

APPENDIX L

ALTERNATE PLUMBING SYSTEMS

L 1.0 Scope.

L 1.1 The intent of this appendix is to provide clarification of procedures for the design and approval of engineered plumbing systems, alternate materials, and equipment not specifically covered in other parts of the code.

L 1.2 The provisions of this appendix apply to the design, installation, and inspection of an engineered plumbing system, alternate material, and equipment.

L 1.3 The Authority Having Jurisdiction has the right to require descriptive details of an engineered plumbing system, alternate material, or equipment including pertinent technical data to be filed.

L 1.4 Components, materials, and equipment must conform to standards and specifications listed in Table 14-1 of this code and other national consensus standards applicable to plumbing systems and materials.

L 1.5 Where such standards and specifications are not available, alternate materials and equipment must be approved per the provisions of Section 301.2 of this code.

L 2.0 Engineered Plumbing Systems.

L 2.1 Definition. *Engineered Plumbing System:* A system designed for a specific building project with drawings and specifications indicating plumbing materials to be installed, all as prepared by a person registered or licensed to perform plumbing design work.

L 2.2 Inspection and Installation. In other than one- and two-family dwellings, the designer of the system is to provide periodic inspection of the installation on a schedule found suitable to the Authority Having Jurisdiction. Prior to the final approval, the designer must verify to the Authority Having Jurisdiction that the installation is in compliance with the approved plans, specifications, and data and such amendments thereto. The designer must also certify to the Authority Having Jurisdiction that the installation is in compliance with the applicable engineered design criteria.

L 2.3 Owner Information. The designer of the system must provide the building owner with information concerning the system, considerations applicable for any subsequent modifications to the system, and maintenance requirements as applicable.

L 3.0 Water Heat Exchangers.

L 3.1 Heat exchangers used for heat transfer, heat recovery, or solar heating shall protect the potable water system from being contaminated by the heat-transfer medium.

L 3.2 Single-wall heat exchangers shall be permitted if they satisfy all of the following requirements:

- (1) The heat-transfer medium is either potable water or contains essentially nontoxic transfer fluids having a toxicity rating or class of 1 (see Section 207.0).
- (2) The pressure of the heat-transfer medium is maintained at less than the normal minimum operating pressure of the potable water system.

Exception: Steam complying with Section L 3.2 (1) above.

- (3) The equipment is permanently labeled to indicate that only additives recognized as safe by the FDA shall be used in the heat-transfer medium.

L 3.3 Other heat exchanger designs may be permitted where approved by the Authority Having Jurisdiction.

L 4.0 Fixture Unit Values for Bathroom Groups.

L 4.1 Tables L-1 and L-2 reflect the fixture unit loads for the fixtures in bathrooms as groups, rather than as individual fixtures. Such fixtures include water closets, lavatories, and bathtubs or showers. The tables reflect diversity in the use of fixtures within a bathroom and between multiple bathrooms.

L 4.2 The listed water supply fixture unit values in Table L-1 reflect the load of entire bathroom groups on the cold-water service. Individual hot and cold water branch piping to the fixtures should be sized according to Chapter 6 and Appendix A.

TABLE L-1
Water Supply Fixture Units (WSFU) for Bathroom Groups^{1,2}

	Individual Dwelling Units	Serving 3 or more Dwelling Units
Bathroom Groups having 1.6 GPF Gravity-Tank Water Closets		
Half-bath or Powder Room	3.5	2.5
1 Bathroom Group	5.0	3.5
1-1/2 Bathrooms	6.0	
2 Bathrooms	7.0	
2-1/2 Bathrooms	8.0	
3 Bathrooms	9.0	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom Group	1.0	
Bathroom Groups having 1.6 GPF Pressure-Tank Water Closets		
Half-bath or Powder Room	3.5	2.5
1 Bathroom Group	5.0	3.5
1-1/2 Bathrooms	6.0	
2 Bathrooms	7.0	
2-1/2 Bathrooms	8.0	
3 Bathrooms	9.0	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom Group	1.0	
Bathroom Groups having 3.5 GPF Gravity-Tank Water Closets		
Half-bath or Powder Room	4.0	3.0
1 Bathroom Group	6.0	5.0
1-1/2 Bathrooms	8.0	
2 Bathrooms	10.0	
2-1/2 Bathrooms	11.0	
3 Bathrooms	12.0	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom Group	1.0	
Bath Group (1.6 GPF Flushometer Valve)	6.0	4.0
Bath Group (3.5 GPF Flushometer Valve)	8.0	6.0
Kitchen Group (Sink and Dishwasher)	2.0	1.5
Laundry Group (Sink and Clothes Washer)	5.0	3.0

Notes:

1. A bathroom group, for the purposes of this table, consists of one water closet, up to two lavatories, and either one bathtub or one shower.
2. A half-bath or powder room, for the purposes of this table, consists of one water closet and one lavatory.

L 4.3 The listed drainage fixture unit values in Table L-2 reflect the load of entire bathroom groups on the sanitary drainage system. Where fixtures within bathrooms connect to different branches of the drainage system, the fixture unit values for the individual fixtures shall be used, as listed in Table 7-3 of this Code.

L 5.0 Vacuum Drainage Systems.

L 5.1 Vacuum drainage systems shall be

considered engineered systems and shall comply with the requirements of L 1.0 and L 2.0.

L 5.2 Vacuum drainage systems, including piping tank assemblies, vacuum pump assembly, and other components necessary for the proper function of the system shall be engineered and installed in accordance with the manufacturer's specifications. Plans and specifications shall be submitted to the Authority Having Jurisdiction for review and approval prior to installation.

TABLE L-2
Drainage Fixture Unit Values (DFU) for Bathroom Groups

	Individual Dwelling Units	Serving 3 or more Dwelling Units
Bathroom Groups having 1.6 GPF Gravity-Tank Water Closets		
Half-bath or Powder Room	3.0	2.0
1 Bathroom Group	5.0	3.0
1-1/2 Bathrooms	6.0	
2 Bathrooms	7.0	
2-1/2 Bathrooms	8.0	
3 Bathrooms	9.0	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom Group	1.0	
Bathroom Groups having 1.6 GPF Pressure-Tank Water Closets		
Half-bath or Powder Room	3.5	2.5
1 Bathroom Group	5.5	3.5
1-1/2 Bathrooms	6.5	
2 Bathrooms	7.5	
2-1/2 Bathrooms	8.5	
3 Bathrooms	9.5	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom Group	1.0	
Bathroom Groups having 3.5 GPF Gravity-Tank Water Closets		
Half-bath or Powder Room	3.0	2.0
1 Bathroom Group	6.0	4.0
1-1/2 Bathrooms	8.0	
2 Bathrooms	10.0	
2-1/2 Bathrooms	11.0	
3 Bathrooms	12.0	
Each Additional 1/2 Bath	0.5	
Each Additional Bathroom	1.0	
Bath Group (1.6 GPF Flushometer Valve)	5.0	3.0
Bath Group (3.5 GPF Flushometer Valve)	6.0	4.0

Notes:

1. A bathroom group, for the purposes of this table, consists of not more than one water closet, up to two lavatories, and either one bathtub or one shower.
2. A half-bath or powder room, for the purposes of this table, consists of one water closet and one lavatory.

L 5.3 Fixtures. Fixtures used in vacuum drainage systems shall comply with L 1.4 and L 1.5.

L 5.4 Drainage Load. The pump discharge load from the collector tanks shall be in accordance with Chapter 7 of this Code.

L 5.5 Water Supply Fixture Units. Water supply fixture units shall be based on the values in Chapter 6 of this Code. The load requirement of a vacuum-type water closet shall be determined per manufacturer's specification.

L 5.6 Traps and Cleanouts. For gravity fixtures, traps and cleanouts shall be per approved plans.

L 6.0 Special Venting of Fixtures.

L 6.1 Batteries of Fixtures (Battery Venting).

L 6.1.1 A maximum of eight (8) floor-outlet water closets, showers, bathtubs, or floor drains connected in battery on a horizontal branch drain shall be permitted to be battery-vented. The drain from each fixture being battery-vented shall connect

horizontally to the horizontal wet-vented drain branch. The horizontal wet-vented branch drain shall be considered as a vent extending from the downstream fixture drain connection to the most upstream fixture connection.

L 6.1.2 Back-outlet water closets having carriers conforming to Section 407.4 shall be permitted to be battery-vented provided they connect horizontally to the horizontal wet-vented section.

L 6.1.3 Trap arm lengths for fixtures shall not exceed those as indicated in Table 10-1.

L 6.1.4 A battery vent shall be connected to the horizontal wet-vented branch drain between the two (2) most upstream fixture drains.

L 6.1.5 The entire length of the wet-vented section of the horizontal branch drain shall be uniformly sized for the total drainage discharge connected thereto as per Table 7-5. The maximum slope of the horizontal drain shall be three-eighths (3/8) inch (10 mm) per foot (300 mm).

L 6.1.6 A relief vent shall be provided on each wet-vented horizontal branch drain below the uppermost floor. The relief vent shall connect to the horizontal branch drain between the stack and the first upstream fixture drain.

L 6.1.7 Battery vents and relief vent connections shall be taken off vertically from the top of the horizontal drain.

Battery vents and relief vents shall not be used as vertical wet vents.

L 6.1.8 Lavatories and drinking fountains shall be permitted to connect horizontally to the horizontal wet-vented branch drain provided that they are located on the same floor as the battery-vented fixtures and each is provided with either an individual or common vent.

L 6.1.9 Batteries of more than eight (8) battery vented fixtures shall have a separate battery vent for each group of eight (8) or less fixtures, and the horizontal branch drain in each group shall be sized for the total drainage into the branch, including all upstream branches and the fixtures within the particular group.

L 6.1.10 All battery vents and relief vents shall be sized according to Section 904.0, but shall be not less than one-half (1/2) the area of the drain pipe that they serve and shall comply with Section 905.0

L 6.2 Single Bathroom or Single Toilet Room.

L 6.2.1 An individually vented lavatory in a single bathroom or single toilet room shall be permitted to serve as the wet vent for one (1) water closet and/or one (1) bathtub or shower stall, or one (1) water closet and/or one (1) bathtub/shower combination if all of the following conditions are met:

- (1) The wet vent, and the dry vent extending from the wet vent, shall be two (2) inch (50 mm) minimum pipe size.
- (2) The wet vent pipe opening shall not be below the weir of the trap that it serves. Vent sizing, grades, and connections shall comply with Sections 904.0 and 905.0.
- (3) The horizontal branch drain serving both the lavatory and the bathtub or shower stall shall be two (2) inch (50 mm) minimum pipe size.
- (4) The length of the trap arm from the bathtub or shower stall complies with the limits in Table 10-1.
- (5) The distance from the outlet of the water closet to the connection of the wet vent complies with the limits in Table 10-1.
- (6) The horizontal branch drain serving the lavatory and the bathtub or shower stall shall connect to the horizontal water closet branch above its centerline. When the bathroom or toilet room is the top-most load on a stack, the horizontal branch serving the lavatory and the bathtub or shower stall shall be permitted to connect to the stack below the water-closet branch.
- (7) No fixture other than those listed in L 6.2.1 shall discharge through a single bathroom or single toilet room wet-vented system.

L 6.3 Double Bathtubs, Bathtub/Shower Combinations, Shower Stalls, and Lavatories.

Two (2) lavatories, each rated at 1.0 drainage fixture unit (DFU), and two (2) bathtubs, bathtub/shower combinations, or shower stalls, installed in adjacent bathrooms, shall be permitted to drain to a horizontal drain branch that is two (2) inch (50 mm) minimum pipe size, with a common vent for the lavatories and no individual vents for the bathtubs, bathtub/shower combinations, or shower stalls,

provided that the wet vent from the lavatories and their dry vent is two (2) inch (50 mm) minimum pipe size and the length of all trap arms comply with the limits in Table 10-1.

L 7.0 Circuit Venting.

L 7.1 Circuit vent permitted. Circuit venting shall be designed by a registered professional engineer as an engineered design. A maximum of eight fixtures connected to a horizontal branch drain shall be permitted to be circuit vented. Each fixture drain shall connect horizontally to the horizontal branch being circuit vented. The horizontal branch drain shall be classified as a vent from the most downstream fixture drain connection to the most upstream fixture drain connection to the horizontal branch.

L 7.1.1 Multiple circuit-vented branches. Circuit-vented horizontal branch drains are permitted to be connected together. Each group of a maximum of eight fixtures shall be considered a separate circuit vent and shall conform to the requirements of this section.

L 7.2 Vent size and connection. The circuit vent shall be a minimum of 2 inches (50 mm) in diameter and the connection shall be located between the two most upstream fixture drains. The vent shall connect to the horizontal branch on the vertical. The circuit vent pipe shall not receive the discharge of any soil or waste.

L 7.3 Slope and size of horizontal branch. The maximum slope of the vent section of the horizontal branch drain shall be 1 inch per foot (25 mm per 305 mm). The entire length of the vented section of the horizontal branch drain shall be sized for the total drainage discharge to the branch.

L 7.3.1 Size of multiple circuit vent. Multiple circuit vented branches shall be permitted to connect on the same floor level. Each separate circuit-vented horizontal branch that is interconnected shall be sized independently in accordance with Section L 7.3. The downstream circuit-vented horizontal branch shall be sized for the total discharge into the branch, including the upstream branches and the fixtures within the branch.

L 7.4 Relief vent. A 2-inch (50 mm) relief vent shall be provided for circuit-vented horizontal branches receiving the discharge of four or more water closets and connecting to a drainage stack that receives the discharge of soil or waste from upper horizontal branches.

L 7.4.1 Connection and installation. The relief vent shall connect to the horizontal branch drain

between the stack and the most downstream fixture drain of the circuit vent. The relief vent shall be installed on the vertical to the horizontal branch.

L 7.4.2 Fixture drain or branch. The relief vent is permitted to be a fixture drain or fixture branch for a fixture located within the same branch interval as the circuit-vented horizontal branch. The maximum discharge to a relief vent shall be four fixture units.

L 7.5 Additional fixtures. Fixtures, other than the circuit-vented fixtures, are permitted to discharge to the horizontal branch drain. Such fixtures shall be located on the same floor as the circuit-vented fixtures and shall be either individually or common vented.

L 8.0 Single-Stack Vent System

L 8.1 Where permitted. Single-stack venting shall be designed by a registered professional engineer as an engineered design. A drainage stack shall be permitted to serve as a single-stack vent system when sized and installed in accordance with Sections L 8.2 through L 8.9. The drainage stack and branch piping in a single-stack vent system shall provide for the flow of liquids, solids, and air without the loss of fixture trap seals.

L 8.2 Stack Size. Drainage stacks shall be sized according to Table L-3. A maximum of two water closets shall be permitted to discharge to a 3-inch (80 mm) stack. Stacks shall be uniformly sized based on the total connected drainage fixture unit load, with no reductions in size.

L 8.2.1 Stack Vent. The drainage stack vent shall have a stack vent of the same size terminating to the outdoors.

L 8.3 Branch Size. Horizontal branches connecting to a single-stack vent system shall be sized according to Table 7-5.

Exceptions:

(1) No more than one water closet within 18 inches (457 mm) of the stack horizontally shall be permitted on a 3-inch (80 mm) horizontal branch.

(2) A water closet within 18 inches (457 mm) of a stack horizontally and one other fixture with up to 1-1/2 inch (40 mm) fixture drain size shall be permitted on a 3-inch (80 mm) horizontal branch when connected to the stack through a sanitary tee.

L 8.4 Length of horizontal branches.

L 8.4.1 Water closets shall be no more than four (4) feet (1,219 mm) horizontally from the stack.

Exception: Water closets shall be permitted to be up to eight (8) feet (2,438 mm) horizontally from the stack when connected to the stack through a sanitary tee.

L 8.4.2 Fixtures other than water closets shall be no more than twelve (12) feet (3658 mm) horizontally from the stack.

L 8.4.3 The length of any vertical piping from a fixture trap to a horizontal branch shall not be considered in computing the fixture's horizontal distance from the stack.

L 8.5 Maximum vertical drops from fixtures. Vertical drops from fixture traps to horizontal branch piping shall be one size larger than the trap size, but not less than two (2) inch (50 mm) in diameter. Vertical drops shall be four (4) feet (1219 mm) maximum length. Fixture drains that are not increased in size, or have a vertical drop exceeding 4 feet shall be individually vented.

L 8.6 Additional venting required. Additional venting shall be provided when more than one water closet is on a horizontal branch and where the distance from a fixture trap to the stack exceeds the limits in Section L 8.4. Where additional venting is required, the fixture (s) shall be vented by individual vents, common vents, wet vents, circuit vents, or a combination waste and vent pipe. The dry vent extensions for the additional venting shall connect to a branch vent, vent stack, stack vent, or be extended outdoors and terminate to the open air.

L 8.7 Stack Offsets. Where there are no fixture drain connections below a horizontal offset in a stack, the offset does not need to be vented. Where there are fixture drain connections below a horizontal offset in a stack, the offset shall be vented. There shall be no fixture connections to a stack within 2 feet above and below a horizontal offset.

L 8.8 Separate Stack Required. Where stacks are more than two stories high, a separate stack shall be provided for the fixtures on the lower two stories. The stack for the lower two stories may be connected to the branch of the building drain that serves the stack for the upper stories at a point that is at least 10 pipe diameters downstream from the base of the upper stack.

L 8.9 Sizing Building Drains and Sewers. In a single-stack vent system, the building drain and branches thereof shall be sized in accordance with Table 7-5, and the building sewer shall be sized in accordance with Table 7-8.

**Table L-3
Single-Stack Size**

Stack Size (inches)	Maximum Connected Drainage Fixture Units		
	Stacks Less than 75 Feet in Height	Stack 75 Feet to Less than 160 Feet in Height	Stack 160 Feet or Greater in Height
3	24	NP	NP
4	225	24	NP
5	480	225	24
6	1,015	480	225
8	2,320	1,015	480
10	4,500	2,320	1,015
12	8,100	4,500	2,320
15	13,600	8,100	4,500

