

## Public Health Research Center Interior Renovations - Plumbing

**Project # BC00392344-B** 

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Project Number: BC00392344-B

Project Name: Public Health Research Center Interior Renovations - Plumbing

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#### **Section II - Technical Specifications:**

Refer to Drawings for all technical specifications.



## **SE-311 Invitation for Minor Construction Quotes**

#### SCBO NOTES 2, 4 and 5 APPLY TO THIS INVITATION FOR QUOTES

AGENCY CONSTRUCTION	ON CERTIFICA	ATTON? (Agency M	IUST check one)	YES NO
, SC 29208/ATTN:Ka	y Keisler	743 Greene St.,	Cola.,SC 2920	
DRESSES:	<u> </u>	MAIL SERVICE	<b>;</b> :	ne St.Cola.SC,Conf.Rm.53
STA	TE: SC ZIP:	29208 Е-МАП	. kkeisler@fm	c.sc.edu
ene Street		PHONE	803-777-581	2 Fax: 803-777-8739
AGENCY COORDINATO	OR: Kay Ke	eisler, Procurem	ent Specialist	
ity of South Carolina				
				Yes X No C, Conf. Rm. 53
	<del></del>			7
	purchasing.sc			Yes No X
	•			
DODGE; X				
AGC: X				
STA	ATE:NC ZIP:	28284 E-MAI	L: bbenson@je	enkinspeer.com
		· PHON	E: _704-372-666	Fax:
- Peer Architects			A/E CONTACT:	Ben Benson
enkins - Peer Architect extures, faucets, piping	ture, plumbing	design enginee	r - RMF Engine	eering. Work includes but
- 155 L		3.131.10C11O11	JOST MANGE.	
	-1 12-1	ONSTRUCTION (	COST DANCE: S	S10,000.00 - \$50,000.00
		CT LOCATION:	Columbia	
Public Health Resear				
	enkins - Peer Architect xtures, faucets, piping ion is encouraged.  - Peer Architects - STA  AGC: X DODGE: X OTHER: Vendor is AINED FROM: http:// DUNT: NONE - NONE - X Yes - TIME: 10:00 AM - Sity of South Carolina - AGENCY COORDINAT - ene Street - STA	NO REQUIRED? Yes No X  OUIRED? Yes No X  QUIRED? Yes No X  ROJECT: Inaterials, equipment and supervision enkins - Peer Architecture, plumbing attures, faucets, piping and insulation ion is encouraged.  - Peer Architects  The Tryon St.  STATE: NC  AGC: X  DODGE: X  OTHER: Vendor is responsible for the plumbing attures and the plumbing attures.  NONE  RENCE? X Yes No M  TIME: 10:00 AM PLACE: 7  Sity of South Carolina  AGENCY COORDINATOR: Kay Keene Street  STATE: SC ZIP:  E: 5/15/2012 TIME: 2:15 Indicates and a SC 29208/ATTN: Kay Keisler	NO REQUIRED? Yes No X  OURED? Yes No X  OURED? Yes No X  CONSTRUCTION O  ROJECT: naterials, equipment and supervision to install compenkins - Peer Architecture, plumbing design enginee xtures, faucets, piping and insulation for complete prion is encouraged.  - Peer Architects  th Tryon St. PHONI  STATE: NC ZIP: 28284 E-MAI  AGC: X  DODGE: X  OTHER: Vendor is responsible for all downlown and the properties of the properties	NO REQUIRED? Yes No X  NO REQUIRED? Yes No X  QUIRED? Yes No X  CONSTRUCTION COST RANGE:  ROJECT:  Interials, equipment and supervision to install complete all plumbin enkins - Peer Architecture, plumbing design engineer - RMF Engine attures, faucets, piping and insulation for complete plumbing system ion is encouraged.  - Peer Architects A/E CONTACT:  - Peer Architects A/E CONTACT:  - Peer Architects A/E CONTACT:  - Phone: 704-372-666  STATE: NC ZIP: 28284 E-MAIL: bbenson@i  AGC: X  DODGE: X  OTHER: Vendor is responsible for all downloads from http://purchasing.sc.edu (See Facilities/Construction is deposit refundable?  NONE IS DEPOSIT REFUNDABLE?  STATE: NO MANDATORY ATTENDANCE?  TIME: 10:00 AM PLACE: 743 Greene Street, Columbia, Some interior is street PHONE: 803-777-581.  STATE: SC ZIP: 29208 E-MAIL: kkeisler@fm  E: 5/15/2012 TIME: 2:15 PM LOCATION: 743 Greene  MAIL SERVICE:  University of South Carolina  MAIL SERVICE:  University of South Carolina

#### **Quote Form**

	Quotes shall be subi	mitted only on SE-331
QUOTE SUBMITTED BY:		
	(0	fferor's Name)
QUOTE SUBMITTED TO:		y of South Carolina
	$(A_{\epsilon})$	gency Name)
FOR PROJECT: BC00392344-B	Public	Health Research Center Interior Renov Plumbing
(Number)		(Name)
the above-named Project, the undersigned AGENCY in the form included in the So Documents, for the prices and within the conditions stated.	OFFEROR proposes an licitation Documents, an e time frames indicated ne SC Code of Laws, as a	on Quotes, and in compliance with the Instructions to Bidders for d agrees, if this Quote is accepted, to enter into a Contract with the d to perform all Work as specified or indicated in the Solicitation in the Solicitation and in accordance with the other terms and amended, OFFEROR has submitted Bid Security as follows in the
Bid Bond with Power of Attorn (OF)	ey Electronic l	
3. OFFEROR acknowledges the receipt said Addenda into its Quote:	of the following Addend	a to the Solicitation documents and has incorporated the effects of
and shall remain open for acceptance for a OFFEROR may agree to in writing upon r. 5. OFFEROR agrees that from the comfor each calendar day the actual construct Contract Time for Substantial Completion, 6. OFFEROR herewith submits its offer the open calendar and the submits its offer the open calendar and t	period of	he AGENCY shall retain as Liquidated Damages the amount of chieve Substantial Completion exceeds the specified or adjusted
6.1 BASE BID		
	(enter BASE BID i	n figures only)
6.2 ALTERNATE NO. 1	N/A	to be ADDED/DEDUCTED from BASE BID. (circle one)
6.3 ALTERNATE NO. 2	N/A	to be ADDED/DEDUCTED from BASE BID. (circle one)
FEIN/SSN:		This Quote is hereby submitted on behalf of the Offeror
SC Contractor's		named above.
License Number:		BY:(Signature of Offeror's Representative)
Address:		(Signature of Offeror's Representative)
		(Print or Type Name of Offeror's Rpresentative)
Telephone/Fax		(2.1. or 2. per time of Official a Apresentative)
E-mail		ITS:

## USC SUPPLEMENTAL GENERAL CONDITIONS FOR CONSTRUCTION PROJECTS

- 1. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.
- 2. Fraternization between Contractor's employees and USC students, faculty or staff is strictly prohibited zero tolerance!
- 3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to \$500 per violation.
- 4. Contractor's employees must adhere to the University's policy of maintaining a drug-free and smoke-free/tobacco free workplace.
- 5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.
- 6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.
- 7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials **must not** be disturbed until approved by the USC Project Manager.
- 8. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractors work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. Personal vehicles must 'be parked in the perimeter parking lots. Parking permits can be obtained at the USC Parking Office located in the Pendleton Street parking garage. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to Parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the PM. The area will be maintained in a neat and orderly fashion.
- 9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.

- 10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.
- 11. For all projects over \$100,000, including IDC's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.
- 12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least <u>one (1)</u> times per week. Construction waste must not be placed in University dumpsters. The construction site must be thoroughly cleaned with all trash picked up and properly disposed of on a daily basis and the site must be left in a safe and sanitary condition each day. The University will inspect job sites regularly and will fine any contractor found to be in violation of this requirement an amount up to \$1,000.00 daily per violation.
- 13. Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.
- 14. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 6' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 3" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone if USC Arborist determines that construction may decrease amount of moisture needed to sustain health of tree(s).
- 15. Contractor shall water trees and other landscape material as directed by USC Arborist until site is returned to Owner.
- 16. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.
- 17. For projects requiring heavy loads to cross walks, tree root zones or lawns on a regular basis (as determined by USC Project Manager), a construction entry road consisting of 10' X 16' oak logging mats placed on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.
- 18. Any damage to existing landscaping (including lawn areas) will be remediated at Contractor's expense before final payment is made.

#### **Contractor Vehicle Requirements on Campus**

- 1. All motorized vehicles on the University campus are expected to travel and park on roadways and/or in parking stalls.
- 2. All motorized vehicle traffic on USC walkways must first be authorized by USC Grounds Department and USC Project Manager. Violators may be subject to fines and penalties.
- 3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.
- 4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 10 below.
- 5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.
- 6. Vehicle drivers who park on landscape or drives must be able to produce written evidence of need or emergency requiring parking on same.
- 7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.
- 8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage.
- 9. All incidents of property damage will be reported to Parking Services or the Work Management Center.
- 10. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the project manager and contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be Afixed@. Parking spaces are restricted to work vehicles only; no personal vehicles.

Project Name:

Public Health Research Center Interior Renovations - Plumbing

Project Number:

BC00392344-B

University of South Carolina

#### **CONTRACTOR'S ONE YEAR GUARANTEE**

STATE OF
COUNTY OF
WE
as General Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee;
Defects or failures resulting from abuse by Owner.
Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.
[Name of Contracting Firm]
*By
Title
*Must be executed by an office of the Contracting Firm.
SWORN TO before me this day of, 2 (seal)
State
My commission expires

# TECHNICAL SPECIFICATIONS

(Refer to Drawings)

#### SECTION 15000 - MECHANICAL AND ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

#### 1.1 SCOPE

- A. THIS SECTION DESCRIBES THE GENERAL PROVISIONS FOR THE MECHANICAL WORK INCLUDED IN DIVISIONS 15. THIS SECTION APPLIES TO ALL SECTIONS OF DIVISION 15.
- B. THE DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, GENERAL REQUIREMENTS AND ALL OTHER SPECIFICATION SECTIONS APPLY TO THE WORK SPECIFIED IN THIS SECTION. IN THE EVENT OF CONFLICT BETWEEN SPECIFIC REQUIREMENTS OF THE VARIOUS DOCUMENTS, THE MORE RESTRICTIVE, THE MORE EXTENSIVE (I.E.: MORE EXPENSIVE) REQUIREMENT SHALL GOVERN.

#### 1.2 RESPONSIBILITY

- A. THE GENERAL CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WORK INCLUDED IN THE MECHANICAL DIVISION. THE DELEGATION OF WORK TO SUBCONTRACTORS SHALL NOT RELIEVE HIM OF THIS RESPONSIBILITY. SUBCONTRACTORS WHO PERFORM WORK UNDER THESE SECTIONS SHALL BE RESPONSIBLE TO THE GENERAL CONTRACTOR. THE TERM "CONTRACTOR" IS USED THROUGHOUT THIS DIVISION AND SHALL MEAN THE GENERAL CONTRACTOR, ALTHOUGH THE ACTUAL PERFORMANCE OF THE WORK MAY BE BY A SUBCONTRACTOR.
- B. THE CONTRACTOR SHALL CAREFULLY REVIEW ALL DIVISIONS OF THE PROJECT SPECIFICATIONS. WHERE CONFLICTS EXIST BETWEEN DIVISIONS AND/OR SECTIONS OF THE SPECIFICATIONS THE MOST STRINGENT REQUIREMENT AS DETERMINED BY THE ENGINEER SHALL APPLY.

#### 1.3 STANDARD SPECIFICATIONS

- A. REFERENCES TO CATALOGS, STANDARDS, CODES, SPECIFICATIONS, AND REGULATIONS APPLY TO THE LATEST EDITION IN EFFECT AT THE DATE OF THE INVITATION TO BID.
- 1.4 CODES, REGULATIONS, AND PERMITS:
- A. GIVE ALL NECESSARY NOTICES, OBTAIN ALL PERMITS, AND PAY ALL FEES AND OTHER COSTS. FILE ALL NECESSARY PLANS, PREPARE ALL DOCUMENTS, AND OBTAIN ALL NECESSARY APPROVALS OF ALL GOVERNMENTAL DEPARTMENTS HAVING JURISDICTION. OBTAIN ALL REQUIRED CERTIFICATES OF INSPECTION AND DELIVER SAME TO THE ARCHITECT BEFORE REQUEST FOR ACCEPTANCE AND FINAL
- B. ALL MATERIALS FURNISHED AND ALL WORK INSTALLED SHALL COMPLY WITH THE LATEST RULES. REGULATIONS, AND RECOMMENDATIONS OF THE FOLLOWING BODIES:
  - ICC INTERNATIONAL BUILDING CODE (2009) ICC INTERNATIONAL MECHANICAL CODE (2009)
  - ICC INTERNATIONAL ENERGY CONSERVATION CODE (2006)
  - ICC INTERNATIONAL PLUMBING CODE (2009) ICC INTERNATIONAL FIRE CODE (2009)
  - NATIONAL ELECTRIC CODE (2005) NATIONAL FIRE PROTECTION ASSOCIATION (LATEST EDITIONS)
  - LOCAL UTILITY COMPANIES ASHRAE/IESNA 90.1
  - ASHRAE STANDARDS AND HANDBOOKS
  - UNDERWRITERS LABORATORIES OWNER'S INSURANCE UNDERWRITER STANDARDS ENVIRONMENTAL PROTECTION AGENCY
- 1.5 MATERIALS LIST AND SHOP DRAWINGS

- A. SUBMIT FOR APPROVAL. DIMENSIONED DRAWINGS OR CUTS SHOWING CONSTRUCTION SIZE, ARRANGEMENT, OPERATING CLEARANCES, PERFORMANCE CHARACTERISTICS, AND CAPACITY OF MATERIAL OR EQUIPMENT. EACH ITEM OF EQUIPMENT PROPOSED SHALL BE A STANDARD CATALOG PRODUCT OF THE APPROVED MANUFACTURER. SUBMITTALS SHALL BE RECEIVED EARLY IN THE CONSTRUCTION PERIOD TO ALLOW THE ENGINEER AMPLE TIME FOR REVIEW AND CHECKING FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS. THE ENGINEER WILL BE EXPECTED TO PROCESS A MAXIMUM OF TEN (10) SUBMITTALS IN A FIVE (5) DAY WORKING PERIOD. THE CONTRACTOR SHALL CAREFULLY SCHEDULE THE SUBMISSION TIME OF ALL SUBMITTALS TO INSURE THAT APPROVALS WILL BE RECEIVED TO MEET THE CRITICAL PATH OF THE CONSTRUCTION PROJECT.
- B. IF THE CONTRACTOR'S SUBMITTALS, UPON REVIEW BY THE ENGINEER, DO NOT CONFORM TO THE REQUIREMENTS OF THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL BE REQUIRED TO RESUBMIT WITH MODIFICATION, WITHIN FIFTEEN (15) WORKING DAYS OF RECEIPT OF THE ENGINEER'S NOTIFICATION AND COMMENTS TO THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE EXTRA EXPENSES FOR SUBSEQUENT REVIEW OF REJECTED OR REVISED SUBMITTALS NECESSITATED BY THE CONTRACTOR'S FAILURE TO PROVIDE A COMPLETE AND ACCURATE SUBMITTAL MEETING THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. SUCH EXTRA FEES SHALL BE DEDUCTED BY THE OWNER FROM PAYMENTS TO THE CONTRACTOR.
- C. IF MATERIAL OR EQUIPMENT IS INSTALLED PRIOR TO RECEIPT BY THE CONTRACTOR OF PERTINENT SHOP DRAWINGS MARKED "NO EXCEPTIONS TAKEN" OR "COMMENTS NOTED", THE CONTRACTOR SHALL BE LIABLE FOR ITS REMOVABLE REPLACEMENT AT NO EXTRA CHARGE TO THE OWNER.

## 1.6 SHOP DRAWINGS

- A. SUBMIT DATA AND SHOP DRAWINGS AS LISTED BELOW, IN ADDITION TO PROVISIONS OF PARAGRAPHS ABOVE. IDENTIFY ALL SHOP DRAWINGS BY THE NAME OF THE ITEM AND SYSTEM AND APPLICABLE SPECIFICATION PARAGRAPH NUMBER.
- SHOP DRAWINGS:
- SECTION 15000 RECORD DRAWINGS
- PIPE AND CONDUIT HANGERS AND SUPPORTS SLEEVES AND PENETRATIONS DRAWINGS WELDER'S CERTIFICATES
- SECTION 15400 CONTRACTOR QUALIFICATIONS
- CONTROL AND DRAIN VALVES
- TAMPER SWITCHES AUTOMATIC SPRINKLERS
- SUPERVISORY AND ALARM EQUIPMENT FLOW SWITCHES
- PIPES AND FITTINGS HANGERS VALVES
- SECTION 15100 IDENTIFICATION ITEMS
- HANGER AND PIPE SHIELDS PIPE. FITTINGS AND JOINTS BALL VALVES
- UNIONS SECTION 15200
- ALL INSULATION TYPES ADHESIVES, SEALERS AND COATINGS FITTING AND VALVE COVERS
- SECTION 15300
- CLEANOUTS PLUMBING FIXTURES
- SECTION 15800 AIR DEVICES
- SECTION 15850 ATC DEVICES/PRODUCT DATA
- DUCTWORK SECTION 15990

TEST REPORTS

B. CONTRACTOR, ADDITIONALLY, SHALL SUBMIT FOR APPROVAL ANY OTHER SHOP DRAWINGS AS REQUESTED BY THE ENGINEER. NO ITEM LISTED ABOVE SHALL BE DELIVERED TO THE SITE, OR INSTALLED, UNTIL APPROVED. AFTER THE PROPOSED MATERIALS HAVE BEEN APPROVED, NO

SUBSTITUTION WILL BE PERMITTED EXCEPT WHERE APPROVED BY THE ENGINEER.

## 1.7 GUARANTEE

A. THE CONTRACTOR GUARANTEES, BY HIS ACCEPTANCE OF THE CONTRACT, THAT ALL WORK INSTALLED, BY HIM OR HIS SUBCONTRACTORS, WILL BE FREE FROM DEFECTS, IN WORKMANSHIP AND MATERIALS, FOR A PERIOD OF ONE (1) YEAR AFTER THE DATE OF CERTIFICATION OF COMPLETION AND ACCEPTANCE OF WORK. ANY DEFECTS IN WORKMANSHIP, MATERIALS OR PERFORMANCE WHICH APPEAR WITHIN THE GUARANTEE PERIOD SHALL BE CORRECTED BY THE CONTRACTOR, WITHOUT COST TO THE OWNER, WITHIN A REASONABLE TIME TO BE SPECIFIED IN NOTICE FROM THE ARCHITECT. IN DEFAULT THEREOF, OWNER MAY HAVE SUCH WORK DONE AND CHARGE THE COST OF SAME TO THE CONTRACTOR.

## 1.8 SITE VISIT

A. PRIOR TO PREPARING THE BID, THE CONTRACTOR AND SUBCONTRACTORS SHALL VISIT THE SITE AND FAMILIARIZE THEMSELVES WITH ALL EXISTING CONDITIONS, MAKE ALL NECESSARY INVESTIGATIONS AS TO LOCATIONS OF UTILITIES, AND ALL OTHER MATTERS WHICH CAN AFFECT THE WORK. NO ADDITIONAL COMPENSATION WILL BE MADE TO THE CONTRACTOR AS A RESULT OF HIS FAILURE TO FAMILIARIZE HIMSELF WITH THE EXISTING CONDITIONS UNDER WHICH THE WORK MUST BE PERFORMED.

## 1.9 DRAWINGS

A. THE CONTRACT DRAWINGS ARE DIAGRAMMATIC AND INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS AND WORK INCLUDED IN THE CONTRACT. ANY OFFSETS. RISES. OR TRANSITIONS NOT SHOWN ON THE DRAWINGS AND REQUIRED TO PROVIDE A COMPLETE SYSTEM SHALL BE PROVIDED AT NO ADDITIONAL CONTRACT COST. DO NOT SCALE THE DRAWINGS. REFER TO THE ARCHITECTURAL DRAWINGS AND DETAILS FOR EXACT LOCATION OF EQUIPMENT AND DEVICES.

#### 1.10 RECORD DRAWINGS

A. CONTRACTOR SHALL KEEP ACCURATE RECORDS OF ALL DEVIATIONS IN WORK, AS A ACTUALLY INSTALLED, FROM WORK INDICATED.

#### 1.11 ELECTRICAL WORK

A. UNDER DIVISION 16 ELECTRICAL, PROVIDE:

#### POWER WIRING

PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. ALL MATERIALS SHALL BE NEW, THE BEST OF THEIR RESPECTIVE KINDS, SUITABLE FOR THE CONDITIONS AND DUTIES IMPOSED ON THEM AT THE BUILDING, AND SHALL BE OF REPUTABLE MANUFACTURERS'. THE DESCRIPTION, CHARACTERISTICS, AND REQUIREMENTS OF MATERIALS TO BE USED SHALL BE IN ACCORDANCE WITH QUALIFYING CONDITIONS ESTABLISHED IN THE SECTIONS FOLLOWING.
- 1. IT IS DISTINCTLY UNDERSTOOD: (1) THAT THE ENGINEER WILL USE HIS OWN JUDGMENT IN DETERMINING WHETHER OR NOT ANY MATERIALS, EQUIPMENT OR METHODS OFFERED IN SUBSTITUTION ARE EQUAL TO THOSE SPECIFIED; (2) THAT THE DECISION OF THE ENGINEER ON ALL SUCH QUESTIONS OF EQUALITY IS FINAL; AND (3) THAT ALL SUBSTITUTIONS WILL BE MADE AT NO INCREASE IN COST TO THE OWNER.
- 2. UPON RECEIPT OF WRITTEN APPROVAL FROM THE ENGINEER, THE CONTRACTOR MAY PROCEED WITH SUBSTITUTION PROVIDING THE CONTRACTOR ASSUMES FULL RESPONSIBILITY FOR, AND MAKES, AT HIS OWN EXPENSE, ANY CHANGES OR ADJUSTMENTS IN CONSTRUCTION OR CONNECTION WITH OTHER WORK THAT MAY BE REQUIRED BY THE SUBSTITUTION OF SUCH MATERIALS, EQUIPMENT OR METHODS. IN THE EVENT OF ANY ADVERSE DECISIONS BY THE ENGINEER NO CLAIM OF ANY SORT SHALL BE MADE OR ALLOWED AGAINST THE OWNER.

#### 2.2 PIPING, CONDUITS, AND SUPPORTS, GENERALLY

- A. PIPING AND CONDUITS SHALL BE RUN PARALLEL WITH THE LINES OF THE BUILDING, UNLESS OTHERWISE SHOWN OR NOTED ON THE DRAWINGS.
- B. HANGERS SHALL BE SPACED TO PREVENT SAG AND PERMIT PROPER DRAINAGE. A HANGER SHALL BE PLACED WITHIN ONE (1) FOOT OF EACH HORIZONTAL ELBOW.
- C. VERTICAL RUNS OF PIPE AND CONDUIT LESS THAN FIFTEEN (15) FEET LONG SHALL BE SUPPORTED BY HANGERS PLACED ONE (1) FOOT OR LESS FROM THE ELBOWS ON THE CONNECTING HORIZONTAL RUNS. VERTICAL RUNS OF PIPE AND CONDUIT OVER FIFTEEN (15) FEET LONG, BUT NOT OVER SIXTY (60) FEET LONG, AND NOT OVER SIX (6) INCHES IN SIZE, SHALL BE SUPPORTED BY HEAVY STEEL CLAMPS. CLAMPS SHALL BE BOLTED TIGHTLY AROUND THE PIPES AND CONDUITS AND SHALL REST SECURELY ON THE BUILDING STRUCTURE WITHOUT BLOCKING. CLAMPS MAY BE WELDED TO THE PIPES OR PLACED BELOW COUPLING.
- D. HANGERS SHALL BE OF MANUFACTURERS HEREINAFTER SPECIFIED IN SECTION 15100. UNLESS OTHERWISE SPECIFIED, PIPE AND CONDUIT HANGERS AND HANGER SUPPORTS SHALL CONFORM WITH THE FOLLOWING GRINNELL FIGURES.
- 1. HANGERS GENERALLY SHALL BE FIGS. 65, 104, 212, 260 AND 295.
- 2. HANGER FIGS. 212 AND 295 SHALL BE PROVIDED WITH TURNBUCKLES AND EYE RODS OR RODS WITH EYE NUTS.
- 3. TURNBUCKLES SHALL BE FIGS. 114 OR 230, SHALL HAVE NOT LESS THAN 1-1/2 INCHES OF ADJUSTMENT, AND SHALL BE PROVIDED WITH LOCKNUTS.
- 4. RISER CLAMPS SHALL BE FIGS. 261 OR CT-121.
- 5. CONCRETE INSERTS SHALL BE FIGS. 281 OR 282.
- 6. ON COPPER PIPES, HANGERS IN CONTACT WITH PIPE SHALL BE COPPER PLATED.
- E. HANGER ATTACHMENTS SHALL BE SUITABLE FOR EACH TYPE OF HANGER AND SHALL BE COMPATIBLE WITH THE BUILDING MATERIALS TO WHICH IT IS SECURED.
- F. WELDED ATTACHMENTS FOR SECURING HANGERS TO PIPING OR TO STRUCTURAL STEEL MAY BE PROVIDED IN LIEU OF OTHER ATTACHMENTS SPECIFIED. WELDED ATTACHMENTS SHALL BE DESIGNED SO THAT THE FIBER STRESS AT ANY POINT IN THE WELD OR ATTACHMENT WILL NOT EXCEED THE FIBER STRESS IN THE HANGER ROD.
- G. ON INSULATED PIPING, PROVIDE PIPE SHIELDS, INC. MODEL NO. A3000 AND A5000 FOR USE ON WARM SYSTEMS AND MODEL NO. A4000 AND A6000 FOR USE ON COLD SYSTEMS. CONTRACTOR SHALL SELECT APPROPRIATE SHIELD FOR SUPPORT APPLICATION.
- H. IN NO CASE SHALL WIRE OR PERFORATED STRAP BE USED FOR PIPE OR CONDUIT SUPPORT.
- I. ALL PIPING, DUCTWORK, AND EQUIPMENT SHALL BE SUSPENDED FROM THE STRUCTURE ABOVE UNLESS OTHERWISE INDICATED OR NOTED ON THE DRAWINGS. PROVIDE STRUCTURAL STEEL MEMBERS CONSISTING OF ANGLES, CHANNELS, AND BEAMS AS REQUIRED TO HANG PIPING, DUCTWORK, AND EQUIPMENT.
- A. ALL PIPE SLEEVES SHALL BE CONSTRUCTED OF ONE (1) PIECE SCHEDULE 40 STEEL PIPE, UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
- B. WHERE WATERTIGHT SLEEVES ARE INDICATED, PROVIDE LINK SEAL RUBBER SEALS, AS MANUFACTURED BY THUNDERLINE CORPORATION, BETWEEN PIPES AND SLEEVES.
- C. ESCUTCHEON PLATES SHALL BE PROVIDED FOR ALL EXPOSED PIPES PASSING THROUGH WALLS, FLOORS, AND CEILINGS IN FINISHED AREAS. PLATES SHALL BE CHROME PLATED BRASS, SPLIT RING TYPE, AND SIZED TO MATCH THE PIPE OR INSULATION WHERE INSTALLED. WHERE PLATES ARE PROVIDED FOR PIPES PASSING THROUGH SLEEVES WHICH EXTEND ABOVE THE FLOOR SURFACE, PROVIDE DEEP RECESSED PLATES TO CONCEAL THE PIPE SLEEVES.
- D. AT ALL SLEEVES, WHERE NOISE CAN BE TRANSMITTED AND AT FIRE RATED SEPARATIONS, SEAL ALL OPENINGS BETWEEN PIPES AND DUCTS AND CORRESPONDING SLEEVE TO PREVENT SOUND TRANSMISSION AND MAINTAIN FIRE RATING OF THE WALL, FLOOR OR CEILING. SUBMIT METHOD OF SEALING SLEEVES FOR APPROVAL. U.L. ASSEMBLY RATING OF FIREWALLS AND FLOORS SHALL BE MAINTAINED AT ALL TIMES. ALL SLEEVES INSTALLED IN MASONRY OR CONCRETE CONSTRUCTION SHALL BE GROUTED IN PLACE.

## 2.4 FIRE RATED PENETRATION SYSTEMS

2.3 SLEEVES AND PLATES

- A. PROVIDE UL LISTED FIRE PENETRATION SYSTEMS IN OPENINGS IN RATED FLOORS, WALLS, AND OTHER ELEMENTS OF CONSTRUCTION. PROVIDE UL LISTED FIRE PENETRATION SYSTEMS AT ALL NEW AND EXISTING PIPE PENETRATIONS OF NEW AND EXISTING RATED CONSTRUCTION WITHIN THE AREA OF WORK. COORDINATE WORK OF THIS SECTION WITH ALL OTHER TRADES NECESSARY FOR THE PROPER INSTALLATION OF THE FIRE RATED PENETRATION SYSTEMS.
- B. SUBMIT SHOP DRAWINGS SHOWING EACH CONDITION REQUIRING PENETRATION SEALS INDICATING PROPOSED UL SYSTEMS MATERIALS, ANCHORAGE, METHODS OF INSTALLATION, AND ACTUAL ADJACENT CONSTRUCTION. SUBMIT A COPY OF UL ILLUSTRATION OF EACH PROPOSED SYSTEM INDICATING MANUFACTURER APPROVED MODIFICATIONS. SUBMIT COPIES OF MANUFACTURER'S SPECIFICATIONS, RECOMMENDATIONS, INSPECTION REQUIREMENTS, INSTALLATION INSTRUCTIONS, AND MAINTENANCE DATA FOR EACH TYPE OF MATERIAL REQUIRED. INCLUDE LETTER INDICATING THAT EACH MATERIAL COMPLIES WITH THE REQUIREMENTS AND IS RECOMMENDED FOR THE APPLICATIONS SHOWN.
- C. ALL FIRE PENETRATION SYSTEMS SHALL REFERENCE ASTM E814/UL 1479 FIRE TEST OF THROUGH PENETRATION FIRE STOPS.
- D. ALL SYSTEMS SHALL BE UL TESTED AND LISTED IN THE UL FIRE RESISTANCE DIRECTORY.
- E. THE FIRE RATED PENETRATION SYSTEMS SHALL BE THE PRODUCTS OF ONE MANUFACTURER TO THE MAXIMUM EXTENT POSSIBLE. THE PRODUCTS OF MORE THAN ONE MANUFACTURER SHALL NOT BE USED AS A COMBINED SEAL.
- F. PROVIDE MATERIALS CLASSIFIED BY UL TO PROVIDE FIRE STOPPING EQUAL TO TIME RATING, BOTH "F" AND "T" RATINGS, OF CONSTRUCTION BEING PENETRATED. PROVIDE ASBESTOS FREE MATERIALS THAT COMPLY WITH APPLICABLE CODES AND HAVE BEEN TESTED UNDER POSITIVE PRESSURE IN ACCORDANCE WITH UL 1479 OR ASTM E814. SYSTEMS SHALL BE SMOKE AND AIR TIGHT.
- G. VERIFY EXISTING CONDITIONS AND SUBSTRATES BEFORE STARTING WORK. CORRECT UNSATISFACTORY CONDITIONS BEFORE PROCEEDING. PROCEED WITH INSTALLATION ONLY AFTER PENETRATIONS OF THE SUBSTRATE AND SUPPORTING BRACKETS HAVE BEEN INSTALLED.
- H. CLEAN SURFACES TO BE IN CONTACT WITH PENETRATION SEAL MATERIALS, OF DIRT, GREASE, OIL, LOOSE, MATERIALS, RUST, OR OTHER SUBSTANCES THAT MAY AFFECT PROPER FITTING, ADHESION OF THE REQUIRED FIRE RESISTANCE.
- I. INSTALL PENETRATION SEAL MATERIALS IN ACCORDANCE WITH PRINTED INSTRUCTIONS OF THE UL FIRE RESISTANCE DIRECTORY AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. SEAL HOLES OR VOIDS MADE BY PENETRATIONS TO ENSURE AN EFFECTIVE SMOKE BARRIER. WHERE FLOOR OPENINGS WITHOUT PENETRATING ITEMS ARE MORE THAN FOUR (4) INCHES IN WIDTH AND SUBJECT TO TRAFFIC OR LOADING, INSTALL FIRE STOPPING MATERIALS CAPABLE OF SUPPORTING SAME LOADING AS FLOOR. PROTECT MATERIALS FROM DAMAGES ON SURFACES SUBJECT TO TRAFFIC.
- J. EXAMINE PENETRATION SEALED AREAS TO ENSURE PROPER INSTALLATION BEFORE CONCEALING OR ENCLOSING AREAS. KEEP AREAS OF WORK ACCESSIBLE UNTIL INSPECTION BY APPLICABLE CODE AUTHORITIES. PERFORM UNDER THIS SECTION PATCHING AND REPAIRING OF FIRE STOPPING CAUSED BY CUTTING OR PENETRATION BY LOCAL INSPECTORS AND OTHER TRADES.

## PART 3 - EXECUTION

## 3.1 WORKMANSHIP

A. WORKMANSHIP SHALL BE SATISFACTORY TO THE ENGINEER AND HIS DECISION AS TO ACCEPTABLE QUALITY IS FINAL. WORKMANSHIP PROVEN TO BE OF POOR QUALITY OR UNSATISFACTORY IN THE COMMISSIONING PHASE OF THE PROJECT AS DEEMED BY THE ENGINEER SHALL BE REMOVED AND REPLACED TO THE SATISFACTION OF THE ENGINEER.

## 3.2. EQUIPMENT PERFORMANCE

- A. ALL EQUIPMENT, DEVICES, CONTROLS, AND HARDWARE SHALL BE PROVEN TO OPERATE SUCCESSFULLY THROUGHOUT THE GUARANTEE PERIOD. SYSTEM COMPONENTS OR EQUIPMENT ITEMS THAT FAIL TO CONSISTENTLY DELIVER THE DESIGN CONDITIONS SHALL BE REMOVED AND REPLACED AS DIRECTED BY THE ARCHITECT. THE COST OF REQUIRED EQUIPMENT REPLACEMENTS SHALL BE BORNE BY THE
- B. ALL EQUIPMENT SHALL BE TESTED AFTER INSTALLATION AND BE PROVEN TO DELIVER THE MANUFACTURERS QUOTED DESIGN CAPACITY. WHEN CAPACITY IS IN QUESTION AS DEEMED BY THE ARCHITECT, THE CONTRACTOR SHALL PERFORM A DETAILED AND COMPREHENSIVE FIELD PERFORMANCE TEST TO CERTIFY THE EQUIPMENT CAPACITY. SYSTEM EFFECT OR INSTALLED PERFORMANCE FACTORS MAY NOT BE APPLIED TO PERFORMANCE RATINGS UNLESS THEY WERE PREVIOUSLY INCLUDED WHEN THE EQUIPMENT WAS SUBMITTED FOR APPROVAL. EQUIPMENT THAT FAILS TO DELIVER MANUFACTURERS QUOTED DESIGN CAPACITY SHALL BE REMOVED AND REPLACED AT THE CONTRACTORS EXPENSE.
- C. WORKMANSHIP PROVEN TO BE OF POOR QUALITY OR UNSATISFACTORY IN THE COMMISSIONING PHASE OF THE PROJECT AS DEEMED BY THE ARCHITECT SHALL BE REMOVED AND REPLACED TO THE SATISFACTION OF THE ARCHITECT.

#### 3.3 EQUIPMENT CONNECTIONS

A. ALL EQUIPMENT SHALL BE INSTALLED AND CONNECTED IN ACCORDANCE WITH THE BEST ENGINEERING PRACTICE AND IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS. AUXILIARY PIPING, PIPING SPECIALTIES, WATER SEALS, VALVES, AND ELECTRIC CONNECTIONS RECOMMENDED BY THE MANUFACTURER, REQUIRED BY CODE OR REQUIRED FOR PROPER OPERATION SHALL BE PROVIDED.

#### 3.4 WATERPROOFING

A. UNDER NO CIRCUMSTANCES SHALL WATERPROOFING BE DAMAGED OR PENETRATED. SHOULD CONDITIONS ARISE WHICH INDICATE SUCH NECESSITY, NOTIFY THE ENGINEER

#### 3.5 CUTTING AND PATCHING

- A. CUTTING AND PATCHING ASSOCIATED WITH THE WORK IN THE EXISTING STRUCTURE SHALL BE PERFORMED IN A NEAT AND WORKMANLIKE MANNER. EXISTING SURFACES, WHICH ARE DAMAGED BY THE CONTRACTOR. SHALL BE REPAIRED OR PROVIDED WITH NEW MATERIALS. ALL PATCHING SHALL BE DONE WITH MATERIALS AND METHODS SIMILAR TO EXISTING ADJACENT WORK, SUBJECT TO APPROVAL OF THE ARCHITECT. STRUCTURAL MEMBERS SHALL NOT BE CUT OR PENETRATED. HOLES CUT THROUGH CONCRETE AND/OR MASONRY TO ACCOMMODATE NEW WORK SHALL BE CUT BY RECIPROCATING OR ROTARY, NON-PERCUSSIVE METHODS.
- B. THE CONTRACTOR SHALL SUBMIT TO THE ARCHITECT FOR APPROVAL DIMENSIONED DRAWINGS SHOWING ALL PENETRATIONS THROUGH STRUCTURAL SLABS OR WALLS REQUIRED FOR MECHANICAL AND ELECTRICAL WORK. DRAWINGS SHALL CLEARLY SHOW OPENING SIZE, PLAN LOCATION, AND/OR ELEVATION AS APPLICABLE. ALL OPENINGS SHALL BE APPROVED BY THE ARCHITECT PRIOR TO STARTING WORK.
- C. PATCHING OF AREAS DISTURBED BY INSTALLATION OF NEW WORK SHALL MATCH EXISTING ADJACENT SURFACES IN MATERIAL, TEXTURE, AND COLOR

#### 3.6 INTERRUPTION OF EXISTING UTILITIES

A. NOTIFY THE OWNER IN WRITING AT LEAST SEVEN (7) DAYS IN ADVANCE OF ANY REQUIRED SHUTDOWN OF WATER, SEWAGE, GAS, ELECTRICAL SERVICE OR OTHER UTILITY. UPON WRITTEN RECEIPT OF APPROVAL FROM OWNER, SHUTDOWNS SHALL BE PERFORMED BETWEEN THE HOURS OF SIX (6) P.M. AND SIX (6) A.M. INCLUDING CLEAN-UP OR AS DIRECTED OTHERWISE AND SHALL BE ACCOMPLISHED AT NO ADDITIONAL COST.

#### 3.7 PROTECTION OF EXISTING WORK

A. WHEN WORKING IN AND AROUND THE EXISTING BUILDING, EXTREME CARE SHALL BE EXERCISED WITH REGARD TO PROTECTION OF THE EXISTING STRUCTURE AND MECHANICAL AND ELECTRICAL SERVICES. REPAIR OR REPLACE, TO THE SATISFACTION OF THE (ARCHITECT/ENGINEER), ANY EXISTING WORK DAMAGED IN THE PERFORMANCE OF THE NEW WORK.

## 3.8 SURVEYS AND MEASUREMENTS

- A. BASE ALL MEASUREMENTS (BOTH HORIZONTAL AND VERTICAL) FROM ESTABLISHED BENCH MARKS. ALL WORK SHALL AGREE WITH THESE ESTABLISHED LINES AND LEVELS. VERIFY ALL MEASUREMENTS AT SITE AND CHECK CORRECTNESS OF SAME AS RELATED TO THE WORK. VERIFY LOCATIONS OF EXISTING UTILITIES AND INVERTS OF SAME PRIOR TO THE START OF ANY SYSTEMS SHOWN CONNECTING TO EXISTING UTILITIES.
- B. SHOULD THE CONTRACTOR DISCOVER ANY DISCREPANCY BETWEEN ACTUAL MEASUREMENTS OR CONDITIONS, AND THOSE INDICATED, WHICH PREVENT FOLLOWING GOOD PRACTICE OR THE INTENT OF THE DRAWINGS AND SPECIFICATIONS, HE SHALL NOTIFY THE ENGINEER AND SHALL NOT PROCEED WITH HIS WORK UNTIL HE HAS RECEIVED INSTRUCTION FROM THE ARCHITECT.

#### A. IF ANY EQUIPMENT AND/OR MATERIALS ARE FOUND TO BE IN POOR CONDITION AT THE TIME OF

3.9 HANDLING AND STORAGE OF MATERIAL

INSTALLATION THE ENGINEER MAY, AT HIS DISCRETION, ORDER THE CONTRACTOR TO FURNISH AND INSTALL NEW EQUIPMENT AND/OR MATERIAL AT NO COST TO THE OWNER

## 3.10 CLEANING AND PAINTING

- A. THOROUGHLY CLEAN ALL EXPOSED SURFACES OF EQUIPMENT AND MATERIAL AND LEAVE IN A NEAT, CLEAN CONDITION READY FOR PAINTING. RESTORE AND TOUCH-UP FACTORY FINISHES WHICH HAVE BEEN DAMAGED DURING CONSTRUCTION. FINISHED PAINTING WILL BE PERFORMED UNDER ANOTHER DIVISION.
- FOLLOWING THE PROPER SURFACE PREPARATION OF THE ZINC COATED METAL. 3.11 WELDING

A. WELDING SHALL CONFORM TO CURRENT STANDARDS AND RECOMMENDATIONS OF THE NATIONAL CERTIFIED

PIPE WELDING BUREAU, WITH ALL SOUTH CAROLINA OCCUPATIONAL SAFETY AND HEALTH ACTS, UNIVERSITY

B. PAINT BEHIND GRILLES AND REGISTERS IN FINISHED AREAS WITH TWO (2) COATS OF FLAT BLACK PAINT

#### OF SOUTH CAROLINA AND STATE AND CITY/COUNTY FIRE PREVENTION CODE REQUIREMENTS. AND NFPA STANDARD 241 INCLUDING PROVISION OF APPROPRIATE PORTABLE FIRE EXTINGUISHERS.

INSTALLATION OF THE NORMAL THICKNESS OF FINISHED MATERIAL.

- 3.12 CONNECTIONS AND ALTERATIONS TO EXISTING WORK A. WHEN EXISTING MECHANICAL AND ELECTRICAL WORK IS REMOVED, ALL PIPES, VALVES, DUCTS, AND MATERIALS SHALL BE REMOVED TO A POINT BELOW THE FINISHED FLOORS OR BEHIND FINISHED WALLS AND CAPPED. SUCH POINTS SHALL BE FAR ENOUGH BEHIND FINISHED SURFACES TO ALLOW FOR THE
- B. WHEN THE WORK SPECIFIED HEREINAFTER CONNECTS TO EXISTING EQUIPMENT, PIPING, OR DUCTWORK, THE CONTRACTOR SHALL PERFORM ALL NECESSARY ALTERATIONS, CUTTINGS, OR FITTING OF EXISTING WORK AS MAY BE NECESSARY OR REQUIRED TO MAKE SATISFACTORY CONNECTIONS BETWEEN THE NEW AND EXISTING WORK AND TO LEAVE THE COMPLETED WORK IN A FINISHED AND WORKMANLIKE CONDITION, TO THE ENTIRE SATISFACTION OF THE ENGINEER.
- C. WHEN THE WORK SPECIFIED HEREINAFTER OR UNDER OTHER DIVISIONS OF THE CONTRACT NECESSITATES RELOCATION OF EXISTING EQUIPMENT, PIPING, OR DUCTWORK, THE CONTRACTOR SHALL PERFORM ALL WORK AND MAKE ALL NECESSARY CHANGES TO EXISTING WORK AS MAY BE REQUIRED TO LEAVE THE COMPLETED WORK IN A FINISHED AND WORKMANLIKE CONDITION, TO THE SATISFACTION OF THE ENGINEER. ALL WORK RESULTING IN AN EXTRA TO THE CONTRACT SHALL BE APPROVED BY THE OWNER
- AND ENGINEER BEFORE PROCEEDING. D. ALL CUTTING AND PATCHING NECESSARY FOR THE INSTALLATION OF THE MECHANICAL WORK SHALL BE DONE UNDER THIS DIVISION. ANY DAMAGE DONE TO THE WORK ALREADY IN PLACE SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. PATCHING SHALL BE UNIFORM IN APPEARANCE AND SHALL MATCH THE SURROUNDING SURFACE.

## 3.13 INTERRUPTION OF EXISTING UTILITIES

- A. INTERRUPTIONS DURING PERIODS OF NORMAL BUILDING OCCUPANCY SHALL BE KEPT TO A MINIMUM. INTERRUPTIONS SHALL ONLY OCCUR AFTER A SCHEDULE OF PROPOSED OUTAGE TIMES IS SUBMITTED TO AND APPROVED BY THE OWNER, ARCHITECT AND ENGINEER.
- B. AT THE END OF EACH INTERRUPTION, ALL SERVICES SHALL BE RESTORED SO THAT NORMAL USE OF THE BUILDING CAN CONTINUE.

## SECTION 15100 - BASIC MATERIALS AND METHODS

#### PART 1 - GENERAL 1.1 SCOPE:

- A. THIS SECTION INCLUDES REQUIREMENTS FOR ITEMS OF MECHANICAL EQUIPMENT, MATERIALS AND PROCEDURES WHICH ARE COMMON TO MORE THAN ONE SECTION OF DIVISION 15 AND WHICH ARE GENERAL IN NATURE AND USE. THIS SECTION APPLIES TO ALL SECTIONS OF DIVISION 15.
- THE DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, GENERAL REQUIREMENTS AND ALL OTHER SPECIFICATION SECTIONS APPLY TO THE WORK SPECIFIED IN THIS SECTION. IN THE EVENT OF CONFLICT BETWEEN SPECIFIC REQUIREMENTS OF THE VARIOUS DOCUMENTS, THE MORE RESTRICTIVE, THE MORE EXTENSIVE (I.E.: MORE EXPENSIVE)

## 1.2 SHOP DRAWINGS:

A. SUBMIT SHOP DRAWINGS FOR ALL ITEMS OF MATERIALS SPECIFIED IN THIS SECTION IN ACCORDANCE WITH THE GENERAL REQUIREMENTS.

## 1.3 TESTS AND ADJUSTMENTS:

REQUIREMENT SHALL GOVERN.

- A. THE CONTRACTOR SHALL FURNISH LABOR, INSTRUMENTS, EQUIPMENT, AND MATERIALS REQUIRED TO PERFORM TESTS PRESCRIBED IN THE SECTIONS DESCRIBING THE VARIOUS SYSTEMS. ALL TESTS SHALL BE PERFORMED IN THE PRESENCE OF THE OWNER AND/OR THE ENGINEER. FORTY-EIGHT (48) HOURS PRIOR NOTICE SHALL BE GIVEN TO THE OWNER AND ENGINEER FOR ALL TESTS. A WRITTEN TEST REPORT SHALL BE SUBMITTED FOLLOWING ALL TESTS AND BEFORE SYSTEMS ARE INSULATED.
- B. REPLACE OR REPAIR DEFECTS FOUND DURING INSPECTION OR TESTS WITH NEW MATERIALS. CAULKING OF WELDED JOINTS, SCREWED JOINTS, CRACKS, OR HOLES IS NOT ACCEPTABLE. CORRECT LEAKS IN

SCREWED FITTINGS BY REMAKING JOINTS. CUT OUT AND REWELD. REPEAT TESTS AFTER DEFECTS HAVE BEEN ELIMINATED.

#### PART 2 - PRODUCTS

2.1 HANGERS

- A. HANGERS AND ACCESSORIES SHALL BE GRINNELL. CARPENTER-PATTERSON. MICHIGAN. B-LINE. OR BASIC ENGINEERING OF THE TYPES SPECIFIED IN SECTION 15000.
- B. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROVIDE AN ADEQUATE PIPE SUSPENSION SYSTEM IN ACCORDANCE WITH RECOGNIZED ENGINEERING PRACTICES, USING STANDARD, COMMERCIALLY
- C. THE DESIGN OF ALL HANGERS AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF THE CURRENT ISSUE OF THE MSS-SP-58 DOCUMENT DEVELOPED AS A STANDARD BY THE MANUFACTURERS' STANDARDIZATION SOCIETY.
- D. HANGERS FOR STEEL PIPE, EXCEPT AS NOTED OTHERWISE, SHALL BE SPACED AT LEAST EVERY TEN (10) FEET. HANGERS FOR CAST IRON PIPE SHALL BE PROVIDED AT EACH JOINT. HANGERS FOR COPPER PIPE SHALL BE PLACED AT LEAST EVERY EIGHT (8) FEET, EXCEPT PIPES 3/4 INCH AND SMALLER SHALL HAVE HANGERS AT SIX (6) FOOT INTERVALS. PLASTIC PIPING SYSTEMS SHALL BE PROVIDED WITH CONTINUOUS PIPE SUPPORT USING LIGHT GAUGE SHEET METAL ANGLES STRAPPED TO PIPES.
- E. ON INSULATED PIPING, PROVIDE PIPE SHIELDS, INC. MODEL NO. A3000 AND A5000 FOR USE ON WARM SYSTEMS AND MODEL NO. A4000 AND A6000 FOR USE ON COLD SYSTEMS. CONTRACTOR SHALL SELECT
- APPROPRIATE SHIELD FOR SUPPORT APPLICATION. F. HANGERS IN DIRECT CONTACT WITH COPPER PIPING SYSTEMS SHALL BE COPPER PLATED.

ACCEPTED PIPE HANGERS AND SUSPENSION EQUIPMENT.

- 2.2 PIPE IDENTIFICATION A. A COMPLETE IDENTIFICATION SYSTEM SHALL BE PROVIDED FOR ALL MECHANICAL AND ELECTRICAL
- B. PIPING SHALL BE IDENTIFIED WITH COLORED, PREROLLED, SEMIRIGID PLASTIC LABELS AS MANUFACTURED BY SETON OR APPROVED EQUAL. LABELS SHALL BE SET ON "SET MARK" SYSTEM AND SHALL BE SET AROUND PIPES WITH A FIELD INSTALLED HIGH STRENGTH CEMENT COMPOUND APPLIED ALONG THEIR LONGITUDINAL EDGE. LABELS SHALL BE PLACED AROUND THE PIPING OR INSULATION EVERY FORTY (40) FEET AND WITH ONE (1) LABEL ON EACH PIPE IN ROOMS SMALLER THAN FIFTEEN (15) FEET.

COMPONENTS WHICH CONFORM WITH THE REQUIREMENTS PUBLISHED IN ANSI STANDARD 13.1.

#### A. PIPING MATERIAL:

2.3 PIPE, FITTINGS AND JOINTS

1. HEATING WATER PIPING — SEAMLESS COPPER WATER TUBE, ASTM B88, TYPE L, HARD.

#### B. PIPING FITTINGS:

C. PIPING JOINTS:

1. HEATING WATER PIPING - SOLDERED: ASTM B32 TIN-ANTIMONY 95-5.

#### 2.4 VALVES

- A. VALVES SHALL BE PROVIDED WHERE INDICATED ON THE DRAWINGS AND AS HEREIN SPECIFIED.
- B. INSTALL SHUT-OFF VALVES IN PIPING WHERE SHOWN AND TO ISOLATE ALL ITEMS OF EQUIPMENT AND BRANCH LINES AT MAINS.

1. HEATING WATER PIPING — WROUGHT COPPER SOLDER JOINT FITTINGS, 150 POUND ANSI B16.22.

- C. VALVE PIPE CONNECTIONS SHALL BE SCREW, SOLDER OR WELD FLANGE AS REQUIRED TO BE CONSISTENT WITH OTHER PARTS OF THE PIPING SYSTEM.
- D. BALANCING VALVES 1. PROVIDE BALANCING VALVES WHERE INDICATED AND REQUIRED TO BALANCE WATER FLOW THROUGH

#### 2. BALANCING VALVES ONE (1) INCH AND SMALLER SHALL BE ARMSTRONG MODEL CBV OR AS MANUFACTURED BY TA HYDRONICS OR APPROVED EQUAL.

THE PIPING SYSTEM.

- E. BALL VALVES:
- 1. BALL VALVES SHALL BE USED IN ALL WATER SYSTEMS SIZE TWO (2) INCHES AND SMALLER. 2. BALL VALVES SHALL BE NIBCO, JAMESBURY, APOLLO OR WATTS.
- 3. THREE (3) PIECE BALL VALVES SIZES 1/2 INCH TO TWO (2) INCH SHALL BE USED FOR ALL WATER PIPING SYSTEMS TO ACCOMMODATE REPLACEMENT OF INTERNAL PARTS. VALVES SHALL BE EQUAL TO NIBCO FIGURE NO. 595-Y-66, SWING OUT DESIGN, BRONZE BODY, FULL PORT, STAINLESS STEEL BALL, AND STAINLESS STEEL STEM (ASTM A-276 TYPE 316), REINFORCED TFE SEATS. BODY BOLTS AND NUTS SHALL BE ZINC DICHROMATE PLATED STEEL AND VALVE SHALL BE SUITABLE FOR 150 POUNDS PER SQUARE INCH SATURATED STEAM SERVICE. VALVES SHALL BE THREADED OR SOLDERED TO SUIT PIPING SYSTEMS WHICH THEY ARE INSTALLED.
- 4. VALVES SHALL BE EQUIPPED WITH LEVER HANDLE WITH EXTENDED STEM FOR INSULATION THICKNESS WHICH SHALL INDICATE POSITION OF BALL ORIFICE AND HAVE STOPS FOR FULLY OPEN AND CLOSED POSITION. CONSTRUCTION SHALL BE SUCH THAT POWER ACTUATOR CAN BE USED. BALL OPENING
- SHALL BE FULL PIPE SIZE. 5. VALVE SHALL BE SUITABLE FOR FLOW IN EITHER DIRECTION AND MUST BE LEAK PROOF AT ALL PRESSURES UP TO 150 POUNDS PER SQUARE INCH GAUGE (PSIG) AND TEMPERATURES FROM MINUS

## TWENTY (-20) DEGREES FAHRENHEIT TO 350 DEGREES FAHRENHEIT IN OPEN OR SHUT POSITION.

- 2.5 DIELECTRIC FITTINGS A. GENERAL: PROVIDE ASSEMBLY OR FITTING WITH INSULATING MATERIAL ISOLATING JOINING OF DISSIMILAR METALS, TO PREVENT GALVANIC ACTION AND STOP CORROSION.
- B. DESCRIPTION: COMBINATION OF COPPER ALLOY AND FERROUS; THREADED, SOLDERED, PLAIN END, OR WELD NECK TYPES MATCHING PIPING SYSTEM MATERIALS.
- D. DIELECTRIC UNIONS: FACTORY-FABRICATED, UNION ASSEMBLY, FOR 250 PSIG MINIMUM WORKING PRESSURE AT 180 DEG. F.

C. INSULATING MATERIAL: SUITABLE FOR SYSTEM FLUID, PRESSURE, AND TEMPERATURE.

LINING, THREADED WITH 300 PSIG MINIMUM WORKING PRESSURE AT 225 DEG. F.

150 OR CLASS 300 FLANGED MATCHING SYSTEM REQUIREMENTS.

BOLT SLEEVES, PHENOLIC WASHERS, AND STEEL BACKING WASHERS. PROVIDE CLASS 150 OR CLASS 300 FLANGES TO MATCH SYSTEM PIPE REQUIREMENTS.

E. DIELECTRIC FLANGE INSULATING KITS: FILED ASSEMBLED, COMPANION FLANGE ASSEMBLY, FULL FACE OR

RING TYPE. COMPONENTS INCLUDE NEOPRENE OR PHENOLIC GASKET, PHENOLIC OR POLYETHYLENE

- F. DIELECTRIC COUPLINGS: GALVANIZED STEEL COUPLING WITH INERT AND NON-CORROSIVE, THERMOPLASTIC LINING, THREADED WITH 300 PSIG MINIMUM WORKING PRESSURE AT 225 DEG. F. G. DIELECTRIC NIPPLES: ELECTROPLATED STEEL NIPPLE WITH INERT AND NON-CORROSIVE, THERMOPLASTIC
- 2.6 FLEXIBLE CONNECTORS A. GENERAL: PROVIDE STAINLESS STEEL BRAIDED FLEXIBLE CONNECTORS WITH DESIGN PRESSURE AND TEMPERATURE RATING MEETING OR EXCEEDING THE TEST PRESSURES AND OPERATING TEMPERATURES OF THE SYSTEMS IN WHICH THEY ARE INSTALLED. PIPE SIZES 2-INCH AND SMALLER SHALL BE SOCKET WELDED OR THREADED MATCHING SYSTEM REQUIREMENTS. PIPE SIZES ABOVE 2-INCH SHALL BE CLASS

B. STAINLESS STEEL HOSE / STEEL PIPE, FLEXIBLE CONNECTORS: CORRUGATED, STAINLESS STEEL INNER

#### TUBING COVERED WITH STAINLESS STEEL SINGLE WIRE BRAID. INCLUDE STEEL NIPPLES OR STEEL FLANGES WELDED TO HOSE. MINIMUM LENGTH SHALL BE THREE TIMES PIPE DIAMETER UP TO 4-INCH PIPE SIZE.

A. ALL PIPING SHALL BE SO INSTALLED THAT IT WILL IN NO WAY BE DISTORTED OR STRAINED BY EXPANSION OR CONTRACTION. ALL EXPANSION AND CONTRACTION SHALL BE TAKEN UP BY MEANS OF SWING JOINTS, LOOPS, BENDS OR LONG OFFSETS. SWING JOINTS MADE UP WITH AT LEAST THREE (3) ELBOWS SHALL BE PROVIDED IN BRANCHES FROM MAINS IN RUNOUTS. SIZE LOOPS FOR THE TOTAL PIPE EXPANSION WITHOUT COLD SPRINGING, BUT FIELD COLD SPRING 1/2 THE PIPE ON EXPANSION

#### CORRECTED FOR AMBIENT TEMPERATURE. PART 3 - EXECUTION

2.7 EXPANSION

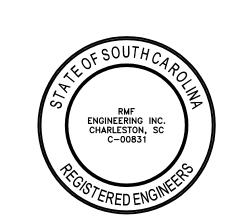
3.1 CLEANING, FLUSHING, INSPECTING

- A. GENERAL: CLEAN EXTERIOR SURFACES OF PIPING SYSTEMS OF SUPERFLUOUS MATERIALS, AND PREPARE FOR APPLICATION OF SPECIFIED COATINGS (IF ANY.) CLEAN INTERIOR OF PIPE BY MECHANICAL MEANS TO REMOVE WELDING SLAG, METAL FILINGS, DIRT, AND DEBRIS. FLUSH OUT PIPING SYSTEMS TO THE SATISFACTION OF THE OWNER BEFORE PROCEEDING WITH REQUIRED TESTS. INSPECT EACH RUN OF EACH SYSTEM FOR COMPLETION OF JOINTS, SUPPORTS, AND ACCESSORY ITEMS.
- B. THE CONTRACTOR SHALL CLEAN AND FLUSH ALL INSTALLED PIPING SYSTEMS WITH A CLEAN WATER SOLUTION WITH ADDITIVES FORMULATED TO ASSIST IN THE REMOVAL OF WELDING SLAG, METAL FILINGS, OIL. AND GREASE. FLUSHING OPERATIONS SHALL MAINTAIN A MINIMUM VELOCITY OF SIX FEET PER SECOND FOR A MINIMUM FOUR HOUR TIME FRAME. REPEAT FLUSHING OPERATIONS TO THE SATISFACTION OF THE OWNER AND UNTIL FLUSHING WATER IS COMPLETELY CLEAR.

## Jenkins • Peer Architects

112 South Tryon Street Charlotte, North Carolina 28284 704/372-6665 704/372-0102

Mechanical, Plumbing, Electrical & Fire Protection Consultant RMF Engineering, Inc. 194 Seven Farms Drive, Suite G Charleston, South Carolina 29492 843/971-9639 843/971-9641 Fax



# JNIVERSITY OF

# **PUBLIC HEALTH INTERIOR**

	OSE # H27-I988	
TAG	DESCRIPTION	DATE

11USC396 Project Drawn By: BEK

Checked By: CRB

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#### 3.2 PIPING INSTALLATION

- A. INSTALL PIPING WITHOUT UNDUE STRESS OR STRAIN IN LOCATIONS SHOWN AND RUN PARALLEL TO THE LINES OF THE BUILDING, EXCEPT TO GRADE THEM AS SPECIFIED. PROVIDE SUCH FITTINGS, VALVES AND ACCESSORIES AS MAY BE REQUIRED TO MEET THE CONDITIONS OF INSTALLATION. INSTALL PIPING TO SUIT NECESSITIES OF CLEARANCE WITH DUCTS, CONDUITS, AND OTHER WORK, AND SO AS NOT TO INTERFERE WITH ANY PASSAGES OR DOORWAYS AND ALLOW SUFFICIENT HEAD ROOM AT ALL PLACES. USE PROPER REDUCING FITTINGS FOR CHANGING PIPING SIZES.
- B. BECAUSE OF THE SMALL SCALE OF THE DRAWINGS, IT IS NOT POSSIBLE TO INDICATE ALL OFFSETS, FITTINGS AND ACCESSORIES THAT MAY BE REQUIRED. CAREFULLY INVESTIGATE THE ARCHITECTURAL AND STRUCTURAL CONDITIONS AFFECTING THE WORK, AND ARRANGE SUCH WORK ACCORDINGLY, PROVIDING SUCH FITTINGS, AND ACCESSORIES AS MAY BE REQUIRED TO MEET SUCH CONDITIONS. DRAWINGS (PLANS, SCHEMATICS, AND DIAGRAMS) INDICATE THE GENERAL LOCATION ARRANGEMENT AND RESTRICTIONS OF THE PIPING SYSTEMS. LOCATION AND ARRANGEMENT OF PIPING LAYOUT SHALL TAKE INTO CONSIDERATION PIPE SIZING AND FRICTION LOSS, EXPANSION, PUMP SIZING, AND OTHER DESIGN CONSIDERATIONS. SO FAR AS PRACTICAL, INSTALL PIPING AS INDICATED ON THE CONTRACT DRAWINGS UNLESS DEVIATIONS TO LAYOUT ARE APPROVED ON THE COORDINATION DRAWINGS. THE CONTRACT DRAWINGS ARE DIAGRAMMATIC IN NATURE AND ARE NOT WELDING FIT—UP DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR A COMPLETE INSTALLATION. REFER TO INDIVIDUAL SYSTEM SPECIFICATIONS FOR REQUIREMENTS FOR COORDINATION DRAWING SUBMITTALS.
- C. INSTALL UNIONS AND FLANGES WHERE SHOWN AND ON EACH SIDE OF ALL PIECES OF EQUIPMENT AND OTHER SIMILAR ITEMS, AND IN SUCH A MANNER THAT THE UNIONS CAN BE READILY DISCONNECTED. DO NOT PLACE ANY UNION OR FLANGE IN A LOCATION WHICH WILL BE INACCESSIBLE AFTER COMPLETION OF THE PROJECT UNLESS SO SHOWN ON DRAWINGS OR SPECIFIED.
- 1. UNIONS IN STEEL PIPE 2 1/2 INCHES AND SMALLER, SHALL BE 250 POUND MALLEABLE IRON, BRASS SEAT TYPE. USE 150 POUND FORGED STEEL FLANGES FOR PIPING THREE (3) INCHES AND LARGER. GASKETS SHALL BE 1/8 INCH THICK.
- D. USE REDUCING FITTINGS, ECCENTRIC WHERE REQUIRED TO PREVENT POCKETING OF AIR AND WATER OR BOTH, TO MAKE CHANGES TO PIPE SIZES.
- E. CONTRACTOR SHALL FULLY COORDINATE THE INSTALLATION OF ALL PIPING SYSTEMS WITH ALL OTHER TRADES INCLUDING SHEET METAL, ELECTRICAL, SPRINKLER, CEILING SYSTEMS, ETC.

#### 3.3 WORKMANSHIP

- A. ARRANGE PIPES TO PERMIT EXPANSION AND CONTRACTIONS WITHOUT MISALIGNMENT OR DAMAGE.
- B. DURING CONSTRUCTION ALL OPENINGS IN PIPING AND EQUIPMENT SHALL BE CLOSED WITH CAPS OR PLUGS TO KEEP OUT ALL FOREIGN MATTER AND TO PREVENT LEAKAGE.

#### 3.4 SLEEVES AND PLATES

- A. SLEEVES SHALL BE PROVIDED BY THE TRADE INSTALLING THE PIPES FOR WHICH SLEEVES ARE TO BE USED. THE SLEEVES SHALL BE CAREFULLY LOCATED IN ADVANCE OF THE CONSTRUCTION OF WALLS AND FLOORS WHERE NEW CONSTRUCTION IS INVOLVED. ALL CUTTING AND PATCHING NECESSARY TO SET SLEEVES WHICH ARE NOT PLACED PRIOR TO CONSTRUCTION SHALL BE THE RESPONSIBILITY OF THE TRADE PROVIDING THE SLEEVES.
- B. SLEEVES SHALL BE PROVIDED FOR ALL PIPING PASSING THROUGH ALL FLOOR SLABS AND CONCRETE,
- C. ALL PIPE SLEEVES SHALL BE CONSTRUCTED OF SCHEDULE 40 STEEL PIPE UNLESS OTHERWISE INDICATED ON THE DRAWINGS.

#### SECTION 15200 - MECHANICAL SYSTEMS INSULATION

SYSTEMS AS SPECIFIED HEREIN.

PLASTER, GYPSUM, OR MASONRY WALL CONSTRUCTION.

#### PART 1 — GENERAL

## 1.1 SCOPE

- A. WORK INCLUDED IN THIS SECTION IS THE THERMAL INSULATING DONE IN THE FIELD ON THE MECHANICAL
- B. THE DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, GENERAL REQUIREMENTS AND ALL OTHER SPECIFICATION SECTIONS APPLY TO THE WORK SPECIFIED IN THIS SECTION. IN THE EVENT OF CONFLICT BETWEEN SPECIFIC REQUIREMENTS OF THE VARIOUS DOCUMENTS, THE MORE RESTRICTIVE, THE MORE EXTENSIVE (I.E.: MORE EXPENSIVE) REQUIREMENT SHALL GOVERN.

#### 1.2 SUBMITTALS

A. PROVIDE SHOP DRAWINGS ON ALL INSULATION, JACKETS FINISHES, ETC. SHOP DRAWINGS SHALL ADDITIONALLY DESCRIBE EACH SYSTEM OR COMPONENT TO BE INSULATED, INSULATION TYPE AND THICKNESS, AND METHOD OF INSTALLATION.

#### PART 2 - PRODUCTS

#### 2.1 GENERAL

A. AFTER THE NECESSARY TESTS HAVE BEEN CONDUCTED TO PROVE THE WATER AND AIR SYSTEMS TIGHT, ALL PIPING, DUCTWORK AND EQUIPMENT TO BE INSULATED SHALL BE THOROUGHLY CLEANED AND THEN COVERED. INSULATION MATERIALS SHALL BE THE PRODUCT OF OWENS CORNING, CSG, SCHULLER OR ARMACELL EQUAL TO THE PRODUCTS SPECIFIED HEREIN.

## 2.2 TYPES OF INSULATION

- A. TYPE I PIPE INSULATION:
- PROVIDE HEAVY DENSITY FIBERGLASS PIPE INSULATION WITH VAPOR BARRIER JACKET. THE K FACTOR SHALL NOT BE MORE THAN 0.23 AT SEVENTY-FIVE (75) DEGREES FAHRENHEIT MEAN TEMPERATURE. INSULATION SHALL BE EQUAL TO JOHNS MANVILLE MICRO-LOK MEETING ASTM C 547 WITH FSK JACKET.

## B. TYPE II - PIPE INSULATION:

1. PROVIDE CLOSED CELL ELASTOMERIC TUBULAR INSULATION WITH BUILT—IN VAPOR BARRIER. THE K FACTOR SHALL NOT BE MORE THAN 0.27 AT SEVENTY—FIVE (75) DEGREES FAHRENHEIT MEAN TEMPERATURE. INSULATION SHALL BE EQUAL TO ARMACELL AP/ARMAFLEX OR AP/ARMAFLEX SS. THE USE OF POLYETHYLENE, POLYOLEFIN OR ENGINEERED POLYMER INSULATION IS PROHIBITED.

## C. TYPE IV - DUCT INSULATION:

1. PROVIDE BLANKET TYPE LIGHTWEIGHT FIBERGLASS DUCT INSULATION WITH VAPOR BARRIER FACING. THE K FACTOR SHALL NOT EXCEED 0.27 AT SEVENTY—FIVE (75) DEGREES FAHRENHEIT MEAN TEMPERATURE AND A MINIMUM INSTALLED R—VALUE OF 6.0 (HR•FT2•°F)/BTU. INSULATION SHALL BE EQUAL TO JOHNS MANVILLE FLEXIBLE FIBERGLASS BLANKET MICROLITE MICROLITE XG FORMALDEHYDE—FREE MEETING ASTM C 553 WITH FSK FACING.

## 2.3 ADHESIVES, SEALERS AND COATINGS

- A. THE VAPOR BARRIER ON ALL INSULATION SYSTEMS SHALL BE MAINTAINED AT ALL TIMES. ANY PENETRATION INTO THE VAPOR BARRIER SHALL BE SEALED VAPOR TIGHT. ALL JOINTS, FITTINGS ETC SHALL BE SEALED VAPOR TIGHT.
- B. PROVIDE ALL ADHESIVES, SEALERS, VAPOR BARRIER COATINGS, ETC., COMPATIBLE WITH THE MATERIAL TO WHICH THEY ARE APPLIED. THEY SHALL NOT CORRODE, SOFTEN OR OTHERWISE ATTACH SUCH MATERIAL IN EITHER THE WET OR DRY STATE AND MUST BE SUITABLE FOR THE SERVICE TEMPERATURES.
- C. ANY CEMENT, SEALER OR COATING USED SHALL BE RESISTANT TO VERMIN AND MOLD AND SHALL BE DURABLE. IT SHALL NOT DISCOLOR ON AGING; AND WHERE APPLIED ON THE FINAL SURFACE OF THE INSULATION, IT SHALL BE LIGHT IN COLOR AND BE CAPABLE OF BEING PAINTED.
- D. ADHESIVES, COATINGS AND COMPOUNDS SHALL BE EQUAL TO THE FOLLOWING:
- 1. VAPOR BARRIER ADHESIVE FOR SEALING JOINTS ON PIPE AND DUCT INSULATION FOSTER 85-75.
- 2.4 FITTING AND VALVE COVERS
- A. PIPE FITTINGS AND VALVES SHALL BE INSULATED WITH ZESTON PREMOLD ONE (1) PIECE PVC INSULATED FITTING COVER AND FACTORY PRECUT INSULATION. FITTINGS SHALL HAVE EDGES OF ONE (1) PIECE

## 2.5 METALLIC COMPONENTS

A. STAPLES SHALL BE OUTWARD CLINCHING TYPE OF 304 OR 316 STAINLESS STEEL.

COVER SEALED WITH ZESTON VAPOR BARRIER PRESSURE SENSITIVE TAPE.

- B. BANDS SHALL BE GALVANIZED STEEL, ALUMINUM, BRASS, OR NICKEL—COPPER ALLOY, OF 3/4 INCH NOMINAL WIDTH. THE BAND THICKNESS, EXCLUSIVE OF COATING, SHALL BE NOT LESS THAN 0.005 INCH FOR STEEL AND NICKEL COPPER ALLOY, 0.007 INCH FOR ALUMINUM, AND 0.01 INCH FOR BRASS.
- C. WIRE SHALL BE FOURTEEN (14) GAUGE, NICKEL—COPPER ALLOY OR COPPER CLAD STEEL, OR SIXTEEN (16) GAUGE, SOFT ANNEALED, GALVANIZED STEEL.
- D. WIRE NETTING USED FOR EXPOSED SURFACES OF INSULATION THAT IS TO BE CEMENT FINISHED SHALL BE TWENTY—TWO (22 GAUGE, ONE (1) INCH GALVANIZED MESH, WITH CONTINUOUS TWENTY—SIX (26) GAUGE GALVANIZED STEEL CORNER BEADS HAVING 2—1/2 INCH WINGS.

## 2.6 INSULATION SCHEDULE

- A. INSULATION MATERIALS FURNISHED MUST MEET THE MINIMUM THICKNESS REQUIREMENTS OF NATIONAL VOLUNTARY CONSENSUS STANDARD 90.1 (CURRENT ACCEPTED EDITION), "ENERGY EFFICIENT DESIGN OF NEW BUILDINGS" OF THE AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE).
- B. AIR CONDITIONING SUPPLY DUCTWORK TYPE IV, 2" THICK.
- C. SUPPLY DIFFUSER BODIES TYPE IV, 1" THICK.
- D. HEATING WATER SUPPLY AND RETURN PIPING TYPE I, 1" THICK, 1  $\frac{1}{2}$ " AND SMALLER. TYPE II, 2" THICK, 2" AND LARGER.

#### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. INSULATION SHALL BE CONTINUOUS AT ALL HANGERS, HANGER RODS, SUPPORTS, SLEEVES AND OPENINGS. CONTINUOUS VAPOR BARRIER MUST BE PROVIDED FOR ALL COLD SURFACES. INSULATION SHALL BE SEALED WHERE IT TERMINATES BECAUSE OF A VALVE, UNION, FLANGE, ETC.
- B. THE APPLICATION OF ALL INSULATION MATERIALS, ACCESSORIES AND FINISHES SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S PUBLISHED RECOMMENDATIONS.
- C. PROVIDE CONTINUOUS INSULATION AND JACKETING WHEN PASSING THRU INTERIOR WALL, FLOOR, AND CEILING CONSTRUCTION.DO NOT INTERMIX DIFFERENT INSULATION MATERIALS ON INDIVIDUAL RUNS OF PIPING OR DUCTWORK.
- D. INSULATION MATERIALS SHALL NOT BE APPLIED UNTIL ALL SURFACES TO BE COVERED ARE CLEAN AND DRY; ALL FOREIGN MATERIAL, SUCH AS RUST, SCALE, DIRT, ETC., HAS BEEN REMOVED, AND WHERE SPECIFIED, SURFACES HAVE BEEN PAINTED. INSULATION SHALL BE CLEAN AND DRY WHEN INSTALLED AND DURING THE APPLICATION OF ANY FINISH. THE INSULATION ON PIPE FITTINGS, VALVES AND PIPE JOINTS SHALL NOT BE INSTALLED BEFORE THE PIPING IS TESTED AND APPROVED.

#### 3.2 PIPE INSULATION

- A. HIGH DENSITY PIPE SADDLES SHALL BE PROVIDED AT ALL POINTS OF SUPPORT AS HEREIN BEFORE
- B. INSULATE ALL VALVES AND STRAINERS. USE PREMOLDED COVERS AND FACTORY PRECUT INSULATION WHERE APPLICABLE. UNIONS AND FLANGES SHALL NOT BE INSULATED EXCEPT ON COLD SERVICES.
- C. APPLICATION TYPE I INSULATION:
  - 1. INSULATE ALL PIPES IN A NEAT AND WORKMANLIKE MANNER. SEAL ALL LONGITUDINAL LAPS OF JACKETS AND STAPLE EVERY SIX (6) INCHES. WHERE THE PIPING OPERATES BELOW AMBIENT TEMPERATURE, THE STAPLES SHALL BE COATED WITH VAPOR BARRIER ADHESIVE. ALL BUTT JOINTS SHALL BE WRAPPED WITH A THREE (3) INCH MINIMUM WIDE STRIP OF JACKETING MATERIAL SECURELY SEALED IN PLACE.
  - 2. INSULATE VALVES AND FITTINGS WITH PRE-CUT BLANKET TYPE FIBERGLASS INSULATION AND PVC COVERS AS SPECIFIED. INSULATION SHALL BE OF THE SAME THICKNESS AS THAT ON ADJOINING PIPE. THE ENDS OF THE INSULATION SHALL BE TUCKED SNUGLY INTO THE THROAT OF THE FITTING AND THE EDGES ADJACENT TO THE PIPE COVERING TUFTED AND TUCKED, FULLY INSULATING THE PIPE FITTING. THE ONE (1) PIECE PVC FITTING COVER SHALL THEN BE SECURED BY STAPLING, TACK FASTENING, BANDING OR TAPING THE ENDS TO THE ADJACENT PIPE COVERING. CHILLED WATER SUPPLY AND RETURN PIPING AND COLD WATER SYSTEMS PIPING SHALL BE INSULATED AS ABOVE AND HAVE ALL SEAM EDGES OF THE COVER SEALED WITH ZESTON VAPOR BARRIER ADHESIVE MASTIC. THE CIRCUMFERENTIAL EDGES OF COVER SHALL BE WRAPPED WITH ZESTON VAPOR BARRIER PRESSURE SENSITIVE COLOR MATCHING TAPE. THE TAPE SHALL EXTEND OVER THE ADJACENT PIPE INSULATION AND OVERLAP ITSELF AT LEAST TWO (2) INCHES ON THE DOWNWARD SIDE.
  - 3. WHERE FITTINGS ARE OPERATING ABOVE AMBIENT THEY MAY, IN LIEU OF THE PROCEEDING PARAGRAPH, BE COVERED WITH A THREE (3) HOUR, HYDRAULIC SETTING, COMBINATION INSULATING AND FINISHING CEMENT HAVING K FACTOR NOT GREATER THAN 0.87 AT A MEAN TEMPERATURE OF 200 DEGREES FAHRENHEIT. THE THICKNESS OF THIS CEMENT SHALL BE SUCH THAT THE SURFACE IS SUBSTANTIALLY FLUSH WITH THE PIPE COVERING. WHERE THE INSULATION TERMINATES AT A FITTING THAT IS NOT COVERED, THE END OF THE INSULATION SHALL BE BEVELED OFF WITH THIS SAME CEMENT. ALL FITTINGS INSULATED IN THIS MANNER SHALL BE COVERED BY A FABRIC JACKET AS SPECIFIED, WHICH SHALL BE CEMENTED DOWN WITH LAGGING ADHESIVE.
  - 4. WHERE EXPANSION JOINTS ARE REQUIRED TO BE INSULATED, THEY SHALL BE COVERED WITH READILY REMOVABLE SECTIONS OF INSULATION OF SAME COMPOSITION AND THICKNESS AS PROVIDED FOR ADJACENT PIPING.

#### D. APPLICATION - TYPE II INSULATION:

- 1. THE MATERIAL SHALL BE SLIT LENGTHWISE TO PERMIT INSTALLATION OR SLIPPED OVER PIPE BEFORE CONNECTIONS ARE MADE. SELF—SEAL INSULATION MAY ALSO BE INSTALLED.
- 2. ALL JOINTS AND SEAMS MUST BE THOROUGHLY BONDED, BOTH MECHANICALLY AND HERMETICALLY, BY THE ADHESIVE RECOMMENDED BY THE INSULATION MANUFACTURER. ALSO, THE MANUFACTURER'S RECOMMENDATIONS SHALL BE FOLLOWED AS TO THE ADHESIVE TO USE WHERE THE INSULATION NEEDS BONDING TO METAL OR OTHER MATERIAL USED FOR ANY SURFACE TREATMENT WHERE A FINISH COAT OF PAINT IS REQUIRED.
- 3. ALL PENETRATIONS OF THE INSULATION MUST BE THOROUGHLY SEALED SO THAT THE INSULATION ITSELF WILL FORM A COMPLETE VAPOR BARRIER. INSULATION SHALL RUN CONTINUOUS AT HANGERS AND SUPPORTS TO FORM A COMPLETE VAPOR BARRIER. WHEREVER THE INSULATION TERMINATES, THE EDGES SHALL BE SEALED TO THE METAL.
- 4. INSULATION SHALL BE EXTENDED TO STOP VALVES UNDER PLUMBING FIXTURES AND/OR WITHIN CABINETS. WATER AND WASTE LINES SERVING HANDICAP PLUMBING FIXTURES SHALL BE INSULATED AND PAINTED TO MATCH ADJACENT SURFACE.

#### 3.3 DUCT INSULATION

#### A. APPLICATION - TYPE IV INSULATION:

1. INSULATION SHALL BE CUT SLIGHTLY LONGER THAN PERIMETER OF DUCT TO INSURE FULL THICKNESS AT CORNERS. ALL INSULATION SHALL BE APPLIED WITH EDGES TIGHTLY STITCHED WITH STAPLES. PROVIDE VAPOR BARRIER MASTIC SEALER AT SEAM. THE INSULATION SHALL BE ADDITIONALLY SECURED TO THE BOTTOM OF ALL SQUARE DUCTS EIGHTEEN (18) INCHES OR WIDER BY MEANS OF WELDED PINS AND SPEED CLIPS. THE PROTRUDING ENDS OF THE PINS SHALL BE CUT OFF FLUSH AFTER THE SPEED CLIPS HAVE BEEN APPLIED. THE VAPOR BARRIER FACING SHALL BE THOROUGHLY SEALED WHERE THE PINS HAVE PIERCED THROUGH WITH A TAPE OF THE SAME MATERIAL BY APPLYING A VAPOR BARRIER ADHESIVE TO BOTH SURFACES AS RECOMMENDED BY THE MANUFACTURER. ALL HANGER RODS, SUPPORT MEMBERS, JOINTS AND PENETRATIONS OF THE VAPOR BARRIER SHALL BE SEALED WITH FULL THICKNESS INSULATION AND VAPOR BARRIER MASTIC SEALER. ALL CUTS OR TEARS SHALL BE SEALED WITH STRIPS OF THE ALUMINUM FOIL TAPE AND VAPOR BARRIER ADHESIVE.

## SECTION 15300 - PLUMBING

## PART 1 — GENERAL

## 1.1 SCOP

- A. THIS SECTION INCLUDES THE SOIL, WASTE, DRAIN, VENT AND DOMESTIC WATER SYSTEMS FROM THEIR SOURCE OF SUPPLY OR POINT OF DISPOSAL TO AND INCLUDING THEIR CONNECTION TO EQUIPMENT AND FIXTURES.
- B. THE DRAWINGS AND GENERAL PROVISIONS OF THE CONTRACT, INCLUDING GENERAL AND SUPPLEMENTARY CONDITIONS, GENERAL REQUIREMENTS AND ALL OTHER SPECIFICATION SECTIONS APPLY TO THE WORK SPECIFIED IN THIS SECTION. IN THE EVENT OF CONFLICT BETWEEN SPECIFIC REQUIREMENTS OF THE VARIOUS DOCUMENTS, THE MORE RESTRICTIVE, THE MORE EXTENSIVE (I.E.: MORE EXPENSIVE) REQUIREMENT SHALL GOVERN.

## 1.2 CODES

A. ALL PLUMBING WORK SHALL COMPLY WITH THE 2009 INTERNATIONAL PLUMBING CODE, LOCAL, CITY AND STATE PLUMBING CODES, AND THE REGULATIONS OF THE SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL (DHEC). OBTAIN ALL APPROVALS BEFORE STARTING PLUMBING WORK. REQUEST ALL INSPECTIONS DURING THE COURSE OF WORK.

## 1.3 CONNECTIONS

A. PROVIDE ALL PLUMBING CONNECTIONS REQUIRED BY EQUIPMENT WHICH IS PROVIDED ON THIS PROJECT.

PART 2 — PRODUCTS

## 2.1 PIPE, VALVES AND FITTINGS

A. PROVIDE MATERIALS AS HEREIN BEFORE SPECIFIED IN SECTION 15100, BASIC MATERIALS AND METHODS. ALL FLOOR, WALL AND CEILING PENETRATIONS FOR PIPING SHALL BE SEALED WITH APPROPRIATE SEALANT.

## 2.2 CLEANOUTS

- A. CLEANOUTS SHALL BE PLACED IN PIPING THROUGHOUT THE BUILDING, WHERE NOTED AND WHERE REQUIRED BY CODE AND AT NOT GREATER THAN SEVENTY FIVE (75) FOOT INTERVALS. CLEANOUTS AT ENDS OF RUNS AND CHANGES OF DIRECTION OF PIPING SHALL CONSIST OF Y BRANCHES, THE FULL SIZE OF PIPES TO WHICH THEY ARE CONNECTED WITH CLEANOUT PLUGS AND COVERS AS LISTED BELOW OR AS DETAILED. CLEANOUTS SHALL BE JOSAM, ZURN OR J.R. SMITH EQUAL TO JOSAM NUMBERS INDICATED BELOW.
- 1. CLEANOUTS ON EXPOSED HORIZONTAL PIPING SHALL BE SERIES 58500 WITH BRONZE THREADED

## 2.3 DOMESTIC WATER HEATING SYSTEM

## . TYPE A.

PROVIDE, WHERE INDICATED ON THE DRAWINGS, A CHROOMITE LABORATORIES INSTANT—FLOW TANKLESS ELECTRIC WATER HEATER MODEL S—901 OR EQUAL.
 HEATER SHALL BE PROVIDED WITH STAINLESS STEEL HEATING COILS AND BE FLOW SWITCH ACTIVATED.

## 2.4 PLUMBING FIXTURES

- A. PROVIDE ALL PLUMBING FIXTURES INDICATED ON THE DRAWINGS AND AS SPECIFIED HEREIN. ALL EXPOSED METAL PARTS OF ALL FIXTURES, INCLUDING ALL TRIM AND FITTINGS, SHALL BE BRASS, CHROMIUM PLATED. EACH HOT AND COLD WATER CONNECTION TO EACH FIXTURE SHALL BE PROVIDED WITH A STOP VALVE AND ALL NIPPLES SHALL BE CHROME PLATED RED BRASS. PROVIDE BACKFLOW DEVICES ON ALL FAUCETS AND FITTINGS REQUIRING SAME. DEVICES MAY BE INLINE TYPE WHEN NOT PROVIDED INTEGRAL WITH THE FAUCET. ALL FAUCET HANDLES, WHERE POSSIBLE, SHALL HAVE COLOR CODED "INDEXES" IDENTIFYING THE SERVICE USED.
- B. INSTALL FIXTURES DESIGNATED "ACCESSIBLE" ACCORDING TO ICC A117.1 FOR HEIGHTS, DIMENSIONS, AND CLEARANCES. WATER SUPPLIES FOR HANDICAPPED WATER CLOSETS SHALL BE ROUGHED—IN FOR FLUSH VALVE HANDLES TO BE OPERATED FROM THE ACCESSIBLE SIDE OF THE WATER CLOSET. THE

- CONTRACTOR SHALL COORDINATE AND PROVIDE FLUSH HANDLES ON THE ACCESSIBLE SIDE OF ALL HANDICAPPED WATER CLOSETS.
- C. THE CONTRACTOR SHALL PROVIDE METAL SUPPORTS NECESSARY TO ADEQUATELY AND SUBSTANTIALLY HANG AND SET ALL FIXTURES SUBJECT TO THE APPROVAL OF THE ARCHITECT. NO WOOD GROUNDS, WOOD PLUGS, OR EXPANSION BOLTS SHALL BE PERMITTED FOR FIXTURE SUPPORT. PROVIDE CARRIERS WHERE SPECIFIED BELOW AND AS REQUIRED TO HANG FIXTURES.
- D. UNLESS OTHERWISE SPECIFIED, PLUMBING FIXTURES SHALL BE AMERICAN STANDARD, CRANE OR KOHLER, EQUAL TO AMERICAN STANDARD OR OTHER MANUFACTURER OF THE TYPES LISTED BELOW. FLUSH VALVES SHALL BE ZURN, DELANY OR CAMBRIDGE BRASS, EQUAL TO ZURN OF THE TYPES LISTED BELOW.

#### 1. P−1 SINK

FIXTURE:

FAUCET:

SUPPLIES/STOPS:

ELKAY LRAD1919, TYPE 304, 18-8 STAINLESS STEEL, SELF RIMMING SINGLE COMPARTMENT SINK. FIXTURE SHALL HAVE BOWL DIMENSIONS OF 19 1/2" LEFT TO RIGHT, 19" FRONT TO BACK, 6" DEEP.

FAUCET: CHICAGO FAUCET NO. 201-AGN8AE2805-5-317CP.

CHICAGO FAUCET NO. 1006.

STRAINER: ELKAY LK-35B.

TRAP: MCGUIRE 8912.

REMARKS: COUNTER MOUNTED. CONTRACTOR SHALL VERIFY AND COORDINATE ROUGH-IN LOCATIONS.

## 2. P-2 SINK

FIXTURE: ELKAY BCRA-150-C, STAINLESS STEEL.

ELKAY LK-2489-8-BH, FOUR (4) INCHES ON CENTER WITH GOOSENECK SPOUT.

STRAINER: ELKAY LK-35

TRAP: MCGUIRE 8912

SUPPLIES AND STOPS: CHICAGO FAUCET NO. 1006

REMARKS: COUNTER MOUNTED. CONTRACTOR SHALL VERUFY AND COORDINATE ROUGH—IN LOCATIONS.

#### 3. P-3 REFRIGERATOR/ICE MAKER CONNECTION:

FIXTURE: IPS WATER-TITEY MODEL 88080 RECESSED ICE MAKER OUTLET BOX.

REMARKS: CHROME 1/4 TURN BALL VALVE WITH 1/2" SWEAT CONNECTION AND HAMMER ARRESTOR. HAMMER ARRESTOR SHALL CONFORM TO IPC-2009, UPC LISTED AND ASSE CERTIFIED TO ANSI/ASSE 1010-2004 STANDARD. PROVIDE PLUMBING CONNECTIONS IN ACCORDANCE WITH MANUFACTURERS WRITTEN INSTRUCTIONS.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF PIPING

- A. INTERIOR DRAINAGE SYSTEMS:
- 1. SOIL, WASTE, VENT AND DRAIN PIPING FOR SANITARY DRAINAGE PIPING SHALL BE ADEQUATELY SUPPORTED AS SPECIFIED.
- 2. CHANGES IN DIRECTION SHALL BE MADE BY APPROPRIATE USE OF FORTY—FIVE (45) DEGREE WYES, 1/2 WYES, OR LONG SWEEP 1/4, 1/6, 1/8, OR 1/16 BENDS. MAKE NO CHANGE IN DIRECTION OF FLOW GREATER THAN NINETY (90) DEGREES. WHERE DIFFERENT SIZES OF DRAINAGE PIPES OR PIPES AND FITTINGS ARE TO BE CONNECTED, USE STANDARD INCREASERS AND REDUCERS OF PROPER SIZE. REDUCTION OF SIZE IN HORIZONTAL DRAINAGE PIPING IN DIRECTION OF FLOW IS PROHIBITED.
- 3. DRILLING AND TAPPING OF DRAINS, SOIL, WASTE, OR VENT PIPING, AND USE OF SADDLE HUBS AND BANDS ARE PROHIBITED.
- 4. CONNECT PIPING TO FIXTURES OR EQUIPMENT BY COUPLINGS OR UNIONS SO THAT DEVICES MAY BE REPLACED WITH NO DISTURBANCE TO PIPING.

#### B. WATER PIPING SYSTEMS:

- 1. WATER PIPING SHALL BE COMPLETE FROM SERVICE CONNECTION TO ALL FIXTURES, EQUIPMENT, OUTLETS, ETC. SIZES OF PIPES SHALL BE SHOWN OR AS SPECIFIED.
- WHERE NON-FERROUS METAL PIPING AND ZINC-COATED METAL PIPING ARE JOINTED, DIELECTRIC (INSULATING) COUPLINGS, FITTINGS OR UNIONS SHALL BE PROVIDED.
   WHERE PIPE SIZES SHOWN OR SPECIFIED DIFFER FROM THE CONNECTION SIZES OF FIXTURES,
- 6.2 CLEANOUTS
- A. WHERE DRAINAGE RISERS CONNECT TO A SEWER OR DRAIN EXTENDING FROM THE BUILDING ABOVE THE LOWEST FLOOR, THE FITTING AT THE BASE OF EACH STACK OR DOWNSPOUT SHALL BE A SANITARY TEE OR A COMBINATION Y AND 1/8 BEND WITH CLEANOUT PLUG IN THE END OF THE RUN OF THE MAIN.

  3.3 TRAPS

OUTLETS, ETC., REDUCING FITTINGS SHALL BE INSTALLED.

A. EACH FIXTURE AND PIECE OF EQUIPMENT CONNECTED TO THE SANITARY SYSTEM SHALL BE EQUIPPED WITH A TRAP. PROVIDE TRAPS FOR STORM WATER LINES WHERE REQUIRED BY CODE. EACH TRAP SHALL BE PLACED AS CLOSE TO THE FIXTURE AS POSSIBLE AND NO FIXTURE SHALL BE DOUBLE TRAPPED. ALL TRAPS ON BELL AND SPIGOT PIPE SHALL BE EXTRA HEAVY CAST IRON AND ALL TRAPS ON THREADED PIPE SHALL BE GALVANIZED CAST IRON RECESSED DRAINAGE TYPE.

## SECTION 15400 - FIRE PROTECTION

## PART 1 — GENERAI

1.1 SCOPE

A. PROVIDE ALL MATERIALS, EQUIPMENT, AND LABOR, INCLUDING ALL REQUIRED DRILLING FOR THE MODIFICATIONS AND EXPANSION OF EXISTING SUPERVISED AUTOMATIC SPRINKLER SYSTEMS FOR THE RENOVATION TAKING PLACE TO THE UNIVERSITY OF SOUTH CAROLINA SCHOOL OF PUBLIC HEALTH BUILDING.

B. THE PIPING FOR EACH SYSTEM SHALL BE SIZED IN ACCORDANCE WITH HYDRAULIC CALCULATIONS TO COMPLY WITH THE HYDRAULIC REQUIREMENTS FOUND IN THE LATEST EDITION OF NFPA STANDARD 13, AND THE

C. SECURE ALL REQUIRED APPROVALS AND INSPECTIONS FROM THE CITY OF COLUMBIA, THE STATE OF SOUTH CAROLINA AND THE UNIVERSITY OF SOUTH CAROLINA.

D. SUBMIT ALL REQUIRED DRAWINGS AND CALCULATIONS AND SECURE ALL APPROVALS FROM THE OWNER'S INSURANCE LINDERWRITERS

## INSURANCE UNDERWRITERS. 1.2 INTENT OF SPECIFICATIONS

OWNER'S INSURANCE UNDERWRITER STANDARDS.

- A. THE WORK PERFORMED SHALL BE COMPLETE IN EVERY RESPECT. EACH SYSTEM THAT HAS BEEN INSTALLED OR MODIFIED SHALL BE COMPLETE IN ACCORDANCE WITH THE APPLICABLE CODES, STANDARDS, THE UNIVERSITIES INSURANCE UNDERWRITER REQUIREMENTS, MANUFACTURER'S RECOMMENDATIONS AND
- UNDERWRITERS LABORATORIES, INC. (UL) LISTINGS.

  B. UPON COMPLETION OF THIS WORK, THE OWNER SHALL BE PROVIDED WITH THE FOLLOWING:
- 1. COMPLETE INFORMATION AND RECORD DRAWINGS DESCRIBING AND DEPICTING ALL SYSTEMS AS INSTALLED, INCLUDING ALL INFORMATION NECESSARY FOR MAINTAINING, TROUBLESHOOTING, AND EXPANDING THE SYSTEMS.
- 2. COMPLETE DOCUMENTATION OF SYSTEM TESTING.

PIPING AND UNDERGROUND PIPING

3. CERTIFY THAT EACH SYSTEM INSTALLED OR MODIFIED HAS BEEN INSPECTED AND TESTED, HAS BEEN INSTALLED OR MODIFIED ENTIRELY IN ACCORDANCE WITH THE APPLICABLE CODE, STANDARDS, MANUFACTURER'S RECOMMENDATIONS AND UL LISTINGS, AND IS IN PROPER WORKING ORDER. CONTRACTOR SHALL USE "CONTRACTOR'S MATERIAL AND TEST CERTIFICATES FOR ABOVEGROUND

## 1.3 SCOPE

INCLUDED.

- A. THE AREA OF WORK SHALL BE FULLY SPRINKLERED THROUGHOUT IN ACCORDANCE WITH NFPA STANDARD 13. PROVIDE AUTOMATIC SPRINKLER PROTECTION THROUGHOUT THE AREA OF WORK IN ACCORDANCE WITH NFPA STANDARD 13, EXCEPT AS MADE MORE STRINGENT HEREIN.
- B. PROVIDE SPRINKLER SYSTEM SUPERVISORY SWITCHES AND WATERFLOW INDICATORS AS REQUIRED. ALL ELECTRICAL WORK RELATED SHALL BE PROVIDED UNDER DIVISION 16, ELECTRICAL.
- C. PROVIDE ALL REQUIRED DRAINS AND INSPECTOR TEST CONNECTIONS, CONNECTED AND READY TO USE.

  D. PREPARE AND SUBMIT SHOP DRAWINGS, RECORD DRAWINGS, AND OTHER SUBMITTALS REQUIRED HEREIN.

  E. PIPE SIZES SHALL BE AS REQUIRED BY NFPA STANDARDS BUT IN NO CASE LESS THAN THOSE SHOWN

ON THE DRAWINGS. FOR THE CONTRACTOR'S INFORMATION, FIRE FLOW TEST DATA IS HEREINAFTER

F. SPRINKLER HEADS SHALL BE PROVIDED AS REQUIRED BY NFPA STANDARDS. SPRINKLER HEAD LOCATIONS SHALL BE COORDINATED WITH THE ARCHITECTURAL REFLECTED CEILING PLANS. SPRINKLER SHOP DRAWINGS SHALL INDICATE THE CEILING GRID, LIGHTING FIXTURES, SMOKE DETECTORS, AIR

DEVICES, ETC. GENERALLY, SPRINKLER HEADS SHALL BE CENTERED IN TILES, PLUS OR MINUS TWO (2) INCHES FROM TILE CENTERLINES.

- G. ALL REQUIREMENTS OF THE STATE OF SOUTH CAROLINA, THE STATE FIRE MARSHAL'S OFFICE, AND THE UNIVERSITY OF SOUTH CAROLINA FIRE PREVENTION BUREAU SHALL APPLY TO THIS SPECIFICATION. PROVIDE SYSTEMS ACCORDING TO NFPA 13-2007 AND THE STATE ENGINEER MANUAL SECTION 5.13.
- H. THE SPRINKLER CONTRACTOR SHALL PROVIDE ALL REQUIRED CONSTRUCTION COORDINATION AS SPECIFIED IN DIVISION 15, SECTION "MECHANICAL AND ELECTRICAL GENERAL PROVISIONS". ALL COORDINATION ISSUES AND CONFLICTS SHALL BE RESOLVED BY THE CONTRACTOR(S) AT NO ADDITIONAL COST TO THE OWNER. RESOLUTIONS MAY INCLUDE, BUT NOT BE LIMITED TO, MOVING PIPE MAINS, SPRINKLER HEADS, DRAIN AND TEST PIPING, VALVES, ETC.
- I. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ATTENDING A PRE—CONSTRUCTION MEETING AND CONSTRUCTION COORDINATION MEETINGS WITH THE OWNER AND ARCHITECT.
- J. THE EXISTING STANDPIPE SYSTEM OR ANY BUILDING FIRE PROTECTION COMPONENT SHALL NOT BE TAKEN OUT OF SERVICE WITHOUT THE PRIOR WRITTEN APPROVAL OF THE OWNER AND NOTIFICATION OF THE CITY OF COLUMBIA AND UNIVERSITY OF SOUTH CAROLINA FIRE DEPARTMENT AND FIRE MARSHAL. WHEN REQUIRED TO BE REMOVED FROM SERVICE AND AFTER APPROVAL FROM THE CITY OF COLUMBIA AND THE UNIVERSITY OF SOUTH CAROLINA FIRE DEPARTMENT AND FIRE MARSHAL, THE STANDPIPE SYSTEM SHALL NOT BE OUT-OF-SERVICE FOR MORE THAN FOUR (4) HOURS

#### 1.4 QUALIFICATIONS OF CONTRACTOR

- A. THE CONTRACTOR SHALL HOLD ALL LICENSES AND OBTAIN ALL PERMITS NECESSARY TO PERFORM WORK OF THIS TYPE IN THE STATE OF SOUTH CAROLINA AND THE CITY OF COLUMBIA. COPIES OF THE CONTRACTOR'S LICENSES SHALL BE PROVIDED WITH BID SUBMITTAL.
- B. THE CONTRACTOR SHALL HAVE AT LEAST FIVE (5) YEARS OF EXPERIENCE IN INSTALLATION OF SYSTEMS OF THIS TYPE AND BE FAMILIAR WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS.
- C. THE CONTRACTOR SHALL BE REGULARLY ENGAGED IN THE DESIGN, INSTALLATION, TESTING, AND SERVICING OF AUTOMATIC SPRINKLER SYSTEMS.

## 1.5 SUBMITTALS A. GENERAL:

- 1. THE OWNER AND ARCHITECT OR THEIR REPRESENTATIVE(S) WILL REVIEW ALL SUBMITTALS FOR
- 2. IF THE CONTRACTOR'S SUBMITTALS, UPON REVIEW BY THE OWNER OR ARCHITECT DO NOT CONFORM TO THE REQUIREMENTS OF THESE SPECIFICATIONS, THE CONTRACTOR SHALL BE REQUIRED TO RESUBMIT WITH MODIFICATIONS, WITHIN SEVEN (7) WORKING DAYS OF RECEIPT OF THE ARCHITECT'S NOTIFICATION TO THE CONTRACTOR. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE EXTRA EXPENSES FOR SUBSEQUENT REVIEW OF REJECTED SUBMITTALS NECESSITATED BY THE CONTRACTOR'S FAILURE TO PROVIDE A COMPLETE AND ACCURATE SUBMITTAL MEETING THE REQUIREMENTS OF THE SPECIFICATIONS. SUCH EXTRA FEES SHALL BE DEDUCTED FROM PAYMENTS TO THE CONTRACTOR.
- 3. IF THE CONTRACTOR'S SUBMITTALS CONFORM TO THE REQUIREMENTS OF THESE SPECIFICATIONS, THE ARCHITECT WILL ISSUE A CERTIFICATE OF COMPLIANCE. SUBSEQUENTLY, THE FIRE SPRINKLER SYSTEM SPECIFICATION SHEET AND CERTIFICATE OF COMPLIANCE WILL ACCOMPANY THE SHOP DRAWING SUBMITTAL TO THE STATE FIRE MARSHAL FOR REVIEW AND APPROVAL.
- B. DRAWING APPROVAL BY CODE AUTHORITY:

CONFORMANCE TO THESE SPECIFICATIONS.

- 1. THE CONTRACTOR SHALL PROVIDE THE OWNER AND ARCHITECT WITH ONE COPY OF ALL DOCUMENTS THAT ARE REVIEWED AND APPROVED BY THE LOCAL CODE AUTHORITIES AND INSURANCE UNDERWRITERS. THESE DOCUMENTS SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING
- a. 2. ALL DOCUMENTS MUST INCLUDE ALL REQUIRED APPROVAL STAMPS, SIGNATURES, OR OTHER INFORMATION NECESSARY TO PROPERLY CERTIFY THAT THE INSTALLATION HAS BEEN REVIEWED AND ACCEPTED BY THE CITY OF COLUMBIA AND THE STATE OF SOUTH CAROLINA BUILDING AND FIRE

## 1.6 GUARANTEE PERIOD

- A. THE CONTRACTOR SHALL GUARANTEE ALL MATERIALS AND WORKMANSHIP FOR A PERIOD OF ONE (1) YEAR BEGINNING WITH THE DATE OF FINAL ACCEPTANCE BY THE OWNER AND ARCHITECT. THE CONTRACTOR SHALL BE RESPONSIBLE DURING THE DESIGN, INSTALLATION, TESTING, AND GUARANTEE PERIODS FOR ANY DAMAGE CAUSED BY HIM OR HIS SUBCONTRACTORS OR BY DEFECTS IN HIS OR HIS SUBCONTRACTORS' WORK, MATERIALS, OR EQUIPMENT.
- B. DURING THE INSTALLATION AND WARRANTY PERIOD, THE CONTRACTOR SHALL PROVIDE EMERGENCY REPAIR SERVICE FOR THE SPRINKLER SYSTEM WITHIN FOUR (4) HOURS OF A REQUEST BY THE OWNER FOR SUCH SERVICE. THIS SERVICE SHALL BE PROVIDED ON A TWENTY—FOUR (24) HOUR PER DAY, SEVEN (7) DAYS PER WEEK BASIS.

#### PART 2 - PRODUCTS

## PIPING A. FIRE PROTECTION SYSTEM PIPING SHALL MEET THE REQUIREMENTS OF NFPA STANDARD 13 AND THE

- FOLLOWING:

  1. SCHEDULE 40 PIPE MEETING ASTM A-53 REQUIREMENTS WITH THE FOLLOWING:
- THREADED JOINTS CONFORMING TO ANSI B2.1

  MECHANICAL GROOVED PIPE COUPLINGS AND FITTINGS FOR ROLL OR CUT PIPE SIZES 2-1/2 INCHES AND LARGER.

BLACK CAST-IRON SCREWED FITTINGS 125 POUND STEAM, 175 POUND WATER ANSI B16.4 AND

- PRESSURE RATINGS OF ALL THE FITTINGS SHALL MEET OR EXCEED MAXIMUM WORKING PRESSURE AVAILABLE WITHIN THE SYSTEM.
   ALL PIPING AND HANGERS WHERE EXPOSED TO THE WEATHER OR INSTALLED IN A CORROSIVE
- ATMOSPHERE SHALL BE PROTECTED AGAINST CORROSION. NO PIPING SHALL BE SUBJECT TO FREEZING.

  A. IF PIPING SYSTEMS UTILIZING MECHANICAL COUPLINGS ARE USED, ALL COUPLING AND PIPE FITTINGS SUCH AS ELBOWS, TEES, REDUCERS, ETC. (NOT INCLUDING VALVES AND SPECIALTIES) SHALL BE

## PROVIDED BY ONE MANUFACTURER AND SHALL BE PART OF A UL/FM APPROVED ASSEMBLY.

- 2.2 AUTOMATIC SPRINKLERS

  A. SPRINKLERS SHALL BE MANUFACTURED BY GRINNELL, VIKING OR RELIABLE. "O" RING SPRINKLER HEADS ARE NOT ALLOWED. SPRINKLERS SHALL BE LISTED BY UNDERWRITER'S LABORATORIES AND ONLY NEW SPRINKLERS SHALL BE USED. ANY SPRINKLER THAT INCURS DAMAGE, IS PAINTED, OR IS SPRAYED WITH ANY FIRE RETARDANT OR OBSTRUCTIVE MATERIAL SHALL BE REPLACED AT NO COST TO THE OWNER. SPRINKLERS SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH NFPA STANDARD 13 AND PROPERLY COORDINATED WITH OTHER WORK INCLUDING DUCT AND ELECTRIC FIXTURE INSTALLATION. THE
- CORRECT TYPE OF SPRINKLER HEAD SHALL BE USED IN EVERY LOCATION.

  B. THE CORRECT TEMPERATURE RATING OF EVERY SPRINKLER HEAD SHALL BE USED ACCORDING TO THE MAXIMUM CEILING TEMPERATURE RATING AND REQUIREMENTS IN NFPA STANDARD 13. ALL SPRINKLERS WITH THE EXCEPTION OF SPECIFIED DECORATIVE TYPES SHALL HAVE THEIR FRAME ARMS COLORED AT THE FACTORY IN ACCORDANCE WITH THE STANDARD TABLE IN NFPA STANDARD 13. HIGH TEMPERATURE HEADS SHALL BE USED WHERE REQUIRED BY NFPA STANDARD 13 AND THE AUTHORITY HAVING
- JURISDICTION.

  C. SPRINKLERS THAT MAY BE SUBJECT TO MECHANICAL DAMAGE DUE TO THEIR LOCATION (UNDER STAIRWELLS, OR LOW HANGING SPRINKLERS IN CORRIDORS, STORAGE ROOMS OR UNDER DUCTS) SHALL BE PROVIDED WITH APPROVED GUARDS (RELIABLE MODEL MA OR EQUIVALENT). SPRINKLERS UNDER
- OPEN GRATINGS SHALL BE PROVIDED WITH APPROVED SHIELDS.

CEILING WITHOUT CUTTING TILES.

- D. AUTOMATIC SPRINKLERS SHALL BE OF THE FOLLOWING TYPES:
   1. QUICK RESPONSE SIDEWALL OR RECESSED PENDENT SPRINKLERS SHALL PROVIDED IN ALL FINISHED AREAS. QUICK RESPONSE SPRINKLERS SHALL BE ORDINARY TEMPERATURE RATED. ALL SPRINKLERS IN THESE AREAS SHALL BE QUICK RESPONSE WHICH WILL PERMIT REMOVAL AND REPLACEMENT OF
- 2. STANDARD UPRIGHT OR PENDENT SPRINKLERS SHALL BE INSTALLED IN AREAS NOT PROVIDED WITH QUICK RESPONSE SPRINKLERS..
- 3. ARCHITECT WILL SELECT FINISH FOR ALL AUTOMATIC SPRINKLERS FROM SAMPLES OF AVAILABLE FINISHES SUPPLIED BY CONTRACTOR FROM THE MANUFACTURER.

4. ALL SPRINKLERS WITHIN A SPACE SHALL BE FROM THE SAME MANUFACTURER AND HAVE THE SAME

HEAT RESPONSE ELEMENT, INCLUDING TEMPERATURE RATING AND RESPONSE CHARACTERISTICS.

5. SPRINKLERS LOCATED ON EXTERIOR PIPING SYSTEMS, OR LOCATED IN CORROSIVE ATMOSPHERES SHALL BE CORROSION RESISTANT.

## 6. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO INSTALL ALL SPRINKLERS SECURELY AND IN A MANNER ACCEPTABLE TO THE OWNER AND ARCHITECT.

A. PROVIDE HANGERS FROM THE BUILDING STRUCTURE IN STRICT ACCORDANCE WITH NEPA STANDARD

## 2.3 HANGERS

13-2007. PROVIDE SEISMIC BRACING AND SUPPORTS FOR ALL FIRE PROTECTION PIPING TO COMPLY WITH NFPA STANDARD 13-2007 AND IBC SECTION 1621.1. SUBMITTAL SHALL DETAIL SEISMIC BRACING AND PIPE SUPPORTS AND SHOW LOCATIONS OF EACH. ALL PIPE SUPPORTS AND SEISMIC BRACING SHALL BE OF UL LISTED COMPONENTS. ENGINEERED PIPE SUPPORTS WILL ONLY BE ALLOWED IF SHOP DRAWINGS CONTAINING CALCULATIONS ACCORDING TO NFPA STANDARD 13-2007 (9.1.1.4) ARE APPROVED BY THE AHJ PRIOR TO THE START OF INSTALLATION.

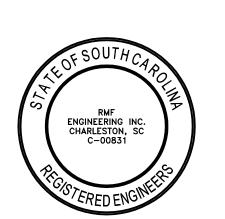
## Jenkins • Peer Architects

112 South Tryon Street Charlotte, North Carolina 28284 704/372-6665

704/372-0102

843/971-9641 Fax

Mechanical, Plumbing, Electrical & Fire Protection Consultant RMF Engineering, Inc. 194 Seven Farms Drive, Suite G Charleston, South Carolina 29492 843/971-9639



U N I V E R S I T Y O F
SOUTHCAROLINA

# PUBLIC HEALTH RESEARCH CENTER INTERIOR

OSE # H27-I988

TAG DESCRIPTION DATE

Date: 5 MAR 2012

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MECHANICAL

**SPECIFICATIONS** 

Drawn By: BEK

Checked By: CRB

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• M6<sub>-</sub>0<sup>-</sup>

#### 2.4 FLOW SWITCHES

- A. APPROVED WATER FLOW SWITCHES (GRIMES MODEL VRS, VS, OR EQUIVALENTS) SHALL BE INSTALLED WHERE REQUIRED. CONDUCTORS SHALL BE PROVIDED UNDER THE ELECTRIC DIVISION TO PROVIDE FIRE ALARM AND ANNUNCIATION. ACTIVATION OF THE SPRINKLER SYSTEM BY ONE (1) SPRINKLER OR EQUIVALENT TEST SHALL CAUSE THE FIRE ALARM SYSTEM TO ACTIVATE AND THE APPROPRIATE LAMP(S) TO ACTIVATE ON THE ANNUNCIATOR. AN APPROVED TEST SHALL BE PROVIDED FOR EACH WATER FLOW SWITCH.
- B. SMOKE DETECTION: SMOKE DETECTORS SHALL BE OF THE PHOTO-IONIZATION TYPE AND SHALL BE COMPATIBLE WITH EXISTING SYSTEM CONTROL PANEL.

#### PART 3 - EXECUTION

- 3.1 INSTALLATION OF PIPING:
- A. INSTALL ALL PIPE, FITTINGS, VALVES, CONTROLS, AND HANGERS AS INDICATED AND REQUIRED IN ACCORDANCE WITH ALL NFPA STANDARDS.
- B. PIPING SHALL BE PITCHED FOR DRAINAGE. INSTALLATION OF ALL PIPING SHALL BE IN COORDINATION WITH AIR DEVICES, DUCTWORK, LIGHT FIXTURES, AND ANY OTHER WORK THAT MAY OBSTRUCT SPRINKLERS.
- C. ALL SPRINKLER PIPING SHALL BE SUBSTANTIALLY SUPPORTED FROM THE BUILDING STRUCTURE WHICH MUST SUPPORT THE TOTAL LOAD OF THE WATER FILLED PIPE PLUS A MINIMUM OF 250 POUNDS APPLIED AT THE POINT OF HANGING IN ACCORDANCE WITH NFPA STANDARDS. ALL HANGING APPARATUS AND EQUIPMENT SHALL BE OF AN APPROVED TYPE INSTALLED IN ACCORDANCE WITH NFPA STANDARDS.

#### 3.2 INSTALLATION, ACCEPTANCES, AND TEST

- A. ALL TESTS AND INSPECTIONS REQUIRED BY THE REFERENCED CODES AND STANDARDS, THE AUTHORITIES HAVING JURISDICTION, AND THE ARCHITECT SHALL BE PERFORMED BY THE CONTRACTOR.
- B. THE FOLLOWING MATERIALS SHALL BE FURNISHED BY THE CONTRACTOR AT THE CONCLUSION OF THE FINAL ACCEPTANCE TEST:
- 1. THE SPARE SPRINKLERS HEREINBEFORE SPECIFIED.
- ANY AND ALL SPECIAL TOOLS NOTED BY THE MANUFACTURER REQUIRED FOR THE FIRE PROTECTION ITEMS FURNISHED.
- C. AFTER COMPLETION OF INSTALLATION AND TESTS, CLEAN INTERIOR AND EXTERIOR SURFACES OF EQUIPMENT AND MATERIALS, PAINTED OR UNPAINTED, INSTALLED UNDER THIS SECTION OF SPECIFICATIONS OF DIRT, RUST, LOOSE SCALE, OILS, GREASE AND OTHER FOREIGN MATTER.

#### SECTION 15800 - AIR DISTRIBUTION

#### PART 1 - GENERAL

#### 1.1 SCOPE

- A. THIS SECTION INCLUDES THE AIR DISTRIBUTION SYSTEMS INCLUDING THOSE DEVICES DISTRIBUTING THE AIR TO THE SPACES, AND THOSE ITEMS WHICH COLLECT, FILTER, CONTROL, AND CONVEY AIR.
- B. THE REQUIREMENTS OF DIVISION 15, SECTION "MECHANICAL AND ELECTRICAL GENERAL PROVISIONS" SHALL APPLY TO THE WORK SPECIFIED UNDER THIS SECTION.
- C. EXCEPT FOR DUCT PRESSURE TESTS, ALL TESTING AND BALANCING OF THE AIR DISTRIBUTION SYSTEMS SHALL BE PERFORMED UNDER DIVISION 15, SECTION "TESTING AND BALANCING" OF THE SPECIFICATIONS.

#### PART 2 - PRODUCTS

#### 2.1 SUPPLY TERMINAL UNIT

- A. PROVIDE TITUS, KREUGER, PRICE, METALAIRE OR NAILOR, HIGH PRESSURE VARIABLE/CONSTANT AIR VOLUME TERMINAL REHEAT UNITS AS SHOWN ON THE PLANS AND SPECIFIED HEREIN, EQUAL TO TITUS MODEL DESV WITH FACTORY INSTALLED CONTROLS FURNISHED UNDER DIVISION 15, SECTION "BUILDING AUTOMATION AND TEMPERATURE CONTROLS".
- B. TERMINALS SHOULD BE CERTIFIED UNDER THE ARI STANDARD 880-94 CERTIFICATION PROGRAM AND CARRY THE ARI SEAL. NON-CERTIFIED TERMINALS MAY BE SUBMITTED AFTER TESTING AT AN INDEPENDENT TESTING LABORATORY UNDER CONDITIONS SELECTED BY THE ENGINEERING CONSULTANT IN FULL COMPLIANCE WITH ARI STANDARD 880-94. THESE TESTS SHALL BE WITNESSED BY THE ENGINEERING CONSULTANT WITH ALL COSTS TO BE BORNE BY THE TERMINAL MANUFACTURER. TESTING DOES NO ENSURE ACCEPTANCE.
- C. THE TERMINAL CASING SHALL BE MINIMUM TWENTY-TWO (22) GAUGE GALVANIZED STEEL, INTERNALLY LINED WITH A NON-POROUS, SEALED LINER WHICH COMPLIES WITH UL 181 AND NFPA 90A. INSULATION SHALL BE 13/16" THICK, 4 LB. DENSITY, RIGID BOARD INSULATION. LINER SHALL BE ATTACHED TO UNIT CASING BY INSULATION ADHESIVE AND FULL-SEAM-LENGTH Z-STRIPS TO ENCLOSE AND SEAL THE INSULATION CUT EDGES. LINERS MADE OF MYLAR, TEDLAR, SILANE, OR WOVEN FIBERGLASS CLOTH ARE NOT ACCEPTABLE. INSULATION SHALL BE EQUIVALENT TO TITUS STERI-LOC OR DOUBLE WALL LINING. THE DISCHARGE CONNECTION SHALL BE SLIP AND DRIVE CONSTRUCTION FOR ATTACHMENT TO METAL DUCTWORK.
- D. THE TERMINALS SHALL BE EQUIPPED WITH PRESSURE INDEPENDENT CONTROLS WHICH CAN BE RESET TO MODULATE AIRFLOW BETWEEN ZERO AND THE MAXIMUM CATALOGED CUBIC FEET PER MINUTE. MAXIMUM AIRFLOW LIMITERS ARE NOT ACCEPTABLE.
- E. THE DIRECT DIGITAL CONTROLS SHALL BE SUPPLIED BY THE CONTROL CONTRACTOR AND MOUNTED BY THE TERMINAL UNIT MANUFACTURER. CONTROL CONTRACTOR SHALL PROVIDE DATA SHEETS ON ALL COMPONENTS TO BE MOUNTED, INDICATING COMPONENT DIMENSIONS, MOUNTING HARDWARE, AND METHODS, AS WELL AS WIRING AND PIPING DIAGRAMS FOR EACH APPLICATION IDENTIFIED BY UNIT TAG PER THE SCHEDULE IN THE DRAWINGS, TO THE TERMINAL MANUFACTURER.
- F. CONTROLS SHALL BE COMPATIBLE WITH PNEUMATIC INLET VELOCITY SENSORS SUPPLIED BY THE TERMINAL MANUFACTURER. THE SENSOR SHALL BE MULTI-POINT CENTER AVERAGING TYPE, WITH A MINIMUM OF FOUR MEASURING PORTS PARALLEL TO THE TAKE-OFF POINT FROM THE SENSOR. SENSORS WITH MEASURING PORTS IN SERIES ARE NOT ACCEPTABLE. THE SENSOR MUST PROVIDE A MINIMUM DIFFERENTIAL PRESSURE SIGNAL OF 0.03 INCH WG. AT AN INLET VELOCITY OF 500 FPM. THE SENSOR MUST PROVIDE CONTROL SIGNAL ACCURACY OF PLUS OR MINUS FIVE (5) PERCENT WITH THE SAME SIZE INLET DUCT AT ANY INLET CONDITION.
- G. CONTROLS SHALL BE FIELD SET BY CONTROL CONTRACTOR FOR THE SCHEDULED MINIMUM AND MAXIMUM FLOW RATES. FLOW MEASURING TAPS AND FLOW CURVES WILL BE SUPPLIED WITH EACH TERMINAL FOR FIELD BALANCING AIRFLOW. ALL PNEUMATIC TUBING SHALL BE UL LISTED FIRE RETARDANT (FR) TYPE. EACH TERMINAL SHALL BE EQUIPPED WITH LABELING SHOWING UNIT LOCATION, SIZE, MINIMUM AND MAXIMUM CUBIC FEET PER MINUTE SETPOINTS, DAMPER FAIL POSITION, AND
- H. THE TERMINAL MANUFACTURER SHALL PROVIDE A CLASS II 24 VAC TRANSFORMER AND DISCONNECT SWITCH. ACTUATOR SHALL BE DIRECT CONNECTION SHAFT MOUNT TYPE WITHOUT LINKAGE. ALL CONTROLS SHALL BE INSTALLED IN APPROVED NEMA TYPE SHEET METAL ENCLOSURE BY TERMINAL MANUFACTURER.
- D. HOT WATER REHEAT COILS SHALL BE ENCLOSED IN A MINIMUM TWENTY (20) GAUGE GALVANIZED STEEL CASING, WITH SLIP AND DRIVE CONSTRUCTION FOR ATTACHMENT TO METAL DUCTWORK. COILS SHALL BE FACTORY INSTALLED ON THE TERMINAL DISCHARGE. FINS SHALL BE RIPPLED AND CORRUGATED HEAVY GAUGE ALUMINUM, MECHANICALLY BONDED TO TUBES. TUBES SHALL BE COPPER WITH MINIMUM WALL THICKNESS OF 0.016 INCH WITH MALE SOLDER HEADER CONNECTIONS COILS SHALL BE LEAK TESTED TO 300 POUNDS PER SQUARE INCH, WITH MINIMUM BURST PRESSURE OF 2000 POUNDS PER SQUARE INCH AT AMBIENT TEMPERATURE. NUMBER OF COIL ROWS AND CIRCUITS SHALL BE SELECTED TO PROVIDE PERFORMANCE AS SCHEDULED ON THE DRAWINGS. COIL PERFORMANCE DATA SHALL BE BASED ON TESTS RUN IN ACCORDANCE WITH ARI STANDARD 410.
- E. PROVIDE THREE (3) YEAR WARRANTY INCLUDING COVERAGE OF OPERATING CONTROLS, FROM THE DATE OF ACCEPTANCE BY THE OWNER.

## 2.2 AIR DEVICES

- A. PROVIDE AIR DEVICES OF THE MINIMUM SIZES AND QUANTITIES INDICATED AND OF THE TYPES SPECIFIED. CONTRACTOR SHALL CAREFULLY STUDY THE DRAWINGS AND THE FIELD CONDITIONS TO ASCERTAIN THE AIR DEVICE REQUIREMENTS AS TO SUITABILITY, LOCATION, AIR CAPACITY, REQUIRED ACCESSORIES AND FINISH. DEVICES SHALL BE SELECTED TO PROVIDE DRAFT-FREE AIR DISTRIBUTION OVER ENTIRE AREA SERVED AND SOUND RATING SHALL NOT EXCEED NOISE CRITERIA (NC) 35.
- B. FRAMES, BORDERS AND MARGINS SHALL BE AS INDICATED OR DIRECTED TO SUIT FIELD CONDITIONS.
- C. PROVIDE CARNES, KREUGER, METALAIRE, PRICE OR TITUS AIR DEVICES IN ACCORDANCE WITH THE SCHEDULE BELOW AND ON THE DRAWINGS. PROVIDE AN OPPOSED BLADE VOLUME DAMPER FOR ALL DIFFUSERS AND REGISTERS.
- D. AIR DEVICE SCHEDULE:
- 1. SUPPLY DIFFUSER TYPE A

TYPE A - PERFORATED CEILING DIFFUSERS SHALL BE TITUS MODEL PAS (STEEL, FLUSH FACE) APPROVED EQUAL. DIFFUSERS SHALL HAVE A PERFORATED FACE WITH 3/16-INCH DIAMETER HOLES ON 14-INCH STAGGERED CENTERS AND NO LESS THAN 51 PERCENT FREE AREA. PERFORATED FACE SHALL BE STEEL. THE BACKPAN SHALL BE ONE PIECE STAMPED HEAVY GAUGE STEEL OF THE SIZES AND MOUNTING TYPES SHOWN ON THE PLANS AND OUTLET SCHEDULE. THE DIFFUSER NECK SHALL HAVE 1 1/8-INCH DEPTH FOR EASY DUCT CONNECTION. DIFFUSERS MUST DISCHARGE A UNIFORM HORIZONTAL BLANKET OF AIR INTO THE ROOM AND PROTECT CEILING AGAINST SMUDGING. PATTERN CONTROLLERS IN THE SUPPLY MODELS SHALL BE MOUNTED ON THE BACK OF THE PERFORATED FACE AND MUST BE FIELD ADJUSTABLE TO ALLOW THE DISCHARGED AIR TO ENTER THE ROOM IN EITHER VERTICAL OR ONE-, TWO-, THREE- OR FOUR-WAY HORIZONTAL JETS. THE PERFORATED FACE MUST BE EASILY UNLATCHABLE FROM THE BACKPAN TO FACILITATE OPTION OF THE FACE FOR PATTERN CONTROLLER ADJUSTMENT.

#### 2. RETURN DIFFUSER - TYPE B

- TYPE B RETURN REGISTER SHALL BE STEEL, TITUS MODEL PAR OR APPROVED EQUAL WITH PERFORATED FACE. RETURN MODELS SHALL HAVE THE SAME FACE AND BORDER CONSTRUCTION AS THE SUPPLY MODELS FOR HARMONIOUS APPEARANCE IN THE ROOM. PERFORATED FACE WITH 3/16" DIAMETER HOLES ON 1/4" STAGGERED CENTERS AND NO LESS THAN 51% FREE AREA. PERFORATED FACE SHALL BE STEEL. BACK PAN SHALL BE ONE PIECE STAMPED HEAVY GAUGE STEEL OF THE SIZES AND MOUNTING TYPES SHOWN ON THE PLANS AND AIR DEVICES SCHEDULE NECK SHALL HAVE 1-1/8" DEPTH FOR EASY DUCT CONNECTION. THE PERFORATED FACE MUST BE EASILY UNLATCHABLE FROM THE BACK PAN TO FACILITATE REMOVAL OF THE FACE TO ACCESS
- E. PAINT THE DUCTWORK BEHIND REGISTERS WITH FLAT BLACK ENAMEL SO THAT BRIGHT SURFACE CANNOT BE SEEN. PROPERLY PRIME GALVANIZED SURFACE PRIOR TO PAINTING.
- F. SUPPLY AIR DIFFUSERS SHALL BE INSULATED IN ACCORDANCE WITH DIVISION 15, SECTION "MECHANICAL SYSTEMS INSULATION."

#### 2.3 DUCTWORK

- D. THE DUCT MANUAL AS HEREIN REFERENCED SHALL MEAN THE SMACNA DUCT MANUAL HVAC DUCT CONSTRUCTION STANDARDS: METAL & FLEXIBLE 2005, 3RD EDITION" AS PUBLISHED BY THE SHEET METAL AND AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION, INC.
- E. UNLESS NOTED OTHERWISE, DUCTWORK SHALL BE CONSTRUCTED OF PRIME, FIRST QUALITY GALVANIZED STEEL OF GAUGES AS CALLED FOR IN THE DUCT MANUAL. REINFORCE ALL DUCTS TO PREVENT BUCKLING, BREATHING, VIBRATIONS, OR UNNECESSARY NOISE. SUCH REINFORCING SHALL BE AS RECOMMENDED IN DUCT MANUAL, PLUS ANY ADDITIONAL REINFORCING AS REQUIRED TO MEET JOB CONDITIONS. LONGITUDINAL AND CROSS JOINTS, ELBOWS, TRANSITIONS, ETC., SHALL BE FURNISHED AS SPECIFIED IN DUCT MANUAL, INCLUDING RECOMMENDED DUCT SUPPORTS TO SUIT JOB CONDITIONS.
- F. ALL UNINSULATED RECTANGULAR DUCTWORK SHALL BE CROSSBROKEN ON ALL FOUR (4) SIDES OF EACH PANEL SECTION. ALL VERTICAL AND HORIZONTAL SHEET METAL BARRIERS, DUCT OFFSETS AND ELBOWS, AS WELL AS THE PANELS OF STRAIGHT SECTIONS OF DUCTS, SHALL BE CROSSBROKEN. CROSSBREAKING SHALL BE APPLIED BETWEEN THE STANDING SEAMS OR REINFORCING ANGLES. THE CENTER OF THE CROSSBREAK SHALL BE OF THE REQUIRED HEIGHT TO ASSURE EACH PANEL SECTION BEING RIGID, TO PREVENT VIBRATIONS AND "BREATHING".
- G. ALL DUCTWORK CONNECTIONS TO EQUIPMENT SHALL BE PER EQUIPMENT MANUFACTURER'S WRITTEN INSTRUCTIONS. ANY COSTS RESULTING FROM INCORRECT DUCTWORK CONNECTIONS, INCLUDING VOIDED WARRANTIES AND EQUIPMENT REPLACEMENT, SHALL BE THE RESPONSIBILITY OF THE
- H. SUPPORT AND RESTRAIN ALL DUCTS IN ACCORDANCE WITH THE DUCT MANUAL AND SMACNA "SEISMIC RESTRAINT MANUAL: GUIDELINES FOR MECHANICAL SYSTEMS", 3RD EDITION, 2008.
- I. SUPPLY AIR DUCTWORK FROM AIR HANDLING UNITS TO THE AIR TERMINAL UNITS SHALL BE "MEDIUM PRESSURE" DUCTWORK. SUPPLY DUCTWORK FROM AIR TERMINAL UNITS TO AIR DEVICES SHALL BE "LOW PRESSURE" DUCTWORK.
- F. LOW PRESSURE DUCTWORK (O"-2" WATER GAUGE)
- 1. DUCTWORK SHALL CONFORM WITH REQUIREMENTS AND DETAILS, UNLESS SPECIFIED OR INDICATED OTHERWISE IN THE SMACNA DUCT MANUAL "HVAC DUCT CONSTRUCTION STANDARDS", FIRST
- 2. CIRCULAR LOW PRESSURE SUPPLY AND EXHAUST DUCTWORK SHALL BE UNITED MCGILL LOW PRESSURE SPIRAL DUCTWORK AND FITTINGS, EQUAL TO UNITED UNI—SEAL SPIRAL LOCKSEAM
- 3. FLEXIBLE DUCT CONNECTIONS WHERE INDICATED SHALL BE "VENTGLASS" DUCT FABRIC AS MANUFACTURED BY VENTFABRICS, INC.
- SMACNA STANDARDS FOR TWO (2) INCHES WATER GAUGE: a. MATERIAL GAUGES (GALVANIZED STEEL) & GENERAL CONSTRUCTION — TABLES 1-5, 1-10 THRU 1-13 SEAL CLASS B

4. RECTANGULAR LOW PRESSURE DUCTWORK CONSTRUCTION SHALL CONFORM TO THE FOLLOWING

- b. LONGITUDINAL SEAMS FIG. #1-5, TYPES L-1, L-3 & L-4
- c. CORNER CLOSURES FIG. #1-13 & # 1-14
- d. HANGERS FIG. #4-1 & 4-4 & TABLES 4-1 & 4-2
- e. RADIUS ELBOWS FIG. #2-2, TYPE RE-1 AND RE-3
- f. vaned elbows (applied to square elbows) fig. #2—2 type re—2 & figs. #2—3 & #2-4, DOUBLE THICKNESS VANES ONLY
- g. TRANSITIONS & OFFSETS FIG #2-9
- h. BRANCH CONNECTIONS FIG. #2-8, 45° ONLY
- i. VOLUME DAMPERS, UP TO 12" DEEP FIG. #2—14, FIGS. A&B W/VENTLOK #555 QUADRANT
- i. VOLUME DAMPERS, OVER 12" DEEP FIG. #2—15, FIG. A W/VENTLOK #555 QUADRANT k. ACCESS DOORS — CESCO #HADF—10 HINGED ONE (1) SIDE W/VENTLOK #100 LATCH, INSULATED, ONE (1) INCH THICK
- 5. SEAL ALL TRANSVERSE JOINTS IN ALL LOW PRESSURE SUPPLY DUCTWORK WITH MINERAL IMPREGNATED WOVEN FIBER TAPE AS MANUFACTURED BY HARDCAST, INC.
- 6. PROVIDE STAND-OFFS ON VOLUME DAMPERS INSTALLED IN ALL INSULATED DUCTWORK.
- 7. FLEXIBLE DUCTWORK SHALL BE GENFLEX TYPE IL OR APPROVED EQUAL. FLEXIBLE DUCT SHALL COMPLY WITH NFPA STANDARD 90A AND SHALL BE U.L. LISTED AS CLASS 1 AIR DUCT & CONNECTOR, STANDARD 181.
- 8. SUPPORT ALL DUCTS IN ACCORDANCE WITH DUCT MANUAL, TABLE #4-1.
- E. MEDIUM PRESSURE DUCTWORK (MEDIUM OVER 2" AND UP TO 6" WATER GAUGE):
- 1. MEDIUM PRESSURE DUCTWORK CONSISTS OF RECTANGULAR, FLAT-OVAL, AND CIRCULAR TYPES AS INDICATED ON THE DRAWINGS.
- 2. SUBMIT SAMPLES OF MEDIUM PRESSURE DUCTWORK FOR APPROVAL AS DIRECTED. SAMPLES SHALL INCLUDE LONGITUDINAL SEAMS, TRANSVERSE JOINTS AND REINFORCEMENT AND OTHERS AS REQUESTED. NO DUCTWORK SHALL BE FABRICATED UNTIL DUCT CONSTRUCTION SAMPLES ARE APPROVED IN WRITING BY THE ARCHITECT.
- 3. ALL MEDIUM PRESSURE DUCT SYSTEMS SHALL BE LEAK TESTED IN STRICT CONFORMANCE WITH CHAPTER 10 OF THE SMACNA HIGH PRESSURE DUCT CONSTRUCTION STANDARDS, THIRD EDITION - 1975 DUCT MANUAL. TESTS SHALL BE WITNESSED BY THE BALANCE SUBCONTRACTOR AS HEREINAFTER SPECIFIED.
- 4. RECTANGULAR MEDIUM PRESSURE DUCTWORK, UNLESS OTHERWISE SPECIFIED HEREIN, SHALL CONFORM WITH THE REQUIREMENTS AND DETAILS CONTAINED IN "HVAC DUCTWORK CONSTRUCTION STANDARDS, FIRST EDITION - 1985", HEREINAFTER REFERRED TO AS "DUCT MANUAL". MEDIUM PRESSURE SHALL BE CONSTRUCTED TO REQUIREMENTS FOR SIX (6) INCHES WATER GAUGE. A COPY OF THE DUCT MANUAL SHALL BE SECURED BY THE CONTRACTOR AND SHALL BE KEPT AT THE PROJECT FOR CONVENIENT REFERENCE. CONSTRUCTION SHALL CONFORM TO THE FOLLOWING:
- a. REINFORCEMENT & GAUGE TABLES #1-7, 1-10 THRU 1-13
- b. TRANSVERSE JOINTS FIGS. #1-4 TYPE T-21, #1-10, #1-12, #1-14, #1-15, TYPE
- T-21, AND T-22, #1-16, #3-2 TYPE RT-1 AND 2 c. LONGITUDINAL JOINTS - FIG. #1-5 TYPE L-1 AND L-3
- d. VANES AND VANE RUNNERS FIG. #2-3
- e. BRANCH CONNECTIONS FIGS. #2-7 AND 2-8
- f. TRANSITIONS FIGS #2-9
- g. OFFSETS FIGS. #2-9 TYPE 3
- h. SUPPORTING SYSTEMS FIGS. #4-16, #4-17, #6-4, AND TABLES #4-1, #4-2 AND #4-3i. RISER SUPPORTS — FIG. #4—6
- j. VOLUME DAMPER HIGH VELOCITY AIR FOIL TYPE, ULTRA—LOW LEAKAGE WHEN CLOSED, RUSKIN CD-50 SUITABLE FOR PNEUMATIC OPERATOR PROVIDED UNDER SECTION 15850.
- k. DUCT SEALANTS SEE SECTION 1 BASIC DUCT CONSTRUCTION DUCT SEALING COMMENTARY.
- 5. CIRCULAR MEDIUM PRESSURE DUCTWORK SHALL BE AS MANUFACTURED BY UNITED SHEET METAL, EASTERN OR SEMCO, AND SHALL CONSIST OF SPIRAL PIPE AND WELDED FITTINGS. 6. CIRCULAR DUCT SHALL HAVE LOCKED SEAMS SO MADE AS TO ELIMINATE ANY LEAKAGE UNDER
- THE PRESSURES FOR WHICH THIS SYSTEM HAS BEEN DESIGNED. LONGITUDINAL SEAM DUCT SHALL HAVE FUSION WELDED BUTT SEAM. CIRCULAR DUCT SHALL BE MANUFACTURED OF GALVANIZED STEEL MEETING ASTM A653/A924 BY THE SPIRAL LOCKSEAM METHOD AND IN THE MINIMUM GAUGES LISTED:
- a. 3" THRU 8" SHALL BE 26 GA.
- b. 9" THRU 14" SHALL BE 26 GA.

- 7. ALL FITTINGS ARE TO HAVE CONTINUOUS WELDS ALONG ALL SEAMS. ALL DIVIDED FLOW FITTINGS ARE TO BE MANUFACTURED AS SEPARATE FITTINGS, NOT AS TAP COLLARS WELDED INTO SPIRAL DUCT SECTIONS. FITTINGS AND COUPLINGS SHALL BE OF THE FOLLOWING MINIMUM GAUGES:
- F. ALL NINETY (90) DEGREE TEES AND FORTY-FIVE (45) DEGREE LATERALS, EITHER FULL SIZE OR REDUCING, SHALL BE CONICAL PATTERN PRODUCED BY MACHINE OR PRESS FORMING. THE ENTRANCE SHALL BE FREE OF WELD BUILD-UP, BURRS OR IRREGULARITIES. PROVIDE TANGENTIAL TEES WHERE INDICATED AND REQUIRED.

a. — 3" THRU 14" SHALL BE 24 GA.

- G. ELBOWS IN DIAMETERS THREE (3) INCHES THROUGH EIGHT (8) INCHES SHALL BE TWO (2) SECTION DIE-STAMPED ELBOWS. ALL OTHER ELBOWS SHALL BE GORED CONSTRUCTION WITH ALL SEAMS CONTINUOUS-WELDED. ELBOWS SHALL BE FABRICATED TO A CENTERLINE RADIUS OF 1.5 TIMES THE CROSS SECTION DIAMETER. ALL ELBOWS NOT DIE-STAMPED SHALL BE FABRICATED ACCORDING TO
- H. GALVANIZED AREAS THAT HAVE BEEN DAMAGED BY WELDING SHALL BE COATED WITH CORROSION RESISTANT ALUMINUM PAINT, MINIMUM TWO (2) COATS.
- I. SUPPORTS AND SEALANTS SHALL CONFORM WITH APPLICABLE PORTIONS OF THE MEDIUM PRESSURE DUCT MANUAL.
- J. FLEXIBLE DUCTWORK SHALL BE AS PREVIOUSLY SPECIFIED FOR LOW PRESSURE DUCT SYSTEMS. PART 3 - EXECUTION

#### 3.1 SEISMIC REQUIREMENTS

THE FOLLOWING SCHEDULE:

A. THE 2009 INTERNATIONAL BUILDING CODE APPLIES TO ALL WORK ASSOCIATED WITH THE SEISMIC INSTALLATION OF ALL NEW MECHANICAL AND ELECTRICAL EQUIPMENT. THIS PROJECT REQUIRES COMPLIANCE WITH IBC 2009, USE GROUP II—A, SEISMIC DESIGN CATEGORY B.

#### 3.2 AIR DEVICES

- A. INSTALL AIR DEVICES IN ACCORDANCE WITH THE MANUFACTURER'S LATEST PUBLISHED INSTALLATION INSTRUCTION TO INSURE AGAINST INCORRECT AIR PATTERN, DRAFTS, AND DIRT SMUDGING.
- B. CONSTRUCT, AND INSTALL SHEET METAL DUCT OR PLENUM CONNECTIONS TO AIR DEVICES IN ACCORDANCE WITH TERMINAL MANUFACTURER'S RECOMMENDATIONS.
- C. MAKE MODIFICATIONS TO THE DUCT SYSTEMS AS REQUIRED TO ACCOMMODATE ACTUAL SIZES OF AIR DEVICES FURNISHED, E.G., TRANSFORMATIONS AND COLLAR SIZES, WITHOUT ADDITIONAL COST.
- D. MAKE JOINTS BETWEEN EACH AIR DEVICE AND ITS COMPONENTS, CONNECTING DUCT, OR THE MOUNTING SURFACE AIRTIGHT, USING GASKET OR ITS EQUIVALENT

#### 3.3 DUCTWORK

- A. DUCTWORK FABRICATED OFF-SITE SHALL BE PROTECTED DURING TRANSIT. OPEN ENDS SHALL BE SEALED WITH PLASTIC COVERS TO PROHIBIT DEBRIS/DUST FROM ENTERING THE DUCT. OPEN ENDS OF THE DUCTWORK SHALL BE SEALED AT THE END OF EVERY SHIFT TO PREVENT THE DUST/DEBRIS FROM ENTERING THE DUCT. NO DUCT SHALL BE LEFT OPEN FOR A PERIOD OF MORE THAN ONE HOUR. AFTER ONE HOUR, THE OPEN END OF THE DUCT MUST BE SEALED WITH A PLASTIC COVER.
- B. INSTALL HANGERS, SUPPORTS, AND THEIR ATTACHMENTS, GENERALLY IN CONFORMANCE WITH SMACNA STANDARD REFERRED TO IN THIS SECTION OF THE SPECIFICATIONS AND APPLICABLE PORTIONS OF ARTICLE "PIPING, CONDUIT AND SUPPORTS", OF SECTION 15000.
- C. FURNISH HANGERS CAPABLE OF WITHSTANDING FIVE (5) TIMES THE WEIGHT OF THE LOAD IMPOSED
- ON THEM WITHOUT DAMAGE TO DUCT OR ANY ADJACENT CONSTRUCTION. D. NEATLY ERECT DUCTS AND PLENUMS OF SIZES AND ARRANGEMENTS SHOWN AND DETAILED AND AS REQUIRED TO CARRY OUT INTENT OF SPECIFICATIONS AND DRAWINGS. WORK MUST MEET APPROVAL
- OF THE ENGINEER IN ALL ITS PARTS AND DETAILS.
- INSTALL DUCTWORK IN SUCH A MANNER AS TO MEET THE RECOMMENDATIONS OF NFPA STANDARD F. PROVIDE EACH AIR OUTLET WITH A COLLAR ADEQUATELY STIFFENED, FASTENED, AND MADE SUITABLE FOR SECURING AIR DEVICE THERETO. MAKE FIELD CHANGES IN DUCTWORK, SUCH AS THOSE REQUIRED TO ACCOMMODATE THE SIZES OF FACTORY FABRICATED EQUIPMENT ACTUALLY FURNISHED, I.E., COILS, AIR FILTERS, FANS, DAMPER AND AIR TERMINAL UNITS AND SIMILAR ITEMS, WITHOUT ADDITIONAL COST. PROVIDE DUCT FLANGES TO MATCH THOSE OF CONNECTING FACTORY FABRICATED EQUIPMENT. WHEN NECESSARY, RELOCATE AND MODIFY DUCTWORK TO AVOID OBSTRUCTIONS SUCH
- G. CONSTRUCT AND INSTALL ALL DUCTWORK IN ACCORDANCE WITH THE SMACNA STANDARDS SPECIFIED. COORDINATE THE INSTALLATION OF ALL DUCT SYSTEMS WITH ALL OTHER TRADES INCLUDING PLUMBING, ELECTRICAL, SPRINKLER, CEILING SYSTEMS, ETC.

AS STRUCTURAL MEMBERS, PIPING AND CONDUIT, IN A MANNER ACCEPTABLE TO THE ARCHITECT.

- H. LEAK TESTING OF DUCTWORK:
- 5. WHEN DEEMED NECESSARY BY THE ENGINEER, TEST LOW PRESSURE DUCTWORK FOR LEAKS BY SEALING OPENINGS AND PRESSURIZING SYSTEM TO THAT STATIC PRESSURE WHICH THE SYSTEM WILL OPERATE. USE TEST METHODS APPROVED BY SMACNA AND ARCHITECT. SEAL ALL JOINTS. LEAKAGE SHALL NOT EXCEED THREE (3) PERCENT OF AIR FLOW SPECIFIED AT THE SYSTEM'S NOMINAL STATIC PRESSURE.

## SECTION 15850 - AUTOMATIC TEMPERATURE CONTROLS

## PART 1 - GENERAL

1.1 SCOPE

- A. THE PROJECT INVOLVES THE EXPANSION OF THE USC SCHOOL OF PUBLIC HEALTH BUILDING AUTOMATION SYSTEM. A FULL COMMUNICATIONS INTERFACE AND COMPLETE INTEROPERABILITY WITH THE EXISTING AUTOMATIC TEMPERATURE CONTROL SYSTEM SHALL BE PROVIDED TO PERFORM THE FUNCTIONS HEREIN DESCRIBED OR INDICATED IN THE CONTRACT DOCUMENTS.
- B. THE ATC CONTRACTOR SHALL PROVIDE ALL PANELS, POWER SUPPLIES, WIRING, CONDUIT, SOLENOID VALVES, RELAYS, TRANSMITTERS, SWITCHES, RTDS, SENSORS, ACTUATORS, PANELS, ETC. NECESSARY FOR A COMPLETE AND OPERABLE AUTOMATIC CONTROL SYSTEM.
- C. THE INSTALLATION/EXPANSION OF THE SYSTEM MUST BE PERFORMED WITHOUT INTERRUPTING THE OPERATION OF EXISTING EQUIPMENT. THE AUTOMATIC TEMPERATURE CONTROL INTERFACE MUST BE SCHEDULED TO BE COMPLETED WITH ALL WORK INSTALLED ON THIS PROJECT.
- D. INSTALLATION OF AUTOMATIC CONTROL SYSTEMS SHALL BE PERFORMED UNDER THE DIRECT SUPERVISION OF A SPECIALIST, AUTHORIZED BY THE MANUFACTURER.
- E. THE SYSTEMS ENGINEERING PHASE SHALL INCLUDE THE SELECTION AND INTEGRATION OF COMPONENTS INTO A COMPLETE SYSTEM WHICH WILL MEET THE PERFORMANCE AND PRESCRIPTIVE REQUIREMENTS OF THE CONTRACT, TOGETHER WITH DRAWINGS, SPECIFICATIONS, DESCRIPTIONS OF OPERATION, DIAGRAMS INCLUDING SYSTEM ARCHITECTURE AND OTHER MATERIALS LISTED UNDER "SUBMITTALS" PARAGRAPH OF THIS SECTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SYSTEMS ENGINEERING.
- F. THE CONTROL MANUFACTURER SHALL COOPERATE WITH THE AIR AND WATER BALANCING AGENCY IN
- THE PERFORMANCE OF THEIR WORK AS REQUIRED OR DIRECTED.
- 1.2 TESTING AND ADJUSTING DURING AND AFTER INSTALLATION A. THE TESTING AND ADJUSTING PHASE OF QUALITY ASSURANCE INCLUDES THE SUBMISSION OF A TEST PLAN WHICH SHALL DESCRIBE IN DETAIL THE METHOD BY WHICH EACH COMPONENT, SUBSYSTEM, AND SYSTEM WILL BE TESTED. CALIBRATED. ADJUSTED. AND RETESTED AFTER INSTALLATION IN ACCORDANCE WITH THE SPECIFIED TEMPERATURE CONTROL SEQUENCES AND OTHER CHARACTERISTICS OF THE CONTROL SYSTEM. A REPORT ON TEST RESULTS, INCLUDING SET POINTS AND OPERATING RANGES OF ALL COMPONENTS SHALL BE SUBMITTED.
- 1.3 COMMISSIONING TESTING AND VERIFICATIONS
- A. THE FINAL PHASE OF THE QUALITY ASSURANCE PROGRAM FOR THE PROJECT IS THE COMMISSIONING TESTING AND VERIFICATIONS. THIS PHASE IS TO ASSURE THAT THE PROJECT IS FULLY COMPLETED AND THAT THE SYSTEMS ARE PERFORMING IN ACCORDANCE TO SPECIFICATIONS FROM END TO END OF THE CONTROL SYSTEMS. DEMONSTRATIONS OF THE AUTOMATIC CONTROL SYSTEMS TO THE COMMISSIONING TEAM IN ACCORDANCE WITH THE REQUIREMENTS SPECIFIED IN PART 3 OF THIS SECTION ARE REQUIRED. A REPORT ON TEST RESULTS, INCLUDING SET POINTS AND OPERATING

## 1.4 SUBMITTALS

A. A SYSTEM FLOW DIAGRAM, CONTROL DIAGRAM, SEQUENCE OF OPERATION, AND SCHEDULE OF COMPONENTS. CONTROL DIAGRAMS SHALL BE COMPLETE WITH END TO END CONNECTIONS OF PIPING AND WIRING FROM COMPONENT TERMINAL.

## PART 2 - PRODUCTS

## 2.1 GENERAL

- A. CONNECT TO THE EXISTING AUTOMATIC CONTROL SYSTEM OF THE DIRECT DIGITAL/PNEUMATIC TYPE. THE EXISTING SYSTEM EXPANSION SHALL BE COMPLETE IN ALL RESPECTS INCLUDING ALL LABOR. MATERIALS, EQUIPMENT, AND SERVICE NECESSARY, AND SHALL BE INSTALLED BY PERSONNEL REGULARLY EMPLOYED BY THE MANUFACTURER.
- B. AN APPROVED MANUFACTURER IS JOHNSON CONTROLS, INC.

RANGES OF ALL COMPONENTS, SHALL BE SUBMITTED.

## 2.2 SYSTEMS INTEGRATION

- A. CAREFULLY EVALUATE THE CHARACTERISTICS OF EACH CONTROL LOOP. THE TIME CONSTANTS. EQUIPMENT CHARACTERISTICS, CONTROL ACCURACY, RELIABILITY, AND PROVIDE A SYSTEM WHICH WILL OPERATE SMOOTHLY, WITHOUT HUNTING, AND WITHIN THE ACCURACIES SPECIFIED.
- B. SELECT COMPONENTS INCLUDING SENSORS, TRANSMITTERS, CONTROLLERS, CONTROL DEVICES, ACTUATORS, AND INSTRUMENTATION CONSIDERING SUCH FACTORS AS HYSTERESIS, RELAXATION TIME, SPAN, LIMITS, AND RESPONSE TIME.

#### 2.3 THERMOSTATS

A. ROOM THERMOSTATS SHALL BE OF THE GRADUAL ACTING TYPE WITH ADJUSTABLE SENSITIVITY OF ONE (1) TO FOUR (4) POUNDS PER SQUARE INCH PER DEGREE FAHRENHEIT. THEY SHALL HAVE A BI-METAL SENSING ELEMENT CAPABLE OF RESPONDING TO A TEMPERATURE CHANGE OF ONE-TENTH OF ONE (1) DEGREE. ALL THERMOSTATS SHALL HAVE CONCEALED ADJUSTMENT AND THERMOMETERS WITH DIAL GRADUATION OF TWO (2) DEGREES FAHRENHEIT OVER SCALE RANGE OF FIFTY (50) TO NINETY (90) DEGREES FAHRENHEIT. PROVIDE THERMOSTAT TO MATCH EXISTING. ALL ROOM THERMOSTATS SHALL BE MOUNTED FOUR (4) FEET FIVE (5) INCHES FROM FINISHED FLOOR EXCEPT IN HANDICAPPED ACCESSIBLE ROOMS WHICH SHALL BE MOUNTED FOR WHEELCHAIR ACCESSIBILITY. THERMOSTATS SHALL BE REVERSED OR DIRECT ACTING AS REQUIRED BY OPERATING SEQUENCE.

#### 2.4 CARBON DIOXIDE SENSOR

A. CARBON DIOXIDE SENSOR SHALL BE REMOTE-MOUNTED, NON-DISPERSIVE INFRARED CARBON DIOXIDE OPTICAL DIFFUSION GAS CELL TYPE WITH PULSED SOURCE AND NON-FREE AIR OPTICAL PATH. SENSING CELL SHALL BE PROVIDED WITH THIRTY (30) INCH CABLE FOR DUCT MOUNTING. SENSOR SHALL PRODUCE LINEAR ANALOG 0-1 VOLT DC, 4-20 MA, AND BINARY ADJUSTABLE SWITCH POINT FORM C OUTPUTS. RANGE SHALL BE 0-2000 PARTS PER MILLION WITH ACCURACY OF THREE (3) PERCENT. SENSOR SHALL BE MOUNTED IN WEATHER TIGHT ENCLOSURE WITH FORTY-ONE (41) DEGREE FAHRENHEIT TO 104 DEGREE FAHRENHEIT OPERATING TEMPERATURE.

#### 2.4 TRANSMITTERS AND ASSOCIATED DEVICES

A. TRANSMITTERS SHALL BE INDUSTRIAL GRADE AND SHALL BE COMPATIBLE WITH THE CONTROLLER EQUIPMENT PROVIDED AND SHALL HAVE ACCURACIES AS STATED HEREIN. INSTRUMENT CHARACTERISTICS SUCH AS HYSTERESIS, RELAXATION TIME, SPARE, INCLUDING MAXIMUM AND MINIMUM LIMITS, SHALL BE COORDINATED FOR EACH APPLICATION OF THE SENSORS AND CONTROLS, SO THE MONITORING AND CONTROL SYSTEMS OPERATE SMOOTHLY AND ACCURATELY THROUGHOUT THE DESIGN

4. PASSWORD PROTECTION: PASSWORD PROTECTION SHALL PROVIDE THE CAPABILITY TO SELECT A

PASSWORD TO PREVENT UNAUTHORIZED USERS FROM ACCESS TO THE UNITS PARAMETERS.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. PROVIDE CONTROL/POWER WIRING, AND CONDUIT TO CONNECT THE AUTOMATIC TEMPERATURE
- CONTROL SYSTEM AND ALL HVAC SYSTEM COMPONENTS FOR A COMPLETE OPERATIONAL SYSTEM. B. PROVIDE WIRING IN ACCORDANCE WITH THE NFPA 70.

THE PROPER OPERATION TO HIS SATISFACTION.

- C. LOCATE TUBING AND WIRING CLEAR OF ACCESS DOORS, ACCESSIBLE CEILINGS, LIGHTING FIXTURES, WALKWAYS, OR ANY LOCATION SUBJECT TO DAMAGE OR ABRASION.
- D. LABEL OR CODE EACH FIELD WIRE AT EACH END, AND EACH CONTROLLER AND CONTROLLED DEVICE.

#### 3.2 SYSTEM OPERATION A. UPON COMPLETION OF THE INSTALLATION, COMPLETELY ADJUST, CALIBRATE AND MAKE READY FOR

B. AFTER VERIFYING THAT THE SYSTEM IS FUNCTIONING PROPERLY AND BEFORE DEMONSTRATING SYSTEM OPERATION TO THE OWNER, REQUEST THE ENGINEER TO MAKE A FINAL CHECK AND DEMONSTRATE

USE THERMOSTATS, VALVES, DAMPER MOTORS, RELAYS, AND OTHER CONTROLS INSTALLED UNDER

THIS SECTION AND VERIFY BY DEMONSTRATION THAT THE SYSTEMS ARE OPERATING PROPERLY IN

ACCORDANCE WITH CONTRACT REQUIREMENTS AND THE MANUFACTURER'S MOST RECENTLY PUBLISHED

- A. WIRING SHALL BE PERFORMED IN ACCORDANCE WITH THE APPLICABLE PROVISIONS OF DIVISION 16, ELECTRICAL. ALL TEMPERATURE CONTROL AND CONTROL POWER WIRING SHALL BE RUN IN RACEWAY IN ACCORDANCE WITH DIVISION 16.
- ENCLOSE IN STEEL CABINETS ELECTRICAL RELAYS, TERMINAL STRIPS, AND MISCELLANEOUS DEVICES THAT ARE NOT MOUNTED ON DUCT OR PIPING SYSTEMS.

C. CONDUCT RESISTANCE TESTS ON CONDUCTORS AND EQUIPMENT AS SPECIFIED UNDER DIVISION 16

## <u> SECTION 15990 — TESTING AND BALANCING</u>

FOR WIRING SYSTEM.

#### PART 1 - GENERAL

#### 1.1 SCOPE

- A. THIS SECTION INCLUDES ALL LABOR AND MATERIALS NECESSARY TO ADJUST, BALANCE AND TEST PERFORMANCE IN ACCORDANCE WITH DESIGN CRITERIA. THE EQUIPMENT AND COMPONENTS OF SYSTEMS INCLUDED IN DIVISION 15 AS FOLLOWS:
- 1. AIR DISTRIBUTION 2. EQUIPMENT PERFORMANCE

## 1.3 QUALIFICATIONS

- A. WORK INCLUDED IN THIS SECTION MUST BE PERFORMED BY AN INDEPENDENT TESTING AND BALANCING AGENCY AND AN APPROVED MEMBER OF THE ASSOCIATED AIR BALANCE COUNCIL (AABC) WHO SHALL TEST, ADJUST, AND BALANCE THE AIR AND WATER SYSTEMS FOR THIS PROJECT. SUBMIT THE NAME OF THE AIR BALANCE FIRM FOR APPROVAL WITHIN THIRTY (30) DAYS AFTER AWARD OF CONTRACT.
- B. IF THE CONTRACTOR FAILS TO SUBMIT THE NAME OF AN ACCEPTABLE AGENCY WITHIN THE SPECIFIED TIME, THE OWNER AND ENGINEER WILL SELECT A FIRM TO ACCOMPLISH THE WORK, AND THE
- SELECTION SHALL BE BINDING AT NO ADDITIONAL COST TO THE OWNER. C. ALL WORK SHALL BE PERFORMED UNDER DIRECT SUPERVISION OF A QUALIFIED ENGINEER. ALL INSTRUMENTS USED SHALL BE ACCURATELY CALIBRATED AND MAINTAINED IN GOOD WORKING ORDER. IF REQUESTED, CALIBRATION TESTS OF EQUIPMENT TO BE USED SHALL BE PERFORMED IN THE

#### PRESENCE OF THE ENGINEER. 1.4 TEST REPORT

A. THE BALANCING AGENCY SHALL PREPARE A WRITTEN REPORT WHICH SHALL INCLUDE DIAGRAMS AND DESCRIPTION OF PROCEDURES TOGETHER WITH ALL RECORDED TEST DATA. REPORT SHALL BE SUBMITTED IN BOUND VOLUMES FOR A PERMANENT RECORD. SUBMIT FOUR (4) COPIES OF THE FINAL REPORT AS A PART OF THE OPERATIONS AND MAINTENANCE MANUALS. A SET OF CONTRACT DRAWINGS SHALL ALSO BE SUBMITTED. DRAWINGS SHALL HAVE EACH AIR DEVICE, FLOW FITTING, FAN, AND TRANSVERSE LOCATION IDENTIFIED IN RED INK BY A NUMBER WHICH SHALL MATCH

## IDENTIFICATION NUMBERS UTILIZED IN THE BALANCING REPORT.

- 1.5 TEST PROCEDURE A. WHEN TESTING AND BALANCING INVOLVE THE BUILDING TEMPERATURE CONTROL SYSTEMS, COOPERATE
- WITH THE TEMPERATURE CONTROL SUBCONTRACTOR TO ACHIEVE THE DESIRED RESULTS. B. PERMANENTLY MARK THE SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES SO THAT ADJUSTMENT CAN BE RESTORED IF DISTURBED AT ANY TIME. DO NOT PERMANENTLY MARK
- C. PERFORM ALL TESTS IN ACCORDANCE WITH AABC STANDARD PROCEDURES. ANY DEVIATION FROM SAME MUST BE APPROVED BY THE ENGINEER.
- D. SHOULD THE BASIC SYSTEM OR ANY OF ITS COMPONENTS FAIL TO MEET CONTRACT REQUIREMENTS AND THEREBY MAKE THE TESTING AND BALANCING WORK INVALID, NOTIFY THE ARCHITECT AND STOP ALL TESTS UNTIL SUCH TIME THAT THE FAILURE IS CORRECTED.

- PART 2 PRODUCTS
- 2.1 TEST INSTRUMENTS A. USE INSTRUMENTS OF EQUAL OR BETTER QUALITY THAN THOSE DESCRIBED IN THE TECHNICAL PORTIONS OF ASSOCIATED AIR BALANCE COUNCIL——"NATIONAL STANDARDS FOR TESTING AND
- B. INSTRUMENTS USED FOR BALANCING AIR AND WATER SYSTEMS MUST HAVE BEEN CALIBRATED WITHIN A PERIOD OF SIX (6) MONTHS PRIOR TO BALANCING.

BALANCING HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS, FIFTH EDITION 1989.

- C. LIST IN THE REPORT TYPES, SERIAL NUMBERS, AND DATES OF CALIBRATION OF ALL INSTRUMENTS USED IN THE FINAL AIR AND WATER BALANCE TESTS.
- D. INSTRUMENTATION SHALL INCLUDE, AS A MINIMUM, THE FOLLOWING ITEMS OF EQUIPMENT:
- 1. PRESSURE GAUGES AND FITTINGS

DEVICES BEFORE FINAL ACCEPTANCE.

- 2. DRY BULB AND WET BULB THERMOSTATS.
- 4. PORTABLE FLOW METER AND, IF REQUIRED, ORIFICE PLATES.

5. PITOT TUBE AND MANOMETERS.

6. ALNOR VELOMETER WITH ATTACHMENTS.

7. AMPROBE.

8. TACHOMETER.

3. CONTACT PYROMETER.

9. SPECIAL WRENCHES AND TOOLS.

Jenkins • Peer Architects

Mechanical, Plumbing, Electrical &

194 Seven Farms Drive, Suite G

Charleston, South Carolina 29492

Charlotte, North Carolina 28284

112 South Tryon Street

Fire Protection Consultant

RMF Engineering, Inc.

704/372-6665

704/372-0102

843/971-9639

843/971-9641 Fax



# **PUBLIC HEALTH INTERIOR**

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#### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. CONDUCT BALANCING AND TESTING IN ACCORDANCE WITH TECHNICAL PORTIONS OF THE ASSOCIATED AIR BALANCING COUNCIL——"NATIONAL STANDARDS FOR FIELD MEASUREMENTS AND INSTRUMENTATION VOL. 2, NO. 12173 "TOTAL SYSTEM BALANCE" 1973 EDITION. TEST PROCEDURES NOT IN ACCORDANCE OR NOT DESCRIBED IN THE STANDARDS, I.E., VARIABLE AIR VOLUME SYSTEMS SHALL BE APPROVED BY THE ENGINEER IN WRITING.
- B. PROVIDE ALL LABOR, TESTING EQUIPMENT, AND MATERIALS REQUIRED TO CONDUCT TESTS AND BALANCE SYSTEMS.
- C. C. SYSTEM SHALL BE OPERATED AT LEAST FOUR (4) HOURS AFTER STABILIZED OPERATING
- CONDITIONS HAVE BEEN ESTABLISHED BEFORE CONDUCTING CAPACITY.

  D. TESTS. CAPACITY AND PERFORMANCE TESTS OF EQUIPMENT AND SYSTEMS SHALL BE PERFORMED ONLY AFTER BALANCING IS COMPLETE.

#### 3.2 AIR DISTRIBUTION SYSTEMS

- A. ALL AIR DISTRIBUTION SYSTEMS INCLUDING SUPPLY DUCTWORK SHALL BE TESTED AND BALANCED.
- B. WHERE THE SYSTEM CANNOT BE PROPERLY BALANCED OR EQUIPMENT TESTED DUE TO SYSTEM DEFICIENCIES SUCH AS INABILITY TO PROPERLY ADJUST FAN SPEEDS, IMPROPERLY SIZED MOTORS, EXCESSIVELY NOISY EQUIPMENT, MALFUNCTIONING CONTROLS, EXCESSIVELY OUT OF BALANCE AIR DISTRIBUTION SYSTEM BRANCH RUNS, AND SIMILAR ITEMS, FURNISH TO THE ARCHITECT IN WRITING A LIST OF THE DEFICIENCIES PRIOR TO THE SUBMISSION OF THE TEST REPORT.
- C. MAKE OPENINGS IN DUCTS REQUIRED FOR PITOT TUBE INSERTION AND SEAL THOSE OPENINGS WITH SNAP—IN PLUGS. NEATLY REMOVE DUCT INSULATION AS REQUIRED FOR TEST. REPLACEMENT OF INSULATION, AFTER TESTING IS COMPLETED, IS INCLUDED UNDER DIVISION 15 SECTION "INSULATION".
- D. SPECIFIC TESTING AND BALANCING PROCEDURES SHALL INCLUDE:
- 1. TEST AND ADJUST SPEED OF ALL AIR APPARATUS.
- 2. TEST AND RECORD MOTOR VOLTAGE AND AMPERAGE.
- 3. MAKE PITOT TUBE TRAVERSE OF MAIN DUCTS AND OBTAIN DESIGN AIR QUANTITY AT FANS.
- 4. TEST AND ADJUST SYSTEMS FOR DESIGN SUPPLY AND RETURN AIR QUANTITIES.
- 5. TEST AND RECORD AIR ENTERING AND LEAVING CONDITIONS AT AIR UNIT ON BOTH HEATING AND COOLING MODES.
- 6. ADJUST ALL MAIN AND BRANCH DUCTS FOR SUPPLY AND RETURN AIR. SET AND "MARK" ALL VOLUME DAMPERS. IDENTIFY, TEST, AND ADJUST EACH GRILLE, REGISTER, AND DIFFUSER TO WITHIN TEN (10) PERCENT OF DESIGN QUANTITIES.
- 7. VERIFY OPERATION OF EACH ROOM THERMOSTAT OVER FULL RANGE OF HEATING AND COOLING TO INSURE PROPER SEQUENCE OF CONTROL. RECORD RESULTS.

#### 3.3 EQUIPMENT PERFORMANCE

- A. CONDUCT PERFORMANCE TESTS ONLY AFTER THE AIR SYSTEMS HAVE BEEN BALANCED AND THE PROPER FLOW RATES ESTABLISHED.
- B. TEST AND RECORD CAPACITY OF HEAT TRANSFER EQUIPMENT INCLUDING ALL COILS. AIR SIDE CAPACITIES MUST AGREE WITHIN FIVE (5) PERCENT OF EACH OTHER. INCLUDE THE MANUFACTURER'S RATED CAPACITY AT THE TEST OPERATING CONDITIONS WITH THE REPORT. PERFORM TESTS WHERE POSSIBLE AT DESIGN CONDITIONS. IF TESTS ARE NOT PERFORMED UNDER DESIGN CONDITIONS, INTERPOLATE RESULTS TO DETERMINE CAPACITY AT FULL LOAD OPERATING CONDITIONS.

## Jenkins • Peer Architects

112 South Tryon Street Charlotte, North Carolina 28284 704/372-6665 704/372-0102

Mechanical, Plumbing, Electrical & Fire Protection Consultant RMF Engineering, Inc. 194 Seven Farms Drive, Suite G Charleston, South Carolina 29492 843/971-9639 843/971-9641 Fax



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SOUTH CAROLINA

PUBLIC HEALTH
RESEARCH CENTER INTERIOR
RENOVATIONS

	OSE # H27-l988	
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Project: 11USC39

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MECHANICAL

SPECIFICATIONS

• M6.03