MECHANICAL SPECIFICATIONS:

01 00 00 - GENERAL

1. INTENT OF PROJECT IS FOR NEW MATERIALS AND COMPONENTS TO MATCH EXISTING. ALL MATERIALS SHALL BE APPROVED BY MAINE MEDICAL CENTER.
2. REVIEW PROTOCOL AND PROCEDURES WITH SOUTHERN MAINE HEALTH CARE PRIOR TO COMMENCING WORK. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING MAINE MEDICAL CENTER PROTOCOL AND PROCEDURES BY ITS EMPLOYEES AND SUB-CONTRACTORS.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING ALL EXISTING CONDITIONS IN THE FIELD PRIOR TO ANY DEMOLITION OR NEW INSTALLATION.
4. ALL WORK SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE MAINE STATE BUILDING CODE AND ANY AND ALL OTHER APPLICABLE FEDERAL, STATE, AND LOCAL ORDINANCES.
5. THE CONTRACTOR SHALL VERIFY SHUTDOWN AND ISOLATION VALVE LOCATIONS. THE CONTRACTOR SHALL COORDINATE ALL SHUTDOWN WORK WITH THE PROJECT COORDINATOR FOR MAINE MEDICAL CENTER.
6. THE CONTRACTOR SHALL VISIT THE SITE, BECOME FAMILIAR WITH THE EXISTING FIELD CONDITIONS, AND MAKE HIS OWN ESTIMATE OF THE DIFFICULTIES IN EXECUTING THE WORK PRIOR TO SUBMITTING ITS BID. NO COMPENSATION WILL BE AWARDED TO THE CONTRACTOR BASED ON A CLAIM OF LACK OF KNOWLEDGE OF EXISTING FIELD CONDITIONS.
7. IF DURING THE CONSTRUCTION ANY HAZARDOUS MATERIAL IS FOUND, NOTE, AND MAINE MEDICAL CENTER WILL PROVIDE THE NECESSARY ABATEMENT.
8. NO SILICON BASED SEALERS, OR COMPOUNDS SHALL BE USED.
9. THE CONTRACTOR SHALL REPORT ALL CHANGES IN THE WORK TO MAINE MEDICAL CENTER AND THE DESIGN ENGINEERS.
10. PIPING, DUCTWORK AND EQUIPMENT ARE NOT COMPLETELY DETAILED ON THE DIAGRAMS AND ELEVATIONS PROVIDED ON THE DRAWINGS ARE APPROXIMATE. THE DISTRIBUTION IS INTENDED AS A GENERAL ROUTING ONLY, BUT DOES ILLUSTRATE THE DESIRED LOCATION. THE CONTRACTOR SHALL AVOID INTERFERENCES WITH OTHER EQUIPMENT AND THE WORK OF OTHER DISCIPLINES.
11. NOT ALL VALVES, INSTRUMENTS AND CONTROLS ARE SHOWN IN THE PLAN VIEWS. INSTALL PIPING AND VALVES AS SHOWN ON PIPING AND INSTRUMENTATION DIAGRAMS AND DETAILS.
12. DUCTWORK, PIPING AND SUPPORTS SHALL NOT INTERFERE WITH EQUIPMENT MAINTENANCE ACCESS OR PULL SPACE.
13. DRAWINGS OF REVISED DUCTWORK OR PIPING ARRANGEMENTS SHALL BE SUBMITTED IF ITEMS ARE NOT SHOWN ON THE DRAWINGS. REVISIONS SHALL BE SUBJECT TO REVIEW AND APPROVAL BY THE ENGINEER PRIOR TO COMMENCEMENT OF THE CHANGES.
14. MECHANICAL CONTRACTOR SHALL PROVIDE ALL SUPPLEMENTARY STRUCTURAL SUPPORTS, ANGLE IRON, PLATES, ROD, ETC. AS NECESSARY FOR PROPER INSTALLATION OF PIPING, EQUIPMENT, AND ACCESSORIES.
15. CONTRACTOR SHALL BE RESPONSIBLE FOR SIZING SUPPORTS, UNISTRUT RACKS, TRAPEZE STEEL, PIPE SUPPORT COMPONENTS, ETC.
16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY AND ALL DAMAGE MADE BY ITS FIRM ON NEW OR EXISTING EQUIPMENT INSTALLED OR RELOCATED BY HIM UNDER THIS CONTRACT. THIS SHALL INCLUDE ALL TOUCH-UP PAINTING.
17. THE CONTRACTOR SHALL RETURN AS-BUILT DRAWINGS TO MAINE MEDICAL CENTER AND THE DESIGN ENGINEERS
18. CONTRACTOR TO PROVIDE ALL MATERIALS NEEDED FOR CONSTRUCTION UNLESS OTHERWISE NOTED OR DIRECTED.
19. DIELECTRIC NIPPLES SHALL BE INSTALLED BETWEEN DISSIMILAR METALS IN SOLDERED AND THREADED PIPING SYSTEMS AND INSULATED FLANGES FOR WELDING SYSTEMS.
20. CONTRACTOR TO LABEL ALL NEW PIPING AND DUCTWORK EVERY 10 FEET. LABELING TO INCLUDE DIRECTION OF FLOW AS WELL AS DESCRIPTION OF CONTENTS. LABELING SHALL BE COLOR/SIZE ACCORDING TO OSHA SPECIFICATIONS.
21. PRIOR TO CONNECTING TO ANY EXISTING PIPING, CONFIRM TIE-IN LOCATIONS WITH SOUTHERN MAINE HEALTH CARE PROJECT MANAGER.
22. PROVIDE HANGERS, SUPPORTS, AND INSERTS CONFORMING TO:
    - 22.1. MSS SP-58
    - 22.2. MSS SP-69
    - 22.3. ANSI B31.9
    - 22.4. PROVIDE PIPE HANGERS, SUPPORTS, AND ACCESSORIES WHICH:
      - A. PERMIT VERTICAL ADJUSTMENT AFTER INSTALLATION OF PIPING.
      - B. ARE DESIGNED FOR SUPPORT OF PIPING AND CONTENTS UNDER ALL CONDITIONS OF OPERATION INCLUDING TESTING.
      - C. WILL NOT CRUSH, INDENT, OR OTHERWISE DAMAGE PIPE, PIPE INSULATION, OR JACKETING.
        - a. PROVIDE COMPLETE HANGER AND SUPPORT ASSEMBLIES, INCLUDING CLAMPS, RODS, WASHERS, NUTS, TURNBUCKLES, AND LOCKING DEVICES, CONSTRUCTED FOR COMPATIBILITY WITH ITEMS SUPPORTED AND SUPPORTING STRUCTURE.
        - b. PROVIDE ALL SIMILAR SUPPORT COMPONENTS BY SAME MANUFACTURER.
        - c. PROVIDE OVERSIZED CLEVIS AND/OR ROLLER HANGERS TO FIT ON OUTSIDE OF INSULATED PIPING.
        - d. PROVIDE INSULATION PROTECTORS AT SUPPORT POINTS FOR ALL INSULATED UNJACKETED PIPING.
        - e. SPECIAL REQUIREMENTS: ALL COMPONENTS SHALL BE SUITABLY SIZED FOR THE LOAD SUPPORTED.
23. SYSTEM CLEANING AND TESTING PROCEDURES SHALL BE SUBMITTED TO AND APPROVED BY MAINE MEDICAL CENTER.
24. CONTRACTOR SHALL SEAL ALL WALL AND FLOOR PENETRATIONS TO PROVIDE LEAK TIGHT CLEAN SPACE.
25. CONTROLS, BALANCING AND CERTIFICATION:
    - A. CONTROLS: CONTRACTOR SHALL PROVIDE CONTROL DEVICES AND MATERIALS.
26. CONTROLS CONTRACTOR SHALL PROVIDE AND INSTALL ALL REQUIRED DEVICES AND SENSORS, AND PERFORM TIE-INS TO EXISTING FACILITY SYSTEM.

01 10 00 - SCOPE OF WORK

1. THIS PROJECT CONSISTS OF REWORK OF THE EXISTING MECHANICAL SYSTEMS; INCLUDING THE ADDITION OF NEW WATER SOURCE HEAT PUMPS, RELOCATION OF DUCTWORK AND RGD'S, THE INSTILLATION OF SPLIT SYSTEMS, ETC.

01 33 00 - SUBMITTALS

1. PRODUCT DATA: SUBMIT MANUFACTURERS PRODUCT DATA AND INSTALLATION INSTRUCTIONS FOR EACH MATERIAL AND PRODUCT USED.
2. OPERATION AND MAINTENANCE DATA: SUBMIT MANUFACTURERS OPERATION AND MAINTENANCE DATA, INCLUDING OPERATION INSTRUCTIONS, LIST OF SPARE PARTS AND MAINTENANCE SCHEDULE.

01 60 00 - WARRANTIES

1. SUBMIT MANUFACTURER'S STANDARD REPLACEMENT WARRANTIES FOR MATERIAL AND EQUIPMENT FURNISHED UNDER THIS SECTION. SUCH WARRANTIES SHALL BE IN ADDITION TO AND NOT IN LIEU OF ALL LIABILITIES WHICH THE MANUFACTURER AND THE HVAC SUBCONTRACTOR MAY HAVE BY LAW OR BY PROVISIONS OF THE CONTRACT DOCUMENTS.
2. ALL MATERIALS, EQUIPMENT AND WORK FURNISHED UNDER THIS SECTION SHALL BE GUARANTEED AGAINST ALL DEFECTS IN MATERIALS AND WORKMANSHIP FOR A MINIMUM PERIOD OF TWO YEAR COMMENCING WITH THE DATE OF SUBSTANTIAL COMPLETION. WHERE INDIVIDUAL EQUIPMENT SECTIONS SPECIFY LONGER WARRANTEES, PROVIDE THE LONGER WARRANTEE. ANY FAILURE DUE TO DEFECTIVE MATERIAL, EQUIPMENT OR WORKMANSHIP WHICH MAY DEVELOP, SHALL BE CORRECTED AT NO EXPENSE TO THE OWNER INCLUDING ALL DAMAGE TO AREAS, MATERIALS AND OTHER SYSTEMS RESULTING FROM SUCH FAILURES.

01 78 00 - INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

1. IT IS THE INTENTION OF THE SPECIFICATIONS AND DRAWINGS TO CALL FOR COMPLETE, FINISHED WORK, TESTED AND READY FOR CONTINUOUS OPERATION. ANY APPARATUS, APPLIANCE, MATERIAL OR WORK NOT SHOWN ON THE DRAWINGS, BUT MENTIONED IN THE SPECIFICATIONS OR VICE VERSA, OR ANY INCIDENTAL ACCESSORIES NECESSARY TO MAKE THE WORK COMPLETE IN ALL RESPECTS AND READY FOR OPERATION, EVEN IF NOT PARTICULARLY SPECIFIED, SHALL BE PROVIDED BY THE HVAC SUBCONTRACTOR OR HIS/HER SUB SUBCONTRACTORS, WITHOUT ADDITIONAL EXPENSE TO THE OWNER OR CONSTRUCTION MANAGER
2. THE DRAWINGS ARE GENERALLY DIAGRAMMATIC. THE LOCATIONS OF ALL ITEMS THAT ARE NOT DEFINITELY FIXED BY DIMENSIONS ARE APPROXIMATE ONLY. THE EXACT LOCATIONS MUST BE DETERMINED AT THE SITE AND SHALL HAVE THE APPROVAL OF THE ARCHITECT BEFORE BEING INSTALLED. THE HVAC SUBCONTRACTOR SHALL FOLLOW DRAWINGS, INCLUDING SHOP DRAWINGS, IN LAYING OUT WORK AND SHALL CHECK THE DRAWINGS OF OTHER TRADES TO VERIFY SPACES IN WHICH WORK WILL BE INSTALLED. MAINTAIN MAXIMUM HEADROOM AND SPACE CONDITIONS. WHERE SPACE CONDITIONS APPEAR INADEQUATE, NOTIFY THE ARCHITECT BEFORE PROCEEDING WITH THE INSTALLATION. THE HVAC SUBCONTRACTOR SHALL, WITHOUT EXTRA CHARGE, MAKE REASONABLE MODIFICATIONS IN THE LAYOUT AS NEEDED TO PREVENT CONFLICT WITH WORK OF OTHER TRADES OR FOR PROPER EXECUTION OF THE WORK.
3. SIZES OF DUCTS AND PIPES AND ROUTING ARE SHOWN, BUT IT IS NOT INTENDED TO SHOW EVERY OFFSET AND FITTING, NOR EVERY STRUCTURAL DIFFICULTY THAT MAY BE ENCOUNTERED. TO CARRY OUT THE INTENT AND PURPOSE OF THE DRAWINGS, ALL NECESSARY PARTS TO MAKE COMPLETE APPROVED WORKING SYSTEMS READY FOR USE, SHALL BE FURNISHED WITHOUT EXTRA CHARGE.

01 78 23 - OPERATION AND MAINTENANCE DATA

1. COMMENCE PREPARATION OF THE OPERATING AND MAINTENANCE (O&M) MANUALS IMMEDIATELY UPON RECEIPT OF "APPROVED" OR "APPROVED AS NOTED" SHOP DRAWINGS AND SUBMIT EACH SECTION WITHIN ONE MONTH. THE FINAL SUBMISSION SHALL BE NO LATER THAN TWO MONTHS PRIOR TO THE PROJECTED DATE OF SUBSTANTIAL COMPLETION OF THE PROJECT.
2. THE MANUAL SHALL CONSIST OF (3) SETS OF MANUALS AND INCLUDE (3) SETS OF CDS. WHICH SHALL CONTAIN THE SCANNED CONTENT OF THE ENTIRE MANUAL. THE MANUAL SHALL HIGHLIGHT THE ACTUAL EQUIPMENT USED AND NOT BE A MASTER CATALOG OF ALL SIMILAR PRODUCTS OF THE MANUFACTURER.

02 41 00 - INSPECTION OF SITE CONDITIONS

1. PRIOR TO SUBMISSION OF BID, VISIT THE SITE AND REVIEW THE RELATED CONSTRUCTION DOCUMENTS TO DETERMINE THE CONDITIONS UNDER WHICH THE WORK HAS TO BE PERFORMED. SEND A REPORT, IN WRITING, TO THE CONTRACTOR'S REPRESENTATIVE, NOTING ANY CONDITIONS WHICH MIGHT ADVERSELY AFFECT THE WORK OF THIS SECTION OF THE SPECIFICATIONS.

23 05 29 - SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

1. PROVIDE ALL SUPPLEMENTARY STEEL, FACTORY FABRICATED CHANNELS AND SUPPORTS REQUIRED FOR PROPER INSTALLATION, MOUNTING AND SUPPORT OF ALL EQUIPMENT AND SYSTEMS PROVIDED UNDER THIS SECTION OF THE SPECIFICATION.
2. SUPPLEMENTARY STEEL AND FACTORY FABRICATED CHANNELS SHALL BE FIRMLY CONNECTED TO BUILDING CONSTRUCTION.
3. THE TYPE AND SIZE OF THE SUPPORTING CHANNELS AND SUPPLEMENTARY STEEL PROVIDED UNDER THIS SECTION OF THE SPECIFICATIONS SHALL BE DETERMINED BY THE SUBCONTRACTOR AND SHALL BE OF SUFFICIENT STRENGTH AND SIZE TO ALLOW ONLY A MINIMUM DEFLECTION IN CONFORMANCE WITH THE MANUFACTURER'S REQUIREMENTS FOR LOADING.
4. ALL SUPPLEMENTARY STEEL AND FACTORY FABRICATED CHANNELS SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER PARALLEL TO THE WALLS, FLOORS AND CEILING CONSTRUCTION. ALL TURNS SHALL BE MADE WITH 90 DEGREE AND 45 DEGREE FITTINGS, AS REQUIRED TO SUIT THE CONSTRUCTION AND INSTALLATION CONDITIONS.
5. ALL SUPPLEMENTARY STEEL INCLUDING FACTORY FABRICATED CHANNELS, SUPPORTS AND FITTINGS SHALL BE GALVANIZED STEEL, ALUMINUM, OR STAINLESS STEEL WHERE EXPOSED OR SUBJECT TO RUST PRODUCING ATMOSPHERE AND SHALL BE MANUFACTURED BY UNISTRUT, H-STRUT, POWERSTRUT, ERICO OR APPROVED EQUAL.

23 05 53 - MECHANICAL IDENTIFICATION

1. PROVIDE EQUIPMENT IDENTIFICATION TAGS ON ALL NEW MECHANICAL EQUIPMENT. COORDINATE EQUIPMENT IDENTIFICATION NAMES W/ SOUTHERN MAINE HEALTH CARE NAMING STANDARDS.
2. LABELING SHALL APPEAR AT INTERVALS OF NOT MORE THAN 20 FEET AND AT LEAST ONCE IN EACH ROOM AND EACH STORY TRAVERSED BY THE PIPING SYSTEM. ALL PIPING SHALL BE CLEARLY IDENTIFIED SPECIFICALLY FOR TYPE OF SERVICE WITH COILED PLASTIC PIPE MARKERS AND FLOW DIRECTION ARROWS.
3. PROVIDE DUCT LABELS ON ALL SUPPLY AND RETURN DUCTWORK.

23 05 93 - AIR AND WATER SYSTEMS BALANCING

1. THE CONTRACTOR SHALL SELECT NEBB-01 AS THE STANDARD FOR PROVIDING TESTING, ADJUSTING AND BALANCING (TAB) OF AIR AND HYDRONIC SYSTEMS. THE SELECTED STANDARD SHALL BE USED THROUGHOUT THE PROJECT. TESTING, ADJUSTING, AND BALANCING SHALL BE ACCOMPLISHED BY A FIRM CERTIFIED FOR IN NEBB'S "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, AND BALANCING OF ENVIRONMENTAL SYSTEMS
2. PRIOR TO TESTING, ADJUSTING, AND BALANCING, THE CONTRACTOR SHALL VERIFY THAT THE SYSTEMS HAVE BEEN INSTALLED AND ARE OPERATING AS SPECIFIED. APPROVED DETAIL DRAWINGS AND ALL OTHER DATA REQUIRED FOR EACH SYSTEM AND/OR COMPONENT TO BE TESTED SHALL BE ATTACHED TO SYSTEM FLOW DIAGRAM DOCUMENTATION.
3. THE CONTRACTOR SHALL VERIFY THAT ALL BALANCING DEVICES REQUIRED DURING THE FIELD COORDINATION PHASE AND CONFIRM DURING THE CONSTRUCTION PHASE THAT THEY ARE PROPERLY INSTALLED TO PERMIT TESTING, ADJUSTING AND BALANCING AND THAT ALL DUCT LEAKAGE TESTS HAVE BEEN COMPLETED PRIOR TO TESTING, ADJUSTING AND BALANCING. THE DESIGN BUILD CONTRACTOR'S REPRESENTATIVE SHALL BE NOTIFIED IN WRITING OF ALL EQUIPMENT, COMPONENTS, OR BALANCING DEVICES, THAT ARE DAMAGED, INCORRECTLY INSTALLED, OR MISSING, AS WELL AS ANY DESIGN DEFICIENCIES THAT WILL PREVENT PROPER TESTING, ADJUSTING, AND BALANCING. TESTING, ADJUSTING, AND BALANCING SHALL NOT COMMENCE UNTIL APPROVED BY THE OWNER'S REPRESENTATIVE. INSTRUMENTATION ACCURACY SHALL BE IN ACCORDANCE WITH THE STANDARD SELECTED IN THIS PARAGRAPH.
4. PROVIDE ADDITIONAL SHEAVES AND BELTS REQUIRED TO REACH DESIGN CFM LEVELS AT NO ADDITIONAL COST.
5. IN ADDITION TO THE PROCEDURES OUTLINED IN THIS SPECIFICATION SECTION, THE PROCEDURES USED FOR AIR AND TEMPERATURE BALANCING SHALL ALSO BE IN CONFORMANCE WITH THE "PROCEDURAL STANDARDS FOR TESTING, ADJUSTING, BALANCING OF ENVIRONMENTAL SYSTEM", SEVENTH (2005) EDITION PUBLISHED BY THE NATIONAL ENVIRONMENTAL BALANCING BUREAU, THE "NATIONAL STANDARDS FOR TESTING AND BALANCING HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS", FIFTH EDITION PUBLISHED BY THE ASSOCIATED AIR BALANCE COUNCIL OR THE PRACTICAL STANDARDS AND PROCEDURES PUBLISHED BY THE NATIONAL BALANCING INSTITUTE.
6. ALL INSTRUMENTATION SHALL BE CHECKED FOR ACCURACY BEFORE BEGINNING TESTING, ADJUSTING AND BALANCING PROCEDURES. INSTRUMENT ACCURACY SHALL BE IN ACCORDANCE WITH THE STANDARD SELECTED IN PARAGRAPH A. GENERAL REQUIREMENTS, IMMEDIATELY ABOVE. CHECKS MAY BE CARRIED OUT AGAINST SIMILAR EQUIPMENT MAINTAINED SPECIFICALLY FOR CHECKING PURPOSES OR BY THE MANUFACTURER OR A RECOGNIZED TESTING FACILITY. ALL INSTRUMENTATION USED FOR TESTING SHALL BE CALIBRATED WITHIN 6 MONTHS OF USE. PITOT TUBES AND U-TUBE MANOMETERS DO NOT REQUIRE CHECKING. IN NO CASE SHALL THE INSTRUMENTATION ACCURACY BE LESS THAN SPECIFIED BY THE INSTRUMENT MANUFACTURER.
7. THREE COPIES OF THE FINAL TAB REPORT ON FORMS SHOWN IN AABC MN-1, SMACNA-07, OR EQUIVALENT FORMS FROM NEBB, WITHIN 2 WEEKS AFTER COMPLETION OF THE TEST AND BALANCE OPERATION. DATA SHALL BE IN A HARD BOUND COVER IDENTIFYING THE PROJECT NAME, LOCATION, DATE OF SUBMITTAL, NAME OF CONTRACTOR, AND A GENERAL TITLE INDICATING THE SPECIFIC AREA AND TYPE OF WORK, AND SHALL BE SIGNED BY A REGISTERED PROFESSIONAL ENGINEER, EMPLOYED BY THE TEST AND BALANCE FIRM, WHO HAS A MINIMUM OF 2 YEARS EXPERIENCE IN TESTING, ADJUSTING AND BALANCING WORK. THE FINAL REPORT SHALL INCLUDE A SUMMARY OF THE PRELIMINARY REPORT DESCRIBING TEST METHODS, TEST RESULTS, AND MAJOR CORRECTIVE ACTIONS TAKEN. THE REPORT SHALL INCLUDE AS-TESTED FLOOR PLANS SHOWING ALL MEASUREMENT LOCATIONS AND TYPES OF MEASUREMENTS MADE. THE AIR HANDLING UNIT DATA SHALL INCLUDE A STATIC PRESSURE PROFILE DIAGRAM, AND PITOT TUBE TRAVERSES WHERE POSSIBLE. PROVIDE MAINE MEDICAL CENTER PROJECT MANAGER WITH COPY OF REPORT FOR REVIEW AND COMMENT.
8. WATER SYSTEMS: EACH SYSTEM SHALL BE ADJUSTED UNTIL FLOW QUANTITIES ARE WITHIN 0% TO PLUS 5%. VERIFY IMPELLER SIZE, CHECK SYSTEM RESISTANCE, VERIFY PUMP MOTOR BRAKE HORSEPOWER, AND REPORT FLOW RATES THAT ARE NOT WITHIN THE DESIGN TOLERANCE.
9. RECORD FINAL PUMP AMPERAGE, VOLTAGE, RPM, PUMP HEAD, AND SYSTEM PRESSURES.
10. RECORD ALL FINAL FLOWS AND PRESSURE DROP AT COILS AND OTHER TERMINAL UNITS
11. AIR SYSTEMS: EACH SYSTEM SHALL BE ADJUSTED UNTIL ALL FLOW QUANTITIES (SUPPLY, RETURN, EXHAUST/RELIEF, AND OUTDOOR AIR) ARE WITHIN PLUS 10% AND MINUS 5%. DAMPERS SHALL BE CHECKED FOR TIGHT SHUTOFF. AIR LEAKAGE AROUND DAMPERS SHALL BE VERIFIED. FANS SHALL BE CHECKED FOR CORRECT DIRECTION OF ROTATION AND PROPER SPEED SHALL BE VERIFIED.
12. GENERAL BALANCING METHODS: IN ADDITION TO THE REQUIREMENTS FOR SPECIFIC SYSTEMS, FLOWS IN SUPPLY, EXHAUST AND RETURN AIR SYSTEMS SHALL BE BALANCED USING THE METHODS IN STANDARD SELECTED IN PARAGRAPH GENERAL REQUIREMENTS. THROTTLING LOSSES SHALL BE LIMITED. AIR FLOW ADJUSTMENTS SHALL BE MADE BY FIRST ADJUSTING THE FAN SPEED TO MEET THE DESIGN FLOW CONDITIONS. FAN SPEED ADJUSTMENT MAY NOT BE REQUIRED FOR FAN MOTORS WHICH ARE LESS THAN 746 W, (ONE HORSEPOWER,) OR IF THROTTLING RESULTS IN NO GREATER THAN AN ADDITIONAL 5% OF THE KW DRAW ABOVE THAT REQUIRED IF THE FAN SPEED WERE ADJUSTED. IF THE EXCESS DRAW CAUSES THE MOTOR TO ENTER ITS SERVICE FACTOR, FAN SPEED SHALL BE REDUCED ACCORDINGLY. FLOWS AND PRESSURES SHALL BE CHECKED IN ALL MAIN RISERS AND SUPPLY DUCTS AT ALL SUPPLY, EXHAUST AND RETURN FAN DISCHARGES. ALL FLOWS SHALL BE RECORDED BEFORE AND AFTER EACH ADJUSTMENT.
13. BALANCING OF DIFFERENTIAL AIRFLOW: FOR AREAS SUCH AS THE ASSEMBLY ROOM, IN ADDITION TO BALANCING THE INDIVIDUAL SUPPLY, RETURN AND EXHAUST AIRFLOWS, THE PRESSURIZATION AIR (POSITIVE OR NEGATIVE) SHALL ALSO BE MAINTAINED AS SHOWN ON DRAWINGS (AIR IN LESS AIR OUT) FOR EACH ROOM.
14. CONTROL SYSTEMS: TESTING, ADJUSTING, AND BALANCING OF THE SYSTEMS SHALL BE COORDINATED WITH THE CONTROL SYSTEM INSTALLATION. WORK WITH THE BAS CONTRACTOR FOR ALL BALANCING ITEMS SHOWN ON THE CONTROL SEQUENCES SUCH AS AIRFLOW AT AIR MONITORING STATIONS, OUTDOOR AIRFLOW, AND OPTIMIZED SETPOINTS FOR REMOTE DIFFERENTIAL PRESSURE SENSORS/TRANSMITTERS (DPT) USED FOR CONTROL OF VFD'S ALL CONTROL COMPONENTS SHALL BE VERIFIED TO BE PROPERLY INSTALLED AND OPERATING AS SPECIFIED BEFORE PROCEEDING WITH TESTING, ADJUSTING, AND BALANCING. VERIFICATION SHALL BE IN ACCORDANCE WITH AABC MN-1.
15. ADJUSTMENT OF THE TEMPERATURE CONTROLS SHALL BE COORDINATED BY THE PERSON IN CHARGE OF THE BALANCING AND ADJUSTING AND SHALL BE PERFORMED CONCIDENTAL THEREWITH. IN CONJUNCTION WITH THE CONTROLS CONTRACTOR SIMULATE A COMPLETE CYCLE OF OPERATION FOR EACH SYSTEM.
16. PERFORM ALL NECESSARY BALANCING IN THE AREA OF RENOVATION, INCLUDING TRANSVERSES, ALL RETURN GRILLES, FILTER SUPPLY GRILLES, AND EXHAUST CONNECTION WITHIN THE AREA OF RENOVATION (CLEAN ROOM AND ADJACENT CHASES).
17. PROVIDE PRE-CONSTRUCTION TESTING AND BALANCING OF AIR CONDITIONING UNIT SERVING THE SPACE, INCLUDING TOTAL AIRFLOW AND FAN SHEAVE LOCATIONS.

23 07 13 - DUCT INSULATION

1. THICKNESS AND MATERIAL SCHEDULE FOR DUCTWORK
   - A. SUPPLY: 1-1/2" FIBERGLASS DUCTWRAP WITH REINFORCED METAL FOIL VAPOR BARRIER. KNAUF ATMOSPHERE DUCTWRAP OR EQUAL.
   - B. OUTDOOR AIR/MAKE-UP:
     - a. INTERIOR: 2" FIBERGLASS DUCTWRAP WITH REINFORCED METAL FOIL VAPOR BARRIER RETURN: NONE REQUIRED.
     - b. EXTERIOR: 2" DUCTBOARD WITH SEALED ALUMINIZED JACKET. POLYGAURD ALUMAGUARD ALL WEATHER, JACKET AND CERTAINTEED POLYISO INSULATION.
   - C. EXHAUST:
     - a. WITHIN TEN FEET OF EXTERIOR PENETRATIONS.
2. DUCTWRAP
   - A. TYPE INSULATION: GLASS FIBER DUCTBOARD WITH A FACTORY APPLIED VAPOR BARRIER FACING. CERTAINTEED STANDARD DUCTBOARD WITH FOIL-SKRIM-KRAFT(FSK) FACING.
   - B. DENSITY: 3 POUND PER CUBIC FOOT.
3. THERMAL CONDUCTIVITY AT 75°F: 0.23 BTU-INCH/HR/SQ. FT./°F. (ASTM C518-70)
   - A. INSULATION EXTERIOR FACING: FSK VAPOR BARRIER WITH ONE 2" FLANGE.
   - B. INSULATION EXTERIOR FACING PERMEABILITY : 0.02 PERM (ASTM E96-66, PROCEDURE A).
   - C. MAXIMUM AIR TEMPERATURE: 250 DEGREES F.
   - D. INSULATION ATTACHMENT ADHESIVE: FOSTER STIC-SAFE ADHESIVE 85-15.
   - E. FASTENERS: WELD PINS OR NYLON TUFF-WELD STICK CLIP UNITS, BY GOODLOE E. MOORE, OR AN APPROVED EQUAL.\FASTENER ATTACHMENT ADHESIVE: TUFF-BOND QUICK-SET ADHESIVE, BY GOODLOE E. MOORE, OR AN APPROVED EQUAL.
   - F. TAPE: REINFORCED FOIL/SCRIM/KRAFT TO MATCH THE FACING, 3" WIDE WITH PRESSURE SENSITIVE ADHESIVE, BY FASSON OR AN APPROVED EQUAL.
   - G. ADHESION (PSTC-1): 80 OZ/INCH OF WIDTH.
   - H. SHEAR (PSTC-7): 3000 MINUTES.
   - I. TENSILE: 25 LBS./INCH OF WIDTH.
   - J. PRESSURE SENSITIVE TAPE COUNCIL.

23 07 19 - PIPE INSULATION

1. SERVICE: CONDENSATE DRAIN PIPING FROM COOLING COILS, EXTERIOR CONDENSER WATER,CHILLED WATER, HEATING HOT WATER, LOW PRESSURE STEAM, LOW PRESSURE CONDENSATE RETURN
2. OPERATING TEMPERATURE: 35 TO 250 DEG F.
3. INSULATION MATERIAL:
   - A. INTERIOR: PRE-MOLDED, CLOSED CELL FLEXIBLE ELASTOMERIC AEROFLEX MODEL AEROCEL OR EQUAL, ASTM E84 25/50 COMPLIANT.
     - a. SERVICE UP TO 100 DEG F.
   - B. INTERIOR: PRE-MOLDED, RIGID FIBERGLASS WITH FSK, KNAUF 1000 DEG. INSULATION OR EQUAL, ASTM E84 25/50 COMPLIANT.
     - a. SERVICE ABOVE 100 DEG F.
   - C. EXTERIOR: POLYISOCYANURATE CLOSE CELL.
4. INSULATION THICKNESS:
   - A. INTERIOR: 1" <60 DEG F, 2" >90 DEG F, 3" >190 DEG F.
   - B. EXTERIOR: 2"
5. VAPOR RETARDER REQUIRED: YES.

23 31 13 - METAL DUCTWORK

1. GALVANIZED STEEL DUCTS: ASTM A 653/A 653M GALVANIZED STEEL SHEET, FORMING STEEL (FS) DESIGNATION, WITH G90/Z275 ZINC COATING.
2. FLEXIBLE DUCT: UL181, NFPA 90A/B. SELF EXTINGUISHING, INSULATED SEALED ENDS.
3. HANGER ROD: ASTM A 36/A 36M; STEEL; THREADED BOTH ENDS, THREADED ONE END, OR CONTINUOUSLY THREADED. ROD SHALL BE GALVANIZED OR ELECTROPLATED.
4. HANGER STRAPS: COMPLY WITH SMACNA "HVAC DUCT STANDARDS-METAL AND FLEXIBLE" FOR STEEL SHEAT WIDTH AND THICKNESS AND SHALL BE GALVANIZED SHEET METAL TO MATCH DUCT.
5. SEALANT (SUPPLY/RETURN/EXHAUST):
   - A. DUCTMATE PROSEAL OR APPROVED EQUAL.
   - B. NON-HARDENING, WATER RESISTANT, FIRE RESISTIVE, COMPATIBLE WITH MATING MATERIALS; LIQUID USED ALONE OR WITH TAPE, OR HEAVY MASTIC.
   - C. WATER BASED WITH A VERY MILD ODOR; UL 723 LISTED. FLAME SPREAD SHALL NOT EXCEED 25 AND SMOKE DEVELOPED RATING SHALL NOT EXCEED 50.
   - D. DRY TIME - TO TOUCH: 1 HOUR
   - E. DRY TIME - TO CURE: 24 TO 72 HOURS.
6. METAL DUCTWORK AND PLENUM FABRICATION
   - A. FABRICATE AND SUPPORT IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE, AND AS INDICATED. PROVIDE DUCT MATERIAL, GAGES, REINFORCING, AND SEALING FOR OPERATING PRESSURES INDICATED.
   - B. CONSTRUCT T'S, BENDS, AND ELBOWS WITH RADIUS OF NOT LESS THAN 1-1/2 TIMES WIDTH OF DUCT ON CENTERLINE. WHERE NOT POSSIBLE AND WHERE RECTANGULAR ELBOWS MUST BE USED, PROVIDE AIR FOIL TURNING VANES. SQUARE THROAT OR MITRED ELBOWS WITHOUT TURNING VANES ARE PROHIBITED.
   - C. RECTANGULAR BRANCH CONNECTIONS SHALL BE 45-DEGREE ENTRY TYPE.
   - D. INCREASE DUCT SIZES GRADUALLY, NOT EXCEEDING 15 DEGREES DIVERGENCE WHEREVER POSSIBLE; MAXIMUM 30 DEGREES DIVERGENCE UPSTREAM OF EQUIPMENT AND 45 DEGREES CONVERGENCE DOWNSTREAM.
   - E. ROUND BRANCHES FROM RECTANGULAR MAIN SHALL BE EITHER CONICAL OR BELLMOUTH. SPIN-IN BRANCHES ALLOWED WHERE DUCT PRESSURE CLASS IS 1" OR LOWER.
   - F. PROVIDE STANDARD 45 DEGREE LATERAL WYE TAKEOFFS UNLESS OTHERWISE INDICATED WHERE 90 DEGREE CONICAL TEE CONNECTIONS MAY BE USED.
5. SEALING AND CONSTRUCTION SCHEDULES
   - A. SUPPLY AND MAKEUP AIR: GALVANIZED STEEL, 2" WG, SEAL CLASS A.
   - B. RETURN: GALVANIZED STEEL, 2" WG, SEAL CLASS A
   - C. EXHAUST: GALVANIZED STEEL AND 2" WG, SEAL CLASS A.
6. DUCTWORK INSTALLATION
   - A. INSTALL AND SEAL METAL AND FLEXIBLE DUCTS IN ACCORDANCE WITH SMACNA HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE.
   - B. PROVIDE OPENINGS IN DUCTWORK WHERE REQUIRED TO ACCOMMODATE THERMOMETERS AND CONTROLLERS. PROVIDE PITOT TUBE OPENINGS WHERE REQUIRED FOR TESTING OF SYSTEMS. COMPLETE WITH METAL CAN WITH SPRING DEVICE OR SCREW TO ENSURE AGAINST AIR LEAKAGE. WHERE OPENINGS ARE PROVIDED IN INSULATED DUCTWORK, INSTALL INSULATION MATERIAL INSIDE A METAL RING.
   - C. LOCATE DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW NORMAL OPERATING AND MAINTENANCE ACTIVITIES.

23 21 13 - HYDRONIC PIPING

1. CHILLED WATER, HEATING HOT WATER AND CONDENSATE DRAIN PIPING, 4-INCH & SMALLER: TYPE L COPPER & SOLDER JOINTS. TWO-PIECE BALL VALVES & SWING CHECK VALVES.
2. VALVES:
   - A. SHUT OFF SERVICE: 2-1/2" & SMALLER, TWO-PIECE BALL VALVE, 3" & LARGER, BUTTERFLY VALVES
   - B. DRAIN SERVICE: TWO-PIECE, BRONZE BODY, 125# WOG RATED, BALL VALVES
   - C. BALANCING: 150# THREADED OR FLANGED, BRONZE BODY, WITH VERNIER TYPE RING SETTING WITH READ OUT PORTS AND MEMORY STOP.
3. EXTENSIONS OF THE TEMPERED WATER SYSTEM MAINS SCHEDULE 80 CPVC PIPE TO MATCH EXISTING, PRESSURE PATTERN FITTINGS, LOW VOC SOLVENT CEMENTED JOINTS.
4. CONDENSATE DRAIN PIPING GRAVITY