

# *Appendix X* Plumbing Piping Requirements

Appendix X\_Plg\_Spec\_Table\_09-12-2014\_rev06.xls

Outline Plumbing Piping requirements

No.	Abbreviation	Source	Location	Pipe Material	Class / Compliance	Type	Joint	Fittings	Values	Insulation Material	Insulation Size	Jacket	Background Color/Liner	Remarks	Social Handling	Pressure Testing / Chemical Cleanout or Passivation	Rod Size / Hangers Spacing
P1	DCW or ICW, Option 1	Domestic Cold Water Supply or Industrial Cold Water Supply	Direct Buried, Below Grade	Pipes 4" & above: AWWA C900 / C900 / PS pressure class PVC	material cell 12454 per ASTM D 1689, NSF/ANSI 61: Drinking Water System components - Health Effects, NSF/ANSI 372: Drinking Water System Components - Lead Content	PVC	Provide polypropylene (PVC) couplings with twin retaining glands which are designed to connect pipe and allow 2 degrees of deflection at each gasket for a total of 4 degrees per coupling.	Provide ductile iron fittings C110 with a minimum rated working pressure of 350 psi. Provide fittings with bells and gaskets. Mega lug series 1700 as cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends.	Pipes up to 2": NIBCO T-585-70-66, Pipes 2.5" - Apollo series 77-140, Pipes 3" - 5", NIBCO LD3122-LD3122-5 lug style butterfly valves, gaskets and B16 studs and nuts. All components associated with potable water system shall be lead-free.	N/A	N/A	DCW: Green / White ICW: Green / White	Install concrete anchor thrust blocks or tie-rods to prevent movement when under pressure. All fittings, couplings, elbows and tees shall be coated. Flanged restraints shall be similar to pipe per manufacturer's instructions. ABS pipe (CPC 315-4), Trenches not to undermine footings when bearing plane is below grade. All water pipe to be buried minimum 18" deep. [CPC 609.1]	Pipe supported on firm sand bed for entire length. [CPC 314.3]. No rock bedding or bedding of any kind. Six inches of sand bed. Minimum for copper, or PVC pipe per manufacturer's instructions. ABS pipe (CPC 315-4), Trenches not to undermine footings when bearing plane is below grade. All water pipe to be buried minimum 18" deep. [CPC 609.1]		N/A	
P2	DCW or ICW, Option 2	Domestic Cold Water Supply or Industrial Cold Water Supply	Direct Buried, Below Grade	Pipes 4" & above: AWWA C900 / C900 / PS pressure class Ductile iron	NSF/ANSI 61: Drinking Water System components - Health Effects, NSF/ANSI 372: Drinking Water System Components - Lead Content	Ductile iron	Mechanical joints, Mega lug series 1100 TDM or Mega lug series 1700 as cast iron equivalent outside diameter PVC pipe. Use application and joint type fittings with bells and gasket ends.	Pipes up to 2": NIBCO T-585-70-66, Pipes 2.5" - Apollo series 77-140, Pipes 3" - 5", NIBCO LD3122-LD3122-5 lug style butterfly valves, gaskets and B16 studs and nuts. All components associated with potable water system shall be lead-free.	Pipes up to 2": NIBCO T-585-70-66, Pipes 2.5" - Apollo series 77-140, Pipes 3" - 5", NIBCO LD3122-LD3122-5 lug style butterfly valves, gaskets and B16 studs and nuts. All components associated with potable water system shall be lead-free.	N/A	N/A	DCW: Green / White ICW: Green / White	All internal components exposed to potable water shall be of lead-free construction as per California AB-1953. Sterilize the system by introducing chlorinating solution into the entire system. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm. Bronze copper pipe joints and non-threaded fittings with 15% Si-Cu. Plug with Nitrogen during process to prevent formation of oxides.	Same as above	Ductile iron, PVC and copper piping system shall be chemically cleaned for a minimum of 48 hours. Pressure test piping system with minimum of 24 hours at 150 psig, record initial and final pressures. Repair any leaks, record the pressure test results, inspector and date of approval noted. Pressure test shall be observed by a Caltech inspection representative and the chemicals and flush the system immediately after cleaning is completed and in compliance with C17 design guide. Refer to campus details of cleaning & passivation and other plastic pipes do not need to be passivated.	N/A	
P3	DCW or ICW	Domestic Cold Water Supply or Industrial Cold Water Supply	Direct Buried, Below Grade	Pipes 1.5" to 3": Copper tubing	ASTM B88, NSF/ANSI 61: Drinking Water System components - Health Effects, NSF/ANSI 372: Drinking Water System Components - Lead Content	Type K, hard lead drawn	Braze with 15% silver content brazing alloy, lead free	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18	Pipes up to 2": NIBCO T-585-70-66, Pipes 2.5" - Apollo series 77-140, Pipes 3" - 5", NIBCO LD3122-LD3122-5 lug style butterfly valves, gaskets and B16 studs and nuts. All components associated with potable water system shall be lead-free.	N/A	N/A	Field wrap with 20 mil PVC 5 mil polyethylene sleeving, blue white color	DCW: Green / White ICW: Green / White	Sterilize Potable water system by introducing chlorinating solution into the system for a minimum period of 24 hours. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm.		N/A	
P4	DCW or ICW	Domestic Cold Water Supply or Industrial Cold Water Supply	Direct Buried, Below Grade	Pipe 0.5" to 1": Soft temper copper	ASTM B88, NSF/ANSI 61: Drinking Water System components - Health Effects, NSF/ANSI 372: Drinking Water System Components - Lead Content	Type K, hard drawn	Braze with 15% silver content brazing alloy, lead free	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18	Pipes up to 1": NIBCO T685-96-LF or Apollo TCU-140 ball valves	N/A	N/A	Field wrap with 20 mil PVC 5 mil polyethylene sleeving, blue white color	DCW: Green / White ICW: Green / White	Repair any leaks, record the pressure test results, inspector and date of approval noted. Pressure test shall be observed by a Caltech inspection representative and the chemicals and flush the system immediately after cleaning is completed and in compliance with C17 design guide. Refer to campus details of cleaning & passivation and other plastic pipes do not need to be passivated.		N/A	
P5	DCW, ICW or SCW	Domestic Cold Water Supply, Industrial Cold Water Supply or soft cold water	Direct Buried, Above Ground	Pipes up to 4": AWWA C900 / C900 / PS pressure class (longitudinal seam and imported piping are allowed.)	ASTM B88, NSF/ANSI 61: Drinking Water System components - Health Effects, NSF/ANSI 372: Drinking Water System Components - Lead Content	Type L, hard drawn, hot temper	Braze with 15% silver content brazing alloys. Exposed to view at finished equipment, seal fresh CP brass pipe with threaded cast bronze fittings. No soft solder on fittings. Minimum 6" of threaded couplings.	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.18	Pipes up to 2": NIBCO T-585-70-66, Pipes 2.5" - Apollo series 77-140, Pipes 3" - 5", NIBCO LD3122-LD3122-5 lug style butterfly valves, gaskets and B16 studs and nuts. All components associated with potable water system shall be lead-free. Isolation valves shall be hand wheel.	N/A	N/A	N/A	DCW: Green / White ICW: Green / White	Braze copper pipe joints and fittings. Threaded fittings shall be soft-soldered using 50/50 lead-free solder. Care should be taken not to anneal the threads. The brazing process to prevent formation of oxides. Sterilize Potable water system by introducing chlorinating solution into the system for a minimum period of 24 hours. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm.	Braze copper pipe joints and fittings. Threaded fittings shall be soft-soldered using 50/50 lead-free solder. Care should be taken not to anneal the threads. The brazing process to prevent formation of oxides. Sterilize Potable water system by introducing chlorinating solution into the system for a minimum period of 24 hours. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm.	As per latest applicable CPC, and fire marshals requirements. Supports shall be designed for seismic zone 4.	

No.	Abbreviation	Service	Location	Pipe Material	Class / Compliance	Type	Joint	Fittings	Valves	Insulation Material	Insulation Size	Jacket	Backout / Shoreline / Cover Color	Remarks	Special Handling	Pressure Testing / Chemicals / Cleaners / Passivation	Red Size / Hangers / Spacing
P6	DHW, HW, HWR, SHW	Domestic hot water supply or indirect water supply / Hot Water Supply / Domestic hot water return or soft hot water	Above Ground	Seamless copper tubing (No ERV, longitudinal seam and allowed)	ASTM B88 Drinking Water System components - Health Effects Drinking Water System Components - Lead Content	Type L, lead drawn, hot temper	Braze with 15% silver content brazing alloys. Exposed to view at finished equipment, safe finished cast bronze threaded CP brass pipe with fittings. No soft solder fittings. All fittings and threaded couplings.	Wrought copper elbows or brass castings, ANSI B16.18	Pipes up to 2" NIBCO T-98570-140, Pipes 5" - 6" NIBCO LD3122-LD3122-5 lug style butterfly valves. Raised full floor spiral wound pipe. All components associated with pipe. Provide stem extensions on all ball valves serving isolated movement. Isolation valves installed higher than 10' above finished floor shall have chain operated hand wheel.	Rigid Fiberglass CS35, K = 1", 1" thick fiberglass, 0.24" air layer, 1.5" thick Certiflex fiberglass or John Meneville	NA	NA	Yellow / Black	Brace copper pipe joints and threaded fittings shall be soft soldered using 50/50 lead free solder. Care should be taken not to anneal the threads. The brazing process shall be done using the brazing procedure to prevent formation of oxides. Sterilize potable water system by increasing chlorinating solution and flushing. Maintain minimum period of 24 hours. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm. design any necessary provisions for thermal expansion and contraction.	As per latest applicable CPC, NFPA, FM global and fire marshals requirements. Supports shall be designed for seismic zone 4.		
P7	DI / RO	De-ionized Water / Reverse osmosis	Above Ground, in installations (e.g. above bar ceilings, areas without direct surface mounted applications)	Stainless steel tubing	UNS-S1603, ASTM-A269 and ASME-SA213, ASTM-A312-SS, S304	Stainless steel tubing with tube wall thickness 0.037" - 0.134", depending on the tube OD. See remarks for wall thicknesses.	Tube fittings by SWAGelok, HyLok or Callon approved similar manufacturer.	Compression style Tube or SWAGelok, Lock or approved equal manufacturer	Full port ball valve, 2 piece body, blowout proof stem, 316 or 316L stainless steel and body construction, threaded ends, 1/4 turn lever handle. Conforms to MSS SP-110, S8-R-66-LL or approved equal by Apollo.	NA	NA	Green / White	Deionized water piping shall be thoroughly cleaned and be free of any oxides, oils or particulate matter prior to being put to service. Scales shall be removed through chemical de-scaling, acid pickling, and mechanical de-scaling. Degreasing and swabbing with, or spraying with, appropriate cleaners or alkaline, emulsion, chelate, acid cleaners, or other pipe cleaners or vapor degreasing by ultrasonics using various cleaners; by steam, with or without high pressure waterjetting as outlined in ASTM-A380.	Install a 0-125 psig Deionized water main pressure regulating valve and pressure relief valve upstream of branch distribution. Residual pressure at the DI panel shall not exceed 25-30 psig. All components shall be compatible with de-ionized water. (i.e. stainless steel or polypropylene construction)- 1/4" OD - 0.037" - 3/8" OD - 0.083", 1/2" OD, 0.035" - 3/4" OD - 0.067", 1" OD - 0.083", 1.25" OD, 0.087", 1.5" OD - 0.127" and 2.0" OD - 0.134" wall thickness	Stainless steel piping system shall be chemically cleaned for a minimum of 48 hours. Pressure testing shall be done with compressed air for a minimum of 24 hours at 150 psig, record initial and final pressures. Repair any leaks, record the pressure test and date of approval noted. Pressure test shall be observed by a Callon inspection representative and the entire piping system immediately after cleaning is completed and acceptance verified with the codes and in compliance with OIT design guide. Refer to campus design guide document for the procedures and chemicals.	As per latest applicable CPC, NFPA, FM global and fire marshals requirements. Supports shall be designed for seismic zone 4.	
P8	DI / RO	De-ionized reverse osmosis water	Above Ground, in concealed installations (e.g. above hand held ceilings and inside wall cavity)	Stainless steel pipe; Low carbon; Seamless, Grade 316L, ERV or longitudinal seam and unacceptable.	ASTM-A312/ASME-SA312	Gas, Trenchless are welding (GTAW) or Tungsten inert gas welding (TIG). Butt welded or socket welded. Mechanical fittings in applications are not acceptable.	Standard weight cast iron no-hub fitting to be marked with the logo of Cast Iron Soil Pipe Institute	Full port ball valve, 2 piece body, blowout proof stem, 316 or 316L stainless steel and body construction, threaded ends, 1/4 turn lever handle. Conforms to MSS SP-110, S8-R-66-LL or approved equal by Apollo.	NA	NA	Green / White	NA	Install a 0-125 psig Deionized water main pressure regulating valve and pressure relief valve upstream of branch distribution. Residual pressure at the DI panel shall not exceed 25-30 psig. All components shall be stainless steel or polypropylene construction)	Pipe supported on firm sand bed for entire length. [CPC 314.3] No rocks supporting or bedding shall be used. Six inches of sand bed minimum for ABS/PVC drain pipe per manufacturer. No backflow preventer (BFP) or backflow arrestor (BFA) or backflow check valve (BFCV) shall be required for backwater valves. Backwater valves required for floors below next upstream manhole cover. Manhole cover shall be elevated not allowed to discharge through backwater valves (typical).	Gravity systems shall be hydrostatic tested for 4 hours at 1.5 times the design pressure. Grout or seal pipe joints with water and use a Br/ho Gauge to record any observed leakage. Record initial and final pressures. Test results with the name of the inspector and date of approval noted. Pressure test shall be observed by a Callon inspection representative. Materials tested shall be listed and all pipes must		
P9	W & V SD (top only)	Sewer & Vent (Gravy)	Direct Buried below Grade	Cast iron no-hub soil pipe to be marked with the logo of Cast Iron Soil Pipe Institute.	CISPI Standard 310 or ASTM A74	No-hub couplings to be Type 304 stainless steel, 1/2" Cast Iron, 150 or 200 SPM, 80 in-hb torque SFM4000, 80 in-hb torque	Standard weight cast iron no-hub fitting to be marked with the logo of Cast Iron Soil Pipe Institute	Back water valves required to be accessible for service. [CPC 710.6]	NA	NA	Yellow / Black	NA	Torque coupling bolts as per manufacturer's recommendation with a calibrated torque wrench. Callon Inspector or plumbing contractor shall document the torque process and randomly spot check the torque torques prior to covering the work. Over-torqued couplings shall be replaced with new torque couplings. Manholes shall be replaced to site conditions. Install sewer ejector pump per CPC 710. Backwater valves required for floors below next upstream manhole cover. Manhole cover shall be elevated not allowed to discharge through backwater valves (typical).	As per latest applicable CPC, NFPA, FM global and fire marshals requirements			

No.	Abbreviation	Service	Location	Pipe Material	Class./Compliance	Type	Joint	Fittings	Valves	Insulation Material	Jacket	Backflow Prevent. Cover	Remarks	Special Handling	Pressure Testing / Chemicals, Cleaners, or Passivation	Test Size / Hangers, Spacing
P10	W & V and (option 42)	Sanitary (Grav) Storm Drain (Grav)	Direct Buried Below Grade	PVC pipe, STD 26. The pipe shall be extruded from compounds meeting the requirements of ASTM D2182, ASTM D2444, ASTM D2412, APMO File No. ASTM D 1784. Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) compounds.	ASTM D3034, ASTM F691, ASTM D2182, ASTM D2444, ASTM D2412, ASTM D2182, ASTM D2444, APMO File No. ASTM D 1784. Plumbing Code 2.2.28 - Uniform Code of Ordinances D3034 SDR 35 for pipes, 4-15 inch outside diameter and SDR 26 for pipes, 18 inch outside diameter.	Extra thick walls	The gasket shall be performed with a steel ring and meet the requirements of ASTM F477. Pipe shall have an integral bell end with a locked-in factory installed gasket and shall meet the requirements of ASTM D2182. Gasketed hub and spigot push type fittings. SDR rating on each project. Recommended installation procedure of PVC drain pipe are outlined in ASTM-D3221. Underground Installation of Flexible Thermoplastic Sewer Pipe.	Black water valves required to be accessible for service. [CPC 710.6]	NA	NA	Yellow / Black	Corrosion resistant pressure pipe, IPS sizes 3/4" through 24", for use at temperatures up to and including 140°F. Pressure rating (100 psi to 200 psi varies with SDR). Series and size shall be as follows: 1) 12 inch and larger: Sanitary sewer waste & vent. Gaseous interceptor waste, storm water drain and sub-soil sale drainage. Fittings to drain by gravity shall be ductile iron. Fittings for water service valves required for fixtures below root. Above manhole cover elevation not allowed to discharge through backwater valves (typical).	Pipe supported on firm sand bed for entire length. [CPC 315.4]. Six inches of sand bed for fittings. [CPC 315.4]. Minimum for ABS/PVC drain pipe per manufacturer. No backfill over ABS pipe. [CPC 315.4]. Trenches not to undermine footings within bearing plane (45'). [CPC 609.1] Minimum 12" deep. [CPC 609.1]	As per latest applicable CPC, NFPA, FM global and fire marshals reports shall be designed for seismic zone 4.		
P11	W, CD, OCD, V	Indirect waste, Cold Drains, Overflows, Condensate Drains	Above Ground	Domestic (US Made) seamless copper tubing (NO ERW, longitudinal seam and imposed piping are allowed.)	ASTM B88	Type L, Hard drawn	Braze with 15% silver content, SH-Fos brazing connections at unions and valves	ANSI / ASME B16.22. Solder wrought copper	NA	Expanded Indogors ASJ 0.27 at least 1/2" thick. [CPC 609.1] Armaflex by Armstrong Industries. Pipes do not	Green / White with arrows in the direction of flow	Sham vent pipes need to be insulated. Air Vent Pipes do not need to be insulated.	As per latest applicable CPC, NFPA, FM global and fire marshals reports shall be designed for seismic zone 4.			
P12	W & V	Sanitary Waste & Vent	Above Ground	Cast iron no-hub soil pipe to be marked with the collective trademark of Cast Iron Soil Pipe Institute	CISPI Standard 310 or ASTM A74	Standard weight	No hub couplings to be used. Type 304 stainless steel, FM Class 1, ASTM C1540 as manufactured by Husky H20200, 60 mph tongue.	Standard weight cast iron no-hub fitting to be marked with the collective trademark of Cast Iron Soil Pipe Institute	Same as above	NA	Yellow / Black	Same as above	N/A	As per latest applicable CPC, NFPA, FM global and fire marshals reports shall be designed for seismic zone 4.		
P13	SSD	Sub-Surface or Foundation Drain	Embedded, Direct Buried, Sub-Surface	PVC pipe, perforated, Class 12454-B (PVC 1120), ASTM D7279, primer, ASTM F666, solvent cement, ASTM D2729 polypropylene fabric filter cover.	Class 12454-B (PVC 1120), ASTM D7279, primer, ASTM F666, solvent cement, ASTM D2729 polypropylene fabric filter cover.	PVC, schedule 40	Solvent cement, chemical adhesive	PVC fittings, perforated, Class 12454-B (PVC 1120), ASTM D7279, primer, ASTM F666, solvent cement, ASTM 2564, with polypropylene fabric filter cover.	NA	NA	Green / White	Pipe supported on firm bed for entire length. [CPC 315.4]. Six inches of sand bed minimum for ABS/PVC drain pipe per manufacturer. No roots or debris in first 12' of backfill over ABS pipe. [CPC 315.4]. Trenches shall be backfilled with concrete (45'). [CPC 315.1]. Sewer and water pipe minimum 12" deep. [CPC 609.1]	Forced main systems shall be hydraulically tested to static pressure exceeding the pressure rating of the system and use a Bristol Gauge to record any observed leakage.	N/A		
P14	PSE	pumped Sewage Ejector, storm drain and Sump Pump Discharge Piping and Fittings	Direct Buried, Pumped Below Ground	Type K, hard drawn copper pipe	ASTM B88	Rigid	Braze with 15% silver content, SH-Fos brazing alloy.	Wrought copper solder sweat type, ANSI B16.22 castings, ANSI B16.18.	Option 1: Rising stem full ported cast iron gate valve, class 300r, ANSI A 74, ASTM A 88, CISPI 301, Option 2: Pipes 3", 5", and above: NIBCO LD3225 lug style signal wound gaskets and B18 studs and nuts. Isolation valves finished higher than 10' above operator hand signal.	8 mil polyethylene piping, Yellow / Black Blue color	Yellow / Black	Piping includes all discharge piping from pumps to main connections. No hub couplings are not acceptable on any pumped discharge line.	As per latest applicable CPC, NFPA, FM global and fire marshals reports shall be designed for seismic zone 4.			
P15	PSE	Sewage Ejector/ pumped storm drain and Sump Pump Discharge Piping	Pumped Discharge Above Ground	Hot dipper galvanized steel pipe, domestic male with grooved ends couplings or screwed ends.	ASTM A 53S, grade A or B	Schedule 40	Screwed Mechanical or Victaulic style couplings	Galvanized Victaulic couplings are acceptable. "No-hub" type couplings are prohibited for this application.	NA	NA	Yellow / Black	Piping includes all discharge piping with earthquake strap from units to a point of connection where pump discharge connects to gravity drainage line. No hub couplings are not acceptable on any pumped discharge line.	Gravily systems shall be hydraulically tested for 4 hours at 10' of head pressure. Close valves, drain water and use a Bristol Gauge to record any observed leakage.	N/A		
P16	SD & OD	Storm Drainage and roof drain for Pipe Fittings	Direct Buried Below Grade	Cast iron no-hub soil pipe to be marked with the collective trademark of Cast Iron Soil Pipe Institute	CISPI Standard 310 or ASTM A74	Service weight	Couplings shall conform to requirements of ASTM C1540, FM 1880, Heavy duty type 304 stainless steel with a 28 Gauge shield, Husky SD4000 or equal.	ASTMA 74-13A, ASTM A 888	NA	NA	Green / White	Alternate Material, where applicable and subject to local jurisdiction. (1) Piping shall be PVC DWV conforming to ASTM D2685-2004A, (2) Fittings shall be PVC DWV conforming to ASTM 3311-2002.	Gravily systems shall be hydraulically tested for 4 hours at 10' of head. Close openings in system and fill with water and use a Bristol Gauge to record any observed leakage	As per latest applicable CPC, NFPA, FM global and fire marshals reports shall be designed for seismic zone 4.		



No.	Abbreviation	Service	Location	Pipe Material	Class./Compliance	Type	Joint	Fittings	Valves	Insulation Material	Insulation Size	Jacket	Background Color/Letter Color	Remarks	Special Handling	Pressure Testing, Chemical Cleaning or Passivation	Rod Size/Handler Spacing
P23	LG	High Purity, toxic gases (e.g. Carbon dioxide, nitrogen, ammonia, HF, etc.)	Above Ground	Stainless Steel tubing (all seam and integrated piping are allowed.)	only using made in Germany shall be acceptable	Stainless SS316L minimum wall thickness: 0.035"-0.095" pressure side of distribution	Compression style for all applications unless specifically called out to be different with VCR type gaskets	Tube type fittings similar to SWAGelok, Hy-Lok or approved equal.	SWAGelok series 40 or 60, Hy-Lok series 105 ball valves, unless specified otherwise by the planner, project specification book or construction drawings.	N/A	N/A	N/A	Yellow /Black	Pipes shall remain sealed during installation and kept free of contaminants	Pipe supported on firm sand bed for entire length. [CPC 314.3] No rocks supporting or touching pipe. [CPC 315.4]. Minimum for ABS/CVPC drain pipe per manufacturer. No rocks or debris in fit. 12" backfill over ABS pipe. [CPC 315.1]. Sewer and water pipe to be buried minimum 18" deep. [CPC 605.1]	Gravily systems shall be hydrostatic tested for 4 hours at 10' of head pressure. Close openings in system and fill with water and use a Bristol Gauge to record any observed leakage	N/A
P24	AW & AV (option 1)	Acid Waste & Acid Vent (gravy)	Direct buried, Below Grade, above and inside wall cavities. (except for applications)	Chem Drain, CPVC, Schedule 40 as manufactured by Charlotte Manufacturing Company	ASTM D 1784 Rigid CPVC Vinyl Chloride Resin ASTM F 221 Underground Thermoplastic applications), ASTM F 493 Solvent Cements for CPVC, ASTM F 1668 Solvent for CPVC compounds with a One-Step solvent cement conforming to ASTM F 493. One-Step solvent cement shall be specially formulated for waste applications and conform to ASTM F493.	Schedule 40 CPVC (IV Grade) compounds with a One-Step solvent cement conforming to ASTM F 493. One-Step solvent cement shall be specially formulated for waste applications and conform to ASTM F493.	Blued pipe shall be installed in accordance with ASTM D 2221 and ASTM F 1668. The system shall be installed in a trench with a maximum working temperature of 220° F. All pipe, fittings and cement shall be supplied as a system by a manufacturer. The system shall be tested by NSF International for use in corrosive drainage systems and shall bear the mark "NSF" over. Special Drain system to be the Chem Drain system as manufactured by Chem Drain. The system shall be installed in accordance with manufacturer's instructions and all applicable local code requirements.	Schedule 40 CPVC fittings to match the pipe	N/A	N/A	N/A	Yellow /Black	Blued pipe shall be installed in accordance with ASTM D 2221 and ASTM F 1668. The system shall be installed in a trench with a maximum working temperature of 220° F. All pipe, fittings and cement shall be supplied as a system by a manufacturer. The system shall be tested by NSF International for use in corrosive drainage systems and shall bear the mark "NSF" over. Special Drain system to be the Chem Drain system as manufactured by Chem Drain. The system shall be installed in accordance with manufacturer's instructions and all applicable local code requirements.	Pipe supported on firm sand bed for entire length. [CPC 314.3] No rocks supporting or touching pipe. [CPC 315.4]. Six inches of sand bed minimum for ABS/CPVC drain pipe per manufacturer. No rocks or debris in fit. 12" backfill over ABS pipe. [CPC 315.1]. Trenches not to undermine footings within 315.1). Sewer and water pipe to be buried minimum 18" deep. [CPC 605.1]	Gravily systems shall be hydrostatic tested for 4 hours at 10' of head pressure. Close openings in system and fill with water and use a Bristol Gauge to record any observed leakage	N/A	
P25	AW & AV (option 2)	Acid Waste & Acid Vent (gravy)	Direct buried, Below Grade, above and inside wall cavities and concealed shaft spaces	Corrosion resisting cast iron drainage piping to be marked with the trademark of Cast Iron Soil Pipe Institute	ASTM A516, ASTM A561	DURIRON mechanical joint series	DURIRON corrosion resistant fittings to be marked with the collective trademark of Cast Iron Soil Pipe Institute. The mechanical joint shall consist of an inner sleeve of PTFE, surrounded by an outer sleeve of Neoprene rubber (a trademark of Parkersdur Corporation), and an outer band of 300 series stainless steel. Mechanical joint couplings shall be tested for corrosion by organic and inorganic acids and their salts	Schedule 40 CPVC fittings to match the pipe	N/A	N/A	N/A	Yellow /Black	For systems being installed underground, a trench shall be excavated so as to provide adequate room toamped joints, and grade compacted and rock-free and shall support the pipe throughout its entire length. Fill material shall be applied in layers not exceeding 6 inches. The trench shall be backfilled and thoroughly compacted. The last 6 inches of fill material shall be rock-free. The system shall be installed and tested in accordance with the manufacturer's instructions and all governing plumbing codes.	Pipe supported on firm sand bed for entire length. [CPC 314.3] No rocks supporting or touching pipe. [CPC 315.4]. Six inches of sand bed minimum for ABS/CPVC drain pipe per manufacturer. No rocks or debris in fit. 12" backfill over ABS pipe. [CPC 315.1]. Trenches not to undermine footings within 315.1). Sewer and water pipe to be buried minimum 18" deep. [CPC 605.1]	Gravily systems shall be hydrostatic tested for 4 hours at 10' of head. Close openings in system and fill with water and use a Bristol Gauge to record any observed leakage	As per latest applicable CPC, NFPA, FM global and fire marshals. Supports shall be designed for seismic zone 4.	

No.	Abbreviation	Service	Location	Pipe Material	Class./ Compliance	Type	Joint	Fittings	Valves	Insulation Material	Insulation Size	Jacket	Backcoat/ Secondary Coat	Remarks	Special Handling	Pressure Testing/ Chemicals/ Cleanups/ Passivation	Rod Size/ Hangers/ Spacing
P26	AW & AV	Acid Waste & Clean Water (grey)	Above Ground, return air plenums in non-occupied accessible spaces	Flame Retardant, Non-Halogenated (PVPDF) piping	ASTM F1401 / EN ISO 11819-1 / ASTM F2208 / UL 720 / FPLP/Plenumite		PEX's mechanical joints	PEX's specification for unmodified polyethylene fluoride (PEX) fitting materials shall be as follows: PEX's mechanical joints shall meet the following: 1. PEX's fittings shall be UL listed to NSF-14 standards and are IAPMO fully listed. 2. PEX's fittings shall have a smoke development (SDI) of 35 as tested in accordance with ASTM E84 (UL 723) and the material is UL listed.	N/A	N/A	N/A	Yellow / Black	Piping system is only intended for gravity lab waste system and not a forced pumped system.	Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be applied to the pipe in accordance with NFPA 54. 2) Test under air pressure to 10 psi for 2 hours. The pipe shall not be recognized after burial by the inspector. After testing is complete, the entire gas system shall be tested to the design pressure to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system. 4) After successful purging have been completed, a leakage test shall be performed in accordance with NFPA 54 piping shall be tested with clean, dry compressed air at 1.5 times the design pressure. All openings between gas carrier and gas carrier shall be protected. Shutoff systems must be demonstrated to be absolutely tight when subjected to the pressure for a period of four hours.	As per latest applicable CFC requirements and fire marshals requirements		
P27	PAW	pumped Acid Waste	Direct buried Discharge piping below ground	Seamless stainless steel/tubing, Grade 316L, ERW or cold drawn galvanized pipes are unacceptable.	ASTM-A312 / ASTM-A312 / ASME-SAS12	schedule 10S	Gas Turquetts are welded (GTAW) or T-tungsten inert gas welding (TIG)	ASTM A312/ASME SA312 seamless schedule 10S stainless steel but welded stainless steel in wet/dry areas. When required, install only long radius elbows.	Pipe up to 27" 80psi Class stainless steel gate valve, 2.5" and above pipe-150 # class rising stem ball valves. Material shall be approved by Caltech.	N/A	N/A	Yellow / Black	piping shall be suitable for a minimum working pressure of 200 PSIG.	Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be applied to the pipe in accordance with NFPA 54. 2) Test under air pressure to 10 psi for 2 hours. The pipe shall not be recognized after burial by the inspector. After testing is complete, the entire gas system shall be tested to the design pressure to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system. 4) After successful purging have been completed, a leakage test shall be performed in accordance with NFPA 54 piping shall be tested with clean, dry compressed air at 1.5 times the design pressure. All openings between gas carrier and gas carrier shall be protected. Shutoff systems must be demonstrated to be absolutely tight when subjected to the pressure for a period of four hours.	Force main systems shall be tested with a salt water pressure without exceeding the pressure rating of the system and use a Bristol Gauge to record any observed leakage. 1) Natural gas systems shall be tested with a salt water pressure without exceeding the pressure rating of the system and use a Bristol Gauge to record any observed leakage. 2) After successful purging have been completed, a leakage test shall be performed in accordance with NFPA 54 piping shall be tested with clean, dry compressed air at 1.5 times the design pressure. All openings between gas carrier and gas carrier shall be protected. Shutoff systems must be demonstrated to be absolutely tight when subjected to the pressure for a period of four hours.		
P28	PAW	pumped Acid Waste	Pumped discharge pipe, above ground	Hot dipped galvanized seamless carbon steel pipe, domestic malleable iron, grooved ends, cast iron or steel couplings or screwed ends.	ASTM A-53S, Grade A or B	Schedule 40	Screwed Mechanical or Vitruloc style couplings	Galvanized Vitruloc couplings are acceptable. Non-tight type couplings are not allowed for this application.	Option 1: Rising stem full ported cast iron gate valve, class 300#, ASTM A 74, ASTM A 888, CISPI 100, NIBCO 300, 6" and above. NIBCO L331225 big style butterfly valves. Raised lift fixed stud and yoke hand wheel spiral wound gaskets and E16 finished floor shall have chain operated hand wheel.	N/A	N/A	Yellow / Black	piping includes all discharge piping with earthquake strap from units to a point of connection where pump discharge connects to the piping. Piping is not acceptable on any pumped discharge line.	Minimum 3 inch wide polyethylene detectable type marking tape. The tape shall be applied to the pipe in accordance with NFPA 54. 2) Test under air pressure to 10 psi for 2 hours. The pipe shall not be recognized after burial by the inspector. After testing is complete, the entire gas system shall be tested to the design pressure to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system. 4) After successful purging have been completed, a leakage test shall be performed in accordance with NFPA 54 piping shall be tested with clean, dry compressed air at 1.5 times the design pressure. All openings between gas carrier and gas carrier shall be protected. Shutoff systems must be demonstrated to be absolutely tight when subjected to the pressure for a period of four hours.	Force main systems shall be tested with a salt water pressure without exceeding the pressure rating of the system and use a Bristol Gauge to record any observed leakage. 1) Natural gas systems shall be tested with a salt water pressure without exceeding the pressure rating of the system and use a Bristol Gauge to record any observed leakage. 2) After successful purging have been completed, a leakage test shall be performed in accordance with NFPA 54 piping shall be tested with clean, dry compressed air at 1.5 times the design pressure. All openings between gas carrier and gas carrier shall be protected. Shutoff systems must be demonstrated to be absolutely tight when subjected to the pressure for a period of four hours.		

No.	Abbreviation	Service	Location	Pipe Material	Class./Compliance	Type	Joint	Fittings	Valves	Insulation Material	Insulation Size	Jacket	Backcoat/Secondary Coat	Remarks	Special Handling	Pressure Testing / Chemicals, Cleaners, or Passivation	Red Size / Hangers, Spacing
P29	NG	Natural Gas	Direct Buried, Below Ground, Downstream of the meter and meter waste of the building	Piping 2" and smaller Schedule 40 carbon steel, ASTM A106 or Type 'S', 2" and larger shall be Schedule 40 black pipe, ERW, longitudinal seam and imported piping are not acceptable	ASTM A-53S, grade A or B, US made, seamless	Schedule 40, Carbon steel, Fletcher coated	Butt or socket welded joints shall be made using factory-fabricated steel welding fittings. De-burr, and wrap all joints that are not Fletcher coated.	Class 150 black malleable iron threaded fittings conforming to ASME B16.3, with Schedule 40 carbon steel ends. Class 250 fittings, ASTM A 234 and but welded joints.	Line Shut-off Valves sizes 2 inches and smaller shall be iron body lubricated plug valve conforming to ASTM A-126, U.L. Listed and service with threaded ends. W.O.G. service pressure and -20 to 200 degrees Fahrenheit, manufactured by Nordstrom Model 143. C. Line Shut-off Valves sizes 2 1/2 inches and larger shall be iron body, full port ball or butterfly type, W.O.G. service pressure and -20 to 200 degrees Fahrenheit, manufactured by Nordstrom Model 1431 or Nordstrom Model 143.	NA	N/A	Yellow / Black	When "Fletcher" coated pipe is not being installed, follow alternate materials and procedure. Surface preparation, De-burr and clean pipe. Wipe entire pipe surface and eliminate any grease & other chemicals and apply appropriate type of primer prior to coating or wrapping the pipe. Epoxy coat pipe at the factory or water impermeable joints. Additionally, wrap the outside of the pipe with (2) half wrapped layers of 20 mil PVC tape (40 mil min.) to make joints waterproof. --- Alternate products: Field applied pipe coating shall be one of the following types: 1) Type B primer and top coat with wood preservative. 2) Type L primer and top coat with wood preservative. 3) Asbestos felt shall not be used. 4) A.G.A. Approved for natural gas service with flanged rds, wrench operation, rated for 200 W.O.G. degrees F, manufactured by Resin Model R-1431 or Nordstrom Model 143.	1) Natural gas systems shall be installed in accordance with NFPA 54. 2) Test under air pressure to 10 psi for 2 hours. 3) After testing is completed, the entire gas system shall be purged with compressed air to eliminate all air, debris and moisture from the piping before natural gas is introduced into the system. 4) After testing and purging have been completed, a leakage test shall be performed in accordance with NFPA 54 Appendix D.	As per latest applicable CPC, NFPA, FM global and fire marshals requirements. Supports shall be assigned for seismic zone 4.		
P30	NG	Natural Gas	Above Ground	Piping 2" and smaller Schedule 40 carbon steel, ASTM A106 or Type 'S', 2" and larger shall be Schedule 40 black pipe, ERW, longitudinal seam and imported piping are not acceptable	ASTM A-53S, grade A or B, US made, seamless	Schedule 40, Carbon steel	Threaded joints. Pipe joint shall be made using factory-fabricated, non-flange, non-welded, hardening, insoluble in the presence of natural gas and comply with Specification TT-S-1722. Temperature service range of -15 degrees F to +400 degrees F. Hercules "Megaloc" or approved equal by Rector seal, La Co or Oatey.	Class 150 black malleable iron threaded fittings conforming to ASME B16.3, with Schedule 40 carbon steel ends. Class 250 fittings, ASTM A 234 and but welded joints.	Appliance Equipment Shut-off Valves of local connections sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, W.O.G. service pressure and 30 to 200 degrees Fahrenheit, manufactured by Nordstrom Model 1585-70-U.L. or Milwaukee Model BB2-100. E. Manual emergency Shut-off Valves sizes 2 inches and larger shall be iron body, full port ball or butterfly type, W.O.G. service pressure and 30 to 275 degrees F, manufactured by Nordstrom Model 1585-70-U.L. or Milwaukee Model BB2-100.	NA	N/A	Yellow / Black	a) All exposed piping, 2" and smaller located within areas utilized as return air plenums shall have welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.3. b) All exposed piping, 2" and smaller serving laboratories from main natural gas riser to each shift-off valve shall have welded joints with Schedule 40 socket welded forged steel fittings conforming to ASME B16.3.	Ductile iron, PVC and copper piping systems shall be installed in accordance with a minimum of 48 hours. Pressure test piping system with compressed air for a minimum of 48 hours. Record all test results, including test date, test pressure, test location and final pressure. Repair any leaks, record the results with the name of the inspector and date of approval. All mechanical equipment shall be inspected by a Catch observed by a Catch inspection representative and signed off in writing. Neutralize the chemicals and flush the cleaning is completed and discharge the chemicals in accordance with the local codes and in compliance with CFI requirements. Design guide document for the details of cleaning & passivation procedures and chemicals.	As per latest applicable CPC, NFPA, FM global and fire marshals requirements. Supports shall be assigned for seismic zone 4.		



No.	Abbreviation	Service	Location	Pipe Material	Class./Compliance	Type	Joint	Elftube	Valves	Insulation Material	Insulation Size	Jacket	Background/Finish/Color	Remarks	Special Handling	Pressure Testing / Chemically Cleaned or Passivated	Root Size / Hangers Spacing
P31	ROW	reclaimed water for trap irrigation, water, urinals and water closets only	inside the building	Pipes up to 4" Stainless steel, longitudinal seam and longitudinal piping are allowed.	ASTM B88	Types L, hard drawn, hot temper, entire exterior of pipe shall be finished CP brass pipe with fittings. No soft solder allowed except within 6' of threaded couplings.	Wrought copper solder sweat type, ANSI B16.22 or brass castings, ANSI B16.16	Rigid Fiberglass, ASTM C330, X = 1" - 1 1/2" thick at all joints & above. Owens Corning, 1.5" thick Certaintec fiberglass Mervite	pipes up to 2": NIBCO T-59570-140, pipes 3"-5": NIBCO LD3122-3, 1/2" pipes 6" and above, NIBCO LD3122-5 lug style butterfly valves. Raised full faced spiral wound gaskets and B16 studs and nuts. All components associated with potable water system shall be lead free	Exposed indoors. ASJ + Aluminum Jacket	RCW: purple / White, All reclaimed water pipe shall be wrapped with an 8 mil thick layer of polyethylene film, purple in color and conforming to ANSIAWWA C105/A215	Run water at every other 1 inch in 60 feet installation so that the usual variation in temperature will not cause stress at any point. Securely anchor where necessary to distribute allow points. Anchor all lines and risers as necessary to prevent noise or vibration when water is turned on or off. Separately valve each branch and riser. Make all such valves, valves and adjust going to provide circulation to all fixtures and to prevent water hammer. [CPC 609.1]	Pipe supported on firm sand touching pipes. [CPC 315.4]. Six inches of sand bed minimum for ABS/PVC drain backfill over ABS pipe. [CPC 315.4]. Trenches not to undermine footings within 18" of pipe. Balance all fixtures and to prevent water hammer. [CPC 609.1]	Same as above + install minimum 3 inch wide polyethylene detectable type marking tape over buried pipe. Marking tape shall be resistant to acids, alkalis and other destructive agents found in soil and impregnated with metal so that it can be readily recognized by ground penetrating equipment. 1. Lamination bond of one (1) layer of Minimum 0.35 mils thick aluminum foil between two (2) layers of minimum 4.3 mils thick polyethylene film. Minimum tensile strength, 63 LBS per 3 IN width, 3. Minimum elongation: 500 percent. 4. Provide continuous yellow with black diagonal stripes warning of pipe buried below (e.g.: "CAUTION RECLAIMED WATER PIPE BURIED BELOW")	N/A		
P32	RCW	reclaimed water for trap primers, irrigation, urinals and water closets only	outside the building and direct buried	Pipes 4" & above: AWWA C900 PVC pipe, DR18 / 200 PSI pressure class	material, cell classification manual cell 121-54 per ASTM D 1744	Provides polyvinyl chloride (PVC) couplings with twin elastomeric gaskets designed to connect straight ends of plain pipe and allow 2 degrees of deflection at each gasket joint and 4 degrees per coupling	Ductile iron fittings or AWWA C900 PVC	pipes up to 2": NIBCO T-59570-86, pipes 2.5" Apollo series 77-140, pipes 3"-5": NIBCO LD3122-3, 1/2" pipes 6" and above, NIBCO LD3122-5 lug style butterfly valves. Raised full faced spiral wound gaskets and B16 studs and nuts. All components associated with potable water system shall be lead free	N/A	Install concrete anchor thrust blocks or tie-rods to prevent movement when under pressure. All tie-rods, clamps, brackets, and bolts shall be ductile iron, stainless steel, galvanized or epoxy coated. Flanged retainers shall be similar to the system by introducing chlorinating solution into the entire system for a minimum period of 24 hours. Maintain concentration of 50-150 ppm. Residual chlorine not to exceed 0.2 ppm.	RCW: purple / White, All reclaimed water pipe shall be wrapped with an 8 mil thick layer of polyethylene film, purple in color and conforming to ANSIAWWA C105/A215	Testing shall be in accordance with the manufacturer's instructions. The completion prior to acceptance of the installation, subject the system to a hydrostatic pressure test with no visible leakage. The test shall be repeated due to materials or workmanship occurring during the test and retest after connections have been made. All testing shall be witnessed by the contractor, the City Global representatives and City of Pasadena Fire Inspector. The contractor shall complete two sets of FM Global test certificates for above ground piping. One set is for Catech permanent records, and one is for FM Global.	N/A				

