## Change History

<table>
<thead>
<tr>
<th>Date</th>
<th>Description of Change</th>
<th>Pages / Sections Modified</th>
<th>Change Approver</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/26/13</td>
<td>Add text encouraging discussion of innovation in newly available products.</td>
<td>2 – 15410, A (Summary)</td>
<td>SO</td>
<td>SO</td>
</tr>
<tr>
<td>3/26/13</td>
<td>Add to item: Dual flush Toilet/ flush valve</td>
<td>6 – 15410, B. #4b.(Fixture Types, Water Closets)</td>
<td>SO</td>
<td>SO</td>
</tr>
<tr>
<td>3/26/13</td>
<td>Add check valves on hot and cold water supply lines to faucet to avoid short circuiting through faucet. Add hose bib and r.p backflow preventer for cleaning station</td>
<td>6 – 15410, C, #1 (Plumbing Fixtures, Manufacturers, Faucets)</td>
<td>SO</td>
<td>SO</td>
</tr>
<tr>
<td>3/26/13</td>
<td>Add to both items: Add check valves on hot and cold water supply lines to faucet. Add hose bib and r.p backflow preventer for cleaning station.</td>
<td>6- 15410, B, #4 &amp; #5 (Plumbing Fixtures, Manufacturers, Janitor’s Sink &amp; Mop Basin)</td>
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<tr>
<td>3/26/13</td>
<td>Add to item: Dual flush Toilets - flush valve</td>
<td>10 – 15140, C #16. (Manufacturers, Flush valves)</td>
<td>SO</td>
<td>SO</td>
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<tr>
<td>3/26/13</td>
<td>Add 2nd paragraph: re. combined bottle filler feature.</td>
<td>15 - 15415, C. (Drinking Fountains and Water Coolers, Product Standards)</td>
<td>SO</td>
<td>SO</td>
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<tr>
<td>3/16/13</td>
<td>Remove Tiger Flow from list Add Grundfos to the list</td>
<td>20- 15441, E, #3 (Manufacturers, City and Hot Water Pressure Booster Pumping Systems)</td>
<td>SO</td>
<td>SO</td>
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<tr>
<td>3/26/13</td>
<td>Add Maxi-Therm to the lists for both.</td>
<td>28 – 15480, E #1 &amp; #2 (Manufacturers, Gas Domestic Water Heaters, Gas &amp; Electric)</td>
<td>SO</td>
<td>SO</td>
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</tbody>
</table>
A. Summary

This section contains design criteria for plumbing fixtures, including faucets and flush valves.

We encourage use of innovative new products: When designers want to use new products, they are required to present to Yale Utilities and Engineering for discussion, review and approval.

B. System Design and Performance Requirements

Design the plumbing system for safety, longevity, durability, and flexibility. Provide thermostatic mixing and pressure balancing valves for all baths and showers.

1. Fixture Quantities (General)

Yale University will tolerate under-fixturing on individual floors or in specific building areas only if horizontal or vertical occupant access to fixtures in other areas is sensible.

a. Base quantities on the anticipated maximum, normal-use building capacity.

b. Quantities must be satisfactory to code-enforcing officials and/or funding agencies. Use the quantities listed in Table 1 as a guide for preliminary planning.
c. For all new or remodeled building construction, the aim is to satisfy anticipated demand. However, avoid over-fxturing because of the comparatively high cost of these facilities and spaces.

d. When comparing proposed quantities to codes or other required standards, be aware that codes and standards usually apply to fixture totals for an entire single-type occupancy building. Therefore, fixture quantities on each floor of such a building need not necessarily meet codes or standards.

2. Fixture Quantities

Verify fixture quantities as specified by state and local building codes.

a. Office Buildings

The OSHA quantities for water closets and urinals listed in Table 1 are satisfactory.

<table>
<thead>
<tr>
<th>Table 1. Fixture Quantities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Closets, Lavatories, and Urinals</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Persons</strong></td>
</tr>
<tr>
<td>1-5</td>
</tr>
<tr>
<td>6-15</td>
</tr>
<tr>
<td>16-35</td>
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<td>36-55</td>
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<td>56-80</td>
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<td>81-110</td>
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<tr>
<td>111-150</td>
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<tr>
<td>151-190</td>
</tr>
</tbody>
</table>
b. **Research Buildings**

Per code, fixture quantities should be the same as for office buildings, but only if it is anticipated that all occupants will be in the building as constantly as occupants of an office building. If the building program does not define this constancy, it must be determined for its effect on fixture quantities. If proposed quantities are less than the code requirements, a code exception will be investigated.

c. **Places Of Assembly**

Designers may recommend fixture quantities in places of assembly. See the applicable code for minimum requirements. However, provide no less than two of each type of fixture in any one toilet room.

d. **Libraries**

Per code, a library, depending on its type, could fall into either the same category as an office building or in the public or semi-public building category. Evaluate each library according to its type and category. Some small libraries can be categorized as classrooms. A large library, such as Sterling Memorial, could fall into a category not covered by code. As a guide for such a separate category, about one sanitary fixture (water closet or urinal) per 50 reader seats (and about the same number of lavatories) should be adequate, if facilities for staff are considered separately. A proposal involving such a separate category should be approved by code or funding authorities prior to incorporation into a building.

e. **Classroom Buildings**

Yale University does not yet have an inventory of fixtures (and adequacy of same) in its classroom buildings. Until such an inventory is available, use Table 2 as a guide. The number of fixtures must be approved by code or funding authorities before incorporation into a building. However, unless the anticipated use by either sex is nominal (under 25), provide at least two of each fixture for each sex.
Table 2. Classroom Fixtures

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Student Stations per Fixture</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
</tr>
<tr>
<td>WCs</td>
<td>100</td>
</tr>
<tr>
<td>Urinals</td>
<td>110</td>
</tr>
<tr>
<td>Lavatories</td>
<td>150</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td></td>
</tr>
<tr>
<td>WCs</td>
<td>60</td>
</tr>
<tr>
<td>Lavatories</td>
<td>100</td>
</tr>
</tbody>
</table>

f. Other Building Types

If fixture quantities are not stated in the building program for other types of buildings, base the quantities on modifications of those developed by the architect and approved by Yale University and code or funding authorities for the types of buildings listed above.

g. Counting Fixtures for the Handicapped

Include all fixtures provided for the physically handicapped in the fixture count. Wherever "unisex" toilet rooms are used, apply each WC as a deduction from the combined requirement for both sexes before apportioning the remaining needs among such gang toilet rooms as might be designated for each sex. Unisex toilet rooms are preferred, where feasible, for this use.

3. Mounting of Fixtures

Hang fixtures on walls wherever possible. Use chair hangers or (as for a battery of lavatories) a less expensive substitute.

4. Fixture Types

   a. Lavatories

   Yale University prefers vitreous china lavatories with integral back and front faucets. The minimum size is 20" W x 18" outside. Space is 26" o.c.
b. Water Closets
Water closets must be elongated, siphon-jet action, with open front white seats. Include flush valves where feasible and specify ‘dual-flush’ flush valves where appropriate.

c. Urinals
Urinals (men only) must be vitreous china, siphon-jet action, with flush valves. For standards of quality, see the manufacturers and model numbers listed below under Manufacturers.

5. Plumbing Fittings
For lavatory faucets, use fittings that are not self-closing.

C. Manufacturers
Yale University requires the use of low flow plumbing fixtures. The flush valves for toilets and urinals must be manufactured by the China Manufacturer. The model numbers for low flow fixtures and flush valves must be compatible. Provide the model numbers for all flush valves for toilets and urinals on the shop drawings for the project.

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Faucets
Symmons
– S-90-2-G-FR for a regular sink, with a centerset single lever, extra-long wrist operation, and grid strainer assembly.
– S-90-2-G-FR-W for a handicapped sink, with a 4” centerset single lever, extra-long wrist operation, and grid strainer drain assembly.
– S-93-2 for a kitchen sink with a hose spray.

Speakman
– SC-5772 for a kitchen sink, with a hose spray and an 8” deck fitting.
– SC-5811 for a mop basin, with an 8” faucet center. Provide integral check valve on hot and on cold water supplies to mop sink faucet.
– SC-5811-RCP for a slop sink, with an 8” faucet center. Provide integral check valve on hot and on cold water supplies to slop sink faucet.
Moen 4420
Kohler
Triton
T&S
– No. B-720 POL cold water hose bib for cleaning solution system. Provide with reduced pressure backflow preventer WATTS No. 909.

American Standard

2. **Metering Faucets**
   - Symmons S-61-G
   - Kohler S-60-G (for a regular sink temperature selection and 4" centerset grid strainer drain assembly)
   - T&S Laboratory

3. **Shower Valves**
   - Symmons 4-500-X
   - Symmons 1-500, for PWG

4. **Angle Stops**
   - Brasscraft
   - Furiyne Ansonia (Teledyne) A-200 series

5. **Janitor’s Sink**
   - Kohler K-6718, (wall hung K-6673 trap standard adjust for 3" IPS connect c.o. plug strainer s.s. rim guard, black back)
   - American Standard 7692.023
   - Provide check valve on hot and cold water supplies to Janitor’s sink faucet.
   - Provide cold water hose bib T&S Brass No. B-720-POL and reduced pressure backflow preventer WATTS No. 909 for cleaning solution system.

6. **Mop Basin**
   - Fiat MSB-3624, 36" x 24" x 10" with shelf
   - MSB-2424, 24" x 24" x 10" without shelf
• Provide check valve on hot and cold water supplies to mop basin faucet.
• Provide cold water hose bib T&S Brass No. B-720-POL and reduced pressure backflow preventer WATTS No. 909 for cleaning solution system.

7. Dorm Sinks
   • Kohler K-6718
   • American Standard 7692.023

8. Dorm Sinks-Cast Iron, Enamel
   • Kohler K-2861
   • American Standard 4869.012 (dorm sink, wall mount 19” x 17” with 4” faucet center)

9. Dorm Sinks
   a. Kohler
      • K-6562 (counter top bar)
      • K-2904 (counter top 4”)
      • K-2900 (counter top)
      • K-5964 (kitchen single)
      • K-5965 (kitchen single)
      • K-5961
      • K-3283
   b. American Standard
      • 7185.803 (sink 3 hole drill)
      • 3303.00 (faucet center)
      • 3211.000 (4” faucet center metal frame)
      • 7024.804 (basin, 4 hole or drillings, 7172.804)
      • 7024.803 (basin, 3 hole or drillings, 7172.803)
      • 7172.803 or 7024.803 (kitchen single, basin 3 hole drillings)
      • ELKAY PSR-3322-4 (kitchen double basin, 4 hole drillings)
10. Dorm Sinks, Vitreous China, Handicapped

   a. Kohler
      • K-12636 (handicapped sink)
      • K-2032 (handicapped sink)
      • K-2054 (handicapped sink)

   b. American Standard
      • 9141.011 (wall mount 27” x 20” with 4” faucet center)
      • 0355.012 (wall mount, back splash, 4” faucet center concealed arm carrier)
      • Wall mount to back splash 4” faucet center concealed arm carrier

11. Urinal, Vitreous China, Regular Use and Handicapped

   • Kohler K-4985 (regular use)
   • American Standard 6561-017 (wall-mount, siphon-jet action, 3/4” top spud inlet, 2” IPS outlet)
   • Kohler K-5014-T (handicapped)
   • American Standard 6541.132 (regular use, wall mount, siphon-jet action, 1/4” top spud inlet, 2” IPS outlet)

12. Toilets, Wall Mount

   • Kohler K-4430-ET (wall mount)
   • American Standard 2257.103 (3.5 gallon)

13. Water Closet, Vitreous China; Regular Use and Handicapped

   • Kohler K-4430-ET (regular use)
   • American Standard 2257.103 (handicapped use, water saving siphon-jet action, 2-1/2” passageway, 1-1/2” top spud)
   • Kohler K-4250 (regular use, floor mount, water-saving siphon-jet action, 2-1/2” passageway, 1-1/2” top spud, 10” – 12” roughing in)
   • Kohler K-3420-ET (regular use)
   • American Standard 2234.015 (floor mount, tank type, 1-3/4” passageway, 3/8” IPS water supply, 12” roughing in)
14. Toilet Tank
   - Kohler K-2867

15. Tubs
   - Kohler K-4250 (floor mount)
   - Kohler K-4330 (wall hung)
   - Kohler K-4350ET (floor bolted)
   - Kohler K-3420EB (floor bolted)
   - American Standard 2234.015 (3.5 gallon)

16. Flush Valves
   - Sloan –186 Royal (for regular urinal, 3/4” IPS angle stop, coupling for 3/4” top spud, 1 to 1-1/2” high)
   - Sloan Royal 180 (for handicapped urinal, 1” IPS angle stop, coupling for 1-1/4” top spud, 11-1/2” high)
   - Sloan Royal (for regular and handicapped water closet, 1” IPS angle stop, coupling for 1-1/2” top spud, 11-1/2” high)
   - Sloan Uppercut WES-111 Dual Flush (for regular and handicapped water closet, 1” I.P.S angle stop, coupling for 1-1/2” top spud, 11-1/2” high)

17. Lab Faucets
   - Chicago 876-F3CP-VP
   - Speakman SC-3004
   - Moen S0003 (spout only, 8132 handles only)
D. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

End of Section
A. Summary
This section contains design criteria for emergency eyewash and shower units.

B. System Design and Performance Requirements
1. Design the plumbing system for safety, longevity, durability, and flexibility.
2. Provide a tempered water supply for all emergency showers and eyewashes.
3. Eyewashes must be full-face.

C. Product Standards
Products shall conform to ANSI-358.1 standards.

D. Manufacturers
Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Emergency Showers
   • Speakman
   • Symmons

2. Emergency Eyewash Units
   • Haws
E. Installation Guidelines

1. Install the floor drain beneath the emergency shower.

2. Verify that tempered water has been specified for emergency fixtures.

3. In conjunction with code and standard requirements, emergency showers must be located in adjacent corridors or at the hazard room door exits. The showers are to be accessible, require not more than 10 seconds to reach, and be within a travel distance of no greater than 50 ft from the hazard rooms.

4. Provide emergency showers and eyewash fountains for:
   - Laboratories
   - Boiler rooms
   - Cooling towers
   - Chemical treatment areas
   - Deionizing acid regenerant tank
   - Battery charging rooms
   - Provide additional emergency showers and eyewash fountains in other areas that:
     - have hazardous materials that will be used in the area, and
     - have no other emergency showers and eyewash fountains located within 50 feet of the area.

5. Provide full-size ball valves to isolate emergency showers or eyewash fountains. Lock the valves in the open position.

F. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

End of Section
15415

Drinking Fountains and Water Coolers

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the Yale University Project Manager.

A. Summary

This section contains design criteria for drinking fountains and water coolers.

B. System Design and Performance Requirements

Design the plumbing system for safety, longevity, durability, and flexibility.

1. Fixture Quantities (General)

Yale University will tolerate under-fixturing on individual floors or in specific building areas only if horizontal or vertical occupant access to fixtures in other areas is sensible.

a. Base quantities on the anticipated maximum, normal-use building capacity.

b. Quantities must be satisfactory to code-enforcing officials and/or funding agencies.

c. For all new or remodeled building construction, the aim is to satisfy anticipated demand. However, avoid over-fixturing because of the comparatively high cost of these facilities and spaces.

d. When comparing proposed quantities to codes or other required standards, be aware that codes and standards usually apply to fixture totals for an entire single-type occupancy building. Therefore, fixture quantities on each floor of such a building need not necessarily meet codes or standards.
2. **Fixture Quantities**

   Verify fixture quantities as specified by state and local building codes.

C. **Product Standards**

   Products must conform to ANSI/NSF 61 standards.

D. **Manufacturers—Stainless Steel Water Coolers**

   Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:
   - Halsey Taylor
   - Elkay
   - Oasis

E. **Bottle Filling Stations**

   Where ever possible, water coolers are to be specified with a bottle filling station, like Halsey Taylor’s HYDROBOOST, Elkay’s EZH2O and Oasis’s Aqua Point.

F. **Quality Control**

   If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

End of Section
15430

Plumbing Specialties

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A. Summary

This section contains design criteria for water and drainage piping specialties, including backflow preventers, vacuum breakers, mixing valves, water hammer arrestors, and domestic water meters.

B. System Design and Performance Requirements

1. Before design commences, professionals shall contact local water authority for complete requirements.
2. Design the plumbing system for safety, longevity, durability, and flexibility.
3. Install an approved, reduced-pressure, double-check type valve in both the potable and non-potable water supplies.
   a. Only potable water must supply drinking fountains, lavatories, sinks, janitor closets, safety showers, eyewash stations, and water heaters.
   b. Non-potable water or potable water is to must supply fire protection systems, toilets, urinals, fume hoods, laboratory sinks, outside hose bibs, and other supplies not for human consumption.
   c. A check valve must be installed upstream from the reduced-pressure valve to prevent valve dumping every time the main line pressure drops.
   d. Provide isolation valves between potable water and non-potable water.
   e. Identify and label gray-water systems.
C. Manufacturers

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. Mixing Valves
   - Speakman
   - Symmons

2. Water Hammer Arrestors
   - Wade
   - JMJ Cord

3. Backflow Preventers
   - Watts

D. Installation Guidelines

1. Where reduced-pressure backflow preventers are installed, install a floor drain nearby that will accommodate the full flow from the backflow preventer emergency dump port, if the valve malfunctions.

2. Install a hose bib at least every 100 ft around a building and in the mechanical room. Install a non-freeze type hose bib on the roof, near the air handling units.

3. Use trap primers only when necessary. Install them in accessible locations for maintenance.

E. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

End of Section
15441

Domestic Water Pumps

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the Yale University Project Manager.

A. Summary

This section includes design criteria for inline, end suction, and water pressure boosters for domestic water pumping systems.

B. System Design and Performance Requirements

1. Provide a three-pump system for water booster pumping. Size one pump for approximately 1/3rd of the total water demand. Size each of the other two pumps for approximately two-thirds of the total water demand. Design the system so the smaller pump will run constantly until the water demand exceeds the capacity of the pump, at which point the smaller pump will stop and one of the large pumps will start. When the water demand exceeds the capacity of the larger pump, the smaller pump will automatically restart and operate together with the larger pump to provide the total water demand. The third pump will act as a standby pump. The pumps must be free of cavitation over their operating range.

2. The system must be controlled by a combination of flow or pressure switches and pressure-regulating valves, and must be designed to prevent water hammer.

3. Provide pressure gauges for every pump.

4. Specify that piping and pumps be installed and connections aligned, but not made-up, until inspection by Yale University. All piping must be supported independently of the pumps.
5. In-line, end-suction, and split-case pumps bearing frame and pump internals must be serviceable without disturbing motors or connected piping.

6. Select pumps for an impeller diameter not greater than 90 percent of the maximum pump impeller diameter.

7. Select pump motors to be non-overloading at any point along the pump impeller curve or in combination with other pumps.

8. Provide pressure gauges for every pump, except small so-called “boosters” which must have gauge cocks only.

9. Select pumps between 65% and 115% of best efficiency point along the impeller curve.

10. Consider a storage tank to reduce the number of pump starts.

C. Submittals

Submit the following construction and certification documentation.

1. **Construction Documents**

   Submit the following test reports:
   
   - Installed pump performance test and balance report.
   - Pump alignment report.

2. **Product Certificates Signed by Manufacturer**

   Specify that pumps be inspected by the manufacturer's authorized representative who must submit a written report to the engineer with a copy to Yale University stating that the pump has been properly installed, is operating correctly, and the installation is acceptable to the manufacturer in every respect.

D. **Product Standards**

Products must conform to the following standards:

- Hydraulic Institute standards
- ASME PTC 8.2 and 9
- CSA standards
- UL Motor-Operated Water Pumps Standard
E. Manufacturers

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. In-Line Pumps
   - Bell & Gossett
   - Taco

2. Booster Pumps—Circulator
   - Bell & Gossett (lubricated bearing with oil seals)
   - Taco (sealed bearing)

3. City and Hot Water Pressure Booster Pumping Systems
   - Bell & Gossett (multiple control panel, 2-3 pumps with small tank)
   - Canaris Corporation
   - Grundfos

4. Suction Diffuser
   - Bell & Gossett
   - Taco

F. Materials

All wetted parts in recirculation hot water pumps and in-line boosters must be of bronze construction (bronze impellers only).

G. Accessories or Special Features

1. Couplings
   Couplings must be approved by the Yale University Facilities group.

2. Strainers
   1. For water service, strainers must be the same size as entering pipe size and have a maximum clean pressure drop of one psig.
   2. Use pump startup strainer screens for cleaning, and remove them afterwards.
3. Provide a blow-off valve, full size full port ball valve on each strainer. Where feasible and permitted by code, blow-off piping must have plug.

4. Strainer material for use in domestic water systems must be of stainless steel construction.

H. Special Requirements—Source Control
The manufacturer must maintain an inventory of all wearing parts within 50 miles of New Haven, CT.

I. Quality Control Testing
After factory assembly, the packaged pumping system must be hydrostatically tested and undergo a complete electric and hydraulic test from 0 to 100% design flow at the factory. All controls, pump sequencing devices, alarms and instrumentation must be tested and calibrated for proper operation during factory testing.

J. Installation Guidelines
1. Specify that pumps be aligned, doweled, and grouted.
2. Provide pump suction fittings on the suction sides of base-mounted, centrifugal pumps.
3. Provide a pump discharge valve on the discharge sides of each base-mounted centrifugal pump.
4. Support pump fittings with floor-mounted pipe and flange supports.
5. Each pump must be level and re-aligned. Base-mounted pumps must be grouted.
6. Provide a spring-loaded check valve in the pump discharge, in lieu of a swing check valve.
7. If the pump motor is above 15 hp, provide a beam or rail system for removal from a crowded mechanical room.
K. Quality Control

1. If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

2. Specify that at least one final alignment be performed in the field.
Sewage and Sump Pumps

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A. Summary

This section includes design criteria for sewage ejector and sump pumping systems.

B. Submittals

Submit the following design, construction, and certification documentation.

1. Designer Submittals
   Submit pump sizing calculations for sewage ejectors and sump pumps.

2. Construction Documents
   Submit an installed pump performance test and balance report.

3. Product Certificates Signed by Manufacturer
   Specify that pumps be inspected by the manufacturer's authorized representative who must submit a written report to the engineer with a copy to Yale University stating that the pump has been properly installed, is operating correctly, and the installation is acceptable to the manufacturer in every respect.
C. **Product Standards**

Products must conform to the following standards:

- Hydraulic Institute standards
- ASME PTC 8.2 and 9
- CSA standards
- UL Motor-Operated Water Pumps Standard

D. **Manufacturers**

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. **Sewage Ejector Pumping System**
   - SKB
   - Weil
   - Peabody Barnes
   - KSB

2. **Sump Pump**
   - Bell & Gossett (vertical flow series 800)
   - Weil

E. **Special Requirements—Source Control**

The manufacturer must maintain an inventory of all wearing parts within 50 miles of New Haven, CT.

F. **Installation Guidelines**

If the pump motor is above 15 hp, provide a beam or rail system for removal from a crowded mechanical room or air handler.

When more than one pump is connected to a common discharge, each pump must have independent intake and discharge isolation valves and discharge check valves. All valves and check valves must be serviceable without entering the sump tank or sump pit. Each sump tank or pit shall have an independent high level alarm that goes to the energy management system.
G. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.
15480

**Domestic Water Heaters**

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the Yale University Project Manager.

A. **Summary**

This section contains design criteria for tankless, instantaneous- and storage-type electric, gas, hot water heaters, both household and commercial.

B. **System Design and Performance Requirements**

1. Design the plumbing system for safety, longevity, durability and flexibility.

2. The setpoint temperature for water heaters must be 120°F for general service and 140°F for kitchen dishwasher preheat. Provide mixing valves to distribute water to fixtures at 110°F.

3. Provide a minimum of two central water heaters for dormitories.

4. Provide temperature and pressure gauges at the inlet and outlet of each water heater.

5. Provide a minimum of two central domestic water heaters for each laboratory facility, each supplying 75% of demand. Coordinate with the Yale University Facilities group for other types of facilities for number of water heaters.

6. Use circulated hot water piping system, limiting dead ends to 20 feet.
7. Install lockable-type shutoff valve, with lock, locked in the open position between the expansion tank and cold water supply.

8. Provide a properly sized pressure and temperature relief valve for each domestic water heater.

9. Recirculating pumps in domestic water heating systems must be of bronze construction.

C. Submittals

Submit the following design and certification documentation.

1. Designer Submittals
   Submit domestic hot water load calculations for:
   - 180° dish washers
   - Building domestic hot water heaters
   - Kitchen booster hot water system
   - Laundry hot water system

2. Product Certificates Signed by Manufacturer
   Specify that water heaters be inspected by the manufacturer's authorized representative who shall submit a written report to the engineer with copy to Yale University stating that the water heaters have been properly installed, are operating correctly, and the installation is acceptable to the manufacturer in every respect.

D. Product Standards

Products must conform to the following standards:
   - ASHRAE 90.1b
   - ASME
E. Manufacturers

Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

1. High-Recovery, High-Efficiency Gas Water Heaters
   - AO Smith
   - Maxi-Therm
   - PVI

2. High-Recovery, High-Efficiency Electric Water Heaters
   - AO Smith
   - Maxi-Therm
   - PVI

F. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards, and listed in the project specifications, do not conflict with commissioning procedures for testing and training.

End of Section
15487

**Heat Exchanger Water Heaters**

This document provides design standards only, and is not intended for use, in whole or in part, as a specification. Do not copy this information verbatim in specifications or in notes on drawings. Refer questions and comments regarding the content and use of this document to the Yale University Project Manager.

## Contents

A. Summary
B. System Design and Performance Requirements
C. Submittals
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E. Manufacturers
F. Installation Guidelines
G. Quality Control

### A. Summary

This section contains design criteria for steam, hot water, instantaneous, and storage-type water heaters.

### B. System Design and Performance Requirements

1. Design the plumbing system for safety, longevity, durability and flexibility.
2. Domestic hot water generators must be double wall.
3. Indirect water—thermo-max.

### C. Submittals

Submit the following design and certification documentation.

1. **Designer Submittals**

   Submit domestic hot water load calculations for:
   - Building domestic hot water heaters
   - Kitchen booster hot water system
   - Laundry hot water system
2. **Product Certificates Signed by Manufacturer**  
   Specify that water heaters be inspected by the manufacturer’s authorized representative who shall submit a written report to the engineer with copy to Yale University stating that the water heaters have been properly installed, are operating correctly, and the installation is acceptable to the manufacturer in every respect.

D. **Product Standards**  
   Products must conform to the following standards:
   - ASHRAE 90.1b
   - ASME

E. **Manufacturers**  
   Subject to compliance with the design requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

   1. **Instantaneous Steam Water Heaters (below 20 psi steam pressure)**
      - Leslie
      - Armstrong

   2. **Semi-Instantaneous Steam Water heaters (greater than 20 psi and less than 60 psi steam pressure)**
      - Patterson-Kelley

   3. **Indirect Water Heaters**
      - Thermo-Max

F. **Installation Guidelines**
   1. Provide pull space for coils.
   2. Provide a 2' minimum clearance around the units for maintenance.
G. Quality Control

If this portion of the project includes commissioning, verify that insertions in the project specifications have been made that refer to the commissioning procedures in the commissioning specification section. Verify that the systems and equipment identified in this section of the standards and listed in the project specifications do not conflict with commissioning procedures for testing and training.