

MECHANICAL SPECIFICATIONS

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PART 1- GENERAL

1.01 GENERAL

- A. THE LATEST EDITION OF AIA DOCUMENTS A201 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, OR AS REQUIRED BY THE ARCHITECTURAL DOCUMENTS AND/OR THE STRUCTURAL ENGINEERS DOCUMENTS ARE PART OF THE CONTRACT.
- B. BIDDERS SHALL VISIT AND CAREFULLY EXAMINE THE AREA AFFECTED BY THIS WORK TO FAMILIARIZE THEMSELVES WITH THE EXISTING CONDITIONS AND THE DIFFICULTIES THAT WILL AFFECT THE EXECUTION OF THIS WORK BEFORE SUBMITTING PROPOSALS. SUBMISSION OF A PROPOSAL WILL BE CONSTRUED AS EVIDENCE THAT SUCH AN EXAMINATION HAS BEEN MADE AND LATER CLAIMS WILL NOT BE RECOGNIZED FOR EXTRA LABOR, EQUIPMENT, OR MATERIALS REQUIRED BECAUSE OF DIFFICULTIES ENCOUNTERED WHICH COULD HAVE BEEN FORESEEN HAD SUCH AN EXAMINATION BEEN MADE. ANY DISCREPANCIES SHALL BE BROUGHT TO THE ENGINEERS ATTENTION PRIOR TO BID. IF DISCREPANCIES ARE NOT RESOLVED TO CONTRACTORS SATISFACTION THEY SHALL BE QUALIFIED IN THEIR BID SUBMISSION.
- C. THIS CONTRACTOR SHALL REVIEW ALL CONSTRUCTION DOCUMENTS ASSOCIATED WITH THIS PROJECT INCLUDING GENERAL CONSTRUCTION, DEMOLITION, ARCHITECTURAL, MECHANICAL, ELECTRICAL, PLUMBING AND SPRINKLER PLANS AND SPECIFICATIONS. ALL WORK REQUIRED IN THE BID WHICH IS INDICATED OR IMPLIED TO BE PERFORMED BY THIS TRADE IN OTHER SECTIONS OF THE WORK SHALL BE INCLUDED IN THEIR BID. IF A CONFLICT OCCURS IN THE BID SPECIFICATIONS AND/OR ON THE DRAWINGS, THE MORE STRINGENT SITUATION SHALL APPLY.
- D. DRAWINGS ARE DIAGRAMMATIC AND INDICATE GENERAL ARRANGEMENT OF SYSTEMS AND WORK INCLUDED IN CONTRACT. IT IS NOT INTENDED TO SPECIFY OR TO SHOW EVERY OBJECT, FITTING, COMPONENT, HOWEVER, CONTRACT DOCUMENTS REQUIRE COMPONENTS AND MATERIALS WHETHER OR NOT INDICATED OR SPECIFIED AS NECESSARY TO MAKE THE INSTALLATION COMPLETE AND OPERATIONAL. FINAL LOCATIONS OF DIFFUSERS, GRILLES, REGISTERS, THERMOSTATS, SENSORS, SWITCHES AND ANY WALL MOUNTED DEVICES SHALL BE AS PER THE ARCHITECT. ALL WORK SHALL BE COORDINATED WITH OTHER TRADES TO AVOID CONFLICT.
- E. GUARANTEE: THE CONTRACTOR SHALL GUARANTEE AND SERVICE THE ENTIRE INSTALLATION FOR A PERIOD OF ONE YEAR FROM THE DATE OF THE FINAL ACCEPTANCE OF THE INSTALLATION. THE CONTRACTOR SHALL, DURING THE PERIOD OF THE GUARANTEE, REPLACE OR REPAIR AT HIS OWN EXPENSE ANY PIECE OF EQUIPMENT AND/OR MATERIAL WHICH IS FOUND TO BE DEFECTIVE. THE REPLACEMENT OR REPAIR SHALL BE PERFORMED THE SAME DAY OF NOTIFICATION IN AN EMERGENCY FASHION WHEN NOTIFIED BY THE OWNER OR AUTHORIZED REPRESENTATIVE. THE CONTRACTOR SHALL ALSO REPAIR ALL DAMAGE TO SURROUNDING WORK CAUSED BY THE FAILURE, REPAIR OR REPLACEMENT OF DEFECTIVE EQUIPMENT. ALL REFRIGERATION COMPRESSORS SHALL HAVE A FACTORY GUARANTEE INCLUDING PARTS AND LABOR FOR FIVE YEARS TOTAL. THE FINAL ACCEPTANCE WILL BE MADE AFTER THE CONTRACTOR HAS ADJUSTED HIS EQUIPMENT, BALANCED THE VARIOUS SYSTEMS, DEMONSTRATED THAT IT FULFILLS THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATION, AND HAS FURNISHED ALL THE REQUIRED CERTIFICATES OF INSPECTION AND APPROVALS.
- F. SUBSTITUTIONS: DEVIATIONS FROM CONTRACT DOCUMENTS AND SUBSTITUTION OF MATERIALS OR EQUIPMENT FOR THOSE SPECIFIED SHALL BE REQUESTED INDIVIDUALLY IN WRITING. SUBMIT LETTER BEFORE THE TRANSMITTAL OF PRODUCT DATA TO THE PROJECT TEAM FOR THEIR REVIEW AND APPROVAL. DESCRIBE REASON FOR CHANGE, CONNECTIONS TO ADJACENT MATERIALS, ELECTRICAL SERVICES, SERVICE ACCESS REQUIREMENTS, DIFFERENCES IN OPERATING CHARACTERISTICS OR CYCLES AND ALL OTHER POINTS OF DEVIATION. CONTRACTOR TO ASSUME FULL RESPONSIBILITY FOR SAFETY, OPERATION AND PERFORMANCE OF ALTERED SYSTEM.
- G. THIS CONTRACTOR IS TO OBTAIN A COPY OF THE BUILDING RULES AND REGULATIONS PRIOR TO BID SUBMISSION. ALL WORK MUST BE INSTALLED IN ACCORDANCE WITH THE BUILDING RULES AND REGULATIONS. DETERMINE REQUIREMENTS AND THE EXTENT OF PREMIUM TIME WORK REQUIRED BY BUILDING. FOR THE PURPOSE OF THE BID ASSUME ANY NOISY WORK (E.G., CHOPPING, CORE DRILLING, WELDING, BRAISING, SOLDERING, ETC.) AND BASE BUILDING SYSTEMS INTERRUPTIONS ARE TO BE PERFORMED OUTSIDE NORMAL BUSINESS HOURS.
- H. REMOVAL, TEMPORARY CONNECTIONS AND RELOCATION OF CERTAIN EXISTING WORK WILL BE NECESSARY FOR THE INSTALLATION OF THE NEW SYSTEMS. ALL EXISTING CONDITIONS ARE NOT COMPLETELY DETAILED ON THE DRAWINGS. THE CONTRACTOR SHALL SURVEY THE SITE AND MAKE ALL NECESSARY CHANGES REQUIRED BASED ON EXISTING CONDITIONS FOR PROPER INSTALLATION OF NEW WORK.
- I. PLAN INSTALLATION OF NEW WORK AND CONNECTIONS TO EXISTING WORK TO INSURE MINIMUM INTERFERENCE WITH REGULAR OPERATION OF EXISTING FACILITIES. ALL SYSTEM SHUTDOWNS AFFECTING OTHER AREAS SHALL BE COORDINATED WITH BUILDING MANAGEMENT.
- J. ALL NECESSARY CUTTING AND PATCHING IN FLOOR SLABS, ROOF SLABS, WALLS, AND CEILINGS FOR THE HVAC WORK SHALL BE PERFORMED BY THIS CONTRACTOR. RESTORE TO MATCH EXISTING CONDITIONS.
- K. WHERE PIPE AND/OR DUCTWORK PENETRATE RATED WALLS, THE SPACE BETWEEN THE INSULATION AND THE WALL SHALL BE CAULKED WITH NON-COMBUSTIBLE MATERIAL IN AN APPROVED MANNER. ALL PIPING AND/OR DUCTWORK TO BE INSTALLED ABOVE HUNG CEILING UNLESS OTHERWISE NOTED ON DRAWINGS. THE CONTRACTOR SHALL COORDINATE WITH ARCHITECTURAL DRAWINGS FOR ALL CEILING ELEVATIONS.
- L. ACCESS DOORS IN FINISHED CONSTRUCTION. THE CONTRACTOR SHALL PREPARE A LIST OF ALL ACCESS DOORS (MINIMUM 18"x18") REQUIRED FOR OPERATION AND MAINTENANCE OF ALL CONCEALED EQUIPMENT AND OTHER DEVICES, WHICH SHALL BE SUPPLIED TO THE GENERAL CONTRACTOR FOR INSTALLATION. THE COST TO FURNISH AND INSTALL ACCESS DOORS SHALL BE INCLUDED IN THIS CONTRACTORS BID. THIS CONTRACTOR IN ADVANCE OF CEILING INSTALLATIONS SHALL SUITABLY FIELD TAG AND IDENTIFY ALL CONCEALED EQUIPMENT, VALVES, DAMPERS, ETC., WHICH REQUIRE ACCESS DOOR PROVISIONS.
- M. NEW DUCTWORK SHALL ARRIVE ON THE CONSTRUCTION SITE SEALED AND REMAIN PROTECTED FROM DEBRIS THROUGHOUT CONSTRUCTION PRIOR TO FINAL INSTALLATION. AIR DISTRIBUTION ACCESSORIES AND INTERNAL COMPONENTS OF ALL HVAC EQUIPMENT SHALL BE SEALED AND PROTECTED FROM DEBRIS WHILE ON THE CONSTRUCTION SITE PRIOR TO FINAL CONNECTION AND START-UP.
- N. ALL VOLATILE ORGANIC COMPOUND (VOC) LIMITS OF ADHESIVES, SEALANTS AND SEALANT PRIMER MUST COMPLY WITH SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT (SCAQMD) RULE #1168, AMENDMENT DATE OF JANUARY 7, 2005.

1.02 SCOPE OF WORK

- A. THE CONTRACTOR SHALL FURNISH AND INSTALL AN HVAC SYSTEM COMPLETE WITH ALL EQUIPMENT, DUCTWORK, PIPING, INSULATION, CONTROLS, ACCESSORIES AND ASSOCIATED WORK IN ACCORDANCE WITH THE MISSOURI CITY BUILDING CODE, ALL NATIONAL, STATE AND LOCAL AUTHORITIES HAVING JURISDICTION, BUILDING MANAGEMENT, DESIGN DRAWINGS AND THIS SPECIFICATION.
- B. THE WORK SHALL INCLUDE ALL LABOR, MATERIALS, EQUIPMENT, HOISTING AND RIGGING, BREAKDOWN AND SETUP OF EQUIPMENT FOR INSTALLATION, SCAFFOLDING, AND SERVICES TO COMPLETE THE SYSTEM AND PROVIDE THE OWNER WITH A FULLY OPERATIONAL SYSTEM. ANY EQUIPMENT, PARTS, MATERIALS, ACCESSORIES, OR LABOR THAT IS NECESSARY FOR PROPER PERFORMANCE OF THE MECHANICAL WORK ALTHOUGH NOT SPECIFICALLY MENTIONED HEREIN OR SHOWN ON THE DRAWINGS, SHALL BE FURNISHED AND INSTALLED WITHOUT ADDITIONAL COSTS.
- C. THIS TENANT/OWNER SHALL PROCURE THE SERVICES OF A THIRD PARTY INSPECTION COMPANY TO PERFORM ALL SPECIAL INSPECTIONS AND TESTING IN ACCORDANCE WITH THE MISSOURI STATE BUILDING CODE. SECURE ALL REQUIRED PERMITS AND APPROVALS AND TRANSMIT SAME TO THE OWNER. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES.

1.03 SHOP DRAWINGS, EQUIPMENT SUBMISSION, MAINTENANCE MANUALS

- A. SUBMIT ONE (1) REPRODUCIBLE AND ONE (1) PRINT OF THE SHEET METAL

- AND PIPING SHOP DRAWINGS, 3/8" SCALE, CERTIFIED BY ALL TRADES THAT COORDINATION HAS BEEN ESTABLISHED.
- B. SUBMIT THREE (3) COPIES OF ALL SHEET METAL AND PIPING SHOP DRAWINGS INCLUDING LEAKAGE TEST CERTIFICATION, AIR AND WATER BALANCING REPORTS, AND CERTIFIED EQUIPMENT CUTS WITH CONSTRUCTION WIRING DIAGRAMS, AND AUTOMATIC TEMPERATURE CONTROL SHOP DRAWINGS INCLUDING CONTROL AND POWER WIRING DIAGRAMS, SEQUENCE OF OPERATIONS AND ALL CUTS OF EQUIPMENT AND DEVICES.
- C. SUBMIT FOUR (4) BOOK BOUND OPERATING AND SERVICE MANUALS WHICH SHALL INCLUDE COPIES OF ALL AS-BUILT SHOP DRAWINGS FOLDED AND PLACED INTO BINDER POCKETS, AS-BUILT DRAWINGS IN ELECTRONIC FORMAT, COPIES OF REVIEWED EQUIPMENT CUTS FOR INSTALLED EQUIPMENT, COPIES OF EQUIPMENT START UP CHECKLISTS, AIR AND WATER BALANCING REPORTS, LEAK TESTS, HYDROSTATIC TESTS, WATER TREATMENT AND CHEMICAL CLEANING CERTIFICATION. CONTRACTOR SHALL INSTRUCT OWNERS PERSONNEL ON THE OPERATION OF ALL HVAC SYSTEMS.
- D. AS WORK PROGRESSES AND FOR DURATION OF CONTRACTOR, MAINTAIN COMPLETE AND SEPARATE SET OF PRINTS OF CONTRACT DRAWINGS AT THE JOB SITE. RECORD WORK COMPLETED AND ALL CHANGES FROM ORIGINAL CONTRACT DRAWINGS CLEARLY AND ACCURATELY INCLUDING WORK INSTALLED AS A MODIFICATION OR ADDITION TO THE ORIGINAL DESIGN. RECORD VALVE TAGS AS THEY ARE INSTALLED. FINAL SUBMISSION OF REPRODUCIBLE AS-BUILT DRAWINGS ARE TO BE SIGNED AND CERTIFIED BY INSTALLING CONTRACTOR THAT THIS IS THE AS-BUILT CONDITION OF THE WORK. AS-BUILT SHOP DRAWINGS SHALL BE SUBMITTED IN DRAWING AND ELECTRONIC FORMAT (AUTOCAD 2007 MINIMUM).

PART 2- PRODUCT/APPLICATION

2.01 DUCTWORK

- A. PROVIDE ALL SUPPLY, RETURN, EXHAUST, AND OUTSIDE AIR SHEET METAL DUCTWORK, FITTINGS, DAMPERS, TURNING VANES, ACCESS DOORS, PLENUMS, FLEXIBLE CONNECTIONS, AND SUPPORTS AND PERFORM LEAK TEST PER LATEST SMACNA STANDARDS AND NFPA90A AS MODIFIED BY N.Y.C. BUILDING CODE. ALL DUCTWORK JOINTS SHALL BE SEALED AIR TIGHT WITH APPROVED DUCT SEALANT, SIMILAR TO 3M-900.
- B. CONTRACTOR SHALL ADHERE TO THE FULL INSIDE CROSS SECTIONAL DUCTWORK AREAS SHOWN ON THE DRAWINGS AND PROVIDE ALL TRANSITIONS AND OFFSETS AS REQUIRED TO MEET FIELD CONDITIONS, ACCOMMODATE EQUIPMENT MAINTENANCE REQUIREMENTS AND COORDINATE WITH ALL TRADES. ALL FIELD CONDITIONS WHICH REQUIRE MODIFIED TRANSITIONS WILL NOT BE APPROVED WITHOUT PRIOR ENGINEER APPROVAL THROUGH SHOP DRAWING OR RFI.
- C. FOR DUCTS WITH ACoustICAL LINING THE SIZES SHOWN ON THE PLAN SHALL BE THE CLEAR INSIDE DIMENSIONS.
- D. EXISTING DUCTWORK TO BE REUSED: CONTRACTOR SHALL INSPECT, SEAL AS PER PRESSURE CLASSIFICATION, LEAK TEST, AND INSULATE ALL EXISTING DUCTWORK TO BE REUSED. ALL REQUIRED WORK SHALL BE PART OF BID.
- E. NEW AND EXISTING DUCTWORK TO BE REUSED SHALL HAVE PRESSURE CLASSIFICATION, SEALING REQUIREMENTS AND LEAKAGE TESTING AS LISTED BELOW UNLESS OTHERWISE SPECIFIED OR SHOWN ON THE DRAWINGS:
1. 4" CLASS: ALL SUPPLY DUCTWORK FROM DISCHARGE OF AIR UNITS TO INLETS OR TERMINAL BOXES. SEAL CLASS A, LEAKAGE CLASS 6 (RECTANGULAR) OR CLASS 3 (ROUND).
2. 3" CLASS: ALL SUCTION AND DISCHARGE OF KITCHEN HOOD, AND SMOKE EXHAUST DUCTWORK. SEAL CLASS B, LEAKAGE CLASS 12 (RECTANGULAR) OR CLASS 6 (ROUND).
3. 2" CLASS: ALL OTHER LOW PRESSURE DUCTWORK. SEAL CLASS B, LEAKAGE CLASS 24 (RECTANGULAR) OR CLASS 12 (ROUND).
- A. LEAKAGE TESTING:
1. FOR DUCT SYSTEMS DESIGNED TO OPERATE AT STATIC PRESSURES IN EXCESS OF 3 INCHES W.G. (746 PA) (3" CLASS AND ABOVE), REPRESENTATIVE SECTIONS (AS DETERMINED BY THE INSPECTOR WHEN APPLICABLE), TOTALING AT LEAST 25% OF THE DUCT AREA SHALL BE TESTED TO VERIFY THAT ACTUAL AIR LEAKAGE IS BELOW ALLOWABLE AMOUNTS AS DEFINED BY ASHRAE 90.1 OR THE ENERGY CODE AS INDICATED ON THE PROJECT'S COMCHECK COMPLIANCE CERTIFICATE, WHICHEVER IS MORE STRINGENT.
- B. ALL EXISTING LOW PRESSURE DUCTWORK SHALL BE LEAK TESTED PRIOR TO REUSE TO VERIFY ITS INTEGRITY.
- C. ALL NEW LOW PRESSURE DUCTWORK (2" CLASS) SHALL BE TESTED ON AN AS-NEEDED BASIS AT THE ENGINEERS DISCRETION OR IF BALANCING AIR QUANTITIES CAN NOT BE MET. IF SPECIMEN FAILS TO MEET ALLOTTED LEAKAGE LEVEL, THE CONTRACTOR SHALL MODIFY TO BRING IT INTO CONFORMANCE AND SHALL RETEST IT UNTIL ACCEPTABLE LEAKAGE IS DEMONSTRATED. TESTS AND NECESSARY REPAIRS SHALL BE COMPLETED PRIOR TO CONCEALMENT OF DUCTS.

F. MATERIALS:

1. SHEETMETAL: HOT-DIPPED GALVANIZED SHEETMETAL WITH G60 COMMERCIAL COATING ACCORDING TO ASTM A653 & A924 FOR ALL DUCTWORK UNLESS OTHERWISE SPECIFIED.
2. STAINLESS STEEL: PROVIDE DUCTWORK OF STAINLESS STEEL CONSTRUCTION, WHERE INDICATED. DUCTWORK SHALL BE 316/NO.4 FINISH FOR EXPOSED DUCT. 304/NO.1 FINISH FOR CONCEALED DUCTS. PROVIDE FOR ALL CORROSIVE EXHAUST SYSTEMS INCLUDING FUME HOODS AND DISHWASHER EXHAUST.
3. ALUMINUM: ALLOY 3003-H14. OF THICKNESS REQUIRED BY THE SMACNA DUCT CONSTRUCTION STANDARDS. PROVIDE FOR ALL DUCTWORK EXPOSED TO WEATHER AND MOISTURE INCLUDING OUTSIDE AIR DUCTS WITHIN 10 FEET OF LOUVERS AND TOILET ROOMS EQUIPPED WITH BATHS OR SHOWERS.
4. FLEXIBLE CONNECTIONS AT FANS SHALL BE NEOPRENE COATED, FLAME RETARDANT GLASS FABRIC (COMPLYING WITH NFPA 90), 30 OZ./SQ. YD. WITH SEWED AND CEMENTED SEAMS.
- G. PROVIDE MANUAL BALANCING DAMPERS AS REQUIRED TO PROPERLY BALANCE THE AIR DISTRIBUTION SYSTEM AS SHOWN ON DRAWINGS AND AS LISTED BELOW:
1. ALL SUPPLY AIR MAIN BRANCHES FROM TRUNK, EACH SPLIT, AND ALL SUB-BRANCHES FROM MAINS SHALL HAVE BALANCING DAMPERS.
2. EXHAUST AND RETURN MAIN BRANCHES FROM TRUNK, EACH SPLIT AND ALL SUB-BRANCHES FROM MAINS SHALL HAVE BALANCING DAMPERS.
3. IF DAMPER IS NOT ACCESSIBLE, OR IS LOCATED ABOVE A PLASTER OR DRYWALL CEILING, PROVIDE A REMOTE DAMPER ACTUATOR AND DAMPER AS MANUFACTURED BY YOUNG REGULATOR MODEL 896-C WITH NO. 1200A RIGHT ANGLE WORM GEAR AND DAMPER MODEL 820 OR APPROVED EQUAL.
- H. FIRE DAMPERS AND FIRE/SMOKE DAMPERS:
1. PROVIDE FIRE DAMPERS, SMOKE DAMPERS, COMBINATION FIRE/SMOKE DAMPERS, SMOKE DETECTORS, AND ASSOCIATED CONTROLS AND ALARMS AS REQUIRED BY CODE.
2. DAMPERS SHALL BE DYNAMIC TYPE, U.L. LISTED AND LABELED, AND IN CONFORMANCE WITH NFPA.
3. FIRE DAMPER SHALL BE FUSIBLE LINK TYPE (165 DEGREE F.), TYPE B SHUTTER OUT OF THE AIR STREAM AS MANUFACTURED BY POTTORFF MODEL VFD-10 (1-1/2 HR RATED) OR MODEL VFD-30 (3HR RATED) AS REQUIRED OR APPROVED EQUAL.
4. COMBINATION FIRE/SMOKE DAMPERS SHALL BE CLASS II, REMOTE RESETTABLE, MULTI-BLADE TYPE WITH FIRESTICK OR HEAT SENSOR DEVICE AND 120-VOLT ACTUATOR MOUNTED OUT OF THE AIR STREAM, WITH DAMPER OPERATOR AND BLADE POSITION INDICATOR SWITCHES. PROVIDE MOTOR MOUNT BRACKET/ STRENGTHENER FOR DAMPERS OVER 10' IN HEIGHT. PROVIDE A 10 GAUGE WELDED VERTICAL STIFFENER AT EACH CORNER TO PREVENT DAMPER MISALIGNMENT.
5. COMBINATION FIRE/SMOKE DAMPERS SHALL BE MANUFACTURED BY POTTORFF MODEL FSD-142 (1-1/2 HR RATED) OR MODEL FSD-342 (3HR RATED) AS REQUIRED OR APPROVED EQUAL.

6. THE HVAC CONTRACTOR SHALL PROVIDE ALL DEVICES, RELAYS, END SWITCHES, EIP SWITCHES, CONTROL COMPONENTS, AIR PIPING, POWER WIRING, CONTROL WIRING AND INTERLOCK WIRING AS REQUIRED TO ACCOMPLISH THE SEQUENCE OF OPERATION FOR THESE DAMPERS.
7. DUCTWORK SHALL BE TRANSITIONED LARGER AT ALL FIRE AND FIRE/SMOKE DAMPERS SUCH THAT THE NET FREE AREA OF THE DUCTWORK IS NOT COMPROMISED.
- I. SLOPE AND DRAIN ALL DUCTS EXPOSED TO MOISTURE, CONSTRUCT OF ALUMINUM AND DO NOT INTERNALLY LINE.
- J. AUTOMATIC CONTROL DAMPERS: PROVIDE DAMPERS WITH PARALLEL BLADES FOR 2-POSITION OR MIXING CONTROL, OR OPPOSED BLADES FOR MODULATING CONTROL OF CONSTANT OR VARIABLE VOLUME SYSTEM. AUTOMATIC DAMPERS ARE TO BE VERY LOW LEAKING TYPE WITH A MAXIMUM LEAKAGE RATE OF 6 CFM PER SQUARE FOOT AT 4" W.G. DAMPER MATERIAL SHALL BE THE SAME AS DUCT. PROVIDE WEATHERPROOF COMPONENTS FOR DAMPERS IN A MOISTURE ENVIRONMENT.

2.02 GRILLES, REGISTERS AND DIFFUSERS

- A. PROVIDE ALL AIR OUTLETS AND RETURNS OF THE TYPE AND SIZES, AS SELECTED AND INDICATED ON DRAWING. ALL DUCTED RETURN AND EXHAUST OUTLETS SHALL HAVE OPPOSED BLADE DAMPERS (ADJUSTABLE THROUGH THE FACE), PROVIDE FRAMES AND MOUNTING TYPES AS REQUIRED TO MATCH SURROUNDING CEILING CONSTRUCTION. FINISHES TO BE SELECTED BY THE ARCHITECT.
- B. ALL CEILING TYPE AIR DIFFUSERS SHALL BE PROVIDED WITH EQUALIZING DEFLECTOR.
- C. A SCHEDULE OF DIFFUSERS, GRILLES AND REGISTERS WITH MANUFACTURERS MODELS, SIZES, ACCESSORIES, FINISHES, ETC., SHALL BE SUBMITTED FOR APPROVAL PRIOR TO RELEASE FOR FABRICATION AND DELIVERY.
- D. DIFFUSERS SHOWN ON DIFFUSER SCHEDULE SHALL BE CHANGED TO MATCH EXISTING DIFFUSER TYPE WHERE EXISTING DIFFUSERS ARE REMAINING.

2.03 PIPING

- A. PROVIDE PIPING WHICH IS SCHEMATICALLY INDICATED AND SIZED ON DRAWINGS. PIPING TO BE INSTALLED TO MEET SPECIFIED HEADROOM OR FIELD CONDITIONS AND SHALL CONFORM TO LATEST ASME CODES FOR PRESSURE PIPING. PIPE MATERIALS AND FITTING MATERIALS SHALL BE AS PER THE PIPE AND FITTING SCHEDULES SHOWN ON DRAWINGS.
- B. PIPING, FITTINGS, AND ALL PIPE APPURTENANCES SHALL BE SUITABLE FOR THE PRESSURE AND TEMPERATURE OF SERVICE.
- C. PROVIDE DIELECTRIC FITTINGS TO CONNECT DIFFERENT PIPING MATERIALS.
- D. PROVIDE AIR VENTS AT EACH HIGH POINT AND DRAIN VALVES WITH HOSE BIB AT EACH LOW POINT.
- E. PIPING SHALL BE INSTALLED WITH PROPER ANCHORS AND EXPANSION/CONTRACTION DEVICES SUCH AS LOOPS OR APPROVED EXPANSION JOINTS TO PREVENT UNDESIRABLE STRAINS ON PIPING OR APPARATUS CONNECTED TO THE PIPING, AS REQUIRED.
- F. SUPPORT PIPING WITH HANGERS EQUIPPED WITH INSULATION SADDLES FROM APPROVED CONCRETE INSERTS, EXPANSION SHIELDS, BEAM CLAMPS, AND/OR SUPPLEMENTARY STEEL ANGLES, PLATES, AND CHANNELS. CONTRACTOR SHALL SUBMIT METHOD OF PIPING SUPPORT SIGNED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER FOR REVIEW.
- G. UNIONS WITH REMOVABLE SECTIONS OF PIPING SHALL BE INSTALLED AT ALL EQUIPMENT TO PERMIT EASE OF DISCONNECTION FOR EQUIPMENT SERVICE/REMOVALS WITHOUT DISMANTLING OF MAJOR PORTIONS OF CONNECTED PIPING.
- H. PROVIDE TEES IN PIPING SYSTEM FOR TESTING AND BALANCING, AND INSTALLATIONS OF FLOW OR PRESSURE GAUGES, THERMOMETERS AND OTHER BALANCING AND CONTROL DEVICES, COORDINATE WITH THE CONTROL CONTRACTOR AND BALANCER.
- I. PROVIDE AUTOMATIC PRESSURE RELIEF VALVES AND VACUUM BREAKERS TO PREVENT AGAINST PIPE RUPTURE OR SYPHONING ACTIONS. EXTEND DRAINS FROM RELIEF VALVES TO SPILL OVER FLOOR DRAINS.
- J. ALL PIPE SLEEVES SHALL BE SCHEDULE 40 GALVANIZED STEEL. ANNULUS BETWEEN PIPE OR PIPE INSULATION AND SLEEVE SHALL BE CAULKED WITH A NON-COMBUSTIBLE MATERIAL TO WITHIN 1/4" OF WALL PAGES AND FILLED WITH CAULKING COMPOUND FOR INTERIOR SLEEVES. EXTERIOR SLEEVES OR WATERPROOF SLEEVES SHALL UTILIZE LINK SEAL (LS) TYPE TO FILL THE ANNULUS. PROVIDE EPOXYCOHESION ON ALL EXPOSED PIPING THROUGH WALLS OR FLOORS HELD IN PLACE WITH SCREWS.
- K. PROVIDE SECURELY FASTENED LABELING OF ALL PIPING (BOTH EXPOSED AND CONCEALED) IN ACCORDANCE WITH ANSI STANDARDS AND COLOR CODED AS PER BUILDING MANAGEMENT STANDARDS. LABELING SHOULD BE PROVIDED 20 FEET ON CENTERS AND/OR AT LEAST ONCE IN EACH ENCLOSED SPACE OR ROOM WHERE THE WALLS EXTEND ABOVE THE CEILING.
- L. PROVIDE VALVE TAGS AND CHARTS:
1. EACH VALVE SHALL HAVE A 2 INCH DIAMETER BRASS TAG WITH 1 INCH HIGH NUMERAL STAMPED THEREON, SECURED TO THE VALVE BY MEANS OF BRASS S HOOK OR BRASS CHAIN. EACH SYSTEM TO HAVE A LETTER DESIGNATION INDICATING SERVICE.
2. THE CONTRACTOR SHALL FURNISH AN APPROVED NEATLY DRAWN VALVE CHART, PROPERLY FRAMED, SHOWING THE USE AND LOCATION OF EACH VALVE THAT IS TAGGED.

M. VALVES AND STRAINERS:

1. VALVES, STRAINERS, STEAM TRAPS, ETC., SHALL NOT CONTAIN ASBESTOS AND HAVE THE NAME OF THE MANUFACTURER AND GUARANTEED WORKING PRESSURE CAST OR STAMPED ON BODIES. VALVES OF SIMILAR TYPE SHALL BE BY A SINGLE MANUFACTURER.
2. VALVES 6" AND LARGER SHALL HAVE GEAR OPERATORS AND HAND WHEELS. VALVES LOCATED 7 FEET OR MORE ABOVE OPERATING FLOOR OR PLATFORM SHALL BE PROVIDED WITH CHAIN OPERATED HAND WHEELS, RUSTPROOF CHAIN AND CHAIN GUIDE.
3. VALVES USED FOR THROTTLING OR CONTROLLING FLOW SHALL BE BALL (3" OR SMALLER) OR PLUG TYPE VALVES (ALL SIZES). VALVES FOR ISOLATION SHALL BE BALL FOR LIQUID SYSTEMS AND GATE FOR STEAM SYSTEMS UNLESS OTHERWISE SPECIFIED. BUTTERFLY VALVE SHALL BE LUG TYPE AND MAY BE SUBSTITUTED FOR BALL VALVES FOR SIZES 4" AND LARGER. BUTTERFLY VALVES SHALL NOT BE USED FOR MODULATING SERVICE OR STEAM SERVICE, USE ONLY FOR 2 POSITION ISOLATION ON WATER SYSTEMS. REFER TO AUTOMATIC TEMPERATURE CONTROL SECTION FOR CONTROL VALVES.
4. VALVES SHALL HAVE WORKING PRESSURE AND TEMPERATURE RATINGS SAME AS PIPE FITTINGS SPECIFIED FOR THE SERVICE. REGARDLESS OF SERVICE, VALVES SHALL NOT BE DESIGNED FOR LESS THAN 125 PSI STEAM WORKING PRESSURE.
5. LUBRICATED, TAPERED PLUG VALVES WITH LOCKING FLOW PLATE SHALL BE PROVIDED IN THE DISCHARGE PIPING FROM WATER CIRCULATING PUMPS, IN THE LEAVING WATER PIPING BRANCHES FROM ALL COILS, HEAT EXCHANGER TYPES OF EQUIPMENT, AND ALL RETURN WATER RISERS OF SUB-MAINS THAT CONNECT TO HYDRONIC MAINS FOR BOTH BALANCING AND ISOLATION PURPOSES.
6. CHECK VALVES SIZED 2-1/2" AND LARGER SHALL BE IRON BODY, FLANGED ENDS, BRONZE MOUNTED, SWING PATTERN, WITH REMOVABLE CAP, RE-GRINDABLE DISC AND SEAT RING. CHECK VALVES SIZED 2" AND SMALLER SHALL BE BRONZE BODY, SCREWED ENDS, SWING PATTERN. PROVIDE SPRING LOADED, SILENT ACTION, NON-SLAM TYPE CHECK VALVE WITH REMOVABLE CAP, RE-GRINDING DISC AND SEAT RING IN ALL VERTICAL INSTALLATIONS AND DISCHARGE PIPING FROM PUMPS AS MANUFACTURED BY SMOLENSKY, MUELLER, WILLIAMS-HAGER OR MILLER.
7. BALL VALVES SHALL BE PROVIDED WITH STAINLESS STEEL BALL, STEM AND SEAT RING, TIE BUSHING AND SEAT RING GASKET. BALL VALVES INSTALLED IN COPPER SYSTEMS SHALL HAVE BRONZE BODIES. BALL VALVES SHALL BE RATED FOR A MINIMUM OF 275 PSI @ 100 DEGREE F. BALL VALVES USED FOR THROTTLING (3" AND 3R" SMALLER) SHALL BE PROVIDED WITH A LOCKING BALANCING STOP.
8. STRAINERS OF SARCO OR MUELLER MANUFACTURER SHALL BE PROVIDED IN THE INLET PIPING TO EACH STEAM TRAP. MAKE UP

- CONNECTION, PUMP, AND AUTOMATIC CONTROL VALVE OF STEAM AND HYDRONIC SYSTEMS. STRAINERS SHALL BE Y-STRIPER UNLESS OTHERWISE SPECIFIED ON DRAWINGS. STRAINERS SHALL BE OF DESIGN TO ALLOW BLOW-DOWN OF ACCUMULATED DEBRIS AND TO FACILITATE REMOVAL AND REPLACEMENT OF THE STRAINER SCREEN WITHOUT DISCONNECTION FROM THE MAIN PIPING. STRAINERS INSTALLED IN COPPER SYSTEMS SHALL HAVE BRONZE BODIES. STRAINER BASKET SHALL BE NICKEL, COPPER, BRASS OR STAINLESS STEEL OF AMPLE STRENGTH TO PREVENT COLLAPSING UNDER SHOCK LOADING. PERFORATIONS SHALL BE AS FOLLOWS: STEAM=1/32", WATER UP TO 3" SIZE=1/16", WATER 4" AND OVER=1/8", FOR STRAINERS 2-1/2" AND LARGER, PROVIDE A VALVE DIRT BLOW-OUT PIPING CONNECTION TERMINATED WITH A PIPE NIPPLE AND CAP. STRAINERS 2" AND SMALLER SHALL HAVE 6" LONG BLOW-OFF NIPPLE WITH CAPPED END.

N. COMBINATION FLOAT AND THERMOSTATIC TRAPS (0-15 PSI):

1. COMBINATION FLOAT AND THERMOSTATIC TRAPS SHALL HAVE A VALVE MECHANISM, THE POSITION OF WHICH IS CONTROLLED BY A CLOSED, STAINLESS STEEL BALL FLOAT. THE SEAT OF THE VALVE WILL BE WATER TIGHT AT ALL TIMES. THE ACTION OF THIS TYPE OF TRAP MUST DISCHARGE THE CONDENSATE AS SOON AS IT ENTERS THE TRAP AND ITS RATE OF DISCHARGE MUST BE PROPORTIONATE TO THE RATE OF THE FLOW OF CONDENSATE TO THE TRAP.
2. THE TRAP SHALL BE PROVIDED WITH AN AUTOMATIC THERMOSTATIC AIR BYPASS OF THE BALANCED PRESSURE, MULTIPLE BELLOWS TYPE.
3. ALL WORKING PARTS SHALL BE OF NON-CORROSIVE METAL (HARD BRONZE, MONEL OR STAINLESS STEEL) AND SHALL BE REMOVABLE WITHOUT DISCONNECTING THE PIPING. FLOATS TO BE OF STAINLESS STEEL. VALVE HEADS AND SEATS TO BE STAINLESS STEEL.
4. BODY AND COVER TO BE OF HIGH GRADE CAST IRON SUITABLE FOR 125 PSI (86 KPA) PRESSURE FOR A 0-15 PSI (0-130 KPA) LINE, SIMILAR TO SARCO FT-15, OR APPROVED EQUAL.

O. THERMOMETERS AND PRESSURE GAUGES:

1. PROVIDE PIPE THERMOMETERS WITH SEPARABLE SOCKETS IN THE ENTERING AND LEAVING WATER PIPING CONNECTIONS TO COOLING TOWERS, CHILLERS, HEAT EXCHANGES, HEATING, COOLING AND CONDENSER COILS. THERMOMETERS SHALL BE WEISS, WEKSLER, THERCIE OR OTHER APPROVED MANUFACTURER AND SHALL BE MINIMUM OF 4-1/2" DIA. TYPE, ALUMINUM FLANGELESS CASE FURNISHED WITH MICROMETER ADJUSTABLE POINTER. THERMOMETER SHALL HAVE A 1% ACCURACY AND MIDPOINT AS SYSTEM OPERATING TEMPERATURE.
2. PROVIDE LIQUID FILLED PRESSURE GAUGES ON INLET AND OUTLET WATER PIPING CONNECTIONS TO ALL PUMPS AND OTHER WATER HEAT EXCHANGE APPARATUS INCLUDING WATER COILS, HEAT EXCHANGERS, CHILLERS. EACH PRESSURE GAUGE INSTALLATION SHALL INCLUDE A 1/4" BALL VALVE FOR ITS CONNECTION TO PIPING. PRESSURE GAUGES SHALL BE WEISS, WEKSLER, THERCIE OR OTHER APPROVED MANUFACTURER AND SHALL BE MINIMUM OF 4-1/2" DIA. TYPE, CAST ALUMINUM CASE, STEEL MOVEMENT, MICROMETER ADJUSTABLE POINTER, 1% ACCURACY AND MIDPOINT AT SYSTEM OPERATING PRESSURE.

P. PIPE TESTING:

1. NO TESTING SHALL BE CONDUCTED UNTIL PIPE CLEANING AND PRETREATMENT HAS BEEN COMPLETED AND RECORDED.
2. ALL TESTING SHALL BE COORDINATED BY THE CONTRACTOR AND SHALL BE WITNESSED BY A BUILDING OWNERS REPRESENTATIVE. ALL SYSTEMS WHICH FAIL THE PRESSURE TESTS SHALL BE FIXED AND RETESTED AT NO EXPENSE TO THE OWNER.
3. ISOLATE ALL EQUIPMENT WHICH IS TO BE EXCLUDED FROM THE PRESSURE TEST AND PROVIDE ALL TEMPORARY PIPING CONNECTIONS, FITTINGS, VALVES, EQUIPMENT, LABOR, ETC., TO PRESSURE TEST ALL SYSTEMS.
4. ALL TENANT WATER SYSTEM SHALL BE ISOLATED FROM THE BASE BUILDING SYSTEM.
5. CHILLED WATER, CONDENSER WATER, AND STEAM SYSTEMS WILL BE HYDROSTATICALLY TESTED WITH WATER AT 1-1/2 TIMES THE WORKING PRESSURE, FOR A MINIMUM PERIOD OF TWO HOURS, WITH NO LEAKS.
6. REFRIGERANT PIPING SHALL BE TESTED IN ACCORDANCE WITH ASHRAE 15-2013 AND ASHRAE 2014 REFRIGERATION HANDBOOK. BETWEEN PIPE OR PIPE INSULATION AND SLEEVE SHALL BE CAULKED WITH A NON-COMBUSTIBLE MATERIAL TO WITHIN 1/4" OF WALL PAGES AND FILLED WITH CAULKING COMPOUND FOR INTERIOR SLEEVES. EXTERIOR SLEEVES OR WATERPROOF SLEEVES SHALL UTILIZE LINK SEAL (LS) TYPE TO FILL THE ANNULUS. PROVIDE EPOXYCOHESION ON ALL EXPOSED PIPING THROUGH WALLS OR FLOORS HELD IN PLACE WITH SCREWS.
7. ALL REFRIGERATION AND OIL LOST DURING GUARANTEE PERIOD SHALL BE REPLACED BY THE CONTRACTOR AT NO EXPENSE TO THE OWNER.
8. FUEL, OIL PIPING CARRIER AND OUTER CONDUIT SHALL BE TESTED WITH WATER TO HYDROSTATIC PRESSURE AT 1-1/2 TIMES THE OPERATING PRESSURE OR 50 PSI WHICHEVER IS GREATER. ALL CONNECTION SHALL BE CHECKED FOR LEAKS WITH SOAP SOLUTION. VACUUM TESTS SHALL BE PERFORMED ON ALL FUEL OIL SUCTION LINES AS REQUIRED BY CODE.
9. HIGH PRESSURE STEAM PIPING WELDS SHALL BE X-RAY TESTED IN ACCORDANCE WITH NEW YORK CITY CODE REQUIREMENTS. TESTING SHALL BE DONE BY AN INDEPENDENT TESTING LABORATORY. PROVIDE CERTIFICATION OF TEST AS WELL AS X-RAYS TO OWNER UPON COMPLETION.

Q. REFRIGERATION SYSTEMS:

1. PROVIDE ALL REFRIGERANT PIPING REQUIRED FOR A COMPLETE REFRIGERATION SYSTEM, WITH ALL VALVES, FITTINGS AND SPECIALTIES NECESSARY FOR SATISFACTORY OPERATION IN ACCORDANCE WITH ASHRAE STANDARD 15-1994 OR LATEST EDITION AND ALL AUTHORITIES HAVING JURISDICTION. REFRIGERATION SYSTEM SHALL INCLUDE ALL REQUIRED ITEMS FOR CHARGING, DRAINING AND PURGING THE SYSTEM.
2. JOINTS IN REFRIGERATION PIPING SHALL BE BRAZED. REFRIGERANT PIPING SHALL BE OF THE SIZE RECOMMENDED BY THE MANUFACTURER AND AS APPROVED BY THE ENGINEER.
3. HORIZONTAL PIPING OF THE COMPRESSOR SUCTION AND DISCHARGE LINES AND THE CONDENSER DISCHARGE LINES SHALL BE PITCHED A MINIMUM OF 1/2" IN 10' IN THE DIRECTION OF REFRIGERANT FLOW. EACH SUCTION GAS VERTICAL RISER SHALL BE TRAPPED AT ITS EVAPORATOR WITH A TRAP AS RECOMMENDED BY THE COMPRESSOR MANUFACTURER.
4. INSTALL REFRIGERANT PIPING TO PREVENT EXCESSIVE OIL FROM BEING TRAPPED IN THE SYSTEM. ANY ADDITIONAL RISERS OR EQUALIZER LINES REQUIRED BY THE MANUFACTURER OF EQUIPMENT FOR THE PROPER SYSTEM OPERATION SHALL BE INSTALLED AS PART OF THIS CONTRACT. PROVIDE A FULLY PIPED OIL SEPARATOR FOR EACH REFRIGERANT SYSTEM AS PER MANUFACTURERS RECOMMENDATIONS.
5. VALVES SHALL BE DESIGNED FOR REFRIGERANT SERVICE. SHUTOFF VALVES SHALL BE BRASS PACKLESS TYPE. UNIONS, FLANGED VALVES OR FITTINGS SHALL BE PROVIDED FOR OR DISCONNECTING EQUIPMENT, CONTROLS, ETC., FOR MAKING REPAIRS. PIPING SHALL BE RUN IN A SINGLE LAYER, WITH EACH LINE ISOLATED FROM ANOTHER TO PREVENT RUBBING. PROVISION SHALL BE MADE FOR EXPANSION AND CONTRACTION OF PIPING. ALL PIPING PASSING THROUGH WALLS, PARTITIONS, ETC. SHALL BE PROVIDED WITH SLEEVES AS REQUIRED.
6. REFRIGERANT PIPING PASSING THROUGH RATED FLOORS OR DEMISING WALLS SHALL BE ENCLOSED IN A RIGID AND GAS-TIGHT CONTINUOUS FIRE-RESISTING PIPE DUCT OR SHAFT VENTED TO THE OUTSIDE, IN ACCORDANCE WITH ASHRAE STANDARD 15-1994 OR LATEST EDITION. PIPE CONDUIT SHALL BE SCHEDULE 40 BLACK STEEL FILE STOPPED AT BOTH ENDS, REFER TO DOUBLE PIPE ENCASED REFRIGERANT PIPING DETAIL.
7. REFRIGERANT PIPING TESTING:
- A) THE REFRIGERANT PIPING FOR TIGHTNESS AND LEAKS UNDER PRESSURE OR VACUUM. THE DURATION OF EACH TEST SHALL BE TWENTY-FOUR (24) HOURS.
- B) TEST JOINTS IN ACCORDANCE WITH ASHRAE 15-1994. THERE SHALL BE NO OBSERVABLE LEAKS OR CHANGES IN PRESSURE. IF EITHER IS OBSERVED, SEAL LEAKS, AND REPEAT TEST PROCEDURES.

2.04 INSULATION REQUIREMENTS

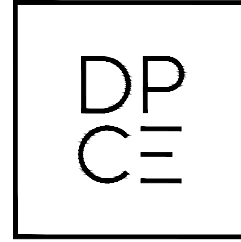
- A. INSULATION SHALL BE APPLIED TO PIPING AND DUCTWORK OF MATERIALS AS SPECIFIED HEREIN AND FOR APPLICABLE SYSTEMS OF THIS PROJECT. INSULATION SHALL HAVE A FLAME SPREAD RATING NOT EXCEEDING 25 AND A SMOKE DEVELOPED INDEX OF 50 OR LESS AND SHALL MEET THE REQUIREMENTS OF ASTM, NFPA.
- B. INSULATION SHALL BE CONTINUOUS THROUGH WALL AND SLAB SLEEVE OPENINGS EXCEPT FOR RATED WALLS OR SLABS WHERE AN APPROVED FIRESTOP IS REQUIRED AS PER NFPA.
- C. INSULATION OF COLD SURFACES WHERE VAPOR BARRIER JACKETS ARE SPECIFIED SHALL BE APPLIED WITH AN UNBROKEN VAPOR SEAL. HANGERS AND SUPPORTS THAT ARE SECURED TO COLD SURFACES SHALL BE ADEQUATELY INSULATED TO PREVENT CONDENSATION.
- D. WHERE INSULATION IS SPECIFIED FOR PIPING, INSULATE SIMILARLY ALL CONNECTIONS, VENTS, DRAINS, FLANGES, FITTINGS, VALVES, TANKS, PUMP CASINGS AND OTHER PARTS OF THE SYSTEM SUBJECT TO HEAT GAIN OR LOSS AND TO PREVENT CONDENSATION.
- E. ALL EQUIPMENT, FITTINGS, DEVICES, ETC. REQUIRING SERVICING OR INSPECTION SHALL HAVE REMOVABLE INSULATION WHICH CAN BE REPLACED WITHOUT DAMAGE.
- F. ALL LEAK AND PRESSURE TESTS SHALL BE COMPLETED PRIOR TO THE INSTALLATION OF ANY INSULATION.
- G. DUCTWORK INSULATION:
1. ALL NEW AND EXISTING SHEET METAL DUCTWORK SHALL BE INSULATED WITH FLEXIBLE DUCT WRAP INSULATION, OF REQUIRED THICKNESS AND DENSITY TO ACHIEVE A MINIMUM INSTALLED R-8 INSULATIVE VALUE AT 75 DEGREES F MEAN TEMPERATURE WHEN LOCATED WITH A CONDITIONED SPACE AND A MINIMUM INSTALLED R-8 INSULATION VALUE WHEN LOCATED IN AN UNCONDITIONED SPACE. INSULATION TO BE PROVIDED WITH REINFORCED FOIL FACED, FLAME RESISTANT, ALUMINUM FOIL VAPOR BARRIER. ALL INSULATION SHALL BE SECURED WITH DUCT ADHESIVE AND SEAMS SEALED BY TWO-INCH SEALING LIP WITH ADHESIVE AND FASTENED WITH 16 GAUGE RUST RESISTANT WIRE OR FIBERGLASS CORD ON 12" CENTERS. ON DUCTS OVER 24" WIDE, WELDING BEAMS AND CLIPS SHALL BE USED ON THE UNDERSIDE FOR FASTENING INSULATION.
2. OUTDOOR DUCTWORK OR DUCTWORK EXPOSED TO THE ELEMENTS SHALL HAVE TWO (2) COATS OF WEATHERPROOF MASTIC AND TWO (2) LAYERS OF GLASS CLOTH EMBED INTO WET COAT APPLIED OVER RIGID DUCT INSULATION OF REQUIRED THICKNESS AND DENSITY TO ACHIEVE A MINIMUM INSTALLED R-8 INSULATIVE VALUE AT 75 DEGREES F MEAN TEMPERATURE. INSULATION TO BE PROVIDED WITH WHITE VINYL FOIL BARRIER FACING. SMOOTH MEMBRANE TO AVOID WRINKLES AND OVERLAP ALL SEAMS AT LEAST 3". APPLY A SECOND COAT OF SAME COATING TO THE ENTIRE SURFACE. TOP CENTER OF RECTANGULAR DUCT SHALL BE PITCH TO EACH SIDE TO AVOID TRAPPING OF WATER IN THE CENTER.
3. OUTDOOR DUCTWORK OR DUCTWORK EXPOSED TO THE ELEMENTS SHALL BE WRAPPED IN A SELF ADHESIVE MEMBRANE APPLIED OVER RIGID DUCT INSULATION OF REQUIRED THICKNESS AND DENSITY TO ACHIEVE A MINIMUM INSTALLED R-8 INSULATIVE VALUE AT 75 DEGREES F MEAN TEMPERATURE. INSULATION TO BE PROVIDED WITH WHITE VINYL FOIL BARRIER FACING. SMOOTH MEMBRANE TO AVOID WRINKLES AND OVERLAP ALL SEAMS AT LEAST 3". APPLY A SECOND COAT OF SAME COATING TO THE ENTIRE SURFACE. TOP CENTER OF RECTANGULAR DUCT SHALL BE PITCH TO EACH SIDE TO AVOID TRAPPING OF WATER IN THE CENTER. SELF ADHESIVE MEMBRANE SHALL BE POLYGUARD OR EQUAL.
- H. PIPING INSULATION:
1. CONDENSATE DRAIN AND DOMESTIC WATER MAKE-UP PIPING SHALL BE INSULATED WITH 1" THICK MOLDED GLASS FIBER WITH A MAXIMUM K FACTOR OF 0.27 AT 75 DEGREE F MEAN TEMPERATURE AND FACTORY APPLIED VAPOR BARRIER JACKET.
2. REFRIGERANT LIQUID AND SUCTION PIPING SHALL BE INSULATED WITH 1-1/2" THICK MOLDED GLASS FIBER FOR PIPE SIZES UP TO 1-1/2" INCHES IN DIAMETER AND 1-1/2" THICK FOR PIPE SIZES LARGER THAN 1-1/2" INCHES IN DIAMETER. INSULATION SHALL HAVE A MAXIMUM K FACTOR OF 0.27 AT 75 DEGREE F MEAN TEMPERATURE AND FACTORY APPLIED VAPOR BARRIER JACKET.
3. OUTDOOR PIPING:
- A) INSULATION ON OUTDOOR PIPING SHALL BE TWICE THE THICKNESS LISTED FOR INDOOR PIPE BUT NOT LESS THAN 4". HEAT TRACE IF USED IN WINTER OR NOT DRAINED.
- B) PROVIDE JACKETS MADE OF 0.016" ALUMINUM HELD WITH A FRICTION TYPE, Z-LOCK AND ALUMINUM BANDS. PROVIDE A MOISTURE BARRIER LINING.
- C) IF PIPING IS TO BE ACTIVE DURING THE WINTER MONTHS, PIPING IS TO BE PROVIDED WITH HEAT TRACING. HEAT TRACING SHALL BE RAYCHEM MODEL XL-TRACE HEAT TRACE SELF REGULATING SYSTEM OR APPROVED EQUAL. THE SYSTEM SHALL BE UL LISTED, CSA CERTIFIED OR FM APPROVED FOR THE INTENDED USE.
- D) COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL HEAT TRACING REQUIREMENTS AND PIPING LENGTH REQUIREMENTS. ELECTRICAL TO PROVIDE CABLEING AND THERMOSTAT.
4. ALL PIPING INSULATION TO BE INSTALLED WITH LONGITUDINAL LAP AND VAPOR BARRIER JOINT SEAL STRIPS WITH ADHESIVE OR SELF-SEALING LAPS, FITTINGS, FLANGES, AND VALVES SHALL BE INSULATED WITH PRE-MOLDED AND PRE-CUT FITTINGS WITH METERED SEGMENTS.

2.05 ACOUSTICAL TREATMENT

- A. ACOUSTICAL LINING SHALL MEET THE MINIMUM THERMAL INSULATION VALUE OF R-6 OR A MAXIMUM K FACTOR OF 0.24 AT 1.5" THICKNESS WITH A MEAN TEMPERATURE OF 75 DEGREE F.
- B. ACOUSTICAL LINING SHALL MEET THE MINIMUM THERMAL INSULATION VALUE OF R-4.2 OR A MAXIMUM K FACTOR OF 0.24 AT 1" THICKNESS WITH A MEAN TEMPERATURE OF 75 DEGREE F.
- C. INSTALL LINER IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS. COMPLETELY COVER ALL PORTIONS OF DUCTWORK PLENUMS AND CASINGS WITH APPROVED ADHESIVE. INSTALL LINER WITH ALL TRAVERSE JOINTS NEATLY BUTTED WITH NO INTERRUPTIONS OR GAPS. COVER ALL EXPOSED EDGES, JOINTS, MECHANICAL FASTENERS AND ANY DAMAGED AREAS WITH ADHESIVE. PROVIDE METAL NOSING AT EQUIPMENT DISCHARGES AND AT END EDGES OF LINING. SECURE LINER WITH APPROVED MECHANICAL FASTENERS INSTALLED IN ACCORDANCE WITH SMACNA DUCT LINER APPLICATION STANDARD.
- D. DO NOT EXTERNALLY INSULATE ACOUSTICALLY LINED DUCTS.
- E. DO NOT INTERNALLY LINE DUCTWORK WHICH IS A PART OF AN OUTSIDE AIR SYSTEM WHICH DISTRIBUTES UNCONDITIONED AIR.
- F. FURNISH AND INSTALL ACOUSTICAL LINING IN DUCTWORK, PLENUMS AND CASINGS AS SHOWN ON THE DRAWINGS AND AS SPECIFIED BELOW:
1. ALL DUCTS WITH DUCT VELOCITIES GREATER THAN 2,000 FPM SHALL HAVE ACOUSTICAL LINING FACED WITH 24 GAUGE PERFORATED ALUMINUM OR GALVANIZED STEEL SUPPORTED 12" ON CENTER.
2. A MINIMUM DISTANCE OF 20 FEET FROM ALL AIR CONDITIONING UNIT INLETS AND DISCHARGES.

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MECHANICAL SPECIFICATIONS (CONT.)

3.

ALL RETURN/EXHAUST FANS SHALL BE ACOUSTICALLY LINED FOR A MINIMUM DISTANCE OF 20 FEET OF THE FAN INTAKE AND DISCHARGE OPENING.
4.

ALL TRANSFER DUCTS SHALL BE PROVIDED WITH 1" THICK ACOUSTICAL LINING FOR ACOUSTICAL PURPOSES ONLY.
5.

ALL DUCTWORK PASSING THROUGH OR SERVING CONFERENCE AND MEETING ROOMS SHALL BE PROVIDED WITH ACOUSTICAL LINING.
6.

ALL EXPOSED DUCTWORK.
- 2.06 VIBRATION ISOLATION SYSTEMS

A.

ALL ROTATING, REVOLVING OR RECIPROCATING EQUIPMENT, INCLUDING PIPING CONNECTIONS TO THIS EQUIPMENT SHALL BE ACOUSTICALLY ISOLATED TO PREVENT THE TRANSMISSION OF OBJECTIONABLE NOISES, SOUND OR VIBRATIONS TO THE OCCUPIED SPACES AND TO THE BUILDING STRUCTURES. ALL VIBRATION ISOLATION PRODUCTS SHALL BE SPECIFICALLY DESIGNED FOR THEIR INTENDED USE.

B.

STATIC DEFLECTION OF ISOLATORS SHALL BE A MINIMUM OF 90% EFFICIENT.

C.

MANUFACTURER OF VIBRATION ISOLATION EQUIPMENT SHALL DETERMINE VIBRATION ISOLATOR SIZES AND LOCATIONS, PROVIDE SUITABLE PIPING AND EQUIPMENT VIBRATION ISOLATION SYSTEMS, GUARANTEE SPECIFIED ISOLATION SYSTEM ATTENUATION AND DEFLECTION, AND PROVIDE INSTALLATION INSTRUCTIONS, DRAWINGS AND FIELD SUPERVISION TO ASSURE PROPER INSTALLATION AND PERFORMANCE.

D.

MOUNTING TYPES:

1.

PROVIDE TYPE SLR SPRING ISOLATORS FOR ROOF MOUNTED EQUIPMENT AND TYPE SLF SPRING ISOLATORS FOR INDOOR EQUIPMENT SUCH AS FLOOR AND ROOF MOUNTING OF FACTORY ASSEMBLED AIR HANDLING UNITS, AIR CONDITIONING UNITS, PUMPS AND CONDENSING UNITS.

2.

PROVIDE SPRING ISOLATORS TYPE 30N FOR CEILING-SUPPORTED FANS, IN-LINE PUMPS, HEAT EXCHANGERS, AND AIR HANDLING UNITS. PROVIDE 1" MINIMUM STATIC DEFLECTION.

3.

PACKAGED AIR CONDITIONING UNITS WITH INTERNAL ISOLATION OF COMPRESSORS, PROVIDE EXTERNAL SPRINGS (TYPE SLR RESTRAINED FOR FLOOR MOUNTING AND 30N FOR CEILING MOUNTED) WITH 1" MINIMUM STATIC DEFLECTION.

4.

SUPPORT OF PIPING EXPOSED ON ROOF AND IN EQUIPMENT ROOMS:

A)

FLOOR SUPPORTED PIPING ISOLATORS (TYPE SLR).

B)

VERTICAL RISER PIPING ANCHOR AND GUIDES (TYPE ADA).

C)

CEILING SUPPORTED PIPING ISOLATORS (TYPE 30N).

5.

PROVIDE FLEXIBLE CONNECTIONS BETWEEN ALL FANS, AHU, AC UNITS AND DUCTWORK AS PER DUCTWORK SPECIFICATION SECTION.

E.

SPRING TYPE 30N HANGERS SHALL BE PROVIDED FOR PIPING FOR A DISTANCE OF 50 FEET OR 50 PIPE DIAMETERS, WHICHEVER IS GREATER, UP AND DOWNSTREAM OF ALL POWER DRIVEN EQUIPMENT. THE HANGER SHALL PROVIDE 1" OF STATIC DEFLECTION FOR PIPES 4" OF OUTSIDE DIAMETER AND LARGER AND 1/2" STATIC DEFLECTION FOR PIPES SMALLER THEN 4" OUTSIDE DIAMETER.

F.

VIBRATION ISOLATORS FOR FLOOR OR CEILING SUPPORTED EQUIPMENT SHALL HAVE A MAXIMUM LATERAL MOTION UNDER EQUIPMENT START-UP OR SHUT-DOWN CONDITIONS OF 1/4" AND MOTIONS IN EXCESS SHALL BE RESTRAINED BY SPRING TYPE MOUNTINGS.

G.

ALL ISOLATORS INSTALLED OUTDOORS SHALL BE PROVIDED WITH CORROSION PROTECTION.

H.

VIBRATION ISOLATOR SHALL BE PROVIDED BY MASON INDUSTRIES, VIBRATION ELIMINATOR CO., CONSOLIDATED KINETICS CO., OR APPROVED EQUAL.

PART 3- EXECUTION

3.01 A.

PROVIDE AND INSTALL ALL EQUIPMENT AND ACCESSORIES OF THE SIZES AND CAPACITIES AS SCHEDULED AND AS INDICATED ON THE DRAWINGS AND IN ACCORDANCE WITH APPROVED SHOP DRAWINGS AND MANUFACTURERS RECOMMENDATIONS. PROVIDE ALL MOTOR STARTERS AS REQUIRED; MOTOR STARTERS WILL BE INSTALLED BY THIS CONTRACTOR AND WIRED BY ELECTRICAL TRADE.

Q.

CONTRACTOR IS RESPONSIBLE FOR MAINTAINING ALL REQUIRED CLEARANCES FOR SERVICING AND MAINTENANCE. COORDINATE REQUIREMENTS WITH ALL TRADES.

R.

IDENTIFICATION OF EQUIPMENT AND CONTROLS:

1.

ALL EQUIPMENT SHALL BE STENCILED OR LABELED WITH LAMACOID PLATES SCREWED THEREON WHICH SHALL INDICATE SYSTEMS SERVICE.

2.

MOTOR STARTERS SHALL BE PROVIDED WITH LAMACOID PLATES WHICH INDICATE SYSTEM SERVED.

3.

CONTRACTOR TO SUBMIT LIST OF EQUIPMENT TO RECEIVE LABELS AND THE COORDINATED DESIGNATIONS, SIZE OF LABEL LETTERING, PLATE SIZE AND COLOR FOR REVIEW PRIOR TO INSTALLATION.

3.02 CHEMICAL CLEANING AND PRETREATMENT

A.

CLEANING OF PIPING SHALL BE PERFORMED IN THE PRESENCE OF A BUILDING REPRESENTATIVE.

B.

PROVIDE ALL DISPERSANTS, SCALE INHIBITORS AND CORROSION INHIBITORS AS REQUIRED FOR CLEANING AND TREATING ALL PIPING SYSTEMS. CHROMATES SHALL NOT BE USED.

C.

ALL CHEMICALS TO BE USED FOR PIPE CLEANING SHALL BE APPROVED BY THE BASE BUILDING CHEMICAL TREATMENT COMPANY.

D.

FLUSH PIPING SYSTEMS WITH THE APPROVED CLEANING CHEMICAL TO REMOVE PIPE DOPE, SLUSHING COMPOUNDS, CUTTING OILS AND OTHER LOOSE EXTRANEIOUS MATERIALS. SEAL ENDS AFTER CLEANING.

E.

THE CONTRACTOR SHALL:

1.

SATISFY EACH CHEMICAL HAS THE PROPER FEED RATES FOR CLEANING AND PRETREATMENT OF EACH SYSTEM AND RECORD.

2.

CHECK THAT THE CLEANING SOLUTION IS ACTUALLY IN EACH SYSTEM.

3.

SATISFY WHEN TO FLUSH THE SYSTEM.

4.

CHECK EACH SYSTEM FOLLOWING FLUSHING TO ENSURE CLEANING CHEMICALS HAVE BEEN REMOVED FROM EACH SYSTEM AND TEST TO ENSURE PH OF NEW SYSTEM IS WITHIN 0.5 OF FRESH INCOMING WATER.

F.

BLOCK MODULATING VALVES, ZONE VALVES AND OTHER SYSTEM RESTRICTIONS. PROVIDE BY PASS PIPING AND VALVING TO ISOLATE NEW AND EXISTING TO BE RE-USED EQUIPMENT SUCH AS CHILLERS, COILS, HEAT EXCHANGERS, ETC. FROM THE CLEANING PROCESS.

G.

PROVIDE PORTABLE PUMPS TO CIRCULATE WATER FOR CLEANING PURPOSES AT RESPECTIVE FLOWS FOR FOUR (4) HOURS. REMOVE AND CLEAN STRAINERS. BLOW OFF LOW POINTS WITH STEAM AFTER CLEANING AND BEFORE TRAPS ARE INSTALLED. DRAIN ENTIRE SYSTEM.

3.03 EQUIPMENT START-UP AND TESTING

A.

UPON COMPLETION OF THE INSTALLATION, THIS CONTRACTOR SHALL ENSURE THAT ALL EQUIPMENT AND SYSTEMS ARE TESTED AND BALANCED UNDER FIELD OPERATING CONDITIONS TO DEMONSTRATE ITS COMPLIANCE WITH SPECIFICATION REQUIREMENTS.

B.

SHOULD ANY PART OF THE EQUIPMENT OR SYSTEM FAIL TO MEET THE CONTRACT REQUIREMENTS, THIS CONTRACTOR SHALL ADJUST, REPAIR OR REPLACE ALL DEFECTIVE OR INOPERATIVE PARTS AND AGAIN CONDUCT THE COMPLETE START-UP TEST.

C.

SUBMIT SYSTEM START UP SHEETS AND TEST RESULTS TO THE OWNER AND ENGINEER.

3.04 ELECTRICAL WORK

A.

ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR POWER WIRING UNDER A SEPARATE DIVISION OF CONTRACT WORK. AUTOMATIC TEMPERATURE, SAFETY AND INTERLOCKING CONTROLS FOR MOTORS, MOTOR STARTERS AND OTHER ELECTRICAL APPARATUS AND DEVICES SHALL BE PROVIDED BY THE HVAC CONTRACTOR. CONTROL WIRING SHALL

INCLUDE BUT NOT LIMITED TO ALL 12, 24, AND 120 VOLT WIRING.

B.

THE MECHANICAL CONTRACTOR SHALL PREPARE AND SUBMIT FOR APPROVAL TERMINAL POINT TO TERMINAL POINT, COMPLETELY COORDINATED AND INTEGRATED WIRING DIAGRAMS FOR ALL WIRING REQUIRING FIELD INSTALLATION BY THE ELECTRICAL CONTRACTOR.

C.

SPECIFIC WIRING DIAGRAMS OF FACTORY INSTALLED EQUIPMENT WIRING SHALL ALSO BE SUBMITTED FOR APPROVAL AND FURNISHED TO THE ELECTRICAL CONTRACTOR FOR HIS INSTALLATION REQUIREMENTS AND OTHER USES.

D.

HVAC CONTRACTOR SHALL MAINTAIN ALL EXISTING CONTROL CONNECTIONS FOR STARTERS TO BE REUSED. CONTRACTOR SHALL COORDINATE EXISTING CONDITIONS AND PROVIDE ALL CONTACTS AND RELAYS REQUIRED FOR EXISTING STARTERS TO BE REPLACED WITH NEW.

E.

HVAC CONTRACTOR SHALL COORDINATE WITH THE ELECTRICAL CONTRACTOR FOR THE INSTALLATION OF DUCT DETECTORS. DUCT DETECTOR SHALL BE FURNISHED AND WIRED BY THE ELECTRICAL CONTRACTOR AND MOUNTED BY THE HVAC CONTRACTOR.

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DESIGNATION	EVAPORATOR UNIT											CONDENSING UNIT													COMMENTS		
	CAPACITY			ENT. AIR (°F)	LVG. AIR (°F)	SUPPLY FAN		ELECTRICAL		WEIGHT (LBS)	DIMENSIONS (LxWxH)	MANUFACTURER/ MODEL	DESIGNATION	TOTAL (MBH)	SENS. (MBH)	COMPRESSOR		CFM	EXT. SP	VFD	AMB. (°F)	ELECTRICAL VOLT/Ø/Hz	COMPRESSOR MCA	WEIGHT (LBS)		DIMENSIONS (LxWxH)	MANUFACTURER/ MODEL
	NOMINAL (TONS)	COOLING (MBH)	HEATING (MBH)			EXT. SP	CFM	VOLT/Ø/Hz	EVAP. FLA							QTY	LRA/RLA (EACH)										
AC-1	3	33.2	25.6	80	67	0.5	1085	208/1/60	2	169	22X21.5X53.62	LENNOX / CBA25UH-036	ACCU-1	34.2	25	1	24.7 / -	-	-	NO	95	208/1/60	19	190	28.25X28.25X33.25	LENNOX / ML14XC1S036-230	--
AC-2	4	46.4	38.5	80	67	0.5	1,360	208/1/60	7.6	179	22X21.5X55	LENNOX / CBA25UH-048	ACCU-2	46.4	33.5	1	27.8 / -	-	-	NO	95	208/1/60	24	218	28.25X28.25X37.25	LENNOX / ML14XC1-048-230	--

SPLIT AIR COOLED AIR CONDITION UNIT SCHEDULE NOTES (TYPICAL FOR EACH UNIT):

- UNITS MOUNTED WITH SECTIONS ADJACENT TO BE PROVIDE WITH SINGLE POWER CONNECTION POINT.
- PROVIDE SPRING TYPE VIBRATION UNDER EACH UNIT SECTION. REFER TO SPECIFICATIONS FOR FURTHER INFO.
- PROVIDE COMBINATION STARTER AND DISCONNECT FOR EACH UNIT/SECTION AS REQUIRED.
- SPEED CONTROLLERS TO BE MOUNTED TO EVAPORATOR SECTION CASINGS FOR BALANCING PURPOSES.
- CONTRACTOR TO PROVIDE INTERCONNECTING INDOOR AND OUTDOOR SECTIONS AS REQUIRED TO MAKE SYSTEM FUNCTIONAL.
- PROVIDE LOW AMBIENT CONTROL FOR EACH SYSTEM.
- OPTIONAL UNIT ORIENTATIONS ARE AVAILABLE. CONTRACTOR TO COORDINATE REQUIRED UNIT ORIENTATIONS PER PLANS OR FIELD CONDITIONS.
- ALL REFRIGERANT PIPING SHALL BE SIZED AS PER MANUFACTURER'S RECOMMENDATIONS.
- CONTRACTOR TO PROVIDE ALL NECESSARY ACCESSORIES AND REFRIGERANT SPECIALTIES REQUIRED FOR REFRIGERANT PIPING RUNS.
- SEE EQUIPMENT SPECIFICATIONS FOR ADDITIONAL INFORMATION.

[illegible]

DESIGNATION	DESCRIPTION	NECK SIZE	FRAME SIZE	CFM RANGE	MAX NC	MANUFACTURER/ MODEL	COMMENTS
CD-1	CEILING DIFFUSER	4Ø	12X12	35-100	25	TITUS TMS	SEE NOTES
CD-2	CEILING DIFFUSER	8Ø	24X24	140-340	25	TITUS TMS	SEE NOTES
CR	CEILING RETURN	--	24X24	0-1600	25	TITUS PAR	PLENUM RETURN GRILLE, NO NECK

AIR OUTLET SCHEDULE NOTES (TYPICAL FOR EACH OUTLET):

1. INSTALL FOUR (4) WAY DIFFUSER UNLESS OTHERWISE NOTED. PROVIDE BLANK OFF BAFFLES FOR DIFFUSERS SHOWN TO HAVE 2-WAY AND 3-WAY PATTERNS. INCREASE NECK SIZES AS REQUIRED TO COMPENSATE FOR BLANKED-OFF AREA.
2. DIFFUSERS SHALL BE SUITABLE FOR THE TYPE OF CEILINGS CONSTRUCTION BEING INSTALLED IN.
3. DIFFUSERS THAT SERVE AREAS WITHOUT HUNG CEILINGS SHALL BE SUITABLE FOR DUCTWORK MOUNTING.
4. FINISHES SHALL BE AS SPECIFIED BY THE ARCHITECT.
5. SEE EQUIPMENT SPECIFICATIONS FOR ADDITIONAL INFORMATION.