

SECTION 23 093

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

- E. TESTING, ADJUSTMENT, AND BALANCING OF AIR SYSTEMS
- F. MEASUREMENT OF FINAL OPERATING CONDITION OF HVAC SYSTEMS
- G. SOUND MEASUREMENT OF EQUIPMENT OPERATING CONDITIONS
- H. VIBRATION MEASUREMENT OF EQUIPMENT OPERATING CONDITIONS

1.02 REFERENCE STANDARDS

- A. ASHRAE STD 111 - MEASUREMENT, TESTING, ADJUSTING, AND BALANCING OF BUILDING HVAC SYSTEMS, 2008
- B. SMACNA (TAB) - HVAC SYSTEMS TESTING, ADJUSTING AND BALANCING, 2002

1.03 SUBMITTALS

- A. SEE SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS, FOR SUBMITTAL PROCEDURES
- B. TAB PLAN, SUBMIT A WRITTEN PLAN INDICATING THE TESTING, ADJUSTING, AND BALANCING STANDARD TO BE FOLLOWED AND THE SPECIFIC APPROACH FOR EACH SYSTEM AND COMPONENT
 - 1. INCLUDE AT LEAST THE FOLLOWING IN THE PLAN:
 - A. LIST OF ALL AIR FLOW, WATER FLOW, SOUND LEVEL, SYSTEM CAPACITY AND EFFICIENCY MEASUREMENTS TO BE PERFORMED AND A DESCRIPTION OF SPECIFIC TEST PROCEDURES, PARAMETERS, FORMULAS TO BE USED
 - B. COPY OF FIELD CHECKOUT SHEETS AND LOGS TO BE USED, LISTING EACH PIECE OF EQUIPMENT TO BE TESTED, ADJUSTED AND BALANCED WITH THE DATA CELLS TO BE GATHERED FOR EACH
 - C. DISCUSSION OF WHAT NOTATIONS AND MARKINGS WILL BE MADE ON THE DUCT AND PIPING DRAWINGS DURING THE PROCESS
 - D. FINAL TEST REPORT FORMS TO BE USED
- C. PROCEDURES FOR FORMAL DEFICIENCY REPORTS, INCLUDING SCOPE, FREQUENCY AND DISTRIBUTION
- D. FINAL REPORT, INDICATE DEFICIENCIES IN SYSTEMS THAT WOULD PREVENT PROPER TESTING, ADJUSTING, AND BALANCING OF SYSTEMS AND EQUIPMENT TO ACHIEVE SPECIFIED PERFORMANCE

- 1. REVISE TAB PLAN TO REFLECT ACTUAL PROCEDURES AND SUBMIT AS PART OF FINAL REPORT
- 2. SUBMIT DRAFT COPIES OF REPORT FOR REVIEW PRIOR TO FINAL ACCEPTANCE OF PROJECT. PROVIDE FINAL COPIES FOR ARCHITECT AND FOR INCLUSION IN OPERATING AND MAINTENANCE MANUALS
- 3. INCLUDE ACTUAL INSTRUMENT LIST, WITH MANUFACTURER NAME, SERIAL NUMBER, AND DATE OF CALIBRATION
- 4. FORM OF TEST REPORTS, WHERE THE TAB STANDARD BEING FOLLOWED RECOMMENDS A REPORT FORMAT USE THAT, OTHERWISE, FOLLOW ASHRAE STD 111
- 5. UNITS OF MEASURE: REPORT DATA IN BOTH 1/4 (INCH/POUND) AND 3/4 (METRIC) UNITS

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. PERFORM TOTAL SYSTEM BALANCE IN ACCORDANCE WITH ONE OF THE FOLLOWING:
 - 1. SMACNA (TAB)
 - 2. BEGIN WORK AFTER COMPLETION OF SYSTEMS TO BE TESTED, ADJUSTED, OR BALANCED AND COMPLETE WORK PRIOR TO SUBSTANTIAL COMPLETION OF THE PROJECT
- B. TAB AGENCY QUALIFICATIONS
 - 1. COMPANY SPECIALIZING IN THE TESTING, ADJUSTING, AND BALANCING OF SYSTEMS SPECIFIED IN THIS SECTION
 - 2. HAVING MINIMUM OF THREE YEARS DOCUMENTED EXPERIENCE
 - 3. CERTIFIED BY ONE OF THE FOLLOWING:
 - A. AABC ASSOCIATED AIR BALANCE COUNCIL - WWW.AABC.COM, UPON COMPLETION SUBMIT AABC NATIONAL PERFORMANCE GUARANTEE
 - B. NEBB NATIONAL ENVIRONMENTAL BALANCING BUREAU - WWW.NEBB.ORG
 - C. TABB THE TESTING, ADJUSTING, AND BALANCING BUREAU OF NATIONAL ENERGY MANAGEMENT INSTITUTE - WWW.TABBTESTING.ORG
- D. TAB SUPERVISOR AND TECHNICIAN QUALIFICATIONS: CERTIFIED BY SAME ORGANIZATION AS TAB AGENCY

3.02 EXAMINATION

- A. VERIFY THAT SYSTEMS ARE COMPLETE AND OPERABLE BEFORE COMMENCING WORK. ENSURE THE FOLLOWING CONDITIONS:
 - 1. SYSTEMS ARE STARTED AND OPERATING IN A SAFE AND NORMAL CONDITION
 - 2. TEMPERATURE CONTROL SYSTEMS ARE INSTALLED COMPLETE AND OPERABLE
 - 3. PROPER THERMAL OVERLOAD PROTECTION IS IN PLACE FOR ELECTRICAL EQUIPMENT
 - 4. FINAL FILTERS ARE CLEAN AND IN PLACE. IF REQUIRED, INSTALL TEMPORARY MEDIA IN ADDITION TO FINAL FILTERS
 - 5. DUCT SYSTEMS ARE CLEAN OF DEBRIS
 - 6. FANS ARE ROTATING CORRECTLY
 - 7. FIRE AND VOLUME DAMPERS ARE IN PLACE AND OPEN
 - 8. AIR COIL FINS ARE CLEANED AND COMBED
 - 9. ACCESS DOORS ARE CLOSED AND DUCT END CAPS ARE IN PLACE
 - 10. AIR OUTLETS ARE INSTALLED AND CONNECTED
 - 11. DUCT SYSTEM LEAKAGE IS MINIMIZED
- B. SUBMIT FIELD REPORTS, REPORT DEFECTS AND DEFICIENCIES THAT WILL OR COULD PREVENT PROPER SYSTEM BALANCE
- C. BEGINNING OF WORK MEANS ACCEPTANCE OF EXISTING CONDITIONS

3.03 PREPARATION

- A. PROVIDE INSTRUMENTS REQUIRED FOR TESTING, ADJUSTING, AND BALANCING OPERATIONS. MAKE INSTRUMENTS AVAILABLE TO ARCHITECT TO FACILITATE SPOT CHECKS DURING TESTING
- B. PROVIDE ADDITIONAL BALANCING DEVICES AS REQUIRED

3.04 ADJUSTMENT TOLERANCES

- A. AIR HANDLING SYSTEMS: ADJUST TO WITHIN PLUS OR MINUS 5 PERCENT OF DESIGN FOR SUPPLY SYSTEMS AND PLUS OR MINUS 10 PERCENT OF DESIGN FOR RETURN AND EXHAUST SYSTEMS
- B. AIR OUTLETS AND INLETS: ADJUST TOTAL TO WITHIN PLUS 10 PERCENT AND MINUS 5 PERCENT OF DESIGN TO SPACE. ADJUST OUTLETS AND INLETS IN SPACE TO WITHIN PLUS OR MINUS 10 PERCENT OF DESIGN

3.05 RECORDING AND ADJUSTING

- A. FIELD LOGS: MAINTAIN WRITTEN LOGS INCLUDING:
 - 1. RUNNING LOG OF EVENTS AND ISSUES
 - 2. DISCREPANCIES, DEFICIENT OR UNCOMPLETED WORK BY OTHERS
 - 3. CONTRACT INTERPRETATION REQUESTS
 - 4. LISTS OF COMPLETED TESTS
- B. ENSURE RECORDED DATA REPRESENTS ACTUAL MEASURED OR OBSERVED CONDITIONS
- C. PERMANENTLY MARK SETTINGS OF VALVES, DAMPERS, AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS
- D. AFTER ADJUSTMENT, TAKE MEASUREMENTS TO VERIFY BALANCE HAS NOT BEEN DISRUPTED OR THAT SUCH DISRUPTION HAS BEEN RECTIFIED
- E. LEAVE SYSTEMS IN PROPER WORKING ORDER, REPLACING BELT GUARDS, CLOSING ACCESS DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES, AND RESTORING THERMOSTATS TO SPECIFIED SETTINGS

3.06 AIR SYSTEM PROCEDURE

- A. ADJUST AIR HANDLING AND DISTRIBUTION SYSTEMS TO PROVIDE REQUIRED OR DESIGN SUPPLY, RETURN, AND EXHAUST AIR QUANTITIES AT SITE ALTITUDE
- B. MAKE AIR QUANTITY MEASUREMENTS IN DUCTS BY PIVOT TUBE TRAVERSE OF ENTIRE CROSS SECTIONAL AREA OF DUCT
- C. MEASURE AIR QUANTITIES AT AIR INLETS AND OUTLETS
- D. ADJUST DISTRIBUTION SYSTEM TO OBTAIN UNIFORM SPACE TEMPERATURES FREE FROM OBJECTIONABLE DRAFTS AND NOISE
- E. USE VOLUME CONTROL DEVICES TO REGULATE AIR QUANTITIES ONLY TO EXTEND THAT ADJUSTMENTS DO NOT CREATE OBJECTIONABLE AIR MOTION OR SOUND LEVELS. EFFECT VOLUME CONTROL BY DUCT INTERNAL DAMPERS SUCH AS DAMPERS AND SPLITTERS
- F. VARY TOTAL SYSTEM AIR QUANTITIES BY ADJUSTMENT OF FAN SPEEDS. PROVIDE OPERATING CURVES AS REQUIRED. BRANCH AIR QUANTITIES BY DAMPER REGULATION
- G. PROVIDE SYSTEM SCHEMATIC WITH REQUIRED AND ACTUAL AIR QUANTITIES RECORDED AT EACH OUTLET OR INLET
- H. MEASURE STATIC AIR PRESSURE CONDITIONS ON AIR SUPPLY SYSTEMS, INCLUDING FILTERS, COILS, DUCTS, DUCT DROPS, AND TOTAL PRESSURE ACROSS THE FAN. MAKE ALLOWANCES FOR 50 PERCENT LOADING OF FILTERS
- I. ADJUST OUTSIDE AIR AUTOMATIC DAMPERS, OUTSIDE AIR, RETURN AIR, AND EXHAUST DAMPERS FOR DESIGN CONDITIONS
- J. MEASURE TEMPERATURE CONDITIONS ACROSS OUTSIDE AIR, RETURN AIR, AND EXHAUST DAMPERS TO CHECK LEAKAGE
- K. MEASURE BUILDING STATIC PRESSURE AND ADJUST SUPPLY, RETURN, AND EXHAUST AIR SYSTEMS TO PROVIDE REQUIRED RELATIONSHIP BETWEEN EACH TO MAINTAIN APPROXIMATELY 0.05 INCHES (1/24 IN) POSITIVE STATIC PRESSURE NEAR THE BUILDING ENTRIES

3.07 SCOPE

- A. TEST, ADJUST, AND BALANCE THE FOLLOWING:
 - 1. PACKAGED ROOF TOP HEATING/COOLING UNITS
 - 2. FANS
 - 3. AIR INLETS AND OUTLETS

SECTION 23 073

DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. DUCT INSULATION

1.02 REFERENCE STANDARDS

- A. ASTM C518 - STANDARD TEST METHOD FOR STEADY STATE THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS, 2017
- B. ASTM C563 - STANDARD SPECIFICATION FOR MINERAL FIBER BLANKET THERMAL INSULATION FOR COMMERCIAL AND INDUSTRIAL APPLICATIONS, 2013
- C. ASTM E84 - STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS, 2018
- D. ASTM E831 - STANDARD TEST METHOD FOR WATER VAPOR TRANSMISSION OF MATERIALS, 2018
- E. UL 723 - STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS, CURRENT EDITION, INCLUDING ALL REVISIONS

1.03 DELIVERY, STORAGE AND HANDLING

- A. ACCEPT MATERIALS ON SITE IN ORIGINAL FACTORY PACKAGING, LABELED WITH MANUFACTURER'S IDENTIFICATION, INCLUDING PRODUCT DENSITY AND THICKNESS
- B. PROTECT INSULATION FROM WEATHER AND CONSTRUCTION TRAFFIC, DIRT, WATER, CHEMICAL, AND MECHANICAL DAMAGE BY STORING IN ORIGINAL WRAPPING

1.04 FIELD CONDITIONS

- A. MAINTAIN AMBIENT TEMPERATURES AND CONDITIONS REQUIRED BY MANUFACTURERS OF ADHESIVES, MASTICS AND INSULATION CEMENTS
- B. MAINTAIN TEMPERATURE DURING AND AFTER INSTALLATION FOR MINIMUM PERIOD OF 24 HOURS

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD INDEX/SMOKE DEVELOPED INDEX OF 25/50, MAXIMUM, WHEN TESTED IN ACCORDANCE WITH ASTM E84 OR UL 723

2.02 GLASS FIBER, FLEXIBLE

- A. MANUFACTURERS
 - 1. JOHNS MANVILLE - WWW.JM.COM
 - 2. KNAUF INSULATION THERMOPHERE DUCT WRAP - WWW.KNAUFINSULATION.COM/SLR
 - 3. OWENS CORNING CORPORATION - WWW.OCBUILDINGSPEC.COM
 - 4. CERTAINTEED CORPORATION - WWW.CERTAINTEED.COM
- B. INSULATION: ASTM C563, FLEXIBLE, NONCOMBUSTIBLE BLANKET
 - 1. 'K' (KSI) VALUE: 0.36 AT 75 DEGREES F (0.82 AT 24 DEGREES C), WHEN TESTED IN ACCORDANCE WITH ASTM C518
 - 2. MAXIMUM SERVICE TEMPERATURE: 1200 DEGREES F (648 DEGREES C)
 - 3. MAXIMUM WATER VAPOR ABSORPTION: 5.0 PERCENT BY WEIGHT
- C. VAPOR BARRIER JACKET
 - 1. KRAFT PAPER WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM
 - 2. MOISTURE VAPOR PERMEABILITY: 0.02 PERM INCH (0.029 IN/PSIA 5 MI), WHEN TESTED IN ACCORDANCE WITH ASTM E96/E97M
 - 3. SECURE WITH PRESSURE SENSITIVE TAPE
- D. VAPOR BARRIER TAPE
 - 1. KRAFT PAPER REINFORCED WITH GLASS FIBER YARN AND BONDED TO ALUMINIZED FILM, WITH PRESSURE SENSITIVE RUBBER BASED ADHESIVE
- E. TIE WIRE: ANNEALED STEEL, 18 GAGE, 0.0508 INCH DIAMETER (1/29 MM DIAMETER)

PART 3 EXECUTION

3.01 EXAMINATION

- A. VERIFY THAT DUCTS HAVE BEEN TESTED BEFORE APPLYING INSULATION MATERIALS
- B. VERIFY THAT SURFACES ARE CLEAN, FOREIGN MATERIAL REMOVED, AND DRY

3.02 INSTALLATION

- A. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS
- B. INSTALL IN ACCORDANCE WITH NAIMA NATIONAL INSULATION STANDARDS
- C. INSULATED DUCTS CONVEYING AIR BELOW AMBIENT TEMPERATURE
 - 1. PROVIDE INSULATION WITH VAPOR BARRIER JACKETS
 - 2. FINISH WITH TAPE AND VAPOR BARRIER JACKET
 - 3. CONTINUE INSULATION THROUGH WALLS, SLEEVES, HANGERS, AND OTHER DUCT PENETRATIONS
 - 4. INSULATE ENTIRE SYSTEM INCLUDING FITTINGS, JOINTS, FLANGES, FIRE DAMPERS, FLEXIBLE CONNECTIONS, AND EXPANSION JOINTS
- D. EXTERNAL DUCT INSULATION APPLICATION
 - 1. SECURE INSULATION WITH VAPOR BARRIER WITH WIRES AND SEAL JACKET JOINTS WITH VAPOR BARRIER ADHESIVE OR TAPE TO MATCH JACKET
 - 2. SECURE INSULATION WITHOUT VAPOR BARRIER WITH STAPLES, TAPE, OR WIRES
 - 3. INSTALL WITHOUT SAG ON UNDERSIDE OF TRAPEZOIDAL DUCT. USE ADHESIVE OR MECHANICAL FASTENERS WHERE NECESSARY TO PREVENT SAGGING. LIFT DUCT OFF TRAPEZOIDAL HANGERS AND INSERT SPACERS
 - 4. SEAL VAPOR BARRIER PENETRATIONS BY MECHANICAL FASTENERS WITH VAPOR BARRIER ADHESIVE
 - 5. STOP AND POINT INSULATION AROUND ACCESS DOORS AND DAMPER OPERATORS TO ALLOW OPERATION WITHOUT DISTURBING WRAPPING

SECTION 23 310

HVAC DUCTWORK AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- B. METAL DUCTWORK
- C. DUCT CLEANING

1.02 REFERENCE STANDARDS

- A. ASTM A36/A36M - STANDARD SPECIFICATION FOR CARBON STRUCTURAL STEEL, 2014
- B. ASTM A563/A563M - STANDARD SPECIFICATION FOR STEEL SHEET, ZINC-COATED (GALVANIZED) OR ZINC-IRON ALLOY-COATED (GALVANNEALED) BY THE HOT-DIP PROCESS, 2017
- C. ASTM E84 - STANDARD TEST METHOD FOR SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS, 2018
- D. NFPA 90A - STANDARD FOR THE INSTALLATION OF AIR-CONDITIONING AND VENTILATING SYSTEMS, 2018
- E. SMACNA (DCS) - HVAC DUCT CONSTRUCTION STANDARDS METAL AND FLEXIBLE, 2008, INCLUDING ALL REVISIONS
- F. UL 181 - STANDARD FOR FACTORY-MADE AIR DUCTS AND AIR CONNECTORS CURRENT EDITION, INCLUDING ALL REVISIONS

1.03 QUALITY ASSURANCE

- A. MANUFACTURER QUALIFICATIONS: COMPANY SPECIALIZING IN MANUFACTURING THIS TYPE OF PRODUCTS SPECIFIED IN THIS SECTION, WITH MINIMUM THREE YEARS DOCUMENTED EXPERIENCE AND APPROVED BY MANUFACTURER
- B. INSTALLER QUALIFICATIONS: COMPANY SPECIALIZING IN PERFORMING THIS TYPE OF WORK SPECIFIED IN THIS SECTION, WITH MINIMUM 3 YEARS OF DOCUMENTED EXPERIENCE

1.04 FIELD CONDITIONS

- A. DO NOT INSTALL DUCT SEALANTS WHERE TEMPERATURES ARE LOWER THAN THOSE RECOMMENDED BY SEALANT MANUFACTURER
- B. MAINTAIN TEMPERATURES WITHIN ACCEPTABLE RANGE DURING AND AFTER INSTALLATION OF DUCT SEALANTS

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. LABORATORY REQUIREMENTS: CONSTRUCT DUCTWORK TO NFPA 90A STANDARDS
 - 1. DUCTS: GALVANNEALED, UNLESS OTHERWISE INDICATED
 - 2. LOW PRESSURE SUPPLY SYSTEMS WITH COOLING COILS: 2 INCH W.G. (500 PA) PRESSURE CLASS, GALVANIZED STEEL
 - 3. LOW PRESSURE RELIEF: 1 INCH W.G. (250 PA) PRESSURE CLASS, GALVANIZED STEEL
 - 4. GENERAL EXHAUST: 1/2 INCH W.G. (125 PA) PRESSURE CLASS, GALVANIZED STEEL
 - 5. TRANSFER AIR AND SOUND BOOTS: 1/2 INCH W.G. (125 PA) PRESSURE CLASS, FIBROUS GLASS

2.02 MATERIALS

- A. GALVANIZED STEEL FOR DUCTS: HOT-DIPPED GALVANIZED STEEL SHEET, ASTM A653/A653M FS TYPE B, WITH G60Z/180 COATING
- B. JOINT SEALERS AND SEALANTS: NON-HARDENING, WATER RESISTANT, MILDEW AND MOLD RESISTANT
 - 1. TYPE: HEAVY MASTIC OR LIQUID USED ALONE OR WITH TAPE. SUITABLE FOR JOINT CONFIGURATION AND COMPATIBLE WITH SUBSTRATES. AND RECOMMENDED BY MANUFACTURER FOR PRESSURE CLASS OF DUCTS
 - 2. SURFACE BURNING CHARACTERISTICS: FLAME SPREAD INDEX OF ZERO AND SMOKE DEVELOPED INDEX OF ZERO, WHEN TESTED IN ACCORDANCE WITH ASTM E84
 - 3. FOR USE WITH FLEXIBLE DUCTS: UL LABELED
- C. HANGER ROD: ASTM A36/A36M, STEEL, GALVANIZED, THREADED BOTH ENDS, THREADED ONE END, OR CONTINUOUSLY THREADED

2.03 DUCTWORK FABRICATION

- A. FABRICATE AND SUPPORT IN ACCORDANCE WITH SMACNA (DCS) AND AS INDICATED
- B. PROVIDE DUCT MATERIAL, GAGES, REINFORCING, AND SEALING FOR OPERATING PRESSURES INDICATED
- C. CONSTRUCT TEE BENDS, AND ELBOWS WITH RADIUS OF NOT LESS THAN 1/12 TIMES WIDTH OF DUCT ON CENTERLINE. WHERE NOT POSSIBLE AND WHERE RECTANGULAR ELBOWS MUST BE USED, PROVIDE AIR FLOW TURNING VANES OF PERFORATED METAL WITH GLASS FIBER INSULATION
- D. INCREASE DUCT SIZES GRADUALLY, NOT EXCEEDING 15 DEGREES DIVERGENCE WHEREVER POSSIBLE. MAXIMUM 30 DEGREES DIVERGENCE UPSTREAM OF EQUIPMENT AND 45 DEGREES CONVERGENCE DOWNSTREAM
- E. FABRICATE CONTINUOUSLY WELDED ROUND AND OVAL DUCT FITTINGS IN ACCORDANCE WITH SMACNA (DCS)

2.04 MANUFACTURED DUCTWORK AND FITTINGS

- A. DOUBLE WALL INSULATED ROUND DUCTS: ROUND SPIRAL LOCKSEAM DUCT WITH GALVANIZED STEEL OUTER WALL, PERFORATED GALVANIZED STEEL INNER WALL, FITTING WITH SOLID INNER WALL
 - 1. MANUFACTURE IN ACCORDANCE WITH SMACNA (DCS)
 - 2. INSULATION
 - A. THICKNESS: 1 INCH (25 MM)
 - B. MATERIAL: AIR
 - C. FLEXIBLE DUCTS: UL 181, CLASS 1, ALUMINUM LAMINATE AND POLYESTER FILM WITH LATEX ADHESIVE SUPPORTED BY HELICALLY WOUND SPRING STEEL WIRE
 - 1. PRESSURE RATING: 10 INCHES WG (250 KPA) POSITIVE AND 1.0 INCHES WG (250 PA) NEGATIVE
 - 2. MAXIMUM VELOCITY: 4000 FPM (203 M/S) C
 - 3. TEMPERATURE RANGE: MINUS 20 DEGREES F TO 210 DEGREES F (MINUS 28 DEGREES C TO 99 DEGREES C)
 - 4. MANUFACTURERS:
 - A. HART & COOLEY, INC. - WWW.HARTANDCOOLEY.COM
 - B. THERMATEX, M.K.C.

PART 3 EXECUTION

3.01 INSTALLATION

- A. INSTALL, SUPPORT AND SEAL DUCTS IN ACCORDANCE WITH SMACNA (DCS)
- B. INSTALL IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS
- C. DURING CONSTRUCTION PROVIDE TEMPORARY CLOSURES OF METAL OR TAPED POLYETHYLENE ON OPEN DUCTWORK TO PREVENT CONSTRUCTION DUST FROM ENTERING DUCTWORK BY SYSTEM
- D. FLEXIBLE DUCTS: CONNECT TO METAL DUCTS WITH ADHESIVE PLUS SHEET METAL SCREWS
- E. DUCT SIZES INDICATED ARE INSIDE CLEAR DIMENSIONS. FOR LINED DUCTS, MAINTAIN SIZES AS DEFINING
- F. LOCATED DUCTS WITH SUFFICIENT SPACE AROUND EQUIPMENT TO ALLOW NORMAL OPERATING AND MAINTENANCE ACTIVITIES
- G. USE DOUBLE NUTS AND LOCK WASHERS ON THREADED ROD SUPPORTS
- H. CONNECT DIFFUSERS OR LIGHT TROFFER BOOTS TO LOW PRESSURE DUCTS DIRECTLY OR WITH 5 FEET (1.5 M) MAXIMUM LENGTH OF FLEXIBLE DUCT HELD IN PLACE WITH STRAP OR CLAMP

3.02 CLEANING

- A. CLEAN DUCT SYSTEM AND FORCE AIR AT HIGH VELOCITY THROUGH DUCT TO REMOVE ACCUMULATED DUST. TO OBTAIN SUFFICIENT AIR, CLEAN HALF THE SYSTEM AT A TIME. PROTECT EQUIPMENT THAT COULD BE HARMED BY EXCESSIVE DIRT WITH TEMPORARY FILTERS OR BY PASS DURING CLEANING

SECTION 23 310

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. DIFFUSERS
- B. REGISTER/GRILLES

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. KRUEGER-HVAC, DIVISION OF AIR SYSTEM COMPONENTS - WWW.KRUEGER-HVAC.COM
- B. PRICE INDUSTRIES - WWW.PRICEHVAC.COM/SLR
- C. TITUS A BRAND OF AIR DISTRIBUTION TECHNOLOGIES - WWW.TITUS-HVAC.COM

2.02 RECTANGULAR CEILING DIFFUSERS

- A. TYPE: PROVIDE SQUARE, STAMPED MULTI-CORE SQUARE, ADJUSTABLE PATTERN, STAMPED MULTI-CORE SQUARE AND RECTANGULAR, MULTILOUVERED, AND SQUARE AND RECTANGULAR, ADJUSTABLE PATTERN DIFFUSER TO DISCHARGE AIR IN 90 DEGREE, ONEWAY, TWOWAY, THREEWAY, AND FOURWAY PATTERN WITH SECTORIZING BAFFLES WHERE INDICATED
- B. CONNECTIONS: ROUND
- C. FRAME: PROVIDE 3/8" X 1/4" IN TYPE IN PLASTER CEILINGS, PROVIDE PLASTER FRAME AND CEILING FRAME
- D. FABRICATION: STEEL WITH BAKED ENAMEL FINISH
- E. COLOR: AS INDICATED

2.03 CEILING SUPPLY REGISTER/GRILLES

- A. TYPE: STREAMLINED AND INDIVIDUALLY ADJUSTABLE CURVED BLADES TO DISCHARGE AIR TO THE FACE OF BLADE, TWO-WAY DEFLECTION
- B. FRAME: 1/4 INCH (2 MM) MARGIN WITH COUNTERSUNK SCREW MOUNTING AND GASKET
- C. CONSTRUCTION: MADE OF ALUMINUM EXTRUSIONS WITH FACTORY FINISH
- D. COLOR: AS INDICATED
- E. DAMPER: INTEGRAL, GANG-OPERATED, OPPOSED BLADE TYPE WITH REMOVABLE KEY OPERATOR, REVERSIBLE FINN FACE

ENERGY REQUIREMENTS:

MECHANICAL SYSTEMS, SERVICE SYSTEMS AND EQUIPMENT

THERMAL ZONE		4A
EXTERIOR DESIGN CONDITIONS		
WINTER DRY BULB		18
SUMMER DRY BULB		94
INTERIOR DESIGN CONDITIONS		
WINTER DRY BULB		70
SUMMER DRY BULB		75
RELATIVE HUMIDITY		50
BUILDING LOADS:		
BUILDING HEATING LOAD	EXISTING	
BUILDING COOLING LOAD	EXISTING	
MECHANICAL SPACE CONDITIONING SYSTEM		
UNITARY		
DESCRIPTION OF UNIT	SEE SCHEDULES	
HEATING EFFICIENCY	SEE SCHEDULES	
COOLING EFFICIENCY	SEE SCHEDULES	
HEAT OUTPUT OF UNIT	SEE SCHEDULES	
COOLING OUTPUT OF UNIT	SEE SCHEDULES	
BOILER		
TOTAL STEAM OUTPUT	NA	
CHILLER		
TOTAL CHILLER OUTPUT	NA	
LIST EQUIPMENT TYPES	SEE SCHEDULES	
EQUIPMENT SCHEDULES WITH MOTORS (MECHANICAL SYSTEMS)		
MOTOR HORSEPOWER	SEE SCHEDULES	
NUMBER OF PHASES	SEE SCHEDULES	
MINIMUM EFFICIENCY	SEE SCHEDULES	
MOTOR TYPE	SEE SCHEDULES	
NUMBER OF POLES	SEE SCHEDULES	



HEALTH HUB/Rx CONSULTATION
STORE NUMBER: 4176

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CS PROJECT NUMBER: 146740

ARCHITECT OF RECORD:



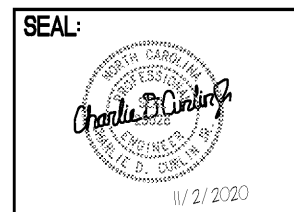
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DEVELOPER:



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CVS PROJECT MANAGER: RJ

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