

23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

Balance may be by a qualified employee of the mechanical contractor. Technician shall be AABC certified

Balance according with NEBB Procedural Standards –1999 Procedural Standards for Building Systems

Adjust system to achieve air quantities shown, then adjust volumes to provide constant temperature (±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 format). Include:

General data: Nameplate data on all equipment. Outside air temp; cfm each supply, exhaust and return grille and actual room temperatures vs. setpoints

Fans: Volume and static pressure; fan rpm and amps

Dx air handlers, fan coils or furnaces: supply and return air temp, volume and static pressure; fan rpm and amps. Outside air cfm.

Dx condensing units: Condensing air temp, units amps

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.

23 07 01 PIPING INSULATION

Pipe insulations, mastics and jackets located in environmental air plenums shall have maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84.

Primary condensate drains inside buildings- 3/4" Armaflex for entire length. No insulation required outdoors. Insulation of secondary (overflow) condensate drains not required.

Refrigerant suction piping: 1" Armaflex. Paint outdoor portions with manufacturer's recommended water retardant ultraviolet solar radiation protective coating.

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:

- 1. In non-conditioned attics, garages or crawl spaces (i.e. outside the bldg envelope insulation): Supply R8; Return –R5.6; Exhaust or relief: R6; Conditioned outside air R8.

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.

Insulate backs of supply diffusers when in attics or when ceiling plenum is not used for return air.

23 09 23 ELECTRIC CONTROLS FOR HVAC

Electric, programmable thermostats and controllers, automatic changeover, battery backup.

When indicated, provide Carrier T-55 Space Temperature Sensor (or approved equal) and Carrier EDGE 33CS2PP2S-02 Programmable thermostat zone controller (or approved equal). See sequence of operation.

23 09 93 SEQUENCES OF OPERATION

1. ALL SYSTEMS

a. **Dead Bands:** Where used to control both heating and cooling, automatic changeover zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum. Exceptions: Special applications where wide temperature ranges are not acceptable (retirement homes, data processing, museums, some areas of hospitals) and are approved by the authority having jurisdiction.

b. **Automatic Shutdown.** Each HVAC system shall have controls that can start and stop the system under different time schedules for seven different daytypes per week, are capable of retaining programming and time setting during loss of power for a period of at least 10 hours, and include an accessible manual override, or equivalent function, that allows temporary operation of the system for up to two hours.

c. **Setback Controls.** Heating systems have the capability to automatically restart and temporarily operate the system to maintain zone temperatures above a heating setpoint adjustable down to 55°F or lower. Cooling systems shall have the capability to automatically restart and temporarily operate the system as required to maintain zone temperatures below a cooling setpoint adjustable up to 85°F or higher or to prevent high space humidity levels.

d. **Gravity Hoods, Vents, and Ventilators.** All outdoor air supply and exhaust hoods, vents, and ventilators shall have motorized dampers that automatically shut when the spaces served are not in use.

e. **Shutoff Damper Controls.** Both outdoor air supply and exhaust systems shall be equipped with motorized dampers that automatically shut when the systems or spaces served are not in use. Ventilation outdoor air dampers shall automatically shutting off during preoccupancy building warm-up, cool down, and setback. Exceptions:

- i. Gravity (non-motorized) dampers are acceptable in exhaust systems in ASHRAE 90.1 2004 climate zones 1, 2, 3, such as City of Houston.
- ii. Gravity (nonmotorized) dampers are acceptable in systems with a design outdoor air intake or exhaust capacity of 300 cfm or less.

2. SINGLE ZONE CONSTANT VOLUME SPLIT SYSTEM:

a. Thermostat or space sensor shall measure temperature in space (as indicated on plans). If space sensor is shown, space sensor shall relay temperature to zone controller located in staff area.

b. Thermostat or zone controller controls system off/on cycles; multiple cycles per day. When system is on, fan runs continuously.

c. Thermostat or zone controller cycles compressor(s), then stages heater to maintain zone thermostat set point.

23 23 00 REFRIGERANT PIPING AND SPECIALTIES

Size per A/C unit manufacturer's recommendation, including requirement for long line applications. Provide solenoid valves, traps and/or accumulator when recommended by condensing unit vendor, such as for underground lines. Use factory sealed line sets, unless size or distance exceeds factory set availability. Route hidden from view. Insulate suction line. Seal wall penetrations.

Copper Tubing: ASTM B280, Type ACR hard drawn or annealed. Fittings: ASME B16.22 wrought copper. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F. Unions, flanges, and couplings: copper pipe: bronze, soldered joints.

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"

Return: -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).

Sealant: Fosters 95-90 or 32-19. Do not use oil or solvent base sealants inside bldgs. Do not exceed LEED/SCAQMD volatile organic compound limits 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.

Flex duct

Shall not exceed 8 ft in length nor to be bent more than 90 deg. Flex duct is same size as diffuser neck. Flexmaster 5B, 5M, 6B, 6M, 8B, 8M or eq. Nylon, CPE or foil/fiberglass/polyester laminate, supported by helically wound spring steel wire; fiberglass insulation; vapor barrier film. UL 181 class I; 25/50 Flame/Smoke rating. Pressure Rating: 6 inches WG positive; 1.0 inches WG negative. Vapor barrier Perm rating of .10 or less per ASTM E96 procedure A. Insulation : R value to meet that required for ductwork. Inner core shall maintain shape and full free area at 90 degree bends without glues or reinforcement.

Grease exhaust duct from cooking hoods

Liquid tight, welded 16-gage steel or 18 gage stainless. Duct sloped toward hood minimum 1/4 inch per linear foot (1" per foot if horizontal length exceeds 75 ft). Minimum 1500 fpm velocity; maximum 2500 fpm. Confirm location and size of hood connections- See Food Service equipment plans.

Access cleanouts doors in changes of direction. UL listed or matching duct construction. In duct side or top (not bottom) and at all changes of direction. Within 18 inches of hood collar when hood has dampers. On both sides of inline fans. On horizontal ducts: 20 x20 for personnel entry; when 20x20 is not possible, provide access panels every 12 feet. Signage on panels: "ACCESS PANEL- DO NOT OBSTRUCT"

Field fabricated ducts: Liquid tight, welded 16-gage steel or 18 gage stainless. Enclose portion of duct from ceiling penetration to or thru roof with 2 hour, UL 1978 classified wrap system *3M FireBarrier Duct Wrap 15A or equal*. Installation, supports, access panel insulation per manufacturer's instructions. Grease duct enclosure systems shall be tested to UL 2221. Enclosures shall be vented to bldg exterior.

DOMESTIC DRIER VENTS

Use 4" minimum diameter rigid metal duct with smooth interior surface. Do not use sheet metal screws or other fasteners which obstruct the air flow. Flexible all metal duct allowed only where field conditions prohibit rigid; use of flex must be specifically approved by Owner for each circumstance. Transitions between drier and wall connection shall be aluminum flex or GE WX8X73 Supurr-FLEX. Wall caps shall be 4" opening and be equal to GE WX8X59 and shall have a backdraft damper. Outlets shall point down and shall be a minimum 12" above the ground or any other obstructions.

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 Damper: 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 end 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.

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.

FLEXIBLE DUCT CONNECTIONS: per SMACNA. Fabric crimped into 24 gage galvanized metal edging 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.

23 37 00 AIR INLETS AND OUTLETS

For air devices located in lay-in ceilings, vendor shall confirm ceiling grid type and size prior to ordering air devices.

SIDEWALL AIR DEVICES

Sidewall supply- double deflection, 3/4" spacing, front blades vertical, opposed blade damper.

Wall return grille: steel or aluminum, white, 35 deg horizontal louvers on 3/4" spacing. Opposed blade damper. T

23 40 00 HVAC AIR CLEANING DEVICES

Filters to be 2", 30 percent efficiency as per ASHRAE 52.2 -1999, Maximum initial resistance at 500 fpm = .25. "AAF Perfect Pleat HC M8" or equal". Use standard sizes only.

23 54 00 GAS FURNACES WITH DX COILS

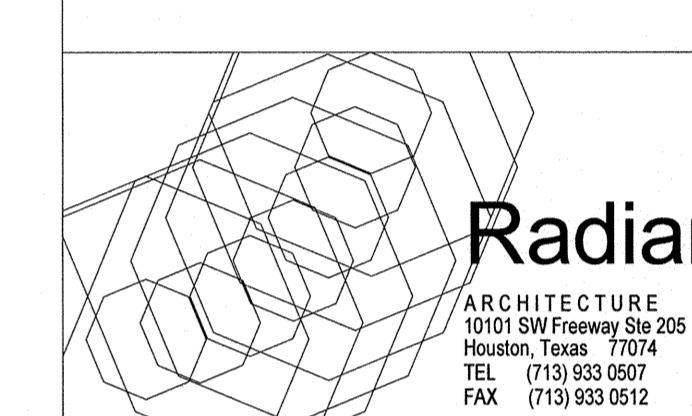
Horizontal or vertical as shown on drawings. AGA certified. Automatic electronic pilot. Route condensate drain (provide 3" deep trap) to floor or hub drain provided by plumber. Install with manufacturer's required clearances to combustibles. Provide overflow pan for attic units, with discharge to drip through soffit. Provide type B flue through roof to Breidert cap. Gas piping is by Plumber.

23 81 26 SPLIT-SYSTEM AIR-CONDITIONERS

DX FAN COIL UNITS: Factory painted galvanized steel, insulated casing; sloped drain pan; filter rack; multispeed blower, control transformer, supply and return duct flanges, copper coil/alum fin. Manufacturer's standard exp. valve or metering device. Coil factory matched to condensing unit.

AIR COOLED CONDENSING UNITS: UL or CSA listed and ARI certified. Copper tube, aluminium fin coils. 5 year compressor warranty for commercial use and have external service valves, crankcase heater, high and low press switches, compressor start capacitor/relay, sound attenuation blanket for compressor, filter drier, reversing valve, antishort cycle timer. Mount outdoor units on poured concrete base. Refrigerant lines shall be factory sealed line kits, sized as per heat pump manufacturer, suction line fully insulated

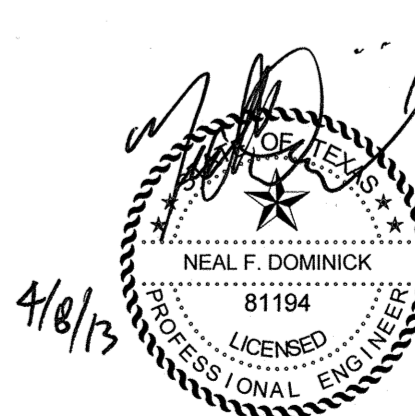
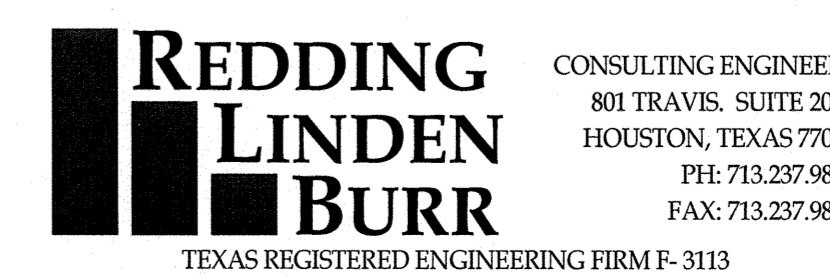
OPTIMUM CARE
SUGAR LAND, TEXAS



Revision Schedule

#	Date	Description
1	4-08-13	PERMIT, PRICING, AND CONSTRUCTION

Project No.
MECHANICAL SPECS
Sheet No.



M3.2

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