SKAGIT JUSTICE CENTER
SEWER REPAIR

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Specifications

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SECTION 02-20-00 SITE CONSTRUCTION

General Site Preparation

Clear areas of outdoor work of all obstructions, rubble, vegetation, and organic matter necessary and as indicated on the drawings. Cut and remove concrete in selected areas, strip topsoil and remove landscaping elements as necessary.

Debris and excess earth materials shall become the property of the Contractor and shall be removed and disposed of in a legal manner off Owner's property. Location of disposal site and length of haul shall be the Contractor's responsibility.

Selective Demolition

Where existing unidentified utilities, structures or services are discovered submit information for resolution prior to proceeding. Notify utilities having service connections within the building.

Items to be demolished are not believed to contain asbestos. If asbestos or other hazardous materials are encountered, provide subsequent testing and abatement under a Change Order to this Contract.

Carefully remove items marked or designated for salvage or reuse and store as directed.

Examine areas affected by Work and coordinate requirements for Excavation, Shoring or Underpinning. Before proceeding with excavation work verify that necessary shoring and other required protection is in place.

Contractor shall be solely responsible for safety, adequacy and satisfactory performance of methods and means employed.

Sequence of removal of concrete, masonry, steel, and similar building elements shall be such that structural integrity of building is maintained at all times. Remove exterior items necessary for Work and as noted on the Drawings.

Legally dispose of demolition materials off site. Location of disposal site and length of haul are the Contractor's responsibility. Remove and dispose of all items marked for demolition as shown on Drawings.

Restore Work which has been cut or removed; install new products to provide completed Work in accordance with Contract Document requirements. Refinish entire surfaces as required to provide even finish to match adjacent finishes.

Repair or replace any surfaces to remain which become exposed, defaced, or damaged as a result of demolition work at no increase in Contract Sum. Repair and repaint surfaces to nearest change in plane.

Earthwork

Comply with regulatory code requirements that might govern the scope of this work.

It is possible that not all buried utilities located on this site are shown. Call Utilities Underground Location, 1-800-424-5555, before commencing excavation of any depth anywhere on the site.

Material for Backfill: As per the Geotechnical Report and the Civil/Structural Drawings.

Perform excavating and backfilling as required for concrete footings, foundations, slabs, utilities, and services. Bottoms of excavations shall be level, firm, undisturbed earth, clean and free from loose material.

If water is present during excavation slope bottom of excavation to one or more shallow sump pits. Slope ground away from building at 3 percent for a minimum of 10 feet.

Coordinate utilities Work with serving utilities. Locate existing underground utilities prior to commencing excavation Work. Protect existing utilities to remain from damage. Take appropriate action for utilities designated for removal or relocation. Ensure that service is not interrupted. Mitigation of damages to utilities caused by Contractor's operations shall be the sole responsibility of the Contractor.

Backfill shall not be placed against concrete retaining structures until concrete has attained 90 percent of design strength. Footings may be backfilled upon form removal, provided backfill is placed and compacted evenly on all sides.

Place backfill material in uniform lifts 8 inches maximum in loose thickness, compact backfill to 95 percent of maximum dry density at optimum moisture content in accordance with ASTM D 4253.

Excavated material shall not be used for backfill under any concrete without prior written approval.

Compact all pit-run fill under concrete to 95 percent of maximum dry density at optimum moisture content using a vibrating compactor. Compaction tests will be conducted by a Testing Laboratory retained by the Owner, as directed by the Architect. Allow adequate time to schedule compaction tests.

Dispose of waste materials as required by regulatory agency.

SANITARY SEWERAGE/STORM REVISIONS

Provide sanitary sewer system and storm water revisions as shown and specified. Comply with requirements of local authorities, ordinances, and local health department.

LANDSCAPE RESTORATION

Fine grade with minimum 2 inches of top soil all landscaping areas disturbed by the work and then top with minimum 3 inches of medium landscape bark. Level flush and blend with existing adjacent.

END OF SECTION

SECTION 02210 SELECTIVE DEMOLITION

GENERAL

REFERENCES

American National Standards Institute (ANSI).
A10.6 "American National Standard Safety Requirements for Demolition."

QUALITY ASSURANCE

Regulatory Requirements: Comply with applicable rules, codes, regulations, and safety orders of all public agencies having jurisdiction.

SITE CONDITIONS

Preplan demolition Work for minimal interruptions or disruptions to Owner's ongoing operations.

Provide dirt and dust barriers, debris containers, removal routes, and disposal to protect areas utilized by Owner.

Where existing unidentified utilities, structures or services are discovered submit information for resolution prior to proceeding.

WORK INLCUDED (See Plumbing, Structural and Civil drawings for relevant work)

Saw cut selected areas of concrete floors as necessary to achieve plumbing work.

Saw cut areas of exterior hard surfaces to achieve plumbing work.

Remove interior wall surfaces as necessary to accomplish the work and. as noted on drawings.

EXAMINATION

Examine areas affected by Work of this Section and verify that necessary shoring and other required protection is in place.

PREPARATION

Provide protection as necessary and in accordance with applicable regulations.

Verify existing utility services to remain in operation, cooperate with Owner in scheduling Work so there will be a minimum of interference. Prearrange utility shutdown or temporary interruption with Owner’s tenant prior to Work commencement.

Notify utilities having service connections within the building.

Contact municipal and regulatory agencies affected by and interested in the Work. Secure necessary information and permits required, and make detailed arrangements for smooth safe prosecution of the Work.

Perform Work in accordance with ANSI A10.6, and regulatory requirements.

Contractor shall be solely responsible for safety, adequacy and satisfactory performance of methods and means employed.

Sequence of removal of demolished items shall be such that structural integrity of building is maintained at all times.

Legally dispose of demolition materials off site. Location of disposal site and length of haul are the Contractor's responsibility.

Carefully remove items to be retained by Owner for reuse and place in an area that is secure and safe from damage.

At beginning of construction, take appropriate measures to minimize construction dust and dirt from entering the existing HVAC system. At conclusion of construction, contractor shall replace all existing and new HVAC equipment filters with new filters.

Contractor to implement dust/debris control measures during installation within the existing building. Dust control for the entire area of remodel must employed by the Contractor during the duration of construction. Temporary visqueen walls and other means/methods shall be employed. Contractor to comply with Department of Health DOH infection control ICRA (Infection Control Risk Assessment) plan for health and safety and infection issues and control.

Provide requirements and be responsible for all cutting, fitting, and patching required to complete the Work, or to:

Make it so several parts fit together and provide for installation of ill-timed Work.

Uncover portions of Work to provide for installation of ill-timed Work.

Remove and replace defective Work.

Remove and replace Work not conforming to Contract Document requirements.

Remove samples of installed Work as specified for testing.

Provide routine penetrations on non-structural surfaces for installation of piping.

Inspect existing conditions including elements subject to damage or movement during cutting

and patching.

After uncovering Work, inspect conditions affecting installation of products or performance of Work.

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Report unsatisfactory or questionable conditions to Architect in writing. Do not proceed with

Work until Architect provides further instructions.

Provide adequate temporary support as required to assure structural value or integrity of the affected portion of the Work which may be exposed by uncovering Work.

Execute cutting and demolition by methods which will avoid damage to other areas, and will provide proper surfaces to receive patching and finishing.

Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.

Restore Work which has been cut or removed; install new products to provide completed Work in accordance with Contract Document requirements.

Refinish entire surfaces as required to provide even finish to match adjacent finishes.

At limits of demolition Work required or specified, provide neat, orderly, and clean joints, lines, and edges of surfaces, whether for junctions with new materials or surfaces or whether to be left as existing.

Repair or replace any surfaces selectively removed to access the Work and any surfaces to remain which become exposed, defaced, or damaged as a result of demolition Work at no increase in Contract Sum. Repair surfaces to existing level of finish to nearest change in plane.

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Provide cutting of gypsum board as required for access and performance of Work. Review areas to be cut, for each type of unit, at pre-construction conference.
absolutely necessary for completion of Work.

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Patch and otherwise prepare gypsum board surfaces for painting where existing wall coverings are removed. Provide surfaces true, even, free of humps and depressions.
10 as required.

At limits of demolition Work shown or specified, provide neat, orderly and clean joints, lines, and edges of surfaces, whether for junctions with new materials or surfaces or whether to be left as existing. Where methods or controls may not permit intended joining, submit conditions and alternatives, and obtain resolution prior to commencing Work.

PATCHING

Repair or replace any surfaces to remain which become exposed, defaced, or damaged as a result of demolition work at no increase in Contract Sum. Repair and repaint surfaces to nearest change in plane.

CLEANING

Leave all portions of demolition area in a level, safe, and sanitary condition acceptable to public authorities and the Architect.

END OF SECTION

SECTION 03 30 01 CONCRETE FLOOR SLABS

SECTION INCLUDES
Formwork, reinforcing, placement, finishing and curing for concrete floor slabs.

Shoring and bracing

Underslab vapor retarder sheet

SUBMITTALS

Refer to Section 01 33 00, for submittal procedures.

Product Data:

Submit product data for concrete design mix(s) from concrete supplier for each different floor slab condition.

Under slab vapor retarder.
Joint Layout Shop Drawings: Indicate proposed layout for control joints.

QUALITY ASSURANCE

Perform work of this section in accordance with ACI 301 and ACI 318.

Acquire cement from same source and aggregate from same source for entire project.

Perform reinforcing steel installation in accordance with ACI 301.

Follow recommendations of ACI 305R when concreting during hot weather and as specified in General Notes on the Structural Drawings

Follow recommendations of ACI 306R when concreting during cold weather and as specified in General Notes on the Structural Drawings.

CONTRACTOR RESPONSIBILITY

Contractor is responsible for designing and engineering the formwork along with the associated bracing and shoring to withstand all imposed construction forces.

REINFORCEMENT

Reinforcing Steel and Welded Wire Mesh as specified in General Notes on the Structural Drawings.

UNDERSLAB VAPOR RETARDER FOR SLAB ON GRADE

Vapor Retarder: 15 mil polyolefin or HD polyethylene film manufactured from virgin resins; conforming to ASTM E1745 Class A; 0.3 perms or less when tested in accordance with ASTM E96 and F1249; the following products are acceptable:

COORDINATION

Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

Coordinate and facilitate recessed concrete slab construction to meet requirements of tile flooring.

Coordinate and facilitate concrete slab construction to meet requirements of floor covering manufacturers.

Coordinate and adjust concrete mix and additives to comply with requirements of manufacturers of coatings, sealants and adhesives applied to concrete.

Coordinate and facilitate rough-in, openings and penetrations for mechanical and electrical items.

Coordinate and facilitate floor slab slope and heights of floor drains to assure adequate drainage.

EXAMINATION

Verify lines, levels, and dimensions before proceeding with work of this section.

UNDERSLAB VAPOR RETARDER INSTALLATION

Install continuous 15 mil vapor retarder sheet under interior slabs on grade, place over the capillary break and directly under concrete slab.

Extend sheet to top of slab at perimeter of slab and adhere to wall with manufacturer’s recommended mastic or sealant.

Lap joints minimum 6 inches and seal watertight by continuously sealing edges and ends using vapor retarder manufacturer's recommended tape or seal.

Install a watertight "boot" (may be manufacturer's prefabricated boot or site fabricated from a piece of vapor retarder) around all pipe penetrations through slab. Extend boot to top of slab elevation and seal edges of "boot" to vapor retarder watertight using manufacturer's recommended tape or sealant.

Protect vapor retarder from damage during construction.

Seal all cuts and holes in vapor retarder with a patch of the same material, sealed full perimeter watertight.

CONTROL OF CONCRETE SLAB CONSTRUCTION

Assembly including the Underslab capillary break, selection of the concrete design mix, water added to concrete on the site, placement of concrete, slab finishing methods, slab curing methods and dry-out of the concrete slabs so as to achieve a crack-free slab and the surface finish, vapor emission rate, moisture content and pH level required for and by the floor covering manufacturer(s) for successful application of their products.

Select and provide the equipment and power/fuel required to dry out concrete floor slabs to required moisture content and vapor emission rate required for the successful installation of any floor covering or coating being applied.

TOLERANCES

Floor Slab Surface Tolerances: Floor slabs shall be constructed to achieve the following tolerances when measured in accordance with ACI 302.1R:

Maximum Variation of Surface Flatness For Concrete Floors: 1/4 inch in 10 feet.

FLOOR FINISHING

General: Finish concrete floor surfaces with bull float, wood/magnesium hand floats and steel trowels in accordance with ACI 301 and ACI 302.1R.

Do not dust slab with cement powder while finishing.

Steel Trowel Finish - Floors Scheduled To Receive Floor Covering & Interior Concrete Floors Exposed To View: Steel trowel surfaces to a smooth finish, free of ripples or surface defects and that conforms to the floor covering manufacturer's requirements.

Do not over trowel or "burn" the slab surface, excessive power troweling can densify the slab surface to such a high degree that the rate of water release from the slab is hindered and the time required to dry out the full depth of the concrete slab (as required for application of adhesively applied floor coverings) is increased substantially.

INTERIOR AND EXTERIOR CONCRETE SEALERS

Exposed slab areas at exterior concrete work including sidewalks and pads (1) one application of sealer (1) one week prior to owner occupancy. Clean slabs as recommended by sealer manufacturer prior to application.

Slab areas to receive floor covering to receive (1) one-coat of acrylic water based sealer at pour

END OF SECTION

SECTION 09 29 00 GYPSUM BOARD ASSEMBLIES

GENERAL

SUMMARY OF WORK

Primarily GWB and Tile Backer Board repair of wall surfaces affected by the Work.

QUALITY ASSURANCE

Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years of consecutive successful experience.

REGULATORY REQUIREMENTS

Conform to applicable codes and installation requirements for any fire rated assemblies indicated on drawings.

PROJECT CONDITIONS

Environmental Conditions: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.

Ventilation: Provide controlled ventilation during joint finishing operations, to eliminate excessive moisture. Avoid drafts during hot, dry weather to prevent finishing materials from drying too quickly.

PRODUCTS

GYPSUM BOARD MATERIALS (GWB)

Interior Gypsum Board (GWB): ASTM C1396; Type X, fire rated, UL or WH tested and listed; sizes to minimize joints in place; ends square cut.

Thickness: 5/8 inch or match existing.
Edges: Tapered.
Length: Longest lengths possible for least number of butt joints.

Water Resistant Panels (GWB-WR):
Manufacturer/Product: USG *Fiberock Brand Aqua-Tough Interior Panels* or approved.
Thickness: 5/8-inch or match existing
Edges: Tapered
Size: Largest size practicable to minimize joints in place.
Ends: Square cut
Tile Backer Board (TBB):
Manufacturer/Product: G-P Gypsum *DensShield Tile Backer* or approved.
Thickness: 5/8” or match existing
Edges: Tapered
Size: Largest size practicable to minimize joints in place.

Ends: Square cut

ACCESSORIES

Joint Materials: Provide products by manufacturer of gypsum board. Conform to ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

Interior Applications: Ready-mixed vinyl-based joint compound
Taping Compound: Type specifically formulated for embedding tape and accessories and for pre-filling.

Topping Compound: Type specifically formulated for finishing drywall over taping compound.
Joint Tape: Manufacturer's standard paper reinforcing tape.

Water Resistant Panels: *Sheetrock Brand Durabond Setting-Type Joint Compound* or *Sheetrock Brand Easy Sand Joint Compound* manufactured by U.S. Gypsum.

Joint Tape: Paper tape, *Sheetrock Brand Joint Tape* manufactured by U.S. Gypsum

Tile Backer Board (With Tile Finish):

Joint and Taping Compound (Thin Set Cement Mortar) as per manufacturers recommendations.

Joint Tape (Glass Fiber Mesh): Specified in Section 09 30 00.

Primer/Surfacer: *Sheetrock Brand Primer-Surfacer Tuff-Hide* manufactured by U.S. Gypsum.

Screws: Interior Application: Conform to ASTM C1002; bugle-head steel, self-drilling type, black phosphate finish.

Screws: Exterior Application and Tile Backer Board: Conform to ASTM C1002; bugle-head steel, self-drilling type, provide with yellow zinc corrosion resistant coating

COORDINATION

Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner.

Inspect finished surfaces with painting applicator and project superintendent, mark areas that require additional finishing.

EXAMINATION

Verify that project conditions are appropriate for work of this section to commence.

Confirm that the framing is straight, is within specified tolerances and meets minimum allowable deflection requirements.

Confirm that utility rough-in fits properly within framing width and will not prevent GWB from fitting tight to face of framing members.

Confirm that there is adequate temporary heat and light.

Beginning of installation indicates acceptance of framing and conditions.

FLOOR PROTECTION

Protect floors from contact with GWB dust, taping mud and primer/surfacer using heavy paper or other method.

GYPSUM BOARD INSTALLATION

Install GWB in conformance with ASTM C840, C1280, GA-216, and manufacturer's installation instructions.

Install in longest lengths possible for minimum number of joints and to minimize butt end joints, especially in highly visible locations.

Comply with any installation requirements of fire rated assemblies listed on the Drawings.

Water Resistant Panels: Use stainless steel screws.

Tile Backer Board: Use corrosion resistant screws, locate cut edges at top of walls only, screw spacing as recommended by manufacturer.

Exterior Gypsum (GWB) Sheathing Board: Use corrosive resistant screws. Fit joints tight as recommended by manufacturer.

Maintain 1/4 inch maximum gap between bottom of gypsum board and floor.

APPLICATION – PRIMER/SURFACER

Apply Primer/Surfacer to all surfaces exposed to view in accordance with manufacturer's installation instructions and at recommended application rate to achieve GA-214 Level 4 appearance, free of visible tape joint lines after finish painting is completed.

Spray-apply Primer/Surfacer to 15 - 20 mil wet film thickness applied in two separate passes at 90 degrees to each other for proper coverage.

Sand surface of Primer/Sealer lightly after it has dried to eliminate any unwanted stipple pattern or texture.

After application of Primer/Sealer, carefully inspect walls and mark any defects in surface finish. Fill/sand defective areas in surface finish and recoat with primer/surfacer.

CLEAN UP

Remove all excess gypsum board and finishing materials from the site.

Remove gypsum board scraps and dust from all concealed spaces including interior spaces of wall framing.

Remove gypsum dust, taping mud and primer/sealer completely from window frames, door frames, subfloor surfaces and any surface/material exposed to view.
Subfloor cleanliness/condition shall conform to floor covering installation requirements.

END OF SECTION

SECTION 09 30 16 CERAMIC TILE FLOOR AND WALLS

SUMMARY

Work is limited to patching areas indicated on the plans that were removed or damaged as part of the saw cutting and removal of selective areas of floor slab, plumbing fixtures and wall surfaces. Type of tile and installation are to match existing adjacent.

Type of Material includes floor, floor base and wall tile. All to match existing adjacent

SUBMITTALS

General: Submit samples of all tile products for approval prior to ordering.

QUALITY ASSURANCE

Installer Qualifications: Installer experienced, as determined by contractor, in performing work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to product manufacturer.

Pre Installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements, Comply with Division 1 Project Management and Coordination, Project Meetings Section.

DELIVERY, STORAGE, AND HANDLING

Ordering; Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Comply with ANSI A137.1 for labeling sealed tile containers.

Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

PROJECT CONDITIONS

Temperature Requirements: Maintain ambient temperature and humidity conditions in spaces where products will be installed for time period before, during and after installation as recommended by manufacturer.

Minimum Temperature: Maintain temperature at 50oF (10oC) minimum during installation and for seven days after completion.

WARRANTY

Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

Manufacturer's Warranty; Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under the Contract Documents.

Warranty Period: (5) years commencing on Date of Substantial Completion.

MAINTENANCE

Extra Materials: Deliver to Owner extra materials from same production run as products installed, Package products with protective covering and identify with descriptive labels. Comply with Division I Closeout Submittals, Maintenance Materials Section.

Quantity: Furnish quantity of full-size units equal to 2% of amount installed for tile and trim units.

Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PRODUCTS

Manufacturer: Match existing and, if not possible, DalTile or equivalent. Size and thickness to match existing adjacent.

Color; Match existing

Grout, edge conditions and other miscellaneous details to match existing adjacent

Backer Board: Refer to section on Gypsum Board.

MANUFACTURER'S INSTRUCTIONS

Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions.

EXAMINATION

Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

PREPARATION

Surface Preparation: Prepare substrates to receive quarry tile in accordance with industry installation reference standards and manufacturer's installation instructions.

INSTALLATION

Floor and Wall Tile Installation:

General: Install tile and trim in accordance with industry reference standards and as similar to existing adjacent.

Joint Widths: Similar to existing adjacent.

Patterns: Install tile in pattern indicated on drawings but in any case, match existing adjacent.

CLEANING AND PROTECTION

Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products, Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

Protection: Protect installed product's finish surfaces from damage during construction.

END OF SECTION

SECTION 09 90 00 PAINTS AND COATINGS

GENERAL

Surface preparation and field painting

REFERENCES

All references shall be the latest adopted edition.

MPI – Architectural Painting Specification Manual, as published by the Master Painters and Decorators Association.

SSPC – Steel Structures Painting Council, Steel Structures Painting Manual.

SUBMITTALS

Product Data: Provide product data based on Owners preference for paint type and color.

Paint Draw Down Samples: Submit two painted samples, illustrating selected colors for each color and system selected. Submit on heavy paper card stock, 8 x 10 inch in size.

QUALITY ASSURANCE

Single Source Responsibility: All paint products used for painting a given material/surface shall be manufactured by the same company.

Applicator Qualifications: Company specializing in performing the work of this section with minimum five years successful experience.

REGULATORY REQUIREMENTS

Conform to applicable code for flame and smoke rating requirements for products and finishes.

DELIVERY, STORAGE, AND PROTECTION

Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

Paint Materials: Store at manufacturers recommended temperature range

Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer’s written literature.

PAINTS AND COATINGS - GENERAL

Paints and Coatings: Confirm paint type and color with Owner. In general, match existing adjacent.

COORDINATION

Review, coordinate and accommodate work of other trades that interface with, affect or are affected by the work of this Section so as to facilitate the execution of the overall Work of this project in a coordinated and efficient manner. .

Coordinate inspection of finish GWB surfaces prior to start of any painting work; identify and mark any defective areas for correction.

Schedule work to follow completion of all dust/dirt producing work.

EXAMINATION

Verify that surfaces are clean and ready to receive paint as required by the product manufacturer.

Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application or performance.

Start of installation indicates acceptance of substrate, finish and conditions and responsibility for proper finish and appearance.

SURFACE PREPARATION

Conform to MPI Manual surface preparation recommendations, paint manufacturer's recommendations and the following for preparation of each different surface scheduled to be painted:

PROTECTION

Protect all adjacent finish surfaces and elements surrounding the work of from overspray, damage or disfiguration.

Maintain subfloor surfaces free from paint and spills using heavy paper or other method.

APPLICATION

Apply products in accordance with manufacturer's instructions and MPI Manual.

Apply sufficient wet film thickness to provide good hiding, do not thin product.

Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

Do not apply finishes to surfaces that are not dry.

Allow applied coats to dry completely before next coat is applied.

Apply each coat to uniform appearance. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

Vacuum clean surfaces of loose particles. Remove dust and particles just prior to applying next coat.

Gypsum Board Surfaces: After paint has been spray or roller applied to uniform wet film thickness, backroll entire surface in same direction to provide uniform texture, reflective value and appearance, free of roller marks or lines.

FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

If impacted by the Work, Remove louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

CLEANING

Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

SURFACES THAT REQUIRE PAINT FINISH

Paint all materials/surfaces new and impacted by the Work.

END OF SECTION

SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

A. SCOPE

1. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

   a. PART 1 – GENERAL
      i. Scope
      ii. Related Work
      iii. Reference
      iv. Reference Standards
      v. Lead Free Requirements
      vi. Quality Assurance
      vii. Continuity of Existing Services
      viii. Protection of Finished Surfaces
      ix. Sleeves and Openings
      x. Sealing and Fire Stopping
      xi. Submittals
      xii. Off Site Storage
      xiii. Codes
      xiv. Certificates and Inspections
      xv. Operating and Maintenance Data
      xvi. Record Drawings

   b. PART 2 - PRODUCTS
      i. Access Panels and Doors
      ii. Identification
      iii. Sealing and Fire Stopping
      iv. Bedding and Backfill

   c. PART 3 - EXECUTION
      i. Demolition
      ii. Excavation and Backfill
      iii. Sheeting, Shoring and Bracing
      iv. Dewatering
      v. Surface Repair
      vi. Concrete Work
      vii. Cutting and Patching
      viii. Building Access
      ix. Equipment Access
      x. Coordination
      xi. Identification
      xii. Lubrication
      xiii. Sleeves and Openings
      xiv. Sealing and Fire Stopping
      xv. Electrical Coordination
      xvi. Agency Training

B. RELATED WORK

1. Division 09

C. REFERENCE

1. Applicable provisions of Division 1 govern work under this section.

2. This section applies to all Division 22 00 00 sections of plumbing.

D. REFERENCE STANDARDS

1. Abbreviations of standards organizations referenced in this and other sections are as follows:

a.	ABMA	American Boiler Manufacturers Association
b.	ACPA	American Concrete Pipe Association
c.	AGA	American Gas Association
d.	AMCA	Air Movement and Control Association
e.	ANSI	American National Standards Institute
f.	ARI	Air Conditioning and Refrigeration Institute
g.	ASME	American Society of Mechanical Engineers
h.	ASPE	American society of Plumbing Engineers
i.	ASSE	American Society of Sanitary Engineering
j.	ASTM	American Society for Testing and Materials
k.	AWWA	American Water Works Association
l.	AWS	American Welding Society
m.	CISPI	Cast Iron Soil Pipe Institute
n.	CGA	Compressed Gas Association
o.	CS	Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
p.	EPA	Environmental Protection Agency
q.	FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
r.	GAMA	Gas Appliance Manufacturers Association
s.	IAPMO	International Association of Plumbing & Mechanical Officials
t.	IEEE	Institute of Electrical and Electronics Engineers
u.	ISA	Instrument Society of America
v.	MCA	Mechanical Contractors Association
w.	MICA	Midwest Insulation Contractors Association
x.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
y.	NBS	National Bureau of Standards
z.	NEC	National Electric Code
aa.	NEMA	National Electrical Manufacturers Association
bb.	NFPA	National Fire Protection Association
cc.	NSF	National Sanitation Foundation
dd.	PDI	Plumbing and Drainage Institute
ee.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
ff.	STI	Steel Tank Institute
gg.	UL	Underwriters Laboratories Inc.
hh.	UPC	Uniform Plumbing Code

2. Standards referenced in this section:

a.	ACI 614	Recommended Practice for Measuring, Mixing and Placing of Concrete
b.	ASTM D1557	Standard Test Method for Moisture-Density Relations of Soils
c.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
d.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
e.	UL1479	Fire Tests of Through-Penetration Firestops
f.	UL723	Surface Burning Characteristics of Building Materials

E. LEAD FREE REQUIREMENTS

1. All materials that contact potable water shall be lead free.

2. This requirement applies to all the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

F. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

2. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

3. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

G. CONTINUITY OF EXISTING SERVICES

1. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to their activities.

H. PROTECTION OF FINISHED SURFACES

1. Refer to Division 1, General Requirements, Protection of Finished Surfaces.

I. SLEEVES AND OPENINGS

1. Refer to Division 1, General Requirements, Sleeves and Openings.

J. SEALING AND FIRE STOPPING

1. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations.

K. OFFSITE STORAGE

1. Prior approval by OWNER and the A/E will be needed. The contractor shall submit Storage Agreement Form for consideration of offsite materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. No material will be accepted for offsite storage unless shop drawings for the material have been approved.

L. CODES

1. Comply with requirements of Washington Administrative Code.

M. CERTIFICATES AND INSPECTIONS

1. Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

2. Obtain and pay for all required installation inspections except those provided by the Architect/Engineer. Deliver the originals of inspection certificates and test records to the Owner's Project Representative. Include copies of the certificates and test records in the Operating and Maintenance Instructions.

N. SUBMITTALS

1. Refer to Division 1, General Conditions, Submittals.

2. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

3. The specific items that will be required for submittals shall be coordinated with the Owner's Project Representative, the A/E, and the General Prime Contractor for inclusion in the project submittal log.

4. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
   a. Operating and Maintenance Manuals 4 copies
      i. Owner 2 copies
      ii. Architect/Engineer 2 copies

O. OPERATION AND MAINTENANCE DATA

1. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

2. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:
   a. Records of tests performed a to certify compliance with system requirements
   b. Manufacturer's wiring diagrams for electrically powered equipment
   c. Certificates of inspection by regulatory agencies
   d. Valve schedules
   e. Parts lists for fixtures, equipment, valves and specialties.
   f. Manufacturers installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
   g. Additional information as indicated in the technical specification sections

P. TRAINING OF OWNER PERSONNEL

1. Instruct user agency personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than 2 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training to be during normal working hours. Video record all instructions and provide Owner with copy.

Q. RECORD DRAWINGS

1. Refer to Division 1, General Requirements, Record Drawings.

PART 2 - PRODUCTS

A. ACCESS PANELS AND DOORS

1. Lay-in Ceilings:
   a. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

2. Concealed Spline Ceilings:
   a. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 09 specifications.

3. Metal Pan Ceilings:

a. Removable sections of ceiling tile held in position by a pressure fit will be provided under Division 09 specifications.

4. MASONRY WALLS, GYPSUM BOARD AND Plaster Walls and Ceilings:
   a. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

B. IDENTIFICATION

1. Stencils:
   a. Not less than 1 inch high letters/numbers for marking pipe and equipment.

2. Engraved Name Plates:
   a. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

3. ADHESIVE LABELS:
   a. Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards. Seton Opti-Code, MSI, Brady or approved equal. Clean piping before application.

4. SNAP-AROUND PIPE MARKERS:
   a. One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, ¾" min. size for lettering. Provide nylon ties on each end of pipe markers. Equal to Seton Setmark.

5. Valve Tags:
   a. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady.

6. Underground Warning Tape:
   a. Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape. Thor Enterprises Magnatec or equal by Carlton, MSI Marking Services, Seton.

7. UNDERGROUND TRACER WIRE:
   a. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

C. BEDDING AND BACKFILL

1. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand or crushed stone chips.

2. Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic, perishable, and frozen materials.

D. SEALING AND FIRE STOPPING

1. FIRE AND/OR SMOKE RATED PENETRATIONS:

a. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with Division 07 Fire Stopping specifications.

2. NON-RATED PENETRATIONS:

a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.

b. At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 - EXECUTION

A. DEMOLITION

1. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

2. All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the Owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

B. EXCAVATION AND BACKFILL

1. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

2. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

3. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

4. Remove surplus excavated materials from site.

5. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

6. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

7. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

8. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

9. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

10. Mechanically compact bedding and backfill to prevent settlement.

C. SHEETING, SHORING AND BRACING

1. Provide shoring, sheet piling and bracing to prevent earth from caving or washing into the excavation.

D. SURFACE RESTORATION

1. Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

E. CONCRETE WORK

1. Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

2. Plumbing related cast-in-place concrete on the exterior of the building to be provided by this Contractor in conformance with requirements of Division 3. This includes piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc.

F. CUTTING AND PATCHING

1. Refer to Division 1, General Requirements, Cutting and Patching.

G. BUILDING ACCESS

1. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

H. EQUIPMENT ACCESS

1. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Prime Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Prime Contractor.

2. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

I. COORDINATION

1. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

2. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

J. IDENTIFICATION

1. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

2. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

3. Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background.

4. Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

5. Identify valves with brass tags bearing a system identification and a valve sequence number. Identify medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)". Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

K. SLEEVES AND OPENINGS

1. Pipe penetrations in new poured concrete horizontal construction requiring F and T rating: Form opening using hole form or core drill opening. Alternatively provide cast in place fire stopping devices/sleeves.

2. Pipe penetrations in new poured concrete horizontal construction requiring F rating but no T rating: Same as pipe penetrations in new poured concrete construction requiring F and T ratings except that schedule 40 steel sleeves may also be used.

3. Pipe penetrations in new poured concrete horizontal construction that do not require F or T ratings: Provide schedule 40 steel pipe sleeve, form opening using hole form or core drill opening.

4. Pipe penetrations in existing concrete floors: Core drill openings.

5. Pipe penetrations through existing floors located in food service areas that do not require a T rating: Core drill sleeve opening large enough to insert schedule 40 sleeve, extend sleeve 2 inches above the floor and grout area around sleeve with hydraulic setting, non-shrink grout. Size sleeve to allow insulated pipe to run through sleeve and paint the sleeve.

6. Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

L. SEALING AND FIRE STOPPING

1. FIRE AND/OR SMOKE RATED PENETRATIONS:
   a. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with Division 07 Fire Stopping specifications.

2. NON-RATED PARTITIONS:
   a. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions. . The bolt heads for the mechanical seal shall face the inside of the building to facilitate repair or replacement of the seal.

   b. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

3. PENETRATIONS SUBJECT TO WATER INTRUSION:
   a. For penetrations (both rated and non-rated) in floors subject to water intrusion or in rooms housing electrical equipment (but not within walls) provide one of the following:
      i. Pipe penetration where steel pipe sleeve is used extend steel sleeve 2” above the floor.
      ii. Pipe penetration where cast in place fire stopping device/sleeve is used, extend device/sleeve 2” above the floor (provided it meets the device’s UL listing).
      iii. Pipe penetration where there is no steel sleeve or cast in place fire stopping device/sleeve, provide 2”x 2” x 1/8” galvanized steel angles fastened to floor surrounding the penetration or group of penetrations to prevent water from getting to penetration. Provide urethane caulk between angles and floor and fasten angles to floor minimum 8”on center. Seal corners water tight with urethane caulk.

   b. Floors subject to water intrusion or rooms housing electrical equipment include the following locations:
      i. Food Service/Kitchen Areas
      ii. Walk In Coolers/Freezers
      iii. Laundries
      iv. Restrooms
      v. Locker/Shower Rooms
      vi. Janitor Rooms w/ Sinks
      vii. Mechanical/Plumbing Equipment Rooms
      viii. Data/Telecommunications Rooms
      ix. Electrical Equipment Rooms

   c. Provide waterproof caulk sealant top coating on fire stopping system (or other approved means to protect the fire stopping system from water) in areas subject to wash down such as Food Service and Dish Washing Areas.

M. AGENCY TRAINING

1. All training provided for agency shall comply with the format, general content requirements and submission guidelines specified.

2. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined.

END OF SECTION

SECTION 22 05 14
PLUMBING SPECIALTIES

PART 1 - GENERAL

A. SCOPE

1. This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

    a. PART 1 – GENERAL
        i. Scope
        ii. Related Documents
        iii. Reference
        iv. Reference Standards
        v. Quality Assurance
        vi. Shop Drawings
        vii. Operation and Maintenance Data

    b. PART 2 - PRODUCTS
        i. Floor Drains
        ii. Floor Sinks
        iii. Cleanouts
        iv. Water Hammer Arrestors
        v. Trap Primer Valves
        vi. Safings

    c. PART 3 - EXECUTION
        i. Installation
        ii. Construction Verification Items
        iii. Agency Training

B. RELATED DOCUMENTS

1. Section 22 08 00 – Commissioning of Plumbing
2. Section 22 11 00 - Facility Water Distribution
3. Section 22 13 00 - Facility Sanitary Sewerage
4. Section 22 05 23 - General-Duty Valves for Plumbing Piping

C. REFERENCE

1. Applicable provisions of Division 1 shall govern work under this section.

D. REFERENCE STANDARDS

1. ANSI A112.21.1 - Floor Drains.
2. ANSI A112.21.2 - Roof Drains.
3. ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
4. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
5. ASSE 1010 - Water Hammer Arrestors.
6. ASSE 1018 - Trap Seal Primer Valves.

E. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

2. Plumbing products requiring approval by the Washington State must be approved or have pending approval at the time of shop drawing submission.

F. SHOP DRAWINGS

1. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

G. OPERATION AND MAINTENANCE DATA

1. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

A. FLOOR DRAINS

1. Manufacturer: Josam, Smith, Wade, Watts, Zurn.

2. Refer to drawings for additional information regarding floor drains.

B. Trap Guards

1. Manufacturer: ProSet Systems Trap Guard, JR Smith Quad Close, Sure Seal or approved equal.

2. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4” size.

C. FLOOR SINKS

1. Manufacturer: Josam, Smith, Wade, Watts, Zurn.

2. Refer to drawings for additional information regarding floor drains.

D. CLEANOUTS

1. Manufacturer: Josam, Smith, Wade, Watts, Zurn.

2. Interior Concrete Floor Areas: Enameled cast iron body with round or square adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.

3. Interior Ceramic Tile Floor Areas: Enameled cast iron body with square adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400-T.

4. Interior Vinyl Tile Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400.

5. Interior Carpeted Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover and secured carpet marker, tapered threaded ABS closure plug. Zurn Z-1400-CM.

6. Interior Finished Wall Areas: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446 (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)

7. Interior Exposed Vertical Stacks: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

8. Interior Horizontal Lines: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

9. Exterior Paved Areas: Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top or surrounding pavement, crowned for drainage. Neenah R-1976 with non-ferrous securing screw.

10. Exterior Unpaved Areas: Cast iron hub or plug with tapered threaded ABS or PVC closure plug, cast iron or PVC frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top. Neenah R-1976 with non-ferrous securing screw.

E. WATER HAMMER ARRESTORS

1. Manufacturer: PPP Industries, Sioux Chief, Wade, Watts.

2. ANSI A112.26.1, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure, 1500 psig surge pressure. Watts series 15.

F. TRAP PRIMER VALVES

1. Manufacturers: Ancon, PPP Industries, Smith, Watts.

2. Bronze body, O-ring seals, integral threaded outlet vacuum breaker, adjustable, in conformance with ANSI/ASSE 1018. PPP model P-1/P-2.

G. SAFINGS

1. Manufacturers: Noble, Oatey.

2. Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

PART 3 - EXECUTION

A. INSTALLATION

1. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

2. Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

3. Provide trap primer connection for all floor drains, mop sinks, trench drains.

4. Install water hammer arrestors where indicated and at quick closing valve installations.

5. Install safing at floor drains above grade. Extend 12" beyond drains in all directions. Cover entire floor in showers and extend 6" up in walls above curbs and to a height of 6' (3" wide each direction) in corners. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test. Install safing at all built-up shower installations. (Note: spray-on and brush applied liquid safing is not acceptable).

B. CONSTRUCTION VERIFICATION ITEMS

1. Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 23 08 00 in accordance with the procedures defined for construction verification.

C. AGENCY TRAINING

1. All training provided for agency shall comply with the format, general content requirements and submission guidelines specified.

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

A. SCOPE

1. This section includes valve specifications for all Plumbing systems except where indicated under Related Work. Included are the following topics:

    a. PART 1 – GENERAL
        i. Scope
        ii. Related Work
        iii. Reference
        iv. Lead Free Requirements
        v. Quality Assurance
        vi. Submittals
        vii. Operation and Maintenance Data
        viii. Design Criteria

    b. PART 2 - PRODUCTS
        i. Water System Valves
            (a) Ball Valves
            (b) Butterfly Valves
            (c) Swing Check Valves
            (d) Spring Loaded Check Valves
            (e) Balance Valves
            (f) Drain Valves

        ii. Natural Gas Systems
            (a) Shut-off Valves
            (b) Exterior Below Grade Shutoff Valves
            (c) Gas Pressure Regulators

        iii. Specialty Valves and Valve Accessories
            (a) Gauge Valves
            (b) Water Pressure Reducing Valves
            (c) Safety Relief Valves

    c. PART 3 - EXECUTION
        i. General
        ii. Shut-off Valves
        iii. Balancing Valves
        iv. Drain Valves
        v. Spring Loaded Check Valves
        vi. Swing Check Valves
        vii. Pressure Reducing Valves
        viii. Safety Relief Valves
        ix. Gas Pressure Regulators

B. RELATED WORK

1. Section 22 05 00 Common Work Results for Plumbing
2. Section 22 05 14 - Plumbing Specialties
3. Section 22 30 00 - Plumbing Equipment

C. REFERENCE

1. Applicable provisions of Division 1 govern work under this section.

D. LEAD FREE REQUIREMENTS

1. All materials that contact potable water shall be lead free.

E. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

F. SUBMITTALS

1. Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

G. OPERATION AND MAINTENANCE DATA

1. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

H. DESIGN CRITERIA

1. ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

2. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

3. Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

4. Valves to be line size unless specifically noted otherwise.

PART 2 - PRODUCTS

A. WATER SYSTEM VALVES

1. All water system valves to be rated at not less than 125 psig water working pressure at 240 degrees F unless noted otherwise.

2. BALL VALVES:
   a. 3" and smaller: Two piece bronze body; sweat, threaded or ASTM F1960 joint connection ends, full port stainless steel ball and stem; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Nibco 585-70-66 LF or equal by Apollo, Milwaukee, Watts.

3. BUTTERFLY VALVES:
   a. 2-1/2" and larger: Cast or ductile iron body; stainless steel shaft; bronze, copper or teflon bushings; EPDM resilient seat; EPDM seals; EPDM encapsulated ductile iron or stainless steel disc. 200 psig WOG through 12. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use tapped lug type valves with stud bolts or cap screws, or grooved end connection valves, permitting removal of downstream piping while using the valve for system shutoff. Nibco LD-2022 or GD-4765, or equal by Milwaukee, Victaulic or Watts.

   b. Provide 10 position locking lever handle actuators for valves 6" and smaller. Provide worm gear operators with external position indication for valves 8" and larger.

4. SWING CHECK VALVES:

a. 3" and smaller: Bronze body, sweat or threaded ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Hammond UP904, Milwaukee UP509, Nibco S413-Y-LF, Watts LFCV, Apollo equal.

b. 4" and larger: Cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, Class 125, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward. Hammond IR 1124, Milwaukee F2974, Nibco F918B, Watts Series 411, Apollo equal.

5. SPRING LOADED CHECK VALVES:
   a. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, teflon seat unless only bronze available. ConBraCo 61 series, Nibco S480-Y-LF, Watts LF600 or equal.

   b. 2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, Class 125. Hammond IR9253 or IR9354, Milwaukee 1400 or 1800 series, Nibco W910-LF or F910-LF.

6. BALANCE VALVES:
   a. 2" and smaller: Brass body, 304 stainless steel ball, sweat or threaded ends, glass filled teflon seat, brass readout valves with EPT checks, with adjustable memory stop position indicator and extended handle stem, suitable for 300 psig water working pressure at 200 degrees F. B&G Xylem Circuit Setter Plus CB1SLF/CB-1LF, or equal by Nibco or Watts.

7. DRAIN VALVES:
   a. 3/4 inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Apollo 70LF-200-HC, Milwaukee BA-100H or BA-150H Hammond 8501H or 8511H or equal by Nibco, or Watts.

B. NATURAL GAS SYSTEMS

1. SHUT-OFF VALVES:
   a. 4" and smaller: Ball or eccentric plug valve, bronze or cast iron body, 2" and under threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seats and seals, lever handle, 175 psi W.O.G., U.L listed for use as natural gas shut-off. Apollo 80-100, DeZurik 425, Milwaukee, Nibco and Watts equals.

   b. 5" and larger: Cast iron body, flanged ends, stainless steel bearings, resilient faced plugs, totally enclosed hand wheel actuators, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

2. EXTERIOR BELOW GRADE SHUT-OFF VALVES:
   a. Plug or ball valve, body of same polyethylene type as piping system, pipe stub ends, high strength plastic stem and operating nut, position indicator, polyethylene plug or polypropylene ball, Buna-N seats and double stem seals, rated for 96 psi natural gas service (150 psi non-lethal service).

3. GAS PRESSURE REGULATORS:
   a. 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20 degrees F to 150 degrees F.

C. SPECIALTY VALVES AND VALVE ACCESSORIES

1. GAUGE VALVES:
   a. Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

2. Water pressure reducing valves:

a. Bronze body, diaphragm operated, with an integral thermal expansion bypass valve, inlet union, stainless steel strainer, renewable monel or stainless steel seat and adjustable reduced pressure range, 300 psig at 160 degrees F. Pre-set for the scheduled pressure. A. W. Cash, Conbraco, Watts, Wilkins.

3. SAFETY RELIEF VALVES:
   a. Bronze body, temperature and pressure actuated, stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Bell & Gossett, A. W. Cash, Conbraco, Watts, Wilkins. Temperature and pressure relief valve shall be sized per AGA rating for BTUH input, Re: SPS 382.40(5)(d).

PART 3 - EXECUTION

A. GENERAL

1. Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

2. Mount valves in locations which allow access for operation, servicing and replacement.

3. Provide valve handle extensions for all valves installed in insulated piping.

4. Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

5. Prior to flushing of piping systems, place all valves in the full-open position.

B. SHUT-OFF VALVES

1. Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

C. BALANCING VALVES

1. Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

2. Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

D. DRAIN VALVES

1. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

E. SPRING LOADED CHECK VALVES

1. Install a spring loaded check valve in each circulating pump discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

F. SWING CHECK VALVES

1. Install swing check valves in recirculation branch lines and elsewhere as indicated. Provide weighted swing check valves at sanitary sump pump discharges.

G. PRESSURE REDUCING VALVES

1. Provide ball valve and strainer at inlet and ball valve at outlet. Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve.

H. SAFETY RELIEF VALVES

1. Install relief valves on all pressure vessels and elsewhere as indicated. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Pipe discharge to drain where indicated or to floor.

I. GAS PRESSURE REGULATORS

1. When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION

SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

A. SCOPE

1. This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors. Included are the following topics:

    a. PART 1 – GENERAL
        i. Scope
        ii. Related Work
        iii. Reference
        iv. Reference Standards
        v. Quality Assurance
        vi. Description
        vii. Shop Drawings
        viii. Design Criteria

    b. PART 2 - PRODUCTS
        i. Manufacturers
        ii. Structural Supports
        iii. Pipe Hangers and Supports
        iv. Beam Clamps
        v. Riser Clamps
        vi. Concrete Inserts
        vii. Continuous Concrete Insert Channels
        viii. Anchors

    c. PART 3 - EXECUTION
        i. Installation
        ii. Hanger and Support Spacing
        iii. Riser Clamps
        iv. Concrete Inserts and Continuous Insert Channels
        v. Anchors

B. RELATED WORK

1. Division 03 - Concrete formwork and cast-in-place concrete for equipment pads specifications.
2. Section 22 07 00 - Plumbing Insulation for insulation protection at support devices.

C. REFERENCE

1. Applicable provisions of Division 1 shall govern work under this section.

D. REFERENCE STANDARDS

1. MSS SP-58

E. REFERENCE

2. Applicable provisions of Division 1 govern work under this section.

F. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

G. DESCRIPTION

1. Provide all supporting devices as required for the installation of mechanical equipment and materials. All support and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

2. Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

3. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

4. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

5. Protect insulation at all hanger points; see Related Work above.

H. SHOP DRAWINGS

1. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

I. DESIGN CRITERIA

1. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

2. Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

P A R T 2 - P R O D U C T S

A. MANUFACTURERS

1. Anvil, B-Line, Pate, G-Strut, Piping Technology, Roof Products & Systems or approved equal.

B. STRUCTURAL SUPPORTS

1. Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

C. PIPE HANGERS AND SUPPORTS

1. HANGERS FOR PIPE SIZES 1/2" THROUGH 2":
   a. Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
   b. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

2. HANGERS FOR PIPE SIZES 2" AND LARGER:
   a. Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

3. MULTIPLE OR TRAPEZE HANGERS:
   a. Steel channels with welded spacers and hanger rods.

4. WALL SUPPORT:
   a. Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

   b. Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil PS 1400 series.

5. VERTICAL SUPPORT:
   a. Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

6. FLOOR SUPPORT:
   a. Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

7. COPPER PIPE SUPPORTS:
   a. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

D. PIPE HANGER RODS

1. STEEL HANGER RODS:
   a. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

   b. Size rods for individual hangers and trapeze support as indicated in the following schedule.

   c. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed rod the limits.

E. BEAM CLAMPS

1. MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

2. MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

F. CONCRETE INSERTS

1. POURED IN PLACE:
   a. MSS SP-58 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.

   b. MSS SP-58 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Anvil 282.

2. DRILLED FASTENERS:
   a. Carbon steel drop-in type expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

G. CONTINUOUS CONCRETE INSERT CHANNELS

1. Steel inserts with an industry standard pre-galvanized finish, nominally 1-5/8 inch wide by 1-3/8 inch deep by length to suit the application, designed to be nailed to concrete forms and provide a linear slot for attaching other support devices. Installed channels to provide a load rating of 2000 pounds per foot in concrete. Manufacturer's standard brackets, inserts, and accessories designed to be used with the channel inserts may be used. Select insert length to accommodate all pipe in the area.

H. ANCHORS

1. Use welding steel shapes, plates, and bars to secure piping to the structure.

PART 3 - EXECUTION

A. INSTALLATION

1. Size, apply and install supports and anchors in compliance with manufacturers recommendations.

2. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

3. Coordinate hanger and support installation to properly group piping of all trades.

4. Trim steel hanger rods to within one inch of the final lock nut position. Hanger and support cutoff burrs shall be removed and sharp edges ground smooth.

5. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

6. Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

7. Perform welding in accordance with standards of the American Welding Society.

B. HANGER AND SUPPORT SPACING

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

2. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

3. Use hangers with 1-1/2 inch minimum vertical adjustment.

4. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

5. Support riser piping independently of connected horizontal piping.

6. Adjust hangers to obtain the slope specified in the piping section of these specifications.

7. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Glass	Per Pipe Mfr.	8'-0"	12'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Steel	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
PEXa*	Tubing* 1/2" through 3/4”	6’-0”	4’-0”
PEXa*	Tubing* 1” through 1-1/2”	8’-0”	4’-0”
Plastic	Pure Water 1-1/2” or less	Continuous	5’-0”

*PEXa Tubing shall have PEXa continuous pipe support with stainless steel strapping around insulated pipe. PEXa tubing without continuous channel (at fittings) shall be supported no less than every 32”.

C. RISER CLAMPS

1. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

D. CONCRETE INSERTS AND CONTINUOUS INSERT CHANNELS

1. Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Locate continuous insert channels on 6'-0" maximum centers and 2'-0" from corners. Furnish inserts to the General Contractor for placement in concrete formwork. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

E. ANCHORS

1. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

A. SCOPE

1. This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:

    a. PART 1 – GENERAL
        i. Scope
        ii. Related Work
        iii. Reference Standards
        iv. Quality Assurance
        v. Description
        vi. Definitions
        vii. Shop Drawings
        viii. Operation and Maintenance Data

    b. PART 2 - PRODUCTS
        i. Materials
        ii. Insulation & Jackets
        iii. Accessories

    c. PART 3 - EXECUTION
        i. Installation
        ii. Piping, Valve and Fitting Insulation
        iii. Construction Verification Items

B. RELATED WORK

1. Section 22 05 00 - Common Work Results for Plumbing
2. Section 22 11 00 - Facility Water Distribution
3. Section 22 13 00 - Facility Sanitary Sewerage
4. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
5. Section 22 30 00 - Plumbing Equipment

C. REFERENCE

1. Applicable provisions of Division 1 govern work under this section.

D. REFERENCE STANDARDS

1. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate
2. ASTM C165 Test Method for Compressive Properties of Thermal Insulations
3. ASTM C177 Heat Flux and Thermal Transmission Properties
4. ASTM C195 Mineral Fiber Thermal Insulation Cement
5. ASTM C240 Cellular Glass Insulation Block
6. ASTM C302 Density of Preformed Pipe Insulation
7. ASTM C303 Density of Preformed Block Insulation
8. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement
9. ASTM C518 Heat Flux and Thermal Transmission Properties
10. ASTM C533 Calcium Silicate Block and Pipe Thermal Insulation
11. ASTM C534 Preformed Flexible Elastomeric Thermal Insulation
12. ASTM C547 Mineral Fiber Preformed Pipe Insulation
13. ASTM C552 Cellular Glass Block and Pipe Thermal Insulation
14. ASTM C553 Mineral Fiber Blanket and Felt Insulation
15. ASTM C578 Preformed, Block Type Cellular Polystyrene Thermal Insulation

16. ASTM C591 Preformed Rigid Cellular Polyurethane Thermal Insulation
17. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation
18. ASTM C612 Mineral Fiber Block and Board Thermal Insulation
19. ASTM C921 Properties of Jacketing Materials for Thermal Insulation
20. ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation
21. ASTM E84 Surface Burning Characteristics of Building Materials
22. MICA National Commercial & Industrial Insulation Standards
23. NFPA 225 Surface Burning Characteristics of Building Materials
24. UL 723 Surface Burning Characteristics of Building Materials

E. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

2. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

F. DESCRIPTION

1. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   a. Pipe Insulation
   b. Equipment Insulation

2. Install all insulation in accordance with the latest edition of the Washington State Energy Code and manufacturer's installation instructions.

G. DEFINITIONS

1. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

H. SHOP DRAWINGS

1. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

I. OPERATION AND MAINTENANCE DATA

1. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

A. MATERIALS

1. Materials or accessories containing asbestos will not be accepted.

2. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

   a. Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 50.

B. INSULATION AND JACKETS

1. Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

2. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

3. RIGID FIBERGLASS INSULATION:
   a. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

   b. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

4. SEMI-RIGID FIBERGLASS INSULATION:
   a. Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

   b. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

5. CALCIUM SILICATE INSULATION:
   a. Rigid hydrous calcium silicate, ASTM C533, Type I, minimum dry density of 12.5 lbs. per cu. ft., thermal conductivity of not more than 0.44 at 300 degrees F, maximum water absorption of 90% by volume, minimum compressive strength 140 psi at 5% deformation, rated for service range of 0 degrees F to 1,200 degrees F. Material to be visually coded or marked to indicate it is asbestos free.

6. ELASTOMERIC INSULATION:
   a. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

7. POLYOLEFIN INSULATION:
   a. Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees F.

8. PHENOLIC INSULATION:
   a. Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor transmission 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.

   b. Kraft reinforced foil vapor barrier laminate all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

9. EXTRUDED POLYSTYRENE INSULATION:
   a. Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.2 at 75 degrees F, minimum compressive strength

of 35 psi, maximum water vapor transmission of 1.1 perm inch, maximum water absorption of .1% by volume, rated for service range of -290 degrees F to 165 degrees F.

10. URETHANE INSULATION:
    a. Rigid closed cell polyisocyanurate, minimum nominal density of 1.8 lbs. per cu. ft., thermal conductivity of not more than 0.19 at 75 degrees F aged 180 days, minimum compressive strength of 19 psi parallel and 10 psi perpendicular, maximum water vapor transmission of 4 perm inch, maximum water absorption of .2% by volume, rated for service range of -290 degrees F to 300 degrees F.

11. CELLULAR GLASS INSULATION:
    a. Rigid closed cell, minimum nominal density of 8.5 lbs. per cu. ft., thermal conductivity of not more than 0.36 at 50 degrees F, minimum compressive strength of 100 psi, maximum water vapor transmission of 0.0 perm inch, maximum water absorption of .2% by volume, rated for service range of -450 degrees F to 900 degrees F.

12. FIREPROOFING INSULATION:
    a. Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 15, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F.

    b. Jacket material shall be the same as jacket for adjacent insulation.

13. PVC FITTING COVERS AND JACKETS:
    a. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

14. METAL JACKETS:
    a. .016 inch thick aluminum or .010 inch thick stainless steel with safety edge.

C. INSULATION INSERTS AND PIPE SHIELDS

1. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

2. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12” and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

3. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

4. Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1”x 6” block for piping through 2-1/2” and three 1” x 6” blocks for piping through 4”. Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

5. Wood blocks will not be accepted.

D. ACCESSORIES

1. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

2. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

3. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

4. Tack fasteners to be stainless steel ring grooved shank tacks.

5. Staples to be clinch style.

6. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

7. Finishing cement to be ASTM C449.

8. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

9. Bedding compounds to be non-shrinking and permanently flexible.

10. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

11. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

A. INSTALLATION

1. Install insulation, jackets and accessories in accordance with manufacturers instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

2. Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

3. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

4. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

5. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

6. Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

7. Provide a complete vapor barrier for insulation on the following systems:
   a. Cold water (potable and non-potable)
   b. Equipment piping with a surface temperature below 65 degrees F

B. PIPING, VALVE, AND FITTING INSULATION

1. GENERAL:

a. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2” lap on jacket seams and 2” tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.

b. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.

c. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

2. INSULATION INSERTS AND PIPE SHIELDS:
   a. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4” and smaller copper piping provided 12” long 22 gauge pipe shields are used.

3. FITTINGS AND VALVES:
   a. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2” band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

4. ELASTOMERIC AND POLYOLEFIN:
   a. Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyeolefin, seal factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces.

5. PROTECTIVE JACKETS:

   a. Provide a protective PVC jacket for the following insulated piping:
      i. Food handling/kitchen areas.
      ii. Wet areas.
      iii. Mechanical spaces below 7 ft.

   b. Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.

   c. Provide a protective metal jacket for the following insulated piping:
      i. Exterior installations.

   d. Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the jacket. Locate seams on bottom for exterior applications.

   e. Provide a protective covering of 2 coats of indoor/outdoor vapor barrier mastic with fabric reinforcing for cold water and chilled water systems.

6. PIPE INSULATION SCHEDULE:

a. Provide insulation on new and existing remodeled piping as required by the current version of the Washington State Energy Code.

b. The following piping and fittings are not to be insulated:
   i. Chrome plated exposed supplies and stops (except where specifically noted).
   ii. Water hammer arrestors.
   iii. Piping unions and flanges for systems not requiring a vapor barrier.

C. EQUIPMENT INSULATION

1. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

2. SEMI-RIGID FIBERGLASS:
   a. Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic. . Use vapor barrier mastic on systems requiring a vapor barrier.

3. ELASTOMERIC/POLYOLEFIN:
   a. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

D. CONSTRUCTION VERIFICATION ITEMS

1. Contractor is responsible for utilizing the construction verification checklists supplied under specification.

END OF SECTION

SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

A. SCOPE

1. This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

    a. PART 1 – GENERAL
        i. Scope
        ii. Reference
        iii. Reference Standards
        iv. Shop Drawings
        v. Quality Assurance
        vi. Delivery, Storage, and Handling
        vii. Design Criteria
        viii. Welder Qualifications

    b. PART 2 - PRODUCTS
        i. Domestic Water
        ii. Dielectric Unions and Flanges
        iii. Unions and Flanges
        iv. Mechanical Grooved Pipe Connections

    c. PART 3 - EXECUTION
        i. General
        ii. Preparation
        iii. Erection
        iv. Copper Pipe Joints
        v. Welded Pipe Joints
        vi. Threaded Pipe Joints
        vii. Solvent Welded Pipe Joints
        viii. Mechanical Hubless Pipe Connections
        ix. Mechanical Joint Pipe Connections
        x. Push-On Gasketed Pipe Connections
        xi. Mechanical Grooved Pipe Connections
        xii. Mechanically Formed Tee Fittings
        xiii. Domestic Water
        xiv. Flushing and Disinfection of Potable Water Systems
        xv. Underground Pipe Wrap
        xvi. Dielectric Unions and Flanges
        xvii. Unions and Flanges
        xviii. Piping System Leak Tests
        xix. Construction Verification Items

B. RELATED WORK

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
2. Section 22 05 14 - Plumbing Specialties

C. REFERENCE

1. Applicable provisions of Division 1 govern work under this section.

D. REFERENCE STANDARDS

1. ANSI A21.4
2. ANSI A21.11
3. ANSI A21.51

4. ANSI B16.3 Malleable Iron Threaded Fittings
5. ANSI B16.4 Cast Iron Threaded Fittings
6. ANSI B16.5 Pipe Flanges and Flanged Fittings
7. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
8. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
9. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
10. ASTM A105 Forgings, Carbon Steel, for Piping Components
11. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
12. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
13. ASTM B32 Solder Metal
14. ASTM B88 Seamless Copper Water Tube
15. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
16. ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
17. ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe
18. ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
19. ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
20. ASTM D2466 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
21. ASTM D2513 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings
22. ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
23. ASTM D2657 Heat Fusion Joining of Polyolefin Pipe and Fittings
24. ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping
25. ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
26. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
27. ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
28. ASTM D4101 Propylene Plastic Injection and Extrusion Materials
29. ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80
30. ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40
31. ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
32. ASTM F493 Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings
33. ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
34. ASTM F876 Standard Specification for Crosslinked Polyethylene (PEX) Tubing
35. ASTM F877 Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
36. ASTM F1960 Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings
37. AWWA C904 Standard for Crosslinked Polyethylene (PEX) Pressure Pipe, 1/2-inch Through 3-inch, for Water Service
38. AWS A5.8 Brazing Filler Metal
39. AWWA C104 Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
40. AWWA C105 Polyethylene Encasement for Ductile Iron Piping for Water
41. AWWA C110 Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
42. AWWA C111 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
43. AWWA C151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
44. AWWA C153 Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
45. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances
46. AWWA C651 Disinfecting Water Mains
47. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

E. SHOP DRAWINGS

1. Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

2. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

F. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

2. Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

3. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

G. DELIVERY, STORAGE, AND HANDLING

1. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

2. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

3. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

4. Storage and protection methods must allow inspection to verify products.

H. DESIGN CRITERIA

1. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, and AWWA specifications as listed in this specification.

2. Construct all piping for the highest pressures and temperatures in the respective system.

3. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings unless approved for this use.

4. Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

5. Where ASTM A53 type F pipe is specified, grade A Type E or S, or grade B Type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

6. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

I. WELDER QUALIFICATIONS

1. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any

metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

2. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

3. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the State's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

A. DOMESTIC WATER

1. ABOVE GROUND:
   a. Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

   b. Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.

   c. Stainless Steel pipe, all sizes: ASTM A312, Type 304, Schedule 10 or 40 pipe, dimensions conforming to ANSI/ASME B36.19M with threaded, welded or grooved joints. Systems used for potable water to include ANSI/NSF 61 lead free certification. Fittings: ASTM A276 and A312 outlets and austenitic stainless steel plain, threaded or grooved ends, Type 304 or 316. Grooved couplings may be standard painted ductile iron, with EPDM gaskets. 1 1/2” and larger: ASTM A312, Type 304/304L Schedule 10 stainless steel pipe, welded or roll grooved connections. Galvanic corrosion protection required when connecting to copper systems in accordance with manufacturer recommendation. Schedule 10 pipe threaded joints and cut grooved joints are not permitted. Schedule 5 pipe and mechanical press-fit joints are not permitted.

   d. Crosslinked Polyethylene (PEX-a Engel Method) plastic pipe and fittings, 1/2” to 2” sizes: ASTM F876, ASTM F877, AWWA C904, with ASTM F1960 cold expansion fittings, rated for a temperature of 180 degrees F at 100 psi, copper tube size (CTS). Transition fittings PEX-to-Metal, one-piece lead free, brass threaded or sweat adapter, with PEX-a reinforcing cold expansion ring. Fittings for PEXa to PEXa connection to be poly plastic. Multiport manifolds with valves shall be accessible. Multiport tees are not required to be accessible. Pipe and fittings by the same manufacturer, Uponor, Rehau, Sioux Chief or equal. Pipe system shall be installed and supported in accordance with the manufacturer’s instructions, and include full manufacturer warranty. Fixture connection stub-out piping shall transition to copper piping within wall, before entry into finished space, and include manufactured rigid support.
   e. PEXa pipe 1” to 2” shall be provided in straight lengths, coil stock may be used for ½” and ¾” sizes. ½’ and ¾” pipe sizes shall be color coded blue for cold water, and red for hot and hot water return water.

2. BELOW GROUND 2-1/2" AND SMALLER:
   a. Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

3. BELOW GROUND 3" AND LARGER:
   a. Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

   b. PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

4. UNDERGROUND TO INTERIOR BUILDING ENTRANCE PIPING 3” AND LARGER:
   a. Ductile iron as specified above with factory threaded and machined flanges.

B. DIELECTRIC UNIONS AND FLANGES

1. Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

C. UNIONS AND FLANGES

1. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

2. 2" AND SMALLER STEEL:
   a. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use galvanized malleable iron on galvanized steel piping. Use stainless steel unions for stainless steel piping.

3. 2" AND SMALLER COPPER:
   a. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

4. 2-1/2" AND LARGER STEEL:
   a. ASTM A181 or A105, threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.

5. 2-1/2" AND LARGER COPPER:
   a. ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

D. MECHANICAL GROOVED PIPE CONNECTIONS

1. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruvlok or Grinnell may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

2. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.

3. Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

4. Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.

5. Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

6. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

7. Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

PART 3 - EXECUTION

A. GENERAL

1. Install pipe and fittings in accordance with reference standards, manufacturers recommendations and recognized industry practices.

B. PREPARATION

1. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

C. ERECTION

1. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

2. Where copper, steel, or plastic piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

3. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

4. Maintain piping in clean condition internally during construction.

5. Provide clearance for installation of insulation, access to valves and piping specialties.

6. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

7. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

8. PEXa pipe joint connections shall be installed per manufacturer's recommendations. Use manufacturer recommended cold-expansion tool for ASTM F 1960 connections.

9. Do not expose PEXa piping to direct sunlight. Provide cover to portions of piping exposed to direct sunlight.

10. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

11. Locate piping and include offsets to avoid interference with building structural members, equipment, building openings, light fixtures, ductwork, electrical work, and other obstructions.

12. Arrange piping to allow access for operation, service, disconnection, and removal and replacement of valves, fixtures, and equipment.

13. In general, maintain the maximum possible headroom in ways of egress, including pedestrian walkways and maintenance aisles, minimum headroom of 6'-8" from floor to bottom of any component.

14. Route piping parallel to column lines and perpendicular to floor unless indicated otherwise.

D. COPPER PIPE JOINTS

1. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

E. WELDED PIPE JOINTS

1. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

F. THREADED PIPE JOINTS

1. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

G. SOLVENT WELDED PIPE JOINTS

1. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

2. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths.

Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturers recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the **OWNER** Project Representative.

H. MECHANICAL HUBLESS PIPE CONNECTIONS

1. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

I. MECHANICAL JOINT PIPE CONNECTIONS

1. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

J. PUSH-ON GASKETED PIPE CONNECTIONS

1. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

K. MECHANICAL GROOVED PIPE CONNECTIONS

1. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

L. MECHANICALLY FORMED TEE FITTINGS

1. Form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. Use an adjustable collaring device. Notch and dimple the branch tube. Braze the joint with neutral flame oxy-acetylene torch, applying heat properly so that pipe and tee do not distort; remove distorted connections.

M. DOMESTIC WATER

1. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

2. Install exterior water piping below predicted frost level in accordance with COMM Table 82.30-6, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve

(reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

3. Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

4. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

N. FLUSHING AND DISINFECTION OF POTABLE WATER SYSTEMS

1. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 10 parts per million of chlorine and allow to stand for 24 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

2. Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

3. Piping that is pressure tested shall be drained completely dry. The piping system is not to be left full of stagnant water. The piping system, water heaters and water softeners shall not be filled until within 10 days of occupancy to guard against microbial growth.

O. UNDERGROUND PIPE WRAP

1. Use for steel piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

P. DIELECTRIC UNIONS AND FLANGES

1. Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

Q. UNIONS AND FLANGES

1. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

R. PIPING SYSTEM LEAK TESTS

1. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

2. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

3. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

4. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

5. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented on forms to be provided to the contractor.

	Test	Initial Test		Final Test	
System	Medium	Pressure	Duration	Pressure	Duration
*Below Ground Domestic Water	Water	N/A		200 psig	2 hr
Above Ground Domestic Water	Water	N/A		100 psig	8 hr
Above Ground Non-potable Water	Water	N/A			100 psig 8 hr
Below Ground Non-potable Water	Water	N/A			100 psig 8 hr

* Leakage on exterior mains 3" and larger may not exceed leakage calculated as follows:

$$\text{GPH Allowable Leakage} = \frac{(\text{Feet of Pipe})(\text{Inches Dia. of Pipe})(\text{Test Pressure})^{.5}}{133{,}200}$$

S. CONSTRUCTION VERIFICATION ITEMS

1. Contractor is responsible for utilizing the construction verification checklists.

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **JTK Project No:** _____

Contractor: _____

□ Plumbing □ Fire Sprinkler

Test Medium: □ Air □ Water □ Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ Initial Pressure: _____ PSIG

Stop Test Time: _____ Final Pressure: _____ PSIG

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

_____

_____

_____

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

A. SCOPE

1. This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

    a. PART 1 – GENERAL
        i. Scope
        ii. Reference
        iii. Reference Standards
        iv. Shop Drawings
        v. Quality Assurance
        vi. Delivery, Storage, and Handling
        vii. Design Criteria
        viii. Welder Qualifications

    b. PART 2 - PRODUCTS
        i. Sanitary Waste and Vent

    c. PART 3 - EXECUTION
        i. General
        ii. Preparation
        iii. Erection
        iv. Copper Pipe Joints
        v. Threaded Pipe Joints
        vi. Solvent Welded Pipe Joints
        vii. Mechanical Hubless Pipe Connections
        viii. Mechanical Joint Pipe Connections
        ix. Mechanical Grooved Pipe Connections
        x. Mechanically Formed Tee Fittings
        xi. Sanitary Waste and Vent
        xii. Piping System Leak Tests
        xiii. Construction Verification Items

B. RELATED WORK

1. Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
2. Section 22 05 14 - Plumbing Specialties

C. REFERENCE

1. Applicable provisions of Division 1 govern work under this section.

D. REFERENCE STANDARDS

1. ANSI A21.4
2. ANSI A21.11
3. ANSI A21.51
4. ANSI B16.3 Malleable Iron Threaded Fittings
5. ANSI B16.4 Cast Iron Threaded Fittings
6. ANSI B16.5 Pipe Flanges and Flanged Fittings
7. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
8. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
9. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
10. ASTM A74 Cast Iron Soil Pipe and Fittings
11. ASTM A105 Forgings, Carbon Steel, for Piping Components

12. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
13. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
14. ASTM A861 High Silicon Iron Pipe and Fittings
15. ASTM A888 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
16. ASTM B32 Solder Metal
17. ASTM B306 Copper Drainage Tube (DWV)
18. ASTM B813 Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
19. ASTM C76 Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
20. ASTM C564 Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
21. ASTM C1540 Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
22. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
23. ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
24. ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
25. ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns
26. ASTM F2618 CPVC Pipe and Fittings for Chemical Waste Drainage Systems
27. AWS A5.8 Brazing Filler Metal
28. CISPI 301 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
29. CISPI 310 Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

E. SHOP DRAWINGS

1. Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

2. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, or CISPI specification contained in this section.

F. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

2. Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

3. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

G. DELIVERY, STORAGE, AND HANDLING

1. Promptly inspect shipments to ensure that the material is undamaged and complies with specifications.

2. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

3. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

4. Storage and protection methods must allow inspection to verify products.

H. DESIGN CRITERIA

1. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

2. Construct all piping for the highest pressures and temperatures in the respective system.

3. Piping that is not in accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50 shall not be utilized in ventilation plenum spaces, including plenum ceilings.

4. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

5. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

6. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

I. WELDER QUALIFICATIONS

1. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

2. Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

3. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 - PRODUCTS

A. SANITARY WASTE AND VENT

1. INTERIOR ABOVE GROUND:
   a. Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the Engineer. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

   b. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP.

c. CPVC plastic pipe, Schedule 40, ASTM D1784, Class 23447 Type IV, with drainage pattern fittings per ASTM D3311, Solvent cement joints utilizing one step primerless cement as approved by the manufacturer. All fittings and pipe shall be tested and listed in accordance with CAN/ULC S102.2 and tested in general accordance with ASTM E-84/UL723 for flame spread of <25 and smoke development of <50. CPVC pipe and fittings shall be of Charlotte Chem Drain or Spears Lab Waste manufacturers, or equal.

2. INTERIOR BELOW GROUND:
   a. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301, and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

3. EXTERIOR BELOW GROUND 10" AND SMALLER:
   a. Non-reinforced concrete sewer, storm drain and culvert pipe, Class III, ASTM C14; rubber gasket joints, ASTM C443; bell and spigot ends with opposing shoulder or confined O-ring seal configuration, ASTM C302.

4. EXTERIOR BELOW GROUND 15" AND SMALLER:
   a. Cast iron soil pipe and fittings, CISPI 301, ASTM A74 or ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute. Cast iron piping and fittings shall be of A B & I Foundry, Charlotte Pipe and Foundry, or Tyler Pipe manufacturers.

PART 3 - EXECUTION

A. GENERAL

1. Install pipe and fittings in accordance with reference standards, manufacturers recommendations and recognized industry practices.

B. PREPARATION

1. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

C. ERECTION

1. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

2. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

3. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

4. Maintain piping in clean condition internally during construction.

5. Provide clearance for installation of insulation, access to valves and piping specialties.

6. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

7. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

8. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

D. COPPER PIPE JOINTS

1. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

E. WELDED PIPE JOINTS

2. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

F. THREADED PIPE JOINTS

3. Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

G. SOLVENT WELDED PIPE JOINTS

1. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

2. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner Project Representative.

H. MECHANICAL HUBLESS PIPE CONNECTIONS

1. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

I. MECHANICAL JOINT PIPE CONNECTIONS

1. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

J. MECHANICAL GROOVED PIPE CONNECTIONS

1. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

K. SANITARY WASTE AND VENT

1. Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.

2. Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection in accordance with SPS 382.30(11)(c).

3. Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

L. PIPING SYSTEM LEAK TESTS

1. Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

2. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

3. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

4. For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

5. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

6. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented on forms to be provided to the contractor.

System	Test Medium	Initial Test Pressure	Initial Test Duration	Final Test Pressure	Final Test Duration
Sanitary Waste and Vent	Water	N/A		10' water	2 hr
Pressurized Sanitary Waste & Vent	Water	N/A		100 psig	2 hr
Acid Waste and Vent	Water	N/A		10' water	2 hr

M. CONSTRUCTION VERIFICATION ITEMS

1. Contractor is responsible for utilizing the construction verification checklists.

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **JTK Project No:** _____

Contractor: _____

□ Plumbing □ Fire Sprinkler
Test Medium: □ Air □ Water □ Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

_____

Test Date: _____
Start Test Time: _____ Initial Pressure: _____ PSIG

Stop Test Time: _____ Final Pressure: _____ PSIG

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

_____

_____

_____

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

A. SCOPE

1. This section includes specifications for plumbing fixtures, faucets and trim.

    a. PART 1 – GENERAL
        i. Scope
        ii. Related Work
        iii. Quality Assurance
        iv. Shop Drawings
        v. Operation and Maintenance Data
        vi. Design Criteria
        vii. Energy Efficiency Requirements

    b. PART 2 - PRODUCTS
        i. Plumbing Fixtures

    c. PART 3 - EXECUTION
        i. Installation
        ii. Construction Verification Items

B. RELATED WORK

1. Section 22 11 00 - Facility Water Distribution
2. Section 22 13 00 - Facility Sanitary Sewerage
3. Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
4. Section 22 05 14 - Plumbing Specialties

C. REFERENCE

1. Applicable provisions of Division 1 shall govern work under this section.

D. QUALITY ASSURANCE

1. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

2. Plumbing products requiring approval by the Washington State must be approved or have pending approval at the time of shop drawing submission.

E. SHOP DRAWINGS

1. Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

F. OPERATION AND MAINTENANCE DATA

1. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

G. DESIGN CRITERIA

1. ANSI A112.6.1M-88 - Supports for Off-the Floor Plumbing Fixtures for Public Use.
2. ANSI A112.18.1-94 - Finished and Rough Brass Plumbing Fixture Fittings.

3. ANSI A112.19.1-90 - Enameled Cast Iron Plumbing Fixtures.
4. ANSI A112.19.2M-82 - Vitreous China Plumbing Fixtures.
5. ANSI A112.19.5-79(R1990) - Trim for Water Closet Bowls, Tanks and Urinals.
6. ARI-1010-94 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
7. ASSE 1011-93 - Hose Connection Vacuum Breakers.

H. ENERGY EFFICIENCY REQUIREMENTS

1. Plumbing fixtures must meet the following maximum water usage requirements.
   a. Lavatory Faucets, flow of 2 gpm or less and .25 gallon per cycle or less (based on inlet pressure of 60 p.s.i.)
   b. Showerheads, flow of 2.2 gpm or less (based on inlet pressure of 80 p.s.i.)
   c. Urinal Flush Valves, 1.0 gallon per flush or less.
   d. Water Closet Flush Valves, 1.6 gallon per flush or less.

PART 2 - PRODUCTS

A. PLUMBING FIXTURES

1. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted.

2. Refer to contractor drawings for additional information on plumbing fixtures.

   a. Water Closets – See contract drawings plumbing fixture schedule.
      i. Water closet carrier: Provide commercial grade with rear support leg and anchoring foot.
      ii. Water Closet Seats: Olsonite, Bemis, Beneke, or approved.

   b. Urinals – See contract drawings plumbing fixture schedule.
      i. Wall mount.
      ii. Low flow is acceptable.
      iii. No waterless urinals.

   c. Lavatories – See contract drawings plumbing fixture schedule.
      i. All lavatory sinks shall be hung with Zurn-1231 hangers or Smith concealed type hangers.

   d. Faucets - See contract drawings plumbing fixture schedule.

   e. Drains - Chicago Faucet, Engineered Brass Co., Kohler, McGuire.

   f. Stops and Supplies - Chicago Faucet Co., McGuire. (Heavy Duty Type Only)
      i. Flex hose, no lead in stops.

   g. Flush Valves - See contract drawings plumbing fixture schedule.
      i. Automatic flush valves shall have manual flush capability.
      ii. Battery.

   h. Traps - Kohler, McGuire, Dearborn, Engineered Brass Co. (17 gauge Min.)

   i. Carriers and Supports - Josam, Smith, Wade, Watts Drainage, Zurn.

   j. Sinks - See contract drawings plumbing fixture schedule.

   k. Laundry Trays - Fiat, Mustee, Stern-Williams.

l. Water Hammer Arrestors – Sioux Chief, Watts, PPP
   i. Provide with isolation valves or ensure isolation valve is adjacent.
   ii. Provide access door.
   iii. Provide bellow type, with mechanical joint. No sweat fitting.

3. Fixture Color: White unless otherwise indicated in the Contract Documents.

4. Exposed Metal Parts: Chromium over nickel finish.

5. Exposed Supplies: 1/2 inch outside diameter, stainless steel, vertical tubing.

6. Fittings and Trim: T & S Brass, McGuire, BrassCraft, or approved.

PART 3 - EXECUTION

A. INSTALLATION

1. Install plumbing fixtures in accordance with manufacturers instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

2. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

3. Install barrier free fixtures in compliance with ADA standards as well as State/Local requirements. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to 27" above floor to avoid contact by wheelchair users.

4. Provide unions at water connections to drinking fountains.

5. Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

6. Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, same items in concealed locations may be of rough brass finish.

7. Provide Truebro Lav Guard, McGuire Pro Wrap, or approved trap and stop guards for all exposed piping on all sinks and lavs, even for fixtures located in casework.

8. Set floor mounted water closets, floor mounted service sinks; counter mounted lavs and sinks; lav and sink faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet bolts with bolt covers.

9. Water closet carrier: Provide commercial grade with rear support leg and anchoring foot.

10. Set mop basins to floor and wall with grout or silicone sealant.

11. Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

12. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow. Adjust self-closing lavatory faucets to 15 second cycle.

13. Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

14. Stop Valves: Include in water connections to fixtures, except where fitting has integral stops. Loose key angle pattern with lock shield, polished chrome plated finish where exposed and rough where concealed.

15. Tailpiece Extension, Trap, and Arm to Wall: 17 gage, seamless, chrome plated tubing with cleanout for sinks.

16. Vacuum Breaker: Include on water supply to each fixture which has a water connection located below the rim and for fixtures with faucets with threaded outlets for hose attachment, flow-through pattern.

17. Trap Primers: Include for floor drains and floor sinks.

18. Cleanouts: Provide wall cleanout above trap of each urinal.

19. Existing Fixtures: Where existing fixtures and fittings are indicated to be reused or relocated, this contractor is responsible for documenting condition prior to construction and for damages incurred during construction.

B. CONSTRUCTION VERIFICATION ITEMS

1. Contractor is responsible for utilizing the construction verification checklists.

END OF SECTION

END OF SPECIFICATIONS