UNIVERSITY OF CALIFORNIA, LOS ANGELES
CAPITAL PROGRAMS - Design and Construction

MECHANICAL-ELECTRICAL-PLUMBING DESIGN AND CONSTRUCTION STANDARDS

June 2017

21 00 00
FIRE SUPRESSION STANDARDS
2017

210000 GENERAL REQUIREMENTS

1. DOCUMENT PREPARATIONS

1.1 Legends, schedules, and notes should contain only items and information that are in the scope of work of that project.
1.2 The construction documents shall include riser-diagrams for fire protection piping system.
1.3 All piping shall be sized and shown on the plan of the floor level in which it will be installed.
1.4 Provide, on the plans, composite building sections, as needed to verify that all components will fit as shown on the plans. Indicate ducts, pipes, conduit, fan coils units, recessed light fixtures, structural beams soffits etc. at each critical location where such elements cross.
1.5 Location of all risers, standpipes, floor control valves, shutoff valves and FDC must be shown on the floor plans in addition to the riser diagrams.
1.6 Record Drawings ("as-builts") are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and inspector should verify at each site visit that the contractor is maintaining adequate as-builts, and should obtain progress copies of the contractor's as-builts during construction. At the completion of the project, it is too late to verify concealed work and documents are often misplaced.
1.7 Specifications shall be prepared to include only systems, items and materials that are in the scope of work for this project. Review and coordinate each specification section so there will be no contradicting information of specified items or materials.

2. DRAWINGS AND CALCULATIONS

2.1. Show all calculations on drawings: hydraulic calculations and pipe sizes.
2.2. 1/4 inch scale or larger equipment room showing each major piece of equipment.
2.3. Show pipe riser diagrams complete with pipes sizes and appropriate unit values.
2.4. All equipment schedules must be provided on the plans, not on the specifications. The plans become the campus' permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.
2.5. Specification title and numbering shall be based on Master Format (version as approved by University's representative) and content shall be in CSI 3-part format (Part 1-General, Part 2-Product, and Part 3-Execution).
2.6. Fire suppression specification sections shall have separate sections, independent of mechanical and plumbing specification sections.
2.7. Fire suppression details to be included in the plans (when applicable):

2.7.1. Equipment and piping supports including seismic bracing installed inside and outside the building. Include wind load for exterior installation.
2.7.2. Vibration isolation and seismic restraints
2.7.3. Pump piping detail
2.7.4. Concealed or exposed pipe penetrations through walls, floors and roof. Coordinate with the architect's drawing.
2.7.5. Underground storage tank
2.7.6. Equipment housekeeping pad
2.7.7. Double check backflow assembly with fire department connections
2.7.8. Floor control valve

2.8. Nomenclatures

CSP	Combination Standpipe Riser
CSFM	California State Fire Marshal
D	Drain
DI	Ductile Iron
DCA	Double Check Valve Assembly
FA	Fire Alarm
FACP	Fire Alarm Control Panel
FCV	Floor Control Valve
FDC	Fire Department Connection
FH	Fire Hydrant

FP	Fire Pump
GPM	Gallon per Minute
PIV	Post Indicator Valve
PSI	Pound per Square Inch
SOV	Shutoff Valve
SP	Standpipe
SPKR	Sprinkler
ST	Storage Tank

211000 WATER-BASED FIRE SUPPRESSION SYSTEMS

1. Most systems are Contractor designed. It is recommended that no layout piping be indicated on the construction drawings. Only the location of sprinkler risers, hub drains or point of drain discharge, and supply mains should be shown. A reflected ceiling plan is OK if there is an issue of the sprinkler head location.
2. The fire protection systems shall be specified to be designed per requirements of the applicable state fire code, N.F.P.A. Standards and the Campus Fire Marshal. The areas to be protected by the sprinkler system including all exterior over-hangs, soffits and covered areas shall be reviewed with and established with the Fire Marshal and so described in the construction documents.
3. All Contractor submittal drawings and working plans shall be prepared utilizing a computer generated system compatible with UCLA's Auto-CAD drawing system.
4. Fire sprinkler services shall have a double check valve assembly (preferably exterior) at point of entrance into building. If backflow assembly is to be located inside the building, a post indicator valve outside the building shall be required. Metering of the fire service is not required. Location of fire department connection shall be within 100 feet of an existing or new fire hydrant and as approved by the Campus Fire Marshal. When a fire sprinkler service is to be provided as part of the work, the specifications shall direct the "Contractor to perform flow tests of the site water main in the presence of the University's Fire Marshal, that in order to determine the design criteria for the sprinkler system. The contractor shall provide all equipment necessary for the testing, including control of the discharged water." The note shall also be on the drawings with the fire protection notes.
5. All fire standpipe systems should be designed to comply with requirements of the Campus Fire Marshal. This shall include location, size and class of system proposed for the project. Standpipe Fire Department Connection(s) shall be located adjacent to the sprinkler FDC. A meeting should be arranged with the Campus Fire Marshal's Office to review the standpipe system requirements.
6. In high-rise buildings where a combination standpipe system is required, the University would prefer a Combination System, fire sprinkler and standpipe would be from a common service and have a single fire department inlet connection. Fire and jockey pumps along with storage tank may be required. In other than high-rise building where it is determined to have a separate Class I standpipe system, the system shall be manual wet charged thru a ¾" reduced pressure backflow preventer. The system is a Class I Manual Wet Standpipe per NFPA 14, 3-2.5. All hose valves are to be wet type.
7. All interior piping shall be specified Schedule 40 ASTM A53 or A795, seamless type S (ERW is not acceptable). Joints shall be threaded with 250 psi rated ductile iron fittings for sizes 2½-inch and smaller. For pipe sizes 3-inch and larger grooved mechanical fittings U/L Listed 250-psi minimum working pressure may be used. Interior riser floor control valves may be approved butterfly type. Pipe shall be continuously marked at the pipe foundry with the schedule and ASTM reference.
8. Hangers, supports and bracing of system shall be in accordance with NFPA 13 requirements. In addition, specify ends of all branches 2½-inches and larger shall be sway braced, and ends of all branches less than 2½-inches shall utilize a splayed seismic brace wire.
9. All fire sprinkler piping shall be installed with an adequate slope to unsure that all portions of the system will drain. All auxiliary drains shall be extended to a visible and accessible location approved by the University Representative.
10. The drawings shall indicate where the system main drain shall discharge. Do not only note "to an approved location." Discharge to exterior is not permitted.
11. Signage for the FDC shall be white letters on Charles E. Young (CEY) brown background.
12. Water supply for fire protection systems shall not require metering.
13. All exposed piping, backflow devices and supports shall be painted CEY brown.
14. As required per code, no sprinkler piping or equipment shall be indicated in any electrical room, vault or areas designated for electrical or communication equipment, unless sprinkler piping is dedicated to serve such rooms.
15. Piping shall not be routed through electrical room, vault or other areas designated for electrical or communication equipment, unless piping will specifically serve such rooms.

22 00 00
PLUMBING STANDARDS
June 9, 2017

22 00 00 PLUMBING

220000 GENERAL REQUIREMENTS

1. DOCUMENT PREPARATIONS

1.1 Legends, schedules, and notes should contain only items and information that are in the scope of work of that project.
1.2 The construction documents shall include riser-diagrams for each piping system, i.e. sanitary waste and vent, storm drain, both domestic and industrial hot/cold water, laboratory waste, medical gases, fuel gas, fire protection, chilled water system, process cooling water system, steam and space heating hot water system.
1.3 All piping shall be sized and shown on the plan of the floor level in which it will be installed.
1.4 Provide, on the plans, composite building sections, as needed to verify that all components will fit as shown on the plans. Indicate pipes, conduit, fan coils units, recessed light fixtures, structural beams soffits etc. at each critical location where such elements cross.
1.5 Location of all shutoff valves must be shown on the floor plans in addition to the riser diagrams. Valves should be shown at each branch takeoff from a main and at each group of fixtures and each piece of equipment (in addition to the fixture stops). Adequately sized access panels must be designated for all concealed valves.
1.6 Record Drawings ("as-builts") are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and inspector should verify at each site visit that the contractor is maintaining adequate as-builts, and should obtain progress copies of the contractor's as-builts during construction. At the completion of the project, it is too late to verify concealed work and documents are often misplaced.
1.7 Specifications shall be prepared to include only systems, items and materials that are in the scope of work for this project. Review and coordinate each specification section so there will be no contradicting information of specified items or materials.

2. DRAWINGS AND CALCULATIONS

3.1. Show all calculations on drawings: hydraulic water calculations and pipe sizes, sump and sewage ejector pump size calculations.
3.2. 1/4 inch scale or larger equipment, restrooms and shower rooms showing each major piece of plumbing equipment and fixtures.
3.3. Show pipe riser diagrams complete with pipes sizes and appropriate unit values: water fixture units, drainage fixture units, GPM, CFH, etc.
3.4. All equipment schedules must be provided on the plans, not on the specifications. The plans become the campus' permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.
3.5. Specification title and numbering shall be based on Master Format (version as approved by University's representative) and content shall be in CSI 3-part format (Part 1-General, Part 2-Product, and Part 3-Execution).
3.6. Plumbing specification sections shall have separate sections, independent of mechanical specification sections.
3.7. Plumbing details to be included in the plans (when applicable):

A. Equipment and piping supports including seismic bracing installed inside and outside the building. Include wind load for exterior installation.
B. Vibration isolation and seismic restraints
C. Pump piping detail
D. Heat exchangers and water heaters piping details
E. Manual air vent and automatic air vent details
F. Open type expansion tank
G. Bladder type expansion tanks
H. Equipment drains. Provide hose end connections to all drain valves. Drain valves above finished ceiling shall be provided with chained cap.
I. Cooling coil condensate drain piping

J. Concealed or exposed pipe penetrations through walls, floors and roof. Coordinate with the architect's drawing.
K. Injection Fittings (including injector and tubing) for chemical treatment of water piping system.
L. Underground storage tank
M. Equipment housekeeping pad

3.8. Nomenclatures

AD	Area Drain
AP	Access Panel
BP	Booster Pump
BT	Bathtub
BWV	Backwater Valve
CA	Compressed Air
CCA	Clean Compressed Air
CD	Condensate Drain
CO	Cleanout
CI	Cast Iron
CP	Circulating Pump
CW	Cold Water, Domestic
DF	Drinking Fountain
DFU	Drainage Fixture Unit
DI	Deionized
DI	Ductile Iron
(E)	Existing
ET	Expansion Tank
EWC	Electric Water Cooler
FCO	Floor Cleanout
FD	Floor Drain
FS	Floor Sink
FT	Flush Tank
FU	Fixture Unit
FV	Flush Valve
GALV	Galvanized
GI	Grease Interceptor
GPF	Gallon Per Flush
GPH	Gallon Per Hour
GPM	Gallon Per Minute
GRW	Grease Waste
GW	Gray Water
HB	Hose Bib
HW	Hot Water, Domestic
HWR	Hot Water Return, Domestic
ICW	Industrial Cold Water
IE	Invert Elevation
INV	Invert
IRW	Irrigation Water
IW	Indirect Waste
KS	Kitchen Sink
LV	Lavatory
LV	Laboratory Vent
LW	Laboratory Waste
MH	Manhole
MS	Mop Sink
(N)	New
O2	Oxygen
OD	Overflow Drain (Secondary Storm Drain)
P	Pressure, Pump
PCW	Process Cold Water
POC	Point Of Connection
PM	Pressure Main, Sanitary Waste
PRV	Pressure Reducing Valve

PSI	Pound Per Square Inch
(R)	Relocated
RD	Roof Drain
RO	Reverse Osmosis
RPBP	Reduce-Pressure Type Backflow Preventer
RR	Roof Receptor/Sink
RW	Recycled Water (Reclaimed)
SD	Storm Drain
SE	Sewage Ejector
SF	Square Feet
SH	Shower
SK	Sink
SOV	Shutoff Valve
SP	Sump Pump
SS	Sanitary Sewer
ST	Storage Tank
T	Temperature
TMV	Thermostatic Mixing Valve
TYP	Typical
UR	Urinal
V	Sanitary Vent
VA	Vaccum
VB	Vacuum Breaker
VTR	Vent Through Roof
W	Sanitary Waste
WC	Water Closet
WFU	Water Fixture Unit
WH	Water Heater
WHA	Water Hammer Arrester

3. GREEN BUILDING POLICY COMPLIANCE

3.1. All projects must comply with the UCLA Campus Green Building Baseline Standard and must meet the UC-equivalent of the USGBC "LEED Silver" with a target of Gold. A copy of the latest baseline standard should be obtained by the designer. Some of the baseline requirements that have particular MEP impact include:

A. Water efficiency and conservation in compliance with CalGreen.
B. Gray water system, cooling coil condensate drain system and/or storm drain system shall be collected and treated on site as reclaimed water for toilet water flushing system and irrigation system.

3.2. In addition to the baseline requirements, each project must consider the additional USGBC LEED criteria that may be feasible to attain a minimum LEED "certified" rating for the project.

LEED and SUSTAINABILITY

221116 PLUMBING WATER PIPING

1. GENERAL REQUREMENTS

    1.1 Campus water main supply pressure is 140 to 160 PSI. Provide multiple pressure-reducing valve assembly as required.
    1.2 Provide meters for domestic, industrial and irrigation water lines. Water line to fire protection systems is not required to be metered. Meter size shall be based on maximum and minimum flow requirements, not line size. Locate meter inside the building after pressure reducing valve assembly.
    1.3 Provide hydraulic calculations and pipe sizing schedule based on water fixture unit counts.
    1.4 Maximum cold water pipe velocity shall be 6 fps; hot water supply shall be 5 fps; hot water return shall be 3 fps.
    1.5 Provide make-up water lines to mechanical hydronic system complete with reduced-pressure type backflow preventer assembly and pressure reducing valve as required. Provide quick-fill line and hose bib downstream of backflow.
    1.6 Provide make-up water lines to reclaimed water system complete with reduced-pressure type backflow preventer assembly and pressure reducing valve as required. Provide quick-fill line and hose bib downstream of backflow.
    1.7 Water piping shall not be routed through electrical room, elevator machine room, telecom, and similar rooms.
    1.8 Water piping shall not be routed under building slab.
    1.9 “Dead leg” branches on water lines shall be cut back as close as possible to the mains or nearest active tee.

2. PIPING MATERIALS

    2.1 Pipe and Fittings:

        A. Hard drawn copper Type K, ASTM B88, permanently color marked with manufacturer’s trademark and country of origin. Type “K” shall be marked in green.
        B. Fittings: Copper fittings shall be factory-made, wrought or cast pressure fittings and have integral formed pipe stops on each connection.
        C. Mechanical formed tee fittings utilizing mechanically extracted collars or brazed outlets shall not be used.

3. VALVES

    3.1. Several valve manufacturers carry separate domestic and import lines. The import lines are often of inferior quality. Where a specification refers to such a manufacturer, the specification writer shall verify that the valve model numbers specified are for the domestic made valves and not the import line of the manufacturer.
    3.2. Ball valves shall be lead-free, full-port, stainless steel ball and stem. Chrome plated ball is not acceptable.
    3.3. Up to NPS 2-1/2: Three-piece, threaded, bronze valve with stainless steel ball and stem, Nibco T-595-Y-66-LF or equal.
    3.4. NPS 3 and larger: Carbon steel, split-body, stainless steel ball, flanged, Nibco F-515-CS-F-66-FS or equal.
    3.5. All valves for future connection shall be capped or plugged. Drain outlets shall be piped to drain or plugged. Unplugged open valve ends will eventually leak and cause damage.
    3.6. Soldered end valves are NOT ACCEPTABLE and should not be specified except when factory installed as part of the equipment

4. DIELECTRIC FITTINGS. Use isolator fittings wherever ferrous and non-ferrous piping material are joined together. Conventional dielectric unions and couplings have been found to be unreliable. Only the following will be accepted: use threaded M.P.S. minimum 3-inches long zinc electro-plated steel casing with inert NSF/FDA listed lining, ASTM F-492 rated at 225F, 300 psi, “Clear Flow” or equal. At contractor’s option, 6-inch long, brass nipple is also acceptable.

5. PRESSURE REDUCING VALVE

5.1 Up to NPS 2: Wilkins all brass body with union FNPT inlet connection. A union shall be located on the discharge side of each valve in a vertical position.
5.2 NPS 2-1/2 and Larger: Clay-Val Pilot Operated Series 90.

6. INSULATION.

7. WATER HAMMER ARRESTERS. Water hammer arresters shall be all copper, piston type. Stainless steel bellow type is not acceptable.

8. EXECUTION

8.1 Piping Application.

A. Water piping shall be hard copper tube, type K, ASTM B88.
B. Fittings: Up to NPS 2 with system temperature up to 140°F, except underground, shall be wrought-copper solder-joint fittings, 95-5 tin-antimony, lead-free soldered.
C. Fittings: Up to NPS 2 with system temperature above 140°F and all underground piping, shall be wrought-copper solder-joint fittings, lead-free Sil-Fos brazed.

1. Cut square, remove burrs and clean outside of pipe and inside of female fittings and to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing.
2. All soldered or brazed joints shall be made by a brazer currently certified for the size of pipe being brazed or for minimum 1-1/2-inch pipe. Certifying individual or agency shall in turn be certified by AWS.
3. All soldered or brazed joints shall be acceptable only if 100% full joint penetration of the soldering or brazing alloy is achieved.
4. All soldered or brazed joints shall comply with Section IX of ASME Boiler and Pressure Vessel Code.

D. Fittings: NPS 3 and larger shall be cast-bronze or wrought-copper, mechanical-grooved fittings suitable for domestic cold and hot water, rated at 300 psi.

8.2 Piping Installation.

A. Water piping shall not be installed below any on-grade interior concrete floor slab; service pipe must rise to be above grade at the perimeter of the building. Island type fixtures will be supplied from overhead if possible, or through piping sleeves below the slab.
B. A multiple pressure reducing valve station and water meter are required on all building water services (excluding fire protection). The campus standard is 2 inch and smaller Wilkins all brass body with union FNPT inlet connection. A union shall be located on the discharge side of each valve in a vertical position. 2½” and larger shall be Clay-Val Pilot Operated Series 90. No by-pass shall be indicated. Campus water main supply pressure is 140 to 160 PSI. The water meter shall be cast bronze body, reading in cubic feet, and located on the low pressure side of the buildings PRV station.
C. A backflow device is not required for the domestic cold water building service, unless required by code.
D. No equipment shall use domestic or industrial cold water for cooling when the water goes to drain; water may be used for cooling if it can be reused for other systems after cooling. Equipment cooling may be through a closed loop system.

E. Industrial water shall be supplied from the domestic water service through a reduced pressure type backflow preventor, which can be fully serviced without removing it from the line. All backflow devices shall be located in an area that is easily accessible for maintenance, with an adjacent receptor or floor sink of sufficient size to carry the drainoff from the device.

F. Industrial hot water shall be generated in a separate heater and supplied from the industrial cold water system.

G. All domestic and industrial hot water piping shall be fully insulated and Title 24/CEC compliant. Return or circulating piping shall be sized for r a three (3) F.P.S. maximum velocity.

H. Industrial hot and/or cold water shall supply all fixtures and equipment within laboratories or used for laboratory work (hoods, sinks, washers, etc).

I. Domestic hot and/or cold water shall only supply those fixtures used for sanitary purposes and food preparation i.e. water closets, urinals, lavatory, drinking fountain, pantry sinks, service sinks, emergency equipment, etc. Locating domestic water piping in laboratory or research areas should be avoided except for eye wash fountains and emergency showers.

J. All plumbing fixtures and related equipment (flush valves) that are specified shall be designed to minimize water consumption.

K. Any equipment that requires a hot water supply shall be able to satisfactorily operate with 115F hot water. A booster heater may be required, if the 115F temperature is not sufficient and therefor the equipment shall be able to operate within those temperature conditions.

L. All domestic and laboratory hot and cold water and fire lines up stream of the double check valve shall be disinfected. Refer to disinfection section.

M. Shut-off valves shall be specified and indicated on the drawings to provide isolation for each riser, group of fixtures and branch mains.

N. Provide a "quick fill" on water make-up and an adjacent hose bib to each cooling tower and evaporative cooler.

O. Provide hose bibs on roof near mechanical equipment and building perimeter every 50 feet. Hose bibs on roof shall not be more than 50 feet from mechanical equipment.

P. Provide reduced-pressure type backflow preventer on make-up water lines to open and closed loop hydronic piping systems.

Q. As required by code, no piping shall be routed in any electrical room, vault or areas designated for electrical or communication equipment.

R. Underground wrapped piping shall require holiday test. Test shall be witnessed by the University’s Representative.

8.3 Field Quality Control.

A. Testing. The following tests by the Contractor are required for site water distribution systems.

1. All testing and chlorination of new site water mains shall be done prior to the final connection to the existing University mains.
2. Pressure test: After the pipe is laid, the joints completed and the trench partially backfilled, leaving the joints exposed for examination (center load the pipe), the newly laid pipe or any valved section of piping shall be subjected to a pressure test of 250 psi static pressure for a period of four (4) hours at the points of reading. Test shall be recorded using a contractor-furnished Bristol recording device. Start and stop test in the presence of the University’s Representative.
3. Contractor to provide adequate thrust containment during testing. A blank flange (cookie) may be installed at system POC shutoff valve.
4. Leakage test: Perform the leakage test in accordance with the requirements of American Water Works Association, Inc. (AWWA) Standard C-600.
5. Contractor shall provide “tee” fittings (not hot tap) required to introduce and flush out the disinfectant agent. Saddle valve not permitted on mains for disinfection of domestic water. A mechanical fitting in a exposed section of pipe where routine inspection for leaks shall provide as a chlorination port.

B. Disinfection of domestic water, industrial water, fire water and reclaimed water lines.

1. General: All newly installed water systems and lines shall be disinfected by a Contractor-furnished commercial water line chlorinator. The commercial chlorinator shall also take water samples for bacteriological analysis. These samples shall be submitted to a California state licensed testing laboratory by the chlorinator.

2. Incurred Costs: All expenses that may result from the disinfection and testing of water systems and lines, and the taking and analysis of water samples shall be borne by Contractor.
3. Advance Notice: Contractor shall notify University's Representative and the UCLA Office of Environment, Health and Safety (EH&S), at least 72 hours in advance of all disinfection and testing procedures. All disinfection and testing procedures shall occur in the presence of an EH&S representative. Notification shall include location, number of chlorinations and tests, day and time.
4. Labor and Materials: Contractor's chlorinator shall furnish labor, equipment, materials and transportation needed to correctly disinfect and test domestic and laboratory hot/cold water systems and fire lines and to take water samples for bacteriological analysis. This includes all items needed to facilitate the introduction of the disinfecting agent into the water systems/lines such as service cooks and valves.
5. Disinfecting Agents: Chlorine is approved for water system disinfection and may be used in gaseous or liquid form. Other types of disinfecting agents may be used only with the prior approval of University'' representative.
6. Disinfecting Procedure: The disinfection of water systems and lines shall be in accordance with the requirements of Title 22, California Code of Regulations (CCR) and the American Water Works Association (AWWA) standards. The disinfecting procedure shall include the following:

    a. Post signs on all water outlets of the system being disinfected reading "Water System Being Chlorinated – Do Not Drink" or similar warning.
    b. With system full of water and under "main" pressure, open all faucets to permit simultaneous trickle flow.
    c. Introduce the disinfectant into the system until a test of the water at each outlet shows a free chlorine residual concentration of:

        c.1. 50 parts per million (ppm). This chlorine concentration shall be held in the pipes for a 24 hour period; or
        c.2. 200 ppm. This chlorine concentration shall be held in the pipes for a 3-hour period.

    d. The test made of the water after the retention time shall indicate a chlorine residual concentration of not less than half of the original concentration. Repeat the disinfection procedure until this standard is attained.
    e. After satisfactory completion of the above test, flush out system until diethyl-p-phenylenediamine (DPD) tests at the water outlets reveal that the free chlorine residual is less than 0.5 ppm or equal to the flushing water chlorine residual.

7. Water samples for Bacteriological Analysis:

    a. Water samples for bacteriological analysis shall be collected by Contractor's chlorinator in sample bottles prepared as required by Title 22, CCR and AWWA standards. Samples shall be taken from a representative number of water outlets so as to ensure an accurate sampling of the water system/line. Water samples shall be taken in the presence of an EH&S representative (University may also collect a sample).
    b. The water samples shall be delivered by Contractor's chlorinator in a timely manner to a California state approved water analysis laboratory. The samples must test negative for coliform organisms and less than 500 for a Standard Plate Count (HPLC).
    c. If the results are positive, the above steps 6(a) through 6(f) shall be repeated. Two consecutive negative tests must be obtained prior to using the water system.

8. Final Results: Submit a copy of the laboratory analysis to the University's Representative and EH&S. If the analysis results do not meet the standards specified, the disinfecting procedure shall be repeated until the specified standards are met, at no additional cost to University. The complete procedure may take up to 4 days if negative results are obtained. This procedure will be longer if the results are positive.

221316 SANITARY WASTE AND VENT PIPING

1. GENERAL REQUIREMENTS

1.1 "Dead leg" branches on waste lines shall be cut back as close as possible to the mains or nearest active tee.

1.2 Where design and space permit, the University prefers submersible type pumps in lieu of vertical wet pit type.

2. PIPING MATERIALS

2.1. Hub-and-Spigot, Cast Iron Soil Pipe And Fittings

A. Pipe and Fittings: Service class, ASTM A74, and latest CISPI Standard 301.
B. Gasket: ASTM C 564, neoprene

2.2. Hubless, Cast-Iron Soil Pipe and Fitting

A. Pipe and Fittings: Service class, ASTM A888, and latest CISPI Standard 301.
B. Couplings: Standard shielded stainless steel couplings, ASTM C1540, CISPI 310, with ASTM C 564 rubber sleeve.
C. Couplings: Heavy duty, shielded stainless steel couplings, ASTM C1540, CISPI 310, with ASTM C 564 sleeve.
D. Couplings: Heavy duty, cast-iron couplings ASTM A48 with stainless steel bolts and ASTM C564 rubber sleeve.

2.3. Steel Pipe And Fittings

A. Steel Pipe: Galvanized steel schedule 40, ASTM A53, seamless

3. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade. Refer to Campus Site Utilities Standard for additional information.

3.2. Piping Application.

A. Gravity Sanitary Waste Pipes and Fittings: Interior pipe and fittings below floor slab on grade shall be cast iron. Pipe and joints shall be hub and spigot with neoprene gasket, and comply with the latest issue of ASTM. Standards A888 and A-74. Stainless steel couplings shall not be specified below grade. Piping above grade may use hubless stainless steel couplings.
B. All cast iron pipe shall comply with the latest issue of C.I.S.P.I. Standards 301 and 310 and be stamped with C.I.S.P.I. trademark and listed by NSF International.
C. Pressure Main Sanitary Waste Pipes and Fittings: Underground and below ground pump discharge shall be DWV copper pipe and fittings with solder joints. Hubless piping shall not be specified.

D. Pressure Main Sanitary Waste Pipes and Fittings: Above ground pump discharge piping shall be schedule 40 galvanized pipe with cast iron drainage pattern screwed or mechanical coupling fittings. Hub-less piping shall not be specified.

3.3. Piping Installation.

A. Dead leg branches on waste lines shall be cut back as close as possible to the mains.
B. Provide floor drains with trap primers in areas that are not expected to be constantly wet, such as toilet and mechanical rooms. There should be at least one 3-inch minimum size floor drain located in each mechanical room or area where wet pipes are installed. Floor sinks shall be sized to accept all indirect waste G.P.M. flow, minimum waste size should be 3-inch.
C. In addition to hangers at each fitting, horizontally run hubless cast iron piping shall be supported independent of couplings. This means that there must be a support on each side of a coupling on straight runs of pipe.
D. Support shall be indicated for each suspended cast iron trap.
E. Horizontal hubless pipe of any size, system or material utilizing a shield type joint shall be braced, where hanger rods exceed 12 inches in length. Bracing shall be installed a maximum of 40 feet on center.
F. Projects that include food preparation facilities shall include a grease interceptor within the scope of the work. Design shall comply with California Plumbing Code Appendix H. Below slab on grade waste piping in food preparation areas shall be acid resistant type (same as laboratory) extending to a point where there will be adequate dilution with the building’s sanitary drainage system.
G. Provide a separate waste and vent system serving laboratory fixtures and equipment. The symbol designation shall be Laboratory Waste (LW) and Laboratory Vent (LV). The terms Acid Waste or Acid Vent shall not be used.
H. Indirect waste receptors should be provided for all roof mounted HVAC equipment (condensate). Receptors shall be piped to the sanitary waste systems. Do not spill on to roof or run drain piping exposed on roof.
I. Laboratory waste piping on the campus has traditionally been glass above grade and duriron below grade. Stainless steel, CPVC or PVDF Plastic by Spears, “Lab-Line” or “Orion” laboratory waste pipe above grade only have been used satisfactorily in some cases, particularly for retrofit projects; however there may be issues with regard to fire hazards and from unpredictable chemicals which may be used, poor resistance to high temperatures, and fire stopping problems. If the designer recommends use of materials other than glass, this should be justified for the particular project based on analysis of the risk as well as the cost reduction. Joints in plastic systems shall be solvent cement, band or mechanical type rather than heat fusion. Fire Marshal approval is required for combustible (plastic) piping. The Fire Marshal may require insulation (wrapping) of unrated plastic piping to comply with smoke development ratings, and listed fire stops through rated walls or floors.
J. All transitions to Duriron shall be made with approved fittings, on the vertical, 6 inches above the floor.
K. The independent laboratory waste piping shall run to a sampling pit or manhole located exterior to the building. Laboratory waste and sanitary waste may combine downstream of the pit or manhole. Detail of the pit or manhole shall comply with all requirements of Los Angeles County Industrial Waste Division.
L. For drainage systems beneath building slabs, a re-test should be specified after backfill but before slab placement to assure that pipes have not been damaged during backfill or compaction.
M. As required by code, no piping shall be routed in any electrical room, vault or areas designated for electrical or communication equipment.
N. Sewage Ejectors: Where design and space permits, the University prefers submersible type sewage ejectors in lieu of vertical wet pit type.

3.4. Field Quality Control.

A. The Contractor shall be required to video tape all new sanitary sewers, storm drains and manholes at the end of the project. Taping shall be done in the presence of the University Representative and a copy of the video given to the University as part of the record drawing requirement.

221400 FACILITY STORM DRAINAGE

1. GENERAL REQUIREMENTS

1.1 Building roof drain and piping system is to be designed based on a rainfall intensity of 3-inches per hour.

2. PRODUCTS

2.1. Hub-and-Spigot, Cast Iron Soil Pipe And Fittings

A. Pipe and Fittings: Service class, ASTM A74, and latest CISPI Standard 301.
B. Gasket: ASTM C 564, neoprene

2.2. Hubless, Cast-Iron Soil Pipe and Fitting

A. Pipe and Fittings: Service class, ASTM A888, and latest CISPI Standard 301.
B. Couplings: Standard shielded stainless steel couplings, ASTM C1540, CISPI 310, with ASTM C 564 rubber sleeve.
C. Couplings: Heavy duty, shielded stainless steel couplings, ASTM C1540, CISPI 310, with ASTM C 564 sleeve.
D. Couplings: Heavy duty, cast-iron couplings ASTM A48 with stainless steel bolts and ASTM C564 rubber sleeve.

3. EXECUTION

3.5. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade. Refer to Campus Site Utilities Standard for additional information.

3.1. Piping Application.

A. Interior pipe and fittings below floor slab on grade shall be cast iron. Pipe and joints shall be hub and spigot with neoprene gasket, and comply with the latest issue of A.S.T.M. Standards A888 and A-74. Stainless steel couplings shall not be specified below grade. Piping above grade may use hubless stainless steel couplings, and comply with the latest issue of C.I.S.P.I. Standards 301 and 310 and stamped with C.I.S.P.I. trademark.

3.2. Piping Installation.

2.1. Piping shall not be encased in concrete or masonry walls or floor slabs. Taping and or foam wrapping of pipe and fittings does not constitute a code or university approved method of separation.
2.2. In addition to hangers at each fitting, horizontally run hubless cast iron piping shall be supported independent of couplings. This means that there must be a support on each side of a coupling on straight runs of pipe

2.3. As required by code, no piping shall be routed in any electrical room, vault or areas designated for electrical or communication equipment.
2.4. Sump Pumps: Where design and space permits, the University prefers submersible type pumps in lieu of vertical wet pit type

3.3. Field Quality Control.

A. The Contractor shall be required to video tape all new sanitary sewers, storm drains and manholes at the end of the project. Taping shall be done in the presence of the University Representative and a copy of the video given to the University as part of the record drawing requirement.

224000 PLUMBING FIXTURES

1. GENERAL REQUIREMENTS

2. PRODUCTS

2.1. Lavatory Faucet: Metering or sensor type faucet, 0.5 gpm, Chicago 3502 series or equal
2.2. Water Closet: Vitreous chine, ultra-low flow 1.25 gpf.
2.3. Urinal: Vitreous china, wall-hung, ultra-low flow 0.125 gpf Zurn Z5798.205 ADA compliant or equal.
2.4. Angle stop: IPS threaded inlet, quarter turn, loose key, chrome-plated all brass, lead-free, Brasscraft KT series, Chicago or equal. Threaded pipe nipple shall be I.P.S. brass or copper pipe adapter shall be sweat x MIP. Compression fittings are not permitted.
2.5. Supply Riser: Rigid, chrome-plated copper tubing, ASTM B68 with brass nuts or couplings.
2.6. Traps: L.A. pattern, chrome-plated, heavy-duty cast brass, adjustable, ground union joint elbow and cast brass slip nuts, without cleanout. Trap arm extension shall be I.P.S. threaded brass nipple. McGuire or equal.
2.7. Insulation: Pre-molded PVC covering conforming with ADA regulations. McGuire, Truebro, or equal.
2.8. Water Closet Carrier: High performance, adjustable water closet carrier, 500-lb load capacity, Zurn Z1201 and Z1202 series or equal.

3. EXECUTION

3.1 Fixture Application:

A. All plumbing fixtures shall be furnished complete with all necessary supports, hangers, trim and accessories to insure the specified installation and operation of each fixture. Trim and accessories shall include stops, supply pipes, drains, strainers, tailpieces, P-traps, escutcheons, and bolt caps. All exposed items and piping shall be chrome-plated.
B. All lavatory faucets in public restrooms shall be specified as metering or sensor type.
C. Water-less urinal is not acceptable.

2. The following text shall be included in the fixture section of the specification:

1.1 All plumbing fixtures shall be furnished complete with all necessary supports, hangers, trim and accessories to insure the specified installation and operation of each fixture. Trim and accessories shall include stops, supply pipes, drains, strainers, tailpieces, P-traps, escutcheons, and bolt caps. All exposed items and piping shall be chrome-plated.
1.2 All fixture stops shall be quarter turn, loose key, all brass with I.P.S. threaded inlet. Threaded pipe nipple shall be I.P.S. brass or copper pipe adapter shall be sweat x M.I.P. Compression fittings are not permitted. Manufacturer shall be Chicago Faucets, Brass Craft “KT” Series, or equal.
1.3 Supply pipe risers shall be rigid copper tubing ASTM B-68 with brass nuts or couplings.
1.4 All traps shall be heavy gauge, L.A. pattern, cast brass, adjustable ground union joint elbow and cast brass slip nuts. Trap arm extension shall be I.P.S. threaded brass nipple. Traps shall be certified by CSA, marked with manufacturer’s name and testing agency.
1.5 Water stops, risers and trap assembly shall be insulated with pre-molded PVC covering conforming with ADA regulations. Manufacturer shall be McGuire Prowrap, Truebro, or equal.

3. All lavatory faucets in public restrooms shall be specified as metering or sensor type. Manufacturer shall be Chicago 3502 Series, 0.5 gpm flow rate or equal.
4. In keeping with the green building policy compliance the University prefers to select ultra-low flow type vitreous china, wall hung urinal. The manufacturer and model number shall be Zurn Z5798.205 ADA compliant or equal.

224300 HEALTHCARE AND LABORATORY PLUMBING FIXTURES

1. All faucets and valves for water service shall have Monel stainless steel stems, seats, and EDPM seat washers in waterway. The faucets shall be manufactured from brass construction. Brass components, which contact water within the faucet, shall be from brass, which contains no more than 3% lead by dry weight. There shall be no operating parts made from plastic or ceramic.
2. Valves shall close with the assistance of, not against, water pressure. Stems shall have ACME thread with o-ring to keep lubricant intact and shall have FDA approved seals. Stems shall be self-contained operating cartridge that allows for repair ability.
3. All parts shall be interchangeable among all faucets and valves for water service. Handle broach on upper valve stem shall be 4 point tapered broach to prevent handle from stripping and to allow ease of handle removal. All water faucets shall meet NSF Standard 61 section 9 for drinking water faucets and shall be certified by Underwriter's Laboratory. Product cartons shall feature the UL logo signifying certification of NSF 61 section 9.
4. Valves shall be capable of being converted to self-closing and slow closing without changing faucet body. Faucets shall be Factory tested at a minimum pressure of 125 psi.
5. Gooseneck spouts shall have double o-ring and be field convertible from swing to rigid. Spout shall be able to be swing or rigid as standard without changing faucet body. Spouts shall be completely interchangeable among all faucets.
6. All faucets and valves for water service shall be ADA compliant and be by one manufacturer. A full stock of repair parts shall be maintained locally in the Los Angeles area.

224500 EMERGENCY PLUMBING FIXTURES

1. Emergency eye wash stations utilizing a spray hose, shall be furnished with a code approved backflow device. Type of device shall conform to location with respect to discharge, or release of water due to testing, pressure fluctuations, or backflow conditions. Devices which discharge water shall not be located below or within cabinets. Atmospheric vacuum breakers shall be located above the top of the cabinet.
2. Provide emergency eye wash station in mechanical rooms near the chemical water treatment equipment.
3. A separate floor drain is not required for emergency shower or eyewash.
4. The domestic water system is accepted as a tepid supply to emergency equipment.

226000 GAS AND VACUUM SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

1. The Campus Standard is hard drawn type "K" copper. Pipe shall comply to ASTM B819, be permanently color marked with manufacturers trademark and country of origin. Type "K" shall be marked in green. All joints shall be brazed. Refer to copper piping mechanical systems at front section of this standard for type of fittings and joints.

2. All outlets shall be solid brass ball valve, ADA compliant color coded handle, polished chrome finish with 3/8 NPT male thread inlet, integral check valve and removable serrated hose nozzle, working pressure of .5-125 psi. Comply with ANSI Z21.5a.
3. There shall be a shut-off valve for each system located in an accessible location in or adjacent to the cabinet with multiple system outlets.

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330000 GENERAL REQUIREMENTS

1. DOCUMENT PREPARATIONS

1.1 Legends, schedules, and notes should contain only items and information that are in the scope of work of that project.
1.2 The construction documents shall include riser-diagrams for each piping system, i.e. sanitary waste and vent, storm drain, both domestic and industrial hot/cold water, laboratory waste, medical gases, fuel gas, fire protection, chilled water system, process cooling water system, steam and space heating hot water system.
1.3 All piping shall be sized and shown on the plan of the floor level in which it will be installed.
1.4 Provide, on the plans, composite building sections, as needed to verify that all components will fit as shown on the plans. Indicate ducts, pipes, conduit, fan coils units, recessed light fixtures, structural beams soffits etc. at each critical location where such elements cross.
1.5 Location of all shutoff valves and cocks must be shown on the floor plans in addition to the riser diagrams. Valves or cocks should be shown at each branch takeoff from a main and at each group of fixtures and each piece of equipment (in addition to the fixture stops). Adequately sized access panels must be designated for all concealed valves and cocks.
1.6 Record Drawings (“as-builts”) are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and inspector should verify at each site visit that the contractor is maintaining adequate as-builts, and should obtain progress copies of the contractor’s as-builts during construction. At the completion of the project, it is too late to verify concealed work and documents are often misplaced.
1.7 Specifications shall be prepared to include only systems, items and materials that are in the scope of work for this project. Review and coordinate each specification section so there will be no contradicting information of specified items or materials.

2. DRAWINGS AND CALCULATIONS

2.1. Show all calculations on drawings: hydraulic water calculations and pipe sizes, sump and sewage ejector pump size calculations.
2.2. 1/4 inch scale or larger equipment, restrooms and shower rooms showing each major piece of plumbing equipment and fixtures.
2.3. Show pipe riser diagrams complete with pipes sizes and appropriate unit values: water fixture units, drainage fixture units, GPM, CFH, etc.
2.4. All equipment schedules shall be provided on the plans, not on the specifications. The plans become the campus’ permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.
2.5. Specification title and numbering shall be based on Master Format (version as approved by University’s representative) and content shall be in CSI 3-part format (Part 1-General, Part 2-Product, and Part 3-Execution).
2.6. Plumbing specification sections shall have separate sections, independent of mechanical and fire protection specification sections.
2.7. Plumbing details to be included in the plans (when applicable):

A. Equipment and piping supports including seismic bracing installed inside and outside the building. Include wind load for exterior installation.
B. Vibration isolation and seismic restraints
C. Pump piping detail
D. Equipment drains. Provide hose end connections to all drain valves. Drain valves above finished ceiling shall be provided with chained cap.
E. Concealed or exposed pipe penetrations through walls, floors and roof. Coordinate with the architect’s drawing.
F. Underground storage tank
G. Equipment housekeeping pad

2.8. Nomenclatures.

A.	CHW	Chilled Water
B.	CHWR	Chilled Water Return
C.	CHWS	Chilled Water Supply
D.	CR	Steam Condensate Return
E.	FH	Fire Hydrant
F.	FW	Fire Water
G.	HPS	High Pressure Steam
H.	LPS	Low Pressure Steam
I.	NG	Natural Gas
J.	SD	Storm Drain
K.	SDMH	Storm Drain Manhole
L.	SS	Sanitary Sewer
M.	SSMH	Sanitary Sewer Manhole
N.	W	Domestic Water

3. GREEN BUILDING POLICY COMPLIANCE

3.1. All projects must comply with the UCLA Campus Green Building Baseline Standard and must meet the UC-equivalent of the USGBC “LEED Silver” with a target of Gold. A copy of the latest baseline standard should be obtained by the designer. Some of the baseline requirements that have particular MEP impact include:

3.1.1 Water efficiency and conservation in compliance with CalGreen.

3.2. In addition to the baseline requirements, each project must consider the additional USGBC LEED criteria that may be feasible to attain a minimum LEED “certified” rating for the project.

331000 WATER UTILITIES

2. GENERAL REQUIREMENTS

1.1 Domestic and fire protection water for all projects located on both the main campus and the southwest campus is obtained from the campus water distribution system, not directly from LADWP. For these projects, there should be no reference in the construction documents to an outside utility company. The project engineer should contact UCLA Capital Programs’ Engineer, not DWP, for location, size, availability, and pressure of campus mains.

1.2 Domestic water service connection into a campus water main shall have a full size (main) shut-off valve on each side of the project service tee and a shut-off valve on the service. These three (3) valves shall be flanged to the tee. Where a single service valve is required, it shall be flanged by MJ, bolted to a flanged tee. There shall be no hot tapping into campus water mains. All shutdowns of campus mains shall be done by Facilities Management staff. A backflow device is not required for a domestic water service.

1.3 Fire sprinkler service connection into a campus water main shall have a full size (main) shut-off valve flanged on each side of the project service tee, with no valve on the fire service.

1.4 The designer must consider the impact of connections to general campus utilities and existing building systems and provide instructions to maintain service continuity and limit shutdown duration. In most cases, the actual connection to the existing Campus water main will be made by campus personnel. Coordinate the responsibility for making the connection with the University.

1.5 Location of hydrant(s) shall be coordinated and approved by the Campus Fire Marshal and coordinated with Campus Utility drawings.

1.6 Provide meters for domestic, industrial and irrigation water lines. Water meter requirements are described in plumbing specification sections. Water line to fire protection systems is not required to be metered.

3. PRODUCTS

2.1 Piping. Cement-lined Class 350 ductile iron pipe and compact pattern AWWA C-153 fittings should be specified for any domestic or fire service water piping below grade (3-inch and larger) with Mechanical or Tyton type joints. Sizes 2 ½-inches and smaller shall be type “K” hard drawn copper pipe with brazed joints. Copper pipe shall be wrapped (refer to section 15050 for pipe wrapping.) Ductile iron pipe shall be encased in Polyethylene per ANSI/AWWA C105/A21.5.

2.2 Valves.

2.3 Fire Hydrant. Fire hydrants shall have a 6-inch inlet connection to the main and shall have one 2-1/2 inch hose connection and one 4-inch pumper connection. Threads shall be National Hose Thread standard. The hydrants shall be James Jones Co. Model J3700, all bronze, to match existing campus hydrants, and shall conform to AWWA C-502. The hydrant bury shall be one piece ductile iron. Paint hydrants one coat of industrial exterior primer paint and two finishing coats of industrial exterior OSHA yellow enamel paint to match the color of existing campus hydrants. Hydrants shall have 6-hole flange and a 1-1/8 inch operating nut. There shall be a shut-off valve indicated between 5 and 15 feet from the hydrant.

4. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

3.2. Piping Application.

A. Piping for landscape irrigation between the campus main and the irrigation backflow – P.R.V. Station shall be the same material as water/fire mains.

B.

3.3. Piping Installation.

A. Only concrete thrust blocks bearing on undisturbed soil shall be used for thrust containment on all below-grade water lines (Domestic and Fire protection). Retainer glands shall be noted as not acceptable. Minimum size ¾ inch tie rods may be used if first approved by the University’s Representative.

B. All tie-rods, clamps, brackets or other below-grade supports or restraining devices shall be galvanized and also coated with heavy-duty bitumastic material. Submit coating material for approval by University representative.

C. A full size flanged 3-valve cluster shall be indicated at all domestic and combined water main interconnection points. A valve on a dedicated fire service should not be indicated. Installation of each valve should be detailed to include two (2) #6 rebar, over the flanged tee (not the valve) and imbedded in 24” x 24” x 18” thick concrete anchor base.

D. Valves shall be specified as : A.W.W.A. cast iron body, resilient seat, non-rising stem, 200 PSI rated working pressure.

E. Below-grade piping shall not be supported directly on backfilled soil compacted or not. Structural supports shall be provided if piping is not installed on undisturbed soil.

F. The drawings shall indicate that any existing water piping below grade that is to be abandoned or removed shall be capped, plugged or flanged at the shut-off valve that controls that line.

G. Dead leg branches on water lines shall be cut back as close as possible to the mains.

3.4. Field Quality Control.

A. Testing. The following tests by the Contractor are required for site water distribution systems.

1. All testing and chlorination of new site water mains shall be done prior to the final connection to the existing University mains.

2. Pressure test: After the pipe is laid, the joints completed and the trench partially backfilled, leaving the joints exposed for examination (center load the pipe), the newly laid pipe or any valved section of piping shall be subjected to a pressure test of 250 psi static pressure for a period of four (4) hours at the points of reading. Test shall be recorded using a contractor-furnished Bristol recording device. Start and stop test in the presence of the University's Representative.
3. Contractor to provide adequate thrust containment during testing. A blank flange (cookie) may be installed at system POC shutoff valve.
4. Leakage test: Perform the leakage test in accordance with the requirements of American Water Works Association, Inc. (AWWA) Standard C-600.
5. Contractor shall provide "tee" fittings (not hot tap) required to introduce and flush out the disinfectant agent.

B. Disinfection of domestic water, industrial water and fire lines.

1. General: All newly installed water systems and lines shall be disinfected by a Contractor-furnished commercial water line chlorinator. The commercial chlorinator shall also take water samples for bacteriological analysis. These samples shall be submitted to a California state licensed testing laboratory by the chlorinator.
2. Incurred Costs: All expenses that may result from the disinfection and testing of water systems and lines, and the taking and analysis of water samples shall be borne by Contractor.
3. Advance Notice: Contractor shall notify University's Representative and the UCLA Office of Environment, Health and Safety (EH&S), at least 72 hours in advance of all disinfection and testing procedures. All disinfection and testing procedures shall occur in the presence of an EH&S representative. Notification shall include location, number of chlorinations and tests, day and time.
4. Labor and Materials: Contractor's chlorinator shall furnish labor, equipment, materials and transportation needed to correctly disinfect and test domestic and laboratory hot/cold water systems and fire lines and to take water samples for bacteriological analysis. This includes all items needed to facilitate the introduction of the disinfecting agent into the water systems/lines such as service cooks and valves.
5. Disinfecting Agents: Chlorine is approved for water system disinfection and may be used in gaseous or liquid form. Other types of disinfecting agents may be used only with the prior approval of University'' representative.
6. Disinfecting Procedure: The disinfection of water systems and lines shall be in accordance with the requirements of Title 22, California Code of Regulations (CCR) and the American Water Works Association (AWWA) standards. The disinfecting procedure shall include the following:

   a. Post signs on all water outlets of the system being disinfected reading "Water System Being Chlorinated – Do Not Drink" or similar warning.
   b. With system full of water and under "main" pressure, open all faucets to permit simultaneous trickle flow.
   c. Introduce the disinfectant into the system until a test of the water at each outlet shows a free chlorine residual concentration of:

      c.1. 50 parts per million (ppm). This chlorine concentration shall be held in the pipes for a 24 hour period; or
      c.2. 200 ppm. This chlorine concentration shall be held in the pipes for a 3-hour period.

   d. The test made of the water after the retention time shall indicate a chlorine residual concentration of not less than half of the original concentration. Repeat the disinfection procedure until this standard is attained.
   e. After satisfactory completion of the above test, flush out system until diethyl-p-phenylenediamine (DPD) tests at the water outlets reveal that the free chlorine residual is less than 0.5 ppm or equal to the flushing water chlorine residual.

7. Water samples for Bacteriological Analysis:

   a. Water samples for bacteriological analysis shall be collected by Contractor's chlorinator in sample bottles prepared as required by Title 22, CCR and AWWA standards. Samples shall be taken from a representative number of water outlets so as to ensure an accurate sampling of the water system/line. Water samples shall be taken in the presence of an EH&S representative (University may also collect a sample).
   b. The water samples shall be delivered by Contractor's chlorinator in a timely manner to a California state approved water analysis laboratory. The samples must test negative for coliform organisms and less than 500 for a Standard Plate Count (HPLC).
   c. If the results are positive, the above steps 6(a) through 6(f) shall be repeated. Two consecutive negative tests must be obtained prior to using the water system.

8. Final Results: Submit a copy of the laboratory analysis to the University's Representative and EH&S. If the analysis results do not meet the standards specified, the disinfecting procedure shall be repeated until the specified standards are met, at no additional cost to University. The complete procedure may take up to 4 days if negative results are obtained. This procedure will be longer if the results are positive.

333000 SANITARY SEWERAGE UTILITIES

1. GENERAL REQUIREMENTS

2. PRODUCTS

3. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

3.2. Piping Application.

A. For gravity pipe sizes 4-inches thru 12-inches, the campus standard is Heavy Wall PVC SDR.26 ASTM D3034 pipe and fittings with Bell and Spigot gasket joints. It should be specified that the pipe and fittings shall be manufactured by the same company. The installation of the pipe and fittings shall be in strict accordance with the manufactures printed installation guide and instructions. Testing of pipe and fitting joints shall be in accordance to ASTM D3212.

3.3. Piping Installation.

A. Dead leg branches on waste lines shall be cut back as close as possible to the mains.
B. Sanitary Sewer and Storm Drain PVC pipe shall be specified with an approved buried label tape and metal tracer wire.

3.4. Field Quality Control.

A. The Contractor shall be required to video tape all new sanitary sewers, storm drains and manholes at the end of the project. Taping shall be done in the presence of the University Representative and a copy of the video given to the University as part of the record drawing requirement.

334000 STORM DRAINAGE UTILITIES

1. GENERAL REQUIREMENTS

2. PRODUCTS

3. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

3.2. Piping Application.

A. For gravity pipe sizes 4-inches thru 12-inches, the campus standard is Heavy Wall PVC SDR.26 ASTM D3034 pipe and fittings with Bell and Spigot gasket joints. It should be specified that the pipe and fittings shall be manufactured by the same company. The installation of the pipe and fittings shall be in strict accordance with the manufactures printed installation guide and instructions. Testing of pipe and fitting joints shall be in accordance to ASTM D3212.

3.3. Piping Installation.

A. Sanitary Sewer and Storm Drain PVC pipe shall be specified with an approved buried label tape and metal tracer wire.

3.4. Field Quality Control.

A. The Contractor shall be required to video tape all new sanitary sewers, storm drains and manholes at the end of the project. Taping shall be done in the presence of the University Representative and a copy of the video given to the University as part of the record drawing requirement.

335000 NATURAL GAS UTILITIES

1. Piping below grade shall be schedule 40 ASTM A-53 steel with welded fittings and joints
2. Underground steel piping buried directly in the soil shall be factory coated with asphalt, wrapped with asphalt saturated felt, finished with a coat of asphalt and wrapped with an overwrap of 50 lb. Kraft paper.
3. Factory applied epoxy coated pipe may be used when first approved by the University Representative.
4. Field made joints shall be wrapped with two layers half-lapped of 20 mil PVC tape to a total thickness of 40 mils. Tape shall be applied only after the complete joint is heated to ensure a complete bonding of the tape to the pipe. A finish coat of approved bitumastic shall be applied.
5. Field wrapping of pipe is not acceptable.
6. Require a holiday test for all underground wrapped pipes. Test to be witnessed by the University's Representative.

336000 HYDRONIC UTILITIES

1. GENERAL REQUIREMENTS

1.1. Building chilled water and heating hot water lines shall be metered. When building steam line is provided with meter then heating hot water line shall not be metered. Meters shall be shall be ultrasonic type, Flexim ADM7407 or equal. Indicate size of meter, maximum and minimum flow, and pressure and temperature sensors on mechanical drawings. Meters shall be sized so minimum flow (or 10% of maximum flow, whichever is lower) is within its range. Meters shall be connected to BAS.

1.2. Provide dielectric flanges on supply and return lines at the entrance to the building to isolate from buried utility lines.

2. PRODUCTS

2.1. Pre-insulated Piping System.

A. Factory pre-fabricated and pre-insulated piping system as fabricated by following manufacturers or equal.

1. Perma-Pipe/Ric Wil, Xtru Therm Gold
2. Rovanco HDPE Jacketed Pipe System with epoxy coated steel pipe

B. All straight sections shall be factory pre-insulated and jacketed. Design and manufacture shall be per ANSI B31.1 latest edition.

C. Service pipe shall be Standard Weight, ASTM A53, Grade B, seamless, carbon steel. All joints shall be butt-welded for sizes 2-1/2" and greater, and socket welded for 2" and below. The exterior of steel pipes and fittings surface shall be abrasive blast-cleaned to a minimum of a near white surface, profile a minimum of 1.5 mil peak to valley range. After blasting, the steel service pipes and fittings shall be coated with epoxy to a minimum thickness of 8-12 mil. Coated fittings and pipes shall be factory holiday tested at 1000 volts to ensure a void free coating. Certified test reports shall be submitted to the University's Representative.

D. Service pipe insulation shall be polyurethane foam 2" thick and 2 pcf density. The insulation shall completely fill the annular space between the service pipe and the jacket.

E. The outer protective insulation jacket shall be high density polyethylene (HDPE) in accordance with ASTM D1248, Type 3, and Class C, Minimum thickness of 0.08". End seals shall be factory installed on all exposed insulation on pipe prior to shipment.

F. All fittings (elbows, tees, reducers, anchors, etc.) shall be factory pre-fabricated and pre-insulated. Straight tangent lengths shall be factory welded to all ends so that all field joints are at the straight section of pipes. Field insulation of fittings is not acceptable.

2.2. Dielectric Flange Kit. Flange isolation kit complete with neoprene-faced phenolic full-faced gasket, double phenolic washers, double steel washers, and phenolic sleeves, ANSI rated 150 psi, 100°F maximum temperature.

2.3. Valves.

3. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

3.2. Piping Application

3.3. Piping Installation

A. Slope all piping to allow venting and draining to building or vault. If this is not possible due to job condition, provide vents in concrete boxes on grade. Concrete box locations shall be approved by the University's Representative.

B. No pipe shall be encased, embedded or cast into the building's concrete footings, floor slabs, walls or other structure. Taping and/or foam wrapping of pipe and fittings does not constitute a code or University approved method of separation.

C. All below grade piping systems shall be identified with acid and alkali resistant polyethylene warning tape 6 inch wide 4 mils thick. Tape shall indicate the name of the utility system. Tape for plastic piping shall have approved tracer wire. Tape shall be installed 12 inches above piping.

3.4. Field Quality Control

A. Require a certification by the manufacturer that the installation is in conformance with the manufacturer recommendations.
B. Hydrostatically field test pipe to 150 psig or 1.5 times the design pressures whichever is greater before insulating the field joints. All insulation and jacketing material for field joints shall be furnished by the system manufacturer.

336300 STEAM UTILITIES

1. GENERAL REQUIREMENTS

1.1. Direct buried factory pre-fabricated and pre-insulated piping system. Piping and insulation shall be designed for 125 psig and 490°F superheated steam.
1.2. Building steam line shall be metered. Meter shall be vortex shedding type, Foxboro 84F or equal. Indicate size of meter, maximum and minimum flow, and pressure and temperature sensors on mechanical drawings. Meters shall be sized so minimum flow (or 10% of maximum flow, whichever is lower) is within its range. Meter shall be connected to BAS.
1.3. Provide dielectric flanges on steam and condensate return lines at the entrance to the building to isolate from buried utility lines.

2. PRODUCTS

2.1 Pre-insulated Piping System.

A. Factory pre-fabricated and pre-insulated piping system as fabricated by following manufacturers or equal.

1. Perma-Pipe, Multi-Therm 500 Gold
2. Rovanco Insul 800 with epoxy coated outer conduit

B. Carrier Pipe:

1. Steam Piping: Steel pipe ASTM A53 Grade B, seamless, Standard Weight, black with butt weld ends.
2. Steam Fittings: Std. weight carbon steel, butt weld, ASTM A234, Class 300 with butt welded joints per AWS D1.1.
3. Condensate Pipe: Extra heavy carbon steel pipe, ASTM A53 Grade B, seamless, black with butt weld ends.
4. Condensate Fittings: Extra heavy weight carbon steel, butt weld, ASTM A234, Class 300 with butt weld joints per AWS D1.1.
5. Insulation: Factory installed mineral wool on pipes and fittings.

C. Conduit: 10-gauge steel welded casing for conduit up to 26” in diameter, 6-gauge for 28” – 36”. Size conduit to accommodate the insulated carrier pipe and a 1-inch air space between the mineral wool and the interior of the conduit.
D. Insulation: Factory installed polyurethane 2 lb/cu. ft. 1” thick.
E. Outer Jacket: Factory installed high density polyethylene with a minimum thickness of 0.100 inch.
F. Steel carrier pipe and conduit exterior shall be abrasive blast clean to a minimum of a near white surface, SSPC-SP10-63T. Apply epoxy coating to a thickness of 8-12 mil. Coated pipes, fittings and conduit shall be factory holiday tested at 1000 volts to ensure a void free coating.

3. EXECUTION

3.1. Earthwork. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

3.2. Piping Application

3.3. Piping Installation

A. Slope all piping to allow venting and draining to building or vault. If this is not possible due to job condition, provide vents in concrete boxes on grade. Concrete box locations shall be approved by the University's Representative.

B. No pipe shall be encased, embedded or cast into the building's concrete footings, floor slabs, walls or other structure. Taping and/or foam wrapping of pipe and fittings does not constitute a code or University approved method of separation.

C. All below grade piping systems shall be identified with acid and alkali resistant polyethylene warning tape 6 inch wide 4 mils thick. Tape shall indicate the name of the utility system. Tape for plastic piping shall have approved tracer wire. Tape shall be installed 12 inches above piping.

3.4. Field Quality Control

A. Require a certification by the manufacturer that the installation is in conformance with the manufacturer recommendations.

B. Hydrostatically field test pipe to 150 psig or 1.5 times the design pressures whichever is greater before insulating the field joints. All insulation and jacketing material for field joints shall be furnished by the system manufacturer.

336400 CAMPUS AIR SUPPLY

GENERAL REQUIREMENTS

1.0 The Campus air supply is rated at 90 psi. In the event that a greater pressure is required, the building shall have its own air compressor.

23 00 00
HVAC STANDARDS
2017

23 00 00 HVAC

230000 GENERAL REQUIREMENTS

1. DOCUMENT PREPARATIONS

1.1 Legends, schedules, and notes should contain only items and information that are in the scope of work of that project. Refer to appendix C for additional requirements and coordination checks.
1.2 The construction documents shall include riser-diagrams for each piping system, i.e. chilled water system, process cooling water system, steam and space heating hot water system.
1.3 All piping shall be sized and shown on the plan of the floor level in which it will be installed.
1.4 Provide, on the plans, composite building sections, as needed to verify that all components will fit as shown on the plans. Indicate ducts, pipes, conduit, fan coils units, recessed light fixtures, structural beams soffits etc. at each critical location where such elements cross.
1.5 Adequately sized access panels must be designated for all concealed valves, electrical devices in support of HVAC equipment and for the largest replaceable device serving any HVAC equipment.
1.6 Record Drawings ("as-builts") are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and inspector should verify at each site visit that the contractor is maintaining adequate as-builts, and should obtain progress copies of the contractor's as-builts during construction. At the completion of the project, it is too late to verify concealed work and documents are often misplaced.
1.7 Specifications shall be prepared to include only systems, items and materials that are in the scope of work for this project. Review and coordinate each specification section so there will be no contradicting information of specified items or materials. No work shall be called out in a manner which is not contractually enforceable.
1.8 A brief description shall be added to the front sheet outlining the scope of work.
1.9 Include all applicable codes, seismic codes and Cal-Green notes when applicable.

2. BASIS OF DESIGN CRITERIA

2.1 Climate design conditions:

A. UCLA is located in California Climate Zone 9, 34.1 Lat., Elev. 430 Ft.
B. ASHRAE (design at 0.4%) for offices, classrooms, residential and other similar buildings.

5.1. Summer: 86°F dry bulb, 69°F wet bulb, 20°F outdoor daily range.
5.2. Winter: 39°F dry bulb, 1509 heating degree days

C. For laboratories, healthcare and other similar buildings.

1. Summer: 92°F dry bulb, 69°F wet bulb, 20°F outdoor daily range
2. Winter: 38°F dry bulb

2.2 Air side:

A. Sizing: grilles, louver, ducts, flex and door gap

Item	Criteria	Notes
Return Air Grille(plenum)	350 FPM max	
Outside Air Louver	400 FPM max	
Diffuser(neck) or Supply Grille(plenum)	500 FPM max	
Door Louver	200 FPM max	
Exhaust Louver(neck or plenum)	500 FPM max	
Transfer Air Duct/Sound Boot	350 FPM max	With acoustic liner. Use ½ inch min. wsm at duct termination.
High Pressure Duct	2200 FPM max or 0.1 friction/100 feet	Use the more stringent of the two.
Medium Pressure Duct	1600 FPM max or 0.08 friction/100 feet	Use the more stringent of the two.
Low Pressure Duct	500 FPM max or 0.05 friction/100 feet	Use the more stringent of the two.
Door under-cut gap	¾” max(80 cfm), ½” (50 cfm)	
Flex Connection	Equal to Grille/Diffuser neck size	7 feet max length of flex.
VAV/CAV inlet length	3-10 feet max Straight duct length	Duct diameter equal to inlet size only for inlet duct. Transition as required prior to duct inlet.
Run-out duct connection to plenum OR main duct.	One(1) duct diameter between taps	When connecting to a plenum section or main duct. Connections shall have a staggered tap arrangement for multiple taps of opposite sides.

2.3 Hydronic(Heating/Cooling):

A.

Item	Criteria	Notes
Piping	3 ft. WC. per 100 ft.	Closed Loop

Valve pressure loss(PIC)	5 ft. max.	Closed Loop
HHW Coils and piping	10 ft. max. ¾ min diameter.	Closed Loop. Flex connections rated at 200 Deg F service use minimum
CHW Coils and piping	10 ft. max. ¾ min diameter.	Closed Loop
Steam flex connector	Rated for 500 deg F service use	

2.2 Consult with UCLA Campus Engineering for off-campus locations.

2.3 For 100% outside air handling unit and chilled beam system, size the system based on 92°F dry bulb, 69°F wet bulb.

2.4 For cooling tower performance, use ambient wet bulb of 74°F.

2.5 Campus chilled water supply of 46°F. Design chilled water system with delta T of 16F.

2.6 Campus high pressure steam is superheated at 490°F at 125 psig, coordinate with Facilities for momentary steam temperatures and pressures that may occur. Valves shall be class 300.

2.7 Special Rooms:

A. Provide air conditioning for electric elevator machine rooms and rooms with heat producing equipment such as transformers to maintain 85 F maximum or lower as required by the elevator manufacturer.

B. Provide mechanical exhaust for electrical and mechanical rooms to maintain required environmental conditions. When exhaust is used, outside air shall be filtered. If exhaust cannot provide required conditions, and with permission from University's Representative, provide a dedicated CHW cooling unit to maintain 85 F maximum or lower.

C. Where cooling is required, rooms can be provided with hydronic FCUs connected to building chilled water system. Depending on the cooling load, up to 3-ton, consider specifying high-wall mounted ductless FCU Multiaqua MHWW series or equal when outside air is not required or other means of outside air has been provided; up to 5-ton, consider Multiaqua CFFWA series or equal. Wired only thermostats shall be used.

D. Where back-up unit is required, consider having two hydronic FCUs, both connected to the same building chilled water system. Split DX units or water-cooled condensing units should not be considered, unless coordinated with Facilities Management. Provide wired thermostats when using FCU.

E. In laboratories, supply and exhaust fans should be designed for operation 24 hours per day, 365 days per year.

F. Provide 24 hour cooling in Data, Electrical, Telephone and Fiber Optic rooms. Verify requirements with UCLA Information Technology Services. Standalone equipment utilizing Campus produced chilled water shall be used for both primary and redundant back-up cooling. Equipment shall be sized to accommodate future load increase of 50 to 100%.

2.8 Operable Windows: Use of operable windows in appropriate spaces is encouraged by the campus, particularly in offices, small classrooms and conference rooms, but not in laboratories where pressure control or isolation is important. Where operable windows are proposed, the HVAC system should be designed to accommodate them. Fan coil units for each space, or other local controls may be suitable to allow the occupant to control the temperature without adversely affecting other spaces. VAV reheat with individual zoning may also be acceptable if adequate local controls are provided. Research by the campus engineer's office has shown that with the mild climate on the campus, most occupants prefer to leave their windows open and the mechanical systems off most of the time, using heating and cooling only during extreme conditions if it is within the control of the occupant to do so. The options should be discussed and coordinated with campus staff during preliminary design.

2.9 Relief Air and Make-up Air Provisions: Where mechanical systems are required to operate in the event of emergency, design of mechanical systems shall include provisions to relief pressurized rooms and/or supply make-up air to exhausted rooms. In lieu of mechanical systems, natural ventilation maybe used for relief and/or make-up air provided it is approved by Fire Marshal.

2.10 Laboratory Equipment Cooling System: Use of once-through city water for laboratory cooling is prohibited. Laboratory systems where equipment or experiment cooling may be required shall include piped chilled water from an isolated plate-frame heat exchanger for use by the researchers. Design of laboratory cooling water systems requires close attention to the types of devices which the researchers will use. Chemical treatment, cleanliness and pressure control may be critical. Appropriate provisions for system flushing must be included, including bypasses at the end of dead legs (including connection points when not in use). The designer should obtain detailed requirements from the end users for supply and return pressures, flow rates, temperature range, and filtration and should consult with the campus engineering staff regarding proposed system designs. A typical user requirement is filtered water to below 25 microns particulate size with pH and conductivity equal to tap water

2.11 Equipment Access: All equipment shall be accessible for maintenance. Equipment installed above ceiling (such as fans, fan coil units, filters, etc.) shall be provided with adequately sized access panels or hatches. Piping, ductwork and conduits shall not interfere with access. Suitable service platforms or catwalks shall be provided for on-going preventive maintenance and repair service. The access panel shall be sized for the removal of the largest serviceable component with a clear service area from the unit ro component and extending down to the floor(desks, shelves, appliances are considered obstacles to servicing equipment above).

2.12 Machinery Rooms: In addition to building codes, follow ASHRAE Standard 15-2013/2007 “Safety Code for Mechanical Refrigeration” for design of mechanical machinery rooms where refrigeration equipment are to be installed. In case of conflict between codes and ASHRAE Standards, the most stringent shall be used.

2.13 Pressure Vessels: All pressure vessels shall be ASME constructed and stamped.

2.14 Refrigerants: Specify ozone friendly refrigerant similar to R410A. Use of HCFC R-22 refrigerant is prohibited.

2.15 Motors: Use high efficiency type motors for fans, pumps, compressors, etc.: General Electrical "Energy Saver", Westinghouse "TEC II", U.S. Motors "XB", Baldor "Super E" or equal. For motors used in conjunction with Variable Frequency Drives, provide motors compatible with drive unit. Additionally, any motor controlled by a variable frequency drive shall incorporate a design to prevent arcing through the motor bearings: Insulated bearings grounded motor shafts or add-on devices such as those manufactured by Shaft Grounding Systems or equal (no known equal). AHU and pump motors serving research, health care facilities or any campus building requiring 24/7 operations are to be provided with VFD’s with by-pass. Provide soft-start for motors 60 HP and larger.

3. DRAWINGS AND CALCULATIONS

3.1. Required Title 24 Energy Compliance documentation: signed in both plans and report.

3.2. Submit fire and life safety analysis by Code Consultant as required by Campus Fire Marshal. When smoke control is required, report shall include calculations and/or simulations showing various fire scenarios and associated supply and exhaust air flows in lobbies, corridors, stairwells, etc. Analysis shall be submitted and approved by Campus Fire Marshal prior to the design of mechanical systems or issuing of bid documents, whichever occurs first. Mechanical Engineers shall design the smoke control systems based on this report. Any changes to smoke control systems that are not in accordance with the approved report shall be verified by calculations by the same Code Consultant. Report shall be revised accordingly and resubmitted for record.

3.3. Separate ductwork and piping floor plans in 1/8 scale (minimum) drawings. Ductwork floor plans shall show all supply, return, exhaust and transfer air devices, all dampers (manual balancing, motorized, fire and smoke) duct smoke detectors, terminal air units, fan coil units, and all access panels. Duct sizes and CFM shall be indicated. All equipment shall be tag, including

3.4. Piping floor plans shall still show ductwork in gray tone (shaded similar to background) for reference and coordination.

3.5. In small projects, where the number of terminal air units and/or FCUs is less than 10, ductworks and piping plans may be combined in same drawings provided it is in 1/4 scale (minimum). Pipe sizes may also be indicated on floor plans.

3.6. HVAC (Bases of Design)
Reports
Submit:
a. HVAC systems and equipment for each building.
b. Envelope and glazing properties identifying further energy use reductions necessary to achieve the mandated energy consumption targets.
c. Mechanical sequences of operation and the operational parameters represented by the energy model.

d. Summary of the life cycle cost analysis with specific recommendations.

Calculations
Submit:
a. Updated energy analysis including UCLA-mandated energy conservation measures. Optimize envelope and glazing properties and identify further energy-use reductions necessary to achieve the federally mandated energy consumption target. State all occupancy, regulated and unregulated load assumptions, and schedule parameters used in the analysis. State all modeled system operational characteristics. Supply air fan selection shall mandate multiple fan selections in which single and/or multiple plenum fans are compared with the conventional housed fans. Computerized selections showing project-specific sound power levels, power input, and overall dimensions shall be submitted for UCLA review and approval.
b. Complete life cycle cost analysis with specific recommendations and full back-up data. State the heating and cooling capacities of each functional area used in the life cycle cost analysis. State the block cooling and heating loads for each new and/or existing building.

Drawings
Submit:
a. Air and water flow diagrams for the existing systems and proposed options.
b. Tentative locations and sizes of all mechanical equipment rooms and principal vertical shafts.
c. Block layout of major pieces of equipment in each mechanical equipment room.
d. Outside air, exhaust air, and relief air louvers. Resolve various items affecting louver location, considering other factors such as visibility, historical considerations, wind direction, noise, physical security, hurricane and storms, and health hazard odors caused by short circuiting of air from emergency generators and truck waiting areas to intake.
e. Humidity control strategy.

HISTORIC PRESERVATION
Reports
b. Notify UCLA Project Managers immediately upon discovery of any historical or archeological data that may warrant investigation.

Calculations and Reports(**100**%DD Level):

Submit the updated BOD report. Coordinate with the Architect and equipment specialists to accommodate equipment, specified for the project. Present all UCLA-approved deviations from HVAC design criteria.

Calculations
Submit:
A. Final version of the room-by-room heating and cooling load calculations:
- Ensure compliance with UCLA HVAC design requirements. These calculations shall be accompanied with the architectural drawings correlating each HVAC zone boundary and the floor area, and a room schedule correlating architectural room numbers and abbreviated/coded room numbers used with computer input data sheets.
- Show derivation of all U-factors for building elements based on the actual building construction and published window data. The accuracy and the level of detail of the calculations shall be consistent with the development of the architectural drawings and include calculations for:
  - Peak zone-by-zone heating and cooling loads
  - Building block heating and cooling loads
  - Psychrometric chart for each air-handling unit showing cooling and heating coil condition and computation of humidification loads
  - Coil entering and leaving conditions and fan-motor heat gains for supply and return air fans
  - Room-by-room air balance sheet for each air-handling unit showing supply, return, exhaust, make-up, and transfer air quantities with the required air balance, that is, positive, negative, or zero with respect to adjoining spaces
  - Indoor and outdoor design temperatures

B. Excel spreadsheet for each air-handling system. Provide the details of supply, return, exhaust, make-up, and relief air, for each room. In addition, for each room provide area, height, volume, value of one air change per hour, actual calculated air changes per hour, required minimum air changes per hour and a spreadsheet with all heat producing equipment for kitchens.

Calculations and Reports(**100**%CD Level):

a. Submit the updated narrative BOD report including an updated energy modeling report and any comments from previous reviews by UCLA. State that the energy model represents the operational parameters of all designed systems and uses actual equipment performance curves from the design selections (mechanical, plumbing, and lighting). Discuss any adjustments and their effects from the previous submittal.
b. Submit complete and final energy and engineering calculations of all systems. In addition to room-by room heating and cooling calculations. Submit each type of calculation, tabulated and indexed, a separate package to include the following:
c. Final selection of all pumps with the pump head calculations based on the actual piping layout and takeoffs, and pressure drop through the equipment selected for the systems.
d. Final selection of all fans with the fan static pressure calculations based on the actual duct layouts and takeoffs, and static pressure drop through the equipment for the systems. (Detailed calculations are required even if variable speed drives are used.)
e. Sizing and selection of all expansion tanks based on the actual piping layout and volume computation.
f. Sizing and selection of all steam to hot water convertors and heat exchangers based on the flow requirement of each terminal unit, i.e., duct-mounted reheat coil, box (air terminal unit). mounted reheat coil, unit heaters, convectors, finned tube radiators, and radiant ceiling panels.
g. Acoustic analysis of all systems and steps taken to ensure compliance with the specified noise levels for projects that are noise sensitive or required by UCLA.
h. Complete selection data including catalog cuts and calculations for all HVAC equipment and drawings, showing all equipment schedules.
i. Complete coordination with equipment by providing utility connections, interface between the local controls, trend log and recording requirements, and local and remote alarms(verify with UCLA for required local and remote alarm requirements).
j. Humidity control calculations and assumptions.

3.7. Air Balance Schedule, indicating CFM of outside air, supply air, return air and exhaust air for <u>each air system.</u> Each system must be reasonably balanced.
3.8. 1/4 inch scale or larger Equipment Room Plan and sections showing each major piece of mechanical equipment, such as water chillers, cooling towers, air conditioning units, fans and air handling units.
3.9. Pipe riser diagrams of hydronic piping systems where the number of terminal air units and FCUs are more than 10. Indicate pipe sizes, flow rates, and valves (shutoff, check balancing, control, relief, air vent, etc.).
3.10. Control diagrams including sequences of operation, and I/O point lists. Indicate point list to be shown on graphics.
3.11. Cooling load calculations shall include tabulation by the designer of the equipment loads within each room. Although the user may provide a list of planned equipment, this list must be adjusted for realistic, actual heat outputs, service factors and diversity to avoid excessive conservatism.
3.12. Use ASHRAE Fundamentals, latest edition, for cooling and heating load calculations. Submit two copies for University review. The procedures guide requires that the designer provide comparative analysis of alternative systems.
3.13. The designer shall use separate “ME” sheets for control diagrams. Show on the plans a <u>complete</u> schematic control diagram, including items furnished, installed, wired or piped by the equipment manufacturer. Each schematic diagram shall include a sequence of operation per University standard formatting.
3.14. Indicate each local pneumatic/electric control panel on the floor plans.
3.15. The Mechanical designer needs to verify that Duct Smoke Detectors are clearly indicated on floor plan and fire alarm system drawings, and that control conduit is shown on plans (probably on electrical plans).

3.16. All equipment schedules must be provided on the plans, not on the specifications. The plans become the campus' permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.

3.17. Specification title and numbering shall be based on MasterFormat (version as approved by University's representative) and content shall be in CSI 3-part format (Part 1-General, Part 2-Product, and Part 3-Execution).

3.18. Mechanical specification sections shall have separate sections, independent of the plumbing specification sections.

3.19. Mechanical details to be included in the plans (when applicable):

A. Equipment, duct and piping supports including seismic bracing installed inside and outside the building. Include wind load for exterior installation.
B. Vibration isolation and seismic restraints
C. Pump piping detail
D. Cooling tower piping detail
E. Heat exchangers, boilers, and coils piping details
F. Manual air vent and automatic air vent details
G. Open type expansion tank
H. Bladder type expansion tanks
I. Chilled water metering, air separator, etc.
J. Equipment drains. Provide hose end connections to all drain valves. Drain valves above finished ceiling shall be provided with chained cap.
K. Boiler piping detail
L. Steam condensate return pump (duplex type) piping details
M. Steam coils
N. Steam humidifiers
O. Steam pressure reducing station
P. Steam main end of line drips
Q. Steam main dirt leg
R. Steam converters
S. Unit heaters
T. Steam condensate metering

U. Flash tank
V. Steam safety vent elbow drip pan
W. Cooling coil pan condensate drain piping
X. Concealed or exposed duct and pipe penetrations through walls, floors and roof. Coordinate with the architect's drawing.
Y. Injection Fittings (including injector and tubing) for chemical treatment of water piping system.
Z. Underground fuel storage tank
AA. Fire/smoke dampers (indicate UL listed and FM approved)
BB. Manual volume damper detail for rectangular and round duct. Damper detail shall indicate all galvanized hardware except use brass trunions and bronze oilite bearing
CC. Branch duct take-off
DD. Supply and return air registers/grilles
EE. Duct elbows
FF. Air foil turning vanes – single vanes with trailing edge is acceptable at Contractor's option. Length of trailing edge shall be 3 times the vane spacing.
GG. Transfer air duct
HH. Flexible connectors
II. Duct access door
JJ. Damper quadrant on "hat" section for insulated ductwork
KK. Constant and variable air volume terminal
LL. Fume hood duct connection (bellmouth connection)
MM. Commercial kitchen exhaust
NN. Equipment housekeeping pad
OO. Pipe/duct thru roof detail

3.20. Nomenclatures:

AC	Air Conditioning Unit
AD	Access Door

AHU	Air Handling Unit
AI	Analog Input
AO	Analog Output
AP	Access Panel
APD	Air Pressure Drop
BDD	Backdraft Damper
BMS	Building Management System
BOD	Bottom of Duct
BTU	British Thermal Unit
BTUH	BTU per Hour
CAV	Constant Air Volume, Terminal Unit
CD	Condensate Drain
CDP	Condensate Drain Pump
CC	Cooling Coil
CFM	Cubic Feet per Minute
CH	Chiller or Chilled
CHB	Chilled Beam
CHW	Chilled Water
CHWP	Chilled Water Pump
CHWR	Chilled Water Return
CHWS	Chilled Water Supply
CLG	Cooling
CO	Carbon Monoxide
CO2	Carbon Dioxide
CR	Condensate Return, Steam, Gravity
CRM	Condensate Return, Steam, Mechanical
CRP	Condensate Return Pump
CT	Cooling Tower
CTP	Cooling Tower Pump
CU	Condensing Unit
CW	Condenser Water
CWP	Condenser Water Pump
CWR	Condenser Water Return
CWS	Condenser Water Supply
DB	Dry Bulb Temperature
DDC	Direct Digital Control
DI	Digital Input
DO	Digital Output
DP	Differential Pressure
DT	Dewpoint Temperature
(E)	Existing
EA	Exhaust Air
EAT	Entering Air Temperature
EF	Exhaust Fan
ESP	External Static Pressure
ET	Expansion Tank
EWT	Entering Water Temperature
FA	Free Area
FCU	Fan Coil Unit
FD	Fire Damper
FEF	Fume Hood Exhaust Fan
FF	Final Filter
FH	Fume Hood
FLA	Full Load Amp
FPM	Feet per Minute
FS	Flow Switch
FSD	Fire/Smoke Damper, Combination
GA	Gauge
GEF	Garage Exhaust Fan
GPH	Gallon per Hour
GPM	Gallon per Minute
HC	Heating Coil

HHW	Heating Hot Water
HHWP	Heating Hot Water Pump
HHWR	Heating Hot Water Return
HHWS	Heating Hot Water Supply
HP	Heat Pump or Horsepower
HPS	High Pressure Steam
HRU	Heat Recovery Unit
HTG	Heating
HX	Heat Exchanger
HZ	Hertz
KEF	Kitchen Hood Exhaust Fan
(L)	Lined
LAT	Leaving Air Temperature
LEF	Laboratory Exhaust Fan
LPS	Low Pressure Steam
LVG	Leaving
LWT	Leaving Water Temperature
MAX	Maximum
MCA	Minimum Circuit Ampacity
MIN	Minimum
MUA	Make-up Air
(N)	New
NC	Normally Closed
NO	Normally Open
OA	Outside Air
OAF	Outside Air Fan
OC	On Center
OV	Outlet Velocity
PCF	Pounds per Cubic Foot
PCHP	Process Chilled Water Pump
PCHR	Process Chilled Water Return
PCHS	Process Chilled Water Supply
PCHW	Process Chilled Water
PD	Pressure Drop
PF	Pre-Filter
PH	Phase
POC	Point of Connection
PRV	Pressure Reducing Valve
(R)	Relocated
RA	Return Air
RF	Return Fan
RH	Relative Humidity
RLF	Relief
RTU	Rooftop Unit
S	Sensor
SA	Supply Air
SD	Smoke Detector, Damper
SF	Supply Fan
SP	Static Pressure
SPF	Stairwell Pressurization Fan
SR	Supply Register
SW	Switch
T	Temperature, Thermostat
TCHW	Tempered Chilled Water
TCHP	Tempered Chilled Water Pump
TCHR	Tempered Chilled Water Return
TCHS	Tempered Chilled Water Supply
TEF	Toilet Exhaust Fan
THHW	Tempered Heating Hot Water
THWP	Tempered Heating Hot Water Pump
THWR	Tempered Heating Hot Water Return
THWS	Tempered Heating Hot Water Supply

TSP	Total Static Pressure
UC	Door Undercut
UH	Unit Heater
VAV	Variable Air Volume, Terminal Unit
VD	Volume Damper, Manual
VFD	Variable Frequency Drive
WB	Wet Bulb Temperature
WC	Water Column
WSHP	Water Source Heat Pump
WPD	Water Pressure Drop

4. GREEN BUILDING POLICY COMPLIANCE

4.1. All projects must comply with the UCLA Campus Green Building Baseline Standard and must meet the UC-equivalent of the USGBC “LEED Silver” with a target of Gold. A copy of the latest baseline standard should be obtained by the designer. Some of the baseline requirements that have particular MEP impact include:

A. Fundamental Building Systems Commissioning.
B. Minimum Energy Performance must outperform California’s Title 24 Energy usage standards by at least 20%(Mechanical and Lighting systems combined). Demonstration of this will be required in the energy compliance certification on the plans. (EA Credit1).
C. Minimum Indoor Air Quality Performance (EQ Prerequisite 1).
D. Construction Indoor Air Quality Management Plan (EQ Credit 3.1).
E. Thermal Comfort – Compliance with ASHRAE 55-2010 required for all mechanically ventilated buildings (EQ Credit 7.1).

4.2. In addition to the baseline requirements, each project must consider the additional USGBC LEED criteria that may be feasible to attain a minimum LEED “certified” rating for the project.

230900 INSTRUMENTATION AND CONTROL FOR HVAC

1.1 Preferred vendors: Andover or Siemens. The campus has standardized on equipment suppliers for Direct Digital Control and Energy Management systems. Buildings in the Campus and the CHS use Siemens Apogee systems to match and connect to the existing central control system. The North Campus Zone central control is located in Royce Hall. The CHS/South Campus Zone central control is located in CHS AV-342. New systems should be connected by optics cable to the closest IT closet. Please discuss selection of control equipment with the University’s Representative before specifying.
1.2 The campus prefers all electronic control systems, including electric actuators for valves and dampers connected to a server based Facility Automation System using DDC technology. The designer should recommend the appropriate choice for the specific project in consultation with campus staff. See CONTROLS section below for DDC/Fire Alarm system interface. Refer to Appendix A for typical control diagram strategies.
1.3 DDC systems for Research, Health Care and other Campus Building requiring 24/7 operations are to be connected to the Emergency Power and provided with battery back-up.
1.4 Low voltage control wiring and conduit shall be shown under the Mechanical Section. Line voltage control wiring and conduit shall be shown under the Electrical Section. Conduit runs must be indicated on electrical drawings. Do not assign work to subcontractors by the use of phrases such as “by electrical” or “by mechanical.”
1.5 For High Rise and H Occupancies, provide a Fireman's Panel (painted red) as approved by Los Angeles City Fire Department adjacent to motor control center (MCC) with hand/off/automatic (HOA) switch for each air system with duct smoke detectors (DSD). Wire HOA switch in Fireman's Panel so that "H" position bypasses the DSD and the "A" position is wired through the DSD. Provide appropriate labeling.
1.6 Smoke control/evacuation: Under normal operation, the DDC system controls all ventilation fan and damper operations. When a fire alarm is initiated, the Fire Alarm Control Panel (FACP) should override the DDC system and assume direct control of all fans and dampers that are part of the smoke control system. This should be done through operation of appropriate relays external to both the DDC and FACP. The FACP should not use the DDC system for smoke control or evacuation.
1.7 Each humidifier installed inside an air duct or plenum shall be equipped with a high limit humidistat.

1.8 Variable frequency drives for HVAC pumps and fan systems are to be controlled by the building energy management system (EMS). HVAC pumps and fans shall be start/stopped by the EMS System. Status, through current sensing relay mounted in the starter bucket, shall be monitored through the EMS. Pumps shall be lead/lag duty. Water Differential Pressure Transmitter located at the end of the piping shall control, through the EMS System, the VFD on the pumps to maintain system pressure.

1.9 Chilled water supply and return temperatures and chilled water flow shall be monitored through the EMS System. The EMS System shall calculate BTU consumption.

1.10 Provide meters for all building utilities (steam and chilled water). Metering specifications for chilled water and steam to be provided by UCLA. Domestic water meter requirements are described in section for building interior plumbing systems.

1.11 Refer to appendix B for dual VFD application of critical facilities. Non critical building shall use a single VFD per fan section with a by-pass.

230593 TESTING, ADJUSTING AND BALANCING

1. Perform testing, adjusting and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed. HVAC Systems Testing and balancing shall be in accordance with the following:

   A. Associated Air Balance Council (AABC) “National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning System” latest edition.
   B. ASHRAE HVAC Applications Manual, 2015, Chapter 38 Testing, Adjusting and Balancing.

231113 NATURAL GAS PIPING SYSTEMS

1. A readily accessible gas cock shall be installed at the point of connection to each gas fired piece of equipment, laboratory bench, fume hood and exposed union.
2. Unions shall not be installed in concealed areas such as ceilings, walls or behind access panels.
3. Gas piping shall not be installed below any on-grade interior concrete floor slab; service pipes must rise to be above grade at the perimeter of the building. Island type fixtures will be supplied from overhead if possible, or through piping sleeves below the slab.
4. Piping material shall be Schedule 40 ASTM A-53 steel with screwed malleable fittings 2 inch and smaller for 10 inches of mercury and welded joints 2½ inch and larger and all pipe sizes for medium 3 to 5 psi pressure. Below on grade floor piping shall not be indicated.

232113 HYDRONIC PIPING SYSTEMS

1. GENERAL REQUIREMENTS

   1.1 Campus chilled water supply of 46°F. Design chilled water system with delta T of 16F.

   1.2 The Southern portion of the main campus is served by a central chilled water distribution system supplied by the Central Chiller & Cogeneration plant (See diagram in appendix). This system supplies 46°F chilled water, and a minimum of 16°F temperature drop. This supply temperature should be used for most air conditioning and laboratory chilled water systems. The appendix contains standard requirements for connection to the central chilled water loop. Systems connected to the central chilled water loop must use two-way valves and variable speed pumping systems to coordinate with the central system. Connections will be “hydraulically coupled” (not decoupled). Provide a normally open bypass control valve piped in parallel with redundant secondary pumps. This valve shall allow Cogen Plant pumps to deliver water under low load conditions without running the secondary building pumps. Insulate buried chilled water supply lines from the point of connection to the building to be served. Provide dielectric flange at the entrance to the building on chilled water supply and return lines.

   1.3 Building chilled water and heating hot water lines shall be metered. When building steam line is provided with meter then heating hot water line shall not be metered. Meters shall be shall be ultrasonic type, Flexim ADM 7407 or equal. Indicate size of meter, maximum and minimum flow, and pressure and temperature sensors on mechanical drawings. Meters shall be sized so minimum flow (or 10% of maximum flow, whichever is lower) is within its range. Meters shall be connected to BAS.

1.4 Provide dielectric flange kits on supply and return lines at the entrance to the building to isolate from buried utility lines. Flange isolation assembly kit shall consist of all components necessary to ensure complete isolation of cathodically protected underground chilled/hot water piping from building piping by means of electronically controlled devices(Impressed current) and preinsulated piping with foam insulation. If ductile iron piping is directly buried, it shall be continuously-coated and insulated to reduce the potential for corrosion. Similar cathodic protection techniques shall be applied to water storage tanks, steel tanks and softeners.

1.5 Use of once-through city water for laboratory cooling is prohibited. Laboratory systems where equipment or experiment cooling may be required shall include piped chilled water from an isolated plate-frame heat exchanger for use by the researchers. Design of laboratory cooling water systems requires close attention to the types of devices which the researchers will use. Chemical treatment, cleanliness and pressure control may be critical. Appropriate provisions for system flushing must be included, including bypasses at the end of dead legs (including connection points when not in use). The designer should obtain detailed requirements from the end users for supply and return pressures, flow rates, temperature range, and filtration and should consult with the campus engineering staff regarding proposed system designs. A typical user requirement is filtered water to below 25 microns particulate size with pH and conductivity equal to tap water.

1.6 Connection to CHS: UCLA personnel shall make the actual connection to any existing piping system in all buildings in Center for Health Sciences and Medical Plaza. Drawings shall show Contractor's point of connection to UCLA furnished outlets.

1.7 Campus Utility Connections: Engineers/designers shall consider the impact of connections to general campus systems and provide instructions to maintain service continuity and minimize shutdown duration. In most cases, the actual connection shall be made by campus personnel. Coordinate the responsibility for making the connection with University's Representative.

1.8 Chilled beam hydronic piping system shall be isolated from campus chilled water loop using plate and frame heat exchanger. Refer to campus standard for operating temperatures (Hot/Cold water systems).

2. PIPING MATERIALS

2.1 Copper Pipes and Fittings

A. Hard drawn copper tube, type K, ASTM B88, permanently color marked with manufacturer's trademark and country of origin. Type "K" shall be marked in green.

B. Fittings: Up to NPS 2 with system temperature up to 140°F shall be wrought-copper solder-joint fittings, 95-5 tin-antimony, soldered.

C. Fittings: Up to NPS 2 with system temperature above 140°F and all underground piping, shall be wrought-copper solder-joint fittings, Sil-Fos silver brazed.

1. Cut square, remove burrs and clean outside of pipe and inside of female fittings and to a bright finish with steel wool, wire brush, sandpaper or emery cloth. Apply solder flux with brush to tubing.
2. All soldered or brazed joints shall be made by a brazer currently certified for the size of pipe being brazed or for minimum 1-1/2-inch pipe. Certifying individual or agency shall in turn be certified by AWS.
3. All soldered or brazed joints shall be acceptable only if 100% full joint penetration of the soldering or brazing alloy is achieved.
4. All soldered or brazed joints shall comply with Section IX of ASME Boiler and Pressure Vessel Code.

D. Fittings: NPS 2-1/2 and larger may be roll grooved mechanical-grooved fittings suitable for-hydronic cold and hot water, rated at 300 psi and only used in <u>exposed areas</u>.

E. All copper fittings shall be approved-type, factory made, wrought or cast pressure fittings and have integral formed pipe stops on each connection. Mechanically formed tee fittings utilizing mechanical extracted collars or blazed outlets shall not be used.

F. Brazing cast copper fittings is not permitted under NFPA 13.

2.2 Steel Pipes and Fittings

A. Pipes: Standard weight, ASTM A53, grade B, seamless, carbon steel.
B. Fittings: Malleable iron fittings (less than 140°F) and cast iron fittings (above 140°F) on screwed joints.
C. Fittings: Carbon steel weld fittings and weld flange.
D. Fittings: Wrought cast- and forged-steel flanges and flange fittings.
E. Fittings: Wrought grooved mechanical-joint fittings and couplings.

2.3 Underground Hydronic Piping: Refer to Site Utilities for hydronic piping below ground.

2.4 Condensate Drain Piping: Hard drawn, copper type L, ASTM B88.

3. VALVES.

3.1 Several valve manufacturers carry separate domestic and import lines. The import lines are often of inferior quality. Where a specification refers to such a manufacturer, the specification writer shall verify that the valve model numbers specified are for the domestic made valves and not the import line of the manufacturer.
3.2 All valves for future connection shall be capped or plugged. Drain outlets shall be piped to drain or plugged. Unplugged open valve ends will eventually leak and cause damage.
3.3 Ball valves shall be full port with stainless steel ball and stem with screwed connections. Ball valves 2-inches and smaller NIBCO T-585-70-66, Hammond 8303A or equal.
3.4 Ball valves 2-1/2-inches and larger shall be carbon steel flanged ball valve NIBCO F-515-CS-F-66-FS, Hammond 9943 or equal.
3.5 Soldered end valves are <u>NOT ACCEPTABLE</u> and should not be specified except when factory installed as part of the equipment.

4. METER. Thermal energy meter shall be Flexim ADM 7407 or equal; complete with transit-time ultrasonic type flow sensor with transmitter, strap-on or insertion type temperature sensor, remote computer panel in NEMA 4X enclosure; Accuracy ±1.5% of reading ±1.0 feet/second; Display shall indicate total volume and thermal-energy flow.

5. DIELECTRIC FITTINGS.

5.1. Dielectric Flange Kit: Flange isolation kit complete with neoprene-faced phenolic full-faced gasket, double phenolic washers, double steel washers, and phenolic sleeves, ANSI rated 150 psi, 100°F maximum temperature. Assembly kit shall be as manufactured by Hoff Company, Inc. (281-997-6482), Pipeline Seal and Insulator, Inc. (713-747-6948), or equal.

5.2. Dielectric Nipple: Electroplated steel nipple with inert, NSF/FDA listed and noncorrosive, thermoplastic lining; minimum 3-inch long; plain, threaded, or grooved ends; and ASTM F-492, 300-psig minimum working pressure at 225°F. Clear Flow or equal.

6. GASKET. Hot water piping systems shall use Garlock 3200/3400 gasket or equal, no known equal.

7. INSULATION. Use rigid insulation (calcium silicate for heating hot water and cellular glass for chilled water) for pipes exposed in equipment rooms and other areas subject to physical damage. Fiberglass is acceptable in other locations. Minimum insulation conductivity and thickness shall comply with Title 24 Section 123.

8. IDENTIFICATION. Piping shall be identified using wraparound markers.

9. INSTALLATION

1. Provide air vents at all high points and intermediate high points created by job conditions. For each manual and automatic air vent, provide drain piping to nearest floor drain or floor sink. Provide automatic air vents in machine rooms and other areas where air vents are accessible and can be easily piped to drain. In areas where vents are inaccessible, provide air chambers at high points and run 1/4" copper tube with shut-off valves to an accessible area (preferably in equipment rooms) and identify location and use. In areas where vents are accessible but impractical to pipe to drain (like above T-bar ceilings) provide ball valves with bend tube positioned for easy drain to a mechanics bucket. Coin operated air vents are not acceptable.
2. For water supply and return lines, cooling coil, heat exchanger, etc., use a balancing valve in addition to the shut-off valve. Combination balancing and shut-off valves are not recommended. Where two-way valves are used for coil control, use pressure independent flow control valves.
3. Avoid bull-headed tees in all piping system.
4. As required by code, no piping shall be routed in any electrical room, vault or areas designated for electrical or communication equipment.
5. Specify replaceable bladder type expansion tanks.
6. Provide air and dirt separator on chilled water and heating hot water piping system. Unit shall be of full flow coalescing type combination air and dirt separator with internal elements filling the entire vessel with no space or void, venting chamber and valves, and valve side tap. Internal elements shall be of copper core tube with continuous wound copper medium permanently affixed to the core. Internal elements consisting of plastics or perforated steel plates/tubes or loosely filled steel rings are not acceptable. Unit shall be Spirovent as manufactured by Spirotherm (no known equal).
7. For roof mounted pumps above sensitive areas such as labs having electron microscopes, classrooms, etc., use neoprene type flexible connectors. Do not use braided metal type connections. Provide vibration isolators for pipes from rotating equipment (pumps etc.) supported on roof.
8. No pipe shall be encased, embedded or cast into the building's concrete footings, floor slabs, walls or other structure. Taping and/or foam wrapping of pipe and fittings does not constitute a code or University approved method of separation.

10. BOIL OUT AND CLEANING OF PIPING SYSTEMS

1. Perform cleaning and boil-out after completion of piping and pressure testing and before the system is put into operation. All piping system cleaning and water treatment must be coordinated with and witnessed by campus operating staff. It is imperative that before any system is filled with water, the operating staff verify that cleaning has been properly completed and proper chemical treatment is in place and maintained. Operating staff should be requested to monitor chemical treatment after the system is filled until the project is completed and turned over to them. The Inspector shall witness the cleaning procedure.
2. Chilled water systems served by the campus central chilled water system should be filled only with clean untreated water.
3. Do not circulate cleaning solution through cooling and heating coils or steam traps. Provide temporary bypasses.
4. The entire cleaning procedure shall be performed by a contractor furnished independent chemical cleaning company approved by the University's Representative.
5. Flush out entire system for a period of not less than 4 hours to clear it of all loose material. Provide necessary cross-connections to loop system and circulate water for 24 hours. During this period, install 80-mesh screen in strainers and periodically clean. Drain entire system. Refill system. Meter water when refilling to determine amount of chemical required in next procedure. Add trisodium phosphate (TSP) to provide a uniform residual concentration of 10ppm. Circulate water for 48 hours. During circulation, periodically clean screens as required. Flush system for approximately 4 hours or until all traces of chemicals are removed. Remove 80-mesh screens.
6. For space heating hot water system, provide injection fitting and required connection piping to a 55 gallon chemical drum. Drum shall have provision for wall straps to safely secure to the wall. Chemical pump, controls and interval timer shall be provided. Coordinate with electrical to provide required power for the pump. Coordinate with the plumbing engineer to provide sink and emergency shower/eyewash in mechanical room where water treatment will be performed. Run ¼" copper tubing from the water piping system to the sink with appropriate labels and service valves for collecting samples.
7. If water treatment is to be provided by UCLA Facilities (shall be determined during the design phase and indicated in the bid document), require a 30 day advance notice to Facilities. The piping system must be complete, pressure tested and cleaned. If water treatment has to be redone due to contractor's incomplete work, extra services provided by UCLA Facilities will be at contractor's expense.

11. PRESSURE TESTING. All pressure pipe testing shall be done using a Bristol Recording Device. Hydrostatically field test pipe to 150 psig or 1.5 times the design pressures whichever is greater before insulating the field joints.

232213 STEAM AND CONDENSATE HEATING PIPING SYSTEMS

1. GENERAL REQUIREMENTS

   1.1. Building steam line shall be metered. Meter shall be vortex shedding type, Foxboro 84F or equal. Indicate size of meter, maximum and minimum flow, and pressure and temperature sensors on mechanical drawings. Meters shall be sized so minimum flow (or 10% of maximum flow, whichever is lower) is within its range. Meter shall be connected to BAS.

2. PIPING MATERIALS

   2.1 Steam Pipes And Fittings: Steel pipe ASTM A53 Grade B, seamless, standard weight, black with butt weld ends; Standard weight carbon steel, butt weld, ASTM A234, Class 300 with butt welded joints per AWS D1.1.
   2.2 Condensate Return Pipes And Fittings: Extra heavy carbon steel pipe, ASTM A53 Grade B, seamless, black with butt weld ends; extra heavy weight carbon steel, butt weld, ASTM A234, Class 300 with butt weld joints per AWS D1.1.
   2.3 Underground Steam and Condensate Return Piping: Refer to Site Utilities for steam and condensate return piping below ground.

3. METER. Meter shall be vortex shedding type, Foxboro 84F or equal. Thermal energy meter shall be Flexim ADM 7407 or equal; complete with transit-time ultrasonic type flow sensor with transmitter, strap-on or insertion type temperature sensor, remote computer panel in NEMA 4X enclosure; Accuracy ±1.5% of reading ±1.0 feet/second; Display shall indicate total volume and thermal-energy flow.

4. GASKET. Garlock 3200/3400 gasket or equal, no known equal.

5. INSULATION. Use rigid insulation (calcium silicate) for pipes exposed in equipment rooms and other areas subject to physical damage. Minimum insulation conductivity and thickness shall comply with Title 24 Section 123

6. IDENTIFICATION. Piping shall be identified using wraparound markers.

7. Provide dielectric flange kits on supply and return lines at the entrance to the building to isolate from buried utility lines. Flange isolation assembly kit shall consist of all components necessary to ensure complete isolation of cathodically protected underground steam water piping from building piping by means of electronically controlled devices(Impressed current) and preinsulated piping with foam insulation. If ductile iron piping is directly buried, it shall be continuously-coated and insulated to reduce the potential for corrosion.

8. INSTALLATION.

   A. No pipe shall be encased, embedded or cast into the building's concrete footings, floor slabs, walls or other structure. Taping and/or foam wrapping of pipe and fittings does not constitute a code or University approved method of separation.

9. BOIL OUT AND CLEANING OF PIPING SYSTEMS

   1. Perform cleaning and boil-out after completion of piping and pressure testing and before the system is put into operation. All piping system cleaning and water treatment must be coordinated with and witnessed by campus operating staff. It is imperative that before any system is filled with water, the operating staff verify that cleaning has been properly completed and proper chemical treatment is in place and maintained. Operating staff should be requested to monitor chemical treatment after the system is filled until the project is completed and turned over to them. The Inspector shall witness the cleaning procedure.
   2. Do not circulate cleaning solution through cooling and heating coils or steam traps. Provide temporary bypasses.
   3. New equipment (or otherwise in very good condition) shall not be used for the circulation of chemical cleaning solutions intended to remove built-up scale and corrosion in existing piping systems at any point, before or after system modification. Options may include the following:
   4. If the existing pump system are already in poor condition and/or would not be appropriate for meeting final operating conditions and are not economical to salvage and thus to be entirely replaced anyway, the contractor may use the existing pump for the circulation of cleaner/dirty fluid prior to replacement.

5. If the existing pump system is otherwise in good condition and planned to be reused after chemical cleaning operations, then:
6. Include all materials and labor for inspection and cleaning of all wetted parts and replacing of worn items, at a minimum the definite replacement of the seals, after all chemical cleaning and flushing is completed and before system is refilled with final clean fluid.

7. The entire cleaning procedure shall be performed by a contractor furnished independent chemical cleaning company approved by the University's Representative.
8. Flush out entire system for a period of not less than 4 hours to clear it of all loose material. Provide necessary cross-connections to loop system and circulate water for 24 hours. During this period, install 80-mesh screen in strainers and periodically clean. Drain entire system. Refill system. Meter water when refilling to determine amount of chemical required in next procedure. Add trisodium phosphate (TSP) to provide a uniform residual concentration of 10ppm. Circulate water for 48 hours. During circulation, periodically clean screens as required. Flush system for approximately 4 hours or until all traces of chemicals are removed. Remove 80-mesh screens.
9. For space heating hot water system, provide injection fitting and required connection piping to a 55 gallon chemical drum. Drum shall have provision for wall straps to safely secure to the wall. Chemical pump, controls and interval timer shall be provided. Coordinate with electrical to provide required power for the pump. Coordinate with the plumbing engineer to provide sink and emergency shower/eyewash in mechanical room where water treatment will be performed. Run ¼" copper tubing from the water piping system to the sink with appropriate labels and service valves for collecting samples.
10. If water treatment is to be provided by UCLA Facilities (shall be determined during the design phase and indicated in the bid document), require a 30 day advance notice to Facilities. The piping system must be complete, pressure tested and cleaned. If water treatment has to be redone due to contractor's incomplete work, extra services provided by UCLA Facilities will be at contractor's expense.

10. PRESSURE TESTING. All pressure pipe testing shall be done using a Bristol Recording Device. Hydrostatically field test pipe to 150 psig or 1.5 times the design pressures whichever is greater before insulating the field joints.

233100 HVAC DUCTS

1. Ductwork material, fabrication and installation shall be per SMACNA, HVAC Duct Construction Standards, Metal and Flexible, 2005, Third Edition except for the following:

1.1 Fig. 2-2 Longitudinal Seams-Rect. Duct – Button punch snap lock is not acceptable. Use Pittsburgh lock 3/8-inch minimum pocket for rectangular ducts.
1.2 Fig. 4-3 Vanes and Vane Runners – Double thickness vanes. Single vanes with trailing edge are acceptable. Trailing edge length shall be 3 times the vanes spacing.
1.3 Fig. 4-6 Branch Connections – Straight Tap, Butt Flange and Dovetail joint are not acceptable. Use a 45 degree entry clinches lock. Use conical or bellmouth branch connections for round ducts.
1.4 Fig. 7-2 Duct Access Doors – Use continuous piano hinge in lieu of butt hinge.
1.5 Fig. 7-3 Access Doors-Round Duct – Split Sleeves are not acceptable.
1.6 Fig. 4-2 Rectangular Elbows – Type RE-1 radius elbow shall always be used when space permits. Square throat elbows with double wall vanes (single vanes with trailing edge are acceptable) may be used for supply ducts when space is limited.
1.7 Fig. 3-2 Round Duct Longitudinal Seams – Snap lock seam is not acceptable.
1.8 Fig. 3-1 Round Duct Transverse Joints – RT-3 Drawband joint and RT-5 Crimp Joint are not acceptable. Use RT-1 Beaded Sleeve Joints.
1.9 Fig. 3-4 Round Duct Elbows – Pleated and Adjustable Elbow are not acceptable. Adjustable elbow may be used in duct pressure under 1-inch static pressure, provided sheet metal straps and screws are installed to lock elbow position and all joints and seams are sealed.
1.10 Fig 3-5 90 degree Tees and Laterals – 90 degree Tap and Saddle Tap are not acceptable. Use 45□ laterals or Conical Tees shown on Fig 3-6.
1.11 Fig. 3-10 and 3-11 Flexible Duct Supports – Use 4-inch wide band in lieu of 1-inch band straps.
1.12 Fig. 5-2 Upper Attachment Devices-Typical – Details 1, 3b, 4, 5, 7, 9, 10-, 11, and 14 are not acceptable.
1.13 Fig. 5-4 Upper Attachments-Typical – This detail is not acceptable.
1.14 Fig 7-11 Flexible Duct Liner Installation – Use only metal weld pins and 100% area coverage of adhesives. This also applies to rigid duct liners.
1.15 Ducts shall be externally insulated and shall conform to Title 24 requirements.

2. Each duct transverse joint and longitudinal seam shall be sealed airtight using UL listed duct sealant in accordance with SMACNA Table 1-1 Duct Sealing Class A Requirements.
3. Pipe penetration of casing shall be sealed with a continuous weld per Fig. 9-14. Mastic sealant is unacceptable.
4. Where duct lining is installed downstream of static pressure dampers, mixing dampers, volume dampers or at any point in the lined duct system where high velocity air may occur, provide perforated sheet metal lining to prevent erosion. This applies to all low, medium and high pressure duct systems.
5. Provide "Hat-Section" for smooth laminar air flow in lined duct at each accessory, i.e., mixing dampers, volume dampers, fire/smoke dampers, etc. Also, on ducts with external insulation, provide "Hat-Section" to exposed quadrant of damper.
6. Adhere to AMCA recommendations.
7. Clearly indicate all ductwork to be insulated either in the drawing or specifications. Identify which ducts are to be acoustically lined.
8. Leak test all ductwork. Test shall be certified by a Balancing Agency (AABC or NEBB member) to comply with the latest SMACNA HVAC Air Duct Leakage Test Manual.
9. All ductwork should be designed so that it does not contribute to noise transmission between adjacent rooms.
10. Provide stainless steel supports for stainless steel ductwork. Galvanized supports for galvanized sheet metal ductwork.
11. Provide manual volume damper at all branch ducts. Install "HAT" section to expose damper quadrant in externally insulated ductwork. Provide tight sealing nylon bushings or grommets at duct openings for damper shafts under the hat section. Fill space under the "HAT" section with insulation. Cut slot in end of damper rod (quadrant end) to indicate blade position. Locate quadrant in accessible location. Provide access doors when located above inaccessible ceiling or remote control mechanism in approved locations with proper labels.
12. Construct ductwork per SMACNA 2005 HVAC Duct Construction Standards, no substitutions or equivalency will be accepted.
13. In remodel work where more than two or three branches are to be demolished from the main duct, they should be removed up to the main duct and the opening smoothly patched.
14. Provide air control valves in laboratories where air pressure relationship to be maintained is critical.
15. In hospital remodel projects in areas where existing lined ducts do not meet the current code requirement, provide all new duct. Do not design for lining removal from existing ductwork.
16. All connections to supply air diffusers in non-hospital projects in lay-in ceiling systems may be made with flexible ductwork, not to exceed seven feet in length. Hospital to be designed as required by OSHPD.
17. Specify that exterior louver for mechanical systems shall be provided with galvanized hardware grade wire cloth, ½-inch mesh, 16 ga. Wire, 0.5-inch square opening, Galvanized after weaving.
18. All seismic restraint of ductwork and equipment shall be per the California Building code. SMACNA, NUSIG or engineered system prepared by a California licensed engineer experienced in seismic design are acceptable.
19. All welders shall be American Welding Society (AWS) or LA certified. Welding procedures shall be per AWS.
20. Exposed ducts shall only be held together using screw, duct tape is not permitted. Duct shall not have any markings.
21. Exposed duct 18 inches in diameter or greater shall be flat oval.

233300 AIR DUCT ACCESSORIES

1. Each volume damper - single blade type: use SMACNA Fig. 7-4 (Fig. A and Fig. C are not acceptable). For multi-blade volume damper, use SMACNA Fig. 7-5 (opposed blade action).
2. Follow SMACNA Fig. 7-4 and 7-4D for all details except as listed herein on single blade and two bladed damper for 2" W.G. class duct with end bearing.
3. Use 3/8" continuous square rod and 18 gauge galvanized stiffened blade for damper blade sizes 18" wide by 10" high and smaller.
4. Use 1/2" continuous square rod and 16 gauge galvanized stiffened blade for damper blade sizes 19" to 48" wide by 10" high. Maximum blade size is 48" by 10" high.
5. Maximum of two blades without a frame. Over two blades, use a manufactured 16 gauge galvanized steel frame. All hardware shall be galvanized except brass trunions and bronze oilite bearings: Pacific Air Products, Series 700; Pottorff Series 400; or equal.
6. Quadrant shall be Durodyne model 3/8" K-4/ 1/2" K-5 Quadline; Ventlox model 555 Ventline; or equal.
7. Provide closed end bearing, Durodyne SB-338 (3/8") /SB-312 (1/2"); Ventlox mode 609; or equal.
8. Cut slot in end of damper rod (quadrant end) to indicate blade position.
9. Volume dampers shall be identified by a bright orange colored ribbon attached to valve and freely hanging to ease in locating the device.

233813 COMERCIAL KITCHEN HOODS

1. Comply with 2013 CMC Chapter 5 Part II.
2. All kitchen hoods shall be listed and labeled according to UL 710, NSF 2 and NFPA 96.
3. Where multiple grease hoods are to be connected to one grease exhaust duct system, kitchen hoods shall be provided with adjustable baffle for balancing air flow between hoods. Adjustable baffles shall be an integral part of the hood.
4. Grease exhaust ducts shall be stainless steel 314 with welded seams and joints. Minimum SMACNA seal class shall be welded seams, joints and penetrations.
5. Duct construction shall be based on the system pressure.
6. All elbow fittings in grease exhaust ductworks shall be long radius elbow without turning vanes.
7. All grease exhaust ducts shall be pressure tested. Static pressure test shall be 3-in WC (or 1.25 times the system static pressure, whichever is larger) using air compressor and Schrader valve. When pressure stabilized at test pressure, duct pressure will be observe for one minute. Duct should hold the pressure for at least one minute in order to pass pressure testing.

233816 FUME HOODS

1. Where fume hood systems are included in building designs, obtain guide criteria from UCLA Environmental Health and Safety Office (EH&S). Follow the latest SMACNA Round Duct Industrial Duct Construction Standards and SMACNA Rectangular Duct Industrial Duct Construction Standards. Fume hood exhaust ductwork shall be 18 gauge, 18-8 stainless steel type 316. All joints, seams and connections shall be continuously heliarc welded with 18-8 stainless steel rod type 318-ELC. Elbows and angles shall have the same gauge as ductwork, inside radius not less than width of duct. Pitch all horizontal ductwork down towards fume hood. Fume hood duct bracing and support shall be 18-8 stainless steel type 316.
2. Fume hood exhaust fans shall be all welded steel and AMCA spark-proof construction. All surfaces in contact with the exhaust fumes shall be coated with baked-on Heresite, or equal.
3. The energy cost of fume hood operation must be carefully analyzed by the designer. Variable air volume and night setback systems should be considered, however such systems require special care in design and construction of the exhaust, supply and control systems to assure proper operation and maintainability. The designer will be required to present life cycle analysis comparing the recommended exhaust system to alternatives to demonstrate that the choice is appropriate considering first cost, energy and O&M costs.
4. Dispersion of the fume hood exhaust plume must be considered to avoid objectionable concentrations of chemical or biological hazards at habitable locations. This may require wind tunnel studies or other special analytical techniques. Simple use of ASHRAE recommendations is probably not adequate for proper design.
5. Specify zero static test leakage in fume hood exhaust and commercial type kitchen exhaust duct. Static pressure test shall be the design static pressure of the duct system. Pass test by holding test pressure for one minute.
6. Fire or combination fire/smoke dampers are not allowed in fume hood exhaust duct.
7. Do not use flexible connection to fan. Use metal sleeve with packing.
8. Fume discharge shall be designed to provide a minimum exit velocity of 3000 fpm, and elevated (exhaust stack) to prevent re-entry to the outside air intake of the building and adjacent buildings.

9. The average air velocity face of a hood intended for standard use shall be 100 linear feet per minute (fpm) with a minimum of 70 fpm at any measured point. Maximum face velocity should not exceed 125 fpm. Designers may choose to design to 110 fpm, to allow for a margin of error in balancing.
10. Address code required operation of fume hood exhaust during emergency condition when supply fans are shut off while fume hood exhaust fans continue to operate. Significant negative pressure can occur in laboratory rooms making opening doors difficult for exit. Provide alternatives for review by the Fire Marshal.
11. Specify bellmouth connection to fume hood.
12. Hoods shall have transparent movable sashes constructed of shatter-resistant, flame-resistant material that is compatible with the materials and processes to be used in the hood, and capable of being moved to close the entire front face.
13. Vertical-rising sashes are preferred. If three or more horizontally sliding sash panels are provided, the panels should be no more than 10 in. (25.4 cm) wide to allow them to serve as a safety shield narrow enough for a person to reach around to manipulate equipment. Multiple sashes may be installed within the same track. ANSI Z9.5 3.1.1
14. Sashes may offer extra protection to lab workers since they can be positioned to act as a shield.
15. A force of five pounds shall be sufficient to move vertically and/or horizontally moving doors and sashes. AIHA Z9.5 3.1.1
16. Sticky sashes and doors are not moved, so they become useless. These specifications result from decades of experience.
17. Automatic sash closers with proximity sensors may be considered to allow for energy savings when the hood is not in operation. Note that a user's training program may be more effective in achieving this desirable end.
18. Sound absorbers, constant volume boxes, and other appurtenances shall be constructed of non-corrosive materials or stainless steel.
19. Laboratory air valves shall be pressure independent air flow control valve with either digital vortex shedding flow control (Accutrol or equal) or metering venturi air valves (Phoenix or equal). Pressure loss through air valve shall be based on 0.3 in wg at design air flow.
20. Provide a low loss pressure drop duct sizing to reduce energy consumption. Duct sizing not exceed .1 in. w.g. per 100 ft of duct work and when possible, a .05 in. w.g. per 100 ft. duct work is advisable when conditions permit.
21. Air handlers for chemical fume hoods should be connected to an emergency power system to maintain flow after a power outage. The fans must be configured to auto-restart so that fans will automatically restart upon shifting to emergency power. The overall ventilation system shall provide at least half of the normal airflow during an electrical power failure.
22. Required by California Building Code for H occupancies.
23. Losses of power shall not change or affect any of the control system's set points, calibration settings, or emergency status. After power returns, the system shall continue operation, exactly as before, without the need for any manual intervention. Alarms shall require manual reset, should they indicate a potentially hazardous condition.
24. When the type and quantity of chemicals or compressed gases that are present in a laboratory room could pose a significant toxic or fire hazard, the room shall be equipped with provision(s) to initiate emergency notification and initiate the operation of the ventilation system in a mode consistent with accepted safety practices.
25. A means such as a clearly marked wall switch, pull station, or other readily accessible device shall be installed to enable the room occupants to initiate appropriate emergency notification and simultaneously activate the ventilation system's chemical emergency (chemical spill, eyewash or emergency shower activation, flammable gas release, etc.) mode of operation if one exists.
26. For rooms served by VAV ventilation systems, the Chemical Emergency mode of operation should maximize the room ventilation rate and, if appropriate, increase negative room pressurization. For rooms served by constant air volume (CAV) ventilation systems that utilize a reduced ventilation level for energy savings, the Chemical Emergency mode of operation should ensure that the room ventilation and negative pressurization are at the maximum rate.
27. Operation of the room ventilation system in a chemical emergency mode should not reduce the room ventilation rate, room negative pressurization level, or hood exhaust airflow rate.
28. A means such as a wall-mounted "FIRE ALARM" pull station or equivalent shall be installed to enable the room occupants to initiate a fire alarm signal and simultaneously activate an appropriate fire emergency mode of operation for the room and/or building ventilation system.
29. For rooms served by VAV ventilation systems, the fire emergency mode of operation should maximize the exhaust airflow rate from the hoods and other room exhaust provisions, and also reduce the room supply makeup air. For rooms served by CAV ventilation systems that utilize a reduced ventilation level for energy savings, the fire emergency mode of operation should ensure that the maximum exhaust airflow rate from the hoods and other room exhaust provisions are in effect, and should also reduce the room supply makeup air.
30. Note, however, that ventilation supply/exhaust imbalance can make the doors extremely difficult to open. Consider programming in a short delay into the fire alarm system (30–60 sec or more) between activation of building evacuation alarms, and shifting the ventilation system to the fire-emergency mode of operation. This delay will allow occupants to evacuate prior to making the doors difficult to operate. The sequence of operations of the emergency

ventilation response must take into account the possible conflicting needs of smoke containment and emergency egress. The Fire Authority Having Jurisdiction and the local EH&S office must concur on the configuration of the fire emergency mode of operation.

Hoods — Perchloric/Hot Acid Use

1. Where perchloric or other acids will be heated above ambient temperature, a dedicated acid hood shall be installed or provisions made to trap and scrub vapors at the point of emission, before they enter the laboratory ventilation system.

NFPA 45, Chapter 6-11.1

If perchloric acid is heated above ambient temperature, it will give off vapors that can condense and form explosive organometallic perchlorates. Limited quantities of perchloric acid vapor can be kept from condensing in laboratory exhaust systems by trapping or scrubbing the vapors at the point of origin. Nitric, hydrochloric, sulfuric, and other mineral acids are often used in digestion procedures at high temperatures.

2. Acid hoods and exhaust ductwork shall be constructed of materials that are acid-resistant, nonreactive, and impervious to the acid being used. No organic materials, including gaskets, shall be used in the hood construction unless they are known not to react with perchloric or other hot acids and/or their by-products;

ANSI Z9.5 3.2.4

NFPA 45, Chapter 6-11.2 and 6-11.5

Perchloric acid digestion may over time result in the condensation and consequential formation of metal perchlorate crystals, which can pose an explosion hazard, especially if combined with organic chemical condensate. Typically, 316 stainless steel or unplasticized PVC has been used. 316 stainless steel may not be appropriate for other hot acid applications, particularly hydrochloric acid. Consult with EH&S for guidance on the appropriate materials of construction of perchloric/hot acid digestion exhaust systems.

3. A water spray system shall be provided for washing down the hood interior behind the baffle and the entire exhaust system, including the stack and exhaust fan. It is not necessary to wash down the interior of the fume hood work area. The hood work surface shall be watertight with a minimum depression of 13 mm (1/2 in) at the front and sides. An integral trough shall be provided at the rear of the hood to collect wash-down water.

NFPA 45, Chapter 6-11.6

Perchloric/hot acid digestion hoods should be washed down after each use to minimize accumulations of potentially explosive perchlorate salts and other highly corrosive by-products.

4. Wash-down spray nozzles shall be installed in the ducts no more than 5 ft apart. The ductwork shall provide a positive drainage slope back into the hood. Ductwork shall consist of sealed sections, and no flexible connectors shall be used.

NFPA, Chapter 6-11.4

5. The hood baffle shall be removable for inspection and cleaning.

NFPA 45, Chapter 6-11.7

6. Ductwork for perchloric/hot acid hoods and exhaust systems shall take the shortest and straightest path to the outside of the building and shall not be manifolded with other exhaust systems. Preference shall be given to a routing that is as vertical as possible.

NFPA, Chapter 6-11.4

7. The exhaust fan shall be acid-resistant and spark-resistant. The exhaust fan motor shall not be located within the ductwork. Drive belts shall be conductive.

NFPA 45, Chapter 6-11.3

237323 CUSTOM CENTRAL STATION AIR HANDLING UNITS

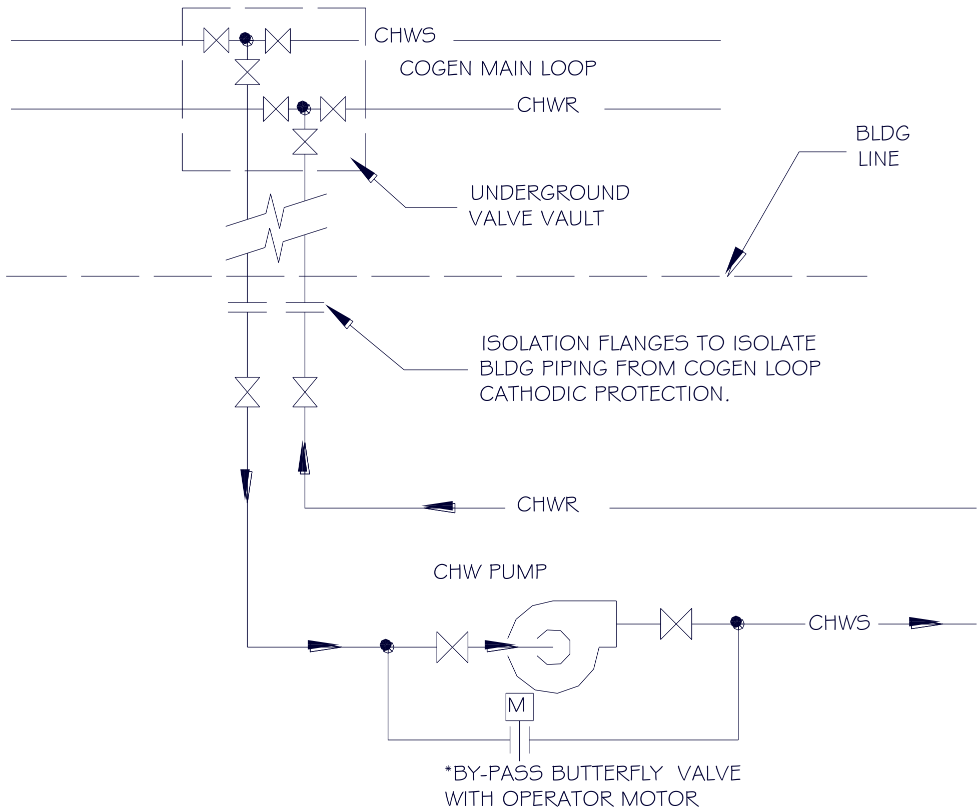
1. Air handling unit manufacturer shall have accredited certification to current ISO 9001 standard.
2. Require UL or ETL listing and AMCA certified test for sound and performance.
3. Air handling systems that normally run 8 to 5 on weekdays and off on weekends are to be provided with morning warm-up controls.
4. All major components used to assemble air handling unit, with the exception of electrical devices, control dampers, drives, bearings, and controls, shall be manufactured by air handling unit manufacturer. Primary fans and coils not manufactured by air handling unit manufacturer is not considered single source responsibility and shall not be acceptable.
5. Drain pans shall be constructed from heavy gage stainless steel, insulated with 2 inches thick, 1-1/2 pound per cu. Ft. density insulation with a heavy gage galvanized steel liner.
6. After final assembly, the unit exterior shall be coated with an industrial grade, high solids acrylic and polyurethane paint. The paint system of outdoor AHU shall meet ASTM B117 salt/fog test for a minimum of 5000 hours.
7. Fan system shall consist of multiple direct driven arrangement 4 plenum fans constructed per AMCA requirements for specified duty. Fan motor shall be premium efficiency totally enclosed air over, NEMA frame, and ball bearing type. Motor shall be designed for variable frequency drives service if controlled by VFD.
8. VFD shall be factory installed by the air handling unit manufacturer. (Refer to CSI Section 15172).
9. Chilled water and hot water coils shall be copper tubes with copper fins. Fins shall not be more than 10 fins per inch. Coils shall have counter-flow design, heavy gauge stainless steel casings and copper headers. Air velocity through coils shall not exceed 500 fpm.
10. Flow measuring stations shall be factory installed by the air handling unit manufacturer.
11. Outside Air Dampers, return, exhaust/relief Dampers shall fail to normal positions so that no damage will be incurred when fan is started manually. Dampers shall be low leak air-foil type with rubber edge seals and stainless steel arc end seals.
12. Specify Filtration Group Aerostar FP minipleat filter, 12" deep, wet laid microglass, 85% efficiency based on ASHRAE 52.1.
13. Provide single source power panels that are constructed according to N.E.C. regulations and carry a U.L. 508 listing. Provide vapor tight marine lights in each access section, factory wired to a single weatherproof switch located on exterior of cabinet. Provide weatherproof 15 amps, GFCI receptacle near the light switch wired to the lighting circuit.
14. HVAC systems should fail to cooling instead of heating. Hospital systems to be as required by OSHPD regulations.
15. Air handling unit shutdown:

    15.1. Unit supplying air in excess of 2,000 CFM shall be equipped with automatic shutdown (CMC 608.0). Duct smoke detector in main supply duct, if use for shutdown, shall be clearly indicated on mechanical floor plans and control drawings.
    15.2. Unit supplying in excess of 15,000 CFM shall be provided with smoke dampers in main supply and return ducts to isolate the unit from remainder of the system (NFPA 90A). Multiple combination fire/smoke dampers at duct penetrations through shaft on every floor are not permitted to be used for unit isolation.
    15.3. Duct smoke detectors require special care in selection of the location and in installation in order to work properly and reliably and to pass required tests. The fire marshal will require testing of all duct smoke detectors as they have found in the past that many of them were not functional due to low air flow or turbulence at the installed location. Duct smoke detectors must be compatible with and operated by the installed building fire alarm system.
    15.4. Comply with NFPA 72E, NFPA 90A, NEMA Application and Installation Guide, CMC and CBC.
    15.5. Duct smoke detectors are specified under Division 16 including wiring and conduits. Mounting of detectors in ducts shall be specified under Division 15, and must comply with manufacturer's requirements.
    15.6. Duct smoke detectors are indicated on the mechanical drawings (by the design mechanical engineer). Prior to installing the duct detectors and when the air balance is completed, the contractor's balancing agency shall test duct detector locations indicated on the plans to verify that air flow is laminar, and that air velocities and differential pressures are within the detector manufacturer's recommendations. For variable volume systems, perform test at minimum and maximum air flows. Record test data on attached form (Duct Mounted Smoke Detector Inspection Data). Submit test results to the University's Representative for approval.
    15.7. Contractor shall provide the services and coordination required for the testing of the duct systems to determine the proper placement of the duct detectors. This procedure shall be accomplished by the services of a contractor-furnished air balance and testing agency which specializes in the balancing and testing of heating, ventilating and air conditioning systems. All work by this agency shall be done under direct supervision of a test and balance professional certified by the Associated Air Balance Council or National Environmental Balancing Bureau. Testing shall comply with NEMA Guide for Proper Use of Smoke Detectors in Duct Applications and NFPA 72E, and shall be witnessed by the Inspector.

238219 FAN COIL UNITS

1. Fan coil units should not be located over expensive equipment such as electron microscopes, computers, etc. Fan coil units installed in furred spaces or attic should have secondary drain pans beneath it to catch overflow drain in case of primary drain clog. Discharge drain to a point where it can be readily observed.
2. Provide access to fan coil units for routine preventive maintenance. This includes replacement of filter and belts, repair of leaks, replacement of motors and controls. Provide all necessary work platforms where units are not directly accessible by a maximum 8 foot step ladder.
3. Provide fan coil units with three speed motors wired to a three speed switch. Design and size fan coil unit to operate at mid-speed.
4. Fan coil controllers shall be DDC and shall seamlessly communicate with the University Facility Automation System (Siemens Apogee).

TYPICAL BLDG CHW CONNECTION TO CENTRAL LOOP



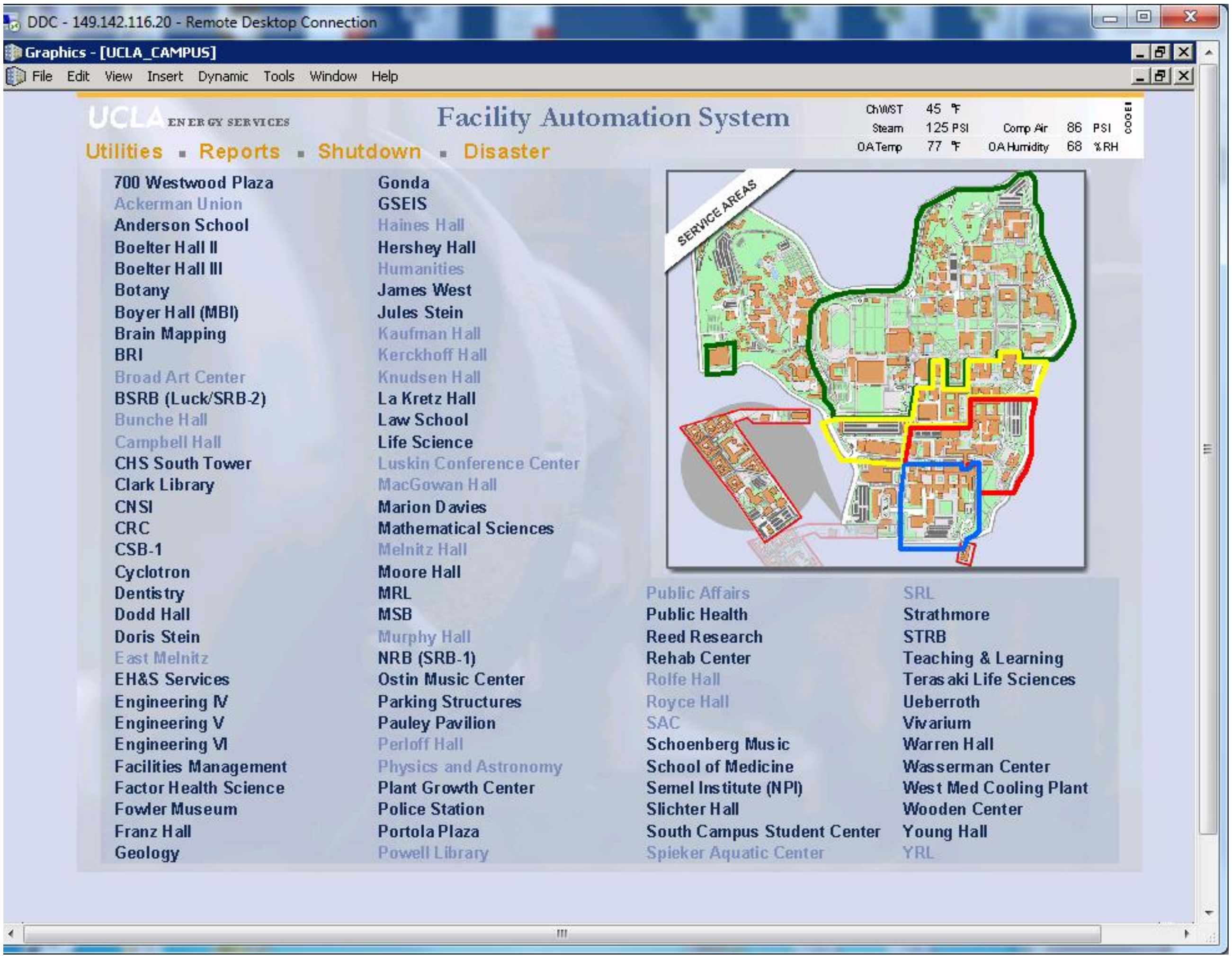
1. ALL CHILLED WATER COOLING COIL CONTROL VALVES SHALL BE DE-ENERGISED TO CLOSE . CONTROL VALVES SHALL CLOSE AGAINST MAXIMUM SYSTEM PRESSURE.

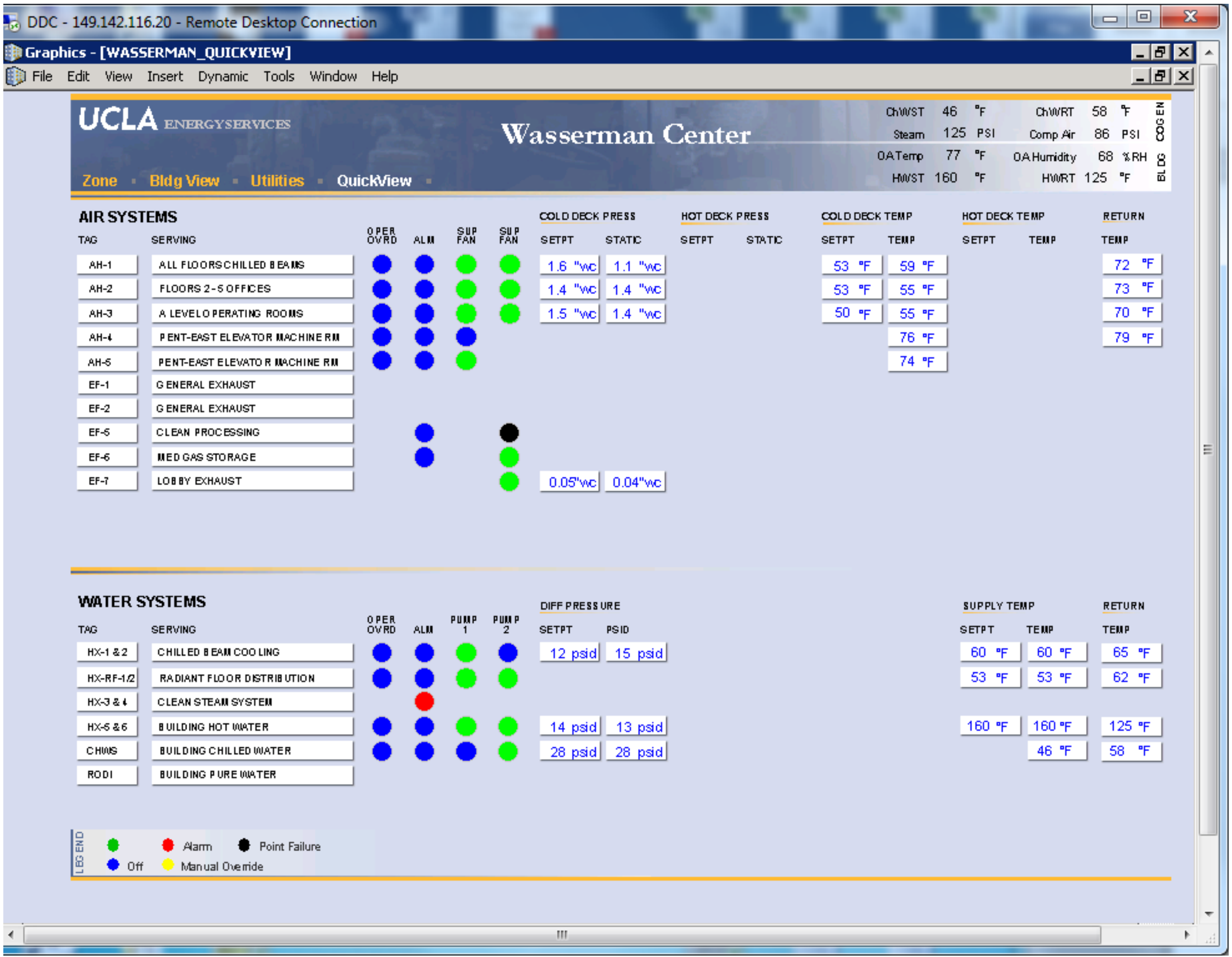
2. CHILLED WATER PUMP SHALL BE VARIABLE SPEED TO PROVIDE CHILLED WATER AS REQUIRED BY THE BLDG LOAD. PUMP OPERATION SHALL STOP AND THE *BY-PASS BUTTERFLY VALVE OPEN WHEN CENTRAL LOOP PRESSURE CAN SATISFY BLDG REQUIREMENT. *BY-PASS BUTTERFLY VALVE SHALL BE CLOSED WHEN PUMPS ARE IN OPERATION AND DURING OFF HOURS.

3. IF DUE TO SITE CONDITIONS BRANCH PIPING ARE TO CHANGE IN ELEVATIONS CREATING INTERMEDIATE HIGH POINTS, PROVIDE AUTOMATIC AIR RELEASE VALVES AT THE HIGH POINTS. LOCATE AIR RELEASE VALVES IN A GROUND-MOUNTED UTILITY BOX. COORINATE LOCATIONS WITH FACILITIES ENERGY SERVICES.

COGENCONN1.DWG
TPP JAN 10/00
TPP FEB 24/00
TPP NOV 8/00

APENDIX A : NAVIGATION - Typical control strategies and diagrams

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Wasserman Center
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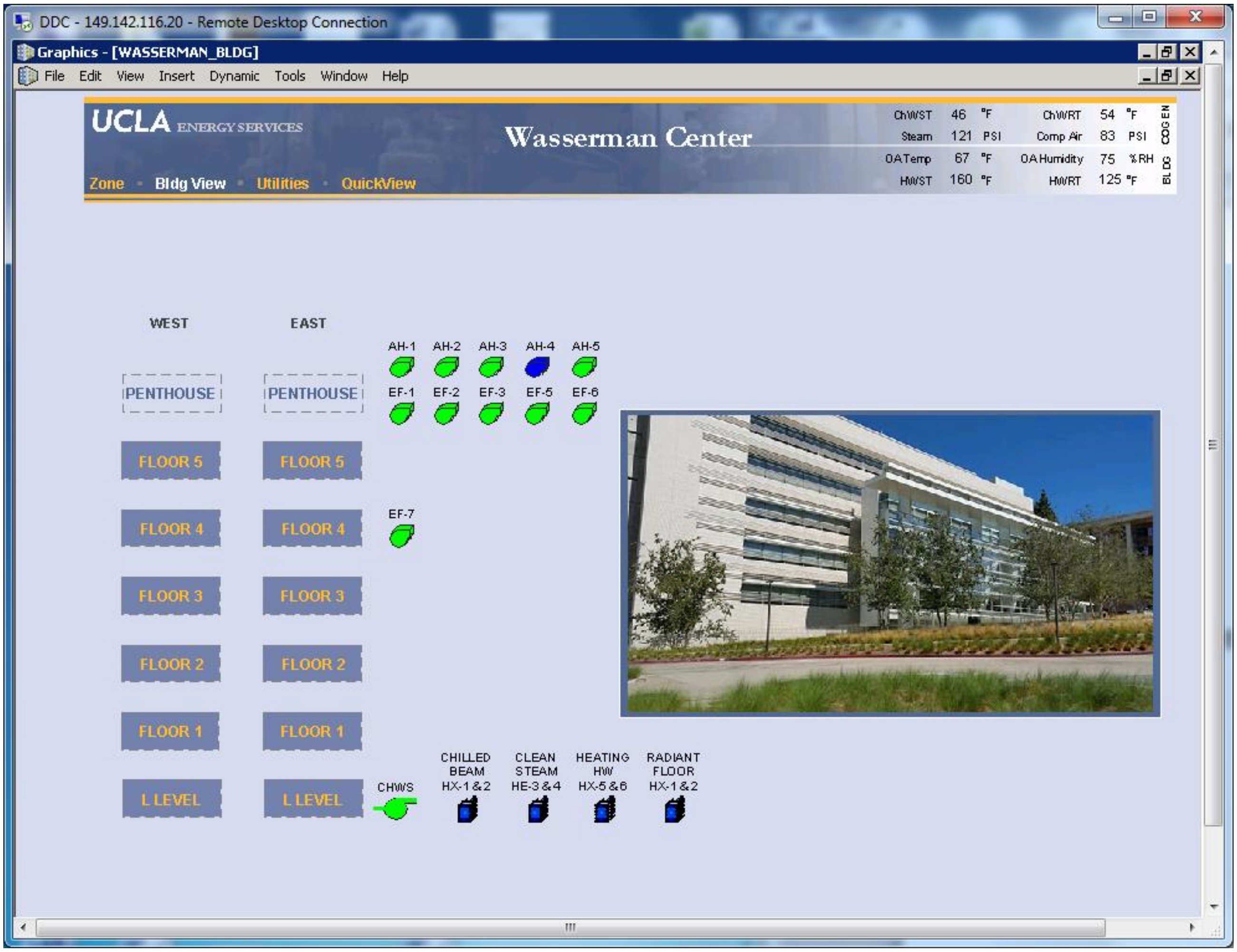
OA Temp 77 °F OA Humidity 68 %RH
HWST 160 °F HWRT 125 °F
AIR SYSTEMS
WATER SYSTEMS
LEGEND Alarm Point Failure Off Manual Override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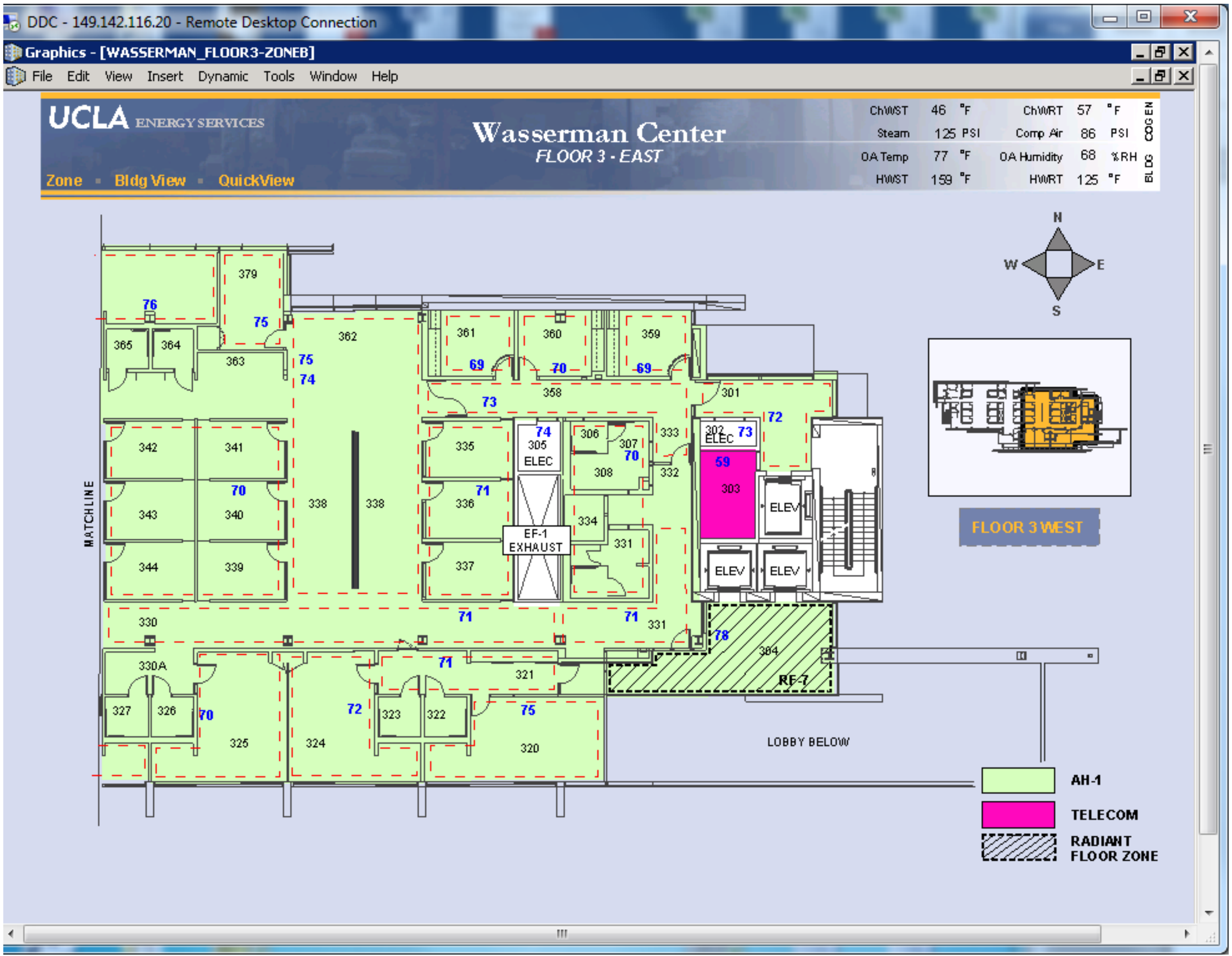
ChWST 46 °F
Steam 121 PSI
OATemp 67 °F
HWST 160 °F
ChWRT 54 °F
Comp Air 83 PSI
OA Humidity 75 %RH
HWRT 125 °F
COGEN
BLDG
WEST
EAST
PENTHOUSE
PENTHOUSE
FLOOR 5
FLOOR 5
FLOOR 4
FLOOR 4
FLOOR 3
FLOOR 3
FLOOR 2
FLOOR 2
FLOOR 1
FLOOR 1
L LEVEL
L LEVEL
AH-1 AH-2 AH-3 AH-4 AH-5
EF-1 EF-2 EF-3 EF-5 EF-6
EF-7
CHWS
CHILLED BEAM HX-1 & 2
CLEAN STEAM HE-3 & 4
HEATING HW HX-5 & 6
RADIANT FLOOR HX-1 & 2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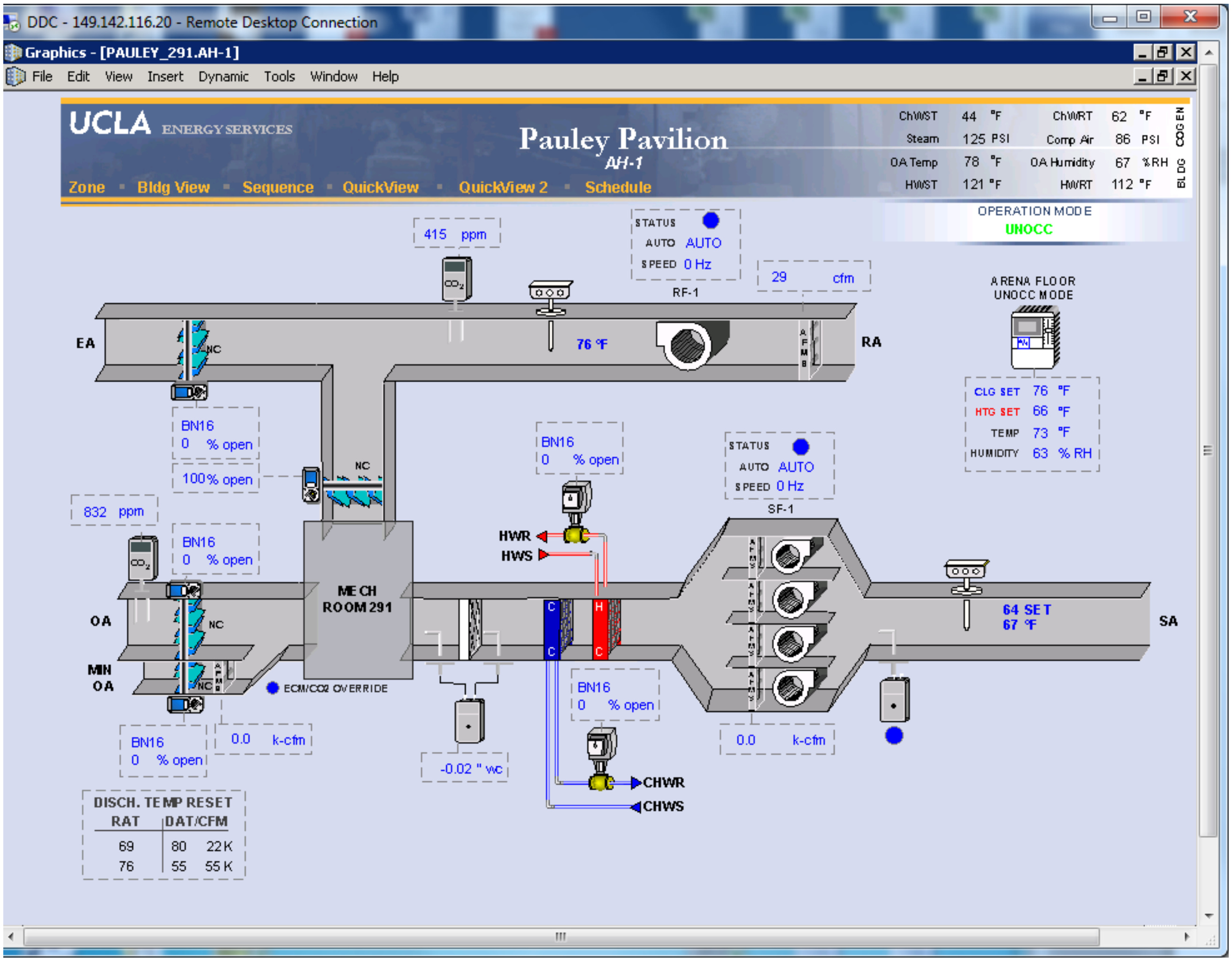
UCLA ENERGY SERVICES
Wasserman Center
FLOOR 3 - EAST
Zone Bldg View QuickView
ChWST 46 °F
Steam 125 PSI
OA Temp 77 °F
HWST 159 °F
ChWRT 57 °F
Comp Air 86 PSI
OA Humidity 68 %RH
HWRT 125 °F
COGEN
BLDG
N
W
E
S
FLOOR 3 WEST
MATCHLINE
EF-1 EXHAUST
ELEC
ELEV
RF-7
LOBBY BELOW
AH-1
TELECOM
RADIANT FLOOR ZONE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Pauley Pavilion
AH-1
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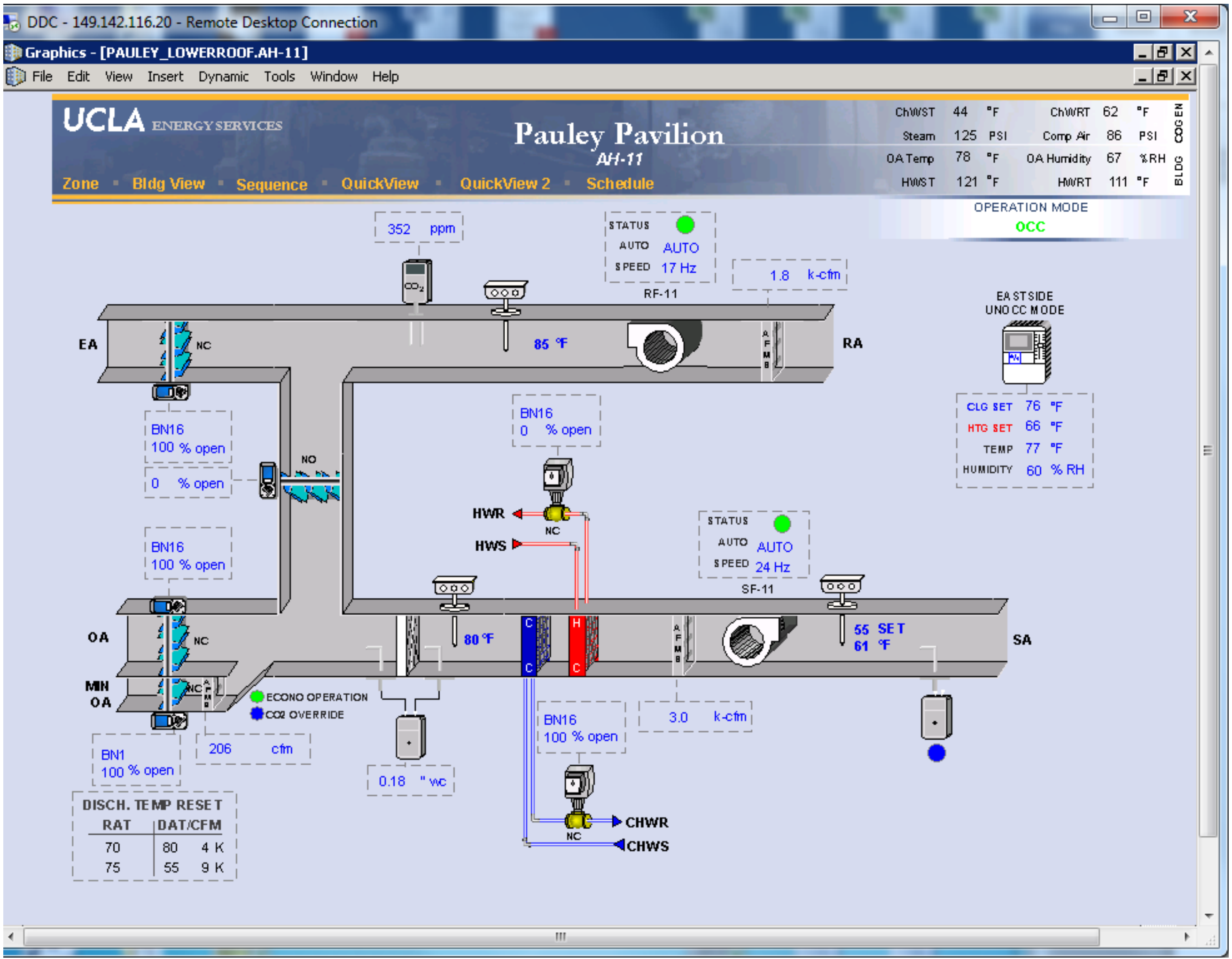
Steam 125 PSI Comp Air 86 PSI
OA Temp 78 °F OA Humidity 67 %RH
HWST 121 °F HWRT 112 °F
OPERATION MODE
UNOCC
STATUS AUTO AUTO SPEED 0 Hz
RF-1
415 ppm
29 cfm
EA
RA
76 °F
ARENA FLOOR UNOCC MODE
CLG SET 76 °F
HTG SET 66 °F
TEMP 73 °F
HUMIDITY 63 % RH
BN16 0 % open
100% open
832 ppm
HWR
HWS
STATUS AUTO AUTO SPEED 0 Hz
SF-1
MECH ROOM 291
OA
MIN OA
SA
64 SET 67 °F
ECM/CO2 OVERRIDE
0.0 k-cfm
-0.02 " wc
CHWR
CHWS
DISCH. TEMP RESET
RAT DAT/CFM
69 80 22K
76 55 55K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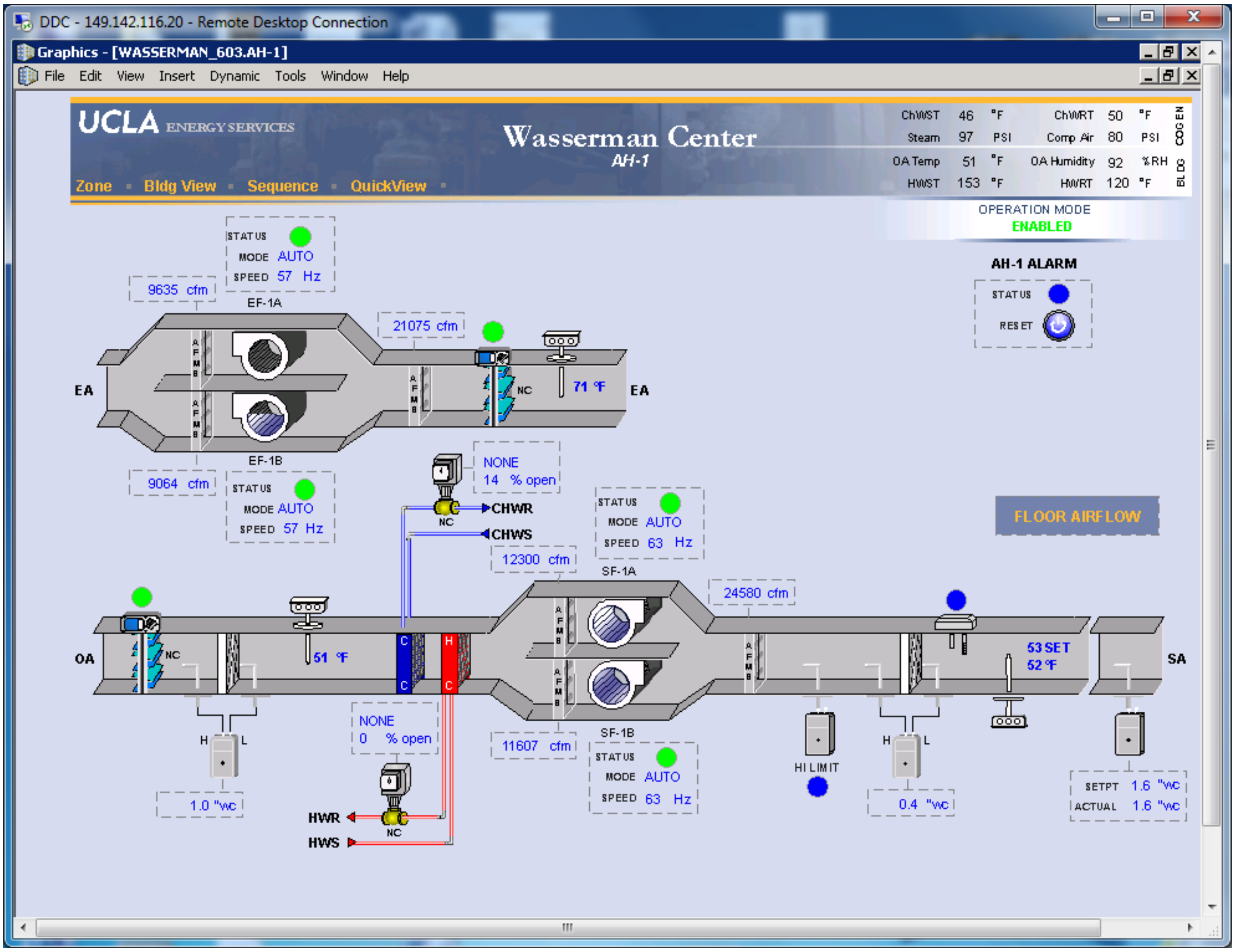
Pauley Pavilion
AH-11
Zone Bldg View Sequence QuickView QuickView 2 Schedule
ChWST 44 °F ChWRT 62 °F
Steam 125 PSI Comp Air 86 PSI
OA Temp 78 °F OA Humidity 67 %RH
HWST 121 °F HWRT 111 °F
COGEN
BLDG
OPERATION MODE
OCC
352 ppm
STATUS
AUTO AUTO
SPEED 17 Hz
RF-11
1.8 k-cfm
EA
NC
85 °F
RA
EASTSIDE
UNOCC MODE
CLG SET 76 °F
HTG SET 66 °F
TEMP 77 °F
HUMIDITY 60 % RH
BN16
100 % open
0 % open
NO
BN16
0 % open
HWR
HWS
NC
STATUS
AUTO AUTO
SPEED 24 Hz
SF-11
BN16
100 % open
OA
MIN
OA
80 °F
55 SET
61 °F
SA
ECONO OPERATION
CO2 OVERRIDE
BN1
100 % open
206 cfm
0.18 " wc
BN16
100 % open
3.0 k-cfm
CHWR
CHWS
DISCH. TEMP RESET
RAT DAT/CFM
70 80 4 K
75 55 9 K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Wasserman Center
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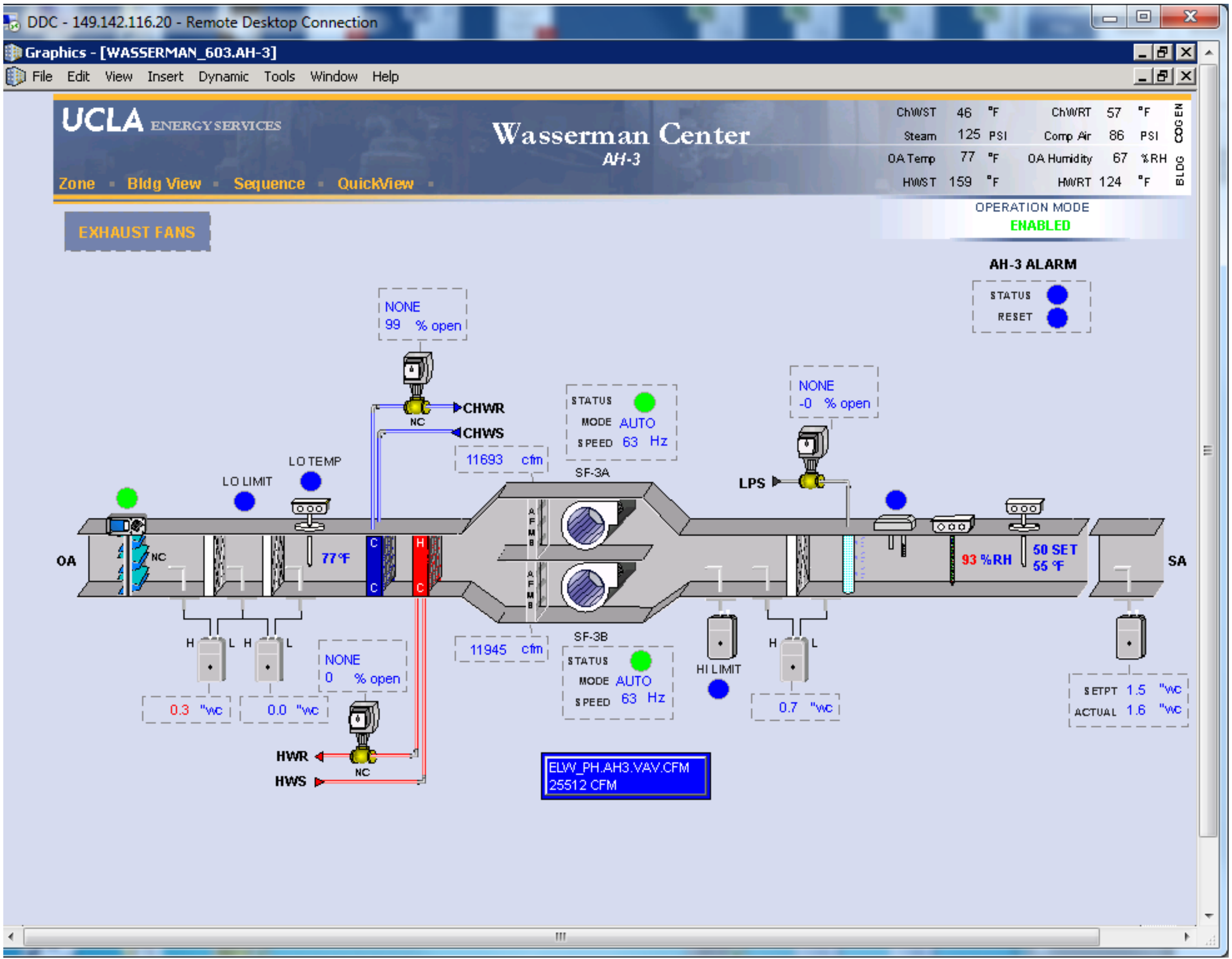
Steam 97 PSI Comp Air 80 PSI
OA Temp 51 °F OA Humidity 92 %RH
HWST 153 °F HWRT 120 °F
COGEN
BLDG
OPERATION MODE
ENABLED
AH-1 ALARM
STATUS
RESET
FLOOR AIRFLOW
STATUS MODE AUTO SPEED 57 Hz
9635 cfm
EF-1A
21075 cfm
EA
NC
71 °F
EF-1B
9064 cfm
STATUS MODE AUTO SPEED 57 Hz
NONE 14 % open
CHWR
CHWS
STATUS MODE AUTO SPEED 63 Hz
12300 cfm
SF-1A
24580 cfm
OA
51 °F
53 SET 52 °F
SA
NONE 0 % open
11607 cfm
SF-1B
STATUS MODE AUTO SPEED 63 Hz
HI LIMIT
1.0 "wc
HWR
HWS
0.4 "wc
SETPT 1.6 "wc
ACTUAL 1.6 "wc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Wasserman Center
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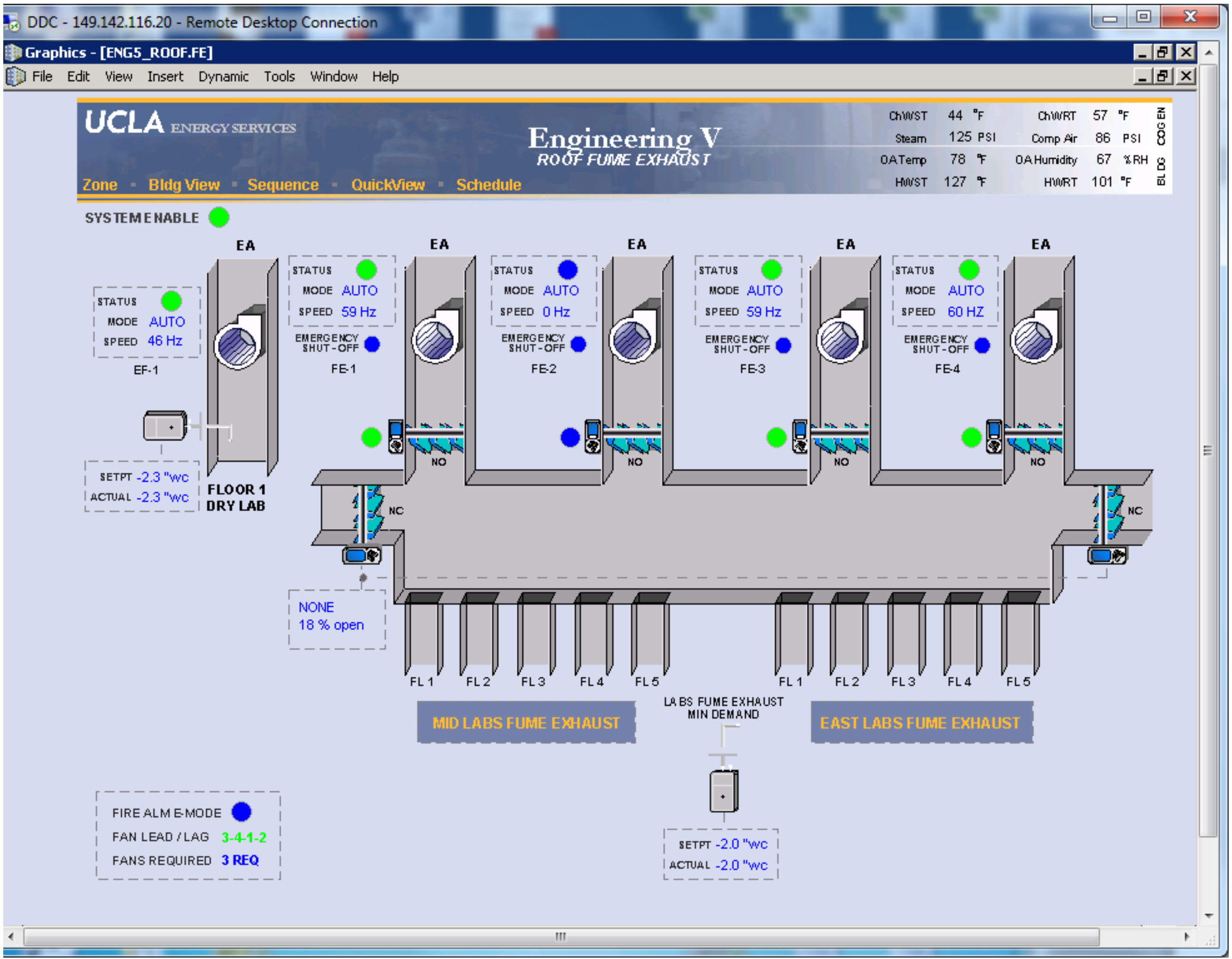
OA Temp 77 °F OA Humidity 67 %RH
HWST 159 °F HWRT 124 °F
COGEN
BLDG
OPERATION MODE
ENABLED
EXHAUST FANS
AH-3 ALARM
STATUS
RESET
NONE
99 % open
CHWR
CHWS
NC
STATUS
MODE AUTO
SPEED 63 Hz
11693 cfm
SF-3A
NONE
-0 % open
LPS
LO TEMP
LO LIMIT
OA
77 °F
93 %RH
50 SET
55 °F
SA
11945 cfm
SF-3B
STATUS
MODE AUTO
SPEED 63 Hz
HI LIMIT
NONE
0 % open
0.3 "wc
0.0 "wc
0.7 "wc
SETPT 1.5 "wc
ACTUAL 1.6 "wc
HWR
HWS
ELW_PH.AH3.VAV.CFM
25512 CFM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Engineering V
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Zone Bldg View Sequence QuickView Schedule
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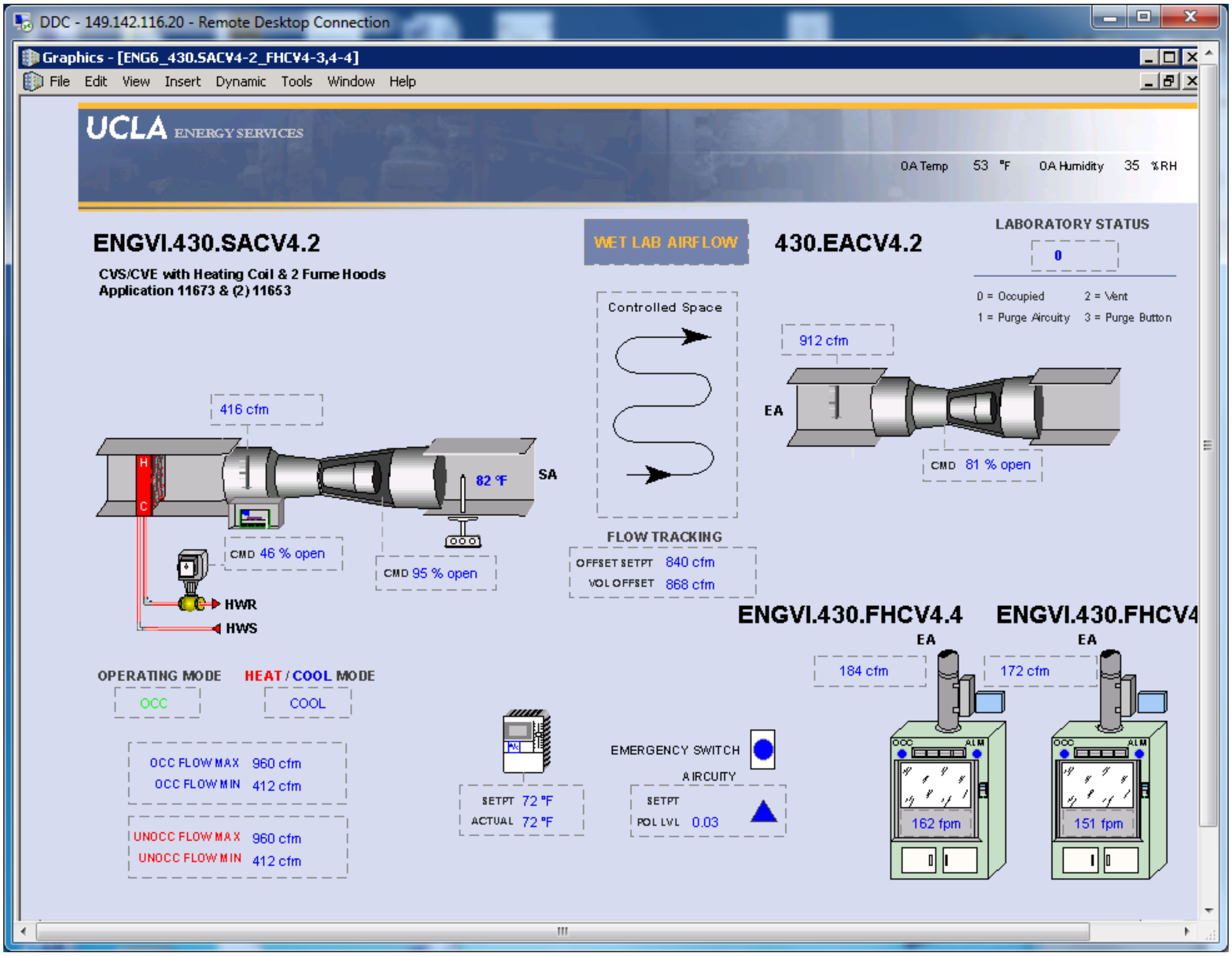
Steam 125 PSI
OATemp 78 °F
HWST 127 °F
ChWRT 57 °F
Comp Air 86 PSI
OA Humidity 67 %RH
HWRT 101 °F
SYSTEM ENABLE
EA
STATUS
MODE AUTO
SPEED 46 Hz
EF-1
SETPT -2.3 "wc
ACTUAL -2.3 "wc
FLOOR 1
DRY LAB
STATUS
MODE AUTO
SPEED 59 Hz
EMERGENCY SHUT-OFF
FE-1
STATUS
MODE AUTO
SPEED 0 Hz
EMERGENCY SHUT-OFF
FE-2
STATUS
MODE AUTO
SPEED 59 Hz
EMERGENCY SHUT-OFF
FE-3
STATUS
MODE AUTO
SPEED 60 HZ
EMERGENCY SHUT-OFF
FE-4
NO
NC
NONE
18 % open
FL 1 FL 2 FL 3 FL 4 FL 5
FL 1 FL 2 FL 3 FL 4 FL 5
MID LABS FUME EXHAUST
LABS FUME EXHAUST MIN DEMAND
EAST LABS FUME EXHAUST
SETPT -2.0 "wc
ACTUAL -2.0 "wc
FIRE ALM E-MODE
FAN LEAD / LAG 3-4-1-2
FANS REQUIRED 3 REQ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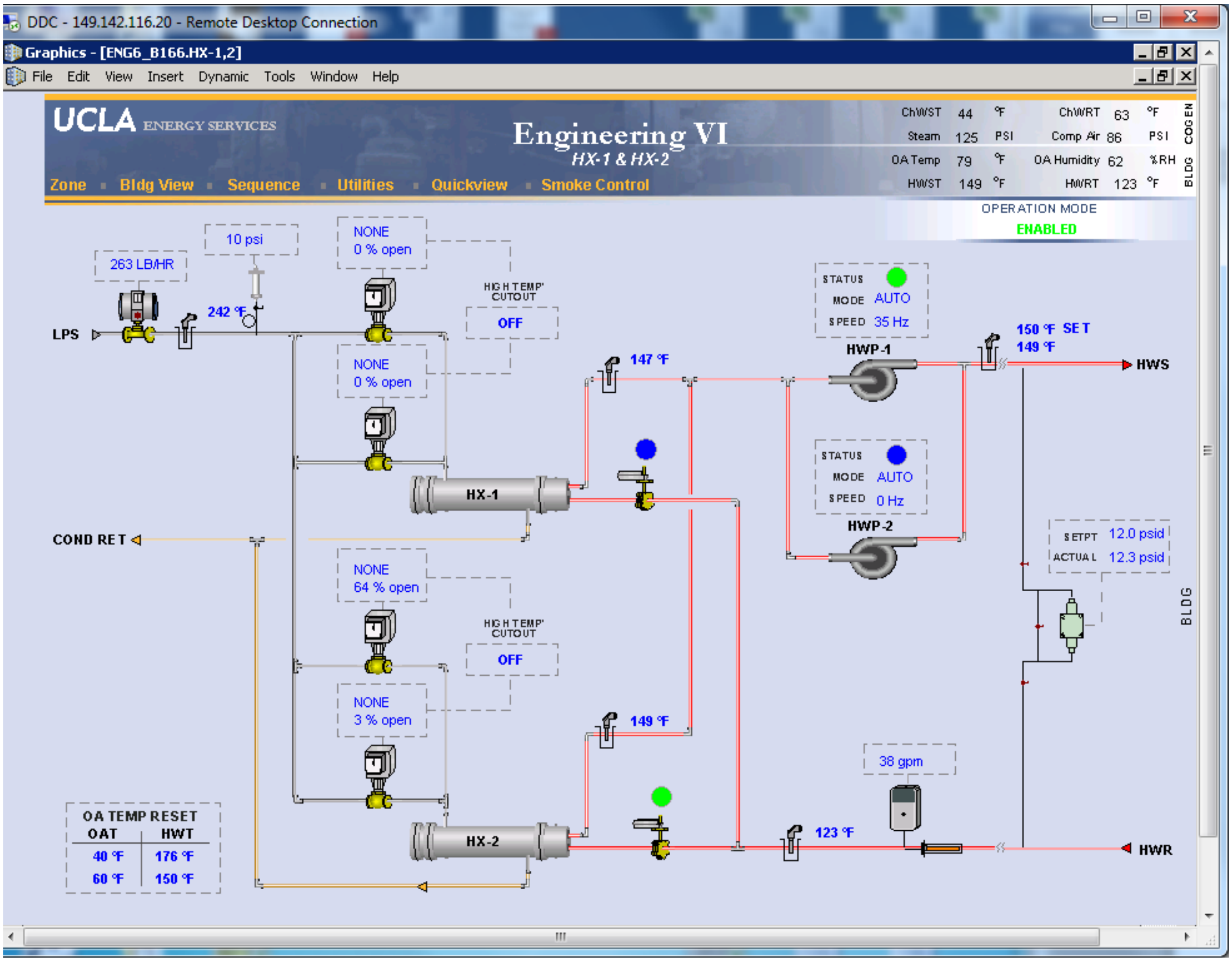
UCLA ENERGY SERVICES
OA Temp 53 °F OA Humidity 35 %RH
ENGVI.430.SACV4.2
CVS/CVE with Heating Coil & 2 Fume Hoods
Application 11673 & (2) 11653
WET LAB AIRFLOW
430.EACV4.2
LABORATORY STATUS
0
0 = Occupied 2 = Vent
1 = Purge Aircuity 3 = Purge Button
Controlled Space
912 cfm
EA
CMD 81 % open
416 cfm
82 °F
SA
CMD 46 % open
CMD 95 % open
HWR
HWS
FLOW TRACKING
OFFSET SETPT 840 cfm
VOL OFFSET 868 cfm
ENGVI.430.FHCV4.4
ENGVI.430.FHCV4
EA
184 cfm
172 cfm
OPERATING MODE
HEAT / COOL MODE
OCC
COOL
OCC FLOW MAX 960 cfm
OCC FLOW MIN 412 cfm
UNOCC FLOW MAX 960 cfm
UNOCC FLOW MIN 412 cfm
SETPT 72 °F
ACTUAL 72 °F
EMERGENCY SWITCH
AIRCUITY
SETPT
POL LVL 0.03
162 fpm
151 fpm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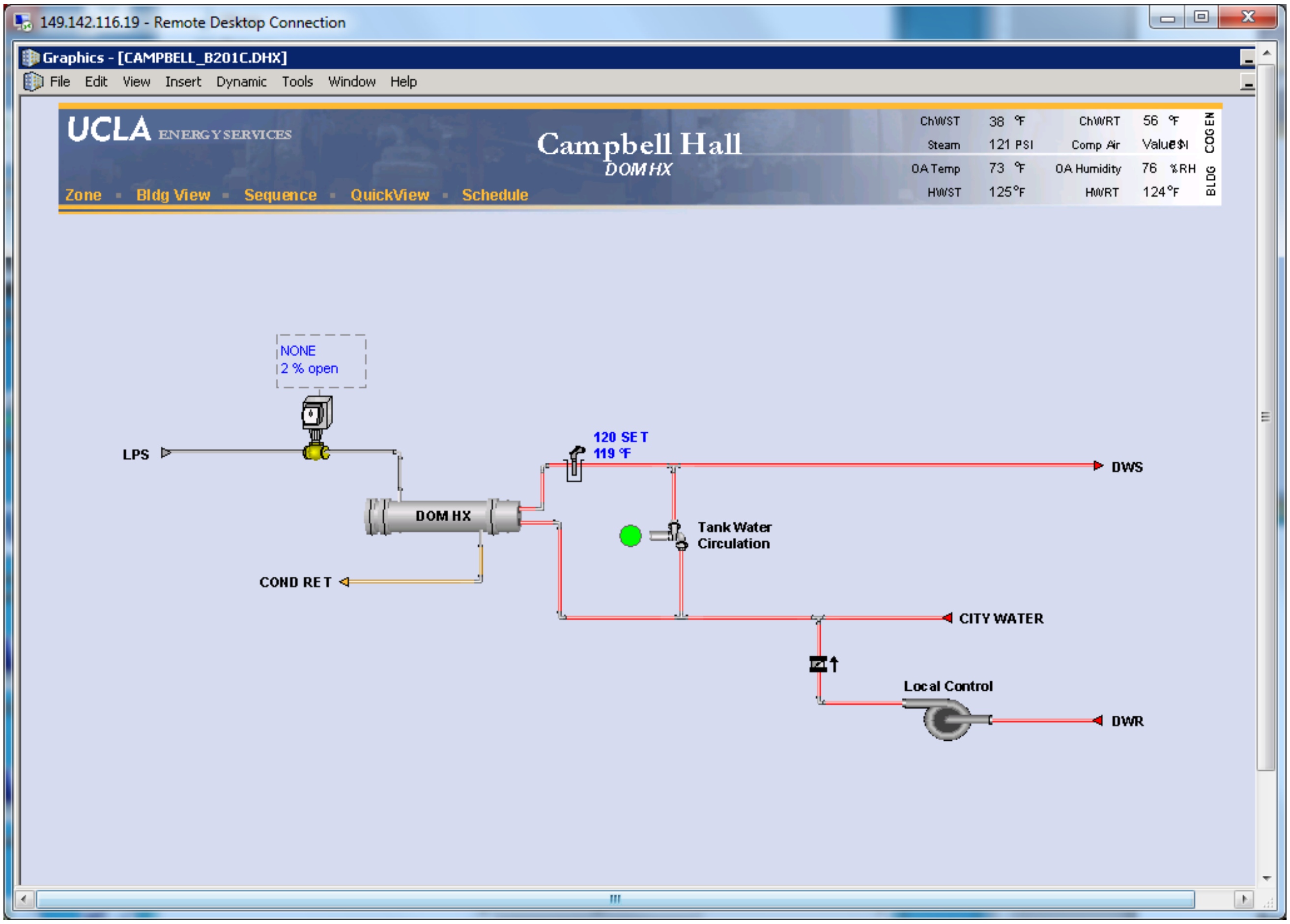
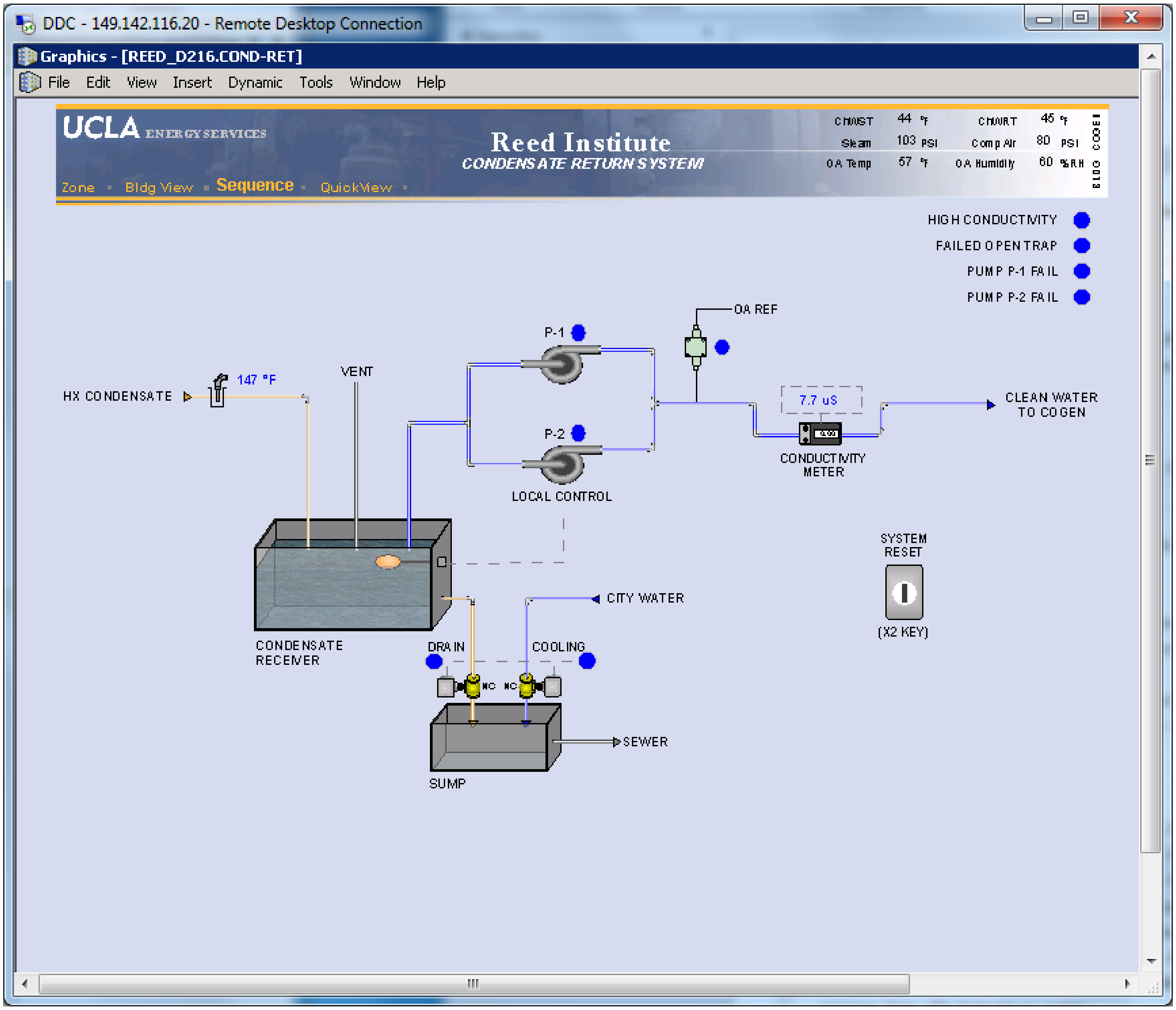
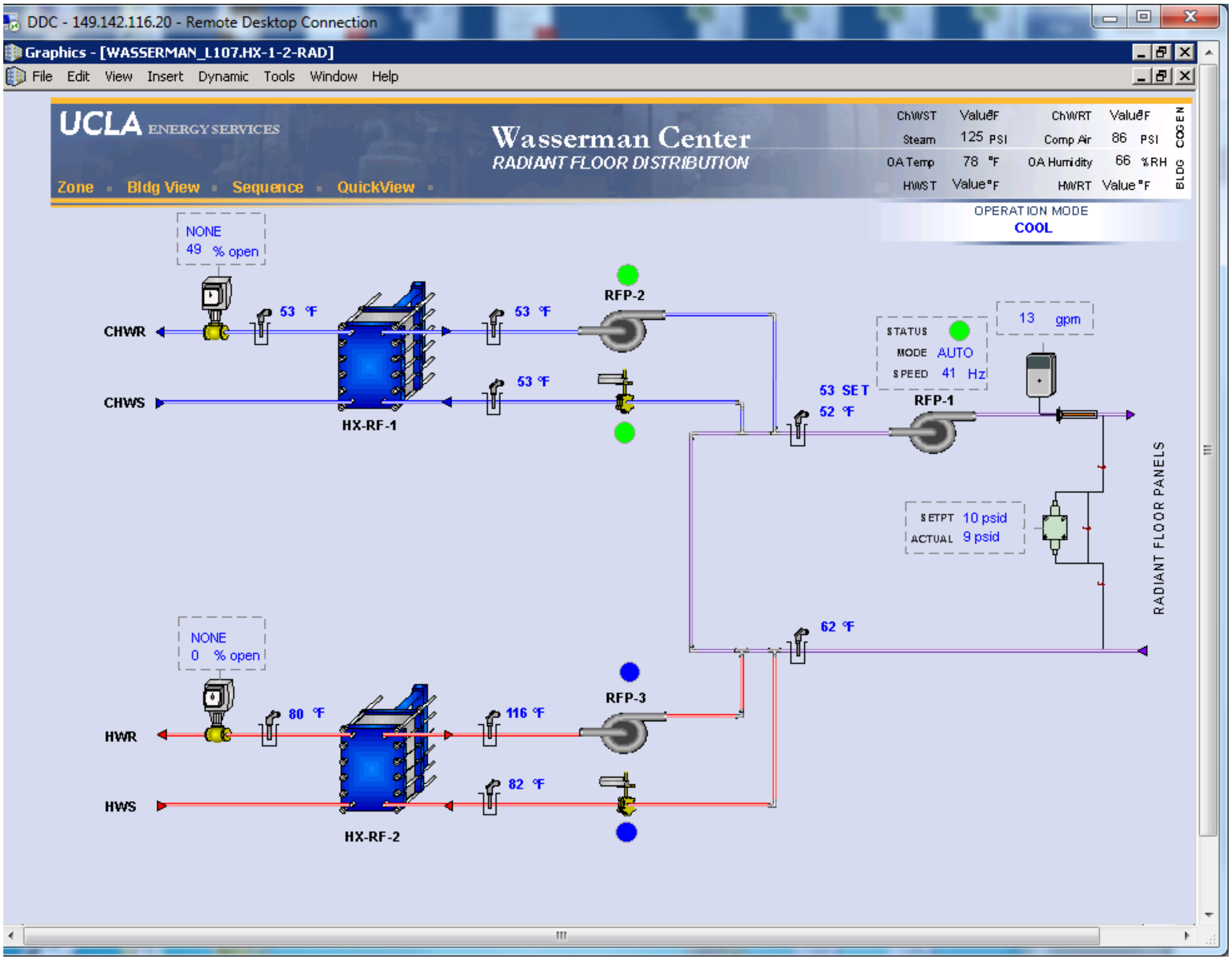
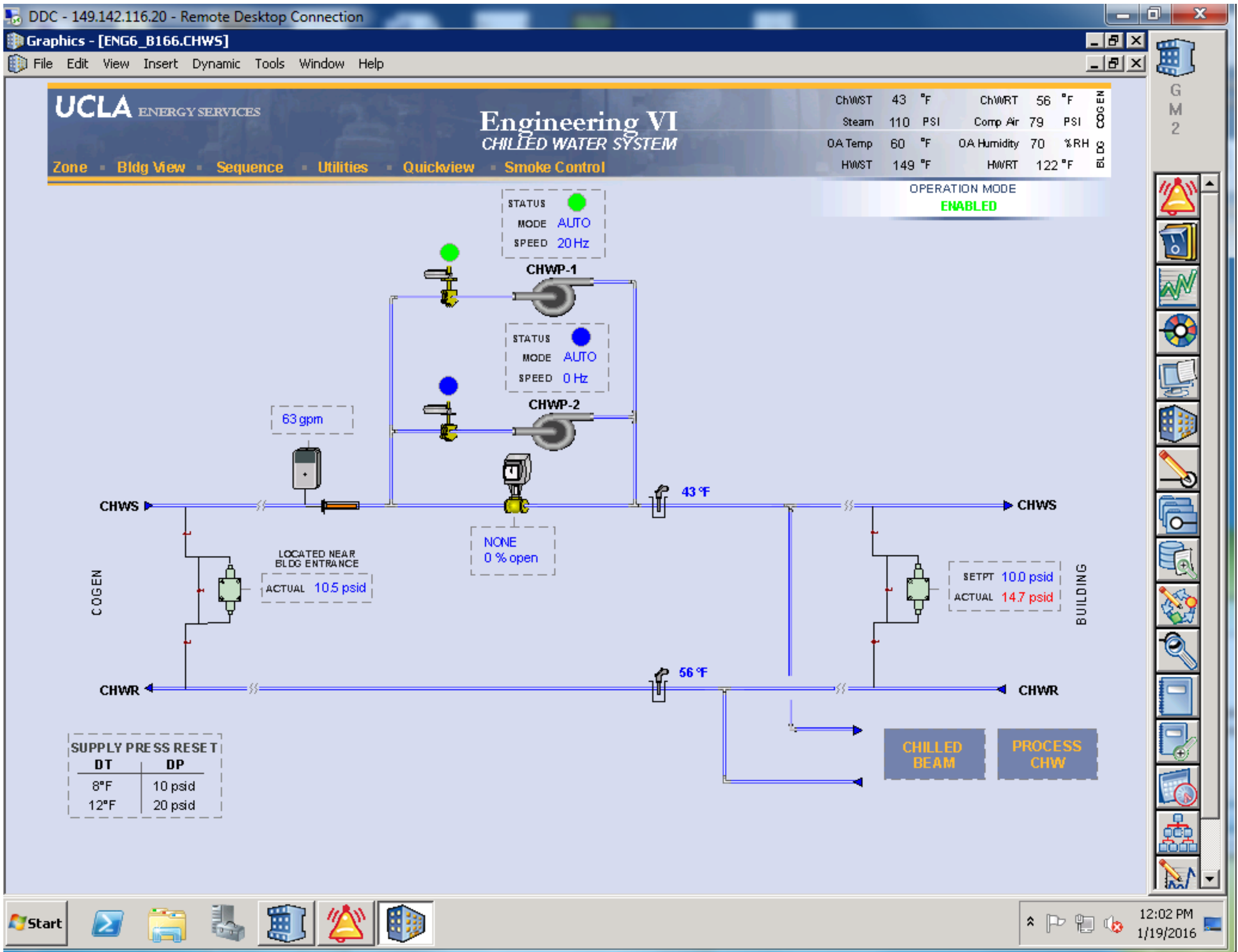
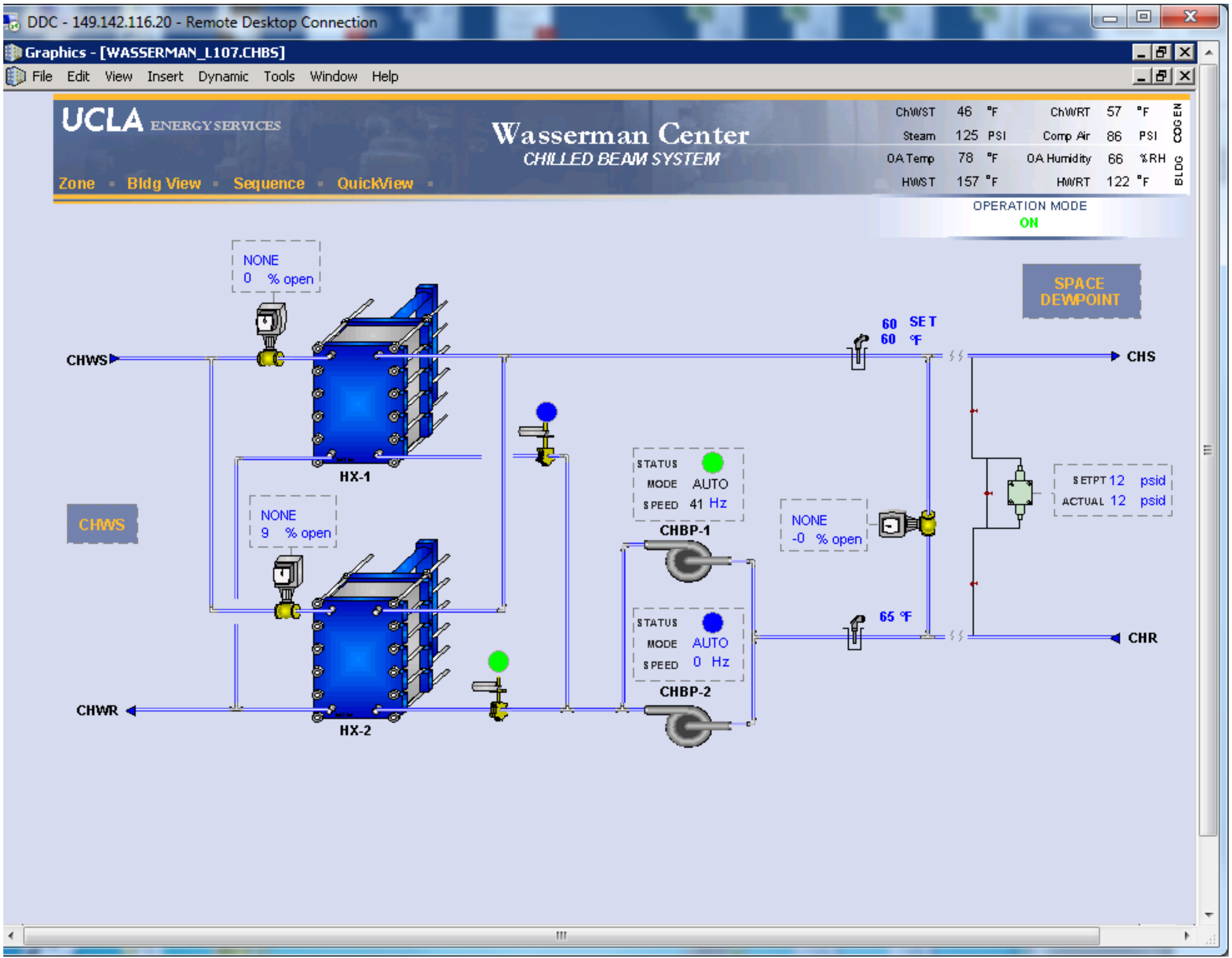
UCLA ENERGY SERVICES
Engineering VI
HX-1 & HX-2
Zone Bldg View Sequence Utilities Quickview Smoke Control
ChWST 44 °F ChWRT 63 °F
Steam 125 PSI Comp Air 86 PSI
OA Temp 79 °F OA Humidity 62 %RH
HWST 149 °F HWRT 123 °F
COGEN
BLDG
OPERATION MODE
ENABLED
263 LB/HR
10 psi
242 °F
LPS
NONE
0 % open
HIGH TEMP CUTOUT
OFF
NONE
0 % open
STATUS
MODE AUTO
SPEED 35 Hz
HWP-1
147 °F
150 °F SET
149 °F
HWS
HX-1
STATUS
MODE AUTO
SPEED 0 Hz
HWP-2
COND RET
SETPT 12.0 psid
ACTUAL 12.3 psid
BLDG
NONE
64 % open
HIGH TEMP CUTOUT
OFF
NONE
3 % open
149 °F
38 gpm
OA TEMP RESET
OAT HWT
40 °F 176 °F
60 °F 150 °F
HX-2
123 °F
HWR

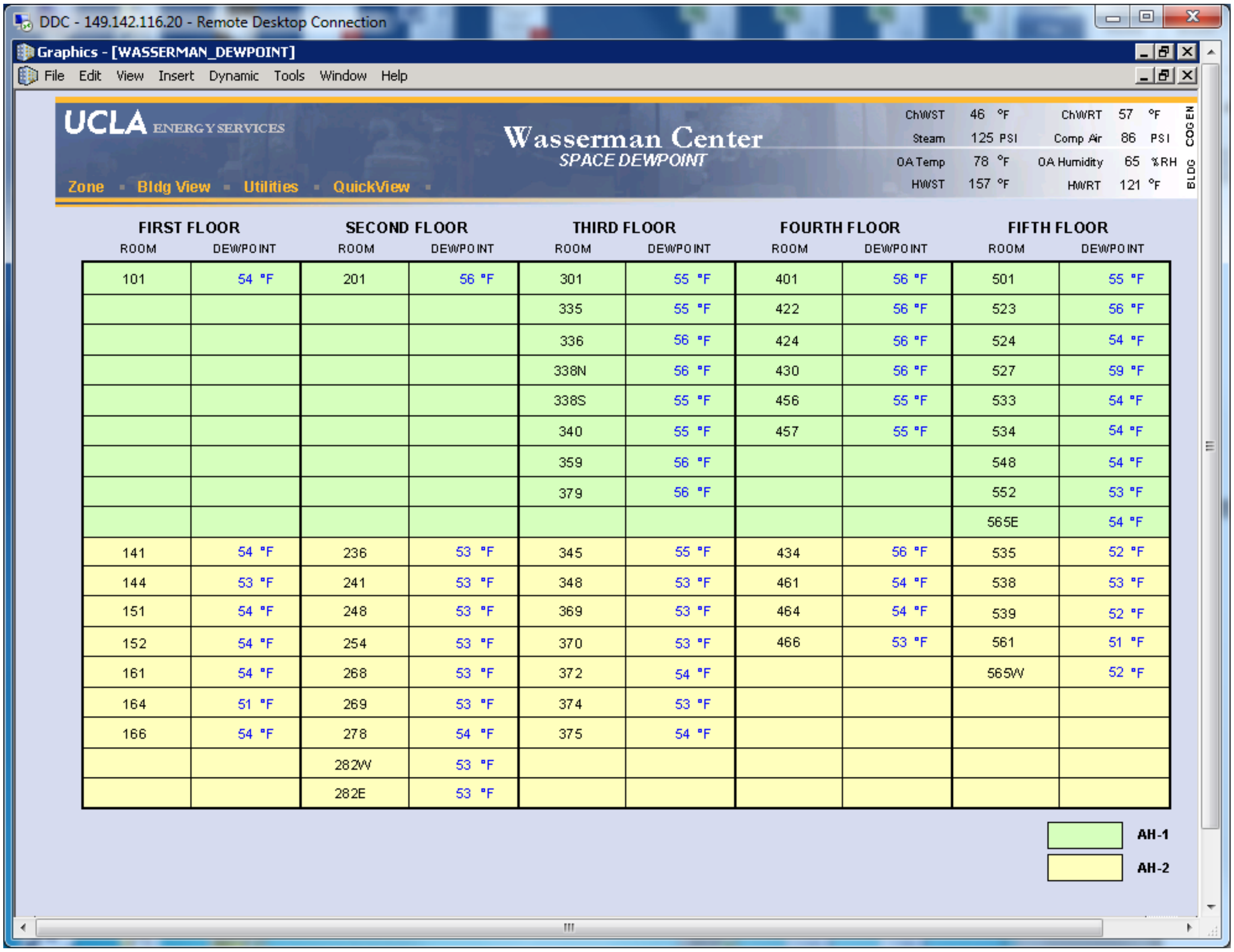

149.142.116.19 - Remote Desktop Connection
Graphics - [CAMPBELL_B201C.DHX]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Campbell Hall
DOM HX
Zone Bldg View Sequence QuickView Schedule
ChWST 38 °F ChWRT 56 °F
Steam 121 PSI Comp Air Value$NI
OA Temp 73 °F OA Humidity 76 %RH
HWST 125°F HWRT 124°F
COGEN
BLDG
NONE
2 % open
LPS
120 SET
119 °F
DWS
DOM HX
Tank Water
Circulation
COND RET
CITY WATER
Local Control
DWR


DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [REED_D216.COND-RET]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Reed Institute
CONDENSATE RETURN SYSTEM
Zone Bldg View Sequence QuickView
CHWST 44 °F
Steam 103 PSI
OA Temp 57 °F
CHWRT 45 °F
Comp Air 80 PSI
OA Humidity 60 %RH
HIGH CONDUCTIVITY
FAILED OPEN TRAP
PUMP P-1 FAIL
PUMP P-2 FAIL
OA REF
P-1
P-2
LOCAL CONTROL
HX CONDENSATE
147 °F
VENT
7.7 uS
CONDUCTIVITY METER
CLEAN WATER TO COGEN
SYSTEM RESET
(X2 KEY)
CITY WATER
CONDENSATE RECEIVER
DRAIN
COOLING
SEWER
SUMP

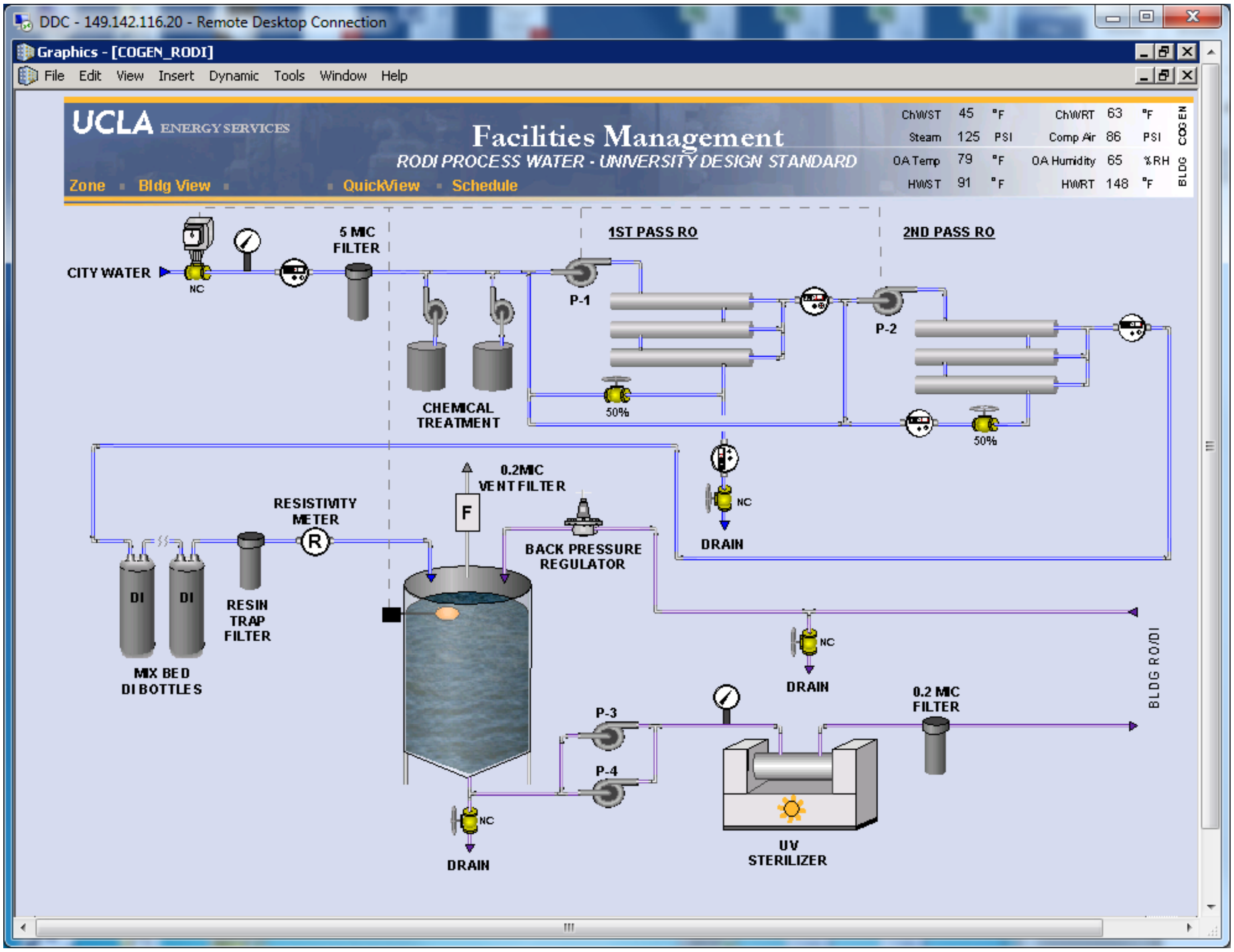

DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [WASSERMAN_L107.HX-1-2-RAD]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Wasserman Center
RADIANT FLOOR DISTRIBUTION
Zone Bldg View Sequence QuickView
ChWST Value°F ChWRT Value°F
Steam 125 PSI Comp Air 86 PSI
OA Temp 78 °F OA Humidity 66 %RH
HWST Value°F HWRT Value°F
OPERATION MODE
COOL
NONE
49 % open
CHWR
CHWS
53 °F
53 °F
53 °F
RFP-2
HX-RF-1
STATUS
MODE AUTO
SPEED 41 Hz
13 gpm
53 SET
52 °F
RFP-1
SETPT 10 psid
ACTUAL 9 psid
RADIANT FLOOR PANELS
62 °F
NONE
0 % open
HWR
HWS
80 °F
116 °F
82 °F
RFP-3
HX-RF-2

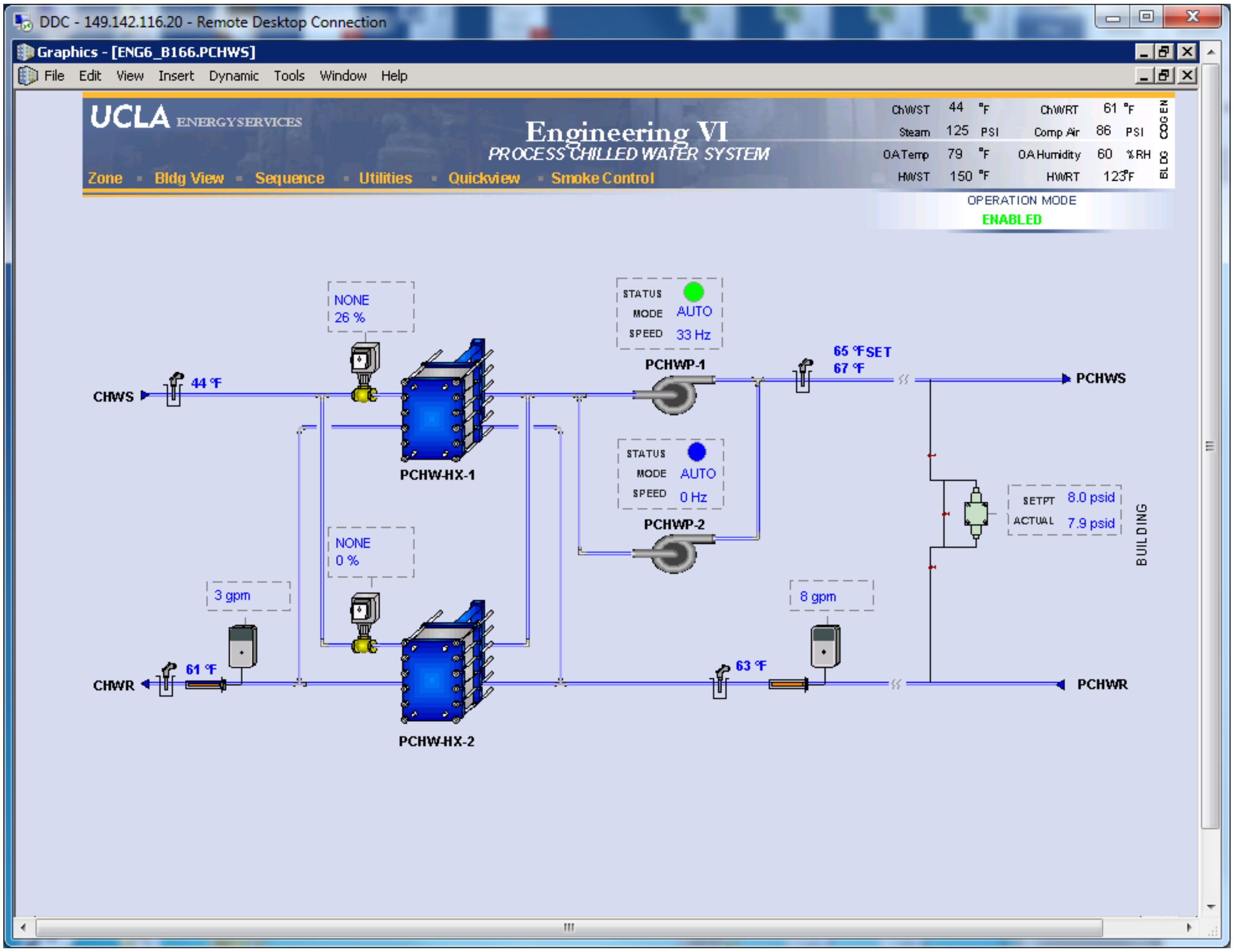

DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [ENG6_B166.CHWS]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Engineering VI
CHILLED WATER SYSTEM
Zone Bldg View Sequence Utilities Quickview Smoke Control
ChWST 43 °F
Steam 110 PSI
OA Temp 60 °F
HWST 149 °F
ChWRT 56 °F
Comp Air 79 PSI
OA Humidity 70 %RH
HWRT 122 °F
COGEN
BLDG
OPERATION MODE
ENABLED
STATUS
MODE AUTO
SPEED 20 Hz
CHWP-1
STATUS
MODE AUTO
SPEED 0 Hz
CHWP-2
63 gpm
CHWS
CHWR
COGEN
LOCATED NEAR BLDG ENTRANCE
ACTUAL 10.5 psid
NONE
0 % open
43 °F
56 °F
SETPT 10.0 psid
ACTUAL 14.7 psid
BUILDING
CHILLED BEAM
PROCESS CHW
SUPPLY PRESS RESET
DT DP
8°F 10 psid
12°F 20 psid
Start
12:02 PM
1/19/2016

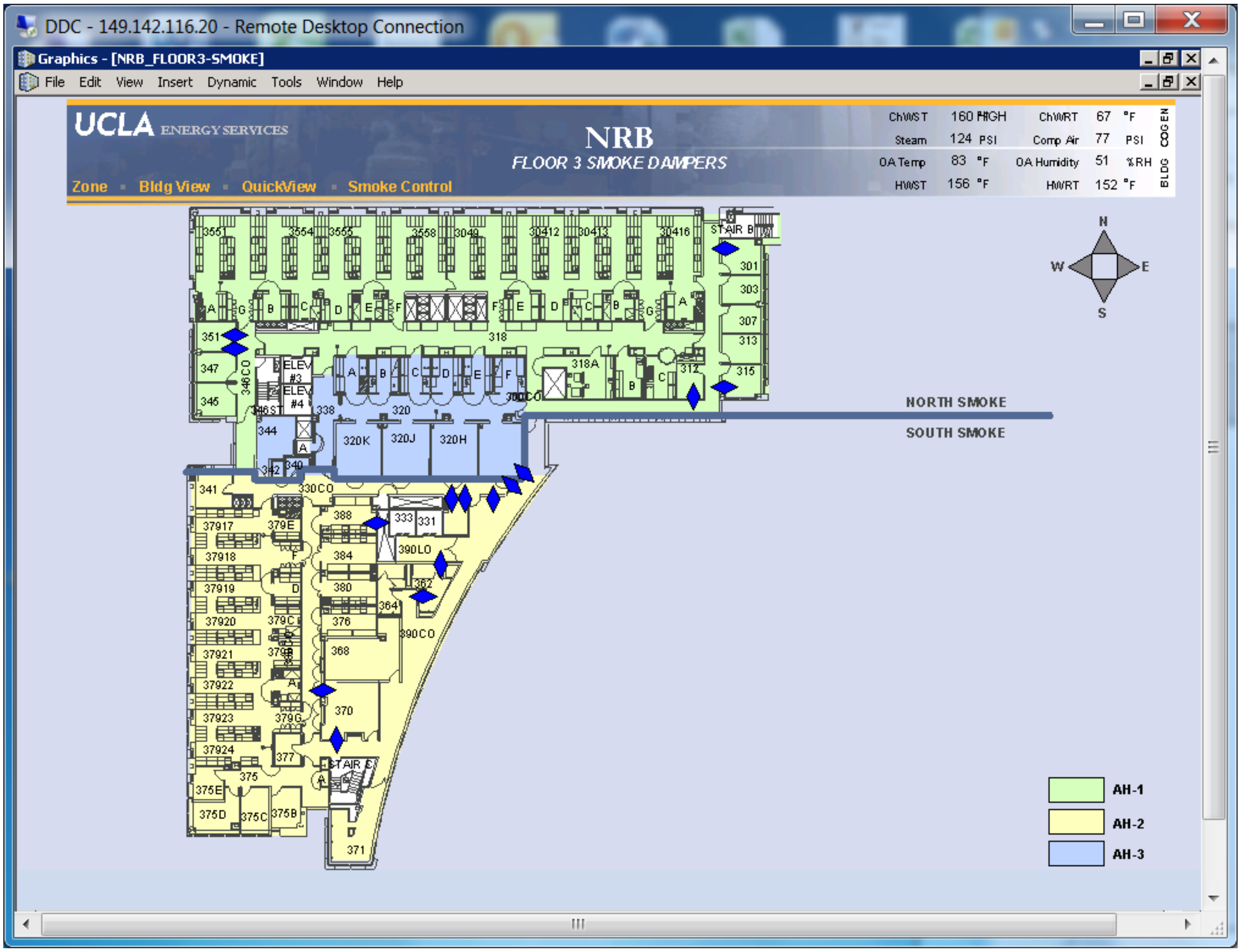

DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [WASSERMAN_L107.CHBS]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Wasserman Center
CHILLED BEAM SYSTEM
Zone Bldg View Sequence QuickView
ChWST 46 °F
ChWRT 57 °F
Steam 125 PSI
Comp Air 86 PSI
OA Temp 78 °F
OA Humidity 66 %RH
HWST 157 °F
HWRT 122 °F
COGEN
BLDG
OPERATION MODE
ON
SPACE DEWPOINT
NONE
0 % open
CHWS
HX-1
CHWS
NONE
9 % open
HX-2
CHWR
STATUS
MODE AUTO
SPEED 41 Hz
CHBP-1
STATUS
MODE AUTO
SPEED 0 Hz
CHBP-2
NONE
-0 % open
60 SET
60 °F
CHS
65 °F
CHR
SETPT 12 psid
ACTUAL 12 psid



FIRST FLOOR ROOM	FIRST FLOOR DEWPOINT	SECOND FLOOR ROOM	SECOND FLOOR DEWPOINT	THIRD FLOOR ROOM	THIRD FLOOR DEWPOINT	FOURTH FLOOR ROOM	FOURTH FLOOR DEWPOINT	FIFTH FLOOR ROOM	FIFTH FLOOR DEWPOINT
101	54 °F	201	56 °F	301	55 °F	401	56 °F	501	55 °F
				335	55 °F	422	56 °F	523	56 °F
				336	56 °F	424	56 °F	524	54 °F
				338N	56 °F	430	56 °F	527	59 °F
				338S	55 °F	456	55 °F	533	54 °F
				340	55 °F	457	55 °F	534	54 °F
				359	56 °F			548	54 °F
				379	56 °F			552	53 °F
								565E	54 °F
141	54 °F	236	53 °F	345	55 °F	434	56 °F	535	52 °F
144	53 °F	241	53 °F	348	53 °F	461	54 °F	538	53 °F
151	54 °F	248	53 °F	369	53 °F	464	54 °F	539	52 °F
152	54 °F	254	53 °F	370	53 °F	466	53 °F	561	51 °F
161	54 °F	268	53 °F	372	54 °F			565W	52 °F
164	51 °F	269	53 °F	374	53 °F				
166	54 °F	278	54 °F	375	54 °F				
		282W	53 °F						
		282E	53 °F						


DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [COGEN_RODI]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
Facilities Management
RODI PROCESS WATER - UNIVERSITY DESIGN STANDARD
Zone Bldg View QuickView Schedule
ChWST 45 °F
Steam 125 PSI
OA Temp 79 °F
HWST 91 °F
ChWRT 63 °F
Comp Air 86 PSI
OA Humidity 65 %RH
HWRT 148 °F
BLDG COGEN
CITY WATER
NC
5 MIC FILTER
1ST PASS RO
2ND PASS RO
P-1
P-2
CHEMICAL TREATMENT
50%
50%
DRAIN
0.2MIC VENT FILTER
F
RESISTIVITY METER
R
BACK PRESSURE REGULATOR
DI
DI
RESIN TRAP FILTER
MIX BED DI BOTTLES
DRAIN
BLDG RO/DI
0.2 MIC FILTER
P-3
P-4
UV STERILIZER
DRAIN


DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [ENG6_B166.PCHWS]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGYSERVICES
Engineering VI
PROCESS CHILLED WATER SYSTEM
Zone Bldg View Sequence Utilities Quickview Smoke Control
ChWST 44 °F ChWRT 61 °F
Steam 125 PSI Comp Air 86 PSI
OATemp 79 °F OA Humidity 60 %RH
HWST 150 °F HWRT 123 °F
OPERATION MODE
ENABLED
NONE
26 %
STATUS
MODE AUTO
SPEED 33 Hz
PCHWP-1
65 °F SET
67 °F
PCHWS
CHWS
44 °F
PCHW-HX-1
STATUS
MODE AUTO
SPEED 0 Hz
PCHWP-2
SETPT 8.0 psid
ACTUAL 7.9 psid
BUILDING
NONE
0 %
3 gpm
8 gpm
CHWR
61 °F
63 °F
PCHWR
PCHW-HX-2


DDC - 149.142.116.20 - Remote Desktop Connection
Graphics - [NRB_FLOOR3-SMOKE]
File Edit View Insert Dynamic Tools Window Help
UCLA ENERGY SERVICES
NRB
FLOOR 3 SMOKE DAMPERS
Zone Bldg View QuickView Smoke Control
ChWST 160 HIGH
Steam 124 PSI
OA Temp 83 °F
HWST 156 °F
ChWRT 67 °F
Comp Air 77 PSI
OA Humidity 51 %RH
HWRT 152 °F
BLDG COGEN
N
W
E
S
NORTH SMOKE
SOUTH SMOKE
AH-1
AH-2
AH-3

DATA DISPLAY

(Observe upper and lower case letters)

Description	Engineering Units	Value Decimals	Display Example	COV
Air Changes	ACH	0	6 ACH	1
Air Flow	cfm	0	20890 cfm	100
Carbon Dioxide CO2	PPM	0	423 PPM	50
Carbon Monoxide	PPM	0	22 PPM	1
Conductivity	u/S	0	12 u/S	1
Dewpoint	F	0	59 F	1
Differential Pressure	psid	0	9 psid	1
Filter Differential Pressure	“wc	1	0.5 “wc	0.1
Humidity on floor plan	%	0	75 %	2
Humidity on schematic	%RH	0	43 %RH	2
Liquid Level	%Full	0	58 %Full	5
Position (valve, damper)	%open	0	60 %open	5
Static Pressure	“wc	1	1.5 “wc	0.1
Steam Pressure	psi	0	129 psi	5
Steam Flow	lbs/h	0	586 lbs/h	100
Temperature on floor plan	(none)	0	72	1
Temperature on schematic	F	0	57 F	1
Total Volatile Organic Compounds	TVOC	2	0.15 TVOC	0.05
Water Flow	gpm	0	234 gpm	10
Water Totalizer	GAL`	0	33456 GAL	1000
VFD Speed	Hz	0	56 Hz	1

TEMERATURE and HUMIDITY

SPACE USE	OCC TEMP SETPOINT RANGE (Degf)	HUMIDITY SETPOINT RANGE (%RH)	REGULATORY CODE	Trouble Call Alarm	Display Control Sensor	Blank Sensor
Area not listed below.	70 to 76	NA			X	
Aquarium	70 to 76	NA			X	
Audio Visual Equipment	74	NA				X
Classrooms, Computer	70 to 76	NA			X	
Classrooms, General	70 to 76	NA			X	
Classroom, Lecture Hall	70 to 76	NA			X	
Clean Room	68 to 73	NA			X	
Conference Room	70 to 76	NA			X	
Corridors	74	NA				X
Data Closet (IDF)	74	NA				X
Diagnostic Equipment	70 to 76	40 to 60			X	
Dining	70 to 76	NA			X	
Equip Rooms, Electrical	76	NA				X
Equip Rooms, Elevator	76	NA				X
Equip Rooms, Mechanical	76	NA				X
Exercise Room	74	NA				X
Gymnasium	74	NA				X
Kitchen & Food Prep	70 to 76	NA			X	
Laboratory, Wet or Dry	68 to 73	NA			X	
Lecture Hall	70 to 76	NA			X	
Library, Stacks	67 to 73	20 to 70	UCLA Library Dept.		X	
Library, Rare Books Store	70	40	UCLA Library Dept.		X	
Lobbies	74	NA				X
Music Rehearsal	70 to 76	NA			X	
Museum Gallery	70 to 74	45 to 55	UCLA Museum Dept	X	X	
Offices	70 to 76	NA			X	
Operating Rooms	68 to 73	20 to 60	CMC 2016	X	X	
OR Substerile	68 to 73	30 to 60	AAMI Standard 79		X	
Patient Prep - Recovery	70 to 76	NA	AIA FGI Guidelines		X	
Patient Sleeping	70 to 76	NA			X	
Public Area	74	NA				X
Restroom	74	NA				X
Server Room	74	NA				X
Storage, General	74	NA				X
Storage, Medical Supplies	74	20 to 70	AAMI Standard 79		X	
Storage, Museum Artifacts	68	45 to 55	UCLA Museum Dept		X	

SPACE USE	OCC TEMP SETPOINT RANGE (Degf)	HUMIDITY SETPOINT RANGE (%RH)	REGULATORY CODE	Trouble Call Alarm	Display Control Sensor	Blank Sensor
Storage, -80 Freezer Farm	74	NA				X
Theater	70 to 76	NA			X	
Vivarium	70 to 76	30 to 70		X	X	
Workshop	70 to 76	NA			X	

DDC POINT NAMING

1. **General rules for all point names shall be as follows:**

a. All point names shall be geographical in nature and as descriptive as feasibly possible.

b. Allowed delimiters shall be used to aid in graphical interpretation.

c. All point names shall begin with the building that the point resides in followed by an underscore to be used as a delimiter and then followed by a room number or descriptive location within the building and then a period.

2. **Building level networks are identified by building**:
   a. Example Boelter Hall is ***BOELTER EBLN***

   b. Another example, Broad Hall is ***BROAD EBLN***

3. **Individual panel nodes on a UCLA Ethernet Building Level Network (EBLN) shall be as follows:**
   a. Use the above general rules followed by the node type (PXCM, EMBC, EMEC, PXCC Insight, etc.)

   b. EBLN node names shall be identical to the EBLN node system names.

   c. An example of EMBC that resides in room 2265 of Boelter Hall would be ***BOELTER_2265.EMBC*** if there is more than one MBC use ***BOELTER_2265.EMBC01***

   d. Node name in the panel does not use underscore for example ***BOELTER_2265.EMBC*** is used in the system profile but ***BOELTER.2265.EMBC*** is used for the node name table in the panel.

4. **Multiple programs can reside in an Apogee BLN cabinet, PPCL programs shall be named as follows:**
   a. Use the above general rules followed by the name of the system being used (ACS-32, AH-1, P-4) followed by a period and then "PGM".

b. PPCL program names shall be identical to the PPCL program system names.

c. An example of the program for AH-2 that is located in the 7th floor penthouse at MRL would be ***MRL_7FL-PH.AH-2.PGM***

5. **FLN devices and TEC naming standards**

a. VFD, DEM, PXM, and BIM location of device is preferred as for TEC is the room it serves. NOT the location of the TEC or VAV box.

b. VFD example use from Boelter Hall ***BOELTER_2265.AH-3.SF.VFD*** or ***BOELTER_2265.AH-3.RF.VFD***

c. DEM example ***DODD_30A.XFMR-A.DEM*** (device being metered)

d. PXM and BIM example ***BOELTER_4818.PXM*** or ***BOELTER_4818.BIM***

e. TEC example ***BOELTER_2760.VAV01***. Room 2760 is serving location of VAV01 even though the VAV01 is located in the room 2763.

6. **Individual physical points and virtual set points shall be named as follows**:

a. Use the above general rules followed by the name of the system being used (ACS-32, AH-1, P-4) followed by a period and then the final terminator.

b. The final terminator shall follow the attached table.

c. The descriptor used in the definition of the point shall follow the attached table.

d. Variations due to special system applications are allowed.

e. To accommodate macros used by terminal programs, the point names and point system names for these types of points will differ slightly. Immediately following the general rules above, the letter Q shall be inserted followed by a period. The rest of the point name shall be identical to the point system name.

f. An example of the point system name for the hot deck static pressure set point for AH-2 in room 7344B of Gonda would be ***GONDA_7344B.AH-2.HSS***.

g. An example of the point name for the hot deck static pressure set point for AH-2 in room 7344B of Gonda would be ***GONDA_7344B.Q.AH-2.HSS***.

h. An example of the descriptor for the hot deck static pressure set point for AH-2 in room 7344B of Gonda would be ***HD STATIC SP***.

7. **<u>All other individual virtual points shall be named as follows:</u>**
   a. Use the above general rules followed by the name of the system being used (ACS-32, AH-1, P-4) followed by a period and then the final terminator.

   b. The final terminator shall follow the attached table.

   c. The point names shall be identical to the point system names.

   d. The descriptor used in the definition of the point name shall follow the attached table.

   e. Variations due to special system applications are allowed.

   f. An example of the point name of the integral gain used in the loop statement for control of the cold deck temperature set point in S-1 located in room B3-059 of Dentistry would be ***DENT_B3-059.S-1.CTI***.

   g. An example of the descriptor for the integral gain used in the loop statement for control of the cold deck temperature set point in S-1 located in room B3-059 of Dentistry would be CD TEMP IG

8. **<u>Dynamic graphic names shall be as follows:</u>**
   a. Use the above general rules followed by the name of the system being used (ACS-32, AH-1, P-4) followed by a period and then DYN.

   b. Graphic names shall be identical to graphic system names.

   c. An example of the building graphic for Royce Hall would be ROYCE.DYN

   d. An example of the graphic for the condenser water system at the 200 Medical Plaza would be ***MP200_7FL-RF.CLG-TOWERS.DYN.***

Final Terminator	Descriptor	Notes
DT	Disch Temp	Physical input
DTS	Dsch Temp SP	Set point
DTP	Dsch Temp PG	Proportional Gain
DTI	Dsch Temp IG	Integral Gain
DTD	Dsch Temp DG	Derivative Gain
DS	Disch Static	Physical input
DSS	Dis Static SP	Set point

DSP	Dis Static PG	Proportional Gain
DSI	Dis Static IG	Integral Gain
Final Terminator	**Descriptor**	**Notes**
DSD	Dis Static DG	Derivative Gain
CT	CD Temp	Physical input
CTS	CD Temp SP	Set point
CTP	CD Temp PG	Proportional Gain
CTI	CD Temp IG	Integral Gain
CTD	CD Temp DG	Derivative Gain
CTL	CD Temp Lo	Reset schedule low
CTH	CD Temp Hi	Reset schedule high
HT	HD Temp	Physical input
HTS	HD Temp SP	Set point
HTP	HD Temp PG	Proportional Gain
HTI	HD Temp IG	Integral Gain
HTD	HD Temp DG	Derivative Gain
HTL	HD Temp Lo	Reset schedule low
HTH	HD Temp Hi	Reset schedule high
CS	CD Static	Physical input
CSS	CD Static SP	Set point
CSP	CD Static PG	Proportional Gain
CSI	CD Static IG	Integral Gain
CSD	CD Static DG	Derivative Gain
HS	HD Static	Physical input
HSS	HD Static SP	Set point
HSP	HD Static PG	Proportional Gain
HSI	HD Static IG	Integral Gain
HSD	HD Static DG	Derivative Gain
CV	CHW Valve	Physical output
CVL	CHW Valve Lo	Low spring range
CVM	CHW Valve M	Mid spring range
CVH	CHW Valve Hi	Hi spring range

HV	HW Valve	Physical output
HVL	HW Valve Lo	Low spring range
Final Terminator	**Descriptor**	**Notes**
HVM	HW Valve M	Mid spring range
HVH	HW Valve Hi	Hi spring range
SV	Steam Valve	Physical output
SVL	Steam Valve Lo	Low spring range
SVM	Seam Valve M	Mid spring range
SVH	Steam Valve Hi	Hi spring range
CD	CD Damper	Physical output
CDL	CD Damper Lo	Low spring range
CDM	CD Damper M	Mid spring range
CDH	CD Damper Hi	Hi spring range
HD	HD Damper	Physical output
HDL	HD Damper Lo	Low spring range
HDM	HD Damper M	Mid spring range
HDH	HD Damper Hi	Hi spring range
MT	Mix Air Temp	Physical input
MTS	MA Temp SP	Set point
MTP	MA Temp PG	Proportional Gain
MTI	MA Temp IG	Integral Gain
MTD	MA Temp DG	Derivative Gain
MD	MA Dampers	Physical output
MDL	MA Damper Lo	Low spring range
MDM	MA Damper M	Mid spring range
MDH	MA Damper Hi	Hi spring range
ST	Supply Temp	Physical input
STS	Sup Temp SP	Set point
STP	Sup Temp PG	Proportional Gain
STI	Sup Temp IG	Integral Gain
STD	Sup Temp DG	Derivative Gain
SP	Supply Press	Physical input

SPS	Sup Press SP	Set point
SPP	Sup Press PG	Proportional Gain
Final Terminator	**Descriptor**	**Notes**
SPI	Sup Press IG	Integral Gain
SPD	Sup Press DG	Derivative Gain
RT	Room Temp or Return Temp	Physical input
RTS	Room Temp SP	Set point
RTP	Room Temp PG	Proportional Gain
RTI	Room Temp IG	Integral Gain
RTD	Room Temp DG	Derivative Gain
DP	Diff Press	Physical input
DPS	Diff Pres SP	Set point
DPP	Diff Pres PG	Proportional Gain
DPI	Diff Pres IG	Integral Gain
DPD	Diff Pres DG	Derivative Gain
OAT	Outside Temp	Physical input
OTL	OSA Temp Lo	Reset schedule low
OTH	OSA Temp Hi	Reset schedule high
FLW	FLOW (STEAM, CHW)	Physical input point
KWH	XFMR POWER	Physical input point

A. Zone Controller Attributes

Override factory default values for the following attributes on each zone application (11658 ref.).

1. ALL ZONES

ADDRESS	DESCRIPTOR	SET	NOTES
61	SWITCH TIME	0	Reduce 10 minute heat-cool delay
9	RM CO2	2000	Inhibit high CO2 alarm
10	RM RH	100	Inhibit high humidity alarm

2. OCCUPANT THERMOSTATS

When the space temperature rises 1 degree above the day cooling setpoint, the COOL mode will be initiated. The box damper will modulate from its minimum cooling airflow setpoint to its maximum airflow setpoint on a continued rise in space temperature. On a fall in space temperature, the reverse will occur. When the room temperature falls 1 degree below the day heating setpoint, the HEAT mode will initiated. The box damper will modulate from its minimum heating airflow setpoint to its maximum airflow setpoint on a continued fall in space temperature. Concurrent with a fall in temperature, the reheat valve will modulate open.

ADDRESS	DESCRIPTOR	SET	NOTES
18	RM STPT MIN	70	Limit zone thermostat low setpoint
19	RM STPT MAX	76	Limit zone thermostat high setpoint
82	STPT DIAL	ON	Local thermostat setpoint control

3. OCCUPANT THERMOSTAT with OCCUPANCY SENSOR

When the space is sensed to be not occupied, the zone will be set to provide minimum heating or minimum cooling airflow.

ADDRESS	DESCRIPTOR	SET	NOTES
Item 2			Attributes for Occupant Thermostat
16	NGT CLG STPT	80	Unoccupied mode cooling setpoint
17	NGT HTG STPT	60	Unoccupied mode heating setpoint
83	WALL SWITCH	YES	Wired occupancy sensor operation
25	CLG FLOW MIN	10% of	CLG FLOW MAX for unoccupied airflow
27	HTG FLOW MIN	10% of	HTG FLOW MAX for unoccupied airflow

4. PUBLIC AREA TEMP SENSOR

ADDRESS	DESCRIPTOR	SET	NOTES
11	DAY CLG STPT	76	Occupied mode cooling setpoint
12	DAY HTG STPT	68	Occupied mode heating setpoint
82	STPT DIAL	OFF	Local thermostat setpoint disable

5. CHILLED BEAM ZONE

ADDRESS	DESCRIPTOR	SET	NOTES
42	CLG P GAIN	1000	2-position cooling valve operation
46	HTG P GAIN	1000	2-position heating valve operation

ALARMS

1. **Critical Alarms**
   a. Critical alarms are implemented for life safety, property damage and laboratory systems affecting critical research.
   b. The Insight system will automatically send a remote notification (RENO) to prelisted responders by email or text message.
   c. Alarms are also sent to the Trouble Desk (TD) that is operated 24/7. A dedicated monitor in the Trouble Call Center will display the alarm.
   d. The alarm will be acknowledged by the TD operator and recorded on a paper log. The TD operator will call the listed responders to validate they received the alarm.
   e. The TD operator will initiate a trouble call workorder for Facilities Management staff followup. Any necessary repairs will be made and the trouble ticket closed out.

2. **Operations Alarms**
   a. Operational alarms are implemented for primary air handling units and primary water distribution systems to flag pending building environmental problems.
   b. Alarms will be limited to fan or pump motors that fail to start when commanded and unit supply temperatures that are +/- 5 degrees from setpoint for more than 30 minutes.
   c. The Insight System will automatically send a remote notification (RENO) to prelisted Engineers by email or text message.
   d. Alarms are also shown on the Insight building QuickView screen.
   e. The alarm will be acknowledged by the responding Engineer and recorded electronically in the system log.

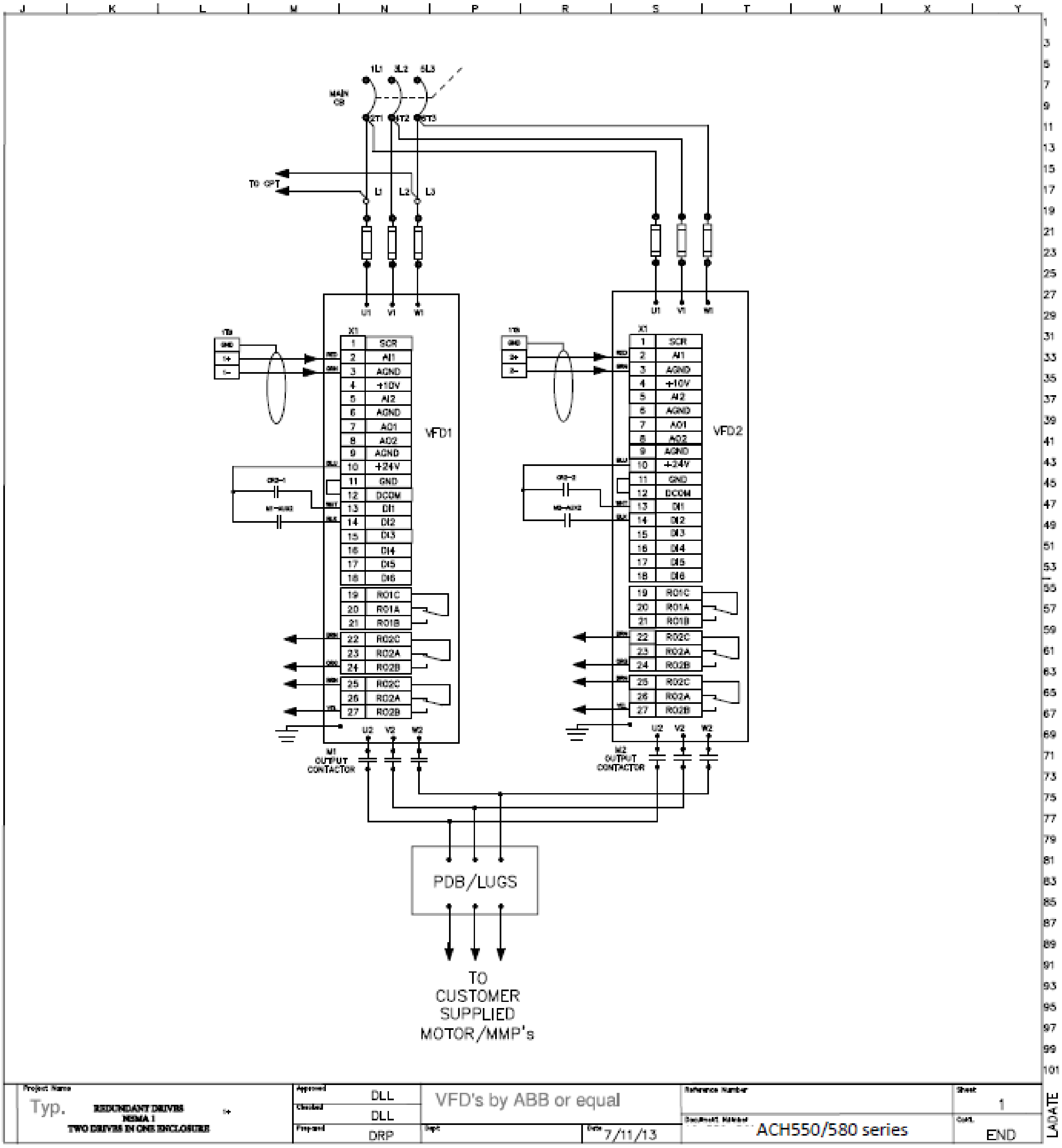
3. **Safety Alarms**
   a. Safety alarms shall be programmed and implemented for the orderly shutdown of mechanical and electrical equipment to prevent unsafe working conditions.
   b. These alarms include smoke detection, high or low static pressure, excessive vibration, water flow, etc.
   c. These alarms shall NOT be reported for immediate attention in the Insight System.

4. **Operation Alarms**
   a. Operational alarms include filter status, CO_2 values exceeding predefined limits, events that do not happen within a time limit, etc.
   b. These alarms shall NOT be programmed or implemented in the Insight System.

Appendix B : VFD - AHU

(Typical VFD arrangement for critical facilities only)

NOTE: A critical examination shall be performed to insure each or any fan is capable of operating a low cfm's by referring to fan curves prior to design



Appendix C : Check Items

Boilers, Chillers, Cooling Towers, Heat Exchangers and Other Central Plan Equipment

- Determine Owner redundancy requirements. Indicate future equipment space been clearly on the drawings. Determine move -in route and replacement access.

- Indicate if multiple pieces of central plant equipment been provided to prevent system shutdown in the event of equipment failure. Evaluate low load conditions and determine if the equipment selected capable of operating at this low load condition.

- Provide proper service access been provided including tube pull and clean space.

- Determine final loads been calculated and final equipment selection. Specify equipment and capacity.

- Determine if chemical treatment of hydronic and steam systems been properly addressed. Flushing and passivation of hydronic and steam systems shall be adequately covered, in particular waste treatment handling of spent flushing water and chemicals.

- Determine if central plant equipment need to be on emergency power.

- When multiple pieces of equipment are header together, have adequate provisions for expansion and contraction been provided, especially boiler systems? Recommendations: Multiple boiler connections to header, from boiler nozzles to header main, should be U-shaped (first traveling away from header, then traveling parallel to header, and finally traveling back toward header) to accommodate expansion and contraction of piping to prevent excess stress on the boiler nozzles.

- When specifying boiler control oxygen trim systems, chiller with remote starters and remote control panels, cooling tower basin heaters, and other electrical or control systems associated with central plant equipment has field wiring required for these systems been coordinated with the electrical and I&C engineers. This includes panel installation, interconnecting power and control wiring, instrument air, and mounting of devices.

- Locate the starter, disconnect switch, adjustable frequency drive, and/or motor control center space shall be coordinated.

- When specifying dual fuel boilers, determine if the Owner want a dual fuel pilot (natural gas and fuel oil) or is a tee connection preferred for connection to portable propane bottle.

Air Handling Equipment - Makeup, Recirculating, and General Air Handling Equipment

- Determine if Owner redundancy requirements been met and future equipment space been clearly indicated on the drawings. Determine if move-in route and replacement access been provided.

- Determine if multiple pieces of air handling equipment been provided to prevent system shutdown in the event of equipment failure.

- Provide adequate coil pull space and service space. Recommendation: The service access space should be a minimum of the unit width plus 2 feet on at least one side and a minimum of 2 feet on the other side.

- show unit components and capacities have been properly specified, detailed, and scheduled-coils, filters, fans, motors, humidifiers, outside air and return air dampers, smoke detectors, smoke dampers, access-section, service vestibules, access doors, interior lighting (incandescent, fluorescent), etc. Show coil and filter air pressure drops been scheduled. Show coil water pressure drops on schedule.

- Insure outside air and return air been mixed prior to entering any air handling unit filters or coils.

- Insure if proper length downstream of humidifiers been provided to absorb humidification vapor trail. The first air handling unit section downstream of the humidifier should be stainless steel, including coil frames, especially with DI, RO, or UPW water.

- Determine if cooling coils been locked out during the air handling unit preheat and humidification operation, unless otherwise required.

- Check for piping in service vestibules for adequate space. Recommendation: A minimum of 6' – 0" wide and minimum of 9'-0" high clearance should be maintained to allow for pipe installation for full length of unit.

- Access doors of adequate size to remove fans, motors, filters, dampers, actuators, inlet guide vanes or other variable flow device, and other devices requiring service and/or replacement shall be provided and sized for the largest removable component.

- Determine if coil selections been made so that low water flows, in direct response to low loads, do not fall into laminar flow region.

- Determine if air conditioning condensate drains been piped to appropriate drainage system.

- Provide receptacles for roof mounted equipment in accordance with the NEC.

- Coordinate starter, disconnect switch, adjustable frequency drive, and/or motor control center space.

- Determine if air handling equipment need to be on emergency power.

Piping Systems – General

- Expansion Tank: Has size, location, adequate space, support, makeup water pressure and makeup water location with been coordinated with Plumbing Engineer?

- Are there provisions for piping expansion and contraction, anchors, guides, loops vs. joints? Have anchor locations and forces been coordinated with Structural Engineer? Locate anchors at steel beams and avoid joists if possible. Is piping coordinated with building expansion joints?

- Do the drawings clearly indicate where ASME code piping and valves are required at the boilers in accordance with ASME Code requirement for high temperature (over 250ºF.) and high pressure boilers (over 15 psig)?

- Does the boiler layout and design have enough expansion and flexibility in the boiler connection piping to prevent overstressing the boiler nozzle? It is best to use U-shaped layout to header.

- Have flexible connections been clearly shown on the drawings and have they been proper detailed? Have the appropriate flexible connections been specified for the application?

- Is there structural support for large water risers?

- Are there drains and air vents on water systems and adequate space for service?

- Are balancing valves required on pitching of pipes?

- Is adequate space available for pitching of pipes?

- Is there space for coil and tube removal or cleaning (i.e., AHUs, Chillers, Boilers, etc.) and is it clearly shown on the drawings where it is required?

- Is coil piped for counterflow or parallel flow as indicated by detail (parallel flow for preheat coils only; all others counter flow)?

- Are relief valve settings noted on drawings or schedules?

- Is there adequate straight pipe up and downstream of flow meter orifices?

- Have all required equipment valves not covered by standard details been indicated? Avoid duplications.

- Do not run horizontal piping in solid masonry walls or in narrow stud partitions.

- Has all piping been eliminated from electrical switchgear, transformer, motor control center, and emergency generator rooms? If not, have drain troughs or enclosures been provided?

- Are shutoff valve provided at base of all risers?

- Are all systems compatible with flow requirements established by control diagrams?
- Is cathodic protection required for buried piping?
- Has required heat tracing been included, coordinated, and insulated?
- Will large mains or risers transmit noise to occupied spaces? Are isolators required in supply and return at pump?
- Is present and future duty for pumps, boilers, chillers, cooling towers, heat exchangers, terminal units, coils, AHUs, etc. specified? Scheduled?
- Are air conditioning and steam condensate (when wasted) piped to storm water or sanitary? Is steam condensate cooled?

Chilled Water and Condenser Water Systems

- Are balancing valves indicated? Are flows measuring stations needed? Have they been indicated?
- Is pressure regulation needed?
- Is bypass filter required? Is GPM included in pump capacity?
- Is standby pump needed?
- Are service valves shown?
- Will branch piping and ducts fit in allotted space or enclosure?
- Are riser shutoff valves shown?
- Are riser drains and vents shown?
- Is there adequate space for installation and use of riser valves?
- Will minimum allowable circulation be maintained through chiller?
- Is distribution system reverse return? If not, will balancing problems result?

- Condenser water piping: Loop traps to avoid excessive drainage, submerged impeller. Has available NPSH been calculated? Is NPSH indicated in pump schedule?

- For cooling tower makeup, overflow, and drain splash blocks, are there balancing valves in branch lines to tower cells? Coordinate makeup with Plumbing Engineer.

Air Systems

- Are adequate balancing dampers provided to prevent noise at outlets due to excessive pressure, or to avoid complicated balancing procedures on extensive low pressure systems or exhaust systems (i.e., each zone of a multizone system; to limit flow variation due to stack effect in vertical low pressure and exhaust systems?

- Are fire damper locations, type, flow restrictions indicated? Is there adequate height for damper recess pocket at shaft wall? Is breakaway ductwork at fire damper wall sleeve detailed or specified?

- Are smoke damper locations, type, and flow restrictions indicated? Is there adequate height for damper at shaft wall? Is breakaway ductwork at smoke damper wall sleeve detailed or specified? Is smoke damper operator located on supported duct and not on breakaway duct?

- Are access doors at fire dampers, smoke dampers, turning vanes, humidifiers, coils, etc., properly specified and included in general notes?

- Are proper relief air provisions provided?

- Is return air fan needed? Is outside air fan needed?

- Are condensate drains provided? Are outside air intake drains provided?

- Are flexible connections shown and specified?

- Is sound lining required? Is it properly located and specified?

- Will duct arrangement permit transfer of excessive noise between office, toilet rooms and rooms of a different function?

- Are there objectionable fan noise from intakes or exhaust points to nearby buildings?

- Are outlets located in supply mains? Are there noisy conditions?

- Do trunk ducts pass above quiet rooms? Will noise be a problem?

- Have fan class, bearing arrangements, motor locations, etc., been shown, scheduled, or specified?

- Are air intakes on party walls?

- Will outlets blow at lights, beams, sprinkler heads, smoke detectors? Sprinkler head and smoke detector locations must meet code requirements. Locate in accordance with code.

- Have outlet and return grilled elevations been coordinated with architect and indicated?

- Adjust outlet air quantities for duct heat grain and duct leakage.

- Are isotope and chemical exhaust ducts accessible?

- Is there interference between sill grille discharge and drapes or blinds? Beware of annoying movement of vertical blinds or light drapes caused by sill air discharge nearby.

- Are present and future duty for air terminal units, AHUs, fans, etc., specified and scheduled?

- Is exhaust or relief discharge or plumbing stack effluent neat intakes. Maintain a minimum of 10 feet clear.

- Is there anti-stratification provision at intakes, large mixing box outlets, downstream of steam coils or water coils? Are air blenders indicated on all AHUs?

- Are there aluminum grilles on shower, sterilizer, etc., exhaust? Is stainless steel ductwork or aluminum ductwork required? is it clearly indicated on drawings as to extent? Has it been specified?

- Are there sealing and sloping of shower, cage washer, etc., exhaust ducts? When more than one type of duct material is used, is extent and location clearly defined?

- Has adequate relief fro rooms been provided? Are there door louvers, undercut doors, transfer grilles and direct exhaust? Have they been coordinated?

- Will door louvers defeat needed acoustical privacy (i.e., conference rooms, private offices, VP office)? Will door louvers defeat needed door fire rating? Are door louvers located in accordance with code?

- Are the types of branch takeoffs and duct splits shown? Are details included on drawings?

- Are there intermediate drip pans on cooling coil banks? Are they piped to floor drain? Include detail.

- Are there drains for kitchen exhaust duct risers?

- Is there excessive duct heat gain from nearby steam pipes and other heat sources?

- Are there combustion air intakes for boilers, water heaters, etc. Are vents, stacks, breeching, and chimneys shown, specified, and detailed? Are termination heights clearly indicated?

- Locate exhaust grilles near floor in operating rooms, flammable storage rooms, chlorine storage rooms, battery rooms (high and low), etc.

- Do not use corridors as return air plenums in hospitals, nursing homes, offices, and other facilities.

- Have insulated louver blank-off panels or sheets been included where required?

- Are filters provided in makeup air to elevator equipment rooms? Are filters provided for air cooled condensers and condensing units located indoors?

- Are there motor operated dampers in wall louvers? Do not use operable louvers. Use stationary louvers with motor operated dampers behind when required.

- Are casings adequately described as prefabricated or field fabricated? Is extent of sound paneling clear? Has adequate pressure rating been specified?

- Has Architect provided adequate framing for linear diffuser in metal lath and plaster or dry wall bulkheads? Do not dimension diffuser lengths for wall to wall installations-note dimension as “wall to wall.”

- Have fan systems been checked for excessive sound transmission?

- Is there adequate space for servicing fans, motors, belts etc.

- Has sufficient space been provided between coils of AHUs to accommodate thermostats?

- Are adequate service space or equipment size access panels noted on drawings to equipment installed above ceilings? Coordinate with Architect who furnishes, installs, provides.

- Are there adequate straight duct branch length or straightening vanes between main duct and diffuser?

- Do ducts pierce partitions at 90 degree angle wherever possible?

- Are wash down systems or fire protection systems required for fume hoods or kitchen hoods?

- Are fume hood exhaust systems balanceable? Are orifice plates required?

- Are correct outside air quantities and pressurization included?

- Is smoke control system required?

- Avoid contamination of air intake from exhaust air, contaminated vents, vehicle exhaust, etc. Are locations in accordance with code?

- Are static pressure sensors indicated or specified?

- Are fire and smoke dampers coordinated with fire and smoke walls? Are fire rated floor/ceiling assemblies used? Will diffusers, registers, and grilles require fire dampers? Are smoke dampers required for air handling units or fans?

- Is floor suitable for “built-up” air handling units?

- Have ventilation systems been provided for equipment rooms and other non-air conditioned spaces?

- Are flow measuring devices located? Is there adequate straight run?

- Is there adequate straight duct upstream of terminal units? VAV, constant volume reheat, dual duct, fan powered, and other air terminal unit runouts should be sized based on the ductwork criteria established for sizing the ductwork upstream of the air terminal unit, and not on the terminal unit connection size. The transition from the runout size to the air terminal unit connection size should be made at the terminal unit. A minimum of 3 feet of straight duct should be provided upstream of all air terminal units.

- Locate exterior wall louvers, especially intake louvers, a minimum of 2’0” above roof, finished grade, etc.

- Locate gravity roof ventilators, especially intake ventilators, a minimum of 1’0” from finished roof to top of roof curb.

- Are air conditioning condensate drains piped to storm water or sanitary?

Process Exhaust Systems

- Branches and laterals should be connected above duct centerline. If branches and laterals are connected below, the duct centerline drains will be required at the low point.

- Provide blast gates or butterfly dampers at each branch, at each submain, and at each equipment or tool connection. Wing loading on blast gates needs to be considered when installed on the roof or outside the building, especially those blast gates which are normally open.

- Blast gate blades for process exhaust systems should be specified with an EPDM wiper gasket to provide a tight seal. For blast gates installed for future use, it is recommended that the blade be removed and a gasketed blind flange be provided where the blade goes in the duct to reduce leakage.

- Does duct pitch to low points and drains? Are drains provided at all low points?

- Has proper pressure class been specified upstream and downstream of scrubbers and other abatement equipment?

- Is ductwork installed outside or in unconditioned spaces and will condensation occur on the outside or inside this duct? Is duct insulation or heat tracing required?

- Are adequate butterfly balancing dampers shown for system balancing?

- Are process exhaust fans on emergency power as required by code?

- Process exhaust ductwork cannot penetrate fire rated construction. Fire dampers are generally not desirable. If penetrating fire rated construction cannot be avoided, process exhaust ductwork must be enclosed in a fire rated enclosure until it exits the building, or sprinkler protection inside the duct may be used if approved by authority have jurisdiction.

- Are pressure ports provided at the ends of all laterals, submains, and mains?

- Are drains required in fan scroll, scrubbed or other abatement equipment?

- Are flexible connections provided at fans and are flexible connection specified suitable for application?

- Are stacks properly located and is discharge height adequate to prevent contamination of outside air intakes, Cooling Tower intakes, combustion air intakes? Are termination heights clearly indicated?

- Have redundancy requirements been met?

- Are adjustable or variable frequency drives required, located, and coordinated with electrical engineer?

Refrigeration

- See Piping Systems-General for additional requirements.
- Is future machine space indicated on drawings?
- Is space for servicing indicated on drawings?
- Are there rigging supports for large water boxes and compressor shell?
- Is noise transmission likely to occupied spaces?
- Is there adequate control of chilled water temperature?
- Are sprinklers required for wood fill towers? NFPA 214.
- Is refrigerant relief piping shown on drawings? Is it piped to outside?
- Is noise from cooling towers likely to be a problem?
- Will cooling tower discharge air pocket or recirculate?
- Should cooling tower be winterized?
- Have cooling tower support locations been cleared with Structural Engineer. When determining cooling tower enclosure height, has height of vibration isolators been considered (8" -12" high) and has height of safety rail been considered?
- Are cooling tower discharge duct connections necessary?
- Are flow diagrams required? Have they been coordinated?
- Are present and ultimate duties noted where applicable and coordinated with pumps and coils, etc?
- Is Ethylene or propylene glycol required? Has it been specified and equipment capacities de-rated?
- Has additional insulation been included for low temperature systems?

- Has split single-phase protection been included for packaged (single and/or split systems) air conditioning and heat pump compressor motors?
- 35.10 Controls
- Are all panels located? Have they been coordinated with Electrical Engineer? Are they local or central?
- Are flow meter locations an adequate distance up and downstream of orifice?
- Are thermostat and humidistat locations indicated? Do not mount stats on glass panels and door frames. Avoid middle of wall locations.
- Are control settings, schedules, and diagrams indicated or specified?
- Are temperature tolerances in lab areas clearly specified?
- Are power and control wiring diagrams shown? Is interlocking wiring included?
- Have reheat coils requiring full capacity in summer been supplied from a constant temperature hot water supply?
- Are low-leak dampers specified on intakes and elsewhere as required?
- Have compressor location and motor size been coordinated with Electrical Engineer?
- Are all AHUs and systems accounted for on control design?
- Coordinate purchase and installation of duct smoke detectors and duct fire stat locations with electrical department for connection to building fire detection system.
- Are direct digital controls appropriate?
- Are valve positions (open or closed) indicated where applicable?
- Is compressor size for ultimate duty?

Laboratory and Medical Gas Systems

- Is separate zone valve required?
- Are medical gas alarm panels required?
- Is air intake for hospital compressor indicated? Is it outside? Does it provide clean air?
- Vacuum pump discharge should not be at rubber membrane roofs, due to adverse reaction of oil with membrane materials.
- Are NFPA 99 requirements met?

General

- Are all mechanical items specified and coordinated with other disciplines as to who provide, furnishes, and/or installs? Have all items on specification coordination list been coordinated? Do all disciplines have the most current drawings showing mechanical equipment?
- Are there a north arrow, title blocks, and engineer's stamp with signature?
- Are scales noted on plans? Does project or client require graphic scales?
- Are there client and project numbers on all projects, and company name, logo, address, etc., on all drawings?
- Check for completeness of general notes, legend, abbreviations, and title blocks.
- Check column numbers and grids.
- Check room names and numbers.
- Is extent of demolition clearly defined? Is what is to remain clearly defined? Are points of connection between new and old clearly defined?
- Check coordination and contrast of new and exiting work.
- Coordinate the following with architectural, structural, and electrical departments:
- Clearances between lighting fixtures, structure and ducts and pipes.
- Clearances between conduits out of electrical panels and pull boxes, structure, and ducts and pipes.

- Wiring of filters (roll filters and air purification systems).

- Does electrical department have the final motor list and heater list?

- Have exiting mechanical/electrical services and available space for new work been adequately field checked?

- Advise electrical department of relocated mechanical equipment having electrical components.

Division of work between Architectural, Structural, Mechanical, and Electrical disciplines been coordinated (as to who furnishes, install and/or provides) on such items as:

1. Starters and disconnect switches?
2. Line and low voltage control wiring and power wiring to control panels?
3. Access panels?
4. Fire extinguishers, fire hoses, and/or cabinets?
5. Catwalks and ladders?
6. Under-window unit discharge grilles on built in cabinets?
7. Louvers?
8. Door grilles, undercut doors?
9. Generators, muffler, fuel oil piping, engine exhaust, engine cooling air ductwork, and accessories?
10. Painting and priming?
11. Mechanical equipment screens?
12. Equipment supports and concrete housekeeping pads?
13. Roof curbs (equipment, ductwork, and piping), flashing, and counter flashing?
14. Site work/building utility design termination (5’0” outside of foundation wall)?
15. Foundation drains?
16. Excavation?
17. Kitchenette units?
18. Bus washer, vehicle lifts, hydraulic piping and accessories, and paint booths and accessories?
19. Countertop plumbing fixtures; built in showers?
20. Kitchen hoods?
21. Laboratory fume hoods?

- Where ceiling height and door or window head heights provide no leeway to lower ceiling, have mechanical and electrical work space above ceiling been closely checked?

- Check framing of holes in existing structures.

- Is structure adequate for new mechanical equipment in existing buildings?

- Is there adequate clearance for removal of ceiling systems for access to equipment. Tee bar system requires 3” minimum from underside of ceiling to equipment.

- Have heating and ventilation of bathrooms and toilet rooms been provided?

- Is there equipment room, PRV room, electrical room, and electrical closet ventilation?

- Has insulation or ventilation been provided to overcome radiant heat from boiler or incinerator stacks?

- Has specified equipment been properly described by current model designation?
- Have all items specified “As indicated on the drawings” been coordinated? Coordinate references between drawings, details, sections, risers, and specifications.
- Is there any material or equipment for which there is no catalog data in the office library?
- Have details been coordinated?
- Has space to future ducts, pipes, fans, pumps, chillers, boilers, cooling towers, water heaters, and other equipment been clearly indicated?
- Are “floating floors” required for noise control? Have they been specified and detailed?
- Has existing area been adequately field checked?
- Are elevator machine rooms free of piping, ductwork, and equipment except elevator machine equipment? Is elevator machine room ventilated? Does elevator machine room need to be air conditioned?
- Have chemical treatment systems been included?
- Have hand wash sinks been included in mechanical equipment rooms?
- Have chain operators for valves more than 7’-0” above finished floor been specified?
- Are General Notes, drawings notes, and Keyed Notes included?
- Is key plan needed?
- Are applicable standard details included and coordinated?
- Have applicable codes been researched?
- Should smoke and fire walls be indicated?
- Are present and ultimate duties included in schedules where applicable and coordinated with Electrical Engineer? Are future flows accounted for in duct and pipe sizing and appropriate provision made?
- Have authorities having jurisdiction been consulted regarding fire detection and protection systems, applicable codes, etc.?

- Is minimum head room (6’-8”) maintained in equipment rooms?
- Is verification that building meets ASHRAE Standard 90 or other Energy Conservation Code required?
- Is access to equipment with electrical connections (such as ceiling mounted heat pumps) adequate to satisfy NEC?
- Have all equipment housekeeping pads been indicated, specified, and coordinated?
- Is asbestos present in existing building? Is preparation of removal documents part of Contract?
- 35.18 Architect and/or Owner Coordination
- Have all shafts/ chases been coordinated? Are they large enough?
- Do shafts/chases line up floor to floor? Are structural members located in shaft space?
- Have pipe or duct chases been provided where required?
- Will partitions accommodate piping and plumbing fixtures?
- Has suitable type stationary louver been specified?
- Are bird screens (not insect screens) specified? Are bird screens located on the inside or outside of louver? Outside of louver easier to clean but appearance is undesirable.
- Have louver locations and sizes been coordinated? Who provides, furnishes, and/or installs louvers?
- Have plumbing fixtures as required been specified under the architectural section?
- Have all plumbing fixtures been coordinated?
- Has all special equipment been coordinated?
- Have NIC or future items requiring “stub-up” services been identified?
- Have masonry air shafts been avoided? In not, are they specified to be airtight?
- Has access to roof mounted equipment been provided?

- Have provisions for equipment replacement been made?

- Have supply air ceiling plenums been coordinated? Are partitions floor to floor where required? Is supply air plenum area sealed where required?

- Have return air ceiling plenums been coordinated? Are partitions floor to floor? If so, have provisions been provided to return air from these spaces?

- Have trenches, sumps, and covers been coordinated?

- Have under-window units been coordinated?

- Have air outlet types been coordinated?

- Have thermostat types been selected and approved by Owner?

- Have plumbing fixtures and types been approved? Have countertop fixtures been coordinated? Who provides, furnishes, and/or installs countertop fixtures?

- Include vibration isolators, grillage, and cooling tower safety rail when dimensioning height of cooling tower for architectural screen.

- Have all skylights, roof hatches, bulkhead, and multiple height ceilings been coordinated with ductwork, piping, and other mechanical equipment?

- Who provides, furnishes, and/or installs roof curbs for mechanical equipment?

- Who provides, furnishes and/or installs flashing and counter flashing?

- Who provides cutting and patching?

Structural Engineer Coordination

- Have equipment locations, sizes, and weights been given to the Structural Engineer? Have equipment housekeeping pad locations and sizes been coordinated? Has final and complete structural list been given to Structural Engineer?

- Have all floor, roof, and wall openings been coordinated?

- Have pipes 6 inches and larger been located and coordinated with structural engineer?

- Have all sleeved beams, grade beams, and foundations been coordinated? Have pipes and ducts been coordinated?
- Has structural framing in shafts been considered?
- Has mechanical layout been coordinated with structural system, especially in post tensioned concrete structural systems (penetrations at columns and column lines are not normally possible)?
- Is structural system adequate for future equipment?
- Where equipment must be “rolled” into place, is the structure over which equipment will be rolled adequate?
- Have catwalks been coordinated?
- Have pipe risers been coordinated?
- Do structural openings allow for insulation and ductwork reinforcing?
- Have anchor locations and associated forces been given to Structural Engineer? Avoid locating anchors at joist or joist girder locations.
- Have louver openings, sizes, and framing been coordinated with Structural Engineer?

Electrical Engineer Coordination

- Has final and complete motor list been given to Electrical Engineer?
- Have all electrical and telecommunication rooms and closets been ventilated? Do they need to be air conditioned?
- Have duct smoke detectors, duct fire stats, and/or smoke dampers been coordinated?
- Have valve position indicators/tamper switches been coordinated?
- Have sprinkler flow switches and alarms and gauges been coordinated?
- Have fuel tank level alarms and gauges been coordinated?

- Have cooling tower electric basin heater and vibration switches for propeller fans been coordinated?
- Have medical gas alarms been coordinated?
- Have automatic trap priming system for kitchen or other areas been coordinated?
- Have automatic trap priming system for AHUs been coordinated?
- Has lighting inside AHUs been coordinated?
- Has power at pneumatic tube stations been coordinated?
- Has power for ATC compressors and refrigerated air dryers been coordinated?
- Who provides starters and disconnect switches? Who provides line voltage and low voltage control wiring? Who provides power wiring to control panels? Have starters, wall switches, remote starter pushbuttons, and disconnect switches been located on mechanical drawings?
- Have 2 disconnects been provide at duplex pumps?
- Are there automatic fire suppression systems for fume hoods and kitchen hoods?
- Are there alarms on sump pumps, condensate pumps, sewage pumps, hot water generators, and similar items?
- Are there diesel generator fuel oil pumps on emergency power? Who provides engine exhaust, fuel oil piping, day tank, muffler, cooling air, fuel storage tank, PM filter and its associated controls, etc.?
- Steam or water flow on BTU meter recorders?
- Have shower controls been coordinated?
- Automatic fire suppression systems for computer rooms? Are AHUs interlocked with computer room shutdown system?
- Smoke or thermal detectors for AHUs and RA fans. Who furnishes, installs, and/or provides them?
- Has heat tracing for piping systems been coordinated?
- Electric fuel tank heating system?

- Auxiliary equipment on water chillers?
- Has motor list been coordinated with equipment schedules?
- Has motor list been coordinated with control diagrams?
- Have electric humidifiers been coordinated?
- Hot water generator or boiler circulating pumps?
- Has relocated equipment been coordinated?
- Allowance for lighting fixtures access? Have height of lighting fixtures been coordinated, especially high hat fixtures?
- No ductwork, piping, or other mechanical equipment should be in electrical rooms or closets.
- Are motor control centers shown and specified? Are starters shown and specified?
- Is there adequate space for MCCs or other future equipment?
- Electric water level detectors?
- Are electric motor operated dampers wired?
- Are there air handling light fixtures, supply, return, and heat transfer?
- Has extent of return air ceilings been coordinated with Electrical Engineer?
- Equipment on emergency power? Include control air compressor and dryer.
- Are explosion proof motors, starters, disconnect switches, etc., required?

26 00 00
ELECTRICAL STANDARDS
2016

DESIGN AND CONSTRUCTION STANDARDS

SECTION 26 00 00 ELECTRICAL GENERAL REQUIREMENTS

1. The word CEC through-out this document refers to the current university approved California Electrical Code edition.

2. All manufacturers and part numbers indicated on this document shall be followed by the word “or equal approved by the University” when included in the specifications. Design Standards provide basis of design manufacturer and part number and do not intent to unique any manufacturer.

3. Existing breakers 100A and above shall be test and labeled “passed” by a third party company before reusing them.

4. Design Standards are developed to assist the engineer in the preparation of the contract documents.

5. Design Standards are intended to supplement and take precedence over any sample specifications as to the basis of design for type and quality that should be included in the contract drawings and specifications.

6. Design Standards should be reviewed and incorporated by the engineer through the specification writer and any questions shall be directed to the University Engineer.

7. Specifications should include information or data for ONLY systems, equipment and materials that are in the scope of work of that particular project. General design documents will not be accepted by the university.

8. Do not make any reference to these “University Standards” on the drawings or in the specifications. They will not be issued to the Contractor, hence not to be part of the Construction Documents. THESE STANDARDS ARE TO BE IMPLEMENTED BY THE DESIGN TEAM – NOT THE CONTRACTOR.

9. Substitution of materials by the project contractor shall be reviewed with the University Engineer, prior to being approved. Materials indicated in the standards have been determined to be “TYPE” and “QUALITY” best suited for university projects.

10. As required by CEC Article 110, no foreign systems shall be placed in any electrical room unless dedicated to the electrical room, vault or areas designated for electrical or communication equipment. Review the architectural design as to type and location of plumbing fixtures on the floor above to determine that no piping is required below the floor.

11. Lighting calculations on approved lighting compliance forms shall be placed on plans for review and approval by UCLA Capital Programs. The certificate of compliance shall be signed by the person responsible for its preparation. All new construction shall comply with the 2013 (or current edition adopted by the University) California Energy Commission Building Energy Efficiency Standards.

12. All materials shall bear the UL label and shall comply with the requirements of the National Electrical Manufacturers Association (NEMA), ANSI, Institute of Electrical and Electronic Engineers, and Institute of Power Cable Engineers Association.

13. All equipment and lighting schedules must be provided on the plans, not on the specifications. The plans become university’s permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.

14. Load balance: the design shall maintain not more than 5% load (KVA/Amps) difference between phases.

15. Engineering software for power system studies acceptable by the University; SKM Power Tools for Windows or equal by Etap.

16. Electrical cabinets shall be sheet steel in conformance with CEC Article 312 requirements, with 3/4-inch fire retardant plywood backboard inside and on the back of the cabinet.

17. The design team shall obtain the approval from the University‘s Representative for the Proposed Building Service Size during 100% Schematic Design.

18. Master clock outlets may be required in corridors, auditoriums and public spaces. This requirement should be coordinated through the project manager for the specific project. The clock system is wireless and the clocks shall be specified compatible with management.

19. Provide conduit boxes, fittings, and necessary power for emergency telephones as required on the exterior grounds of the buildings. Telephone instruments and housing shall be determined by UCLA Information Technology Services. Telephones shall be connected directly to UCLA Police Station.

20. Any deviance from project specifications shall be communicated in writing through respective product shop drawing specification (typically this is performed by contractor's provider by adding the word "comply" or "deviate" next to each spec section). In addition, product data sheets should highlight all parts intended to provide. If failed to do so, the University may not review the submittal and will be returned to the contractor.

21. Surge-Protective Devices (SPDs) are required in new projects. UL1449, type 2 SPD must be installed on the load size of the service disconnect overcurrent protection or main gear, and type 3 SPDs on the load size of a branch circuit overcurrent protective device. At least one UL1449 type 2 for commercial and institutional buildings is required. Data Centers require up to three levels. The design engineer to propose and justify the number of SPD levels that are require for the new design.

22. Load monitoring documentation is required for existing switchboards and panels where new loads are being added. The University may ask for two levels of load monitoring in some cases. In addition, a partial or complete existing single-line diagram shall be included. OTC (Over the counter) remodeling and additions projects documentation will become the building record drawings, therefore, existing panels and devices remaining in the new scope of work shall be clearly identified on plans along with existing circuitry. OTC projects will be rejected if not complied.

23. Investigate design and manufacture of existing special systems in the UCLA CHS (Center for Health Sciences). Unless overriding considerations exist, provide (subject to University approval) system in the new facility to match such special systems as:

    A. Isolated power (anaesthetizing areas, invasive procedures, surgeries).

    B. Grounding systems in surgical, recovery or special patient care spaces.

    C. Intercom Systems.

    D. Nurse Call Systems.

    E. Medical Gas Alarm Systems.

    F. Fire Alarm System.

    G. Master Clock System

21. Conductor supplying power conversion equipment (VFD's) shall comply with CEC 430.122.

22. Conductors shall be sized per CEC sections 210 and 215

23. If approved by University, additional meters maybe required to achieve LEED "Saving by Design" requirements.

24. Capital Programs will provide 15KV available fault current (AFC), voltage, and X/R values at the service point of connection.

<u>REQUIREMENTS FOR EXISTING BUILDINGS:</u>

1. Most of these buildings are over 20-years old with an aging electrical system still in operation. Before starting new scope of work/remodeling, the engineer is to evaluate existing installation conditions and provide a complete report and recommendations to whether he is agree to continue use it or not. A third-party may be hired to do so. The report is due on/or before schematic design (SD).

2. The University requires copper bus bars equipment and conductors for new installations. If Aluminum equipment distribution is to remain in place, new conductors to comply with CEC Section 314 which allows aluminum conductors AA-8000 series for branch circuit up to 8 AWG. In addition, the University requires two-hole compression connectors.

DOCUMENT PREPARATION:

1. All plans require stamp and wet signature by the registered electrical engineer responsible of their preparation.

2. Legends, schedules, and notes should contain only items and information that are in the scope of work of that project.

3. Construction documents (CDS) shall include riser-diagrams for each system with respective equipment interconnection. One-line for normal and emergency systems, ground riser, fire alarm and special systems (Telecomm, PA, security, PV systems, etc.).

4. All feeders shall indicated length within 5' accuracy and voltage drop values.

5. All distribution equipment (i.e., service switchboard, distribution boards, panelboards, motor control centers, variable frequency drives, and disconnect switches, etc.) shall indicate The AFC (available fault current) and design “KVA” it serves on the single-line diagram. See note 11 below.

6. Electrical plans shall indicate conduit routing of both medium (12.47kV) and utilization voltages (208V and 480V).

7. All conduits shall be sized and shown on one-line drawing(s) and/or as required to clarify respective system design intention. If drawings are not cleared, the University may ask for additional riser.

8. Electrical drawings shall include electrical rooms in ¼ “scale showing complete equipment layout as well as equipment clearances per CEC Article 110.

9. As-built record drawings are extremely important to the ongoing operation of the facility, but are often neglected in the crisis of construction. The engineer and UCLA inspector shall verify at each site visit that the contractor is maintaining adequate “as-built”, and should obtain progress copies of the contractor’s “as-built” during construction. At the completion of the project generally, it is too late to verify concealed work and documents are often misplaced.

10. Specifications shall be prepared to include only systems/items and materials that are in the scope of work for this project. Review and coordinate each specification section for consistency with information shown on plans.

REPORTS AND CALCULATIONS:

1. Reports:

   A. Preliminary short circuit analysis.
   B. Voltage drop considering 80% of the selected feeder capacity through-out.
   C. Load flow study considering design loads through-out. (Where new distribution is provided only)
   D. Data centers shall include harmonics studies.
   E. Provide generator’s size report using software by CAT or equal. (Where new emergency distribution is provided only)

2. On Drawings:

   A. Total service size connected and demand load (KVA/Amps) table.
   B. Switchgear/ switchboards UL listing, i.e. UL-67, UL-891 design intention, and load schedules including connected and demand loads (KVA/Amps)
   C. Complete panel schedules.
   D. UPS/Battery calculations
   E. For existing facilities, existing panels shall include a table showing panel existing load plus new load will be added (Minimum 3-day and up to 7-day load monitoring as determined by the University’s Representative)

26 05 13 MEDIUM-VOLTAGE CABLES

Cables shall be new 15 kV rated EPR 133% insulated, single conductor and 25% overlap tape shield shall be provided. The Contractor shall be required to submit cable splicer qualifications to University's Representative for approval. Cables shall be factory-tested. Factory test reports shall be submitted to University's Representative for approval prior to installation. Upon delivery to the site, cable shall be examined for mechanical injury prior to installation. After installation, cable shall be hi-pot tested to specifications. Field test reports shall be submitted to University's Representative for approval. Cables shall be identified as to phases and feeder designation (see sample specification for details).

Standard radial distribution conductors size to be 250MCM. Standard loop distribution conductors size to be 500 MCM. Splices shall be made with molded rubber straight separable connectors rated 15 kV, 600 A. Separable connectors to be Elastimold or equal. Separate set of connectors shall be provided at each manhole. Contractor to coordinate connectors' type (i.e. Straight, T or L) with UCLA facility before purchasing. Straight connector may not be applicable in some cases, therefore, provisions of them per application.

Minimum Conductors size for transformers 500KVA, 15kV and below to be # 2 AWG.

The consultant shall obtain a copy of the latest sample specification sections for 15 kV insulated power cables and molded rubber separable connectors from Capital Programs. These sections should be modified only with specific concurrence from Capital Programs.

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CABLES

Feeders serving lighting and miscellaneous power loads must be of greater capacity than required by code with final rating to be reviewed and approved by the University's Representative to allow for future growth. All Conductors shall be copper, THW or THHN/THWN for 600 Volts or less. Feeders serving Motor Control Centers shall be sized as required by code plus 25% spare capacity.

26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

Provisions for grounding should be according to CEC Article 250. If manholes are required, install ground rods 3/4"x10' at each manhole, ground conductors and conductor shields (if splices are made) shall be connected to ground rods by approved connectors. All 15KV cables in manholes shall be spliced with 15KV Elastimold connectors. Grounding conductors for campus loop distribution to be # 3/0 AWG (600V) and for radial distribution 1/0 AWG. (600V).

Special circumstances (CHS System only): grounding systems in surgical, recovery or special patient care spaces shall be compatible with existing CHS grounding system.

26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

A. Use rigid steel conduit where exposed to weather, and in areas susceptible to damage and for high and low-voltage feeders inside the building. In addition, rigid conduits must be installed in the main electrical room (Normal and emergency)

B. EMT may be used in concealed spaces up to 1½" maximum size as per "sample specifications. Compression type connectors only.

C. Flexible Steel Conduit (Aluminum Flex Not Allowed): Short runs from ceiling J-Boxes to light fixtures, final connection to motors or other appliances and equipment (use Liquid-Tight in damp locations) or where special permission is granted for use.

D. Conduits shall be 3/4" minimum, except for single circuit branches, which dead-ends into light fixtures and receptacles, which may be 1/2".

E. Use PVC Schedule 40, encased in concrete, for runs outside the building. At building entry points (inside building) provide tags on all conduits clearly stating "CAUTION -- HORIZONTAL RUNS EXTERIOR TO BUILDING ARE PLASTIC. GROUND CONDUCTOR REQUIRED".

   i. All nonmetallic feeder conduit installed underground shall be encased in a 3-inch concrete envelope. Duct bank shall be steel reinforced at building entry points. Extend concrete envelope a minimum of 3 inches beyond external sides of outermost conduit. Space the external surfaces of conduit within a bank, a minimum of 3 inches apart, except that all sound, telephone, and intercommunication circuits contained within nonmetallic conduit shall have minimum separation of 12 inches from any light or power circuits that parallel them within a bank. Use manufactured concrete or plastic spacers to ensure required concrete coverage. Concrete shall be 2500 psi. Structural details must be included on structural drawings.

ii. Concrete for conduit and duct banks containing high-voltage cables (above 600 volts line-to-line) shall have "red oxide" added to the wet concrete mix to provide a distinctive red color to the entire concrete envelope. Red Oxide shall be added to the wet mix in the proportion of 8 pounds of red oxide per yard load. Concrete color shall be subject to approval of the UCLA University Representative.

iii. Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 4 inches in 100 feet. Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25 feet. Manufactured bends may only be used at ends of short runs (100 feet or less).

iv. High voltage cable shall be installed with a maximum of 2-90 degrees bends between manholes or pull boxes.

v. Backfill material for site utilities below paved areas (streets, parking lots, walkways) shall be one-sack cement slurry, up to the underside of the finished pavement. In planting areas, slurry shall be up to 24 inches below finished grade, then backfilled with compacted native soil to finished grade.

vi. Provide high duct bank reinforcement below streets crossing. Reinforcement shall be extended up to 15’ to 20’ before and after the cross section. The installation and specifications shall comply with UCLA Electrical distribution system expansion 6A and 6B Projects. Underground high voltage duct-bank installation is subject to UCLA approval

F. Conduit supports shall be as required by SMACNA guidelines. Seismic restraint shall be provided for suspended conduits 2 inches and larger in accordance with sample specification section

G. Surface raceway: Metal Raceway shall be used for surface distribution of branch circuit electrical wiring and cabling for voice data, multi-media, low voltage and optical fiber. A complete raceway system includes raceway, covers, mounting hardware, various fittings and outlet boxes installed at specific locations. Compliance to codes and standards is required for installation, grounding and bonding and cable deployment. Metallic raceway shall be Hubbell series 500, 750, 2000, 3000, 4000, 6750, ALU 3800/4800 or equal, as applicable. Utilize Hubbell Metal pre-wired PlugTrak or equal, where practical.

Non-Metallic Surface Raceway, boxes, and fittings can be utilized only as indicated per drawings. Non-metallic raceway shall be Hubbell series PT1, PP1, PL1, PW2, PB2, PB3, PS3 or equal.

26 05 36 CABLE TRAYS FOR ELECTRICAL SYSTEMS

Use of cable tray requires specific approval of the UCLA Information Technology Services, and is strongly discouraged. It would be allowed only as a last resort. If permitted, cable trays must be fully enclosed with side access and conduit drops from the tray to the workstations. Other types of wire ways, such as underfloor duct, should only be used with special approval. Only enclosed wireways shall be permitted, and must be plenum-rated where used in ceiling plenums.

All conduits attached to cable tray shall be bonded to the tray per CEC 250.8

26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS

The following color code prevails for all branch circuits and feeders (numbers in parenthesis indicate system voltages): Neutral/White (120/208), Ground/Green, Neutral/Gray (277/480) and Phase A/Black (120/208)/Brown (480/277), Phase B/Red (120/208)/Yellow (480/277), Phase C/Blue (120/208)/Purple (480/277), three-way travelers/Orange, switch legs same color as phase leg.

26 05 73 OVERCURRENT PROTECTIVE DEVICE SHORT CIRCUIT AND COORDINATION STUDIES AND ARC FLASH HAZARD ANALYSIS

The specifications shall require the contractor to provide a short circuit study, coordination study and arc-flash hazard analysis to be submitted for approval by the University Representative prior to equipment submittal. The studies shall be prepared by a California registered electrical engineer. The short circuit study shall be based on criteria preset by design engineer. All equipment in the power system shall be rated to withstand 110% of available short circuit current at equipment location. Short circuit current, together with the equipment short circuit rating, shall be indicated for all equipment on the Contractor's Electrical Single-Line Diagram. Electrical distribution system shall be fully rated (series rating is not allowed). The Coordination study shall verify that the power system is coordinated with upstream and downstream devices. The Arc Flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2012, Annex D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (substations, switchboards, switchgear, motor-control centers, panelboards, busway, etc.) where work could be performed on energized parts. The Arc-Flash hazard analysis shall start at medium voltage through 480V locations and significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA. Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering incident energy of 1.2 cal/cm2. The Arc-Flash hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions. Upon approval of the Arc Flash Study by the University Representative, Arc-Flash hazard warning labels shall be produced and applied to the electrical equipment. Coordination study and Arc Flash hazard analysis shall be based on actual distribution equipment being provided, and shall be reviewed and approved by the University prior to the building being energized with permanent power.

Distribution equipment shop drawing submittals final approval is subject to approved power systems studies by the University engineer. Even if approved before the power systems studies did, contractor is still liable to update equipment ratings and others per systems studies results and recommendations.

Contractor shall mitigate incident energy levels to Category Level 2 and below without additional cost to the University. Reduction methods such as adjusting trip settings, addition of optical relays and Arc Flash Reduction Maintenance Switch (ARMS) or their combination may be used. Reductions Methods (RM) often bring significant add-cost during construction's phase to have installed; therefore, the design team shall provide directions; whether in the specs or one-line drawings that Reduction Methods cost are included in the project's scope of work. If omitted, the University is not liable for any additional cost related to RM parts and/or work involved. Consultant may be liable for missing its implementation.

26 06 20.16 ELECTRICAL PANELBOARD SCHEDULES

All equipment and lighting schedules must be provided on the plans, not on the specifications. The plans become the University's permanent record, and are referred to for maintenance and operations purposes. The specification book is not a readily accessible record.

26 10 00 MEDIUM-VOLTAGE ELECTRICAL DISTRIBUTION

Power for most projects located on the main campus and the southwest campus is provided from the campus power distribution system, not directly from LADWP or Southern California Edison (SCE). For these projects, there should be no reference in the construction documents to the utility company.

The UCLA main campus has multiple distribution voltages: Old 4.8 kV and 4.16 kV systems, which currently serve CHS are being phased out with the new 12.47 kV distribution system already in place. Service transformer primary windings shall be 12.47 kV except in project sites where the available source is still 4.8KV (dual voltage 4.8 kV and 12.47 kV shall be specified for initial connection to the 4.8-kV system and later reconnection to the 12.47 kV loop system with reconnection capabilities from one voltage to the other). Minimum two 2-1/2% taps above nominal and two 2-1/2% taps below nominal voltage shall be provided on the 12.47 kV windings. The secondary voltage shall be as determined most feasible in the design of the project. Transformers shall be sized based on connected load. Only code-approved demand factors will be allowed.

The campus 12.47 KV loop distribution is served via double-ended switchgear from Cogen Plant. Each loop serves multiple SF6 switches (daisy-chained) with the one set of conductors terminating in one end, and the second set in the other end giving more reliability to the campus power network. Based on the project load requirements, the University will provide directions or assist the contractor about the new service feed provisions. This includes a loop expansion by adding to the scope of work a new SF6 switch with two poles dedicated to the loop (In and out of the switch) or a radial feed from existing SF6 switch. If a new SF6 switch is decided, a minimum of one spare pole shall be required. New buildings will be fed from the 12.47 KV loop system and service conduits shall not use any part of the loop infrastructure (pull-boxes and/or spare conduits installed for the loop system). New service feed will have its own path (trenching) from SF6 switch to respective building and will run in a separate trench away from 12.47KV loop U/G system. No exceptions.

26 11 16 SECONDARY UNIT SUBSTATIONS

Provide substation(s) with primary load break switch and primary fuses, Envirotemp FR-3 high fire point biodegradable fluid transformer equipped for future fan-cooling and metal-clad draw-out secondary circuit breakers, quantity as required. For indoor installations, transformer with cast coil primary and secondary windings is preferred. Solid insulation in the transformer shall consist of inorganic materials such as glass fiber, electrical grade epoxy and Nomex. The average temperature rise of the transformer windings shall not exceed 80 degrees C when the transformer is operated at full nameplate rating. The transformer(s) shall be capable of carrying 100% of nameplate kVA rating in a 40 degrees C max. 30 degrees C average ambient as defined by ANSI C57.12.00. High- and low- voltage windings shall be copper. The designer should select a “K” factor for the transformer based on the non-linear and linear load analysis. Secondary breakers shall be equipped with long time, short time and instantaneous trip, and ground-fault protection, as well as test block for attachment of external recording instrumentation. Substation secondary main breakers shall be provided with Arc Flash Reduction Maintenance Switch that has multi-setting adjustment of peak-sensing arc flash current levels. The trip unit shall have this Arc Flash Reduction switch integrated using an enabled/disabled setting along with a blue indicating light to remind the maintenance personnel to re-engage the normal setting once maintenance is completed. Provide arc reduction maintenance switch for those feeder breakers ≥ 400AT supplying power to main lugs distribution boards. Substation transformer shall be factory tested as specified in NEMA publication TRI-1954 and ANSI Test Code for Transformers. Provide complete test reports for University’s representative approval. Factory testing of substation and major electrical equipment as determined by the University shall be witnessed by a University Representative. Specifications must contain language requiring contractor to notify the University Representative thirty days in advance of factory tests. For secondary unit substations 1000 kVA and above, specifications shall include “University Representative to witness equipment manufacturer test procedure at manufacturing testing location” Contractor to consider University Representative travel and accommodation expenses as needed.

26 13 19 MEDIUM-VOLTAGE SWITCHES

The consultant shall obtain a copy of the latest sample specification sections for 15 kV rated SF6 sectionalizing switches and 15kV- rated load interrupter air switches from Capital Programs. SF6 switches shall be designed specific/unique to the project conditions, complete with wiring compartment and pull boxes integral to the switch. A spare position shall be provided in every sectionalizing switch. The sections should be modified only with specific concurrence from Capital Programs.

26 22 13 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

Transformers shall be sized based on connected load. Only code-approved demand factors will be allowed. Provide copper primary and secondary windings as well as copper lug pads for primary and secondary terminators.

Dry-type transformers (used only for 480V step-down to 208Y/120V) shall be NL and NLP series for non-linear loads. The appropriate “K” rating is to be recommended by the design engineer based on the intended loads.

Energy efficiency for transformers rated 15 KVA and larger shall comply with DOE 10 CFR PART 431 Appendix A of Subpart K 2016.

Special circumstances: transformers shall be compatible with existing CHS Isolated power system (anaesthetizing areas, invasive procedures, surgeries.)

26 24 13 SWITCHBOARDS

Factory testing of switchboards, and major electrical equipment as determined by the University shall be witnessed by a University Representative. Specifications must contain language requiring the contractor to notify the University Representative thirty days in advance of factory tests.

Main and distribution switchboards shall be of same manufacture throughout and shall meet UL Standard UL-891 and NEMA Standard PB-2. All switchboard bussing shall be copper. Main service switchboard section shall be fifty inches deep, and shall be dead front and rear, 90 inches high, capable of floor standing, front and rear accessible. A ground bus shall be furnished, minimum 25% ampacity of main bussing. Adequate space shall be provided to permit addition of a future switchboard of equivalent size. Switchboard main breakers ≥ 400AT shall be provided with Arc Flash Reduction Maintenance Switch that has multi-setting adjustment of peak-sensing arc flash current levels. The trip unit shall be compatible to work with the Arc Flash Reduction switch or integrated (if available) using an enabled/disabled setting along with a blue indicating light to remind the maintenance personnel to re-engage the normal setting once maintenance is completed. Provide arc reduction maintenance switch for those feeder breakers ≥ 400AT supplying power to main lugs panelboards. Low voltage switchboard(s) shall be Eaton Pow-R-Line C switchboard. Provide Eaton PowerXpert 6000 with display for service entrance main switchboards, substation secondary main switchboards or where metering 2000A or greater. For compliance with Title 24 disaggregation of loads, provide for the grouping of common type load breakers using Eaton type IFS switchboard or PRL-C switchboard with space for future CT's integrated into the vertical distribution section bussing. For those switchboards where disaggregation is not practical, utilize Eaton's PowerXpert PXMP multi-point metering system for monitoring each branch circuit in compliance with Title 24 disaggregation exception.

26 24 16 PANELBOARDS

Panelboards shall be UL listed. All bussing shall be copper. Ground and neutral bus shall be provided in all panelboards. Isolated ground bus, where required, shall be provided. Door-in-Door trims shall be provided with concealed trim and no exposed trim hardware with the panelboard door closed. Piano hinge and similar exposed hinge arrangements are not acceptable. Circuit breakers shall be industrial type. Arc Fault Circuit Interrupting (AFCI) circuit breakers, where required by the California Electric Code, shall be provided. AFCI breakers shall meet UL 1699 requirements and shall be listed and labeled per this standard. Combination-type AFCI breakers shall be specified and shown on plan drawings. AFCI breakers shall be self-test design and include integral ground fault protection, 20A 1-pole 120VAC, Eaton type QBCAF or equal for panelboards and Eaton type BRCAF, or equal for residential load centers . For compliance with Title 24 disaggregation of loads, provide for the grouping of common type load breakers in dedicated panelboards per the Title 24 requirements. Alternately, provide the grouping of common type load breakers in Eaton's PRL-4 power panel with space for future CT's integrated into the vertical bussing. For those panelboards where disaggregation is not practical, utilize Eaton's BCM Branch Circuit Monitoring system for PRL-1a, PRL-2a and PRL-3a panelboards. Panelboards shall be provided with a minimum of 20% spare capacity in terms of circuits and connected load. Panelboard enclosures shall be sized to accommodate 42 circuits minimum.

26 24 19 MOTOR-CONTROL CENTERS

Factory testing of control centers and major electrical equipment as determined by the University shall be witnessed by a University Representative. Specifications must contain language to require the contractor to notify the University Representative thirty days in advance of factory tests.

Motor Control Centers of Class II Type B construction shall be provided. Motor starters shall be of the "MCP" (Motor Circuit Protector Type), draw-out construction, and each starter shall be equipped with its own control transformer, providing 120 volt control. Control transformer sizes shall be per manufacturer's recommendations. All motor control center bussing shall be copper. Each starter shall be equipped with hand/off/auto switches and pilot lights or other appropriate devices as required by control considerations. Provide Eaton type C441M, or equal solid state overload relay with Modbus. Include all accessories as required to meet requirements of mechanical control diagrams. A copper ground bus of 25% ampacity of main bus shall be furnished. Motor Control Centers shall be of the same manufacturer as the switchboard.

26 27 13 ELECTRICAL METERING

Each secondary breaker shall be equipped with an Eaton PXM-6000 as detailed in the metering specification. Eaton meters and gateways are the UCLA electrical metering standard for uniform compatibility and communication with existing and future campus-wide electrical system metering and monitoring, including compatibility with Eaton PowerXpert Software.

For metering total power of distribution switchboards or individual branch breaker load metering, provide Eaton PM-3 where available or IQ-2270 where PM-3 is not available. All metering devices shall communicate via Incom to be compatible with existing meters or shall connect to Eaton PowerXpert Gateway. All projects shall include Eaton PXG-600 gateway – one provided for each electrical room where metering devices are located/installed in equipment.

Provide meters for applications where metering of a panelboard is needed to comply with CA Title 24 and/or LEED certification energy measurement. For metering total power at a panelboard, provide Eaton IQ-35. For metering individual small panelboard branch breaker loads provide Eaton type BCM metering system. All metering devices shall communicate via Incom as to be compatible with existing meters or shall connect to Eaton PowerXpert Gateway. All projects shall include Eaton PXG-600 gateway – one provided for each electrical room where metering devices are located/installed in equipment. Panelboards shall be of the same manufacturer as the switchboards.

26 27 26 WIRING DEVICES

Convenience Receptacles shall be heavy duty design, 20-Amp, 125-volt with one-piece brass integral grounding strap, brass bypass power contacts, external wiring clamps, rynite base and nylon face. Emergency receptacles shall be red in color. Receptacles shall comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 and FS W-C-596. Receptacles shall be Eaton/Cooper 5361 (single), AH5362 (duplex) or equal.

Hospital Grade Receptacles shall be heavy duty corrosion resistant design 20-Amp, 125-Volt with one-piece nickel plated brass integral grounding strap, nickel plated brass bypass power contacts, secondary nickel plated brass ground contacts, rynite base and nylon base. Receptacles shall comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd and FS WC-596. Receptacles shall be Eaton/Cooper 8310 (single), AH8300 (duplex) or equal. Emergency receptacles shall be red in color, Eaton/Cooper 8310 (single), 8300 (duplex) or Hubbell HBL8300 series or equal.

Ground Fault Circuit Interrupting Receptacles (GFCI) shall meet UL943 requirements. GFCI receptacles shall be NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS WC-596, 20-Amp, 125-volt and shall be self-test design, with whole system test functionality, surge immunity and noise filtering. GFCI receptacles shall be Eaton/Cooper VGFH20 Hubbell Autoguard Series GFR5352ST or equal. Hospital grade GFCI receptacles shall be Eaton/Cooper VGFH20/AH8300 Hubbell Series GFR8300ST or equal

Switches shall be heavy duty design 20-Amp, 120-277 Volt AC, corrosion resistant steel nickel plated bridge, one piece integral grounding terminal with #8 brass screw, stainless steel automatic grounding clip, one piece rivet-less copper alloy spring contact arm and terminal plate, large silver cadmium oxide contacts. Back wire shall be terminated at receptacle external bundling terminals, voiding pigtail. Switches shall be Eaton/Cooper AH1221 (single pole), AH1222 (two pole), AH12233 (three way), AH1224 (four-way) Hubbell HBL1221 series or equal. Pilot-Light Switches, 20A Eaton/Cooper AH1221PL (120 V and 277 V) or equal.

In hospital or medical facility construction, receptacles shall be hospital grade.

Emergency light switches shall be red in color. Cover plates for emergency lights and receptacles shall be red nylon.

Occupancy/vacancy sensors shall be used to control lights in most areas, wherever practical. Sensors shall incorporate both ultrasonic and passive infrared detection technologies. Dual technology sensors provide the most reliable means of automatic lighting control. PIR Sensor shall be suitable for the control of incandescent/halogen, CFL, LED, MLV, ELV (120V 15A, 1800W), fluorescent (120V, 10A, 1200W and 277V, 8A, 2200W). Sensors shall have a ½ HP rating and shall bear the UL marking – UL244A. Sensors must be California Title 24 compliant – Manual On/Auto/Off operation, selectable time delay of 5 seconds (test), 5 minutes, 15 minutes, and 30 minutes for lights to remain on after room is vacated. Sensors to have a minimum coverage of 180 degrees and 1000 sq. ft. Sensor lens shall be tamper-resistant reinforced Fresnel type. Sensors shall be Eaton/Cooper OSP10M Sensors Hubbell Adaptive Technology Sensors ATD, ATU, ATP Series or equal.

26 32 13 ENGINE GENERATORS

Provide Emergency Generator. The generator shall be sized at a minimum of 120% of required capacity. Emergency power shall be supplied for elevators, electrical and signal room lights and outlets, generator room/enclosure lights and outlets and all code-required outlets. Where there are multiple elevators in a bank, it is acceptable to provide capacity for one elevator per bank with a method for switching the emergency power to each elevator. On-site fuel supply shall be capable of running the generator for 10 hours minimum. For generators 1000 kVA and above as well as paralleling gears 5000A and above, specifications shall include "University Representative to witness equipment manufacturer tests procedure at manufacturing testing location" Contractor is to consider University Representative travel and accommodations expenses as needed.

CHS EMERGENCY POWER:

Emergency switchboards, motor control centers, panelboards and automatic transfer switches shall meet UCLA's specific requirements and standards in terms of Critical, Life Safety and Equipment branches (“A”, “B” and “C” priorities). Special labeling designation of new electrical equipment connected to the emergency power system, to conform to the existing labeling system, shall be obtained from Capital Programs. Any new load added to the emergency system shall be subject to “load capacity verification” per requirements of the California Electrical Code (CEC) and the capacity limits of the existing emergency system. Also, voltage drop in the emergency system is a critical factor. ATSs close transition shall be provided for branches A and B.

26 55 00 SPECIAL PURPOSE LIGHTING

Interior lighting shall comply with the above-mentioned C.E.C. Title 24 documentation. Light levels shall be in accordance with latest Illuminating Engineering Society (I.E.S.) recommendations. Illumination calculations shall be provided for review and approval by UCLA Capital Programs.

Lighting should be designed for optimal conservation of energy. High efficiency lamps, ballasts and fixtures should be specified. Occupancy sensors shall be used to control lights in most areas, wherever practical.

A. Recessed lensed light fixture shall be 5” deep to reduce lamp image, spring-loaded latches, and mitered doorframe, hemmed over side rails and built in earthquake clips. Doorframe shall be regressed aluminum with virgin acrylic lens thickness of .125 inch. Doorframe shall be interchangeable with a 1” deep silver specular louver doorframe. Fixture shall be Lightolier SPS series, Prudential 8600 series or equal.

C. Surface mounted wrap shall be .187-inch lens and shall be Lightolier CBS series, Prudential 1600 series or equal.

D. All down lights shall be horizontal lamping for maximum efficiency and housing shall be made of aluminum construction. Cutoff shall be 55 degrees or better. Fixture shall be Lightolier Calculite series, Staff Spec series or equal.

E. All ballast shall be electronic type and an “A” rating for sound.

F. Fluorescent lamps shall be T8 or triple tube compact fluorescent with a color temperature of 4100K

G. For parking garage use Cree Edge series Lighting Catalog # ARE EHO-3M/3MB-HV-LV-12-E-UL-700mA-40K-ML, and for parking lots use pole lighting by CREE Lighting Catalog # ARE EHO-2M-AA-D-UL1000mA-40K/DIM.

I. Exit lights shall be made of extruded aluminum and shall have a depth of no greater than .65” and edge lite shall have a depth no greater than 1.5” low profile design. Lamps should be of LED source. Lettering shall be red with white housing or red lettering on a clear panel. Fixture shall be Lightolier EX or DX series, Evenlite Sovereign or Razor series or equal. Not-equal for gym facilities <u>only</u> shall be approved by the University’s Representative

26 56 00 EXTERIOR LIGHTING

Exterior lighting shall comply with the above-mentioned C.E.C. Title 24 documentation. Exterior lighting shall be Sternberg B750 Avenue Series with proven QL induction technology kit. Metal Halide is limited to certain specific areas, which should not be expanded, to match existing lighting. Low Pressure Sodium shall not be used. Poles and fixtures shall be of a style and quality harmonious with that of similar areas on Campus. Consult with UCLA Capital Programs before selecting styles of luminaires and poles. Light levels shall be in accordance with latest Illuminating Engineering Society (I.E.S.) recommendations, upper range. Illumination calculations shall be provided for review and approval by UCLA Capital Programs. Outdoor LED lighting shall be UL Listed and approved by the University’s Representative.

28 30 00 FIRE ALARM SYSTEM

The campus fire alarm system includes fire alarm systems in each building that report over a dedicated wireless to a central monitoring system that reports to the Campus Police dispatch center. The central monitoring system is a Keltron Life Safety Event Management System that annunciates fire alarm activations to UCPD and supervisory, trouble and student room smoke detector activations to UC trouble desk. Wiring to the central monitoring goes via telecommunications facility located in Campus Services Building I. In order to interconnect with the central system and to maintain a degree of commonality among systems, there are three compatible manufacturer’s systems which are acceptable for the general campus. These are Keltron, Simplex/Grinnel, Siemes and Notifier. There are standard provisions for interconnection of these systems from the Fire Alarm Control Panel (FACP) in a building to the Keltron system, which must be specified for inclusion in the FACP. The actual connection from the FACP will be made by Facilities Management, so the contractor's scope will end at the FACP. Because so many details of the fire alarm system are critical to compatibility with the campus system, the designer should obtain and use the latest version of sample specification provided by the campus engineer's staff. This section should be modified only with the specific concurrence of Capital Programs. For fire alarms in the CHS complex see separate CHS section below.

The Fire Alarm/Life Safety system shall be Simplex/Grinnel 4100 or Notifier 30/30, Siemens XLS to match existing campus systems. The fire alarm/Life Safety system shall report to the Keltron work station located in the U C L A Police Station (UCPD) via Keltron wireless radio Life Safety event management system located in Room 3171J of Facility Management Building. The cable connection interface to existing shall be made by UCLA. The Contractor shall provide a complete, functioning system which shall be approved by the California State Fire Marshal, and which meets campus requirements per UCLA Campus Fire Marshal.

A. The FACP shall be fully field programmable and shall be programmed to provide the outputs as follows for transmission to the main monitoring system at the Campus Police Station (each signal should be prefixed by building identification number):

1. Manual alarm: Energize and close upon activation of any manual station of the system.
2. Autoalarms: Energize and close upon activation of any automatic alarm (i.e.: smoke detector, heat detector, duct detector, etc.).
3. Waterflow alarms: Energize and close upon activation of any waterflow alarm.
4. Common trouble: Energize and close upon activation of any supervisory alarm or system trouble.
5. Subsequent trouble: FAIL-SAFE REPORTING/OPERATION: De-energize and close upon activation of any unacknowledged supervisory alarm or system trouble on the system.
6. Student room smokes

B. Each type of alarm noted above shall activate a CSFM listed fire alarm signaling relay, which will interface with the campus central reporting system. Each relay shall be identified as indicated above. A relay module shall be provided with as many relays as necessary to perform all functions.

C. The system shall be provided with an annunciator, to be installed at a location recommended by the designer and approved by the UCLA Project Manager and the Campus Fire Marshal during design. The Campus Fire Marshal is a designated representative of the California State Fire Marshal (CSFM) and will also coordinate with the L.A. City Fire Department. The specific type of annunciator (graphic vs. matrix) should be coordinated with the Campus Fire Marshal for the particular building. A complete sequence of operations chart shall be provided on plans, along with a riser diagram and floor plans showing all devices.
Construction documents and contractor submittals shall use NFPA standard fire alarm symbols.

D. Duct Smoke Detector are specified under Division 26, however, they shall comply with 23 00 00 Mechanical Specs for mounting and manufacturer's power requirements.

CHS FIRE ALARM:

1. The CHS, which includes all of the interconnected buildings in the Hospital and School of Medicine complex, is considered to be a single building for purposes of fire alarms. The CHS uses Notifier NFS2-3030 fire alarm panels with voice evac. All panels shall be networked together and report to the Fire Command Center in room 12-213. The designer should obtain specific technical details for the CHS networked Notifier Fire Alarm System from Capital Programs.

2. Fire Alarm Systems in the existing shall be Notifier NFS2-3030 fire alarm panels with voice evac and compatible network hardware to connect with the CHS Notifier fire alarm network.

3. New Fire Alarm system integrated with existing campus fire alarm shall be permitted only if new Fire Alarm complies with UL 864.