

## MECHANICAL (HVAC) SPECIFICATIONS

### GENERAL

#### SCOPE

THE GENERAL SCOPE OF THE HVAC WORK IS TO REMOVE EXISTING SYSTEMS, MODIFY THE EXISTING SYSTEMS, AND PROVIDE NEW SYSTEMS AS INDICATED ON THESE DOCUMENTS

THE WORK TO BE DONE UNDER THIS DIVISION OF THE SPECIFICATIONS INCLUDE THE FURNISHING OF ALL EQUIPMENT, SUPPLIES, LABOR, SUPERVISION AND ALL MATERIALS NOT SPECIFICALLY MENTIONED BUT NECESSARY OR REQUIRED TO PROVIDE COMPLETE AND FULLY OPERATIONAL HVAC SYSTEMS. IT IS THE INTENTION OF THE SPECIFICATIONS AND DRAWINGS TO CALL FOR FINISHED WORK, TESTED AND READY FOR OPERATION.

IT IS THE INTENT THAT ALL MECHANICAL WORK AND MATERIALS NECESSARY TO COMPLETE THE ENTIRE PROJECT IN ACCORDANCE WITH THE CONTRACT PLANS AND SPECIFICATIONS, WHETHER SPECIFICALLY MENTIONED HERE OR NOT, SHALL BE FURNISHED. ALL WORK AND MATERIALS NECESSARY TO FULFILL THIS INTENT SHALL BE SUPPLIED UNDER THE MECHANICAL SPECIFICATIONS WITHOUT ADDITIONAL COST TO THE OWNER.

#### DEFINITIONS

**"FURNISH" OR "PROVIDE"** – TO FURNISH, ERECT, INSTALL AND CONNECT UP COMPLETE AND READY FOR OPERATION PARTICULAR WORK REFERRED TO, UNLESS SPECIFICALLY INDICATED OR SPECIFIED OTHERWISE.

**"WORK"** – LABOR, MATERIALS, EQUIPMENT, APPARATUS, CONTROLS, ACCESSORIES AND ALL OTHER ITEMS CUSTOMARILY FURNISHED AND/OR REQUIRED FOR PROPER AND COMPLETE INSTALLATION OF WORK.

**"EXPOSED"** – NOT INSTALLED UNDERGROUND OR "CONCEALED" AS DEFINED ABOVE.

**"INDICATE" OR "SHOW"** – AS INDICATED OR SHOWN ON DRAWINGS OR SPECIFIED WITH SPECIFICATIONS.

**"PIPING"** – PIPE, FITTINGS, FLANGES, VALVES, CONTROLS, HANGERS, TRAPS, DRAINS, INSULATION AND ITEMS CUSTOMARILY OR REQUIRED IN CONNECTION WITH OR RELATING TO SUCH PIPING.

**"SUPPLY"** – TO PURCHASE, PRODUCE, ACQUIRE AND DELIVER COMPLETE WITH ALL RELATED ITEMS.

**"INSTALL"** – TO ERECT, MOUNT AND CONNECT UP COMPLETE WITH ALL RELATED ACCESSORIES.

**"NOTED"** – AS INDICATED ON DRAWINGS AND/OR SPECIFIED.

#### CODES, RULES, PERMITS AND FEES

THIS CONTRACTOR SHALL GIVE ALL NECESSARY NOTICES, OBTAIN ALL PERMITS AND PAY ALL STATE AND LOCAL TAXES, FEES AND OTHER COSTS IN CONNECTION WITH HIS WORK; MAINTAIN ALL RECORDS AND DOCUMENTS AND OBTAIN ALL NECESSARY APPROVALS OF ALL STATE AND LOCAL DEPARTMENTS HAVING JURISDICTION; OBTAIN ALL REQUIRED CERTIFICATES OF INSPECTION FOR HIS WORK AND DELIVER TO THE OWNER BEFORE REQUEST FOR ACCEPTANCE AND FINAL PAYMENT FOR THE WORK.

THIS CONTRACTOR SHALL INCLUDE IN THE WORK, WITHOUT EXTRA COST TO THE OWNER, ANY LABOR, MATERIALS, SERVICES, APPARATUS, DRAWINGS (IN ADDITION TO CONTRACT DRAWINGS AND DOCUMENTS), IN ORDER TO COMPLY WITH ALL APPLICABLE LAWS, ORDINANCES, RULES AND REGULATIONS WHETHER OR NOT SHOWN ON THE DRAWINGS AND/OR SPECIFIED.

THIS CONTRACTOR SHALL PERFORM AND FILE ALL TESTS IN ACCORDANCE WITH THE CURRENT REGULATIONS OF THE STATE AND LOCAL AUTHORITIES. HE SHALL FURNISH AND INSTALL SIGNS REQUIRED BY THE STATE AND LOCAL AUTHORITIES.

ALL MATERIALS FURNISHED AND ALL WORK INSTALLED SHALL COMPLY WITH THE RULES AND RECOMMENDATIONS OF THE NATIONAL BOARD OF FIRE UNDERWRITERS, WITH ALL REQUIREMENTS OF LOCAL UTILITIES COMPANIES, WITH THE RECOMMENDATIONS OF THE FIRE INSURANCE RATING ORGANIZATION HAVING JURISDICTION.

ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE CURRENT NEW YORK STATE BUILDING CODE, INCLUDING THE MOST CURRENTLY ADOPTED NEW YORK STATE SUPPLEMENT AND APPLICABLE AMENDMENTS, STATE FIRE SAFETY CODE, NATIONAL BUILDING CODE, INTERNATIONAL RESIDENTIAL CODE, INTERNATIONAL MECHANICAL CODE, INTERNATIONAL PLUMBING CODE, N.E.P., A.D.A., U.L., NEMA, O.S.H.A. AND WITH ALL REQUIREMENTS OF ALL GOVERNMENTAL DEPARTMENTS HAVING JURISDICTION. REQUIREMENTS OF THE ABOVE SHALL TAKE PRECEDENCE OVER PLANS AND SPECIFICATIONS.

#### INSURANCE

THE MECHANICAL CONTRACTOR SHALL FURNISH STATUTORY COMPENSATION INSURANCE CERTIFICATES FOR PERSONAL AND PROPERTY DAMAGE LIABILITY/ABILITY AS REQUIRED BY THE OWNER AND/OR AS HEREINFORE DESCRIBED.

#### GUARANTEE AND SERVICE

THE CONTRACTOR SHALL GUARANTEE ALL MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM THE DATE OF ACCEPTANCE OF THE INSTALLATION. IN ADDITION, THE CONTRACTOR SHALL PROVIDE, FREE OF CHARGE, ONE YEAR'S MAINTENANCE GUARANTEE ON MAINTAINED SERVICE AND ADJUSTMENT OF ALL EQUIPMENT IN THIS CONTRACT.

ALL COMPRESSORS TO HAVE (5) FIVE YEAR EXTENDED WARRANTIES.

#### DRAWINGS AND INTENT

DRAWINGS ARE INTENDED AS WORKING DRAWINGS FOR GENERAL LAYOUT OF THE VARIOUS HVAC SYSTEMS. HOWEVER, LAYOUT OF EQUIPMENT, ACCESSORIES, SPECIALTIES, DUCTWORK, AND PIPING SYSTEMS ARE DIAGRAMMATIC UNLESS SPECIFICALLY DIMENSIONED, AND DO NOT NECESSARILY INDICATE EVERY REQUIRED PIPE, VALVE, FITTING, TRAP, ELBOW, TRANSITION, OFFSETS, OR SIMILAR ITEMS REQUIRED FOR A COMPLETE INSTALLATION.

ALL EXISTING CONDITIONS ARE NOT INDICATED ON THE DOCUMENTS AND THOSE SHOWN ARE APPROXIMATIONS. THE CONTRACTOR IS TO VERIFY, IN THE FIELD, ALL EXISTING CONDITIONS.

EXAMINATION OF PREMISES – SPECIAL NOTE: NO CONSIDERATION OR ALLOWANCE WILL BE GRANTED FOR FAILURE TO VISIT SITE, OR ANY ALLEGED MISUNDERSTANDING OF MATERIAL TO BE FURNISHED, OR WORK TO BE DONE, IF BEING THAT TENDER OF PROPOSAL INDICATED WITH ITS AGREEMENT TO ITEMS AND CONDITIONS REFERRED TO HEREIN OR INDICATED ON AFOREMENTIONED DRAWINGS.

#### MEASUREMENTS

ALL MEASUREMENTS TAKEN AT THE BUILDING SHALL TAKE PRECEDENCE OVER SCALE DIMENSIONS. EVERY PART OF THE PLANS SHALL BE FITTED TO THE ACTUAL CONDITIONS AT THE BUILDING. IF IN CONFLICT WITH SCALE DIMENSIONS, CONTACT ARCHITECT FOR CLARIFICATION.

#### TEMPORARY SERVICES

THE HVAC CONTRACTOR IS TO COORDINATE WITH THE GENERAL CONTRACTOR, PRIOR TO PERFORMING WORK REQUIRING INTERRUPTION OF EXISTING SERVICES, THE CONTRACTOR SHALL SECURE FROM THE OWNER, APPROVAL OF THE PROPOSED OPERATION.

WORK SHALL BE ARRANGED FOR CONTINUOUS PERFORMANCE WHENEVER POSSIBLE. THE MECHANICAL CONTRACTOR SHALL PROVIDE TEMPORARY SERVICES AND/OR CONNECTIONS WHERE REQUIRED AND/OR SCHEDULE AND PERFORM OVERTIME WORK FOR ANY OPERATION WHICH REQUIRED SHUTDOWN OF THE FACILITIES AT NO ADDITIONAL COST TO THE OWNER.

THE AREA OF CONSTRUCTION AND/OR ADJACENT SPACES MAY BE OCCUPIED DURING THE CONSTRUCTION PERIOD. THE CONTRACTOR IS TO TAKE ALL NECESSARY MEASURES AND PROVIDE ALL MATERIALS TO ENSURE A SAFE ENVIRONMENT FOR THE FACILITY'S OCCUPANTS.

#### CONTINUITY OF EXISTING SYSTEMS

WHEREVER AN EXISTING SYSTEM IS REMOVED, PARTIALLY REMOVED, OR MODIFIED THE REMAINING SYSTEM IS TO FUNCTION FULLY AS BEFORE.

MAINTAIN CONTINUITY OF THE EXISTING AIR SYSTEMS, HYDRONIC SYSTEMS, AND CONTROL SYSTEMS TO THE AREAS NOT AFFECTED BY THIS ALTERATION.

#### SCAFFOLDING, RIGGING AND HOISTING

UNLESS OTHERWISE SPECIFIED, CONTRACTOR SHALL FURNISH ALL SCAFFOLDING, RIGGING, HOISTING AND SERVICES NECESSARY FOR ERECTION AND DELIVERY INTO THE PREMISES OF ANY EQUIPMENT AND APPARATUS FURNISHED.

THE CONTRACTOR SHALL REMOVE SAME FROM PREMISES WHEN NO LONGER REQUIRED.

#### HOUSEKEEPING

THIS CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING STOCK OF MATERIALS AND EQUIPMENT STORED ON PREMISES, AT LOCATIONS DESIGNATED FOR SUCH USE, IN A NEAT AND ORDERLY MANNER.

THIS CONTRACTOR SHALL AT ALL TIMES, KEEP THE PREMISES FREE FROM ACCUMULATION OF WASTE MATERIAL OR RUBBISH CAUSED BY HIS EMPLOYEES AT WORK. HE SHALL REMOVE HIS RUBBISH AND SURPLUS MATERIALS FROM THE JOB SITE AT THE END OF EACH WORK DAY AND SHALL LEAVE THE PREMISES AND HIS WORK IN A CLEAN AND ORDERLY CONDITION.

ALL MATERIAL SCHEDULED FOR REMOVAL IS TO BE DISPOSED OF IN A MANNER MEETING ALL FEDERAL, STATE, AND LOCAL REGULATIONS.

#### PROTECTION OF MATERIALS AND EQUIPMENTS

CLOSE PIPE OPENINGS WITH CAPS OR PLUGS DURING INSTALLATION.

PROVIDE TEMPORARY CLOSURES ON OPEN ENDED DUCTS DURING CONSTRUCTION PERIOD.

TIGHTLY COVER AND PROTECT FIXTURES AND EQUIPMENT AGAINST DIRT, WATER AND CHEMICAL OR MECHANICAL INJURY.

AT COMPLETION OF ALL WORK, FIXTURES, EXPOSED MATERIALS AND EQUIPMENT SHALL BE THOROUGHLY CLEANED.

#### WORK NOT INCLUDED

ALL ELECTRICAL WORK  
CUTTING AND PATCHING  
LINTELS AND STRUCTURAL FRAMING  
ALL CONCRETE WORK  
ALL PAINTING

THIS CONTRACTOR SHALL FURNISH THE GENERAL CONTRACTOR WITH THE SIZES AND LOCATIONS OF CHASES AND OPENINGS WHICH OCCUR IN WALLS, PARTITIONS, FLOORS, ROOFS, ETC., REQUIRED FOR THE INSTALLATION OF THE WORK CALLED FOR UNDER THIS CONTRACT. THIS WORK WILL BE DONE BY THE GENERAL CONTRACTOR, EXCEPT CUTTING REQUIRED FOR THE INSTALLATION OF HANGERS.

#### SHOP DRAWINGS

PRIOR TO DELIVERY TO THE JOB SITE, BUT SUFFICIENTLY IN ADVANCE OF REQUIREMENTS NECESSARY TO ALLOW ENGINEER AMPLE TIME FOR REVIEW, CONTRACTOR SHALL SUBMIT FOR APPROVAL, FIVE (5) COPIES OF EACH SHOP DRAWING.

INDICATE ON EACH SUBMISSION:

1. PROJECT NAME AND LOCATION
2. ARCHITECT AND ENGINEER
3. DRAWING NUMBER
4. APPROVAL STAMP OF PRIME CONTRACTOR

ALL DUCTWORK SHOP DRAWINGS AND COORDINATION DRAWINGS SHALL BE SUBMITTED ON 3/8 IN SCALE DRAWINGS AND SHALL INCLUDE LOCATIONS AND SIZES OF EXISTING EQUIPMENT ALONG WITH NEW WORK. DRAWINGS SHALL INDICATE LOCATIONS OF HANGERS, SUPPORTS, EXPANSION JOINTS, GUIDES, ANCHORS AND ANCHOR LOADS.

COORDINATION DRAWINGS SHALL INDICATE ALL MEP EQUIPMENT, DUCTS AND PIPES AND PERTINENT ARCHITECTURAL ITEMS. MOUNTING HEIGHTS SHALL BE NOTED.

SUBMIT SHOP DRAWINGS FOR THE FOLLOWING:

1. DUCTWORK LAYOUT, SHEET METAL DETAILS/STANDARDS
2. COORDINATION DRAWINGS

#### SUBMITTALS

PRIOR TO DELIVERY TO THE JOB SITE, BUT SUFFICIENTLY IN ADVANCE OF REQUIREMENTS NECESSARY TO ALLOW ENGINEER AMPLE TIME FOR REVIEW, CONTRACTOR SHALL SUBMIT FOR APPROVAL, FIVE (5) COPIES OF EACH SHOP DRAWING.

INDICATE ON EACH SUBMISSION:

1. PROJECT NAME AND LOCATION
2. ARCHITECT AND ENGINEER
3. ITEM IDENTIFICATION
4. APPROVAL STAMP OF PRIME CONTRACTOR

SUBMIT SUBMITTALS ON THE FOLLOWING:

1. PIPING MATERIALS
2. PIPING SPECIALTIES
3. PIPING INSULATIONS
4. DUCT MATERIALS
5. DUCTWORK SPECIALTIES
6. DUCTWORK INSULATORS
7. AIR OUTLETS (ROD)
8. HEATING EQUIPMENT
9. AIR CONDITIONING EQUIPMENT
10. FANS
11. CONTROLS
12. HYDRONIC SYSTEMS BALANCING REPORTS
13. AIR SYSTEMS BALANCING REPORTS

#### EQUIPMENT DETAILING

THE PLANS AND/OR SPECIFICATIONS INDICATE THE NAME, MODEL NUMBER OR TYPE OF EQUIPMENT. MATERIALS SPECIFIED TO SET THE STANDARD OF THE EQUIPMENT FOR THE PROJECT. THE ENGINEER WILL ENTERTAIN THE USE OF OTHER MANUFACTURER'S EQUIPMENT OF LIKE FUNCTIONS AND EQUAL QUALITY. FINAL ACCEPTANCE OF SUBSTITUTES IS AT THE ENGINEER'S DISCRETION. SHOULD THE BIDDER DESIRE TO USE EQUIPMENT OR MATERIALS OR A MANUFACTURER OTHER THAN THOSE SPECIFIED OR SHOWN, HE SHALL ATTACH A RIDER TO THE BID FORM LISTING THE DEDUCTIONS AND/OR ADDITIONS TO HIS BASE BID, TOGETHER WITH THE MANUFACTURER'S NAME AND MODEL NUMBERS OF THE EQUIPMENT OR MATERIALS HE PROPOSED TO FURNISH AS "SUBSTITUTES". IF NO SUBSTITUTE INFORMATION IS FURNISHED, IT WILL BE EXPRESSLY UNDERSTOOD THAT ALL EQUIPMENT AND MATERIALS NAMED WILL BE FURNISHED IN FULL ACCORDANCE WITH THE PLANS AND/OR SPECIFICATIONS.

#### RECORD DRAWINGS

CONTRACTOR SHALL KEEP ACCURATE RECORD OF ALL DEVIATIONS IN WORK AS ACTUALLY INSTALLED FROM WORK INDICATED PAYING PARTICULAR ATTENTION TO DIMENSIONING OUTSIDE UNDERGROUND UTILITY LINES, THEIR OFFSETS AND VALVES.

AT THE CLOSE-OUT OF THE PROJECT THE CONTRACTOR IS TO DELIVER TO THE OWNER TWO SETS OF "AS-BUILT" DRAWINGS COPIES OF ALL APPROVED SHOP DRAWINGS.

#### OWNER'S INSTRUCTIONS AND SYSTEM OPERATION

THE CONTRACTOR IS TO INSTRUCT THE OWNER, OR HIS REPRESENTATIVE, ON THE OPERATION AND MAINTENANCE PROCEDURES FOR ALL OF THE INSTALLED SYSTEMS AND EQUIPMENT. IN ADDITION TO THE VERBAL INSTRUCTIONS, THESE INSTRUCTIONS SHALL BE WRITTEN IN LAYMAN'S LANGUAGE AND SHALL BE INSERTED IN VINYL-COVERED THREE-RING LOOSE LEAF BINDER. THIS INFORMATION IN BINDER SHALL BE FIRST SENT TO AND APPROVED BY THE ARCHITECT/ENGINEER BEFORE TURNING OVER TO OWNER.

#### INSTALLATIONS

##### SLEEVES

PROVIDE NO. 22 GA. GALVANIZED IRON SLEEVES EXTENDED THROUGH CONSTRUCTION AT ALL PENETRATIONS THROUGH CEILINGS, WALLS AND PARTITIONS.

FOR INSULATED PIPING THE SLEEVE IS TO BE SIZED TO ALLOW INSULATION TO PASS THROUGH SLEEVE, PROVIDE 1/2 INCH SPACE BETWEEN PIPE AND/OR INSULATION AND SLEEVE.

FIRE SEAL ALL SLEEVES IN ACCORDANCE WITH BUILDING CODE AND APPLICABLE SECTIONS OF THE NFPA.

##### EXPANSION ANCHORS

SUSPEND HANGERS FROM EXPANSION ANCHORS IN SOLID CONCRETE SLABS SIMILAR TO HLTI HDI. PROVIDE HANGER IN PLACE WITH DOUBLE NUTS.

PROVIDE PROTECTION SHELDS IN INSULATED PIPING. INSTALL HANGERS OVER INSULATION AND SHELDS.

WHERE OVERHEAD CONSTRUCTION DOES NOT PERMIT FASTENING HANGER RODS IN REQUIRED LOCATIONS, PROVIDE ADDITIONAL STEEL FRAMING AS REQUIRED AND REVIEWED.

#### HANGERS AND SUPPORTING

PIPE HANGING AND SUPPORTING – PIPING SHALL NOT BE SUPPORTED BY OTHER PIPING, BUT SHALL BE SUPPORTED WITH PIPE HANGERS SUITABLE FOR THE SIZE OF PIPE AND PROPER STRENGTH AND QUALITY AT PROPER INTERVALS, SO THAT THE PIPING CANNOT BE MOVED ACCIDENTALLY FROM THE INSTALLED POSITION AS FOLLOWS:

PROVIDE CLEVIS HANGERS	AT CENTER OF CENTER SPACING (UNLESS OTHERWISE NOTED)
1/2 INCH PIPE OR TUBING	6 FEET
3/4 INCH OR 1 INCH PIPE OR TUBING	8 FEET
1-1/4 INCH OR LARGER (HORIZONTAL)	10 FEET
1-1/4 INCH OR LARGER (VERTICAL)	EVERY FLOOR LEVEL

DUCT HANGING AND SUPPORTING – DUCTWORK SHALL NOT BE SUPPORTED BY OTHER DUCTWORK OR PIPING, BUT SHALL BE SUPPORTED WITH HANGERS OF TYPE AND AT SPACING AS PER SMACNA STANDARDS.

#### VIBRATION AND SEISMIC CONTROL

**QUIET OPERATION** – ALL WORK SHALL OPERATE UNDER ALL CONDITIONS OF LOAD WITHOUT ANY SOUND OR VIBRATION WHICH IS OBJECTIONABLE IN THE OPINION OF THE ENGINEER. IN CASE OF MOVING MACHINERY, SOUND OR VIBRATION NOTICEABLE OUTSIDE OF ROOM IN WHICH IT IS INSTALLED OR ANYNOING INSIDE ITS OWN ROOM, WILL BE CONSIDERED OBJECTIONABLE BY THE ENGINEER AND SHALL BE REMEDIED IN APPROVED MANNER BY THE CONTRACTOR AT HIS EXPENSE.

PROVIDE FLEXIBLE PIPE CONNECTIONS AT ALL PIPING CONNECTED TO MOVING EQUIPMENT.

PROVIDE FLEXIBLE DUCT CONNECTIONS AT ALL DUCTWORK CONNECTED TO MOVING EQUIPMENT. FLEXIBLE CONNECTIONS SHALL BE 29 OZ. NEOPRENE COATED FIBERGLASS, 6" WIDE. BURNING PROPERTIES SHALL CONFORM TO NFPA 90A. FASTEN TO DUCTWORK PER MANUFACTURER'S RECOMMENDATIONS. FABRIC SHALL NOT BE STRESSED OTHER THAN BY AIR PRESSURE. ALLOW AT LEAST ONE INCH SLACK TO INSURE THAT NO VIBRATION IS TRANSMITTED.

INSULATE PIPING WITH ISOLATION SPRINGS OR PADS AT MOUNTING AND SUPPORTS FOR ALL EQUIPMENT CAPABLE OF TRANSMITTING VIBRATIONS.

#### SEISMIC RESTRAINTS

SEISMIC RESTRAINTS DESIGNED AND CONSTRUCTED FOR LATERAL FORCES IN ANY DIRECTION SHALL BE PROVIDED FOR ALL MECHANICAL EQUIPMENT IN ACCORDANCE WITH THE STATE BUILDING CODE.

SEISMIC RESTRAINTS SHALL NOT BE REQUIRED FOR THE FOLLOWING:

1. PIPING IN BOILER AND MECHANICAL ROOMS LESS THAN 1-1/4 INCH INSIDE DIAMETER.
2. ALL OTHER PIPING LESS THAN 2-1/2 INCH INSIDE DIAMETER.
3. RECTANGULAR AIR-HANDLING DUCTS LESS THAN 6 SQUARE FEET IN CROSS-SECTIONAL AREA.
4. ROUND AIR-HANDLING DUCTS LESS THAN 28 INCHES IN DIAMETER.
5. PIPING SUPPORTED BY INDIVIDUAL HANGERS 12 INCHES OR LESS IN LENGTH FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE SUPPORT FOR THE HANGER.
6. DUCTS SUSPENDED BY HANGERS 12 INCHES OR LESS IN LENGTH FROM THE TOP OF THE DUCT TO THE BOTTOM OF THE SUPPORT FOR THE HANGER.

SEISMIC RESTRAINT FOR DUCTWORK; PROVIDE REQUIRED BRACING MATERIAL. DUCTWORK SHALL BE SUPPORTED AND BRACED TO RESIST ALL DIRECTIONAL (TRANSVERSE, LONGITUDINAL AND VERTICAL) FORCES EQUAL TO 10 PERCENT OF THE WEIGHT OF THE DUCT SYSTEM.

#### IDENTIFICATION

ALL IDENTIFICATION LABELING IS TO COMPLY WITH ASME A13.1.

ALL PIPING IS TO BE LABELED WITH INDICATIONS OF SERVICE AND DIRECTION OF FLOW.

ALL DUCTWORK IS TO BE LABELED WITH INDICATIONS OF SERVICE, DIRECTION OF FLOW AND ASSOCIATED SYSTEM DESIGNATION.

ALL EQUIPMENT IS TO HAVE PERMANENT LABELS INDICATING EQUIPMENT DESIGNATION.

#### PIPING INSTALLATION

SIZES AND APPROXIMATE LOCATION OF PIPING SYSTEMS ARE SHOWN ON THE DRAWINGS. CHECK CAREFULLY WITH THE ARCHITECTURAL DRAWINGS, DRAWINGS SHOWING WORK OF OTHER TRADES, AND EXISTING FIELD CONDITIONS TO MAKE SURE THAT THERE WILL BE NO CONFLICT BETWEEN THESE TRADES AND THE PIPING SYSTEMS. PIPES SHALL BE OFFSET AS REQUIRED TO CLEAR STRUCTURAL MEMBERS AND EXISTING FIELD CONDITIONS.

PIPING TO BE INSTALLED WITH PROPER PITCH TO LOW POINTS. PROVIDE DRAIN VALVES AT ALL LOW POINTS AND AIR VENTS AT ALL HIGH POINTS OF THE PIPING SYSTEM.

INSTALL PIPING TO ALLOW FOR PIPE EXPANSION.

#### DUCT INSTALLATION

SIZES AND APPROXIMATE LOCATION OF ALL DUCTS ARE SHOWN ON THE DRAWINGS. CHECK CAREFULLY WITH THE ARCHITECTURAL DRAWINGS, DRAWINGS SHOWING WORK OF OTHER TRADES, AND EXISTING FIELD CONDITIONS TO MAKE SURE THAT THERE WILL BE NO CONFLICT BETWEEN THESE TRADES AND THE DUCTS. DUCTS SHALL BE OFFSET AS REQUIRED TO CLEAR STRUCTURAL MEMBERS AND EXISTING FIELD CONDITIONS; IF NECESSARY, THE DIMENSIONS OF THE DUCT MAY BE ALTERED PROVIDED THE CROSS-SECTIONAL AREA IS IN NO CASE REDUCED.

#### FIELD QUALITY CONTROL

PERFORM THE FOLLOWING FIELD TESTS AND INSPECTIONS ACCORDING TO SMACNA'S "HVAC AIR DUCT LEAKAGE TEST MANUAL" AND PREPARE TEST REPORTS:

DISASSEMBLE, REASSEMBLE AND SEAL SEGMENTS OF SYSTEMS TO ACCOMMODATE LEAKAGE TESTING AND FOR COMPLIANCE WITH TEST REQUIREMENTS.

CONDUCT TESTS AT STATIC PRESSURES EQUAL TO MAXIMUM DESIGN PRESSURE OF SYSTEM OR SECTION BEING TESTED. IF PRESSURE CLASSES ARE NOT INDICATED, TEST ENTIRE SYSTEM AT MAXIMUM DESIGN PRESSURE. DO NOT PRESSURIZE SYSTEMS ABOVE MAXIMUM DESIGN OPERATING PRESSURE. GIVE SEVEN DAYS ADVANCE NOTICE FOR TESTING.

MAXIMUM ALLOWABLE LEAKAGE: COMPLY WITH REQUIREMENTS FOR LEAKAGE CLASS 3 FOR ROUND AND FLAT-OVAL DUCTS, LEAKAGE CLASS 12 FOR RECTANGULAR DUCTS IN PRESSURE CLASSES LOWER THAN AND EQUAL TO 2-INCH WG (500 PA) (BOTH POSITIVE AND NEGATIVE PRESSURES), AND LEAKAGE CLASS 6 FOR PRESSURE CLASSES FROM 2- TO 10- INCH WG (500 TO 2500 PA).

REMAKE LEAKING JOINTS AND RETEST UNTIL LEAKAGE IS EQUAL TO OR LESS THAN MAXIMUM ALLOWABLE.

#### MATERIALS

##### DISSIMILAR METALS

WHENEVER DISSIMILAR PIPING MATERIALS ARE CONNECTED THE TWO SHALL BE SEPARATED WITH AN 'INSULATION' CONNECTION (DIELECTRIC) FITTING.

##### PIPING

##### STEAM & CONDENSATE RETURN PIPING

STANDARD WEIGHT, SCHEDULE 40, OPEN HEARTH STEEL, NATIONAL OR EQUAL. FITTINGS FOR STEEL PIPE SHALL BE AS FOLLOWS: GENERALLY, BUTT WELDING FITTINGS OVER TWO INCHES SHALL BE USED AND EITHER SOCKET-WELD OR SCREWED FOR TWO INCHES AND UNDER. WELDING FITTINGS SHALL BE STANDARD FORGED STEEL WITH CHAMFERED ENDS. ALL BRANCHES SHALL BE WELDED WITH EITHER WELDLLETE OR TEES, OR MATCH EXISTING MATERIALS.

##### HOT WATER HEATING PIPING

TYPE L COPPER TUBING WITH SWEAT FITTINGS WITH 95-5 SOLDER OR STANDARD WEIGHT, SCHEDULE 40, OPEN HEARTH STEEL, NATIONAL OR EQUAL. FITTINGS FOR STEEL PIPE SHALL BE AS FOLLOWS: GENERALLY, BUTT WELDING FITTINGS OVER TWO INCHES SHALL BE USED AND EITHER SOCKET-WELD OR SCREWED FOR TWO INCHES AND UNDER. WELDING FITTINGS SHALL BE STANDARD FORGED STEEL WITH CHAMFERED ENDS. ALL BRANCHES SHALL BE WELDED WITH EITHER WELDLLETE OR TEES, OR MATCH EXISTING MATERIALS.

##### CONDENSER WATER PIPING

TYPE L COPPER TUBING WITH SWEAT FITTINGS WITH 95-5 SOLDER OR PVC (EXCEPT IF LOCATED IN A SPACE USED AS AN AIR PLENUM) OR MATCH EXISTING MATERIALS.

#### CONDENSATION DRAIN PIPING

TYPE DWV COPPER TUBING WITH DWV SWEAT FITTINGS OR PVC (EXCEPT IF LOCATED IN A SPACE USED AS AN AIR PLENUM)

#### REFRIGERANT PIPING

TYPE ACR SERVICE COPPER TUBING MEETING ASTM B280: HARD DRAWN (ANY SIZE) OR SOFT DRAWN (1-5/8" ID OR SMALLER), OR AS PER MANUFACTURER'S RECOMMENDATIONS.

#### PIPE INSULATION

THE FOLLOWING PIPING SYSTEMS ARE TO BE INSULATED:

STEAM SUPPLY PIPING  
STEAM CONDENSATE RETURN PIPING WITHIN 10'-0" OF THE FLOOR  
HEATING HOT WATER SUPPLY AND RETURN PIPING  
CHILLED WATER SUPPLY AND RETURN PIPING  
CONDENSATION DRAIN PIPING  
REFRIGERANT SUCTION LINE PIPING

#### HOT WATER & STEAM HEATING AND CHILLED WATER PIPING INSULATION

INSULATE WITH RIGID PREFORMED FIBERGLASS WITH AP-1 PLUS JACKET, SCHULLER MICRO-LOK OR EQUAL. INSULATION THICKNESS SHALL BE 1" THICK FOR BELOW 1 1/4" OR SMALLER PIPING, 1-1/2" THICK FOR 2" TO 3" PIPING AND 2" THICK FOR PIPING 4" AND LARGER. PROVIDE ZESTON COVERS ON ALL FITTINGS.

#### CONDENSATE DRAIN PIPING INSULATION

INSULATE WITH 1/2" THICK HEAVY DENSITY FIBERGLASS 25 ASJ WITH VAPOR BARRIER AND LAP ADHESIVE JACKET. INSULATION ON FITTINGS SHALL BE FIBERGLASS WITH PRE-MOLDED JACKET.

#### REFRIGERANT PIPING INSULATION

INSULATE SUCTION LINE WITH ARMXFLEX INSULATION. MINIMUM INSULATION THICKNESS SHALL BE 1".

#### VALVES AND SPECIALTIES

##### BALANCING FITTINGS

PROVIDE "B & C" CIRCUIT SETTER BALANCING FITTINGS ON ALL WATER SYSTEMS WHENEVER REQUIRED FOR BALANCING OF SYSTEMS.

##### HOT AND CHILLED WATER VALVES

BALL TYPE VALVES TO BE JAMESBURY, CLINCHER, OR APOLLO GATE TYPE VALVES TO BE MILWAUKEE #F-2888M (FLANGED) OSEY TYPE VALVES TO BE IRON BODY, BRONZE MOUNTED OR (SCREWED), BRONZE, RISING STEM. CHECK VALVES TO BE CRANE/JENKINS VALVES.

##### THERMOMETERS

SHALL BE THERCIE UNIVERSAL ANGLE TYPE #LB0732, SOLID LIQUID FILLED, 4 1/2" DIAL SIZE. FURNISH WITH SEPARABLE SOCKET WITH 2" EXTENSION NECK.

##### STEAM SPECIALTIES

ALL STEAM TRAPS AND SPECIALTIES TO BE B & G OR SARCO.

##### DUCTWORK

##### SHEET METAL DUCTWORK

ALL DUCTWORK SHALL BE CONSTRUCTED OF #1 QUALITY SHEETS OF GALVANIZED STEEL FREE OF CRACKS OR BLEMISHES. WHEN PITCHBURGING OR SNAP LOCKING A JOINT, THE NECESSARY TO ALLOW ENGINEER AMPLE TIME FOR REVIEW, CONTRACTOR SHALL SUBMIT FOR APPROVAL, FIVE (5) COPIES OF EACH SHOP DRAWING.

##### FLEXIBLE DUCTWORK

FLEXIBLE DUCTS TO BE INSULATED TYPE UL 181, CLASS 1, 2-PLY VINYL FILM SUPPORTED BY HELIXOLUST STEEL-STEEL WIRE WITH FIBROUS-GLASS INSULATION AND POLYETHYLENE VAPOR BARRIER FILM. THE LENGTH OF FLEXIBLE DUCT IS NOT TO EXCEED 12'-0". FLEXIBLE DUCT MAY ONLY BE USED ON THE SUPPLY AIR SIDE OF LOW PRESSURE DUCT SYSTEMS.

##### MOISTURE LADEN AIR DUCTWORK

DUCTWORK WHICH CONVEYS AIR WITH A HIGH MOISTURE CONTENT, SUCH AS SHOWER EXHAUST AND AIR VENTS AT ALL HIGH POINTS OF THE PIPING SYSTEM.

##### DUCT INSULATION

##### SOUND (ACOUSTIC) INSULATION

PROVIDE INTERNAL SOUND INSULATION IN ALL DUCTS WITHIN 10'-0" OF THE DISCHARGE OF AN AIR HANDLING UNIT AND WHERE INDICATED ON THE DRAWINGS. THE DUCTWORK SHALL BE LINED WITH JOHNS MANVILLE PERMACOTE ACOUSTIC THICKNESS, UNLESS SPECIFIED OTHERWISE, SHALL BE 1". LINER SHALL BE APPLIED TO DUCT IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND SMACNA GUIDELINES, LATEST EDITION. WHERE SOUND INSULATION IS INDICATED, DUCTWORK SIZES DENOTED ARE THE INSIDE DIMENSIONS AFTER THE INSULATION HAS BEEN INSTALLED.

##### THERMAL INSULATION

COVER ALL CONCEALED UNLINED SUPPLY AIR AND OUTSIDE AIR DUCTWORK WITH FIBERGLASS DUCT WRAP HAVING A MIN. R-6, EQUAL TO JOHNS MANVILLE R-SERIES MICROLOTE WITH F-162, VAPOR BARRIER. ALL SUPPLY DUCTS, LOCATED IN ATTIC SHALL BE INSULATED TO MINIMUM R-8. COVER ALL EXPOSED UNLINED SUPPLY AIR AND OUTSIDE AIR DUCTWORK WITH RIGID FIBERGLASS BOARD INSULATION HAVING MIN. R-6. PROVIDE ALL TAPS, MASTER SEALERS, INSULATION, RESIDENTIAL DUCTS OUTSIDE THE BUILDING ENVELOPE SHALL BE INSULATED TO A MINIMUM OF R-8. RESIDENTIAL DUCTWORK INSIDE THE BUILDINGS THERMAL ENVELOPE DOES NOT REQUIRE INSULATION. ALL EXTERIOR DUCTS TO BE INSULATED TO A MINIMUM OF R-8.

##### THERMAL INSULATION SCHEDULE

INSULATE DUCTS IN COMPLIANCE WITH THE INTERNATIONAL ENERGY CONSERVATION CODE. COMMERCIAL DUCTWORK SHALL BE INSULATED TO R-6 WHEN IN UNCONDITIONED SPACES AND R-8 WHEN LOCATED OUTSIDE THE BUILDING. COMMERCIAL DUCTWORK IN CONDITIONED SPACES DOES NOT REQUIRE INSULATION. RESIDENTIAL DUCTS OUTSIDE THE BUILDING ENVELOPE SHALL BE INSULATED TO A MINIMUM OF R-8. RESIDENTIAL DUCTWORK INSIDE THE BUILDINGS THERMAL ENVELOPE DOES NOT REQUIRE INSULATION. ALL EXTERIOR DUCTS TO BE INSULATED TO A MINIMUM OF R-8.

##### DUCT SEALING

SEAL ALL DUCTWORK IN COMPLIANCE WITH THE INTERNATIONAL ENERGY CONSERVATION CODE.

COMMERCIAL DUCTS, SEAL ALL LONGITUDINAL AND TRANSVERSE JOINTS, SEAMS AND CONNECTIONS.

RESIDENTIAL DUCTS, VERIFY DUCT LEAKAGE WITH POST CONSTRUCTION OR ROUGH-IN TEST. RESIDENTIAL DUCT LEAKAGE VERIFICATION NOT REQUIRED IF AIR HANDLER AND