UCDH FACILITY STANDARDS MECHANICAL/PLUMBING

SUMMARY OF CHANGES

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1. Clarified general requirements for VFDs.

General Duty Valves for Plumbing Piping – 22 05 23

1. Clarified general requirements for shut off valves.
2. Clarified general requirements for isolation valves.

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1. Clarified requirements for horizontal cast-iron soil pipe hangers or supports.
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A. FIRE SUPPRESSION 21 00 00

1. Referenced Standards
   a. NFPA (National Fire Protection Agency) current edition, with California amendments
   b. California Fire Code, current edition
2. Hydraulically Designed System
   a. All hydraulically designed sprinkler systems shall be provided with a minimum of a 10% safety margin on either the supply or pressure side of the design graph.
   b. All sprinkler systems shall be designed to provide the appropriate density based upon a hazard occupancy classification specified by NFPA 13. In those cases where NFPA 13 does not specifically identify the hazard occupancy classification, the UC Davis Health's Campus Fire Marshal's office shall determine the hazard classification.
   c. The water supply requirement for sprinklers only shall be calculated from the density curves in NFPA 13.
   d. Submittals having inaccurate hydraulic calculations, content which is illegible, incomplete, or unclear, shall be returned without review or approval.
3. Materials
   a. Underground Piping
      i. See Section 33 11 19 Fire Suppression Utility Water Distribution Piping and 33 11 00 Water Distribution, for requirements on underground piping.
   b. Above Ground Piping
      i. Insulate water-filled supply piping in areas exposed to freezing, such as under eaves, cold rooms, passageways, etc. per NFPA standard.
      ii. Sprinkler piping shall be American Society for Testing and Materials (ASTM) Schedule 40 black steel pipe with UL and FM listed fittings. Schedule 10 grooved piping is allowed for pipe sizes 2-1/2" and larger.
      iii. MRI rooms shall use nonferrous copper piping. All joints for copper fire sprinkler piping shall be brazed. Copper piping shall be ASTM B88. Alternatively, Schedule 40 stainless steel with cast stainless steel listed fittings may be used in MRI rooms.
      iv. Automatic air vents shall be provided at high points in the system to help eliminate air to reduce corrosion.
      v. Sprinkler contractor shall provide welding certifications.
      vi. Provide means to flush piping per NFPA 13.
      vii. Provide injection port for central microbiological and/or corrosion control.
      viii. Preaction systems shall be used for data centers and TER rooms unless accepted otherwise as a wet pipe system by UCD representative.
      ix. Central Plant main electrical rooms shall be provided a clean agent suppression design such as Tyco SAPPHIRE system as well as preaction system, or equal.
      x. All dry pipe systems shall include a Nitrogen generation system to inhibit corrosion.
      xi. Piping subject to corrosion or exposed to the elements shall be stainless steel or galvanized piping.
      xii. O ring style drop nipples are not permitted.
      xiii. Provide a means of testing the standpipe system. This shall include a 4" drainage pipe riser with 2 ½" tees and valves at each floor. The 4" riser shall terminate to an appropriate sewer drain.

c. Main Drain

   i. Manufactured by AGF, or equal, Test and Drain model 1011A, 400 psi rated with 175 psi rated pressure relief valve.
   ii. Comply with applicable and current NFPA codes.

d. Sprinkler Heads

   i. Sprinkler Heads
   ii. Sprinkler heads shall be UL listed or FM approved. **Concealed** heads are required as a standard due to frequent discharges throughout the campus caused by accidental contact.
   iii. For exterior and corrosive atmospheres, provide wax-coated sprinkler heads.

1. Refer to Division 1 for substitutions of products.
2. Renovation and remodel projects shall employ strategies that use 20 percent less water in aggregate than the water use baseline calculated for the building (not including irrigation), after meeting the California Green and California Plumbing Code fixture performance requirements.
3. These guidelines shall be implemented into project designs. Where code or local jurisdiction conflicts with the guidelines, the codes shall govern.
4. The project designer shall incorporate an exception to the Design Guidelines listing standards that cannot be adhered to and reasoning compliance cannot be met. Obtain approval of exceptions from UCD.

A. COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT 22 05 13

1. Combination magnetic starters shall have circuit breaker disconnects with trip size of breaker as required for motor size.
    a. Motor starters shall be provided by the mechanical equipment supplier where they are readily available as a standard option. These motor starters shall be specified by the mechanical engineer and installed by the mechanical contractor.
    b. Where motor starters are not available from the equipment manufacturer they shall be sized and specified by the electrical engineer and provided and installed by the electrician. The mechanical engineer shall coordinate and provide adequate information to the electrical engineer for sizing each motor starter.
    c. Where motor starters are to be included in a motor control center (MCC) they shall be specified by the electrical engineer and installed by the electrician. Mechanical engineer shall coordinate the motor sizes and full load amps with the electrical engineer.
    d. There may be conditions where a motor starter cannot be used due to seismic certification requirements. An OSP certified variable frequency drive (VFD) can be used as a substitution for any motor starter. When a VFD is provided for mechanical equipment, it shall be specified by the mechanical engineer, installed by the mechanical contractor, and wired to and from the device by the electrician.
    e. Coordinate BAS control of all motor starters and VFD's.
2. Shaft grounding shall be provided on all VFD assemblies with operating motors 5 HP and above. Provide factory-installed shaft grounding devices, either by motor or equipment manufacturer. All motors driven by VFD's shall be inverter-rated. Where ceramic bearings are utilized and manufacture does not recommend shaft grounding, they may be omitted. Follow shaft grounding device manufacturer's specific installation literature, specifications, and recommendations. Field-installed shaft grounding systems shall be tested for proper conductive path to ground and shall pass manufacturer's published test procedure. Motor shall be grounded to the common earth ground with drive.
3. For motors operating at 100 horsepower or more: Follow shaft ground manufacturer's recommendations. Often it is required by the manufacturer that two shaft grounding devices be installed.
4. Provide VFD's with 3 contactor bypass (not electronic bypass). VFD's shall have ultra-low harmonics (THD of 3% maximum). Provide ABB ACH 580 ULH or equal. If 3 contactor bypass is not available due to OSP availability, provide with electronic bypass.
5. If motor is subject to contaminants, debris or moisture, special shaft ground systems and/or seals shall be required. Follow manufacturer's applicable recommendations.

6. Motor bearing(s) shall be guaranteed from electrical bearing fluting damage during the motor warranty period. Motor or bearing(s) shall be replaced at no additional cost to UC Davis Health.
7. All motors 1 HP and over that are used at least 1,000 hours per year shall be premium efficiency with no shaded pole motors on fractional horsepower motors 1/20 HP and larger.
8. Electronically Communicated Motors (ECM) are not allowed except where approved by UCD representative.

B. METERS AND GAGES FOR PLUMBING PIPING 22 05 19

1. All new buildings shall be provided with water meters connected to BAS. Water meters shall be included for domestic water and irrigation water. City required meters that are not remotely readable thru BAS do not satisfy this metering requirement for UCD. Where is occurs, it shall be necessary to have two meters in series to achieve BAS goals.
2. Pulse Totalizer water meters are allowed. Meters shall be non-resettable and connected to a readable by the BAS. Provide Xylem Omni R2 water meter or equal.
3. Provide meters for the following:
    a. Hydronic make-up water (i.e. chilled water, heating water). Used for detecting leaks. Alarm BAS if there is water volume of 5 cubic feet or more.
    b. Cooling tower or other evaporative condensing equipment make up water.
    c. Cooling tower blowdown piping.

C. GENERAL DUTY VALVES FOR PLUMBING PIPING 22 05 23

1. General Requirements
    a. Provide shut off valves on piping serving each floor including, but not limited to, cold water, hot water, hot return, chilled water, heating water, soft water, RO water, plant air, etc.
    b. Provide isolation valves at restrooms serving multiple water closets and multiple lavatories. Men's and Women's rooms do not require separate isolation (one isolation valve can shut off both restrooms).
    c. Provide isolation valves for each fixture (except toilet rooms or bank of adjacent fixtures, where one isolation valve can shut off the group). An example is each exam room sink or back-to-back exam sink is to have an isolation valve located above the ceiling adjacent to the sink. In addition, each sink has a wall stop. Fixture isolation ball valves do not require a valve tag but do require ceiling label to identify the valve location.
    d. Provide isolation valves upstream and downstream of balance valves.
    e. Provide bypass loops and valves around all major pieces of equipment.
    f. Provide water hammer arrestors with stainless steel access doors at fast acting valves where required by the California Plumbing Code and where required to control water hammer. Access doors shall be stainless steel 12 inches x 12 inches. Contractor shall coordinate the location of the access doors to not conflict with the restroom partitions, obstructions, and ADA access grab bars.
    g. Valves shall be located in accessible areas. Locate a maximum of 3'-0" above ceiling grid or access panel.
    h. Valves shall be lead free for potable systems.
    i. Valves that are concealed shall be accessible via clearly marked access panels when located above or behind new or existing finished surfaces. Access panel size shall be a minimum of 24

inches x 24 inches, except where otherwise approved by the university representative.

2. General Purpose Shut-off Valves: All isolation valves through 2 ½" size shall be IPS full port ball valves and valves 3" and above shall be butterfly valves. Ball valves shall be two-piece bronze body.
3. Pressure Reducing Valves shall be lead free. Provide isolation valve and strainer at inlet of pressure reducing valves. Pressure reducing valves for hot water systems shall be rated for the temperature they serve.
4. Fixture Shut-off Valves shall be all brass, quarter-turn angle stops, IPS threaded inlet only. Each fixture shut off shall have a lock shield and loose key regardless of concealed or exposed.
5. Check Valves shall be all brass swing check or spring check type, threaded or flanged connection (depending on application). Spring checks shall be used for water hammer reduction applications.
6. Bench Valves (i.e. laboratory) shall be quarter turn, chrome plated, with index button identification of gas served. Materials shall be compatible with gases served.
7. Laboratory Valves (air, gases, and vacuum) shall be 2 piece or 3 piece full port valves with materials compatible with gases served.

D. HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT 22 05 29

1. Fasten all piping securely to building construction with hangers, supports, guides, anchors, or sway braces to maintain pipe alignment, to prevent any sagging, and to prevent noise or excessive strain on the piping due to uncontrolled movement under operating conditions. Relocate hangers and/or add as necessary to correct unsatisfactory conditions that may become evident when system is put into operation. All piping shall be independently supported from the building structure. No piping shall be used to support other piping. Provide seismic bracing per current code requirements.
2. Provide hangers to supports sized to support the weight of the pipe, weight of fluid, and weight of the pipe insulation with a minimum factor of safety of five based on the ultimate tensile strength of the material used. This is to prevent unzipping of hangers during failure.
3. Use of powder-actuated fasteners is not permitted for the support of any overhead piping.
4. Provide hangers or supports for horizontal cast-iron soil pipe at each side of a joint and within 18 inches of the joint. Spacing of hangers shall not exceed 8 feet. Provide adequate sway bracing to prevent shear. On horizontal and vertical cast iron piping and fittings, use felt pad vibration isolators, Bline, Superstrut, Semco Trisolators, or equal. Provide felt isolators or PVC coated hangers. Provide isolation from copper piping to steel hangers and supports with Neoprene, felt, PVC coatings or similar means provided by the pipe hanger manufacture.
5. All hangers, hanger supports, hanger trapeze supports, fire piping hangers and strut supports shall have washers and one nut on top and one nut below. Provide jam nut below lower nut.
6. Provide pipe isolators at all hangers for non-insulated lines. Provide felt or plastic coated hangers at non-insulated copper piping.
7. Install hanger on insulated piping in a manner which shall not produce damage to insulation. Provide steel pipe saddles for piping thru 1 ¼" nominal diameter and calcium silicate (allowed for all pipe sizes) or equivalent rigid pipe blocks with similar diameter as the insulation to protect pipe covering. Calcium silicate blocks shall have galvanized cover shields. Where pipe saddles are used, they shall be 18 gauge, 12 inches long, 180 degree, shaped for the outside diameter of the insulation. Install pipe hangers on insulated piping on the outside of the insulation and not in contact with the pipe., unless not allowed by authority having jurisdiction. In cases where hanger is required to be in direct contact with the pipe, provide details of how piping shall be insulated to control condensation and heat loss.
8. Provide cushioning clamps at pipe clamps attached to strut.

9. Provide seismic bracing in accordance with CBC 1617 and ASCE 7. Mason OPM 0143-13 and Eaton Bline OPM-0052-13 are approved systems that the designer shall use. Provide clear identification of project requirements including project importance factor (i.e. Ip = 1.5 for hospitals), exemptions of piping based on steel, copper, and non-ductile piping. Provide pipe bracing criteria for piping with flexible connections and without flexible connections. List trapeze exemptions (i.e. trapezes with less than 5 lbs/lf), and list piping with hazardous content bracing requirements.
10. Gripple type cable hangers are not permitted for gravity loads.

E. FACILITY DRAINAGE PIPING CLEANOUTS 22 05 76

1. Make all cleanouts accessible. Cleanouts are not allowed to be installed in ceiling spaces. Where feasible, wall cleanouts shall be used. Use graphite on all cleanouts with all threads being thoroughly greased after acceptable pressure test. Provide end of line clean outs on upper floor branch lines. Cleanouts shall be provided at maximum 50 ft interval and at the base of any risers. At least one cleanout shall be provided in the upper floors for any horizontal carriers. Provide cleanouts 6” above the flood level of the fixture (i.e. break room sink, exam sink, hand sink). For piping 3” and larger provide cleanouts at a maximum height of 30” above the floor. Lavatory cleanouts can be below the sink if in conflict with the mirror.
2. Where cleanouts occur in walls, cavity shall be sized to accommodate the pipe size, insulation, and hardware.
3. Types of Cleanout Bodies
    a. Exposed: Cast iron plug.
    b. In Wall: Cast-iron body, stainless steel cover.
    c. Finished Floor Cleanouts: Adjustable, cast-iron body, ABS or brass threaded plug. Plug shall be installed within 1 -inch of finished floor. Provide Teflon pipe sealant to prevent plug from becoming seized in the body.
    d. 2-Way Cleanouts: Provide back-to-back combos. Manufactured single access 2-way cleanouts are not acceptable.
4. Where sewer piping is epoxy coated provide “EPOX” identification on cleanout cover so facility will understand that no cutters can be used in the line.

F. PLUMBING INSULATION 22 07 00

1. Insulate
    a. Rainwater leader and overflow drain piping inside the building for up to 25 feet from the roof drain or overflow inlet. Fiberglass or closed cell insulation such as AP Armacell, or equal, is acceptable.
    b. AC unit condensate drains and similar drainage systems that are extremely cold have had issues with condensation, causing water damage inside the building. Provide insulation on condensate drains that may have risk of condensing inside the building. Locate for a minimum of 15 feet from the AC unit connection. Fiberglass or closed cell ½” insulation such as AP Armacell, or equal, is acceptable.
    c. Water piping, 6-inches and smaller, exposed to the weather, including interior spaces subject to outside temperatures.
    d. Domestic hot water piping.
    e. Domestic hot water return piping.
    f. Industrial hot water piping.

g. Domestic water pipes in spaces that can experience high humidity such as central sterile or steam processing or in places where pipe can experience temperature below ambient dewpoint. Intent is to control against condensation.

h. Comply with California Energy Code for insulation thickness, R value, and conductance. Comply with California Mechanical Code for allowable flame spread and smoke developed ratings. Refer to insulation Section 23 07 19.

i. Insulated piping outside the building shall be protected with aluminum jacket for piping and fittings. PVC elbows are not allowed.

j. Provide PVC jacketing color coded to UCD standards or preferences for all exposed insulated lines is occupied spaces and in mechanical rooms.

k. Provide labeling of all insulated and non-insulated piping. Provide labels at 20-foot intervals, a minimum of one per room. Provide directional arrows of flow, and a label adjacent to any shut off valve describing content.

G. COMMISSIONING OF PLUMBING 22 08 00

1. Disinfection of Water Systems

   a. All water systems shall be disinfected per California Plumbing Code and authority having jurisdiction (AHJ).

   b. Provide valved ports for chlorination with plugs. This may require freezing line to minimize facility downtime. Valve size to shall be a minimum of ½". All valved ports shall have a plug or cap.

2. Balance hot water return systems and verify hot water temperature to fixtures meets requirements.

3. On new systems verify hot water return pumps are operating in accordance with the intended sequence of operations. Test hot water high temperature alarms, test start/stop sequences of hot water return pumps, test aquastat off operation where applicable.

4. Tests and Adjustments

   a. Test only new piping. Final connection between new and existing piping shall be tested at normal system operating pressures. Make no high pressure test against an existing service valve or meter except where approved by UCD representative. Isolate all existing piping systems from new or existing equipment which may be damaged by test pressure. Line pressure testing against an existing valve with visual inspection for 20 minutes with no leakage is acceptable where allowed by authority having jurisdiction and the Inspector of Record (IOR) witnesses the test.

   b. There shall be no loss in pressure or visible leaks shall show after 2 hours at the pressures indicated in the table below unless noted otherwise.

System Tested Sanitary and Lab, Waste, Drain, Vent, Storm drains, Overflows	Test Pressure PSI 10 ft. head 5 psi	Test with Sanitary & Lab Water Air (30 minutes)
Compressed Air	150 PSI	Air & Soap
Deionized or Reverse Osmosis Water	100 PSI	Deionized or RO water
Industrial and Domestic Hot & Cold Water	150 PSI*	Water
Gas	100 PSI	Air & Soap
Medical Gas and Vacuum	150 psi Initial Test	All Testing in Accordance with NFPA

*or 1.5 times the operational pressure, whichever is higher.

High pressure steam pipe test pressure: 150% more than operational pressure

Low pressure steam and condensate: 150 psi, water

Other systems not listed: Test at 150% of operating pressure.

H. FACILITY WATER DISTRIBUTION 22 11 00

1. Systems Definition
   a. The potable water system is identified as the Domestic Water Distribution System. This system serves the building domestic water, building industrial water, and fire water.
2. Building Domestic Water
   a. This system is used to provide for consumption and sanitary needs, industrial water needs, make-up water for mechanical system, and process water needs (i.e., DI, RO, etc.).
   b. The service at the building shall provide the following.
      iv. A reduced pressure backflow prevention device (RPBP). Provide two with 100% capacity in parallel.
      v. Shut off valve.
      vi. Water meter connected to and readable from the Building Automation System (BAS). Provide Xylem Omni pulse type.
      vii. Provide a 1” ball valve with plug at the main supply line entrance feeding the building to allow for domestic cold-water chlorination.
   c. Provide a 1” ball valve with plug to allow domestic hot water chlorination. This shall be located at the building’s water heater source. (Chlorination is used to periodically disinfect to reduce the risk of Legionella.AlAn accessible main strainer with “blow down” capabilities to prevent well water sediment from reaching building’s water supply and fixtures. Strainer shall be #20 mesh (1/32-inch). Coordinate location with UCD representative.
   d. Water pressure calculations shall be performed for the project to determine the need for a booster pump. Water booster pumps shall be controlled with variable frequency drives (VFDs) in lieu of hydraulic controls. Booster pump systems shall have a minimum of two pumps and a hydro pneumatic tank. Request a water pressure test for all new buildings during project SD or DD phases. Provide a minimum of 30 psi to the top floor for multi-story buildings. Size the booster system for a minimum of 120% of the calculated demand and estimated growth. Provide demand analysis and performance for the university’s acceptance.
   e. Domestic water service inside each building shall provide the following.
      i. Isolation valves on branch lines serving each floor and at each equipment connection to facilitate maintenance and future building renovation projects. Provide a plan to shut off

patient rooms and multi-person occupancy toilet rooms that minimizes the impact on adjacent rooms and areas.

ii. In large floors provide isolation valves for every quadrant or for each department.

iii. The building plumbing systems shall have appropriate shut off valve zoning to allow for ease of maintenance with minimal shutdown impact to building occupants. At minimum, shut off valves shall be provided for the following: each floor, multi person toilet rooms, each laboratory room, each equipment room, and each kitchen.

iv. Provide accessible water hammer arrestors for hot and cold-water supplies to each quick-closing plumbing fixture or solenoid valve (e.g., water closet, urinal, dishwasher, washing machine, clinic sink, food service hand-held sprayers, etc.) in accordance with the American Society of Sanitary Engineers Standard 1010, Water Hammer Arrestors.

v. Size and locate arrestors per Plumbing Drainage Institute (PDI) Standard PDI-WH 201, Water Hammer Arrestors, latest edition, requirements.

vi. Water hammer arrestors shall have a minimum 12” x 12” stainless steel access door. Coordinate the access door location with partitions, grab bars, and obstructions. Install above ceilings or behind wall access door at each applicable plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

vii. For renovation projects, dead-end piping shall be removed in the area of the renovation back to the nearest active main or branch line. Empty risers, mains, and branch lines stubbed with line size shut-off valves for future use are permitted. These requirements apply to all domestic water utilities.

viii. For potable hot water systems, provide a recirculation loop that serves all areas of the facility. Provide a balance valve for each floor and provide a recirculation loop that shall allow domestic hot water systems to maintain hot temperatures to the fixtures. Provide additional balance valves as necessary to maintain hot water throughout the space. Piping arrangement shall limit the number of balance valves and utilize larger recirculation loops. Due to fixture layouts, it recognized this is not always possible. Balance valves on new systems shall be constant flow style with a cartridge for set gpm flow. Each balance valve shall have an upstream strainer and ball valve, and a downstream ball valve for complete isolation and replacement of a cartridge. Existing systems may use cartridge style or circuit setters depending on existing types of valves and available pump pressure. Cartridge style setters are expected to have a higher-pressure loss and they shall be analyzed for usefulness in an existing return pumping system. Hot water return designs shall limit the maximum velocity to 4 fps to minimize the potential of pipe pitting and erosion. California Plumbing Code allows a maximum of 25 feet of uncirculated domestic hot water piping. UCD standard is to have up to 15 feet maximum (horizontal and vertical) of unrecirculated domestic hot water. For nourishment/ kitchen areas the maximum allowed time before hot water is available at the fixture is 10 seconds or as otherwise required by the Authority Having Jurisdiction (AHJ). Kitchens shall have 140oF water supply (or as specified by California Plumbing Code) and shall incorporate thermostatic mixing valves for hand sinks and other fixtures requiring supply temperatures below 140oF.

ix. Provide digital water tempering mixing valve system at the water heater. Store potable hot water at 140oF. Provide a high tempered water alarm per the California Plumbing Code. Alarm to the BAS and alarm locally at the water heater with a visual and a cancelable audible alarm. BAS control points shall include tempered water supply, temperature, hot water return temperature, recirculation pump status, recirculation pump start/stop, domestic hot water storage supply. Points may be obtained from the digital tempering valve or separate wired points. Smart mixing valves shall be on emergency power for hospitals.

x. Do not use once-through potable water for medical equipment cooling unless approved by the university representative. Where once thru cooling systems are used they shall only flow during demand and not flow continuously.

3. Hose Bibbs

a. Exterior Hose Bibbs: Shall be served by industrial or utility water services (where feasible). Provide hose bibbs within 20 feet of entrances into the building. Provide each hose bibb with an isolation ball valve, vacuum breaker, loose key handle, ¾ inch hose outlet. Exterior wall boxes shall be chrome-plated rough bronze, and vandal proof. Provide hose bibbs on roof within 150 feet max of each other. Provide hose bibbs within 40 feet of HVAC units for washing coils. Provide removable water-resistant canvas insulation covers for hose bibbs. Insulate domestic water on roof, refer to insulation specification.

b. Interior Hose Bibbs: Vacuum breaker, loose key handle, ¾ inch hose outlet, chrome plated brass, vandal proof.

4. Backflow Preventers

a. Provide lead-free reduced pressure principal backflow preventers consisting of assembly, including shutoff valves on inlet and outlet, and strainer on inlet.

b. Where required, provide backflow preventers to separate industrial water from domestic water, and any other locations where prevention of backflow is critical for safety.

c. On industrial water for labs, hospitals, and all other new buildings, provide parallel backflow prevention devices sized at 100 percent of the flow each.

d. On make-up water to hydronic systems, provide a single RPBP device.

e. Backflow preventers shall include test cocks, and pressure-differential relief valve located between two positive seating check valves. For single backflow applications, provide independent isolation valves on each side of backflow device to allow for removal and replacement. This is in addition to the manufacture provided isolation valves.

f. Provide a strainer upstream of the backflow devices with union, and a blowdown ball valve with hose connection fitting and cap.

g. Install no higher than 5 feet above finished floor, 12 inch minimum from floor, 12 inch minimum from wall.

h. RPBP's located inside a building are subject to water discharge and shall have air gap fittings and piped drains to a floor sink or an approved location. The wall adjacent to a backflow preventer shall be protected from water discharges with a minimum of FRP or similar water protection for a distance of 24 inches above and 24 inches to the sides of the discharge location, all the way to the floor of the room.

5. Piping

a. Domestic Cold Water

i. Underground: Type K copper tubing, drawn temper, seamless, ASTM B88. Piping shall be installed in a plastic sleeve wrap. Joints underground shall be brazed.
ii. Above Ground: Type L copper tubing, hard drawn temper, seamless, ASTM B88.
iii. Below Grade cold water to trap primers: Type L annealed soft temper, no joints. Piping shall be installed within plastic sleeve wrap.

b. Domestic Hot Water

i. Underground: Preinsulated Type L, ASTM B88, brazed joints. Provide with high-density polyethylene (HDPE) exterior jacket. Permapipe or equal.
ii. Above Ground: Type L copper tubing, hard drawn temper, seamless, ASTM B88.

6. Joints

a. Copper Tubing for Domestic Water: All above grade piping, 1-1/2" and larger, and all below grade piping, regardless of size, shall be brazed with silver solder 1000oF. All joints 1-1/4" or less are allowed to be soldered with lead free 95/5 tin antimony for pipes above ground. UCD has had

leakage with solder joints due to water hammer. Male and female threaded adaptors of any size shall be soldered in lieu of brazing (the higher brazing temperatures anneal the threads making them more susceptible to weakening and leaking).

b. Dissimilar Materials: Install 6" long brass nipple, dielectric transition at points where dissimilar metal pipes connect together. Dielectric unions are not to be used unless approved specifically by the UCD representative. Dielectric Waterway that are NSF listed and are specific for transitioning from steel to copper are acceptable, ASTM F-1545. Clearflow or Victaulic or equal.

c. Pro-press can only be used with approval from university representative and in limited conditions. In no cases can Pro-press be 1 ½" and larger.

7. Fittings

a. Copper tubing: Wrought copper or cast brass unions and flanges

i. Unions and flanges shall be provided at the inlet and outlet of all apparatus and equipment, at all valves, and elsewhere as required to facilitate removal of valves and equipment. When connecting dissimilar metals, use brass nipples. Do not use dielectric unions.
ii. Two inches and smaller ground joint shall be cast bronze unions. Cast brass unions may be used for pipe sizes 1" and smaller.
iii. Two-and-one-half inches and larger shall be CTS flange or 150-pound flange, cast brass.
iv. Do not use tee pulling methods (no extracted tees).

I. FACILITY SANITARY SEWAGE 22 13 00

1. Floor Sinks
    a. All mechanical spaces shall be provided with floor sinks.
2. Floor Drains
    a. Install vented P-trap below each drain. Provide trap primer connection for drains with infrequent use.
    b. All toilet rooms with more than one toilet or a toilet and urinal, laundry rooms, mechanical rooms, plumbing equipment rooms (i.e. water softener or R.O. rooms) and first floor trash rooms shall have floor drains. Kitchen floor drains with grease potential shall be a minimum of 3” pipe size.
    c. Provide flashing ring and clamp at floors with waterproofing membrane. Adjustable set top with the top of the drain installed slightly below the finished floor to ensure drainage.
3. Trap Primers
    a. Install with Type L, hard copper piping (above grade) and soft copper piping with no joints (below grade) to trap primer connection on floor drains and floor sinks with infrequent use. Underground piping shall be within a plastic sleeve wrap.
    b. Install trap primer piping to ensure that the line shall drain fully to the floor drain or floor sink.
    c. Provide a ball valve to the inlet at each trap primer location.
    d. Mount trap primer in wall. Size access door and box to suit valve and primer operation. Provide locking door when installed in occupied spaces.
    e. Where one trap primer shall be used for more than one trap, provide a distribution unit with feeder piping for a maximum of four traps sized for equal pressure drop to each trap.
4. Drain, Waste, and Vent Piping
    a. Provide a statement of the sewer pipe design slope in the project Basis of Design. Record any slope restrictions and proposed design solutions. Slope piping at ¼”/LF whenever possible.
    b. Coordinate with the local Utility District and Health Department to determine if kitchen waste requires a grease removal system.
    c. Pipe and Fittings
        i. Above and Below Grade: Cast iron soil pipe and fittings, asphaltic coated, conforming to ASTM A888 and Cast-Iron Soil Pipe Institute Standard (CISPI) 301 and so marked. Pipe and fittings shall be manufactured by AB&I, Charlotte, Tyler Pipe, or equal. Pipe and fittings shall be the products of a single manufacturer.
        ii. Horizontal cast iron piping (waste and vent) shall have hangers installed on each side of piping and fitting joints. Hangers shall be within 18" of the joints.
        iii. Joints: Couplings above and below grade: No-Hub couplings, meeting the requirements of FM 1680 Class 1, ASTM C1540, ASTM C564, IAPMO listed. Four band stainless steel clamps, 3/8-inch bolt heads, Type 304 stainless steel corrugated shield, welded, flanged.015-inch thickness. Husky SD 4000 or equal, no known equal. Couplings shall be torqued to manufacture specified values (80 ft lbs).
        iv. UCHD shall only accept the use of Husky 4000, stainless steel 4 band couplings.
        v. No reducing couplings allowed. Sewer lines at toilet room sinks shall be designed properly with sweeps rather than “Ts” to allow for snaking when blockage occurs.
    d. Vent Pipe
        i. Provide hubless cast iron soil pipe and fittings conforming to ASTM A888 and Cast-Iron Soil Pipe Institute Standard 301 and so marked.

ii. Joints in cast iron vent pipe shall be the same as specified for cast iron waste pipe below ground. Two band, no hub couplings are not permitted. Provide No-Hub couplings, meeting the requirements of FM 1680 Class 1, ASTM C1540, ASTM C564, IAPMO listed. 4 Band stainless steel clamps, 3/8-inch bolt heads, Type 304 stainless steel corrugated shield .015-inch thickness. Husky SD 4000 or equal, no known equal. Couplings to be torqued to manufacture specified values (80 ft lbs).

iii. Type DWV copper tubing shall be allowed with approval from the UCD representative. DWV copper is not allowed for laboratory venting.

e. Condensate Drain Piping

i. Inside and outside buildings provide ASTM B88, Type L copper tubing and fittings. Provide Wye fittings with capped cleanout plug for tubing up to 1 inch size. Provide wrought copper or cast DWV fittings for sizes 1-1/4 inch and larger. Drainage fittings may be used for condensate piping.

ii. Connect condensate drains to mechanical equipment per equipment manufacturers recommendations; provide P-trap where required. Slope piping to drain, with 1/8 inch per foot minimum pitch. Provide dielectric couplings at connections to dissimilar materials.

iii. Mechanical equipment on spring isolation rails or spring mounted curbs provided with threaded metal connector at mechanical equipment, Metraflex Model SST or BST, Unisource Mfg. Co. “V” connector, or equal, listed for the potential movement. Arrange flexible connection to ensure drainage of condensate under all installation conditions and arrange for support of flexible connection at end of the connector, to ensure alignment at all times.

iv. Where condensate drain P-traps are required, install trap using Wye fitting on inlet and outlet of trap. Provide cap on top of each Wye, made removable for cleaning and inspection. Drill 1/8-inch diameter hole in cap at outlet of the trap to allow venting of the system. Minimum depth of the trap shall be 4 inches, or as recommended by the manufacturer in printed literature.

v. Provide cleanout tees or “Wye” at each change in direction.

vi. Condensing-Type Equipment Condensate Drainpipe: CPVC pipe where allowed by jurisdiction and fittings conforming to ASTM 2618, stainless steel piping and cast stainless fittings.

vii. Provide continuous support for horizontal plastic piping.

viii. Piping and fittings shall be as manufactured by Spears Manufacturing, Charlotte Pipe, and Foundry Co., or equal.

f. Sanitary Sewer Ejector

i. General Requirements: Provide duplex sewage ejectors or duplex grinder ejectors. Coordinate with UCD. Provide general alarms to BAS for monitoring.

g. Drip Pans

i. Piping is not allowed to run above electrical rooms or IT rooms. Where existing conditions have piping above these rooms, provide drain pans as specified below and incorporate a moisture sensor connected to the BAS for alarming if wet conditions exist. Each drain pan shall have a 1” piped drain with a ball valve incorporating a hose connection and cap.

ii. Drip pans located directly below hydronic piping or similar sources of possible damage shall be provided to protect electrical and electronic work which is sensitive to moisture.

iii. Pans shall be 2" deep, extending a minimum of 10" beyond each edge of overhead piping for electrical work to be protected.

iv. Fabricate pans with 20-gauge galvanized steel, with rolled edges and reinforced for proper support, soldered fully watertight, and fitted with a copper drainpipe.

v. For drain pans that cannot be feasibly piped to a drain, provide moisture sensor and valve with hose connection per item 1 above.

J. FACILITY STORM DRAINAGE 22 14 00

1. General
   a. The maximum allowable size for storm drains is 12 inches.
   b. Provide daylight overflow drains to exterior with a cast bronze downspout nozzle that drips away from building (cow tongue). Provide NPT threaded connection only. “No hub” connection for outlets is not allowed. Size nozzle to match connected pipe. Overflow outlets located lower than 8 ft above grade shall be permanently labeled as an “overflow”.
   c. If a pump is required, locate it outside of the building.
   d. Do not drain outside building sub-soil drains to interior sump pumps.
   e. Insulate all horizontal piping runs inside buildings for 25 feet to control condensation.
   f. Roof and overflow drain piping shall not be combined.
   g. Overflow drain piping shall be day-lighted through exterior wall, minimum 18-inches above grade, in a location that is readily visible.
   h. Surface drains and building foundation drains shall be provided as necessary.
   i. Size piping for rainfall rate of 3”/hr unless otherwise approved by UCD chief engineers.
2. Piping
   a. Same as above sanitary sewage piping. Refer to Section 22 13 00 - Facility Sanitary Sewage.
3. Drains
   a. Area Drain: Provide heel proof grate for public walk areas and traffic grate with locking clips & retained bolts for traffic areas.
   b. Roof/Overflow Drain: Cast iron with flange, flashing ring, gravel stop, underdeck clamp, extension, sump receiver, 5-inch-high cast iron vandal proof dome type strained inlet and clamping collar.

K. PLUMBING EQUIPMENT 22 30 00

1. Domestic water treatment
   a. At the beginning of a project that requires water treatment (new sterilizer, washes, deaerators, cooling towers, etc.) obtain water analysis by the UCD water treatment specialist (currently Evoqua) to determine the level of water treatment necessary for maintaining proper equipment performance. Provide necessary water softeners, deionizer system, reverse osmosis system, pressure boosters, etc. in accordance with water treatment specialist report. Water treatment systems shall have valved bypasses and flow meters.
2. Carbon filters
   a. Performance Requirements
      i. Equipped with an electro-mechanical metered valve.
      ii. Filter shall be activated carbon and regenerated by a backwash cycle.
   b. Products: Valve: Fleck, or equal.
3. Provide neutralizing basin for acid waste.
   a. Furnish sufficient limestone chips in chunks 1 inch to 3 inches in size to fill the tank to within 2 inches of the outlet. Place this material in the tank at the completion of the work. Dwell time in the tanks is to be designed in accordance with ASPE standards of 2 ½ to 3 hours. Provide UCD staff training for limestone regular replenishment and inspection of basin. Replenishment is

generally 1 to 3 months but must be adjusted based on usage. Provide PH monitoring and BAS alarming when effluent is below allowable PH levels (generally 5.5 PH is accepted, verify with local jurisdictions). Chemical caustic dosing systems may be utilized for larger systems. All materials are to be acid resistant. Point of use neutralization is acceptable where the neutralization quantity of fixtures is small. Point of use neutralization does not require PH monitoring unless necessary by the authority having jurisdiction (AHJ).

4. Commercial Electric Water Heaters
    a. Provide commercial electric water heaters that comply with ASHRAE 90.1 for energy efficiency with UL listing.
    b. UCD is moving away from gas water heaters where possible. Consideration shall be given to heat pump water heaters.
    c. Provide the following accessories.
        i. Brass or bronze drain valve
        ii. 3/4-inch minimum temperature and pressure relief valve
        iii. Thermometer
        iv. Expansion tank
        v. Electronic mixing valve connected for BAS.
5. Instantaneous Point-of-Use Electric Water Heaters
    a. Cabinet mounted stainless steel electric heating style. Flow switch activated, UL listed, 150 PSI rated.
    b. Point-Of-Use instantaneous electric water heaters shall be used for remote located fixtures or at fixtures with limited use.
    c. Identify in plans fixture gpm and water temperature rise.
6. In-line Domestic Hot Water Recirculation Pumps
    a. Provide in-line domestic water recirculation pumps to maintain design temperature of the domestic hot water supply throughout the building.
    b. Pumps shall be of the centrifugal type with non-overloading characteristics and shall not overload the motor above its nameplate horsepower rating under any operating condition. No allowance for service factor shall be used in pump selection.
        i. Provide redundant pumps for hospitals and medical office buildings (MOBs).
        ii. Size pump heads to accommodate constant flow balancing valves (higher pressure drop).
        iii. Provide BAS timer function and aquastat for medical office buildings.
        iv. Provide pump status to BAS for hospitals and medical office buildings.
        v. Provide domestic hot water return temperature monitoring and alarm at the suction side of the circulating pump.
7. Concrete Grease Interceptors
    a. Furnish and install a concrete grease interceptor with minimum capacity as required by the AHJ. Provide manholes to grade for access to each section. Provide gastight cast-iron ring and cover at grade for each manhole. Provide effluent sample box where required by local jurisdiction.
8. Domestic Water Booster Pumps
    a. Provide skid mounted, centrifugal pumps with integrated control panel, alarms, and variable speed drives.
        i. Provide variable speed booster systems. Do not utilize mechanical regulating valves except with UCD approval.

ii. Ensure that Variable Frequency Drives (VFD) communicate with the Building Automation (BAS) and Control Networks. Provide pumps status and alarm to BAS.
iii. Motors shall be premium efficient. Provide shaft grounding.
iv. Provide hydro pneumatic tank for draw down at low flows.
v. Provide a minimum of 30 psi pressure at the highest floor.
vi. Provide bypass valving with check valve around domestic booster pump to allow for operation when booster pumps are out of service. Provide inlet and outlet isolation valves at the booster and at each pump.
vii. Consider future demands for the booster system in the Basis of Design. Coordinate with UCD representative for expansion projections.
viii. Provide a duplex system for MOBs with each pump able to accommodate 2/3rds of the total demand. The total performance of the system shall be a minimum of 115% of the demand with both pumps in operation. Each pump shall have an identical performance.

b. Provide a triplex domestic booster pump system for hospitals. Size each pump to accommodate 75% of the total demand. The third pump is redundant. The total demand of any two pumps operating shall be a minimum of 130% of the demand. Each pump shall have identical in performance. List on design drawings the total calculated building demand and the pump performance requirements.

9. Sumps in Elevator Pits:

a. Avoid adding a sump pump in an elevator pit unless required by the State or AHJ. Provide for a means of water removal from a temporary pump being inserted into the pit.

L. COMMERCIAL PLUMBING FIXTURES 22 42 00

1. General Requirements

a. Comply with Cal Green water conservation flow rates.

b. Provide fixtures and trim listed here in this section. Alternate or special fixtures not listed shall be presented to the UCD representative for review and written approval.

c. Provide all water supplies to fixtures with shut-off stops with IPS inlets with threaded brass nipples at pipe connection and lock shield-loose key. Concealed stops as well as exposed stops are required to have lock shield and loose key.

d. Provide 3/8” risers for all sinks and lavatories. IPS supply flex risers can be compression type connector.

e. Fixtures not having integral traps shall be provided with "P" traps of chromium-plated brass connected to concealed waste in wall and sanitary fittings. Provide 17-gauge minimum traps and tailpieces.

f. Install wall-mounted vitreous china fixtures with concealed arm carrier with floor feet anchored securely to the floor.

g. Install wall-mounted urinals with carriers with floor feet anchored securely to the floor.

h. Bottle Filling Stations: Provide bottle filling station, one for each high/low drinking fountain.

i. Bottle filling stations shall be installed at an accessible height. The unit shall be lead-free; contain bayonet style, non-proprietary, built-in filtration system and shall include antimicrobial protection. Basin shall be designed to minimize splashing and standing water.
ii. Refrigerated units shall be provided if installed above the second floor or if piping passes through an unconditioned basement. Verify refrigeration requirements with the UCD representative.

2. Products: Fixtures shall be American Standard, Zurn, Kohler or an equal. Faucet shall be Chicago

HyTronic series, or equal. Appendix lists fixtures that have been preapproved by UCDH. Designer is encouraged to use these fixtures where they are applicable to the project. Designer is responsible for ensuring all fixtures used meet the project requirements, jurisdictional code requirements, and all handicap/barrier free requirements.

a. Faucets serving lavatories in public and private restrooms shall be domestic made, with 0.5 gpm laminar flow restrictor. Provide with 120v plug-in sensor faucet. Battery operated sensor faucets may be used only with the university's approval. Provide faucets with thermostatic mixing valve with integrated check valves. All wiring below sink shall be neatly organized and coordinated with the electrician for placing the power source directly below the sink. All low voltage wiring shall be concealed behind raceways. Provide faucet with DC battery backup.

b. Faucets serving hand wash sinks shall be domestic made, gooseneck faucet with laminar flow 1.5 gpm restrictor. Provide with 120v plug-in sensor faucet. Battery operated sensor faucets may be used only with the university's approval. Provide faucets with thermostatic mixing valve with integrated check valves. All wiring below sink shall be neatly organized and coordinated with the electrician for placing the power source directly below the sink. All low voltage wiring shall be concealed behind raceways. Provide faucet with DC battery backup.

c. Electronic infrared 120v sensor faucets shall have DC battery backup or shall be on emergency power.

d. Except where specifically approved by PO&M, the use of turbine, self-generating power, sensor operated faucets are not allowed. The generating power fails when fixture is infrequently used.

e. Electronic infrared sensor flush valves shall operate on 120 volt power. Battery operated flush valves can only be used with PO&M approval.

3. Water Closet: Floor mounted. Vitreous china, top-spud, siphon jet, dual flush 1.6/1.1 GPF flush valve. Complete toilet assembly (bowl and flushometer) shall have a Maximum Performance (MaP) flush score of 1000 and be WaterSense labeled. Seat shall be self-sustaining with check hinge. Electronic infrared sensor flush valve 120v power. 1.1 GPF is not acceptable. ADA toilets shall be floor mounted due to bariatric patients.

4. Water Closet: Wall hung, vitreous china, siphon jet action, Maximum Performance (MaP) score of 1000. Dual flush 1.6/1.1 GPF. Provide white, open front seat, less cover. Seat: White, heavy- duty, commercial type, elongated, open front, solid plastic, with self-sustaining stainless steel check hinge. Duco cast iron floor mounted carrier. Electronic infrared sensor flush valve 120v power. 1.1 GPF is not acceptable. Wall hung units shall be used in restrooms with multiple toilets. ADA toilets that are wall hung shall have a bariatric heavy duty wall carrier rated for 1000 lbs.

5. Urinal (UR-1): Wall Hung, ADA compliant, vitreous china, top-spud, 0.125 GPF flush valve. Complete urinal assembly (urinal and flushometer) shall be WaterSense labeled. Electronic infrared sensor flush valve 120v power. Wall carrier with floor feet anchored securely to the floor.

6. Lavatory (L-1): Under Mount vitreous china lavatory with electronic infrared Chicago HyTronic sensor faucet non-aerating (0.5 gpm), grid drain, 17-gauge seamless brass P-Trap less trap screw cleanout with chrome plated body, brass connection nuts, wall return and chrome plated wall escutcheon to match trap finish.

a. For handicapped applications use offset grid drain and insulate hot water and drain piping exposed below lavatory.

b. Provide Trubro or equal insulated protective covers for water and waste below the sink.

c. Provide thermostatic mixing valve with integrated check valves.

7. Lavatory (L-2): Wall Hung, vitreous China lavatory with electronic infrared Chicago HyTronic sensor faucet non-aerating (0.5 gpm). Concealed arm support with carrier and floor feet secured to the floor, 17-gauge seamless brass P-Trap less trap screw cleanout with chrome plated body, brass

connection nuts, wall return and chrome plated wall escutcheon to match trap finish.

a. For handicapped applications use offset grid drain and insulate hot water and drain piping exposed below lavatory.

b. Provide Trubro or equal insulated protective covers for water and waste below the sink or provide shroud over plumbing below the sink.

c. Provide thermostatic mixing valve with integrated check valves.

8. Mop Sink (MS): Floor mounted, terrazzo with faucet that includes vacuum breaker, wall support, integral check stops, 5' hose and hose bracket mounted with stainless steel. Where steam humidifiers discharge to the mop sink, provide 16-gauge stainless steel mop sink, in lieu of terrazzo.

9. At rooms requiring a mop sink, install a hot and cold water stainless steel wall box with check valves for each supply line for the users' soap system. Supplies shall have a vacuum breaker. Final connection to soap filter will be by the Owner.

10. Bottle Filler Stations: Elkay EZH20 System Cooler/Bottle Filling Station, Oasis Universal Barrier-Free VersaCooler II with VersaFiller, or equal, 115v, ADA compliant, sensor activated, filter.

11. Hand Sink (Counter Mounted Exam Room Sink): 18-gauge, type 304 stainless steel sink counter mounted, single bowl, 19-inch by 18-inch by 5-½-inches deep. Deck mounted, 1.5 gpm faucet, Chicago HyTronic gooseneck, laminar flow faucet, discharge is a minimum of 7" above flood level, 17-gauge brass chrome plated 1-½-inch by 1-½-inch trap. Products: Just Manufacturing, Elkay, or equal.

12. Ice Maker Cut Sink: Just Manufacturing, 18-gauge stainless steel drop in sink. Used for counter mounted ice makers. Coordinate with ice maker vendor to provide four feet to allow for drain piping to the cup sink.

13. Break Room Sink Counter Mounted Drop In: 18-gauge, Type 304 stainless steel, single bowl, 22"x19-1/2"x5-1/2" deep, deck mounted, 1.5 gpm, manual Chicago faucet (no garbage disposal, no pull out heads), 17-gauge brass chrome plated 1-1/2"x1-1/2" trap, basket strainer. Product: Just Manufacturing, Elkay or equal.

14. Laboratory Faucets: Deck-mounted, atmospheric vacuum breaker, gooseneck spout with replaceable stainless-steel seat. Faucet shall be fully assembled, and factory tested prior to shipment. Water Saver, Chicago, or equal. Coordinate with lab technician for specific requirements.

a. Shower Valve: Pressure balancing integrated, quarter turn stops. 36" grab bar, 60" stainless steel flex hose, outlet diverter, 1.5 gpm shower/1.5 gpm hand shower. Product: Simmons, or equal.

b. Laboratory Sinks, general purpose: Epoxy resin, under counter mount, chemical resistant. Faucet: Deck-mounted, gooseneck spout, replaceable stainless-steel seats, built in stops; self-closing for D.I. applications. Sink: Durcon, Orion, or equal. Chicago faucet, or equal.

15. Laboratory Sinks Used for Dry Ice Disposal: Sink: 18-gauge, Type 304 stainless steel. Faucet: Deck-mounted, gooseneck spout, replaceable stainless-steel seats, built in stops. Products: Sink: Elkay, Just Manufacturing, or equal. Faucet: Chicago, or equal.

M. EMERGENCY PLUMBING FIXTURES 22 45 00

1. General

a. Emergency eye or eye/facewash equipment shall be provided in all work areas where, during routine operations or foreseeable emergencies, the eyes of an employee may come in contact with a substance which can cause corrosion, severe irritation, or permanent tissue damage or which is toxic by absorption. Eyewash shall be provided if there shall be processes that produce flying particles, including sawdust, metal shavings, biological agents, etc. This equipment shall

meet the performance and installation requirements of American National Standards Institute (ANSI) Z358.1 1998 *(current version).* UC Davis Health's EH&S shall make final determination on selection of equipment to ensure the equipment meets this standard.

2. Emergency Eye Wash and Showers
    a. The units shall be
        i. Supplied by domestic water.
        ii. Readily visible and accessible to the laboratory or work site. The unit shall be located as close to the hazard as possible and cannot be blocked by building structures, cabinets, supplies or equipment.
        iii. Provided with an activation device, such as stay open ball valve, that allows the user full movement of both hands after the valve is turned on.
        iv. Identified with a highly visible sign.
        v. Drain shall be plumbed to sanitary sewer.
        vi. Located so as not to pose an electrical shock hazard. No electrical outlets within 6 feet unless GFI protected.
        vii. Indoor units are not required to deliver tempered water unless water is 60oF or less. Units installed outdoors or in adverse climates shall be tempered. The need for tempered water shall be reviewed by the UCD representative and EH&S during the design phase.
3. Emergency Eye Wash
    a. Emergency eye or eye/face wash units are Haws 7611 or Guardian G1805 (laboratory unit – install at sink), Haws 7000BT or Guardian G1750PT (Barrier Free), Haws 7656WC or Guardian GBF 1735DP (recessed), or equal.
    b. In addition to the requirements above, the units shall be
        i. Regulated to provide a spray force of three to six gallons per minute at 30 psi.
        ii. Mounted such that the water nozzles are 33-inches to 45-inches from the floor level; and 17 to 25-inches from bowl edge, wall, or obstruction; height shall comply with Americans with Disabilities Act of 1990 (ADA) requirements and at least 34-inches of clearance around the eyewash must be maintained.
        iii. Mounted so that spray nozzles, when activated, are no more than 18 inches from the counter front when located above work counters or benches.
        iv. Drain shall be plumbed to sanitary sewer.
        v. For laboratory units installed at sinks, provide eyewash unit which swings spray head assembly over sink activating continuous flow of water.
        vi. For barrier Free units, provide wall-mounted, low-profile eyewash with plastic receptor and aluminum wall bracket.
        vii. For recessed units, provide swing down eyewash in a fully recessed wall mounted stainless steel cabinet with drain pan.
        viii. Provide Chicago Faucet eyewash at location that it is required to be an eyewash/faucet combo.
4. Emergency Showers
    a. The unit shall be installed and located so both the shower and eyewash can be used at the same time by one person. Eyewash/emergency shower units are Haws 8346 or Guardian G1909 HFC (GBF1909 Barrier Free), Haws 8355WC (recessed), Guardian GBF2150 (recessed), or equal. Eyewash component shall meet the requirements for Emergency Eye Wash above. In addition to the requirements above, the units shall be:
        i. Adequately supplied with potable water to meet the requirements of each component. The shower shall be able to deliver a minimum of 30 gallons per minute. The diameter of the water pattern of the shower measured 60 inches above the surface on which the user

stands shall be a minimum of 20-inches. The center of the spray pattern shall be located at least 16-inches from any obstruction.

ii. Supplied by a minimum pipe size of 1-1/4 inch.
iii. Shower component activated yearly to verify proper operation.
iv. Emergency shower with integral eyewash unit is required if during routine operations there is a risk of a splash of corrosive or other skin hazardous material to the body.
v. Units shall be adequately supplied with potable water to meet the requirements of each component.
vi. Use of a floor drain is encouraged.
vii. A combination eyewash/emergency shower shall be located within a research laboratory using hazardous chemicals; or a combination eyewash/emergency shower may be located outside the laboratory provided an eyewash is located in the laboratory. The combination unit shall be located so that the travel distance is no more than 10 seconds or 55 feet with no obstructions and only one door to pass through to reach the unit.

N. MEDICAL GASES AND MECHANICAL VACUUM 22 63 13

1. Medical Gas equipment requirements shall be coordinated with the UCD representative during the design phase. Vacuum pumps and air compressors shall be installed on the ground floor. Provide acoustical evaluation for equipment located in hospital patient areas or other sensitive areas. Consider spring isolation even if the OSP does not cover spring isolation (coordinate with the project structural engineer.)
2. All piping shall be copper Type L ASTM B819 Med, Oxy labelled per NFPA 99.
3. All joints shall be brazed per NFPA 99. Lokring type joints are allowed for tie in locations in remodel areas.
4. All installation and testing shall be in accordance with NFPA 99.
5. Label all piping per NFPA 99.
6. Medical vacuum pumps shall be by Beacon Medaes, or equal, NFPA 99 compliant, oilless, BACNet connection to BMS.
7. Medical air compressors shall be by Beacon Medaes, or equal, NFPA 99 compliant, BACnet connection to BMS.
8. Medical gas outlets shall be Beacon Medaes, Series B (Geometric Index PB style). Ceiling outlets shall be Series B DISS key style.

O. CHEMICAL WASTE SYSTEMS FOR LABORATORY & HEALTHCARE FACILITIES 22 66 00

1. General
    a. Coordinate with the local jurisdiction and the UCD representative if chemical drainage is required to pass through an acid-neutralizing tank before connection to the building sanitary sewer system. When an acid-neutralizing tank is required, specify a Ph sensor and a point to monitor through the Building Automation System (BAS).
2. Piping
    a. Piping shall be Orion Watts PVDF chemical waste piping and fittings, joined with electro fusion joints or socket fusion joints by the same manufacture. Piping around the benches and equipment can have chemical waste no hub joints by Orion Watts. Compression fittings are not allowed. Verify compatibility of chemicals with piping materials. Alternate materials may be required for U.L. penetrations through rated walls and shafts.
3. Supports

a. Horizontal PVDF piping shall have a continuous 16-gauge galvanized sheet metal trough support or maximum 48-inch support spacing system (or as otherwise required by the manufacture).

4. Fixtures
   a. Chemical resistant lab sinks, Orion or equal.
   b. Cup Sink: Polyethylene, oval with integral waste fitting, 1-½-inch with polypropylene or PVDF trap.

1. Refer to Division 1 for substitution of products.
2. The project designer shall incorporate an exception to the Design Guidelines listing standards that cannot be adhered to and reasoning compliance cannot be met. Obtain approval of exceptions from UCD.
3. These guidelines are to be implemented into project designs. Where code or local jurisdiction conflicts with the guidelines, the codes shall govern.
4. Calculations and Sizing of Equipment: Use the most recent American Society of Heating, Refrigeration & Air Conditioning Engineers (ASHRAE) Climatic Data Region X, Zone 12 (Sacramento) to determine outside design conditions.
    a. For 100 percent outside air systems: Review project criteria with UCD representative. The minimum outside air design temperature to be used is the 0.1% design dry bulb and coincident wet bulb (104oF DB/ 72oF WB) However, it shall be recognized that localized warming patterns are prevalent and 100% fresh air mechanical system can be dramatically impacted by higher ambient temperatures. Therefore, most 100% fresh air systems shall need a higher design temperature to maintain comfort and process loads. Provide recommended design temperature with explanation for the UCD campus engineer approval. The winter design temperature shall be selected as the ASHRAE Median of Extreme temperature (30oF).
    b. For recirculating air systems: The minimum outside air design temperature to be used is the 0.1% design dry bulb and coincident wet bulb (104oF DB/ 72oF WB). The winter design temperature shall be selected as the ASHRAE Median of Extreme temperature (30oF). The 0.5% design dry bulb and MCWB shall be considered on a case-by-case basis with approval from UCD campus engineer.
    c. Special consideration shall be given to environmental conditions for certain projects such as animal facilities, pathology laboratories, operating rooms, sterile processing departments, and sensitive areas (defined by the California Mechanical Code in Chapter 3) where maintaining temperature and humidity can be critical. The design shall be discussed with the UCD representative, with a default starting point of 107oF dry bulb for summer and 26oF for winter to ensure interior design conditions are maintained throughout unusual weather cycles.
    d. Submit cooling and heating load calculation for each individual zone in the building's HVAC system and sizing data for all applicable proposed equipment such as air handling equipment, pumps, etc., by 50% completion of the design development phase. Calculations shall be performed using a standard HVAC load calculation program such as: Trane Trace, Carrier E20 or equal.
    e. Size air handling systems with an additional 15% safety factor for cooling and 20% safety factor for heating. For buildings that shut down on weekends and/or holidays such as medical office buildings, the heating safety factor is expected to be increased and morning warmup cycles implemented. Special consideration shall be made for heating systems that are all electric and discharge temperatures are below 100oF. This condition requires a higher safety factor for improving morning warm up duration.
    f. Size chillers with an additional 25% safety factor. Size boilers with an additional 25% safety factor. Safety factors listed are to be used as a guide. Provide description of proposed safety factors for UCD acceptance. There may be cases where safety factors need to be increased depending on the circumstance of the design and possible future expansions.
    g. Safety factors shall be identified by the beginning of the Design Development phase and approved by UCD.
    h. For interior temperature conditions (other than special use in the building), for hospital, research

facilities, medical office buildings and laboratory: 74oF degrees for cooling and 70oF degrees for heating.

i. For all OSHPD/HCAi projects a mechanical system shall be designed to maintain the temperatures and humidity as listed in California Mechanical Code Chapter 4. For areas not listed, use ASHRAE standard 170- (current version) or best engineering practices. The California Mechanical Code identifies required temperature ranges that specific rooms should control to. Design shall incorporate being able to control to all temperature within this range. There shall be special considerations for rooms that may need control beyond these ranges based on vendor equipment requirements or based on specific procedures. Orthopedic surgery requires lower temperature rooms of 64oF due to their processes.

i. For cooling tower selection and evaporative condensing systems use the 0.1 percent design wet bulb conditions (74oF), based on 2022 Building Efficiency Standards Title 24 Part 6 Reference Appendices California Design Location Data Cooling 0.1%.

j. Internal heat loads.

i. Lighting: Per Title 24 but coordinate with electrical engineer for actual density. For remodels without alterations in lighting use actual density.
ii. Equipment: Per manufacturer's data or ASHRAE 2017 Fundamentals Latest edition, Ch.18.
iii. The following spaces are normally assumed to have no equipment load: Toilets, Locker Rooms, Showers, Corridors, Storage Rooms, Lobby.
iv. People: Per ASHRAE Fundamentals (current version), Ch. 18.

k. The building pressure shall be slightly positive to ambient but allow exterior doors to close automatically. For buildings under OSHPD/HCAi jurisdiction follow California Mechanical Code and California Building Code for accessibility.

5. General Noise Conditions

a. HVAC system noise: Design all other areas within the NC standards recommended in the latest edition of ASHRAE Applications Handbook.

b. Minimize the number of penetrations due to all ducts and pipes through sound rated construction. Provide an airtight seal around the perimeter of all penetrations through rated construction using acoustical sealant. Avoid unnecessary penetrations into the conference rooms.

c. Lay out ductwork and diffusers to avoid crosstalk between rooms.

d. For mechanical rooms, incorporate spring isolation on equipment with excessive vibration. Discuss with UCD representative to provide acoustical engineering analysis where there is a probable reason to need additional noise and vibration protection.

6. Air distribution design: (Deviations from these criteria may be exercised as necessary for proper air balance and acoustic control. Discuss any deviations with the UCD representative).

a. 425 cfm or more. Provide adjustable modular core diffusers. Double deflection grilles shall be used at sidewalls and in IT rooms to blow air downward. Ceiling return and exhaust grilles shall be perforated type. Diffusers, grilles and registers shall be selected and laid out so that air velocities at the occupied levels do not exceed 50 fpm.

b. Low pressure ductwork shall be sized for a friction rate of 0.08 inch/100 foot of duct and not exceeding 1200 fpm or as otherwise suggested by the sound consultant. The use of round ducts is encouraged if space allows it. All main distribution ductwork shall be sized to accommodate the air handlers' peak cooling air flow including the 15% safety factor. Velocities up to 1500 fpm are allowed for straight low-pressure ducts located in shafts.

c. Medium pressure ductwork shall be sized for velocities not exceeding 1750 fpm on main ducts

and a friction loss of 0.2 inch/100 foot of duct. Supply ductwork in existing shafts may have velocities up to 2000 fpm. Return ductwork in shafts is to have a maximum design velocity of 1600 fpm. Sizing considerations shall be given to conditions such as duct size with respect to distance to the fan. Long runs of ducting, back-to-back elbows, etc. may require enlarged duct sizing. Ductwork runouts from main supply duct to VAV or CAV boxes that are less than 10 feet long shall generally be one size larger than the box inlet size (i.e. 8" box shall have a 10" duct feeding the box). Medium pressure ductwork shall be used with approval from the UCD representative. Sound consultant my govern velocities.

d. Terminal boxes shall be provided for up to 900 square feet of open space. Corner offices shall have independent boxes and control. Terminal boxes shall have rooms with similar exposures and similar use (i.e., west facing offices). Provide separate terminal boxes for large conference rooms. A maximum of 6 exam rooms may be on one terminal box. A maximum of 5 offices may be on one terminal box.

e. Provide sandwich style, gasketed removable access panel at each fire/smoke damper and at 100 ft intervals on return and exhaust ductwork to allow for duct cleaning. Label ceiling to identify duct access panel. Provide access panels adjacent to turning vanes on exhaust and return. Access doors are not necessary on supply ducting except where necessary to have access to fire dampers or other equipment. Sandwich style access doors are used due to their low/no leakage characteristics. Hinged access doors are only allowed where larger access to interior ductwork components is necessary (such as an FSD actuator inside the duct). Hinged access doors shall be equipped with a continuous hinge on one side and cam locks at 6" on center. Size of access door is to be large enough to provide easy access for removing/replacing devices and can be up to 22"x22". Access door must be fabricated for the duct pressure class.

f. MRI rooms wave guides are prone to having the return or exhaust air clogged with lint. Provide a 20% efficient filter for each return or exhaust wave guide grille. There shall be no ferrous metal for the grille and filter assembly.

7. Hydronic Distribution

   a. Pumps shall be selected for stable and efficient operation throughout the entire operating range, not only the peak design operating point.

   b. Size piping for a maximum friction loss of up to 4.0 feet per 100 feet of pipe with the velocities not to exceed 5 fps in occupied area, 7.5 fps for main and large branches inside buildings, and 10 fps outside buildings at maximum flows. Velocities in pipes that can lead to erosion in pipes shall not be accepted. Certain piping has flow limits identified by the manufacturer (such as plastic piping). Follow max flow limitations where they are recommended. Friction rates shall take into consideration available pumping pressures on existing systems.

8. Outdoor refrigeration equipment, air handlers, and HVAC units require a hose bib and 115-volt electrical receptacle be installed to allow cleaning, service and maintenance. Non-freeze or insulated hose bibbs are required for project sites located in freezing conditions.

9. Metering

   a. All new buildings shall be designed for metering of thermal utilities. Meter shall report energy usage to BAS.

10. Thermal Comfort

    a. Comply with latest edition of ASHRAE Standard 55, Thermal Comfort Conditions for Human Occupancy.

11. Ventilation

    a. Outside air shall be provided according to California Mechanical Code, Title 24 Energy Code, and ASHRAE standard 62.1 "Ventilation for Acceptable Indoor Air Quality" (utilize the more stringent

of the three). The location of all air intakes shall be remote from any pollution sources and the building air intakes and exhaust shall be remotely located from each other to prevent contamination.

b. For buildings falling under OSHPD/HCAi jurisdiction, the ventilation rates shall be set as per California Mechanical Code Table 4A and ASHRAE STD 170.

c. Consideration shall be given to proximity of fresh air intakes to noxious odors that will travel further than the code requirement minimum clearances. This includes, but is not limited to, generator exhaust (monthly testing), fume exhaust, cooling tower air discharge, garbage containment areas, and chemical storage areas. In these cases, it may be necessary to increase intake distances significantly to the source of odors. Air scrubbing systems may also be considered.

12. Ventilation Monitoring

    a. Install permanent monitoring and alarm systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements in a form that affords operational adjustments:

        i. For mechanical ventilation systems that predominantly serve densely occupied spaces install a CO2 sensor within each densely occupied space per Title 24. This applies to buildings that must comply with Title 24.
        ii. For all other mechanical ventilation systems, provide minimum outdoor airflow measurement system capable of measuring the minimum outdoor airflow rate at all expected system operating conditions. UC Davis Health has encountered maintenance difficulties with typical air measurement devices. Consult and review proposed airflow measurement device with UCD representative before specifying for a project.

13. Requirements for CO2 Sensors when required by section above.

    a. To ensure that sensors can reliably indicate that ventilation systems are operating as designed:

        i. CO2 sensors shall be located within the breathing zone of the room as defined in the latest edition of ASHRAE Standard 62.1 and Title 24.
        ii. CO2 sensors shall be certified by the manufacturer to have an accuracy of no less than 75 ppm, factory calibrated or calibrated at start-up, and certified by the manufacturer to require calibration no more frequently than once every 5 years.

    b. A building automation system (BAS) alarm visible to the system operator/engineer.

    c. CO2 sensors shall be used for demand-controlled ventilation. The control strategy shall comply with the latest edition of Standard 62.1 and Title 24 requirements.

        i. Space CO2 alarms and demand-controlled ventilation set points shall be based on the differential corresponding to the ventilation rates prescribed in Standard 62.
        ii. When outdoor CO2 concentration is not measured, refer to Title 24 for assumed concentration.

14. Coordinate with design team for creating a tight envelope which shall assist in obtaining room pressure differentials. This shall be cone by gasketing doors, sealing penetrations, sealing conduits, providing gyp ceilings. Etc.

15. Ventilation Criteria for Laboratories and Similar Use Rooms

    a. Hazardous materials that are used or stored in Chemical, Biological, or Radiological Research and Teaching Laboratories require special ventilation.

    b. Room Ventilation

        i. The laboratory ventilation rate is dependent on the hazards, heat, and/or odors to be

controlled. At no time during occupied periods shall the ventilation rate be less than 1 cfm/sf. The system shall be designed to reduce the ventilation rate during unoccupied periods by utilizing approved sensing technologies. Obtain approval from the UCD representative for any reduced ventilation for the type of use and hazards.

c. Room Pressurization and Containment

   i. Laboratories and storage areas shall be maintained negative relative to non-laboratory or storage areas (hallways, offices, conference rooms, etc.); a room offset value of 10 percent of the maximum air value to the room is recommended. This may need to be increased to control room pressure.
   ii. Animal facilities containing noninfectious animals/agents and that are located within mixed-use buildings, shall maintain room air pressure differentials so that room pressure is negative to all adjacent areas.
   iii. Positively pressurized laboratories may be necessary under defined circumstances, such as cell culture.
   iv. Special containment (ventilated storage cabinets, special local exhaust, etc.) may be required for extremely noxious operations (muffle furnaces, etc.), extremely odiferous materials (mercaptans, sulfur compounds, etc.), carcinogenic, radioactive, or infectious animals/agents.
   v. Toxic gases (arsine, phosphine, etc.) require ventilated cabinets with alarms.
   vi. Coordinate with design team for creating a tight envelope which shall assist in obtaining room pressure differentials. This shall be done by gasketing doors, sealing penetrations, sealing conduits, providing gyp ceilings, etc.

d. Exhaust

   i. The fume hood exhaust discharge location shall be a minimum of 10 feet above the finished roof with velocity in accordance with NFPA.
   ii. Special air cleaning devices may be required for some fume hood applications as required by the local jurisdiction. Consult the UCD representative for any special requirements.
   iii. Fume hood ducts may be ganged onto exhaust plenum w/ multiple fans, with the exception of hot-acid, radioactive, etc.
   iv. Ductwork shall be non-reactive, acid resistant and compatible with intended usage.

16. Telecommunication Rooms

a. Temperature design of 74oF cooling; no heating; No Relative Humidity control unless directed by the UCD representative. See UC Davis Health's Telecommunication Standard for more details. 78oF setpoint may be used when room is unoccupied as sensed by an occupancy sensor.

b. Provide air conditioning on a 24/7 basis for all IT rooms. A secondary source of cooling capable of handling the full cooling load may be required by the IT Dept. Coordinate with the IT Dept during the design phase for redundancy requirements. We encourage using a fan array house air system as a primary source of air conditioning through means of VAV/CAV boxes. The fan array generally provides the appropriate level of redundancy for most IT rooms in a hospital. Note that UCD chillers may not be available during cold ambient temperatures. Where this occurs ensure the air handling systems serving IT rooms are equipped with economizers. UCDH has standardized on supply air reset for air handlers. Due to this some air handlers can utilize up to 65oF supply air. Air quantities for rooms should reflect the altering supply air temperatures. Coordinate with PO&M during the design phase.

c. For medical office buildings that shut down at evenings and nights provide a secondary source of cooling to become the lead air conditioning source during off hours. Do not utilize the main AC units during unoccupied hours to cool process rooms. Provide a VAV for the primary cooling of an MOB for occupied hours. The off hour source shall be DX.

d. Air circulation within the room shall be discussed with the UCD representative during the design

phase. Consideration shall be given to hot isle/cold isle configuration.

e. Internal load: Per IT department if information available or otherwise Per National Telecommunication Standard.

f. Ductwork or piping not supporting equipment dedicated to the telecommunications room shall not be installed in, pass through, or enter the telecommunications room. Mechanical equipment shall not be installed directly above telecom equipment. Consideration of service clearance, access, and the potential of water damage from dripping or leaking equipment or piping shall be given. Wall mounted fan coils are not desired by UCD IT. Piping from condensate or pressure piping should not run above IT room.

g. Provide monitoring and alarm status for each IT room. Alarm high room temperature and motor status for all fan coils.

17. Electrical and Mechanical Rooms

a. Provide cooling to building electrical and mechanical rooms from the house air handling system for hospitals. Air handlers with a fan array generally provide the level of redundancy needed. Separate fan coils shall not be used for electrical or mechanical rooms. Non-hospital buildings that shut down their main AC units on weekends and nights should have Dx fan coils or unitary AC units to cool the electrical or mechanical rooms if they produce heat.

A. COMMON MOTOR REQUIREMENTS 23 05 13

1. General

a. Combination magnetic starters shall have circuit breaker disconnects trip size of breaker as required for motor size, or equal.

b. Motor starters shall be provided by the mechanical equipment supplier where they are readily available as a standard option. These motor starters shall be specified by the mechanical engineer and installed by the mechanical contractor.

c. Where motor starters are not available from the equipment manufacturer, they shall be sized and specified by the electrical engineer and provided and installed by the electrician. The mechanical engineer is to coordinate and provide adequate information to the electrical engineer for sizing each motor starter.

d. Where motor starters are to be included in a motor control center (MCC) they shall be specified by the electrical engineer and installed by the electrician. Mechanical engineer shall coordinate the motor sizes and full load amps with the electrical engineer.

e. There may be conditions where a motor starter cannot be used due to seismic certification requirements. An OSP certified variable frequency drive (VFD) can be used as a substitution for any motor starter. When a VFD is provided for mechanical equipment, it shall be specified by the mechanical engineer, installed by the mechanical contractor, and wired to and from the device by the electrician.

f. Coordinate BAS control of all motor starters and VFD’s.

g. Motors and VFDs furnished under Mechanical Work shall be installed under Electrical Work.

h. Shaft grounding device manufacturer’s specific installation literature, specifications, and recommendations shall be followed.

i. Field installed shaft grounding systems shall be tested for proper conductive path to ground and shall pass manufacturer’s published test procedure. Motor shall be grounded to the common earth ground with drive.

j. All motors 1 HP and over that are used at least 1,000 hours per year shall be premium efficiency.

No shaded pole motors on fractional horsepower motors 1/20 HP and larger.

k. ECM motors are not permitted except where specifically approved by the university representative.

l. Provide VFDs with 3 contactor bypass (not electronic bypass). VFDs shall have ultra-low harmonics (THD of 3% maximum). For fan arrays and direct drive motors provide redundant VFDs in lieu of a bypass. On large fan arrays provide multiple redundant VFDs (coordinate with the PO&M during design). Do not use micro VFD's (one for each fan in the array). Micro VFDs are prone to larger harmonics, and premature bearing failure Provide ABB ACH 580 ULH or equal.

2. Shaft Grounding

a. Shaft grounding is required on all VFD assemblies with operating motors 5 HP and above. Provide shaft grounding systems manufactured by Aegis, SGS or equal. Provide factory installed shaft grounding devices, either by motor or equipment manufacturer. VFD driven motors shall be inverter-rated, premium efficient. Where shaft grounding is not recommended by the manufacturer (i.e. ceramic bearings on some fan wall systems) it may be omitted.

b. For field installed devices, consult the UCD representative for approval. If field installed devices are provided, they shall be installed by a certified representative of the equipment, motor, or shaft grounding device manufacturer.

c. Shaft grounding device manufacturer's specific installation literature, specifications, and recommendations shall be followed.

d. Shaft grounding systems shall be installed so that they are accessible for maintenance and inspection.

e. Field installed shaft grounding systems shall be tested for proper conductive path to ground and shall pass manufacturer's published test procedure. Motor shall be grounded to the common earth ground with drive.

f. If the motor is subject to contaminants, debris or moisture, special shaft ground systems and/or seals shall be required. Follow manufacturer's applicable recommendations.

g. For motors operating at 100 horsepower or more: Follow shaft ground manufacturer's recommendations. Often it is required by the manufacturer that two shaft grounding devices be installed.

h. Motor bearings shall be guaranteed from electrical bearing fluting damage during the motor warranty period. Motor or bearing(s) shall be replaced at no additional cost to UC Davis Health.

B. METERS AND GAGES FOR HVAC PIPING 23 05 19

1. General

a. All new buildings shall be designed for metering of thermal utilities integrated to Building Automation System (BAS). This includes, but is not limited to, heating water, chilled water, and steam.

2. Products

a. Thermometers

i. Bimetal helix or liquid-filled type, Weston, Marshal Town, or equal. All thermometers shall be 5-inch diameter round, stainless steel case construction with glass front and shall be accurate within plus or minus one of the smallest scale divisions throughout the entire range.

ii. Liquid thermometers for tanks and similar equipment shall have a minimum 5-inch diameter

face. Thermometers for piping shall have a minimum face diameter of 5 inches and be liquid filled.

iii. Thermometers used for air temperature in ductwork, plenum boxes, etc., shall have a minimum scale face of 5 inches and shall have an adjustable mounting flange.

b. Pressure gauges shall be of high quality, with accuracy to be within 1% in the middle third of the dial range and equipped with front calibration. Gauges shall be liquid filled with pigtail and shut off. Minimum diameter of gauges shall be 4 inches.

i. Pumps shall use one gauge with separate valve isolation for suction and discharge.
ii. Provide pressure gauge at inlets and outlets of steam pressure reducing stations.
iii. Provide gauges at inlet and outlet of main equipment such as chillers and boilers.
iv. Provide gauge downstream of pressure reducing valves for hydronic make up water.
v. Provide Pete's plugs adjacent to gauge locations of hydronic systems.

c. Fluid Flow meters: Shall be magnetic full bore or insertion type. Manufacturer Onicon or equal.

d. Domestic cold water and irrigation shall be pulse flow measuring.

e. Steam energy meters shall measure LBS/HR.

f. Meters shall be non-resettable.

C. VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT 23 05 48

1. Isolate all ventilating equipment connections including conduit, piping drains, etc., so that equipment will operate under continuous demand without objectionable vibration.
2. Support all fans on anti-vibration bases. Individual fans shall have integral fan and motor bases, spring type, unless otherwise noted.
3. Selection of the bases or supporting units shall be in accordance with the vibration eliminator manufacturer's recommendations. Smaller equipment may have 1-inch deflection such as small inline fans, larger equipment (chillers) shall have 3-inch deflection. Consult with vibration isolation manufacturer to control the equipment vibration. Where vibration isolation curbs and vibration spring isolation fans are both used on one system (i.e. large AC units) the spring deflection ratio shall be 1 to 3 or as otherwise recommended by the vibration isolation manufacturer.
4. Most fan array systems shall not require spring isolation. Some arrays with larger fans require spring isolation. Provide analysis and recommendation for fan arrays best practices to limit noise and vibration. Coordinate with UCD representative.

D. HVAC INSULATION 23 07 19

1. Pipe insulation materials

a. Calcium Silicate: Hydrous calcium silicate material with galvanized outer shield recommended for temperatures up to 1200°F. Applied per manufacturers recommendations. Provide at pipe hanger attachment locations where allowed.

b. Fiberglass Insulation: Fiberglass Heavy Density 25, Johns-Manville Microlok, Owen Corning Fiberglass, with ASJSSL jacket, or equal, with factory-applied, fire-retardant jacket and self-sealing laps, applied per manufacturers recommendations.

c. Meet the requirements of the California Energy Code and minimum requirements listed below, provide more stringent of the two.

2. Piping insulation:

a. Piping system equipment, pumps, valves, unions, couplings and other components: Insulate with removable formed insulated covers. Formed covers may be made from AP Armaflex sheet

insulation. Provide with PVC jacket indoors and aluminum jacket outdoors. PVC jackets shall match the UCD color standards.

b. Chilled water and domestic cold-water valves installed in insulated piping lines shall have valve handle extensions to clear the insulation. Affix label for valve location and directional flow.

c. Cover all insulation that is exposed to outdoors with aluminum jacket. Do not use PVC jacket covers outdoors.

d. Cover all piping insulation that may be exposed to occupied rooms and mechanical rooms, etc. with 20 mil thick fire-retardant PVC jacket. The color must match the UCD standard. Request color chart from UCD representative. Covers in contact with piping or equipment surfaces that exceed 120oF shall have aluminum jacket.

e. Insulate domestic cold-water piping when routing occurs through unconditioned spaces (e.g., mechanical room, sterilizer room, etc.) or through uninsulated soffits.

f. Insulate domestic hot water system components and piping to maintain piping temperature throughout the system. Identify design temperature loss of the system for UCD approval.

g. Isolation valves and balance valves on domestic hot water can be uninsulated.

h. Provide insulation on piping systems and components which are subject to condensation.

i. Provide insulated jacket for valves, manways, blind flanges, strainers, pressure reducing valves and equipment needing access. Insulated with silicone fiberglass cloth insulation flexible jacket with stainless steel lace up wiring, pins, washers and retention hooks, as manufactured by Unitherm International or equal. Thickness and specific finish is to be in acceptance with operating temperatures of the piping or equipment.

j. Steam and Condensate Piping: Insulate steam and condensate piping with high temperature mineral fiber insulation with jacketing or fiberglass insulation with ASJ-SSL per manufacturer's recommendation. Provide insulation thickness and R value per the California Energy Code and Title 24.

k. Steam Piping (251oF – 350oF) Minimum Insulation thickness reference:

   i. Piping 3/4" and smaller: 3".
   ii. Piping 1" to 1-¼": 4".
   iii. Piping 1-½" to 3": 4-½".
   iv. Piping 4" to 8": 4-1/2".

l. Heating hot water and chilled water piping: Insulate all heating hot water supply and return piping with 4 lb. nominal density fiberglass insulation. Provide insulation thickness and R value per the California Energy Code and Title 24.

   Heating hot water piping minimum insulation thickness reference:

   i. Piping 1-¼" and smaller: 1-½".
   ii. Piping 1-½" and larger: 2".
   iii. Chilled water piping minimum insulation thickness reference:
   iv. Piping 1" and smaller: 1".
   v. Piping 1-¼" and larger: 1-½".

m. Chilled water system equipment: Insulate equipment, including chilled water pump bodies, air separators, heat exchangers, tanks, etc.

   i. Insulation shall be closed cell flexible insulation (Armacell or equal).
   ii. Provide aluminum jacket for outdoor insulated equipment. Provide PVC jacket color coded per UCD standards for indoor equipment.

n. Heating water system equipment: Insulate equipment, air separators, heat exchangers, tanks,

etc.

i. Cover the hot water equipment with rigid fiberglass pipe and tank insulation with factory applied FRK or ASJ vapor seal systems operating below ambient temperatures or high temperature mineral fiber blocks, securely wired on. Provide PVC proto or aluminum jacketing over insulation. Owens Corning or equal.
ii. Valves: Insulate valves with “Isocover” insulation jacket. Coves are to be provided with stainless steel safety lace wire and stainless steel lacing hooks and washers. Insulation is form fitted and with insulation thickness suitable for system temperature.

o. Refrigerant Piping Insulation.

i. Consideration shall be given to temperature of refrigeration system to determine type of refrigerant pipe insulation. The California Energy Code shall apply and industry standard practices.
ii. Industrial piping and cold refrigerant lines: Use rigid molded fiberglass pipe insulation of appropriate wall thickness with white kraft paper reinforced with self-sealing longitudinal laps and butt strips. PVC jacket indoors, aluminum dimple jacket outdoors. No PVC jacketing outdoors.
iii. Standard refrigeration systems walk in boxes, remote condensing units, split systems: Use Armaflex closed cell insulation or equal. Minimum ½” wall thickness (40oF – 60oF) for medium and high temperature applications and minimum ¾” wall thickness for low temperature applications (below 40oF).
iv. Small split systems: Pre insulated “line sets” may be utilized with approval from UCD representative.

p. Insulated Piping Outdoors.

i. All pipe insulation and fittings exposed to the weather shall be protected with an aluminum jacket, no exceptions. PVC elbows are not permitted.

q. Insulated Piping on Roof Protection from Damage.

ii. Provide stepover bridges for insulated piping wider than 18” at locations where personnel may need to cross. Coordinate locations with the Architect.

3. Ductwork Insulation

a. Manufacturers: CertainTeed Corporation, Johns-Manville Corporation, Owens-Corning Fiberglass Corporation, or equal.

b. All ductwork insulation to be exterior only. Wrap all supply and return ductwork and sound traps, unless with 1-½” thick, 1-pound density Fiberglass 100P, FSK faced, Johns-Manville, or equal. Where required by Title 24 or California Mechanical Code (CMC) provide additional insulation thickness to meet the authority having jurisdiction (AHJ) code required minimum R values. Medical office buildings can use acoustic lining only when approved by UCD.

c. For rectangular ducts exceeding 24” in width, provide mechanical fasteners on the bottom of duct at maximum spacing of 18” c.c. Fasteners shall be weld pins or clinch pins: adhesive type pins shall not be used.

d. Cover all ductwork that may be exposed to the mechanical rooms, with fiberglass, and protect with a sealant adhesive, Foster SEALFAS, Hardcast Flex-Grip, Childers Chil-Perm or equal.

e. Ductwork exposed to outdoors: Provide 2” thick (or as required by Title 24) closed cell elastomeric (AP Armaflex) insulation on the exterior of the ductwork or Polyisocyanurate insulation (Thermasheath-3). Provide Butyl backed hardcast foil grip at all joints of polyisocyanurate insulation. Provide galvanized painted sheet metal cover around the insulation. Where accepted by UCD provide aluminum jackets over all sides, top and bottom. Highly visible areas shall use galvanized painted jackets. Slope the top surface to avoid ponding at minimum

3/8” LF.

E. COMMISSIONING OF HVAC 23 08 00

1. Refer to UC Davis Health’s “Owner Project Requirements for Commissioning.”

F. INSTRUMENTATION & CONTROL FOR HVAC 23 09 00

1. Additional Building Automation System (BAS) Integration:
2. UCD requires systems integration and special considerations as described below. This is required on every new construction event. These integrations enable UCD to centralize alarming and monitoring of key facility systems. All integrations shall be BACnet with a manufacture provided gateway. In the event a gateway is not an equipment feature - engineer shall coordinate with Johnson Controls Inc. (JCI) for alternate protocol integration (modbus) or dry contact status monitoring. All integrations shall have a dedicated floor plan graphic providing device locations and using color identify alarms/alerts.

Integration Type	Description	Integration Use case
Indoor/Outdoor Air Quality	Provide CO2, PM2.5 PM10.0, VOC, Temp/Humid, Ozone	Provide one outdoor unique to each building and one on each floor public waiting area and one on each floor staff hallway in back of house. Change ventilation requirements based on outdoor and indoor air quality (i.e., wildfire smoke mode) to improve indoor air quality for staff and patients.
Refer Monitoring	Monitor Temp and Freezers	Trend, Alarm and Report Fridge Data for Compliance. Leverage manufacture provided temperature outputs where available, otherwise provide Temp Sensor in Glycol Bottle. Includes patient related fridges/freezers that hold drugs or other medical items (does not include fridges for popsicles or patient food) (this system is not intended for Validation, just monitoring trending and alarming). Integrate with Aeroscout vendor for all food and nutrition monitoring. All else shall be Aeroscout and Johnson Controls Metysis.
Weather Station	Ambient Light. Outdoor Temp, Humidity, CO2	This station shall be secondary to the weather data provided at the CUP for control SOO's.
ATS Integration	Integration of ATS	Metasys to provide Modbus to BACnet gateway to provide Full integration of ATS system to show use data and provide remote enable/disable.
Generator Integration	Integration of Generator	Metasys to provide Modbus to BACnet gateway to provide full integration of generator. Provide alarm, fault, fuel tank level, run hour information via this gateway.
OR Scheduling	Integrate to OR Scheduling Software	Change HVAC SOO based on what type of surgery is scheduled (optimal start/setback/temp/humidity set points). The goal is to automatically adjust ORs for specific procedures and to put into setback (temperature and airflow) if an OR is unscheduled.
OR Environment Display	Provide 7" Loytech Display with Environment Data	Provide touch screen display to show temperature, humidity, temperature adjust, pressure relationships and if integrated - type of surgery via the OR schedule integration. Work with MEOR to show OR ready status for temperature, airflow, pressure.
Critical Room Pressure	Display Screen with Visual and Cancellable Audible Alarm Monitors shall be standardized on TSI RPM 20 series.	Provide room pressure monitoring of critical rooms: USP Pharmacies, Sterile Processing rooms, isolation rooms, Operating rooms, soiled utility rooms (negative pressure), and other sensitive areas required by UCD. Integrate alarm with Metasys. Provide door contacts.
Alarm/Intrusion	Integrate to Intrusion System	Simple integration to monitor Armed and Disarmed status of Alarm system. When Armed, HVAC should be off (unless local override).

Integration Type	Description	Integration Use case
Indoor Lighting	Integrate to Lighting System	Provide BACnet IP integration to lighting controls system. Lighting system to provide main/daily/dimming control of lights. BAS to provide lighting system on/off schedules to sync with HVAC schedule (same schedule). Exception schedules and overrides in the HVAC shall similarly override in lighting (in addition to integral lighting system overrides). Outdoor lighting to have simple schedule and status control via Metasys. Additionally - leverage lighting system occupancy sensors for occupied standby sequences during normal hours.
Outdoor Lighting	Integrate to Lighting System	Provide BACnet IP integration to outdoor lighting to have simple schedule and status control via Metasys.
Motorized Shade System	Integrate to Shade System	Integrate to Shade System to provide locations, alarm and shade position displayed in Metasys. Sync enable/disable/override/schedule control with HVAC system - for example when HVAC is unoccupied close shades. Daily control of shades to be in Shade Control system with override and schedule synchronization via Metasys.
Nurse Call	Integrate to Nurse Call System	Leverage Nurse Call system to provide in-bed patients ability to Adjust Temp, Lighting, Shade Position from Nurse Call system.
KW Meters	Integrate into the KW Meter System	Div 26 to provide single BACnet IP connection for all KW metering in building. Metasys to report and visualize data in user interface.
G36 SOO	Energy Improvements	UCD wants to continue to improve the energy efficiency of their buildings. Please provide trim and response logic on: • CHW and HW Temperature/Pressure setpoints • AHU DAT temp and DP setpoints Please provide faulting/alerting on VAV boxes per 5.6.6 in G36 2021 for low airflow, low DAT, airflow sensor calibration, leaking damper and leaking valve.
Medical Gas	Monitor Med Gas Alarms	Metasys to monitor ALL medical gases in the building. Div 22 contractor to provide appropriate level of monitoring (locations/qty of pressure transducers) with integration to Metasys. Metasys to additionally monitor gas switchover manifolds for switch to reserve tanks and any bulk storage tanks. Provide BACnet integrations to Medical Air and Medical Vacuum Skids.

Integration Type	Description	Integration Use case
BTU Meter Summary	Provide unique to each system load	Provide BTU meter on HW and CHW unique to each system load (not device load). IE - if there is a CHW system with both cooling for HVAC and process systems, provide a BTU meter on each system loop to provide total CHW BTU.
Water Meter Summary	Water Meters	Provide water meters for the below feeds. Meter may be provided by Div 22 monitored by Metasys. • Irrigation • Domestic Water • Domestic Hot Water
Miscellaneous Plumbing Systems	Additional Plumbing Systems	Monitor and Alert to the following additional plumbing systems: Domestic Booster Pump Skids • RO/DI Water Skids • Domestic HW systems (supply temp and interlock to pumps) • Sump Pumps • Water Treatment Systems • Water Filtration Systems • Water Softeners
Fire Alarm System Integration	Status of FLS	Provide a status/monitoring only (no control) of the FLS system. Leverage a BACnet integration to get system info and alarms. Provide graphics for floor plan layout with locations of FSDs and smoke detectors. Use FLS contractor shop drawings to generate floor plan graphics. Alert for afterhours incident at OWS.
FSD Monitoring	Open/Close	JCI to have Metasys Directly Monitor FSD open/close status and display on floor plan graphic. Where building is existing without BM integration, monitoring through the fire alarm system can be utilized.
Solar PV Integration	Monitor Status of PV System	Provide BACnet integration to PV controller to monitor system status, alerts and totalization of KW produced.

G. HYDRONIC PIPING AND PUMPS 23 21 00

1. System Design

   a. For the hospital campus, differential pressure shall be verified at point of connection. Coordinate with UCD representative for available pressures on the Sacramento Hospital Campus. For buildings where the secondary loop cannot provide the necessary pressure to overcome the pressure drop across the new building piping system, a tertiary pump must be used to maintain adequate pressure. Unless otherwise directed by the UCD representative, consider chilled water supply temperature 43oF and hot water from the central plant 220oF. The future campus setpoint shall be as low as 120oF. Coordinate design temperatures to accommodate resetting of the heating loop to a lower temperature. The exact temperature has not been identified and a design approach shall be discussed with UCD. The design temperature shall be different for remodels vs new building construction. Heat exchangers shall be provided for all floors above the 8th floor of a building for chilled water and 6th floor for heating water. All loads at or below the listed floors shall be directly connected to the central plant hydronic system without a secondary loop.

b. Coordinate with the existing tertiary pipe arrangement whether serial pumping or provide a blending loop. Unless otherwise directed by the UCD representative, consider chilled water supply temperature 43oF and hot water from the central plant 220oF.

c. Provide BTU meter integrated with the BAS controls on the CHW and HW supply on the loop.

d. Provide full size by-pass with check valve around tertiary CHW pumps for first stage cooling.

e. Provide two tertiary CHW pumps each sized for 100 percent max flow requirement. Pumps to have variable frequency drives (VFDs).

f. Provide two tertiary HHW pumps each sized for 100 percent max flow requirement. Pumps to have VFDs.

g. Shaft grounding is required on VFD driven pump motors. Refer to Section 22 05 13 Common Motor Requirements.

h. For hydronic systems where variable water volume (VWV) is used, provide the following:

i. Install modulating valves with tight shut-off rated to close against a differential pressure of 1-1/2 times pump head.

j. Locate differential pressure sensor at hydraulically most remote coil. Wire directly back to the central plant pumping system. A minimum of one per building is required.

k. If hydraulically most remote coil is variable, provide multiple differential pressure sensors and use a low signal selector to send proper signal to variable frequency drive.

l. Three-way valves shall be minimized: Limit total bypass gpm through 3-way by installing balance valve in the bypass of all 3-way valves. Use 3-way valves to maintain minimum required VFD speeds. Use 3-way valves at end of runs to maintain heating loop temperatures to minimize thermal cycling of heating loops. Approximate pump turndown is expected to be 25% of the total flow. (Coordinate minimum speed to maintain motor cooling with motor manufacture).

m. In coil schedule, identify the control valve Cv value. Target CV is 2-5 psi drop at the design flow.

2. Piping, Joints and Fittings for Chilled and Heating Water

a. Below grade: Schedule 40 steel, welded, flanged.

b. Above ground: Black steel welded, ASTM A53 or ASTM A106, flanged or screwed fittings. Type L copper tubing 4 inches or smaller and type K copper tubing 5 inches and larger are also acceptable. Copper tubing joints of all sizes shall be brazed with silver solder 1100oF. Provide CTS flanges for copper connections to flanged piping. Facility has numerous failures at joints – all sizes are to be brazed.

c. Mechanical grooved couplings are allowed on chilled water systems in mechanical rooms only. Mechanical grooved couplings are not allowed on heating hot water systems. Provide 50-year warranty on grooved couplings.

d. Underground direct-buried chilled water and heating hot water piping shall be factory pre-insulated Schedule 40 carbon steel, ASTM A-53, Grade B., ERW (Type E) or seamless (Type S), standard weight for sizes 2” and larger, and shall be ASTM A-106, Grade B, standard weight for sizes 1-1/2” and smaller (Std. Wt. is the same as Sch. 40 through 10”). All carbon steel pipes shall have ends cut square and beveled for butt-welding. Straight sections of factory insulated pipe shall have 6” of exposed pipe at each end for field joint fabrication. Underground piping systems shall be pre-engineered. Factory shall provide piping stress calculations and expansion and contraction compensation provisions, utilizing factory prefabricated and pre-insulated expansion elbows, Z-bends, expansion loops, and anchors specifically designed for the intended application. Provide a leak detection system.

i. Underground chilled water piping insulation shall be 90% closed cell polyurethane with a

minimum 2.0 lbs. per cubic foot density, compressive strength of 30 psi @ 75°F, and coefficient of thermal conductivity (K-Factor) of not higher than 0.16 @ 75°F per ASTM C-518. Jacketing shall be extruded, black, high-density polyethylene (HDPE), having a minimum wall thickness not less than 100 mils for pipe sizes less than or equal to 12", 125 mils for jacket sizes larger than 12" to 24". Chilled water factory pre-insulated pre-engineered piping systems shall be Ferro-Therm by Thermacor Process, L.P., of Fort Worth, Texas or equal.

ii. Underground heating hot water piping insulation shall be suitable for carrying an absolute minimum of 300°F heating hot water at a minimum 150psi. Insulation shall be polyisocyanurate foam insulation bonded to both the jacketing and carrier pipe with a minimum thickness of 2-1/2" for systems operating at or below 300°F. Insulation shall be rigid, 85% closed cell foam insulation with not less than 2.4 pounds per cubic foot density, having a compressive strength of not less than 30 psi @ 75°F and a coefficient of thermal conductivity (K-Factor) not higher than 0.17 @ 75°F and 0.30 @ 300°F. The maximum operating temperature of the system shall not exceed 300°F. Polyurethane foam insulation shall NOT be acceptable for heating hot water piping. Furnish a complete HDPE jacketed system of factory pre-insulated steel piping for the specified service. The jacket throughout the entire system shall incorporate electric fusion, butt fusion, or extrusion welding at all fittings, joint closures, or other points of connection. All pre-insulated pipes, fittings, insulating materials, and technical support shall be provided by the Pre-insulated Piping System manufacturer. Factory pre-insulated pre-engineered piping system for underground heating hot water shall be HT-406, manufactured by Thermacor Process, L.P., of Fort Worth, Texas or equal.

iii. Provide manufacturer's shop drawings with dimensioned piping layout and details of all expansion loops, Tee joints, elbows, anchor points, building and/or manhole entry points and all other pertinent information.

iv. Underground systems shall be buried in a trench not less than 2-feet deeper than the top of the pipe and not less than 18-inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches, unless specified otherwise elsewhere, of compacted backfill over the top of the pipe shall meet H-20 highway loading.

v. Piping systems shall be cleaned, flushed and water treated to the satisfaction of the University. The cleaning and flushing are to be overseen by a water treatment specialist (company specializing in water treatment such as EAI Water. They shall provide all cleaning chemicals and provide identification of required duration and velocity of cleaning agent in a complete submittal. Contractor shall provide means of circulation of the piping including bypasses, valves, and the like to perform cleaning to the water treatment specialist's criteria. Coordinate with University for providing a final water treatment that matches the existing campus closed loop treatment. Utilize the campus water treatment supplier for final chemical requirement.

vi. Valves: Heating Hot Water (HHW) full ported pre-insulated ball valves and Chilled Water (CHW) full ported, flanged valves suitable for direct buried in the ground. Shut off valves on CHW shall be butterfly type. All valves shall be flanged. Valves installed in insulated piping lines shall have valve handle extensions to clear the insulation. All underground valves shall be pre-insulated. Valves and valve operator stem to the surface shall be fully protected from exposure to soil. Shut-off valves shall be provided local to the point of connection to the main HHW and CHW loops and at the point of connection to the building. Isolation valve located below ground shall be direct buried in the ground with sleeve to the surface to allow for operation of the valve. Valve insulation shall match the piping system insulation and outer jacketing shall be High Density Polyethylene. Refer to other sections of this specification for additional valve requirements. Do not use quarter turn isolation valves on piping greater than 4" pipe size below grade. Provide 250 psi WP gate valves for piping greater than 4".

3. Shut Off Valves

    a. Threaded or flanged, two-piece, bronze body, full port, ball valves, with stainless steel ball and stem, for isolation/shut off valves. Isolation valves shall be provided for all heating and cooling control valves, strainers, and coils. Chilled water valves shall have an extended stem to allow for insulation thickness to be continuous around the stem.

    b. Balance valves shall not be substituted for isolation valves. Design criteria for balance valves shall be based on best practices for optimal location to facilitate maintenance without compromising building operations and shall include the following minimums: one for each floor, one at each terminal unit. If piping kits are provided at terminal units, separate isolation valves are required to allow complete removal and replacement.

    c. Butterfly Valves: Nibco, or equal. Provide lug body on valves located adjacent to equipment. All valves shall have EPDM seats with aluminum bronze disc and throttling handle with memory stop. Furnish flow performance curve for each valve. EPDM seats are acceptable up to 180oF hydronic systems (secondary loops after heat exchangers in the buildings). Provide gear operators handles, for valve sizes 8” and larger, for shut-off service, and infinite position throttling handles with indicator plates for balancing service. All valves on heating water system from the central plant loop (primary loop) shall be rated for water 250ºF or higher (campus heating water can be 200-220oF). Heating water valves shall be Nibco LCS6822 high performance, 400oF, Teflon seat, Class 150.

    d. All building shut-off valves from Central Plant distribution system shall be Class 150 stainless steel body flanged ball valves, Nibco or equal (Model F-515-S6, full port, 275 psi WP @ 330oF, available in ½” to 4” size. For piping larger than 4” provide 250 psi WP gate valve. Provide building shut off valves with valve box (or equal) and max 36” below grade.

        i. Provide valves with operator nut with tee handle and 6-inch diameter PVC sleeve/access cover only where approved by UCD. Deep valves accessed in this manner are discouraged. If sleeves are allowed by PO&M, provide permanent label mechanically fastened on sleeve as to the type of valve (i.e., gate, butterfly).
        ii. Underground valves shall be identified with GPS coordinates. Coordinate with PO&M.
        iii. Valves below 36” deep shall be installed in a vault. Valves within 36” of the grade shall be installed within a valve box. Identify valve box cover with welded description of fluids.

    e. Provide butterfly control valves at building entrance to allow chilled and heating water to be isolated through the BAS (supply and return). Valves shall be inside the building, accessible.

    f. All equipment branch lines shall have shut-off valves at branch connection.

    g. Shut off valves on heating and chilled water shall be ball valves thru 2" and butterfly 2-½" and up. Valves serving the building from the central plant are ball valves as listed above up to 4” in size and gate valves larger than 4” diameter.

    h. Locate valves to be accessible. All branches from vertical risers shall have shut off valves.

    i. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.

    j. Install isolation valves on each side (supply and return) of heating, chilled, and reheat coils to allow for coil replacement.

        i. If piping upstream of the valves is in the way of coil replacement install main isolation valves in the entrance of the mechanical room.

    k. All strainers shall be cleaned after the project has gone through pipe cleaning and start up.

4. Water Treatment

    a. Any project that uses more than 50 gallons of hydronic water in the remodel or in new work must

import and inject chemically treated water matching the campus chemical composition. Remodels or new projects with less than 50 gallons of hydronic water can use the campus hydronic fluid for make-up water.

i. Provide services from a water treatment specialist (EAI Water) and identify pipe cleaning agent, circulation duration, and circulation velocities. EAI currently manages closed loop systems in the hospital. Provide all necessary testing, analysis, and chemicals to be compatible with the campus loops to control biocide and corrosion.

5. Labeling of Piping and Ceiling

a. Provide pipe labelling in every room and at 20 feet on center.

b. Provide direction of flow at each label. Provide identification of piping content at each valve and direction of flow at each valve. Provide numbering of each valve coordinated with PO&M.

c. Provide label for each valve and each piece of equipment above the ceiling. Labels shall be permanently adhered to the ceiling grid or access door. Labels shall be plastic engraved, white background with black letters. Letter size shall be ½".

H. STEAM AND CONDENSATE 23 22 00

1. System Design

a. Size steam pipe and steam condensate flows per good engineering practices and allow for future system expansion. If steam is run through building, engineer to calculate requirements for expansion loop and design support. Designs are to minimize water hammer by ensuring sloping piping is in the direction of flow.

2. Piping, Joints and Fittings

b. High Pressure Steam Piping, Above Ground.

- Steel Pipe: ASTM A53 or A106, Schedule 80, black.
- Fittings: ASTM B16.3, malleable iron Class 250, or ASTM A234 forged steel welding type, Class 3000.
- Joints: Screwed, or AWS D1.1 welded.

c. Low Pressure Steam Piping, Above Grade.

- Steel Pipe: ASTM A53 or A106, Schedule 40, black.
- Fittings: ASTM B16.3, malleable iron Class 125, or ASTM A234, forged steel Class 125.
- Joints: Screwed, or AWS D1.1, welded.

d. High Pressure Steam Condensate Piping Buried.

e. High Pressure Steam Condensate Piping, Above Ground.

- Steel Pipe: ASTM A53 or A106, Schedule 80, black.
- Fittings: ASTM B16.3, malleable iron Class 125, or ASTM A234, forged steel Class 125.
- Joints: Screwed, or AWS D1.1, welded.

f. Low Pressure Steam Condensate Piping Buried.

g. Low Pressure Steam Condensate Piping, Boiler Feedwater Piping Above Grade.

- Steel Pipe: ASTM A53 or A106, Schedule 80, black.
- Fittings: ASTM B16.3, malleable iron Class 125, or ASTM A234, forged steel Class 125.
- Joints: Screwed, or AWS D1.1, welded.

h. Piping connected to low pressure stand along canister style humidifiers may utilize copper Type "L" ASTM B88 for steam and condensate where recommended by the steam generator manufacture.

3. Buried Steam and Steam Condensate:

a. Pre-insulated Piping – Factory pre-insulated steel piping. the system shall be a combination of a drainable, dryable, testable type conduit system, suitable for all ground water and soil conditions, site Classification "A" (Federal Construction Guide Spec. 02695), with an external covering of polyurethane insulation and a high-density polyethylene (HDPE) jacket.

b. The pre-insulated pipe manufacturer shall make a complete layout of the system showing anchors, expansion provisions, and building entrance details. Means for expansion must be made in pipe offsets or loops unless this is compensated for integrally in the system.

c. The conduit shall be 10 gauge, welded, smooth-wall black steel conforming to ASTM A-139, A-134, and A-135. Conduit shall be tested at the factor to ensure air and watertight welds prior to any fabrication or application of coating. No internal coating of conduit.

d. Conduit closures shall be 10-gauge steel, furnished with the conduit at a ratio of one closure for each fabricated item or length. Closures shall be field welded over adjacent units after pipe insulation.

e. Piping in the conduit shall be standard weight (Std. Wt. is the same as Sch. 40 through 10"), steel, ASTM A-53, Grade B, ERW 2" and larger and A-106 Smls for 1-1/2" and smaller. Steam lines shall be standard weight, and condensate lines shall be extra strong (XS is the same as Sch. 80 through 8"). Pipe joints shall be welded in accordance with the Pressure Piping Code, ASME/ANSI B 31.1.

f. The Class "A" pipe insulation shall be mineral wool applied to the R-Value and thickness as required by the California Energy Code and as required to control proper heat loss at possible operating pressures/ temperatures.

g. Prefabricated ells, loops, and tees shall be furnished and installed and shall consist of pipe, insulation, and conduit conforming to the same specification as hereinbefore stated for straight runs. Expansion loops shall be designed in accordance with the stress limits as dictated by the Power Piping Code, ASME/ANSI B31.1. Loop piping shall be installed in conduit suitably sized to handle indicated pipe movement. Elbows, loops, offsets, or any other direction changes shall conform to the standards set by ASME B31.1, Code for Power Piping.

h. The steel conduit for the steam and condensate shall be insulated with polyurethane foam insulation to a nominal thickness of 1". Insulation shall be rigid, minimum 90% closed cell polyurethane with a minimum 2.0 lbs per cubic foot density, compressive strength of 30 psi @ 75oF, and a coefficient of thermal conductivity (K factor) not higher than .17 @ 75oF per ASTM C518. Maximum conduit interface temperature shall not exceed 200oF.

i. Jacketing material shall be extruded, black, HDPE, having a minimum wall thickness of 125 mils for jacket sizes less than or equal to 12", 150 mils for jacket sizes larger than 12" to 20", and 175 mils for jacket sizes greater than 20". The inner surface of the HDPE jacket shall be oxidized by means of corona treatment, flame treatment (patent pending), or other approved methods. This will ensure a secure bond between the jacket and foam insulation preventing any ingression of water at the jacket/foam interface.

j. Straight run joints are insulated using a wraparound HDPE jacket placed over the field joint and insulated with polyurethane foam. The HDPE jacket is sealed with a heat shrink sleeve, as recommended by the manufacturer.

k. Conduit fittings are factory prefabricated and pre-insulated with urethane to the thickness specified and jacketed with a molded, extrusion welded, or butt fusion welded PE jacket. No

taping or hot air welding shall be allowed.

l. Underground systems shall be buried in a trench not less than 2-feet deeper than the top of the pipe and not less than eighteen inches wider than the combined O.D. of all piping systems. A minimum thickness of 24 inches of compacted backfill placed over the top of the pipe shall meet H-20 highway loading.

m. Trench bottom shall have a minimum of 6" of sand as a cushion for the piping. All field cutting of the pipe shall be performed in accordance with the manufacturer's installation instructions.

n. The system shall be Duo-Therm "505" as manufactured by Thermacor Process Inc. of Fort Worth, Texas or equal.

4. Valves

   a. All low-pressure steam (below 50 psi) shall have valves rated for a minimum of 300 psi @ 300oF.

   b. High pressure steam (above 50 psi) shall have Class 800 valves.

5. Pressure Reducing Valves and Regulators

   a. Steam pressure shall be reduced from the high-pressure distribution system in two stages, the first being a reduction to 65 psi (adjustable) and the second to 15 psi. Each stage shall have two pilot operated pressure regulating valves piped in parallel. The sizing of step-down regulators is 2/3 and 1/3 of the total design flow. The design flow shall incorporate safety factors appropriate for the project. Consideration is to be made for future demand changes.

6. Support

   a. Pipe supports shall have calcium silicate or equivalent rigid insulation blocks with galvanized covers. Provide pipe rollers, pipe alignment guides, and pipe protection saddles (rigid bottom rib such as Bline B3100 series) where necessary to allow for expansion and contraction.

7. Steam Traps

   a. Campus is using BAS monitored steam traps in some areas such as outside the building footprint in vaults. Coordinate with UCD BAS specialist for areas where this is required. Otherwise follow industry standards for types of traps. UCD campus preference is Spirax Sarco and TLV.

   b. Where integrated BAS traps are not used, provide monitoring of temperature sensors strapped on condensate lines entering and leaving the steam trap. Provide BAS alarm when temperatures are out of range indicating failure of the steam trap and abnormal inlet temperature.

   c. All steam traps shall have a dirt pocket, isolation valve, strainer, trap and downstream isolation valve. Clean all strainers after start up.

8. Steam Humidifiers

   a. Campus has standardized on Condair Nortec OSP certified, electrode humidifiers with replaceable cylinders. Provide with BACnet interface to BAS. Provide airflow proving switch, high limit humidistat, and BAS temperature/humidity sensor. Provide status and faults to BAS. Provide condensate water cooler to maintain discharge temperature to sewer less than 140oF.

9. Condensate Return Pumps

   a. Provide condensate return pumps with integration to BAS. Integration shall provide pump status and alarm for when water overflows (high temperature drain discharge alarm).

I. REFRIGERANT PIPING 23 23 00

1. General

   a. At all times during brazing a nitrogen purge is required.

b. ACR Type L nitrogenized refrigeration grade copper pipe (ASTM B280) is required for all refrigerant piping. All copper-to-copper joints shall be made with 15 percent silfoss and all copper to brass connections shall be made with 45 percent silver solder.

2. Testing of Refrigerant Piping

a. Refrigerant piping shall be pressure tested to a minimum of 175 psig. Test pressure shall not exceed the maximum rating of the weakest component of the system.

b. Each system upon completion of the pressure test shall be evacuated to a minimum of 500 microns. The system shall hold 500 microns for 20 minutes without deviation of more than 10 percent.

c. Where manufacture recommends testing pressures and evacuation procedures, follow their guidelines.

J. HVAC AIR DISTRIBUTION 23 30 00

1. Systems Design

a. Indicate on the drawings or specifications that low-pressure loss duct fittings shall be installed per Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

b. Specify appropriate SMACNA duct air leakage class (see SMACNA HVAC Air Duct Leakage Test Manual and SMACNA Technical Paper on Duct Leakage). Identify duct pressure classes on the plans, such as 2", etc. Refer to SMACNA HVAC Duct Construction Standards, Figure 1-1. Require duct leakage testing for all ducts rated at three (3) inches of water and greater. Recommended maximum system leakage shall be listed 1% of design air flow according to ASHRAE 2017 Fundamental Handbook chapter 21. Minimum pressure class for ductwork shall be +2" and -2". Pressure class upstream of terminal boxes is expected to be 4".

c. In medical office buildings where the code allows it, plenum return is acceptable. Do not use a build shaft as a plenum. Provide galvanized ducting to the floors of which it serves.

d. Ductboard ductwork is not permitted.

e. Gripple type cable hangers are not permitted.

2. Fans, Motors, and Drives

a. Fans shall be licensed to bear the Air Movement and Control Association (AMCA) ratings seal. Fans shall be tested for air and sound performance in accordance with the appropriate AMCA standard in an AMCA accredited laboratory.

b. The design horsepower rating of each drive shall be at least 1.5 times the nameplate rating of the motor. Proper allowances for sheave diameters, speed ration, arcs of contact and belt length shall be followed in meeting the design horsepower of the drive.

c. All variable speed drives shall be selected to allow an increase or decrease of a minimum of 10 percent of design fan speed.

d. Motor shaft grounding: See Division 23 05 13 Common Motor Requirements.

e. Motors over 10 HP: Adjustable sheaves shall be removed and replaced with fixed diameter sheaves prior to final air balancing.

f. For fans with variable frequency drives (VFD's): Sheaves shall be sized to allow for the fan to operate within 10% of the design CFM when the VFD is in bypass.

g. Sheaves shall be cast of fabricated, bored to size or bushed with fully split tapered bushings to fit properly on the shafts.

3. Shafts and Bearings

a. The fan shaft shall be ground and polished solid steel with an anti-corrosive coating.

b. Bearing shall be selected for a minimum L-10 life in excess of 100,000 hours at maximum cataloged operating speed. Bearings shall be locked to the shaft concentrically without marring or burring the shaft.

c. All shaft bearings shall have extended lube lines with zerk fittings. Extended lube lines shall be UV resistant where exposed to the sun. Provide grease type and recommend by the manufacture.

4. Ductwork

a. Use low pressure drop duct design. Use round duct wherever space permits. Only use flex duct to connect ducts to terminal diffusers, registers and grilles. Maximum length in a hospital shall be 7 feet and at the end of the runout for medical office buildings the maximum length is 5'-0". Do not install flex ducts downstream of HEPA filters. The throat radius of all bends shall be 1-1/2 times the width of the duct wherever possible and in no case shall the throat radius be less than one width of the branch duct. Provide square elbows double thickness turning vanes where space does not permit the above radius and where square elbows are shown. The slopes of transitions shall be approximately one to five, and no abrupt changes or offsets of any kind in the duct system shall be permitted. Design pressure drop to 0.08 inches water per 100 feet. Insulation shall comply with the latest CCR-Title 24, and California Energy Code.

b. Provide drive slip or equivalent flat seams for ducts exposed in the conditioned space or where necessary due to space limitations. Provide Ductmate flanged transverse joints. On ducts over 48 inches wide, and where required by SMACNA, provide standard reinforcing on inside of duct. Run outs to grilles, registers or diffusers on exposed ductwork shall be the same size as the outer perimeter of the flange on the grille, register or diffuser. Provide flexible connections on inlet and outlet of each fan. Provide galvanized cover over flexible connections where exposed outdoors. Seal all seams around fan and coil housings airtight with appropriate sealing compound.

c. Flexible duct connections shall be made with listed tape (UL 181 listed) seal for the inner core membrane to the galvanized duct with a minimum of 3 wraps. The inner core shall be secure with a stainless steel worm gear or Panduit strap with minimum 150 psi tensile strength. The outer insulation shall be secured with a second stainless steel worm gear band or Panduit strap.

5. Dampers

a. Motor-operated, opposed blade type shall be galvanized iron or extruded aluminum airfoil with nylon bearings, and to prevent leakage. Dampers shall have replaceable blade seals and stops for minimum air leakage. Blades shall be heavy gauge aluminum airfoil or galvanized 16-gauge minimum with 8 inches maximum width. The frame shall be sealed airtight to ductwork. Dampers exposed to the weather shall be weatherproof and made of corrosion proof materials. Provide Belimo 120v damper actuators.

b. Manual dampers shall be provided with locking quadrant with standoff. Manual dampers for low CFM ducts shall be tight fitting to allow balancing company to balance to tight tolerances. Manual dampers are to utilize end bearings or low leakage end bushings. Dampers are to be constructed in accordance with SMACNA guidelines.

6. Duct Smoke Detector and Fire Smoke Dampers.

a. For additional information, refer to UC Davis Health's Standard Specification Section 28 31 00, Fire Detection and Alarm. Activation of fire smoke dampers shall be through area detection where the building is equipped with total coverage area detection.

b. Layout ductwork and locate duct smoke detectors to ensure clearance is available upstream.

c. Duct detectors shall be compatible with the building's Fire Alarm System and shall be approved by the Fire Marshal of record. Duct detectors shall be accessible for testing and maintenance.

Duct detectors shall disable fan motors and send signals to building automation system (BAS) to shutdown unit.

d. Activation of a fire smoke damper is to cause associated air handler to shut down and alarm sent to the BAS. Some areas of the existing hospitals do not have BAS integrations. For these areas match the existing means of monitoring the damper position.

e. Campus standard for fire smoke dampers is Ruskin FSD60 with Belimo actuators, EFL/SP100 switch, test reset switch, and TS150 where override is necessary on smoke control system. Provide all actuators outside of the ductwork. There are families of FSD 60 that allow actuators in alternate locations. Where side access is not achievable, bottom access is available. Provide access door for inspection of dampers.

7. Duct Access Doors

a. Provide sandwich style gasketed, removable access panel at fire/smoke dampers and elsewhere where needed to provide access to interior ductwork components. Provide access panels at 100 ft intervals on return and exhaust ductwork to allow for duct cleaning. Label ceiling to identify duct access panel location. Locate access panels adjacent to turning vanes on exhaust and return ducts and downstream of detectors pursuant to detector manufacturer's requirements.

8. VAV and CV Boxes

a. The maximum air pressure drop (PD) of a terminal box with a reheat coil shall be based on the system limitations and is expected to be below a .35" wg (exception is venturi valves). As heating water designs change to low temperatures (potentially 110oF) due to electrification of heating systems over natural gas, the rows in a coil are expected to increase to more than 2. CAV boxes in OSHPD/HCAi facilities shall be double wall construction.

b. Terminal boxes: UCD is trending toward the standardization of Accutrol (AVT4000 series) terminal boxes with hot water reheat, BACnet controller, and no interior liners (exterior insulation is required). The boxes can provide variable or constant volume control in the return, exhaust, or supply with little risk of drifting due to dust in the airstream (making them suitable for critical environments). The box is pressure independent, does not require straight inlet conditions to work effectively, and has an accuracy is +/- 5%. Early in the design phase discuss the terminal box type being proposed with UCD for approval.

9. Grilles, Registers and Louvers

a. Provide all outlets with gaskets to minimize the streaking of the walls or ceilings due to leakage.

b. Provide modular core diffusers (i.e., Titus MCD no exceptions). Omit opposed blade dampers. Provide ceiling regulators in hard lid areas or provide access doors within 2 feet of damper.

c. Provide perforated return and exhaust registers. Omit opposed blade dampers. Perforated are used to allow for easier cleaning than eggcrate style registers.

10. Labeling of Equipment

a. Label each piece of equipment with plastic engraved labels. Black background with white letters 1" high minimum. All equipment includes, but is not to be limited to VAV's, CAV's, fans, fan coils, filter racks, etc. Label the ceiling grid or access doors to identify equipment above the ceiling. Provide plastic white background with black ½" high lettering. Permanently adhere to the ceiling grid at location of access. Label all equipment, such as terminal boxes, fire smoke dampers, valves, fan coils, main balancing dampers, and valves.

K. FUME HOOD FANS 23 38 16

1. Refer to UC Davis Health's Standard Specifications, Division 11 on Laboratory Equipment for information on fume hood construction. Refer to Section 23 09 10 for Laboratory Airflow Control

Requirements. Refer to Division 11 for fume hood requirements. Coordinate mechanical engineering concepts with hood selections.

2. Laboratory Hood Exhaust Fans
    a. Fan type and materials shall be carefully engineered and selected to meet or exceed its intended usage.
    b. Fan assemblies shall be constructed with corrosion resistant materials engineered for the intended application.
    c. Fan shall be licensed and bear the AMCA ratings seal. Fans shall be tested for air and sound performance in accordance with the appropriate AMCA standard in an AMCA accredited laboratory.
    d. Each fan shall be vibration tested as an assembly before shipping in accordance with AMCA 204-05.
    e. Unit shall bear an engraved nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM.
    f. Unit fasteners exposed to corrosive airstream shall be of stainless-steel construction.
    g. Provide fan curves for each fan at the specified operation point, with flow, static pressure, and horsepower clearly plotted.
    h. Analysis shall be provided to UCD identifying the fan discharge height shall be a minimum of 10 feet above the roof, and location of discharge with respect to fresh air intakes and openings into the building, and prevailing winds.
3. Fans, Motors, and Drives
    a. Motors shall be premium efficiency, standard NEMA frame, 1800 or 3600 RPM, TEFC with a 1.15 service factor.
    b. Motor shaft grounding: See Division23 05 13 Common Motor Requirements.
    c. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components. The belt drive configuration (if equipped) shall be AMCA arrangement 1, 9, or 10. High plume arrangement 9 fans shall feature a bifurcated housing with the motor, belt drive (if equipped), and bearings located outside of the contaminated airstream. Direct drive arrangement 4, or direct drive arrangements requiring access and handling of hazardous and contaminated fan components for motor replacement are not acceptable.
    d. Drive belts and sheaves shall be sized for 200 percent of the fan operating brake horsepower and shall be readily and easily accessible for service. Drive shall consist of a minimum of two belts under all circumstances.
    e. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 200,000 hours for high plume fans and critical applications, and L -10 100,000 hours for all others. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be acceptable.
    f. All shaft bearings shall have extended lube lines with Zerk fittings. Extended lube lines shall be UV resistant.
    g. Provide manufacturer recommended grease for all bearing applications.

1. Identification
    a. Refrigerant and compressor oil type shall be clearly marked using nameplates on each unit.
    b. The initial refrigerant charge shall be clearly listed using nameplates on each condensing unit.
    c. A permanent nameplate shall be installed on both indoor and outdoor equipment stating the room number the equipment is serving (or located within) and identifying each piece of equipment clearly.
2. Electrical
    a. All motors over 1.5 horsepower shall have three phase characteristics.
    b. Each refrigeration system shall be served by its own dedicated circuit breaker and disconnect means.
3. Condensing Units
    a. The refrigeration system shall be the standard product of a single manufacturer and shall be cataloged as systems, complete with system capacities. All components including controls and accessories shall be furnished by the system manufacturer and shall include a fully piped air-cooled condensing unit (as described below), evaporator (as described below), thermostatic expansion valve, liquid line drier, room thermostat, liquid line solenoid valve, suction line filter, etc.
    b. Condensing units shall include motor-compressor, condenser, receiver, electrical control panel and all defrost components completely assembled on a steel rack, piped, wired, run-in and tested by the manufacturer. The motor compressors shall be semi hermetic with inherent 3-leg overload protection.
    c. Air-cooled condensing units not located outside the building shall be located in a controlled temperature room. All systems with outdoor condensers or condensing units shall be provided with low ambient controls including a crankcase heater and a condenser fan control.
    d. Condensing units shall carry a 5-year com pressor warranty.
    e. All refrigeration pressure relief lines shall be piped to a location outside the building.
    f. All refrigeration pressure relief lines shall be piped to a location outside the building.
    g. A complete wiring and control diagram shall be permanently affixed in a waterproof container to the inside of each compressor control panel.
    h. Equipment charged in the field shall have a permanent label affixed to the condensing unit stating the refrigerant type, oil type, and operating refrigerant charge in pounds.
    i. An oil failure control shall be required on all semi-hermetic compressors with an oil pump.
    j. Suction lines shall have traps at intervals not exceeding manufactures recommendations.
4. Evaporators
    a. Evaporator drain shall be provided with a trap outside of the refrigerated areas.
    b. Drains shall include a clean out tee and a pipe union.
    c. Freezer drains shall include a drain line heater and rubber insulation.
    d. Fan motors shall have built-in thermal overload protection.
    e. Systems having electric defrost shall include an evaporator fan thermostat and defrost termination control.
    f. Drain pans shall be stainless steel.

M. DECENTRALIZED UNITARY HVAC EQUIPMENT 23 81 00

1. General
    a. Filtration: MERV 13 filters are to be used for medical office buildings.
    b. 100 percent outdoor air: Units over 5 tons shall have two stages of mechanical cooling. Gas fired heating in this application shall have a modulating burner.
    c. All refrigeration circuits shall be equipped with high- and low-pressure safety pressure switches.
    d. All compressors shall be mounted on vibration isolators.
    e. Temperature controls integrated with BAS.

N. CONVECTION HEATING 23 82 00

1. Heaters over 100,000 BTUH shall be hard piped to their external shut off valve.
2. Fan and blower motors shall be wired to allow cooling of the heat exchanger upon cycling on temperature.
3. In alignment with UC Davis Health's Sustainability Policy, gas-fired equipment shall be avoided unless approved by the UCD representative.
4. A dirt leg shall be installed on gas supply piping at each appliance.
5. Gas fired unit heaters installed indoors shall have forced draft combustion.
6. Gas fired equipment installed in a dirty, dusty, or otherwise contaminated location shall feature separated combustion ducted directly to the outdoors.
7. Gas fired equipment installed in a negative pressure environment shall feature separated combustion ducted directly to the outdoors.
8. Gas fired equipment heating 100 percent outside air or heating air at an inlet air temperature below 40oF shall feature stainless steel burners and heat exchangers.

O. BUILDING MECHANICAL ROOMS 23 90 00

1. The final size and layout of the mechanical rooms is dependent on the final accepted mechanical system and required equipment. All mechanical rooms shall be sized adequately to allow, not just code compliant clearances, but manufacturers required service clearances for maintenance. Review and coordinate the size, design and layout of the mechanical rooms with the UCD representative.
2. Equipment rooms shall not be used for return air plenums.
3. Mechanical rooms shall be sized to allow removal and replacement of coils, motors, fans, pumps, and dampers.
4. Each mechanical room shall have noise and vibration control. Where questionable provide acoustical engineering evaluation.
5. Equipment shall be placed on minimum of 4” high housekeeping pads.
6. Mechanical room location shall take into consideration adjacent sensitive spaces, noise and vibration. For sensitive areas provide an acoustical engineering evaluation.
7. Mechanical room shall be provided with concrete curbs below the walls for protection from wash down and floor drains appropriately placed.
8. Allow for additional space for future equipment such as pumps, DI systems, compressor(s), or similar common hospital equipment.
9. Verify all equipment has a means of fitting through the size of the door.

P. BUILDING AUTOMATION SYSTEM (BAS) 23 00 00

APPENDIX A – OWNER PROJECT REQUIREMENTS FOR BUILDING AUTOMATION SYSTEMS

1. Reference “Owner Project Requirements for Building Automation Systems”. See Appendix.

APPENDIX B – OWNER PROJECT REQUIREMENTS FOR COMMISSIONING

1. Reference “Owner Project Requirements for Commissioning”. See Appendix.

APPENDIX C – PREFERRED PLUMBING FIXTURES

1. Reference “Preferred Plumbing Fixtures”. See Appendix.

APPENDIX A

OWNER PROJECT REQUIREMENTS FOR BUILDING AUTOMATION SYSTEM

Owner's Project Requirements for Building Automation System

University of California

Davis Health

Sacramento California

Issue Date:

Project Name:

Project Number:

1. Overview and Scope

1.1 Overview and Definition

The following UC Davis Health (UCDH) Plant Operations and Maintenance (PO&M) Owner's Project Requirements (OPR) for Building Automation Systems (BAS) provides an explanation of the ideas, concepts, and criteria that are important to the owner and describes the BAS scope to include in the Basis of Design (BOD) and final construction documents. The BAS OPR is developed by the owner to provide direction for the design team. The OPR document sets the functional goals that the design is judged against and establishes the basis of the criteria used during construction and acceptance to verify actual performance. The OPR does not list all items that are already required by code. Architects, engineers, designers, and construction professionals under contract to UCDH Facilities Design and Construction (FD&C) are encouraged to work with the PO&M shops to define the requirements.

The BAS OPR will be followed by the BOD or design narrative written by the design team and included with the design package submissions. The basis of design documents are the primary thought processes and assumptions behind the design decisions and describes the BAS requirements to provide PO&M with a complete and operational project.

The OPR's intent is to ensure that installation and renovation projects build high-quality, durable, and sustainable buildings and infrastructure that are cost-effective to maintain while providing latitude for innovation.

Architects, engineers, designers, and construction professionals, under contract to UCDH Facilities Design and Construction are encouraged to propose innovative and cost-effective variations that meet or exceed this OPR. Any deviations during design and construction shall be brought to the attention of the PO&M shops for review and consideration. FD&C project managers shall confirm written approval prior to incorporation into the project.

All designs and construction are subject to review and approval by the University and appropriate authorities having jurisdiction.

Referenced documentation: *UCDH FD&C Specifications*.

- *Section 23 08 00 – Mechanical & Control Systems Commissioning*
- *Section 25 55 00 – General Provisions for Building Automation System*
- *Section 25 55 20 – Direct Digital Control System and User Interface*
- *Section 25 55 30 – Electronic Sensors, Devices and Field Hardware*

Design professionals shall coordinate with Johnson Controls Inc. (JCI) during development of the controls design, communicate with the University PO&M staff, and with the University's JCI representative; Zachary Dillow (zachary.j.dillow@jci.com).

1.2 Scope

This document includes systems that are required by PO&M to be controlled and monitored under the BAS scope of work. This document is not a comprehensive project OPR, and only includes systems that require commissioning.

Reference Section 4 for systems included in the Building Automation System.

2. General Requirements

The Division 25 controls contractor shall contract with the general contractor (GC) and provide a fully functioning BAS which interfaces with the existing Johnson Control Inc. Metasys® server.

The BAS shall be an electronic, microprocessor-based automation and control system designed to monitor, control, manage energy use, process data, report and alert users on the operation and alarming of mechanical, plumbing, and electrical systems shown in Section 4 of this document.

The BAS shall monitor information provided by the lighting control system and provide general scheduling capability of lighting systems.

The BAS shall also monitor process equipment (refrigerators, freezers, and medical gas systems, etc.) and alert users when they are out of compliance.

2.1 Manufacturer

Johnson Controls, Inc. Metasys® to match campus standard. See Section 3 for details.

2.2 Installer

Johnson Controls, Inc. factory-direct branch located in Folsom, CA.

Controls companies submitting as an “approved equal” to JCI Metasys must be pre-approved prior to bid with the owner’s acceptance.

2.3 DDC Controllers

Provide most current Metasys® DDC controllers compatible with the existing Johnson Controls campus infrastructure.

All new DDC system controllers, terminal device controllers, shall be BACnet Testing Laboratories (BTL) Certified and shall communicate using BACnet MS/TP protocol.

Network controllers, variable frequency drives (VFDs), and any other intelligent control device shall communicate with each other, and BAS Servers using BACnet MS/TP. Coordinate quantity and locations of new network controllers with building owner.

2.4 Communications Protocol

Communication to field control devices shall be through BACnet MS/TP (not JCI N2) unless otherwise approved by UCDH PO&M for specific applications. Provide the necessary BACnet Gateway to convert from N2 to BACnet.

Provide all labor, supervision, technical and professional services, equipment, materials and supplies necessary for the design, installation, and performance verification of a BAS including complete and seamless integration into the UC Davis Health’s Johnson Controls Metasys system.

Control systems locally with communication up to the UI integration platform for remote monitoring, trending, control, troubleshooting and adjustment by UCDH PO&M Department.

Integrate specified systems to the Metasys system for remote monitoring, trending, control, management, troubleshooting and adjustment by UCDH PO&M Department.

The entire BAS shall be:

- *Approved and listed by Underwriters Laboratories, Inc. (UL).*
- *Listed by State Fire Marshall as an approved Smoke Management System if smoke control is specified.*
- *Approved by California Energy Commission as an approved Control and Energy Management System in compliance with California Energy Conservation Code Title 24 requirements.*
- *ASHRAE Standard 135 BACnet for DDC control components.*
- *The BAS manufacturer shall be ISO9001 certified for design and manufacture of environmental control systems for precise control and comfort, indoor air quality, HVAC plant operation, energy savings and preventive.*

2.5 Submittals

Provide an electronic copy of the data sheets for the equipment and DDC controls being provided for the specific project. The drawings shall be drawn in Visio or AutoCAD and include job number, revision block, title page, index page, communication riser diagram, flow diagrams, panel detail, wiring schematics, bill of materials, point to point wiring diagrams (with termination at controllers), full points list (including any global or virtual points), valve schedule, VAV room schedule, damper schedule, and controller .CAF files for all equipment types.

3. Building Automation System Requirements

3.1 Software

- *Metasys® Release 10.1 or latest installed version, including Metasys UI enhancements and the new Metasys Open Application. MUI will be deployed once site is upgraded to version R13 or higher.*
- *Application Data Server (ADX is existing)*
- *System Configuration Tol (SCT) Release 13.2 or latest installed version, including Metasys UI Offline 4.1 or latest installed version, the NAE Update SCT Pro 10.2 or latest installed version*
- *Controller Configuration Tool (CT) Release 13.1 or latest installed version*
- *Mobile Access Portal (MAP) Gateway Release 5.1 or latest installed version*

3.2 Integration of 3rd Party Equipment

- *BACnet MS/TP (RS-485) or BACnet IP*

3.3 Space Temperature and Humidity Requirements

Space temperature and humidity requirements (P&P1689 document) that are listed in the Mechanical OPR shall be adhered to in the BAS controls, with specific temperature requirements provided in a variety of rooms and as required by code requirements and room template requirements. *See UC Davis Health Administrative Policy #1689-Temperature, Humidity and Air Exchange Monitoring and Control for additional information.*

Where temperatures are not specified either in the Mechanical OPR or Policy #1689, the common zone temperature setpoint shall be 73.0°F with an occupied-mode deadband of ± 3°F (76°F/70°F), a standby-mode deadband of ± 5°F (78°F/68°F), and an unoccupied-mode deadband of ± 7°F (80°F/66°F). Typical unoccupied spaces such as Mechanical Rooms and Telecom Closets shall use the unoccupied deadbands. All spaces shall be operated to maintain non-condensing conditions.

3.4 Point Naming Conventions

Reference Table in Section 5.

3.5 Trend Logs and Alarms

Reference Table in Section 5.

3.6 Controls Checkout and Test Sheets

3.6.1 Pre-Functional Checklists

Contractor is to pretest all systems and subsystems and submit documentation to Owner's Commissioning Authority for review and approval. Pre-Functional checklists are generated by the CxA

and reviewed by the contractors. Controls contractor shall provide controller point-to-point checkout sheets for all controllers.

3.6.2 Functional Performance Testing

The Functional Performance Tests (FPT) are generated by the CxA and reviewed by the contractors. The controls contractor shall review the Functional Performance Tests and pretest in preparation for demonstrating the proper function of all control sequences and alarming functions.

3.6.3 Final Testing

Demonstration of final control system performance shall be conducted by the controls contractor and witnessed by the Owner's Representative and the Commissioning Authority.

3.7 Opposite Season Testing

A second off-season tuning shall be performed on all systems not less than four months and not more than eight months subsequent to original system tuning, as directed by the Commissioning Authority. If the original tuning was performed in the cool or cold weather, then the off-season tuning shall be performed in the warm or hot weather or if the original tuning was performed in the warm or hot weather, then the off-season tuning shall be performed in the cool or cold weather.

3.8 Graphics

Controls Contractor shall develop and complete graphics for the Metasys UI. MUI will be deployed once site is upgraded to version R13 or higher.

Prior to building graphics, contact the PO&M for preferred graphics tree and a template or reference for each type of graphic.

3.9 O&M's

Provide one hard copies and one soft copy (.PDF) of the Operation and Maintenance Manuals.

3.10 As-Builts

Provide one hard copy, one soft copy (.PDF), and a laminated copy of the control drawings for the field panels. At close of project, perform page turn of the as-builts demonstrating system installation and performance.

3.11 Warranty

3.11.1 Controls Warranty

Provide a three-year warranty on parts and a one-year warranty on control system installation unless longer durations are specified elsewhere.

3.11.2 Mechanical, Electrical, and Plumbing Warranty

Provide a one-year warranty on parts and a one-year warranty on system installation unless longer durations are specified elsewhere.

Provide the PO&M Department with all equipment extended warranties provided by the manufacturer.

3.12 Training

3.12.1 Interim Training

Provide minimal training so the operating staff can respond to tenant needs and other operating requirements during construction and installation.

3.12.2 Formal Training

Provide training sessions at locations and times determined acceptable by the PO&M Department.

Training shall be conducted after all start-up is complete and systems are fully operational.

The length of each training period will depend on the complexity of the system and the audience. Minimum training shall be 8 hours per building and may be spread over multiple days, but the training duration shall be longer if required.

Owner shall be permitted to video record training sessions.

3.13 Software

Provide electronic copy of the any software purchased by UCDH.

Provide copy of all field controller programs and a backup copy of every network engine and network control engine.

3.14 Leadership in Energy and Environmental Design (LEED)

UCDH strives for LEED Gold Certification on new projects, but at a minimum shall meet LEED Silver Certification.

3.15 Controllers

Controllers	Manufacturer	Part No.	Description
Network Controllers 10.1			
Metasys® Network Application Engine	JCI	SNE Series	TBD
Metasys® Network Control Engine	JCI	SNC Series	TBD
Metasys® Field Equipment Controllers			
General Purpose Application Controller	JCI	M4-CGM	TBD
CAV/VAV Box Controller	JCI	M4-CVM	TBD
Mobile Access Portal (MAP) Gateway	JCI	TL-MAP1810-0P	TBD

3.16 Field Devices

The controls contractor shall provide control devices as show below and described in BAS Specification Section 25.

(Nomenclature: JCI = Johnson Controls Inc., N/A = Not Applicable, TBD = To Be Determined)

Sensor / Hardware	Mfr	Part No.	Accuracy	Range
Temperature Only, Warm/Cool Adjust, White	JCI	NSB8BTN140-0	±0.5°F	+32 to +122 °F
Temperature and Humidity with LCD Display	JCI	NSB8BHN340-0	±0.5°F	+32 to +122 °F
Temperature, Humidity, and CO2 with LCD Display	JCI	NSB8BHC340-0	±0.5°F	+32 to +122 °F
Space Humidity Sensor	JCI	NSB8 Series	±2% for 20% to 80% RH	10% to 90 % RH
Space CO2 Level	JCI	NSB8 Series	±30 ppm	0 to 2000 ppm

Sensor / Hardware	Mfr	Part No.	Accuracy	Range
Immersion Temperature Sensor	JCI	TE-6000 Series	±1.0 %	-50 to +250 °F
Duct Temperature Sensor	JCI	TE-6000 Series	±0.5°F	-50 to +250 °F
Averaging Temperature Sensor	JCI	TE-6000 Series	±0.5°F	-50 to +250 °F
Outdoor Air Temperature Sensor	JCI	TE-6000 Series	±0.5°F	-4°F to +140 °F
Outdoor Air Humidity Sensor	Dwyer	RHP Series	±3% RH	0 to 100 % RH
Duct Static Pressure Sensor	JCI	DPT260-MS2-SP	±1.0%	0 to 5.0 in wc
Building Static Pressure Sensor	JCI	DPT260-MS1	±1.0%	-0.1 to +0.1 in wc
Filter Differential Pressure Sensor	JCI	DPT260-MS2	±1.0%	0 to 2.5 in wc
Room Differential Pressure Monitoring	TSI	RPM Series	±0.00001	-0.20 to 0.20 in wc
Water Differential Pressure Sensor.	JCI	DPT230 Series with 3-Valve Manifold Assembly	±0.25%	0 to 10.0 in wc
Low Temperature Safety Switch	JCI	A70 Series	±1.0%	+15.0 to +55.0 °F
High Pressure Safety Switch	JCI	P32 Series	±0.025 in wc	+0.05 to 5.0 in wc
Chiller Refrigerant Monitor	MSA (or equal)	Chiller Guard	±10.0%	0 to 2000 ppm
Current Sensing Switches	Veris	CSDSC Series	±0.05 A	0.1 to 20 A
Water Flow Meters	Onicon	F3500	±1.0%	0.1 to 20.0 ft/s
BTU Meters	Onicon	System 10 BTU Meter	±0.15%	+32 to +200 °F
Air Flow Meters	JCI	AD-1272 Thermal Dispersion Probe AFMS	±0.25%	0 to 5000 FPM
Air Flow Meters (small ducts)	JCI	RA-1252V Low Flow/VAV Electronic AFMS Low Flow	±0.25%	40 to 4000 FPM
Damper Actuators	JCI	M9220 Series	1.0%	0 to 100 %
2-way Control Valve	Belimo	VG1241 Series	1.0%	0 to 100 %
3-way Control Valve	Belimo	VG1841 Series	1.0%	0 to 100 %
Butterfly Control Valve	Belimo	VF6000 Series	1.0%	0 to 100 %
Operating Room Information Display	JCI	TAD Series	N/A	N/A
Variable Frequency Drives	ABB	ACH Series	±1%	1 to 60 HP

4. BAS Systems Overview

(Provide a brief description of systems to be included in the Building Automation System scope for control and monitoring.)

4.1 HVAC Systems

(Review the following list of systems that are to be controlled and/or monitored by the BAS.)

- *Chillers*

- *Cooling Towers*
- *Heating Hot Water Boilers*
- *Steam Boiler*
- *Chemical Water Treatment*
- *Pumps*
- *Piping Systems*
- *Ductwork*
- *Air Handling Units*
- *Humidifiers*
- *Air Terminal Units*
- *Fan Coil Units*
- *Computer Room Units*
- *Variable Frequency Drives*
- *Room Pressure Monitors*
- *Room Pressurization (positive, negative, or neutral)*
- *Equipment Vibration Monitoring*
- *Test, Adjust, and Balance Work*
- *Building Automation System (Johnson Controls)*

4.2 Plumbing Systems

(Review the following list of systems that are to be controlled and/or monitored by the BAS.)

- *Domestic Water Flow Meter*
- *Domestic Hot Water Systems*
- *Irrigation Water*
- *Low Flow Plumbing Fixtures*
- *Medical Gas Alarm Systems*
- *Medical Vacuum Pumps*
- *Medical Air Compressors*

4.3 Electrical Systems

(Review the following list of systems that are to be controlled and/or monitored by the BAS.)

- *Power Distribution System*
- *Lighting*
- *Lighting Controls*
- *Emergency Generators and Paralleling Switch Gear*
- *Automatic Transfer Switches*
- *Uninterruptable Power Supplies*
- *Solar Power Panels*

- *Ground Fault Protection Systems*
- *Grounding System*
- *Power Metering and Monitoring*

5. Point Naming Conventions and Trend Log Setup

The controls contractor shall follow the point naming conventions and trend log setup as shown below.

Nomenclature: (AI = Analog Input, AO = Analog Output, AV = Analog Value, BI = Binary Input, BO = Binary Output, BV = Binary Value, COS = Change of State, COV = Change of Value, MI = Multistate Input, MO = Multistate Output, MV = Multistate Variable, N/A = Not Applicable)

Input / Output Point Name	Point Description	Units / Descriptors	Significant Value	Trend Type	Trend COV
Heat Pump					
OCC-C	Occupancy Command	Unoccupied / Occupied	N/A	COS & 1 day	N/A
EFF-OCC	Effective Occupancy	Unoccupied / Occupied	N/A	COS & 1 day	N/A
FAN-C	Fan Command (G)	Off / On	N/A	COS & 1 day	N/A
HTG-C	Heating Command (W1)	Off / On	N/A	COS & 1 day	N/A
CLG-C	Cooling Command (Y1)	Off / On	N/A	COS & 1 day	N/A
FAN-MODE	Fan Mode	On / Auto / Smart	N/A	COS & 1 day	N/A
SYS-MODE	System Mode RTU	Auto/Manual	N/A	COS & 1 day	N/A
CLGOCC-SP	Occupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGOCC-SP	Occupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGSTBY-SP	Standby Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGSTBY-SP	Standby Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGUNOCC-SP	Unoccupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGUNOCC-SP	Unoccupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
EFFCLG-SP	Effective Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
EFFHTG-SP	Effective Heating Setpoint	deg F	0.1	COV & 1 day	0.5
TOCC-HRS	Temporary Occupancy (Duration)	hours	1	COV & 1 day	0.5
CLG-DMD	Cooling Demand	%	1	COV & 15 min.	10
HTG-DMD	Heating Demand	%	1	COV & 15 min.	10
CLG-LOK	Cooling Lockout Temperature Stpt.	deg F	1	COV & 1 day	0.5
HTG-LOK	Heating Lockout Temperature Stpt.	deg F	1	COV & 1 day	0.5
Roof Top Unit					
FAN-C	Fan Command	Off / On	N/A	COS & 1 day	N/A
FAN-S	Fan Status	Off / On	N/A	COS & 1 day	N/A
OCC-C	Occupancy Status Display	Unoccupied / Occupied	N/A	COS & 1 day	N/A
EFF-OCC	Effective Occupancy	Unoccupied / Occupied	N/A	COS & 1 day	N/A
FAN-MODE	Fan Mode	Auto / On	N/A	COS & 1 day	N/A
SYS-MODE	System Mode	Auto / Cooling / Heating	N/A	COS & 1 day	N/A
ZN-T	Zone Temperature	deg F	0.1	COV & 15 min.	0.2
DA-T	Discharge Air Temperature	deg F	0.1	COV & 15 min.	1.0
DAT-SP	Discharge Air Temperature Setpoint	deg F	0.1	COV & 15 min.	1.0
EFFDAT-SP	Effective Discharge Air Temp. Setpoint	deg F	0.1	15 minutes	N/A
MA-T	Mixed Air Temperature	deg F	0.1	15 minutes	N/A

Input / Output Point Name	Point Description	Units / Descriptors	Significant Value	Trend Type	Trend COV
RA-T	Return Air Temperature	deg F	0.1	15 minutes	N/A
OA-T	Outside Air Temperature	deg F	0.1	15 minutes	N/A
CLGOCC-SP	Occupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGOCC-SP	Occupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGUNOCC-SP	Unoccupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGUNOCC-SP	Unoccupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGSTBY-SP	Standby Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGSTBY-SP	Standby Heating Setpoint	deg F	0.1	COV & 1 day	0.5
EFFCLG-SP	Effective Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
EFFHTG-SP	Effective Heating Setpoint	deg F	0.1	COV & 1 day	0.5
ECON-O	Economizer Output	%	1	COV & 15 min.	5.0
MINPOS	Economizer Minimum Position Setpoint	%	1	COV & 1 day	5.0
ECON-COSP	Economizer Changeover Setpoint	deg F	0.1	COV & 1 day	0.5
BLDG-P	Building (Static) Pressure	in wc	0.001	COV & 15 min.	0.005
Air Handling Unit					
OCC-C	Occupancy Command	Unoccupied / Occupied	N/A	COS & 1 day	N/A
OCC-OVR	Occupancy Override	Normal / Override	N/A	COS & 1 day	N/A
AVGZN-T	Average Zone Temperature	deg F	0.1	15 minutes	N/A
ZN-T	Zone Temperature	deg F	0.1	COV & 15 min.	0.2
ZNT-SP	Zone Temperature Setpoint	deg F	0.1	15 minutes	N/A
ZN-H	Zone (Relative) Humidity	% RH	1	COV & 15 min.	2
ZN-Q	Zone Quality (CO2 Level)	ppm	1	COV & 15 min.	50
CLGOCC-SP	Occupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGOCC-SP	Occupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGUNOCC-SP	Unoccupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGUNOCC-SP	Unoccupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGSTBY-SP	Standby Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGSTBY-SP	Standby Heating Setpoint	deg F	0.1	COV & 1 day	0.5
EFFCLG-SP	Effective Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
EFFHTG-SP	Effective Heating Setpoint	deg F	0.1	COV & 1 day	0.5
BLDGP-SP	Building Static Pressure Setpoint	in wc	0.001	COV & 1 day	0.005
BLDG-SP	Building Static Pressure	in wc	0.001	COV & 15 min.	0.005
SF-C	Supply Fan Command	Off / On	N/A	COS & 1 day	N/A
SF-S	Supply Fan Status	Off / On	N/A	COS & 1 day	N/A
SF-O	Supply Fan Speed Output	%	1	COV & 15 min.	10%
SF-HZ	Supply Fan Speed Feedback	Hz	1	15 minutes	N/A
SF-ALM	Supply Fan Feedback Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
DA-P	Discharge Air Pressure	in wc	0.01	COV & 15 min.	0.1
DAP-SP	Discharge Air Pressure Setpoint	in wc	0.01	COV & 15 min.	0.1
SA-F	Supply Air Flowrate	cfm	1	COV & 15 min.	100
RF-C	Return Fan (Start) Command	Off / On	N/A	COS & 1 day	N/A
RF-S	Return Fan (Running) Status	Off / On	N/A	COS & 1 day	N/A
RF-O	Return Fan (Speed) Output	%	1	COV & 15 min.	10%

Input / Output Point Name	Point Description	Units / Descriptors	Significant Value	Trend Type	Trend COV
RF-HZ	Return Fan (Speed) Hertz	Hz	1	15 minutes	N/A
RF-ALM	Return Fan Feedback Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
RA-F	Return Air Flowrate	cfm	1	COV & 15 min.	100
OA-T	Outside Air Temperature	deg F	0.1	15 minutes	N/A
OA-Q	Outside Air Quality (CO2 Level)	ppm	1	15 minutes	N/A
OA-F	Outside Air Flowrate	cfm	1	COV & 15 min.	100
MAXOAF-SP	Maximum Outside Air Flowrate Stpt.	cfm	1	COV & 1 day	100
MINOAF-SP	Minimum Outside Air Flowrate Stpt.	cfm	1	COV & 1 day	100
RA-Q	Return Air Quality (CO2 Level)	ppm	1	15 minutes	N/A
RAP-ALM	Return Air Pressure Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
RA-T	Return Air Temperature	deg F	0.1	15 minutes	N/A
MA-T	Mixed Air Temperature	deg F	0.1	15 minutes	N/A
ECON-O	Economize Damper Output	%	1	COV & 15 min.	10
OAD-O	Outside Air Damper Output	%	1	COV & 15 min.	10
MAD-O	Mixed Air Damper Output	%	1	COV & 15 min.	10
RAD-O	Return Air Damper Output	%	1	COV & 15 min.	10
PF-DP	Pre Filter Differential Pressure	in wc	0.1	15 minutes	N/A
FF-DP	Final Filter Differential Pressure	in wc	0.1	15 minutes	N/A
LT-ALM	Low Temperature Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
LT-SP	Low Temperature Setpoint	deg F	1	COV & 1 day	1
HTG-T	Heating Coil Entering Air Temperature	deg F	0.1	15 minutes	N/A
HWS-T	Hot Water Supply Temperature	deg F	0.1	15 minutes	N/A
HWR-T	Hot Water Return Temperature	deg F	0.1	15 minutes	N/A
HTG-EN	Heating Enable	Off / On	N/A	COS & 1 day	N/A
HTG-O	Heating Output	%	1	COV & 15 min.	10
CLG-T	Cooling Coil Discharge Temperature	deg F	0.1	15 minutes	N/A
CLG-O	Cooling Output	%	1	COV & 15 min.	10
CLG-EN	Cooling Enable	Off / On	N/A	COS & 1 day	N/A
RH-DAT	Reheat Coil Discharge Air Temp.	deg F	0.1	15 minutes	N/A
RH-O	Reheat Coil Valve Output	%	1	COV & 15 min.	10
RH-EN	Reheat Enable	Off / On	N/A	COS & 1 day	N/A
HUM-EN	Humidifier Enable	Off / On	N/A	COS & 1 day	N/A
HUM-C	Humidifier Command	Off / On	N/A	COS & 1 day	N/A
HUM-O	Humidifier Output	%	1	COV & 15 min.	10
HUM-SP	Humidifier Setpoint	% RH	1	1 day & COV	5
DA-T	Discharge Air Temperature	deg F	0.1	15 minutes	N/A
DA-H	Discharge Air Humidity	% RH	1	COV & 15 min.	5
DA-P	Discharge Air (Static) Pressure	in wc	0.01	COV & 15 min.	0.1
DA-SD	Discharge Air Smoke Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
DAHP-ALM	Discharge Air High Pressure Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
WARMUP-C	Warmup Command	Off / On	N/A	COS & 1 day	N/A
MAD-MINPOS	Economizer Minimum Position Setpoint	%	1	COV & 1 day	5
MOA-CO2RSTA	Minimum Position Reset Setpoint ‘A’	%	1	COV & 1 day	5

Input / Output Point Name	Point Description	Units / Descriptors	Significant Value	Trend Type	Trend COV
MOA-CO2RSTB	Minimum Position Reset Setpoint 'B'	%	1	COV & 1 day	5
OALT-SP	Outside Air Low Temperature Setpoint	deg F	0.1	COV & 1 day	1
PURGE-C	Purge Command	Off / On	N/A	COS & 1 day	N/A
DATH-SP	Discharge Air High Temp. Setpoint	deg F	0.1	COV & 1 day	1
DATL-SP	Discharge Air Low Temp. Setpoint	deg F	0.1	COV & 1 day	1
Constant/Variable Air Volume Terminal Unit					
ZN-T	Zone Temperature	deg F	0.1	COV & 15 min.	0.2
ZN-SP	Zone Setpoint	deg F	0.1	COV & 1 day	0.5
ZN-H	Zone Relative Humidity	% RH	1	15 minutes	N/A
ZN-Q	Zone Quality	ppm	1	15 minutes	N/A
CLGOCC-SP	Occupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGOCC-SP	Occupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGUNOCC-SP	Unoccupied Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGUNOCC-SP	Unoccupied Heating Setpoint	deg F	0.1	COV & 1 day	0.5
CLGSTBY-SP	Standby Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
HTGSTBY-SP	Standby Heating Setpoint	deg F	0.1	COV & 1 day	0.5
EFFCLG-SP	Effective Cooling Setpoint	deg F	0.1	COV & 1 day	0.5
EFFHTG-SP	Effective Heating Setpoint	deg F	0.1	COV & 1 day	0.5
HTG-O	Heating Output	%	1	COV & 15 min.	10
DA-T	Discharge Air Temperature	deg F	0.1	COV & 15 min.	1.0
SA-F	Supply Air Flow	cfm	1	COV & 15 min.	100
SAFLOW-SP	Supply Air Flow Setpoint	cfm	1	15 minutes	N/A
DPR-O	Supply Damper Output	%	1	COV & 15 min.	10
AUTOCAL	Autocalibration Status	Normal / In Calibration	N/A	COS & 1 day	N/A
OCC-C	Occupancy Command	Unoccupied / Occupied	N/A	COS & 1 day	N/A
EFF-OCC	Effective Occupancy	Unoccupied / Occupied	N/A	COS & 1 day	N/A
Exhaust Fan					
EF-C	Exhaust Fan Command	Off / On	N/A	COS & 1 day	N/A
EF-S	Exhaust Fan Status	Off / On	N/A	COS & 1 day	N/A
EF-O	Exhaust Fan Speed Output	%	1	COV & 15 min.	10
EF-FB	Exhaust Fan Speed Feedback	Hz	1	15 minutes	N/A
Chiller System					
CH-C	Chiller Command	Off / On	N/A	COS & 1 day	N/A
CH-S	Chiller Status	Off / On	N/A	COS & 1 day	N/A
CH-A	Chiller Amperage	A (Amps)	1	COV & 15 min.	10
CH-ALM	Chiller Alarm	Normal/Alarm	N/A	COS & 1 day	N/A
CHWS-T	Chilled Water Supply Temperature	deg F	0.1	COV & 15 min.	1.0
CHWR-T	Chilled Water Return Temperature	deg F	0.1	COV & 15 min.	1.0
CHWS-SP	Chilled Water Supply Temp. Setpoint	deg F	0.1	COV & 15 min.	1.0
CWS-T	Condenser Water Supply Temperature	deg F	0.1	COV & 15 min.	1.0
CWR-T	Condenser Water Return Temperature	deg F	0.1	COV & 15 min.	1.0
CWS-SP	Condenser Water Supply Temp. Stpt.	deg F	0.1	COV & 15 min.	1
CHWP-C	Chilled Water Pump Command	Off / On	N/A	COS & 1 day	N/A

Input / Output Point Name	Point Description	Units / Descriptors	Significant Value	Trend Type	Trend COV
CHWP-S	Chilled Water Pump Status	Off / On	N/A	COS & 1 day	N/A
CHWP-ALM	Chilled Water Pump Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
CHW-F	Chilled Water Flowrate	gpm	1	COV & 15 min.	100
CHW-P	Chilled Water Differential Pressure	psi	0.1	COV & 15 min.	0.5
CWP-C	Condenser Water Pump Command	Off / On	N/A	COS & 1 day	N/A
CWP-S	Condenser Water Pump Status	Off / On	N/A	COS & 1 day	N/A
CWP-ALM	Condenser Water Pump Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
CW-F	Condenser Water Flowrate	gpm	1	COV & 15 min.	100
TWR-C	Tower Fan Command	Off / On	N/A	COS & 1 day	N/A
TWR-S	Tower Fan Status	Off / On	N/A	COS & 1 day	N/A
TWR-O	Tower Fan Speed Output	%	1	COV & 15 min.	10
TWR-FB	Tower Fan Speed Feedback	Hz	0.1	15 minutes	N/A
Boiler System					
BLR-C	Boiler Command	Off / On	N/A	COS & 1 day	N/A
BLR-S	Boiler Status	Off / On	N/A	COS & 1 day	N/A
BLR-ALM	Boiler Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
HWP-C	Hot Water Pump Command	Off / On	N/A	COS & 1 day	N/A
HWP-S	Hot Pump Status	Off / On	N/A	COS & 1 day	N/A
HWP-ALM	Hot Pump Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
HWS-T	Hot Water Supply Temperature	deg F	0.1	COV & 15 min.	1.0
HWR-T	Hot Water Return Temperature	deg F	0.1	15 minutes	N/A
HWS-SP	Hot Water Supply Temp. Setpoint	deg F	0.1	COV & 15 min.	1
HW-F	Hot Water Flowrate	gpm	1	COV & 15 min.	100
HW-DP	Hot Water Differential Pressure	psi	0.1	COV & 15 min.	0.5
PHWP-C	Primary Hot Water Pump Command	Off / On	N/A	COS & 1 day	N/A
PHWP-S	Primary Hot Water Pump Status	Off / On	N/A	COS & 1 day	N/A
PHWP-O	Primary Hot Water Pump Output	%	1	COV & 15 min.	10
PHWP-ALM	Primary Hot Water Pump Alarm	Normal / Alarm	N/A	COS & 1 day	N/A
SHWP-C	Secondary Hot Water Pump Command	Off / On	N/A	COS & 1 day	N/A
SHWP-S	Secondary Hot Water Pump Status	Off / On	N/A	COS & 1 day	N/A
SHWP-O	Secondary Hot Water Pump Output	%	1	COV & 15 min.	10
SHWP-ALM	Secondary Hot Water Pump Alarm	Normal / Alarm	N/A	COS & 1 day	N/A

6. Generic Prefix and Suffix

Prefix Symbol	Description	Suffix Symbol	Description
#-EKW	Bldg Number – Emergency Kilowatt	ALM	Alarm
#-KW	Bldg Number – Kilowatt	C	Command
BLDG	Building	EN	Enable
CHW	Chilled Water	F	Flow
CLG	Cooling – Air/Valve	H	Humidity
CP	Central Plant	HZ	Hertz

CW	Condenser Water	M	Meter
DA	Discharge Air	O	Output
DHW	Domestic Hot Water	P	Pressure
DPR	Damper	PUR	Purge
DW	Domestic Water	Q	Air Quality (CO2)
EA	Exhaust Air	SP	Setpoint
EAD	Exhaust Air Damper	T	Temperature
EF	Exhaust Fan		
EFF	Effective		
FF	Final Filter		
HTG	Heating - Air		
HUM	Humidifier		
HW	Hot Water		
ID	Isolation Damper		
IRR	Irrigation		
LT	Low Temperature Limit		
MAD	Mixed Air Damper		
OA	Outside Air		
OAD	Outside Air Damper		
OCC	Occupancy		
P	Pump		
PF	Pre Filter		
RA	Return Air		
RAD	Return Air Damper		
RF	Return Fan		
RH	Reheat		
SA	Supply Air		
SF	Supply Fan		
ZN	Zone		

Network Engines: NxE Model-Bldg#-NxE# (example SNE-98-5)

Field Controller: Bldg#-Flr#-“equipment type”-Controller# (example 98-6-VAV-20)

Refrigerator Monitoring: Bldg#-Flr#-Refer#-“Suffix”

7. Control Loop Accuracy Requirements

Controlled Variable	Control Accuracy
Room Temperature	± 0.5°F
Duct Temperature	± 1.0°F
Chilled Water Temperature	± 1.0°F
Hot Water Temperature	± 2.0°F
Room Relative Humidity	± 5.0% RH
Duct Static Pressure	± 0.1” w.c.

Building Static Pressure	± 0.005” w.c.
Critical Room Differential Pressure	± 0.001” w.c.
Water Differential Pressure	± 1.5 psi
Air Flow Rate	± 10% of full scale cfm

8. BAS Installation Requirements

8.1 AHU Standard Installation, Devices, and Setup Parameters

CGM controller to include digital display.

The controls contractor is responsible for calibrating the supply air temperature within ± 1.0°F of actual temperature and recording offset in AHU checkout sheets. Control contractor to verify temperature meter is within 0.2°F of the Cx Authority meter.

8.2 VAV Standard Installation, Devices, and Setup Parameters

Install Zone Temperature sensors 48” AFF (Above the Finished Floor).

Offices, exam rooms, conference rooms, and employee areas have a zone temperature sensor with a warmer/cooler adjustment dial (± 2.0°F).

Public space such as waiting rooms, hallways, and bathrooms have a zone temperature sensor with no adjustment dial but will include an occupancy override feature.

Use zone temperature sensor with no adjustment dial when replacing a zone temperature sensor above 48” AFF but will include an occupancy override feature.

If there are two VAV’s serving a space, the temperature sensor nearest the door has its adjustment dial enabled with the other sensor’s adjustment dial disabled. The setpoint from the first VAVs sensor is then mapped to the second VAV so that both VAVs have the same setpoint.

Conference rooms and public spaces with varying occupancy may require a zone temperature and CO2 sensors and will include an occupancy override feature.

Insulate all zone temperature sensors ensuring that no air flow from inside the wall adversely affects temperature sensor readings.

The controls contractor is responsible for calibrating zone temperature sensors within ± 1.0°F of actual temperature and recording offset in VAV checkout sheets. Control contractor to verify their temperature meter to Cx Authority meter.

The VAV controller program shall include an automated demand response (ADR) binary network input and ADR analog temperature offset setpoint.

The Common Zone Setpoint was identified previously in Section 3.4.

VAV boxes serving pharmacy rooms, rooms with medical storage units (refrigerators and freezers), and PYXIS machine rooms, shall be occupied at all times.

The VAV naming convention is VAV-*x*-*y*-*z* where *x* = Building #, *y* = Floor #, and *z* = VAV #.

8.3 Automatic Control Valves and Actuators

Automatic control valves and actuators shall be selected and sized based on the following requirements:

- *Provide two-way and three-way control valves for all coils and terminal units as specified on schedules.*
- *Valve actuator and trim shall be furnished to provide close off pressure of 150% of total system (pump) head at the valve location.*

- *Select control valves for branch design-flow and location on hydronic distribution network. Valves shall be selected, when at design flow, to provide pressure drop of at least 25% of the branch circuit from supply line to the return line. Valves nearer to pumps on direct return systems will be smaller than line size and provide more system dynamic pressure drop than valves far from the pumps. Obtain campus distribution flow model from the University to confirm system differential pressure available at the building.*
- *Cooling and heating coil control shall be fully proportioning throttling type with modulating plugs or characterization discs for equal percentage flow characteristics.*
- *Modulating valves (other than heating or cooling coil flow control control) shall be proportional "Globe" or ball type with linear characteristics.*
- *Butterfly valves shall have a cast iron lug body, 304 stainless steel disk, 416 stainless steel shaft, ethylene propylene diene monomer (EPDM) O-ring, and reinforced polytetrafluoroethylene (RPTFE) bushings.*

8.3.1 Automatic Control Valve Actuators

Electric actuators shall consist of a high torque, reversible electric motor coupled directly to a valve stem coupling and an output for position to be monitored by Metasys.

8.3.2 Quality Assurance

Belimo shall manufacture valves and actuators unless a required valve is not available from Belimo. Bray or JCI valves are acceptable where Belimo does not have a valve for an application.

8.4 Variable Frequency Drives

The Variable Frequency Drives shall be supplied with BACnet MS/TP (RS-485) communication board. The controls contractor shall map the standard points approved by the PO&M Department. The VFD shall act as the local controller for the process with Metasys only providing setpoint resets, on/off commands and receiving status and alarms via BACnet.

8.5 Miscellaneous Controls Installation

- *All wiring must be color-coded and all terminations shall be numbered in accordance with applicable wiring standards and Division 26 requirements.*
- *Outside air temperature sensor mounts on north side of building in the shade.*
- *Smoke detector that are required to shut down fans shall do so by not disrupting power to the unit's controller.*
- *Supervisory Controllers (SNEs and SNCs) shall be supplied with UPS power or a local UPS (Sola HD UPS or preapproved equal).*
- *Place AHUs and their associated terminal devices (VAVs, CAVs, etc.) on the same supervisory controller.*

8.6 Cable Wiring

All wiring performed by the BAS Subcontractor shall be installed in accordance with the requirements of Division 26 as well as all current and applicable local and national codes including but not limited to:

- *NEC (NFPA 70) – National Electrical Code*
- *CMC – California Mechanical Code*
- *CFC – California Fire Code*
- *CBC – California Building Code*

Except for Smoke Control systems, and unless required by Division 26 specifications, plenum-rated low voltage wiring may be installed without conduits in accessible, concealed spaces above ceiling plenums, if installed in a neat workmanlike manner, suspended from the structure on hangers and not touching any hot surfaces (coils). Laying bare wires and cables on the ceiling grid is prohibited.

For Smoke Control systems, and if required by Division 26 specifications, in addition to meeting the requirements of the electrical codes, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways (conduit). Concealed wiring within partition wall to temperature sensors needs to be in conduit to 8 ft. AFF.

8.7 Conduit

The BAS Subcontractor shall furnish and install all necessary conduits, control wiring, low voltage power wiring and conduit to control panels and field devices and all interlock wire and conduit as shown on the drawings, stated in the sequence of operation and listed on point list and necessary for the proper operation of all specified systems.

Power supply conduit and wiring from distribution panels to BAS field panels and devices, such as, but not limited to, valve actuators, terminal box controllers, and damper actuators are a part of the work of this section. Power supply shall be from an emergency power source for all equipment connected to emergency power and/or used for Fire Life Safety operation.

All wiring to outdoor panels and devices shall be arranged so that the conduits enter the panels and devices from the bottom in order to minimize the risk of water leaks. All conduit entries into outdoor panels and devices must be made with special weatherproof fittings.

Disconnects as required by the UMC 2013 section 308.0 “Means of Disconnect”, are a part of the work of this section.

APPENDIX B

OWNER PROJECT REQUIREMENTS FOR COMMISSIONING

Owner's Project Requirements for Commissioning

University of California

Davis Health

Sacramento California

Issue Date:

Project Name:

Project Number:

1. Overview and Scope

1.1 Overview and Definition

The following UC Davis Health (UCDH) Plant Operations and Maintenance (PO&M) Owner's Project Requirements (OPR) for Commissioning (Cx) provides an explanation of the ideas, concepts, and criteria that are important to the owner and describes the commissioning scope to include in the Basis of Design and final construction documents. The Cx OPR is developed by the owner and Commissioning Authority (CxA) and provides direction for the design team. The OPR document sets the functional goals that the design is judged against and establishes the basis of the criteria used during construction and acceptance to verify actual performance. The OPR does not list all items that are already required by code. Architects, engineers, designers, and construction professionals, under contract to UCDH Facilities Design and Construction (FD&C) are encouraged to work with the PO&M shops to define the commissioning requirements.

The Cx OPR will be followed by the basis of design or design narrative written by the design team and included with the design package submissions. The basis of design documents are the primary thought processes and assumptions behind the design decisions and describes the commissioning requirements to provide PO&M with a complete and operational project.

1.2 Scope

This document includes systems that are required by PO&M to be verified under the commissioning scope of work. This document is not a comprehensive project OPR, and only includes systems that require commissioning.

The systems included in the commissioning scope of work are:

(Edit the information shown below in Blue as applicable to project.)

- *Mechanical Systems*
- *Electrical and Lighting Systems*
- *Plumbing and Irrigation Systems*
- *Control Systems*
- *Energy and Sustainability*
- *Building Envelope*
- *Leadership in Energy and Environmental Design (LEED) Standards (Silver or Gold)*
- *Security Systems (Access Control and Intrusion Detection)*
- *Fire System (Review AHJ testing)*

2. General Requirements

Today's building industry is embracing sustainable building standards, designed to improve environmental and health principles and practices into the planning, design, and construction of new buildings. Decisions made in the facility planning stage will have significant impacts on the built environment throughout the life cycle of the building. UC Davis Health desires to reduce adverse impacts upon the environment, the community and our buildings' patients, caregivers and staff resulting from the design, construction, and operations of our health care facilities. This goal complements our desire to provide high-performance healing environments and responsible financial management.

2.1 Design Requirements and Environmental Goals

Per “UC – Policy on Sustainable Practices” all new buildings shall achieve at least LEED Silver and strive for LEED Gold. Lab spaces shall also meet at least the prerequisites of the Laboratories for the 21st Century (Labs21) Environmental Performance Criteria (EPC).

- *2019 Title 24*
- *Reference the Plumbing (Division 22) OPR*
- *Reference the HVAC Mechanical (Division 23) OPR*
- *Reference the Building Automation Systems (Division 25) OPR*
- *Reference the Electrical (Division 26) OPR*

2.2 Energy Efficiency Goals.

Per “UC – Policy on Sustainable Practices” all new building and major renovation projects, other than acute care facilities, shall outperform the California Building Code (CBC) energy-efficiency standards by at least 20% and strive for 30%. New acute care/hospital facilities, medical office buildings, and their major renovations shall outperform ASHRAE 90.1 - 2010 by at least 30%.

2.3 O&M Manuals, As-Builts, and Warranties

Contractors are required to provide two hard-copy binders of the Operation & Maintenance (O&M) manuals and as-builts, and a soft copy of the O&M manuals and as-builts on a USB stick to be delivered to the PO&M manager.

Contractors are required to provide single-line system flow diagrams beyond the control diagrams of the primary systems. The diagrams shall include chilled water, heating hot water, air handlers, VAV boxes, exhaust fans, and all applicable HVAC equipment

Contractors are required to provide floor plan zoning diagrams showing the HVAC and lighting zones in differentiating colors

Contractors are required to provide one year warranties on material, equipment, and installation. The contractors shall also provide the PO&M department with a list of manufacturer extended warranties on controls materials and on HVAC mechanical, plumbing, and electrical equipment.

2.4 Commissioning Documents Required

The following documents contained in the Cx Report are supplied by the CxA and are described in detail in Section 4 - Commissioning Requirements.

- *Cx Executive Summary*
- *Cx Plan*
- *Cx Issue Log*
- *Cx Document Request Form*
- *Cx Design Review*
- *Cx Status and Field Reports*
- *Pre-Functional Checklist Forms*
- *Functional Performance Tests*
- *Training Verification*

Additionally, the following documents may also be requested from the CxA:

- *Systems Manual*
- *Opposite Season Testing Report*

2.5 Training and Orientation of Owner Personnel

The contractors will provide a detailed training agenda to the PO&M manager for review and approval before training. The trainer signs and dates the training documents and obtains the signature of each trainee.

Provide training to three shifts of facility engineers. Each training session will be two to four hours long.

Most systems will have their training video recorded with a copy provided to the PO&M manager for future use.

2.6 Facility Maintenance Requirements

The occupants will have the ability to override occupancy at the zone level via a button on the zone temperature sensor or thermostat. In general, occupants will not have the ability to make setpoint adjustments or observe the zone temperature.

3. Design Process

3.1 Basis of Design Documentation

With each design submission, the design team will include a written basis of design. This will be updated and become more detailed with each successive submission. The basis of design includes two primary elements - a design narrative and the design rationale.

During the schematic design phase, the design narrative is the written description and discussion of the concepts and features the designer intends to incorporate into the design. In subsequent design phases the design narrative is a description of what they have incorporated to meet the owner's project requirements and associated performance criteria.

The design rationale is the basis, rationale and assumptions for calculations, decisions, schemes and system and assemblies selected to meet the owner's project requirements and to satisfy applicable regulatory requirements, standards, and guidelines.

3.2 Design Reviews

There will be an owner review as well as third party commissioning reviews of commissioned systems for 50% Design Development (DD), 100% DD, 50% Construction Documents (CD), and 95% CD design submissions. The design team will respond in writing to each comment and will consult with the Owner on issues that may increase scope, project budget or timeline beyond what they feel the Owner may desire. Reviewer comments will be responded to and comments with questions or disagreements between reviewers and the design team will be adjudicated prior to proceeding with impacting portions of the next design phase, unless directed by the Owner.

4. Commissioning Requirements

Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by reviewing the

design and continuing through the construction and acceptance phases with verification of performance. The Commissioning Authority (CxA) will be independent of the design and construction teams.

4.1 Roles and Responsibilities

4.1.1 Team Members

The members of the commissioning team consist of the CxA, Owner, Project Manager, Inspector of Record (IOR), Area Superintendent, Architect, Structural Engineer, Mechanical Engineer, Electrical Engineer, General Contractor, Mechanical Contractor, Electrical Contractor, Controls Contractor, Test, Adjust & Balance (TAB) Contractor, and any other installing subcontractors or suppliers of equipment. The Owner's energy manager and building engineer is also a member of the commissioning team and encouraged to participate.

4.1.2 General Management Plan

The CxA coordinates the commissioning activities and reports to the owner. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

4.1.3 Communication Protocols

The CxA communicates with the owner and construction team through project meetings, email, and construction management software. The project meetings provide direct communication with outcomes documented on the meeting minutes.

4.1.4 General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

- *CxA: The CxA oversees the commissioning process, verifies startup of equipment, performs and documents Functional Performance Tests (FPTs), verifies training of owner personnel, and supplies final closeout documentation.*
- *Owner: The building owner facilitates and supports the Cx process and gives final approval of the Cx work.*
- *Project Manager: The Project Manager is responsible for planning, organizing, and directing the completion of the project while ensuring the projects is on time, on budget, and within scope.*
- *IOR: The Inspector of Record is assigned by OSHPD and performs inspections specific to the project for which the IOR has been approved.*
- *A/E: The Architect and Engineers design the systems, perform construction observation, approve submittals and O&M manuals, and assist in resolving problems.*
- *GC: The General Contractor facilitates the Cx activities, ensures that Subs perform their responsibilities and integrates Cx into the construction process and schedule.*
- *Subs: The Subcontractors (mechanical, electrical, controls, and TAB) install system equipment, submit required documents, and demonstrate proper system performance.*

4.2 Commissioning Process

4.2.1 Commissioning Process During the Pre-Design Phase

Pre-Design is a preparatory phase of the project delivery process in which the Owner's Project Requirements are developed and defined with the assistance of the CxA. The OPR forms the foundation for the design, construction, and operation of the facility and are the basis for the Commissioning Plan and schedule.

- *Developing the Owner's Project Requirements.*
- *Identifying a scope and budget for the Commissioning Process.*
- *Review and use of lessons-learned information from previous projects.*

4.2.2 Commissioning Process During the Design Phase

- *The CxA works with the Commissioning Team to document the Owner's Project Requirements for the facility.*
- *The CxA verifies the Basis of Design meets the Owner's Project Requirements.*
- *The CxA determines the commissioning requirements and activities to include in the Construction Documents, with review by the design team, for integration into the project's construction specifications.*
- *The CxA performs design review at 50% and 100% Design Development (DD) and 50% and 100% Construction Development (CD) completion of the drawings and specifications.*

4.2.3 Plans and Specification Review

The CxA reviews the plans and specifications and provides comments to the owner and design team.

4.2.4 Commissioning Plan

The Cx Plan includes an overview of the Commissioning Scope, a list of equipment and systems included in the commissioning, and project information. Roles and responsibilities are detailed, and details of the commissioning process and functional tests are provided. The Cx Plan includes verification of training, O&M manual and as-builts, and the final Cx Report.

4.2.5 Commissioning Kick-Off Meeting

A commissioning scoping meeting is planned and conducted at the beginning of construction. At the meeting, commissioning parties are introduced, and the commissioning process is reviewed.

4.2.6 Commissioning Schedule

The CxA coordinates with the GC to add commissioning milestones to the project schedule.

4.2.7 Submittal Review

The CxA reviews the equipment submittals and provides a formal review document with comments and recommendations.

4.2.8 Site Observation

The CxA makes periodic visits to the site, as necessary, to witness equipment and system installations.

4.2.9 Status Reporting and Issue Log

During construction, the CxA provides the GC with commissioning status reports. The CxA keeps an Issue Log of all commissioning related issues that require attention or correction.

4.3 System Installation and Startup

4.3.1 Overview

Equipment installation and startup documentation is important to ensure that the equipment and systems are installed and operational and that functional performance testing may proceed without unnecessary

delays. Each piece of equipment receives a complete checkout and startup by the responsible contractor. No sampling strategies are used.

4.3.2 System Installation

System installation checklists developed by the contractor and equipment manufacturer must be submitted to the CxA before testing begins.

4.3.3 Equipment Startup

System startup documentation is completed by the installing contractor and/or manufacturer startup technician and verifies the equipment or system operation before functional testing. System startup documentation developed by the contractor and equipment manufacturer must be submitted to the CxA before testing begins.

4.3.4 Signed Documents

This project requires that the installation and startup procedures be documented in writing by the responsible contractor. The contractors execute the installation and startup tests and submit a signed copy of the completed start-up documents to the GC.

4.3.5 TAB

The TAB contractor submits the outline of the TAB plan and approach to the CxA and the controls contractor. Included in the approach, is an explanation of the intended use of the building control system.

4.3.6 Control System Checkout Plan

The controls contractor develops and submits a check out form on which they will document the controls commissioning process.

4.3.7 Control System Trend Logs

The CxA will provide the control contractor with a list of points to trend that includes the point name, interval, and format.

4.4 Development of Functional Performance Test Documents

4.4.1 Overview

Functional testing is the dynamic testing of systems under various modes of operation, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to operate in accordance with the sequences.

4.4.2 Development Process

Before test procedures are written, the CxA obtains all requested documentation and a current list of change orders affecting equipment or systems. The CxA develops specific test procedures to verify proper operation of each piece of equipment and system. The CxA provides a copy of the Functional Performance Test to the installing subcontractor who reviews the tests for feasibility, safety, warranty, and equipment protection prior to execution of the testing.

4.5 Execution of Functional Performance Tests

4.5.1 Overview

The CxA schedules functional tests through the GC. For any given system, prior to performing functional testing, the CxA waits until the Installation Checklists and Startup documents have been submitted with the necessary signatures, confirming that the system is ready for functional testing. The CxA coordinates, witnesses, and documents the functional testing of all equipment and systems according to the plans, specifications, and Cx Plan.

4.5.2 Deficiencies and Retesting

The CxA documents the results of the tests. Corrections of minor deficiencies identified are made during the tests at the discretion of the CxA. The CxA records the results of the test on the functional test form. Deficiencies or non-conformance issues are noted in the Issue Log and reported to the GC and Owner. Subcontractors correct deficiencies and notify the CxA and schedule retesting. Decisions regarding deficiencies and corrections are made at as low a level as possible, preferably between CxA or GC and the Sub. For areas in dispute, final authority, resides with the Owner and A/E.

4.5.3 Substantial Completion and Occupancy

The CxA completes the Functional Performance Tests and verifies resolution of the Issue Log items before Substantial completion and tenant Occupancy. Any unresolved issues are specified in the final Cx Report and treated as a warranty call and corrected by the GC and/or Subs.

4.5.4 Facility Staff Participation

The Owner's facilities operating staff are encouraged to attend and participate in the testing process.

4.5.5 Sampling

Commissioning does not include sampling. All equipment and systems included in the Cx scope shall be commissioned.

4.5.6 O&M Manuals and Warranty

The CxA reviews the O&M manuals and Warranties for commissioned systems to verify compliance with the plans and specifications.

4.5.7 Training and Orientation of Owner Personnel

The CxA will verify that training is complete and may attend training sessions as required.

4.6 Final Cx Documentation

4.6.1 Commissioning Report

A final commissioning report shall be assembled by the CxA after all commissioning actions have been performed. The report shall include a final analysis of the commissioning process and all acquired documentation, field reports, issue logs, meeting minutes, correspondence, installation and startup documents, and Functional Performance Test documents. All outstanding non-compliance items shall be specifically listed. The Cx Report is submitted for review by the Owner, PO&M, and Architect.

The CxA will compile, organize, and index the commissioning data into labeled, indexed, and tabbed three-ring binders and deliver two copies to the building owner. The CxA will submit a soft copy in .PDF format to the owner for electronic storage.

4.6.2 Systems Manual

A Systems Manual shall be assembled by the CxA after all commissioning actions have been performed. The report shall include system flow diagrams, set points, strategies for seasonal control optimization, shutdown procedures, emergency procedures, energy optimization and tracking recommendations, retesting and calibration methods and frequencies.

The CxA will compile, organize, and index the systems data into labeled, indexed, and tabbed three-ring binders and deliver two copies to the building owner. The CxA will submit a soft copy in .PDF format to the owner for electronic storage.

4.6.3 Opposite Season Testing Report

An Opposite Season testing follow-up report shall occur before the one-year warranty expires. The follow-up includes reviewing the equipment operation, interviews with the facility operators, control system graphics, trend logs, event logs, and alarm logs. Additional commissioning can include measurement and verification of the control systems and building performance. The CxA will request assistance from the controls contractor and facility engineers to gather the required trend data and maintenance information.

During the Opposite Season follow up, the CxA reviews all systems included in this Cx Plan scope of work. The process is intended to identify issues within the construction warranty period and heating or cooling issues that initial testing during the winter or summer were unable to detect. The Opposite Season Testing Report is submitted to the Owner, PO&M, and GC.

5. Energy and Sustainability

The design team shall provide water and energy usage calculations during the schematic phase and update the calculations during the design development and construction document completion.

The table below shows the owner's requirements and provides a benchmark for the design team.

Design Element	Design Benchmark	Owner Requirements
Sustainability	Leadership in Energy and Environmental Design 2019 CA Green Building Standards Code, Title 24, Part 11	Minimum of LEED Silver but strive for LEED Gold or higher
Energy Design	2019 CA Energy Code, Title 24, Part 6	Meet mandatory code requirements For non-medical facilities, exceed Energy Code by 20%
Energy Use Intensity	UC Davis Health standards	TBD
Building Energy Consumption	2019 CA Energy Code, Title 24 Part 6 ASHRAE Standard 90.1 - 2010	Provide energy model and establish the baseline energy use For medical facilities, 30% improvement in energy use over the ASHRAE 90.1 baseline.
Building Envelope	2019 CA Energy Code, Title 24, Part 6 2019 CA Green Building Standards Code, Title 24, Part 11	
Flow Measurement and Verification (M&V)	Include Domestic City Water with separate meters for Irrigation, Cooling Tower makeup, Heating Hot Water, Chiller	Publish M&V plan and provide data in units of energy (kBTU, kW, EUI)

Design Element	Design Benchmark	Owner Requirements
	Water, and other significant uses	
Power Measurement and Verification (M&V)	Include Power monitoring of main feed into building Include submetering of distribution panels and major users as identified in 2019 CA Energy Code Table 130.5-B	Publish M&V plan and provide data in units of energy (kBTU, kW, EUI)
Water Use	2019 CA Green Building Standards Code, Title 24, Part 11	Meet mandatory requirements but strive for Green Code Tier 2 (25% savings)

Reference the Mechanical, Plumbing, Electrical, and Building Automation System OPR's for information on the required equipment and controls to meet the Energy and Sustainability goals.

6. HVAC Systems Commissioning

6.1 Mechanical Systems Commissioning

Specifications shall include commissioning requirements to ensure that the building delivered at the end of construction has fully operational mechanical systems.

The table below shows the owner's requirements and provides a benchmark for the design team.

Mechanical Element	Design Benchmark	Owner Requirements
Mechanical Design	2019 CA Mechanical Code, Title 24, Part 4 ASHRAE 36-2021	Every zone temperature sensor or thermostat will have an integrated occupancy override button
Thermal Comfort	ASHRAE 55-2019 CA Table 4A	
Indoor Air Quality	ASHRAE 62.1-2019 CA Table 4A	
Acoustics	ASHRAE HVAC Applications, Chapter 48	
Vibration	ASHRAE HVAC Applications, Chapter 48	
Pressurization	ASHRAE 170 or CA Table 4A	

Reference the Mechanical, Plumbing, Electrical, and Building Automation System OPR's for information on the required equipment and controls to meet the HVAC goals.

6.2 Electrical Systems Commissioning

Specifications shall include commissioning requirements to ensure that the building delivered at the end of construction has fully operational electrical systems.

The table below shows the owner's requirements and provides a benchmark for the design team.

Electrical Element	Design Benchmark	Owner Requirements
Electrical Design	2019 CA Electrical Code, Title 24, Part 3 2019 CA Energy Code, Title 24, Part 6 section 130.5	
Lighting	2019 CA Electrical Code, Title 24, Part 6 2019 CA Green Building Standards Code, Title 24, Part 11	Include recommended foot-candles for typical space types and encourage task lighting vs. over-illumination
Lighting Controls	2019 CA Electrical Code, Title 24, Part 6 2019 CA Green Building Standards Code, Title 24, Part 11	Meet mandatory requirements but strive for Green Code Tier 2 Use Acuity nLight control to meet the UC Davis Health standard Include preferred control by room type where the code is not explicit

Reference the Mechanical, Plumbing, Electrical, and Building Automation System OPR's for information on the required equipment and controls to meet the Energy and Sustainability goals.

6.3 Plumbing Systems Commissioning

Specifications shall include commissioning services to ensure that the building delivered at the end of construction has fully operational plumbing systems.

The table below shows the owner's requirements and provides a benchmark for the design team.

Plumbing Element	Design Benchmark	Owner Requirements
Plumbing Design	2019 CA Plumbing Code, Title 24, Part 5 2019 CA Green Building Standards Code, Title 24, Part 11	Meet mandatory requirements but strive for Green Code Tier 2 at 25% savings
Domestic Hot Water	2019 CA Energy Building Standards Code, Title 24, Part 6	
Medical Gas Systems	NFPA 99-2018	
Landscape Irrigation	2019 CA Green Building Standards Code, Title 24, Part 11	Meet mandatory requirements but strive for Green Code Tier 2 at 25% savings

Reference the Mechanical, Plumbing, Electrical, and Building Automation System OPR's for information on the required equipment and controls to meet the plumbing goals.

6.4 Control Systems Commissioning

Specifications shall include commissioning requirements to ensure that the building delivered at the end of construction has a fully operational control system. (Johnson Controls Metasys® is the approved control system.)

The table below shows the owner's requirements and provides a benchmark for the design team.

Control Element	Design Benchmark	Owner Requirements
Supervisory Controller	UC Davis Health standards	Reference the BAS OPR
Unitary (Field) Controllers	UC Davis Health standards	Reference the BAS OPR
Field Devices	UC Davis Health standards	Reference the BAS OPR
User Views & Graphics	UC Davis Health standards	Reference the BAS OPR
Trends and Alarms	UC Davis Health standards	Reference the BAS OPR

Reference the Mechanical, Plumbing, Electrical, and Control System OPR's for information on the required equipment and controls to meet the BAS goals.

APPENDIX C

PREFERRED PLUMBING FIXTURES

Touchless Faucets
116.757.AB.1T

HyTronic Hand Sink Faucet

CHICAGO FAUCETS
Geberit Group

Product Type

Touch-free, programmable faucet with above-deck electronics

Features & Specifications

- Includes optional 1.5 GPM (5.7 L/min) laminar flow insert
- Internal Antenna Specifications: Peak Gain of the antenna: –5.47 dBi, Frequency range: 2400-2500 MHz, FCC ID: 2APTX-CFC01
- 40 second run time with hand presence. Safety auto-timeout feature will shut the water off after 40 seconds. Reactivate faucet by removing hands from the sensor for at least 10 seconds.
- Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App.
- Single hole (4" and 8" deck plates available, see Accessories)
- HyTronic® Curve spout with 1.5 GPM flow control
- Vandal Proof Pressure compensating Econo-Flo™ non-aerating laminar spray 0.5 GPM
- HyTronic® module kit with Bluetooth® communication
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.

Performance Specification

- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F

Warranty

- 3-Year Limited Electronics and Solenoid Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty
- 5-Year Limited Mechanical Warranty

Codes & Standards

- ASME A112.18.1/CSA B125.1
- ADA ANSI/ICC A117.1
- Complies with CALGreen requirements
- NSF/ANSI 372 Low Lead Content
- NSF/ANSI/CAN 61: Q ≤ 1

Provide non-aerating laminar flow.

Provide 131-AB-NF thermostatic mixing valve with internal check valve.

Provide EBPS emergency back up power battery.

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

Date _____

ECAST

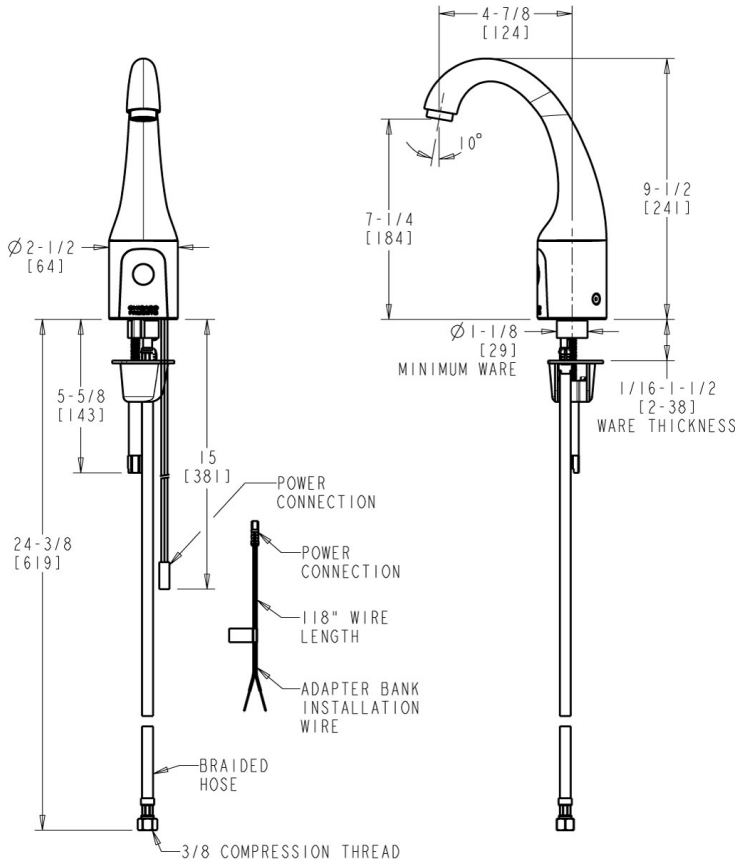
ECAST products are intended for installation where state laws and local codes mandate lead content levels or in any location where lead content is a concern.

2100 South Clearwater Drive
Des Plaines, IL
P: 847/803-5000
F: 847/803-5454
Technical: 800/TEC-TRUE
www.chicagofaucets.com

116.757.AB.1T

Architect/Engineer Specification

Chicago Faucets No. 116.757.AB.1T, HyTronic electronic faucet with dual-beam infrared sensor. Curve spout, chrome plated. Single-hole, deck mount. 0.5 GPM (1.9 L/min) vandal-proof, pressure compensating, Econo-Flo, non-aerating spray. Includes optional 1.5 GPM (5.7 L/min) insert. Single supply for tempered water. 12-volt AC transformer required (order separately). Flexible supply hoses included. Multiple field-adjustable modes and ranges. Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App. ECAST® construction with less than 0.25% lead content by weighted average. CALGreen compliant. This product meets ADA ANSI/ICC A117.1 requirements and is tested and certified to industry standards: ASME A112.18.1/CSA B125.1, Certified to NSF/ANSI 61, Section 9, California Health and Safety Code 116875 (AB1953-2006), Vermont Bill S.152, NSF/ANSI 372 Low Lead Content, and California Green Building Standards Code (CALGreen).



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

Chicago Faucets, member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports and sport facilities. Call 1.800.TECTRUE or 1.847.803.5000 Option 1 for installation or other technical assistance.

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Touchless Faucets
116.101.AB.1T

HyTronic Lavatory Faucet

CHICAGO FAUCETS
Geberit Group

Product Type

Touch-free, programmable faucet with above-deck electronics

Features & Specifications

- Includes optional 1.5 GPM (5.7 L/min) laminar flow insert
- Internal Antenna Specifications: Peak Gain of the antenna: –5.47 dBi, Frequency range: 2400-2500 MHz, FCC ID: 2APTX-CFC01
- 40 second run time with hand presence. Safety auto-timeout feature will shut the water off after 40 seconds. Reactivate faucet by removing hands from the sensor for at least 10 seconds.
- Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App.
- Single hole (4" and 8" deck plates available, see Accessories)
- HyTronic® Traditional spout
- Vandal Proof Pressure compensating Econo-Flo™ non-aerating laminar spray 0.5 GPM
- HyTronic® module kit with Bluetooth® communication
- ECAST® design provides durable cast brass construction with total lead content equal to or less than 0.25% by weighted average
- Complies with the requirements of the Buy American Act of 1933.

Performance Specification

- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F

Warranty

- 3-Year Limited Electronics and Solenoid Warranty
- Lifetime Limited Faucet Warranty
- 1-Year Limited Finish Warranty
- 5-Year Limited Mechanical Warranty

Codes & Standards

- ASME A112.18.1/CSA B125.1
- ADA ANSI/ICC A117.1
- Complies with CALGreen requirements
- NSF/ANSI 372 Low Lead Content
- NSF/ANSI/CAN 61: Q ≤ 1

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

Date _____

Provide 131-AB-NF thermostatic mixing valve with internal check valves.

Provide EBPS emergency power back up battery pack.

Provide non-aerating laminar flow.

ECAST

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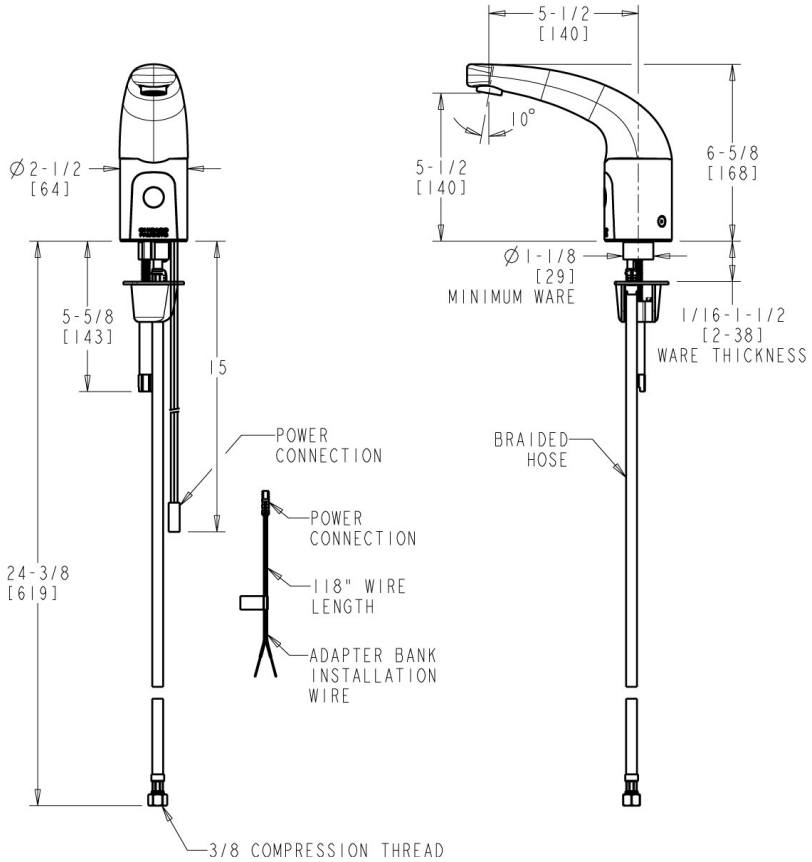
116.101.AB.1T

CHICAGO FAUCETS
Geberit Group

Architect/Engineer Specification

Chicago Faucets No. 116.101.AB.1T, HyTronic electronic faucet with dual-beam infrared sensor. Traditional-style integral spout, chrome plated. Single-hole deck mount. 0.5 GPM (1.9 L/min) vandal-proof, pressure compensating, Econo-Flo, non-aerating spray. Includes optional 1.5 GPM (5.7 L/min) insert. Single supply for tempered water. 12-volt AC transformer required (order separately). Flexible supply hose included. Multiple field-adjustable modes and ranges. Built-in Bluetooth® technology allows for easy adjustments and mode changes using a smartphone or tablet with the Chicago Faucets CF Connect App. ECAST® construction with less than 0.25% lead content by weighted average. CALGreen compliant. This product meets ADA ANSI/ICC A117.1 requirements and is tested and certified to industry standards: ASME A112.18.1/CSA B125.1, Certified to NSF/ANSI 61, Section 9, California Health and Safety Code 116875 (AB1953-2006), Vermont Bill S.152, NSF/ANSI 372 Low Lead Content, and California Green Building Standards Code (CALGreen).



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

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SPECIFICATIONS

Just Mfg Stainless Steel 19" x 18" x 5-1/2" Single Bowl Drop-in ADA Sink

Hand Sink

Model(s) SLADA17519A55-J

PRODUCT SPECIFICATIONS

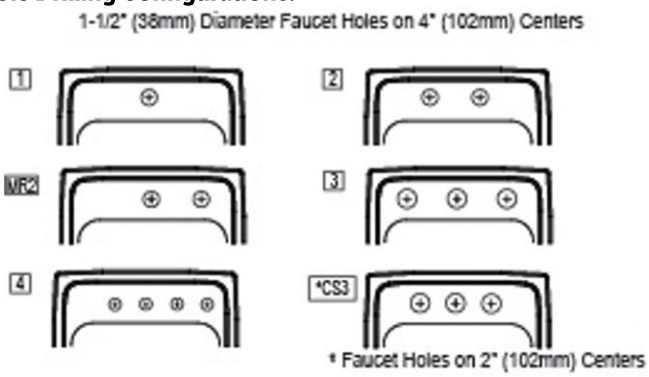
Just Mfg Stainless Steel 19" x 18" x 5-1/2" Single Bowl Drop-in ADA Sink. Sink is manufactured from 18 gauge 304 Stainless Steel with a Lustrous Satin finish, Rear Center drain placement, and Bottom only pads.

Installation Type:	Drop-in
Material:	304 Stainless Steel
Finish:	Lustrous Satin
Gauge:	18
Sound Deadening:	Bottom only pads
Number of Bowls:	1
Sink Dimensions:	19" x 18" x 5-1/2"
Bowl 1 Dimensions:	16" x 11-1/2" x 5-3/8"
Drain Size:	3-1/2" (89mm)
Drain Location:	Rear Center
Minimum Cabinet Size:	24"
Cutout Template #:	1000001260

Template is available for download at justmfg.com. CAD software will be required to open the template.

Cutout Dimensions for Drop-in Installation:
18-3/8" x 17-3/8" (467mm x 441mm) with 1-1/2" (38mm) corner radius

Hole Drilling Configurations:



Shown with one-hole configuration. Other configurations available.

Quality Grade Plumbing Products.
Since 1933 we have become the industry standard for designing and producing quality grade plumbing products and fixtures. Our role as an industry leader remains unsurpassed.

Product Compliance: ASME A112.19.3/CSA B45.4
ADA & ICC A117.1

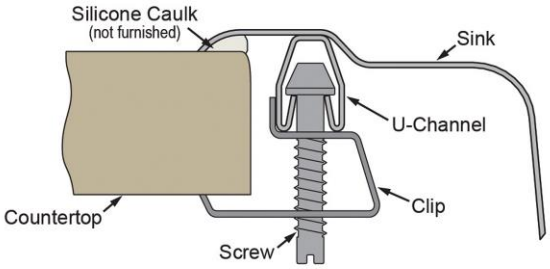
Complies with ADA & ICC A117.1 accessibility requirements when installed according to the requirements outlined in these standards.

Clean and Care Manual (PDF)
Installation Instructions (PDF) - 2000000856
Warranty (PDF)

PART:_____QTY: _____
PROJECT:_____
CONTACT:_____
DATE:_____
NOTES:_____
APPROVAL:_____

In keeping with our policy of continuing product improvement, Just Mfg reserves the right to change product specifications without notice. Please visit justmfg.com for the most current version of Just Mfg product specification sheets. This specification describes a product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Installation Profile:



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MURRO™ UNIVERSAL DESIGN WALL-HUNG LAVATORY WITH EVERCLEAN®

VITREOUS CHINA/ACRYLIC

BARRIER FREE

MURRO™ UNIVERSAL DESIGN WALL-HUNG LAVATORY WITH EVERCLEAN®

- Vitreous china with EverClean
- Available with rear overflow or less overflow
- Recessed self-draining deck
- For concealed arm or wall support
- Optional vitreous china shroud/knee contact guard 0059.020EC available
- Optional acrylic shroud/knee contact guard 0062.000 available
- ADA and TAS compliant

❏ **0954.004EC** Faucet holes on 102mm (4") Ctrs with overflow (Illustrated)
❏ **0954.123EC** Faucet holes on 102mm (4") Ctrs with overflow
  • Extra right-hand hole
❏ **0954.121EC** Faucet holes on 102mm (4") Ctrs with overflow
  • Extra left-hand hole
❏ **0954.904EC** Faucet holes on 102mm (4") Ctrs less overflow
❏ **0958.008EC** Faucet holes on 203mm (8") Ctrs with overflow
❏ **0958.908EC** Faucet holes on 203mm (8") Ctrs less overflow
❏ **0955.001EC** Center hole only with overflow
❏ **0955.123EC** Center hole only with overflow
  • Extra right-hand hole
❏ **0955.121EC** Center hole only with overflow
  • Extra left-hand hole
❏ **0955.901EC** Center hole only less overflow

Nominal Dimensions:
520mm (20.5") deep, 540mm (21-1/4") wide

Bowl sizes:
394mm (15-1/2") wide, 343mm (13-1/2") front to back, 127mm (5") deep

❏ **0062.000 Acrylic Shroud/Knee Contact Guard**
(Must be purchased separately)

❏ **0059.020EC Shroud/Knee Contact Guard**
(Vitreous China with EverClean)
(Must be purchased separately)

Shown with 0062.000 shroud

Shown with 0059.020EC shroud

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

To Be Specified:
❏ Color: ❏ White
❏ Optional Acrylic Shroud/Knee Contact Guard: 0062.000
❏ Optional Vitreous China Shroud/Knee Contact Guard: 0059.020EC
❏ Faucet*:
❏ Faucet Finish:
❏ Supplies:
❏ 1-1/4" Trap:
❏ Nipple:

* See faucet section for additional models available

Compliance Certifications -
Meets or Exceeds the Following Specifications:
• ASME A112.19.2 for Vitreous China Fixtures

ADA **MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**
Top of front rim mounted 864mm (34") from finished floor.

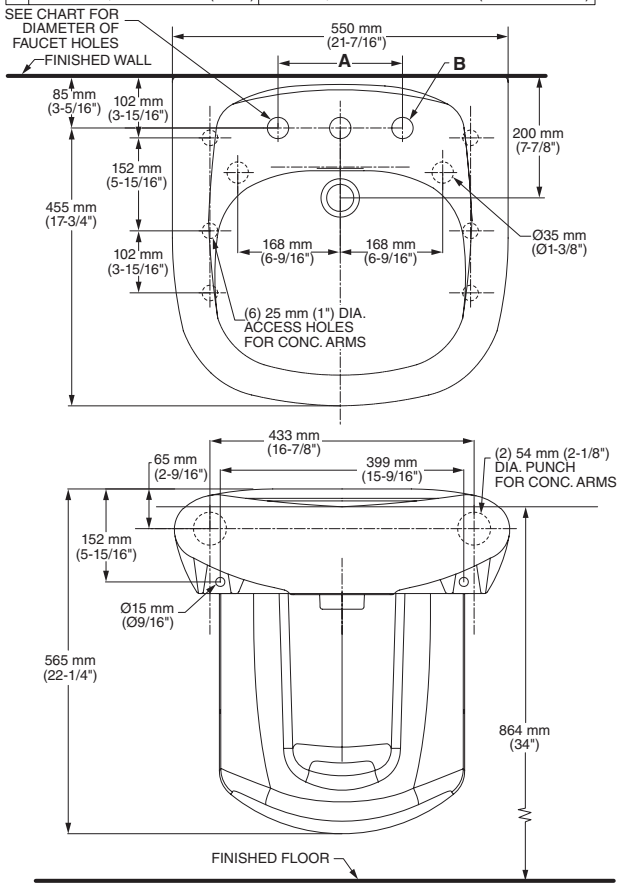
MURRO™ UNIVERSAL DESIGN WALL-HUNG LAVATORY WITH EVERCLEAN®

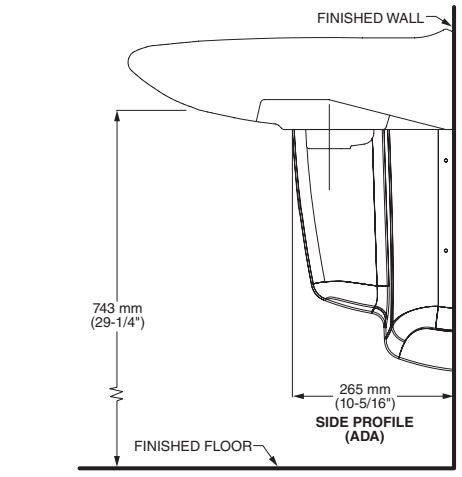
VITREOUS CHINA/ACRYLIC

BARRIER FREE

MURRO WITH ACRYLIC SHROUD

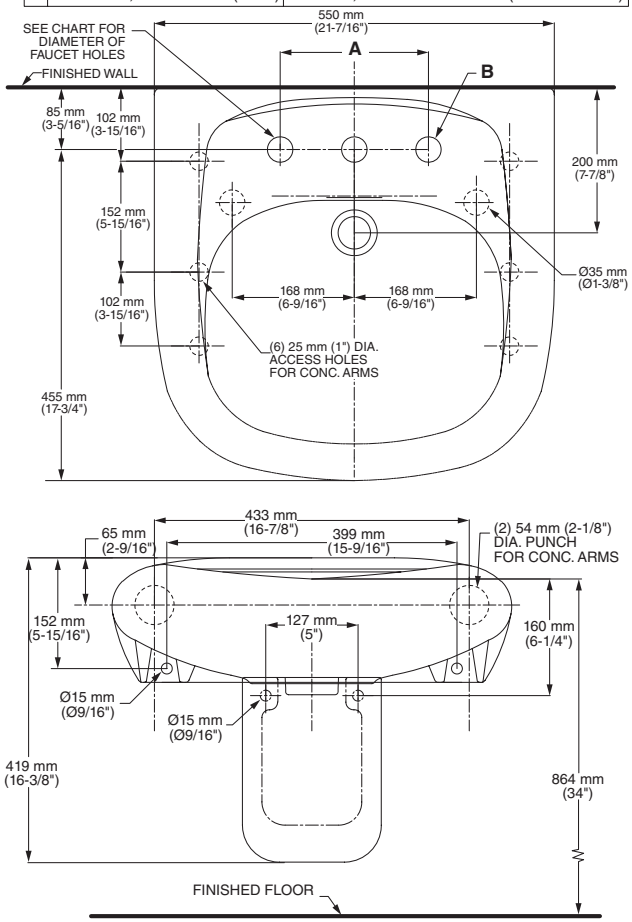
FAUCET HOLE SPREAD AND DIAMETER		
A	4" (102mm)	8" (203mm)
B	Ø 31.8mm, 1-1/4" ± 1/8" (3mm)	Ø 35mm, 1-3/8" + 1/8" - 1/16" (+3mm/-1.5mm)

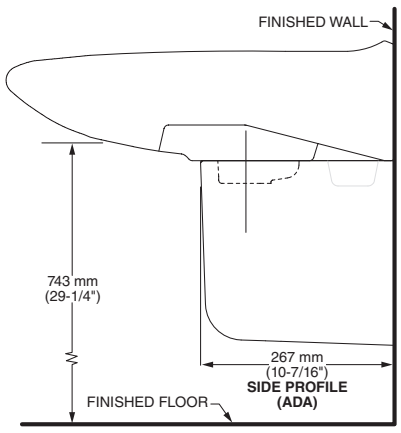




MURRO WITH VITREOUS CHINA SHROUD

FAUCET HOLE SPREAD AND DIAMETER		
A	4" (102mm)	8" (203mm)
B	Ø 31.8mm, 1-1/4" ± 1/8" (3mm)	Ø 35mm, 1-3/8" + 1/8" - 1/16" (+3mm/-1.5mm)





NOTES:
● LOOSE KEY ANGLE STOPS, LESS WALL ESCUTCHEONS. SUPPLIES REQUIRED.
* DIMENSIONS SHOWN FOR LOCATION OF SUPPLIES AND "P" TRAP ARE SUGGESTED.
SHROUD/KNEE CONTACT GUARD 0059.020 NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
■ SUITABLE FOR REINFORCEMENT ONLY, ACTUAL DIMENSIONS MUST BE TAKEN FROM FIXTURE.
FITTINGS NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.
INSTALLATION INSTRUCTIONS SUPPLIED WITH LAVATORY.
IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2.
These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

Lavatory - Rectangular (Undermount Preferred)

Verticyl®

19-3/4" rectangular undermount bathroom sink

K-2882

Features

- Geometric rectangular basin with vertical sides
- Overflow drain
- No faucet holes; requires wall- or counter-mount faucet

Material

- Vitreous china

Installation

- Undermount

Recommended Products/Accessories

K-8998 P-Trap
K-23726 Drain treatment
K-23725 Cast iron cleaner

Included Components

1193643 Basin clamps

ADA

Codes/Standards

ASME A112.19.2/CSA B45.1
ADA
ICC/ANSI A117.1
IAPMO Certification

KOHLER® One-Year Limited Warranty

See website for detailed warranty information.

Available Colors/Finishes

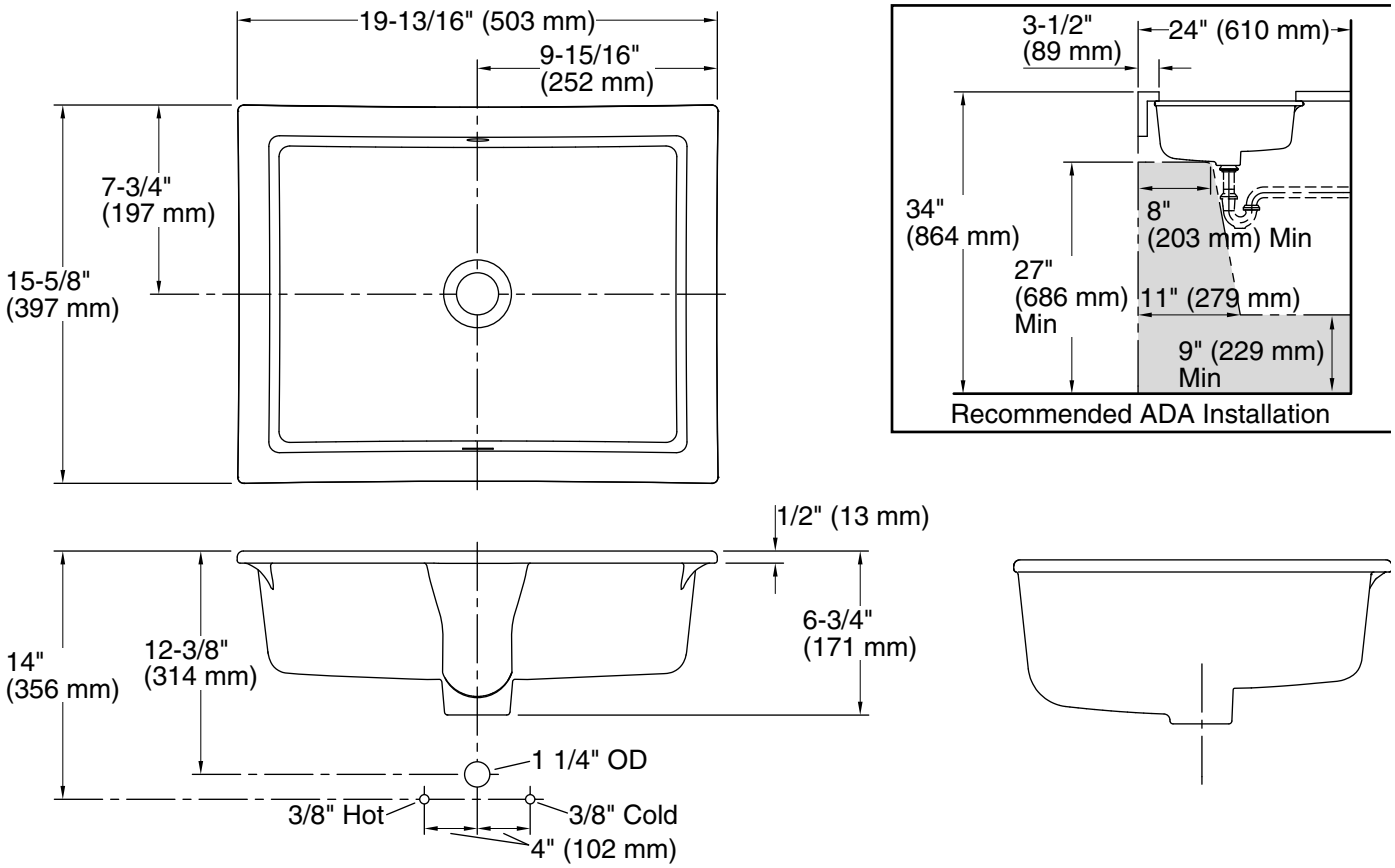
Color tiles intended for reference only.

Color	Code	Description
	0	White
	96	Biscuit
	NY	Dune
	95	Ice™ Grey
	58	Thunder™ Grey
	7	Black Black™
	17	Teal
	42	Aspen Green

Verticyl®

19-3/4" rectangular undermount bathroom sink

K-2882



Technical Information

All product dimensions are nominal.

Bowl configuration:	Single
Bowl area (Only):	Length: 17-1/4" (438 mm) Width: 13" (330 mm) Water depth: 3-1/8" (79 mm)
With overflow:	Yes
Drain hole:	1-3/4" (44 mm)
Template:	1109226-7, required, not included

Notes

Install this product according to the installation instructions.

NOTICE: Countertop manufacturer or cutter must use the current product template available at www.kohler.com, or by calling 1-800-4KOHLER. Kohler Co. is not responsible for cutout errors when the incorrect cutout template is used.

ADA compliant when installed to the specific requirements of these regulations.

American Standard
Style That Works Better

BARRIER FREE

OVALYN UNIVERSAL ACCESS™ UNDERCOUNTER SINK

VITREOUS CHINA

OVALYN UNIVERSAL ACCESS™ SINK

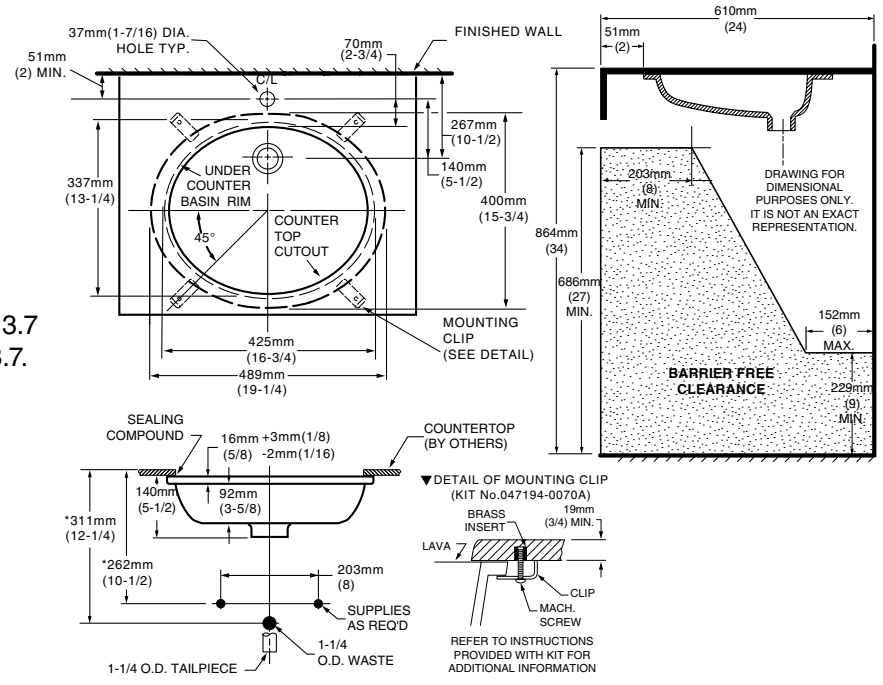
- Made from vitreous china
- Unglazed rim for under counter mount
- Rear overflow
- Supplied with mounting kit (047194-0070A) and template

❑ **9482.000**

Nominal Dimensions:
489 x 400mm
(19-1/4" x 15-3/4")

Bowl sizes:
425mm (16-3/4") wide
337mm (13-1/4") front to back
140mm (5-1/2") deep
102mm (4") bowl depth

Compliance Certifications - Meets or Exceeds the Following Specifications:
- ASME A112.19.2M for Vitreous China Fixtures
- CAN/CSA B45 series
- 1995 National Building Code, section 3.7 and CAN/CSA-B651-M90 and OBC 3.7.



To Be Specified:
❑ Color: ❑ White ❑ Bone
❑ Linen ❑ Silver
❑ Fawn Beige ❑ Black
❑ Faucet*:
❑ Faucet Finish:
❑ Supplies:
❑ 1-1/4" Trap:

* See faucet section for additional models available

For Universal Design Options, top of counter may be mounted at 813mm (32") minimum from finished floor to meet ADA and ANSI A117.1 requirements. A 838mm (33") minimum mounting height is required for Ontario. Check local codes for heights and faucet handles requirements.

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.
Countertop 864mm (34") from finished floor. Lavatory installed 51mm (2") MIN. from front edge of countertop. Countertop thickness to be 25mm (1") maximum.

NOTES:
* DIMENSIONS SHOWN FOR LOCATION OF SUPPLIED AND "P" TRAP ARE SUGGESTED.
▼ UNDERCOUNTER MOUNTING KIT SUPPLIED WITH BASIN.
FITTINGS NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
USE ENCLOSED TEMPLATE FOR COUNTERTOP CUTOUT
SEALING COMPOUND SUPPLIED BY OTHERS.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

SPECIFICATIONS

Just Mfg Stainless Steel 22" x 19-1/2" x 4" 3-Hole Single Bowl Drop-in ADA Sink

Break Room Sink

Model(s) SLADA1921A403-J

PRODUCT SPECIFICATIONS

Just Mfg Stainless Steel 22" x 19-1/2" x 4" 3-Hole Single Bowl Drop-in ADA Sink. Sink is manufactured from 18 gauge 304 Stainless Steel with a Lustrous Satin finish, Rear Center drain placement, and Bottom only pads.

Installation Type:	Drop-in
Material:	304 Stainless Steel
Finish:	Lustrous Satin
Gauge:	18
Sound Deadening:	Bottom only pads
Number of Bowls:	1
Sink Dimensions:	22" x 19-1/2" x 4"
Bowl 1 Dimensions:	18" x 14" x 4"
Drain Size:	3-1/2" (89mm)
Drain Location:	Rear Center
Minimum Cabinet Size:	27"
Cutout Template #:	1000001255

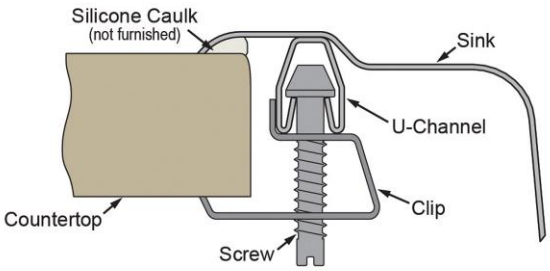
Template is available for download at justmfg.com. CAD software will be required to open the template.

Cutout Dimensions for Drop-in Installation:
21-3/8" x 18-7/8" (543mm x 479mm) with 1-1/2" (38mm) corner radius

Hole Drilling Configurations:

Hole #	Description
3	3 Faucet Holes on 4" Centers

Installation Profile:

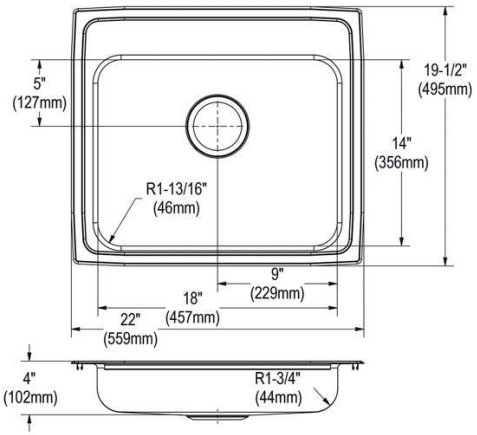


Quality Grade Plumbing Products.
Since 1933 we have become the industry standard for designing and producing quality grade plumbing products and fixtures. Our role as an industry leader remains unsurpassed.

Product Compliance: ADA & ICC A117.1
ASME A112.19.3/CSA B45.4

Complies with ADA & ICC A117.1 accessibility requirements when installed according to the requirements outlined in these standards.

Clean and Care Manual (PDF)
Installation Instructions (PDF) - 2000000856
Warranty (PDF)



PART:_____QTY: _____

PROJECT:_____

CONTACT:_____

DATE:_____

NOTES:_____

APPROVAL:_____

In keeping with our policy of continuing product improvement, Just Mfg reserves the right to change product specifications without notice. Please visit justmfg.com for the most current version of Just Mfg product specification sheets. This specification describes a product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Manual Sink Faucets
436-ABBN

Break Room Faucet

CHICAGO FAUCETS
Geberit Group

Product Type

Deck-mounted kitchen faucet, single-hole mount, high arc faucet

Features & Specifications

- User adjustable temperature control mixer
- 1.5 GPM (5.7 L/min) laminar flow outlet
- Single hole
- Laminar flow outlet for 436 Series faucet, 1.5 GPM
- Ceramic operating cartridge with volume control and hot water limit stop

Performance Specification

- Rated Operating Pressure: 20-125 PSI
- Rated Operating Temperature: 40-140°F (Note: 180°F max. during temporary high-temperature system flush)

Warranty

- 5-Year Limited Faucet Warranty
- 5-Year Limited Cartridge Warranty
- 1-Year Limited Finish Warranty

Codes & Standards

- ASME A112.18.1/CSA B125.1
- ADA ANSI/ICC A117.1
- NSF/ANSI/CAN 61: Q ≤ 1

Job Name _____

Item Number _____

Section/Tag _____

Model Specified _____

Architect _____

Engineer _____

Contractor _____

[ ] Submitted as Shown [ ] Submitted with Variations

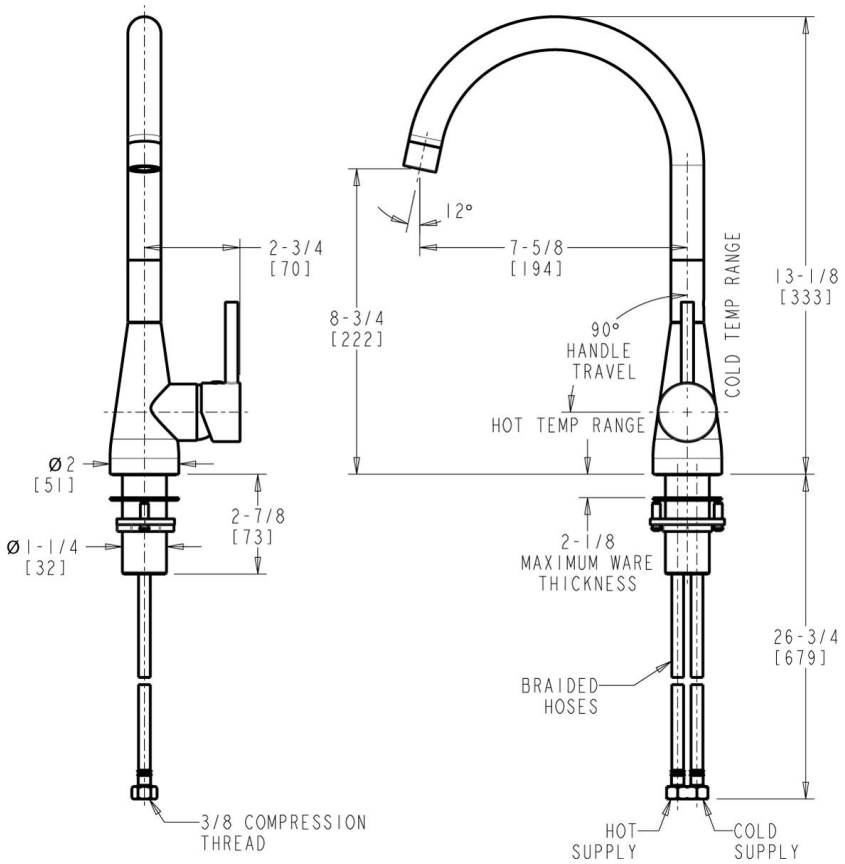
Date _____

2100 South Clearwater Drive
Des Plaines, IL
P: 847/803-5000
F: 847/803-5454
Technical: 800/TEC-TRUE
www.chicagofaucets.com

436-ABBN

Architect/Engineer Specification

Chicago Faucets No. 436-ABBN, Sink Faucet for hot and cold water, single lever, deck-mounted with single hole mounting, brushed nickel finish. Integral, tubular SUS 304 stainless steel spout. 1.5 GPM (5.7 L/min) laminar flow outlet. Flexible supply hoses included. ECAST® construction with less than 0.25% lead content by weighted average. CALGreen compliant. This product meets ADA ANSI/ICC A117.1 requirements and is tested and certified to industry standards: Certified to NSF/ANSI 61, Section 9, and California Green Building Standards Code (CALGreen).



Operation and Maintenance

Installation should be in accordance with local plumbing codes. Flush all pipes thoroughly before installation. After installation, remove spout outlet or flow control and flush faucet thoroughly to clear any debris. Care should be taken when cleaning the product. Do not use abrasive cleaners, chemicals or solvents as they can result in surface damage. Use mild soap and warm water for cleaning and protecting the life of Chicago Faucet products. For specific operation and maintenance refer to the installation instructions and repair parts documents that are located at www.chicagofaucets.com.

Chicago Faucets, member of the Geberit Group, is the leading brand of commercial faucets and fittings in the United States, offering a complete range of products for schools, laboratories, hospitals, office buildings, food service, airports and sport facilities. Call 1.800.TECTRUE or 1.847.803.5000 Option 1 for installation or other technical assistance.

2100 South Clearwater Drive
Des Plaines, IL
P: 847/803-5000
F: 847/803-5454
Technical: 800/TEC-TRUE
www.chicagofaucets.com

Floor Mounted Water Closet

Madera™ FloWise® 16-1/2" Height Elongated Flushometer Toilet

VITREOUS CHINA LESS EVERCLEAN®

BARRIER FREE

Madera™ FloWise® 16-1/2" Height Elongated LESS EverClean®

- Floor mount flushometer valve toilet
- Vitreous china
- High Efficiency, Low Consumption. Operates in the range of 1.1 gpf to 1.6 gpf (4.2 Lpf to 6.0 Lpf)
- Meets definition of HET (High Efficiency Toilet) when used with a high efficiency flush valve (1.1, 1.28 gpf or 1.6 / 1.1 gpf dual flush)
- Fully glazed 2-1/8" trapway
- Elongated bowl
- 10" or 12" roughing-in
- 16-1/2" rim height for accessible application
- Condensation channel
- Powerful direct-fed siphon jet action
- 10" x 12" water surface area
- 1-1/2" inlet spud
- 2 bolt caps included
- Tested to support static weight load of 2,500 lbs. (1,134 kg)

❑ **3043.001** Elongated bowl only, top spud
❑ **3248.001** Elongated bowl only, top spud with slotted rim for bedpan holding
❑ **3249.001** Elongated bowl only, back spud

Component Parts:
❑ **047007-0070A** Inlet Spud (furnished with bowl)
❑ **034783-0200A** Bolt caps with retainers (furnished with bowl)

Nominal Dimensions:
718 x 356 x 419mm
(28-1/4" x 14" x 16-1/2")

Fixture only, less seat and flush valve

Compliance Certifications -
Meets or Exceeds the Following Specifications:
- ASME A112.19.2 / CSA B45.1 for Vitreous China Fixtures

Also available in non-ADA.

Provide self-sustaining check hinge.

Consider using floor mounted ADA patient toilets to accommodate bariatric patients.

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

System MaP* Score:
- 1,000 grams of miso @ 1.1 gpf, 1.28 gpf or 1.6 gpf when used with an American Standard flush valve

* Maximum Performance (MaP) testing performed by IAPMO R&T Lab. MaP Report conducted by Veritec Consulting, Inc. and Koeller and Company.

OPERATING PRESSURE:
25 psi (flowing) - 80 psi (static)

FLOW REQUIREMENT:
25 gpm (94.6 L/min.)

To Be Specified:
❑ Color: ❑ White
❑ Seat:
- ❑ American Standard #5901.100 Heavy duty open front less cover
- ❑ American Standard #5901.100SS Extra heavy duty open front less cover with EverClean®

❑ Flushometer Valve:

ENVIROMENTAL PRODUCT DECLARATION

When used with **1.1 or 1.28 gpf** toilet flush valves

EVERCLEAN

WATER EFFICIENT

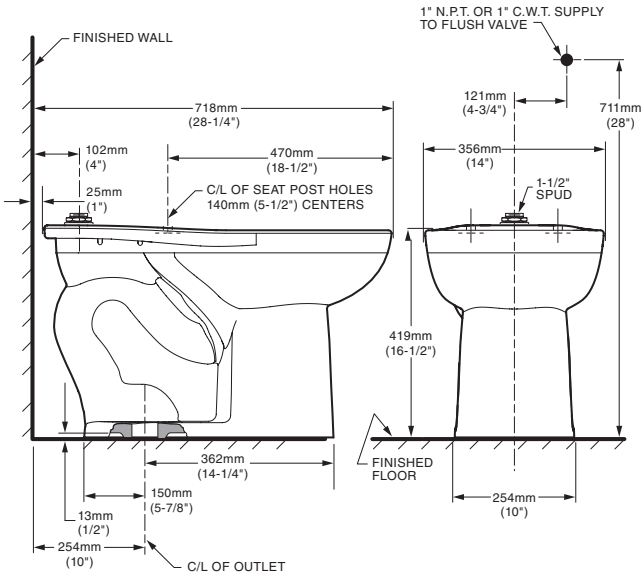
MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES - CHECK LOCAL CODES.

Madera™ FloWise® 16-1/2" Height Elongated Flushometer Toilet

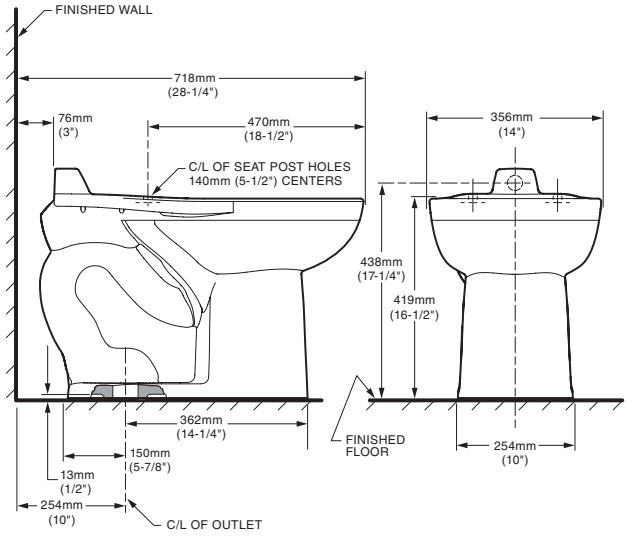
VITREOUS CHINA LESS EVERCLEAN®

BARRIER FREE

3043.001/3248.001



3249.001



NOTES:
PRODUCT 3043 SHOWN, 3248 SAME EXCEPT WITH SLOTTED RIM FOR BED PAN HOLDING.
TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON THE FLUSHOMETER VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING.
THIS TOILET DESIGNED TO ROUGH-IN AT A MINIMUM DIMENSION OF 254MM (10") AND A MAXIMUM DIMENSION OF 305MM (12") FROM FINISHED WALL TO C/L OF OUTLET.
FLUSHOMETER VALVE NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY. FLUSHOMETER VALVE REQUIREMENTS FOR 12" (305MM) ROUGH-IN: SWEAT EXTENSION NIPPLE IS REQUIRED. REFER TO VALVE MANUFACTURER AND LOCAL CODES.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

Wall Mounted Water Closet

Afwall® Millennium™ FloWise® Elongated Flushometer Toilet

VITREOUS CHINA with EVERCLEAN®

BARRIER FREE

Afwall® Millenium™ FloWise® Elongated Flushometer Toilet with EverClean®

- Wall-mounted flushometer valve toilet
- Vitreous china
- High Efficiency, Low Consumption. Operates in the range of 1.1 gpf to 1.6 gpf (4.2 Lpf to 6.0 Lpf)
- Meets definition of HET (High Efficiency Toilet) when used with a high efficiency flush valve (1.1 gpf - 1.6 gpf or 1.28/1.1 gpf dual flush)
- Maximum Performance (MaP) score of 1,000 grams at 1.1 gpf - 1.6 gpf
- Permanent EverClean® antimicrobial surface inhibits the growth of stain- and odor-causing bacteria, mold, and mildew on the surface
- Condensation channel
- Concealed trapway design
- Elongated bowl
- Powerful direct-fed siphon jet action
- 1-1/2" inlet spud
- Fully-glazed 2-1/8" trapway
- 10" x 12" water surface area
- Tested to support static weight load of 1,000 lbs. (454 kg)

❏ **3351.101** Elongated bowl only, top spud
❏ **3352.101** Elongated bowl only, top spud with slotted rim for bedpan holding
❏ **3353.101** Elongated bowl only, back spud
❏ **3354.101** Elongated bowl only, back spud with slotted rim for bedpan holding

System MaP* Score:

- 1,000 grams of miso @ 1.1 gpf to 1.6 gpf when used with an American Standard flush valve

* Maximum Performance (MaP) testing performed by IAPMO R&T Lab. MaP report conducted by Gauley Associates Ltd. and Koeller and Company.

Component Parts:

❏ **047007-0070A** Inlet Spud (furnished with bowl)

Nominal Dimensions:

660 x 356 x 381mm
(26" x 14" x 15")

Recommended working pressure–between 25 psi at valve when flushing and 80 psi static

Fixture only, less seat, bolt caps, and flushometer valve

Compliance Certifications - Meets or Exceeds the Following Specifications:

- ASME A112.19.2/CSA B45.1 for Vitreous China Fixtures

* This product is not recommended for bariatric use.

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES - CHECK LOCAL CODES.

- When installed so top of seat is 432 to 483mm (17" to 19") from the finished floor.

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

To Be Specified:

❏ Color: ❏ White
❏ Seat:
  ❏ American Standard #5901.100 Heavy duty open front less cover
  ❏ American Standard #5905.100 Extra heavy duty open front less cover
❏ Flushometer Valve:
  ❏ 1.6 gpf:
    ❏ Sensor-Operated: American Standard Selectronic®
      DC Power #6065.161.002 (Top Spud)
      AC Power #6067.161.002 (Top Spud)
    ❏ Manual: American Standard #6047.161.002 (Top Spud)
  ❏ 1.28 gpf:
    ❏ Sensor-Operated: American Standard Selectronic®
      DC Power #6065.121.002 (Top Spud)
      AC Power #6067.121.002 (Top Spud)
    ❏ Manual: American Standard #6047.121.002 (Top Spud)
  ❏ 1.6 / 1.1 gpf Dual Flush:
    ❏ Sensor-Operated: American Standard Selectronic®
      DC Power #6065.761.002 (Top Spud)
      AC Power #6067.761.002 (Top Spud)
  ❏ 1.28 / 1.1 gpf Dual Flush:
    ❏ Sensor-Operated: American Standard Selectronic®
      DC Power #6065.721.002 (Top Spud)
      AC Power #6067.721.002 (Top Spud)

ENVIROMENTAL PRODUCT DECLARATION

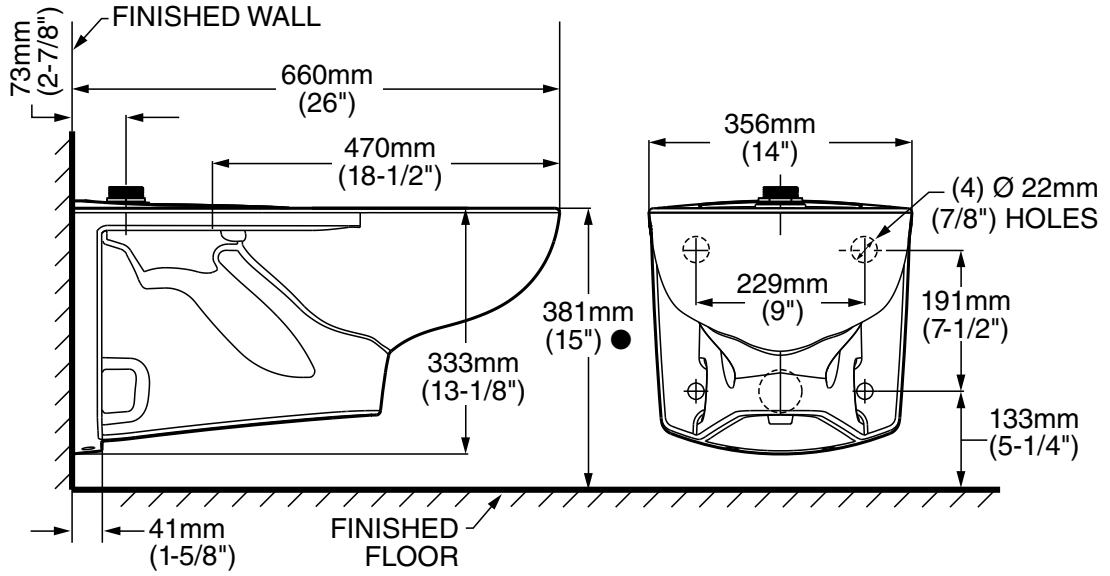
When used with **1.1 or 1.28 gpf** toilet flush valves

ADA COMPLIANT

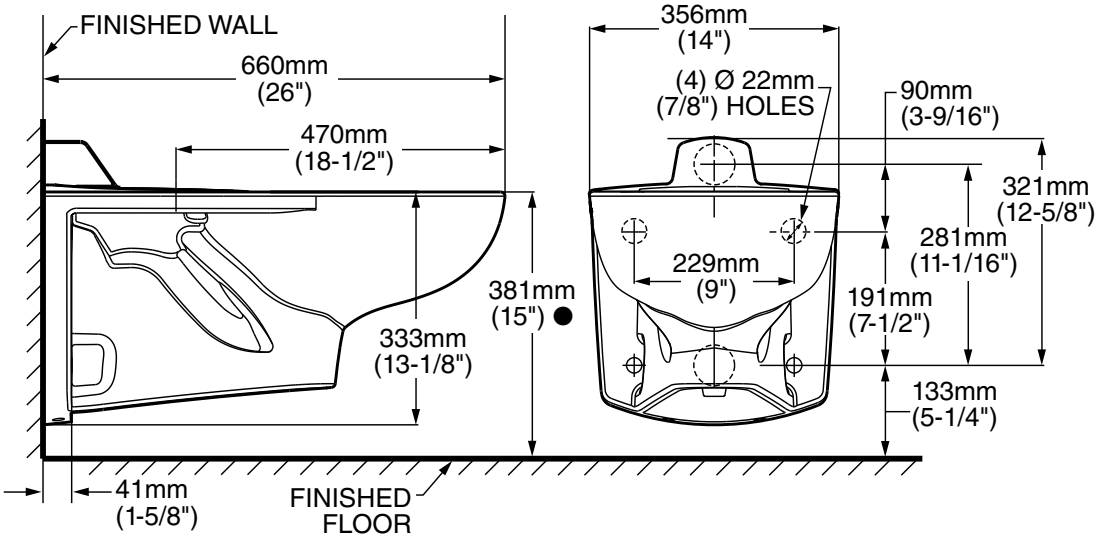
EVERCLEAN

WATER EFFICIENT

3351.101/3352.101



3353.101/3354.101



NOTES:

● Toilet designed to meet ADA accessibility standards when top of seat height set at 432 to 483mm (17" to 19") from finished floor.

PRODUCT 3351 AND 3353 SHOWN, 3352 AND 3354 SAME EXCEPT WITH SLOTTED RIM FOR BED PAN HOLDING.
WASTE OUTLET SEAL RING MUST BE NEOPRENE OR GRAPHITE-FELT (WAX RING NOT RECOMMENDED).
SUGGESTED 2mm (1/16) CLEARANCE BETWEEN FACE OF WALL AND BACK OF BOWL.
TO COMPLY WITH AREA CODE GOVERNING THE HEIGHT OF VACUUM BREAKER ON THE FLUSHOMETER VALVE, THE PLUMBER MUST VERIFY DIMENSIONS SHOWN FOR SUPPLY ROUGHING.
FLUSHOMETER VALVE NOT INCLUDED WITH FIXTURE AND MUST BE ORDERED SEPARATELY.
CARRIER FITTING AS REQUIRED TO BE FURNISHED BY OTHERS.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORT.

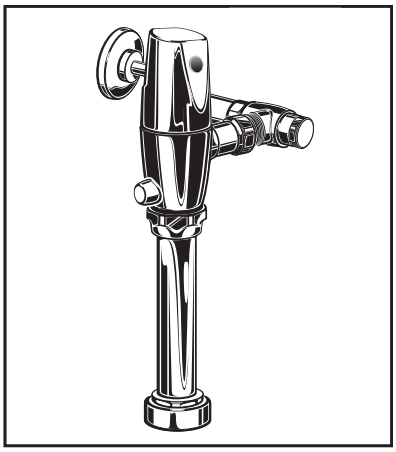
IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages

American Standard

WC Flush Valve Dual Flush Hardwired 1.6/1.1 GPF

SELECTRONIC® SENSOR-OPERATED TOILET FLUSH VALVE

HARD-WIRED AC POWER, BASE MODEL



BASE MODEL: (Does Not Include Power Supply)

❑ **606B.161** Base Model, 1.6 gpf/6.0 Lpf
For use with Hard-Wired AC or Multi-AC power kits. 11-1/2" rough-in

❑ **606B.121** Base Model, 1.28 gpf/4.8 Lpf
SAME AS ABOVE

❑ **606B.111** Base Model, 1.1 gpf/4.2 Lpf
SAME AS ABOVE

❑ **606B.761** Base Model, Dual Flush 1.6/1.1 gpf/6.0/4.2 Lpf
SAME AS ABOVE

❑ **606B.721** Base Model, Dual Flush 1.28/1.1 gpf/4.8/4.2 Lpf
SAME AS ABOVE

GENERAL DESCRIPTION:

Exposed, Sensor Operated Selectronic Water Closet Flush Valve for floor-mounted or wall-hung 1-1/2" top spud bowls.

Inlet includes 1" I.P.S. angle stop with back-flow protection, vandal-resistant cap, sweat solder kit, cover tube and wall flange.

Outlet includes 1-1/2" vacuum breaker, spud coupling and flange.

PRODUCT FEATURES:

- **Self-Cleaning Piston** with integral wiper spring significantly reduces clogging and maintenance
- **No Routine Maintenance:** no diaphragms to replace; no filters to clean
- **Optional Cover Plate** for transformer installation from the front
- **Selectronic Proximity System** with universal sensor provides hygienic, "hands free" operation
- **State-of-the-Art Electronics** prevent ghost flushing
- **Dezincification Resistant** brass alloy
- **Fully Mechanical Manual Override Button** can flush the valve without power
- **Fail-Safe:** Valve automatically closes upon loss of power or water pressure and does not need to be reset
- **Adjustable Sanitary Flush** cleans the fixture & maintains the trap seal.
- **Chemical Resistant EPDM Seals** for extended life
- **High Back Pressure Vacuum Breaker**
- **Adjustable Tailpiece**
- **Range can be adjusted manually or with optional remote control**
- **No external volume adjustment**
- **Can be installed left or right handed**

POWER KITS: (Must be Purchased Separately)

❑ **PK00.HAC** Hard-Wired AC transformer, 10' extension cable and capacitor module

❑ **PK00.MAC** Multi-AC adapter and 10" extension cable

OPTIONAL Battery Back-up

❑ **PK00.BBU** Allows faucet to continously operate during a power failure

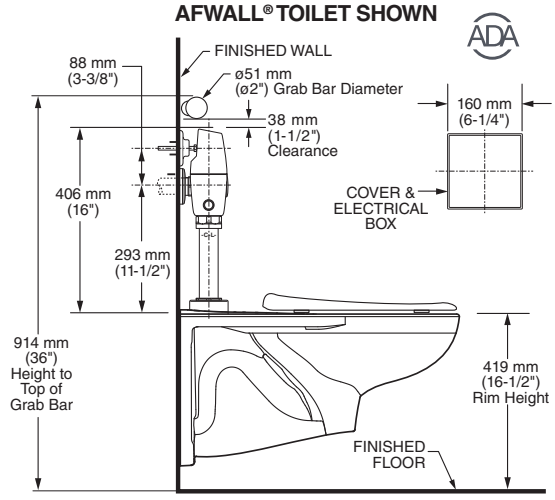
OPERATING PRESSURE:

25 psi (flowing) - 80 psi (static)

FLOW REQUIREMENT:

25 gpm/94.6 L/min

ADA WATER CLOSET INSTALLATION:
AFWALL® TOILET SHOWN



** Flush Valve can be installed to meet ADA 2010 Section 609 when installed as shown

RECOMMENDED SPECIFICATION:

Electronic proximity infrared sensor activated toilet flush valve shall feature self-cleaning piston valve. Includes a fully mechanical manual over-ride that can provide a complete flush without power. Includes dezincification-resistant brass valve body and metal cover with chrome finish and vandal resistant stop cap. Angle stop with back-flow protection and vacuum breaker included. Flush valve shall be American Standard Model # 606B.___.002

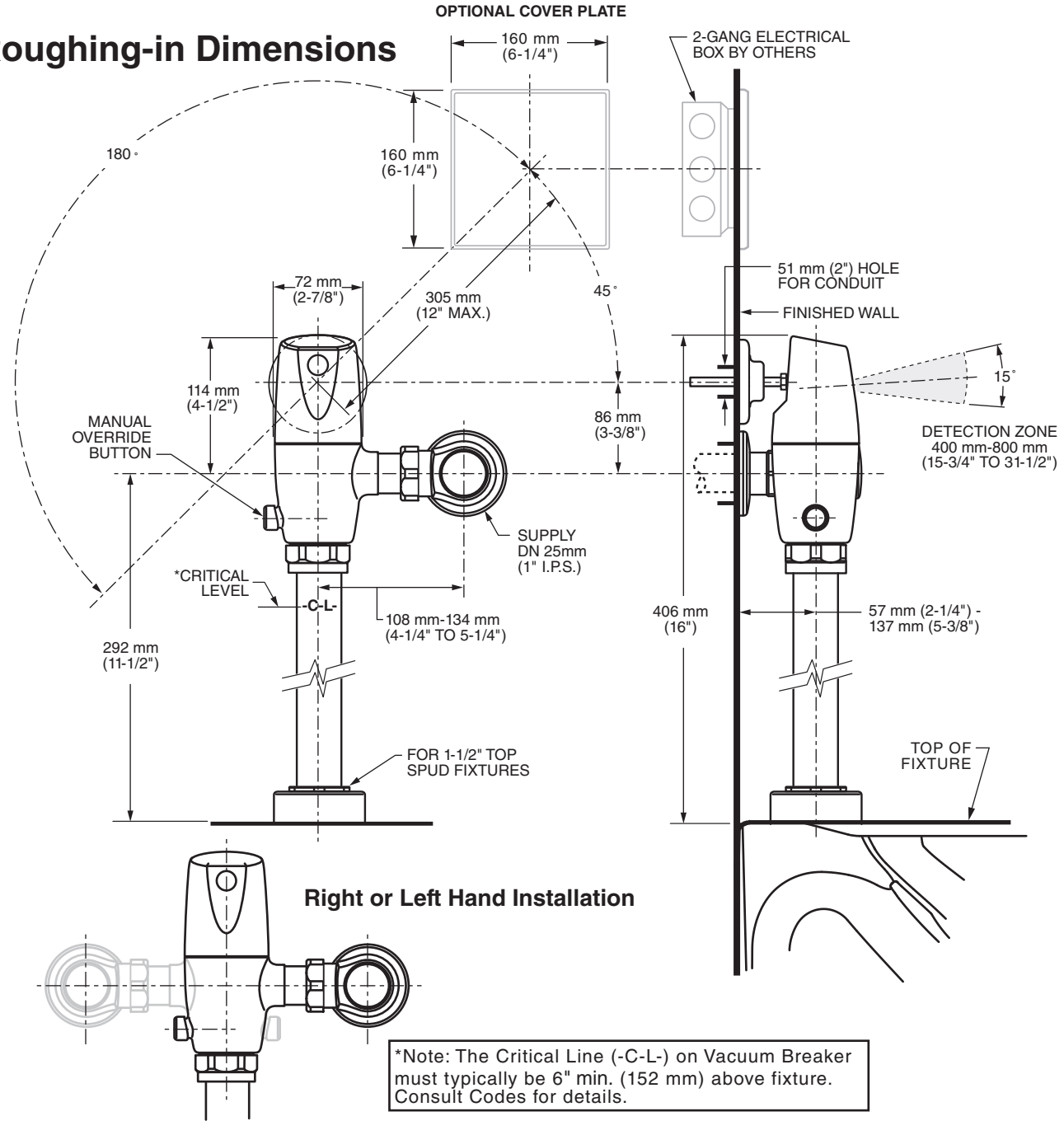
SELECTRONIC® SENSOR-OPERATED TOILET FLUSH VALVE

HARD-WIRED AC POWER, BASE MODEL

LISTINGS:

- ASSE 1037
- ANSI/ASME A112.19.2
- ADA Compliant

Roughing-in Dimensions



Right or Left Hand Installation

*Note: The Critical Line (-C-L-) on Vacuum Breaker must typically be 6" min. (152 mm) above fixture. Consult Codes for details.

ADA Meets the American Disabilities Act Guidelines and **ANSI A117.1** Requirements for accessible and usable building facilities - check local codes

PART OF LIXIL

Urinal with 0.125 Flush Valve

Washbrook® FloWise® Universal Urinal

VITREOUS CHINA

BARRIER FREE

Washbrook® FloWise® Universal Urinal

- Vitreous china
- Ultra High Efficiency, Low Consumption. Operates in the range of 0.125gpf to 1.0gpf (0.5 Lpf to 3.8 Lpf)
- Flushing rim
- Elongated 14" rim from finished wall
- Washout flush action
- Extended sides for privacy
- 3/4" inlet spud
- Outlet connection threaded 2" inside (NPTF)
- 2 wall hangers
- Fixture only
- Strainer included
- Meets ASME flush requirements at 0.125 to 1.0 gpf

❏ **6590.001** Universal Top spud
❏ **6515.001** Universal Back spud

Nominal Dimensions:
360 x 480 x 664mm
(14-1/8" x 18-7/8" x 26-1/8")

Recommended working pressure – between 20 psi at valve when flushing and 80 psi static

Compliance Certifications -
Meets or Exceeds the Following Specifications:
- ASME A112.19.2-2008/CSA B45.1-08 for Vitreous China Fixtures

SEE REVERSE FOR ROUGHING-IN DIMENSIONS

To Be Specified:
❏ Color: ❏ White
❏ Flush Valve:

1.0 gpf Flush Valve: Sensor-Operated:
- ❏ American Standard Selectronic® #6063.101.002 DC Power (Top Spud)
- ❏ American Standard Selectronic® #6062.101.002 AC Power (Back Spud)

1.0 gpf Flush Valve: Manual-Operated:
- ❏ American Standard # 6045.101.002

0.5 gpf Flush Valve: Sensor-Operated:
- ❏ American Standard Selectronic® #6063.051.002 DC Power (Top Spud)
- ❏ American Standard Selectronic® #6062.051.002 AC Power (Back Spud)

0.5 gpf Flush Valve: Manual-Operated:
- ❏ American Standard #6045.051.002

0.125 gpf Flush Valve: Sensor-Operated:
- ❏ American Standard Selectronic® #6063.013.002 DC Power (Top Spud)
- ❏ American Standard Selectronic® #6062.013.002 AC Power (Back Spud)

0.125 gpf Flush Valve: Manual-Operated:
- ❏ American Standard #6045.013.002

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.
● When installed so top of rim is 432mm (17") MAXIMUM from finished floor.

When used with **0.125 gpf** urinal flush vale

When used with **0.125 or 0.5 gpf** urinal flush vale

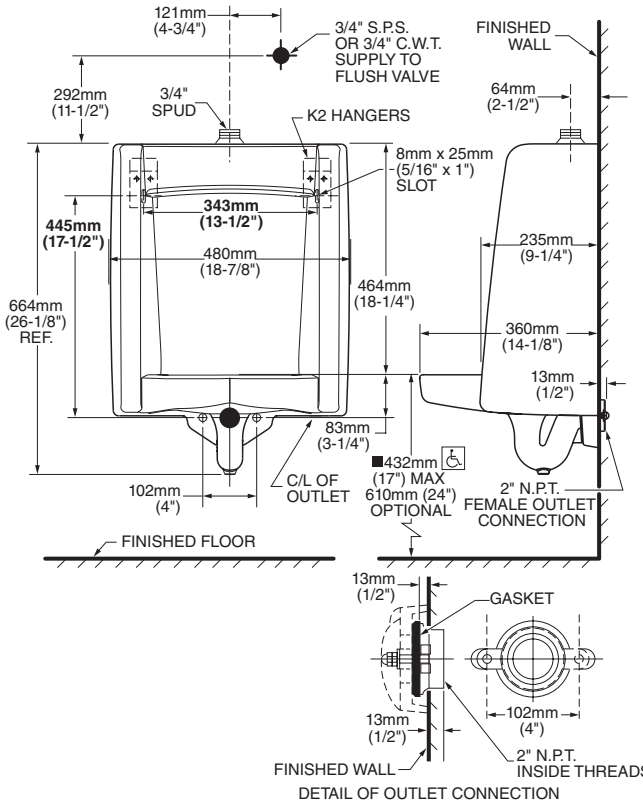
ADA COMPLIANT

Washbrook® FloWise® Universal Urinal

VITREOUS CHINA

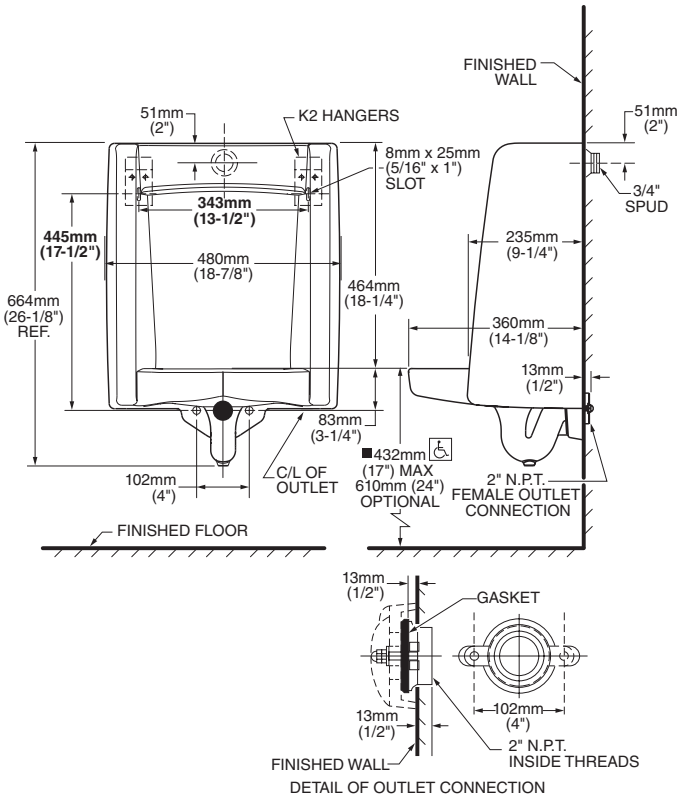
BARRIER FREE

6590.001 TOP SPUD



DETAIL OF OUTLET CONNECTION

6515.001 BACK SPUD



DETAIL OF OUTLET CONNECTION

■ ADA **MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 ACCESSIBLE AND USABLE BUILDINGS AND FACILITIES - CHECK LOCAL CODES.**

- When installed so top of rim is 432mm (17") MAXIMUM from finished floor.

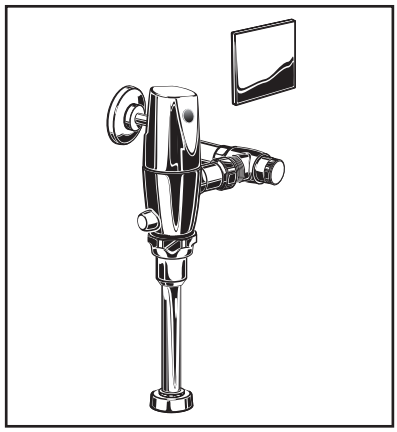
NOTES:
FLUSH VALVE NOT INCLUDED AND MUST BE ORDERED SEPARATELY.
PROVIDE SUITABLE REINFORCEMENT FOR ALL WALL SUPPORTS.

IMPORTANT: Dimensions of fixtures are nominal and may vary within the range of tolerances established by ANSI Standard A112.19.2. These measurements are subject to change or cancellation. No responsibility is assumed for use of superseded or voided pages.

Urinal Flush Valve

SELECTRONIC™ FloWise® EXPOSED 0.125 GPF URINAL FLUSH VALVE

HARD-WIRED AC POWERED, SENSOR OPERATED



WaterSense · Meets EPA Criteria · Certified by IAPMO R&T

GENERAL DESCRIPTION:

Exposed, Hard-wired AC Powered, Sensor Operated Selectronic™ Urinal Flush Valve for 3/4" top spud urinals.

Inlet includes 3/4" I.P.S. angle stop with back-flow protection, vandal-resistant cap, sweat solder kit, cover tube and wall flange.

Outlet includes 3/4" vacuum breaker, spud coupling and flange.

PRODUCT FEATURES:

- Exclusive Pressure Compensation feature eliminates the need for the installer to adjust the stop valves, saving time and money and ensuring water savings
- Electronic flush valve with Selectronic™ proximity system for “Hands Free” operation
- Includes UL approved hard-wired AC transformer
- Input Voltage: 100 - 250 VAC, 50 / 60 Hz. Output Voltage: 6 VDC.
- Self-Cleaning Piston operation with integral wiper spring prevents clogging and reduces maintenance
- Piston operation delivers superior flush accuracy and repeatability
- Adjustable tailpiece
- Chemical resistant EPDM seals are unaffected by chloramines and ammonia
- Valve remains closed and does not need to be reset after loss of power or water pressure
- Stadium Feature: Valve automatically switches to water conservation mode during periods of heavy usage
- Fully Mechanical Manual Override Button can flush toilet during a power outage
- Vandal-resistant metal cover plate (for 2-gang electric box supplied by others) with no visible fasteners
- Sensor & electronic controls are fully enclosed and water resistant
- Range can be adjusted manually or by remote control
- Sanitary Flush - Valve automatically flushes after 24 hours of non-use to clean fixture & maintain trap seal
- No external volume adjustment
- 5 second Arming Delay prevents unintentional flushing
- 3-second Flush Delay
- Can be installed left or right-handed

MODEL NUMBER:

❑ **6062.013.002 HARD-WIRED AC POWERED:**
Includes UL-approved Hard-Wired AC transformer (electrical box by others). 11-1/2" rough-in

❑ **6061.013.002 MULTI-AC POWERED:**
Includes 10' extension cable. One transformer (sold separately) can operate up to 15 faucets and/or flush valves. 11-1/2" rough-in

OPERATING PRESSURE:

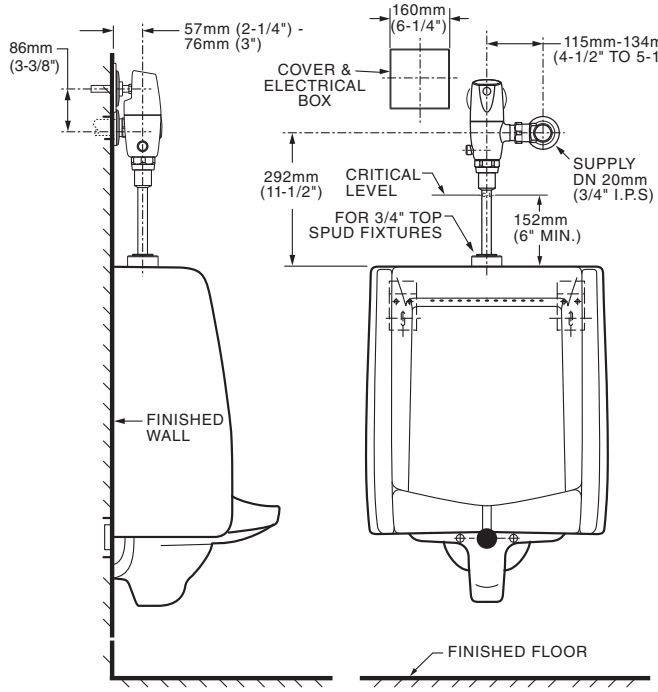
20 psi (flowing)-80 psi (static)

FLOW REQUIREMENT:

8 gpm (30.3 L/min.)

ACCESSORIES:

• Cast wall flange (3/4")



MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES

RECOMMENDED SPECIFICATION:

Electronic proximity infrared sensor activated toilet flush valve shall feature self-cleaning piston valve. Includes a UL listed hard-wired power supply that provides 6 VDC power to run system. Includes a fully mechanical manual over-ride that can provide a complete flush without power. Includes cast brass valve body and metal cover with chrome finish and vandal resistant stop cap. Angle stop with back-flow protection and vacuum breaker included. 0.125 gpf / 0.5 Lpf. Flush valve shall be American Standard Model # 606_.013.002

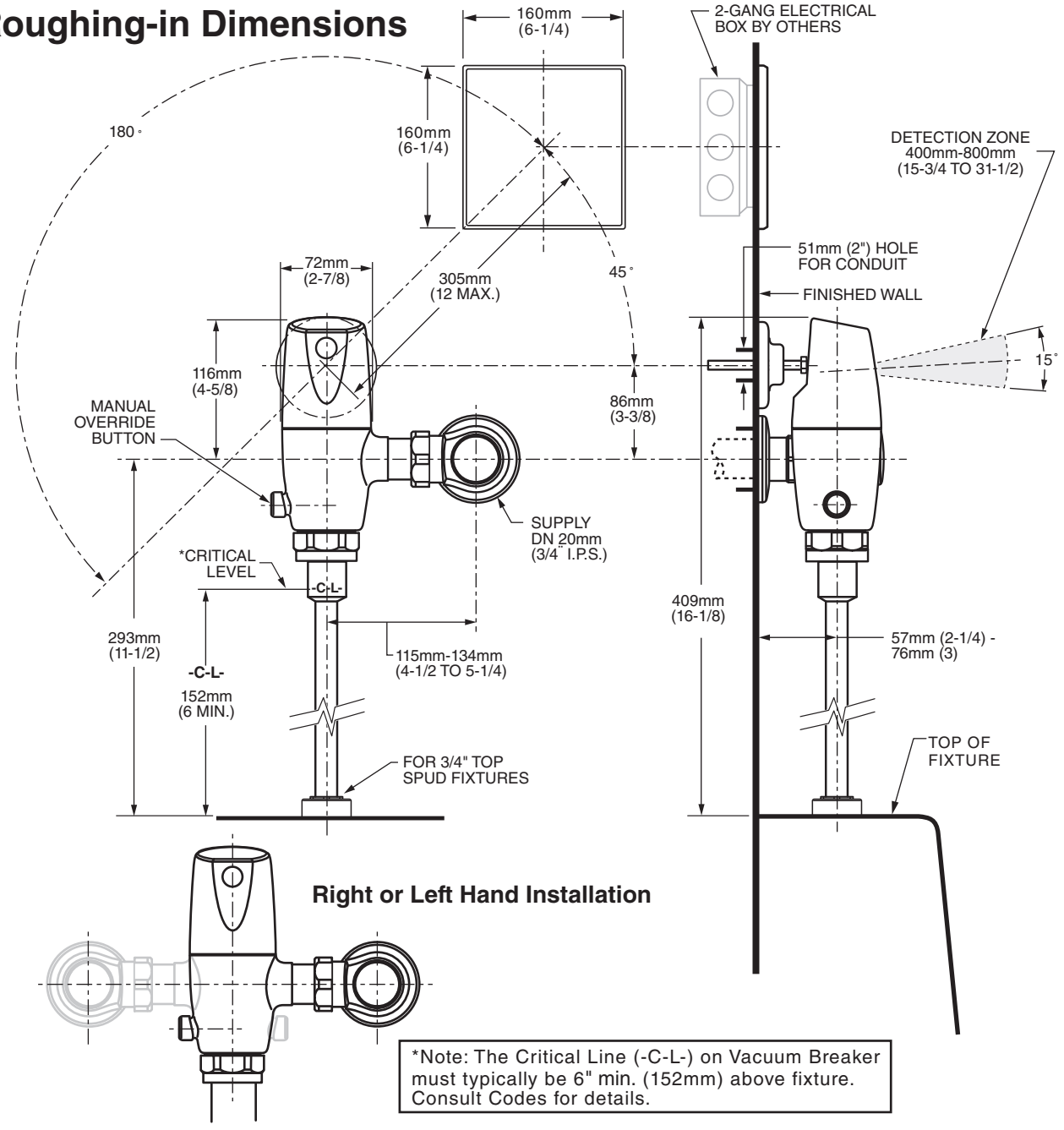
SELECTRONIC™ FloWise® EXPOSED 0.125 GPF URINAL FLUSH VALVE

HARD-WIRED AC POWERED, SENSOR OPERATED

LISTINGS:

- ASSE 1037
- ANSI/ASME A112.19.2
- ADA Compliant

Roughing-in Dimensions



Right or Left Hand Installation

*Note: The Critical Line (-C-L-) on Vacuum Breaker must typically be 6" min. (152mm) above fixture. Consult Codes for details.

MEETS THE AMERICANS WITH DISABILITIES ACT GUIDELINES AND ANSI A117.1 REQUIREMENTS FOR ACCESSIBLE AND USABLE BUILDING FACILITIES-CHECK LOCAL CODES

PART OF LIXIL

Revised 5/16

Location: ADA Shower with Grab Bar

SYMMONS® Origins

9605-PLR, 9605-PLR-TRM, 9605-PLR-TRMTC, 9605PLR, 9605PLRTRM, 9605PLRTRMTC Shower/Hand Shower Trim

Specification Submittal

Feature Highlights

- Origins Shower/Hand Shower System or Trim
- Requires Temptrol® Pressure Balancing Shower Valve (included with 9605-PLR)
- Requires Symmons Dual Outlet Diverter Valve (included with 9605-PLR)
- Adjustable stop screw to limit handle turn (included with 9605-PLR)
- Metal lever handles
- ADA 36" grab bar for hand shower wand
- Dual checks for backflow protection
- 60" flexible metal hose
- ADA 1 mode hand shower wand with non-positive shutoff
- 1 mode showerhead with easy to clean nozzles
- 2.0 gpm (7.6 L/min) flow restrictors
- Tub spout not included
- Components shall be metal and nonmetallic construction, plated in standard Polished Chrome finish
- Available with TA-10 flow control spindle and T-12A cap assembly for Temptrol valve bodies installed with Test Cap (order p/n 9605PLRTRMTC)
- For optional in-line vacuum breaker order p/n EF-109

Model Numbers

☐ **9605-PLR**
Shower/Hand Shower Trim with Temptrol Pressure Balancing Shower Valve and Symmons Dual Outlet Diverter Valve

☐ **9605-PLR-TRM**
Shower/Hand Shower Trim, Temptrol Pressure Balancing Shower Valve and Symmons Dual Outlet Diverter valve ordered separately

☐ **9605-PLR-TRMTC**
Shower/Hand Shower Trim with TA-10 flow control spindle and T-12A cap assembly, must order Temptrol valve with Test Cap

☐ **9605-PLR**
Shower/Hand Shower Trim with Temptrol Pressure Balancing Shower Valve and Symmons Dual Outlet Diverter Valve

☐ **9605-PLR-TRM**
Shower/Hand Shower Trim, Temptrol Pressure Balancing Shower Valve and Symmons Dual Outlet Diverter valve ordered separately

☐ **9605-PLR-TRMTC**
Shower/Hand Shower Trim with TA-10 flow control spindle and T-12A cap assembly, must order Temptrol valve with Test Cap

Note:
-Append appropriate -suffix to model number.
-When ordering L1-L7 modifiers, remove hyphens from model number.

Options/Modifications

☐	1.5 CG	1.5 gpm (5.7 L/min) flow restrictor
☐	L1	Less showerhead
☐	L2	Less hand shower wand
☐	L3	Less showerhead & hand shower wand
☐	L4	Less head, arm & flange
☐	L5	Less hand shower system
☐	L6	Less tub spout
☐	VP	Vandal resistant escutcheon screws in place of standard screws
☐	STN	Satin Nickel finish
☐	B	Brass escutcheon (chrome only)
☐	X	Integral service stops - allows water shut-off at valve for service
☐	CHKS	Integral check stops - for use in installations where a positive shut-off device is used downstream of mixing valve

Note: Append appropriate suffix to model number.

Compliance

- ASME A112.18.1/CSA B125.1
- Buy American Act (9605-PLR only)
- WaterSense @ 1.5 gpm (5.7 L/min), 2.0 gpm (7.6 L/min)
- (does not apply to L3 modification)

Warranty

Limited Lifetime - to the original end purchaser in consumer/residential installations.
10 Years - for commercial/industrial installations. Refer to www.symmons.com/warranty for complete warranty information.

Architectural/ Engineering Specification

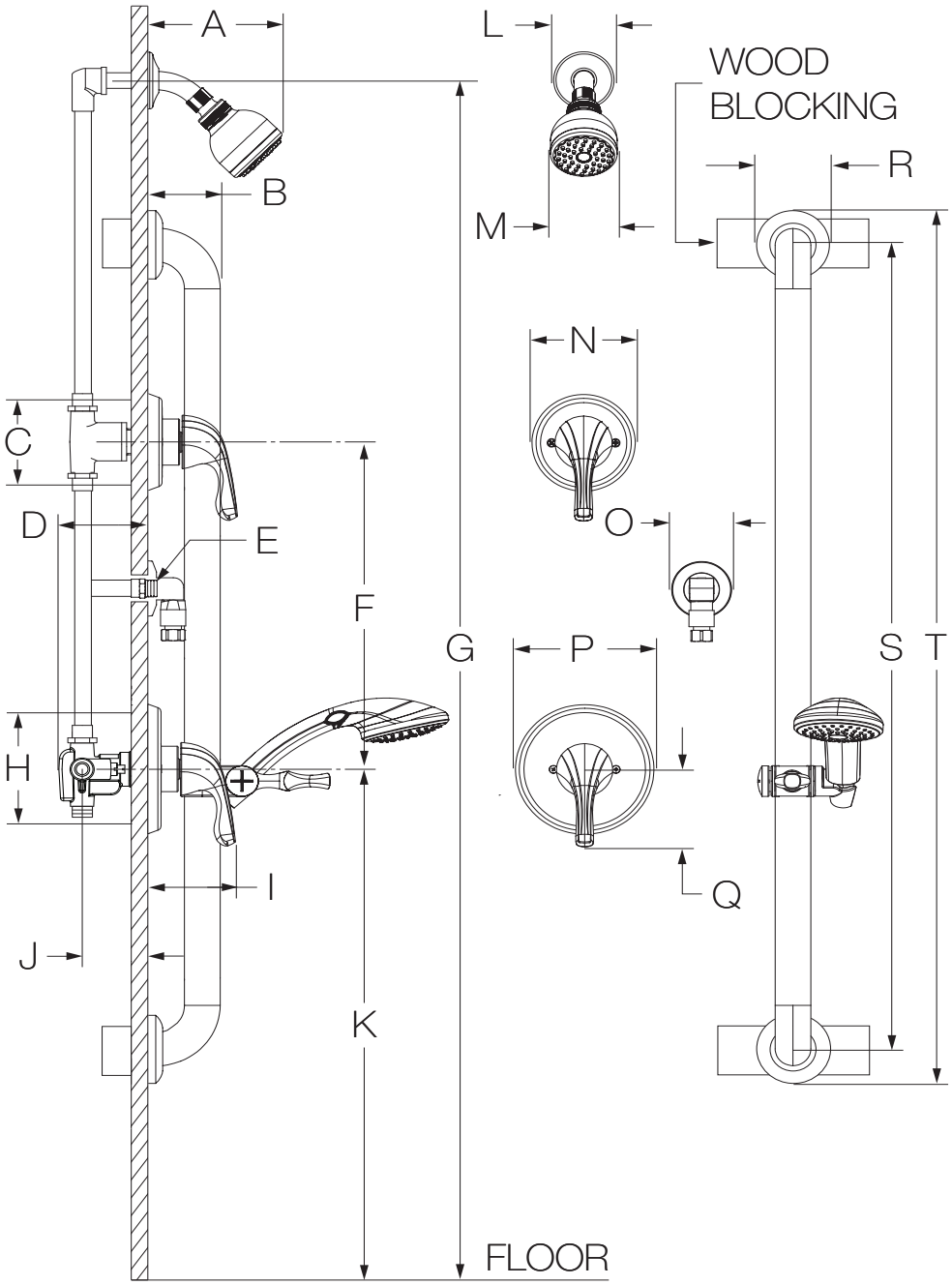
Symmons Origins _____ With Origins Shower/Hand Shower System or Trim, Requires Temptrol® Pressure Balancing Shower Valve (included with 9605-PLR), Requires Symmons Dual Outlet Diverter Valve (included with 9605-PLR), Adjustable stop screw to limit handle turn (included with 9605-PLR), Metal lever handles, ADA 36" grab bar for hand shower wand, Dual checks for backflow protection, 60" flexible metal hose, ADA 1 mode hand shower wand with non-positive shutoff, 1 mode showerhead with easy to clean nozzles, 2.0 gpm (7.6 L/min) flow restrictors, Tub spout not included, Components shall be metal and nonmetallic construction, plated in standard Polished Chrome finish, Available with TA-10 flow control spindle and T-12A cap assembly for Temptrol valve bodies installed with Test Cap (order p/n 9605PLRTRMTC), For optional in-line vacuum breaker order p/n EF-109. 10 Year Commercial Warranty. ASME A112.18.1/CSA B125.1, WaterSense @ 1.5 gpm (5.7 L/min),2.0 gpm (7.6 L/min), complaint. Available options include: " 1.5 - 1.5 gpm (5.7 L/min) flow restrictor", "L1 - Less showerhead" , "L2 - Less hand shower wand", "L3 - Less showerhead & hand shower wand", "L4 - Less head, arm & flange", "L5 - Less hand shower system", "L6 - Less tub spout", "Vp - Vandal resistant escutcheon screws in place of standard screws", "STN - Satin Nickel finish", "B - Brass escutcheon (chrome only)", "X - Integral service stops - allows water shut-off at valve for service", "CHKS - Integral check stops - for use in installations where a positive shut-off device is used downstream of mixing valve".

Symmons Industries, Inc. ▪ 31 Brooks Drive ▪ Braintree, MA 02184 ▪ Phone: (800) 796-6667 ▪ Fax: (800) 961-9621

SYMMONS® Origins

9605-PLR, 9605-PLR-TRM, 9605-PLR-TRMTC, 9605PLR, 9605PLRTRM, 9605PLR-TRMTC

Dimensions



Measurements	
A	6-3/8″, 162 mm
B	3″, 76 mm
C	Diverter Valve Hole Size Min. Ø 3″, 76 mm Max. Ø 3-1/4″, 83 mm
D	3-1/2″, 89 mm
E	Male 1/2″ NPT fitting must protrude 3/8″ from finished wall
F	Ref. 10″, 254 mm
G	Ref. 77″, 1956 mm
H	Shower Valve Hole Size Min. Ø 3″, 76 mm Max. Ø 4″, 102 mm
I	3-5/8″, 92 mm
J	Rough-in 2-3/8″ ± 1/2″, 60 mm ± 13 mm
K	Ref. 42″, 1067 mm
L	Ø 2-1/2″, 64 mm
M	Ø 2-3/4″, 70 mm
N	Ø 4-1/4″, 108 mm
O	Ø 2-1/2″, 64 mm
P	Ø 5-3/4″, 146 mm
Q	3-3/8″, 86 mm
R	Ø 3-1/8″, 79 mm
S	36″, 914 mm
T	39″, 991 mm

Notes:

1) Valve body and piping not included and shown as reference only.
2) Plaster shield (p/n T-176) for dry wall, plaster or other type walls 1/2″ or greater.
3) All dimensions measured from nominal rough-in (see J as reference).
4) Dimensions subject to change without notice.

Symmons Industries, Inc. ▪ 31 Brooks Drive ▪ Braintree, MA 02184 ▪ Phone: (800) 796-6667 ▪ Fax: (800) 961-9621

Location: ADA Shower Alternate (UCDH Choose One)

SYMMONS® Dia®

3505-H321-V-CYL-B-TRM, 3505H321CYLBTRMTC
Shower/Hand Shower Trim
Specification Submittal

Feature Highlights

- Dia Shower/Hand Shower Trim
- Requires Temptrol® Pressure Balancing Shower Valve
- Requires Symmons Dual Outlet Diverter Valve
- Metal lever handles
- 30" slide bar for hand shower wand
- Dual checks for backflow protection
- 60" flexible metal hose
- 1 mode hand shower wand
- 1 mode showerhead
- Standard flow rate, 2.0 gpm (7.6 L/min)
- Tub spout not included
- Components shall be metal and nonmetallic construction, plated in standard Polished Chrome finish
- Available with TA-10 flow control spindle and T-12A cap assembly for Temptrol valve bodies installed with Test Cap
  (order p/n 3505H321CYLBTRMTC)
- For optional in-line vacuum breaker order p/n EF-109

Options/Modifications

☐	**1.5** CG	**1.5 gpm (5.7 L/min) flow restrictor**
☐	**Delete Suffix B**	**Chrome plastic escutcheon on valve with color graphic/indicators in place of standard brass escutcheon**
☐	**BBZ**	**Brushed Bronze finish**
☐	**MB**	**Matte Black finish**
☐	**STN**	**Satin Nickel finish**

Note: Append appropriate -suffix to model number.

Model Numbers

☐ **3505-H321-V-CYL-B-TRM**
Shower/Hand Shower Trim,
Temptrol Pressure Balancing Shower Valve and Symmons Dual Outlet Diverter valve ordered separately

☐ **3505H321CYLBTRMTC**
Shower/Hand Shower Trim with TA-10 flow control spindle and T-12A cap assembly, must order Temptrol valve with Test Cap

Warranty

Limited Lifetime - to the original end purchaser in consumer/residential installations.
10 Years - for commercial/industrial installations. Refer to www.symmons.com/warranty for complete warranty information.

Compliance

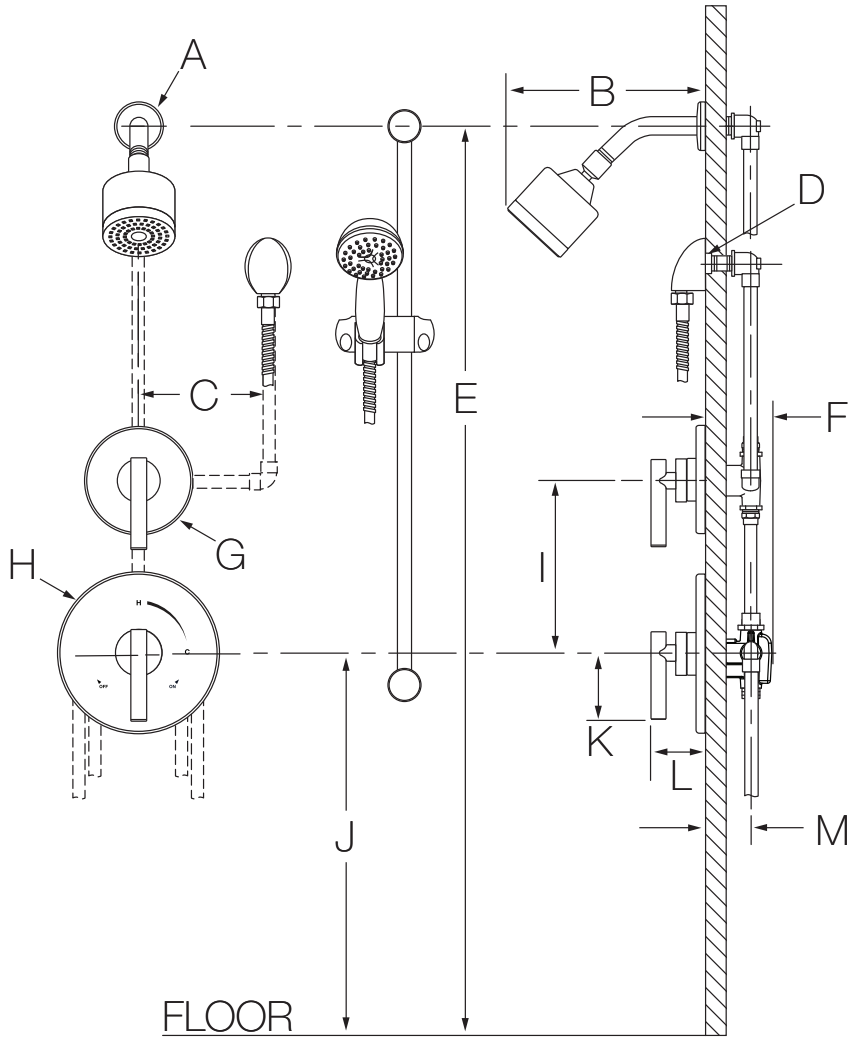
- ASME A112.18.1/CSA B125.1
- WaterSense @ 1.5 gpm and 2.0 gpm

C US SHOWERHEAD WaterSense Meets EPA Criteria Certified by CSA Group

Architectural/Engineering Specification

Symmons Dia Shower and Hand Shower Trim _____ Includes Dia Shower/Hand Shower Trim, Requires Temptrol® Pressure Balancing Shower Valve, Requires Symmons Dual Outlet Diverter Valve, Metal lever handles, 30" slide bar for hand shower wand, Dual checks for backflow protection, 60" flexible metal hose, 1 mode hand shower wand, 1 mode showerhead, Standard flow rate, 2.0 gpm (7.6 L/min), Tub spout not included, Components shall be metal and nonmetallic construction, plated in standard Polished Chrome finish, Available with TA-10 flow control spindle and T-12A cap assembly for Temptrol valve bodies installed with Test Cap (order p/n 3505H321CYLBTRMTC), For optional in-line vacuum breaker order p/n EF-109. 10 Year Commercial Warranty. ASME A112.18.1/CSA B125.1, WaterSense @ 1.5 gpm and 2.0 gpm compliant. Available options: "1.5 - 1.5 gpm (5.7 L/min) flow restrictor", "Delete Suffix B - Chrome plastic escutcheon on valve with color graphic/indicators in place of standard brass escutcheon", "BBZ - Brushed Bronze finish", "MB - Matte Black finish", "STN - Satin Nickel finish".

Dimensions



Measurements	
A	Ø 2-1/2″, 64 mm
B	6-3/4″, 171 mm
C	6″, 152 mm
D	Male 1/2-14 NPT thread must be recessed 1/4″ (6 mm) from finished wall
E	Ref. 77″, 1956 mm
F	3-1/2″, 89 mm
G	Ø 5″, 127 mm
H	Ø 7-1/2″, 191 mm
I	Ref. 10″, 254 mm
J	Ref. 42″, 1067 mm
K	3″, 76 mm
L	2-7/8″, 73 mm
M	Rough-in 2-3/8″ ± 1/2″, 60 mm ± 13 mm

Notes:

1) Valve body and piping not included and shown as reference only.
2) Plaster shield (p/n T-176) for dry wall, plaster or other type walls 1/2″ or greater.
3) All dimensions measured from nominal rough-in (see M as reference).
4) Dimensions subject to change without notice.

ELKAY®
SPECIFICATIONS

Elkay ezH2O Bottle Filling Station & Versatile Bi-Level ADA Cooler Filtered Refrigerated Light Gray
Model LZSTL8WSLK

Drinking Fountain

PRODUCT SPECIFICATIONS

Not to be used in lobbies.

Elkay ezH2O® Bottle Filling Station & Versatile Bi-Level ADA Cooler Filtered Refrigerated Light Gray. Chilling Capacity of 8.0 GPH (gallons per hour) of 50° F drinking water, based on 80° F inlet water and 90° F ambient, per ASHRAE 18 testing. Features shall include Antimicrobial*, Filtered, Green Ticker™, Hands Free, Laminar Flow, Real Drain, Visual Filter Monitor. Furnished with Flexi-Guard ® Safety Bubbler. Electronic Bottle Filler Sensor with Electronic Front and Side Bubbler Pushbar activation. Product shall be Wall Mount (On Wall), for Indoor applications, serving 2 station(s). Unit shall be certified to UL 399 and CAN/CSA C22.2 No. 120.

Special Features:	Antimicrobial, Filtered, Green Ticker™, Hands Free, Laminar Flow, Real Drain, Visual Filter Monitor
Finish:	Light Gray Granite
Power:	115V/60Hz
Bubbler Style:	Flexi-Guard ® Safety Bubbler
Activation by:	Electronic Bottle Filler Sensor with Electronic Front and Side Bubbler Pushbar
Mounting Type:	Wall Mount (On Wall)
Chilling Capacity*:	8.0 GPH
Full Load Amps	6
Rated Watts:	370
Dimensions (L x W x H):	36-3/4" x 19" x 39-1/16"
Approx. Shipping Weight:	104 lbs.
Installation Location:	Indoor
No. of Stations Served:	2
*Based on 80° F inlet water & 90° F ambient air temp for 50° F chilled drinking water.	

Special Note: Installs with stainless steel back panel (1000004920); accessory to enhance design & ease of installation.

- Visual Filter Monitor: LED Filter Status Indicator for when filter change is necessary.
- Filter is certified to NSF 42 and 53 for lead, cyst, particulate, chlorine, taste and odor reduction. 3,000 gal. capacity.
- Green Ticker: Informs user of number of 20 oz. plastic water bottles saved from waste.
- Laminar flow provides clean fill with minimal splash.
- Key plastic components are manufactured with silver ion antimicrobial agent helping to provide clean, stain- and odor-free surfaces.
- Real Drain System eliminates standing water.

Included with Product: **Water Cooler (LZSTL8WSLC), Bottle Filler (LZWSR), Filter**

▼ Ships in multiple boxes.

A Century of Tradition and Quality.
For more than 100 years, Elkay has been making innovative products and providing exceptional customer care. We take pride in offering plumbing products that make life easier, inspire change and leave the world a better place.

PRODUCT COMPLIANCE

ADA & ICC A117.1
ASME A112.19.3/CSA B45.4
Buy American Act
CAN/CSA C22.2 No. 120
GreenSpec®
NSF/ANSI 42, 53, 61, & 372 (lead free)
UL 399

Installation Instructions (PDF) - 1000002243

5 Year Limited Warranty on the refrigeration system of the unit. Electrical components and water system are warranted for 12 months from date of installation. **Warranty pertains to drinking water applications only. Non-drinking water applications are not covered under warranty.**

Warranty (PDF)

PART:_____QTY: _____
PROJECT:_____
CONTACT:_____
DATE:_____
NOTES:_____
APPROVAL:_____

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Elkay ezH2O Bottle Filling Station & Versatile Bi-Level ADA Cooler Filtered Refrigerated Light Gray
Model LZSTL8WSLK

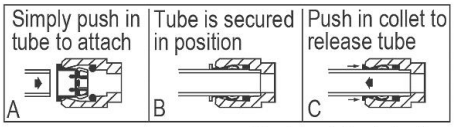
IMPORTANT!
INSTALLER PLEASE NOTE :

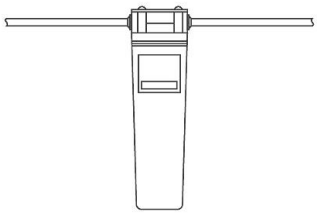
This water cooler has been designed and built to provide water to the user which has not been altered by materials in the cooler waterways. The grounding of electrical equipment such as telephone, computer, etc. to water lines is a common procedure. The grounding may be in the building but may also occur away from the building. This grounding can cause electrical feedback into a water cooler creating an electrolysis which creates a metallic taste or causes an increase in the metal content of the water. This condition is avoidable by installing the cooler using the proper materials as shown below.

NOTICE

This water cooler must be connected to the water supply using a dielectric coupling. The cooler is furnished with a non-metallic strainer which meets this requirement. The drain trap which is provided by the installer should also be plastic to completely isolate the cooler from the building plumbing system.
Bottle filler unit on bracket attached to wall by 6 holes (as shown). Water and electrical will connect through pre-punched hole in basin.
These products are designed to operate on 20 psi to 105 psi supply line pressure. Simultaneous operation of both bubblers on a bi-level unit may not be possible depending on water supply pressure. If simultaneous operation is desired, please ensure a minimum of 65 psi supply.

OPERATION OF QUICK CONNECT FITTINGS

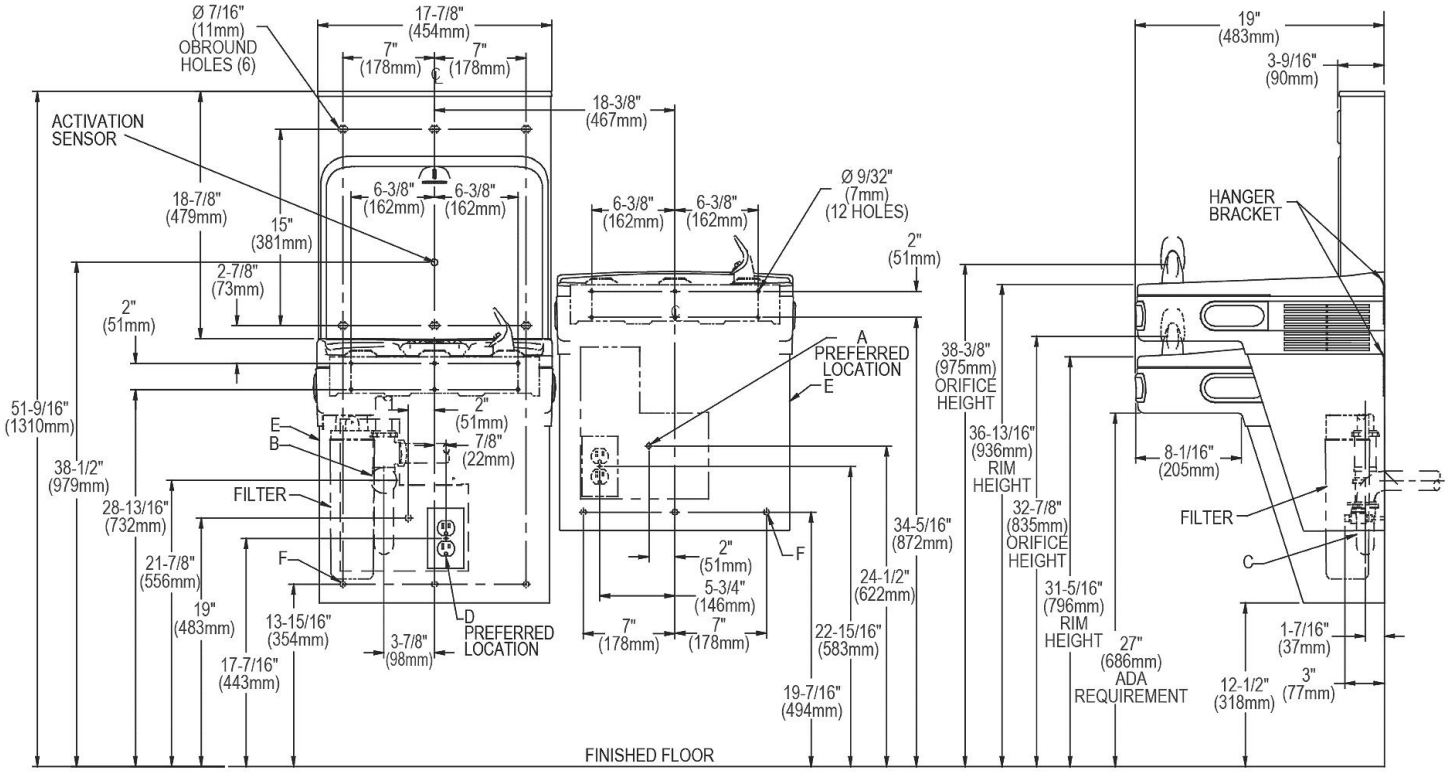




Pushing tube in before pulling it out helps to release tube

WaterSentry® Plus Filter System

ROUGH-IN FOR RIGHT-HAND HIGH SIDE MODELS



REDUCE HEIGHT BY 3 INCHES FOR INSTALLATION OF CHILDRENS ADA COOLER

LEGEND:
A = Recommended Water Supply location. Shut-off Valve (not furnished) to accept 3/8" O.D. unplated copper tube. Up to 3" (76mm) maximum out from wall.
B = Recommended Waste Outlet location. To accommodate 1-1/2" nominal drain. Drain stub 2" (51mm) out from wall.
C = 1-1/2" Trap (not furnished).
D = Electrical Supply (3) Wire Recessed Box Duplex Outlet.
E = Insure proper ventilation by maintaining 6" (152mm) minimum clearance from cabinet louvers to wall.
F = 7/16" (11mm) Bolt Holes for fastening to wall.
Note : New Installations Must Use Ground Fault Circuit Interrupter (GFCI). It is highly recommended that the circuit be dedicated and the load protection be sized for 20 amps.

In keeping with our policy of continuing product improvement, Elkay reserves the right to change product specifications without notice. Please visit elkay.com for the most current version of Elkay product specification sheets. This specification describes an Elkay product with design, quality, and functional benefits to the user. When making a comparison of other producers' offerings, be certain these features are not overlooked.

Series B Medical Gas Outlet
Geometric Index (PB) Style

SPECIFICATION

Quick Connect Medical Gas Wall Outlet

The geometric index medical gas outlets are gas specific for the services indicated and accept only corresponding geometric index adapters. The outlets are UL listed, CSA certified, and are fully compliant with the latest edition of NFPA 99. All outlets are 100% tested for flow, leaks and connector attachment. The outlets are cleaned for oxygen service in the manufacturing process. The outlets are made in the U.S.A.

Outlet Design

A complete medical gas outlet consists of a gas specific rough-in assembly for installation before the wall or console is completed. A matching gas specific latch valve assembly and trim plate are installed after the finish is complete.

Rough-in Assembly

The rough-in assembly is of modular design and includes a gas specific 16 gauge steel mounting plate. Wall versions permit on site ganging of multiple outlets, in any order, on 5" (12.7cm) centerline spacing. A 3/8" (9.5 mm) high metal flange around the outlet opening provides a plaster barrier. A temporary cover is provided to keep debris out of the outlet during installation. Console rough-ins fit standard electrical box cutouts and screw locations.

A machined brass outlet block is permanently attached to the rough-in plate to permit the 1/2" OD (3/8" nominal), type K copper inlet tube to swivel 360° for attachment to the piping system.

Gas service identification is affixed to the inlet tube and the face of the rough-in plate. A secondary valve is installed in the outlet block of the rough-in assembly (except vacuum and WAGD) for both pressure testing and preventing gas flow when the latch valve assembly is removed for service.

The outlet block contains a double seal to prevent gas leakage between the rough-in and latch valve assemblies after the wall is finished. Outlets using a single o-ring seal are not acceptable.

Latch Valve Assembly

The latch valve assembly includes a captured o-ring seal primary valve, is gas specific for the labeled service, and accepts only hose and apparatus with corresponding geometric index adapters. The latch valve assembly is indexed to the corresponding rough in assembly to avoid accidental cross connection and self adjusts up to 3/4" (1.9 cm) to allow for variation in finished wall thickness from 1/2" (12.5 mm) up to 1-1/4" (3.175 cm).

Trim Options

Either a die cast, light gray, epoxy powder-coated trim plate or a smaller plastic trim plate can be provided to trim each outlet. A hook plate with a retractable arm can also be provided to trim each outlet. The die cast plate and hook plate are designed specifically to fill the space between adjacent outlets. The finish of the hook plate is treated with Biomaster, an additive that has been shown to reduce bacteria growth.* All trim plates allow latch valves to be individually removed for servicing.

**Disclaimer: Use of this product does not protect user from disease-bearing and food-borne pathogens.*

Geometric Index Outlets
(Note that a typical complete outlet consists of one Rough-in, one matching Latch Valve and one Trim Plate - Standard (325161-00) or Hook Plate (4107 2205 71))

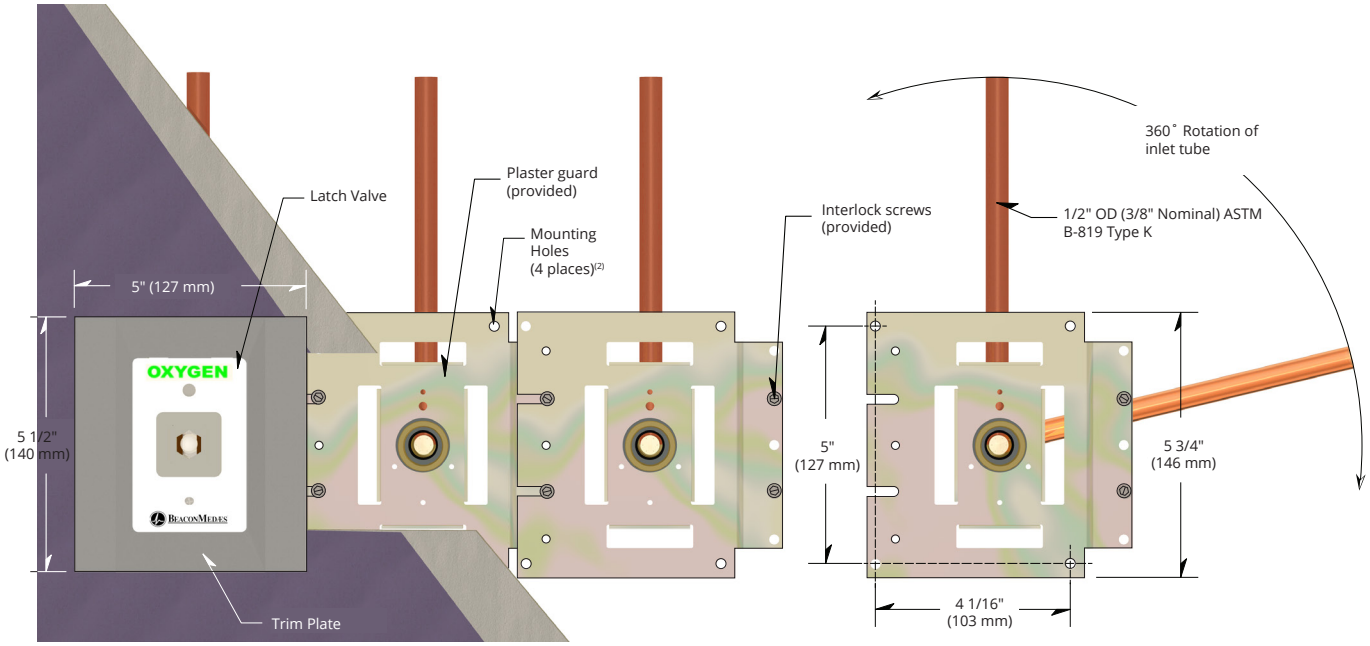
Gas Service	Color Code (Background/Text)	Complete Assembly, Wall Outlet (Standard Trim Plate)	Complete Assembly, Wall Outlet (Hook Trim Plate)	Rough-in Assembly, Wall Outlet	Rough-in Assembly, Console Outlet	Latch-Valve Assembly, Wall or Console
Oxygen	White/Green	☐ 121020-00	☐ 121020-01	☐ 233110-00	☐ 233010-00	☐ 230930-00
Nitrous Oxide	Blue/White	☐ 121021-00	☐ 121021-01	☐ 233111-00	☐ 233011-00	☐ 230931-00
Medical Air	Yellow/Black	☐ 121022-00	☐ 121022-01	☐ 233112-00	☐ 233012-00	☐ 230932-00
Vacuum	White/Black	☐ 121023-00	☐ 121023-001	☐ 233113-00	☐ 233013-00	☐ 230933-00
WAGD	Purple/White	☐ 121029-00	☐ 121029-01	☐ 233119-00	☐ 233019-00	☐ 230939-00
Medical Air (ISO)	White-Black/ Black-White	☐ 151022-00	☐ 151022-01	☐ 233116-00	☐ 233016-00	☐ 230937-00
Vacuum (ISO)	Yellow/Black	☐ 151023-00	☐ 151023-01	☐ 233117-00	☐ 233017-00	☐ 230938-00

Accessories *(Note good design provides one slide with each vacuum)*

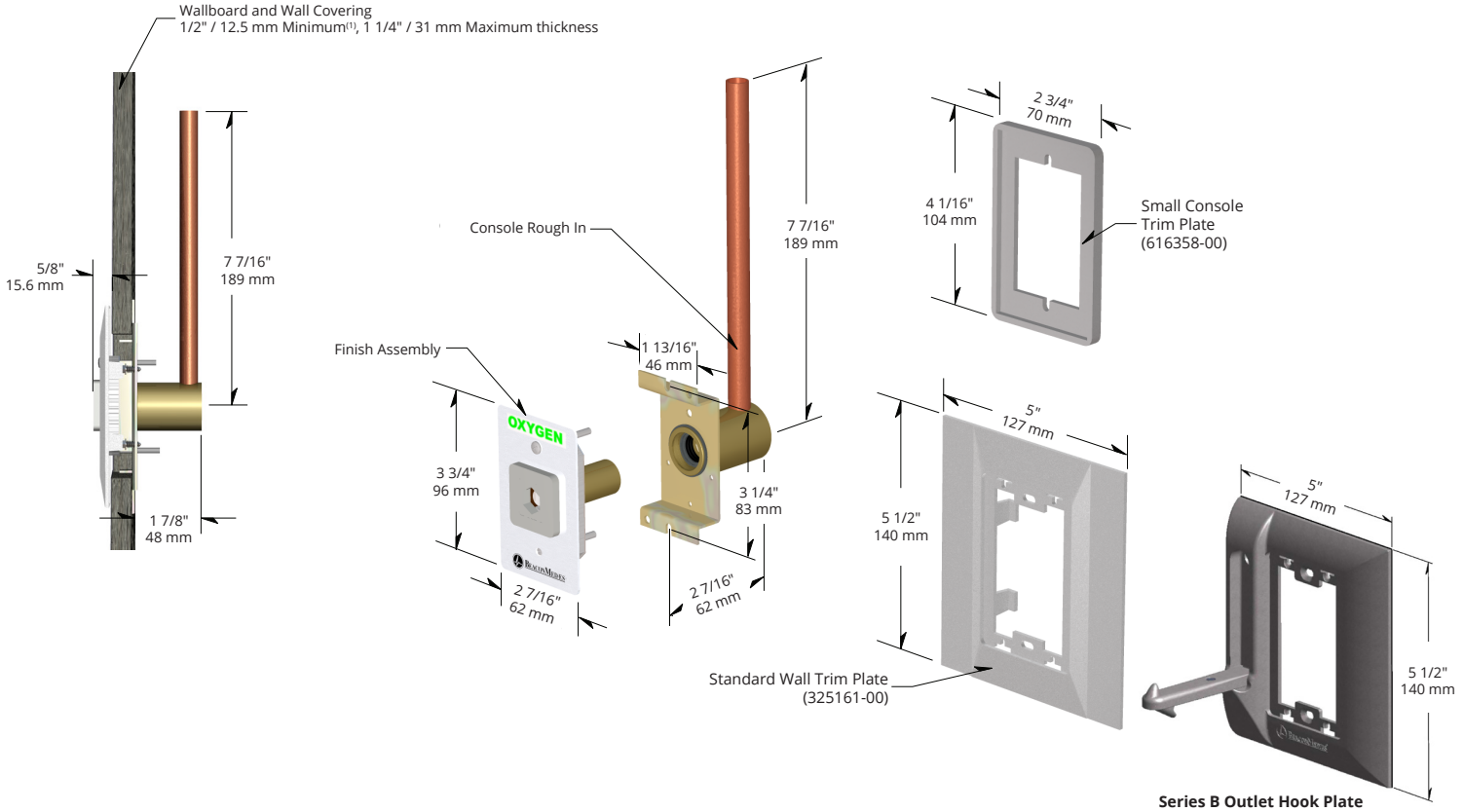
Slide (Wall outlet style, Complete)	☐ 120978-00	Duplex Electrical Receptacle* (Gray 15A, 125V, Wall outlet style, Complete)	☐ 120972-00
Slide (Surface mount style)	☐ 135012-00	Trim Plate, Wall (Large) Style	☐ 325161-00
Blank, Gas (Complete with RI and finish)	☐ 120979-00	Trim Plate, Console (Small) Style	☐ 616358-00
Blank, Gas (Cover plate only)	☐ 415169-00	Series B Outlet Hook Plate	☐ 4107 2205 71

**See specification sheet SSB-840-13 for additional electrical receptacles.*

Dimensions and Installation



(1) When wallboard is less than 1/2" / 12.5 mm thick, as in consoles and headwalls, console outlets should be considered.
(2) Plates may gang together in any length. Up to three may be ganged without additional support, however, top and bottom support is always recommended. Total finished length will be 5"/127 mm x number of outlets in the gang (e.g. three outlets = 5 x 3 = 15").



Series B Outlet Hook Plate
(4107 2205 71)
US Patent No. D756,754

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Series B Recessed Medical Gas Ceiling Outlet With Rear Entry Tube

DISS Key Style

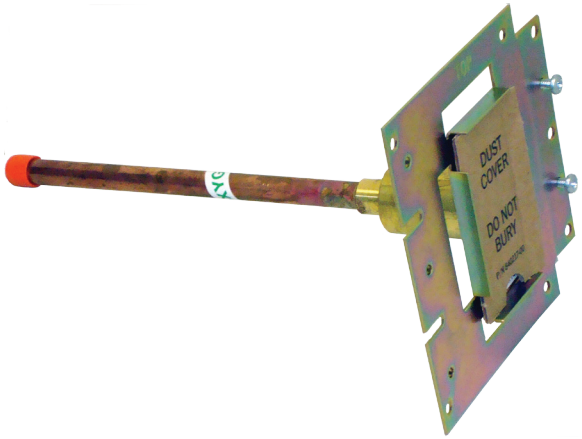
SPECIFICATION

DISS Medical Gas Ceiling Outlet

The DISS Medical Gas ceiling outlets shall be gas specific for the services indicated and accept only corresponding DISS nuts and nipples. The outlets shall be UL listed, CSA certified, and be fully compliant with the latest edition of NFPA 99. All outlets shall be 100% tested for flow, leaks, and connector attachment. The outlets shall be cleaned for oxygen service and capped prior to shipping. The outlets shall be made in the U.S.A. A die cast, light gray, epoxy powder coated trim plate can be provided to trim each wall outlet and to fill the space between adjacent outlets. The trim plate shall allow latch valves to be individually removed for servicing.

Outlet Design

A complete medical gas outlet shall consist of a gas-specific rough-in assembly for installation before the ceiling is finished and a matching gas-specific latch-valve assembly and cover plate for installation after the ceiling is finished.



Rough-in Assembly

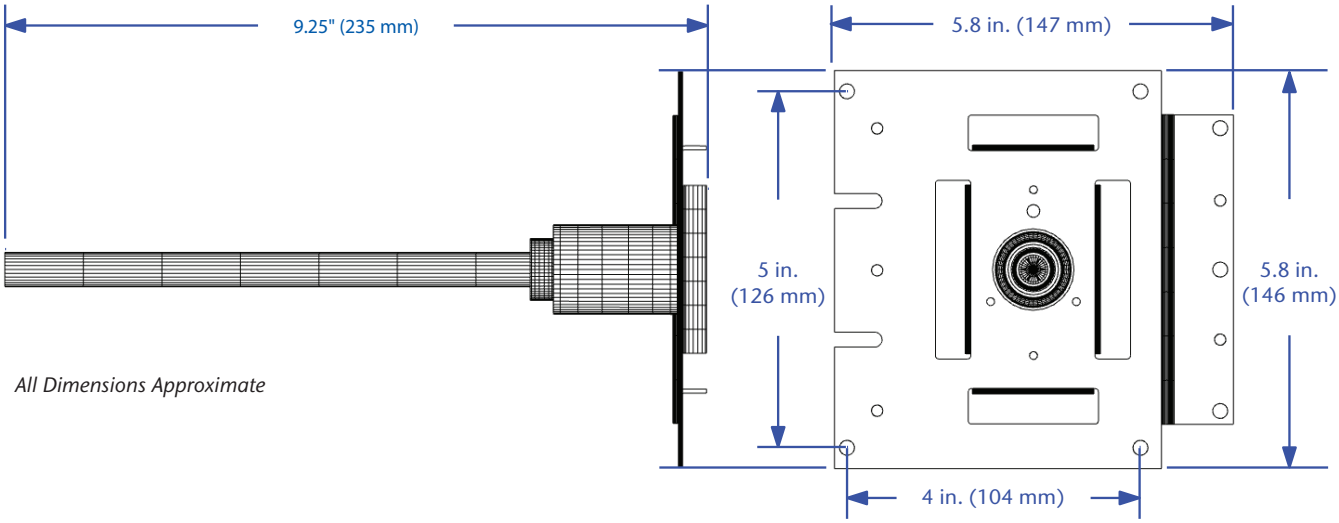
The rough-in assembly shall be of a modular design and include a gas-specific 16-gauge steel mounting plate designed to permit on-site ganging of multiple outlets, in any order, on 5" centerline spacing. The gas inlet of the outlet body shall be 1/2" OD (3/8" nominal) B-819 copper tube, pre-brazed to the outlet body. Gas service identification shall be affixed to the inlet tube and the face of the mounting plate.

A secondary valve shall be included in the outlet block of the rough-in assembly for both pressure testing and preventing gas flow (except vacuum and WAGD) when the latch valve is removed for service. A 3/8" high metal flange around the outlet opening shall provide a plaster barrier. A temporary cover shall be provided to keep debris out of the outlet during installation. The rough-in assembly shall contain a double seal to prevent gas leakage between the rough-in and latch valve assemblies after the ceiling is finished. A single o-ring seal shall not be acceptable.

Latch Valve Assembly

The latch-valve assembly shall include an o-ring seal primary valve, be gas specific for the labeled service, and accept only corresponding hose and apparatus with DISS nut and nipple adapters. The latch-valve assembly shall be indexed to the corresponding rough-in assembly to avoid accidental cross-connection and shall telescope up to 3/4" to allow for variation in finished wall thickness from 1/2" up to 1-1/4". A metal cover plate insert with permanent, color-coded marking of service identifcation shall be included as part of the latch-valve assembly.

Reference Dimensions

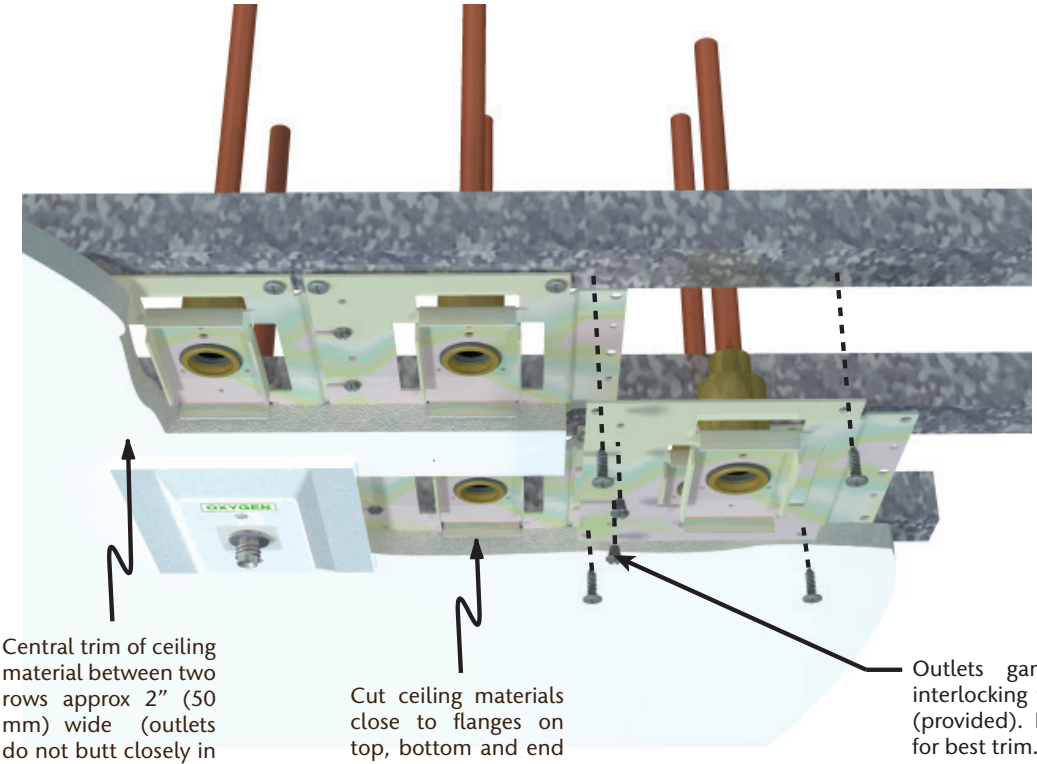


All Dimensions Approximate

Concealed Ceiling Outlet				
Item	**Gas Service**	**Complete Assembly**	**Rough-in Assembly (Rear Tube)**	**Latch-Valve Assembly (DISS)**
Series B DISS (U.S.)	O_2	☐ 4107 2092 69	☐ 233710-00	☐ 230910-00
	N_2O	☐ 4107 2092 70	☐ 233711-00	☐ 230911-00
	AIR	☐ 4107 2092 71	☐ 233712-00	☐ 230912-00
	VAC	☐ 4107 2092 72	☐ 233713-00	☐ 230913-00
	N_2	☐ 4107 2092 73	☐ 233714-00	☐ 230914-00
	I AIR	☐ 4107 2092 74	☐ 233718-00	☐ 230916-00
	WAGD	☐ 4107 2092 75	☐ 233719-00	☐ 230919-00
	CO_2	☐ 4107 2092 76	☐ 233720-00	☐ 230920-00
	CO_2-O_2 (CO_2>7%)	☐ 4107 2092 77	☐ 233721-00	☐ 230921-00
	O_2-CO_2 (CO_2<7%)	☐ 4107 2092 78	☐ 233722-00	☐ 230922-00
	HE-O_2 (HE>80%)	☐ 4107 2092 79	☐ 233723-00	☐ 230923-00
	O_2-HE (HE<80%)	☐ 4107 2092 80	☐ 233724-00	☐ 230924-00
Series B DISS (International)	AIR - ISO	☐ 4107 2092 81	☐ 233716-00	☐ 230917-00
	VAC - ISO	☐ 4107 2092 82	☐ 233717-00	☐ 230918-00
Miscellaneous	Blank, Gas	☐ 120979-00		
	Trim Plate (5")	☐ 325161-00		

Note: Complete assembly includes rough-in assembly, latch-valve assembly and a trim plate.

Recommended Installation Method



Use 1 1/4" (32mm) square or "U" channel for support. Brace solidly or suspend from deck. Space parallel rows 5 3/4" (146 mm) centerline to centerline. Outlet plates must be secured to supports top and bottom (4 places).

Central trim of ceiling material between two rows approx 2" (50 mm) wide (outlets do not butt closely in parallel rows).

Cut ceiling materials close to flanges on top, bottom and end of rows.

Outlets gang together with interlocking flanges and screws (provided). Fit together tightly for best trim.