PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS, UNIVERSITY GUIDELINES AND STANDARDS

A. Code Rules and Safety Orders:

1. Construction as called out on working drawings shall be in full accordance with the rules and regulations of all ten parts of the California Code of Regulations, Title 24 (The California Building Standards Code) per University administrative policy. Title 24 includes amended versions of the Uniform Building Code, Uniform Mechanical Code, Uniform Plumbing Code, National Electric Code and the Uniform Fire Code. Also included is the California Energy Code (Title 24, Part 6).

B. Additional government codes and regulations shall be complied with as applicable to the project.

1. The regional air quality management district with jurisdiction over the Cal Poly Campus is the San Luis Obispo County Air Pollution Control District ((805) 781-5912) with headquarters in San Luis Obispo, California. Mechanical systems regulated by the district include: fume exhaust systems, cooling towers, fuel burning equipment (depending on size & fuel type), paint spray booths, incinerators, and dust handling equipment. A “Permit to Construct” must be obtained from the District prior to beginning construction or modification on any system regulated by the District. The Design Professional shall be responsible for identifying project impacts requiring compliance with Air Pollution Control District regulations. Alternatives for compliance shall be discussed with the Cal Poly Project Manager. The Design Professional shall provide Cal Poly with all information required to obtain a “Permit to Construct”. Permit applications, and related correspondence shall be channeled through the Cal Poly Environmental Health & Safety Office (Environmental Programs Manager).

2. Systems discharging to the campus sewer system shall be in compliance with the requirements of the City of San Luis Obispo Waste Water Treatment Plant (Industrial Waste Inspector (805) 781-7215). Mechanical systems discharging unusual wastes may require special provisions or may not be allowed. Triggers include high or low pH, oil, grease, chemical contamination, biological contamination, and rain water to the sewer. Mechanical systems typically impacted include commercial kitchen waste, elevator sump pump discharge, lab
process waste, and water purification system waste. The Design Professional shall be responsible for confirming impacts to the project due to the City Waste Water Discharge Ordinance. Alternatives for compliance shall be discussed with the University’s Representative. Negotiations involving specific project issues shall be channeled through the CAL POLY Environmental Health & Safety Office (Director).

1.02 BASIC DESIGN PRIORITIES:

A. Program Requirements / Design Guidelines / Government Codes: Mechanical systems shall be designed to meet the more stringent of: the user requirements as identified in the Program, the requirements these Design Guidelines, or applicable government codes and regulations. The Design Professional shall be responsible for notifying the University’s Representative of conflicting requirements. The University’s Representative shall provide the final decision as to how conflicts will be resolved.

B. Ease of Maintenance / Operation: Mechanical systems shall be designed to be easily maintained and operated. Access and service space shall be key considerations of the design. Equipment requiring the movement of heavy items for service shall be located such that it is assessable by a hand truck from service vehicle parking locations. Equipment requiring frequent monitoring shall be located so as to be easily accessible from service vehicle parking locations.

1.03 EQUIPMENT REPLACEABILITY:

A. Mechanical equipment shall be located such that replacement is possible without building demolition. Buildings shall be provided with special provisions (oversized doors, removable louvers, access plates, etc.) as required to meet this requirement.

1.04 SYSTEM LIFE:

A. Mechanical systems shall be designed to last the life of the building. Components shall typically be institutional grade. With approval of the University’s Representative, an exception to this requirement may be granted for systems to support specialized applications with a short life expectancy.

1.05 WATER CONSERVATION:

A. Mechanical system shall be designed to minimize water use. CAL POLY has a long-standing tradition of frugal water use. Design decisions which significantly impact water use shall be brought to the attention of the University’s Representative. The University’s Representative shall provide the final decision on such matters.

1.06 UTILITY METERING:

A. All mechanical utilities serving a building shall be metered. This shall include Water, Natural Gas, Campus Heating Hot Water, Campus Chilled Water and Chilled Water
(when produced at a plant outside the building). See applicable Sections for metering specifics. A complex of residential buildings may be master metered with approval of the University’s Representative.

1.07 DESIGN DOCUMENTATION:

A. Design documentation shall be provided for all mechanical systems to assure efficiency in the mechanical design process and to serve as a reference after construction.

B. Conceptual Design Report / Mechanical Systems: At the Schematic Design phase, submit a “Conceptual Design Report” for the project’s mechanical systems, covering each anticipated mechanical system in the project. A key element of the report shall be a discussion of the alternative systems available to meet the identified needs. Design Development work for the mechanical systems shall not begin until the University’s Representative has approved a conceptual alternative for each mechanical system.

   1. Conceptual Design Report shall include:

      a. Identification of the mechanical services required in each type of space included in the project.

      b. The base criteria to be used for capacity sizing each mechanical service to each space type within the project. Identify the source of the criteria (e.g., consultant recommendation, program requirement, building user interview, code requirement, campus standard, equipment manufacturer). State extent to which services will be oversized to accommodate future growth.

      c. A discussion of the pro and cons of the design alternatives available for each mechanical system.

      d. A recommended alternative for each mechanical system.

      e. Space allocation required for each recommended alternative.

      f. A description of access to be provided to each major piece of mechanical equipment.

C. Design Development Report / Mechanical Systems:

   1. The Design Development submittal shall include a "Design Development Report" covering each mechanical system in the project. This report shall include:

      a. Room by room documentation of required mechanical services.

      b. A written description of each mechanical system covering system purpose, system type, utility inputs, and locations of all major equipment.

      c. The criteria to be used in sizing and laying out each mechanical system and the source of the criteria (similar to Conceptual Design Report).
d. Rough schematics of the proposed systems indicating major equipment, points of connection to existing utilities, and the rooms served by each mechanical utility.

e. A description of the required space to accommodate each major element of the proposed mechanical systems, including mechanical rooms, exterior mechanical yards, roof mounted mechanical equipment, mechanical shafts, and ceiling space provisions.

f. A complete description of access for maintenance and replacement to each piece of mechanical equipment.

g. Rough equipment sizing calculations.

h. Catalog cut sheets on all major mechanical equipment.

2. Title 24 Building Envelope Plan Check Compliance Documents: The Design Professional shall submit Title 24, Part 6; Building Envelope Plan Check Compliance Documentation no later than the 50% Working Drawing Submittal. This documentation shall include applicable portions of forms; ENV-1, ENV-2, & ENV-3.

3. Title 24 Mechanical Plan Check Compliance Documents: Title 24 The Design Professional shall submit Title 24, Part 6; Mechanical Plan Check Compliance Documentation no later than the 50% Working Drawing Submittal. This documentation shall include applicable portions of forms; MECH-1, MECH-2, MECH-3 and MECH-4.

4. Final Mechanical Calculations & Equipment Documentation: Final mechanical calculations shall be submitted no later than the 50% Working Drawing Submittal. These calculations shall document the final basis of design for all mechanical equipment and systems. Title 24 plan check documentation may be used to supplement the calculations where applicable. Also included shall be manufacturer’s catalog cut sheet and sizing tables on all major mechanical equipment being used as the basis of design.

D. Working Mechanical Drawings

1. Maintenance access space as recommended by the manufacturer shall be indicated on the drawings for all mechanical equipment. Designated access spaces shall include as a minimum: equipment access door swings, control panel access, tube pulls, coil removal space, fan shaft removal space, lubrication point access, and fire box access.

2. No abbreviation or symbol shall be used on the drawings unless included in the legend.

3. No work shall be called out in a manner which is not contractually enforceable.
4. Work shall not be called out in a design / build format on drawings intended for competitive bidding unless specifically approved by the University’s Representative.

5. Mechanical Equipment shall have all important features specified. (Model number alone shall not be considered sufficient) Specifications for University Projects must be open to more than one bidder per Public Works Contract Law except in very specific situations. The specifications should be written in a manner which encourages competition among vendors of equivalent mechanical equipment yet precludes inferior products. To this end the quality level of all major features should be specified. See Part 1 of the Guidelines for further guidance on the method of calling out equivalent products for University contracts.

6. Natural and Mechanical Ventilation
   a. California Mechanical Code (CMC) requires that naturally ventilated space must also be provided with mechanical ventilation unless the system meets any of the following exceptions:
      1) Exception #1: An engineered natural ventilation system where approved by the AHJ need not comply with Section 402.2.
      2) Exception #2: A mechanical ventilation system is not required where natural ventilation openings comply with the requirements of Section 402.2 and are permanently open or have controls that prevent the openings from being closed during occupancy.
      3) Exception #3: A mechanical ventilation system is not required where the zone is not served by heating or cooling equipment.

E. Energy Design Goals:
   1. Energy Efficiency: Mechanical system shall be designed to minimize energy use. Cal Poly has a long-standing tradition of frugal energy use. Design decisions which significantly impact energy use or cost shall be brought to the attention of the University’s Representative. The University’s Representative shall provide the final decision on such matters.

   2. Depending on the project size, the ER is responsible for performing the energy model to demonstrate a project’s energy efficiency to meet requirements of 2013 Title 24 Part 6 Energy Code, LEED Gold, and the CSU Energy Policy.

   3. The following systems may be considered to help reach sustainability goals:
      a. Cogeneration
      b. Condensing boilers
      c. Solar thermal for domestic hot water
      d. Photovoltaic panels
e. Phase Change Material
f. Wall insulation
g. Glazing performance
h. Sunshades
i. Variable air volume system for Make-up Air and Exhaust

   a. Depending on the project size, the design team is responsible for the energy modeling and performing additional LCCAs associated with any of the sustainability options listed.

5. For LEED documentation, at least one year of data collection is required, consisting of:
   a. Total plant building and equipment electricity used, in kWh.
   b. Total plant building and equipment gas used, in therms for MBTU.
   c. Total heating energy output, in pounds or MBTU.

F. Mechanical Load Basis of Design

1. Outdoor Design Conditions
   a. Summer: 87°F db/65°F WB (ASHRAE 0.5%, San Luis Obispo, CA)
   b. Winter: 33°F (ASHRAE 0.2%, San Luis Obispo, CA)
   c. Elevation: 320 ft.
   d. California Climate Zone: 5

2. Indoor Design Conditions
   a. Lecture Halls: heat to 70°F, cool to 76°F
   b. Lab Space: heat to 70°F, cool to 76°F
   c. Other spaces: heat to 70°F, cool to 76°F
   d. Bedroom: Heating only, 70°F +/-2°F
   e. Living Room: Heating only, 70°F +/-2°F
   f. Study Room: Heating only, 70°F +/-2°F
   g. Laundry Room: Ventilation and Heating only
   h. Entry/Lobby (in dorm buildings): Ventilation and Heating only
   i. Admin Spaces: 75°F cooling, 70°F heating
   j. Elec. Rooms: Cooling only, 85°F
   k. Data/telecom rooms: Cooling only, 75°F
I. Elevator machine rooms: Cooling only, 85°F

G. Indoor Humidity Control
1. All areas, unless otherwise noted: no humidifiers required.

H. California Minimum Ventilation Criteria
1. All areas: 15 cfm/person or 0.15 cfm/sq.ft. minimum, whichever is greater.
3. Comply with Chapter 4 of 2013 CMC.

I. Exhaust to Outdoors (Minimum Rates)
1. Toilet rooms: 12 air changes per hour or 75 cfm/fixture, whichever is greater.
2. Janitor closet: 100 cfm or 10 air changes per hour, whichever is greater.
3. Shower rooms: 12 air changes per hour
4. Main trash rooms: 12-15 air changes per hour
5. Floor trash closets: 50 to 100 cfm per floor
6. Kitchenette: 0.3 cfm per sf or hood exhaust rate, whichever is greater.

J. Building Envelope
1. Glazing: glass/frame combination
2. Typical vertical:
   a. Description: double pane, low-e, and thermal break frame
   b. U= 0.26 (center-of-glass summer daytime)
   c. = 0.45 (with frame)
   d. Solar heat gain factor = 0.27 (center-of-glass)
3. Typical skylight:
   a. Description: double pane, low-e, and thermal break frame
   b. U= 0.26 (center-of-glass summer daytime)
   c. U = 0.45 (with frame)
   d. Solar heat gain factor = 0.27 (center-of-glass)
4. Wall construction
   a. Description: 4” metal framing at 16” O.C.
   b. Insulation: R-13 batt insulation and 1” continuous rigid insulation at R-5 per inch.
   c. Overall U-value = 0.105
5. Roof construction:
a. Insulation: R-30
b. Overall U-value = 0.030

K. Internal Heat Gains

1. Lighting (The D-B Team shall confirm and coordination the following values with the Lighting Designer):
   a. Bedroom: 1 W/sq.ft.
   b. Corridor: 0.6 W/sq.ft.
   c. Restroom: 0.6 W/sq.ft.
   d. Living Room: 1.1 W/sq.ft.
   e. Study Room: 1.2 W/sq.ft.
   f. Community Kitchen: 1.6 W/sq.ft.

2. Receptacle power:
   a. Bedroom: 2.5 W/sq.ft.
   b. Living Room: 1 W/sq.ft.
   c. Study Room: 1.5 W/sq.ft.
   d. Light Recreation Space: 1 W/sq.ft.

3. Occupant heat gain:
   a. All areas: 250 Btuh sensible/250 Btuh latent
   b. Light Recreation Space: 275 Btuh sensible/475 Btuh latent

4. Electrical transformers: 2% loss

5. Elevator machine rooms: refer to elevator drawings.

6. Telecom/MDF/IDF rooms: refer to low-voltage drawings.

L. Ductwork Design Criteria (Maximum Allowable Values)

1. Air velocities above these maximum values require acoustical treatment.

2. Supply ducts:
   a. Exposed in occupied spaces: 0.08” wg/100 ft and 1500 ft/min velocity
   b. Above ceiling in occupied spaces: 0.08” wg/100 ft and 1800 ft/min velocity
   c. In shafts adjacent occupied spaces: 0.20” wg/100 ft and 2000 ft/min velocity
   d. In shafts adjacent unoccupied spaces: 0.30” wg/100 ft and 3000 ft/min velocity.

3. Return/exhaust ducts:
   a. Exposed in occupied spaces: 0.06” wg/100 ft and 1000 ft/min velocity
b. Above ceiling in occupied spaces: 0.06” wg/100 ft and 1500 ft/min velocity

c. In shafts: 0.10” wg/100 ft and 2000 ft/min velocity

d. In mechanical rooms: 0.20” wg/100 ft and 3000 ft/min velocity

4. General building/toilet exhaust ducts: 0.10” wg/100 ft and 1500 ft/min velocity

M. Coils

1. Maximum face velocity: 450 fpm

2. Maximum fins per inch: 12

3. Maximum air pressure drop – heating coil: 0.25” wc

4. Maximum tube pressure drop: 10 ft. wg.

5. Minimum tube pressure drop: 2 ft. wg.

6. Minimum tube rows – heating coil in air handler: 1

7. Minimum tube rows – reheat coil in VAV terminal unit: 2

N. Hydronic Piping Design Criteria

1. Max water pressure drop: 4 ft.wg./100 ft.

2. Max water velocity: 6 ft/sec

3. Max allowable water velocity: 10 ft/sec in mechanical rooms

4. Provide shut off valve for isolation of major areas, at each piece of equipment, and each air handling system.

O. Heating Hot Water Temperatures

1. Plant heating water supply/return temperatures: 180°F/140°F

2. Radiant heating panels supply/return water temperatures: 180°F/160°F

3. Fin-Tube Baseboard Heaters supply/return water temperatures: 180°F/160°F

P. Redundancy Assumptions

1. Boilers: provide N+1 boiler redundancy

2. Heating water pumps: provide N+1 pump redundancy

3. If Cogen is used, provide full back-up capacity with boilers.

Q. Metering and Controls

1. Provide BTU meter at each building to monitor heating hot water usage and DHW usage.

2. Building Automation System (BAS) DDC control system for complete system optimization of major equipment. Campus Standard is Siemens Apogee.

R. Economizers:
1. Evaluate life cycle costs for using economizers on units smaller than 75,000 Btuh, especially on 24/7 loads.

S. 24-Hour Cooling:
   1. Provide dedicated HVAC equipment/systems to spaces requiring 24-hour cooling (allowing unoccupied parts of the building to be shut down).
   2. Types of Spaces: Review program to determine spaces requiring 24-hour cooling (such as main data frame rooms, server rooms, telephone equipment rooms, elevator equipment rooms, labs and other areas containing special equipment).
   3. Equipment Function: Based upon critical functions of equipment, evaluate and analyze cooling options and redundancy -- DX Units verses Central Plant Chilled Water verses Hybrid CHW/DX units.

T. Equipment Access:
   1. Provide clear access to equipment for inspection and maintenance.
   2. Access Panels: Provide adequate, unobstructed access to equipment and ceiling access panels.
   3. Volume/Balancing Dampers: Locate access panels within 18 inches of service point.
   4. Pumps in Mechanical Rooms: Orient pumps with motor end towards center of room, and pump end towards wall (making sure suction strainer is accessible).
   5. Building Isolation Valves: Valves need to be raised, accessible and housed in a covered box, flush with ground level.

END OF SECTION 23 00 00