HVAC SPECIFICATIONS

DIVISION 23 HVAC

23 05 00 BASIC HVAC REQUIREMENTS

A. SEE DIVISION 00 PROCUREMENT AND CONTRACTING AND DIVISION 01 GENERAL REQUIREMENT FOR ADDITIONAL REQUIREMENTS.
B. HVAC CONTRACTOR SHALL VERIFY REQUIREMENTS FOR TEMPORARY HEATING WITH GENERAL CONTRACTOR AND INCLUDE IN HIS SCOPE OF WORK WHEN DIRECTED BY G.C. INSTALL IN ACCORDANCE WITH ALL CODE AND OSHA REQUIREMENTS FOR CONSTRUCTION PROJECTS.
C. SUBSTITUTIONS
   1. SEE DIVISION 01 23 00 PRODUCT SUBSTITUTION PROCEDURES FOR ADDITIONAL REQUIREMENTS.
   2. CONTRACTOR SHALL PROVIDE ALL SUPPORTING DATA AND ASSUME THE BURDEN OF PROOF THAT ANY SUBSTITUTE IS EQUIVALENT AS TO APPEARANCE, CONSTRUCTION, CAPACITY, AND PERFORMANCE. THE JUDGMENT OF EQUIVALENCY SHALL BE MADE BY THE ENGINEER AT THE TIME OF SHOP DRAWING REVIEW, NOT DURING BIDDING.
   3. WHERE SUBSTITUTE EQUIPMENT REQUIRES REDESIGN OF ANY PART OF THE PROJECT, THE COST OF REDESIGN AND ADDITIONAL COSTS OF THE WORK SHALL BE PAID BY THE CONTRACTOR. REDESIGN SHALL BE SUBJECT TO THE APPROVAL OF ALL AUTHORITIES HAVING JURISDICTION OVER THE WORK INCLUDING THE ARCHITECT/ENGINEER.
   4. CONTRACTOR SHALL ASSUME ALL COORDINATION RESPONSIBILITIES FOR SUBSTITUTE EQUIPMENT INCLUDING COORDINATION ACROSS TRADES AND COORDINATION OF PREVIOUSLY REVIEWED AND APPROVED SHOP DRAWING SUBMITTALS, SHOULD THESE SHOP DRAWINGS BE AFFECTED BY THE SUBSTITUTED EQUIPMENT.
D. SHOP DRAWINGS, PRODUCT DATA, TEST RESULTS, PROJECT CLOSEOUT DOCUMENTS:
   1. SEE DIVISION 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES FOR ADDITIONAL REQUIREMENTS
   2. CONSTRUCTION ADMINISTRATION SUBMITTAL LIST:
      a. DUCTWORK
      b. DUCTWORK ACCESSORIES
      c. INSULATION
      d. GRILLES
      e. FANS
      f. ROOFTOP AIR CONDITIONING UNITS.
      g. TEST AND BALANCE REPORT
   3. PROJECT CLOSEOUT
      a. PROVIDE HVAC EQUIPMENT OPERATING AND MAINTENANCE MANUALS TO THE OWNER PER IECC C303.3 AND C408.2.5.1.
      b. AS-BUILT DRAWINGS SHALL BE MARKED ON A FINAL SET OF DRAWINGS WHICH INCLUDES ALL REVISIONS.
      c. PROVIDE "AS-BUILT" DRAWINGS TO THE OWNER IN AUTOCAD FORMAT
E. DETAILS AND SCHEDULES ARE SHOWN TO AID THE CONTRACTOR AND ARE NOT MEANT TO BE INCLUSIVE OF ALL DEVICES. PROVIDE REQUIRED EQUIPMENT AND ACCESSORIES FOR A COMPLETE INSTALLATION.
F. INSTALL ALL EQUIPMENT PER MANUFACTURER'S INSTALLATION INSTRUCTIONS AND REQUIREMENTS. PROVIDE ADDITIONAL WORK AND MATERIALS AS REQUIRED.
G. COORDINATE INSTALLATION OF HVAC WORK WITH THE OTHER CONTRACTORS TO AVOID CONFLICTS WITH OTHER WORK.
H. PROVIDE ALL CUTTING AND PATCHING NECESSARY FOR HVAC WORK INSTALLATION UNLESS THIS WORK IS IDENTIFIED TO BE THE WORK OF OTHER CONTRACTORS. PATCHING SHALL MATCH ADJACENT SURFACES.
I. PROJECT COMPLETION
   1. INSTALL CLEAN SET OF FILTERS IN ALL UNITS AT TIME OF TESTING AND BALANCING.
   2. CLEAN GRILLES AND EQUIPMENT AND LEAVE IN PROPER WORKING CONDITION AT THE TIME OF FINAL CLEAN-UP.

23 05 13 MOTORS AND ELECTRICAL WORK

A. MOTORS
   1. MANUFACTURERS: GENERAL ELECTRIC, LOUIS ALLIS, MARATHON, AND BALDOR.
   2. MOTORS LESS THAN 250 WATTS: EQUIPMENT MANUFACTURER'S STANDARD AND NEED NOT CONFORM TO THESE SPECIFICATIONS.
   3. OPEN DRIP-PROOF TYPE EXCEPT TOTALLY ENCLOSED FAN COOLED FOR THE FOLLOWING MOTORS:
      a. EXTERIOR LOCATIONS
      b. WHERE NOTED ON EQUIPMENT SCHEDULES
   4. DESIGN FOR CONTINUOUS OPERATION IN 40 DEGREES C ENVIRONMENT AND FOR TEMPERATURE RISE IN ACCORDANCE WITH NEMA MG 1 LIMITS.
   5. SINGLE PHASE POWER (PERMANENT-SPLIT CAPACITOR MOTORS) WITH STARTING TORQUE EXCEEDING ONE FOURTH OF FULL LOAD TORQUE AND STARTING CURRENT UP TO SIX TIMES FULL LOAD CURRENT. CLASS A (50 DEGREES C TEMPERATURE RISE) INSULATION, MINIMUM 1.0 SERVICE FACTOR, PRELUBRICATED SLEEVE OR BALL BEARINGS, AUTOMATIC RESET OVERLOAD PROTECTOR.
   6. THREE PHASE POWER (SQUIRREL CAGE MOTORS) WITH STARTING TORQUE BETWEEN 1 AND 1-1/2 TIMES FULL LOAD TORQUE AND STARTING CURRENT SIX TIMES FULL LOAD CURRENT. NEMA DESIGN B MOTOR AND INSULATION SYSTEM. MINIMUM 1.15 SERVICE FACTOR FOR OPEN DRIP-PROOF MOTORS, 1.0 (MINIMUM) FOR OTHER TYPES. MINIMUM 85% NOMINAL POWER FACTOR UNDER RATED LOAD CONDITIONS. GREASE LUBRICATED ANTI-FRICTION BALL BEARINGS, RATED FOR MINIMUM AFBMA 9, L-10 LIFE OF 200,000 HOURS.
B. STARTERS
   1. SEE ELECTRICAL STARTER DISCONNECT SCHEDULE ON PLANS.

23 07 00 INSULATION

A. GENERAL
   1. SEE INSULATION SCHEDULES ON PLANS FOR ADDITIONAL INFORMATION.
   2. INSULATION, INSULATION SYSTEM AND JACKETS SHALL MEET UL-723/ASTM E84 REQUIREMENTS OF MAX. FIRE HAZARD CLASSIFICATIONS OF 25, AND MAX. FLAME SPREAD, FUEL CONTRIBUTED, AND SMOKE DEVELOPED OF 50.
   3. INSTALL MATERIALS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND MICA PUBLICATION "NATIONAL COMMERCIAL AND INDUSTRIAL STANDARDS", 2011 SEVENTH EDITION.
   4. CONTINUE INSULATION WITHOUT INTERRUPTIONS THROUGH WALLS AND FLOOR PENETRATIONS AND HANGERS.
B. FIBERGLASS (F.G.) INSULATION
   1. FLEX. F.G.:
      a. O.C. SOFTR DUCT WRAP, KNAUF FRIENDLY FEEL DUCT WRAP, CERTAINTEED SOFTTOUCH, JOHNS MANVILLE MICROLITE EQ FSK DUCT WRAP.
      b. GLASS FIBER INSULATION FACTORY LAMINATED TO FRK/FSK VAPOR RETARDER. LISTED THICKNESS IS NOMINAL.
      c. 0.75 LB/CU. FT., R=3.3 / NOMINAL INCH AT 75 DEG F.
      d. MAX 250 DEG F, JACKET MAX 150 DEG F, 0.02 PERM.
C. DUCT INSULATION REQUIREMENTS
   1. INSULATE FITTINGS, JOINTS, FLANGES, FLEXIBLE CONNECTIONS, DAMPERS AND IN-LINE ACCESSORIES WITHOUT INTERNAL LINING/INSULATION WITH SAME MATERIAL AND THICKNESS AS SPECIFIED FOR THE DUCT SYSTEM. STOP AND POINT INSULATION AROUND ACCESS DOORS AND DAMPER OPERATORS TO ALLOW OPERATION WITHOUT DISTURBING WRAPPING.

23 31 13 DUCTWORK

A. PERFORM WORK IN ACCORDANCE WITH THE LATEST EDITIONS OF SMACNA - HVAC DUCT CONSTRUCTION STANDARDS.
B. GENERAL
   1. PAINT THE INSIDE OF ALL DUCTS VISIBLE THROUGH GRILLES IN ROOMS WITH CEILINGS WITH DULL BLACK PAINT.
   2. CERTAIN VERTICAL AND HORIZONTAL OFFSETS ARE INDICATED IN DUCTS TO INDICATE THE GENERAL POSITION RELATIONSHIP OF THE DUCTWORK SYSTEMS; PROVIDE ADDITIONAL OFFSETS AS REQUIRED TO COORDINATE WITH THE INSTALLATION OF OTHER SYSTEMS, CEILINGS AND STRUCTURE. THE DRAWINGS SHALL NOT BE SCALED TO DETERMINE EXACT LOCATION OF DUCTWORK.
   3. PROVIDE TEMPORARY CLOSURES OF METAL OR TAPED POLYETHYLENE ON OPEN DUCTWORK TO PREVENT CONSTRUCTION DUST FROM ENTERING DUCTWORK SYSTEM.
   4. LOCATE DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW NORMAL OPERATING AND MAINTENANCE ACTIVITIES.
   5. INCREASE DUCT SIZES GRADUALLY, NOT EXCEEDING 15 DEGREES WHENEVER POSSIBLE. 30 DEGREE MAXIMUM.
   6. ROUND DUCTS MAY BE SUBSTITUTED FOR RECTANGULAR IF SIZED IN ACCORDANCE WITH ASHRAE TABLES OF EQUIVALENT RECTANGULAR AND ROUND DUCTS.
C. ROUND DUCTWORK
   1. CONCEALED BRANCH DUCTWORK TO GRILLES AND DIFFUSERS MAY BE LONGITUDINAL LOCKSEAM. ALL OTHER ROUND DUCTWORK SHALL BE SPIRAL LOCKSEAM WITH FITTINGS AND COUPLINGS MINIMUM 2 GAUGES HEAVIER THAN DUCT.
D. FLEXIBLE DUCTWORK
   1. MANUFACTURERS: THERMAFLEX, FLEXMASTER, CLEVAFLEX.
   2. U.L. 181 LISTED CLASS 1 FACTORY FABRICATED FLEXIBLE AIR DUCT, COMPLY WITH NFPA 90A, FLAME SPREAD OF 25 OR LESS, SMOKE DEVELOPED RATING OF 50 OR LESS.
   3. MINIMUM PRESSURE RANGE -1/2" TO 4" W.C., TEMPERATURE RANGE 0-200 DEG F.
   4. ACOUSTIC: THERMAFLEX M-KE OR G-KM, FLEXMASTER TYPE 1 OR 6
      a. POLYETHYLENE, SPUNBOUND NYLON OR CHLORINATED POLYETHYLENE LINER.
      b. DUCTWORK TO HAVE TESTED ACOUSTICAL PERFORMANCE NOT LESS THAN 2 DB LESS THAN THE TYPES SPECIFIED.
   5. SEMI-RIGID FLEXIBLE ALUMINUM DUCTWORK NOT PERMITTED.
   6. SUPPLY DUCTWORK SHALL BE INSULATED WITH FIBERGLASS INSULATION, MINIMUM R VALUE 4, WITH VAPOR BARRIER JACKET WITH MAXIMUM 0.10 PERM RATING
   7. CONNECT TO SUPPLY DUCTWORK BY SLIDING CORE OVER COLLAR, TAPE JOINT WITH MINIMUM 3 WRAPS OF TAPE, AND APPLY METAL BAND CLAMP OR PANDUIT. FOR INSULATED DUCTWORK, PULL INSULATION AND OUTER JACKET BACK INTO POSITION, AND TAPE WITH MINIMUM 3 WRAPS OF TAPE BETWEEN FLEX DUCT AND DUCT INSULATION.
   8. CONNECT TO GRILLES AND RETURN AND TRANSFER DUCTWORK WITH METAL BAND CLAMP OR PANDUIT.
   9. MAXIMUM LENGTH FROM DUCTWORK TO GRILLES OR SLOTS 8'-0" WITH ONE 90 DEG ELBOW.
   10. DO NOT RUN THROUGH WALLS OR PARTITIONS.
E. DUCTWORK SEALANTS
   1. MANUFACTURERS: HARDCAST SURE-GRIP 404 SOLVENT BASED DUCT SEALANT OR EQUIVALENT.
      a. SYNTHETIC RUBBER RESIN BASE.
      b. -20 TO 200 DEG F.
      c. PRESSURE CLASSES UP TO 10" W.C., MEETING SEAL CLASS A.
      d. MAXIMUM FLAME SPREAD OF 25, SMOKE DEVELOPED OF 50.
      e. APPLY MINIMUM 20-MIL THICK WET FILM AT TEMPERATURES BETWEEN 35-100 DEG F.
   2. HARDCAST ALUMA-GRIP 701 OR EQUIVALENT PRESSURE SENSITIVE DUCT JOINT ROLLED SEALANT MAY BE USED IN PLACE OF MASTIC. SEALANT SHALL COMPLY WITH THE FOLLOWING:
      a. MILL FINISH ALUMINUM SUSTRATE WITH GRAY ADHESIVE.
      b. MINIMUM 30 MIL THICK
      c. MIN. 17 LB PER LINEAR INCH PEEL STRENGTH
      d. MAX FLAME SPREAD OF 25, MAX SMOKE DEVELOPED OF 50 WHEN TESTED IN ACCORDANCE WITH ASTM G-53.
      e. VOC: 0 G/L, COMPLIANT WITH LEED SCAQMD RULE 1168.
      f. PRESSURE CLASSES UP TO 10" W.C.
F. DUCT CLEANING
   1. PROTECT DUCTWORK AGAINST ENTRY OF FOREIGN MATTER DURING CONSTRUCTION. PROVIDE TEMPORARY END CAPS AND SEALS. PROVIDE TEMPORARY FILTERS OVER RETURN OR EXHAUST AIR INLETS IF DUCTWORK IS USED DURING CONSTRUCTION.
   2. REMOVE ALL DIRT AND FOREIGN MATTER AND CLEAN DIFFUSERS, REGISTERS, AND GRILLES BEFORE OPERATING FANS.
G. SEALING DUCT PENETRATIONS
   1. THRU NON-RATED WALLS WHERE DRYWALL, CONCRETE, OR MASONRY EXTENDS TO STRUCTURE, FILL VOID BETWEEN DUCT AND WALL WITH MINERAL WOOL AND CAULK BOTH SIDES WITH NON-HARDENING CAULK.

23 33 00 DUCTWORK ACCESSORIES

A. GENERAL - ALL DUCT ACCESSORIES SHALL BE CONSTRUCTED OF SAME MATERIAL AS DUCTWORK BEING INSTALLED IN.
B. TURNING VANES
   1. MANUFACTURERS: AERO/DYNE CO. H.E.P., HART & COOLEY, UNITED MCGILL, SEMCO.
   2. RECTANGULAR DUCTWORK: AIRFOIL TURNING VANES IN ACCORDANCE WITH SMACNA FIG. 2-3 AND 2-4. VANE RADIUS AS PROVIDED BY AERO/DYNE H.E.P. OR 4-1/2 INCHES WITH A 3-1/2 INCH SPACING.
   3. ROUND DUCTWORK: TWO-PIECE MITERED, MINIMUM 20 GAUGE.
C. CONTROL DAMPER INSTALLATION
   1. RECEIVE CONTROL DAMPERS FROM TEMPERATURE CONTROL CONTRACTOR AND INSTALL DAMPERS.
   2. DAMPER SECTIONS AND MULTIPLE SECTION ASSEMBLIES MUST BE COMPLETELY SQUARE AND FREE FROM RACKING, TWISTING, OR BENDING.
   3. FOLLOW MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION OF CONTROL DAMPERS.
   4. INSTALL EXTENDED SHAFT OR JACKSHAFT PER MANUFACTURER'S INSTRUCTIONS.
   5. PROVIDE A VISIBLE INDICATION OF DAMPER POSITION ON THE DRIVE SHAFT END.
   6. AFTER INSTALLATION OF LOW-LEAKAGE DAMPERS WITH SEALS, CAULK BETWEEN FRAME AND DUCT OR OPENING TO PREVENT LEAKAGE AROUND PERIMETER OF DAMPER.
D. MANUAL VOLUME DAMPERS
   1. MANUFACTURERS: RUSKIN, VENT PRODUCTS, UNITED MCGILL.
   2. DAMPERS WITH EXTENDED SHAFTS AND QUADRANT OPERATOR WITH LOCKING DEVICE, POSITION INDICATOR, AND ELEVATED PLATFORM FOR EXTERNALLY INSULATED DUCTWORK.
   3. EVERY SUPPLY, RETURN AND EXHAUST GRILLE SHALL HAVE EITHER A VOLUME DAMPER IN THE BRANCH DUCT OR AT THE GRILLE WHERE SHOWN. IF ONE IS NOT SHOWN, CONTRACTOR SHALL PROVIDE VOLUME DAMPER IN DUCT IF DUCT IS ACCESSIBLE, OTHERWISE AT THE GRILLE.
   4. RECTANGULAR DAMPERS WHICH DO NOT EXCEED 12" HIGH OR 36" WIDE: BUTTERFLY DAMPER, MINIMUM 22 GAUGE. SHAFT ALONG ENTIRE LENGTH OF DAMPER FOR DAMPERS EXCEEDING 18" IN WIDTH.
   5. RECTANGULAR DAMPERS GREATER THAN 12" HIGH OR 36" WIDE: MULTI-BLADE DAMPER WITH CONNECTING LINKAGE TO CONTROL FROM A SINGLE POINT. BLADES MINIMUM 16 GAUGE WITH OPPOSED BLADE ACTION.
   6. ROUND DAMPERS: MINIMUM 20 GAUGE BUTTERFLY DAMPER.
E. TAKE-OFF FITTINGS
   1. MANUFACTURERS: FLEXMASTER, UNITED MCGILL.
   2. ROUND BRANCH TAKE-OFFS TO MULTIPLE GRILLES SHALL BE CONICAL.
   3. RECTANGULAR BRANCH TAKE-OFFS TO MULTIPLE GRILLES SHALL BE PER DUCT FITTING DETAIL ON PLANS.
   4. ROUND TAKE-OFFS TO INDIVIDUAL GRILLES AND SLOT DIFFUSERS: ONE PIECE SPIN-IN WITH INTEGRAL FACTORY INSTALLED LOCKING TYPE BALANCING DAMPERS.
F. DUCT ACCESS DOORS
   1. PROCESS DUCT: SEE DETAIL ON PLANS.
   2. MANUFACTURERS: CESCO, FLEXMASTER, VENT PRODUCTS, KEES, UNITED MCGILL, SEMCO, DUCTMATE.
   3. HINGE, LATCHES, HANDLES, AND RUBBER GASKET IN FRAME. 1" INSULATED DOUBLE WALL CONSTRUCTION FOR DOORS IN LINED OR EXTERNALLY INSULATED DUCTWORK. ATTACHMENT CABLES FOR SPIN-IN UNITS. DOOR SUITABLE FOR DUCT STATIC PRESSURE CLASS.
   4. DOOR SIZE 2" LESS THAN THE WIDTH OF THE DUCT (MAX. DOOR SIZE 24"X 24" (24" DIA.).
   5. ROUND DUCTWORK: 16 GAUGE ROLLED SHEET METAL HINGED ACCESS DOOR WITH BUCKLE LOCKS.
   6. PROVIDE AT:
      a. MOTOR OPERATED AND BACKDRAFT DAMPERS
      b. UPSTREAM SIDE OF TURNING VANES IN RETURN AND EXHAUST DUCTWORK
      c. AT ANY DEVICE IN THE DUCT WHICH REQUIRES MAINTENANCE, SERVICE OR CLEANING.
   7. USE HINGED ACCESS DOORS WHERE POSSIBLE. USE CAM OPERATED REMOVABLE DOORS WHERE SPACE PREVENTS THE OPENING OF A HINGED MODEL.
G. FLEXIBLE CONNECTIONS
   1. MANUFACTURERS: VENTFABRICS, DURO-DYNE.
   2. MATERIAL BOLTED SECURELY TO THE EQUIPMENT AND CONNECTING DUCTWORK WITH #16 GAUGE GALVANIZED IRON BAND (LOOP) CLAMPS BOLTED TIGHT TO MAKE AN AIRTIGHT CONNECTION, MINIMUM 6" WIDE.
   3. PROVIDE AT INLET AND OUTLET OF ALL ROOFTOP UNITS AND FANS IN ACCORDANCE WITH SMACNA FIGURE 2-19.
   4. CONVENTIONAL INTERIOR: VENTGLAS, -20 TO 200 DEG F., 30 OZ. PER SQUARE YARD GLASS FABRIC DOUBLE COATED WITH NEOPRENE, UL 214 APPROVED.
H. BACKDRAFT DAMPERS
   1. MANUFACTURERS: RUSKIN, VENT PRODUCTS.
   2. ALUMINUM FRAME AND BLADE CONSTRUCTION WITH BLADE AND EDGE SEALS. LEAKAGE LESS THAN 12 CFM PER SQ. FT. AT 1/2" W.G., COUNTERBALANCE TO OPEN AT APPROXIMATELY 1/8" STATIC PRESSURE.

23 90 00 TEMPERATURE CONTROLS

A. ALL PRODUCTS USED IN THIS INSTALLATION SHALL BE NEW, CURRENTLY UNDER MANUFACTURE, AND SHALL BE APPLIED IN STANDARD OFF THE SHELF PRODUCTS. THIS INSTALLATION SHALL NOT BE USED AS A TEST SITE FOR ANY NEW PRODUCTS UNLESS EXPLICITLY APPROVED BY THE ENGINEER IN WRITING. SPARE PARTS SHALL BE AVAILABLE FOR AT LEAST 5 YEARS AFTER COMPLETION OF THIS CONTRACT.
B. ELECTRICAL COMPONENTS, DEVICES, AND ACCESSORIES: LISTED AND LABELED AS DEFINED IN NFPA 70, ARTICLE 100, BY A TESTING AGENCY ACCEPTABLE TO AUTHORITIES HAVING JURISDICTION, AND MARKED FOR INTENDED USE.
C. LABOR AND MATERIALS FOR THE CONTROL SYSTEM SPECIFIED SHALL BE WARRANTED FREE FROM DEFECTS FOR A PERIOD OF 12 MONTHS AFTER FINAL COMPLETION AND ACCEPTANCE. CONTROL SYSTEM FAILURES DURING THE WARRANTY PERIOD SHALL BE ADJUSTED, REPAIRED, OR REPLACED AT NO ADDITIONAL COST OR REDUCTION IN SERVICE TO THE OWNER.
D. POWER SUPPLIES: UL LISTED TRANSFORMERS WITH CLASS 2 CURRENT-LIMITING TYPE OR OVERCURRENT PROTECTION; LIMIT CONNECTED LOADS TO 80 PERCENT OF RATED CAPACITY. DC POWER SUPPLY SHALL MATCH OUTPUT CURRENT AND VOLTAGE REQUIREMENTS AND BE FULL-WAVE RECTIFIER TYPE.
E. POWER LINE FILTERING: INTERNAL OR EXTERNAL TRANSIENT VOLTAGE AND SURGE SUPPRESSION.
F. THERMOSTAT INSTALLATION
   1. INSTALL ALL THERMOSTATS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
   2. ROOM THERMOSTATS SHALL BE INSTALLED ON CONCEALED JUNCTION BOXES PROPERLY SUPPORTED BY THE WALL FRAMING WITH CONDUIT STUB TO ABOVE THE CEILING.
   3. COORDINATE LOCATION OF THERMOSTATS WITH PLANS AND ROOM DETAILS BEFORE INSTALLATION.
   4. ALL WIRES ATTACHED TO THERMOSTAT SHALL BE AIR SEALED IN THEIR RACEWAYS OR IN THE WALL TO STOP AIR TRANSMITTED FROM OTHER AREAS AFFECTING SENSOR READINGS.
G. ELECTRICAL WIRING AND CONNECTION INSTALLATION
   1. ALL CONTROL AND INTERLOCK WIRING SHALL COMPLY WITH NATIONAL AND LOCAL ELECTRICAL CODES AND ELECTRICAL SPECIFICATION. WHERE THE REQUIREMENTS OF THIS SECTION DIFFER WITH THOSE IN THE ELECTRICAL SPECIFICATIONS, THE MORE STRINGENT REQUIREMENTS SHALL TAKE PRECEDENCE.
   2. ALL NEC CLASS 1 (LINE VOLTAGE) WIRING SHALL BE UL LISTED IN APPROVED RACEWAY PER NEC AND ELECTRICAL SPECIFICATIONS.
   3. SEE ELECTRICAL SPECIFICATIONS FOR CONDUIT REQUIREMENTS.
   4. ALL LOW-VOLTAGE WIRING SHALL MEET NEC CLASS 2 REQUIREMENTS. (LOW-VOLTAGE POWER CIRCUITS SHALL BE SUB-FUSED WHEN REQUIRED TO MEET CLASS 2 CURRENT-LIMIT).
   5. ALL WIRING IN MECHANICAL, ELECTRICAL, OR SERVICE ROOMS AND WHERE SUBJECT TO DAMAGE SHALL BE INSTALLED IN RACEWAY.
   6. WHERE NEC CLASS 2 (CURRENT-LIMITED) WIRES ARE IN CONCEALED AND ACCESSIBLE LOCATIONS, APPROVED CABLES NOT IN RACEWAY MAY BE USED PROVIDED THAT CABLES ARE UL LISTED FOR THE INTENDED APPLICATION.
   7. DO NOT INSTALL CLASS 2 WIRING IN RACEWAY, BOXES AND PANELS CONTAINING CLASS 1 WIRING.
   8. SUPPORT CABLES AND RACEWAYS FROM STRUCTURAL MEMBERS. CABLES AND RACEWAYS SHALL NOT BE SUPPORTED BY DUCTWORK, ELECTRICAL RACEWAYS, PIPING, OR CEILING SUSPENSION SYSTEMS. SECURE AND SUPPORT CABLE AT INTERVALS NOT EXCEEDING 30 INCHES AND NOT MORE THAN 6 INCHES FROM CABINETS, BOXES, FITTINGS, OUTLETS, RACKS, FRAMES, AND TERMINALS.
   9. INSTALL WIRING IN SLEEVES WHERE IT PASSES THROUGH WALLS AND FLOORS. MAINTAIN FIRE RATING AT ALL PENETRATIONS.
   10. SIZE OF WIRE AND RACEWAY SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, AND BE PER THE MANUFACTURER'S RECOMMENDATION AND NEC REQUIREMENTS.
   11. FLEXIBLE METAL RACEWAYS ARE NOT PERMITTED OVER 6 FEET.

23 90 10 SEQUENCE OF OPERATION

A. ROOFTOP AIR CONDITIONING UNITS
   1. PROVIDE A CARRIER 33CS2PP2S-03 EDGE PRO COMMERCIAL SERIES PROGRAMMABLE HEATING/COOLING THERMOSTAT CAPABLE OF 2 STAGES OF HEATING AND 2 STAGES OF COOLING.
      a. SET FAN SETTING TO "ON" FOR FAN TO RUN CONTINUOUSLY IN OCCUPIED PERIODS, AND TO RUN WITH EQUIPMENT OPERATION DURING UNOCCUPIED PERIODS.
      b. DRY CONTACT OUTPUT SHALL BE USED TO ENERGIZE ECONOMIZER TO OPEN OUTDOOR AIR DAMPER TO MINIMUM POSITION DURING OCCUPIED OPERATION.
      c. THERMOSTAT INSTALLATION SETUP SHALL OTHERWISE UTILIZE FACTORY DEFAULTS.
   2. MOUNT AND WIRE ALL CONTROL WIRING ASSOCIATED WITH THE ROOFTOP AND PROVIDE ANY ADDITIONAL DEVICES NECESSARY FOR A COMPLETE OPERATIONAL SYSTEM.

23 95 00 TESTING, ADJUSTING AND BALANCING

A. QUALITY ASSURANCE
   1. PERFORM TOTAL SYSTEM BALANCE IN ACCORDANCE WITH AABC NATIONAL STANDARDS FOR FIELD MEASUREMENT AND INSTRUMENTATION, TOTAL SYSTEM BALANCE OR NEBB PROCEDURAL STANDARDS FOR TESTING, BALANCING AND ADJUSTING OF ENVIRONMENTAL SYSTEMS, AND ASHRAE STANDARD 111.
   2. THE TESTING, ADJUSTING AND BALANCING (TAB) CONTRACTOR SHALL BE AN INDEPENDENT COMPANY SPECIALIZING IN THE TESTING, ADJUSTING, AND BALANCING OF SYSTEMS WITH MINIMUM THREE YEARS EXPERIENCE AND NOT ASSOCIATED WITH THE SUPPLIERS OF EQUIPMENT OR THE INSTALLING CONTRACTOR.
   3. PERFORM WORK UNDER SUPERVISION OF AABC CERTIFIED TEST AND BALANCE ENGINEER OR NEBB CERTIFIED TESTING, BALANCING AND ADJUSTING SUPERVISOR.
B. SUBMITTALS
   1. CONTRACTOR SHALL SUBMIT THE FINAL TESTING AND BALANCING REPORT PRIOR TO PROJECT COMPLETION AND IN ADVANCE OF DATE OF OCCUPANCY. SUBMIT REPORTS ON AABC NATIONAL STANDARDS FOR TOTAL SYSTEM BALANCE OR NEBB FORMS.
   2. SUBMIT THE DESIGN AND ACTUAL DATA FOR EACH SCHEDULED PIECE OF EQUIPMENT: MODEL; SUPPLY, RETURN, AND OUTSIDE AIR FLOWS; STATIC PRESSURE PROFILES OF AIR HANDLING UNIT COMPONENTS AND ALL FANS; FAN RPM, BHP, AMPERAGE; FAN AND MOTOR SHEAVE, DIAMETER, BORE AND MAKE; BELT SIZE AND QUANTITY; MOTOR SHEAVE CENTER LINE AND OPERATOR DISTANCE; ROOM AIR FLOW.
C. INSTALLATION TOLERANCES
   1. AIR HANDLING SYSTEMS: ADJUST SUPPLY SYSTEMS TO WITHIN PLUS OR MINUS 5 PERCENT OF DESIGN AND RETURN AND EXHAUST SYSTEMS TO PLUS OR MINUS 10 PERCENT OF DESIGN.
   2. AIR OUTLETS AND INLETS: ADJUST TOTAL AIR FLOW TO SPACE TO WITHIN PLUS 10 PERCENT AND MINUS 5 PERCENT OF DESIGN.
   3. ADJUST OUTLETS AND INLETS IN SPACE TO WITHIN PLUS OR MINUS 10 PERCENT OF DESIGN.
D. AIR SYSTEM BALANCE
   1. VARY TOTAL SYSTEM AIR QUANTITIES BY ADJUSTING FAN SPEEDS. VARY BRANCH AIR QUANTITIES BY DAMPER REGULATION.
   2. ADJUST SETTINGS ON DIRECT DRIVE FANS WITH ECM MOTORS AS REQUIRED TO ACHIEVE DESIGN AIRFLOW.
   3. ADJUST OUTSIDE AIR, RETURN AIR, AND EXHAUST AIR AUTOMATIC DAMPERS FOR DESIGN CONDITIONS.
   4. TEST AIR HANDLING UNITS AT MINIMUM AND 100% OUTSIDE AIR.
E. FANS WITH FIXED MOTOR SHEAVES - TEST THE FAN EQUIPMENT. IF THE DESIGN CONDITIONS ARE NOT OBTAINED, CALCULATE THE FINAL FIXED MOTOR SHEAVE AND/OR BELTS REQUIRED TO OBTAIN DESIGN CONDITIONS. HEATING CONTRACTOR SHALL OBTAIN THE FINAL FIXED MOTOR SHEAVE AND BELT(S) FROM THE FAN MANUFACTURER AND TURN THEM OVER TO THE TAB CONTRACTOR FOR INSTALLATION.

LEGEND

NOTE: ALL SYMBOLS SHOWN MAY NOT APPEAR ON DRAWINGS.

SYM.	ABBR.	IDENTIFICATION	SYM.	ABBR.	IDENTIFICATION
DUCTWORK					
		DUCT (R)ISE/(D)ROP			SA OR OA DUCT DOWN OR AWAY
		RADIUS ELBOW			EA DUCT DOWN OR AWAY
		SQUARE ELBOW WITH TURNING VANES			RA DUCT DOWN OR AWAY
		SQUARE ELBOW WITHOUT TURNING VANES		VD	VOLUME DAMPER
		SQUARE OR RECTANGULAR BRANCH TAKEOFF		BDD	BACKDRAFT DAMPER
		RECTANGULAR TO ROUND TAKEOFF		MOD	MOTOR OPERATED DAMPER
		TEE WITH TURNING VANES	DS	DSD	DUCT SMOKE DETECTOR
		ROUND TO ROUND CONICAL TAKEOFF		FD	FIRE DAMPER
		ECCENTRIC TRANSITION		SD	SMOKE DAMPER
		CONCENTRIC TRANSITION		FSD	FIRE/SMOKE DAMPER
		SQUARE TO ROUND TRANS.		SG	SUPPLY GRILLE
		DUCT CAP		EG,RG, TG	(E)XHAUST / (R)ETURN / (T)RANSFER GRILLE
	AL	ACOUSTICALLY LINED DUCT (NOT ALWAYS SHOWN)	UCD	UCD	UNDERCUT DOOR (BY GC)
	SA	SUPPLY AIR DUCT UP	DTG (0 SF)	DTG	DOOR TRANSFER GRILLE
	OA	OUTSIDE AIR DUCT UP		FC	FLEXIBLE CONNECTION
	RA	RETURN AIR DUCT UP		AD	ACCESS DOOR
	EA	EXHAUST AIR DUCT UP			
MISCELLANEOUS AND CONTROLS					
T		THERMOSTAT / TEMP. SENSOR		OC	ON CENTER
	AFF	ABOVE FINISHED FLOOR		PC	PLUMBING CONTRACTOR
	AFG	ABOVE FINISHED GRADE		RAO	RETURN AIR OPENING
	AP	ACCESS PANEL		TAO	TRANSFER AIR OPENING
	BJ	BETWEEN JOISTS		TCC	TEMPERATURE CONTROL CONTRACTOR
	BOD	BOTTOM OF DUCT		TCP	TEMPERATURE CONTROL PANEL
	BOG	BOTTOM OF GRILLE		TJ	THRU JOISTS
	EAO	EXHAUST AIR OPENING		TYP.	TYPICAL
	EC	ELECTRICAL CONTRACTOR		TTS	TIGHT TO STRUCTURE
	GC	GENERAL CONTRACTOR / CONSTRUCTION MANAGER		TV	TURNING VANES
				VFD	VARIABLE FREQUENCY DRIVE
	HC	HVAC CONTRACTOR		WP	WEATHER PROOF
	NTS	NOT TO SCALE		WWM	WELDED WIRE MESH

PROJECT DESIGN CRITERIA

MECHANICAL CODE 2015 SCMC
ENERGY CODE 2009 SCECC
SEISMIC DESIGN CATEGORY D
NEAREST ASHRAE CITY FLORENCE RGNL ARPT.
ELEVATION 151

	OUTSIDE	
	DB	WB
WINTER:	23.8	N/A
SUMMER:	96.2	79.3

BASED ON ASHRAE 0.4% DESIGN CONDITIONS.

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COLLABORATION
AspenDental

PROJECT INFORMATION
TENANT BUILD-OUT FOR:
ASPEN DENTAL
~12150 FRONTAGE ROAD • MURRELLS INLET, SC 29576

PROFESSIONAL SEAL

SHEET DATES
ISSUE DATE MAR. 16, 2020
REVISIONS

JOB NUMBER
1860160

HVAC LEGEND & SPECIFICATIONS

SHEET NUMBER
H0.1

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