# DESIGN GUIDELINE 221113
# BASIC PIPING MATERIALS AND METHODS

*REVISIONS AUGUST 2025 – MULTIPLE REVISIONS AND REFORMATTING.*

## Scope

Piping material and methods for domestic water, hydronic systems, high purity water, vacuum, compressed gases, waste and vent (including laboratory), steam and steam condensate, refrigeration, and other piping systems.

## Related Sections

**U-M Design Guideline Sections:**
210000 - Fire Protection
220020 - High Purity Water Systems
220719 - Mechanical Insulation
230000 Basic Mechanical Requirements
31000 Sitework
SBA 5.9 -Tunnels

**U-M Master Specification Sections:**
211313 - Wet Pipe Sprinkler Systems
220516 - Pipe Expansion Joints
221113 - Basic Piping Materials and Methods
220719 - Mechanical Systems Insulation
232116 - Hydronic Piping Specialties
232216 - Steam and Condensate Piping Specialties
232300 - Refrigerant Piping
331100 - Water Distribution Piping
333100 - Sanitary Sewer
334100 - Storm Utility Drainage
336100 - Hydronic Utilities
336330 - Steam and Condensate Distribution Piping

## Ductile Iron Pressure Pipe Inside Buildings

In all cases, ductile iron pressure pipe running inside buildings shall be equipped with restrained joints. This includes new construction and renovation work.

Ductile iron pressure pipe should normally not be run inside buildings. A typical case when this is unavoidable is underground domestic, fire protection, or chilled water ductile iron pipe

connecting to the associated building piping system. The transition between the underground ductile iron pressure pipe and the building pipe shall be accomplished with a flange located inside the building.

For existing buildings with unrestrained plain end or mechanical joint ductile iron piping, replace with restrained flange adapters with actuating screws that break off when tightened to the proper torque, such as EBAA Iron Incorporated MEGAFLANGE Series 2100. Do not specify restrained flange adapters that do not incorporate break-off actuating screws.

## General Material Requirements

U-M Master Specification Section 221113 Basic Piping Materials and Methods shall be used as the piping specification on all projects. Edit MS221113 to make it project specific. Turn on hidden text and read all spec. editors notes when editing the specification. Note that only the more typical piping applications are covered in the U-M master specification; assure every pipe application specific to the project is specified. Additional clarification is included in paragraphs that follow.

### Polypropylene Pipe

Refer to UM Master Specification Section 221113 for polypropylene pipe. The maximum temperature and pressure ratings shall not exceed the manufacturer recommendations.

If used in a return air plenum, the pipe must be fire wrapped.

Engineer of record shall add the following table to the drawings. Edit accordingly for each specific project. Confirm with manufactures representative for each pipe type, based on pipe specific conditions.

Poly Pro Pipe Schedule (Example)

| Service | Temperature (F) | Pressure (psi) | Min SDR |
|---|---|---|---|
| Domestic Cold Water | 55 | 55 | 11 |
| Chilled Water | 42 | 100 | 11 |
| Condenser Water/ Cooling Tower | 90 | 125 | 11 |
| Domestic Hot Water | 140 | 65 | 7.4 |
| Heating Hot Water | 180 | 100 | 7.4 |
| Pumped Waste | | | 11 |

| | | | |
|---|---|---|---|
| Compressed Air | 75 | 100 | 7.4 |

**Mechanical Piping Material Requirements**

Refer to U-M Master Specification Sections for details of piping material requirements. Clarifications and exceptions are noted below.

**Domestic Cold Water and Hot Water**

Domestic Hot Water piping installed in the central campus tunnel system shall use exclusively Victaulic grooved copper pipe and fittings. Refer to UM Master Specification Section 331100.

**Storm and Sanitary Waste and Vent Piping**

Vent piping shall be the same as waste piping.

Master specification includes both cast iron and PVC piping. Use cast iron unless specifically instructed by U-M Design Manager to use PVC. While PVC may have some appropriate applications in small projects, there can be smoke/fire related problems with using PVC.

**Laboratory Waste and Vent Piping**

For most chemistry and biology labs, dumping of acids and other corrosive chemicals is prohibited. As such the waste stream is generally diluted, within pH limits suitable for discharge to city sanitary sewers. Therefore, in most cases, neutralization systems are not required. Confirm design philosophy on lab waste system with U-M Design Manager.

For general lab applications, above ground lab waste piping is typically specified as corrosion resistant polypropylene, Schedule 40. Joints may be mechanical type or fuse-sealed, depending on application. For new lab buildings, or renovations with extensive new drainage networks, fused joints should normally be specified. Consult U-M Design Manager. Fused joints are generally less prone to developing leaks, but may be more expensive. All sink P-traps shall be of the same material as the waste pipe, and include mechanical fittings for ease of maintenance.

Underground piping shall be polypropylene, Schedule 80. Joints shall be fused type. Consult U-M Design Manager. Double walled underground piping is not generally required.

Alternate piping material shall be considered on a case-by-case basis where high temperature waste or other factors may be present. High silicon cast iron may be considered if the application warrants the added expense. Glass piping may be considered where high temperature waste is present.

All Cage wash & laboratory waste shall continue to be polypropylene until it leaves the building.

## High Purity Water Piping

Design piping system to meet project specific requirements. Some applications can use PVC piping (humidifiers), while others require polypropylene (most labs). Consult U-M Design Guideline 220020 – High Purity Water Systems for detailed requirements.

## Lab Vacuum Piping

Provide a plugged cross at all turns greater than 45 degrees, slope in the direction of flow and provide hose end drain valves at all low points for cleaning the system.

## Chilled Water Piping

Large underground piping has historically been uninsulated ductile iron (Class 52 with Polyethylene wrap). However for new projects the advantages of HDPE pipe shall be thoroughly considered, in consultation with the UM Design Manager. For small piping, consider alternate materials and need for insulation. Nonmetallic piping shall be installed, with tracer wire.

## Hot Water Heating Piping

Underground piping shall be installed using a preinsulated piping system. Carrier pipe shall match above ground piping. Jacket pipe shall be minimum 10 gauge steel, with butt welded fittings, and a fiberglass reinforced urethane elastomeric coating. Refer to section 220719 for insulation requirements.

## Condenser Water Piping

Generally use non-ferrous (stainless steel, fiberglass, ABS) piping alternatives for improved water quality. Preliminary analysis indicates that non-ferrous piping may be justifiable, especially in applications where the cooling tower is drained seasonally, and where piping is not heat traced and insulated.

Basis of design is to provide schedule 10 stainless steel from the cooling tower to five feet below the roof. Fiberglass, HDPE and ABS are acceptable alternates.

Underground condenser water piping shall be ductile iron.

## Steam Piping

Underground steam piping up to 125 psig shall be Schedule 40 black steel with butt welded fittings, in a pre-insulated system as described for underground hot water heating piping. For any underground steam connected to utilities distribution mains, consult with the U-M Design Manager who will consult with U-M Utilities.

## Civil Pipe Material Requirements

Generally, underground piping 5 feet or more from building exterior walls is considered to be "Civil Piping". Refer to Site Civil specification sections.

There may be a change in pipe materials that takes place at this point. For additional requirements refer to U-M Design Guidelines / Technical Requirements 6.4 and Master Specifications 7.4 Site/Civil.

## Lawn Sprinkler Piping

Coordinate irrigation system design (including sizing water main, backflow preventer, and water meter) and installation with the University Landscape Architects Office and the U-M Plumbing shop, via the U-M Design Manager.

## Pipe Hangers and Supports

Refer to U-M Standard Details, U-M Master Specification 230000 for additional hanger and support requirements previously addressed in Design Guideline Section 221113. Coordinate with U-M Design Manager. Refer to Design Guideline Section 230000 for building attachment requirements previously included in this section.

Prior to beginning design, A/E shall review building design and construction and design suitable building attachment and pipe support and anchoring system, verifying that the existing building structure can support new piping loads.

The A/E shall include the following in piping designs:

- Pipe hanger details, including components, hanger spacing.
- Pipe hanger systems that accounts for thermal expansion of piping.
- Details of building attachments, including clarifying when support of piping from concrete slab using expansion anchors is acceptable.
- For large piping or where the design otherwise impacts the integrity of the building structure, indicate locations of all pipe hangers.
- For existing buildings with concrete floors, determine the extent to which vertical drill-in or similar type inserts can be used, and delineate any limitations regarding their use in the specifications. Many older buildings may not have sufficient floor thickness or integrity to allow the use of such inserts.
- Indicate locations and details of pipe anchors, guides and expansion joints or bends.
- For PVC or other plastic pipes, the spacing is typically much closer than for other piping materials. The designer should use manufacturer's recommended spacing for the maximum spacing based on pressure and temperature of transported solutions.

### Design for Thermal Expansion:

Account for thermal expansion when designing pipe hangers and supports. Where space allows, expansion bends fabricated from standard piping are preferred over expansion

compensation devices. Review submittals to verify adequate provisions for thermal expansion will be provided.

A/E shall include the following in the Project OPR/BOD document:

- Pipe expansion and stress calculations for hot pipes (120°F and above), 6" and larger inside building. Show compliance with ANSI piping codes. For Expansion Design Requirements for steam in tunnels, see U-M Design Guideline SBA-5.9.
- For steam tunnels, on low pressure steam (LPS), externally pressurized bellows type expansion joint shall be used. For low pressure condensate (LPC), use externally pressurized bellows type expansion joint or equal expansion bellows type expansion joint. For domestic hot water (DHW), use equal expansion type bellows joints with all Stainless steel construction (no carbon steel on wetted parts). Refer to U-M Master Specification 220516 – Pipe Expansion Joints.

## Pipe Penetrations and Sleeves

Provide pipe sleeves in floors and wall per U-M Details. Revise details to meet project specific requirements.

Fire Protection Piping, Compressed Air and other uninsulated piping: Sleeves are generally not required, unless required to maintain integrity of rated walls.

Chilled Water and Cold Water: Sleeves are generally required for all piping 2" and larger penetrating walls and floors.

Steam, Condensate, Heating Hot Water, and other hot insulated piping: Sleeves are required for all piping in walls and floors.

For underground exterior wall penetrations, piping penetrations must be watertight. For new construction, provide cast-in-place pipe sleeve with integral water-stop, oversized for use of linkseal between piping and sleeve. In existing concrete, where concrete can be core drilled and properly sealed with a linkseal, a sleeve may not be required.

For renovation work with existing concrete floors or for new floors where cast-in-place sleeves were not installed, pipes penetrating above grade floors typically require “double core” sleeves, especially in areas where floors are likely to get wet, and where water leaks to floors below would be disruptive to operations. Piping in stairwells does not require floor sleeves.

## Pipe Pressure Testing Requirements

Use U-M Pressure Test Table. Revise to meet project specific requirements.

## Flushing and Cleaning of Piping Systems

At minimum, the A/E shall include the flushing and cleaning requirements found in Part 3 of U-M Master Specification 221113 – Basic Piping Materials and Methods. Refer to the spec. editors notes in U-M Master Specification 221113 for additional information. Certain projects

may require special flushing and cleaning requirement (e.g. geo thermal systems). The A/E shall develop detailed flushing & cleaning procedures in such cases, which may require specialized equipment.

**Dye Testing Requirements for Storm and Sanitary Piping**

Dye testing is required on most new connections to new and existing storm and sanitary waste piping. Refer to Master Specification Section 221113) and U-M Environment, Health & Safety Dye Testing Guidelines for Storm Water & Sanitary Systems.

Dye testing of underground piping should be done during design phase to validate that the design is in compliance with effluent discharge codes and regulatory requirements. Special attention should be paid to mechanical room floor drains and cooling tower overflow drains, both of which are now required to be routed to sanitary waste.