DIVISION 22 – Plumbing

Preface

The Texas Tech University System's '*Design and Construction Standards*', as administrated by Facilities Planning and Construction, are intended to serve as guidelines to the Design Professional and Construction Management teams for design development and construction administration of Texas Tech University System (TTUS) Capital Projects. They communicate the minimum expectations and requirements relative to specific building systems, design provisions, general specification requirements, and administrative procedures for new facilities being constructed on Texas Tech University System (ASU, MSU, TTU, TTUHSC, and TTUHSC El Paso) campuses. Several, but not all requirements for each component Institution or Agency within the TTU System are covered. Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall also refer to provisions covered in their service Agreements, as well as within the project's Basis of Design (BOD) document.

In addition, the 'Design and Construction Standards' shall also be utilized in conjunction with the approved project specific Program and Schematic Design development. In the event of conflict between this document and specific project requirements, Design Professionals, Construction Managers at Risk and/or Design-Build Firms shall contact Facilities Planning & Construction for clarification.

The guidelines within the '*Design and Construction Standards*' are not intended to prohibit the use of alternative design solutions, methods, systems, products or devices not covered in this document. Offered alternatives deviating from or not covered in these standards shall be documented by the Design Professional and/or Construction Management teams and submitted to Facilities Planning & Construction for approval prior to implementation.

Throughout the '*Design and Construction Standards*' there are references to manufacturer specific products. These are to be considered the 'Basis of Design' to establish the expected minimum quality

requirements. Design Professionals are encouraged to identify and include equivalent products and/or manufacturers offering comparable products to facilitate open bidding environments.

General Requirements for Plumbing

This standard is not intended to prohibit the use of alternative methods, systems, or products not listed in this document. The Design Team is encouraged to pursue new innovative ideas to enhance the performance of the building systems. If the project team would like an exception to the standards to be considered, the request must be submitted in written form to the FP&C Project Team.

On the TTU main campus, the majority of all buildings are cooled using chilled water from Central Heating and Cooling Plant No. 1 (CHACP1). There are three steam and two electric turbine driven chillers in the plant designed to operate at a chilled water ΔT of 16 degrees Fahrenheit. Chilled water is distributed to the buildings in a network of piping located in underground utility tunnels. The network has three pairs of 30" pipes that leave the plant and connect to each building through a series of smaller branch pipes. There are also a number of pipes that connect the main pipes to each other for improved distribution. Each building has one or more booster pumps that are intended to overcome friction loss through the building piping, cooling coils, and valves. Future project locations, demands, and CHACP1 capacities will determine design and tie in capabilities.

The following mechanical system items shall be completed and approved by the FP&C Project Team prior to requesting the University to provide chilled water or steam from the campus distribution system:

1. All chilled and hot water piping systems must be complete.
2. All hydronic-piping systems must be cleaned in accordance with TTU Standards.
3. All chilled water piping must be insulated and sealed.
4. All pumps, air handlers and other and other associated equipment must be installed in their permanent location with all valves, strainers, piping, vibration isolation, electrical connections and safety devices in place.
5. Controls to regulate temperature and water flow must be in place and operational.
6. Provide and service fine mesh construction inserts in pump strainers.
7. Temporary filters must be installed on AHU's and fan powered VAV boxes during construction. Provide temporary filter media ahead of permanent filters and replace when dirty. Under no circumstance shall any AHU be started without temporary protective filters installed. All spacers

shall be installed and filters tight prior to starting air handling equipment. All permanent filters for air handlers must be in place at substantial completion.

8. Factory startup of the VFD drives shall be completed prior to turning on units.

Equipment layout including but not limited to AHU's, pumps, piping, water heaters, VFD's, PRV Stations, fire pumps, and flow meters will be approved by the Owner or Owner's Representative. All equipment/systems shall be installed per manufacturer's recommendations.

The campus furnished utilities will be measured by a BAS Energy Measurement System that shall be built and calibrated by a single manufacturer. A certificate of NIST traceable calibration shall be provided with each system component. All equipment shall be covered by the manufacturer's two-year warranty.

Avoid whenever possible installing mechanical/electrical equipment, where future access is required, above hard ceilings. If access cannot be obtained through the removable ceiling or through other means, the Contractor shall provide access doors a specified in Division 8. Equipment is to be "readily accessible" per ANSI/ASHRAE standards.

In no case shall PVC piping be installed in a return air plenum or supply/return ductwork without UL Listed and ASTM tested fire resistant plenum wrap. Plenum wrap to be 3M Fire Barrier Plenum Wrap 5A+ or approved equal.

For the safety of the workers and the spirit of LEED, mechanical rooms, fire pump rooms, and electrical rooms lighting shall be controlled by a programmable digital time switch. Specify the Watt Stopper TS-400 or approved equal. Motion or timer actuated lighting will not be allowed in elevator machine rooms and hoist ways.

When performing hydrostatic testing on piping, leave all pipe joints un-covered for visual inspection.

Specify adjustable angle thermometers. Solar powered thermometers will not be specified.

Subcontractors are to provide their own test sheets and test certificates for all mechanical testing. All testing or certifications are to be witnessed by the FP&C Project Inspector or appointed Owner's

Representative and appropriate documentation is to be forwarded to the Project Manager within 5 days of the test.

For RO water, specify the Onicon Series F-1100 single turbine flow meter or approved equal for lines 2" and smaller. Specify the Onicon Series F-1200 inline electromagnetic flow meter or approved equal for lines 2 1/2" and larger. Locate meters in an accessible area in the mechanical room of the building being served. Meters shall communicate to BMS via BACnet D-100 controller.

For compressed air, specify the Onicon series F-2600 inline vortex mass flow meter. Utilize ANSI Class 150 pressure sensor with external 24 VDC. Meters shall communicate to BMS via BACnet transmitter.

Unless noted otherwise, the Design Professionals shall certify that the project complies with the Energy Conservation Standard and submit a copy of that certification to the State Energy Conservation Office (SECO) at least thirty calendar days prior to start of construction. This certification form can be found on the SECO website at: http://www.seco.cpa.state.tx.us/ . The design team shall provide TTUS three bound copies containing the completed certification form and all necessary information and calculations to support certification. The project should be designed and built to meet the minimum LEED BC+D certification standards.

Pursuant to Texas Government Code 447.004 subsection (a) and the Texas Administrative Code Title 34, Part 1, Chapter 19, Subchapter C § 19.32, the State Energy Conservation Office has adopted, by reference, the latest version of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)/ Illuminating Engineering Society of North America (IESNA), Energy Standard for Buildings Except Low-Rise Residential Buildings. The new standard is ASHRAE/IESNA Standard 90.1-2010. This change applies to any construction or major renovation project with a design assignment date of September 1, 2011 or later.

Pipe and Pipe Fittings

All piping materials shall be manufactured and tested according to applicable NFPA, ANSI, ASTM, ASME, AWWA, U.L., FM Global and CISPI standards.

Unless otherwise noted, all piping materials shall be domestically manufactured in the U.S.A.

Provide a minimum of 12-gauge tracer wire for all below grade non-metallic piping systems. Metallic warning tape shall not be considered equivalent.

Piping Identification

Pipe identification shall be in accordance with the latest standards of ASME A13.1 and ANSI.

For underground piping, specify bright colored continuously printed non-detectable plastic ribbon tape. Ribbon shall be not less than six (6) inches wide by minimum four (4) mil thick, and shall be manufactured for direct burial service. Refer also to Division 2 and TTU Operating Policies and Procedures 61.11 "*Underground Trenching of Utilities*" for more specifics.

Specify that plastic pipe markers shall be pre-coiled or snap on type with markings to convey fluid and direction of flow. Approved manufacturers: W.H. Brady Company, Craftmark, 3M, Seton, or equal approved by Architect/Engineer and Owner's Representative. Locate identification at pumps, at each side of penetration of structure or enclosure, at each obstruction, and every 20 foot of horizontal or vertical runs.

Only stenciled/painted markers shall be allowed outdoors unless the plastic markers are demonstrated to be durably suitable for that service (adhesion, fading, cracking, etc.). Where plastic markers are accepted for outside service, provide clear protective coating recommended by manufacturer.

Insulation - General

Applicator shall be a company specializing in insulation application with minimum 5 years' experience. References will be made available upon request.

Before installing insulation, build mockups for each type of insulation and finish to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Owner. Use materials indicated for the completed Work. Mockups shall include piping insulation, ductwork insulation and equipment insulation.

Pipe Insulation

This section shall be followed for minimum requirements for all pipe insulation common to several mechanical piping systems. It shall include all insulation, fittings and jacketing. The manufacturer's installation instructions shall be referenced for each and every insulation application, and the insulation shall be installed in accordance with manufacturer's installation instructions.

Subject to compliance with requirements, provide products by one of the following:

1. Cellular-Glass Insulation:
    a. Pittsburgh Corning "Foamglass" or approved equal
2. Flexible Elastomeric Thermal Insulation:
    a. Armstrong World Industries, Inc.
    b. Rubatex Corp.
3. Calcium Silicate Insulation:
    a. Owens-Corning Fiberglas Corp.
    b. Johns-Manville-Thermo-12
4. Fiberglass:
    a. Johns Manville
    b. Owens Corning
    c. Pittsburgh Corning

Cellular-glass insulation to be inorganic foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Pre-formed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.
2. Pre-formed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.

Flexible elastomeric thermal insulation to be closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

Calcium silicate insulation is to be pre-formed pipe sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I. Johns-Manville Thermo-12 Insulation is the standard calcium silicate insulation for use at Texas Tech.

Fiberglass insulation to be one-piece molded insulation with fire retardant multi-purpose all service jacket with a flame/smoke rating of 25-50. Temperature service range of -20 °F to 180 °F.

Prefabricated thermal insulating fitting covers shall comply with ASTM C 450 for dimensions used in pre-forming insulation to cover valves, elbows, tees, and flanges.

Specify field applied jackets as:

1. General: ASTM C 921, Type 1, unless otherwise indicated.
2. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
3. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
    i. Adhesive: As recommended by insulation material manufacturer.
    ii. PVC Jacket Color: White or gray.
    iii. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system, and in accordance with ASME A13.1.
4. Heavy PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 30-mil thick, high-impact, ultraviolet-resistant PVC.
    i. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
    ii. Adhesive: As recommended by insulation material manufacturer.
5. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC.
    i. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
    ii. Adhesive: As recommended by insulation material manufacturer.
6. Aluminum Jacket: Aluminum roll stock, ready for shop or field cutting and forming to indicated sizes. Comply with ASTM B 209, 3003 alloy, H-14 temper.
    i. Finish and Thickness: Smooth finish, 0.010 inch (0.25 mm) thick.
    ii. Finish and Thickness: Corrugated finish, 0.016 or 0.020 inch thick.
    iii. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    iv. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish and thickness as jacket.
7. Preformed Aluminum Jacket: ASTM 0.020-inch-thick; factory cut and rolled to indicated sizes.

Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Below-grade piping, unless otherwise indicated by Design Professional.
5. Chrome-plated pipes and fittings, unless potential for personnel injury.
6. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.
7. Steam traps and condensate cooling (drip) legs.

Interior Insulation Application Schedule:

Service: Domestic hot and re-circulated hot water

1. Insulation Material: One-piece molded fiberglass
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Per Design Professional
4. Vapor Retarder Required: Per Design Professional

Service: Domestic water

1. Insulation Material: One-piece molded fiberglass
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Per Design Professional
4. Vapor Retarder Required: Per Design Professional

Service: Condensate drain piping

1. Insulation Material: Flexible elastomeric
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: None
4. Vapor Retarder Required: Yes

Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled

1. Insulation Material: Flexible elastomeric
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: PVC P-trap and supply covers
4. Vapor Retarder Required: No

Service: Chilled-water supply and return

1. Insulation Material: Tunnels and Mechanical Rooms to be Foamglass or equal. Interior
   a. spaces to be fiberglass or equal
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Mechanical Room and Tunnel to have aluminum jacket with stainless
   a. steel bands
4. Vapor Retarder Required: Yes

Service: Refrigerant suction and hot-gas piping

1. Insulation Material: Flexible elastomeric
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Per Design Professional
4. Vapor Retarder Required: Yes

Service: Heating hot-water supply and return

1. Insulation Material: One-piece molded fiberglass
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: interior building spaces per Design Professional and Aluminum in tunnel
4. Vapor Retarder Required: Per Design Professional

Service: Steam and condensate

1. Insulation Material: Calcium silicate
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Aluminum or fiberglass Per Design Professional
4. Vapor Retarder Required: Yes

Exterior Insulation Application Schedule:

This application schedule is for aboveground insulation outside the building.

Service: Refrigerant suction

1. Insulation Material: Flexible elastomeric
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Per Design Professional
4. Vapor Retarder Required: Yes

Service: Chilled-water supply and return.

1. Insulation Material:
    a. Pittsburgh Corning “FoamGlass” or approved equal , with jacket (tunnel Applications).
    b. One-piece molded fiberglass.
2. Insulation Thickness: Per Design Professional
3. Field-Applied Jacket: Aluminum
4. Vapor Retarder Required: Yes.

All underground steam and condensate lines shall be Thermacor, Permapipe, or an approved equal pre-insulated pipe.

Valves

This section shall be followed for all valves common to several mechanical piping systems. It shall include all valves and connections.

Use gate valves for isolation and shut off duty. Do not use for throttling or balancing duty.
Gate Valves, 2-1/2 Inches and Smaller: Class 125, 200-psi cold working pressure (CWP), or Class 150, 300-psi CWP; cast-bronze body and bonnet, solid-bronze wedge, rising stem, teflon-impregnated packing with bronze packing nut, threaded or soldered end connections; and with malleable-iron hand wheel.

Gate Valves, 3 Inches and Larger: Class 125, 200-psi CWP, cast-iron body and bonnet, solid cast-iron wedge, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with 2-piece packing gland assembly, flanged end connections; and with cast-iron hand wheel.

Ball valves shall be used for all isolation type applications, except in steam systems. Ball valves may also be used for throttling duties. It is recommended ball valves larger than 6” not be used.

Ball Valves, 2-1/2 Inches and Smaller: Class 125, 200-psi CWP, or Class 150, 300-psi CWP, bronze body and bonnet, 2-piece construction; chrome-plated brass ball, full size port; blowout proof; bronze or brass stem; teflon seats and seals; threaded or soldered end connections:

1. Operator: Vinyl-covered steel lever handle.
2. Stem Extension: For valves installed in insulated piping.
3. Memory Stop: For operator handles.

Ball Valves, 3 Inches thru 6 inches: Class 125, 200-psi CWP, or Class 150, 300-psi CWP, bronze body and bonnet, 2-piece construction; chrome-plated brass ball, full size port; blowout proof; bronze or brass stem; teflon seats and seals; flanged end connections:

1. Operator: Lever operators with lock.
2. Stem Extension: For valves installed in insulated piping.
3. Memory Stop: Where required.

Plug valves shall be used only for shut off duty.

Plug Valves: 175-psi CWP, cast-iron body and bonnet, cast-iron plug, teflon packing, flanged end connections:

- Operator: Lever or Square head.

Globe valves maybe used for both shut off and throttling duty.

Globe Valves, 2-1/2 Inches and Smaller: Class 125, 200-psi CWP, or Class 150, 300-psi CWP; cast-bronze body and screwed bonnet, bronze, or teflon disc, silicon bronze-alloy stem, teflon-impregnated packing with bronze nut, threaded or soldered end connections; and malleable-iron hand wheel.

Globe Valves, 3 Inches and Larger: Class 125, 200-psi CWP, cast-iron body and bolted bonnet with bronze fittings, renewable bronze seat and disc, brass-alloy stem, outside screw and yoke, teflon-impregnated packing with cast-iron follower, flanged end connections; and with cast-iron hand wheel.

Butterfly valves may be used for both shut off and throttling duty.
Butterfly Valves: 200-psi CWP, 150-psi maximum pressure differential, cast-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals, lug style:

1. Disc Type: Aluminum bronze.
2. Operator for Sizes 2 Inches to 6 Inches: Lever handle with latch lock.

Swing Check Valves, 2-1/2 Inches and Smaller: Class 125, 200-psi CWP, or Class 150, 300-psi CWP; horizontal swing, Y-pattern, cast-bronze body and cap, rotating bronze disc with composition seat, threaded end connections:

Swing Check Valves, 3 Inches and Larger: Class 125, 200-psi CWP, cast-iron body and bolted cap, horizontal-swing bronze disc, flanged end connections.

Wafer Check Valves: Class 125, 200-psi CWP, cast-iron body, bronze disc/plates, stainless-steel pins and springs, Buna N seals, installed between flanges.

Lift Check Valves: Class 125, bronze body and cap (main components), horizontal or vertical pattern, lift-type, bronze disc with stainless-steel holder threaded or soldered end connections.

Isolation valves for steam supply shall be gate valves. Valves for condensate return shall be steam rated ball valves or OS&Y gate valves.

Installation of valves:

1. Install valves in horizontal piping with stem at or above the center of the pipe.
2. Install valves in a position to allow full stem movement.
3. For chain-wheel operators, extend chains to 60 inches above finished floor elevation.
4. Installation of Check Valves: Install for proper direction of flow as follows:
    a. Swing Check Valves: Horizontal position with hinge pin level.
    b. Wafer Check Valves: Horizontal or vertical position, between flanges.
    c. Lift Check Valve: With stem upright and plumb.

All soldered joints shall be made with high temperature solid string or wire solder, 95% tin, 5% antimony, using non-corrosive paste flux. 50-50 or 40-60 low temperature solder shall not be used.

Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2 Inches and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
2. Steel Pipe Sizes, 2 Inches and Smaller: threaded.
3. Steel Pipe Sizes, 2 ½ Inches and Larger: flanged.

Application Schedule:

Use gate, ball, and butterfly valves for shutoff duty; globe, ball, and butterfly for throttling duty.

Application Schedule:

Domestic Water Systems: Use the following valve types:

1. Gate Valves: Class 125, bronze or cast-iron body to suit piping system.
2. Ball Valves: Class 150, 300-psi CWP, with stem extension.
3. Plug Valves: Neoprene-faced plug, Buna N packing.
4. Globe Valves: Class 125, bronze or cast-iron body to suit piping system, and bronze disc.

5. Butterfly Valves: Nickel-plated ductile iron disc; EPDM sleeve and stem seals.
6. Bronze Swing Check: Class 125, with rubber seat.
7. Check Valves: Class 125, swing or wafer type as indicated.

Heating Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze or cast-iron body to suit piping system.
2. Ball Valves: Class 150, 300-psi CWP, with stem extension and memory stop.
3. Plug Valves: teflon packing.
4. Globe Valves: Class 150, bronze or cast-iron body to suit piping system, and bronze disc.
5. Butterfly Valves: Nickel-plated ductile iron disc; EPDM sleeve and stem seals.
6. Bronze Swing Check: Class 150, with composition seat.
7. Check Valves: Iron swing, wafer, or lift type, as indicated. Swing check shall be Class 150 with bronze seat ring.

Steam and Condensate Return Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 300-psi CWP, with stem extension.
3. Plug Valves: teflon packing.
4. Globe Valves: Class 150, bronze body with teflon disc; or Class 125, cast-iron body.
5. Check Valves: Class 150, bronze body swing check with composition seat; Class 150, cast-iron body swing check with bronze seat ring; or Class 125, cast-iron body wafer check.

Chilled-Water Systems: Use the following valve types:

1. Gate Valves: Class 150, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 300-psi CWP, with stem extension and memory stop.
3. Plug Valves: Buna N packing.
4. Globe Valves: Class 125, bronze body with bronze disc; or Class 125, cast-iron body.
5. Butterfly Valves: Nickel-plated ductile iron disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, bronze body swing check with rubber seat; Class 125, cast-iron body swing check; or Class 125, cast-iron body lift check.

Condenser Water Systems: Use the following valve types:

1. Gate Valves: Class 125, bronze body; or Class 125, cast-iron body.
2. Ball Valves: Class 150, 300-psi CWP, with memory stop.

3. Plug Valves: Buna N packing.
4. Globe Valves: Class 125, cast iron body with bronze disc; or Class 125.
5. Butterfly Valves: Aluminum bronze disc; EPDM sleeve and stem seals.
6. Check Valves: Class 125, cast-iron body swing check with rubber seat

Press Connect Fittings

Press connect type fittings will be Viega ProPress System with Smart Connect Feature or approved equal. Press connect type fittings will only be allowed for 2" or smaller. Press connect type fittings will be allowed for domestic water and for chilled and heating water and shall meet the following requirements:

Copper and copper alloy press-connect fittings shall comply with the material and performance requirements of ASME B16.51. Press connect fittings shall have an indicating feature to positively identify un-pressed fittings during testing procedures. All fittings shall be identified as having the indicating feature by markings on the rim of the fittings. The indicating feature shall be created by a mechanical deformation in the metal casing that allows media in the pipe to pass around the sealing element of an un-pressed fitting. No such feature created by deformation of the sealing element shall be permitted. The installers shall clearly mark the depth of each pipe/fitting being pressed for verification and/or inspection that the pipe is fully inserted into the fitting prior to the pressing operation. Each installer shall be factory trained by the manufacturer and shall carry authorized training credentials. Sealing elements shall be recommended by the manufacturer. For water applications, EPDM sealing elements shall be used. Brass fitting systems shall be compatible with Rigid press tools.

Press connect type fittings to have a 50-year warranty against defects in material and workmanship.

Mechanical/plumbing contractor shall furnish the owner a new press fit tool and fitting attic stock per the Owner's requirement.

Plumbing Fixtures and Equipment

Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer. If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

Specify that electric or gas water heaters are to be sized to meet the project demand and voltage requirements set forth by the A/E. Specify Rheem, AO Smith, or approved equal. Tanks shall have a five-year warranty and other components shall have a minimum of a one-year warranty from date of substantial completion. Tank shall be UL rated and meet ASME standards with pressure ratings. Safety relief valves shall be ASME rated and be both pressure and temperature sensitive. Units shall be supplied with applicable drain pans.

Specify that steam water heaters are to be factory assembled, instantaneous type, with all controls, valves, safety solenoids, traps, and temperature regulating equipment to provide hot water with adjustable set-points. The unit shall have cupro-nickel (copper nickel) tubes to resist the hard water in this area. Internal baffles when specified shall be Brass or similar metals. Teflon or other similar types of materials will not be allowed. Specify Patterson Kelly or approved equal. All related UL and ASME ratings apply for tank components, valves, solenoids, etc. Provide storage tank for designs requiring heavy demands**.**

Specify that recirculating pumps are to be Taco, Bell and Gosset, Grundfos, or approved equal. Pumps shall have sealed bearings that do not require lubrication. Pumps shall be accessible for maintenance and installed with a disconnect switch in sight of the unit. Pumps shall have a minimum one-year warranty.

All drinking fountain units shall be UL listed and comply with A.R.I. Standard 1010. Units shall operate on 115V/60Hz and have a flow regulator accessible for adjustment.

Wall mounted drinking fountains shall be stainless steel Standard Dual Bi-Level unit with satin finish and a galvanized frame. Specify a TAS/ADA apron allowing frontal approach. Unit shall operate up to 105 psi while providing 8 GPH constant stream of water. Water controls shall operate with a maximum of 5 lbs. of force. If a bottle filling station is included in the design, specify an Elkay Halsey Taylor, or approved equal, Bi-Level ADA/TAS side approach filling station, sanitary, no-touch push activation bar operating with a maximum of 5lbs of force, water filter included with visual interface for replacement notification. Bottle filling station shall be “hands-free” automatic with a 30 second shut-off timer and be rated 1.1 GPM for refrigerated units 1.5 GPM for non-refrigerated units. Unit shall be lead-free and include antimicrobial protected plastic components to prevent mold and mildew.

Specify water closets to be American Standard, Kohler, or approved equal, either floor or wall mounted, siphon jet, elongated bowl, ADA/TAS compliant, white vitreous china unless specified otherwise, low water consumption, 1 ½" inlet, heavy duty open front solid plastic seat, meeting ASME A112.19.2-2008/CSA B45.1-08,

Specify urinals to be Sloan or approved equal with fixture/flush valve, white vitreous china unless specified otherwise, HEU wall mount wash down with Integral trap and ¾" top spud and carrier, floor mounted carrier with hanger plate, adjustable supporting rods, rectangular structural uprights and welded feet. Water less urinals will be specified per the TTU PM's request.

If waterless urinals are specified, specify touchless-free operation, sealed locking style cartridge (with the maintenance key for changing cartridges), odor-free, vitreous china, and white in color unless noted otherwise. Cartridges shall have a minimum of 7000 usages.

Specify angle stops and flush valves to be Sloan Royal or approved equal, quiet exposed permex rubber diaphragm type flush valve with ADA Non-Hold-Open Handle, free spinning stop cap, no external volume adjustment, and is TAS compliant. Automatic flush sensor type valves to be Sloan or approved equal and battery operated. Install new batteries on substantial completion.

Specify water meters to be compound or turbine style suitable for the anticipated consumption of water usage in the facility. Meter shall be accessible for reading and maintenance and can be either located inside the building or in an outside vault at the tie-in location. Owner shall direct location.

Specify water hammer arrestors to be Watts or approved equal. Arrestors to be threaded for maintenance removal; sweat fittings are not preferred. Install in an accessible location.
Specify lavatories and sinks to be American Standard, Kohler or approved equals. Lavatories and sinks to be either vitreous china, stainless steel, acid resistant, or polymer/resin construction depending on the application and Owner's preference.
Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

Domestic Water Piping

This Section specifies requirements for furnishing and installing domestic hot and cold-water piping, including hot water return, within buildings and underground within 10 feet of building.

Comply with AWWA Standards for public drinking water and Disinfecting Water Mains.

All buildings will be designed for metering of campus water. Domestic water shall have water meters installed either outside of the building or if approved by the Owner installed in the mechanical room of the building being served. Water meters up to 2 ½" shall be Onicon F-3000 series and water meters 3" and larger shall be Onicon F-3500 series. Meters shall communicate to BMS by BACnet via D-100 controller.

For underground piping sizes 4" and smaller, provide ASTM B 88, hard-drawn, Type K copper water tube with wrought copper fittings with socket ends, ANSI B16.22. Provide Sil-Fos lead-free solder for all solder joints.

For aboveground piping provide seamless, ASTM B 88, Type L copper water tube with ANSI B16.22 wrought copper fittings with socket ends. Provide lead-free solder for all solder joints. Solder shall be alloy Grade E in accordance with ASTM B32, equal to Engelhard Silvabrite 100.

Wrap all ductile iron fittings and valves in polyethylene sheet in accordance with AWWA C105.

Specify a reduced pressure backflow preventer sized as indicated on drawings, manufactured of bronze, rated for 175 psi, and shall include strainer, gate or ball valves based on size, pressure differential relief valve, check valves, test cocks, and relief vent and funnel drain. Unit shall meet the requirements of ASSE 1013, and AWWA, University of Southern California tested and approved.
Manufactured by Watts
Regulator No. 909, or approved equal by Wilkens or Flomatic.

Backflow prevention assemblies shall be tested upon installation by a recognized backflow prevention assembly tester and certified to operating within specifications. Test certifications will be provided to FP&C and TTU Physical Plant.
Atmospheric vacuum breakers shall be full line size, manufactured of brass or bronze with full size orifice, dry guide out of the liquid pressure area and disc float closing vent with minimum flow.
Manufactured by Watts Regulator, No. 188A Series, or approved equal by Wilkens or Flomatic.

The water hydrostatic test pressure shall be a minimum 125 psi and a maximum of 1.5 times the working pressure. The pressure test shall be maintained for sufficient time to inspect all joints, with a minimum time of four hours.

Hot Water Heaters

Specify Patterson Kelley PK06, PK08, PK10 or approved equal.

Domestic Water Pumps

Specify complete factory assembled package tested, adjusted, and mounted securely on steel framing. Unit shall have two (2) pumps and a control panel with a main disconnecting switch that is inter-locked with the panel door. Units shall be sized for the Project demand. The pumping system shall be lead lag style with the secondary pump activating upon primary pump failure. The system as a whole unit shall have a five (5) year warranty. Domestic pump system to be Bell and Gossett, Grundfos, TACO or approved equals.

Sanitary Waste and Vent Piping

The Design Professionals and the FP&C Project Team will determine whether to specify cast iron or PVC piping for the sanitary waste and vent piping based on the project type and location.

For cast iron drain piping, specify piping to be service weight cast iron marked with collective trade mark of CISPI. Piping to be manufactured by Charlotte, Tyler, AB & I, or approved equal.

For underground cast iron drain piping within 5 ft. of building line, specify ASTM A74, service weight cast iron bell-and-spigot soil pipe and DWV pattern fittings with ASTM C 564 neoprene gaskets.
For underground PVC piping, specify Schedule 40 with solvent cemented joints.

For above ground cast iron piping, specify service weight cast iron no-hub soil pipe and DWV pattern fittings, conforming to ASTM A888-05 and most current version of CISPI 301. Provide CISPI 310, type 304 stainless steel heavy-duty 4-band no-hub couplings for pipe sizes 4” and less and 6-band no-hub couplings for pipe sizes over 4” with neoprene gaskets.

In no case shall PVC piping be installed in a return air plenum or supply/return ductwork without UL Listed and ASTM tested fire resistant plenum wrap. Plenum wrap to be 3M Fire Barrier Plenum Wrap 5A+ or approved equal.

For cast iron soil vent pipe and fittings, specify same as above grade piping indicated above. Provide heavy duty type 304 stainless steel minimum 4-band no-hub couplings, conforming to C.I.S.P.I. 310 as specified for drainage piping. Pipe shall conform to ASTM A 74, ASTM A 53 or ASTM B 306, where applicable. For underground vent pipe and fittings, provide same as specified for underground drainage pipe and fittings.

In situations where wastewater temperatures exceed the PVC temperature ratings, cast iron or CPVC piping will be specified.

For piping below Floors, test pipe before backfilling and connecting to sewers by maintaining not less than 10’ of hydrostatic head for 2 hours without a leak.

After all the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by plugging all outlets and filling vertical sections with water to maintain not less than 10 feet of hydrostatic head for a minimum of 2 hours without any drop-in water level, for all sections of piping. Provide wyes as required to facilitate plugging. Cold weather testing will be an option upon Owner’s approval and when excessive cold conditions exist.

Roof Drainage Piping System

The Design Professionals and the FP&C Project Team will determine whether to specify cast iron or PVC piping for the storm and overflow drainage piping based on the project type and location.

For cast iron drain piping, specify piping to be service weight cast iron marked with collective trade mark of CISPI. Piping to be manufactured by Charlotte, Tyler, AB & I, or approved equal.

For underground cast iron storm and overflow drainage piping within 5 ft. of building line, specify ASTM A74, service weight cast iron bell-and-spigot soil pipe and DWV pattern fittings with ASTM C 564 neoprene gaskets.

For aboveground cast iron storm and overflow drainage piping for sizes up to 10”, specify, service weight cast iron no-hub soil pipe and DWV pattern fittings, conforming to ASTM A888-05 and most current version of CISPI 301, with CISPI 310 stainless steel heavy weight 4-band no-hub couplings for pipe sizes 4” and less and 6-band no-hub couplings for pipe sizes over 4” with neoprene gaskets, manufactured by Mission HW, Anaco "Husky 2000", Mi Fab XHUB, or approved equal. Pipe sizes over 10”, shall be bell-and-spigot soil pipe.

For aboveground and underground PVC storm and overflow drainage piping, specify Schedule 40 PVC with solvent cemented joints. In no case shall PVC piping be installed in a return air plenum or supply/return ductwork. Do not use perforated underground piping.

For horizontal pipe joints, 1/8 bend and greater, provide angle braces to structure to restrain both lateral and longitudinal movement of piping.

For horizontal piping, provide angle braces to structure, at maximum 25’ spacing, to restrain lateral pipe movement.

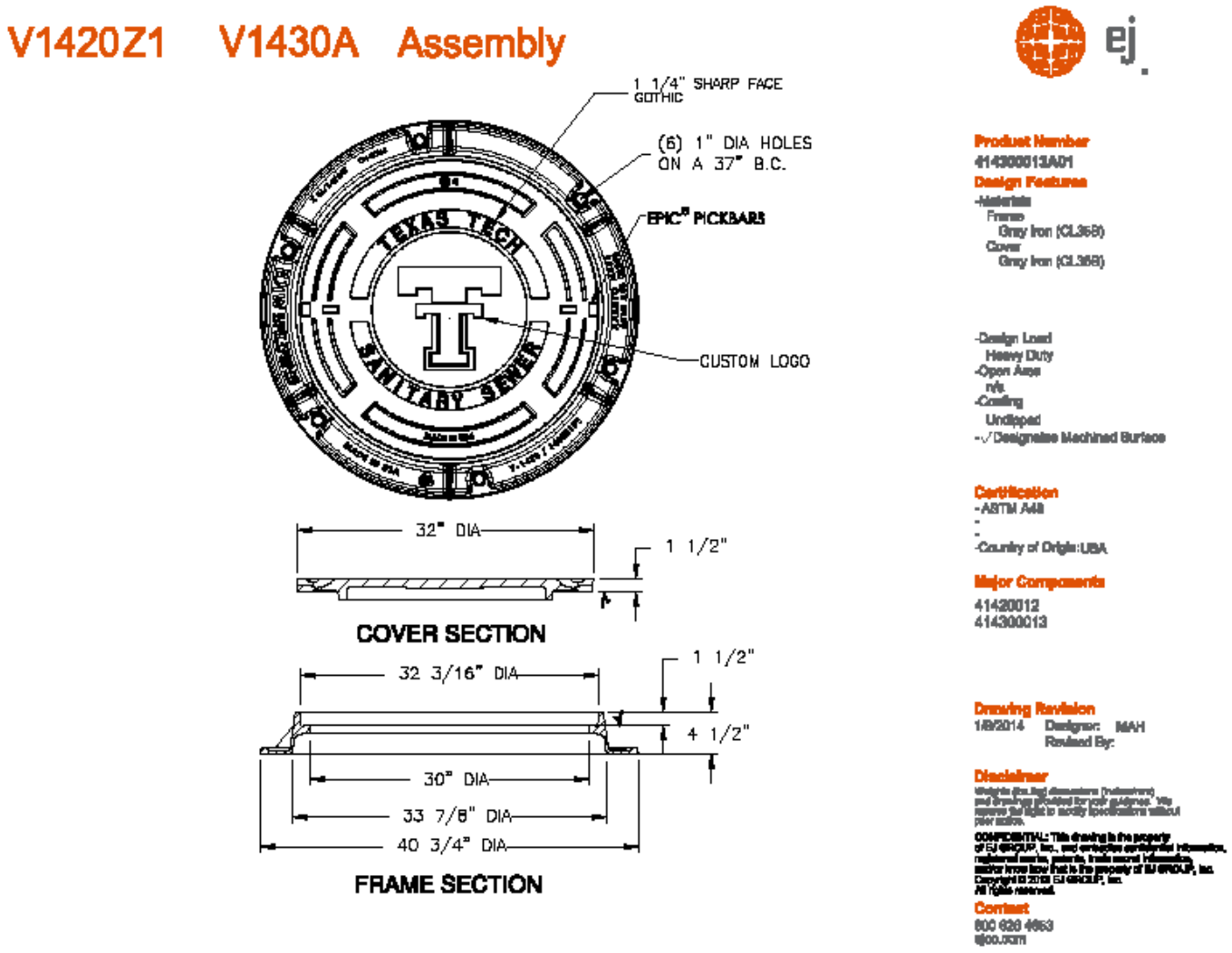
Specify to give horizontal pipe a minimum grade of 1/8” per foot, unless otherwise noted on drawings.
Specify to use reduction fittings to connect two pipes of different diameter.
Specify to change directions by appropriate use of 45-degree wyes; long-sweep quarter-bends, and sixth, eighth, and sixteenth-bends. Sanitary tees may be used on vertical stacks. Use long sweeps at the base of risers.

For underground piping, test pipe before backfilling and connecting to sewers. Maintain not less than 10 feet of hydrostatic head for 2 hours without a leak.

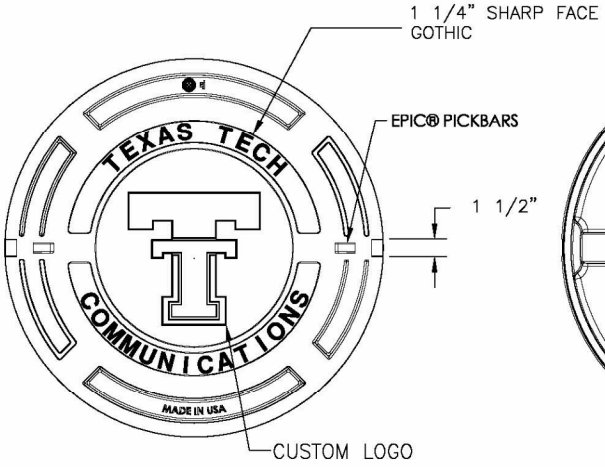
After all the various sections of roof drain piping are installed, test the system by plugging all outlets and filling vertical sections with water to maintain not less than 10’ of hydrostatic head for 2 hours without any drop in water level, for all sections of piping. All sections with pipe joints shall be tested. Provide wyes as required to facilitate plugging. Provide test tees at bases of all roof drain risers for testing.
Refer to latest edition of the International Plumbing Code for additional testing requirements.

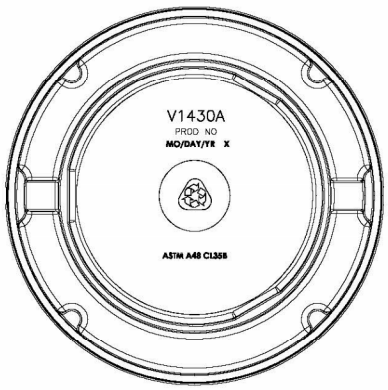
Manhole Covers

Please reference Attachment 1 and 2 for the sanitary and storm water manhole covers. The castings are manufactured from grey iron ASTM A48 Class 35B iron. The ring is named in EJ's Dictionary as a V1420. and the Cover is a V1430.



V1430A Cover



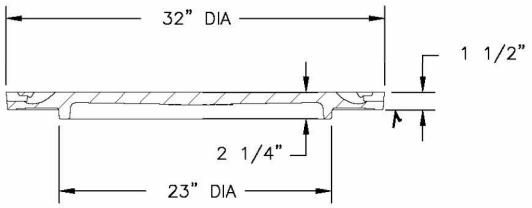


BOTTOM VIEW

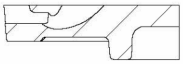
Product Number
NPR14-4228

Design Features
-Materials
Gray Iron (CL35B)
-Design Load
Heavy Duty
-Open Area
n/a
-Coating
Undipped
-√ Designates Machined Surface

Certification
-
-ASTM A48
-
-Country of Origin: USA



SECTION



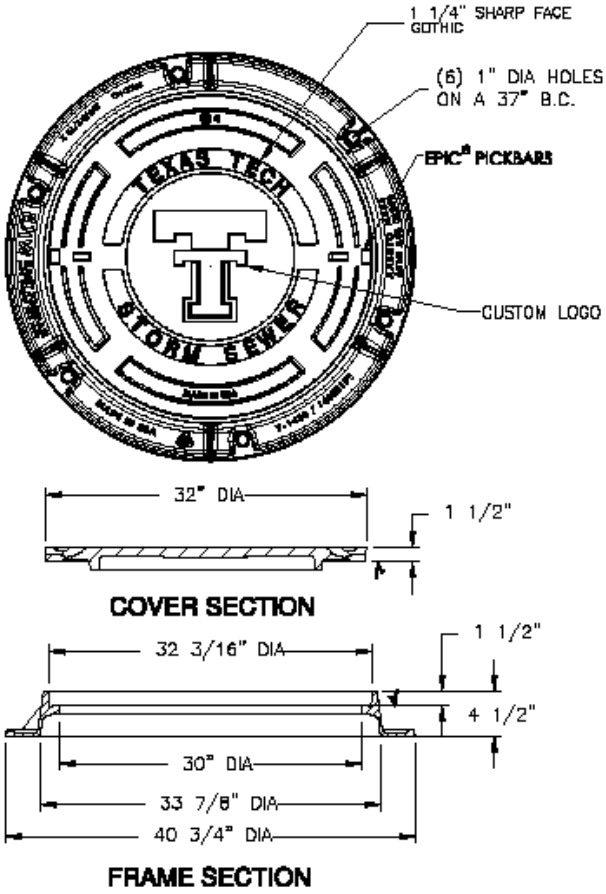
PICKHOLE DETAIL

Drawing Revision
10/17/2014 Designer: MAH
Revised By:

Disclaimer
Weights (lbs./kg) dimensions (inches/mm) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

Contact
800 626 4653
ejco.com

V1420Z1 V1430A Assembly



Product Number
414300014A01

Design Features
-Materials
Frame
Gray Iron (CL35B)
Cover
Gray Iron (CL35B)

-Design Load
Heavy Duty
-Open Area
n/a
-Coating
Undipped
-√Designates Machined Surface

Certification
-ASTM A48
-
-
-Country of Origin: USA

Major Components
41420012
414300014

Drawing Revision
1/8/2014 Designer: MAH
Revised By:

Disclaimer
Weights and dimensions (nominal) and drawings provided for your guidance. We reserve the right to modify specifications without prior notice.

Contact
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Disinfection of Potable Water System

All new, altered, or repaired potable water system piping and tanks shall, after successful pressure testing, be thoroughly flushed with clean potable water and then disinfected prior to utilization/final connection in strict accordance AWWA C651. The preliminary flushing velocity in the main shall not be less than 2.5 ft/sec unless the owner determines that conditions do not permit the required flow to be discharged to waste. Disinfection shall be with either liquid chlorine or chlorine granules (no tablets allowed) of adequate volume to give a water/chlorine solution concentration of 25 ppm (250 mg/L) based upon the volume of the system being treated. The solution will be allowed to stand for a period of 24 hours. If the water temperature is less than 41°F, the water shall remain in the pipe at least 48 hours. A detectable free chlorine residual should be found at each sampling point after the 24- or 48-hour period. Sample points will be selected in accordance with AWWA C651. After final flushing with clean potable water and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1,200 ft. of the new water main, plus one set from the end of the line and a least one set from each branch. The procedure shall be repeated where shown by a bacteriological test that contamination remains in the present system. The above are minimum requirements and all disinfection procedures shall be in strict accordance with the International Plumbing Code, AWWA, TCEQ, Texas Administrative Code (TAC), all local codes and authorities having jurisdiction. The record of compliance shall be the bacteriological test results certifying that the water sampled from the new water main is free of coliform bacteria contamination, absent from free chlorine residual, and is equal to or better than the bacteriologic water quality in the distribution system. Under no circumstances shall the Contractor permit the use of any portion of the domestic water system until the Owner has received a Biological Contamination Reports from a certified testing lab stating that the systems are clean and the system is safe for human consumption.

In lieu of the 25 ppm for 24 hours requirement, filling the system with a water/chlorine solution of 200 ppm or greater and allowing it to stand for a minimum of 3 hours will only be allowed with the Owner’s permission.

The Contractor shall be responsible for the disposal of all domestic water with chemicals resulting from new construction. Water shall be disposed per Owner, State and local requirements.

Contractor to use the City of Lubbock Water Microbiology Laboratory (806-775-2907) for potable water testing. The lab is located at 6001 N. Guava.