

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING

23 00 00 HEATING, VENTILATING AND AIR CONDITIONING

23 05 00 COMMON WORK RESULTS FOR HVAC

23 05 01 GENERAL REQUIREMENTS

1. Design building projects to comply with both the mandatory and prescriptive provisions of ASHRAE 90.1-2004 as listed in LEED-NC 2.2 Reference Guide. Proposed building performance rating compared to baseline building performance rating per ASHRAE Standard 90.1-2004 (without amendments) by building simulation method is to be 14% higher on new buildings and 7% higher on existing buildings.
2. Design systems that require zero use of CFC-based refrigerants for new systems; complete a comprehensive CFC phase-out conversion when reusing existing systems.
3. Design HVAC and Refrigeration systems with refrigerants with no or very little ODP (Ozone-Depleting Potential) and GWP (Global Warming Potential). Projects shall comply with the formula listed in EA Credit 4 in the LEED-NC 2.2 Reference Guide.
4. Require the development and implementation of an Indoor Air quality (IAQ) Management Plan with flush-out procedures as listed in this credit for the preoccupancy phase.
5. Establish temperature and humidity comfort ranges and design the building envelope and HVAC system to maintain these comfort ranges, in accordance with ASHRAE 55-2004. Set points shall be:
 - A. Occupied: 68° to 76°
 - B. Unoccupied: 60° to 80°
6. Access doors and panels: See Section 08 31 00 of these Standards.
7. GVSU Facilities Engineering will participate in selection of systems.
8. On large new projects investigate potential for limited capacity stand-alone cooling (possible direct-fired natural gas chiller).
9. Air handlers to have variable frequency drive and shall be Dan Foss-Graham or Yakasawa., Drives shall include a control card that will communicate, seamlessly, to the University's HVAC controls. The drives shall have a harmonic distortion that is less than three (3%) percent. Each air handler to have fresh air measurement.
10. Filter outside air **prior** to any air reading stations.
11. Investigate heat recovery systems when building type requires large amounts of exhausted air.
12. Piping shall be properly grounded.
13. AHU's supply/return pipes, a vent on both lines give the ability to vent air in low velocity lines. The supply and return lines should be vented in all high points of piping, and/or prior to a vertical drop. Vents shall be one-half inch (1/2") ball valves with plugs.
14. AHU and other equipment shall not be used for storage of tools and construction equipment at any time during the project.
15. AHU; provide properly installed condensate drains to prevent build up of condensate in drain pans. See Appendix C, Standard Detail 23.001.
16. Valve tag schedules, to be provided as part of project closeout documentation, shall properly list and identify all valves and locations. Use room numbers as one possible benchmark for valve location.
17. Generic locations, such as "First Floor" are not acceptable. An example of acceptable identification is "First floor, south wing corridor, above ceiling, adjacent to room 104".

18. All closed loop heating and cooling systems shall be treated with MITCO CW28L corrosion inhibitor. Additionally, Contractors shall use only MITCO treatment where required for initial treatments in new and repaired systems.
19. All piping is to be labeled and color-coded according ANSI Z535.1-1991 Safety Color Code and ANSI A13.1-1981 Scheme for Identification of Piping Systems. Pipe markings must effectively communicate the contents of the pipes and give additional information if special hazards (such as extreme temperatures or pressures) exist, ie. "Steam 100 PSIG". Arrows shall indicate direction of flow. Label placement shall insure that labels can be easily read based upon label elevation and viewing angle of individual. Labels, at a minimum, shall be placed near valves (within 6 feet max.), where change in direction occurs, on entry/re-entry points thru walls and floors, and on straight segments with spacing between labels that allows for easy identification.
20. Mechanical pipe joints such as Victaulic, Groove-Lok, etc, shall be permitted in dry fire protection systems and in mechanical rooms only. Under no circumstances shall this type of piping be permitted above classroom, laboratory, office, auditorium, theatrical or otherwise publicly occupied spaces.

23 05 02 MECHANICAL DRAWINGS

- 1 New piping and equipment to shown in heavy layer, existing to be shown in light layer. Underground piping to be shown in dashed layer with numbers/lettering system.
- 2 Building column lines to be shown.
- 3 Major equipment (AHU's, chillers, pumps, boilers, tanks, heat exchangers.) to be dimensioned off a benchmark or column line. Support details to be provided.
- 4 Piping/equipment schematics/diagrams correspond to layout.
- 5 Provide match lines between plans.
- 6 All piping to be described with size and service.
- 7 All major equipment to be named and numbered and shown on schedules. Same names and numbers to be used in specifications.
- 8 Provide sufficient straight runs for flow meters.
- 9 Provide isolation unions or flanges for all major equipment, control valves, in-line instruments, and pressure reducing stations.
- 10 Designate pipe slope where necessary.
- 11 Flow arrows shall be shown.
- 12 Relief devices shall point away from personnel areas.
- 13 Utility service pressures/temperatures properly shown.
- 14 Show room names and numbers.
- 15 AHU condensate drains to be per GVSU Standard Detail 15.001, Appendix C
- 16 Drawings are to have properly noted all of the following, located in a position that is legible (not on top of other drawings entities or text):
 - A. Duct and pipe sizes
 - B. Air diffusers, grilles, dampers and louver nomenclature.
 - C. CFM's

23 05 19 METERS AND GAUGES FOR HVAC PIPING

- 1 Metering:
 - A. Steam: EMCO turbine wheel with signal to CEMS.
 - B. Chilled Water: consult with GVSU energy department.
 - C. Contractor shall obtain documentation and certification from Manufacturers and deliver same to the Commissioning Authority.

23 05 23 GENERAL DUTY VALVES FOR HVAC PIPING

- 1 Specify proper valve stem orientation.
- 2 Provide ball valves on 2" or smaller pipe. Provide butterfly valves on 2-½ " or larger pipe. Do not provide gate valves.
- 3 Provide isolation valves at all pieces of equipment and coils for maintenance and service.
- 4 Locate valves where they can be reached for service, in hallways and public spaces wherever possible. Do not place valves in classrooms, offices or other related spaces where emergency service may be disruptive to activities occurring within the room. Where access panels are provided, placement shall allow clear and direct access to valves with no obstructions, i.e.: ductwork, piping, conduit, etc.
- 5 Label all valves in HVAC systems. Provide a listing of the labels at close out.

23 05 93 TESTING, ADJUSTING AND BALANCING FOR HVAC

- 1 Require that all test results are to be given to the Commissioning Authority.
- 2 Contractors do not change a location of a valve, pump, alter design work, change system operating procedures, etc. unless when directed by the design engineer or owner in writing. Commissioning agents do not have the authority to have system parameters modified unless approved by the owner or design engineer in writing.
- 3 Require the development and implementation of a Measurement and Verification (M&V) Plan consistent with International Performance Measurement & Verification Protocol (IPMVP). The M&V period shall cover a period of no less than one year of post-construction occupancy
- 4 After completion of balancing of systems, all sheaves should be changed to fixed sheaves (do not leave variable sheaves in place).
- 5 All hydronic piping to be pressure tested with GVSU representative present (provide one-week notice of testing).
- 6 Require the Testing and Balance Contractor to complete work, ready for Owner balancing, prior to occupancy or system verification by the Commissioning Authority. The Contractor is to coordinate the TAB plan with the Commissioning Authority and schedule time frames for TAB at the pre-construction meeting to be incorporated in the overall project schedule. Provide a minimum of two weeks prior to occupancy.
- 7 All supply and return air duct systems and critical or environmentally sensitive ductwork installations shall be pressure tested prior to connection to fans and prior to knockouts for final connections

23 06 00 SCHEDULES FOR HVAC

23 06 20 SCHEDULES FOR HVAC PIPING AND PUMPS

- 1 Pumps: Bell and Gosset pumps shall be the sole supplier for heating, cooling and any other type of water recirculation application.

23 07 00 HVAC INSULATION

23 07 19 HVAC PIPING INSULATION

- 1 Install complete insulation of all piping, valves, terminal units and all sections. Do not leave un-insulated gaps between components that can cause condensation that will damage finishes, equipment or building components.

- 2 Preformed fitting jackets equal to Zeston 25/50 rated PVC fitting covers may be used only in concealed or protected areas such as in chases, above ceilings or in areas 8 feet above the floor, where surface temperatures are less than 150 degrees F.
- 3 Straight pipe runs and pipe fittings less than eight-feet off finish floor, catwalk or other working platform surfaces shall have an insulated base with scrim cloth exterior and waterproof coating.
- 4 Service parts such as strainers, valves, etc. shall have removable insulation.

23 08 00 COMMISSIONING OF HVAC

- 1 Arrange and pay for pump manufacturer's representative to perform pump alignment, lubrication and start up. Submit a written report, prepared by the manufacturer's representative, to the design engineer and owner. This is a required submittal.

23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

23 09 13 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

- 1 Exhaust fans will be controlled from central energy management system, (exception - housing units).
- 2 The entire building will be controlled through existing energy management system at each campus. Direct digital control (DDC) shall be used.
- 3 GVSU Energy Management will assist engineer in developing control strategy and specifications. Bid documents include but are not limited to sequence of operation, points list, product specification, graphics development, alarm and report programming.
- 4 Location of temperature sensors and thermostats shall be coordinated with furniture, equipment, sunlight (relationship to window locations) and prevailing breezes. Final location of all temperature sensors and thermostats must be reviewed by GVSU.
- 5 Thermostats shall be low voltage 24 vac.
- 6 Valve actuators shall be low voltage 24 vac.
- 7 Engineer is required to define the control system and operations on the design and construction documents. Such definitions should illustrate the operational and control expectations for the system.
- 8 Energy management system to be interfaced with fire alarm and lighting control systems.
- 9 Provide 3 copies of prints identifying HVAC zones.
- 10 Hot water sensors shall be located and positioned so they are easily read without use of ladders.
- 11 All temperature gauges shall be manufactured by Weiss Instruments Inc.

23 20 00 HVAC PIPING AND PUMPS

23 21 00 HYDRONIC PIPING AND PUMPS

- 1 Water Treatment: Provide chemical pot feeder in all closed looped water systems.
- 2 Provide ball valves on each side of control valves. Circuit setters are not to be used for isolation purposes. Valves must be accessible.
- 3 Provide two (2) 1-1/4" male cam-lok fittings per supply and return and to be installed across pumps and in mechanical rooms.
- 4 Installation shall include a CUNO 6 gpm by-pass filter loop.

23 22 00 STEAM AND CONDENSATE PIPING AND PUMPS

- 1 Steam Equipment: Steam traps shall be Armstrong or Spirax-Sarco.
- 2 Domestic water heating: instantaneous, steam driven. Provide proper setting for steam pressure used; 5#/15#/50#.
- 3 Coils:
 - A. All coils to have 10-fins/inch maximum, 12 fins/inch difficult to clean.
 - B. Provide access panels for coil cleaning up and down stream of all coils. Size should be sufficient to allow inspection and use of cleaning equipment, except where duct can be easily removed for cleaning.
- 4 Coils should be located to be accessible for service from hallways wherever possible.
- 5 Provide high point vents and low point drains on all coils. Provides a dirt leg on all chilled water supply and return at coils.
- 6 Clean existing coils serving newly remodeled areas after completion of renovations. Protect all coils, during construction, from accumulation of construction dust.
- 7 All steam and condensate lines will be cleaned and/or purged prior to being put in service in so as to be free of contaminants. Contractors shall make provisions for an initial condensate discharge period of 7 days. Condensate samples must be provided to the Central Utilities Building staff after this period for testing and deemed sufficiently clean by GVSU to allow final steam condensate connection to the system.
- 8 Steam trap piping shall be designed and fabricated in accordance with Standard Detail 23.002 in Appendix C of these Standards.

23 30 00 HVAC AIR DISTRIBUTION

- 1 Require the establishment of minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings by complying with minimum requirements of sections 4 through 7 of ASHRAE 62.1-2004.

23 31 00 HVAC DUCTS AND CASINGS

- 1 Vents and exhaust system shall have access for cleaning; minimize turns.
- 2 All ducts and piping installed below 8 feet shall be fiberglass or canvas covered, to protect against bump hazards.
- 3 All ductwork is to be sealed. No leakage is acceptable. Require contractor to reseal when leaks are discovered.
- 4 All ductwork is to be pressure tested in conformance with SMACNA Standards. University representative is to be notified a minimum of three (23) days prior to testing.
- 5 Require any ductwork that is deformed, from initial installation or due to excess static pressure due to improper installation to be replaced, resealed and retest on pressure. Indicate contractor is responsible for all cost including rebalancing.

23 36 00 AIR TERMINAL UNITS

23 36 16 VARIABLE-AIR-VOLUME UNITS

- 1 Variable Air Volume (VAV) boxes and related installation shall conform to the following:
 - A. All boxes shall be Titus brand.
 - B. Without exception, unless otherwise approved by the University, all box duct runs shall have 5-times (5x) duct diameter of straight run before the VAV box.
 - C. Provide access panels in bottom of VAV box ahead of coil. VAV's are to be furnished from the manufacturer with this access panel option installed.

- D. Where VAV units are installed above a non-accessible ceiling (e.g. drywall) separate access panels shall be provided in the inaccessible ceiling allowing access to the access panels required in 23 31 00 (3)(D) above. Center point of both sets of access panels SHALL BE ALIGNED.
- E. Where VAV units are installed above a accessible ceiling (e.g. 2'x2' suspended acoustical), the center point of the accessible ceiling tile SHALL BE ALIGNED with the center point of the access panels required in 23 31 00 (3)(D) above.
- F. A minimum clear area of 24-inches by 24-inches shall be provided at all access panel locations and shall be free of any interference caused by building structure, bridging or bracing, piping, ductwork, conduit, hangers for piping and ductwork, air distribution diffusers, light fixtures, ceiling grid and related hangers.

23 40 00 HVAC AIR CLEANING DEVICES

23 41 00 PARTICULATE AIR FILTRATION

- 1 Require the development and implementation of an IAQ management plan for the construction and preoccupancy phases of the building. Use MERV-8 filters during construction and replace all filters with MERV- 13 filters immediately prior to occupancy.
- 2 Require MERV-13 or better filters for regularly occupied buildings on both return and outside air that is to be delivered as supply air prior to occupancy.
- 3 Allow clear area for filter removal.
- 4 Air filters to be GVSU standard pleated and bag types to meet current indoor air quality standards.
- 5 All filters to be changed at time building is occupied by GVSU.
- 6 Install filters prior to air reading station on all outdoor air intakes that have honeycomb.

23 83 00 RADIANT HEATING UNITS

23 83 16 RADIANT-HEATING HYDRONIC PIPING (SNOW MELT)

- 1 All snow melt systems shall be filled with Mitco CW-1665L. the access panels required in 23 31 00 (3)(D) above
- 2 Clean, flush and filter system prior to turning over to the University.
- 3 Snowmelt systems shall be designed for connection to and control by the University's EMS controls.

END OF SECTION