disciplines.

D. All submittals shall be identified by the equipment mark or tag identification numbers shown on the Contract Drawings. Each individual submittal item shall be marked to show which specification section pertains to the item.

E. The Contractor shall provide a written statement confirming coordination of voltage requirements for all HVAC equipment requiring an electrical connection. Statement shall bear the names and signatures of the HVAC and electrical contractors. A photocopied reproduction of the below statement is acceptable.

VOLTAGE COORDINATION STATEMENT

This statement is to confirm that the voltages of the equipment provided under this specification have been coordinated with the Electrical Drawings, as well as with the Electrical Contractor.

HVAC Contractor: _____
Project Manager Name: _____
Project Manager Signature/Date: ____
Electrical Contractor: _____
Project Manager Name: _____
Project Manager Signature/Date: ____

1.09 PERMITS

A. The Contractor shall obtain all permits and inspections required for the installation of the HVAC work and pay all charges incident thereto. He shall deliver copies of all certificates of permit and inspection to the Architect.

1.10 COORDINATION OF TRADES

A. The Contractor shall give full cooperation to other trades, and shall furnish all information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.

B. Piping and other HVAC equipment shall not be installed without first coordinating the installation of same with other trades. The Contractor, at his own expense, shall relocate all uncoordinated ductwork, piping and other HVAC equipment installed should they interfere with the proper installation and mounting of electrical, plumbing equipment, ceilings and other architectural or structural finishes.

C. The Contractor shall coordinate the elevations of all ductwork, piping and equipment above ceilings and in exposed areas with the work of all other disciplines prior to installation.

D. In areas where more than one trade is required to use common openings in beams, joists, chases, shafts and sleeves for the passage of conduits, raceways, piping, ductwork and other materials, the Contractor must coordinate the positions of all piping and equipment to be furnished under this section so that all items including the materials and equipment of other trades may be accommodated within the space available.

E. The HVAC Contractor shall confirm that his work does not interfere with the clearances required for finished columns, pilasters, partitions, walls or other architectural or structural elements as shown on the Contract Documents.

F. Work that is installed under this Contract which interferes with the architectural design or building structure shall be removed and relocated as required at no additional cost to the Contract.

G. Coordinate power and fire alarm requirements of all combination fire/smoke dampers and smoke dampers with the electrical contractor.

H. The General Contractor shall coordinate service access paths for roof-mounted equipment requiring routine maintenance. Provide code compliant galvanized steel crossing structure (e.g. stairs with handrails, ladders, etc.) for any obstruction (ductwork, piping, etc.) that exceeds 1'-6" in height x 1'-6" in width. In addition, refer to Part 3 below - EQUIPMENT INSTALLATION - COMMON REQUIREMENTS. Details of such crossings shall be included with piping and ductwork layout and coordination drawings.

I. Coordinate with the roof system used so that a minimum of 8" of the roof curb is above the finished roof for flashing purposes. The top of the curb shall be level and the slope of the roof shall be compensated for by the curb.

1.11 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall prepare a minimum of two (2) instruction manuals, one of which shall be submitted to the Architect for the Engineer's review. Manuals shall describe installation, operation and maintenance of all HVAC equipment and shall include copies of control schematics, sequences of operation, function and operations of all components, as well as the Contractor's name, address, and telephone number. Manuals shall also contain one copy of all manufacturers' drawings, pamphlets, data, parts lists, and instruction manual for each piece of equipment. Upon approval, one copy shall be delivered to the Owner; one copy shall be kept by the Contractor. The pamphlets and drawings are to be neatly bound in (a) 3-ring binder(s). In addition to the hard copy, provide electronic files (PDF format) of the manuals.

1.12 AS-BUILT DRAWINGS

A. The Contractor shall maintain a record of all changes in the work from that shown in the Contract Documents. The record shall be by red-line mark-up on the most current set of Engineer's Drawings kept in the field office. After all work is completed, the Contractor shall prepare a set of "as-built" reproducible drawings of similar type and quality as the Engineer's Drawings. As an alternate to hard copy drawings, provide electronic files (PDF format) of the as-built conditions. As-built drawings shall accurately depict actual final arrangement of all HVAC items. As-built drawings shall be delivered to the Architect.

1.13 WARRANTY

A. All equipment furnished and installed under this Contract shall be provided with the manufacturer's standard warranty unless otherwise noted.

B. All reciprocating, rotary and scroll air conditioning compressors shall be provided with an extended 5-year parts warranty.

C. The Contractor shall make good all defects in material, equipment, or workmanship disclosed within a period of one (1) year from date of building acceptance by the Owner. The phrase "make good" shall mean to furnish promptly, without charge, all work necessary to remedy the defects to the satisfaction of the Engineer.

PART 2 - PRODUCTS

2.01 GENERAL

A. All equipment, materials, accessories, etc. used shall be new and of current production unless specified otherwise. Equipment not specified in the Engineer's Drawings shall be suitable for the intended use and shall be subject to approval by the Engineer.

B. All equipment, products and materials shall be free of defects and shall be constructed to operate in a safe manner without excessive noise, vibration, leakage, or wear.

C. All equipment shall bear the inspection Label of Underwriters Laboratories Inc.

D. All equipment and material for similar applications or systems shall be provided from the same manufacturer unless noted otherwise.

2.02 ELECTRICAL WORK

A. Except as otherwise specified or noted, electrical equipment used for HVAC systems shall be as specified herein.

B. Motor controls, system controls, switchers, disconnects, pilot lights, push buttons, etc. shall be furnished by the HVAC Contractor complete with the apparatus that it operates. Electrical equipment shall be wired for the voltage shown on the Electrical Drawings.

C. The Contractor shall be responsible for coordinating and furnishing equipment of voltage shown on the electrical documents.

D. Electric motors shall be NEMA Premium Efficiency open drip proof type. Motors shall meet NEMA MG1 Table 12-12 of EISA, 2010. Motors shall be selected with a minimum of 15% safety factor greater than the fan brake/horsepower (e.g. 4.75 BHP would require a nominal 7½ HP motor). The motor service factor shall not be used as part of the safety factor. All motors shall have thermal overload protection. Motors shall be capable of operating at ± 10% of the design voltage without voiding the manufacturer's warranty. Motors that drive equipment that will run continuously shall be IEC 60034-1 continuous duty rated.

E. Starters for motors ½ HP and smaller shall be manual type, and for ½ HP and larger, shall be magnetic type. Starters shall be minimum size 0, combination type (with disconnect and lockable handle) with molded case circuit breaker. Starters for motors with remote or automatic control shall be magnetic. Relays, interlocks and auxiliary contacts shall be provided as specified and required.

F. Motor controls shall be either "Hand-Off-Auto" switches or "On-Off" push buttons with one indicating light. "Hand-Off-Auto" switches shall be provided for automatically controlled apparatus.

G. Motor starters that are not an integral part of HVAC equipment shall be installed in conformance with Division 26 - Electrical Requirements.

H. All "loose" disconnects and starters shall be installed by Division 26.

I. Power wiring to disconnects, starters, and equipment shall be provided and installed by Division 26. All equipment requiring electrical power shall be provided with a disconnect switch at each piece of equipment. Coordinate switch type (fused or non-fused) with equipment characteristics, manufacturer's recommendations and the electrical drawings.

J. Provide all system controls and associated control and interlock wiring for complete and operable systems. 120 volt and higher wiring shall be MC cable or in conduit in accordance with local codes and the materials and installation requirements of Division 26 - Electrical.

K. All starters for 3-phase equipment shall have overload devices in each phase.

L. Wiring diagrams shall be furnished by the Contractor.

M. Coordinate with the electrical drawings for the required short circuit current rating of the panelboard serving multi-motor and combination-load equipment. The equipment nameplate shall bear a rating of not less than the panelboard rating.

N. Acceptable manufacturers shall be General Electric, Square D, Eaton, Siemens and Allen Bradley.

2.03 AIR FILTERS

A. All filters shall be U.L. 900 classified.

B. Filters shall be pleated disposable type (MERV 6 minimum) unless specified otherwise.

C. Install one set of new filters in air handling equipment during construction and install a new set prior to test and balance. Fan powered induction units shall have a temporary roll filter media installed at the plenum air inlet during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

D. Temporary roll filter media shall be provided at the inlets to all air handling equipment operated during construction. Remove temporary filter media prior to test and balance. Clean and vacuum all inlets prior to test and balance.

PART 3 - EXECUTION

3.01 GENERAL

A. All equipment and materials shall be completely installed, adjusted, and fully operational with all accessories and connections.

B. Equipment, piping, ductwork, etc. shall fit into the spaces provided in the building and shall be installed at such time and in such a manner as to avoid damage and as required by the job progress. In general, ductwork, piping, equipment, etc. shall be installed tight to structure above. The Contractor shall coordinate work with other trades and locate work described herein to avoid interferences with structural, electrical and architectural work. Shop drawings shall clearly indicate any conflicts with other trades. Equipment, accessories and similar items requiring normal servicing or maintenance shall be accessible.

C. The Engineer reserves the right to direct the removal of any item which, in his opinion, does not present an orderly and reasonably neat or workmanlike appearance. Such removal and replacement shall be done when directed by the Engineer and without additional cost to the Owner.

D. Listed mounting heights are to the finished bottom of the device unless otherwise noted.

E. All work shall be designed and installed to comply with the requirements for the seismic design category and use group for the area in which the building is constructed.

3.02 STORAGE AND PROTECTION OF STORED MATERIALS

A. During construction, all equipment shall be properly protected against damage, defacing and freezing with shipping cartons, plastic sheeting, shipping covers, etc.

B. All open ends of piping and equipment shall be sealed with nipples and caps, plugs, and test plugs until final connection to system is made.

C. All equipment, piping and ductwork shall be protected to prevent entrance of foreign matter and debris by covering exposed openings during construction.

D. Handle and store materials in accordance with manufacturer's and supplier's recommendations and in a manner to prevent damage to materials during storage and handling. Replace damaged materials.

E. Equipment and materials shall not be installed until such time as the environmental conditions of the job site are suitable to protect the equipment or materials. Equipment or materials damaged, or which are subjected to these elements, are unacceptable and shall be removed from the premises and replaced.

3.03 PROTECTION OF HVAC SYSTEMS IN OCCUPIED BUILDINGS

A. Protect equipment and air distribution systems as outlined in SMACNA's IAQ Guidelines for Occupied Buildings Under Construction, latest edition.

3.04 BUILDING DRY-OUT DURING CONSTRUCTION

A. HVAC equipment shall not be used to dehumidify the building interior and dry-out construction materials. The HVAC system does not have the capacity to perform a building dry-out. The HVAC equipment shall not be operated until the building is completely dried-in and construction is substantially complete.

B. Coordinate with the general contractor to provide industrial grade desiccant type dehumidifiers to perform building dry-out. Propane or diesel space heaters are not acceptable as the combustion process adds moisture to the air.

3.05 CUTTING AND PATCHING

A. The work shall include all cutting and patching required as part of the HVAC installation. Refer to Division 1 - General Requirements.

3.06 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right-of-way for piping to be installed with the required slope.

E. For roof and attic mounted equipment requiring routine maintenance, allow for an unobstructed path from the roofattic service entry point to the equipment. The path area shall be a minimum of 6'-0" high by 3'-0" wide.

F. Split system outdoor unit equipment has been shown indicating matched systems of the indoor unit with its associated outdoor unit. While the location of the outdoor units are approximate, the importance of unit locations relative to the refrigerant line set penetration through a wall or roof is critical for the project. Prior to ordering equipment, the contractor shall carefully coordinate the line set routing and requirements with the split system manufacturer to insure installation guidelines, especially for long line applications, are being followed. Refrigerant line sets shall be routed to reduce the system total equivalent length and minimize system capacity losses due to elbows, fittings, valves, etc. After the coordinated routing drawings have been approved and certified by the split system manufacturer, they shall be submitted for review along with the equipment and any required accessories. During installation, the contractor is responsible for keeping as-built refrigerant piping installation drawings noting any deviations to the proposed routing. Deviations that may affect proper system operation or performance shall be reviewed by the manufacturer immediately and corrective action implemented as required.

3.07 EQUIPMENT SUPPORTS

A. Major equipment supports (structural steel frames, framed structural slab and wall openings, etc.) shall be furnished and installed by others; however, the HVAC work shall include furnishing and installation of all miscellaneous equipment supports, structural members, rods, clamps and hangers required to provide adequate support of all HVAC equipment.

B. Unless otherwise shown on the Drawings, all HVAC equipment, piping, and accessories shall be installed level, square, and plumb.

C. All equipment, piping, etc. supported by structural bar joists shall be supported only by the top chord of the joists. Hangers shall not be attached to the bottom chord of any joists.

3.08 PIPE AND DUCTWORK PENETRATIONS

A. Sleeves shall be installed in all masonry or concrete walls, floors, roofs, etc. for pipe and ductwork penetrations. Sleeves for pipe shall be schedule 40 black steel pipe. Refer to Section 23 21 13 - Piping and Accessories for additional information. Sleeves for ductwork shall be 20-gauge galvanized steel. Ductwork sleeves shall be sized to provide a minimum of ¼" clearance between the sleeve and duct. For insulated ducts, the clearance shall be between the sleeve and the insulation.

B. As far as possible, all pipe and ductwork penetrations shall be provided for at the time of masonry or concrete construction. Where drilling is required, only core drills shall be used. Star drills shall not be used.

C. All pipes penetrating walls or floors of any construction shall be installed with escutcheon plates on both sides of the penetration securely fastened to the wall or floor. In exposed areas, escutcheon plates shall be chrome plated. All escutcheon plates shall be sized to completely conceal the penetration.

D. Ductwork penetrating walls or floors of any material shall be installed with closure plates on both sides of the penetration.

E. Pipe penetrations through exterior walls shall be sealed weather-tight with a factory fabricated mechanical type rubber seal. Refer to Section 23 21 13 - Piping for additional information.

3.09 FLASHING

A. All piping and ductwork penetrating roofs shall be flashed in an approved manner, shall be watertight, and shall conform to the requirements detailed in Division 7 - Thermal and Moisture Protection.

3.10 EQUIPMENT LABELING

A. All HVAC equipment shall be labeled. This shall include all central plant, air handling or air conditioning equipment, air terminals, and other similar and miscellaneous equipment.

B. Labels for air terminals or other devices shall be located for optimum visibility through access panel or removed ceiling tiles.

C. Equipment labeling shall be one of the following, unless noted or specified otherwise:
1. Permanently attached plastic laminated signs with 1" high lettering
2. Stencil painted identification, 2" high letters, with standard fiberboard stencils and standard black (or other appropriate color) exterior stencil enamel

3.11 CLEANING

A. At all times, the premises shall be kept reasonably clean and free of undue amounts of waste, trash and debris by periodic cleaning and removal. After completion, all foreign material, trash and other debris shall be removed from the job site.

B. After all equipment has been installed, but prior to testing and balancing, all equipment, piping, ductwork, etc. shall be thoroughly cleaned both inside and out.

C. All water piping shall be chemically flushed and cleaned prior to circulating water through equipment.

D. After cleaning, filters shall be installed where required and all systems shall be tested and balanced.

E. After testing and balancing and just prior to Owner review and acceptance, all systems shall be finally cleaned and left ready for use.

3.12 PAINTING

A. Painting will be done under Division 9 - Painting except as otherwise noted, but the HVAC Contractor shall leave all surfaces of work free of rust, dirt and grease.

B. The HVAC Contractor shall touch-up any equipment scratched in shipment or during installation to match the original finish. Touch-up painting of HVAC equipment shall be part of the HVAC work.

C. Any visible ductwork through grilles, registers and diffusers shall be painted flat black.

D. Provide one coat of rust preventive primer on all new structural steel supports and new ferrous surfaces not galvanized, including insulated and non-insulated HVAC piping. Rust preventive painting shall be part of the HVAC work. Rust preventive paint shall be "Rust Destroyer" by Advanced Protective Products, Inc., Fair Lawn, NJ, (800) RUST-007. Product shall have a 5-year warranty when applied directly over rust. Clean and prepare surface per manufacturer's recommendations.

E. All painting and coating shall match the original finish and shall conform to the requirements detailed in Division 9 - Finishes.

F. Do not paint over equipment nameplates, nonferrous hardware, accessories or trim.

3.13 PRESSURE TESTING

A. Unless otherwise specified herein, all HVAC piping shall be tested as required by Code to 1½ times the rated system pressure or 100 psig, whichever is greater. Care shall be taken to isolate all equipment not suitable for this test pressure by installing pipe caps or blank flanges at the equipment connections. All valves and fittings shall be tested under pressure.

3.14 PERFORMANCE AND DEMONSTRATION TESTS

A. All testing and demonstration of any and all HVAC systems required for acceptance by any authorities having jurisdiction shall be included as part of the HVAC work. This shall include the furnishing of any and all testing equipment, smoke generation devices, and any other required equipment or accessories, and all necessary labor required to perform any required tests or demonstrations. The Contractor shall coordinate and verify all devices, equipment and sequence of testing and/or events with such authorities having jurisdiction. The Contractor shall perform a minimum of two (2) satisfactory preliminary tests or demonstrations prior to any formal tests and/or demonstrations for any code authorities and shall give a minimum of five (5) days advance notice to the Engineer of any and all preliminary tests and/or demonstrations, indicating the date and time of such tests.

B. For testing and demonstration of smoke control systems, the requirements in paragraph 3.14.A apply. In addition, coordinate with the owner/operator for witnessing of formal testing.

3.15 TRAINING

A. Upon completion of the work, the Contractor shall conduct operation and training session(s) for the Owner's key operating personnel. These sessions shall be of sufficient length and duration to adequately explain the design intent and proper operating and maintenance techniques for all HVAC equipment and systems. After these sessions are completed, the Contractor shall provide a copy of a signed statement by the Owner that his personnel are thoroughly familiar with and capable of operating all HVAC equipment and systems.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING (TAB)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to specification section 23 00 00 - HVAC General, all of which applies to work described in this section as if written in full herein.

B. The work described by this section of the specifications consists of furnishing all materials, instruments, labor, and appurtenances to test, adjust and balance all of the HVAC systems furnished and installed under Division 23 of the specifications.

C. The TAB agency shall be a subcontractor of the General Contractor and shall not report to or be paid by the HVAC Contractor. The HVAC subcontractor shall be responsible to cooperate with and provide for the balancing subcontractor any and all materials, services, labor, etc. to facilitate completion of the balancing work.

1.02 QUALITY ASSURANCE

A. The TAB agency and its specialists shall be certified members of Associated Air Balance Council (AABC) or certified by the National Environmental Balance Bureau (NEBB) to perform TAB service for HVAC. The certification shall be maintained for the entire duration of duties specified herein. The TAB agency shall have been in business for at least the past five years and must be free of disciplinary action by either the AABC or the NEBB during that time.

B. All TAB technicians performing actual TAB work shall be experienced and must have done satisfactory work on a minimum of 3 projects comparable in size and complexity of this project and must be certified so by the TAB agency in writing.

C. The basic instrumentation shall be calibrated to accuracy requirements by its manufacturer, AABC or NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems. Submit calibration history of the instruments to be used for test and balance purpose during the preliminary and final submittal phase.

D. One or more of the applicable AABC, NEBB or SMACNA publications, supplemented by the ASHRAE Handbooks and requirements stated herein shall be the basis for planning, procedures, tolerances and reports. Final report shall cite the exact names of publications used as a basis or reference for the TAB work or reports.

1.03 DEFINITIONS

A. Retain definition(s) remaining after this Section has been edited.

B. AABC: Associated Air Balance Council.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An entity engaged to perform TAB Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide plastic plugs to seal holes drilled in ductwork for test purposes.

B. Provide for repair of insulation removed or damaged for TAB work to match installation.

PART 3 - EXECUTION

3.01 TAB PROCEDURES

A. TAB shall be performed in accordance with the requirements of the Standard under which the TAB agency is certified, either AABC or NEBB.

B. During TAB all related system components shall be in full operation including the Automatic Temperature Controls system.

C. Adjustment of the temperature controls shall be coordinated by the TAB work specialist in conjunction with the Building Automation System/Automatic Temperature Control Company's Engineer. Both shall cooperate to simulate a complete cycle for every system in every mode of operation (automatic, economizer, fire emergency, etc.).

D. Coordinate TAB procedures with any phased construction completion requirements for the project. Provide TAB reports for each phase of the project prior to partial final inspections of each phase of the project.

E. Record dates and time of day of all tests, and ambient conditions (dry bulb and wet bulb).

3.02 AIR SYSTEMS TAB

A. Systems shall be tested, adjusted and balanced so that air quantities and temperatures at outlets are as shown on the Contract Drawings and so that the distribution from supply outlets is uniform over the face of each outlet.

B. Direct reading velocity meters may be used for comparative adjustment of individual outlets, but air quantities in ducts having velocities of 1,000 feet per minute or greater shall be measured by means of pitot tubes and inclined gauge manometers. Instrument test opening enclosures shall be provided as required at the direction of the TAB agency.

C. Adjustments shall be made in such a manner that splitter and volume adjusters close to air outlets will have the least pressure drop consistent with volume requirements. Primary balancing shall be obtained by adjustment of the dampers at branch duct take-offs. Adjustable fan drives shall be used for making final adjustments of total air quantities. Additional dampers or other air volume adjusters required to accomplish the balancing and adjusting shall be furnished and installed as part of the HVAC work.

D. Check and readjust factory set minimum and maximum air terminal unit flow rates if necessary. Balance air distribution on full cooling maximum. Reset room thermostats and check operation from maximum to minimum cooling, to the heating mode, and back to cooling. Record and report the heating coil leaving air temperature when in the maximum heating mode.

E. Adjust fan speeds to provide design air flow. Adjust V-belt drives, including fixed pitch pulley requirements.

F. After completion of the testing, adjusting and balancing of the air systems, provide electronic files (e.g. PDFs, etc.) of the complete test report showing the minimum following information which shall be submitted to the Engineer for review:
1. Systems inspection narrative on equipment and installation for conformance with design
2. Duct Air Leakage Test Report
3. Systems Readiness Report
4. TAB report covering flow balance and adjustments, performance tests, [vibration tests and sound tests]. Required information:
a. Location of each air outlet or inlet. This shall be presented in the form of a reduced size floor plan showing outlet number keyed to the outlet number in the report.
b. Dimensions or size of each outlet or inlet
c. Type and manufacturer of diffusers, grilles, registers. Indicate duty as supply, return, exhaust, etc.
d. CFM of air as indicated on the Drawings for each outlet or inlet with corresponding velocity
e. Velocity of air as measured and corresponding cfm at which system has been balanced and adjusted, for each outlet or inlet
f. Velocity of air measured and corresponding cfm, after each complete system has been balanced and adjusted, for each main branch or zone duct at the supply fan, the return fan and the exhaust fan, as the case may be
g. After each complete system has been balanced and adjusted, the total cfm at fan discharge, the total return air to the apparatus, the total outside air to the apparatus, the total outside air to the apparatus, static pressure at fan outlet, total static pressure for apparatus, fan speed, motor amperage for each phase and voltage
5. Narrative of uncorrected installation deficiencies noted during TAB and applicable explanatory comments on test results that differ from design requirements.

G. The above testing, adjusting and balancing shall be performed for the first season of the year, cooling season or heating season, which occurs at the completion of the building. Additional balancing and adjusting which may be required for the season of the year next following shall be performed as part of the work under this specification.

H. Ventilation air distribution systems (outdoor air and exhaust air) shall be balanced to achieve the airflow rates indicated on the drawings. These airflow rates shall be considered minimum rates. The measured air balance tolerance for both outdoor air and exhaust air rates shall be -0% to +10%.

3.03 MARKING OF SETTINGS AND TEST PORTS

A. Following the approval of the final TAB Report, the setting of all HVAC adjustment devices including valves, splitters and dampers shall be permanently marked by the TAB Specialist so that adjustment can be restored if disturbed at any time. Style and colors used for markings shall be coordinated with the General Contractor.

B. The TAB Specialist shall permanently and legibly identify the location points of duct test ports. If the ductwork has exterior insulation, the identification shall be made on the exterior side of the insulation. All penetrations through ductwork and ductwork insulation shall be sealed to prevent air leaks and maintain integrity of vapor barrier.

END O

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. The insulation shall be installed in a neat and workmanlike manner by trained personnel regularly engaged in the installation of insulation and approved by the insulation manufacturer. Insulation, adhesives, coverings and coatings shall be applied in strict accordance with its respective manufacturer's recommendations. Installer has been in business for no less than 5 years and has completed at least 10 installations of similar size projects.

C. The contractor shall verify that test and inspection of the work to be insulated have been completed and approved before the insulation is applied.

D. All insulation must meet applicable codes for Flame Spread and Smoke Developed ratings when tested in accordance with ASTM 84 and UL 723.

1.02 WORK INCLUDED

A. The work done under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all insulation, complete, as indicated on the Drawings and as specified herein.

1.03 QUALITY ASSURANCE

A. Materials shall be the standard products of manufacturers regularly engaged in the production of insulation products. Insulation materials shall be products that have been in use in commercial buildings for at least 2 years prior to bid opening.

B. Surface Burning Characteristics:

1. Insulation shall have a composite insulation, jacket, binders, and adhesive Flame-Spread rating of 25 or less and a Smoke-Developed rating of 50 or less and shall be so listed by UL.
2. Insulation and related materials shall have surface burning characteristics determined by test performed on identical products per ASTM E 84, NFPA 255, and UL 723, mounted and installed as per ASTM E 2231.
3. Adhesives, mastics, tapes, and other accessories shall have the same component ratings.
4. Materials shall be labeled indicating compliance with the above requirements.
5. All testing shall be performed by a testing and inspecting agency acceptable to authorities having jurisdiction. Insulation, jacket materials, adhesives, mastics, tapes and cement material containers shall be labeled with appropriate markings of applicable testing and inspecting agency.

1.04 RELATED WORK

A. Where pipes and ducts pass through fire walls, fire partitions, above grade floors, and fire rated chase walls, the penetration shall be protected and sealed with fire-stopping materials as specified in Section 23 00 00 - HVAC General.

B. Adequate provisions shall be made to protect the premises, equipment, and the work of other trades against droppings, adhesives and coatings used in the installation.

C. Where indicated, painting of insulation jackets shall be as specified in Section 09 91 00 - Painting.

D. Refer to Section 23 23 00 Refrigerant Piping for refrigerant piping insulation.

1.05 SUBMITTALS

A. Submit product information for insulation materials to the Architect in accordance with Division 1 and Section 23 00 00 - HVAC General.

B. Submit shop drawings and data to prove complete compliance with these specifications on products and methods of installation. Include materials used, thickness for each application, flame and smoke ratings, thermal conductivity, permeance, density for each product, and jackets (both factory and field applied). Indicate methods of applications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide materials which are the standard products of manufacturers regularly engaged in the manufacture of such products and that essentially duplicate items that have been in satisfactory use for at least 2 years prior to purchase. Insulation shall be CFC and HCFC free.

B. Provide insulation that meets or exceed the requirements of ASHRAE 90.1.

C. Insulation exterior shall be cleanable, grease resistant, non-flaking and non-peeling. Materials shall be compatible and shall not contribute to corrosion, soften, or otherwise attack surfaces to which applied in either wet or dry state.

2.03 BLANKET TYPE INSULATION (DUCTWRAP)

A. Description:

1. Flexible, limited combustible, blanket type insulation composed of mineral or inorganic glass fibers bonded together with a thermosetting resin, meeting ASTM C 553, Type 1 and ASTM C 1290.
2. Vapor retarder jacket: Provide one of the following types of vapor retarder jackets:
   a. Foil-scrim-kraft (FSK), foil reinforced kraft (FRK), or polypropylene-scrim-kraft (PSK) with a 2" (50mm) (min.) stapling and taping flange on one edge.
   b. Conforming to ASTM C 1136 Type II.
3. Surface Temperature Application Limits: Insulation shall be rated for use on surfaces operating at temperatures up to 250°F.
4. Ratings:

Insulation Type:	Type 1:		
Minimum R-Value: (at of package*) (at 75°F mean temperature)	4.2 K		
Minimum R-Value, installed (at 75°F mean temperature)	4.0 (0.28)		
Maximum U-value installed (at 75°F mean temperature)	0.25 (1.42)		
Minimum Density (lb/ft³ (kg/m³))	1 (16)		
Thickness inches (mm)	2 (51)		
Maximum U-value installed (at 75°F mean temperature) (Btu•in/h•ft²•°F (W/m•°K))	0.27 (1.23)		

Value may vary by manufacturer; minimum installed value must be met

B. Insulate the following with Type 1 blanket insulation:

1. All galvanized steel ductwork containing heated and/or cooled supply air, except:
   a. Ductwork indicated to be internally lined or insulated with external insulation.
2. Concealed surfaces of ceiling diffusers exposed to non-return air plenums.
3. Return air ductwork exposed to attics or non-return air plenums.

2.04 DUCT LINER

A. Refer to Section 23 31 00 - Ductwork and Accessories for duct liner requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Shop drawing submittals shall include a complete package of materials and methods intended for use as described in this section.

B. All work shall be in strict accordance with applicable codes, ordinances and the manufacturer's recommendations.

C. All work shall be performed in a professional workmanlike manner and standard trade practice. It shall be smooth in appearance and suitable for finish painting.

D. All exterior piping shall be installed with a corrugated aluminum jacket with bands 3'-0" on center.

END OF SECTION

SECTION 23 36 16

VARIABLE AIR VOLUME UNITS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified in this section is subject to the provisions of Section 23 00 00 - HVAC General.

B. Variable air volume units (VAV) shall be provided to meet the minimum capacities scheduled at the indicated conditions and shall meet all constraints of construction.

1.02 COORDINATION

A. The variable air volume units of one manufacturer (Titus) have been used as the basis of design. Any modifications to controls, ductwork, structural supports, etc., that result from the use of equipment by any other manufacturer, shall be coordinated with all trades; this coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring additions to the Contract.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Variable air volume units (VAV) shall consist of primary air damper, attenuator section and noise shroud (if required to meet listed sound pressure levels), primary air damper actuator, primary air controller and any other items required to perform as specified. The only field connections required shall be the DDC interface, thermostat wiring and the duct connections.

B. The maximum acceptable NC at the unit discharge is 40 at 1.5" inlet static pressure; the maximum acceptable radiated NC is 40 at 1.5" inlet static pressure. The maximum pressure drop through the unit shall be 0.3" W.C.

C. Unit housing shall be constructed of galvanized steel sheets, reinforced to eliminate excessive flexing. Housing shall be internally lined with 1" thick acoustical fibrous glass liner conforming to NFPA requirements for lining in a Class I air duct. Service to internal parts shall be through an access door in the housing.

D. VAV controller shall be as specified in Section 23 09 00 - Automatic Controls.

E. Pressure independent primary air controllers shall be furnished by the temperature controls contractor for factory mounting by the VAV unit manufacturer. Temperature controls contractor shall pay all shipping charges. Pressure independent primary air volume controller shall control the supply air quantity within 5% of the air volume required to satisfy the thermostat, regardless of changes in system static pressure. Each box shall be factory set and field adjusted for maximum and minimum cfm.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Variable air volume units shall be installed in complete conformance with the manufacturer's recommendations and the Contract Documents.

B. The manufacturer's designated representative shall be present for testing of the units and shall verify in writing that the units are installed in accordance with the manufacturer's recommendations.

3.02 ADJUSTMENT

A. The VAV units shall be tested and adjusted to provide the scheduled capacities.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING, INSULATION AND ACCESSORIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. Refrigerant piping shall meet the requirements of the Safety Standard for Refrigeration Systems (ANSI/ASHRAE Standard 15-Latest Edition) and the Code for Pressure Piping (ANSI/ASME Standard B31.5-Latest Edition: Refrigeration Piping and Heat Transfer Components).

C. Piping, valves, accessories and insulation installed indoors shall have a flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.02 WORK INCLUDED

A. The work under this section shall include all labor, materials, accessories, services and equipment necessary to furnish and install all refrigerant piping, insulating systems, and accessories, complete, as indicated and specified herein.

B. Without limiting the generality thereof, the work in this section shall include the following items:

1. Direct expansion (DX) system piping (cooling only)
2. Insulating the following systems:
   a. Refrigerant suction (low pressure gas) piping
   b. Refrigerant hot gas (discharge or high-pressure gas) piping.
   c. Refrigerant liquid piping for ductless split systems

1.03 RELATED DOCUMENTS

A. Specification sections:

1. 23 81 28.12 Ductless Cooling Only Split Systems

1.04 RELATED REFERENCES

A. Designation and Safety Classification of Refrigerants (ANSI/ASHRAE Standard 34-Latest Edition).

1.05 QUALITY ASSURANCE

A. Installer Qualification: Only trained and experienced installers skilled in refrigeration pipe installation and brazing of copper tubing shall be used.

B. Piping, valves and accessories shall be manufactured in the United States. Submit Certificate of Manufacture with shop drawings.

1.06 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, valve arrangements and locations, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

Retain subparagraph below to have Contractor size and design refrigeration piping.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

C. Piping materials including Certificate of Manufacture

D. Insulation products, adhesives, coatings, etc. including Material Safety Data Sheets

E. Field quality-control test reports

F. Operation and maintenance data

1.07 PRODUCT STORAGE AND HANDLING

A. Store piping, insulation, valves and specialties in a clean and protected area.

B. Piping, tubes, and coils shall be stored with end caps in place to ensure that piping interior and exterior remain clean prior to installation.

PART 2 - PRODUCTS

2.01 REFRIGERANT PIPING

A. Piping shall be:

1. Type "L" hard drawn seamless copper tube conforming to ASTM B88, or
2. Type "ACR" (Air Conditioning and Refrigeration) service copper tubing conforming to ASTM B280.
   a. Straight Lengths: ASTM B 75, UNS C12200, H55 Temper (Light Drawn). ACR Bending Quality; Cleaned, Eddy Current Tested, and Plugged per ASTM B 280.
   b. Coiled: ASTM B 280, UNS C12200, O60 Temper (Soft Annealed), ACR, cleaned and capped. Coils shall be dehydrated, purged with Nitrogen and tightly capped to insure cleanliness. Piping shall be engineered and constructed to support R-410A to 700 psi @ 250°F.
   1) Acceptable manufacturers:
      a) Streamline/Mueller
      b) Refteik, Inc.
      c) Linesets, Inc.
      d) ACR Green Proshield by Select Manufacturing, Inc.
      e) JMF Company

B. Joints shall be brazed. Brazing filler metals shall comply with AWS A5.8. Mechanical press type joints are not allowed.

2.02 VALVES, FITTINGS AND SPECIALTIES

A. Fittings shall be wrought copper conforming to ASME/ANSI Standard B16.

B. Valves, filter-driers and other accessories shall be suitable for refrigerant service.

C. Field Swaged Brazing Cups: MSS-SP-73, ASME B 16.50

D. Field Bends (all angles): ASME B31.5

E. Full Port Refrigeration Service Valves:

1. Body: Forged brass uni-body style with brass cap including key end to remove core
2. Schrader service valve with cap
3. Core: Removable ball-type check valve with stainless-steel spring
4. Seat: Polytetrafluoroethylene
5. End Connections: Socket ends
6. Working Pressure Rating: 700 psig (factory tested)
7. Maximum Operating Temperature 300°F
8. Valves must be specifically rated for R-410A
9. Approved manufacturers: Diamondback, Parker, Mueller/Streamline

2.03 INSULATION

A. Refrigerant piping shall be insulated as follows:

1. Operating temperatures up to 220°F: flexible elastomeric tubing insulation (PVC/NBR), AP/Armaflex Black LapSeal™ pipe insulation as manufactured by Armacell, LLC or approved equal. All joints and seams shall be sealed weather-tight with Armaflex Black LapSeal™ Tape. Black LapSeal™ Tape shall also be used to secure the thermostat cable to the pipe insulation prior to applying the finish coat. The finish coat for flexible elastomeric insulation installed outdoors shall be two coats of a water-based latex paint designed for use over all forms of flexible elastomeric insulation. Finish coat shall provide a protective finish suitable to both indoor and outdoor applications, formulated for cold weather flexibility to resist cracking and weather-resistant to ultraviolet (UV) and ozone. Coating shall be Armaflex WB finish or equivalent product compatible with the insulation.
   a. Acceptable alternate products:

1) Aerotex, USA, Inc. Aerocell with Protape and two coats of field applied Aerocel Aerocoat.
2) K-Flex Titan™ (no field applied protective coating required)

B. Insulation thickness shall be as follows:

IECC 2015

1. Mini-Split Cooling Only (TXV located at outdoor unit) - Insulate all piping - 1" insulation

PART 3 - EXECUTION

3.01 GENERAL

A. Refrigerant piping shall be supported as shown on the Drawings and as required at intervals not over 6'-0" O.C. and at all turns and offsets. Hangers and pipe clamps shall be copper plated tubing hangers of adequate size to fit around tubing and insulation as required. Saddles shall be used under insulated tubing to protect insulation. Piping routed in excess of 6 (six) lineal feet on the roof shall be supported by B-Line "Dura-Blok" rooftop supports or approved equal.

B. Pressure testing of piping systems shall be in accordance with standard industry practice for the refrigerant used.

C. Refrigerant piping shall be clean and free of outside contaminants at all times. Prior to start-up of any equipment or insulation installation, all piping shall be cleaned, tested, dehydrated and charged as recommended by the refrigerant compressor manufacturer.

1. Procedure: Joints and connections in refrigerant piping shall not be installed in partitions or walls or where inaccessible for testing, inspection and rework. Make provisions to prevent contact of dissimilar metals. During construction, cap all tubing to prevent moisture from entering. Keep in dry location.
2. Leak testing and recharging: Upon completion of installation of air conditioning equipment, test all refrigerant piping, components and accessories, including quick-connect refrigerant connectors for evaporator and condensing unit; test with a halide torch; prove tight by Contractor to assure a leak-tight refrigerant system. If leaks are detected at the time of installation or during warranty period, remove entire refrigerant charge from system, correct leaks, and retest system. After system is found to be leak free, evacuation shall be accomplished by use of a reliable gauge and a vacuum pump capable of pulling vacuum of at least one mm Hg absolute. Accomplish system evacuation in strict accordance with equipment manufacturer's printed instruction. System leak testing, evacuation, dehydration and charging with refrigerant shall comply with standard industry practice and local codes and ordinances.

D. Refrigerant piping shall be run continuously, without joints, where possible. All joints in refrigerant piping shall be made accessible. Joints shall not be permitted in concrete slabs or below grade.

E. Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access.

F. All piping shall be run true to grade and shall be arranged to make the best possible appearance. Except where otherwise required by conditions of installation, all piping shall be symmetrical and parallel with lines of buildings or structure in which it is installed. All piping shall be run concealed except in mechanical room and where indicated otherwise.

G. All piping and equipment shall be supported and guided. Anchors shall be provided to absorb or transmit thrust and eliminate vibration or pulsation. Hangers or supports shall be provided near each change of direction. Supports shall be so located or shall be of such type as not to unduly restrict the movement of the pipe due to lateral or longitudinal expansion.

3.02 PIPING APPLICATIONS

A. Suction (low pressure gas), Hot Gas (high pressure gas) and Liquid Lines 7/8" OD and Smaller for Conventional Air-Conditioning, Heat Pump, and Heat Recovery Applications: Copper, Type ACR, O60 (soft annealed)-temper tubing and field bent fittings with brazed joints.

3.03 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves as specified or as required to isolate system components.

3.04 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; route and size piping based on manufacturer's recommended line lengths and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15 (latest version).

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas. Concealed locations shall be free of pipe joints.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping adjacent to machines to allow service and maintenance.

F. Install piping free of sags and bends.

G. Field bend changes in direction.

H. Select system components with pressure rating equal to or greater than maximum allowable working pressure.

I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

K. Provide jacketed insulation in locations where exposed to mechanical injury.

L. When brazing, remove solenoid-valve coils and sight glasses; also, remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 23 00 00 HVAC General.

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 23 00 00 HVAC General.

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 00 00 HVAC General.

Q. Provide proper compensation for pipe/tube expansion and contraction per equipment manufacturers recommendations.

3.05 PIPE JOINT CONSTRUCTION

A. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube".

1. Use Type BcuP-5 (15% Ag, 80% Cu, 5% P), copper-phosphorus alloy pre-formed brazing rings for joining copper swage fittings and copper socket fittings with copper pipe. Do NOT use flux.
2. Use Type Bag-5 (45% Ag), cadmium-free silver alloy for joining copper with bronze or steel. Use manufacturers recommended flux.

B. Field Swaged Brazing Cups: Fabricate brazing cup on one tubing end for each coupling. Only O60 (soft annealed) and H55 (light drawn) may be swaged. Do NOT swage H58 (drawn general purpose). Use swaging tool designed to provide a minimum of 0.0015" brazing gap and a maximum of 0.005" brazing gap. Brazing cup depth for each tube size shall be as follows:

1/4"3/8"1/2"5/8"3/4"7/8"1-1/8"1-3/8"1-5/8"2-1/8"0.250"0.280"0.310"0.390"0.420"0.460"0.510"0.560"0.600"0.700"

C. Field Bends: Fabricate field bends with a center-line bend radius greater than or equal to 4 times the nominal OD of the pipe or tube. Tube shall be bent with a tubing bender sized for ACR OD tube sizes and shall not cause cracks or wrinkles in the tube or pipe. Do NOT use a conduit bender for bending ACR copper. The difference between maximum and minimum diameters for pipe bends should not exceed 8% of the nominal outside diameter of the pipe. Only O60 soft annealed-temper and H55 light drawn-temper shall be field bent. Do NOT field bend H58 drawn general purpose-temper copper tube.

D. Brazing and joining procedure:

1. Tube ends shall be cut with a clean sharp tubing cutter.
2. Deburr the I.D. of the cut tube end with a clean deburring tool.
3. Visually inspect the interior of each tube for obstructions and debris before assembly. Protect the joint from contamination before brazing.
4. Method of pre-cleaning: Non-shedding abrasive pads (Scotch Bright) to remove all oxides in the brazing area followed by wiping with a clean lint-free white cloth. Do not groove the surfaces while cleaning.
5. Purge all tubing with oil free nitrogen while brazing and until cool to the touch. Use an oxygen analyzer to verify the absence of oxygen prior to brazing. The oxygen content shall be less than 1% before start of brazing.
6. Use a neutral to slightly reducing flame using oxy/acetylene or oxy/propane.
7. Use the proper torch tip based on tube size as recommended by the torch manufacturer. Use of Turbo-Torch or Rosebud is permitted.
8. Post Brazing Cleaning: Exterior of all completed joints shall be washed with a water-soaked rag or sponge, followed by brushing with a stainless-steel hand wire brush to remove any residue for inspection.

3.06 HANGERS AND SUPPORTS

A. Piping hangers and supports must accommodate expansion and contraction, vibration, dead load of piping and its contents, and seismic-bracing requirements.

B. Install the following pipe attachments or combination thereof:

1. Adjustable steel clevis hangers for individual horizontal runs.
2. Channel strut or angle iron trapeze for multiple horizontal runs
3. Galvanized steel saddle with attachment screw for channel strut applications
4. Rigid high compressive strength foam insulating pipe support at all clamps and support points.
5. Rigid high compressive strength foam pipe support at all riser clamps.
6. Do NOT attach hangers directly to pipe or tube.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

Verify actual supported loads for hanger sizes and spacing. Consult structural engineer. Spacing and sizes in subparagraphs below are from the 2000 ASHRAE HANDBOOK - "HVAC Systems and Equipment."

1. Up to 3/4" OD: Maximum span, 60 inches; minimum rod size, 3/8 inch.
2. Greater than 3/4" thru 1" OD: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. Greater than 1" thru 2-1/8" OD: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Support multi-floor vertical runs every 10 feet and at least at each floor with riser clamps.

3.07 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test as follows or as recommended by the equipment manufacturer's installation instructions:
   a. Line Test Pressure for Refrigerant R-410A:
      1) Suction (low pressure gas) Lines: 550 psig, or per equipment manufacturers recommendation.
      2) Hot-Gas (high pressure gas) and Liquid Lines: 550 psig, or per equipment manufacturers recommendation.
3. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
   a. Fill system with 95/5 nitrogen/hydrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test all joints and fittings with hydrogen leak detector, at test pressure.
   d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.08 SYSTEM CHARGING

A. Charge system using the following procedures and per equipment manufacturer's installation instructions.

1. Evacuate (triple evacuation procedure) entire refrigerant system with a vacuum pump to obtain a steady state vacuum of less than 500 micrometers. If vacuum holds for 12 hours, system is ready for charging. Do NOT evacuate the system through a charging manifold. Use only suction rated hoses and core removal tools.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system as recommended by equipment manufacturer.

3.09 OWNER REVIEW OF MAINTENANCE REQUIREMENTS

A. Review manufacturer's maintenance instructions with the owner's representative to make them aware of any reoccurring maintenance requirements such as recoating piping insulation, lubricating service valves, etc.

SECTION 23 31 00

DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General.

B. Furnish and install all material, labor, accessories, etc. shown on the drawings and as specified herein to completely install all ductwork systems.

C. Ductwork systems shall be classified as follows:
1. Static pressure class +2 in. wg - from constant volume air handling unit, and terminal unit to supply diffusers; all return and exhaust ductwork.
2. Static pressure class +4 in. wg - from VAV air handling unit to terminal units.

D. Refer to PART 3 - EXECUTION for duct sealing requirements.

E. Ductwork shall be constructed according to the latest edition of SMACNA ductwork construction standards applicable to the type of ductwork, system pressures described above, and the system material construction.

F. Duct sizes shown on the drawings are nominal inside clear.

1.02 SUBMITTALS

A. Product Data:
1. Duct materials:
   a. Flexible duct connectors
   b. Flexible ductwork
2. Dampers and accessories
3. Remote damper operators
4. Access doors
5. Flexible duct connectors
6. Duct liner
7. Sealants, mastics, adhesives and coatings

B. For all fire dampers, combination fire and smoke dampers, and smoke dampers, submit UL approved installation instructions for each specific application.

PART 2 - PRODUCTS

2.01 DUCTWORK

A. Ductwork shall be constructed of galvanized steel sheets of the thickness listed in the SMACNA manuals for the pressures referenced above.

B. Single-Wall Rectangular Ducts and Fittings:
1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
2. Transverse Joints: Select joint types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Transverse (Girth) Joints," for static pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. Alternate Product: Subject to compliance with requirements, provide Ductmate Industries, Inc.: 25/35/45 Rectangular Flange System or comparable product by one of the following:
      1) Nexus PDQ; a division of Shilco Holdings, Inc.
      2) Ward Industries, Inc; a division of Hart & Cooley, Inc.
      3) Prior Approved Equal
   b. Slide-on Flanges:
      1) Description: Roll-formed, add on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
      2) Material: galvanized steel.
      3) Gauge and Shape: For duct constructed using prefabricated systems, refer to the manufacturer's guidelines for sheet gauge, intermediate reinforcement size and spacing, and proper joint reinforcement.
      4) Manufacturers of prefabricated systems must provide duct construction and reinforcement guidelines along with independent testing for leakage, deflection, and seismic performance.
      5) Independent leakage testing must be provided for systems operating at pressures of 10 in. wg (or greater) positive or negative.
      6) Manufacturer's prefabricated systems printed assembly and installation procedures must be adhered to at all times.
      7) Manufacturer's procedures must include fastener and cleat spacing along with details for all system variations including break-away and roofing connections.
      8) All manufactured system components must be clearly embossed with manufacturer's name or markings. Substitution of manufacturer's system components is not permitted.
   c. Formed flanges will be accepted on ductwork 42 inches wide or less and subjected to 2 in. wg static positive pressure or less.
      1) Formed on Flanges: Construct as T-25 A/B flanges, of which construction guidelines are given in Figure 2-1 of the 2005 SMACNA "HVAC Duct Constructions Standards, Metal and Flexible." No other construction standards pertaining to formed on flanges will be accepted.
      2) Formed on flanges must include the use of corners, securely crimped in place, bolts, cleat, and gasket
3. Longitudinal Seams: Select seam types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
4. Snap-lock longitudinal duct seams are not allowed in public spaces unless secured with sheet metal fastening screws as recommended by SMACNA.
5. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Single-Wall Round.
1. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Lore Industries
      2) McGill AirFlow, LLC
      3) SEMCO, LLC
      4) Sheet Metal Connectors, Inc.
      5) Spiral Manufacturing Co., Inc.
      6) Prior Approved Equal
2. Transverse Joints: Select joint types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. Transverse Joints in Ducts Larger Than 50 Inches in Diameter: Flanged.
      1) Unexposed Duct 3 inches to 30 inches in diameter: Round duct connects with a one-piece interior slip coupling at least two gages heavier than duct wall, beaded at center and fastened to duct with screws. Seal joint with an approved sealant applied continuously around both ends of coupler prior to assembling and after fastening.
3. Longitudinal Seams: Select seam types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
   b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
4. Tees and Laterals: Select types and fabricate per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Rectangular sheet metal duct elbows shall be smooth radius type without turning vanes or square (or mitered) type with turning vanes. Sharp throat elbows (ASHRAE Fitting No. CR3-2) shall not be permitted. Round sheet metal duct elbows shall be smooth radius type without turning vanes, gored type or mitered type with turning vanes.

E. Unless otherwise indicated, elbows shall have a centerline radius of not less than 1½ times the width of the duct. Where space limitations necessitate use of short radius or square elbows, provide turning vanes.

F. Exhaust ductwork shall be galvanized sheet metal (G 90 minimum) constructed to SMACNA standards and shall not be insulated unless noted otherwise.

G. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 FLEXIBLE DUCTWORK

A. Flexible ducts shall be listed and labeled as UL Standard 181 Class 1 air duct. Air connectors are not allowed.

B. Flexible ductwork shall comply with the following:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems"
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems"
3. SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.
4. Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
5. ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

C. Flexible ductwork shall be installed between main supply ducts and diffusers. Length shall be a maximum of 8'-0" long, except in residential applications, where the length shall be as indicated.

D. Flexible ductwork shall be Thermaflex M-KE R-6 (R value = 6.0 minimum or as required by local energy code) flexible air duct or approved equal.

E. Flexible ductwork size shall be the same size as the diffuser neck it serves, unless indicated otherwise.

F. Take-offs for sheet metal ductwork shall be made using a conical spin-in type fitting with manual balancing damper.

G. Flexible duct connections to ceiling diffusers shall be installed without kinks or sags to provide unrestricted airflow. Provide Flex Flow Elbow supports by Thermaflex.

H. Tapes and mastics used to seal metallic and flexible air ducts shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic.

I. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with ul 181b and shall be marked "181B-C".

J. Photoelectric [ionization] Type Smoke Detector (if indicated on the drawings): rated for air velocities from 300 [100] to 4000 fpm; UL268A listed, factory mounted internally on the damper sleeve.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All ductwork shall be installed in accordance with applicable SMACNA Standards according to the pressure class described in PART 1 - GENERAL.

B. Seal, inspect and test ductwork prior to insulating or concealing. Seal all ductwork and plenums to meet the following SMACNA duct seal class:
1. Class A: Seal all transverse joint, longitudinal seams, and duct wall penetrations.
   a. Pressure-sensitive tape shall not be used as the primary sealant, unless it has been certified to comply with UL 181A or UL 181B by an independent testing laboratory and the tape is used in accordance with that certification.
   b. All connections shall be sealed, including but not limited to spin-in fittings, taps, other branch connections, access doors, and duct connections to equipment.
   c. Sealing that would void product listings is not required.
   d. Spiral lock seams need not be sealed.
2. Tapes, sealants and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic/sealant.
3. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181B-C".

C. Ductwork shall be supported as recommended by SMACNA Standards from structural members. Ductwork shall not be allowed to rest on ceilings, light fixtures or structural members. Ductwork supported from joists shall be supported from the top chord of all joists.

D. All ductwork accessories shall be installed in strict accordance with manufacturer's recommendations.

E. Ductwork that is designed to operate at static pressures in excess of 3 in. wg and all ductwork located outdoors shall be leak-tested in accordance with SMACNA Standards. Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. All sections shall be selected by the building owner or the designated representative of the building owner. Positive pressure leakage testing is acceptable for negative pressure ductwork. The maximum permitted duct leakage shall be:

$$L_{max} = C_L P^{0.65}$$

where

L_{max} = maximum permitted leakage, cfm per100 ft^2 of duct surface area

C_L = 4, duct leakage class, cfm per100 ft^2 of duct surface area per inch of water$^{0.65}$

$P^{0.65}$ = test pressure, which shall be equal to the design duct pressure class rating, in. of water

All ductwork seams shall be sealed with mastic to provide a system that is within the recommended SMACNA leakage limits. As an alternate, water-based spray-on hardcast products may be used provided they meet or exceed the project requirements.

The ductwork test report shall be submitted in electronic (PDF) format to the Engineer prior to the Contractor's request for final payment.

F. All ductwork shall be cleaned inside and out prior to system start up and shall be left in a neat and orderly manner.

G. Duct sizes shown on drawings are inside clear dimensions.

H. Unless otherwise approved, ducts shall be true to dimensions indicated, straight and smooth on the inside with neatly finished joints, securely anchored to the building in an approved manner, and installed to be completely free from vibration under all conditions of operation. Exact routing of ductwork will be dependent on location of framing members. Route ductwork to avoid cutting framing members.

I. Brace ducts not more than 60 inches on center.

J. Make slip joints in the direction of air flow.

K. Offset ducts around obstructions where possible. Where duct must encompass obstruction, area of duct shall remain constant.

L. Duct tapers shall not exceed 1:4 ratio and transformations 30 degrees between air flow and diverging or converging air flow.

M. Provide access doors for access to all equipment, dampers and motors concealed by sheet metal.

N. Where applicable, provide seismic bracing and restraints for ductwork per ASCE/SEI 7, latest edition and the latest edition of the SMACNA Seismic Restraint Manual. Also, refer to Section 23 05 48 Noise and Vibration Control.

3.02 BALANCING DAMPERS

A. Install manual volume dampers where indicated on the drawings and where required to properly balance the air distribution system.

B. Provide an opposed blade damper behind the face of each supply register which shall be adjustable through the face of the register with a screwdriver.

C. Provide an opposed blade damper behind the face of return air registers, where indicated, which shall be adjustable through the face of the register with a screwdriver.

D. Provide a butterfly damper in the neck of each ceiling diffuser unless noted otherwise.

END OF SECTION

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SECTION 23 81 28.12

DUCTLESS COOLING ONLY SPLIT SYSTEMS (1 to 3½ TONS)

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work specified herein shall be accomplished in accordance with the applicable requirements of Section 23 00 00 - HVAC General.

B. Furnish and install direct expansion air-to-air split system cooling only units of the size and capacity shown on the equipment schedule. The unit shall be completely factory assembled and tested, and shall include variable speed compressor, indoor and outdoor coils, fan motors, wireless or wired remote controller, interconnecting refrigerant tubing, and power and control wiring. The outdoor unit shall be of the inverter driven design and factory matched with the indoor unit.

C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.

D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

1.02 RELATED DOCUMENTS

A. For piping, valves, accessories and piping insulation refer to Section 23 23 00 - Refrigerant Piping.

1.03 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and shall bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (NEC).

C. The units shall be rated in accordance with Air-Conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210/240 and bear the AHRI Certification label.

D. The units shall be manufactured in a facility registered to ISO 9001 and ISO 14001.
E. A dry air holding charge shall be provided in the indoor section.

F. System efficiency shall meet or exceed the scheduled values.

G. Delivery, Storage and Handling:

1. Equipment shall be stored and handled according to the manufacturer's recommendations.
2. The controller shall be able to withstand a storage temperature of 105°F and 95% relative humidity without any adverse effects.

1.04 SUBMITTALS

A. Product Data: Include performance data (including extended capacity ratings if other than AHRI standard conditions are scheduled); installation, operation and maintenance manual; operating characteristics; furnished specialties; and accessories.

B. Submit AHRI Certificates.

1.05 COORDINATION

A. Coordinate size, weight and location with Architectural and Structural drawings. Where concrete pads are indicated, conform to Division 03 for concrete, reinforcement, and formwork requirements.

1.06 WARRANTY

A. The indoor and outdoor units shall carry a manufacturer's standard parts and defects warranty for a period five (5) years from the date of installation. The compressor shall carry a warranty of seven (7) years from the same date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

PART 2 - PRODUCTS

2.01 INDOOR UNITS

A. The indoor units shall be following types: wall mount. All indoor units shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board, fan and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and an auto restart function after power interruption. Indoor unit shall be purged with dry air before shipment from factory.

B. Wall Mount Type:

1. Unit Cabinet:
   a. The cabinet shall be formed from high strength molded plastic with smooth finish, flat front panel design with access for filter. Cabinet color shall be white.
   b. A separate metal installation plate that secures the indoor unit firmly to the wall shall be furnished with the unit. The installation plate shall be securely attached to the wall using an appropriate anchoring method for the wall type the unit will be attached to.
2. Fan:
   a. The fan shall be a high performance direct drive double inlet forward curved sirocco type design driven by a single motor. The fan shall be statically and dynamically balanced and be powered by a motor with permanently lubricated bearings.
   b. The fan shall have three (3) speeds: Low, Mid, High and Auto. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
3. Directional Air Flow Vane: An integral, motorized multi-position vane shall automatically direct air flow in a horizontal and downward direction to provide uniform air distribution.
4. Filter: Return air shall be filtered by means of an easily removable washable filter.
5. Coil :
   a. The indoor unit coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow.
   b. All tube joints shall be brazed with PhosCopper or silver alloy.
   c. The coils shall be pressure tested at the factory.
   d. Condensate mini-pump shall be provided when scheduled to provide a means of condensate disposal when a gravity drain is not available.

2.02 OUTDOOR UNIT

A. General:

1. The outdoor unit shall be specifically designed and matched to operate with the indoor unit. The outdoor unit shall be completely factory assembled, piped and wired and run tested at the factory.
2. The outdoor unit shall be equipped with an electronic control board that interfaces with the indoor unit to perform all necessary operation functions.
3. The unit shall be capable of cooling operation down to 23°F (-5°C) ambient temperature without additional low ambient controls (an optional wind baffle shall be required for cooling operation down to 0°F (-17.7°C).
4. The outdoor unit shall be able to operate with a maximum height difference of 100 feet (30 meters) between the indoor and outdoor units.
5. System shall be capable of operation up to a maximum refrigerant tubing length 165 feet (50 meters) for the 2 thru 3½ ton units between indoor and outdoor units without the need for line size changes, traps or additional oil.

B. Unit Cabinet:

1. The casing shall be fabricated of galvanized steel finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection.
2. Serviceable parts shall be accessible by means of removable panel sections.
3. Cabinet color shall be the manufacturer's standard color.
4. The unit shall have two (2) mild steel mounting feet, transversely mounted and welded to the cabinet base pan. The mounting feet shall have a slotted mounting hole at each end for a total of four (4) mounting holes. The cabinet assembly shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas.

C. Fan:

1. The unit shall be furnished with single or dual direct drive fan wheels.
2. The fan motor shall be a direct current (DC) motor with permanently lubricated bearings.
3. The fan motor shall be mounted for quiet operation.
4. The unit shall be provided with a raised fan safety guard to prevent contact with moving parts.
5. The outdoor unit shall have horizontal discharge airflow.

D. Coil:

1. The L shaped condenser coil shall be constructed of copper tubing with flat aluminum fins to reduce debris build up and allow maximum airflow. The coil shall be protected with an integral metal guard.
2. Refrigerant flow from the outdoor unit shall be regulated by means of an electronic linear expansion valve (LEV) metering device.
3. The outdoor unit shall be pre-charged with sufficient R-410a refrigerant to accommodate up to twenty-five (25) feet of refrigerant piping for capacities up to 18,000 btu/hr., and up to thirty-three (33) feet of refrigerant piping for capacities above 18,000 btu/hr.
4. Refrigerant lineseats between the outdoor and indoor units shall be annealed refrigeration grade copper tubing. Type ACR, meeting ASTM B280 requirements. The lines shall be individually insulated in twin-tube, flexible, closed-cell, UV/ozone degradation protected (if and), elastomeric material for the insulation of refrigerant pipes and tubes with a thermal conductivity equal to or better than 0.27 BTU-inch/hour per ft^2/°F and a water vapor transmission equal to or better than 0.08 Perm-inch. Insulation thickness shall be as required to satisfy project specific energy code requirements (refer to Section 23 23 00 Refrigerant Piping for additional information). Insulation shall have a Flame-Spread Index of less than 25 and a Smoke-development Index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102.
5. Refrigerant piping connections between the outdoor and indoor units shall be flare type.

E. Compressor:

1. The compressor shall be the high performance, hermetic, inverter driven, variable speed, dual rotary type.
2. The compressor motor shall be the direct current (DC) type equipped with a factory installed inverter drive package.
3. The outdoor unit shall be equipped with an accumulator and high pressure safety switch.
4. The compressor shall be equipped with internal thermal overload protection.
5. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater will be required.
6. There shall be no need for line size changes. Filters, sight glasses, and traps shall not be used, and no additional refrigerant oil shall be required.
7. The compressor shall be resiliently mounted to reduce vibration transmission.

F. Electrical:

1. The unit electrical characteristics shall be 208/230 volts, 1-phase, 60 hertz and shall be capable of satisfactory operation within voltage limits of 187 volts to 253 volts.
2. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have a Pulse Amplitude Modulation circuit to utilize 98% of the input power supply.

2.03 CONTROLS

A. General:

1. The system shall have either a wired or wireless remote controller as scheduled to perform input functions necessary to operate the system.
2. The controllers shall have a Power On/Off switch, Mode Selector - Auto, Cool, Dry Modes - Temperature Setting, Timer Control with Clock, Fan Speed Select and Vane / Airflow Direction selector. Controllers shall have a programmable Smart Set button for pre-selected Temperature, Fan Speed, and Vane position settings.
3. The controller shall support multiple languages (Spanish, German, Japanese, Chinese, English, Russian, Italian, or French) for display information.
4. The indoor unit shall be capable of performing self-diagnostic functions and check mode switching.
5. Temperature changes shall be displayed in 1°F (1°C) increments with a range of 61 - 88°F (16-31°C).
6. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless or a wired controller, providing emergency operation and controlling the outdoor unit.
7. The system shall be capable of automatically restarting and operating at the previously selected conditions when the power is restored after power interruption.
8. Control system shall control the continued operation of the air sweep louvers, as well as provide On/Off, System/Mode function.
9. Controller options:
   a. Wired wall mounted remote controller: The wired remote controller shall be furnished with a communications interface to communicate with the indoor unit. The interface will be mounted at the indoor unit.
   The wired remote controller shall have a light-green LCD display. There shall be a built-in weekly timer with up to 8 pattern settings per day. The controller shall consist of an On/Off button, Increase/Decrease Set Temperature buttons, a Cool/Auto/Fan/Dry mode selector, a Timer Menu button, a Timer On/Off button, Set Time buttons, a Fan Speed selector, a Ventilation button, a Test Run button, and a Check Mode button. The controller shall have a built-in temperature sensor.

2.04 ACCESSORIES

A. Wind Guard/Baffle: if specified or if required to achieve proper operation due to high wind conditions and/or low ambient operation.

B. Condensate pump: provide where condensate drain piping cannot be installed to achieve gravity flow.

PART 3 - EXECUTION

3.01 GENERAL

A. Units shall be installed as indicated and in strict accordance with manufacturer's recommendations and installation instructions.

B. Units shall be installed level.

C. Test for positive condensate drainage.

D. Units shall be installed to allow adequate service to all components.

E. Review the Installation, Operation, and Maintenance Manual with the Owner's representative.

END OF SECTION

SECTION 23 37 00

LOUVERS, GRILLES, REGISTERS AND DIFFUSERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. All work in this section shall be subject to the provisions of Section 23 00 00 - HVAC General.

B. Furnish and install all louvers, grilles, registers and diffusers of the size, type, capacity, and characteristics as shown on the equipment schedules and specified herein.

C. Equipment schedules and specifications are intended to establish a minimum level of quality and workmanship for the project. When other than the basis of design equipment is proposed, the Contractor shall be responsible for all costs associated with engineering and construction modifications necessary in his or any other trade that may be required to satisfy the Contract Documents.

D. Refer to the drawings for basis of design manufacturer and acceptable alternates.

PART 2 - PRODUCTS

2.01 LOUVERS

A. Louver components (heads, jambs, sills, blades, etc.) shall be factory assembled by the manufacturer into a complete unit. Louver sizes too large for shipping shall be built-up from factory assembled louver sections to provide the overall sizes required.

B. Louver design shall incorporate structural supports required to withstand a wind load of 20 lbs./square foot.

C. All louver performance data submitted for approval shall bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration.

D. All louvers shall have a factory applied finish coating as scheduled with the color selection made by the Architect at the time of shop drawing approval. Color charts shall be submitted with louver shop drawings.

E. Screens:

1. General: Provide a screen at each exterior louver.
2. Frames: Same kind and form of metal as indicated for louver to which screens are attached.
3. Screening material:
   a. Bird Screen: Aluminum, ¼" by ¼" square mesh wire; 0.047" thick

2.02 GRILLES, REGISTERS AND DIFFUSERS

A. Units shall be of the type, size, and construction as scheduled or indicated.
B. Unless otherwise noted or indicated, all air devices shall be supplied with a factory finish of manufacturer's standard white.

C. Grilles, registers and diffusers shall be ordered with borders compatible with the ceiling system type in which they are installed. Refer to architectural drawings for type of ceiling and/or suspension system.

D. Aluminum air devices shall be used for all areas subject to excessive moisture or humidity (e.g. showers, pools, bathrooms, etc.).

PART 3 - EXECUTION

3.01 LOUVERS

A. Louvers shall be installed in accordance with the manufacturer's recommendations.

B. The louver installation shall be made weatherproof by caulking and sealing at the frame and flanges in accordance with the manufacturer's recommendations.

3.02 GRILLES, REGISTERS AND DIFFUSERS

A. All air devices located in ceiling tiles shall be centered or shall be on quarter points of 2 ft. x 2 ft. tiles.

B. Where a line of sight allows the ductwork, wall, or ceiling structure to be seen behind any units, such ductwork, wall or ceiling structure shall be painted with nonflammable flat black paint to minimize visibility.

C. All air devices not installed on T-bar ceiling grids shall be securely fastened to adjacent structures.

D. Where air distribution devices are installed in inaccessible ceilings, provide the spin-in fitting without a volume damper. Provide an opposed blade damper in the neck of the air distribution device with access to the damper control through or at the face of the device.

END OF SECTION

SECTION 23 36 15

FAN-POWERED INDUCTION UNITS

PART 1- GENERAL

1.01 DESCRIPTION

A. All work specified in this section is subject to the provisions of Section 23 00 00 - HVAC General.

B. Fan-powered induction units (FPB) shall be provided to meet the minimum capacities scheduled, shall meet all constraints of construction, and shall comply with all specifications Sections.

1.02 COORDINATION

A. The units of one manufacturer have been used as the basis of design. Any modifications to ductwork, wiring, controls, building structure, etc., that result from the use of any other units shall be coordinated with all trades; this coordination shall occur before delivery of equipment from the manufacturer. Any modifications shall be performed without incurring additions to the Contract.

B. Approved manufacturers: Titus.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Powered induction units shall be factory fabricated complete with variable air volume fan-powered induction section, backdraft damper for fan section, acoustically lined plenum section, factory mounted electric or hot water heating coil, as scheduled and DDC operator.

B. Intermittent operation fan-powered induction section shall consist of:

1. An acoustically lined sheet metal housing and centrifugal direct drive fan wheel.
2. Resiliently mounted, permanently lubricated, 3-speed, PSC motor of the voltage shown on the electrical drawings. In lieu of 3-speed motor, a speed controller will be acceptable.
3. Maintenance-free backdraft damper to prevent reverse flow through blower.
4. Manual damper for volume control.

C. Plenum section shall be acoustically lined and shall receive air from either the primary VAV controller or the induction fan, and distribute the air through the low pressure duct system. Parallel (side by side) discharge is unacceptable.

D. Controls shall be factory mounted and DDC compatible with the temperature controls.

E. The maximum acceptable NC at the unit discharge is 40 at 1.5" inlet static pressure; the maximum acceptable radiated NC is 40 at 1.5" inlet static pressure. The maximum pressure drop through the unit shall be 0.3" W.C.

2.02 HEATING COILS

A. All heating coils shall have the capacity and SCR of heat listed on the Drawings and shall be factory mounted and tested.

B. Coils shall be rated in accordance with ARI-410.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Units shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

3.02 ADJUSTMENT

A. The units shall be tested and adjusted to provide the scheduled capacities.

END OF SECTION

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CallisonRTKL Project No: 010-210033.00

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08/13/21

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firstsource

Issue Drawing Log

#	DATE MM.DD.YYYY	ISSUE NAME
0	07.30.2021	ISSUE FOR PERMIT & CONSTRUCTION
1	08.13.2021	ADDENDUM 01

Seal

Sheet Identification

MECHANICAL SPECIFICATION

M-0006

Jordan & Skala Engineers
17850 North Dallas Parkway, Suite 320 ● Dallas, TX, 75287
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Texas Registered Engineering Firm F-4990

Project Number: 213011.5 Drawn By:RW Checked By:DW

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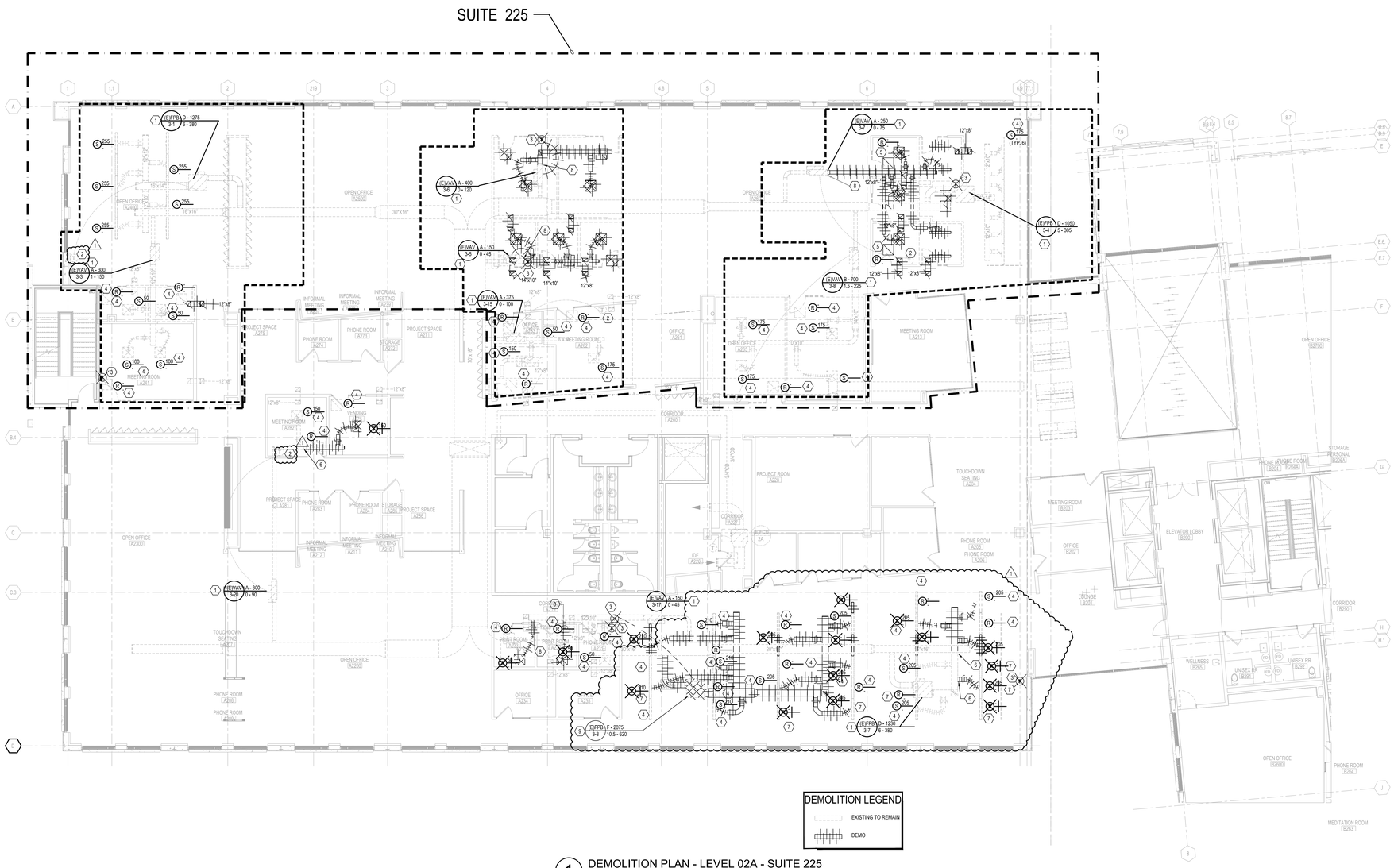

DEMOLITION LEGEND

EXISTING TO REMAIN

DEMO

1 DEMOLITION PLAN - LEVEL 02A - SUITE 225

SCALE: 1/8" = 1'-0"

TENANT IMPROVEMENT NOTES

THESE DRAWINGS, REPRESENTING EXISTING CONDITIONS, WAS PREPARED WITH LIMITED INFORMATION. EXISTING CONDITIONS AND USE OF THE SPACE DURING THE INITIAL EVALUATION MAY HAVE HAMPERED THE ENGINEERS EFFORTS IN DETERMINING THE CONDITION OF THE ASSOCIATED SYSTEMS. EXISTING DRAWINGS MAY NOT HAVE BEEN AVAILABLE AT THE TIME OF EVALUATION OR DURING THE COURSE OF DESIGN IN DEVELOPMENT OF THESE DRAWINGS. ANY SYSTEMS, SCHEDULES, AND EQUIPMENT SHOWN TO BE REVISED OR SHOWN FOR REFERENCE OF THE EXISTING CONDITIONS MAY HAVE BEEN ADDED TO, MODIFIED, OR REVISED AFTER THE DATE OF THE ORIGINAL EXISTING DRAWINGS (IF AVAILABLE).

THE CONTRACTOR SHALL BECOME FAMILIAR WITH THE SITE AND SCOPE OF WORK PRIOR TO SUBMITTING THE BID. THE CONTRACTOR SHALL BE RESPONSIBLE TO FIELD VERIFY ALL EXISTING CONDITIONS AFFECTING THE INTENT OF THE DRAWINGS AND PROJECT SCOPE FOR A COMPLETE AND OPERABLE SYSTEM. RECOMMENDATIONS TO THE SYSTEMS AND COMPONENTS WHICH ARE PART OF A REGULAR MAINTENANCE SCHEDULE AND FOUND TO BE DEFECTIVE OR IN NEED OF REPAIR THAT AFFECT THIS PROJECT SCOPE SHALL ALSO BE IDENTIFIED. NOTIFY THE ARCHITECT AND ENGINEER IMMEDIATELY OF ANY DISCREPANCIES OR DEVIATIONS WITHIN THESE SYSTEMS.

THE GENERAL CONTRACTOR SHALL SECURE AN INDEPENDENT AABC OR NEBB CERTIFIED TEST AND BALANCE (TAB) AGENCY TO MEASURE AND PROVIDE AN AIR AND WATER BALANCE REPORT OF THE EXISTING SYSTEM(S). THE REPORT SHALL INCLUDE ALL EQUIPMENT SERVING THE PROJECT AREA AND BE PERFORMED PRIOR TO THE START OF WORK AND DEMOLITION TO VERIFY SYSTEM AIR AND WATER FLOW READINGS. THE TAB CONTRACTOR SHALL WORK WITH THE MECHANICAL CONTRACTOR AND ENGINEER IN EVALUATING THE FINAL SCOPE OF WORK, AND MAKE RECOMMENDATIONS ON THE EXISTING SYSTEMS AND EQUIPMENT (E.G. ADDITIONAL BALANCING DAMPERS, DUCT SIZE MODIFICATIONS, CLEANING, SHEAVE AND BELT ADJUSTMENTS, FILTER REPLACEMENT, ETC.) TO PROVIDE THE NECESSARY AIRFLOWS. PROVIDE A COPY OF THE FINAL REPORT TO THE ARCHITECT AND ENGINEER PRIOR TO STARTING THE NEW WORK.

GENERAL NOTES:

1. CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING AND START OF CONSTRUCTION AND SHALL NOTIFY THE ARCHITECT/ENGINEER OF ANY CONFLICTS OR DISCREPANCIES WITH THE DRAWINGS. ANY REQUIRED MODIFICATIONS NOT IDENTIFIED BEFORE THE START OF CONSTRUCTION SHALL BE MADE AT NO ADDITIONAL COST TO THE OWNER.
2. CONTRACTOR SHALL COORDINATE WITH TENANT AND BUILDING MANAGEMENT FOR ACCESS TO OTHER SPACES AND ANY LANDLORD REQUIREMENTS.
3. COORDINATE WORK ON MECHANICAL SHEETS WITH ALL TRADES. WORK SHOWN ON THE DRAWINGS IS INTENDED TO PROVIDE THE OVERALL ENGINEERING DESIGN CONCEPT AND DOES NOT ACCOUNT FOR RELOCATIONS, OFFSETS, ETC. THAT ARE REQUIRED BY THE COORDINATION OF TRADES. THESE SHALL BE PROVIDED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE CONTRACT.
4. THE LOCATIONS, ARRANGEMENT AND EXTENT OF EQUIPMENT, DEVICES, AND OTHER APPURTENANCES RELATED TO THE INSTALLATION OF MECHANICAL WORK SHOWN ON DRAWINGS ARE APPROXIMATE. THE DRAWINGS ARE DIAGRAMMATIC AND DO NOT NECESSARILY DEPICT EXACT CONDITIONS. THE LOCATION OF EQUIPMENT, DUCTWORK, ETC. IS APPROXIMATE ONLY. SCALES ARE SHOWN FOR REFERENCE ONLY. THE CONTRACTOR SHALL NOT SCALE DRAWINGS. REFER TO THE ARCHITECTURAL DRAWINGS FOR DIMENSIONAL DATA OF BUILDING COMPONENTS. SHOULD A CONFLICT EXIST BETWEEN THE ARCHITECTURAL AND ENGINEERING DRAWINGS REGARDING DIMENSIONS AND SCALE, THE CONTRACTOR SHALL NOTIFY THE ARCHITECT OF THE DISCREPANCY.
5. CONTRACTOR SHALL REPAIR AND/OR REPLACE, WITHOUT ANY COST TO THE OWNER, ANY SYSTEMS DAMAGED DUE TO HIS WORK.
6. CONTRACTOR SHALL PROTECT ALL EQUIPMENT AND THE INSIDE OF DUCTWORK DURING DEMOLITION, DELIVERY, STORAGE, HANDLING, AND INSTALLATION. CONTRACTOR SHALL UNDERTAKE THE APPROPRIATE PROTECTION MEASURES DURING THE COURSE OF CONSTRUCTION AS RECOMMENDED IN THE ANSI/SMACNA 008-2008 IAQ GUIDELINES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION, CHAPTER 3. ENSURE THAT DUST AND CONSTRUCTION DEBRIS ARE RESTRICTED FROM ACCUMULATION WITHIN DUCTWORK AND EQUIPMENT. PROVIDE FILTER ELEMENT OVER RETURN AIR GRILLES TO PROTECT DUCTWORK CONTAMINATION DURING START-UP.
7. MATERIALS, EQUIPMENT OR LABOR NOT INDICATED BUT WHICH CAN BE REASONABLY INFERRED TO BE NECESSARY FOR A COMPLETE INSTALLATION SHALL BE PROVIDED. DRAWINGS AND SPECIFICATIONS DO NOT UNDERTAKE TO INDICATE EVERY ITEM OF MATERIAL, EQUIPMENT, OR LABOR REQUIRED TO PRODUCE A COMPLETE AND PROPERLY OPERATING INSTALLATION.
8. CLEAN AND INSPECT ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, ETC. WITHIN SCOPE OF WORK INDICATED TO REMAIN. REPAIR AND SEAL DUCTWORK INDICATED TO REMAIN AS NEEDED.
9. REPAIR ALL DISTURBED EXISTING DUCTWORK AND INSULATION INDICATED TO REMAIN TO LIKE-NEW CONDITION, INCLUDING ANY CONDITIONS ASSOCIATED WITH DEMOLISHED DUCTWORK.
10. UNLESS SPECIFICALLY NOTED TO BE REMOVED, EXISTING EQUIPMENT, PIPING, DUCTWORK, ETC. IS TO REMAIN. ANY EQUIPMENT, PIPING OR APPURTENANCES REMOVED WHICH ARE NECESSARY FOR THE OPERATION OF THE EXISTING SYSTEM SHALL BE REPLACED TO THE SATISFACTION OF THE ARCHITECT WITHOUT INCURRING ADDITIONS TO THE CONTRACT.
11. CHECK, TEST AND CALIBRATE ALL EXISTING THERMOSTATS INDICATED TO REMAIN OR BE RE-USED. NOTIFY ARCHITECT IMMEDIATELY IF NOT WORKING PROPERLY.
12. IT SHOULD BE NOTED THAT SOME HVAC SYSTEMS ARE TO REMAIN. IF ANY OF THESE SYSTEMS ARE DAMAGED DURING THE PROGRESS OF CONSTRUCTION OR DEMOLITION, THEY SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE ARCHITECT WITHOUT INCURRING ADDITIONS TO THE CONTRACT.
13. COORDINATE WITH ELECTRICAL CONTRACTOR ANY DEMOLITION OF EQUIPMENT WITH POWER CONNECTIONS. ALL ELECTRICAL SHALL BE MADE SAFE PRIOR TO DEMOLITION.

KEY NOTES: (DESIGNATED BY "#")

1. EXISTING TERMINAL BOX TO REMAIN. REFER TO VAV BOX SCHEDULE FOR BALANCE INFORMATION.
2. EXISTING THERMOSTAT TO REMAIN.
3. EXISTING THERMOSTAT TO BE RELOCATED. REFER TO NEW WORK PLAN FOR NEW LOCATION.
4. EXISTING AIR DEVICE TO REMAIN.
5. EXISTING AIR DEVICE TO BE RELOCATED. REFER TO NEW WORK PLAN FOR MORE INFORMATION.
6. CAP DUCT AND INSULATE AT THIS LOCATION.
7. EXISTING SLOT DIFFUSER TO BE MODIFIED. REFER TO NEW WORK PLAN.
8. REMOVE DUCT BACK TO THIS POINT AND PREPARE FOR RENOVATION.
9. FPB BOX TO BE ABANDON IN CEILING, CAP SUPPLY AIR OUTLET. REMOVE THERMOSTAT AND PLACE NEST TO TERMINAL BOX IN CEILING.

SCOPE OF WORK

SCOPE AREA

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CallisonRTKL Project No: 010-210033.00

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Issue Drawing Log

#	DATE MM.DD.YYYY	ISSUE NAME
0	07.30.2021	ISSUE FOR PERMIT & CONSTRUCTION
1	08.13.2021	ADDENDUM 01

Seal

B

0' 4' 8' 16'

SCALE: 1/8" = 1' - 0"

N

JSE
Jordan & Skala Engineers
17855 North Dallas Parkway, Suite 320 ● Dallas, TX, 75287
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Texas Registered Engineering Firm F-4990
Project Number: 210015 Drawn By:RW Checked By:DW

Sheet Identification

DEMOLITION PLAN - LEVEL 02A - SUITE 225

M-1102A.1

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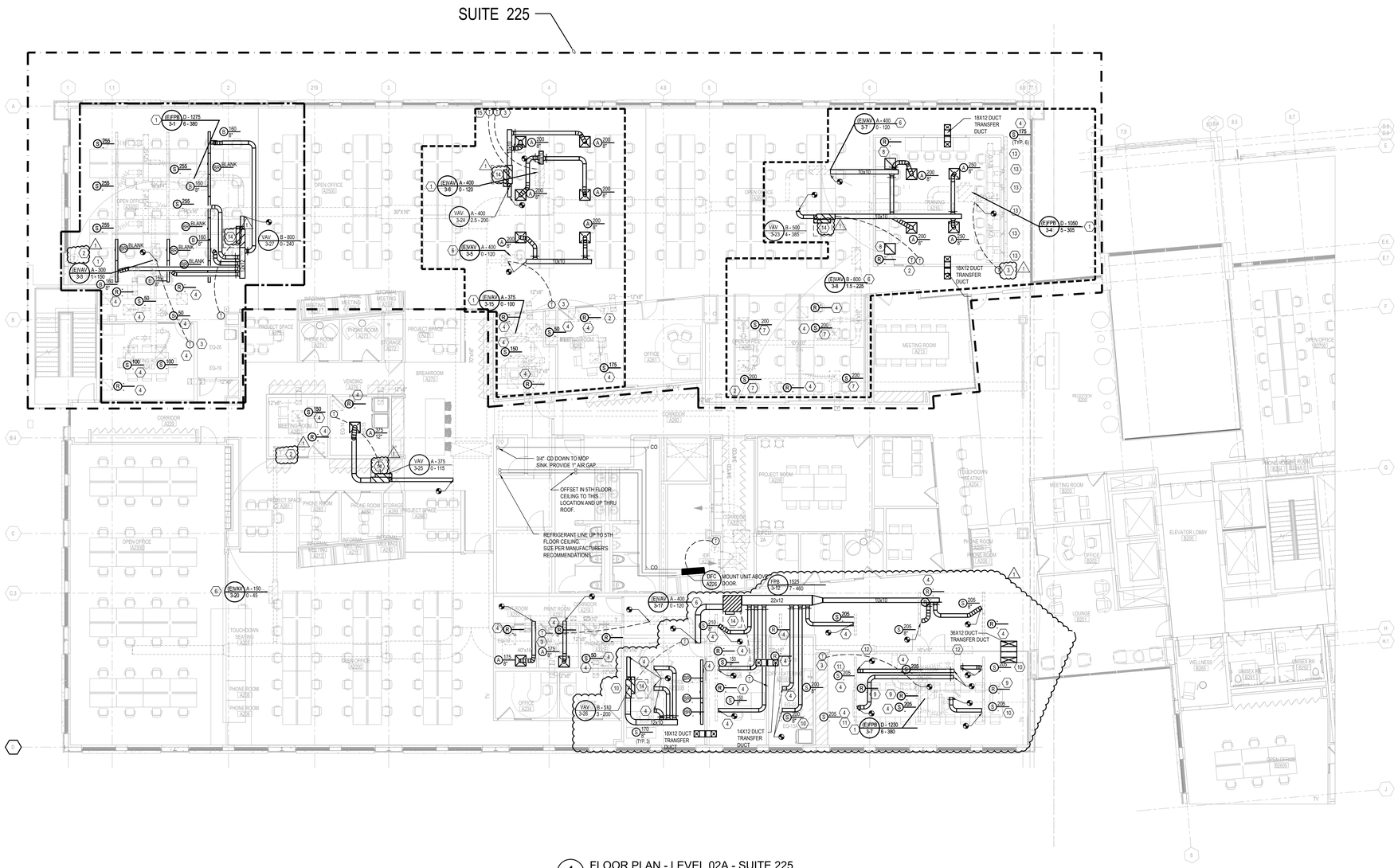

1 FLOOR PLAN - LEVEL 02A - SUITE 225

SCALE: 1/8" = 1'-0"

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5. CONTRACTOR SHALL REPAIR AND/OR REPLACE, WITHOUT ANY COST TO THE OWNER, ANY SYSTEMS DAMAGED DUE TO HIS WORK.
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8. CLEAN AND INSPECT ALL EXISTING EQUIPMENT, DUCTWORK, PIPING, ETC. WITHIN SCOPE OF WORK INDICATED TO REMAIN. REPAIR AND SEAL DUCTWORK INDICATED TO REMAIN AS NEEDED.
9. REPAIR ALL DISTURBED EXISTING DUCTWORK AND INSULATION INDICATED TO REMAIN TO LIKE-NEW CONDITION. INCLUDING ANY CONDITIONS ASSOCIATED WITH DEMOLISHED DUCTWORK.
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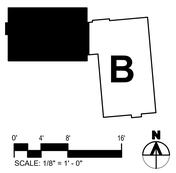
11. CHECK, TEST AND CALIBRATE ALL EXISTING THERMOSTATS INDICATED TO REMAIN ON BE RE-USED. NOTIFY ARCHITECT IMMEDIATELY IF NOT WORKING PROPERLY.
12. IT SHOULD BE NOTED THAT SOME HVAC SYSTEMS ARE TO REMAIN. IF ANY OF THESE SYSTEMS ARE DAMAGED DURING THE PROGRESS OF CONSTRUCTION OR DEMOLITION, THEY SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE ARCHITECT WITHOUT INCURRING ADDITIONS TO THE CONTRACT.
13. COORDINATE WITH ELECTRICAL CONTRACTOR ANY DEMOLITION OF EQUIPMENT WITH POWER CONNECTIONS. ALL ELECTRICAL SHALL BE MADE SAFE PRIOR TO DEMOLITION.
14. ALL EXISTING TO REMAIN THERMOSTAT SHALL BE COVERED AND SEALED DURING RENOVATION. AFTER CONSTRUCTION CALIBRATE ALL THERMOSTATS TO MATCH SPACE TEMPERATURE. 1
15. PROVIDE A MINIMUM OF 36" WORKING CLEARANCES FOR VAV AND FPB TERMINAL BOXES.
16. PROVIDE CONSTRUCTION FILTERS ON ALL RETURN AIR DEVICES AND FPBS. COORDINATE HVAC OPERATIONS WITH BUILDING MANAGEMENT TO PROTECT HVAC EQUIPMENT.
17. PROVIDE RETURN OPENINGS ABOVE CEILING IN WALLS WHICH GO TO STRUCTURE AS NECESSARY TO ALLOW FOR RETURN BACK TO MAIN SYSTEMS. PROVIDE DAMPERS AS REQUIRED.
18. PROVIDE ALL OFFSETS AND TRANSITIONS IN DUCTWORK AS NEEDED TO MAINTAIN CEILING HEIGHTS AND TRANSITIONS OVER OR UNDER NEW DUCTWORK AIR AND OTHER BUILDING SYSTEMS WHETHER SHOWN ON DRAWINGS OR NOT.
19. CONTRACTOR SHALL OBSERVE ALL MANUFACTURER CLEARANCES AND INSTALLATION GUIDELINES FOR MECHANICAL EQUIPMENT.

KEY NOTES: (DESIGNATED BY "#")

1. EXISTING TERMINAL BOX. REFER TO VAV BOX SCHEDULE FOR BALANCE INFORMATION. REBALANCE TO CFM INDICATED.
2. EXISTING THERMOSTAT. RE-CALIBRATE, CLEAN AND REPAIR TO NEW LIKE CONDITIONS.
3. NEW LOCATION OF EXISTING THERMOSTAT. RE-CALIBRATE, CLEAN, AND REPAIR TO NEW LIKE CONDITIONS. EXTEND CONTROL WIRE TO NEW LOCATION.
4. EXISTING AIR DEVICE. CLEAN AND REPAIR TO NEW LIKE CONDITIONS.
5. EXISTING AIR DEVICE. RE-ALIGN IN NEW CEILING GRID. CLEAN AND REPAIR TO NEW LIKE CONDITIONS. REBALANCE SUPPLY TO CFM INDICATED.
6. EXISTING TERMINAL BOX. REBALANCE BOX TO NEW CFM INDICATED. REFER TO VAV BOX SCHEDULE FOR BALANCE INFORMATION.
7. EXISTING AIR DEVICE. CLEAN AND REPAIR TO NEW LIKE CONDITIONS. REBALANCE TO CFM INDICATED.
8. EXISTING AIR DEVICE. RE-ALIGN IN NEW CEILING GRID. CLEAN AND REPAIR TO NEW LIKE CONDITIONS.
9. MODIFY SLOT DIFFUSER TO A RETURN SLOT. PROVIDE LIGHT SHIELD. CLEAN GRILLE AND REPAIR GRILLE TO NEW LIKE CONDITIONS.
10. MODIFY BLANK AND CONVERT TO SUPPLY SLOT DIFFUSER. ADD FACTORY INSULATED PLENUM TO MATCH EXISTING. CLEAN GRILLE AND REPAIR GRILLE TO NEW LIKE CONDITIONS.
11. ROTATE EXISTING TO REMAIN SLOT DIFFUSER.
12. VERIFY LOCATION OF EXISTING MEDIUM PRESSURE DUCT. RELOCATE OUTSIDE OF BOARD ROOM IF DUCT IN WITHIN BOARDROOM OR OVERTOP OF NEW BOARD ROOM WALL.
13. RE-ALIGN AIR DEVICE TO THIS LOCATION. EXTEND DUCT AS REQUIRED.
14. PROVIDE A MINIMUM 36" MAINTENANCE CLEARANCE FOR TERMINAL BOX. 1
15. PROVIDE EXTERIOR WALL MOUNTED T-STATS WIRING IN CONDUIT AND INSULATION BEHIND. COORDINATED INSTALLATION REQUIREMENTS AND LOCATION WITH LANDLORD PRIOR TO INSTALLATION.

1 SCOPE OF WORK

SCOPE AREA



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Consultant

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08/13/21

3100 OLYMPUS FIRSTSOURCE

ISSUE FOR CONSTRUCTION AND PERMIT

Client/Owner/Project Address

FIRSTSOURCE
3100 Olympus Blvd
2ND FLOOR
Dallas, TX 75063

firstsource

Issue Drawing Log

#	DATE MM.DD.YYYY	ISSUE NAME
0	07.30.2021	ISSUE FOR PERMIT & CONSTRUCTION
1	08.13.2021	ADDENDUM 01

Seal

Sheet Identification

FLOOR PLAN - LEVEL 02A - SUITE 225

M-1104A.1

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