

#### HVAC DESIGN CRITERIA

INDOOR TEMPERATURE: 75 DEG F COOLING; 73 HEATING  
HUMIDITY CONTROL: THIS PROJECT HAS NO DIRECT CONTROL OF HUMIDITY

OUTDOOR DESIGN CONDITIONS (HOUSTON, TEXAS) PER ASHRAE 90.1-2004 TABLE 5.1.4): 96 DEG. F DB, 80 DEG. WB SUMMER; 28 DEG. DB WINTER. 1371 DEGREE DAYS HEATING; 7357 DEGREE DAYS COOLING; CLIMATE ZONE 2A

#### CODE INFORMATION:

APPLICABLE CODES INCLUDE BUT ARE NOT LIMITED TO:  
CITY OF HOUSTON BLDG CODE: 2003 IBC, AMENDED  
CITY OF HOUSTON MECHANICAL CODE: 2000 UMC, AMENDED  
CITY OF HOUSTON ENERGY CODE: ASHRAE 90.1-2004 (WITH NO ASHRAE AMENDMENTS) PLUS CITY OF HOUSTON AMENDMENTS

#### OUTSIDE AIR REQUIREMENTS PER CITY HOUSTON MECH CODE TABLE 4-1

EXAM ROOM: .08 CFM /SQ FT  
LAB AREA: .25 CFM /SQ FT  
CORRIDOR: .05 CFM /SQ FT  
OFFICES: .08 CFM /SQ FT

#### Ventilation: (per 2000 UMC Houston amend. table 4-1)

Revised Project Area:

Exam Rooms:	0.08 cfm/sq.ft. x 576 sq.ft. =	46 cfm
Lab:	0.25 cfm/sq.ft. x 163 sq.ft. =	41 cfm
Corridors:	0.05 cfm/sq.ft. x 428 sq.ft. =	21 cfm
Offices:	0.08 cfm/sq.ft. x 486 sq.ft. =	39 cfm
	Total =	147 cfm

Existing outside air on floor is sufficient.

#### HVAC DESIGN CRITERIA

#### ENERGY CODE PER 2003 IECC

COOLING DEGREE DAYS: 3058  
HEATING DEGREE DAYS: 1371  
CLIMATE ZONE 6B

#### PER CHAPTERS 8:

- ECONOMIZER (FREE COOLING) CYCLES ARE NOT REQUIRED IN ZONE 6B
- UNIT EERS AND IPLVS SHALL BE PER TABLES 803.2.2(1, 2, 3, 4, and 5)
- SEAL ALL TRANSVERSE AND LONGITUDINAL DUCTS JOINTS
- FOR SIMPLE HVAC SYSTEMS, THERMOSTATS SHALL BE SOLID STATE PROGRAMMABLE AND HAVE A DEAD BAND

#### HVAC SPECIFICATIONS

#### 23 05 00 BASIC MECHANICAL REQUIREMENTS

**Demolition:** Remove ducts/pipe to above ceiling or below floor. Resupport any remaining duct/pipe that was supported by demolition walls. Damage to existing materials/equipment will be repaired at no additional cost. Give demolished equipment to Owner, dispose of if Owner does not want. Refrigerants become the property of the Contractor and shall be removed per EPA regulations and ARI Std 770.

**Warranty:** Guarantee labor and materials for 1 year. Warranties begin upon Owner's acceptance of substantial completion of the installation.

**Shop drawings:** Submit complete information on all equipment, air devices, valves, duct accessories and controls. Submit complete ductwork and piping shop drawings, based on approved equipment and field observation of building conditions. Submit detailed layout of mechanical rooms and yards. Incomplete submittals will be returned to the contractor unreviewed. No time extensions or cost increases will be allowed for delays caused by return of incomplete submittals.

**Operations and maintenance instructions:** Provide 3 copies of operation and maintenance manuals to Owner. Provide within 90 days after the date of system acceptance. These manuals shall be in accordance with industry-accepted standard such as ASHRAE Guideline 1 and shall include, at a minimum, the following: (a) Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance. (b) Operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified. (c) Names and addresses of at least one service agency. (d) HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments. (e) A complete narrative of how each system is intended to operate, including suggested setpoints. Provide instruction on system operation to Owner's representatives.

**Record drawings:** Within 90 days after the date of system acceptance, provide record drawings in AutoCAD 2004 or higher, plus full size hard copy. Electronic backgrounds may be available from Engineer for a fee. Record drawings shall include as a minimum the installed location and performance data on each piece of equipment, air devices, control sensors, control panels, general configuration of duct and pipe distribution system including sizes, and the terminal air or water design flow rates.

**Coordination:** Provide Electrical Contractor with electrical requirements of approved equipment in sufficient time to order panel boards, disconnects, etc.

**Access doors:** Provide Milcor or equal as required for access to all valves, filters, controls, dampers or other devices requiring attention. Doors shall match wall or ceiling rating. Architect must approve location and appearance of all access doors. Access panels for fire or smoke dampers shall be operable without the use of tools.

**Sleeves:** Provide metal sleeves where pipes or control wiring penetrate walls

**Overflow drain pans:** Provide under all furred in units. Pans to be minimum 24 gauge galvanized sheet steel, minimum 1-1/2" deep and not less than 3" larger than unit or coil dimensions. Provide separate 3/4" drain from pan to conspicuous location; provide escutcheon plates at ceiling penetrations. When allowed by local authority, may provide float switch in overflow pan instead of discharge piping; float switch shall shut unit off if water is detected. Pans equipped with float switch shall have screw cap nipple on bottom or side of pan to allow water to be drained from pan.

#### 23 05 29 HANGERS AND SUPPORTS FOR HVAC DUCTWORK, PIPING & EQUIPMENT

Pipe, duct and equipment hangers and supports shall be per the local code. Support piping at a minimum every 10' or less for 1" and larger pipe, every 6' on 3/4" or smaller. With copper pipe use copper hangers or tape at contact point.

Support flex ducts per manufacturer's installation instructions (provide instructions for inspector review). Alternate acceptable flex duct support (in City of Houston) is 26 gage, 1.5 inch wide galvanized iron straps on 4 ft maximum spacing.

#### 23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

Balance shall be by an employee of the balance contractor that is qualified to perform the task.

Balance according with NEBB Procedural Standards -1999 Procedural Standards for Building Systems, or AABC 2002 Associated Air Balance Council Test and Balance Procedures.

Adjust system to achieve air quantities shown, then adjust volumes to provide constant temperature ( $\pm 2$  deg F) throughout the zone. Adjust fan sheaves. Calibrate all thermostats. Mark setpoints on all dampers and valves. Return to project at 1 and 3 month intervals after completion to make balance adjustments in response to Owner's perceived comfort.

Submit report (NEBB or AABC format). Include:

General data: Nameplate data on all equipment. Outside air temp; cfm each supply, exhaust and return grille and actual room temperatures and humidities vs. setpoints  
Fans: Volume and static pressure; fan rpm and amps

Ductwork designed to operate at static pressures in excess of 3 in. w.c. shall be leak tested according to SMACNA Duct Leakage Test Procedures- 1985 <<803.3.6 of the IECC>>  
Representative sections totaling no less than 25% of the total installed duct area for the designated pressure class shall be tested. The maximum permitted duct leakage shall be no more than 1% of the total airflow in the section tested.

Air systems shall be balanced in a manner to first minimize throttling losses. Then, for fans with fan system power greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. Submit test documentation. (All existing controls shall be utilized as is and only used for controlling the units during re-balancing.)

No adjustment to existing air handlers and fans serving the area are allowed without Owner's express knowledge and consent.

#### 23 07 03 DUCTWORK INSULATION

Flame spread less than 25, smoke developed less than 50 as per ASTM E84, NFPA 255, UL273. Minimum required installed R values for non-residential projects (excluding film resistance) are:

- On roof or elsewhere on bldg exterior: Supply R8; Return R8; Exhaust or relief-none req'd; Conditioned outside air R8
- Within the conditioned space: Supply R5.6; Return -none req'd; Exhaust or relief: none req'd; Conditioned outside air R5.6
- In return air plenums (but inside bldg insulation envelope): Supply R5.6; Return -none req'd; Exhaust or relief: none req'd; Conditioned outside air R5.6
- In shafts, plenums or furrows not used for return air (but inside bldg insulation envelope): Supply R5.6; Return -R5.6; Exhaust or relief: R5.6; Conditioned outside air R5.6

External duct wrap: foil face rigid or flexible fiberglass with vapor retarder. R value stenciled on outside. ASTM A96 Water Vapor Permeance: 0.5 perms maximum. Mold Growth per ASTM C1338- No Growth. GREENGUARD Environmental Institute Certified. Vapor Retarder Jacket conforming to ASTM C 1136 Type II. Foil Scrim Kraft (FSK), or White polypropylene - scrim -kraft (PSK). 2" Staple flange on longitudinal seam. Adhere to duct with vapor barrier type adhesive. Overlap all joints. Cover all joints or breaks with glass fab imbedded in vapor barrier mastic.

#### 23 09 23 DIRECT DIGITAL CONTROLS FOR HVAC

There are no system controls located within the project area. existing units serving the project area are single zone units with one controlling thermostat for each unit. The existing thermostat will stay in it's present location and continue to control the unit as originally designed.

#### 23 31 00 HVAC DUCTS

Do not fabricate duct from these drawings, confirm all dimensions and available space in field. Dimensions given on drawings are inside free area, sheet metal is larger on lined duct. Branch takeoffs to have 45 degree entry fitting with volume damper. Elbows to be radius type with minimum centerline radius 1.5 times width or mitered elbows with single thickness turning vanes.

**Sheet metal:** Use galvanized sheetmetal, conforming to current SMACNA for construction, reinforcing, support and other aspects.

**PRESSURE CLASS:**

- Supply from single zone units: +1'
- Supply upstream of VAV boxes: + 2'
- Supply downstream of VAV boxes: +1'
- Exhaust: -1' upstream of fan, 1' downstream

**DUCT SEALING:**

Definitions (per ASHRAE 2008 TABLE 18-1) :

- Seal Level A: All transverse joints and longitudinal seams, and all duct wall penetrations
- Seal Level B: All transverse joints and longitudinal seams
- Round or flat oval spiral seams need not be sealed
- Transverse joints include connections (including but not limited to spin-ins, taps, branches, access door frames, duct connections to equipment)
- Duct wall penetrations include but are not limited to screws, pipe, tubes, rods, wires & non self-sealing fasteners

Supply and outside air ducts, all locations: Seal Level A.

Return or exhaust ducts, outdoors: Seal Level A; all other locations: Seal Level B

Seal all metal ducts using Hardcast or equal mastic plus fiberglass scrim. Do not use oil or solvent base sealants inside bldgs. Tape sealants are not allowed

Externally insulated ducts shall be sealed before being insulated. Sealants of exterior ducts shall form a water and air-tight seal, bond to the metal involved, remain flexible with metal movement and have a service temperature range of -30 to 175 F. If exposed to direct sunlight, sealant shall be UV and ozone resistant.

**DUCT LINER / INSULATION SCHEDULE:**

Rectangular supply: Unlined, externally insulated, except that 25 ft closest to fan or air units shall be internally lined

Round supply: Unlined, externally insulated

Exhaust- No liner, no insulation; except that exhaust ducts in non-conditioned attics shall be externally insulated

Outside air- Unlined, externally insulated, except that 15 ft closest to a fan shall be internally lined

Liner (when specified in duct description above): Schuller Permacote Linacoustic; Certaineed Tough Gard or equal, 1.5 pcf density, coated fiberglass conforming to ASTM C1071; coating to be cleanable and shall prevent microbial growth per ASTM G21, G22. Attached with adhesive (90% coverage) and stick clips. Meet minimum noise reduction std of ASTM C1071. Leading edges and transverse joints to be sealed.

Liner R values shall meet duct insulation values spec'd in section 15290. In addition to meeting R values, the following minimum thicknesses shall be maintained for acoustic reasons: Supply duct: 1". Return ducts: 1/2" except that within 15 feet of fan or air unit use 1". Return air sound traps: 1"

**Flex duct**

Shall not exceed 8 ft in length nor to be bent more than 90 deg. Flex duct to be externally insulated, UL listed, class 1. Flex duct is same size as diffuser neck.

#### 23 33 00 DUCTWORK ACCESSORIES

Provide manual balancing dampers in all supply and exhaust branches. Provide manual balancing dampers in outside air and return ducts to each air unit. Provide manual balancing damper at each location motorized duct damper location.

**VOLUME CONTROL DAMPERS:** per SMACNA HVAC Duct Construction Standards - Metal and Flexible. Single blade dampers for duct sizes up to 6 x 30 inch. Multi-Blade Dampers: opposed blade pattern. Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware. Except in round ductwork 12 inches and smaller, furnish and bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.

Outdoor air, supply and exhaust air dampers shall have a maximum leakage rate of 0.3 cfm per square foot.

**Splitter Dampers:** Material: Same gage as duct to 24 inches size in both dimensions, and two gages heavier for sizes over 24 inches. Blade: sheet metal streamline shape, secured with continuous hinge or rod. Operator: Min. 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw.

Furnish locking, indicating quadrant regulators on single and multi-blade dampers. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters to allow full insulation thickness. Where rod lengths exceed 30 inches furnish regulator at both ends.

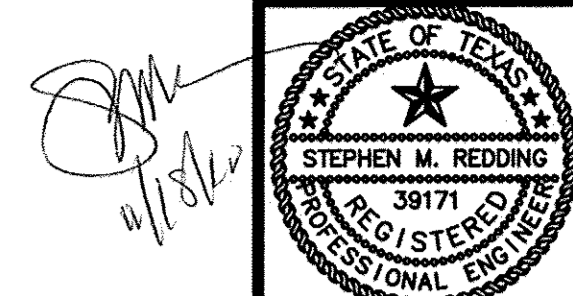
All balance damper operators shall be accessible via access panel, lay-in ceiling or remote cable operator. All motorized damper operators shall be accessible and shall not block the air stream.

**BACKDRAFT DAMPERS:** Parallel-action, gravity-balanced, galv. 16 gage thick steel or extruded aluminum blades with felt or flexible vinyl sealed edges. Blades linked together in rattle-free manner with 90-degree stop, steel ball bearings, and plated steel pivot pin. Adjustment device to permit setting for varying differential static pressure.

**DUCT ACCESS DOORS:** per SMACNA, rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish same insulating value as adjacent duct, plus sheet metal cover. Less than 12 inches sq. secure with sash locks. Up to 18 inches sq: two hinges and two sash locks. Up to 24 x 48 inches: Three hinges and two compression latches. Access panels with sheet metal screw fasteners or requiring use of tools are not acceptable. Stencil or label fire and smoke damper access doors per local requirements

**FLEXIBLE DUCT CONNECTIONS:** per SMACNA. Fabric crimped into 24 gage galvanized metal edgeing strip. Fabric: Approx. 3 inches wide. UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A.

**DUCT TEST HOLES:** air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.



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M-4

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