PART 1: GENERAL

1.01 Scope of Standard

A. This standard provides general guidance concerning the specific preferences of Texas State University for Heating, Ventilating, and Air Conditioning (HVAC).

B. Texas State University recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for Texas State University projects.

1.02 Design Guidelines:

A. The guidelines are intended to be typical in nature. Applications for specific projects shall be reviewed with Texas State University prior to proceeding with design. These guidelines are not intended to be guide specifications; rather, they are intended to be design standards for the purpose of aiding in appropriate design for building projects located at San Marcos Campus of Texas State University-San Marcos.

B. It is Texas State University preference for the HVAC Building System to be a 4 pipe (Chilled Water and Steam) with Air Systems that is Dual Duct VAV with DDC.

C. Mechanical Engineers are to prepare a life cycle cost analysis indicating the benefits of the deviation from the preferred construction standard of a dual duct system vs. single system for the project. This analysis is to include constructability advantages/disadvantages, floor to floor height changes/envelope cost and increased chase size, mechanical room size, etc. in regards to programmable space. This analysis should be performed no later than 30 days from the A/E being issued a Notice To Proceed.

D. Every effort shall be made during design to insure that the systems meet the following criteria:

1. The systems shall be safe;

2. The systems shall be flexible;

3. The systems shall be maintainable;

4. The systems shall be affordable;

5. The systems shall be energy efficient.

6. The systems shall be durable.

7. The systems shall be reliable.

E. Mechanical Rooms**.**

1. Size mechanical rooms to provide adequate housing for equipment and to provide ample clearance around piping and equipment for proper maintenance and repair.

2. All mechanical rooms over occupied space shall have a 100% waterproof membrane floor including all surfaces of equipment pads. Such membrane shall turn up walls 4 inches. A flood test is required. Provide water dam at doors or depressed mechanical room floor.

3. Do not plan mechanical rooms as return air plenums.

4. Provide locks for mechanical rooms to be keyed to campus mechanical master.

5. Make mechanical rooms accessible without necessity of passing through another assigned space.

6. Provide lifting eyes in mechanical room where the lifting or moving of heavy equipment might be anticipated.

7. Provide adequate fluorescent lighting for machine maintenance in mechanical rooms.

8. Position light fixtures to avoid blocking of light by piping or equipment. Use 4’-0” fluorescent fixtures with wire guards for lamp protection.

9. Do not light mechanical rooms with incandescent fixtures.

10. Provide hose bibb connection from domestic water system in each mechanical room for use in cleaning of coils and equipment.

11. Allow tube coil and shaft removal space for AHU’s boilers and refrigeration machines.

12. Designate removal space on contract document.

13. Provide accessibility to all sides of machine.

14. Provide permanent identification signs for equipment.

15. Provide at least one 110 Volt Duplex Receptacle per Mechanical Room for Maintenance Operations.

F. Air Terminal Units.

1. Air terminal shall have a maximum air flow of two thousand/cfm.

2. Units are to be equipped to function as either VAV or constant volume.

3. Box shall be designed to accomplish mixing of hot and cold deck before exit from box.

4. Discharge side of box shall have uniform air flow.

5. Air supply to the air terminal units shall be straight for three diameters preceding hard duct box.

6. Four feet maximum of flex duct to be allowed between medium pressure box and medium pressure duct.

7. Air terminal units are to be factory tested and independently certified for full range of operations.

8. Certification to be affixed to box.

9. Controls are to be fully accessible without removing ductwork.

10. Provide access doors as necessary.

G. Ventilation.

1. Ventilate storage spaces and serve with conditioned air by exhausting building air through storage spaces or by supplying conditioned air to storage spaces.

2. Provide storage spaces and restrooms with negative ventilation system.

3. Place controls for exhaust of equipment under control of building EMS.

4. Electrically interlock fume hoods in science laboratories with make-up air supply.

5. Separate ventilation for adjacent toilet rooms to prevent sound transmission.

6. Provide transformer vaults with separate ventilating fans connected to an emergency electrical power system.

7. Vent transformer vaults directly to outside in conformance to requirements of "National Electric Code".

H. Filters.

1. Equip air units with disposable media filters **or pleated filters in standard sized rectangular frames.

2. Provide filter frames with integrated retainers **for filter media that are zinc electroplated after fabrication.

3. Use standard filter sizes: 24" x 24" x 2", 24" x 12" x 2", 20"x 20"x 2", 20" x 25"x 2", and 16" x 25"x 2".

4. Other sizes may be used with Texas State University-San Marcos approval.

5. **Each separate closed water loop will be provided with a combination pot feeder/cartridge filter canister united filter model UFA-6-1-CS-150-2 or approved equal.

I. Controls.

1. Use Direct Digital Controls that are interfaced with the Campus Wide Control System.

2. Provide operator terminal at the building that is capable of reading and changing all data including setpoints.

3. Variable frequency drives will be used on all AHU's, Pumps and Cooling Towers.

4. Provide gauges and Digital Thermometers at each AHU Discharge Air (Hot & Cold deck), at supply & return to each coil, and chiller and on the supply & return chilled water lines entering the building.

J. Valves.

1. Use Full Port Ball Valves on all piping 2 inches and smaller.

2. Use Lug Mounted Butterfly Valves or Rising Stem Gate Valves on 2 ½ inches and larger.

3. Install shut-off valves to be able to isolate each building, piece of equipment, floor of building and all other locations that seem reasonable to keep from having to shut down complete system for maintenance or repairs.

4. Locate valves in an easily accessible location or make provisions for easy access.

K. Air Handling Units.

1. All units will be floor level and housed in a suitable sized mechanical room for ease of service.

2. Units will be double wall with stainless steel drain pans.

3. Hinged access doors will be provided to allow access to blowers, motors, filters and coils without remounting panels.

4. Access door will be fully gasketed and large enough to allow entry for cleaning, maintenance and repair.

5. Fan coil units will not be used unless approved by University and then will not be allowed above ceilings where leakage can cause damage or accessibility problems.

L. Pumps.

1. Use end suction or horizontal split case centrifugal pumps only.

2. All pumps will have mechanical seals and replaceable bronze sleeves.

3. Aurora or Pacific pumps are preferred.

4. All pumps will have galvanized drip pans that are piped to the closest floor drain.

M. Regulators.

1. **Provide separate make-up regulators and water meters to all closed loops. Where make-up is required.

N. Drains.

1. Use floor drains in mechanical rooms which are accessible; do not locate floor drains beneath equipment.

2. Use floor drains in area for mechanical maintenance where spillage may be expected.

3. Insulate those floor drain lines, from drain to connection with main line, which have A/C condensate discharging into them.

4. Pipe insulated condensate drain lines to floor or hub drain in immediate area.

5. Do not extend drain piping across and aisle area.

6. Do not use a plumbing fixture as drain.

7. Grade pipe lines for drains with the low point in the direction of flow.

O. Ductwork and Registers.

1. All ductwork will be externally insulated metal duct.

2. No internally lined duct will be allowed.

3. No more than 7 feet of R-6 flex duct will be allowed to register drops.

4. Use 2x2 high volume louvered registers with removable cores.

P. Coils.

1. Use water coils of continuous copper tube with **aluminum fins.

2. Size cooling coils for maximum face velocity of 450 ft./min.

3. Size heating coils for maximum face velocity of 650 ft./min.

4. Where steam coils are used to temper outside air, use “non-freeze” type, so equipped and controlled that all condensate will be eliminated as soon as condensed.

Q. Outside Air Intake.

1. Design air conditioning system to maintain slight positive pressure within building and provide instrumentation to monitor and control.

2. Provide automatic outside air dampers and manual outside air dampers on all air handler units.

3. Employ a coordinated system of exhaust fan and fresh air intake.

4. Carefully plan locations of air intake ducts well away from emergency generators or loading docks or parking areas.

5. Avoid intakes in below grade pit situations.

6. Avoid horizontal grilles in direct weather.

7. Protect or cover intakes from gathering rain.

R. Duct and Pipe Supports.

1. Make certain that duct systems are properly supported throughout their lengths.

2. Provide floor openings for ducts passing through floors with 4" high concrete curbs.

3. Seal all vertical ducts, chases, conduit, and pipes at each floor of the building.

4. Provide sleeves for piping which passes through walls.

5. Use metal saddles to protect pipe supported by rollers.

6. Avoid damage to long runs of piping by using anti-friction pipe supports.

7. For future extensions of piping, provide valved and capped tees at strategic locations.

8. Require that all duct, piping and conduit be independently supported.

9. **Isolate all copper refrigeration tubing with rubber inserts to prevent rubbing at all supports.

S. Catch Pans.

1. Provide catch (or drip) pans to catch coolants, lubricants, condensate, process chemicals, and other fluids.

2. Make catch pans accessible for emptying and clearing.

3. Use corrosion-resistant catch pans.

4. Provide drip pans where leakage is likely to be a problem.

T. Condenser Water Treatment Controllers.

1. Use ALLO 3D Trasar or approved equal controller.

U. Piping Identification.

1. Identify all above-ground piping by means of color and labels.

V. Motors and Bearings: Refer to Section 23 05 13.

W. Texas State University-San Marcos preference for mounting of temperature control valves is for serviceability from floor without the use of ladder—maximum height 5'0" AFF. Where control valves are above serviceability height, locate over equipment in an accessible location such that top of equipment can be used for service platform. Other types of service valves shall be similarly located. Where service valves are mounted 8 feet above the floor (or other walkway) and not over service platform, provide with Rotohammer chain wheels and safety-trimmed chains.

1.03 Codes:

A. Whenever practical, systems shall conform to Uniform Mechanical and Plumbing Codes, NFPA standards of National Fire Code, NFPA 45 requirements for ventilation in buildings with laboratory operations:

B. Designs shall be in accordance with ASHRAE standards.

C. Mechanical Engineer's design shall meet or exceed minimum standard requirements of State Energy Conservation Office (SECO) requirements. SECO adopted by reference the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE 90.1 – 2010). Refer to SECO for the latest updates to the SECO requirements.

1. Before beginning construction of a new state building or major renovation project, a institution of higher education must submit to SECO a copy of the certification by the design architect or engineer that verifies that the construction or renovation complies with the standards that are established under 34 TAC, Chapter 19.34, including engineering documentation.

1.04 Mechanical Systems Selection:

A. Airside – HVAC

1. It is Texas State University preference that the AHU systems shall be double duct systems with separate hot deck and cold deck fans where feasible with draw through coils.

2. Design HVAC systems with as few air handlers as feasible, preferably one air handling unit (AHU) system per floor.

3. Chilled water coils are to be two coils if greater than 4 rows, and with interstitial space between the coils for maintenance. Face velocity shall be 450 f.p.m. on cooling coils and 650 f.p.m. on steam coils.

4. Ventilation system to provide for 100% outside air for winter operation vent cycle.

5. Do not use reheat for temperature control.

6. Locate building air intakes as high as possible to ensure the cleanest possible air. Devote special attention to noxious fume exhaust systems to make certain that the exhaust contents escape boundary layer entrainment and subsequent contamination of the building or its neighbors. No less than U.M.C. requirements where practical, locate intakes directly adjacent to (near base of) exhaust stack where stacks penetrate above re-entrainment boundaries of building.

7. Use variable frequency drives (VFDs) for static pressure control; of air ducts. Variable inlet vanes are not acceptable.

8. Construct supply duct risers to withstand 4” w.c. of air pressure, construct horizontal ductwork to withstand 2” w.c. of air pressure, operate the system at 0.3” to 0.5” static pressure.

9. Laboratories or areas with high airflow rates require special design consideration for pollutant containment or control and for energy recovery or reduction.

10. Supply air ductwork shall be externally insulated and return air in unconditioned space in special applications where noise or other criteria is an overruling factor.

B. Waterside

1. Chilled Water

a. Use full reverse-return routing on all chilled water coil piping.

b. Control chilled water flow through units with 2-way valves.

c. Chilled water design supply water temperature should be 45F, with a minimum return water temperature of 58F to maximize the usable lifetime (optimize pipe size of existing piping) of water systems. This shall be accomplished without the use of blending stations.

d. Modulate chilled water pumps with variable frequency drives.

e. Chilled water pumps shall typically be end suction or horizontal split case type with mechanical seals and bronze fitted and connected to campus chilled water loop whenever practical.

f. Cleaning of Piping Systems.

(1) Clean piping systems thoroughly. Purge pipe of construction debris and contamination before placing the system in service. Use whatever temporary connections are required for cleaning, purging and circulating. All cleaning shall be performed in the presence of the Texas State University-San Marcos Representative.

(2) Install temporary strainers in front of pumps, tanks, water still, solenoid valves, control valves, and other equipment where permanent strainers are not indicated. Keep these strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blowoff valve.

(3) Circulate filtered steam and condensate piping systems to remove all scale, grease, oil and silt. For called water, circulate NAICEAN 8900. Circulate for 48 hours, flush system and replace with clean water. The chilled water system should then be treated with NALCO CW4751. Do not open to campus piping loop until Texas State University-San Marcos provides approval and after Contractor and Vendor certify piping systems are cleaned of any contaminants and comply with requirements of Texas State University-San Marcos Contract must provide an allowance amount for disposal if effluent is not accepted by City Waste Water System.

(4) Special Requirements, if any, are specified in the Section on each type of piping.

2. Heating shall be provided via steam coils wherever steam is available to building; otherwise, use hot water heating coil (central station) with closed loop water treatment typical for current University maintenance requirements.

C. Plumbing

1. Floor drain traps installed in inaccessible areas shall be brought to the attention of the Owner for consideration of priming at that time.

1.05 Other General Building Criteria:

A. General

1. Layout building structure and space utilization to preserve dedicated straight avenues for large duct runs at locations separate from electric runs and plumbing runs. On buildings, which may in the future be used for scientific research, provide organized space for future ductwork in the ceilings and chases.

2. Structural components shall in general be of uniform depth throughout a floor, allowing maximum space for routing of ducts, pipes, etc. above ceiling.

3. Frame in the building chase with a ring beam above, not below, the floor to minimize bottlenecking the air ducts and to minimize floor-to-floor spacing. Include open steel grating at each floor inside chases.

4. Paint bright stripe on the treads of machine-room steps, to benefit workers with limited sight. Add visually-contrasting nosings to steps, particularly steps made of exposed aggregate.

5. Protect stair treads during remodel projects, and repair or replace any damaged.

6. Coat floors of mechanical rooms. Coating selected shall remain pliant to span structural settling cracks and shall produce a seamless membrane resistant to puncture or damage. Floor coating shall extend up perimeter walls and floor penetrations a minimum of 12 inches. Exterior of tunnel walls and floors shall be sealed and drained in accordance with standard subsurface exterior structural building walls. Coating system shall consist of 2 coats with a non-slip abrasive applied between first and second coat.

1.06 Mechanical System Warranties

A. All mechanical systems, components and controls shall be provided with a minimum 2-year warranty. Specific mechanical components may have longer warranty periods. Warranty shall be unconditional and include material, labor and response within 24 hours of notification.

1.07 Equipment Serviceability and Access

A. Access

1. Design shall provide for service and maintenance access to all equipment. Service area shall comply with codes and shall be reasonably planned for human access. Project shall provide elevator access to all levels including basement and attic mechanical spaces. Elevators shall be sized and designed for equipment removal as noted in paragraph B.

B. Removal

1. Design shall include plan for removal of all equipment. Plan shall indicate sizes of major pieces of equipment and clearly marked paths of removal and egress for this equipment from point of installed equipment-to-equipment loading area exterior to building. Entire egress path shall be coordinated for removal of equipment. Preference is to remove all equipment through elevators to ground level. Egress paths of equipment through removable louvers or roof cupolas is acceptable provided louver or cupolas locations are crane accessible.

PART 2: PRODUCTS (NOT USED)

PART 3: EXECUTION (NOT USED)

END OF SECTION 23 00 00