

PART 2 - PRODUCTS (CONTINUED)

J. HYDRONIC SYSTEMS PIPING

1) HYDRONIC PIPING FOR CHILLED WATER, CONDENSER WATER AND HEATING WATER SHALL BE AS FOLLOWS:

- a. MATERIALS:
i. 1 INCH AND SMALLER: TYPE "L" HARD DRAWN COPPER
ii. 1-1/4 INCHES AND LARGER: SCHEDULE 40 BLACK STEEL
b. FITTINGS:
i. 1 INCH AND SMALLER: WROUGHT COPPER FITTINGS WITH 95/5 SOLDER OR SIL-FOS FOR PRESSURES GREATER THAN 50 PSI.
ii. 1-1/4 INCHES THROUGH 2 INCHES: 300# MALLEABLE IRON FITTINGS.
iii. 2-1/2 INCHES AND LARGER: BLACK STEEL WELDED FITTINGS.
c. PROVIDE DIELECTRIC UNIONS BETWEEN DISSIMILAR METALS.
d. ALL PIPING SHALL BE IN STRICT CONFORMANCE WITH ASTM, ASA, AND LANDLORD'S REQUIREMENTS, WHICHEVER IS MOST STRINGENT.
e. UNIONS OR FLANGES MUST BE USED AT EQUIPMENT CONNECTIONS WHERE SERVICE OR REMOVAL MAY BE REQUIRED.

2) ALL ELBOWS SHALL BE LONG RADIUS TYPE.

K. HYDRONIC SYSTEMS VALVES

1) VALVES FOR CHILLED WATER, CONDENSER WATER AND HEATING WATER SHALL BE AS FOLLOWS:

- a. BALL VALVES, 2- INCHES AND SMALLER:
i. CAST BRASS BODY, FULL PORT CHROME PLATED BRASS BALL, TEFLON SEATS AND LEVER HANDLE, 600 PSI COLD WORKING PRESSURE.
ii. NIBCO OR APPROVED EQUAL.
b. BUTTERFLY VALVES, 2-1/2 INCHES AND LARGER:
i. CAST IRON BODY, 200 PSI PRESSURE RATING, EPDM SEAT, STAINLESS STEEL STEM WITH COPPER BUSHINGS, LEVER LOCK.
ii. NIBCO OR APPROVED EQUAL.
c. SWING CHECK VALVES, 2- INCHES AND SMALLER:
i. CLASS 150, CAST BRONZE BODY AND CAP CONFORMING TO ASTM B62 WITH HORIZONTAL SWING, Y-PATTERN, RENEWABLE BRONZE DISC, AND HAVING THREADED OR SOLDERED ENDS.
ii. NIBCO OR APPROVED EQUAL.
d. SWING CHECK VALVES, 2-1/2 INCHES AND LARGER:
i. CLASS 125, CAST IRON BODY AND BOLTED CAP, HORIZONTAL SWINGS, RENEWABLE BRONZE DISC, FLANGED ENDS AND CAPABLE OF BEING REFITTED WHILE THE VALVE REMAINS IN THE LINE.
ii. NIBCO OR APPROVED EQUAL.
e. CALIBRATED BALANCE VALVES:
i. BELL & GOSSETT CIRCUIT SETTER OR APPROVED EQUAL. TACO OR HOMESTEAD ARE CONSIDERED AS EQUAL.
ii. CIRCUIT SETTER SHALL BE PROVIDED WITH LOCKING SET POINT.
iii. A CIRCUIT SETTER BALANCE WHEEL MUST BE INCLUDED WITH O&M MANUAL.

L. HYDRONIC SYSTEMS SPECIALTIES

- 1) PRESSURE/TEMPERATURE TEST PLUGS
a. PETE'S PLUG WITH NORDEL CORE AND BRASS BODY.
b. RATED AT 400 PSIG AT 0 DEGREES F TO 200 DEGREES F.

- 2) STRAINERS
a. FOR CHILLED WATER AND HEATING HOT WATER SYSTEMS
i. "Y" PATTERN STRAINER, NIBCO OR APPROVED EQUAL.
ii. STRAINER SHALL HAVE A CAST IRON BODY, AND RATED TO 125 PSIG.
iii. STRAINER SHALL HAVE THREADED CONNECTIONS FOR 2 INCHES AND SMALLER.
iv. STRAINER SHALL HAVE FLANGED CONNECTIONS FOR 2-1/2 INCHES AND LARGER.
v. PERFORATED STAINLESS STEEL SCREEN:
a. HEATING HOT WATER: 0.033 INCHES
b. CHILLED WATER: 1/8 INCH
vi. PROVIDE WITH BLOWDOWN VALVE AND HOSE END FITTING.
b. FOR CONDENSER WATER SYSTEMS
i. FABROTECH BASKET MODEL 125 BASKET STRAINER.
ii. CAST IRON BODY AND COVER.
iii. QUICK RELEASE KNOBS.
iv. PERFORATED 304 STAINLESS STEEL SCREEN: 0.062 INCH

3) THERMOFLO INDICATOR
a. BELL & GOSSETT MODEL "TFI".

M. REFRIGERANT PIPING

- 1) REFRIGERANT PIPING SHALL BE TYPE "L" HARD DRAWN COPPER TUBING IN ACCORDANCE WITH ASTM B88.
2) ALL FITTINGS AND JOINTS SHALL BE WROUGHT COPPER OR CAST BRONZE IN ACCORDANCE WITH ANSI B16.22.
3) COPPER TO COPPER JOINTS SHALL BE BRAZED WITH A COPPER-PHOSPHORUS ALLOY.
4) COPPER TO BRONZE JOINTS SHALL BE BRAZED WITH SIL-FOS 5 ALLOY.
5) ALL ELBOWS SHALL BE LONG RADIUS TYPE.

N. CONDENSATE PIPING

- 1) INDOOR INSTALLATIONS:
a. TYPE "L" DRAWN COPPER TUBING WITH 1/16" TIN-ANTIMONY SOLDERED JOINTS AND WROUGHT COPPER FITTINGS.
b. PROVIDE DIELECTRIC SEPARATION BETWEEN DISSIMILAR METALS.
c. SCHEDULE 40 PVC PIPE MUST BE USED INDOORS WITH PROPER SUPPORT SPACING PER 152003.2D AND ACCORDANCE WITH LOCAL CODES.

2) OUTDOOR INSTALLATIONS:

- a. SCHEDULE 40 UNRESISTANT PVC PIPING.
b. PVC JOINTS SHALL BE GMP FIT.

O. DUCTWORK INSULATION

- 1) INSULATE THE FOLLOWING DUCTWORK:
a. INSULATED SUPPLY DUCTWORK: 1 1/2 INCHES
b. UNTREATED OUTSIDE AIR DUCTWORK LOCATED WITHIN THE INTERIOR: 2 INCHES

- c. ALL EXTERIOR SUPPLY AND RETURN AIR DUCTWORK: 2 INCHES
2) THERMAL RESISTANCE SHALL BE AT LEAST R-5.2 FOR INTERIOR DUCTWORK AND R-8.0 FOR EXTERIOR DUCTWORK, OR AS REQUIRED BY LOCAL CODE, WHICHEVER IS MORE STRINGENT.
3) INSULATION SHALL HAVE A FLAME SPREAD RATING OF NO MORE THAN 25 AND A SMOKE DEVELOPED RATING NO HIGHER THAN 50.
4) INSULATION SHALL BE JOHNS MANVILLE MICROLITE XG OR APPROVED EQUAL.
5) PROVIDE EXTERIOR DUCTWORK INSULATION WITH PVC WEATHERPROOF JACKETING.
6) INSULATION IS NOT REQUIRED ON SUPPLY DUCTWORK INSTALLED WITH INTERNAL DUCT LINING.

P. DUCT LINING

- 1) ALL RECTANGULAR SUPPLY DUCTWORK WITHIN 15 FEET AND RETURN DUCTWORK WITHIN 10 FEET OF THE HVAC UNIT SHALL BE INTERNALLY LINED.
2) INTERNAL LINING SHALL BE 1 INCH THICK FIBERGLASS LINER, JOHNS MANVILLE LINACOUSTIC RC OR APPROVED EQUAL.
3) LINER SHALL HAVE A COATED SURFACE EXPOSED TO AIRSTREAM TO PREVENT EROSION, APPLY ADHESIVES AND MECHANICAL FASTENERS AS RECOMMENDED BY SMACTA AND THE MANUFACTURER TO PREVENT LINER SEPARATION FROM THE DUCT. ALL TRANSVERSE EDGES SHALL BE COATED WITH ADHESIVE.

Q. PIPING INSULATION

- 1) INSULATION THICKNESS SHALL BE PER THE FOLLOWING:
a. REFRIGERANT SUCTION LINES: 1 1/2 INCH
b. CONDENSATE LINES : 1 INCH
c. HEATING HOT WATER SUPPLY AND RETURN: 1 1/2 INCHES
d. CHILLED WATER SUPPLY AND RETURN: 1 1/2 INCHES
2) INSTALLED THERMAL RESISTANCE SHALL BE AT LEAST R-6.0 AT 1 1/2 INCH THICKNESS.
3) INSULATION SHALL HAVE A FLAME SPREAD RATING OF NO MORE THAN 25 AND A SMOKE DEVELOPED RATING NO HIGHER THAN 50.
4) INSULATION SHALL BE ARMACELL ARMAFLEX AP OR APPROVED EQUAL.
5) DO NOT INSULATE HOT GAS LIQUID LINES, HOT GAS BYPASS LINES, OR CONDENSER WATER SYSTEMS, WHERE APPLICABLE.
6) PROVIDE EXTERIOR PIPING INSULATION WITH PVC WEATHERPROOF JACKETING.
7) INSULATION AT ALL HANGERS FOR PIPING 2-1/2 INCHES AND LARGER SHALL BE HARD AND NON-COMPRESSIBLE.
8) PROVIDE JOHNS MANVILLE ZESTON 300 INSULATION OR APPROVED EQUAL FOR ALL TEES, ELLS OR SPECIALTY FITTINGS.

PART 3 - EXECUTION

3.1 - INSTALLATION

- A. REFRIGERANT SYSTEMS:
1) SUCTION LINES SHALL HAVE ADEQUATE LIFT TRAPS AND/OR DOUBLE SUCTION RISERS TO MEET THE REQUIREMENTS OF FIELD CONDITIONS AND EQUIPMENT MANUFACTURER'S RECOMMENDATIONS.
2) BRAZE ALL JOINTS WITH SILFOS-5 STARTING AT THE INDOOR UNIT AND WORKING TOWARD THE OUTDOOR UNIT. THE SEALS ON THE OUTDOOR UNIT SHALL BE BROKEN LAST. A NITROGEN BLEED SHALL BE USED DURING ALL BRAZING AND ANY TIME THE SYSTEM IS OPEN. ALL OPEN LINES SHALL BE CAPPED AND SEALED BEFORE LEAVING THE SITE DURING CONSTRUCTION. PRESSURE TEST FOR LEAKS WITH AN INERT GAS UP TO 245 PSIG. REDD LEAKING JOINTS AND RETEST UNIT SYSTEM IS TIGHT. EVACUATE ENTIRE SYSTEM TO 200 MICRONS OF MERCURY. CHARGE SYSTEM WITH 25 PSI OF SATURATED REFRIGERANT AND AN INERT GAS TO 245 PSI AND RETEST SYSTEM WITH HALOGEN DETECTOR. ALL LEAKING JOINTS MUST BE COMPLETELY RESEALED UNTIL NO LEAKS EXIST. TURN ON CRANK CASE HEATERS 24 HOURS PRIOR TO STARTING COMPRESSOR TO ENSURE ALL REFRIGERANT LIQUID IS OUT OF THE COMPRESSOR.
3) THE CONTRACTOR SHALL FURNISH AND INSTALL A COMPLETE REFRIGERANT PIPING SYSTEM BETWEEN THE INDOOR FAN UNITS AND OUTDOOR FAN UNITS.

- B. EQUIPMENT SHALL BE INSTALLED AND START-UP PERFORMED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. ALL AIR CONDITIONING EQUIPMENT MUST BE TRAPPED IN ACCORDANCE WITH MANUFACTURERS DATA.
C. FURNISH AND INSTALL INSULATION PRODUCTS IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS, AND IN ACCORDANCE WITH RECOGNIZED INDUSTRY PRACTICES.
D. INSTALL WATER MAINS WITHOUT PITCH. USE ECOFLEX REDUCING COUPLINGS AT CHANGES IN SIZE WITH THE TOP OF PIPES AT SAME ELEVATION.
E. BRANCHES TO UNITS BELOW PIPING MAINS SHALL BE TAKEN FROM BOTTOM OF MAINS AT A 45 DEGREE ANGLE. PITCH DOWNWARD TOWARD UNITS. BRANCHES TO UNITS ABOVE MAINS SHALL BE TAKEN FROM TOP OF MAINS AT A 45 DEGREE ANGLE PITCHED UPWARD TOWARDS UNITS. PITCH NOT LESS THAN 1 INCH PER 10 FEET.
F. INSTALL ALL NECESSARY HANGERS AND SADDLES TO PROPERLY SUPPORT ALL CONDENSATE PIPING. HANGERS SHALL BE SUIT TYPE OF PIPING PROVIDED AND BE SPACED AT A MAXIMUM SPAN OF 5 FEET. PROVIDE SWAY AND SEISMIC BRACING AS REQUIRED BY CODES.

- G. DUCTWORK DIMENSIONS SHOWN ON DRAWINGS ARE INSIDE CLEAR DIMENSIONS. INCREASE DUCTWORK SIZES AS REQUIRED FOR INTERNALLY LINED DUCT TO MAINTAIN INSIDE CLEAR DIMENSIONS.
H. CONDENSATE DRAINS SHALL TERMINATE AT A CODE APPROVED LOCATION.
I. CURBS AND STEEL FRAMING FOR SUPPORT

1) THE CONTRACTOR WILL FURNISH AND INSTALL ALL NECESSARY CURBS AND BLOCKING REQUIRED TO INSTALL ALL HVAC EQUIPMENT AS DESCRIBED OR IMPLIED ON THE DRAWINGS. CURBS SHALL BE A MINIMUM OF 14 INCHES HIGH OF THE SAME MANUFACTURER OF THE EQUIPMENT SUPPORTED, UNLESS NOTED OTHERWISE. INSULATE UNDER THE COMPRESSOR SECTION. ALL CURBS MUST BE INSTALLED SO THAT TOP OF CURBS ARE "DEAD" LEVEL. ALL PENETRATIONS OF EXISTING STRUCTURE SHALL BE DONE IN ACCORDANCE TO THE LANDLORD'S GUIDELINES AT THE CONTRACTOR'S EXPENSE. COORDINATE STEEL FRAMING REQUIREMENTS, ROOF PENETRATIONS, AND ROOF FLASHING WITH G.C. TO DETERMINE SCOPE OF WORK PRIOR TO BID. CONTRACTOR MUST RECEIVE WRITTEN APPROVAL BEFORE ANY ADDITIONAL WORK TAKES PLACE.

3.2 - FIELD QUALITY CONTROL

- A. UPON COMPLETION OF TESTING, BUT BEFORE THE REFRIGERANT PIPING INSULATION IS APPLIED, THE PIPING MUST BE INSPECTED BY A REPRESENTATIVE OF THE LOCAL GOVERNING AUTHORITY AS NECESSARY.
B. ALL PIPING AND EQUIPMENT SHALL BE PRESSURE TESTED WITHOUT LEAKAGE AT A MINIMUM PRESSURE OF 125 PSI.

3.3 - CLEANING

A. ALL HYDRONIC PIPING AND EQUIPMENT CONNECTED TO THE HVAC PIPING SYSTEM SHALL BE CLEANED AND FLUSHED. REMOVE, CLEAN, AND REPLACE STRAINER SCREENS. FILL TENANT'S SYSTEM WITH DOMESTIC WATER, VENT ALL PIPING AND EQUIPMENT PRIOR TO CONNECTION TO THE LANDLORD'S SYSTEM. CONTRACTOR SHALL NOT FILL TENANT'S SYSTEM WITH WATER FROM THE LANDLORD'S SYSTEM UNLESS SPECIFICALLY INSTRUCTED TO DO SO FROM THE LANDLORD'S FIELD REPRESENTATIVE.

- B. ALL DUCTWORK REQUIRING PAINTING AND EXPOSED IN SALES AREAS AND FITTING ROOMS SHALL BE PHOSPHATIZED OR "PAINTGRIP" SPIRAL GALVANIZED UNINSULATED SHEET METAL EXCEPT FOR SPIRAL DUCTWORK BY LINDAB PRODUCTS WHICH SHALL BE PREPARED ACCORDING TO THE PAINT MANUFACTURERS RECOMMENDATIONS FOR THE ADHERENCE OF PAINT. SURFACES SHALL BE CLEAN, DRY AND FREE FROM SPIRAL MANUFACTURER'S LUBRICANTS THAT WILL ADVERSELY AFFECT ADHESION OR APPEARANCE OF APPLIED PAINT COATING. REMOVE ALL DIRT AND GREASE FROM GALVANIZED SPIRAL DUCTWORK WITH A WATER BASED COMMERCIAL DETERGENT AND WIPE DRY WITH DRY CLEAN CLOTHS. SURFACE SHALL BE FREE OF ALL FOREIGN MATERIALS.
C. REFRIGERANT PIPING SHALL BE CLEAN, CAPPED AND NITROGEN CHARGED.

END OF SECTION 15500 SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 - SUMMARY

A. SECTION INCLUDES TESTING, ADJUSTING, AND BALANCING OF AIR, WATER AND REFRIGERATION SYSTEMS AND MEASUREMENT OF FINAL OPERATING CONDITION OF HVAC SYSTEMS.
1.2 - RELEVANT CODES AND CRITERIA
A. AABC (ASSOCIATED AIR BALANCE COUNCIL)
B. NEBB (NATIONAL ENVIRONMENTAL BALANCING BUREAU)

1.3 - SUBMITTALS

- A. TAB REPORT SHALL BE SUBMITTED ELECTRONICALLY TO THE ARCHITECT/ENGINEERING CONSULTANT AND TO GAP ENGINEERING FOR REVIEW.
B. TEST REPORTS: THE TAB REPORT SHALL BE IN THE FORMAT OF THE AABC NATIONAL STANDARD REPORT OR THE NEBB CERTIFIED REPORT FORMS AS PUBLISHED IN THEIR MOST CURRENT EDITIONS.
C. REPORTS SHALL BE COMPLETE WITH TABLE OF CONTENTS PAGE AND INDEXING TABS AND WITH COVER IDENTIFICATION AT FRONT. INCLUDE SET OF REDUCED INDEX DRAWINGS WITH AIR OUTLETS AND EQUIPMENT IDENTIFIED TO CORRESPOND WITH DATA SHEETS, AND INDICATING THERMOSTAT LOCATIONS.
D. INCLUDE A COPY OF AABC NATIONAL PROJECT PERFORMANCE GUARANTEE OR COPY OF NEBB CERTIFICATE OF CONFORMANCE CERTIFICATION.
E. THE COMPLETE TAB REPORTS SHALL BE PROVIDED TO THE OWNER NO LATER THAN ONE (1) WEEK PRIOR TO CONSTRUCTION END DATE.

1.4 - QUALITY ASSURANCE

- A. PERFORM WORK IN ACCORDANCE WITH AABC NATIONAL STANDARD FOR FIELD MEASUREMENT AND INSTRUMENTATION, TOTAL SYSTEM BALANCE OR NEBB PROCEDURAL STANDARDS FOR TESTING, BALANCING AND ADJUSTING OF ENVIRONMENTAL SYSTEMS.
B. QUALIFICATIONS

- 1) THE TESTING, ADJUSTING AND BALANCING (TAB) OF ALL WORK SHALL BE PERFORMED BY AN INDEPENDENT CONTRACTOR THAT IS CURRENTLY LICENSED BY AABC OR NEBB. THE COMPANY SHALL SPECIFY IN TAB REPORTS THE EXPERIENCE SPECIFIED IN THIS SECTION AND SHALL HAVE A MINIMUM THREE YEAR DOCUMENTED EXPERIENCE CERTIFIED BY AABC OR NEBB.
2) PERFORM WORK UNDER SUPERVISION OF AABC CERTIFIED TEST AND BALANCE ENGINEER OR NEBB CERTIFIED TESTING, BALANCING AND ADJUSTING SUPERVISOR EXPERIENCED IN PERFORMANCE OF THIS WORK AND LICENSED AT PLACE WHERE PROJECT IS LOCATED.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

1.1 - INSTALLERS

A. THE HVAC CONTRACTOR SHALL VERIFY THAT THE HVAC SYSTEMS ARE COMPLETE AND OPERABLE BEFORE TAB WORK IS STARTED. THE HVAC CONTRACTOR SHALL BE PRESENT DURING THE TEST ADJUSTING AND BALANCING OF THE HVAC SYSTEM TO PROVIDE ASSISTANCE TO THE TAB CONTRACTOR. REQUIREMENTS SHALL INCLUDE THE FOLLOWING:

- 1) SYSTEMS ARE STARTED AND OPERATING IN SAFE AND NORMAL CONDITION.
2) TEMPERATURE CONTROL SYSTEMS ARE INSTALLED COMPLETE AND OPERABLE.
3) ALL BALANCING DEVICES AND HVAC EQUIPMENT ARE ACCESSIBLE
4) PROPER THERMAL OVERLOAD PROTECTION IS IN PLACE FOR ELECTRICAL EQUIPMENT.
5) NEW AIR FILTERS ARE INSTALLED JUST PRIOR TO AIR BALANCE AND IMMEDIATELY AFTER PROJECT IS COMPLETE.
6) DUCT SYSTEMS ARE CLEAN OF DEBRIS.
7) FANS ARE ROTATING CORRECTLY.
8) FIRE AND VOLUME DAMPERS ARE IN PLACE AND OPEN.
9) AIR COIL FINS ARE CLEANED AND COMBED.
10) ACCESS DOORS ARE CLOSED AND DUCT END CAPS ARE IN PLACE.
11) AIR OUTLETS ARE INSTALLED AND CONNECTED.
12) DUCT SYSTEM LEAKAGE IS MINIMIZED.
13) HYDRONIC SYSTEMS ARE FLUSHED, FILLED, AND VENTED.
14) PUMPS ARE ROTATING CORRECTLY.
15) PROPER STRAINER BASKETS ARE CLEAN AND IN PLACE OR IN NORMAL POSITION.
16) SERVICE AND BALANCING VALVES ARE OPEN.

B. IF THE TAB CONTRACTOR DETERMINES THAT A FAN SHEAVE OR BELT REPLACEMENT IS NEEDED TO MEET THE BALANCING REQUIREMENTS, THEN THE HVAC CONTRACTOR SHALL REPLACE THE FAN SHEAVE/BELT AS REQUIRED. THE HVAC CONTRACTOR SHALL NOTIFY THE OWNER IN WRITING OF THE REPLACEMENT WORK.
C. TAB PROCESS & PROCEDURE TAB CONTRACTOR SHALL PROVIDE INITIAL REPORT TO GENERAL CONTRACTOR FOR REVIEW.

3.2 - FIELD QUALITY CONTROL

- A. ALL AIR AND WATER SYSTEMS MUST BE BALANCED WITHIN PLUS OR MINUS 10% OF DESIGN.
B. IF ANY ITEMS ON TAB REPORT ARE NOT WITHIN ABOVE NOTED DESIGN THRESHOLD, TAB AND GENERAL CONTRACTOR SHALL MAKE THE APPROPRIATE CHANGES TO MEET DESIGN SPECIFICATION. IF DESIGN SPECIFICATION CAN NOT BE MET SUBMIT A DEFICIENCY REPORT TO GAP, INC. FOR REVIEW. GENERAL CONTRACTOR TO SUBMIT FINAL TAB REPORT TO GAP, INC. WHEN ALL ITEMS ARE WITHIN SPECIFICATION.

3.3 - ADJUSTING

- A. VERIFY RECORDED DATA REPRESENTS ACTUAL MEASURED OR OBSERVED CONDITIONS.
B. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS SHALL BE RESTORED. SET AND LOCK MEMORY STOPS.

- C. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED. IF DISRUPTED, VERIFY CORRECTING ADJUSTMENTS HAVE BEEN MADE.
D. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES, AND RESTORING THERMOSTATS TO SPECIFIED SETTINGS.
E. AT FINAL INSPECTION, RECHECK RANDOM SELECTIONS OF DATA RECORDED IN REPORT. RECHECK POINTS OR AREAS AS SELECTED AND WITNESSED BY OWNER.

3.4 - SYSTEM PROCEDURES

A. AIR SYSTEMS

- 1) ADJUST AIR HANDLING AND DISTRIBUTION SYSTEMS TO OBTAIN REQUIRED DESIGN SUPPLY, RETURN, AND EXHAUST AIR QUANTITIES AT SITE ALTITUDE.
2) MAKE AIR QUANTITY MEASUREMENTS IN MAIN DUCTS BY PITOT TUBE TRAVERSE OF ENTIRE CROSS SECTIONAL AREA OF DUCT.
3) MEASURE AIR QUANTITIES AT AIR INLETS AND OUTLETS.
4) ADJUST DISTRIBUTION SYSTEM TO OBTAIN UNIFORM SPACE TEMPERATURES FREE FROM OBJECTIONABLE DRAFTS.
5) USE VOLUME CONTROL DEVICES TO REGULATE AIR QUANTITIES ONLY TO EXTENT ADJUSTMENTS DO NOT CREATE UNDESIRABLE VIBRATION OR SOUND LEVELS. EFFECT VOLUME CONTROL BY VOLUME DAMPERS LOCATED IN DUCTS.
6) VARY TOTAL SYSTEM AIR QUANTITIES BY ADJUSTMENT OF FAN SPEEDS. PROVIDE SHEAVE DRIVE CHANGES TO VARY FAN SPEED. VARY BRANCH AIR QUANTITIES BY DAMPER REGULATION.
7) PROVIDE SYSTEM SCHEMATIC WITH REQUIRED AND ACTUAL AIR QUANTITIES RECORDED AT EACH OUTLET OR INLET.
8) MEASURE STATIC AIR PRESSURE CONDITIONS ON AIR SUPPLY UNITS, INCLUDING FILTER AND COIL PRESSURE DROPS, AND TOTAL PRESSURE ACROSS FAN. MAKE ALLOWANCES FOR 50 PERCENT LOADING OF FILTERS.
9) ADJUST OUTSIDE AIR AUTOMATIC DAMPERS, OUTSIDE AIR, RETURN AIR, AND EXHAUST DAMPERS TO DESIGN CONDITIONS.
10) MEASURE TEMPERATURE CONDITIONS ACROSS OUTSIDE AIR, RETURN AIR, AND EXHAUST DAMPERS TO CHECK LEAKAGE.
11) AT MODULATING DAMPER LOCATIONS, TAKE MEASUREMENTS AND BALANCE AT EXTREME CONDITIONS, BALANCE VARIABLE VOLUME SYSTEMS AT MAXIMUM AIRFLOW RATE, FULL COOLING, AND AT MINIMUM AIRFLOW RATE, FULL HEATING.
12) FOR VARIABLE AIR VOLUME SYSTEM POWERED UNITS SET VOLUME CONTROLLER TO AIRFLOW SETTING INDICATED. CONFIRM CONNECTIONS PROPERLY MADE AND CONFIRM PROPER OPERATION FOR AUTOMATIC VARIABLE-AIR-VOLUME TEMPERATURE CONTROL.
13) ON FAN POWERED VAV BOXES, ADJUST AIRFLOW SWITCHES FOR PROPER OPERATION.

B. WATER SYSTEMS

- 1) ADJUST WATER SYSTEMS, AFTER AIR BALANCING, TO OBTAIN DESIGN QUANTITIES.
2) USE CALIBRATED VENTURI TUBES, ORIFICES, OR OTHER METERED FITTINGS AND PRESSURE GAUGES TO DETERMINE FLOW RATES FOR SYSTEM BALANCE. WHERE FLOW-METERING DEVICES ARE NOT INSTALLED, BASE FLOW BALANCE ON TEMPERATURE DIFFERENCE ACROSS VARIOUS HEAT TRANSFER ELEMENTS IN SYSTEM.
3) ADJUST SYSTEMS TO OBTAIN SPECIFIED PRESSURE DROPS AND FLOWS THROUGH HEAT TRANSFER ELEMENTS PRIOR TO THERMAL TESTING. PERFORM BALANCING BY MEASUREMENT OF TEMPERATURE DIFFERENTIAL IN CONJUNCTION WITH AIR BALANCING.
4) EFFECT SYSTEM BALANCE WITH AUTOMATIC CONTROL VALVES FULLY OPEN OR IN NORMAL POSITION TO HEAT TRANSFER ELEMENTS.
5) EFFECT ADJUSTMENT OF WATER DISTRIBUTION SYSTEMS BY MEANS OF BALANCING COCKS, VALVES, AND FITTINGS. DO NOT USE SERVICE OR SHUT-OFF VALVES FOR BALANCING UNLESS INDEXED FOR BALANCE POINT.
6) WHERE AVAILABLE PUMP CAPACITY IS LESS THAN TOTAL FLOW REQUIREMENTS OR INDIVIDUAL SYSTEM PARTS, SIMULATE FULL FLOW IN ONE PART BY TEMPORARY RESTRICTION OF FLOW TO OTHER PARTS.

3.5 - REPORTS

- A. REFER TO PLANS FOR EQUIPMENT DESIGN DATA SCHEDULES.
B. REPORT FORMS
1) TITLE PAGE
a. NAME, ADDRESS, TELEPHONE, AND FACSIMILE OF TESTING, ADJUSTING, AND BALANCING AGENCY
b. AABC OR NEBB CERTIFICATION NUMBER AND SIGNATURE OF CONTRACTOR
c. PROJECT NAME, LOCATION, ARCHITECT, ENGINEER, CONTRACTOR, ALTITUDE AND DATE TAB WAS PERFORMED.
2) SUMMARY COMMENTS
a. COPY OF CERTIFICATE OF CONFORMANCE WITH NATIONAL STANDARDS (AABC OR NEBB) FOR THIS PROJECT.
b. ACTUAL SPACE TEMPERATURES WITH CORRESPONDING THERMOSTAT SET POINTS FOR EACH UNIT.
c. DESIGN VERSUS FINAL PERFORMANCE
d. NOTABLE CHARACTERISTICS OF SYSTEM
e. DESCRIPTION OF SYSTEMS OPERATION SEQUENCE
f. SUMMARY OF OUTDOOR AND EXHAUST FLOWS TO INDICATE BUILDING PRESSURIZATION
g. NOMENCLATURE USED THROUGHOUT REPORT
h. TEST CONDITIONS PER TABLE BELOW:

INSTRUMENT LIST -

- INSTRUMENT
• MANUFACTURER
• MODEL NUMBER
• SERIAL NUMBER
• RANGE
• CALIBRATION DATE

NOTE: THIS IS A STANDARD SPECIFICATION, NOT ALL SECTIONS ARE USED.



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