ORDINANCE NO._____

An ordinance amending Title 28 – Plumbing Code – of the Los Angeles County Code, to adopt and incorporate by reference portions of the 2025 California Plumbing Code, with certain changes and modifications, and to make other revisions thereto.

The Board of Supervisors of the County of Los Angeles ordains as follows:

SECTION 1. Sections 119.1.2.0 through 119.1.14.0 of Chapter 1, Chapters 2 through 17, Appendices A, B, D, H, I, and J, of the Los Angeles County Code, which incorporate by reference and modify portions of the 2022 California Plumbing Code, and Appendix S, are hereby repealed.

SECTION 2. Chapter 1 is hereby amended to read as follows:

CHAPTER 1

ADMINISTRATION

100 ADOPTION AND INCORPORATION BY REFERENCE.

Except as hereinafter changed or modified, Sections 1.2.0 through 1.14.0 of Chapter 1, Division I, of that certain Plumbing Code known and designated as the ~~2022~~2025 California Plumbing Code, as published by the California Building Standards Commission, are adopted and incorporated by reference into this Title 28 of the Los Angeles County Code as if fully set forth below, and shall be known as Sections 119.1.2.0 through 119.1.14.0, respectively, of Chapter 1 of Title 28 of the Los Angeles County Code.

Except as hereinafter changed or modified, Chapters 2 through 17 and Appendices A, B, D, H, I, and J, of that certain Plumbing Code known and designated as the ~~2022~~2025 California Plumbing Code as published by the California Building Standards Commission, are adopted and incorporated by reference into this Title 28 of the Los Angeles County Code as if fully set forth below, and shall be known as Chapters 2 through 17, and Appendices A, B, D, H, I, and J, of Title 28 of the Los Angeles County Code.

A copy of the ~~2022~~2025 California Plumbing Code shall be at all times maintained by the Chief Plumbing Inspector for use and examination by the public.

. . .

SECTION 3. Section 204.0 is hereby amended to read as follows:

204.0 – B –

. . .

Building Code. The most recent edition of Title 26 of the Los Angeles County Code.

. . .

SECTION 4. Section 206.0 is hereby amended to read as follows:

206.0 – D –

. . .

Demand Hot Water Recirculation System. A hot water recirculation system requiring manual activation and equipped with a thermostat that will automatically shut off the recirculation pump when the water temperature reaches a preset level at the

point of use.

. . .

SECTION 5. Section 207.0 is hereby amended to read as follows:

207.0 – E –

. . .

Electrical Code. The most recent edition of Title 27 of the Los Angeles County Code.

. . .

SECTION 6. Section 210.0 is hereby amended to read as follows:

210.0 – H –

. . .

Hot Water Recirculation System. A hot water distribution system that reduces the time needed to deliver hot water to fixtures that are distant from the water heater, boiler, or other water heating equipment. The recirculation system is comprised of hot water supply and return piping with shutoff valves, balancing valves, and circulating pumps, and a method of controlling the circulating system.

. . .

SECTION 7. Section 215.0 is hereby amended to read as follows:

215.0 – M –

. . .

Mechanical Code. The most recent edition of Title 29 of the Los Angeles County Code.

. . .

SECTION 8. Section 301.2.2 is hereby amended to read as follows:

301.2.2 Standards. Standards listed or referred to in this ~~c~~Chapter or other chapters cover materials that will conform to the requirements of this ~~c~~Code, where used in accordance with the limitations imposed in this or other chapters thereof and their listing. Where a standard covers materials of various grades, weights, quality, or configurations, the portion of the listed standard that is applicable shall be used. Design and materials for special conditions or materials not provided for herein shall be permitted to be used only by special permission of the Authority Having Jurisdiction after the Authority Having Jurisdiction has been satisfied as to their adequacy. A list of plumbing standards that appear in specific sections of this ~~c~~Code is referenced in Table 1701.1. Standards referenced in Table 1701.1 shall be applied as indicated in the applicable referenced section. A list of additional approved standards, publications, practices, and guides that are not referenced in specific sections of this ~~c~~Code appear in Table 1701.2. Solar thermal energy systems and material standards are referenced in Tables S 18.1 and S 18.2 of Appendix S. ~~An~~IAPMO Installation Standards ~~is~~are referenced in Appendix I for the convenience of the users of this ~~c~~Code. It is not considered as a part of this ~~c~~Code unless formally adopted as such by the Authority Having Jurisdiction.

SECTION 9. Section 301.3 is hereby amended to read as follows:

301.3 Alternate Materials and Methods of Construction ~~Equivalency~~ and Modifications.

301.3.1 Alternate Materials and Methods of Construction.

Nothing in this ~~c~~Code is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this ~~c~~Code. Technical documentation shall be submitted to the Authority Having Jurisdiction to demonstrate equivalency prior to installation. The Authority Having Jurisdiction shall have the authority to approve or disapprove the system, method, or device for the intended purpose on a case-by-case basis. [HCD 1] (See Section 1.8.7).

. . .

301.3.1.1 Testing.

. . .

301.3.1.1.1 Tests.

. . .

301.3.1.~~2~~.1.2 Request by Authority Having Jurisdiction.

. . .

301.3.2 Modifications. Whenever there are practical difficulties involved in carrying out the provisions of this Code, the Authority Having Jurisdiction shall have the authority to grant modifications on a case-by-case basis, upon application of the owner or the owner's authorized agent, provided the Authority Having Jurisdiction shall first find that a special individual reason makes the strict letter of this Code impractical, that the modification is in conformity with the spirit and purpose of this Code, and that such modification does not lessen any health, fire-protection, or other life-safety-related requirements. The details of any action granting modifications shall

be recorded and entered in the files of the Authority Having Jurisdiction. Application for approval of a modification shall be in accordance with Section 103.12.2.

SECTION 10. Section 304.1 is hereby amended to read as follows:

304.1 General. Plumbing fixtures, drains, appurtenances, and appliances, used to receive or discharge liquid wastes or sewage, shall be connected properly to the drainage system of the building or premises, in accordance with the requirements of this ~~c~~Code.

Exception: *[HCD 1] Limited-density owner-built rural dwellings. Where conventional plumbing, in all or in part, is installed within the structure, it shall be installed in accordance with the provisions of this ~~c~~Code. Alternative materials and methods shall be permitted provided that the design complies with the intent of the ~~c~~Code, and that such alternatives shall perform to protect health and safety for the intended purpose.*

Dual waste piping shall be installed to permit the discharge from clothes washers, bathtubs, showers, and bathroom/restroom wash basins to be used for a graywater irrigation system. Partial connection of plumbing fixtures to the graywater system, based on accepted engineering practices and required volume of water for irrigation, shall be accepted. Graywater systems shall be designed and installed in accordance with Chapter 15 and other parts of this Code.

Exceptions:

(1) Buildings with a graywater system, rain catchment system, or recycled water system.

(2) Sites with landscape areas not exceeding 500 square feet.

(3) Projects where graywater systems are not permitted due to geological conditions.

(4) Additions and alterations that use the existing building drain.

SECTION 11. Section 601.2.3 is hereby added to read as follows:

601.2.3 Hot Water Recirculation Systems. A hot water recirculation system shall be installed, as defined in Chapter 2, and shall not allow more than 0.6 gallons of water to be delivered to any fixture before hot water arrives. Hot water recirculation systems may include, but are not limited to, the following:

(1) Timer-initiated systems.

(2) Temperature sensor-initiated systems.

(3) Occupancy sensor-initiated systems.

(4) Smart hot water recirculation systems.

(5) Demand hot water recirculation systems.

(6) Other systems acceptable to the Authority Having Jurisdiction.

Exception: Minor additions and alterations as determined by the Authority Having Jurisdiction that use the existing water distribution pipe system and which does not contain a hot water recirculation system.

SECTION 12. Section 609.7 is hereby amended to read as follows:

609.7 Abutting Lot. Nothing contained in this ~~c~~Code shall be construed to prohibit the use of all or part of an abutting or adjacent lot or lots to:

. . .

SECTION 13. Section 721.3 is hereby added to read as follows:

721.3 Public Sewer. If the public sewer does not extend to a point from which each building on a lot or parcel of land large enough to permit future subdivision can be independently served, the property owner shall construct a public sewer as required by Title 20 – Utilities – of the Los Angeles County Code, Division 2 (Sanitary Sewer and Industrial Waste), to provide adequate sewerage for each such possible parcel.

Exception: When the Authority Having Jurisdiction finds that the character of a lot is such that no further subdivision can be reasonably anticipated, or the use is such as to preclude subdivision, or where the owner has executed a covenant stating that the lot or parcel of land, together with all improvements thereon, will be maintained as a unit and that before any subdivision is made or any portion of said lot is transferred to another owner, separate sewerage facilities as hereinbefore required in this Section will be installed, the drainage system of all buildings may be connected to a common building sewer or private sewage disposal system. The covenant shall be recorded by the owner in the office of the Registrar-Recorder as part of the conditions of ownership of said property. Such agreement shall be binding on all heirs, successors, and assigns to said property.

This exception shall apply only while the whole of such lot remains in one undivided ownership. Upon the transfer of any portion of such lot other than the whole thereof to another owner, whether such transfer is made before or after the operative date of the ordinance adding this provision, the exception shall cease and a person

shall not use or maintain any building or structure except in compliance with the provisions of this Code. As used in this Section, a sale, foreclosure, or contract to sell by the terms of which the purchaser is given the right of possession shall be deemed a transfer.

SECTION 14. Section 728.0 is hereby added to read as follows:

728.0 Building Sewer Connection Requirements.

728.1 Size. That portion of the building sewer extending from the public sewer to the property line shall be not less than 4 inches (100 mm) in internal diameter.

728.2 Depth. When laid within the limits of any public thoroughfare when the public sewer is sufficiently deep, no building sewer shall be less than 6 feet (1.8 m) below grade. Whenever practicable, the alignment and grade of each building sewer shall be straight from the public sewer to the property line.

728.3 Taps and Saddles. Whenever it becomes necessary to connect a building sewer to a public sewer at a point where no branch fitting has been installed in the public sewer, such connection shall be made as required by Title 20 – Utilities – of the Los Angeles County Code, Division 2 (Sanitary Sewer and Industrial Waste).

728.4 Connection to Trunks. Whenever required, an approved-type unvented running trap shall be installed in each building sewer, which is connected directly to a trunk sewer by any means whatsoever. Each such running trap shall be installed in the building sewer between the house drain or drains and the connection to

the trunk sewer. A T-type cleanout shall be installed in the building sewer immediately below the running trap. This cleanout need not be extended to grade. Every running trap and cleanout shall be located on the lot served by the building sewer.

728.5 Street Widening. Where a future street or road-widening area has been established by the master plan of highways or in any other manner, all work installed in such area shall conform to the requirements established in this or other related ordinances for work on public property.

728.6 Main Line Required. Building sewer construction shall conform to the requirements of main line sewers as set forth in Title 20 – Utilities – of the Los Angeles County Code, Division 2 (Sanitary Sewer and Industrial Waste), when either of the following conditions exists:

1. Where the Authority Having Jurisdiction requires such construction because of the character or quantity of the sewage or industrial waste to be discharged.

2. Where the sewer is designed to be, or proposed to be, dedicated to the County of Los Angeles at the present or any future time.

SECTION 15. Table H 101.8 of Appendix H is hereby amended to read as follows:

TABLE H 101.8
LOCATION OF SEWAGE DISPOSAL SYSTEM

MINIMUM HORIZONTAL DISTANCE	BUILDING SEWER	SEPTIC TANK	DISPOSAL FIELD	SEEPAGE PIT OR CESSPOOL
Building or structures[1]	2 feet	5 feet	8 feet	8 feet
Property line adjoining private property	Clear[2]	5 feet	5 feet	8 feet

Water supply wells[9]	50 feet[3]	50 feet	100 feet	150 feet
Streams and other bodies of water[9]	50 feet	50 feet	100 feet[7]	150 feet[7]
Trees[10]		10 feet		10 feet
Seepage pits or cesspools[8]		5 feet	5 feet	12 feet
Disposal field[8]		5 feet	4 feet[4]	5 feet
On-site domestic water service line	1 foot[5]	5 feet	5 feet	5 feet
Distribution box			5 feet	5 feet
Pressure public water main	10 feet[6]	10 feet	10 feet	10 feet

For SI units: 1 foot = 304.8 mm

Notes:

1 Including porches and steps, whether covered or uncovered, breezeways, roofed porte cocheres, roofed patios, carports, covered walks, covered driveways, and similar structures or appurtenances.

2 See Section 312.3.

3 Drainage piping shall clear domestic water supply wells by not less than 50 feet (15 240 mm). This distance shall be permitted to be reduced to not less than 25 feet (7620 mm) where the drainage piping is constructed of materials approved for use within a building.

4 Plus 2 feet (610 mm) for each additional 1 foot (305 mm) of depth in excess of 1 foot (305 mm) below the bottom of the drain line. (See Section H 601.0)

5 See Section 720.0.

6 For parallel construction -- For crossings, approval by the Health Department shall be required.

7 These minimum clear horizontal distances shall also apply between disposal fields, seepage pits, and the mean high-tide line.

8 Where disposal fields, seepage pits, or both are installed in sloping ground, the minimum horizontal distance between any part of the leaching system and ground surface shall be 15 feet (4572 mm).

9 Where special hazards are involved, the distance required shall be increased as may be directed by the Authority Having Jurisdiction.

10 The septic tank and seepage pit shall not be within the protected zone of an oak tree as defined by Section 22.14.150 of Title 22 – Planning and Zoning – of the Los Angeles County Code.

SECTION 16. Table H 201.1(1) of Appendix H is hereby amended to read as follows:

TABLE H 201.1(1)
CAPACITY OF SEPTIC TANKS[1, 2, 3, 4, 5]

SINGLE-FAMILY DWELLINGS - NUMBER OF BEDROOMS	MULTIPLE DWELLING UNITS OR APARTMENTS - ONE BEDROOM EACH	OTHER USES: MAXIMUM FIXTURE UNITS SERVED PER TABLE 702.1	MINIMUM SEPTIC TANK CAPACITY (gallons)
1 or 2	—	15	750
3	—	20	1000
4	2 units	25	1200
5 or 6	3	33	1500
—	4	45	2000
—	5	55	2250
—	6	60	2500
—	7	70	2750
—	8	80	3000

—	9	90	3250
—	10	100	3500

For SI units: 1 gallon = 3.785 L

Notes:

1 Extra bedroom, 150 gallons (568 L) each.
2 Extra dwelling units over 10:250 gallons (946 L) each.
3 Extra fixture units over 100: 25 gallons (94.6 L) per fixture unit.
4 Septic tank sizes in this table include sludge storage capacity and the connection of domestic food waste disposers without further volume increase.
5 Applies to mobile homes not installed in a mobile home park.

SECTION 17. Table H 201.1(2) of Appendix H is hereby amended to read as follows:

TABLE H 201.1(2)
DESIGN CRITERIA OF ~~FIVE~~SIX TYPICAL SOILS

TYPE OF SOIL	REQUIRED SQUARE FEET OF LEACHING AREA PER 100 GALLONS	MAXIMUM ABSORPTION CAPACITY IN GALLONS PER SQUARE FEET OF LEACHING AREA FOR A 24 HOUR PERIOD
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam ~~or sandy clay~~	40	2.5
Sandy clay	60	1.66
Clay with considerable sand or gravel	90	1.1
Clay with small amount of sand or gravel	120	0.8

For SI units: 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L, 1 gallon per square foot = 40.7 L/m^2

SECTION 18. Table H 201.1(3) of Appendix H is hereby amended to read as follows:

TABLE H 201.1(3)
LEACHING AREA SIZE BASED ON SEPTIC TANK CAPACITY

REQUIRED SQUARE FEET OF LEACHING AREA PER 100 GALLONS SEPTIC TANK CAPACITY (square feet per 100 gallons)	MAXIMUM SEPTIC TANK SIZE ALLOWABLE (gallons)
20-25	7500
40	5000
60	3500
90	~~3500~~3000

120	~~3000~~2500

For SI units: 1 square foot per 100 gallons = 0.000245 m^2/L, 1 gallon = 3.785 L

SECTION 19. Table H 201.1(4) of Appendix H is hereby amended to read as follows:

TABLE H 201.1(4)
ESTIMATED WASTE SEWAGE FLOW RATES[1, 2, ~~3~~]

TYPE OF OCCUPANCY	GALLONS PER DAY
Airports (per employee)	15
Airports (per passenger)	5
Auto washers – check with equipment manufacturer	-
Bowling alleys – with snack bar only (per lane)	75
Campground – with central comfort station (per person)	35
Campground – with flush toilets - no showers (per person)	25
Camps (day) – no meals served (per person)	15
Camps (summer and seasonal camps) – (per person)	50
Churches – sanctuary (per seat)	5
Churches – with kitchen waste (per seat)	7
Dance halls – (per person)	5
Factories – no showers (per employee)	25
Factories – with showers (per employee)	35
Factories – with cafeteria (per employee)	5
Hospitals – (per bed)	250
Hospitals – kitchen waste only (per bed)	25
Hospitals – laundry waste only (per bed)	40
Hotels – no kitchen waste (per bed)	60
Institutions – resident (per person)	75
Nursing home – (per person)	125
Rest home – (per person)	125

Laundries – self-service with minimum 10 hours per day (per ~~wash cycle~~machine)	300~~50~~
Laundries – commercial check with manufacturer's specification	-
Motel (per bed space)	50
Motel – with kitchen (per bed space)	60
Offices – (per employee)	20
~~Parks – mobile homes (per space)~~	~~250~~
Parks (picnic) – with toilets only (per parking space)	20
Parks (recreational vehicles) – without water hook-up (per space)	75
Parks (recreational vehicles) – with water and sewer hook-up (per space)	100
Restaurants – cafeteria (per ~~employee~~seat)	50~~20~~
~~Restaurants – with toilet waste (per customer)~~	~~7~~
~~Restaurants – with kitchen waste (per meal)~~	~~6~~
~~Restaurants – with kitchen waste disposable service (per meal)~~	~~2~~
~~Restaurants – with garbage disposal (per meal)~~	~~1~~
~~Restaurants – with cocktail lounge (per customer)~~	~~2~~
Schools staff and office (per person)	20
Schools – elementary (per student)	15
Schools – intermediate and high (per student)	20
Schools – with gym and showers (per student)	5
Schools – with cafeteria (per student)	3
Schools (boarding) – total waste (per person)	100
Service station – with toilets for 1st bay	1000
Service station – with toilets for each additional bay	500
Stores – (per employee)	20

Stores – with public restrooms (per 10 square feet of floor space)	1
Swimming pools – (per person)	10
Theaters – auditoriums (per seat)	5
Theaters – with drive-in (per space)	10

For SI units: 1 square foot = 0.0929 m^2, 1 gallon per day 3.785 L/day

Notes:

~~1 Sewage disposal systems sized using the estimated waste/sewage flow rates shall be calculated as follows:~~

~~(a) Waste/sewage flow, up to 1500 gallons per day (5678 L/day)~~
~~Flow x 1.5 = septic tank size~~

~~(b) Waste/sewage flow, over 1500 gallons per day (5678 L/day)~~
~~Flow x 0.75 + 1125 = septic tank size~~

~~(c) Secondary system shall be sized for total flow per 24 hours.~~

~~2~~1 See Section H 201.1.

~~3~~2 Because of the many variables encountered, it is not possible to set absolute values for waste/sewage flow rates for all situations. The designer should evaluate each situation and, where figures in this table need modification, they should be made with the concurrence of the Authority Having Jurisdiction**.**

SECTION 20. Section H 301.1 is hereby amended to read as follows:

H 301.1 General.

. . .

(3) No excavation for a leach line or leach bed shall be located within 5 feet (1524 mm) of ~~the~~groundwater ~~table~~ nor to a depth where sewage ~~is capable of contaminating~~may contaminate the underground water stratum ~~that is useable for domestic purposes~~.

Exception: ~~In areas where the records or data indicate that the groundwaters are grossly degraded, the 5 foot (1524 mm) separation requirement shall be permitted to be reduced by the Authority Having Jurisdiction~~When approved by the Authority Having Jurisdiction, this distance may be reduced to 5 feet (1524 mm) from ocean water. The applicant shall supply evidence of groundwater depth to the satisfaction of the Authority Having Jurisdiction.

(4) The minimum effective absorption area in any seepage pit shall be calculated as the excavated sidewall area below the inlet exclusive of any hardpan, rock, clay, or other impervious formations. The minimum required area of porous formation shall be provided in one or more seepage pits. No excavation shall extend within 10 feet (3048 mm) of ~~the~~groundwater ~~table~~ nor to a depth where sewage ~~is capable of contaminating~~may contaminate the underground water stratum ~~that is useable for domestic purposes~~.

Exception: ~~In areas where the records or data indicate that the groundwaters are grossly degraded, the 10 foot (3048 mm) separation requirement shall be permitted to be reduced by the Authority Having Jurisdiction~~When approved by the Authority Having Jurisdiction, this distance may be reduced to 5 feet (1524 mm) from ocean water.

. . .

SECTION 21. Section H 401.3 is hereby amended to read as follows:

H 401.3 Absorption Rates. Where a percolation test is required, the proposed system shall have the capability to absorb a quantity of clear water in a 24-hour period equal to at least five times the liquid capacity of the proposed septic tank. ~~n~~No private disposal system shall be permitted to serve a building if that test shows the absorption capacity of the soil is less than 0.83 gallons per square foot (gal/ft^2) (33.8 L/m^2) or more than 5.12 gal/ft^2 (208.6 L/m^2) of leaching area per 24 hours. Where the percolation test shows an absorption rate greater than 5.12 gal/ft^2 (208.6 L/m^2) per 24 hours, a private disposal system shall be permitted where the site does not

overlie groundwaters protected for drinking water supplies, a minimum thickness of 2 feet (610 mm) of the native soil below the entire proposed system is replaced by loamy sand, and the system design is based on percolation tests made in the loamy sand.

SECTION 22. Section H 601.5 is hereby amended to read as follows:

H 601.5 Distribution Boxes. Where two or more drain lines are installed, an approved distribution box of sufficient size to receive lateral lines shall be installed at the head of each disposal field. The inverts of outlets shall be level, and the invert of the inlet shall be not less than 1 inch (25.4 mm) above the outlets. Distribution boxes shall be designed to ensure equal flow and shall be installed on a level concrete slab in natural or compacted soil. Distribution boxes shall be coated on the inside with a bituminous coating or other approved method acceptable to the Authority Having Jurisdiction.

SECTION 23. Section H 601.8 is hereby amended to read as follows:

H 601.8 Dosing Tanks. ~~Where the quantity of sewage exceeds the amount that is permitted to be disposed in 500 lineal feet (152.4 m) of leach line, a dosing tank shall be used. Dosing tanks shall be equipped with an automatic siphon or pump that discharges the tank once every 3 or 4 hours. The tank shall have a capacity equal to 60 to 75 percent of the interior capacity of the pipe to be dosed at one time. Where the total length of pipe exceeds 1000 lineal feet (305 m), the dosing tank shall be provided with two siphons or pumps dosing alternately and each serving one-half of the leach field~~Automatic syphon or dosing tanks shall be installed when required or as permitted by the Authority Having Jurisdiction.

SECTION 24. Section H 701.2 is hereby amended to read as follows:

H 701.2 Multiple Installations. Multiple seepage pit installations shall be served through an approved distribution box or be connected in series ~~using watertight connection laid on undisturbed or compacted soil. The outlet from the pit shall have~~. When connected in series, the effluent shall leave each pit through an approved vented leg fitting extending not less than 12 inches (305 mm) ~~below the inlet fitting~~downward into such existing pit and having its outlet flow line at least 6 inches below the inlet. All pipe between pits shall be laid with approved watertight joints.

SECTION 25. Section H 1001.1 is hereby amended to read as follows:

H 1001.1 Inspection. Inspection requirements shall comply with the following:

(1) Applicable provisions of Section ~~105.0~~104.0 of this ~~c~~Code and this ~~a~~Appendix shall be required. Plans shall be required in accordance with Section ~~103.3~~102.1 of this ~~c~~Code.

. . .

(5) Disposal fields and seepage pits shall not be installed in uncompacted fill.

SECTION 26. Section H 1101.6 is hereby added to read as follows:

H 1101.6 Excavation. No excavation for an abandoned sewer or sewage facility shall be left unattended at any time, unless the permittee shall have first provided a suitable and adequate barricade to assure public safety.

SECTION 27. Appendix M is hereby removed as follows:

~~APPENDIX M~~

~~SWIMMING POOLS~~

~~**M 1.0** Swimming pool waste water shall be disposed of as hereinafter set forth in this Section and the type of disposal proposed shall be approved by the Authority Having Jurisdiction prior to the commencement of any work. A means of disposal of the total contents of the pool (periodic emptying) without surface runoff shall be established to the satisfaction of the Authority Having Jurisdiction.~~

~~**M 2.0** The following are legal methods of swimming pool waste water disposal.~~

~~**(1)** To a public sewer.~~

~~**(2)** On the property if the property is large enough to ensure that runoff will not encroach on abutting property.~~

~~**(3)** To a tank truck.~~

~~**(4)** In the case where none of the above can be accomplished, alternate methods of disposal acceptable to the State Regional Water Quality Control Board (SRWQCB) may be used. Prior to discharge, the swimming pool water must be tested by the owner to insure that it is within all water quality standards established by the SRWQCB. Contact Department of Public Works, Environmental Programs Division for information.~~

~~**M 3.0** No direct connection shall be made between any storm drain, sewer, drainage system, drywell or subsoil irrigation line and any line connected to a swimming pool.~~

M 4.0 Waste water from any filter, scum gutter overflow, pool emptying line or similar apparatus or appurtenance when discharging to any part of a drainage system, shall be provided with a three (3) inch (76.2 mm) trap.

M 5.0 Except as provided in Section M 6, the discharge outlet terminal from any pool or filter shall be protected from backflow by an air gap at least six (6) inches (152.4 mm) above the flood rim of the receptor.

M 6.0 No scum gutter drain, overflow drain, backwash discharge drain, or pool emptying line shall enter any receptor below the rim unless the pool piping at its deepest point, the bottom of the filters, and the bottom of the scum gutter drain trough or overflow inlets are at least six (6) inches (152.4 mm) above the overflow rim of the receptor.

M 7.0 A positive point of potable water supply to each swimming pool shall be established and shall be installed as required by Chapter 6 of this Code.

M 8.0 Plans for other than private swimming pools shall be approved by the Health Officer before any water supply or waste discharge permit is issued.

Note: The forgoing applies only to outdoor swimming, bathing, or wading pools. Plans and specifications for all indoor installations shall be submitted to the Authority Having Jurisdiction for approval prior to the commencement of any work, and all piping, equipment and construction shall be equal to the types prescribed in the Installation Requirements of this Code for indoor work.

M 9.0 All new swimming pools constructed or installed in Fire Zone 4 or in a Very High Fire Hazard Severity Zone and having a capacity of 5000 gallons or more shall

~~have a minimum four (4) inch diameter drain and discharge line connected to a draft hydrant, the type, location, and installation of which shall be approved by the chief of the fire department. Materials used for the discharge line shall be as approved in this Code for potable water systems except that brass, cast iron, galvanized wrought iron, and copper shall not be used. If PVC is used, it shall be a minimum of Schedule 40.~~

~~**Exception:** Swimming pools constructed or installed with the bottom of the pool more than 15 feet below the proposed draft hydrant connection elevation, measured vertically, need not be provided with a draft hydrant system.~~

~~To identify that pool draft system, an appropriate sign (as designated by the fire department) including the location of the swimming pool shall be posted on the pool safety fence and/or at the draft hydrant location.~~

~~**M 10.0** For one- and two-family dwellings, any new permanently installed outdoor in-ground swimming pool or spa shall be equipped with an automatic cover. For irregular-shaped pools where it is infeasible to cover 100 percent of the pool due to its irregular shape, the largest possible area of the pool (minimum 80 percent) shall be covered. For additions and alterations, non-automatic covers shall be accepted.~~

SECTION 28. Appendix P is hereby added as follows:

APPENDIX P

SWIMMING POOLS

P 1.0 Swimming pool waste water shall be disposed of as hereinafter set forth in this Section and the type of disposal proposed shall be approved by the Authority

Having Jurisdiction prior to the commencement of any work. A means of disposal of the total contents of the pool (periodic emptying) without surface runoff shall be established to the satisfaction of the Authority Having Jurisdiction.

P 2.0 The following are legal methods of swimming pool waste water disposal.

(1) To a public sewer.

(2) On the property if the property is large enough to ensure that runoff will not encroach on abutting property.

(3) To a tank truck.

(4) In the case where none of the above can be accomplished, alternate methods of disposal acceptable to the State Regional Water Quality Control Board (SRWQCB) may be used. Prior to discharge, the swimming pool water must be tested by the owner to insure that it is within all water quality standards established by the SRWQCB. Contact Department of Public Works, Environmental Programs Division for information.

P 3.0 No direct connection shall be made between any storm drain, sewer, drainage system, drywell or subsoil irrigation line and any line connected to a swimming pool.

P 4.0 Waste water from any filter, scum gutter overflow, pool emptying line or similar apparatus or appurtenance when discharging to any part of a drainage system, shall be provided with a three (3) inch (76.2 mm) trap.

P 5.0 Except as provided in Section P 6, the discharge outlet terminal from any pool or filter shall be protected from backflow by an air gap at least six (6) inches (152.4 mm) above the flood rim of the receptor.

P 6.0 No scum gutter drain, overflow drain, backwash discharge drain, or pool emptying line shall enter any receptor below the rim unless the pool piping at its deepest point, the bottom of the filters, and the bottom of the scum gutter drain trough or overflow inlets are at least six (6) inches (152.4 mm) above the overflow rim of the receptor.

P 7.0 A positive point of potable water supply to each swimming pool shall be established and shall be installed as required by Chapter 6 of this Code.

P 8.0 Plans for other than private swimming pools shall be approved by the Health Officer before any water supply or waste discharge permit is issued.

Note: The forgoing applies only to outdoor swimming, bathing, or wading pools. Plans and specifications for all indoor installations shall be submitted to the Authority Having Jurisdiction for approval prior to the commencement of any work, and all piping, equipment and construction shall be equal to the types prescribed in the Installation Requirements of this Code for indoor work.

P 9.0 All new swimming pools constructed or installed in Fire Zone 4 or in a Very High Fire Hazard Severity Zone and having a capacity of 5000 gallons or more shall have a minimum four (4) inch diameter drain and discharge line connected to a draft hydrant, the type, location, and installation of which shall be approved by the chief of the fire department. Materials used for the discharge line shall be as approved in this Code

for potable water systems except that brass, cast iron, galvanized wrought iron, and copper shall not be used. If PVC is used, it shall be a minimum of Schedule 40.

Exception: Swimming pools constructed or installed with the bottom of the pool more than 15 feet below the proposed draft hydrant connection elevation, measured vertically, need not be provided with a draft hydrant system.

To identify that pool draft system, an appropriate sign (as designated by the fire department) including the location of the swimming pool shall be posted on the pool safety fence and/or at the draft hydrant location.

P 10.0 For one- and two-family dwellings, any new permanently installed outdoor in-ground swimming pool or spa shall be equipped with an automatic cover. For irregular-shaped pools where it is infeasible to cover 100 percent of the pool due to its irregular shape, the largest possible area of the pool (minimum 80 percent) shall be covered. For additions and alterations, non-automatic covers shall be accepted.

SECTION 28. Appendix S is hereby added to read as follows:

APPENDIX S

SOLAR THERMAL ENERGY SYSTEMS

S 1.0 General.

In addition to the requirements of this Appendix, the provisions of this Code and Title 29 – Mechanical Code – of the Los Angeles County Code shall apply to the erection, installation, alteration, relocation, replacement, addition to, use, maintenance and repair of solar thermal energy systems, including, but not limited to, equipment and appliances intended to utilize solar thermal energy for water heating and swimming pool heating.

S 2.0 Definitions.

For the purpose of this Appendix, certain terms, words, phrases, and their derivatives shall be construed as set forth in this Section. Whenever terms are not defined, their ordinary dictionary meaning shall apply.

Absorber. That part of the solar collector that receives the incident radiation energy.

Absorptance. The collecting of heat, measured as percent of total radiation available.

Ambient Temperature. Surrounding temperature.

Anchors. See Supports.

Antifreeze. An additive used in water-based heat transfer fluids to decrease the freezing temperature of the fluids and protect hydronic systems from freezing.

Appliance. A device that utilizes an energy source to produce light, heat, power, refrigeration, or air conditioning. This definition also includes electric storage or tankless water heaters.

Area, Absorber. The total projected heat transfer area from which the absorbed solar irradiation heats the transfer media.

Area, Aperture. The maximum projected area of a solar collector through which the unconcentrated solar radiant energy is admitted.

Automatic. That which provides a function without the necessity of human intervention.

Auxiliary Heating System. Equipment using non-solar energy sources to supplement or back up the output provided by a solar thermal energy system.

Closed Loop System. A system where the fluid is enclosed in a piping system that is not vented to the atmosphere.

Collector. See Solar Collector.

Collector System. That section of the solar collector system that includes the collector and piping or ducts from the collector to the storage system.

Combustible Liquid. A liquid having a flash point at or above 100°F (38°C). Combustible liquids shall be divided into the following classifications:

(1) Class II liquids having a flash point above 100°F (38°C) and below 140°F (60°C).

(2) Class IIIA liquids having a flash point at or above 140°F (60°C) and below 200°F (93°C).

(3) Class IIIB liquids having a flash point at or above 200°F (93°C).

The classifications of combustible liquids do not include compressed gases or cryogenic fluids.

Concentrating Solar Collector. A solar collector that uses reflectors, lenses, or other optical elements to concentrate the radiant energy passing through the aperture onto an absorber of which the surface area is smaller than the aperture area.

Corrosion. The gradual degradation and destruction of metals and other natural and synthetic materials typically resulting from and/or electrochemical reactions with their environment including, but not limited to, weathering, dissolution, and direct photochemical attach.

Cover, Collector (Glazing). The material covering the aperture to provide thermal and environmental protection.

Design Pressure. The maximum allowable pressure for which a specific part of a system is designed.

Design Temperature. The maximum allowable continuous or intermittent temperature for which a specific part of a solar energy system is designed to operate safely and reliably.

Distribution System. That section of the solar energy system from the storage system to the point of use.

Drainback System. A closed loop system which allows gravity draining of the heat transfer fluid into lower portions of the solar loop under prescribed circumstances.

Draindown (Drainback). An active solar energy system in which the fluid in the solar collector is drained from the solar energy system under prescribed circumstances.

Energy Collector Fluid. That fluid used to transfer energy from the collector to the storage system or point of use.

Energy Storage Fluid (or Media). That fluid (or media) used in the storage container for storing collected energy.

Energy Transfer Fluid. That fluid used within a closed system either from the collector to the storage system or from the storage system to the point of use.

Essentially Nontoxic Transfer Fluid. Fluid generally recognized as safe by the Food and Drug Administration (FDA) as food grade.

External Auxiliary Heating. Auxiliary heating device located outside the storage. The heat is transferred to the storage by direct or indirect charging via a charge loop.

Flammable Liquid. Any liquid that has a flash point below 100°F (38°C), and has a vapor pressure not exceeding 40 psi (276 kPa) at 100°F (38°C). Flammable liquids shall be known as Class I liquids and shall be divided into the following classifications:

(1) Class IA liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

(2) Class IB liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

(3) Class IC liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

Flash Point. The minimum temperature corrected to a pressure of 14.7 psi (101 kPa) at which a test flame causes the vapors of a portion of the sample to ignite under the conditions specified by the test procedures and apparatus. The flash point of a liquid shall be determined in accordance with ASTM D 56, ASTM D 93, or ASTM D 3278.

Freeze Protection. Any method for protecting solar thermal systems from damage due to freezing conditions where installed in locations where freezing ambient temperature conditions exist.

Freeze Protection, Fail-Safe. A freeze-protection method that does not rely on the activation or continued operation of any mechanical or electrical component.

Heat Exchanger. A device that transfers heat from one medium to another.

Heat Transfer Medium. The medium used to transfer energy from the solar collectors to the thermal storage or load.

Immersed Heat Exchanger. Heat exchanger, which is completely surrounded with the fluid in the storage tank.

Instantaneous Efficiency. The amount of energy removed by the transfer fluid per gross collector area, during a specified time period, divided by the total solar radiation incident on the collector per unit area during the same test period, under steady state or quasi-steady state.

Integral Collector Storage. A solar thermal heating system that uses a solar collector that has all or most of its heat transfer medium inside the collector.

Langelier Saturation Index. A formula used to measure water balance or mineral saturation control of pool, spa, or hot tub water. Total alkalinity, calcium hardness, pH, water temperature, and total dissolved solids are measured, given a factor, and calculated to determine whether water has a tendency to be corrosive or scale forming.

Open Loop System. A system where the fluid is enclosed in a piping system that is vented to the atmosphere.

Out-Gassing. As applied to thermal energy, the thermal process by which materials expel gas.

Passive Solar Systems. As used in these requirements, are solar energy systems that utilize elements of a building, without augmentation by mechanical components such as blowers or pumps, to provide for the collections, storage, or distribution of solar energy for heating, cooling, or both.

Rock Storage. A bin, basement, or other container filled with rock to act as an energy reservoir for a solar energy system.

Solar Collector. A device used to absorb energy from the sun.

Solar Energy System. A configuration of equipment and components to collect, convey, store, and convert the sun's energy for a purpose.

Solar Energy System Components. Any appliance, assembly, device, equipment, or piping used in the conversion of solar energy into thermal energy for

service water heating, pool water heating, space heating and cooling, and electrical service.

Solar Thermal Energy System. See Solar Thermal System.

Solar Thermal System. A complete assembly of subsystems which convert solar energy into thermal energy and utilize this energy for service water heating, pool water heating, space heating and cooling purposes.

Storage Temperature. Temperature of the storage medium.

Thermal Energy. The amount of sensible heat energy stored within a material or fluid. The product of the mass, specific thermal capacity, and temperature increase/decrease of the material or fluid. Also known as sensible heat energy.

Thermal Storage. A tank or vessel used in a solar thermal, hydronic, or geothermal system, in which thermal energy is stored.

Thermosiphon. The natural circulation of fluids due to temperature differential.

Total Alkalinity. The sum of all alkaline minerals in the water that is primarily in bicarbonate form, but also as sodium, calcium, magnesium, potassium carbonates, and hydroxides. It is a measure of the water's ability to resist changes in pH.

S 3.0 Permits Required.

It shall be unlawful for a person, firm, or corporation to construct, install, alter, repair, replace, or remodel a solar thermal energy system regulated by this Code or cause the same to be done without first obtaining a separate permit for each separate system or interconnected set of systems as specified in Section 103.0 of this Code.

S 4.0 Plans and Specifications.

Plans, engineering calculations, diagrams, and other data shall be submitted in one or more sets with each application for a permit. Where required by the Authority Having Jurisdiction, the plans, computations, diagrams, specifications, and other data shall be prepared by, and the solar thermal energy system designed by, an engineer, an architect, or both, who shall be licensed by the state to practice as such.

Exception: The submission of plans, calculations, or other data may be waived where the Authority Having Jurisdiction determines that the nature of the work applied for is such that reviewing of plans is not necessary to obtain compliance within the Code.

S 5.0 Installation.

S 5.1 Listed Appliances. Except as otherwise provided in this Code, the installation of appliances regulated by this Code shall be in accordance with the conditions of the listing. The appliance installer shall leave the manufacturer's installation and operating instructions attached to the appliance. Clearances of listed appliances from combustible materials shall be as specified in the listing or on the rating plate.

S 5.2 Standards. Standards listed or referred to in this Appendix or other provisions of this Code cover materials that will conform to the requirements of this Code, where used in accordance with the limitations prescribed in this Code and their listing. Where a standard covers materials of various grades, weights, quality, or configurations, the portion of the listed standard that is applicable shall be used. Design and materials for special conditions or materials not provided for herein may be

permitted as authorized by Section 301.3. A list of standards that appear in specific sections of this Appendix are referenced in Table S 18.1. A list of additional standards, publications, practices, and guides that are not referenced in specific sections of this Appendix appear in Table S 18.2. The documents indicated in Table S 18.2 shall be permitted in accordance with Section 301.3.

S 6.0 Inspection and Testing.

S 6.1 General. Solar thermal energy systems for which a permit is required by this Code shall be inspected by the Authority Having Jurisdiction. No solar thermal energy system or portion thereof shall be covered, concealed, or put into use until it first has been tested, inspected, and approved as prescribed in this Code. Neither the Authority Having Jurisdiction nor the jurisdiction shall be liable for expense entailed in the removal or replacement of material required to permit inspection. Solar thermal energy systems regulated by this Code shall not be connected to the water, the energy fuel supply, or the sewer system until authorized by the Authority Having Jurisdiction. Installation of a solar thermal energy system shall comply with other parts of this Code, including Section 104.0.

S 6.2 Required Inspection. New solar thermal energy system work and such portions of existing systems as affected by new work, or changes, shall be inspected by the Authority Having Jurisdiction to ensure compliance with the requirements of this Code and to ensure that the installation and construction of the solar thermal energy system is in accordance with approved plans. The Authority Having Jurisdiction shall make the following inspections and other such inspections as

necessary. The permittee or the permittee's authorized agent shall be responsible for the scheduling of such inspections as follows:

(1) Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place.

(2) Rough-in inspection shall be made prior to the installation of wall or ceiling membranes.

(3) Final inspection shall be made upon completion of the installation.

S 6.3 Testing. Solar thermal energy systems shall be tested and approved as required by this Code or the Authority Having Jurisdiction.

S 6.3.1 Piping. The piping of the solar thermal system shall be tested with water, air, a heat transfer medium, or as recommended by the manufacturer's instructions, except that plastic pipe shall not be tested with air. The Authority Having Jurisdiction shall be permitted to require the removal of plugs, etc., to ascertain where the pressure has reached all parts of the system.

S 6.3.2 System Requirements. Prior to the installation of insulation and startup, a solar thermal system, including piping, collectors, heat exchangers, and other related equipment, shall be tested and proved airtight.

S 6.3.2.1 Direct (Open Loop) Systems. Direct (open loop) systems shall be tested under a water pressure not less than one and one-half times the maximum design operating pressure or 150 pounds force per square inch (psi) (1034 kPa), whichever is more. Systems shall withstand the test without leaking for a period of not less than 15 minutes.

S 6.3.2.2 Indirect (Closed Loop) Systems. Indirect (closed loop) systems shall be hydrostatically tested at one and one-half times the maximum designed operating pressure in accordance with the manufacturer's installation instructions. Systems shall withstand the test without leaking for a period of not less than 15 minutes.

S 6.3.3 Test Pressure for Storage Tanks. The test pressure for storage tanks that are subject to water pressure from utility mains (with or without a pressure reducing valve) shall be two times the working pressure but not less than 300 psi (2068 kPa).

S 6.3.3.1 Pressure Type. Pressure-type storage tanks exceeding 15 psi (103 kPa) shall be tested in accordance with ASME BPVC Section VIII. Pressure-type storage tanks not exceeding 15 psi (103 kPa) shall be hydrostatically tested at one and one-half times the maximum design operating pressure.

S 6.3.3.2 Atmospheric-Type. Atmospheric-type thermal storage tanks shall be tested by filling with water for a period of 24 hours prior to inspection and shall withstand the test without leaking. No thermal storage tank or portion thereof shall be covered or concealed prior to approval.

S 6.3.4 Connection to Service Utilities. No person shall make connections from a source of energy or fuel to a solar thermal energy system or equipment regulated by this Code and for which a permit is required until approved by the Authority Having Jurisdiction. No person shall make connection from a water-supply line nor shall they connect to a sewer system regulated by this Code and for which a permit is required until approved by the Authority Having Jurisdiction. The Authority

Having Jurisdiction shall be permitted to authorize temporary connection of the solar thermal energy system equipment to the source of energy or fuel for the purpose of testing the equipment.

S 7.0 Water Heating Systems.

S 7.1 Solar Water Heating System. Solar water heating systems shall be in accordance with IAPMO S1001.1 or ICC 900/SRCC 300. Where solar collectors are capable of being isolated from the remainder of the system, a suitable pressure relief valve shall be installed in the isolatable section.

S 7.2 Auxiliary Heating System. An auxiliary heating system shall be installed in conjunction with the solar thermal system and shall be adequate to provide service in the absence of solar thermal energy input. An auxiliary heating system that utilizes electricity as the energy source shall be in accordance with Section S 15.0. Auxiliary heating systems that utilize solid fuel or fuel gas as the energy source shall be in accordance with Title 29 – Mechanical Code – of the Los Angeles County Code.

S 8.0 Abandonment.

S 8.1 General. An abandoned solar thermal energy system or part thereof shall be disconnected from remaining systems, drained, plugged, and capped in a manner satisfactory to the Authority Having Jurisdiction.

S 8.2 Storage Tank. An underground water storage tank that has been abandoned or discontinued otherwise from use in a solar thermal energy system shall be completely drained and filled with earth, sand, gravel, concrete, or other approved material or removed in a manner satisfactory to the Authority Having Jurisdiction.

S 9.0 Tanks.

S 9.1 Storage Tanks.

S 9.1.1 Plans. Plans for tanks shall be submitted to the Authority Having Jurisdiction for approval, unless listed by an approved listing agency. Such plans shall show dimensions, reinforcing, structural calculations, and such other pertinent data as required by the Authority Having Jurisdiction.

S 9.1.2 Atmospheric Tanks. Atmospheric storage tanks shall be vented to the atmosphere and installed in accordance with the manufacturer's installation instructions.

S 9.1.2.1 Overflow. Gravity tanks shall be installed with an overflow opening of not less than 2 inches in diameter. The openings shall be above ground and installed with a screened return bend.

S 9.1.2.2 Makeup Water. Makeup water from a potable water system to an atmospheric tank shall be protected by an air gap.

S 9.1.2.3 Draining. An overflow shall be provided for an atmospheric tank. The overflow shall be provided with a means of drainage in accordance with Section 303.0 of this Code. The overflow for an atmospheric tank containing nonpotable water shall be emptied into an approved container.

S 9.1.3 Prefabricated Storage Tanks. Prefabricated tanks shall be listed by an approved agency and labeled.

S 9.1.4 Pressure Vessels. A pressure-type storage tank exceeding an operating pressure of 15 psi (103kPa) shall be constructed in accordance with ASME

BPVC Section VIII.1. Fiber-reinforced plastic storage tanks shall be constructed in accordance with ASME BPVC Section X.

S 9.1.5 Devices. Devices attached to or within a tank shall be accessible for repair and replacement.

S 9.1.5.1 Safety Devices. Pressure-type thermal storage tanks shall be installed with a listed combination temperature and pressure relief valve in accordance with Section S 14.3.1. The temperature setting shall not exceed 210°F (99°C) and the pressure setting shall not exceed 150 percent of the maximum designed operating pressure of the system, or 150 percent of the established normal operating pressure of the piping materials, or the labeled maximum operating pressure of a pressure-type storage tank, whichever is less. The pressure and temperature setting shall not exceed the pressure and temperature rating of the tank or as recommended by the tank manufacturer.

Storage tanks and bottom fed tanks connected to a water heater shall be designed to withstand vacuum induced pressure, or shall be provided with a vacuum relief in accordance with Section S 14.3.4. The vacuum relief valve shall be installed at the top of the tank and shall have an operating pressure not to exceed 200 psi (1379 kPa) and a temperature rating not to exceed 250°F (121°C). The size of such vacuum relief valves shall have a minimum rated capacity for the equipment served. This Section shall not apply to pressurized captive air diaphragm or bladder tanks.

S 9.1.6 Separate Storage Tanks. For installations with separate storage tanks, a pressure relief valve and temperature relief valve or combination thereof shall be installed on both the main storage tank and auxiliary tank.

S 9.1.6.1 Isolation Valves. Storage tanks shall be provided with isolation valves for servicing.

S 9.1.7 Underground Storage Tanks. Tanks shall be permitted to be buried underground where designed and constructed for such installation.

S 9.1.8 Tank Covers. Tank covers shall be structurally designed to withstand anticipated loads and pressures in accordance with the manufacturer's instructions.

S 9.1.9 Drainage Pan. Where water heater, boiler, or other thermal storage tank is installed in an attic, attic-ceiling assembly, floor-ceiling assembly, or floor subfloor assembly where damage could result from a leaking water heater, boiler or tank, a watertight pan of corrosion-resistant materials shall be installed beneath the water heater, boiler, or tank, with not less than 3/4 of an inch (20 mm) diameter drain to an approved location. Such pan shall be not less than 1 ½ inches (38mm) in depth.

S 9.1.10 Storage Tank Construction and Materials.

S 9.1.10.1 Construction. Storage tanks shall be constructed of durable materials not subject to excessive corrosion or decay and shall be watertight. Each such tank shall be structurally designed to withstand anticipated loads and pressures and shall be installed level and on a solid bed.

S 9.1.10.2 Concrete. The walls and floor of each poured-in-place, concrete tank shall be monolithic. The exterior walls shall be double-formed so as to provide exposure of the exterior walls during the required water test. The compressive strength of a concrete tank wall, top and covers, or floor shall be not less than 2500 pounds-force per square inch (psi) (lb/in^2) (1.7236 E+04, kPa). Where required by the Authority Having Jurisdiction, the concrete shall be sulfate resistant (Type V Portland Cement).

S 9.1.10.3 Metal Tanks. Metal tanks shall be welded, riveted and caulked, brazed, bolted, or constructed using a combination of these methods.

S 9.1.10.4 Filler Metal. Filler metal used in brazing shall be non-ferrous metal or an alloy having a melting point above 1000°F (538°C) and below that of the metal joined.

S 9.1.10.5 Insulation. Tank insulation shall have a thermal resistance not less than as shown in Table S 9.1.10.5. The temperature difference shall be calculated as the difference between the design operating temperature of the tank and the temperature of the surrounding air, or soil where the tank is installed underground. Where such data is not available, a temperature difference of 50°F (28°C) shall be used.

TABLE S 9.1.10.5

TEMPERATURE DIFFERENCE(°F)	THERMAL RESISTANCE (*R*)[°F•h•ft² /(Btu)]
50	6
100	12
150	18

200	24
250	30

For SI units: °C = °F(0.5555556), 1 degree Fahrenheit hour square foot per British thermal unit = [0.176 (m2•K)/W], 1 British thermal unit inch per degree Fahrenheit hour square feet = 0.1441 W/(m•K)* Based on thermal conductivity (*k*) of 0.20 [(Btu•inch)/(°F•h•ft^2)] (0.03 W/(m•K)

S 9.2 Expansion Tanks.

S 9.2.1 Where Required. An expansion tank shall be installed in a solar thermal energy system as a means for controlling increased pressure caused by thermal expansion. Expansion tanks shall be of the closed type and securely fastened to the structure. Tanks shall be rated for the pressure of the system. Supports shall be capable of carrying twice the weight of the tank filled with water without placing strain on the connecting piping.

Solar thermal energy systems incorporating hot water tanks or fluid relief columns shall be installed to prevent freezing under normal operating conditions.

Exception: An engineered fluid expansion storage system shall be permitted to incorporate fluid storage in vessels open to the atmosphere. Storage tanks and components for such systems shall be constructed of non-corrosive materials, or the system fluid shall be treated to inhibit corrosion. [See Figure S 9.2.1(2) for an example of an engineered fluid expansion storage system which incorporates fluid storage in a vessel open to the atmosphere.]

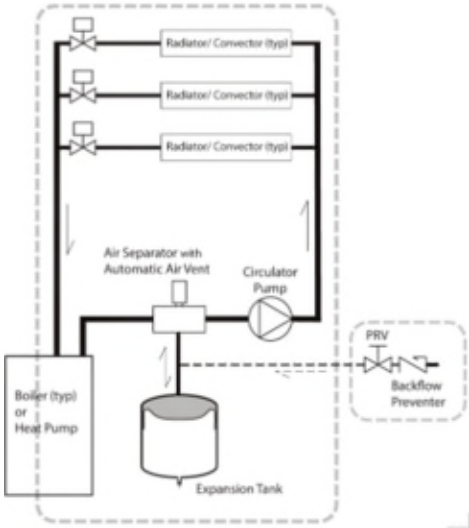

FIGURE S 9.2.1(1)[1,2]
EXAMPLE OF A CLOSED-LOOP SYSTEM WITH DIAPHRAGM TYPE EXPANSION TANK (SIMPLIFIED SCHEMATIC)
Notes:
1 This schematic does not include all system components, and configurations may vary based on design.
2 A makeup supply may be provided using any type of fluid source. The makeup supply is not considered part of the closed-loop.

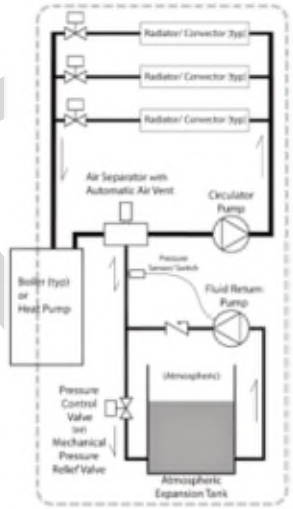

FIGURE S 9.2.1(2)[1,2]
EXAMPLE OF AN ENGINEERED FLUID EXPANSION STORAGE SYSTEM (ATMOSPHERIC) (SIMPLIFIED SCHEMATIC)
Notes:
1 This schematic does not include all system components, and configurations may vary based on design.
2 The atmospheric expansion tank accommodates thermal expansion and, or contraction of the system fluid.

S 9.2.2 Closed-Type Solar Thermal Energy Systems. Closed-type systems shall have an airtight tank or other approved air cushion that will be consistent with the volume and capacity of the system, and shall be designed for a hydrostatic test pressure of two and one-half times the allowable working pressure of the system. Expansion tanks for systems designed to operate at more than 30 pounds-force per square inch (psi) (207 kPa) shall comply with ASME BPVC Section VIII.1. Provisions shall be made for draining the tank without emptying the system.

S 9.2.3 Minimum Capacity of Closed-Type Expansion Tanks. The minimum capacity for a gravity-type hot water system expansion tank shall be in accordance with Table S 9.2.3(1). The minimum capacity for a forced-type hot water system expansion tank shall be in accordance with Table S 9.2.3(2) or Equation S 9.2.3(1). The minimum capacity for diaphragm tanks shall be in accordance with Table S 9.2.3(2) or Equation S 9.2.3(2).

Equation S 9.2.3(1)

$$Vt(\text{forced type}) = \frac{(C_1 t - C_2)V_s}{\left(\frac{P_a}{P_f} - \frac{P_a}{P_o}\right)}$$

Equation S 9.2.3(2)

$$Vt(\text{diaphram}) = \frac{(C_1 t - C_2)V_s}{\left(1 - \frac{P_f}{P_o}\right)}$$

Where:
C_1 = 0.00041
C_2 = 0.0466
Vt = Minimum volume of expansion tank, gallons (L)
Vs = Volume of system, not including expansion tank, gallons (L)

t = Average operating temperature, °F (°C).
Pa = Atmospheric pressure, pounds per square inch (kPa)
Pf = Fill pressure, pounds per square inch (kPa)
Po = Maximum operating pressure, pounds per square inch (kPa)
For SI units: C_1 = 0.000738, C_2 = 0.03348, 1 gallon = 3.785 L, °C = (°F-32)/1.8, 1 pound per square inch = 6.8947 kPa

TABLE S 9.2.3(1)
EXPANSION TANK CAPACITIES FOR GRAVITY HOT WATER SYSTEMS[1]

INSTALLED EQUIVALENT DIRECT RADIATION[2] (square feet)	TANK CAPACITY (gallons)
Up to 350	18
Up to 450	21
Up to 650	24
Up to 900	30
Up to 1100	35
Up to 1400	40
Up to 1600	2 to 30
Up to 1800	2 to 30
Up to 2000	2 to 35
Up to 2400	2 to 40

For SI units: 1 gallon = 3.785 L, 1 square foot = 0.0929 m^2

Notes:

1 Based on a two-pipe system with an average operating water temperature of 170°F (77°C), using cast-iron column radiation with a heat emission rate of 150 British thermal units per square foot hour [Btu/(ft^2•h)] (473 W/m^2) equivalent direct radiation.

2 For systems exceeding 2400 square feet (222.9 m^2) of installed equivalent direct water radiation, the required capacity of the cushion tank shall be increased on the basis of 1 gallon (4 L) tank capacity per 33 square feet (3.1 m^2) of additional equivalent direct radiation.

TABLE S 9.2.3(2)
EXPANSION TANK CAPACITIES FOR FORCED WATER SYSTEMS[1]

SYSTEM VOLUME[2] (gallons)	TANK CAPACITY DIAPHRAGM TYPE (gallons)	TANK CAPACITY (gallons)
100	9	15
200	17	30
300	25	45
400	33	60
500	42	75
1000	83	150
2000	165	300

For SI units: 1 gallon = 3.785 L

Notes:

1 Based on an average operating water temperature of 195°F (91°C), a fill pressure of 12 psig (83 kPa), and an operating pressure of not more than 30 psig (207 kPa).

2 Includes volume of water in boiler, radiation, and piping, not including expansion tank.

S 10.0 Solar Collectors.

S 10.1 General. Frames and braces exposed to the weather shall be constructed of materials for exterior locations, and protected from corrosion or deterioration, in accordance with the requirements of the Authority Having Jurisdiction.

S 10.1.1 Construction. Collectors shall be designed and constructed to prevent interior condensation, out-gassing, or other processes that will reduce the transmission properties of the glazing, reduce the efficiency of the insulation, or otherwise adversely affect the performance of the collector.

S 10.1.2 Flat Plate Collector Glass. Flat plate collector glass shall be tempered.

S 10.1.3 Plastic. Plastic used in collector and other parts of the solar thermal energy system construction shall be installed in accordance with the manufacturer's installation instructions.

S 10.1.4 Listing. Collectors that are manufactured as a complete component shall be listed or labeled by an approved listing agency in accordance with ICC 901/SRCC 100, UL 1279, or equivalent standard.

S 10.1.5 Air Collectors. Materials exposed within air collectors shall be noncombustible or shall have a flame spread index not to exceed 25 and a smoke developed index not to exceed 50 where tested as a composite product in accordance with ASTM E 84 or UL 723.

S 10.1.5.1 Testing. Materials used within an air collector shall not smoke, smolder, glow, or flame where tested in accordance with ASTM C 411 at temperatures exposed to in service. In no case shall the test temperature be less than 250°F (121°C).

S 10.2 Solar Collector Installation.

S 10.2.1 General. Solar collectors shall be ballasted or anchored to roof structures or other surfaces in accordance with the manufacturer's installation instructions and Title 26 – Building Code – of Los Angeles County. Collectors shall be mounted to minimize the accumulation of debris. Connecting pipes shall not be used to provide support for a solar collector.

S 10.2.2 Roof Installations. Anchors secured to and through a roofing material shall be made to maintain the water integrity of the roof covering. Roof

drainage shall not be impaired by the installation of collectors. Solar collectors that are not an integral part of the roofing system shall be installed to preserve the integrity of the roof surface.

S 10.2.3 Protection Against Decay. Wood shall not be used in the construction of collector or system mounting.

S 10.2.4 Above Or On The Roof. Collectors located above or on roofs, and functioning as building components, shall not reduce the required fire-resistance and fire-retardance classification of the roof covering materials.

Exceptions:

(1) Collectors located on one- and two-family dwellings.

(2) Collectors located on buildings not exceeding three stories in height or 9,000 square feet (836.13 m^2) total floor area, or both, provided:

(a) The collectors are noncombustible.

(b) Collectors with plastic covers have noncombustible sides and bottoms, and the total area covered and the collector shall not exceed the following:

(i) Plastic CC1 – 33 1/3 percent of the roof area;

(ii) Plastic CC2 – 25 percent of the roof area; and

(c) Collectors with plastic film covers having a thickness of not more than 0.010 of an inch (0.25 mm) shall have noncombustible sides and bottoms, and the total area covered by the collector shall not exceed 33 1/3 percent of the roof area.

S 10.2.5 Ground Installations. Solar collectors shall terminate above finished grade to avoid obstruction by vegetation, snow, or ice. The supporting columns shall extend below the frost line.

S.10.2.6 Wall Mounted. Solar collectors mounted on a wall shall be secured and fastened in accordance with Section 313.0 of this Code.

S 10.2.7 Access. Access shall be provided to collectors and components in an approved manner. A work space adjacent to collectors for maintenance and repair shall be provided in accordance with requirements of the Authority Having Jurisdiction.

S 10.2.8 Stagnation Condition. The collector and other parts of the solar thermal assembly shall be capable of withstanding stagnant conditions in accordance with the manufacturer's instructions where high solar flux and no flow occurs.

S 10.2.9 Waterproofing. Joints between structural supports and buildings or dwellings, including penetrations made by bolts or other means of fastening, shall be made watertight with approved material.

S 10.2.10 Fasteners. Mountings and fasteners shall be made of corrosion-resistant materials. Carbon steel mountings and fasteners shall be classified as noncorrosive in accordance with ASME SA194.

S 10.2.11 Combustible Materials. Solar thermal energy systems constructed with combustible materials shall not be located on or adjacent to construction required to be of noncombustible materials or in Very High Fire Hazard Severity Zone as defined in Title 32 - Fire Code – of the Los Angeles County Code, unless approved by the Authority Having Jurisdiction.

S 10.2.12 Orientation. Collectors shall be located and oriented in accordance with the manufacturer's installation instructions.

S 10.3 Fire Safety Requirements.

S 10.3.1 Building Components. Collectors that function as building components shall be in compliance with Title 26 – Building Code – of the Los Angeles County Code and Title 32 – Fire Code – of the Los Angeles County Code.

S 11.0 Hazardous Heat Transfer Medium for Solar Thermal Energy Systems. Heat-transfer mediums that are hazardous shall not be used in solar thermal energy systems, except where approved by the Authority Having Jurisdiction.

S 11.1 Flash Points. The flash point of a heat-transfer medium shall be 50°F (10°C) or more above the design maximum temperature.

S 11.2 Discharge. The collector, collector manifold, and manifold relief valve shall not discharge directly or indirectly into the building or toward an open flame or other source of ignition.

S 12.0 Heat Exchangers.

S 12.1 General. Solar thermal energy systems utilizing heat exchangers shall protect the potable water system from being contaminated by the heat transfer medium. Systems that incorporate a single-wall heat exchanger to separate potable water from the heat transfer fluid shall meet all of the following requirements:

(1) The heat transfer medium is either potable water or contains fluids recognized as safe by the Food and Drug Administration (FDA) as food grade.

(2) A tag or label shall be securely affixed to the heat source with the word "CAUTION" and the following statements:

(a) The heat transfer medium shall be water or other nontoxic fluid recognized as safe by the FDA.

(b) The maximum operating pressure of the heat exchanger shall not exceed the maximum operating pressure of the potable water supply.

(3) The word "CAUTION" and the statements listed above shall have an uppercase height of not less than 0.120 of an inch (3.048 mm). The vertical spacing between lines of type shall be not less than 0.046 of an inch (1.168 mm). Lowercase letters shall be not less than compatible with the uppercase letter size specification.

Systems that do not comply with the requirements for a single-wall heat exchanger shall install a double-wall heat exchanger. Double-wall heat exchangers shall separate the potable water from the heat transfer medium by providing a space between the two walls vented to the atmosphere.

S 13.0 Valves.

S 13.1 General. Valves shall be rated for the operating temperature and pressures of the solar thermal energy system and shall be compatible with the type of heat transfer medium and piping materials. Valves shall be installed in accordance with this Section.

S 13.2 Heat Exchanger. Shutoff valves and isolation valves shall be installed on the supply and return side of the heat exchanger.

Exception: Where a heat exchanger is an integral part of a boiler or is a part of a manufactured boiler and heat exchanger packaged unit, and is capable of being isolated from the hydronic system by supply and return valves.

S 13.3 Pressure Vessels. Isolation valves shall be installed on connections to pressure vessels.

S 13.4 Pressure Reducing Valves. Isolation valves shall be installed on both sides of a pressure reducing valve.

S 13.5 Equipment, Components, and Appliances. Serviceable equipment, components, and appliances within the system shall have isolation valves installed upstream and downstream of such devices.

S 13.6 Expansion Tanks. Isolation valves shall be installed at connections to non-diaphragm-type expansions tanks.

S 13.7 Flow Balancing Valves. Where flow balancing valves are installed, such valves shall be capable of increasing or decreasing the amount of flow by means of adjustment.

S 13.7.1 Location. Balancing valves shall be installed at the outlet of each group of collectors.

S 13.8 Control Valves. An approved three-way valve shall be permitted to be installed for manual control systems. An approved electric control valve shall be permitted to be installed for automatic control systems. The installation and operation of automatic control valves shall comply with the manufacturer's instructions.

S 13.8.1 Mixing or Temperature Control Valves. Where mixing or temperature control valves are installed, such valves shall be capable of obtaining the design water temperature and design flow requirements.

S 13.9 Thermosiphoning. An approved type check valve shall be installed on liquid heat transfer piping to control thermosiphoning of heated liquids.

S 13.10 Air Removal Device or Air Vents. Isolation valves shall be installed where air removal devices or automatic air vents are utilized to permit cleaning, inspection, or repair without shutting the system down.

S 13.11 Closed Loop Systems. Closed loop systems, where hose bibbs or similar valves are used to charge or drain the system, shall be of loose key type; have valve outlets capped; or have handles removed where the system is operational.

S 13.12 Fullway Valves. A fullway valve shall be installed in the following locations:

(1) On the water supply to a solar thermal energy system.

(2) On the water supply pipe to a gravity or pressurized water tank.

(3) On the water supply pipe to a water heater.

S 13.13 Accessible. Required fullway or shutoff valves shall be accessible.

S 14.0 Piping and Cross-connection Control For Solar Thermal Energy Systems.

S 14.1 Cross Connection Control. No piping installation, or part thereof, shall be made in such a manner that it will be possible for used, unclean, polluted, or contaminated water, mixtures, or substances to enter a portion of the potable water

system from a pipe, tank, receptor, or any other equipment by reason of backsiphonage, suction, or any other cause, either during normal use and operation thereof, or where such pipe, tank, receptor, or equipment is subject to pressure exceeding the operating pressure in the potable water system.

S 14.2 Materials.

S 14.2.1 Piping Materials. Piping, tubing, and fittings materials shall comply with Table S 14.2. Joining methods shall be in accordance with Section 605.0. Materials in contact with the heat transfer medium shall be approved for such use. Galvanized steel shall not be used for solar thermal piping systems containing antifreeze. Black steel shall not be used in systems with entrapped or entrained air. Unions between dissimilar metals shall comply with Sections 310.6 and 605.15. The material used shall be capable of withstanding the maximum temperature and pressure of the system.

S 14.2.1.1 Plastic. Plastic used in the construction of a solar thermal system shall be installed in accordance with the manufacturer's installation instructions.

S 14.2.1.2 Combustible Materials. Combustible materials shall not be located on or adjacent to construction required to be of noncombustible materials or in fire areas, unless approved by the Authority Having Jurisdiction.

S 14.2.1.3 Adhesives. Adhesives used in a solar collector shall not vaporize at the design temperature and shall be identified and approved for the intended use.

S 14.2.1.4 Potable Water. Materials in contact with potable water shall comply with NSF 61/ANSI/CAN 61. Piping in solar thermal systems designed to convey potable water shall be flushed and disinfected in accordance with this Code.

S 14.2.1.5 Racks. Dissimilar metals used for racking shall be isolated to prevent galvanic corrosion. Paint shall not be used as a method of isolation.

S 14.2.1.6 Fasteners. Mountings and fasteners shall be made of corrosion-resistant materials. Carbon steel mountings and fasteners shall be classified as noncorrosive in accordance with ASME SA194.

S 14.2.2 Storage Tank Connectors. Flexible metallic storage tank connectors or reinforced flexible storage tank connectors connecting a storage tank to the piping system shall be in accordance with the applicable standards referenced in Table S 18.1. Copper or stainless steel flexible connectors shall not exceed 24 inches (610 mm). PEX, PE-AL-PE, or PE-RT tubing shall not be installed within the first 18 inches (457 mm) of piping connected to a storage tank.

S 14.2.2.1 Flexible Connectors. Listed flexible connectors shall be installed in readily accessible locations, unless otherwise indicated in the listing.

S 14.3 Safety Devices.

S 14.3.1 Pressure Relief Valves. Solar thermal energy system components containing pressurized fluids shall be protected against pressures exceeding design limitations with a pressure relief valve. Each section of the system in which excessive pressures are capable of developing shall have a relief device located so that a section cannot be isolated from a relief device. Pressure and temperature

relief valves shall be installed in accordance with the terms of their listing and the manufacturer's installation instructions.

TABLE S 14.2
MATERIALS FOR SOLAR THERMAL SYSTEM, PIPING, TUBING, AND FITTINGS

MATERIAL	STANDARDS	
	PIPING/TUBING	FITTINGS
Copper and Copper Alloys	ASTM B42, ASTM B43, ASTM B75, ASTM B88, ASTM B135, ASTM B251[2], ASTM B302, ASTM B447	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.23, ASME B16.24, ASME B16.26, ASME B16.29, ASME B16.51, ASSE 1061, ASTM F3226, IAPMO/ANSI/CAN Z1117
Ductile Iron	AWWA C115/A21.15, AWWA C151/A21.51	AWWA C110/A21.10[1], AWWA C153/A21.53
Steel	ASTM A53, ASTM A106, ASTM A254	ASME B16.5, ASME B16.9, ASME B16.11, ASTM A420, ASTM F3226, IAPMO IGC 353, IAPMO/ANSI/CAN Z1117
Gray Iron	—	ASTM A126
Malleable Iron	—	ASME B16.3
Chlorinated Polyvinyl Chloride (CPVC)	ASTM D2846, ASTM F441, ASTM F442, CSA B137.6	ASSE 1061, ASTM D2846, ASTM F437, ASTM F438, ASTM F439, ASTM F1970, CSA B137.6
Polyethylene (PE)	ASTM D1693, ASTM D2683, ASTM D2737, ASTM D3035, ASTM D3350, ASTM F714, ASTM F2165, AWWA C901, CSA B137.1, NSF/ANSI 358-1	ASTM D2609, ASTM D2683, ASTM D3261, ASTM F1055, ASTM F2165, CSA B137.1, NSF/ANSI 358-1
Cross-Linked Polyethylene (PEX)	ASTM F876, ASTM F2165, ASTM F3253, CSA B137.5, NSF/ANSI 358-3	ASSE 1061, ASTM F877, ASTM F1055, ASTM F1807, ASTM F1960, ASTM F2080, ASTM F2098, ASTM F2159, ASTM F2165, ASTM F2735, ASTM F3253, ASTM F3347, ASTM F3348, CSA B137.5, NSF/ANSI 358-3
Polypropylene (PP)	ASTM F2165, ASTM F2389, CSA B137.11, NSF/ANSI 358-2	ASTM F2165, ASTM F2389, CSA B137.11, NSF/ANSI 358-2
Polyvinyl Chloride (PVC)	ASTM D1785, ASTM D2241, CSA B137.3	ASTM D2464, ASTM D2466, ASTM D2467, ASTM F1970, CSA B137.2, CSA B137.3
Polyethylene of Raised Temperature (PE-RT)	ASTM F2165, ASTM F2623, ASTM F2769, CSA B137.18	ASSE 1061, ASTM D3261, ASTM F1055, ASTM F1807, ASTM F2159, ASTM F2165, ASTM F2735, ASTM F2769, ASTM F3347, ASTM F3348, CSA B137.18
Cross-Linked Polyethylene/Aluminum/Cross-Linked Polyethylene (PEX-AL-PEX)	ASTM F1281, ASTM F2165, CSA B137.10	ASTM F1281, ASTM F1974, ASTM F2165, ASTM F2434, CSA B137.10
Polyethylene/Aluminum/Polyethylene (PE-AL-PE)	ASTM F1282, ASTM F2165, CSA B137.9	ASTM F1282, ASTM F1974, ASTM F2165, CSA B137.9

Stainless Steel	ASTM A269, ASTM A312, ASTM A554, ASTM A778	ASTM F1476, ASTM F1548, ASTM F3226, IAPMO IGC 353, IAPMO/ANSI/CAN Z1117
Chlorinated Polyvinyl Chloride/Aluminum/ Chlorinated Polyvinyl Chloride (CPVC/AL/CPVC)	ASTM F2855	ASTM D2846

Notes:
[1] Ductile and gray iron.
[2] Only Type K, L, or M shall be permitted to be installed.

S 14.3.2 Pressurized Vessels. Pressurized vessels shall be provided with overpressure protection by means of a listed pressure relief valve installed in accordance with the manufacturer's installation instructions.

S 14.3.3 Discharge Piping. The discharge piping serving a temperature relief valve, pressure relief valve, or combination of both shall have no valves, obstructions, or means of isolation and comply with the following:

(1) The discharge pipe shall equal the size of the valve outlet and shall discharge full size to the flood level of the area receiving the discharge and pointing down.

(2) Materials shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A112.4.1.

(3) The discharge pipe shall discharge independently by gravity through an air gap into the drainage system or outside of the building with the end of the pipe not exceeding 2 feet (610 mm) and not less than 6 inches (152 mm) above the ground and pointing downwards.

(4) The discharge pipe shall discharge in such a manner that does not cause personal injury or structural damage.

(5) No part of such discharge pipe shall be trapped or subject to freezing.

(6) The terminal end of the pipe shall not be threaded.

(7) Discharge from a relief valve into a water heater pan is prohibited.

(8) The discharge termination point shall be readily observable.

S 14.3.4 Vacuum Relief Valves. System components that are subjected to a vacuum while in operation or during shutdown shall be protected with vacuum relief valves. Where the piping configuration, equipment location, and valve outlets are located below the storage tank elevation, the system shall be equipped with a vacuum relief valve at the highest point.

S 14.3.5 Temperature Regulation. Where a system is capable of providing potable water at temperatures that exceed 140°F (60°C), a thermostatic mixing valve that is in accordance with ASSE 1017 shall be provided to limit the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less.

S 14.4 Protection of System Components.

S 14.4.1 Materials. System components in contact with heat-transfer mediums shall be approved for such use. Components installed outdoors shall be resistant to ultraviolet radiation.

S 14.4.2 Corrosion. Solar thermal energy systems and components subject to corrosion shall be protected in an approved manner. Metal parts exposed to atmospheric conditions shall be of corrosion-resistant material.

S 14.4.3 Mechanical Damage. Portions of a solar thermal energy system installed where subjected to mechanical damage shall be guarded against such damage by being installed behind approved barriers or, where located within a garage, be elevated or located out of the normal path of a vehicle, defined as a line

perpendicular to the garage vehicle opening to the back wall extending 36 inches (914 mm) to either side along the back wall and to a height of 48 inches (1219 mm). Protective barriers for energy storage systems (ESS) shall be designed to resist, deflect, or visually deter vehicle impact in accordance with Section S 14.4.3.1 through Section S 14.4.3.3. (See Figure S 14.4.3).

Exception: Where the clear height of the vehicle garage opening is equal to or less than 90 inches (2286 mm), ESS installed at least 36 inches (914 mm) above the finished floor shall not be subject to vehicle impact protection requirements.

S 14.4.3.1 Bollards. Where installed, construction of bollards shall be in accordance with one of the following:

(1)48 inches (1219 mm) in length by 3 inches (76 mm) in diameter, Schedule 80 steel pipe embedded in a concrete pier 12 inches (305 mm) deep and 6 inches (152 mm) in diameter, with 36 inches (914 mm) of pipe exposed, filled with concrete, and spaced at intervals not exceeding 60 inches (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from an ESS.

(2)36 inches (914 mm) in height by 3 inches (76 mm) in diameter, Schedule 80 steel pipe fully welded to an 8 inch (203 mm) by 8 inch (203 mm) by 1⁄4 of an inch (6.4 mm) thick steel plate and bolted to a concrete floor by means of four ½ inch (12.7 mm) concrete anchors with not less than 3 inches (76 mm) of embedment. Spacing shall not exceed 60 inches (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.

(3)Pre-manufactured steel pipe bollards shall be filled with concrete and anchored in accordance with the manufacturer's installation instructions. Spacing between bollards shall not exceed 60 inches (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from the ESS.

S 14.4.3.2 Wheel Barriers. Where installed, construction of wheel barriers shall be in accordance with one of the following:

(1) 6 inches (152 mm) in height by 6 inches (152 mm) in width, wheel stop made of concrete or polymer, anchored to the concrete floor at intervals of not less than 36 inches (914 mm) and located not less than 54 inches (1372 mm) from the ESS. Not less than two ½ inch (12.7 mm) diameter concrete anchors with 3 inches (76 mm) of embedment per wheel stop shall be used. Spacing between wheel stops shall not exceed 36 inches (914 mm).

(2) Pre-manufactured wheel stops shall be anchored in accordance with the manufacturer’s installation instructions.

S 14.4.3.3 Other Approved Methods. Protective barriers installed 24 inches (610 mm) above grade and designed to resist a 2000 pound-force (8896 N) impact in the direction of vehicle travel shall be permitted.

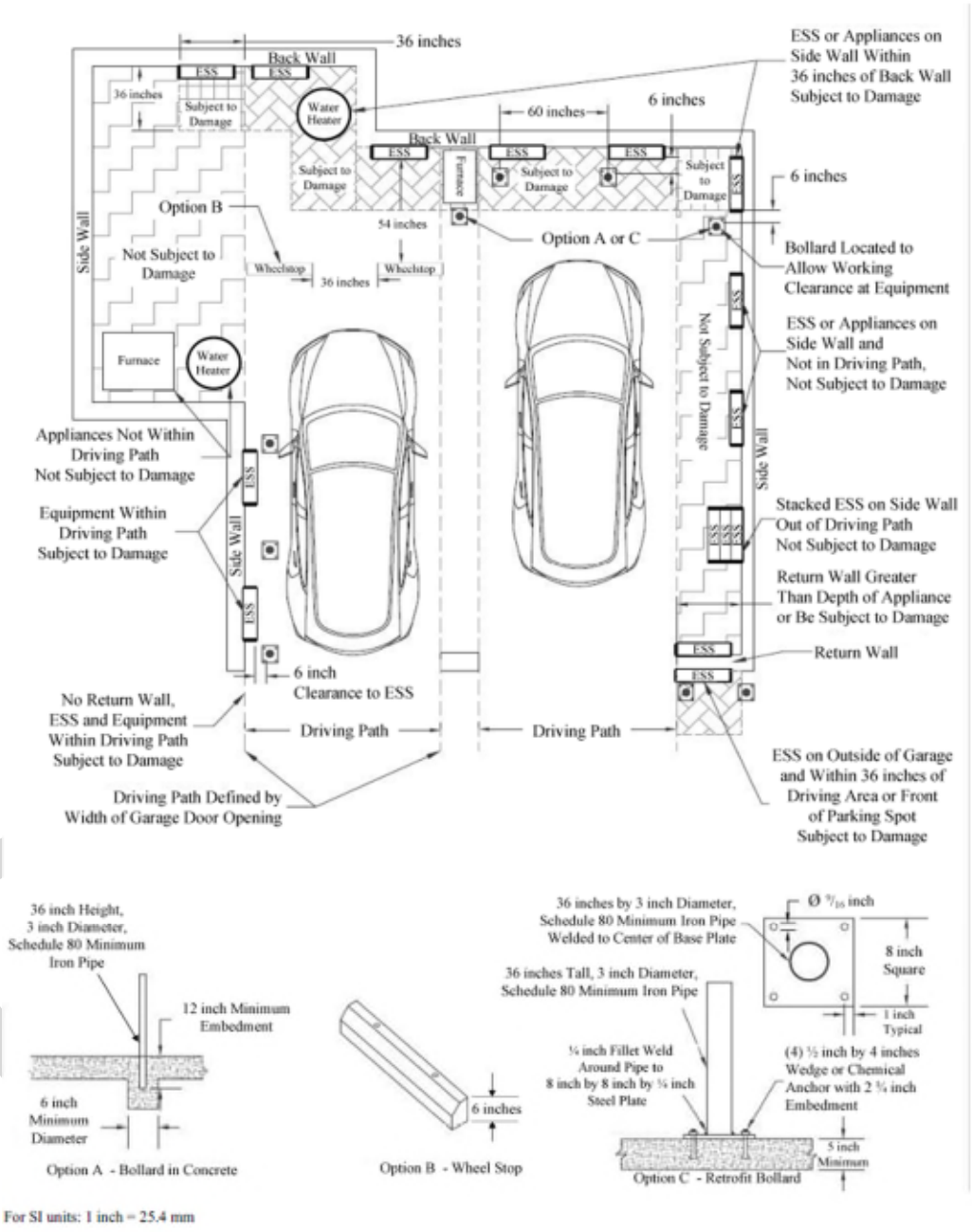

Figure S 14.3.3

PROTECTIVE BARRIERS FOR ESS

S 14.4.4 Freeze Protection. Unless designed for such conditions, solar thermal energy systems and components that contain liquid as the heat transfer medium shall be protected from freezing, by means of fail-safe freeze protection in accordance with this Section, where the ambient temperature may be less than 46°F (8°C).

S 14.4.4.1 Antifreeze. Antifreeze shall be used in accordance with the solar thermal system manufacturer's instructions.

S 14.4.4.2 Drainback. Drainback systems shall drain by gravity and shall be permitted to be installed in applications where the ambient temperature may not be less than -60°F (-51°C).

S 14.4.4.3 Integral Collector Storage. Integral collector storage systems shall be permitted to be installed in applications where the ambient temperature may not be less than 23°F (-5°C) and the duration of below-freezing episodes exceeding 18 hours. Exposed piping in a solar thermal energy system shall be protected with insulation having a thermal resistance of not less than R-5.0.

S 14.4.4.4 Indirect Thermosiphon. Indirect thermosiphon systems shall be permitted to be installed in applications where the ambient temperature may not be less than 23°F (-5°C). Exposed piping in a solar thermal energy system shall be protected with insulation having a thermal resistance of not less than R-5.

S 14.4.4.5 Air Heating Systems. Air solar heating systems shall be permitted to be used in accordance with the manufacturer's instructions.

S 14.4.4.6 Labeling. A label indicating the method of freeze protection for the system shall be attached to the system in a visible location.

S 14.4.4.7 Piping. Fittings, pipe slope, and collector shall be designed to allow for manual gravity draining and air filling of solar thermal energy system components and piping. Pipe slope for gravity draining shall be not less than 1⁄4 inch per foot (20.8 mm/m) of horizontal length. Collector header pipes or absorber plate riser tubes internal to the collector shall be sloped in accordance with the manufacturer's instructions. Where a means to drain the system is provided, a drain valve shall be installed.

S 14.4.5 Water Hammer Protection. The flow of the hydronic piping system shall be designed to prevent water hammer.

S 14.4.6 Heat Transfer Fluid Quality. Heat transfer fluids used in closed-loop hydronic systems shall be in accordance with IAPMO/ANSI H1001.1.

S 14.4.6.1 Ethylene Glycol. Ethylene glycol shall not be used in one- and two-unit residential systems. In existing systems, where ethylene glycol is used, there shall be no direct or permanent potable water connections. Where a temporary potable water connection is required, a backflow preventer shall be installed.

S 14.4.7 Heat Transfer Fluid. Solar thermal piping shall be identified with an orange background with black uppercase lettering, with the words "CAUTION: HEAT TRANSFER FLUID, DO NOT DRINK." Each solar thermal energy system shall be identified to designate the medium being conveyed. The minimum size of the letters and length of the color field shall comply with Table S 14.4.7.

Each outlet on the solar thermal piping system shall be posted with black uppercase lettering as follows:

"CAUTION: HEAT TRANSFER FLUID, DO NOT DRINK."

TABLE S 14.4.7

MINIMUM LENGTH OF COLOR FIELD AND SIZE OF LETTERS

OUTSIDE DIAMETER OF PIPE OR COVERING (inches)	MINIMUM LENGTH OF COLOR FIELD (inches)	MINIMUM SIZE OF LETTERS (inches)
½ to 1¼	8	½
1½ to 2	8	¾
2½ to 6	12	1¼
8 to 10	24	2½
Over 10	32	3½

For SI units: 1 inch = 25.4 mm

S 14.4.8 Identification of Chemical Additives. In systems where chemical additives are used, documentation including the following information shall be readily accessible and maintained onsite:

(1) Concentrations

(2) Maintenance requirements

(3) Maintenance log

(4) Safety data sheet (SDS)

S 14.4.9 Insulation.

S 14.4.9.1 General. The temperature of surfaces within reach of building occupants shall not exceed 140°F (60°C) unless the surfaces are protected by insulation. Where sleeves are installed, the insulation shall continue full size through them. Coverings and insulation used for piping shall be of material approved for the

operating temperature of the system and the installation environment. Where installed in a plenum, the insulation, jackets and lap-seal adhesives, including pipe coverings and linings, shall have a flame spread index not to exceed 25 and a smoke-developed index not to exceed 50 where tested in accordance with ASTM E84 or UL 723.

S 14.4.9.2 Heat Loss. Insulation shall be installed on interconnecting solar and hot water piping. The final 5 feet (1524 mm) of the cold water supply line, or the entire length where less than 5 feet (1524 mm), shall be insulated. The insulation shall have an R-value of not less than R-2.6 degree Fahrenheit hour square foot per British thermal unit (°F•h•ft^2/Btu) (R-0.46 m^2•K/W). Piping, storage tanks, and circulating air ductwork shall be insulated. Ductwork and piping shall be permitted to not be insulated where exposed in conditioned spaces, and the heat loss from such ducts or piping does not otherwise contribute to the heating or cooling load within such space.

Exception: Low temperature, aboveground piping installed for swimming pools, spas, and hot tubs in accordance with the manufacturer's installation instructions unless such piping is located within a building.

S 14.4.9.3Piping. Pipes and fittings, other than unions, flanges, or valves, shall be insulated. Insulation material shall be approved for continuous operating temperatures of not less than 220°F (104°C).

S 14.4.9.4 Fittings. Fittings shall be insulated with mitered sections, molded fittings, insulating cement, or flexible insulation.

S 14.4.9.5 Installation. Insulation shall be finished with a jacket or facing with the laps sealed with adhesives or staples so as to secure the insulation on the pipe. Insulation jacket seams shall be on the underside of the piping and shall overlap in accordance with the manufacturer's installation instructions. Joints and seams shall be

sealed with a sealant that is approved for both the material and environmental conditions. In lieu of jackets, molded insulation shall be permitted to be secured with 16 gauge galvanized wire ties not exceeding 9 inches (229 mm) on center.

S 14.4.9.5.1 Exterior Applications. Insulation for exterior applications shall be finished with an approved jacket, coating or facing with the surfaces and laps sealed. Jacketing, coating, facing, and tape used for exterior applications shall be designed for such use. Where flexible insulation is used, it shall be wrapped and sealed against water penetration. Insulation used for exterior applications shall be resistant to extreme temperatures, UV exposure, and moisture.

S 15.0 Specific Requirements.

S 15.1 Electrical.

S 15.1.1 Wiring. Electrical connections, wiring, and devices shall be installed in accordance with NFPA 70. Electrical equipment, appliances, and devices installed in areas that contain flammable vapors or dusts shall be of a type approved for such environment.

S 15.1.2 Controls. Required electrical, mechanical, safety, and operating controls shall be listed or labeled by a listing agency. Electrical controls shall be of such design and construction as to be suitable for installation in the environment in which they are located.

S 15.2 Flow Directions. Flow directions shall be permanently affixed on the solar thermal energy system.

S 15.3 Attic Installations. An attic space in which solar energy system components are installed shall comply with Section 508.4 of this Code.

S 15.4 Connections to Drainage System Required. Receptors, drains, appurtenances, and appliances, used to receive or discharge liquid waste, shall be connected to the drainage system of the building or premises in accordance with the requirements of this Code.

S 15.5 Dry Storage Systems.

S 15.5.1 Waterproofing. The containment structure for dry thermal storage systems shall be constructed in an approved manner to prevent the infiltration of water or moisture.

S 15.5.2 Detecting Water Intrusion. The containment structure shall be capable of fully containing spillage or moisture accumulation that occurs. The structure shall have a means, such as a sight glass, to detect spillage or moisture accumulation, and shall be fitted with a drainage device to eliminate spillage.

S 15.5.3 Rock as Storage Material. Systems utilizing rock as the thermal storage material shall use clean, washed rock that is free of organic material.

S 15.5.4 Odor and Particulate Control. Thermal storage materials and containment structures, including interior protective coating, shall not impart toxic elements, particulate matter, or odor to areas of human occupancy.

S 15.6 Heat Pumps. Heat pumps shall comply with UL 1995 or UL 60335-2-40. Air-source heat pumps shall also comply with AHRI 210/240. In addition, ground-source heat pumps shall comply with AHRI/ASHRAE/ISO 13256-1 for water-to-air heat pumps and AHRI/ASHRAE/ISO 13256-2 for water-to-water heat pumps. Heat pumps shall be fitted with a means to indicate that the compressor is locked out.

S 16.0 Solar Thermal Energy Systems for Swimming Pool, Spas, and Hot Tubs.

S 16.1 Water Chemistry. Where water from a swimming pool, spa, or hot tub is heated by way of circulation through solar collectors, the chemistry of such water shall comply with the requirements of Section S 16.2 and shall be filtered in accordance with Section S 16.3 and Section S 16.3.1 of this Code.

S 16.2 Parameters. Parameters for chemicals used within a swimming pool, spa, or hot tub shall be in accordance with Table S 16.2.

TABLE S 16.2
WATER CHEMISTRY

PARAMETER	ACCEPTABLE RANGE
Calcium hardness	200 – 400 parts per million (ppm)
Langelier Saturation Index	0 (+ or - 0.3 acceptable)
pH	7.2 – 7.8
TDS	< 1500 ppm
Total alkalinity	80 – 120 ppm

For SI Units: 1 part per million = 1 mg/L

S 16.3 Filter. A filter shall be provided to remove debris from the water entering the solar loop.

Exception: A solar swimming pool, spa, or hot tub heating system with a heat exchanger.

S 16.3.1 Location. A filter shall be located upstream of a pump used to direct water to solar collectors.

S 16.4 Corrosion Resistant. Glazed solar collectors made of copper shall not be used for solar pool, spa, or hot tub heating.

Exception: Where a heat exchanger is provided between the collector circuit and the swimming pool, spa, or hot tub water.

S 17.0 Certificate of Compliance. Upon completion of the solar thermal energy system, the permittee shall sign a Certificate of Compliance with this Code. The Certificate of Compliance shall also list the following information:

(1) Type of freeze protection;

(2) Mixing valve setting degrees Fahrenheit (º F);

(3) Subsystem working pressure (if applicable) pounds per square inch;

(4) Subsystem test pressure (if applicable) pounds per square inch;

(5) Heat exchanger make and model number (if applicable);

(6) Circulating pump over temperature protection shut-off setting degrees Fahrenheit (º F) for one-tank systems where the water heater controls utilize fusible-link type over temperature protection.

This Certificate shall be posted in a conspicuous location at or near the water heater.

S 18.0 General.

S 18.1 Referenced Standards. The standards listed in Table S 18.1 are referenced in various sections of this Appendix and shall be considered part of the requirements of this Code. The standards are listed herein by the standard number and

effective date, the title and application. The application of the referenced standard(s) shall be as specified in Section S 5.2.

TABLE S 18.1
REFERENCED STANDARDS

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
AHRI			
AHRI 210/240-2020	Performance Rating of Unitary Air-conditioning & Air- source Heat Pump Equipment	Air-Source Heat Pumps	407.5
AHRI 870-2016	Performance Rating of Direct Geoexchange Heat Pumps	Equipment	706.1
AHRI/ASHRAE/ISO 13256-1-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
AHRI/ASHRAE/ISO 13256-2-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Performance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
ASHRAE			
AHRI/ASHRAE/ISO 13256-1-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Perform- ance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
AHRI/ASHRAE/ISO 13256-2-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Perform- ance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
ASHRAE 34-2022	Designation and Safety Classification of Refrigerants	Refrigerant Classifications	706.3
ASHRAE 194-2017	Method of Test for Direct-Expansion Ground-Source Heat Pumps	Ground-Source Heat Pumps	706.1
ASME			
ASME A112.1.2-2012 (R2022)	Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors)	Backflow Protection	402.2
ASME A112.1.3-2000 (R2019)	Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and	Backflow Protection	402.2

	Appurtenances		
ASME A112.4.1-2009 (R2019)	Water Heater Relief Valve Drain Tubes	Discharge Piping	311.3(2)
ASSE 1070/ASME A112.1070/CSA B125.70- 2020	Water Temperature Limiting Devices	Valves	402.5
ASME B1.20.1-2013 (R2018)	Pipe Threads, General Purpose (Inch)	Joints	410.3(3), 410.5(7), 410.13(3), 410.14(2)
ASME B16.3-2021	Malleable Iron Threaded Fittings: Classes 150 and 300	Fittings	Table 409.1
ASME B16.5-2020	Pipe Flanges and Flanged Fittings: NPS 1⁄2 Through NPS 24 Metric/Inch	Fittings	Table 409.1
ASME B16.9-2018	Factory-Made Wrought Buttwelding Fittings	Fittings	Table 409.1
ASME B16.11-2021	Forged Fittings, Socket-Welding and Threaded	Fittings	Table 409.1
ASME B16.15-2018	Cast Copper Alloy Threaded Fittings: Classes 125 and 250	Fittings	Table 409.1
ASME B16.18-2021	Cast Copper Alloy Solder Joint Pressure Fittings	Fittings	Table 409.1
ASME B16.22-2021	Wrought Copper and Copper Alloy Solder-Joint Pressure Fit- tings	Fittings	Table 409.1, 715.3
ASME B16.23-2021	Cast Copper Alloy Solder Joint Drainage Fittings: DWV	Fittings	Table 409.1
ASME B16.24-2021	Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500	Fittings	Table 409.1
ASME B16.26-2018	Cast Copper Alloy Fittings for Flared Copper Tubes	Fittings	Table 409.1
ASME B16.29-2017	Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings – DWV	Fittings	Table 409.1
ASME B16.51-2021	Copper and Copper Alloy Press-Connect Pressure Fittings	Fittings	Table 409.1
ASME BPVC Section VIII.1-2021	Rules for Construction of Pressure Vessels Division 1	Miscellaneous	408.3, 601.2.1, 603.6, 605.2
ASME BPVC Section X-2021	Fiber-Reinforced Plastic Pressure Vessels	Pressure Vessel Construction, Pressure Vessels	603.6
ASME SA194-2021	Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both	Mounting	501.5.6

ASSE			
ASSE 1013-2021	Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies	Backflow Prevention	402.2
ASSE 1017-2009	Performance Requirements for Temperature Actuated Mix- ing Valves for Hot Water Distribution Systems	Valves	311.5, 407.3.1
ASSE 1061-2020	Performance Requirements for Push-Fit Fittings	Fittings	Table 409.1, 410.3(1), 410.5(5)
ASSE 1070/ASME A112.1070/CSA B125.70- 2020	Water Temperature Limiting Devices	Valves	402.5
ASSE 1079-2012 (R2021)	Performance Requirements for Dielectric Pipe Unions	Fittings	410.16.1
ASTM			
ASTM A53/A53M-2022	Standard Specification for Pipe, Steel, Black and Hot- Dipped, Zinc-Coated, Welded and Seamless	Piping	Table 409.1
ASTM A106/A106M-2019a	Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service	Piping	Table 409.1
ASTM A126-2004 (R2019)	Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings	Piping	Table 409.1
ASTM A254/A254M-2012 (R2019)	Standard Specification for Copper-Brazed Steel Tubing	Piping	Table 409.1
ASTM A269/A269M-2022	Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service	Piping	Table 409.1
ASTM A312/A312M-2022a	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes	Piping	Table 409.1
ASTM A420/A420M-2022	Standard Specification for Piping Fittings of Wrought Car- bon Steel and Alloy Steel for Low-Temperature Service	Fittings	Table 409.1
ASTM A554-2021	Standard Specification for Welded Stainless Steel Mechanical Tubing	Piping	Table 409.1
ASTM A778/A778M-2022	Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products	Piping	Table 409.1
ASTM B32-2020	Standard Specification for Solder Metal	Joints	410.5(6)
ASTM B42-2020	Standard Specification for Seamless Copper Pipe, Standard Sizes	Piping	Table 409.1
ASTM B43-2020	Standard Specification for Seamless Red Brass Pipe, Standard Sizes	Piping	Table 409.1
ASTM B75/B75M-2020	Standard Specification for Seamless Copper Tube	Piping	Table 409.1
ASTM B88-2022	Standard Specification for Seamless Copper Water Tube	Piping	Table 409.1
ASTM B135/B135M-2017	Standard Specification for Seamless Brass Tube	Piping	Table 409.1
ASTM B251/B251M-2017	Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	Piping	Table 409.1
ASTM B280-2020	Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	Piping	715.3
ASTM B302-2017	Standard Specification for Threadless Copper Pipe, Standard Sizes	Piping	Table 409.1
ASTM B447-2012a (R2021)	Standard Specification for Welded Copper Tube	Piping	Table 409.1

ASTM B813-2016	Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	Joints	410.5(6)
ASTM B828-2016	Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings	Joints	410.5(6)
ASTM C411-2019	Standard Test Method for Hot-Surface Performance of High- Temperature Thermal Insulation	Duct Coverings and Linings	502.4.1
ASTM D1693-2021	Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics	Piping	Table 409.1
ASTM D1785-2021a	Standard Specification for Poly(Vinyl Chloride) (PVC) Plas- tic Pipe, Schedules 40, 80, and 120	Piping	Table 409.1
ASTM D2241-2020	Standard Specification for Poly(Vinyl Chloride) (PVC) Pres- sure-Rated Pipe (SDR Series)	Piping	Table 409.1
ASTM D2464-2015	Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80	Fittings	Table 409.1
ASTM D2466-2021	Standard Specification for Poly(Vinyl Chloride) (PVC) Plas- tic Pipe Fittings, Schedule 40	Fittings	Table 409.1
ASTM D2467-2020	Standard Specification for Poly(Vinyl Chloride) (PVC) Plas- tic Pipe Fittings, Schedule 80	Fittings	Table 409.1
ASTM D2564-2020	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems	Joints	410.13(2)
ASTM D2609-2021	Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe	Fittings	Table 409.1
ASTM D2683-2020	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing	Fittings	Table 409.1, Table 703.3
ASTM D2737-2022	Standard Specification for Polyethylene (PE) Plastic Tubing	Piping	Table 409.1, Table 703.2
ASTM D2846/D2846M-2019a	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems	Piping	Table 409.1, 410.3(2), 410.4(2)
ASTM D3035-2022	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter	Piping	Table 409.1, Table 703.2
ASTM D3138-2021	Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components	Joints	410.16.2.1
ASTM D3139-2019	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals	Joints	410.13(1)
ASTM D3261-2016	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	Fittings	Table 409.1, Table 703.3
ASTM D3350-2021	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials	Piping	Table 409.1, 703.4.1, 703.4.2
ASTM E84-2023	Standard Test Method for Surface Burning Characteristics of Building Materials	Miscellaneous	401.2, 502.4, 503.1, 606.5
ASTM F437-2021	Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80	Fittings	Table 409.1
ASTM F438-2017	Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	Fittings	Table 409.1
ASTM F439-2019	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80	Fittings	Table 409.1
ASTM F441/F441M-2020	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80	Piping	Table 409.1

ASTM F442/F442M-2020	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)	Piping, Plastic	Table 409.1, 410.3(2)
ASTM F493-2022	Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings	Joints	410.3(2), 410.4(2)
ASTM F656-2021	Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings	Joints	410.3(2), 410.4(2), 410.13(2)
ASTM F714-2022	Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter	Piping	Table 409.1, Table 703.2
ASTM F876-2023	Standard Specification for Crosslinked Polyethylene (PEX) Tubing	Piping	Table 409.1, 410.6, Table 703.2
ASTM F877-2023	Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems	Piping	Table 409.1, Table 703.3
ASTM F1055-2016a (R2022)	Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing	Fittings	Table 409.1, Table 703.3, 703.4.1.1(3)
ASTM F1281-2023	Standard Specification for Crosslinked Polyethylene/ Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe	Piping	Table 409.1
ASTM F1282-2017	Standard Specification for Polyethylene/Aluminum/Poly- ethylene (PE-AL-PE) Composite Pressure Pipe	Piping	Table 409.1
ASTM F1476-2007 (R2019)	Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications	Fittings	Table 409.1
ASTM F1548-2001 (R2018)	Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications	Fittings	Table 409.1
ASTM F1807-2023	Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps, for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1, Table 703.3
ASTM F1960-2023	Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1, Table 703.3
ASTM F1970-2023	Standard Specification for Special Engineered Fittings, Appurtenances or Valves for Use in Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Systems	Piping	Table 409.1
ASTM F1974-2009 (R2020)	Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe	Fittings	Table 409.1, 410.7(1), 410.10(1)
ASTM F2080-2023	Standard Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Crosslinked Polyethylene (PEX) Pipe and SDR9 Polyethylene of Raised Temperature (PE-RT) Pipe	Fittings	Table 409.1, Table 703.3
ASTM F2098-2018	Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) to Metal Insert and Plastic Insert Fittings	Fittings	Table 409.1

ASTM F2159-2023a	Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring, or Alternate Stainless Steel Clamps for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1, Table 703.3
ASTM F2165-2019	Standard Specification for Flexible Pre-Insulated Plastic Piping	Fittings, Piping and Tubing	Table 409.1
ASTM F2389-2023	Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems	Piping	Table 409.1, 410.12(1), Table 703.2, Table 703.3
ASTM F2434-2019	Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing	Fittings	Table 409.1, 410.7(1), Table 703.3
ASTM F2620-2020ae2	Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings	Joints	410.9(1), 410.9(3), 703.4.1.1(1), 703.4.1.1(2)
ASTM F2623-2022	Standard Specification for Polyethylene of Raised Temperature (PE-RT) Systems for Non-Potable Water Applications	Piping	Table 409.1, Table 703.2
ASTM F2735-2021	Standard Specification for Plastic Insert Fittings for SDR9 Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1
ASTM F2769-2023	Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems	Piping, Fitting	Table 409.1, Table 703.2, Table 703.3
ASTM F2855-2019	Standard Specification for Chlorinated Poly (Vinyl Chlo- ride)/Aluminum/Chlorinated Poly (Vinyl Chloride) (CPVC- AL-CPVC) Composite Pressure Tubing	Piping, Plastic	Table 409.1
ASTM F3226/F3226M-2019	Standard Specification for Metallic Press-Connect Fittings for Piping and Tubing Systems	Fittings	Table 409.1
ASTM F3253-2019	Standard Specification for Crosslinked Polyethylene (PEX) Tubing with Oxygen Barrier for Hot- and Cold-Water Hydronic Distribution Systems	Piping, Fittings	Table 409.1, 410.6
ASTM F3347-2023	Standard Specification for Metal Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1, Table 703.3
ASTM F3348-2023	Standard Specification for Plastic Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing	Fittings	Table 409.1, Table 703.3
AWS			
AWS A5.8M/A5.8-2019	Filler Metals for Brazing and Braze Welding	Joints	410.5(1), 715.3, 715.5
AWS A5.9/A5.9M-2022 (ISO 14343-2017 MOD)	Specification for Bare Stainless Steel Welding Electrodes and Rods	Joints	410.15.2
AWWA			
AWWA C110/A21.10- 2021	Ductile-Iron and Gray-Iron Fittings	Fittings	Table 409.1

AWWA C111/A21.11- 2017	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fit- tings	Joints	410.8
AWWA C115/A21.15- 2020	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges	Piping	Table 409.1
AWWA C151/A21.51- 2017	Ductile-Iron Pipe, Centrifugally Cast	Piping	Table 409.1
AWWA C153/A21.53-2019	Ductile-Iron Compact Fittings	Fittings	Table 409.1
AWWA C901-2020	Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. (19 mm) Through 3 In. (76 mm), for Water Service	Piping	Table 409.1, Table 703.2, 703.4.1
CSA			
ASSE 1070/ASME A112.1070/CSA B125.70- 2020	Water Temperature Limiting Devices	Valves	402.5
CSA B137.1-2020	Polyethylene (PE) Pipe, Tubing, and Fittings for Cold-Water Pressure Services	Piping	Table 409.1, Table 703.2, Table 703.3
CSA B137.2-2020	Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications	Fittings	Table 409.1
CSA B137.3-2020	Rigid Polyvinylchloride (PVC) Pipe and Fittings for Pressure Applications	Piping, Fittings	Table 409.1
CSA B137.5-2020	Crosslinked Polyethylene (PEX) Tubing Systems for Pres- sure Applications	Piping	Table 409.1, Table 703.2, Table 703.3
CSA B137.6-2020	Chlorinated Polyvinylchloride (CPVC) Pipe, Tubing, and Fittings for Hot- and Cold-Water Distribution Systems	Piping, Fittings	Table 409.1
CSA B137.9-2020	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems	Piping	Table 409.1
CSA B137.10-2020	Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Composite Pressure-Pipe Systems	Piping	Table 409.1
CSA B137.11-2020	Polypropylene (PP-R & PP-RCT) Pipe and Fittings for Pres- sure Applications	Piping	Table 409.1, 410.12(1), Table 703.2, Table 703.3
CSA B137.18-2020	Polyethylene of Raised Temperature Resistance (PE-RT) Tubing Systems for Pressure Applications	Piping, Fittings	Table 409.1, Table 703.2, Table 703.3
CSA C22.2 No. 108-2014 (R2019)	Liquid Pumps	Pumps	308.1.1
ANSI/CSA/IGSHPA C448 Series-2016 (R2021)	Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings	Ground-Source Heat Pumps	701.11.1, Table 703.2, Table 703.3, 708.7, 709.1, 710.7, 710.7.2, 715.4
CSA/ANSI Z21.10.1-2019/CSA 4.1-2019	Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less	Fuel Gas, Appliances	Table 403.2
CSA/ANSI Z21.10.3-2019/CSA 4.3-2019	Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous	Fuel Gas, Appliances	Table 403.2
IAPMO			
IAPMO/ANSI H1001.1-2021	Standard for Quality of Heat Transfer Fluids Used in Hydronics Systems	Heat Transfer Fluid	401.6, 701.11.1
IAPMO/ANSI/CAN Z1117-2022	Standard for Press Connections	Fittings	Table 409.1

IAPMO IGC 353-2019[e1]	Branch Connectors	Fittings	Table 409.1
IAPMO S1001.1-2013 (R2019)	Design and Installation of Solar Water Heating Systems	Solar Thermal Systems	501.7
ICC			
ICC 900/SRCC 300-2020	Solar Thermal System Standard	Solar Thermal Systems	501.7
ICC 901/SRCC 100-2020	Solar Thermal Collector Standard	Collectors	502.6
IGSHPA			
ANSI/CSA/IGSHPA C448 Series-2016 (R2021)	Design and Installation of Ground Source Heat Pump Systems for Commercial and Residential Buildings	Ground-Source Heat Pumps	701.11.1, Table 703.2, Table 703.3, 708.7, 709.1, 710.7, 710.7.2, 715.4
ISO			
AHRI/ASHRAE/ISO 13256-1-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Performance – Part 1: Water-to-Air and Brine-to-Air Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
AHRI/ASHRAE/ISO 13256-2-1998 (R2012)	Water-Source Heat Pumps – Testing and Rating for Performance – Part 2: Water-to-Water and Brine-to-Water Heat Pumps	Water-Source Heat Pumps	407.5, 706.1, Table 706.1, 716.3.1
NFPA			
NFPA 70-2023	National Electrical Code	Miscellaneous	304.4.5, 315.1, 717.1, 801.1, 804.1, 806.1.3(4)(d), 806.4.1(2), 807.2, 809.1.1, 812.2.2(2), 812.3.2, 812.3.3, 812.3.4, 812.3.5, 812.3.6, 812.4.2(8), 812.4.2(11), 812.4.2(12), 812.6, 818.1, 818.1.3.1, 818.1.4, 819.1, 819.2.1, 819.2.3, Table 819.1, 820.1.9(3), 820.2, 820.2.2, 820.3, 826.1, 827.1, 830.2(2), 830.4, B 104.1
NGWA			
NGWA-01-2014	Water Well Construction Standard	Geothermal	712.2, 712.3, 713.4, 713.6
NSF			
NSF/ANSI/CAN 60-2021	Drinking Water Treatment Chemicals-Health Effects	Backfill	710.7.1
NSF/ANSI/CAN 61-2022	Drinking Water System Components - Health Effects	Miscellaneous	501.5.4, 712.1
NSF/ANSI 358-1-2021	Polyethylene Pipe and Fittings for Water-Based Ground- Source “Geothermal” Heat Pump Systems	Piping, Fittings	Table 409.1, Table 703.2, Table 703.3
NSF/ANSI 358-2-2017	Polypropylene Pipe and Fittings for Water-Based Ground- Source “Geothermal” Heat Pump Systems	Piping, Fittings	Table 409.1, Table 703.2, Table 703.3

NSF/ANSI 358-3-2021	Cross-Linked Polyethylene (PEX) Pipe and Fittings for Water- Based Ground-Source (Geothermal) Heat Pump Systems	Piping, Fittings	Table 409.1, Table 703.2, Table 703.3
NSF/ANSI 358-4-2022	Polyethylene of Raised Temperature (PE-RT) Tubing and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems	Piping, Fittings	Table 703.2, Table 703.3
NSF/ANSI/CAN 372-2022	Drinking Water System Components - Lead Content	Miscellaneous	712.1
SRCC			
ICC 900/SRCC 300-2020	Solar Thermal System Standard	Solar Thermal Systems	501.7
ICC 901/SRCC 100-2020	Solar Thermal Collector Standard	Collectors	502.6
UL			
UL 98B-2015	Outline of Investigation for Enclosed and Dead-front Switches for use in Photovoltaic Systems	Electrical	Table 802.2.1
UL 248-2019	Low-Voltage Fuses – Part 19: Photovoltaic Fuses (with revisions through February 28, 2020)	Electrical	Table 802.2.1
UL 489B-2016	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures for Use with Photovoltaic (PV) Systems (with revisions through May 19, 2021)	Electrical	Table 802.2.1
UL 508I-2015	Outline of Investigation for Disconnect Switches Intended for Use in Photovoltaic Systems	Electrical	Table 802.2.1
UL 723-2018	Test for Surface Burning Characteristics of Building Materials	Miscellaneous	401.2, 502.4, 503.1, 606.5
UL 778-2016	Motor-Operated Water Pumps (with revisions through June 29, 2021)	Pumps	308.1.1, 310.1
UL 834-2004	Heating, Water Supply, and Power Boilers – Electric (with revisions through July 17, 2019)	Appliances	Table 403.2
UL 1279-2010	Outline of Investigation for Solar Collectors	Electrical	502.6
UL 1699B-2018	Photovoltaic (PV) DC Arc-Fault Circuit Protection (with revisions through May 18, 2021)	Electrical	Table 802.2.1
UL 1703-2002	Flat-Plate Photovoltaic Modules and Panels (with revisions through November 25, 2019)	Electrical	Table 802.2.1
UL 1741-2021	Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources (with revisions through October 18, 2022)	Electrical	Table 802.2.1
UL 1995-2022	Heating and Cooling Equipment	Heat Pumps	407.5, 706.1
UL 2523-2009	Solid Fuel-Fired Hydronic Heating Appliances, Water Heaters, and Boilers (with revisions through October 20, 2022)	Fuel Gas, Appliances	Table 403.2
UL 2703-2015	Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels (with revisions through March 24, 2021)	Electrical	Table 802.2.1
UL 2846-2014	Fire Test of Plastic Water Distribution Plumbing Pipe for Visible Flame and Smoke Characteristics (with revisions through January 14, 2021)	Piping	606.5
UL 2989-2022	Outline of Investigation for Tracer Wire	Tracer Wire	707.18.8
UL 3703-2015	Solar Trackers (with revisions through April 7, 2020)	Electrical	Table 802.2.1
UL 3730-2014	Photovoltaic Junction Boxes (with revisions through June 11, 2021)	Electrical	Table 802.2.1

UL 3741-2020	Photovoltaic Hazard Control	Electrical	Table 802.2.1
UL 4703-2014	Photovoltaic Wire (with revisions through August 11, 2020)	Electrical	Table 802.2.1
UL 6703-2014	Connectors for Use in Photovoltaic Systems (with revisions through June 10, 2021)	Electrical	Table 802.2.1
UL 7103-2019	Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings	Electrical	Table 802.2.1
UL 8703-2011	Outline of Investigation for Concentrator Photovoltaic Mod- ules and Assemblies	Electrical	Table 802.2.1
UL 60335-2-40-2022	Household and Similar Electrical Appliances-Safety-Part 2- 40: Particular Requirements for Electrical Heat Pumps, Air- Conditioners and Dehumidifiers	Heat Pumps	407.5, 706.1
UL 61730-1-2022	Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction	Electrical	Table 802.2.1
UL 61730-2-2022	Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing	Electrical	Table 802.2.1
UL 62109-1-2014	Safety of Power Converters for Use in Photovoltaic Power Sys- tems - Part 1: General Requirements (with revisions through April 30, 2019)	Electrical	Table 802.2.1

TABLE S 18.2
STANDARDS, PUBLICATIONS, PRACTICES, AND GUIDES

DOCUMENT NUMBER	DOCUMENT TITLE	APPLICATION
ASHRAE		
ASHRAE 90.1-2019	Energy Standard for Buildings Except Low-Rise Residential Buildings	Energy
ASHRAE 93-2010 (RA2014)	Methods of Testing to Determine the Thermal Performance of Solar Collectors	Testing
ASHRAE 95-1981 (RA1987)	Methods of Testing to Determine the Thermal Performance of Solar Domestic Water Heating Systems	Testing
ASHRAE Handbook-2021	Fundamentals	Electrical
ASHRAE 96-1980 (RA1989)	Thermal Performance of Unglazed Flat-Plate Liquid-Type Solar Collectors	Testing, Collector
ASME		
ASME A13.1-2020	Scheme for the Identification of Piping Systems	Piping
ASME B16.21-2021	Nonmetallic Flat Gaskets for Pipe Flanges	Joints
ASME B16.34-2020	Valves - Flanged, Threaded, and Welding End	Valves
ASME B16.47-2020	Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch	Fittings
ASME BPVC Section IV-2021	Rules for Construction of Heating Boilers	Miscellaneous
ASME BPVC Section IX-2021	Welding, Brazing, and Fusing Qualifications	Certification
ASSE		
ASSE 1010-2021	Performance Requirements for Water Hammer Arresters	Water Supply Component
ASTM		
ASTM A377-2018 (R2022)e1	Standard Index of Specifications for Ductile Iron Pressure Pipe	Piping, Ferrous
ASTM A733-2016 (R2022)	Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples	Piping, Ferrous
ASTM D56-2022	Standard Test Method for Flash Point by Tag Closed Cup Tester	Testing
ASTM D93-2020	Standard Test Method for Flash Point by Pensky-Martens Closed Cup Tester	Testing
ASTM D635-2022	Standard Test Methods for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position	Testing
ASTM D2235-2022	Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings	Joints
ASTM D2672-2020^{e1}	Standard Specification for Joints for IPS PVC Pipe Using Solvent Cement	Joints
ASTM D2855-2020	Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets	Joints
ASTM D3278-2021	Standard Test Method for Flash Point of Liquids by Small Scale Closed-Cup Apparatus	Testing
ASTM E136-2022	Standard Test Method for Assessing Combustibility of Materials Using a Ver- tical Tube Furnace at 750°C	Furnace
ASTM F480-2014 (R2022)	Standard Specification for Thermoplastic Well Casing Pipe and	Piping, Plastic

	Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80	
ASTM F891-2016	Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core	Piping, Plastic
AWS		
AWS B2.2/B2.2M-2016	Brazing Procedure and Performance Qualification	Certification
AWWA		
AWWA C507-2018	Ball Valves, 6 In. through 60 In. (150 mm Through 1,500 mm)	Valves
BS		
BS EN 12975-1-2006 (R2010)	Thermal Solar Systems and Components – Solar Collectors – Part 1: General Requirements	Collector
BS EN 12976-1-2021	Thermal Solar Systems and Components – Factory Made Systems – Part 1: General Requirements	Solar Thermal Systems
BS EN 12976-2-2019	Thermal Solar Systems and Components – Factory Made Systems – Part 2: Test Methods	Solar Thermal Systems
BS EN ISO 9806-2017	Solar Energy – Solar Thermal Collectors – Test Methods	Collector
BS EN ISO 9488-2022	Solar Energy – Vocabulary	Miscellaneous
CSA		
ANSI Z21.22-2015 (R2020)/CSA 4.4-2015 (R2020)	Relief Valves for Hot Water Supply Systems	Valves
CSA/ANSI Z21.24-2022/CSA 6.10-2022	Connectors for Gas Appliances	Fuel Gas
IAPMO		
IAPMO IGC 332-2017a	Hydronic Radiators	Hydronic Systems
IAPMO IS 34-2020	Installation Standard for Residential Solar Photovoltaic and Energy Storage Systems	Solar PV Systems
IAPMO/ANSI WE•Stand- 2020	Water Efficiency and Sanitation Standard for the Built Environment	Water Conservation
IEEE		
IEEE 937-2019	Installation and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems	Installation and Maintenance, Photovoltaic
IEEE 1013-2019	Sizing Lead-Acid Batteries for Stand-Alone Photovoltaic (PV) Systems	Photovoltaic, Sizing
IEEE 1361-2014	Selecting, Charging, Testing, and Evaluating Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems	Testing, Evaluation
IEEE 1526-2020	IEEE Recommended Practice for Testing the Performance of Stand-Alone Photovoltaic Systems	Testing, Photovoltaic
IEEE 1547-2018	Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces	Connections, Photovoltaic
IEEE 1562-2021	Sizing of Stand-Alone Photovoltaic (PV) Systems	Array, Battery, Photovoltaic
IEEE 1661-2019	Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems	Testing and Evaluation, Photovoltaic
MSS		
MSS SP-58-2018	Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation (including Amendment 1, dated October 17, 2019)	Fuel Gas
MSS SP-80-2019	Bronze Gate, Globe, Angle, and Check Valves	Valves
NEMA		

ANSI/NEMA 250-2020	Enclosures for Electrical Equipment (1000 Volts Maximum)	Electrical
NFPA		
NFPA 13D-2022	Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes	Fire Safety
NFPA 54/Z223.1-2021	National Fuel Gas Code	Fuel Gas
NFPA 70E-2021	Electrical Safety in the Workplace	Electrical Safety
NFPA 274-2018	Standard Test Method to Evaluate Fire Performance Characteristics of Pipe Insulation	Pipe Insulation
NSF		
NSF/ANSI 14-2022	Plastics Piping System Components and Related Materials	Piping, Plastic
UL		
UL 174-2004	Household Electric Storage Tank Water Heaters (with revisions through December 16, 2021)	Appliances
UL 916-2015	Energy Management Equipment (with revisions through October 21, 2021)	Electrical
UL 1453-2016	Electric Booster and Commercial Storage Tank Water Heaters (with revisions through May 18, 2018)	Appliances
UL 60730-1 2016	Automatic Electrical Controls – Part 1: General Requirements (with revisions through October 18, 2021)	Electrical

ABBREVIATIONS IN TABLE S 18.1 AND TABLE S 18.2

AHRI Air-Conditioning, Heating, and Refrigeration Institute, 2311 Wilson Boulevard, Suite 400, Arlington, VA 22201.

ANSI American National Standards Institute, Inc., 25 W. 43rd Street, 4th Floor, New York, NY 10036.

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.

ASME American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASSE American Society of Sanitary Engineering, 18927 Hickory Creek Drive, Suite 220, Mokena, IL 60448.

ASTM ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

AWS American Welding Society, 8669 NW 36 Street, # 130, Miami, FL 33166-6672.

AWWA American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235.

BSI (BS EN) British Standard International, 12950 Worldgate Drive, Suite 800 Herndon, VA 20170.

CSA Canadian Standards Association, 178 Rexdale Boulevard, Toronto, ON, Canada M9W 1R3.

IAPMO International Association of Plumbing and Mechanical Officials, 4755 E. Philadelphia Street, Ontario, CA 91761.

ICC International Code Council, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001.

IEEE The Institute of Electrical and Electronics Engineers, Inc., 445 and 501 Hoes Lane, Piscataway, NJ 08854.

IGSHPA International Ground Source Heat Pump Association, 312 S. 4th Street, Suite 100, Springfield, IL 62701.

ISO International Organization for Standardization, Chemin de Blandonnet 8, CP 401 - 1214 Vernier, Geneva, Switzerland.

MSS Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street NE, Vienna, VA 22180.

NEMA National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 900, Rosslyn, VA 22209.

NFPA National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NGWA National Ground Water Association, 601 Dempsey Road, Westerville, OH 43081.

NSF NSF International, 789 N. Dixboro Road, Ann Arbor, MI 48105.

SRCC Solar Rating and Certification Corporation, 3060 Saturn Street, Suite 100, Brea, CA 92821.

UL Underwriters Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062.

SECTION 29. The provisions of this ordinance contain various changes, modifications, and additions to the 2025 California Plumbing Code. Some of those changes are administrative in nature in that they do not constitute changes or modifications to requirements contained in the building standards published in the California Building Standards Code.

Pursuant to California Health and Safety Code sections 17958.5, 17958.7, and 18941.5, the Board of Supervisors hereby expressly finds that all of the changes and modifications to requirements contained in the building standards published in the California Building Standards Code that are contained in this ordinance are reasonably necessary because of local climatic, geological, or topographical conditions in the County of Los Angeles due to the potential for seismic activity in the region, topographical conditions that contribute to the spread of wild fires, and climatic conditions that impact air quality and increase the risk of wild fires. Without limiting the foregoing, the County makes additional findings herein:

PLUMBING CODE AMENDMENTS

CODE SECTION	CONDITION	EXPLANATION
Section 304.1	Geological Topographical Climatic	The County of Los Angeles is a densely populated area with buildings constructed within a region where water is scarce and domestic water service is impacted by immoderate and varying weather conditions, including periods of extended drought. The proposed measures will require buildings to be more water efficient and allow greater conservation of domestic water due to these local conditions.
Sections 601.2.3	Geological Topographical Climatic	The County of Los Angeles is a densely populated area with buildings constructed within a region where water is scarce and domestic water service is impacted by immoderate and varying weather conditions, including periods of extended drought. The proposed measures will require buildings to be more water efficient and allow greater conservation of domestic water due to these local conditions.
Section 721.3	Geological Topographical	To allow for the proper operation of existing Los Angeles County sewer infrastructure and establish consistency with Title 20 – Utilities – of the Los Angeles County Code, Division 2 (Sanitary Sewers and Industrial Waste) due to local soil conditions and topography.
Sections 728.1 to 728.6	Geological Topographical	To allow for the proper operation of existing Los Angeles County sewer infrastructure and establish consistency with Title 20 – Utilities – of the Los Angeles County Code, Division 2 (Sanitary Sewers and Industrial Waste) due to local soil conditions and topography.

Table H 101.8	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions and to provide protections for native, protected oak trees that are consistent with Title 22 – Zoning and Planning – of the Los Angeles County Code, Chapter 22.174 (Oak Tree Permits).
Table H 201.1(1)	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions, sewer capacity, and sewage treatment.
Table H 201.1(2)	Geological Topographical	To establish consistency with requirements of the County Health Department for sewer capacity and sewage treatment due to local soil conditions.
Table H 201.1(3)	Geological Topographical	To establish consistency with requirements of the County Health Department for sewer capacity and sewage treatment due to local soil conditions.
Table H 201.1(4)	Geological Topographical	To establish consistency with requirements of the County Health Department for sewer capacity and sewage treatment due to local soil conditions.
Section H 301.1	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions.
Section H 401.3	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions.
Section H 601.5	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions.
Section H 601.8	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions.
Section H 701.2	Geological Topographical	To establish more restrictive requirements for protection of local groundwater due to local soil conditions.

Section H 1001.1	Geological	To establish more restrictive requirements to prevent earth movement based on local soil and seismic conditions.
Section H 1101.6	Geological	To establish more restrictive requirements to prevent earth movement based on local soil and seismic conditions.
Appendix P		
Appendix S	Climatic	To establish requirements for solar thermal energy systems based on provisions in the Uniform Solar, Hydronics and Geothermal Code (USHGC), which is developed by the International Association of Plumbing and Mechanical Officials. The County of Los Angeles is a densely populated area, with elevated levels of greenhouse gas emissions. Standards to regulate the installation of solar thermal energy systems will facilitate safe and efficient installations of these systems to improve local air quality, thereby improving the health of the County's residents, businesses and visitors.

SECTION 30. This ordinance shall become operative on January 1, 2023.

[TITLE28PLUMBINGCODE2025CSCC]