SECTION 22 00 10 - PLUMBING DESIGN GUIDELINES

1. GENERAL:

A. This section details the general design requirements for building plumbing systems, including domestic water, sanitary sewer and drainage systems, for both new and retrofit applications.

B. Related Sections:

1. Section 01 13 01 - Design Guidelines for Energy and Environment
2. Section 01 17 71 – Project Turnover Requirements
3. Section 01 17 73 – Operations & Maintenance Manuals
4. Section 01 35 25 – Facilities Fall Protection
5. Section 01 70 10 – MEPS Identification & Labeling
6. Section 01 78 25 – Facilities Visual Aids Documentation
7. Section 01 81 10 - Building Service Equipment Accessibility Requirements
8. Section 01 81 11 – Confined Spaces
9. Section 01 93 10 – Equipment-Specific Energy Control Measures
10. Section 13 00 01 – General Laboratory Design Standards
11. Section 13 00 22 – Laboratory Plumbing Design Criteria
12. Section 26 09 02 - Campus Central Metering System Design Criteria

2. BACKGROUND:

A. Brown University typically utilizes city mains to provide domestic water, fire protection water, sewer, and storm water utilities to each building on an individual building basis. However, there are locations on the main campus where buildings are served from shared, Brown-owned, campus water, fire protection, sewage and drainage utilities.

B. For new construction, the intent is for each building to have individual and separate lateral connections for city water, fire protection, sanitary sewer, and storm drains back to the respective city systems.

3. DESIGN SUBMITTAL REQUIREMENTS:

A. Plumbing system designs shall include the following:

1. Conceptual/schematic design: A design narrative including the basis of design with description of each system and the proposed utility or building connections, shall be provided. Systems shall include domestic water, specialty water systems, sewage, stormwater, drainage and water reclamation systems. The Basis of Design shall include the following:
   a. Description of the proposed system including connected and demand loads, system sizing and redundancy considerations.
   b. Provide details of spare capacity for any new systems, or details of reduction in spare capacity when connecting into existing systems.
   c. Any proposed deviations from the Brown Design Standards.

2. Construction Documents: Updated/revised basis of design including the following:
   a. Updates/deviations from all previous submittal items.
   b. Approved deviations from Brown Standards (approval process should be documented for each).
   c. All basis of design components shall be integrated into the design documentation in drawing schedules, drawing notes or design specifications, system flow and 1-line diagrams, equipment schedules and equipment sequence of operation descriptions.

4. PRELIMINARY DESIGN STUDIES:

A. For all projects, the Engineer of Record shall perform the following basic studies and investigations in the course of the design. Existing system information required for these studies shall be provided by Brown as required:

1. Available city water pressure and flow requirements from Providence Water.
2. Available sanitary and storm water capacity from Narragansett Bay Commission.
3. Storm Water master plan from City of Providence
4. Other utility information as may be required.

5. RELIABILITY AND REDUNDANCY CONSIDERATIONS FOR FACILITIES:

A. Review the need for redundant water services at the project planning phase for critical buildings, such as Research, Laboratory and certain campus support facilities. Considerations for water system redundancy may be in the form of:

1. Valved hose connections at the water service entrance
2. Valved and isolated emergency cross-ties to adjacent facilities domestic water service
3. Multiple domestic water services entering the facility from different street services

6. FLOW AND RISER DIAGRAMS:

A. All system designs shall include detailed building (and site as applicable) riser and flow diagrams. Include the following for each system diagram as applicable:

1. Diagrams shall be generally geographic in nature. For example, a building with the domestic service in the basement, and risers located throughout the building: the service would be at the bottom of the riser diagram, each of the major distribution risers would be shown diagrammatically correct to the general room and shaft configuration throughout the building, and inclusive of the room numbers where it is located.
2. Diagrams shall indicate all line sizes, the major equipment loads and equipment served, as well as the design ratings of key components in each system. Equipment shall be referenced by its specific common name identification and include its nominal equipment ratings (or capacities), relevant line sizes and interfaces with other building systems and utilities.
3. Diagrams shall include room numbers for the location of the equipment as well as room number of the spaces being served by the specific system.

4. Indicate relevant incoming utility capacities (i.e.: static and dynamic pressures and flow rates).
5. Show all major system and branch isolation valves.

7. GENERAL PLUMBING DESIGN REQUIREMENTS:

A. All system designs shall include detailed building riser and one-line system diagrams showing all major distribution system components, meters, controls, isolation valves, vents and drains and interfaces with other building and campus utility systems.

B. For renovation projects, existing building riser diagrams shall be provided with updates to clearly indicate locations of all new system tie-ins being added, or components to be removed.

C. Plumbing Rooms:

1. Refer to Section 01 81 10 - Building Service Equipment Accessibility Requirements for additional requirements.
2. Floor mounted plumbing equipment shall be installed on concrete housekeeping pads.

D. Avoid the use of central water filtration or treatment systems: where water conditioning is required, preference is to use "point of use" water treatment systems. Show water treatment system connections on the plumbing risers, including associated backflow preventer(s) and isolation valves.

E. For new construction, utilize a single common manufacturer for each type of equipment or equipment category, such as fixtures, faucets, accessories and equipment.

F. All plumbing risers shall have isolation or sectionalizing valves at each floor level to allow for localized draining and servicing of the water system.

G. All branch mains shall be provided with shutoff valves to permit servicing of systems without affecting other areas of the building. Each toilet area (men's or women's) and kitchen area/ break room shall also be provided with isolation valves.

H. Provide drain valves at the base of each plumbing riser or isolated piping section. Provide drain valves with hose end fitting, chain and cap; cap pressure rating shall match or exceed system or hydrostatic pressure (whichever is greater) at the point of installation.

I. Ensure that cleanouts for drainage, sewage and stormwater piping are readily accessible; locate cleanouts in common public spaces or utility rooms whenever possible.

J. Sanitary and lab waste systems shall be gravity-flow wherever possible; minimize the use of pumped sanitary and lab-waste systems.

K. Capping of Lines: Whenever demolition of existing plumbing or piping systems occurs, lines shall be cut back to the branch tee, and the tee fitting cut out. No "dead leg" piping sections are allowed. All abandoned piping shall be removed completely.

L. Plumbing devices requiring routine preventive maintenance or testing (such as backflow

preventers, water heaters, circulators, mixing valves, and control or sensing devices) shall be readily accessible working from the ground level.

M. All domestic water piping shall be insulated and labeled.

N. In the absence of more stringent design criteria, domestic water piping shall be sized to maintain a minimum flow of 25 GPM and a minimum pressure of 35 psig at the farthest flush valve and 30 psig at the hydraulically most remote safety shower. Water velocity in the distribution piping system shall not exceed 6 feet per second.

O. Provide water hammer arrestors, with local isolation valves, to mitigate water hammer issues. Locate arrestors in hot and cold-water lines at the end of each battery of plumbing fixtures, at major load connections and where otherwise required per good engineering practices. Ensure devices are readily accessible.

P. Design potable water supply piping so that food areas, break-room sinks, and water fountains are not at the end of a plumbing run and are located so that the water supply has a high rate of turn-over to assure high water quality.

Q. Coordinate with the project architect that within custodial rooms, the walls, floors and wall to floor cove moldings shall be waterproof material. Wall mounted sinks shall be sealed to the wall. Floor-mounted basins shall be sealed to the floor. All piping penetrations in the room shall be sealed.

R. Coordinate with project architect for showers, that shower heads shall not to be aimed at open area; aim towards a solid wall.

S. In public toilet rooms, toilets shall be wall-mounted for easy cleaning. Floor mounted toilets shall be used only in private bathrooms.

8. DOMESTIC WATER SERVICES:

A. Water Service Rooms:

1. Water service entrance rooms shall be adequate in size for the proper servicing of equipment, including access for replacement of all components and provide for required spare parts storage. Rooms shall be accessible by a standard stair or elevator; ship's ladders are NOT acceptable.

2. Provide adequate floor drains in rooms; drains shall be connected to the sanitary sewer system, not to storm sewer.

B. Water Meters:

1. Provide each building water service entrance with a dedicated building meter. Review proposed meter size and meter quantities during the Design phase, as in many cases multiple smaller-size meters are most cost-effective than a single larger meter.

2. Provide separate irrigation service, complete with backflow preventer and exclusion meter per Narragansett Bay Commission requirements, where landscape irrigation is supplied.

3. Meters shall be provided with a supplemental dry contact pulse output head, for

connection of metering consumption data into the campus metering system.

C. Gauges:

1. Include a 0-100 psi pressure gauge with isolation valve on the main domestic water building service entrance line, as well as downstream of each backflow preventer.

D. Protection:

1. Each building water service (Potable and Non-Potable systems) shall be protected by two reduced pressure backflow preventers with strainers, piped in parallel, equidistant and properly sized for flow as a pair with ball or butterfly shut-off valves.
2. Branches providing service to mechanical systems shall be provided with backflow preventers.
3. Backflow preventers shall be provided with isolation valves on each side of the device.
4. Manufacturers:
   - Watts
   - Febco (vertical use)
   - Ames – allowed for Fire Protection only

E. Water Pressure Booster Sets:

1. Domestic water booster sets shall be duplex or triplex type, with each pump powered from a variable speed drive (VFD). VFD's shall be controlled with automatic alternating lead/lag controls, with VFD speed control paced from a system pressure transducer.
2. Connect alarms from the water booster sets to the building BAS where available. At a minimum, provide alarms for low and high-water pressure and pump failure.
3. Connect water booster sets to building Standby generator and power system where available
4. Manufacturers:
   - Grundfos, Taco, or equal
   - Amtrol for small bladder tank/booster pump sets

F. In-line Circulator Pumps: Taco (bronze or stainless steel).

G. Expansion Tanks:

1. Diaphragm-Type Compression Tanks
2. Welded steel, rated for working pressure of 150 psig minimum
3. Manufacturers: Amtrol
4. Accessories: Provide with tank pressure gage, air-charging fitting and tank drain
5. Commercial type with replaceable bladder.
6. Manufacturers:
   - Amtrol
   - Taco

7. Pipe expansion tanks to the system with a local isolation valve, piping union fitting and drain valve.

9. TRAP PRIMERS:

A. Provide trap primer devices on all floor drains. Traps shall have a reliable means of maintaining water in the trap seal at all times.

B. For floor drains in all occupiable building areas; provide automatic trap primers with timers.

C. For floor drains in other locations requiring a trap primer: provide mechanical-type trap primer, Sloan VBS or equal, piped to each trap.

10. STORM WATER DRAINAGE SYSTEMS:

A. Storm water drainage system shall be provided for all roof and area drains and be connected into the site storm system.

B. A storm water drainage overflow system shall be provided for all roofs which cannot support the buildup of rainwater caused by an obstructed primary roof drain and where scuppers are not provided.

C. Parking area drains shall connect into the storm drainage system. Oil and sand interceptors shall be provided for the storm drainage from parking facilities.

D. Where stormwater lines connect to combined storm/sanitary sewers, provide serviceable backwater valves to prevent water flow into the building system. Backwater valves shall be located in readily accessible locations and shall not be installed within manholes due to confined space concerns for access.

11. SANITARY WASTE AND STORMWATER DRAINAGE SYSTEMS:

A. The sanitary and stormwater drainage systems shall be gravity type drainage systems. Pumped systems shall only be used where gravity type drainage systems cannot be used.

B. Where pumping systems are required, pumps serving the sanitary sewer system shall be independent from pumps serving the storm drainage subsoil/foundation drainage systems.

C. Where sanitary lines exit the building, provide serviceable backwater valves to prevent water flow into the building system. Backwater valves shall be located in readily accessible locations and shall not be installed within manholes due to confined space concerns for access.

D. Design and size indirect waste receptors, and associated piping receiving discharge from equipment and relief valves, to evacuate the maximum possible flow. The design shall prevent flooding, splashing and ponding on floor surfaces.

E. Provide cleanouts at locations and with clearances as required by the Plumbing Code, at the base of each stack, at intervals not exceeding 50’ in horizontal runs and at changes of direction. All interior cleanouts shall be accessible from walls or floors. Coordinate locations of all cleanouts with the Architect.

F. Provide floor drains in all toilet rooms designed to be occupied by more than one user at a time.

G. Provide grease recovery units for food service areas within the building as required by the Plumbing Code and EH&S.

H. In-sink garbage or waste disposals shall not be allowed.

I. Rainwater from roof and area drains may be diverted or collected for on-site reuse in order to meet the University's stormwater permit requirements. Alternately, storm water drainage systems shall be provided to convey rainwater from roof and area drains to the site municipal storm sewer system.

12. GREASE INTERCEPTORS:

A. Grease recovery units (GRUs) are required when there is the potential to discharge waste containing fats, oils, or greases from food preparation areas into the sanitary sewer system. All renovations and/or construction projects that will involve any type of food establishment or necessitate the installation or modification of a grease trap or grease waste system shall be approved by Environmental Health and Safety (EHS).

B. Grease recovery units shall be situated so that they are easily serviceable by a grease waste pump truck. Locate GRU as close as possible to the kitchen it serves to minimize the length of grease-laden plumbing lines. Heat trace may be required when long runs cannot be avoided or grease waste piping flows through cooled spaces. Grease waste piping shall be gravity drained; avoid designs that pump grease waste. Locate GRUs away from building entries or plazas where people will congregate, as well as away from mechanical air intakes. Locate GRU in a landscaped area, if possible, to avoid waste spillage that could enter the storm drain system.

C. GRUs shall be installed with monitoring equipment that notifies occupants when the unit needs servicing.

D. Provide placards on the equipment detailing the unit service requirements and emergency contact information.

13. SUMP, SEWAGE EJECTOR & HOT PIT EJECTOR SUMP PUMPS:

A. Provide pumps with the following features:

1. Duplex Type with automatic lead-lag controls, each pump sized for full design flow.
2. Provide pumps with motor failure and high sump pit level controls.
3. Pump discharge shall be equipped with individual isolation valves and check valves.

B. Connect pump failure and high-level alarms to the building BAS where available.

C. Connect pumps to the building Standby generator and power system where available.

D. Sewage ejectors shall be “grinder”- type.

E. All wetted components of hot pit ejector pumps shall be rated for high temperature (200°F) use.

F. Manufacturers:

1. Hot pit ejectors: Zoeller or approved equal.
2. Sump and sewage ejector pumps: Zoeller, Grundfos, Weil or Little Giant.

14. DOMESTIC WATER PIPING:

A. Above Ground:

1. Copper Pipe: types K or L

2. Fittings: cast copper alloy, wrought copper or bronze
3. Joints: flared or solder
4. Pro-press mechanical joints and fittings are permissible, from the following manufacturers:
    - Viega
    - Apollo

B. Underground:

1. Ductile Iron, mechanical joint pipe per AWWA C110, 250 PSIG rated.
2. Copper pipe: types K or L
3. HDPE Pipe: Will be considered for limited applications, consult with FM- Operations.

15. DOMESTIC WATER VALVES:

A. Ball Valves: all isolation valves, 2" and below shall be ball valves, minimum Class 150, full port, with lever handle and balancing stops. Isolation valves 2.5" and larger shall be flanged-type butterfly valves with EPDM seat.

1. Manufacturers:
    - Apollo – 77WCLF bronze body

B. Hot Water Temperature Mixing Valves:

1. Manufacturers: Symmons
2. Provide isolation ball valves upstream of mixing valves for isolation; provide bypass line with its own isolation valve around the mixing valve.
3. Provide a purge valve on the discharge side of the mixing valve such that the temperature setting can be set at the valve.
4. See Detail-1 for hot water mixing valve piping configuration.

C. Shower Valves:

1. Provide with built-in shut-off
2. Extension kits are not acceptable
    - Manufacturer: Symmons

D. Washing Machine Connections:

1. Provide each washer with a wall box assembly containing water supply and drain connections.
2. Include water supply line and single control valve with lever handle.

E. Vending Machine and Ice Maker Connections:

1. Provide valved cold water supply piping with reduced pressure type backflow preventer.
2. Plastic or PEX lines are not allowed.

F. Mechanical equipment connections:

1. Provide valved cold water supply piping with reduced pressure type backflow preventer.

16. HOSE BIBS AND HYDRANTS:

A. Interior locations: provide hose bibs in multi-stall bathrooms, trash rooms, custodial closets and mechanical rooms

B. Interior single service type: bronze or brass with integral mounting flange, hose thread spout, and integral vacuum breaker. Provide with hand wheel in mechanical rooms; provide with lock shield and removable key in public spaces.

C. For custodial closets only-Interior mixing type: Chicago 897-CP utility faucets.

D. Exterior: non-freeze, self-draining type with polished bronze hose thread spout

E. Manufacturers:
- J.R. Smith
- Zurn
- Josam
- Prier

17. PLUMBING FIXTURES AND ACCESSORIES:

A. Water Coolers:

1. Provide with water dispenser for bottle filling at hydration stations.

2. Manufacturers:
- Elkay
- Halsey-Taylor
- Oasis

B. Toilets and Urinals:

1. Waterless toilets and urinals are not allowed

2. Manufacturers:
- American Standard
- Kohler
- Toto

C. Toilet Seats:

1. Plastic, white color, open front

2. Manufacturers:
- American Standard
- Kohler
- Toto
- Church

D. Sinks, Stainless Steel:

1. 18 Gauge minimum thickness

2. Manufacturers: Elkay

E. Sinks, Other: Terrazzo, Swanstone or cast iron.

F. Sink Faucets:

1. In residence halls, provide manual-controlled faucets.
2. In public-access bathrooms, provide automatic sensor-type faucets. Configure faucets to be warm water with an adjustable set point. Chicago, Hytronic series with battery.
3. In private offices and bathrooms, and other locations, manual or automatic faucets are acceptable.
4. Sink faucets shall be configured such that water flow is straight-down; water flow that is angled toward the user is not acceptable.
5. Faucets with hose threads or spray hose shall be provided with integral check valves and vacuum breaker.
6. All faucet stops shall include integral checks on the hot and cold-water lines. Example: McGuire ICV Defender.
7. Manufacturers:
    - Delta (manual faucets only)
    - Chicago (manual and automatic faucets)
8. Laboratory sink faucet manufacturers:
    - Chicago
    - Watersaver

G. Toilet Flush Valves:

1. Toilet valves shall be dual-flush type.
2. In residence halls, provide manual flush valves.
3. In public-access bathrooms, provide automatic flush valves, water-powered turbine charger, battery or 120 VAC powered; in offices and other private bathroom locations, manual or automatic flush valves are acceptable.
4. Manufacturers:
    - Sloan (Royal)
    - Toto

H. Bathtubs:

1. Cast–iron type
2. Manufacturers:
    - American Standard
    - Kohler

I. Shower Stalls: Schluter system

1. Stalls shall be installed by certified Schluter-trained installers, and completed installations inspected and approved by Schluter manufacturer's rep.

J. Shower Bases:

1. Lasco (fiberglass)
2. Fiberglass pans shall be set in structo-lite terrazzo. Flooring surrounding showers shall be waterproofed.

18. STORM WATER PIPING:

A. Buried: Cast Iron or PVC Schedule 40 (or higher).

B. Above-Grade-in locations where noise is not objectionable:

1. Cast Iron or PVC Schedule 40 (or higher)
2. Low-noise applications, including academic, research and residential occupancies: Cast Iron or sound-insulated PVC Schedule 40 (or higher)
3. 1-3 family residential occupancies: PVC Schedule 40 (or higher).

19. SANITARY SEWER PIPING:

A. Buried:

1. Research and Laboratory facilities, large Academic facilities and any locations that have large central hydronic water heating systems or campus heating hubs: extra-heavy cast iron.
2. Small Academic facilities and 1-3 family residences: extra-heavy cast iron or PVC Schedule 40 solid core (or higher).

B. Above-Grade:

1. In 1-3 family Residential and small Academic occupancies, and in other locations not subject to high wastewater temperatures (over 140°F from equipment failures or leaks), or high ambient temperatures (over 140°F in normal operation or due to equipment failure), and where noise is not objectionable: cast iron or PVC Schedule 40 (or higher).
2. In locations subject to high wastewater temperatures (over 140°F from equipment failures or leaks), or high ambient temperatures (over 140°F in normal operation or due to equipment failure), or where noise is objectionable: cast iron.

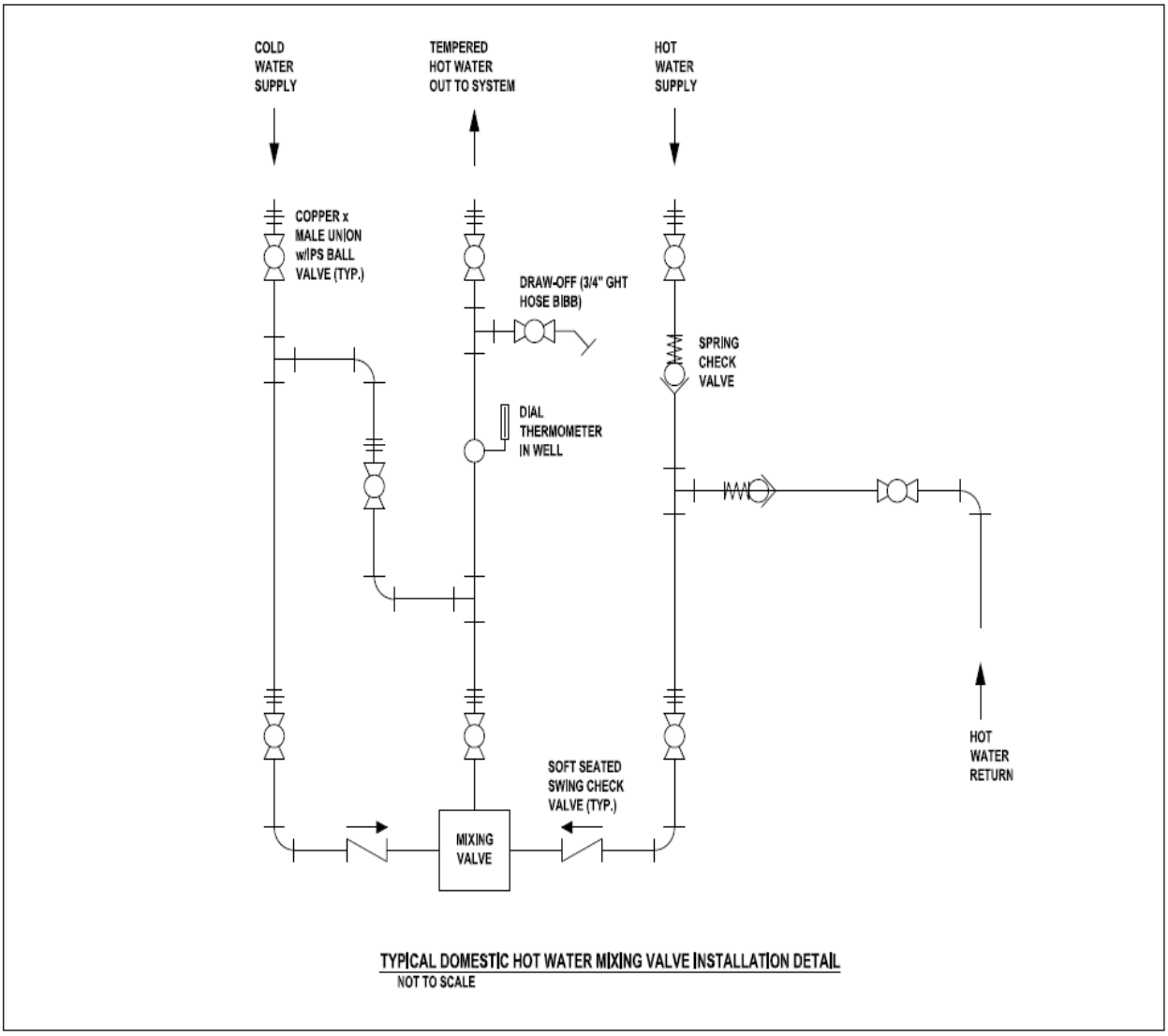
20. TESTING & TURNOVER

A. Pressure Testing – In the absence of more detailed project testing procedures, comply with the below basic testing requirements.

1. Apply a hydraulic pressure at 150% of the normal operating pressure or 100 psi, whichever is greater, not to exceed the working pressure rating of the lowest pressure rated component in the system (i.e. threaded components, flanges, unions, valves, etc.) for a minimum of 2 hours to carefully check all piping and every fitting for leaks.
2. Repair each leak and retest until no leaks occur.

3. PVC pipe Testing: Avoid the use of air or compressed gas for pressure testing, as it can cause explosive failures. Perform testing with water filled lines only.

B. Prior to Turnover, properly clean all equipment, install clean filter media, properly adjust all system pressure, flow and temperature regulators.



Detail-1 Hot Water Temperature Control Valve Piping Schematic

End of Section