CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

CONSTRUCTION GUIDELINES FOR RESIDENTIAL CONSTRUCTION

2022 California Residential Code

Based on the 2021 International Residential Code

2022 California Building Code

Based on the 2021 International Building Code

2022 California Electrical Code

Based on the 2020 National Electrical Code

2022 California Plumbing Code

Based on the 2021 Uniform Plumbing Code

2022 California Mechanical Code

Based on the 2021 Uniform Mechanical Code

2022 California Energy Code

San Jose Reach Code and Ordinances

These construction guidelines are for residential projects within the City of San Jose. This handbook is not exhaustive in scope, nor intended as an installation guide for untrained construction workers. It is merely a guideline for some common items found during the inspection of typical single-family and duplex residential construction. The standards, codes, ordinances, interpretations, and practices described in this handbook may be changed, updated, or corrected at any time without correcting or re-publishing this handbook. Refer to the adopted Codes for full requirements.

This handbook addresses the common construction topics for the following types of residential projects:

Residential Dwellings

Accessory dwelling unit or ADU. An attached or detached residential dwelling which is ancillary to a One-Family, Two-Family, or Multiple-Family Dwelling and provides complete independent living facilities for one or more persons that include permanent provision for living, sleeping, eating, cooking, and sanitation on the same parcel as the main Dwelling is situated.

Junior accessory dwelling unit or JADU. JADU is not more than 500 sq ft in size, contained entirely within an existing or proposed single-family structure, and meets all the requirements.

1. Any exterior alteration is limited to accommodating ingress/egress requirements.
2. Shall include a separate entrance from the main entrance to the primary dwelling unit and may have an interior entry to the primary dwelling.
3. May include separate sanitation facilities or may share sanitation facilities with the existing primary dwelling.
4. Shall require owner-occupancy in the single-family residence in which the junior accessory dwelling unit will be permitted. Owner occupancy shall not be required if the owner is another governmental agency, land trust, or housing organization.
5. Shall require the recordation of a deed restriction, which shall run with the land, and which shall be on file with the City, to

include a restriction on the size and attributes of the junior accessory unit that conforms with this section; and prohibition on the sale of the junior accessory dwelling unit separate from the sale of the single-family residence, including a statement that the deed restriction may be enforced against future purchasers.

6. Shall include at least an efficiency kitchen which shall include a cooking facility with appliances; and A food preparation counter and storage cabinets that are of reasonable size in relation to the size of the JADU.

Tiny Home on Wheels or THOW. A structure intended for separate, independent living quarters for one household that meets all of the following criteria:

1. Is a detached self-contained unit, designed and built to look like a conventional building structure, and which includes basic functional areas that support normal daily routines such as cooking, sleeping, toilet, and bathing facilities; and
2. Is licensed and registered with the California Department of Motor Vehicles; and
3. Meets the American National Standards Institute (ANSI) 119.5 requirements or the National Fire Protection Association (NFPA) 1192 standards and is certified for ANSI or NFPA compliance. Certification must be made by a qualified third-party inspector; and
4. Is towable by a bumper hitch, frame-towing hitch, or fifth-wheel connection and cannot move under its own power; and
5. A min. of 150 sq ft and max. of 400 sq ft as measured within the exterior faces of the exterior walls.

ADUs, JADUs, and THOWS:
General ADU permit checklist: San Jose Bulletin 210
Tiny Home on Wheels Permit Checklist: San Jose Bulletin 291

Throughout this handbook, items pertaining specifically to accessory dwellings (ADUs, JADUs, or THOWs) will be noted in a similar format.

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LOCAL CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

Ground Snow Load	0
Wind Design Speed (mph)	95 Ultimate
Presumptive soil load-bearing value	1500 psi
Topographic Effects	No
Seismic Design Category	D1 through E
Subject to Damage from	
• Weathering:	Negligible
• Termite:	Very High
• Frost Line Depth:	5 inches
Winter Design Temp (ºF)	40
Ice Barrier Underlayment	Not required
Air Freezing Index (Table 403.3(2))	1500
Mean Annual Temp (ºF)	59.7
Maximum building height (Ft.)	35

Part I
BUILDING REQUIREMENTS

2022 California Residential Code
2022 California Building Code
FOUNDATION INSPECTION

(CRC Chapter 4 or CBC Chapter 18)

Quick Inspection checklist

- ✓ Setbacks conform to zoning, easements
- ✓ Setbacks from slope are ok
- ✓ Soil observation report (if noted on plans, structural notes)
- ✓ Soil compaction report (if noted on plans, structural notes)
- ✓ Flood Elevation Certificate (If noted on plans, permit)
- ✓ Geo Hazard clearance for special conditions (Geo Hazard zones)
- ✓ Rebar placement special inspection (if noted in structural notes)
- ✓ Footing depths and dimensions, height above grade
- ✓ Rebar steel grade (check structural notes), size, laps, ties, clearances
- ✓ Trenches are free of debris, water ponding
- ✓ HD Placement and size (per foundation plan and HD's schedule)
- ✓ A.B spacing per shear schedule
- ✓ Interior piers
- ✓ Plumbing is wrapped to avoid contact with concrete
- ✓ Concrete Grounding Electrode
- ✓ Prior to any subtrade inspection, the Inspection checklist form for ADUs (SJC bulletin 213) must be filled out and ready. For THOWs, complete sections A, and B of the form.

Setbacks

Detached ADUs and THOWs: Required fire separation, min. 6' wall to wall, from adjacent building(s). Detached ADU is not allowed when THOW is present, and vice versa.

□ Property lines are marked or easily determined from existing references. Existing fences can be used if the dimensions between the fence lines match the site plan. If references are not identified or when a discrepancy occurs, a survey letter can be requested.

□ Setbacks conform to zoning, Easements and must allow room for construction of required rated and/or high-performance wall assembly if occurs.

Residential Zoning Districts Development Standards

Regulations	Zoning District					
	R-1-8	R-1-5	R-1-2	R-1-1	R-1-RR	R-2
Min. lot area (sf or acreage)	5,445	8,000	20,000	43,560	5 acres	5,445
Minimum setback (feet)						
Front	20	20	30	30	50	15
Side, interior	5	5	15	20	20	5
Side, corner	12.5	12.5	15	20	30	10
Rear, interior	20	20	25	25	30	25
Rear, corner	20	20	25	25	30	25
Min. driveway length (ft) measured from lot line	18	18	18	18	18	0
Max. height (ft)	35	35	35	35	35	35
Max. number of stories	2.5	2.5	2.5	2.5	2.5	2.5
Floor area ratio	Generally, max 45% or single-family house permit criteria may apply					

Accessory Buildings and Structures Development Regulations

Front Setback (feet)	
Retaining walls	None
Swimming pool, built-in	30
Detached garage on a lot with two intersecting front property lines	25
Detached garage with a max. length of twenty ft that maintains a min. side setback of five ft	45
All other accessory buildings and structures	60
Side Setback (feet)	
Swimming pool, built-in	
Interior lot	5
Corner lot	9
All other accessory buildings and structures [(2),(3),(8)]	None
Rear Setback (feet)	
Swimming pool, built-in	5
All other accessory buildings and structures [(2),(3),(8)]	None
Height (feet)	
Retaining wall	2
All other accessory buildings and structures	12
Maximum number of stories	1
Area (square feet)	
Maximum size (cumulative sf) [(5),(6),(7)]	650

Notes:

2. On a corner lot, no accessory buildings/structures, excluding fences, shall be built within ten feet of the side property line of the street side.

3. Accessory buildings/structures on a corner lot that abuts upon a key lot that is for residential use, shall be set back not less than four feet from the rear lot line of such lot, provided that the setback for swimming pools shall not, in any event, be reduced to less than five feet.

4. Maximum height of two feet measured from existing grade unless a greater height is otherwise approved with a development permit.
5. The size of an individual accessory building or accessory structure or the total aggregate square footage of all accessory buildings and accessory structures built on any property may be increased to exceed six hundred fifty square feet only pursuant to a special use permit.
6. The calculation of square footage shall not include any square footage of an accessory building or accessory structure that is entirely below grade.
7. shall not contain living space or sleeping quarters and shall be limited to two plumbing connections to serve an appliance or fixture, and unconditioned space as defined in Title 24 of the San José Municipal Code.
8. Increased setbacks may be required based upon fire and life safety requirements in this Code.

Setback Regulation for ADUs

Shall be subject to the setback requirements for a One-Family Dwelling in the zoning district in which the One-Family Dwelling is located, except as follows:

- Conversion of Existing Accessory Building—No setback over the setback specified for an Accessory Building shall be required for an existing Accessory Building.

- New detached ADUs:
  Less than 40% of rear yard coverage:
  No side and rear setback requirement, with min 60' front setback. 4' side setback is required if front setback is min. 45' but less than 60'.

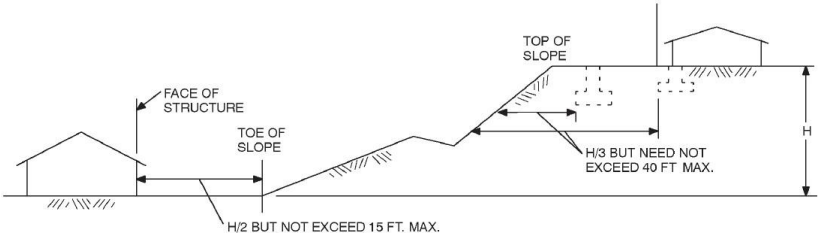
  2nd story ADUs and ADUs with 40% or more of rear yard coverage: Min. 4 ft side and rear setbacks. 2nd story ADUs with an overhang of 1 ft or less.

- New attached ADUs: Min. 4ft ft rear and side setbacks for the first story of ADUs no more than 20 feet in height.

Setback Regulation for Tiny Home On Wheels (THOWs)

- Shall be located in rear yard with Min. 4 ft side and rear setbacks 10 ft from a corner property line.
- If the size of the rear yard is insufficient to accommodate a THOW, a THOW may be located in the interior side yard area and shall have min. 45 ft front setback and min. 4 ft side setback.

□ Setbacks from slopes are OK (i.e. Refer to figure R403.1.7.1 or CBC 1808.7.1 below), OR
□ When the grade slope exceeds 1:5 average slope across the full length of any side of dwelling, AND the tallest cripple wall (or post) height exceeds 7ft, AND less than 50% of area below lowest framed floor is living space, design in accordance with engineering practice is required. (R301.2.2.6(8))



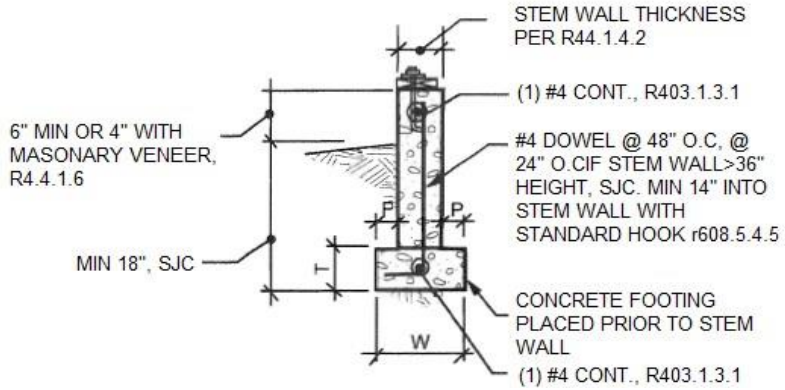
☐ Review soils report if applicable for new footing/pad - SJC 17.04.340)

☐ Verify soils engineer inspection for compaction and/or backfill if applicable

Footings

Tying a new conventional shallow footing to an existing pier and grade beam footing shall not be approved without an acceptance from a design engineer.

□ Footing depth & dimensions conform to plan and minimum code requirements (Table R403.1(1)), not less than 12" in width (W), 6" in depth (T) and min. 2" projection (P)



□ 6" stem wall thickness ok if stem wall height is less than 4'-6" (R404.1.4.2) Manufactured shear walls and Holdown anchors larger than 5/8" in diameter require 8" min. stem wall width, except for SSTB28" on a garage curb less than 11-1/4" in height

Horizontal steel (conventional design): 2-#4 min., 1 T & B (Per R403.1.3.1 & TableR404.1.2(1)) Grade 40 min.

Additional horizontal #4 18" o.c if stem wall height exceeds 24" (City of San Jose)

Steel rebar laps: 20" for #4 splice unless engineered
(Table R608.5.4(1))

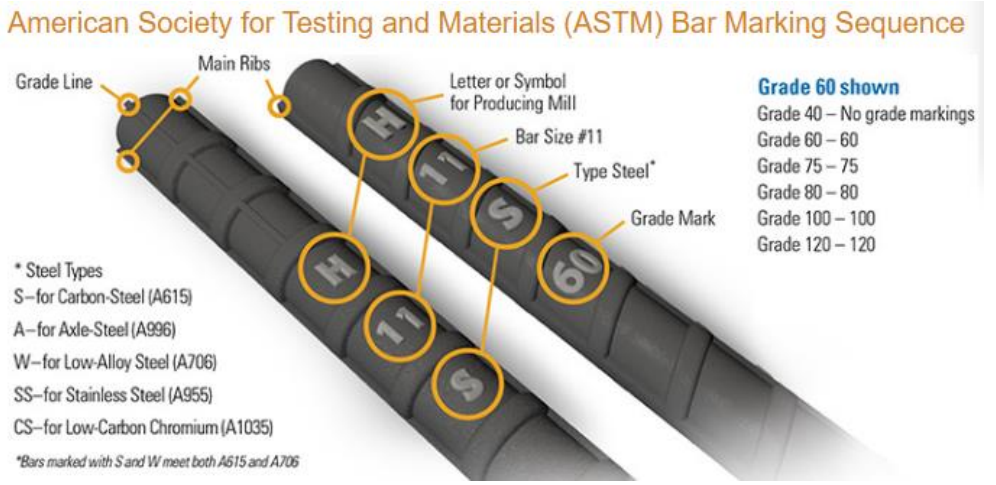
Clear spacing between parallel rebars shall be at least the greatest of 1", bar diameter, or 4/3 of max. size of coarse aggregate. (ACI 318, 25.2)

Clearances: 3" min to earth, 1-1/2" min to forms, 3/4" when not exposed to weather or earth (R404.1.3.3.7.4)

When horizontal construction joints exist, vertical steel, #4 @ 48" o.c. with standard hooks and extends

min 14” into stem wall (Grade 60 min. per R403.1.3.1)
Vertical #4@24” o.c if stem wall height exceeds 36” (CSJ)

□ Steel grade, size, laps, ties & clearances
Verify rebar grade per schedule for engineered designs.



There will be a grade marking (60, 75, 80, 100, 120) or by the addition of one line (60) or two lines (75), three lines (80, 100), or four lines (120) that must be at least five deformations long.

□ Foundation elevation
Top of exterior footing must be a min of 12” plus 2% above the street gutter per R403.1.7.3. In flood zones, footing shall be min 12” above flood plain elevation.
6” min fall within 10 ’to slope away from building foundation (R401.3)

☐ Top of footings must be level, bottom of footing not to exceed 10% slope (R403.1.5)

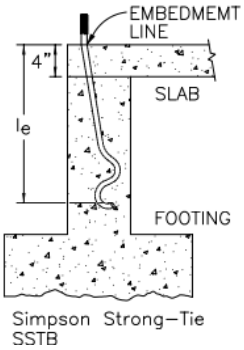
☐ Plumbing is wrapped to accommodate expansion and contraction where embedded in concrete

☐ Trenches are clean, free of debris & no soil cracking

□ Verify HD placements, type of bolts, embedment depth, and edge distances, in conformance with the approved plan & manufacturer’s recommendations. Holdown anchor bolts shall be templated into place.

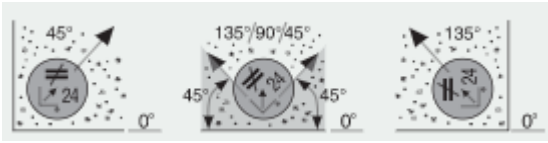
SB bolts yield higher uplift resistance than SSTB bolts having equivalent embedment depth. Therefore, they can replace SSTBs on plans, but not vice versa.

HD anchors require a horizontal #4 bar 3-5" from the top of concrete, bar to extend min 2x the required embedment depth each side of bolt. Bolts at corner will be installed inside of rebar bend. Footing rebars can be used to satisfy these requirements.



Two-pour installation shall require adjustment to bolt scheduled as follow (Simpson):

- SSTB20: use the equivalent loads of the SSTB16.
- SSTB24, use the equivalent loads of the SSTB20.
- SSTB34 or 36, use the equivalent loads of the SSTB28.



HD bolt placement to yield min. 45-degree angle from either edge and arrow marking.

□ Hardware for manufactured shear walls may require embedment into footing or grade beam, <u>not JUST in stem wall</u>. Manufacture templates must be used.

□ Min 1/2" diameter foundation anchor bolts with a min embedment of 7"; spaced at no more than 6 'o.c. for up to 2 stories and 4 'o.c. for over 2 stories (R403.1.6 & R403.1.6.1). Located in the middle 1/3 of Mudsill

Piers

(CRC R403.1.1 requires footing size based on tributary load and allowable soil pressure)

□ 20" round, 16" square, 18" deep or per soil report/engineer's design.

☐ Min. 8" above grade

☐ Piers larger than 30" x 30" require a bottom mat of min. 2-#4 EW

Slab Reinforcement – Under-slab plumbing must be approved before Slab Reinforcement inspection.

ADUs & JADUs: Conversion of an existing accessory structure, with slab on grade floor, to an ADU requires a moisture barrier, topical application of listed moisture barrier shall be applied prior to framing walls. Where an accessory structure has open side(s) and top of slab flush with grade, the design needs to address drainage and wood-to-earth clearance.

3-1/2" min thickness (R506.1/CBC 1910)

- ❑ Base rock requirements 4" (R506.2.2)
- ❑ Vapor barrier requirements 10 mil min. directly placed under concrete with min 6" lap at joints. (R506.2.3)
- ❑ Reinforcement installed per plan

Grounding Electrode

□ 20' #4 rebar ground in footing (not stem wall), or

□ 20' #4 bare copper ground in footing (not stem wall), or

□ L shaped rebar with 20" lap at bottom bar and extends min 6" above mud sill

Flood Resistant Construction (R322)

- ❑ Slab not part of foundation of structure
    1. Shall not have turn-down edge, nor reinforcement, no dowels

2. Shall have isolation joints at foundation or columns and control or construction joints max 4’ o.c in both directions
3. Shall not be more than 4” thick at any point.

- Substantial improvement in a flood zone (SJC 17.08.280)

• Verify flood vents in stem walls matching flood vent calculation for area enclosed under flood elevations.

Min 2 vents on different sides of each enclosed area

- Bottom of each vent shall not be more than 1’ above the higher of interior floor and the finished exterior grade. Flood vents are often blocked out in foundation stem walls.
- Total net vent area shall be not less than 1 square inch for each square foot of the enclosed area.

• For new structures, Provide Elevation Certificate and contact Public Work for inspections and Final approval (Contact Arlene Lew @ 408-535-6827)

UNDERFLOOR/SUBFLOOR INSPECTION
(R502/CBC 2304)

ADUs: Identify locations of all rated walls. Rated wall assembly needs to continue from foundation to roof, extends through concealed spaces, tightly against exterior wall. Attached ADU shall not share crawlspace or air transfer with main dwelling. Rated wall below floor to be completed prior to under floor frame approval.

In general, triple 2x rimboards or blocks will satisfy 1hr rating where required. Foundation vents are permitted in rated walls (CRC302.1 (5))

Foundation/setback must be previously approved for Under Floor area to be inspected.

Subfloor must be approved prior to plating next floor walls.

Girders and Posts

□ Girder supporting single floor min 4 x 6, with spans less than 6', spaced max 8' o.c. (CBC2308.4.1)

□ Girder bearing (R502.6/CBC 2308.4.1& 2304.11.2)

1-1/2" min on wood or metal

3" min on masonry or concrete

Girder will be connected to supporting post with hardware to ensure against uplift and lateral displacement. Support for girder ends can be by posts or hangers. (R502.9)

Non pressure treated posts are allow if installed on elevated piers 8" min above earth @ under floor, OR earth is covered by moisture barrier (R317.1/ CBC 1809.8)

1/2" air spaces @ sides, ends & top with mudsill bearing in girder masonry pockets (R317.1 #4)

Girder to post connection (R502.9/CBC 2304.11.2)

☐ 12" min earth to girders (R317.1/CBC 2304.12.1.1)

☐ End of girders to have min 1/2 air gap from concrete or protected by hardware/flashing.

☐ Squash blocks required under all posts above floor.

Mudsill

□ Pressure treated lumber with accredited agency label (R504.3/CBC 2304.12.1) or naturally durable wood.

□ 2x or larger plate or sill having a width at least equal to the width of the studs (R602.3.4/CBC 2304.3.1)

General Mud sill Bolting (R403.1.6/CBC 2308.3.1 & City Policy)

□ 6 'o.c. max for 1 & 2 story buildings

☐ 4 'o.c. max for over 2 stories (R403.1.6 #4/CBC 2308.3.1, except. 2)

☐ A.B spacing must be per shear schedule for engineered shear walls

□ Min 2 bolts per each piece, 1/2" diameter min with 3"x3"x229" plate washers (R602.11.1/CBC 2308.3.2)

Min 7 bolt diameters and max 12" from splices or ends (R403.1.6)
Min 4" & max 12" from ends of plates (CBC 2308.3.1)
Within middle 1/3 of plate width.

- Edge distance: Min $1^{1/8}$" for 2x4 plate or $1^{3/4}$" for 2x6 plate

□ Fasteners, including nuts and washers, in contact with Pressure treated lumber shall be hot-dipped, zinc-coated galvanized steels, stainless steels, silicon bronze or copper. Except for ½" or greater steel bolts or when used in SBX/DX and zinc borate preservative-treated wood in an interior, dry environment (R317.3)

Floor Joists

❑ 18" min earth to bottom of joists (R317.1/CBC 2304.12.1.1)

❑ Bearing (R502.6/CBC 2308.4.2.2)
- 1-1/2" min on wood or metal
- 3" min on masonry or concrete

❑ Joist laps (R502.6.1/CBC 2308.4.2.3)
- 3" min laps with 3-10d's face nails
- 1-1/2" min bearing, and butts strapped with ST9 or equal
- Joist blocking (R502.7/CBC 2308.4.2.3)
- At ends and all bearing points with 2x full depth blocking, 2x12 joists with solid blockings @ max 8' oc

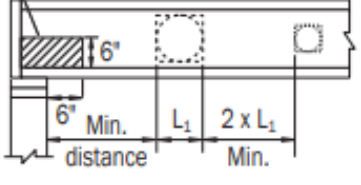
❑ Joist nailing Table (Table R602.3(1),(2)/CBC 2304.10.1)

- To sill or girder with 4-8d box or 3-8d common
- Sole plate to joist or blocking 2-16d common @ 16" oc
- 2x subfloor to joist or girder face nail with 2-16d common

- ❑ Double Joist under all bearing walls (R502.4/CBC 2308.4.5)
- ❑ Joist cutting, drilling and notching for sawn lumber
  - not exceed 1/6, and longer than 1/3, of the joist's depth, and shall not be located in the middle one-third of the span.
  - Notches at the ends of joist shall not exceed ¼ of joist's depth. *No notches on bottom of 4x lumber except at the ends.*
  - holes bored or cut shall not exceed 1/3 of joist's depth and shall have min. 2" distance to both edges, any other hole, or to a notch.
- ❑ Manufactured floor joists and trusses per plan & manufacturer's details. TJI Field cut holes need to follow chart below. Other engineered joists, headers (with uniformed load) shall not have hole outside of middle third, except for LSL. (TJ-9015)

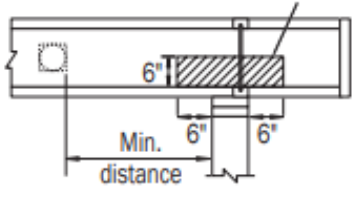
Depth	TJI®	Minimum distance from edge of hole to inside face of nearest: End Support							Intermediate or Cantilever Support						
		2"	3"	4"	6½"	8⅞"	11"	13"	2"	3"	4"	6½"	8⅞"	11"	13"
9½"	110	1'-0"	1'-6"	2'-6"	5'-0"				2'-0"	2'-6"	3'-6"	7'-6"			
	210	1'-0"	2'-0"	2'-6"	5'-6"				2'-0"	3'-0"	4'-0"	8'-0"			
	230	1'-6"	2'-0"	3'-0"	5'-6"				2'-6"	3'-6"	4'-6"	8'-6"			
11⅞"	110	1'-0"	1'-6"	2'-0"	4'-6"	6'-0"			1'-0"	1'-6"	2'-6"	7'-0"	9'-6"		
	210	1'-0"	1'-6"	2'-6"	5'-0"	6'-6"			1'-0"	2'-0"	3'-0"	8'-0"	10'-0"		
	230	1'-0"	2'-0"	2'-6"	5'-6"	7'-0"			1'-0"	2'-6"	3'-6"	8'-6"	10'-6"		
	360	1'-6"	2'-6"	3'-6"	6'-6"	7'-6"			2'-0"	3'-6"	5'-0"	9'-6"	11'-0"		
	560	2'-6"	3'-6"	4'-6"	7'-0"	8'-0"			3'-0"	4'-6"	6'-0"	10'-6"	12'-0"		
14"	110	1'-0"	1'-0"	1'-6"	3'-6"	6'-0"	8'-0"		1'-0"	1'-0"	1'-0"	5'-0"	9'-0"	12'-0"	
	210	1'-0"	1'-0"	2'-0"	4'-0"	6'-6"	8'-6"		1'-0"	1'-0"	2'-0"	6'-0"	10'-0"	13'-0"	
	230	1'-0"	1'-0"	2'-0"	4'-0"	7'-0"	9'-0"		1'-0"	1'-0"	2'-6"	6'-6"	11'-0"	13'-6"	
	360	1'-0"	1'-6"	2'-6"	6'-0"	8'-0"	9'-6"		1'-0"	2'-0"	4'-0"	9'-0"	12'-0"	14'-0"	
	560	1'-6"	3'-0"	4'-0"	7'-0"	9'-0"	10'-0"		1'-0"	3'-0"	5'-0"	10'-0"	13'-6"	15'-0"	
16"	110	1'-0"	1'-0"	1'-0"	3'-0"	5'-6"	7'-6"	10'-0"	1'-0"	1'-0"	1'-0"	3'-6"	8'-6"	11'-6"	15'-0"
	210	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	8'-0"	11'-0"	1'-0"	1'-0"	1'-0"	4'-6"	10'-0"	12'-6"	16'-0"
	230	1'-0"	1'-0"	1'-0"	3'-6"	7'-0"	9'-0"	11'-0"	1'-0"	1'-0"	1'-0"	5'-0"	10'-6"	13'-6"	16'-6"
	360	1'-0"	1'-0"	1'-6"	5'-0"	9'-0"	10'-0"	11'-6"	1'-0"	1'-0"	2'-0"	7'-6"	13'-0"	14'-6"	17'-0"
	560	1'-0"	2'-0"	3'-0"	6'-6"	10'-0"	11'-0"	12'-0"	1'-0"	1'-0"	3'-6"	9'-0"	14'-6"	16'-0"	18'-0"

No field cut holes in hatched zone



- Locate hole so required min. distance from **both** end and intermediate support is maintained.
- Leave ⅛" of web (min.) above and below hole.
- Distances are based on uniform loads.

No field cut holes in hatched zone



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FLOOR JOIST SPAN TABLES R502.3.1(1)/CBC2308.4.2.1(1)
With 30 psf live load and 10 psf dead load Deflection = 1/360
Residential Sleeping Areas

		Douglas Fir		Hem Fir	
Size	Spacing	#1	#2	#1	#2
2 x 6	12”	12’-0”	11’-10”	11’-7”	11’-0”
	16”	10’-11”	10’-9”	10’-6”	10’-0”
	24”	9’-7”	9’-3”	9’-2”	8’-9”
2 x 8	12”	15’-0”	15’-7”	15’-3”	14’-6”
	16”	14’-5”	14’-2”	13’-10”	13’-2”
	24”	12’-4”	11’-8”	12’-1”	11’-4”
2 x 10	12”	20’-3”	19’-10”	19’-5”	18’-6”
	16”	18’-5”	17’-5”	17’-8”	16’-10”
	24”	15’-0”	14’-3”	14’-10”	13’-10”
2 x 12	12”	24’-8”	23’-4”	23’-7”	22’-6”
	16”	21’-4”	20’-3”	21’-1”	19’-8”
	24”	17’-5”	16’-6”	17’-2”	16’-1”

FLOOR JOIST SPAN TABLES R502.3.1(2)/CBC2308.4.2.1(2) With 40 psf live load and 10 psf dead load Deflection = 1/360 **Residential Living Areas other than sleeping areas**					
		Douglas Fir		Hem Fir	
Size	Spacing	#1	#2	#1	#2
2 x 6	12”	10’-11”	10’-9”	10’-6”	10’-0”
	16”	9’-11”	9’-9”	9’-6”	9’-1”
	24”	8’-8”	8’-3”	8’-4”	7’-11”
2 x 8	12”	14’-5”	14’-2”	13’-10”	13’-2”
	16”	13’-1”	12’-9”	12’-7”	12’-0”
	24”	11’-0”	10’-5”	10’-10”	10’-2”
2 x 10	12”	18’-5”	18’-0”	17’-8”	16’-10”
	16”	16’-5”	15’-7”	16’-0”	15’-2”
	24”	13’-5”	12’-9”	13’-3”	12’-5”
2 x 12	12”	22’-0”	20’-11”	21’-6”	20’-4”
	16”	19’-1”	18’-1”	18’-10”	17’-7”
	24”	15’-7”	14’-9”	15’-5”	14’-4”

Shear Connection

- Identify shear wall type and length for each shear wall.
- Shear transfer connection per shear wall table
- Verify installation of drag blockings and straps
- HDs extended to engage posts for full load capacity
- Max 18” from top of stem wall/slab to bottom of HD (Simpson.)

Crawlspace Access (R408.4/CBC 1209.1)

□ 18" x 24" min opening unobstructed by pipes, ducts and etc.

□ Pipes, ducts and other construction shall not interfere with the accessibility to or within underfloor areas

Cripple Walls (R602.9/CBC 2308.6.6.2)

□ See Prescriptive Wall Bracing Table 2308.9.3(1) & (2)

>4' high—frame wall as an additional story

<14" high—sheath one side between top and bottom plates or solid blocked

Cripple wall to be supported on continuous foundation

Under-floor Ventilation (R408/CBC 1203.4.1)

□ Cross flow provided on at least two opposite sides, equally distributed, and within 3 'to corners to remove dead air

□ At additions, maintain & extend existing vents and add required ventilation of new addition

□ 1 sq. ft. per 150 sq. ft. of new floor area

Unvented Crawlspace (R408.3)

❑ Exposed earth is cover with class I vapor retarder, 6" overlap at seams, and 6" up and attached to the stem wall, all edges to be sealed or taped. **AND** one of the followings:

- Continuous running mechanical exhaust or conditioned air supply sized at 1cfm or each 50sf of crawlspace, with air transfer pathway (grille or duct) to the common area.
- **Or**, Dehumidification sized to provide 70 pints of moisture per day for every 1000sf of crawlspace area.

Sub-floor Nail

Second floor framing is inspected at the time of sub-floor nailing with drags and collectors before plating.

□ Check floor framing to verify conformance with plan

□ ¾" wood subfloor fastened to framing with 8d common, 0.131 x$2^{1/2}$ nails @6"o.c edge and 12" o.c in field, T 602.3(2). Joints staggered

□ Min 24” wide unless blocked and edge nailed

Fire Protection of Floor (R302.13)

If crawlspace or basement houses fuel burning appliance or is used as storage space, it will be protected with 1/2” drywall or 5/8 structural panel or equivalent, from underside.

Exception:
□ Space is protected with fire sprinklers,
□ Allow up to 80sf aggregate unprotected with fire blockings at perimeter
□ Floor joists are solid lumber equal to or greater than 2x10.

TIPS

T-24: Check T-24’s Required HERS features if ductwork to be located in conditioned space.

SHEAR INSPECTIONS

Roof structure, interior, exterior shear walls can be looked at in one inspection or separate inspections. At each inspection, however, all connections for the entire load path and lateral distribution path must be complete and the framing supporting the shear system is as per plan.

CSJ amendment to CBC 2308.6.9: All braced wall panels shall extend to the roof sheathing and shall be attached to parallel roof rafters or blocking above with framing clips.

General Requirements CBC 2308.6 & Table 2306.3(1) Footnotes

- Where panels are applied on both faces of a wall and fastener spacing is less than 6" o.c. on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3" nominal or thicker at adjoining panel edges.
- In Seismic Design Category D, E or F, where shear design values exceed 350 plf, all framing members receiving edge fastening from abutting panels shall not be less than a single 3" nominal member, or two 2x nominal members fastened together in accordance with Section 2306.1 to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered at the panel edges. See AF&PASDPWS for sill plate size and anchorage requirements.

Hardware

- Uplift and compression posts are properly sized
- Sill attachment must be complete and per schedule.
- Holdowns are installed per manufacture installation instruction.
- Retrofit HD's require special inspection, or engineer of record, either at time of installation or by pull test after installation and provide an approval letter. Epoxy installation can be inspected by San Jose Building Inspector for conventional braced walls.
- Straps are extended on uplift posts for full nailing with specified nails
- All transfer connections to roof & floor system must be installed at the time of each inspection

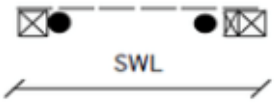
- All drag blocking and straps must be installed and transferred to shear walls
- On a shear wall less than 4 feet in length, if the Holdown post and Holdown are installed away from the end, or closer to the middle of the wall, the engineer of record needs to provide written verification that Holdown placement is acceptable. (SJC-Field Note 301)

CASE A

ACCEPTABLE

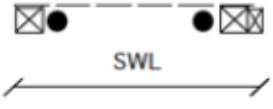
CASE B

ACCEPTABLE



CASE C

REFER TO ENGINEER



CASE D

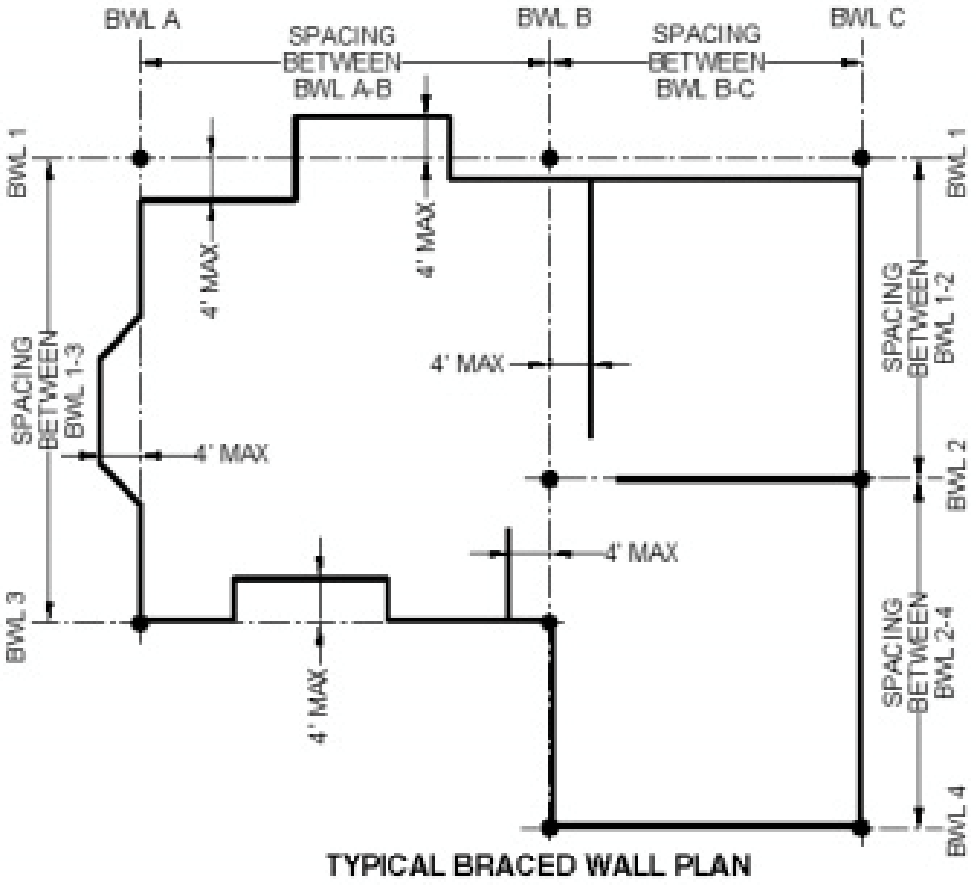
REFER TO ENGINEER

Diaphragm

- Shear ply is nailed to uplift posts with edge nailing
- Blocked diaphragms must have all blockings installed and zone nailing completed
- Plywood grade/plies & thickness per shear schedule
- Nail size and spacing per shear schedule
- Nail heads should not penetrate face ply
- 3/8” min edges distance must be maintained
- Bottom/sole plate nailed per shear schedule
- Top plate splice
  - Min splice in top plates is 48” with 8-16d’s or as required by a plan (CBC 2308.5.3.2) – or per engineer design. For conventional construction, min splice is 24” with min total of 8-16d face nails to each side of end joints. CRC 602.3.2

PRESCRIPTIVE WALL BRACING
(R602.10.1.4/CBC 2308.9.3.1)

Since CSJ is in Seismic Design Category 2, prescriptive bracing is only applicable for up to 2 story one- and two-family dwellings, with PFH, PFG and ABW methods are only permitted on the first story. CRC T602.10.3(3)



TYPICAL BRACED WALL PLAN

Diaphragm Material (Table R602.10.3(3)) & SJC Amendment

- Wood structural panels (WSP), diagonal boards (DWB), particleboard (PBS), fiberboard (SFB), hardboard panels (HPS) etc.
- Portland cement plaster (PCP) on studs spaced at 16" o.c. for single story buildings only (R-3 & U)
- Nominal 1x4 let-in braces or Gypsum boards not allowed (CSJ)

Braced Wall Lines

- Provided on the exterior, and on interior at 25' max spacing (Table R602.10.1.3)
- In one- and two-story buildings, one room or equal not exceeding 900 sq. ft. may have walls not more than 35' apart. Table 602.10.1.3
- Walls within a braced wall line must not be offset by more than 4' (R602.10.1.2), not more than 2/3 of required braced panel length is located to one side of the braced wall line.
- ABW, PFH, or BV-BSP are permitted to begin not more than 10ft from each end of a braced wall line. WSP is also allowed if a 1800lb Holdown provided at closest end of first braced panel to the end of braced wall line. (R602.10.2.2.1), or a min. 24" panel is provided to each side of the building corner at the end condition.
- Distance between adjacent brace panel edges shall not be greater than 20' (R602.10.2.2)
- Floor and roof diaphragms must be supported on all edges by braced wall lines. *Exception*: Portions of roofs or floors that do not support braced walls sections above may extend 6' beyond a braced wall line (R301.2.2.2.5, Irregular Building Section)
- Braced wall lines must be provided in two perpendicular directions
- Any portion of a a wall along braced wall line permitted to be angle out of plan for max 8'. (R602.10.1.4)
- Min splice in top plates is 24" with 8-16d common or 12-16d box nails or as required by plan (Table R602.3(1) item 13) - for CRC conventional designs

Braced wall types

Braced Wall Panel (BWP)

(City Ordinance & CRC 602.10.5)

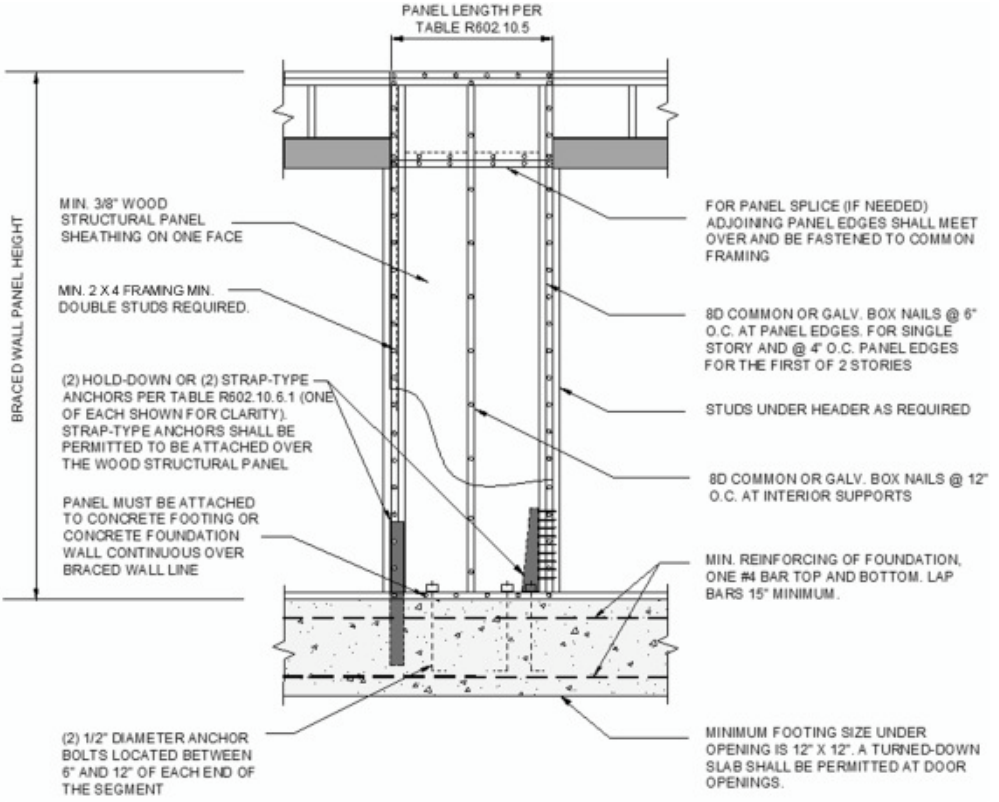
- Each panel must be not less than 48 inches in length
- Vertical joints of panel sheathing shall occur over studs and adjacent panel joints shall be nailed to common framing members. 602.10.4.4
- Horizontal joints shall occur over blocking or other framing equal in size to the studding.
- Sole plates shall be nailed to the floor framing in accordance with Table R602.3(1). Where joists are perpendicular to braced wall lines above, blocking shall be provided under and in line with the braced wall panels.
- Top plates shall be connected to the framing above in accordance with R602.10.8.2 and CSJ Ordinance.

Alternate Braced Wall Panel (ABW)

(Table R602.10.6.1 & Figure R602.10.6.1)

Min 2'-8" by max 9' height or 2'-10" by 10' max with Holdowns at each end (Table R602.10.5)

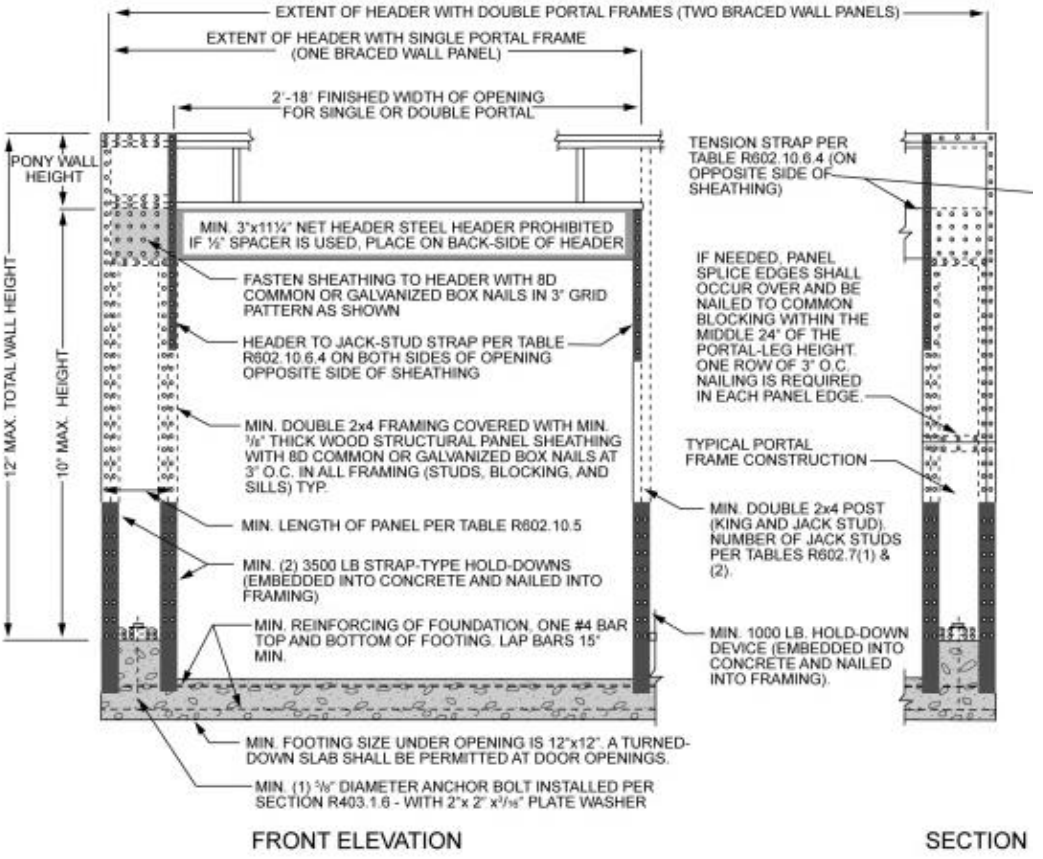
- Min 3/8" ply nailed at 6" edge and 12" field with 8d on one face for single story, 4" & 12" for 2 stories
- Min (2) 1/2" diameter anchor bolts and 1800# tie-downs embedded in continuous foundation
- First story of 2 stories: Requires 3000# tie downs



Portal Frame with Holdown (PFH)

CRC602.10.6

- Min 16” (W) by 10’ max (H) if only supporting roof
- Min 24” (W) by 10’ max (H) if supporting one floor and roof
- Can be constructed in accordance with Figure CRC602.10.6.2 below



Irregular Building exceptions

Irregular portions of structures, if not in one of the exceptions below, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system

- Walls in a plane vertically from the foundation to the uppermost story except: R301.2.2.2.5
- Floors that are cantilevered or setback not exceeding 4 times

the depth of the joist and comply with the following

  - Joists are 2 x 10 or greater and not spaced more than 16" o.c.
  - Ratio of back span to the cantilever is at least 2:1
  - Joists at ends of braced wall panels are doubled
  - A continuous rim is used at the cantilever end, splices must be secured with a galvanized metal tie of 16 gauge and 1-1/2" wide connector (6-16d nails min) on each side of the splice or a block of the same rim side with 8-16d on each side of the splice
  - Gravity loads are limited to uniform wall and roof only, and header reactions of 8' or less span

- Braced wall panels must not extend more than 1' horizontally over an opening below unless the header below is at least 2-2 x 12 and the opening is not more than 8' wide
- Floor levels cannot be vertically offset unless they are lapped or tied together per R502.6.1 or equal or are supported directly by a continuous foundation at the perimeter of the building
- Walls may be supported by continuous footings at the exterior and at 50' intervals provided: (R602.10.9.1/R403.1.2)

Cripple walls do not exceed 4' high

1st-floor braced walls are supported by doubled floor joists or continuous blocking between floor beams

Distance between braced wall lines does not exceed twice the building width

Cripple Walls (R602.9/CBC 2308.6.6.2)

□ Stud heights 14" min or solid blocked or sheathed

□ Stud heights exceeding 14" shall be braced per (Table R602.3 (1)#30/CBC Table 2308.6.1)

1 story: 3/8" wood structural panel nailed with 8d at 6"/12" for 48% of wall length

□ Stud height exceeding 4' shall be the same size as studs for an additional story

T24:

With Exterior shear approved, check exterior wall construction assembly for compliance. If a high-performance wall was proposed in T-24, exterior sheath insulation is to be installed and inspected over building paper and prior to lath installation (underlayment directly over studs, sheathing)

WUI(CRC337.3):

Non-combustible wall covering at exterior. Exterior walls to be 1h rated. Roof and floor projections to be protected with 5/8 gyp or stucco. Glazing to be 20-minute rated or tempered. 20-minute rated or 1-3/8" solid core exterior doors

ROOF STRUCTURE/NAIL

Framing

- Min. Design Criteria Dead Load = 10psf, Live Load = 20psf
- Portion of roof for solar zone can omit panel weight (exception 2, CRC 324.4.1.1)

conventional design (CRC802)

□ Ridge boards/hips/ valleys (CRC802.3)

- Ridge board shall be not less than 1-inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter.
- Valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter.

□ Rafter size & spacing Table R802.4.1(1) or (2)

- Shall be framed not more than $1^1/_2$-inch offset from each other to ridge board or directly opposite from each other with a gusset plate as a tie
- Purlins to be same size or larger than rafters R802.4.5
- Purlin struts go to bearing walls, are 45° min from horizontal @ max 4 'oc with 2 x 4 braces & are laterally braced if greater than 8'

□ Ceiling Joists/Rafter ties and Heel connection (R802.5.2)

- Joist size & spacing per CRC Table 802.5(1) or (2)
- Where joists are parallel to rafters, ceiling joist must be nailed to per Table R802.5.2
- Where not parallel, rafter ties shall be min 2 x 4 installed at just above ceiling joists nailed to rafters per Table R802.5.2 and increased by adjustment factor per footnote (g)
- Joist/rafter tie to be continuous, or splice to have same connection as heel connection

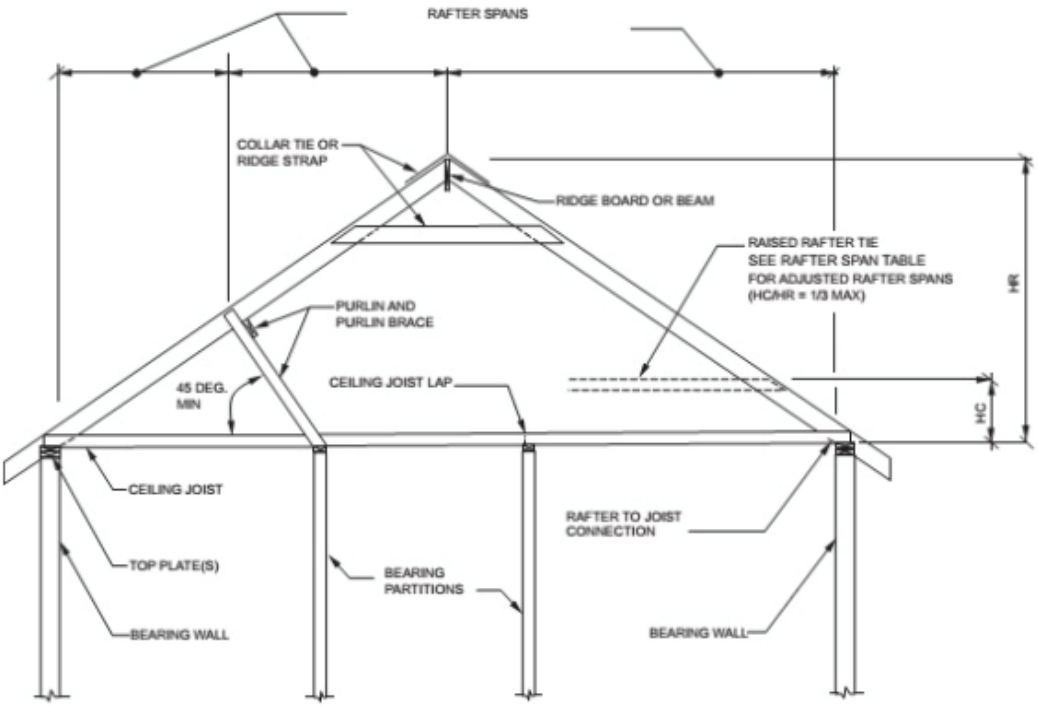


Figure R802.4.5

- Collar ties (R802.4.6) @ 4’ max. spacing
  - Install 1x4 collar ties, nailed to rafters with (3)-10d common or (4)-10d box nails, at the upper 1/3 of attic space
  - Or 1-1/4” by 20gage ridge straps with min. (3) 10d common (3”x0.148”) nails, with min $2^{3/8}$” from the end of rafter to the closest nail.

HEEL CONNECTION TABLE CRC802.5.2

Rafter slope	Rafter spacing (inches)	20lb snow load or less		
		Roof span (feet)		
		12	24	36
		number of 16d ($3^{1/2}$"x0.162") common nails per heel joint splices, multiply by 1.2 for 10d (3"x0.148") common nails		
3:12	12	3	5	8
	16	4	7	10
	19.2	4	8	12
	24	5	10	15
4:12	12	3	4	6
	16	3	5	8
	19.2	3	6	9
	24	4	8	11
5:12	12	3	3	5
	16	3	4	6
	19.2	3	5	7
	24	3	6	9
7:12	12	3	3	4
	16	3	3	5
	19.2	3	4	5
	24	3	5	7
9:12	12	3	3	3
	16	3	3	4
	19.2	3	3	4
	24	3	4	5
12:12	12	3	3	3
	16	3	3	3
	19.2	3	3	3
	24	3	3	4

H_C/H_R	Heel Joint Connection Adjustment Factor
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

TABLE R802.5.1(1)/CBC 2308.10.2(1)
CEILING JOIST SPANS FOR COMMOM LUMBER SPECIES
(Inhabitable attics without storage, live load = 10 psf)

JOIST SPAC-ING	SPECIES & GRADE	DEAD LOAD = 5 psf			
		2 x 4	2 x 6	2 x 8	2 x 10
		Max ceiling joist spans			
12”	Douglas fir #1	12’-8”	19’-11”	> 26’-0”	> 26’-0”
	Douglas fir #2	12’-5”	19’-6”	25’-8”	> 26’-0”
	Hem- fir #1	12’-2”	19’-1”	25’-2”	> 26’-0”
	Hem-fir #2	11’-7”	18’-2”	24’-0”	> 26’-0”
16”	Douglas fir#1	11’-6”	18’-1”	23’-10”	> 26’-0”
	Douglas fir #2	11’-3”	17’-8”	23’-4”	> 26’-0”
	Hem- fir #1	11’-0”	17’-4”	22’-10”	> 26’-0”
	Hem-fir #2	10’-6”	16’-6”	21’-9”	> 26’-0”
24”	Douglas fir #1	10’-0”	15’-9”	20’-1”	24’-6”
	Douglas fir #2	9’-10”	14’-10”	18’-9”	22’-11”
	Hem- fir #1	9’-8”	15’-2”	19’-7”	23’-11”
	Hem-fir #2	9’-2”	14’-5”	18’-6”	22’-7”

RAFTERS SPAN TABLE 20 lb live load & 10 lb deadload Table R802.4.1(1)/CBC Table 2308.10.3(1) Ceiling not attached to rafters					
Size	Spacing	Douglas fir		Hem Fir	
		#1	#2	#1	#2
2 x 4	12” oc	11’-1”	10’-10”	10’-7”	10’-1”
	16” oc	10’-0”	9’-10”	9’-8”	9’-2”
	24” oc	8’-7”	8’-2”	8’-5”	7’-11”
2 x 6	12” oc	17’-4”	16’-10”	16’-8”	15’-11”
	16” oc	15’-4”	14’-7”	15’-2”	14’-2”
	24” oc	12’-6”	11’-11”	12’-4”	11’-7”
2 x 8	12” oc	22’-5”	21’-4”	22’-0”	20’-8”
	16” oc	19’-5”	18’-5”	19’-2”	17’-11”
	24” oc	15’-10”	15’-1”	15’-8”	14’-8”
2 x 10	12” oc	> 26’	26’-0”	> 26’	25’-3”
	16” oc	23’-9”	22’-6”	25’-3”	21’-11”
	24” oc	19’-5”	18’-5”	19’-2”	17’-10”
2 x 12	12” oc	> 26’	> 26’	> 26’	> 26’
	16” oc	> 26’	26’-0”	> 26’	25’-5”
	24” oc	22’-6”	21’-4”	22’-2”	20’-9”

RAFTERS SPAN TABLE
20 lb live load & 10 lb deadload
Table R802.4.1(2)/CBC Table 2308.10.3(1)
Ceiling attached to rafters

Size	Spacing	DF#1	DF#2	Hem Fir #1	Hem Fir #2
2 x 4	12” oc	10’-10”	9’-10”	9’-8”	9’-2”
	16” oc	9’-10”	8’-11”	8’-9”	8’-4”
	24” oc	8’-0”	7’-10”	7’-8”	7’-3”
2 x 6	12” oc	15’-9”	15’-6”	15’-2”	14’-5”
	16” oc	14’-4”	14’-1”	13’-9”	13’-1”
	24” oc	12’-6”	11’-11”	12’-0”	11’-5”
2 x 8	12” oc	20’-10”	20’-5”	19’-11”	19’-0”
	16” oc	18’-11”	18’-5”	18’-1”	17’-3”
	24” oc	15’-10”	15’-1”	15’-8”	14’-8”
2 x 10	12” oc	> 26’	26’-0”	25’-5”	24’-3”
	16” oc	23’-9”	22’-6”	23’-1”	21’-11”
	24” oc	19’-5”	18’-5”	19’-2”	17’-10”
2 x 12	12” oc	> 26’	> 26’	> 26’	> 26’
	16” oc	> 26’	26’-0”	> 26’	25’-5”
	24” oc	22’-6”	21’-4”	22’-2”	20’-9”

Manufacture Trusses

□ review approved truss plans & details

- Compressive webs are laterally supported as per truss details if required
- Trusses designed for lateral loads are connected to shear walls & match truss details

❑ Truss bearing: verify point load locations from the truss plan. (SJC Field Note 303)

- Stud directly beneath truss with bearing 1500 - 2500lbs in 2x4 walls/ 2000 –4000lbs in 2x6 walls
- Two studs or 4x directly beneath truss with bearing 2501-4000 lbs in 2x4 walls/ 4001 –6000lbs in 2x6 walls
- For reaction loads exceed 4000lbs and 6000lbs in 2x4 and 2x6 walls respectively, Engineer Design required

❑ Mechanical connections

- Hangers at header conditions match reaction loads listed on truss details
- Uplift conditions greater than 500lbs, require verification of connection for uplift forces
- Verify hurricane ties where trusses/rafters spaced more than 24" o.c.
- Trusses shall be cambered for full dead load and maintain clearance to non-bearing walls once loaded, STC clips to be installed at the head of non-bearing walls to trusses. (SJC-Plan Review Note #16)

Post and Beam Roof Framing

❑ Verify beams match span, type, and size on plan

❑ Post to beam connections per details and hardware schedule

❑ Beam to have full bearing post and full transfer to foundation or beam below.

❑ Notches on beams must be within allowable parameters in manufacture guidelines for engineer beams or not more than allowed per CRC502.8.1 for sawn lumber

Roof Deck

- Wood structural panels shall conform to DOC PS 1, DOC PS 2, CSA O437 or CSA O325, and shall be identified for grade, bond classification and performance category by a grade mark (CRC803.2.1)
- Shall not cantilever more than 9 inches beyond the gable end wall unless supported by gable overhang framing. (CRC803.2.3)
- Verify nailing per schedule at all collectors
- Typical 6"o.c nailing at edges and at field.
- Blocking and nailing at all blocked diaphragm (if any) to be completed
- Plywood with any dimension less than 16" to be blocked and edge nailed at all sides, and at least 3 sides for panel with any dimension from 16" to 24"
- Verify eave proximity to property line (Table R302.1(1) or (2)). No eave projection in 2 'side setback, rear 15 'setback, front porch overhang (using 5 'setback exception), Front overhang into Front Building Setback (for lots with Front Building Setback Easement)
- Spaced lumber sheathing is not allowed in Seismic Design Category D_2 (R803.1)

Attic Ventilation

- The minimum net free ventilating area shall be $^1/_{150}$ of the area of the vented space.
- OR, The minimum net free ventilation area shall be $^1/_{300}$ if not less than 40 percent and not more than 50 percent of the venting located in the upper portion of the attic not more than 3 feet below the ridge or highest point of the space, vertically. The balance shall be located in the bottom one-third of the attic space. (CRC806.2)
- Min 1" air space to be maintained between roof deck, except high performance attic "option B" insulation can be installed directly below roof deck, and insulation and at location of the vent.
- **WUI requirement:** Roof and Eave vent shall be listed to ASTM E2886 or approved and listed by California State Fire Marshall.

Ridge vents and Dormer vents shall also be covered with noncombustible/corrosion-resistant mesh with openings of min 1/16" to max 1/8".

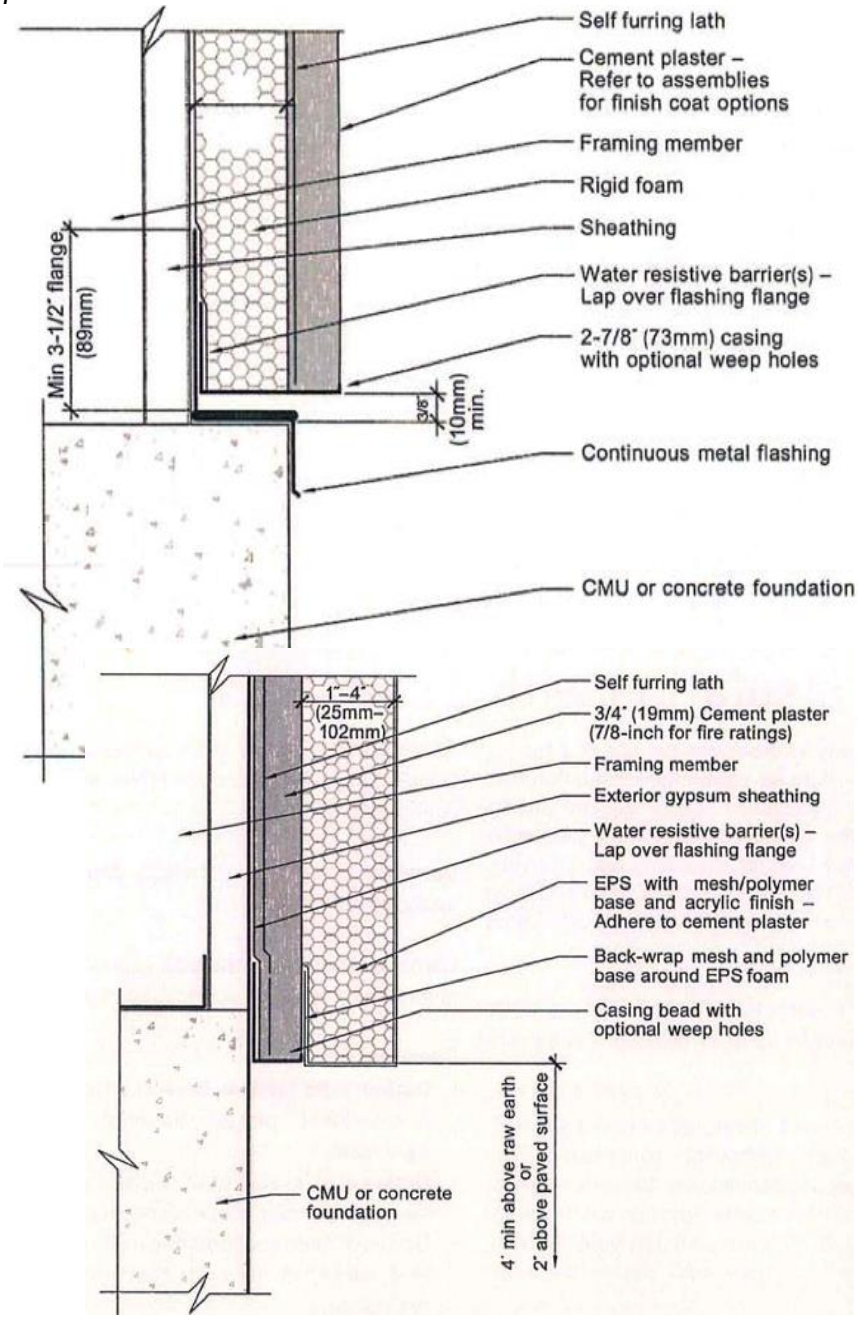
Unvented roof assembly (R806.5, vapor diffusion not required in CZ4)

- ❑ air-impermeable insulation, most closed cell spray foam types, applied in direct contact with the underside of roof deck
- ❑ **OR,** Where air-permeable insulation is installed directly below the structural sheathing, R-5 rigid board or sheet insulation shall be installed directly above the structural roof sheathing.

LATH INSPECTION (R703.7/CBC2507)

- ❑ Check plan for lateral bracing requirements, and shear inspection signed off on permit
- ❑ When installed over solid wood backing, 2 layers type D paper installed independently with separate continuous plane and any flashing is placed between layers. (R703.7.3)
- ❑ Windows flashed, counter flashed & caulked
- ❑ Paper laps are 2" min horizontal & 4" min vertical (R703.2)
- ❑ Wire laps are one diamond min ASTM C1063
- ❑ Break backs & tie-ins did not damage existing paper
- ❑ Lath fastened at 6" o.c. to studs, plates or blocking with 11 gage 1-1/2" long 7/16" head nails or 16 gage 7/8" head staples must penetrate 3/4" into framing members (R703.7.1).
- ❑ Expanded rib lath attached to horizontal wood framing member with nails or staples with not less than $1^{3/4}$" penetration into horizontal wood framing member (ASTM 1063-03)
- ❑ Corners reinforced per ASTM C1063-03
- ❑ 3-1/2" 26 gage galvanized weep screed installed 4" above earth & 2" above concrete (R703.7.2.1)

Samples of Exterior 1-hr rated wall with continuous sheet insulation from Wall and Ceiling Conference. Setbacks must have been checked at foundation to accommodate construction of wall assembly with added foam PWA-104 /PWA-105



ROUGH FRAME INSPECTION

Inspections below must be complete prior to Frame Inspection

- Foundation, Piers, Slab & Setbacks
- Underfloor subtrades/frame or Under-slab inspections
- Subfloor (for multi-story)
- Roof and shear structure/nail

Mandatory Inspection Condition

- ❑ Exterior weatherproof at time of Frame Inspection (R701.2), Siding is on, or lath installed, and roof covered
- ❑ Exterior to be weather tight before electrical installation has begun.
- ❑ Electrical, plumbing & mechanical must be completed, inspected and approved by the time of rough frame approval (R109.1.4/CBC 110.3.4). Can be inspected at the same time with Frame Inspection.
- ❑ Fire alarm/Fire sprinkler must be completed and approved by SJFD

Fire Blocks and Draft Stops (R302.11/CBC 718.2)

□ Fire blocking in combustible construction

- 2” lumber, 2 layers of 1 x, 23/32” structural plywood, 3/4” type 2-M particle board, 1/2” gypsum, 1/4” cement-based millboard, or glass fiber
- In walls both vertical at ceiling and floor levels, and horizontal @ 10 ’spacing max
- Between vertical & horizontal spaces @ soffits, drop or cove ceilings & furred spaces
- Concealed stair stringer spaces at top & bottom of the run
- Openings around vent pipes, ducts, chimneys, fireplaces, and at floor and ceiling levels
- Cornices of a two-family dwelling at the separation line

□ Draft stops combustible construction for R-3 (R302.12)

- 1/2” gypsum, 3/8” plywood, 3/8” particle board, 1 x lumber, cement board, glass fiber
- At 1000 sq ft max in floors where there is usable space above & below

- Ceiling is suspended under the floor framing
- Truss-type or open-web perforated member floor framing
- In roof/ceiling assemblies between dwelling units
- Not required in single family attics unless it's a duplex.

Fire-Resistance construction (CRC302)

- Exterior wall rating to comply with table 302.1(1) & (2)
- Dwelling units in two-family dwellings (attached ADUs, Duplexes) shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating. (CRC302.3)

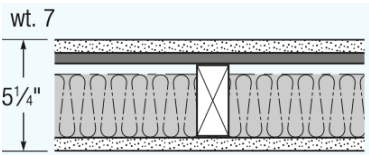
TABLE R302.1(1) EXTERIOR WALLS
BUILDINGS WITHOUT AUTOMATIC FIRE SPRINKLERS

EXTERIOR WALL ELEMENT		MIN FIRE-RESISTIVE RATING	SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hr-tested in accordance with ASTM E119 or UL263 with exposure form both sides	0'
	Not fire-resistance rated	0 hour	≥ 5'
Projections	Not allowed	N/A	< 2'
	Fire-resistance rated	1 hour on the underside	≥2' - 5'
	Not fire-resistance rated	0 hour	≥ 5'
Openings in walls	Not allowed	N/A	< 3'
	25% max of wall area	0 hour	3' - 5'
	Unlimited	0 hour	≥ 5'
Penetrations	All	Comply with Section R302.4	< 3'
		None required	≥ 3'

- Rating underside of roof projection can be omitted if fire blocks installed from wall top plate to underside of roof

TABLE R302.1(2) EXTERIOR WALLS-BUILDINGS WITH AUTOMATIC FIRE SPRINKLER PROTECTION			
EXTERIOR WALL ELEMENT		MIN FIRE-RESISTANCE RATING	SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour-tested in accordance with ASTM E 119 or UL 263 with exposure form outside	0’
	Not fire-resistance rated	0 hour	≥ 3’
Projections	Not allowed	N/A	< 2’
	Fire-resistance rated	1 hour on the underside	2’
	Not fire-resistance rated	0 hour	≥ 3’
Openings in walls	Not allowed	N/A	< 3’
	Unlimited	0 hour	≥ 3’
Penetrations	All	Comply with Section R302.4	< 3’
		None required	≥ 3’

Commonly implemented 1hr rated wall assembly UL Des U327. Similar assembly can be used at exterior wall, substitute 5/8” gyp with 7/8” stucco at exterior. (CBC TABLE 721.1(1))



- 5/8" SHEETROCK FIRECODE C Core gypsum panels
2 x 4 wood stud 16" or 24" o.c.
3" THERMAFIBER SAFB
RC-1 channel or equivalent one side joints finished

UL Des U327

ADU Fire Separation (CRC T302.3)

- Attached ADUs:

  Shall be separated from the main house by min. 1hr wall and floor assemblies and shall not have air transfer between units. Rated walls shall extend from foundation to roof.

- Detached ADUs (CSJ- Building Division Note B007)
  - A dwelling unit and garage shall be separated as required by CRC Section R302.6 and Table R302.6. This applies to both an SFR and an ADU.
  - An SFR, garage (or other accessory structure), and a detached ADU on the same parcel will be considered as one building without fire separation distance/imaginary line requirements per Exception 2.
  - The two units (SFR and ADU) are required to maintain a minimum separation of 6 feet.
  - If the exterior walls of the two units (SFR and ADU) are separated by less than 10 feet, the exterior wall of the ADU facing the SFR is limited to 25% openings and shall be framed from the foundation to the roof. 5. All other exterior walls of the SFR, ADU, and accessory structures shall comply with the distance and rating requirements of CRC section R302.

Structural Bearing

- Check notching and boring - See Table. In no case shall the edge of the bored hole be nearer than 5/8" to the edge of the stud. (R602.6). Simpson Stud shoes HSS or SS can be used.

NOTCHING AND BORING			
	Notching		Boring
Joist, Rafters	1/6 allowed in 1st 1/3 of span	25% allowed at ends	D/3 allowed 2" from top & bottom
2 x 6	7/8"	1-3/8"	1-13/16"
2 x 8	1-1/4"	1-7/8"	2-7/16"
2 x 10	1-1/2"	2-3/8"	3-1/8"
2 x 12	1-7/8"	2-7/8"	3-13/16"
2 x 14	2-1/4"	3-3/8"	4-1/2"
STUDS	Notching		Boring
Bearing Members	25% allowed		40% allowed or 60% w/ double studs for 2 bays
2 x 4	7/8"		1-3/8"
2 x 6	1-3/8"		2-3/16"
Nonbearing Members	40% allowed		60% allowed
2 x 4	1-3/8"		2-3/16"
2 x 6	2-3/16"		3-1/4"

- Strap top plate if less than 50% width remaining with 16 gauge thick and 1-1/2" wide strap fastened with 8-10d nails at each side of notch or hole, or as specified on plan.
- Engineered wood products: Cuts, notches and bores are prohibited, except when permitted per manufacture's recommendations or such

alteration specifically designed by EOR (R502.8.2) Check structural notes for limits on notches and bores. See Floor Joists in Under Floor Frame inspection section for engineered notching chart.

- ❑ Check allowable stud heights - See Table

STUD SIZE & SPACING (TABLE R602.3(5)/cbc 2308.9.1)						
	Bearing Walls				Non-Bearing Walls	
	Height	Max Stud Spacing Supporting			Height	Spacing
		Roof	1-floor	2-floor		
2 x 3	-	-	-	-	10’	16”
2 x 4	10’	24”	16”	-	14’	24”
3 x 4	10’	24”	24”	16”	14’	24”
2 x 6	10’	24”	24”	16”	20’	24”

Or, From for D.F#2, 115mph wind load

STUD HEIGHT	SUPPORTING	STUD SPACING[a]	Maximum roof/floor span[c]	
			12 ft.	24 ft.
11 ft.	Roof Only	12 in.	2 × 4	2 × 4
		16 in.	2 × 4	2 × 4
		24 in.	2 × 6	2 × 6
	Roof **Table R602.3(6)** and One Floor	12 in.	2 × 4	2 × 6
		16 in.	2 × 6	2 × 6
		24 in.	2 × 6	2 × 6
12 ft.	Roof Only	12 in	2 × 4	2 × 4
		16 in.	2 × 4	2 × 6
		24 in.	2 × 6	2 × 6
	Roof and One Floor	12 in	2 × 4	2 × 6
		16 in.	2 × 6	2 × 6
		24 in.	2 × 6	2 × 6

Footnote – Table 602.3(6)

a. Wall studs not exceeding 16 inches on center shall be sheathed with minimum $^1/_2$-inch gypsum board on the interior and $^3/_8$-inch wood
structural panel sheathing on the exterior. Wood structural panel sheathing shall be attached with 8d (2.5" x 0.131") nails not greater than 6 inches on center along panel edges and 12 inches on center at intermediate supports, and all panel joints shall occur over studs or blocking.
b. N/A for San Jose Area, due to windspeed
c. The maximum span is applicable to both single- and multiple-span roof and floor conditions. The roof assembly shall not contain a habitable attic.

Headers

- Header span and support: Per engineer design or Table R602.7(1) & R602.7(2)

Top of header is laterally braced by perpendicular framing, or the tabulated spans for 2x8 size and larger shall be multiplied by 70%, footnote (f) from both tables.

- Full Height Studs: In addition to the required jack studs, each end of header also supported by full height studs, attached to header with min 4-16d. Where framing hardware is used to support header in lieu of jack studs, the minimum number of studs will be from 140mph, exposure B column (footnote (b)Table R602.7.5)

TABLE R602.7(1)
GIRDER SPANS AND HEADER SPANS FOR EXTERIOR BEARING WALLS (Maximum spans for Douglas fir, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs (NJ))

Note: Jack Studs are sometimes referred to as trimmer studs or cripple studs, interchangeably.

GIRDERS AND HEADERS SUPPORTING	SIZE	Building width					
		12’		24’		36’	
		Span[f]	NJ[d]	Span[f]	NJ[d]	Span[f]	NJ[d]
Roof and ceiling	1-2 × 6	4-0	1	3-1	2	2-7	2
	1-2 × 8	5-1	2	3-11	2	3-3	2
	1-2 × 10	6-0	2	4-8	2	3-11	2
	1-2 × 12	7-1	2	5-5	2	4-7	3
	2-2 × 4	4-0	1	3-1	1	2-7	1
	2-2 × 6	6-0	1	4-7	1	3-10	1
	2-2 × 8	7-7	1	5-9	1	4-10	2
	2-2 × 10	9-0	1	6-10	2	5-9	2
	2-2 × 12	10-7	2	8-1	2	6-10	2
	3-2 × 8	9-5	1	7-3	1	6-1	1
	3-2 × 10	11-3	1	8-7	1	7-3	2
	3-2 × 12	13-2	1	10-1	2	8-6	2
	4-2 × 8	10-11	1	8-4	1	7-0	1
	4-2 × 10	12-11	1	9-11	1	8-4	1
	4-2 × 12	15-3	1	11-8	1	9-10	2
Roof, ceiling and	1-2 × 6	3-3	1	2-7	2	2-2	2
	1-2 × 8	4-1	2	3-3	2	2-9	2
one center-	1-2 × 10	4-11	2	3-10	2	3-3	3
	1-2 × 12	5-9	2	4-6	3	3-10	3
bearing floor	2-2 × 4	3-3	1	2-6	1	2-2	1
	2-2 × 6	4-10	1	3-9	1	3-3	2
	2-2 × 8	6-1	1	4-10	2	4-1	2
	2-2 × 10	7-3	2	5-8	2	4-10	2
	2-2 × 12	8-6	2	6-8	2	5-8	2
	3-2 × 8	7-8	1	6-0	1	5-1	2
	3-2 × 10	9-1	1	7-2	2	6-1	2
	3-2 × 12	10-8	2	8-5	2	7-2	2
	4-2 × 8	8-10	1	6-11	1	5-11	1
	4-2 × 10	10-6	1	8-3	2	7-0	2
	4-2 × 12	12-4	1	9-8	2	8-3	2
Roof, ceiling	1-2 × 6	2-11	2	2-3	2	1-11	2
	1-2 × 8	3-9	2	2-10	2	2-5	3
and one clear-	1-2 × 10	4-5	2	3-5	3	2-10	3

	1-2 × 12	5-2	2	4-0	3	3-4	3
span floor	2-2 × 4	2-11	1	2-3	1	1-10	1
	2-2 × 6	4-4	1	3-4	2	2-10	2
	2-2 × 8	5-6	2	4-3	2	3-7	2
	2-2 × 10	6-7	2	5-0	2	4-2	2
	2-2 × 12	7-9	2	5-11	2	4-11	3
	3-2 × 8	6-11	1	5-3	2	4-5	2
	3-2 × 10	8-3	2	6-3	2	5-3	2
	3-2 × 12	9-8	2	7-5	2	6-2	2
	4-2 × 8	8-0	1	6-1	1	5-1	2
	4-2 × 10	9-6	1	7-3	2	6-1	2
	4-2 × 12	11-2	2	8-6	2	7-2	2
Roof, ceiling	1-2 × 6	2-8	2	2-1	2	1-10	2
	1-2 × 8	3-5	2	2-8	2	2-4	3
and two center-	1-2 × 10	4-0	2	3-2	3	2-9	3
	1-2 × 12	4-9	3	3-9	3	3-2	4
bearing floors	2-2 × 4	2-8	1	2-1	1	1-9	1
	2-2 × 6	4-0	1	3-2	2	2-8	2
	2-2 × 8	5-0	2	4-0	2	3-5	2
	2-2 × 10	6-0	2	4-9	2	4-0	2
	2-2 × 12	7-0	2	5-7	2	4-9	3
	3-2 × 8	6-4	1	5-0	2	4-3	2
	3-2 × 10	7-6	2	5-11	2	5-1	2
	3-2 × 12	8-10	2	7-0	2	5-11	2
	4-2 × 8	7-3	1	5-9	1	4-11	2
	4-2 × 10	8-8	1	6-10	2	5-10	2
	4-2 × 12	10-2	2	8-1	2	6-10	2
Roof, ceiling,	1-2 × 6	2-3	2	1-9	2	1-5	2
	1-2 × 8	2-10	2	2-2	3	1-10	3
and two clear-	1-2 × 10	3-4	2	2-7	3	2-2	3
	1-2 × 12	4-0	3	3-0	3	2-7	4
span floors	2-2 × 4	2-3	1	1-8	1	1-4	1
	2-2 × 6	3-4	1	2-6	2	2-2	2
	2-2 × 8	4-3	2	3-3	2	2-8	2
	2-2 × 10	5-0	2	3-10	2	3-2	3
	2-2 × 12	5-11	2	4-6	3	3-9	3
	3-2 × 8	5-3	1	4-0	2	3-5	2

	3-2 × 10	6-3	2	4-9	2	4-0	2
	3-2 × 12	7-5	2	5-8	2	4-9	3
	4-2 × 8	6-1	1	4-8	2	3-11	2
	4-2 × 10	7-3	2	5-6	2	4-8	2
	4-2 × 12	8-6	2	6-6	2	5-6	2

Footnote:

a. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.

b. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

TABLE R602.7(2): GIRDER SPANS AND HEADER SPANS FOR INTERIOR BEARING WALLS

HEADERS AND GIRDERS SUPPORTING	**SIZE**	**BUILDING Width[c] (feet)**					
		12		**24**		**36**	
		Span[e]	**NJ[d]**	**Span[e]**	**NJ[d]**	**Span[e]**	**NJ[d]**
One floor only	2-2 × 4	4-1	1	2-10	1	2-4	1
	2-2 × 6	6-1	1	4-4	1	3-6	1
	2-2 × 8	7-9	1	5-5	1	4-5	2
	2-2 × 10	9-2	1	6-6	2	5-3	2
	2-2 × 12	10-9	1	7-7	2	6-3	2
	3-2 × 8	9-8	1	6-10	1	5-7	1
	3-2 × 10	11-5	1	8-1	1	6-7	2
	3-2 × 12	13-6	1	9-6	2	7-9	2
	4-2 × 8	11-2	1	7-11	1	6-5	1
	4-2 × 10	13-3	1	9-4	1	7-8	1
	4-2 × 12	15-7	1	11-0	1	9-0	2
Two floors	2-2 × 4	2-7	1	1-11	1	1-7	1
	2-2 × 6	3-11	1	2-11	2	2-5	2
	2-2 × 8	5-0	1	3-8	2	3-1	2
	2-2 × 10	5-11	2	4-4	2	3-7	2
	2-2 × 12	6-11	2	5-2	2	4-3	3
	3-2 × 8	6-3	1	4-7	2	3-10	2
	3-2 × 10	7-5	1	5-6	2	4-6	2

	3-2 × 12	8-8	2	6-5	2	5-4	2
	4-2 × 8	7-2	1	5-4	1	4-5	2
	4-2 × 10	8-6	1	6-4	2	5-3	2
	4-2 × 12	10-1	1	7-5	2	6-2	2

Habitable Room/Attic/Basement Dimensions (R304, R305)

- ❑ Hall width: min. 3' – CRC 311.6
- ❑ Min habitable room size: min 7' in any dimension & 70 sq. ft. except kitchen (R304)
- ❑ Min ceiling heights: 7', except
  - Bathrooms, storage rooms, & laundry rooms: 6'8"
  - Habitable basement: 6'8", 6'4" under beams, girders, ductworks (R305.1.1 exceptions)
  - Beams/girders spaced min 36" in clear finish width: 6'6"
  - Sloped ceilings: min 5', with min 50% of required area having 7' ceiling.

□ Bathrooms

24" min depth in front & 30" min width at water closet & min 15" from center line of water closet to wall or obstruction (CPC 402.5)
Shower 30" min dimension & 1024 sq. in. min per (CPC 408.6)

Emergency Escape and Rescue (R310.1), Means of Egress (R311)

- ❑ Window or Door to Exterior (R310/CBC 1030) required for bedrooms, habitable attics, and basements
- ❑ 20" min. in width and 24" min. in height
- ❑ 5.7 sq. ft. (821 sq. in.) min net clear opening except on or below grade floor openings can be 5 sq. ft. min net clear opening when outside grade to opening is 44" or less
- ❑ 44" max. above the finished floor
- ❑ Bedroom doors are not allowed into garages (R302.5.1)
- ❑ Egress Door with an opening below grade shall open to an Area Well (R310.3.2), with
  - Proper drainage, connecting to building foundation drainage system or approved alternative
  - Ladder has rungs with min 12" inside width, max 18" o.c vertical spacing, min 3" clear from wall. Alternatively, steps can be provided. Compliance to Stairs (R311.7) not mandatory.

□ Egress openings below decks, porches or cantilevers shall have a path with min. 36" in height and width to a yard or court.

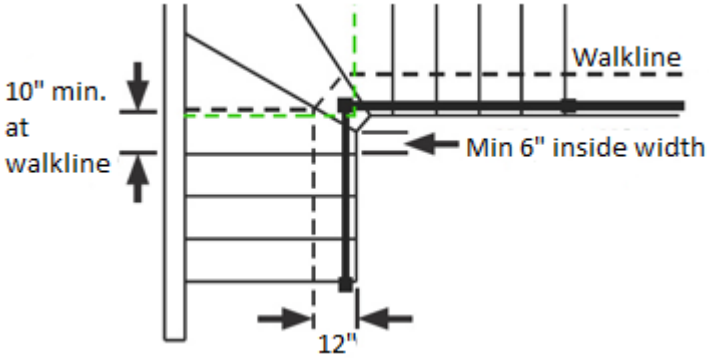
Exception:

- Basement houses only mechanical equipment, less than 200 sf.
- Basement alteration or repair, no new bedroom created
- New basement addition with egress from new bedroom
- New basement addition connecting to an existing basement with Egress having net clear of min 4sf, 22" in clear height and 20" in clear width. Or the largest window size that will fit within the existing rough opening. (R310.7)
- Basement, equipped with fire sprinklers and having 2 means of egress complying with R311, can have bedrooms with no egress

Stairs for R-3 occupancy (R311.7)

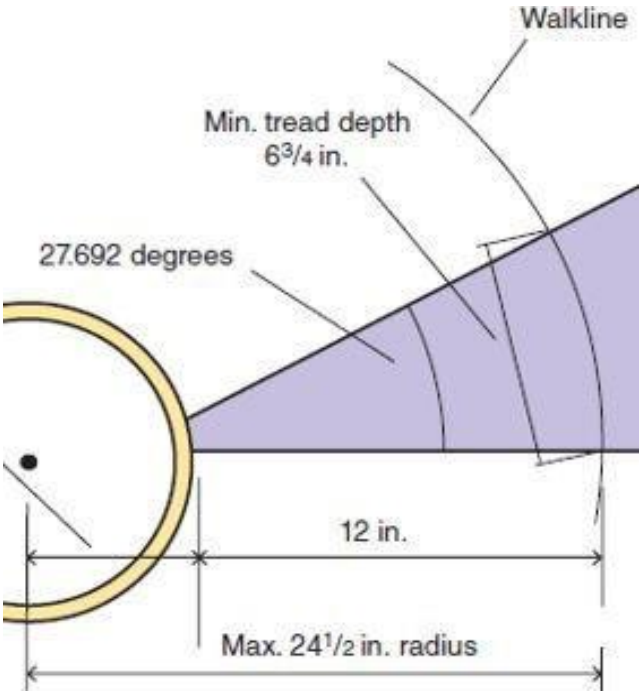
- Width:
  - Min 3' clear width above and handrail, no reduction until above 6'8"
  - Min $31^{1/2}$ at handrail and below with handrail installed on 1 side, and min 27" with handrails installed on both sides.
- Max. 151" stair rise between floor levels or landing
- 10" min tread depth with min 3/4" & max 1-1/4" nosing/11" min without nosing
- 7-3/4" max risers, solid risers, or max. 4" sphere at opening.
- 3/8" max variance between all risers and between all treads.
- 6'-8" minimum headroom
- Landings 36" min depth, the same width as stairs served at bottom of stairs. No landing at the top of an interior stair flight is required, provided no door swings over the stairs.
- Landings and treads shall not have more than 2% slope, except exterior bottom landing can have 5% in direction of travel for surface drainage.
- **Flood zone requirement**
  - Part of the stairs below the lowest level will have open or partially open guard rails and risers (not more than 4")
  - Area below stairways shall not be enclosed
  - Designed to resist flood load independently or break away.

Winder (R311.7.5.2.1)



- Min 6” tread depth at narrow end of walk-line and not less than 10” at wide end of walk-line, walk-line: located 12” from the narrower side of winders.
- Nosing min 3/4” and max 1-1/4” with solid risers

Spiral Stairs (R311.7.10.1/)



- Min clear width 26" below handrail, with 6'6" headroom
- Walk line radius is not greater than $24^{1/2}$ inches
- Min $6^{3/4}$" tread at walk line, treads shall be identical
- Max $9^{1/2}$" rise, open risers permitted
- Headroom min 6'6"

Tip: the compliant spiral staircase has 13 treads per revolution

Guardrail and Handrail: *see* Building Final, provide blockings for attachment.

Smoke Alarms (R314.3/CBC 907.2.11.2)

❑ Locations

One every floor
Rooms or hallways giving access to bedrooms
Every bedroom
Occupiable Basements & habitable attics

- ❑ Power (R314.4)
  - AC direct power with battery backup for new construction, built-in 10 yr. battery power or direct power for remodels & additions, and when a bedroom is added, direct power is required.
- ❑ Smoke detectors shall sound an alarm audible in all sleeping areas of the dwelling. (R314.5)
- ❑ Specific requirements
  - Min 3’ from bathroom opening, heat register, tip of a fan blade
  - Min 20’ from a permanent cooking surface, ok to reduce to 10’ with ionization alarm with silencing switch, ok to reduce to 6’ with photo-electric smoke alarm
  - Max 12” vertically down from the ceiling’s highest point
- ❑ Interconnection (CRC314.4)
  - Where New building, Alteration, Addition, or Repairs that require a permit, SFR shall be equipped with Smoke alarms as new dwellings
  - Physical interconnection is required unless wireless alarms are installed, and all alarms sound upon actuation of one alarm.

Carbon Monoxide Alarms (R315)

- ❑ Required for dwelling units and sleeping units with fuel-burning appliances and/or with attached garage
- ❑ Locations

Rooms or hallways giving access to bedrooms

One every level, including basement & habitable attic

In bedroom if gas burning appliance installed within a bedroom or its attached bathroom.

- ❑ Power & Alarm Audibility
  - Same as smoke detectors
- ❑ Interconnection (CRC315.5)
  - Physical interconnection is required unless wireless alarms are installed, and all alarms sound upon actuation of one alarm.

Exception: Where works do not result in a removal of wall/ceiling finishes exposing the structure and no access from the basement, crawlspace, or attic.

Attic Ventilation (R806)

See Roof Structure/Nail section for additional information

- ❑ Min 1/16" & max 1/4" corrosion-resistant metal mesh screen required.
- ❑ Check for isolated and unvented attic spaces
- ❑ Must be vented top & bottom @ 1/150 if a radiant barrier is required with 30% min at the top (California Energy Code)

Light, Ventilation & Heating(R303)

- ❑ Habitable rooms
- Min 8% of floor area for natural light
- Min opening 4% of floor area for ventilation
- For light & ventilation purposes, any room may be considered as part of an adjoining room when 1/2 of the common wall area is open & unobstructed. The opening shall also be a min of 1/10 of the floor area of the interior room or min 25 sq ft, whichever is greater.
- Exterior windows open to yards or courts, min 3 'wide yard or court spaces (CBC 1206.2)
- Must meet ASHREA 62.2 standards

- ❑ Required Heating
- Every dwelling unit shall be provided with heating facilities capable of maintaining a room temperature of not less than 68°F at a point 3 feet above the floor and 2 feet from exterior walls in habitable rooms. Portable space heaters shall not be used to achieve compliance with this section.

□ Bathrooms & Laundry Rooms, Water Closet compartment (R303.3/ASHREA62.2)

- 1-1/2 sq ft min opening of a 3 sq ft window to the exterior or mechanical ventilation capable of 50 cu ft per minute for intermittent ventilation or 20 cu ft per minute for continuous ventilation.
- Exhaust shall terminate directly to the outdoors at point of discharge min 3 'from any openings into the building and min 3 'from a property line (CMC 504.5)

- Exhaust device is required for humidity control, even when an operable window is in place (R303.3.1)

Safety Glazing (R308.4/CBC 2406)

□ All glazing in doors, see exceptions for decorative glazing and opening size limits a 3" diameter sphere to pass

□ All glazing adjacent to door, less than 60" above floor and meet any of the followings:

- within 24" of either vertical edge of the door, in plane with the door in a closed position,
- Within 24" of hinge side, on a wall less than 180 degrees from the plane of an in-swing door.

Exception: decorative glazing, where an intervening wall or permanent barrier between door & glazing. The access door to a closet or storage area ≤ 3 'deep, and glazing adjacent to fixed panel of patio door

❑ Glazing adjacent to bottom landing of a stairway and less than 3' above the landing within 5' horizontal arc less than 180 degrees from the bottom tread nosing.

Exception: Protected by a guard and plane of glass is more than 18" from guard.

❑ Glazing in walls, enclosures or fences containing or adjacent to hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers & indoor or outdoor swimming pools where the bottom exposed edge of the glazing is < 60" above standing or walking surface and glazing is less than 60" measured horizontally from the water edges of these fixtures.

Note: When there is no shower door or curtain installed the bathroom becomes the enclosure for tub & shower.

❑ All glazing in guards and railings

❑ Glazing adjacent stairs & ramps where the bottom exposed edge of glazing is < 36" above walking surface of stairways and intermediate landings, unless a rail installed between 34" & 38" above walking surface

- ❑ All glazing that is within 36” of a walking surface if it conforms to the following:
  - Greater than 9 sq ft on an individual pane
  - Bottom edge is less than 18” above the floor
  - Top edge is greater than 36” above the floor
  - Not protected by barrier at 34” to 38”

Protection from Water Damage (R307/CBC 1210)

- ❑ Wood framing must have water protection at shower walls, smooth, nonabsorbent surface min for 70” above the drain inlet (CBC 1210.2.3)
- ❑ Shower walls shall be finished with a nonabsorbent surface extend to 6 ’min above the floor (R307.2)

Aging-in-Place Design and Fall Prevention (R327) – New construction only.

- ❑ Max 48” to the top of a doorbell button or control from ext. landing
- ❑ Electrical outlets, switches, controls (including HVAC controls) mounted at max 48” to the top, 15” to the bottom, of outlet box.

  Exception: controls located on appliances, electrical outlets on floor or below windows.

- ❑ At least one bathroom on the entry level, or upper level if no bathroom located on entry level, shall have 2x8 solid blockings, or equivalent, grab bar reinforcement located between 32” and $39^{1/4}$” above finished floor.
  - Shall be on both side walls, or one side wall and the back wall adjacent to water closet. When there is no sidewall, provide backings for floor-mounted or foldaway grab bar.

  - Shall be continuous on wall framing for shower, tub, and tub/shower combination. Additionally, blocking for lower grab bar located no more than 6” above the bathtub rim, on the back wall.

Exception:

1. Shower enclosure with built-in backing for grab bars.
2. Floor-mounted grab bars shall be provided where bathtubs with no surrounding walls, or where shower/tub wall panels do not allow grab bar installation.

- Effective July 1st, 2024, at least one bedroom and one bath on the entry level shall have 32” min. clear doorway.

Exception: can be on upper level if a bathroom or bedroom not located on the entry level

FIREPLACES AND CHIMNEYS

Mechanical Fireplaces

□ Installed as per manufacturers' installation instructions
□ Hearth insulation underlayment installed, i.e. MICORE

Wood Burning Appliances

See City of San Jose Ordinance 26133/Field Note 34

□ Wood burning appliances must be pellet-fueled, listed gas appliance, or EPA certified wood burning heater

□ Existing wood burning appliances that are repaired or reconstructed or are within 12" of a building remodel or renovation (measured on a plane of the wall where the appliance is located; walls at right angles are exempt) must comply as new
Exception: Repairs to existing costing less than $1759 (Adjusted annually on July 1st) in valuation

Chimney Repairs (R1003)

- ❑ Up to 40" wide, up to 5' high 4 #4 vertical bars, upsize to #5 bars when height exceed 5', chimney > 8', it must be engineered
- ❑ > 40" wide, 2 additional #4 vertical bars for each additional 40" in width or fraction thereof
- ❑ Ties—1/4" steel 90° bends with 6" min extensions at ends & 18" o.c. max, 2 ties at each bend in vertical bars
- ❑ Anchor—install at each floor, ceiling or roof line with $2^{3/16}$" x 1" straps cast 12" into chimney, hooked around the outer bars and extend 6" beyond the bend and fastened to min 4 floor joists with 2 1/2" diameter bolts each. If framing does not run parallel to straps, install 2x runner nailed with 2 16d's to min 4 joists with $2^{1/2}$" bolts straps to runner. Anchor ties are not required for interior chimneys (R1001.4.1)
- ❑ Flue liner must be bedded in mortar & joints smoothed on the inside per ASTM C199 (R1003.12)
- ❑ Chimney flue size see Table R1003.14(1) & (2)

- Chimney termination extends at least 2’ higher than any portion of a building within 10’, but not less than 3’ above the highest point where chimney passes through the roof (R1003.9)
- An approved spark arrestor required at final inspection (R1003.9.2)
- A cricket or saddle required for 30” or wider chimney. (R903.2.2)

ROOFING (CRC CHAPTER 9/CBC 1507)

Only Final inspection is required

Composition (slopes 2:12 or greater) R905.2, Read instructions on bundles.

- 1 overlay is allowed (R908.3.1.11)
- Solid sheathing required or over existing comp shingles R905.2.1/CBC1507.2.1
- 15lb underlayment required unless overlaying existing comp per Table R905.1.1(1) with 2" horizontal lap and 4" end lap.
- Nails 12 gage 3/8" heads or meets ASTM F1667
- Fasteners must penetrate 3/4" into or through sheathing, or reduced to sheathing thickness at overhangs
- Number of fasteners and exposure as per manufacturer's instructions, but not less than 4 fasteners per strip shingle or 2 fasteners per individual shingle (R905.2.6)
- Slopes 2:12 to 4:12 are as above except where 2 layers of 15lb underlayment are required with 19" overlap & shingles must be self-sealing (R905.1.1)
- Check bundle for nailing location requirement
- Exposed edges of sheathing to be covered with L-metal or equal (R905.2.8.5)
- Counter flashing required when flashing meets vertical surface (R905.2.8.3)

Wood Shake

- Slopes 3:12 or greater (R905.8)
- Fire treated required for new or additions or re-roofs (R902.2)
- 18" wide of strips of not less than 30lb interlayment is required between courses (R905.8.7)
- Corrosion-resistant fasteners 2 per shake, 3/4" penetration into sheathing (R905.8.6)
- Exposure per Table R905.8.6, most common $7^{1/2}$"
- Side lap $1^{1/2}$" min, shakes spaced 3/8" to 5/8" apart
- Nail location approximately 1" from edge & 2" above exposure

- Slopes of 3:12 are OK with 15lb underlayment in addition to all of the above in CRC only. CBC (1507.9.2) requires 4:12 min slope
- Open porches > 1-1/2:12 are OK with 90lb underlayment

Roof Tiles R905.3/CBC 1507.3 (installed as per manufacturer's installation instructions)

- Re-roofs to be lightweight tile unless supporting structure is approved for heavyweight tile
- Slope 2-1/2:12 up to 4:12 with double 30lb felt, 4:12 or greater with 30lb felt
- Solid structural sheathing
- Underlayment:
  - 30lb felt must be installed with all flashings and roof jacks integrated in a weatherboard fashion and sealed to the felt to provide a weather tight temporary roof cover
  - Valley flashing at 3:12 slope-min 36" wide, 1 layer of 15lb
  - Greater than 4:12 slope-1 layer of 30lb
  - Low slopes up to 4:12-2 layers of 30lb with 19" starter course and 36" overlapping
- Fastening
  - If lightweight tiles (< 9 psf), one nail on every tile
  - If heavy weight tile (> 9 psf), see Table R905.3.7
  - Slopes up to 5:12, nail perimeter for 3' border
  - Slopes > 5:12, see manufacturer's instructions for additional nailing requirements or Table R905.3.7
  - Corrosion resistant nails not less than 11 gauge, 5/16" head with 3/4" penetration, wire ties min 0.083"
  - 26 gage galvanized flashing and see manufacturer's instruction

Built Up/Modified Bitumen/Single-Ply/Sprayed Foam Roofing/ Liquid-applied coatings (R905.9)

- Min slope of 1/4" per foot
- See manufacturer's installation instruction.

Metal Roof (R905.10)

- Slope 3:12 or greater for no lap sealant and see manufacturer installation instruction.
- Install underlayment per manufacturer's instruction.
- Fasteners per manufacturer's instruction or
- Galvanized fasteners for steel roofs
- Copper, brass, bronze, copper alloy & 300 series stainless steel fasteners for copper roofs
- Stainless steel fasteners are acceptable for metal roofs.

Skylights (for more information, see SJC Bulletin #280, plan check, and rough inspection required)

- Operating skylights are to be located:
    - 10 feet from or 3 feet below a plumbing vent
    - 4 feet from or 1 foot below a gas flue
    - 3 feet from and 1 foot below an air exhaust duct

If unable to meet these location criteria, it must be a fixed type.

- Skylights must be dual-glazed and have a min. U-value of .75.
- Plastic skylights must have an ICC Listing number provided.
- Glass skylights must be listed by an approved agency.

REACH code *(2022 CalGreen, with CSJ Amendments)*

Electric Vehicle Charging Infrastructure (Calgreen 4.106) and Reach Code.

- Required in new single- and two-family dwellings, ADUs, and townhouses with attached private garages (CRC309.8)

- Reach Code (Effective 1/1/2020) requires min. 1 EV ready for each new Single-Family Building, and each new detached ADU, when parking space is required.

Exception: ADU and Junior ADU without additional parking facilities.

- Install raceway dedicated 240-volt branch circuit for min. 40Amp.
- Originates at main service or subpanel (label space for EV OCPD)
- Terminates in a listed cabinet, box, or other enclosure, in a close proximity to the parking space.
- Termination location stamped “EV capable” (4.106.4.2)

ENERGY CONSERVATION INSPECTION
Mandatory Measures (CA Energy Code 150.0)

Pipe Insulation 150(j)2 & CPC 609.12

- ❑ All domestic hot water piping shall be insulated. Insulation shall have thickness of <u>not less than diameter</u> of pipe, and not less than 2" thick for 2" pipe or larger.

  <u>Exceptions:</u>
  - Installed in attics encased in min. of 4" attic insulation.
  - Installed in walls with insulation compliance with Quality Insulation Installation (QII)
  - Surrounded with a minimum of 1" of wall insulation, 2" of crawlspace insulation, or 4" of attic insulation.

- ❑ Insulation protection (Energy Code 120.3(b))
  - Insulation exposed to weather shall be protected with a cover suitable for outdoor. Adhesive tape shall not be accepted.
  - Buried below grade, must be in a water-proof and non-crushable casing or sleeve

Indoor Lighting (150.0(k)) part 1

□ All installed luminaries shall be high efficacy

□ Blank electrical boxes that are more than 5 feet above the finished floor shall be no greater than the number of bedrooms and must be served by a dimmer, vacancy sensor control, or fan speed control.

<u>Recessed Luminaires</u>

- ❑ shall be IC rated and labeled that certifies the luminaire is airtight with air leakage less than 2.0 CFM at 75 Pascals. Sealed with a gasket or caulk between the luminaire housing and ceiling,
- ❑ Shall not contain screw base sockets; and shall contain light sources that are marked "JA8-2016-E" as specified in Reference Joint Appendix JA8.

<u>Night Lights.</u> Permanently installed night lights and night lights integral to installed luminaries or exhaust fans shall be rated <5W per luminaire <u>Screw based luminaries</u>.

□ The installed lamps shall be marked with “JA8-2016” or “JA8 -2016-E”

NOTE: Light sources that are not marked “JA8-2016-E” shall not be installed in enclosed luminaries.

Indoor Light switching devices and controls (150.0(k)) part 2

- ❑ Exhaust fans shall be switched separately from lighting systems. EXCEPTION to Section 150.0(k)2B: Lighting integral to an exhaust fan may be on the same switch as the fan provided the lighting can be switched OFF while allowing the fan to continue to operate for an extended period of time.
- ❑ No bypass option on a dimmer or vacancy sensor function
- ❑ An Energy Management Control System (EMCS) may be used to comply with dimmer requirements in Section 150.0(k)
- ❑ In bathrooms, garages, laundry rooms, and utility rooms, at least one luminaire in each of these spaces shall be controlled by a vacancy sensor.
- ❑ Dimmers or vacancy sensors shall control all luminaries required to have light sources compliant with Reference Joint Appendix-JA8. *Exception:* Luminaries in closets < 70 sf. and in hallways.
- ❑ Under-cabinet lighting shall be switched separately from other lighting systems.

Residential Outdoor Lighting.

All luminaries shall be high efficacy or JA8 listed, and meet one of the followings:

- Controlled by photocell and motion sensor. With manual ON/OFF switch that does not override to ON unless the override automatically reactivates the motion sensor within 6 hours
- Controlled by photocell and time switch control with manual ON/OFF switch that does not override to ON unless the override automatically reactivates the photo control and timer switch within 6 hours
- Controlled by Astronomical timer. With manual ON/OFF switch that does not override to ON unless programmed to automatically turn the outdoor lighting OFF during daylight hours

- Energy management control system per 150.0(k)

Mechanical Compliance

- Gas burning FAUs are ONLY allowed with performance approach.
- Mandatory compliance for air handlers with more than 12' of supply duct (including the length of the air handler) shall need Roof deck having area weight U-Factor at 0.184 or better. This can be achieved by adding R3 below the roof deck or R4 sheath insulation above the roof deck.
- Air Filter (min MERV 13) shall be provided, except evaporative coolers, filter shall not exceed system's allowable pressure drop stated on a permanent table affixed at filter location. Makeup supply-only ventilation air systems are also subject to this requirement.
- Return Duct sizing
  - Return duct length max. 30 ft and with max. 180 degrees total bend. If exceeds 90 degrees, one bend shall be a metal elbow.
  - Return grille devices shall be labeled to disclose the grille's design airflow rate and a max allowable clean-filter pressure drop of 12.5Pa for the air filter media

Single Duct Systems 1.5 to 2.5 tons (CEC Table150.0-B)		
System Cooling Capacity (Ton)*	Min. Return Duct Diameter (inch)	Min. Total Return Filter Grille Gross Area (inches^2)
1.5	16	500
2	18	600
2.5	20	800

Multiple Return Air Duct Systems (CEC Table150.0-C)			
System Cooling Capacity (Ton)	Duct 1 Diameter	Duct 2 Diameter	Min. Return Grille Gross Area (inches^2)

1.5	12	10	500
2	14	12	600
2.5	14	14	800
3	16	14	900
3.5	16	16	1000
4	18	18	1200
5	20	20	1500

*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 ton

Heat Pump Water Heater ready (Energy Code 150.0(n))

- ❑ 3-10AWG min. branch circuit wiring, terminated in an electrical box, within 3' from the water heater, labeled "240V ready"
- ❑ Space for a double pole circuit in the main service panel, labeled "For Future 240V use"
- ❑ Min clear space of 30"x30" with 7' headroom for future replacement with a Heat Pump Water Heater.
- ❑ A condensate drain located max 2" above the floor for future use.

Solar-Ready *(California Energy Code 110.10)*

SJC Reach Code (effective 08/01/2021): Solar readiness is required for all newly constructed buildings, except ADUs.

- ❑ Solar Zone:
  - Minimum total of 250 sf solar zone that can be comprised of areas of minimum 80 sf with no dimension less than 5'. In WUI area, building with a whole house fan can have total solar zone no less than 150sf. Solar zone to be away from any shading object a distance of twice the height difference.
  - Solar zone, location reserved for inverters metering equipment with pathway for conduit routing, or plumbing path for water solar heating, to be indicated in construction document

- Ridge Setback/Pathways (CRC324.6.1 & 324.6.2.1)
- Non sprinklered Building: Min Ridge setback of 18" from ridge when array covers less than 33% of roof, otherwise 36" from ridge for each roof plane.
- Fully sprinklered Building: Min Ridge setback of 18" from ridge when array covers less than 66% of roof, otherwise 36" from ridge for each roof plane.
- Min. 2 pathways to ridge, one on the street or driveway side, one on each roof plane with PV array.

❑ Raceways for PV installed with reserved space for 240V back-feed breaker, labeled "Future PV"

❑ Main service panel with 200amp bus bar min., and space for double pole breaker, permanently marked "For Future Solar"

Energy storage systems (ESS) ready. *(Cal. Energy Code 150.0 (s))*

❑ At least one of the following shall be provided:
- ESS-ready interconnection equipment with a min. backed-up capacity of 60 amps and a min. of four ESS-supplied branch circuits,

OR,
- A dedicated 1", or larger, raceway from the main service to a subpanel that supplies the branch circuits, listed in the section below. The subpanel must be labeled "Subpanel shall include all backedup load circuits.", and can be supplied by the main service panel prior to the installation of an ESS.

❑ A minimum of four branch circuits shall be identified and have their source of supply collocated at a single panelboard suitable to be supplied by the ESS. At least one circuit shall supply the refrigerator, one lighting circuit shall be located near the primary egress and at least one circuit shall supply a sleeping room receptacle outlet.

❑ The main panelboard shall have a min. busbar rating of 225 amps.

❑ Sufficient space shall be reserved to allow future installation of a system isolation equipment/transfer switch within 3 feet of the main panelboard. Raceways shall be installed between the panelboard and the system isolation equipment/transfer switch location to allow the connection of backup power source.

Heat pump space heater ready. (Cal Energy Code 150.0(t))

- A dedicated 240V branch circuit wiring shall be installed within 3 feet from the furnace and accessible to the furnace with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as "240V ready." All electrical components shall be installed in accordance with the California Electrical Code.
- The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future heat pump space heater installation. The reserved space shall be permanently marked as "For Future 240V use."

Electric cooktop ready. (Cal. Energy Code 150.0 (u))

- A dedicated 240V branch circuit wiring shall be installed within 3 feet from the cooktop and accessible to the cooktop with no obstructions. The branch circuit conductors shall be rated at 50 amps minimum. The blank cover shall be identified as "240V ready." All electrical components shall be installed in accordance with the California Electrical Code.
- The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric cooktop installation. The reserved space shall be permanently marked as "For Future 240V use."

Electric clothes dryer ready. (Cal. Energy Code 150.0 (v))

- A dedicated 240V branch circuit wiring shall be installed within 3 feet from the clothes dryer location and accessible to the clothes dryer location with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as "240V ready." All electrical components shall be installed in accordance with the California Electrical Code.
- The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric clothes dryer installation. The reserved space shall be permanently marked as "For Future 240V use."

Prescriptive approach for new buildings
(CA Energy Code T150.1-A)

Under floor, walls, and ceiling batt insulation can be inspected at same time. Blown-in insulation is inspected at Final. (SJC Field Note 29)

Building Envelope (150.1(c))

- Max 1:12 slope ceiling for blown in insulation
- Faced insulation has to be in substantial contact with approved wall or ceiling material or has to meet 25 flame index and 450 smoke index. (CRC 302.10)

Attic

Wall above lower ceiling to be insulated as attic
There are three options that may be used to comply:
Option A:

Removed from 2022 California Energy Code, but can be implemented as an alternative to Option B, see footnote 2

Option B:

- ❑ Ducts and air handlers may be located in the attic
- ❑ Install R-38 insulation on the ceiling
- ❑ Install below roof deck insulation (at rafter) R-13 with air space above insulation/ R-18 with no space

Option C:

- ❑ Ducts and air handlers must be located in a conditioned space
- ❑ Install attic radiant barrier
- ❑ Install R-30 insulation on the ceiling

Walls

New Dwellings

2x6 @ 16" OC framing—R19 cavity + R5 continuous
2x4 @ 16" OC framing—R15 cavity + R8 continuous

Additions

Install R-15 in 2x4 framing
Install R-19 in a 2x6 framing

Underfloor

- Faced batt insulation shall have paper side installed facing the conditioned area.

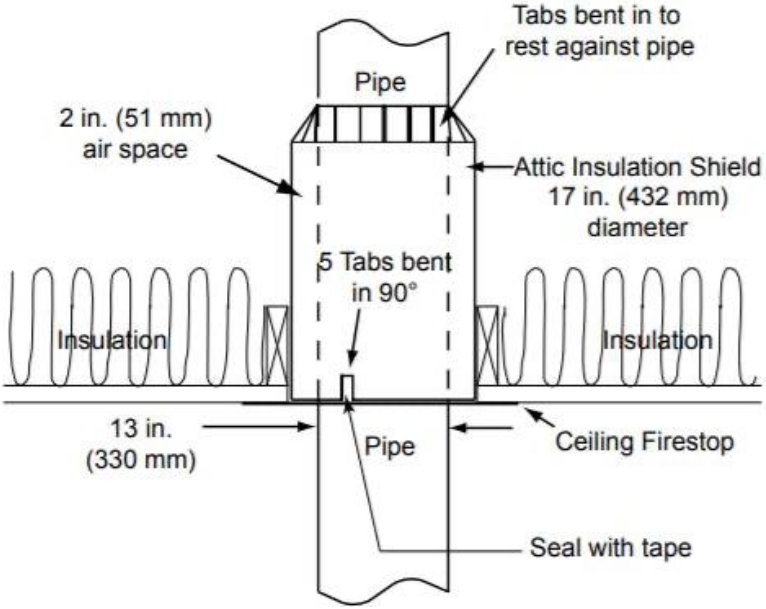
(not required) but to be in substantial contact with floor sheathing if used.

- Secure insulation if not held in place by finishes
- Cripple walls to have same insulation as underfloor
- A Class I or II vapor retarder is required on unvented attic space side with air permeable insulation (R806.5)

All exposed insulation must have a flame spread rating of 25 Or less and a smoke-developed index of not more than 450 (CBC 720.3)

Chimney shield (CRC1005.8 & CPC 509.6.1.7)

- Factory Built chimneys, which have minimum clearance requirement to insulation, are now required to have insulation shield to provide clearance.



AS10 Attic Insulation Shield Straight Hearth Home Technologies

Fenestrations & Penetrations

- U-Factor of Windows Match CF1 Form
- Glazing to be inspected at frame inspection
- Prescriptive is .30 U-factor/labeled/.23 SHGC
- SHGC may be impacted by approved permanent shading device
- Exterior Openings Sealed to Prevent Infiltration
- Exterior openings around doors, windows & exterior penetrations are sealed (California Energy Code 110.6(b))
- Sill plates are sealed at floor line on slab floors (California Energy Code 110.7)
- Penetrations in plates are sealed between attic and under floor
- Exterior sheathing is sealed to prevent openings into wall cavities

Ventilation

- Attic & Under Floor Vents Maintained open, unless prohibited due to rating
- Cathedral ceilings require vents top and bottom and 1" min air space in every bay.
- If attic has blown in insulation, wind blocks must be installed at eave vents. Block-outs must not restrict vent openings

Unvented roof assembly

- air-impermeable insulation, most closed-cell spray foam types, applied in direct contact with the underside of roof deck
- OR, Where air-permeable insulation is installed directly below the structural sheathing, R-5 rigid board or sheet insulation shall be installed directly above the structural roof sheathing.

Table 150.1-A COMPONENT PACKAGE – STANDARD BUILDING DESIGN FOR CLIMATE ZONE 4			
Building Envelope			
Roofs/Ceilings	Option B (meets §150.1(c)9 A)	Below Roof Deck Insulation[1,2] (With Air Space)	R 19
		Ceiling Insulation	R 38
		Radiant Barrier	NR
	Option C (§150.1(c)9 B)	Ceiling Insulation	R 30
		Radiant Barrier	REQ
Walls	Above Grade	Framed[3]	U 0.048
		Mass Wall Interior[4,5]	U 0.077 R 13
		Mass Wall Exterior[4,5]	U 0.125 R 8.0
	Below Grade	Below Grade Interior[6]	U 0.077 R 13
		Below Grade Exterior [8]	U 0.200 R 5.0
Floors		Slab Perimeter	NR
		Raised	U 0.037 R 19
		Concrete Raised	U 0.269 R 0
Quality Insulation Installation (QII)			Yes
Roofing Products	Low-sloped	Aged Solar Reflectance	NR
		Thermal Emittance	NR
	Steep-sloped	Aged Solar Reflectance	NR
		Thermal Emittance	NR
Fenestration	Maximum U-factor		0.30
	Maximum SHGC		0.23
	Maximum Total Area		20%
	Maximum West Facing Area		5%
Door	Maximum U-factor		0.20

Table 150.1-A COMPONENT PACKAGE - *Continued*

HVAC SYSTEM	Space Heating [9]	Electric-Resistance Allowed		No
		If gas, AFUE		NA
		If Heat Pump, HSPF [7]		MIN
	Space Cooling	SEER		MIN
		Refrigerant Charge Verification or Fault Indicator Display		NR
		Whole House Fan[8]		NR
	Central System Air Handlers	Central Fan Integrated Ventilation System Fan Efficacy		REQ
	Ducts[10]	Roof/Ceiling Options B	Duct Insulation	R-8
			§150.1(c)9A	NA
		Roof/Ceiling Option C	Duct Insulation	R-6
			§150.1(c)9B	REQ
Water Heating	All Buildings - System shall meet Section 150.19c08			

FOOTNOTE REQUIREMENTS TO TABLE 150.1-A

1. Install the specified R-value with an air space present between the roofing and the roof deck. Such as standard installation of concrete or clay tile.
2. R-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. Alternatives including insulation above rafters or above roof deck.
3. Assembly U-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly U-factor equal to or less than the U-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, Table 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to be less than or equal to the required max. U-factor.

4. Mass wall has a heat capacity of not less than 7.0 Btu/h-ft^2.
5. “Interior” denotes insulation installed on the inside surface of the wall. “Exterior” denotes insulation installed on the exterior surface of the wall.
6. Below grade “interior” denotes insulation installed on the inside surface of the wall, and Below grade “exterior” denotes insulation installed on the outside surface of the wall.
7. HSPF means "heating seasonal performance factor."
8. When whole house fans are required (REQ), only those whole house fans that are listed in the Appliance Efficiency Directory may be installed. Compliance requires the installation of one or more WHFs whose total airflow CFM is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12.
9. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
10. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required.

Exterior wall: U-factor to Insulation conversion JA4.3

Spacing	Insulation	Framing size	R-0	R-2	R-4	R-5	R-6
			Continuous Insulation R Value				
16 in. OC	None	Any	0.356	0.209	0.146	0.127	0.113
	R-11	2x4	0.11	0.088	0.074	0.068	0.064
	R-13	2x4	0.102	0.082	0.069	0.064	0.06
	R-15 1	2x4	0.095	0.077	0.065	0.06	0.056
	R-19	2x6	0.074	0.063	0.055	0.051	0.049
	R-211	2x6	0.069	0.059	0.051	0.048	0.046
	R-22	2x6	0.072	0.062	0.054	0.051	0.048
	R-23	2x6	0.067	0.057	0.049	0.047	0.044
	R-25	2x6	0.065	0.055	0.048	0.045	0.043
	R-19	2x8	0.065	0.057	0.051	0.048	0.045
	R-22	2x8	0.061	0.053	0.047	0.045	0.043
	R-25	2x8	0.057	0.05	0.044	0.042	0.04
	R-301	2x8	0.056	0.049	0.044	0.041	0.04
24 in. OC	None	Any	0.362	0.211	0.148	0.128	0.114
	R-11	2x4	0.106	0.086	0.072	0.067	0.062
	R-13	2x4	0.098	0.079	0.067	0.062	0.058
	R-15	2x4	0.091	0.074	0.063	0.059	0.055
	R-19	2x6	0.071	0.061	0.053	0.05	0.048
	R-211	2x6	0.066	0.057	0.05	0.047	0.045
	R-22	2x6	0.069	0.06	0.052	0.049	0.047
	R-23	2x6	0.064	0.054	0.048	0.045	0.043
	R-25	2x6	0.061	0.052	0.046	0.043	0.041
	R-19	2x8	0.063	0.055	0.049	0.047	0.045
	R-22	2x8	0.058	0.051	0.046	0.044	0.042
	R-25	2x8	0.055	0.048	0.043	0.041	0.039
	R-301	2x8	0.054	0.047	0.042	0.04	0.038

Spacing	Cavity Insulation	Framing size	R-7	R-8	R-10	R-12	R-15
			F	G	H	I	J
16 in. OC	None	Any	0.101	0.092	0.078	0.067	0.056
	R-11	2x4	0.06	0.056	0.05	0.045	0.04
	R-13	2x4	0.056	0.053	0.047	0.043	0.038
	R-15 1	2x4	0.053	0.05	0.045	0.041	0.036
	R-19	2x6	0.046	0.044	0.04	0.037	0.033
	R-211	2x6	0.043	0.041	0.038	0.035	0.031
	R-22	2x6	0.045	0.043	0.037	0.036	0.033
	R-23	2x6	0.042	0.04	0.037	0.034	0.03
	R-25	2x6	0.04	0.039	0.035	0.036	0.032
	R-19	2x8	0.043	0.041	0.038	0.035	0.032
	R-22	2x8	0.041	0.039	0.036	0.033	0.03
	R-25	2x8	0.038	0.037	0.034	0.032	0.029
	R-301	2x8	0.038	0.036	0.033	0.031	0.028
24 in. OC	None	Any	0.102	0.092	0.078	0.067	0.056
	R-11	2x4	0.059	0.055	0.05	0.045	0.039
	R-13	2x4	0.055	0.052	0.047	0.043	0.038
	R-15	2x4	0.052	0.049	0.044	0.04	0.036
	R-19	2x6	0.045	0.043	0.04	0.036	0.033
	R-211	2x6	0.042	0.04	0.037	0.034	0.031
	R-22	2x6	0.044	0.042	0.036	0.036	0.033
	R-23	2x6	0.041	0.039	0.036	0.033	0.03
	R-25	2x6	0.039	0.037	0.034	0.035	0.031
	R-19	2x8	0.043	0.041	0.037	0.035	0.031
	R-22	2x8	0.04	0.038	0.035	0.033	0.03
	R-25	2x8	0.037	0.036	0.033	0.031	0.028

	R-301	2x8	0.037	0.035	0.033	0.03	0.028

Notes
1. Higher-density fiberglass batt is required in these cases.
2. Continuous insulation may be installed on either the inside or the exterior of the wall, or both.

Prescriptive approach for additions
CA Energy Code 150.2 (a)

- Existing inaccessible piping shall not require insulation
- Heating and cooling from an existing system shall not need to comply with energy requirements. New or replacement units can be heat pump or gas.
- The existing duct system and the extended duct HERS verification for sealing. New ducts shall have min R-8 insulation
- Additions 1000sf or less and JADUs are exempt from ventilation cooling and ventilation for indoor air quality requirements. All others will have mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit.
- Additions that are greater than 700 sq.ft.
  - Wood-framed walls shall have R15 in a 2×4 and R19 in a 2×6 framing.
  - The max. fenestration area shall be the greater of 175 sf or 20% of the addition floor area, with 70sf max. west facing
  - Conversion of existing unconditioned to conditioned space, QII shall not include insulation at existing door/window headers and air barrier sealing.

- Additions that are 700 sq.ft. or less
  - Roof assembly to have max 0.025 U-factor, achieve by installing R38 or greater for attic insulation, with radiant barrier.
  - New walls can have same dimension of the existing, provide R15 insulation in 2x4 and R21 insulation in 2x6 framing
  - Max. allowed west-facing fenestration: 60 sqft. and the aggregate fenestration is the greater of 120 sf or 25% of the condition floor addition area. When adding 400 sqft or less of condition area,

max. aggregate fenestration can be the greater of 75sqft or 30% of conditioned area.

- QII requirements do not apply.
- When a 2nd water heater is installed as part of an addition, it shall be one of the followings:
  - A single HPWH is installed on an incompressible insulated (min R-10) surface, not located outside.
  - Or, A single NEEA Tier 3 or greater HPWH.
  - Or, a gas tankless instantaneous WH with max. rating of 200k Btuh.
  - When the new addition is less than 500sf of conditioned space, an instant resistance water heater is allowed, with a point-of-use distribution system design.

Water Heaters (150.1(c)8) Prescriptive approaches

- New construction: Provide one 240v, NEEA Tier 3 or greater, heat pump water heater with a storage tank located in the garage or conditioned space.

  Exceptions:
  - Instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank, when the space-heating system is a heat pump.
  - When the new dwelling unit with less than 500sf of conditioned space, an instant resistance water heater is allowed, with a point-of-use distribution system design.
  - One 120v heat pump water heater is permitted for a new one-bedroom or studio unit.

Photovoltaic Requirements and System Sizing (Energy code

All low-rise residential buildings shall have a PV system meeting the min. output as determined by the equation below.

EQUATION 150.1-C annual PV electrical output for CZ4

$$kW_{PV} = (CFA \times 0.586)/1000 + (NDwell \times 1.21)$$

WHERE:

kW_{PV} = kWdc size of the PV system
CFA = Conditioned floor area
NDwell = Number of dwelling units (= 1 for single family)

Prescriptive approach for alterations
CA Energy Code 150.2 (b)

- Added fenestration will have U-factor of .30 and SHGC of .23 per Table 150.1A. Skylights shall have U-factor of .55 and SHGC of .30. Up to 75 sq.ft of fenestration and 16 sq.ft of skylight are allowed without complying to section 150.1(c).

- Replacement of vertical fenestration no greater than 75 square feet with a U-factor of 0.40, and a SHGC of 0.35. Replaced skylights must meet a U-factor of0.55, and a SHGC of 0.30.

- New or Altered heating and air conditioning system shall have duck leakage verified through HERS test. Leakage shall be max 5% for new duct system, 6% for altered duct system, 10% for extension and A/C installation.

  If it is not possible to meet the duct sealing requirements, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater

- No electric resistance space heating systems, unless replacing the existing space heating system is electric resistance.

- Water Heater:

  If the existing water heater is an electric resistance water heater, a consumer electric water heater is allowed. Otherwise, *same requirement as 2nd water heater for addition. See previous section.*

- Roofs: Roof covering will have min. Aged solar reflectance of 0.2 and thermal emittance of 0.75 for slope roofs. 0.63 and 0.75 for low-slope roofs, respetedly.

Exceptions.

- Slope roofs with R38 ceiling insulation, radiant barrier, no ductwork in attic, or with min R2 above roof deck.
- Low slope roof Roofs shall be insulated or existing roofs with R-10 or insulation.

- Lighting. The altered luminaires shall be hi efficacy per Section 150.0(k) and Table 150.0-A. Where existing screw-base sockets are present in ceiling-recessed luminaires, removal of these sockets is not required provided that new JA8-compliant trim kits or lamps designed for use with recessed downlights or luminaires are installed.

- Local mechanical exhaust:
  Kitchens and Bathrooms shall have exhaust fan

- Exterior doors. Alterations that add exterior door area shall meet the U-factor of .20 (Section 150.1(c)5 and Table 150.1A)

RATED WALL/CEILING INSPECTION

Rated Wall/Ceiling (Table R302.6/CBC 406.)

- ❑ Firewall extends to roof sheathing, through crickets above ceiling
- ❑ Ceiling rocked with 5/8" type X if living area above. Lid must extend to end of garage or 6' beyond second story wall and to roof sheathing
- ❑ Supporting walls, beams & posts for second floor are protected with 1/2" gyp or heavy timber, i.e., 8 x 8 posts & 6 x 10 beams and girders (CBC 602.4.3 & 602.4.4)

Access in garage *rated* ceiling/wall (CRC 302.6/Field Note 45)

- ❑ Doors are 20-minute rated or 1 3/8" solid core to be self-latching and equipped with self-closing or automatic closing device (R302.5.1/CBC 406.3.4)
- ❑ Ceiling access

Attic Access cover: 5/8" Type X drywall attached to a ¾" plywood with (2) hinges, minimum, to prevent loss, self-closing (spring hinges or by gravity). Non-combustible support for the cover (dry wall rip or metal L-bracket; not just wood trim)

Attic Access Ladders: 20-minute (minimum) Fire-Rated ladder, installed per manufacturer's instructions OR

Standard ladder with 5/8" Type X drywall attached, overlapping the framing at least ½" on the three non-hinged sides, a double spring kit (must close easily), and a latch to hold the ladder up and tightly shut. OR, Non-Rated Attic Ladder *AND* Standard Access Cover installed *ABOVE* the ladder

Plumbing Penetrations (Field Note 30 or R302.11 item 4/CBC 714)

□ Seal annular space on all metallic piping

□ Install listed penetration protection on all ABS piping (Listed Firestop collar required for nonmetallic pipes over 2" in diameter)

□ Duct penetrations are 26 gage galvanized sheet metal. No duct openings in garage

□ All holes are fire caulked or mudded tight, no flat taping allowed

□ Protect Furnace/water heater platforms with min 1/2 gyp if part of rated wall.

FINAL INSPECTION

BUILDING REQUIREMENTS

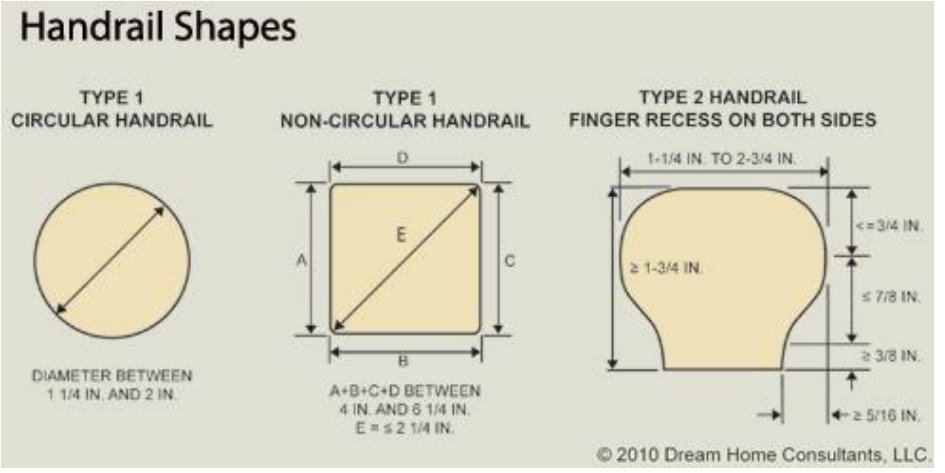
All applicable inspections below must be complete prior (or concurrent) to Final Inspection

- Insulation, QII, HERS report
- Gas pressure test
- Rated wall
- PG&E meter releases were done with sub-trade final
- Fire Sprinklers, Public Works, CDDD final
- Special inspection report, structural observation letter, and/or soil report collected (R109.2)
- Inspection for Photovoltaic system.

Stairs, Landings, & Guardrails (R311.7.5)

See Stairs in Rough Frame Inspection

Handrail(R311.7.8)



- 34” - 38” high from the sloped plane adjoining the tread nosing and continuous for the full length of the flight
- 1-1/2” min space between the wall & handrail except at terminations
- Terminate in newel posts, volute, or return to wall
- Type I: Grip size between 1-1/4” & 2” and cross section not more than $2^{1/4}$”
- Type II: width of the handrail above the recess shall be not less than $1^{1}/_{4}$” and not more than $2^{3}/_{4}$”. Where handrail perimeter greater than $6^{1}/_{4}$”, a graspable finger recess area on both sides to be provided, begin within ¾” vertically from the tallest portion, of the profile, min depth of $^{5}/_{16}$”. This required depth shall continue for not less than $^{3}/_{8}$” to a level that is not less than $1^{3}/_{4}$” below the tallest portion of the profile.

- No vertical drop and no more than 45° shift in direction, no 90-degree bend. (City of San Jose policy)

Guard rails (R312.1)
- 42” high min unless serving as handrail on open side of stair
- Openings to be 4” max, except:
  - $4^{3/8}$” max at side of stairs,
  - 6” max at the triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a guard

Window Fall Protection (R312.2)
Operable window with sill height less than 24” above floor and greater than 72” above grade must comply with the following:
- Window will not open more than 4”
- A fall-protection device in compliant with ASTM F2090 is installed.
- Window is provided with opening control device complying with section R312.2.2
- When window serves as an egress opening, fall protection device shall not reduce the required net clear opening area of the window.

Bulkhead Enclosure (R311.7.10.2)

□ Not part of required egress
□ Exterior access to basement is exempt from requirements of Sections R311.3 and R311.7
□ Covered with hinged doors

Smoke Detectors are Installed (R314/CBC 907.2.11.2 see Frame Inspection for locations)

Egress (see requirements in Frame Inspection)

Fireplace (R1001/CBC 2111)
□ Hearth, mantle, and doors are installed—check manufacturer's specifications
□ Glass doors are installed (California Energy Code 150.0(e) 1A)
Verify Required Safety Glazing

Grading
□ Check soils report for grading & drainage requirements
□ Rainwater leaders discharge as per plan and soils report
□ Grade slopes 2% away from structure and toward street or drainage easement
□ Verify clearance: 8" from earth to wood, 4" from earth to stucco & 2" from concrete to stucco from finish grade.

Energy Conservation
□ All exterior doors and windows weather stripped
□ Insulation certificate is posted
□ Fireplace has doors installed
□ Fluorescent or LED lighting is installed throughout, or alternative lighting permitted by Energy code

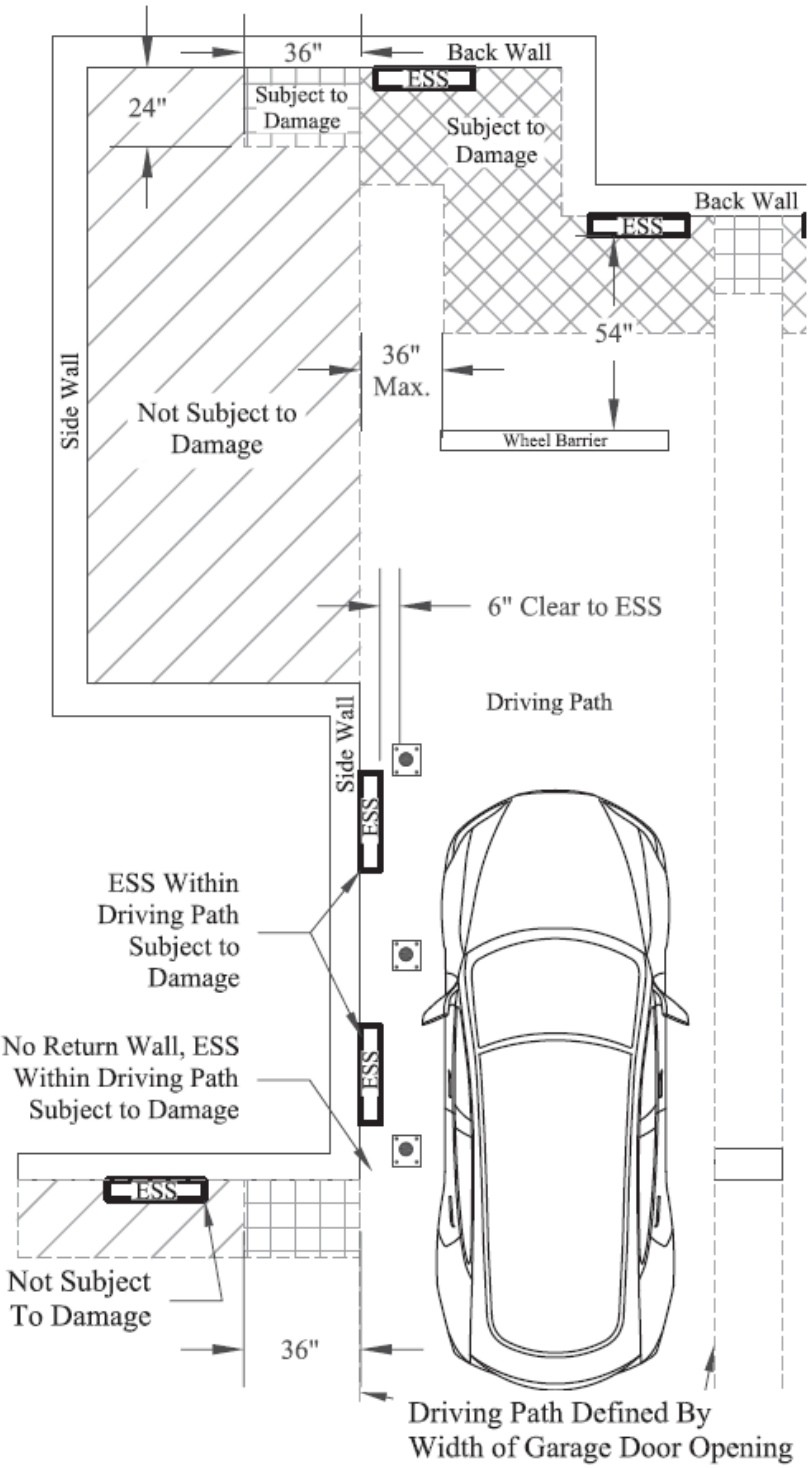
Energy Storage System (ESS) (R328)
Electrical installation shall be installed in accordance with 2022 California Electrical Code and Manufacturer's instructions
❑ Shall be listed and labeled in accordance with UL 9540, or installed not less than 5'from exterior walls, public ways, property lines. EVs

used as ESS shall comply with the vehicle manufacture's instruction and California Electrical Code.

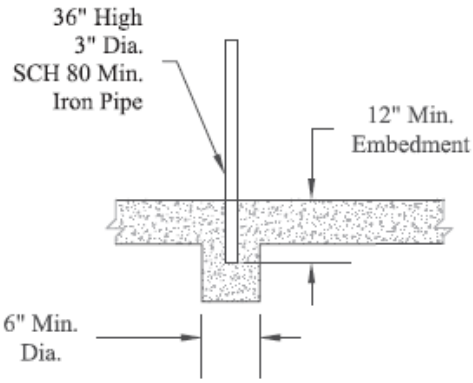
- ❑ Shall be spaced min. 3' from each other, or per documented large-scale fire testing from SJFD.
- ❑ Shall have max. rating of 20kWh each. And shall be installed in:
  - Garages and detached accessory structures. Maximum 80kWh aggregate rating of ESS system.
  - Outdoor, on exterior side of an exterior wall, with min 3' to doors and windows. Maximum 80kWh aggregate rating of ESS system.
  - When installed in dwelling units, ESS shall located in a space with noncombustible wall/ceiling finishes, or not less than 5/8" type X gypsum board. Maximum 40kWh aggregate rating of ESS system
- ❑ When installed within dwelling or attached garage, basement, ESS's area shall be protected by smoke alarm. Where location violates the alarm's listing, a listed heat detector shall be provided and interconnected to the smoke alarms.
- ❑ Ventilation: Indoor installations of ESS that produce flammable gases during charging shall be provided with mechanical ventilation per California Mechanical Code. ESS that releases toxic gas is prohibited for residential use.
- ❑ Protection from impact is required when ESS installed on garage back walls and within 36" of the normal driving path; or on side wall and located within 24 from the back wall and 36' of the normal driving path. Where similar condition occurs outside, more likely driveway areas, same requirement will apply. (R328.8)

  Exception: not required where garage door's clear opening is less than 7'6" and ESS is installed more than 36" above floor.

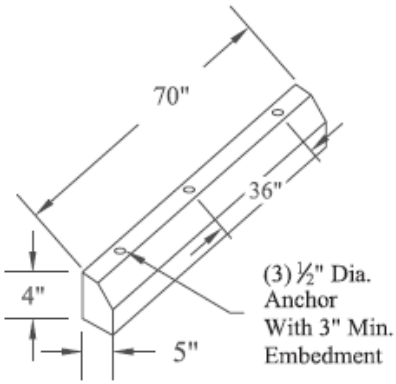
  See illustrations


36"
Back Wall
ESS
24"
Subject to Damage
Subject to Damage
Back Wall
ESS
54"
36" Max.
Side Wall
Not Subject to Damage
Wheel Barrier
6" Clear to ESS
Driving Path
Side Wall
ESS
ESS Within Driving Path Subject to Damage
No Return Wall, ESS Within Driving Path Subject to Damage
ESS
ESS
Not Subject To Damage
36"
Driving Path Defined By Width of Garage Door Opening

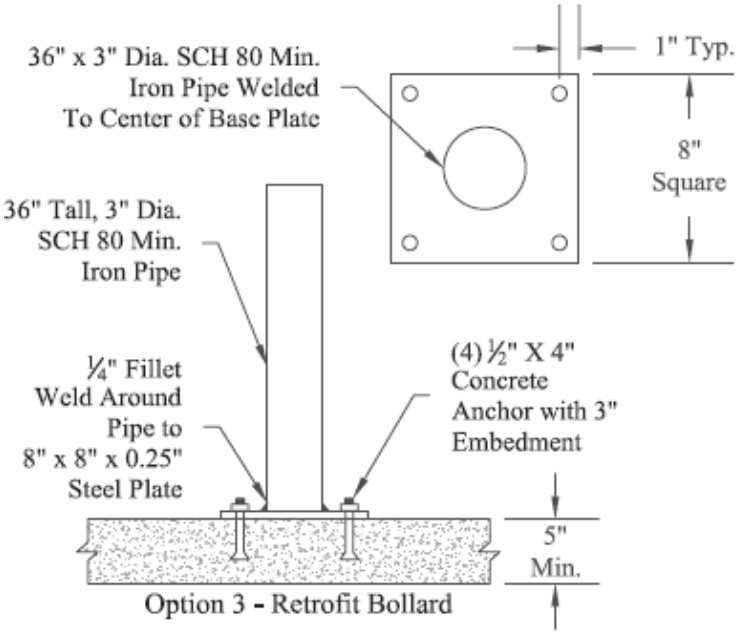
Impact Protection Options.



Option 1 - Pipe Bollard



Option 2 - Wheel Barrier



Option 3 - Retrofit Bollard

Garage Door Labeling (R609.4.1)

Permanent label shall be affixed to door, identifying the door manufacture, door model/series number, design wind pressure rating, the applicable test standard, and installation drawing reference number.

Building Identification

Verify Street Address Installed at Front of House. 4" high character, ½" stroke and visible from street.

See also Final Inspection sections in Plumbing, Mechanical, and Electrical.

DEMOLITION INSPECTIONS
(CSJ POLICY & CBC 3303)

(Also see Plumbing/Mechanical/Electrical Checklist)

□ Building Demolition

- Utilities discontinued, capped-off, safe-off (CBC 3303.6)
- "non-build" areas match plan
- Buildable areas require special inspection & final letter of compaction approval

□ Pool Demolition

- Plumbing, mechanical & electrical abated
- "non-build" areas match plan
- Buildable area requires special inspection & final letter of compaction approval

Part II
PLUMBING REQUIREMENTS

2022 California Plumbing Code
Based on the 2021 Uniform Plumbing Code

UNDERGROUND SEWER - CHAPTER 7

Approved Materials 701

- ABS and PVC DWV in residential buildings are limited to buildings no more than two stories per HCD (SJC P-004)
- DWV copper tubes, cast-iron soil pipes, and Galvanized pipes
- Polyethylene (Trenchless pipe replacement) and Vitrified Clay pipes can't be installed within 2 'of a building, and Clay pipes are not to be pressurized by a pump or ejector. (Table 701.2)

Protection of Piping

- Material other than those approved for use under or within a building will be min 1' below ground surface and 2' away from structures. 718.3

Grade and Support 718

- Slope shall not be less than 2% or 1/4" per ft. 718.1
- 4" through 6" pipe may slope at 1% or 1/8" per ft, if structural conditions dictate and approved 718.1 (Exception)
- Shall be laid on a firm bed for its entire length. 718.2
- Change of direction (type of sweep) 706
    a. Horizontal to horizontal = 45° wye, combo wye & 1/8 bend or equivalent
    b. Vertical to horizontal = 45° wye, combo wye & 1/8 bend. 60° offset is permitted to be used only when installed in true vertical position.
    c. Horizontal to vertical = 45° wye, 60° wye, combo wye & 1/8 bend, sanitary tee/sanitary tapped tee or equivalent

Cleanout

- Intervals exceeding 100'. 719.1
- Each aggregate horizontal change of direction >135°
- 2 'inside or outside of building, near building drain connection to building sewer. 715.1
- ≤ 2" cleanout requires min. 18"x18" clearance in front. 707.9
- > 2" cleanout requires min. 24"x24" clearance in front. 707.9
- Under floor cleanout shall be within 5 'from access.
- 4" cleanout within 5 'of property line extended to grade. CSJ Ordinace 17.56.160

Backwater Valve Requirements 710

- For fixtures on a floor level that is not above the upstream manhole by 1'. (SJC P-002)

Fixtures above the upstream manhole more than 1' cannot discharge through the backwater valve. (Check for split system requirement.)

Location of Building Sewer 307.1

- Sewer shall be located on the same lot, or in easement, as the building it serves.

Size of Building Sewer 717

- On the basis of total fixture units per Table 703.2
- Min. of 3" with a water closet connected to it. Table 703.2
- 3" dia. drain not to exceed 5 water closets or 5 six-unit traps, a horizontal 4" drain can serve up to 216 fixture units. (Table 703.2, note 4)
- Size shall be based on Tables 702.1 & 703.2

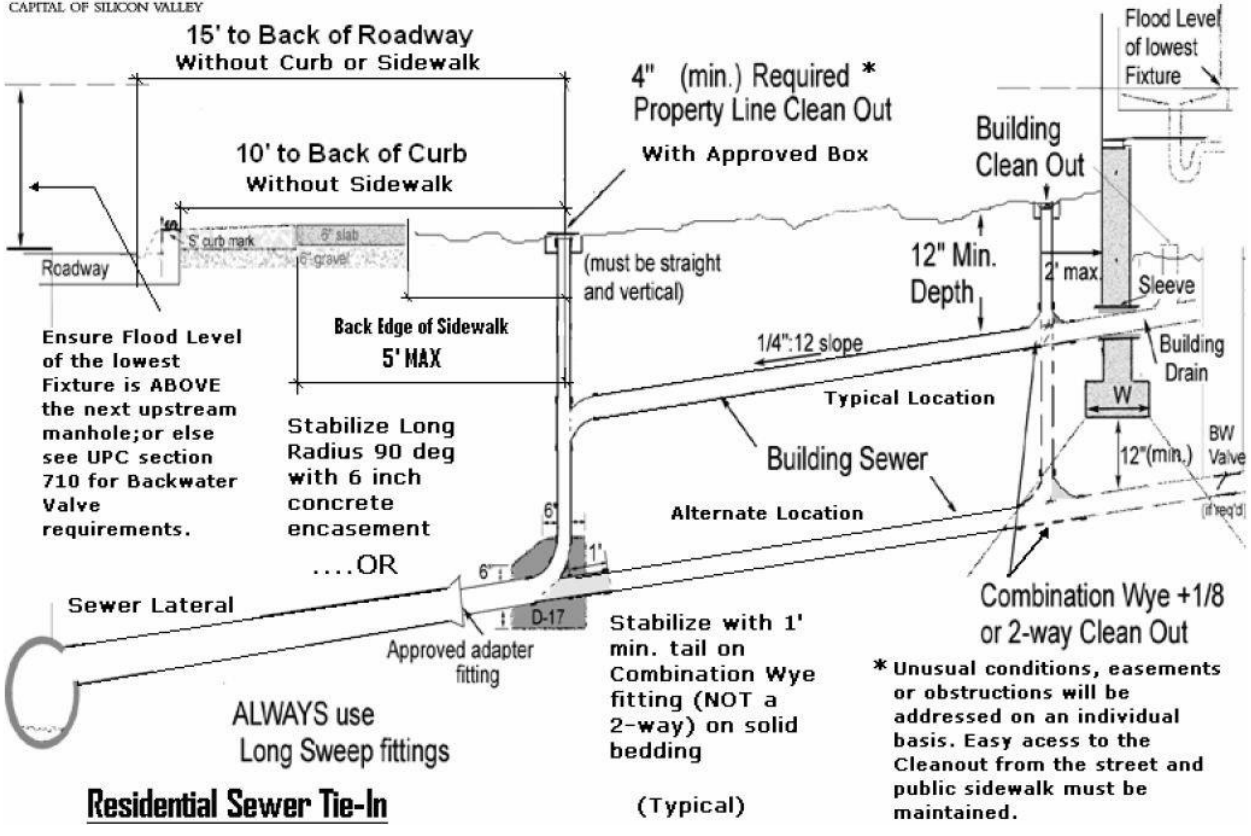
Backfill Requirements for Property line Cleanout Installations

Property line cleanout/piping shall be laid on a firm bed of ¾" base rock (before inspection)

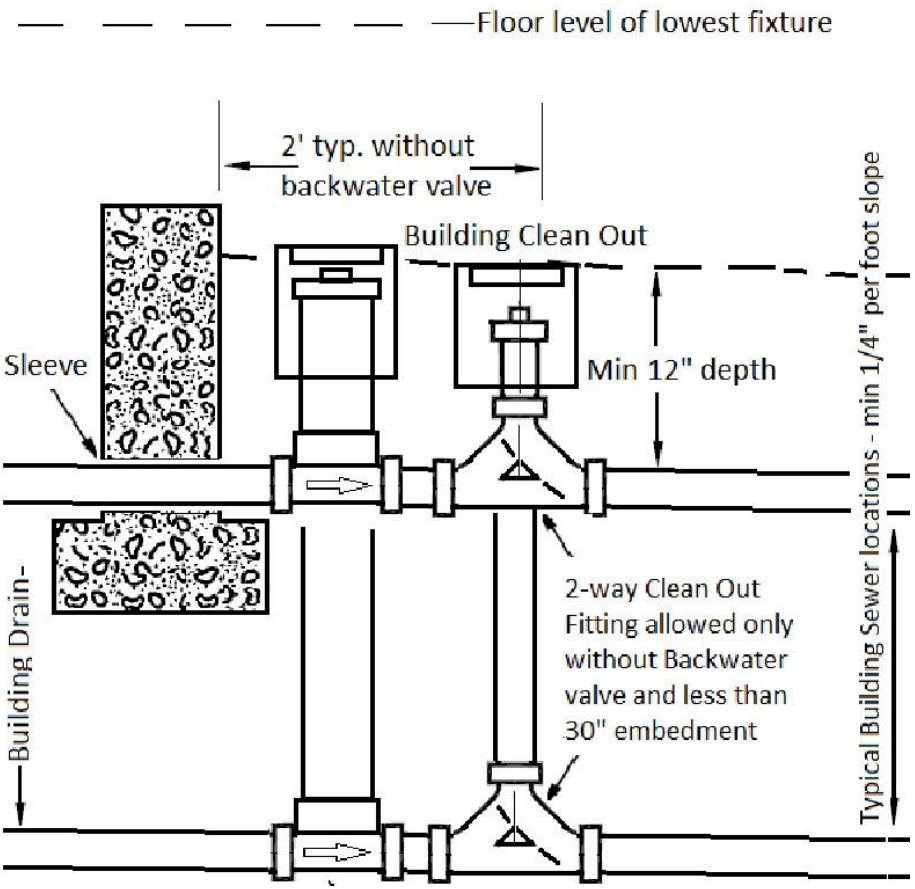
- Property line cleanout/piping shall have a minimum cover of 4" of ¾" base-rock, then native dirt. The ¾ inch base-rock shall be at jobsite and shall be installed after final inspection.

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Department of Planning, Building and Code Enforcement
JOSEPH HORWEDEL, ACTING DIRECTOR



Building Cleanout/Backwater valve



UNDERGROUND WATER - CHAPTER 6

Approved Materials 604

- Brass, copper, CPVC, galvanized steel, polyethylene, PP, schedule 40 PVC, stainless steel, Ductile-Iron, Malleable Iron, PE, PE-AL-PE, PE-AL-PEX, PE-RT per Table 604.1
- Copper shall be a min. of type "M" 604.3 exception
  - DWV is marked in yellow (usually not in single-family dwellings)
  - Type M is marked in red
  - Type L is marked in blue
  - Type K is marked in green
- Metallic water pipe replaced nonmetallic material shall have electrical grounding provided. 604.10 exception
- A full-way gate valve shall be on the discharge side of a water meter. 606.2
- PVC female adapters allowed only with plastic male fittings 605.12.3

Service Pressure 608.1 &608.2

- Min. pressure is 15 psi.
- Max. pressure 80 psi
- Pressure regulators are required at more than 80 psi.

Testing

- Shall be tested with either working pressure or a 50 lb. air test. 609.4
- No air test on plastic pipe is allowed. 609.4, 712.1, 723.1, exception: PEX, PP or PE-RT where permitted by manufacture.

Sizing 610

- Min. size of water service is 3/4". Table 610.4
- Water piping shall be sized from Tables 610.3 & 610.4.

Building Supply Protection 609

- Min. cover shall be 1 'below grade. 609.1
- Min. 14 AWG, blue insulated copper tracer wire that is listed for direct burial with plastic building supply. 604.10.1

APPLIANCES, APPURTENANCES, OR FIXTURES[2]	MIN FIXTURE BRANCH PIPE SIZE1,4 (INCHES)	PRIVATE
Bathtub or Combination Bath/Shower (fill)	1/2	4.0
3/4” Bathtub Fill Valve	3/4	10.0
Bidet	1/2	1.0
Clothes Washer	1/2	4.0
Dishwasher, domestic	1/2	1.5
Drinking Fountain or Water Cooler	1/2	0.5
Hose Bibb	1/2	2.5
Hose Bibb, each additional[8]	1/2	1.0
Lavatory	1/2	1.0
Lawn Sprinkler, each head[5]	-	1.0
Sinks	-	-
Bar	1/2	1.0
Kitchen, domestic with or without dishwasher	1/2	1.5
Laundry	1/2	1.5
Service or Mop Basin	1/2	1.5
Shower, per head	1/2	2.0
Water Closet, 1.6 GPF Gravity Tank	1/2	2.5
Water Closet, greater than 1.6 GPF Gravity Tank	1/2	3.0

TABLE 610.3 WATER SUPPLY FIXTURE UNIT (WSFU) & MINIMUM FIXTURE BRANCH PIPE SIZES[3]

Notes:

1. Size of the cold branch pipe, or both the hot and cold branch pipes.
2. Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.
3. The listed fixture unit values represent their load on the cold-water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold-water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.
4. The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.
5. For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.
6. Assembly (Public Use (See Table 422.1))
7. Where sizing flushometer systems, see Section 610.10.
8. Reduced fixture unit loading for additional hose bibs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

Sizing Water Supply and Distribution Systems (CPC T610.4)

Systems within the range of Table 610.4 shall be permitted to be sized from that table or by the method in accordance with Section 610.5. Listed parallel water distribution systems shall be installed in accordance with their listing, but at no time shall a portion of the system exceed the maximum velocities allowed by the code.

Meter and service size (inches)	Building Supply & Branches	Maximum Allowable Length (feet)														
		Pressure Range 30-45 PSI														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
3/4"	1/2"	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
3/4"	3/4"	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
3/4"	1"	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1"	1"	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
3/4"	1-1/4"	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1"	1-1/4"	54	47	42	38	32	28	25	23	21	19	17	12	12	11	11
1-1/2"	1-1/4"	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1"	1-1/2"	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1-1/2"	1-1/2"	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2"	1-1/2"	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1"	2"	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1-1/2"	2"	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2"	2"	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2"	2-1/2"	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133

Meter and service size	Building Supply & Branches	Maximum Allowable Length (feet)														
		Pressure Range 45-60 PSI														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
3/4"	1/2"	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
3/4"	3/4"	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
3/4"	1"	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1"	1"	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
3/4"	1-1/4"	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1"	1-1/4"	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1-1/2"	1-1/4"	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1"	1-1/2"	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1-1/2"	1-1/2"	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2"	1-1/2"	151	151	151	151	150	117	98	84	67	55	42	38	35	35	30
1"	2"	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1-1/2"	2"	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2"	2"	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2"	2-1/2"	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250

Meter and service size	Building Supply & Branches	Maximum Allowable Length (feet)														
		Pressure Range Over 60 PSI														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
3/4"	1/2"	7	7	7	6	5	4	3	3	2	1	1	1	1	1	0
3/4"	3/4"	20	20	20	20	17	13	11	10	8	7	6	6	5	4	4
3/4"	1"	39	39	39	39	35	30	27	24	21	17	14	13	12	12	11
1"	1"	39	39	39	39	38	32	29	26	22	18	14	13	12	12	11
3/4"	1-1/4"	39	39	39	39	39	39	39	39	34	28	26	25	23	22	21
1"	1-1/4"	78	78	78	78	74	62	53	47	39	31	26	25	23	22	21
1-1/2"	1-1/4"	78	78	78	78	78	74	65	54	43	34	26	25	23	22	21
1"	1-1/2"	85	85	85	85	85	85	85	85	81	64	51	48	46	43	40
1-1/2"	1-1/2"	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2"	1-1/2"	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
1"	2"	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1-1/2"	2"	370	370	370	370	360	335	305	282	244	212	187	172	153	141	129
2"	2"	370	370	370	370	370	370	370	340	288	245	204	172	153	141	129
2"	2-1/2"	654	654	654	654	654	650	610	570	510	460	430	404	380	356	329

UNDERGROUND GAS

General requirement

- ❑ Underground gas piping must have a visual inspection before covering. 1203.2
- ❑ Min 12” of cover from top of pipe, min 18” if external forces likely to result (ex. pipe buried under driveway) 1210.1.1
- ❑ Connections and fittings
- Unions are allowed at exposed fixture connections and exposed exterior locations on the discharge side of a shut off valve only. 315.1 & 1212.6
- In other locations, left & right couplings may be used. 1210.3
- No bushings are allowed in concealed locations. 1210.3
- ❑ Gas piping is sized from tables in Chapter 12 of CPC.
- ❑ 1000 BTU per cubic foot to be used to calculate CFH.

Gas Piping Materials & Installation

- ❑ Schedule 40 factory-wrapped or galvanized steel pipe 1208.6.3.1
- Galvanized pipe is not allowed closer than 6” above ground.
- Pipe within 6” of ground or in the ground shall have a manufacture-applied coating.
- Field wrap & primer are restricted to short sections & fittings.
- Coating protection shall extend a min. of 6” above grade.
- Shall have a min. or 12” cover, where external damage to pipe from external forces is likely, the cover shall be not less than 18” 1210.1.1
- Shall be tested with a min. of 10 lbs. of air pressure for 15 minutes for pipe pressure at 14” water column or less. 1213.3
- Use max. 15 lbs. gauges for pressure tests of 10 lbs. or less shall be calibrated with increments of 1/10 lb. or less. 318.5

- ❑ Polyethylene Gas Piping 1208.6.5
- Shall be marked “gas” and “ASTM D2513”
- Shall have a min. 18” IS12-2006
- Shall be laid in a firm bed for its entire length 1210.1.2

- Shall have a min. 14 gauge electrically continuous corrosion-resistant tracer wire attached to the entire length & extend above grade on one end. 1210.1.7.2

❑ Gas Pipe Sizing

See Underfloor inspection section

UNDERFLOOR DRAINAGE INSPECTION

Drainage Systems Material & Testing

- ❑ Approved materials (Table 701.2)
  - DWV copper, ABS, PVC, Cast Iron or Galvanized steel (Galvanized steel must be kept a min. 6" above ground, and is not allowed for burial as DWV.)
- ❑ Testing system
  - Water test with a min. 10 'head. 712.2
  - Air test with a min. 5 psi for 15 minutes for metallic pipe only. 712.1 & 712.3
- ❑ Change of direction (Fittings) 706
  - Horizontal to horizontal = long sweep or equivalent
  - Vertical to horizontal = long sweep or equivalent
  - Horizontal to vertical = long sweep, sanitary tee or equivalent
  - Inlets at the same level shall be constructed so that the discharge from one cannot readily enter the other.
- ❑ Horizontal Grade of Pipe
  - Min. 2% or 1/4" per foot 708.1
- ❑ Verify backwater valve requirements 710.1
  - Only required where plumbing fixtures installed on floor level that is less than one foot above the next upstream manhole cover. SJC P002

Protection of Piping 312

- All pipes passing through concrete shall be protected from breakage and corrosion. 312.1
- Trenches deeper than the footing shall be at a 45° angle there from. 314.1 (angle of repose)
- No direct embedment in concrete. 312.2
- Exposed ABS and PVC pipes only allowed above roof jack, to be protected with water based synthetic latex paints. IAPMO IS 5-2006 and IS9-2006
- Firestop all fire rated wall, floor penetrations. CBC 312.7

Testing 723

- No air test on plastic pipes 712.1 & 723.1

- Filled with water from its lowest point to its highest.
- The building sewer shall be watertight.

Hangers and Supports 313

- Pipe shall be laid on a firm bed for its entire length. 313.5
- Upward movement shall be restricted. (Installation standards) Cast iron shall be supported within 18" of all bands.

Horizontal Piping Support

Support must be adequate to prevent sagging & maintain alignment. 313.4

- Plastic horizontal piping Table 313.3 · Max. 4 'o.c.
  - 18-gauge band iron or approved plastic hangers to restrict upward movement.
  - Shall be supported at ends of branches, at each change of direction & elevation.
- Cast Iron horizontal piping Table 313.3 · When over 4 'pipe length, support every joint.
  - Supports shall be within 18" of joints, not on couplings Table 313.3 Note 1
- Copper tubing Table 313.3
  - Shall be supported at 6 'intervals for 1 1/2" & smaller
  - Shall be supported at 10 'intervals for 2" & larger.

Note: Plumber's tape is not approved for sole support at any horizontal plumbing pipe. Plumber's tape may be used to strap cast iron down to blocking, or to keep vertical risers in stud bays in alignment only.

Cleanout Requirements 707

- Required Locations (707.4)
  - At all upper terminals, (a 2-way cleanout at the connection of the building drain to the building sewer may be substituted for the upper terminal cleanout.) if drain is 135°change of direction or less
  - Each aggregate change of direction exceeding 135°.
  - Pipe runs exceeding 100'.
  - All branch lines exceeding 5 'in length.

- Sinks & urinals regardless of branch length.

❑ Access & Working Clearance in Front of Cleanouts 707.9
- Min. 18”x18” in front of cleanouts for pipes 2” & smaller.
- Min. 24”x24” in front of cleanouts for pipes larger than 2”.
- Max. 5 ’from crawl hole access.

Sizing DWV Systems 703

❑ All DWV piping shall be sized from Tables 702.1 & 703.2.

❑ Min. size of cleanouts as per Table 707.1

❑ Min. size of a vent for a water closet is 2” per note #3 of T703.2

TABLE 707.1 CLEANOUTS		
SIZE OF PIPE (inches)	SIZE OF CLEANOUT (inches)	THREADS (per inches)
1 1/2	1 1/2	11 1/2
2	1 1/2	11 1/2
2 1/2	2 1/2	8
3	2 1/2	8
4 & larger	3 1/2	8

TABLE 703.2

SIZE OF PIPE (inches)	1-1/4	1-1/2	2	3	4
Maximum Units-Drainage Piping[1]					
Vertical	1	2[2]	16[3]	48[4]	256
Horizontal	1	1	8[3]	35[4]	216[5]
Maximum Length-Drainage Piping					
Vertical, (feet)					
Horizontal (unlimited)	45	65	85	212	300

Vent Piping-Horizontal and Vertical[6]					
Maximum Units	1	8[3]	24	84	256
Maximum Lengths, (feet)	45	60	120	212	300

MAXIUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

Notes:

[1] Excluding trap arm.

[2] Except sinks, urinals, and dishwashers - exceeding 1 fixture unit.

[3] Except six-unit traps or water closets.

[4] Not to exceed 5 water closets or 5 six-unit traps

[5] Based on $^1/_4$ inch per foot (20.8 mm/m) slope. For $^1/_8$ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.

[6] The diameter of an individual vent shall be not less than $1^1/_4$ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(2). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply

TABLE 702.1 DRAINAGE FIXTURE UNIT VALUES (DFU)		
PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	**MIN SIZE TRAP & TRAP ARM[7] (INCHES)**	**PRIVATE**
Bathtub or Combination Bath/Shower	1 1/2	2.0
Bidet	1 1/4	1.0
Bidet	1 1/2	2.0
Clothes Washer, domestic, standpipe[5]	2	3.0
Dishwasher, domestic, with independent drain[2]	1 1/2	2.0
Floor Drain (for additional sizes, see Section 702.0)	2	2.0
Shower, single-head trap [8]	2	2.0
Multi-head, each additional	2	1.0
Lavatory, single	1 1/4	1.0
Lavatory, in sets of two or three	1 1/2	2.0
Sinks	-	-
Bar	1 1/2	1.0
Kitchen, domestic[2] (with or without food waste grinder, dishwasher, or both)	1 1/2	2.0
Laundry[2] (with or without discharge from a clothes washer)	1 1/2	2.0
Water Closet, 1.6 GPF Gravity Tank [6]	3	3.0
Water Closet, 1.6 GPF Flushometer Tank[6]	3	3.0
Water Closet, 1.6 GPF Flushometer Valve[6]	3	4.0

Notes:

1. Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with T702.2(b).
2. Provide a 2" minimum drain.
3. For refrigerators, coffee urns, water stations, and similar low demands.
4. For commercial sinks, dishwashers, and similar moderate or heavy demands.
5. Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
6. Water closets shall be computed as 6 fixture units where determining septic tank sizes based on Appendix H of this code.
7. Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
8. For a bathtub to shower retrofit, a 1 ½- trap and trap arm shall be permitted with a maximum shower size of 36 inches in width and 60 inches in length.

Trap Arms

- Change in direction allowed without cleanout 1002.3 · Max. 90° on pipe 2 1/2" & smaller.
  - · Max. 135° on pipe 3" & larger.
- Size of trap arms Table 1002.2

Table 1002.2: LENGTHS OF TRAP ARMS (EXCEPT FOR WATER CLOSETS & SIM. FIXTURES)[1,2]

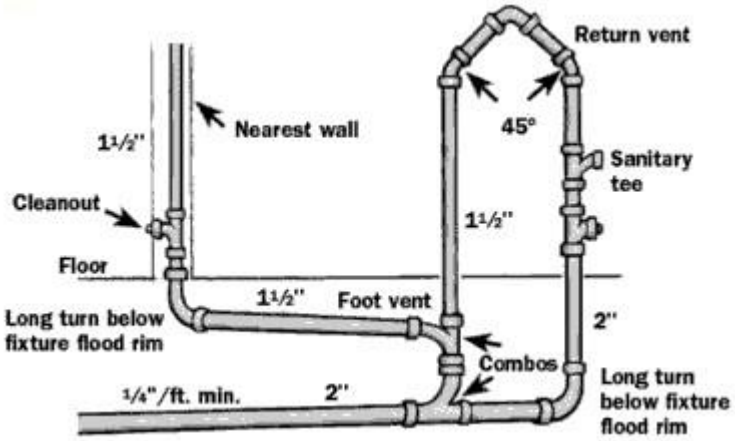
TRAP ARM PIPE DIAMETER (inches)	DISTANCE TRAP TO VENT MINIMUM (inches)	LENGTH MAXIMUM (inches)
1 1/4	2 1/2	30
1 1/2	3	42
2	4	60

3	6	72
4	8	120

Notes:

1. Maintain 1/4” per foot slope.
2. The developed length between the trap of a water closet or similar fixture (measured from the top of the closet flange to the inner edge of the vent) and its vent shall not exceed 6’.

Island Sinks 909 — Limited to sinks truly installed in an island.



Underfloor Water Piping 604

- Materials Table 604.1
- PVC is not allowed to be used in water distribution piping and fittings.
- Only water piping supplying island sinks are allowed under a slab and short sections per 609.3(2) & CSJ.
- Support of horizontal water piping Table 313.3
  - Copper tubing
    - Every 6 ’for pipe 1 1/2” & smaller.
    - Every 10 ’for pipe 2” & larger.
  - PEX

- Every 32” for pipe 1” & smaller.
- Every 4 ’for pipe 1 1/4” & larger.

- Steel & Brass
  - Every 10 ’for pipe 3/4” & smaller.
  - Every 12 ’for pipe 1” & larger.

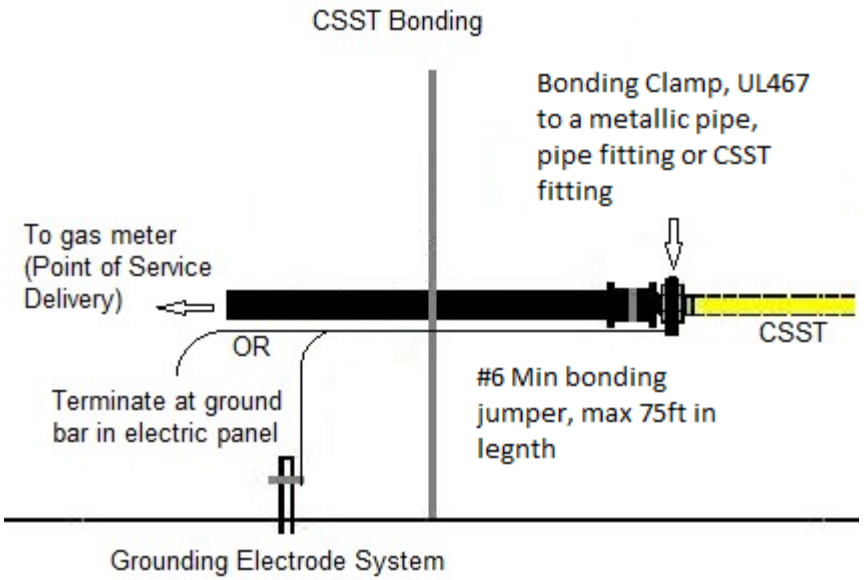
- All water pipe shall be reamed to the full bore of the pipe or tube.
- Sizing water pipe use Tables 610.3 & 610.4
- Pipe Insulation. See Energy Code section

Gas Piping

- Materials 1208.6
  - No copper & brass & Aluminum alloy pipe/tube to be used with gases corrosive to such material or hydrogen sulfide content exceeds .7mg/100L 1208.5.2.2 ·
    CSST with plan check approval only. SJC P001
  - Schedule 40 Black steel if protected from weather.
- Schedule 40 Galvanized steel or painted black steel if exposed to weather.

- Bonding and Grounding (1211.0)

Gas piping, and arc-resistant jacketed CSST, shall be considered bonded with appliance connection. Non arc-resistant CSST shall be bonded as shown below.



- Gas pipe sizing (2 methods)

Method 1: Longest Length Method (1215.1.1)

The pipe size of each section of gas piping shall be determined using the longest length of piping from the point of delivery to the most remote outlet and the load of the section

Method 2: Branch Length Method (1215.1.2)

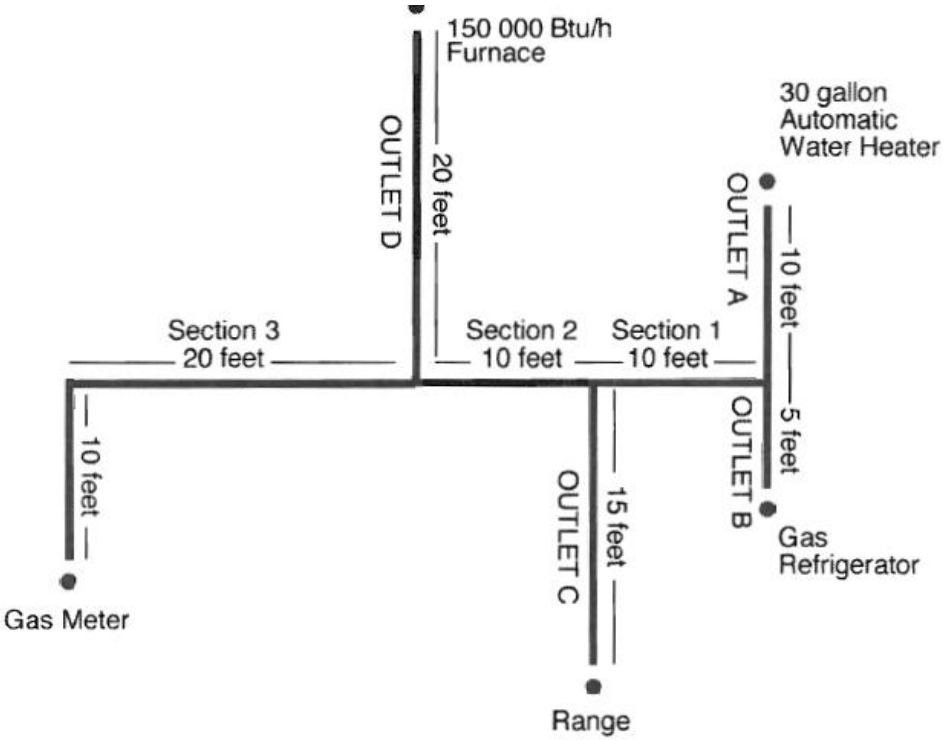
Pipe shall be sized as follows:

1. The pipe size of each section of the longest pipe run from the point of delivery to the most remote outlet shall be determined using the longest run of piping and the load of the section.
2. The pipe size of each section of branch piping not previously sized shall be determined using the length of piping from the point of delivery to the most remote outlet in each branch and the load of the section. [NFPA 54:6.1.2]

EXAMPLE (Method 1): Determine the required pipe size of each section and outlet of the piping system shown in Figure 1215.1.1. Gas to be used has a specific gravity of 0.60 and 1000 British thermal units (Btu)

per cubic foot (0.0114 kW•h/L), delivered at 8-inch water column (1.9 kPa) pressure.

For SI units: 1 foot = 304.8 mm, 1 gallon = 3.785 L, **1000** British thermal units per hour = 0.293 kW (Example in Code Book uses 1100 Btu per hour, local gas supplied rated at 1000 Btu per cfh), 1 cubic foot per hour = 0.0283 m^3/h



Solution:

Maximum gas demand of

Outlet A: 35 cubic feet per hour (0.91 m^3/h)

Outlet B: 3 cf/h (0.08 m^3/h)

Outlet C: 65 cubic feet per hour (1.67 m^3/h)

Outlet D: 150 cf/h (3.85 m^3/h) [150k Btu/hr (44 kW) divided by

1000 Btu per cf (0.0114 kW•h/L)].

The length of pipe from the gas meter to the most remote outlet (Outlet A) is 60 ft. Using column row marked 60 ft in Table 1215.2(1):

Outlet A, supplying 35 cf/h, requires $^{1}/_{2}$- inch pipe.

Outlets A and B, or 38 cf/h, requires $^{1}/_{2}$-inch pipe.

Section 2, supplying Outlets A, B, and C, or 103 cf/h requires $^{3}/_{4}$inch pipe.

Section 3, supplying Outlets A, B, C, and D, or 253 cf/h, requires 1-inch pipe.

Using the column marked 60 ft in Table 1215.2(1) [no column for actual length of 55 ft]:

Outlet B supplying 3 cf/h, requires $^{1}/_{2}$-inch pipe.

Outlet C, supplying 65 cf/h, requires $^{1}/_{2}$-inch pipe.

Outlet D, supplying 150 cf/h, requires $^{3}/_{4}$-inch pipe.

TABLE 1208.4.1 (NFPA 54: TABLE 5.4.2.1) APPROXIMATE GAS INPUT FOR TYPICAL APPLIANCES		
APPLIANCE		INPUT (Btu/h)
Space Heating Units		
Warm air furnace, Single family		100,000
Hydronic boiler, Single family		100,000
Space and Water Heating Units		
Hydronic boiler, Single family		120,000
Water Heating Appliances		
Water heater, automatic storage	30 to 40-gallon tank	35,000
	50-gallon tank	50,000
Water heater, automatic instantaneous	Capacity at 2 gallons per minute	142,800
	Capacity at 4 gallons per minute	285,000
	Capacity at 6 gallons per minute	428,400
Cooking Appliances		
Range, freestanding, domestic		65,000
Built-in oven or broiler unit, domestic		25,000
Built-in top unit, domestic		40,000
Other Appliances		
Clothes dryer, Type 1 (domestic)		35,000
Gas fireplace direct vent		40,000
Gas log		80,000

Barbecue	40,000
Gaslight	2500

TABLE 1215.2(1)
SCHEDULE 40 METALLIC PIPE (NFPA 54: TABLE 6.2(B))[1, 2]

NATURAL GAS WITH INLET PRESSURE: LESS THAN 2psi
PRESSURE DROP: 0.5 in. w.c., SPECIFIC GRAVITY: 0.60

PIPE SIZE (inch)							
NOMINAL:	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2
LENGTH(ft)	CAPACITY IN CUBIC FEET OF GAS/HOUR						
10	172	360	678	1390	2090	4020	6400
20	118	247	466	957	1430	2760	4400
30	95	199	374	768	1150	2220	3530
40	81	170	320	657	985	1900	3020
50	72	151	284	583	873	1680	2680
60	65	137	257	528	791	1520	2430
70	60	126	237	486	728	1400	2230
80	56	117	220	452	677	1300	2080
90	52	110	207	424	635	1220	1950
100	50	104	195	400	600	1160	1840
125	44	92	173	355	532	1020	1630
150	40	83	157	322	482	928	1480
175	37	77	144	296	443	854	1360
200	34	71	134	275	412	794	1270
250	30	63	119	244	366	704	1120

Notes:

1. Table entries are rounded to 3 significant digits.
2. NA means a flow of less than 10 ft^3/h.

For pipe size 3” and longer than 250’, refer to the CPC Table 1215.2(1).

TABLE 1216.2(20) POLYETHYLENE PLASTIC PIPE			Gas: natural, Inlet pressure: less than 2psi Pressure drop: 0.5 in. w.c., Specific gravity: 0.60				
PIPE SIZE	1/2	3/4	1	1 1/4	1 1/2	2	3
DESIGNATION:	SDR 9.3	SDR 11	SDR 11	SDR 10	SDR 11	SDR 11	SDR 11
ACTUAL ID:	0.660	0.860	1.077	1.328	1.554	1.943	2.864
LENGTH (ft)	CAPACITY IN CUBIC FEET OF GAS PER HOUR						
10	201	403	726	1260	1900	3410	9450
20	138	277	499	865	1310	2350	6490
30	111	222	401	695	1050	1880	5210
40	95	190	343	594	898	1610	4460
50	84	169	304	527	796	1430	3950
60	76	153	276	477	721	1300	3580
70	70	140	254	439	663	1190	3300
80	65	131	236	409	617	1110	3070
90	61	123	221	383	579	1040	2880
100	58	116	209	362	547	983	2720
125	51	103	185	321	485	871	2410
150	46	93	168	291	439	789	2180
175	43	86	154	268	404	726	2010

200	40	80	144	249	376	675	1870
250	35	71	127	221	333	598	1660
300	32	64	115	200	302	542	1500
350	29	59	106	184	278	499	1380
400	27	55	99	171	258	464	1280
450	26	51	93	160	242	435	1200
500	24	48	88	152	229	411	1140

Notes:

1. Table entries are rounded to 3 significant digits.
2. Table includes losses for four 90-degree bends and two end fittings. Tubing runs with larger numbers of bends, fittings, or both shall be increased by an equivalent length of tubing to the following equation: $L=1.3n$, where L is the additional length (ft) of tubing and n is the number of additional fittings, bends, or both.

ROUGH PLUMBING INSPECTION

Same rules as underfloor for:

- Materials, Grade of pipe, Trap arms, Change of direction, Support of pipe, & Wet vents

Protection of Piping

- Nail plates required when plastic or copper is less the 1" from face of plate or stud, and min. 1 1/2" beyond the pipe or tubing. 312.9

- ABS & PVC piping shall not be exposed to direct sunlight with the exception of plumbing vents through roof protected by water base synthetic latex paints. (Installation Standard UPC IS 5-2006 & IS Section 2.2.3)

Closet Flanges

- Shall be 15" from center to finish sidewall. 402.5
  (Shall require 30" W by 24" D in front of bowl at final)
- Flanges shall be secured with brass or stainless-steel screws, bolts or other listed equally non corrosive materials. 402.6.2

Tub Waste Openings (CPC 312.12.3)

- Tub waste openings in framed construction to crawl spaces at or below the first floor shall not have opening exceeding ½" in the least dimension.

Hangers and Supports – CPC**,** *Table 313.3*

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10-foot lengths are installed1, 2, 3	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint1, 2, 3	Base and each floor, not to exceed 15 feet
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint1, 2, 3, 4	Base and each floor, not to exceed 15 feet
Copper & Copper Alloys	Soldered, Brazed, Threaded, or Mechanical	$1^{1/2}$ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet5
Steel Pipe for Water, DWV	Threaded or Welded	3/4 inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor,not to exceed 25 feet5
Steel Pipe for Gas	Threaded or Welded	1/2 inch, 6 feet; 3/4 inch and 1 inch, 8 feet; 11/4 inches and larger, 10 feet	1/2 inch, 6 feet; 3/4 inch and 1 inch, 8 feet; $1^{1/4}$ inches every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet; allow for expansion every 30 feet3	Base and each floor; provide mid-story guides; provide for expansion every 30’
CPVC	Solvent Cemented	1 inch and smaller, 3 feet;11/4 inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX	Cold expansion, Insert and Compression	1 inch and smaller, 32 inches; $1^{1/4}$ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression		Base and each floor; provide mid-story guides

Vents

- Every fixture trap shall be vented. 901.2
  - Shall be level or graded to drain back to the drain served. 905.1
  - Shall be 6” above the flood rim of the fixture before offsetting horizontally. 905.3
  - Shall extend above a roof a min. of 6” & 1’ from vertical surfaces. 906.1
  - Shall be 10 ’away from or 3 ’above any openable openings including skylights, air intake, or vent shaft. 906.2
  - Shall terminate min. 3 ’from property line. 906.2
- Sizing
  - The aggregate cross-sectional area shall not be less than that of the largest required building sewer per Table 703.2. 904.1
- Vertical Wet Venting 908.1
  - Limited to vertical drainage receiving the discharge from the trap arm of 1 & 2 fixture unit fixtures. (Note: Clothes washer is 3 fixture unit fixture, laundry sink is 2)
  - Max. 4 fixtures
  - Fixtures within the same story ·
  - Max. 6 ’in developed length.
  - Min. 1 pipe size larger than the required minimum waste pipe size of the upper fixture or 1 pipe size larger than the sum of the fixture units served, whichever is larger.
  - Min. 2” pipe size for the wet vented section.

Water, Waste & Gas Piping (same rules as underfloor) Gas pressure test inspection only after sheetrock is installed.

Shower Receptors (CPC 408)

- ❑ Shower pans shall be inspected at the time of rough inspection.
- ❑ Shower Compartment Dimensions 408.6
  - Min. 1024 in^2 of finished interior
  - Capable of compassing a 30” circle
  - Min. 70” above the shower drain outlet with no protrusions other than the fixture valve or valves, shower head, soap dishes, shelves, and safety grab bars or rails.
- ❑ Dam, Curb, or Threshold 408.5
  - Min. 1” lower than the sides and back of the receptor.
  - Min. 2” & max. 9” in depth, measured from the top of the dam or threshold to the top of the drain.
  - Threshold shall be wide enough to accommodate a min. 22” clear finished opening
  - Min. 1/4” per foot or max. 1/2” per foot for the slope of the shower floor.
  - Without a threshold, the floor space within the same room shall be considered a wet location. Waterproofing shall extend min 4’ past the shower area for wood-frame floor construction– CSJ.
- ❑ Shower Pan 408.6
  - Hot Mopped—3 layers of grade 15 pound felt 408.7 · UPC listed 40-mil liners may be used.
  - Lining materials shall extend upward with min. 3” above horizontal surfaces and on top of the finished dam or threshold.
  - Must be tested with water filled up to the top of the rough threshold.
- ❑ Shower pan test 408.7.5
  - Min. 2” drain 408.4
  - Drain plugged below weep holes.
  - Pull the plug and check complete drainage with the subfloor slope to drain.
  - Verify weep holes are functional.
  - Check for leaks.

Tubs

- Fill tubs with water to the bottom of the overflow.

- Tub & shower valves must be listed for anti-scald and thermal shock protection.
- Valve & shower riser must be secured to the structure.
- When slip joints are used on a trap or waste & overflow a min. 12" x 12" access panel is required. 402.11 · Tub spout shall be min. 1" above the flood rim.

Pressure Balancing or Thermostatic Mixing Tub/Shower Valves

- Verify listing valves ASSE 1016/ASME a112.1016/CSA B125.16 or ASME A112.18.1/CSA B125.1
- Verify pressure balance/thermostatic mixing valve type.
- Shower and tub/shower combinations shall be provided with pressure balancing or thermostatic mixing valves. 408.3
- Valve and shower head shall be arranged to allow the bather to use the valves prior to stepping into the spray. 408.9
- Tub filler valves: hot water temp. limited to 120 degrees by device conforming to ASSE1070 or CSA B125.3 (409.4)

Or: A water heater conforming to ASSE 1084 will satisfy the temperature limiting requirement.

Cleanouts 707

- ❑ No cleanouts are required above the first floor except those serving the building drain & its branches. 707.4 Exception 3.

PLUMBING FINAL INSPECTION

Gas

- ❑ Verify rough inspection approval.
- ❑ Pressure test
  - Air test—10 lb. for 15 minutes.
  - Must use appropriate gauge—max. 15 lb. and 1/10 lb increments
- ❑ Shut off valves
  - Shall be listed for use with gas.
  - Shall be within 6 ’of gas appliances. 1212.5
- ❑ Appliance connectors 1211.3
  - Shall not be concealed and shall not be extended from one room to another or passed through wall partitions, ceilings, or floors.
  - Shall be sized per manufacturing listing.
  - Max. 6 ’in length

Vents

- ❑ Must be painted & terminate into an approved flashing.

Cleanouts

- ❑ Cleanout within 5 ’of property line must be brought to grade in an approved box.

Back Water Valves

- ❑ Shall be installed in an accessible Cristy box. 710.6

Pressure Reducing valves (PRV)

- ❑ Shall be installed if pressure is greater than 80 psi. 608.2
- ❑ A listed expansion tank is required when PRV is installed. 608.2
- ❑ A “closed” water system (presence of check valve, backflow preventer) requires Expansion tanks. 608.3
- ❑ Required on all hose bibs (603.5.7) & on landscape piping (603.5.6), and Plumbing fixtures (603.5.19). Plumbing fixture fittings with integral backflow protection shall comply with ASME A112.18.1/CSA B125.1

Fixtures

- ❑ All fixtures shall be installed and complete.
- ❑ All fixtures shall be trapped. 1001.2

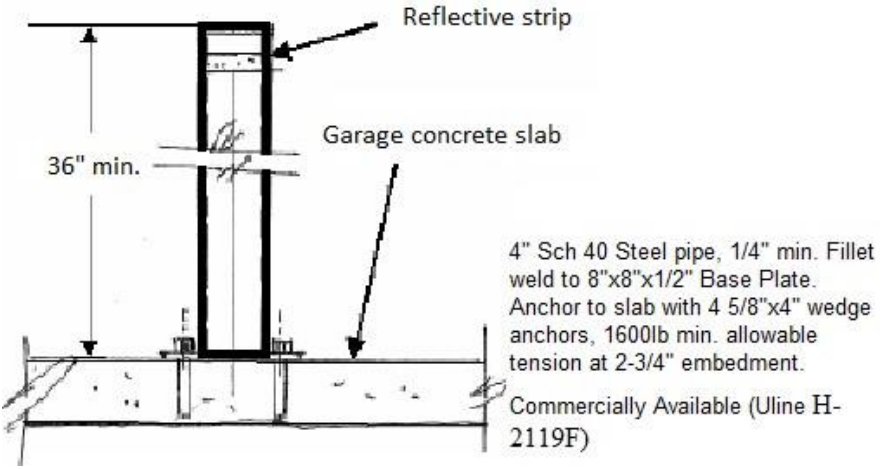
- Water supplies must be UPC or IAPMO listed.
- Water Closets
  - Shall be secured to floor with corrosion resistant fasteners. 402.6.2
  - Requires 15” from center of fixture to finished wall clearance. 402.5
  - Requires 24” clearance in front. CPC 402.5 & CBC11B-604.5.1

- Air gaps—Min. 1” from filler to flood rim of fixture. Table 603.3.1
- Dishwasher—Shall drain through an approved airgap fitting. 807.3

Water Heater

Number of Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
Number of Bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating, gallons	38	49	49	49	62	62	74	62	74	74	74

- Storage water heater sizing (Table 501.1(2)) of California Plumbing Code)
- Garage Installation 507.13
  - Shall be elevated or have an adequate barrier to guard against damage. (507.13, SJ Bulletin #293) Min. 18” elevation from flame source to floor unless listed as flammable vapor ignition resistant. 507.13
  - Earthquake straps are required as per 507.2. Strap at the vertical upper and lower third, at least 4” above control, of water heater, a 75-gallon unit requires 3 straps, and a 100-gallon unit requires 4 straps



Tape Method - Use 24-gauge (minimum) plumber's tape to encircle the water heater and use lag screws to bolt it to a 2x4-inch ledger that is bolted to the wall framing. The 2x4-inch ledger is required at each strap location.

Conduit Method - Use round thin wall conduit along with 24gauge (minimum) plumber's tape, bolts, and lag screws. (SJ Bulletin #293)

- ❑ Water Heater Closet Locations 504.1

- Closet located in the bedroom or bathroom with a listed, gasket door assembly and a listed self-closing device, exception: direct vent water heater
- Seal bottom of closet door with threshold or gasket.
- Provide outdoor combustion air (506.4)

  Two Openings method (506.4.1): Directly vent to outdoor or through vertical duct EACH opening will be based on 1 square inch min. per 4000 Btu/h. 2000Btu/h where venting through horizontal ducts, Openings shall commence within 12" from top and bottom of the enclosure.

  One Opening Method (506.4.2) Commencing within 12" of the top of enclosure, min 1 square inch per 3000 Btu/h and not less

than the sum of the areas of connectors in the space. AND appliance shall have min clearance of 1" from sides and back, and 6" from front.

Wood louvers shall be assumed yielding 25% free area, 75% for metal louvers for required venting calculation.

- The closet shall be for the exclusive use of the water heater and/or FAU (not storage space). Otherwise, direct vent type and non–fuel burning types may be installed in closet locations without the requirements above.

Installations in Attics 508.4

Provide a corrosion resistant watertight pan (in attic, attic-ceiling assembly, floor-subfloor assembly), min 1-1/2" depth, beneath the water heater with min. 3/4" dia. drain to exterior.

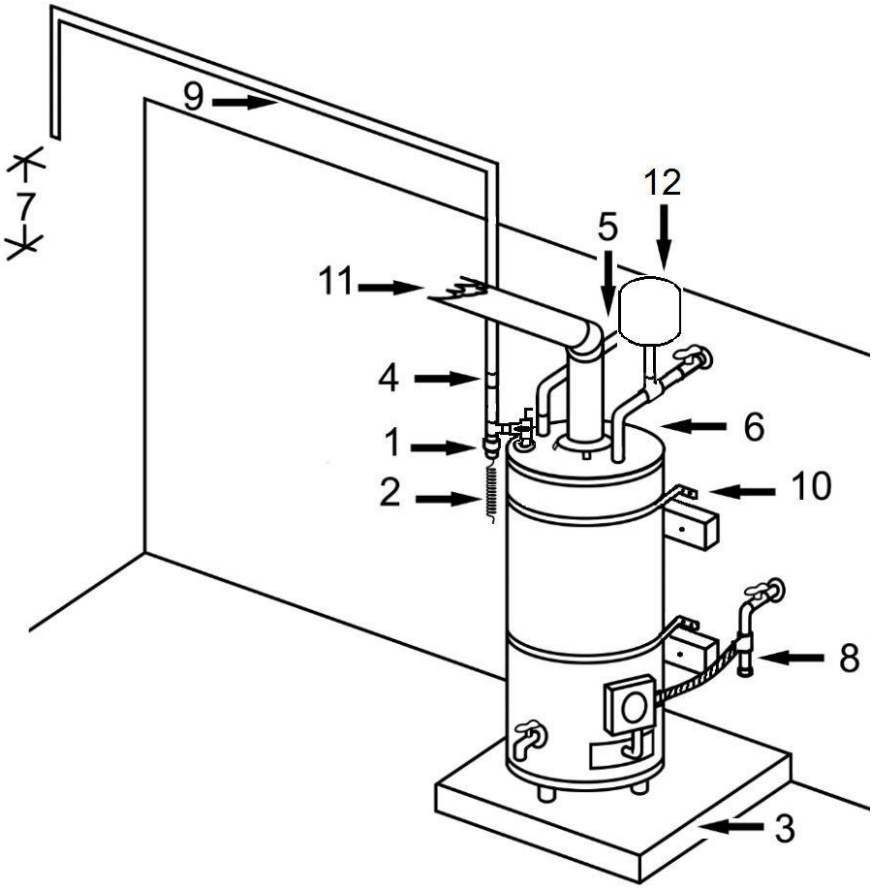
Provide access, clearances to combustibles, switched lighting, and adjacent receptacle, Access to the attic may not be from a bedroom or bathroom; however, access from a walk-in closet is permissible.

Clearances & Access 504.3

Subject to manufacturer's installation instruction. 504.3.1

Access door shall be min. 22" x 30". 508.4

- Installation in Basement



1) 3/4” Tee with 1/8” Reducer
2) 1/8” Tubing, “drip coil” with slightly crimped end
3) 3” min. slab or base
4) 3/4” Union within 12”
5) Hot water line (insulated first 5’)
6) Cold water line with shut-off valve (insulated first 5’)
7) Terminate not less than 6” and not more than 24” at exterior
8) Gas supply line with sediment trap, downstream of shutoff valve

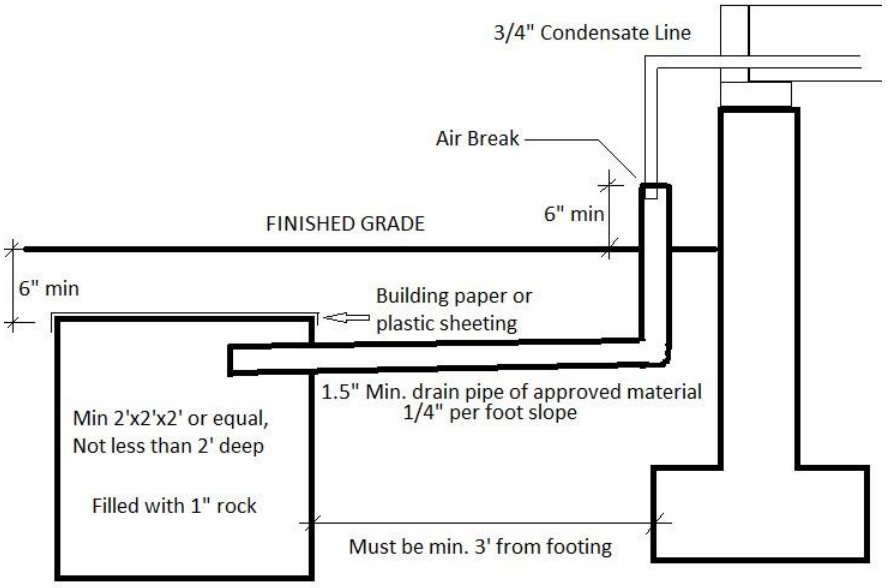
9) 3/4” CPVC or Copper tubing, 1/4 per foot slope toward termination
10) Seismic straps, listed for size or use 24g straps (50gal: 2 straps, 75gal: 3 straps, 100gal: 4 straps)
11) Vent connector: Single appliance vent with Max. horizontal length 75% of vertical for single wall, 100% for b-vent
12) Expansion tank if required per CPC 608.3

❑ Tankless Water Heater

- Can also be Installed on exterior side/back wall: allowed *if* listed for exterior use, and if not restricted by any planned development requirements
- Per Manufacture Installation Instructions
- Vents: positive pressure (forced) vents.
- Installation of these vents must comply with the vent manufacturer’s instructions. Most vents are stainless steel due to the slightly acidic content of the condensate. Type B venting material is not acceptable for positive pressure vents.

□ Condensate:

Discharge to trapped and vented receptors, dry-wells, leach pits or a tailpiece of plumbing fixtures. Drywell specifications are as follows:



RESIDENTIAL CONDENSATE LINE & DRYWELL

Temperature & Pressure Relief Valve 504.6

Shall be provided with a temperature & pressure relief valve.

T & P valve drain line shall be within 6" to 24" from the floor. 608.5

T& P drain line shall extend full size to the outside of the building. 608.5 (If T & P originates in garage, then it may terminate in the garage per City Policy.) It is not allowed to terminate in a building's crawl space.

Water Hammer 609.10

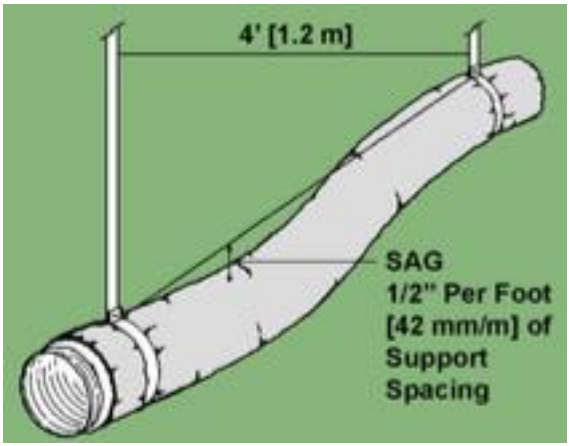
- Water pressure shock arrestors shall be installed as close as possible to quick-acting valves at the end of long pipe or near batteries of fixtures or both.
- Mechanical device s shall be installed according to the manufacturer and shall be listed.
- Re-pipes require water hammer arrestors per City policy

Part III
MECHANICAL REQUIREMENTS
Adopted Codes
2022 California Mechanical Code

GENERAL INFORMATION
HVAC DUCT MATERIALS AND INSTALLATION

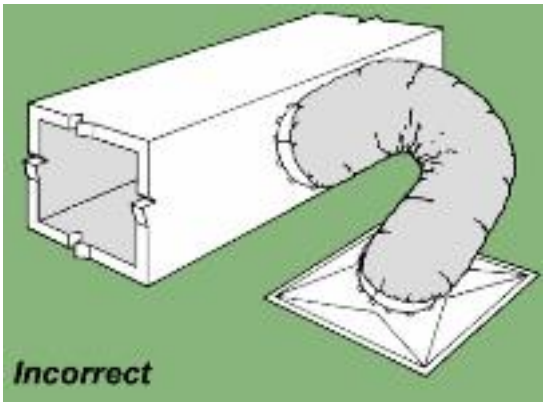
- Joints & Seams of Ducts 603.10
  - Min. 1-1/2” contact lap for round ducts
  - Min. 3 screws equally spaced around the joint except dryer ducts 504.4
  - Shall be airtight
- Installation of Ducts 603
  - At underfloor or crawl space
    - Duct shall not block or reduce underfloor access
    - Min. 18” vertical clearance between underside of ducts and grade at the passage to equipment
    - Min. 4” clearance to earth
    - Secure heat boots on all sides
    - Install ducts above the flood elevation
- Support 603.7
  - Refer to manufacturer’s installation instructions
  - SMACNA
    - Metal round duct: Min. 1” wide 22g strap at 12’-0” o.c
    - Metal rectangular ducts: Min. 1” wide 22g strap at 10’-0” o.c
    - Flexible aluminium air ducts : Min. 1” wide 22g strap at 4-0” o.c
- Factory-Made Air Ducts and Connector 603.4
  - Shall be listed and labeled UL181
  - Vertical risers up to 2 stories with straps at max. 6’-0” o.c. CMC Standard

- Joint secured per manufacturer's specifications and fitting for non-metallic duct shall be beaded, min. 2" collar length, and metal worm-gear clamps shall be used. (CMC 603.4(8))
- Supports per manufacturer's field fabrication and installation instructions or SMACNA
- 26 ga, 1-1/2" galvanized straps at max. 4 'o.c. horizontally & max. 6 'o.c. vertically



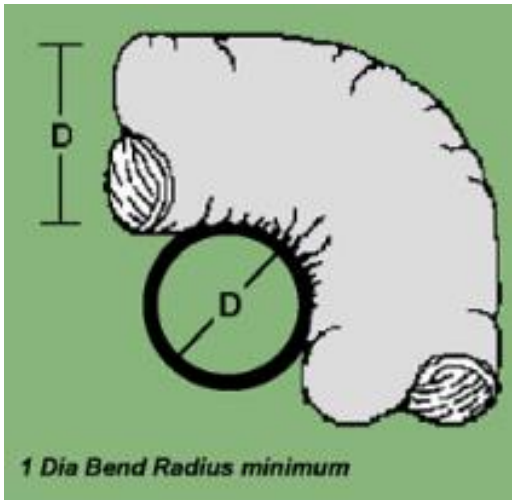
From Flexible Duct Performance and Installation Standard, 5th Ed.

- Max. 1/2" sag per ft
- Use minimum length of ducts, do not install duct in compressed state



- Avoid exposure to sunlight & sharp bends

From Flexible Duct Performance and Installation Standard, 5th Ed.



- Provide additional supports at bends up to 1 diameter
- Seal damaged vapor barriers with UL 181 listed tape

From Flexible Duct Performance and Installation Standard, 5th Ed.

UNDERGROUND/UNDERSLAB

MECHANICAL INSPECTION

Gas Piping

- ❑ See Plumbing Section

HVAC metal ducts in or underslab

- ❑ Require 2” concrete encagement 603.12
- ❑ Insulation
  - Protect against moisture
  - Package A: Min. R-6 (Energy Code Table 151.1-A)
  - Other unconditioned areas: Min. R-8
- ❑ Down-draft domestic range ducts exception 504.3
  - Schedule 40 PVC is allowed to be installed under a concrete slab

UNDERFLOOR INSPECTION

Clothes Dryers Ducts 504.4

- Refer to manufacturer's installation instructions
- Booster fans in dryer vent is not permitted
- No screws or rivets at joints, joints assembled in direction of air flow.
- Equipped with back-draft damper
- No screen at duct termination
- Shall not connect to a gas vent connector, gas vent, or chimney
- Min. 4" diameter duct
- Smooth interior metal ducts except max. 6 'of exposed flexible duct
- Min. 100 in^2 opening for makeup air when dryer is located in a closet. 504.3.1
- Min. 3 'from termination to property line and openings into the building. 502.2.1
- Min 5 'from AC condenser (Energy code)
- Max. length of 14 'including 2-90° elbows and deduct 2 'for every added elbow. 504.4.2.1 or max. 35 'and each elbow used deduct 5'

per CSJ Directive M-001

When conditions prohibit compliance with CMC 504.4.2.1, use the dryer's manufacture's installation Instructions and the following

a. The make and the model of the clothes dryer and the corresponding manufacture's installation instructions shall be provided to the Building Division for prior approval
b. Regardless of the manufacture's installation instructions, the max. allowable equivalent length of the vent shall not exceed 35'
c. The length of the vent shall be measured from the transition duct connected to the dryer up to the outlet terminal.
d. The equivalent length of the vent shall be the total combined vertical and horizontal fittings shall be determined using the table below

DRYER EXHAUST DUCT FITTING EQUIVALENT LENGTH
(SJC Bulletin #258)

Fitting Type	Dryer Exhaust Duct Equi. length
4"radius mitered 45 degree elbow	30”
4"radius mitered 90 degree elbow	60”
6"radius smooth 45 degree elbow	12”
6"radius smooth 90 degree elbow	21”
8"radius smooth 45 degree elbow	12”
8"radius smooth 90 degree elbow	19”
10"radius smooth 45 degree elbow	9"
10"radius smooth 90 degree elbow	18”

e. A durable placard, min 3”x5” shall be affixed on a wall visible from and close to the dryer location. The Placard shall provide the actual length of the installed dryer exhaust vent. The following is an example of such placard.

WARNING

CHECK THE MANUFACTURE'S INSTALLATION INSTRUCTIONS FOR ANY DOMESTIC DRYER THAT WILL BE INSTALLED AT THIS LOCATION. THE INSTALLATION INSTRUCTION SHOULD ALLOW THE DRYER TO BE CONNECTED TO AN EXHAUST DUCT (VENT) THAT IS A MAXIMUM ____ FEET LONG.

DO NOT REMOVE THIS PLACARD

Condensate Wastes 310.1-310.7, 802.9

- Required at air conditioning coils and category II & IV equipment (high efficiency appliances)

- Min. 1/8” per foot slope to drain 312.1 except pump discharge is allowed where gravity drainage is impractical to where the required slope can be resumed
- Min. 3/4” pipe up to 20 tons of refrigeration Table 312.3
- Max. 4 ’o.c. for PVC support; listed primer and glue are required CPC Table 313.1
- Max. 3 ’o.c. for CPVC support; listed primerless glue required, CPC Table 313.1
- Exposed plastic pipes shall be protected with water based synthetic latex paint. Metallic only for above roof installation.
- Primary condensate drain shall discharge in a drywell with an airgap or airbreak or tailpiece of plumbing fixtures 312.6
    - Min. size of a drywell is 2 ’x 2 ’x 2 ’filled with 1” clean drain rocks
    - Min. 3 ’away from building foundation
    - Cover with protective slit barrier
    - 3/4” primary drain pipe into 1-1/2” underground riser with an air break 6” above grade
    - Verify manufacturer’s instruction for vent and trap requirement on condensate drain line.

Underfloor Furnace 904.3.1

- Verify with manufacturer’s installation instructions
- Need to meet floor fire protection requirement (CRC3.2.13)
- Supported by min. 3” of concrete slab above ground, or
- Clearance from finished grade:
    - Min. 6” above grade
    - Min. 12” on sides and back
    - Min. 30” on service front
    - Min. 4” of concrete or masonry wall liners above the adjoining ground when either the excavation or passageway exceeds 12” deep
- Passageway to appliance 904.4

- Min. 22” x 30” access opening or the largest piece of component of the appliance, whichever is greater
- Max. 20 ’in length between access and appliance when head-room is less than 6’
- Min. 30” x 30” work platform in front of the service side unless furnace can be serviced at the access opening within 12”
- GFCI protected service receptacle within 25 ’of equipment and light fixture are required near the appliance with lighting switch at passage entrance
- HVAC disconnect shall be within sight 301.4

❑ Furnace in flood zone shall be elevated at or above the flood elevation 308.2

Hydronic Piping 1201

❑ Hydronic system piping, tubing & fittings see Table 1201.1 for ASTM listings

❑ Hydronic Panel Heating System 1202

- Backflow protection may be required when connected to potable water
- Steel pipe, type L copper, plastic pipe or tubing rated for 100 psi at 180° can be used to pipe for heating panel
- Embedded joints
  - ¨ Steel pipe welded with electrical arc or oxygen/ acetylene method 1211.2
  - ¨ Copper tubing joined with brazing alloys having a melting point above 1000°F, 1221.2.2

❑ Testing 1221.3

- Hydrostatic test method required
- Min. 100 psi water pressure or 1-1/2 times the operating pressure, whichever is greater for 30 minutes

  Flexible plastic piping requires makeup water for stretching and visual inspection for tightness
- Materials & installation practices see Table 1201.1

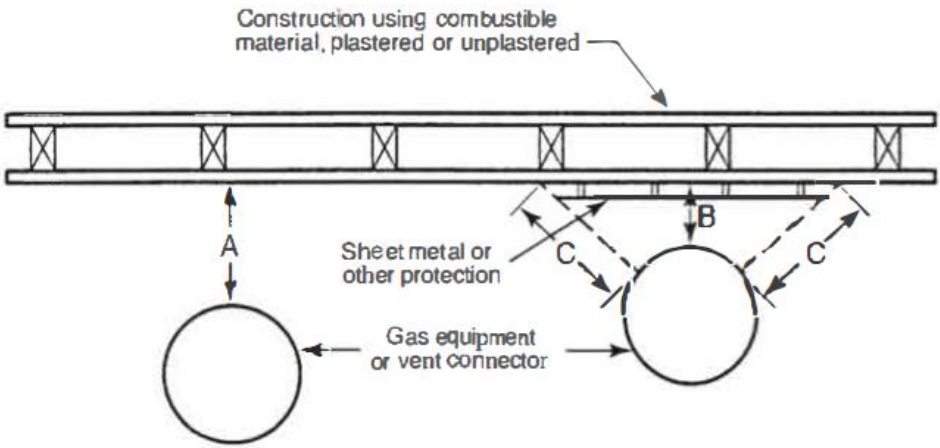
Floor Furnace 906

- Installation 906.1
  - Listed floor furnaces refer to manufacturer's installation instruction
  - Unlisted floor furnaces not allowed in combustible floors
  - Thermostats shall not be located in a room or space that is capable of being separated from the room or space in which the register of the floor furnace is located.
- Placement 906.4
  - Floor furnaces not allowed at doorways, stairway landing, aisle, or passageway of an enclosure, or in an exitway
  - Min. 6" from wall to register
  - Min. 18" from two adjoining sides of the floor furnace register to walls
  - Min. 6" from a wall register to a corner
  - Min. 12" from register to door, drapery, or similar objects
- Bracing 906.5
  - Doubled joists and with headers not lighter than the joists
- Clearance 906.7
  - Min. 6" from bottom of furnace to grade except manufacture sealed units can be 2"
  - When excavation is needed, provide min. 12" on sides and min. 18" on the control side
- Access 906.8
  - Min. 18" x 24" in foundation, 24"x24" in trap door.

ROUGH MECHANICAL INSPECTION

- **Required Clearance for Unlisted Equipment (T 904.2.2) - in inches**

APPLIANCE	ABOVE, SIDES OF FURNACE PLENUM	TOP OF BOILER	JACKET SIDES AND REAR	FRONT	DRAFT HOOD AND BAROMETRIC DRAFT REGULATOR	SINGLE-WALL VENT CONNECTOR
1. Automatically fired, forced air or gravity system, equipped with temperature limit control that is not capable of being set to exceed 250°F.	6	-	6	18	6	18
2. Automatically fired heating boilers - steam boilers operating at not over 15 pounds-force per square inch (psi) and hot water boilers operating at 250°F or less.	6	6	6	18	18	18
3. Central heating boilers and furnaces, other than in 1 or 2.	18	18	18	18	18	18



Reduced clearance, CMC 303.10, TABLE 303.10.1 (1)

Wall Furnace 907

- Installation 907.1
  - Listed wall furnaces shall be installed per manufacturer's instructions. Unlisted wall furnaces are not allowed to be in or attached to combustible materials
  - Vented wall furnaces require Type B-W gas vents and listed for multistory installation
    - 1st ceiling level top plates shall be cut flush with the adjacent studs with ceiling plate spacers
    - Subsequent ceiling, floor level shall use firestop spacers
    - Min. 12 'from bottom of furnace to vent termination 802.6.2.2
    - Vent in attic shall be protected from insulations by a metal sleeve 12" above ceiling or 2" below roof sheathing
    - ≤ 12" diameter gas vents need min. 8 'from a vertical wall, when > 12" and < 8 'from vertical obstruction requires to terminate min. 2 'above the highest point where they pass through the roof and min. 2 'above a portion of a building within 10 'horizontally
    - Direct-Vent wall furnaces shall be installed in accordance of manufacture installation instruction and Vent terminated min 12" above ground, 6" from to opening for 10K BTU or less, 9" for >10K up <50 K BTU, and 12" for more than 50K BTU.
  - Removable panels, grilles, and access doors for servicing operations shall not be attached to the building, also see Section 802 for venting
- Locations

  Per Manufactures Listing AND
  - Avoid causing a hazard to walls, floors, curtains, furniture, or doors.
  - When located between bathrooms and adjoining rooms, do not circulate air from bathrooms to other parts of the building
- Combustion & Circulating Air

- Min. 50 cu ft per 1000 BTU per hour

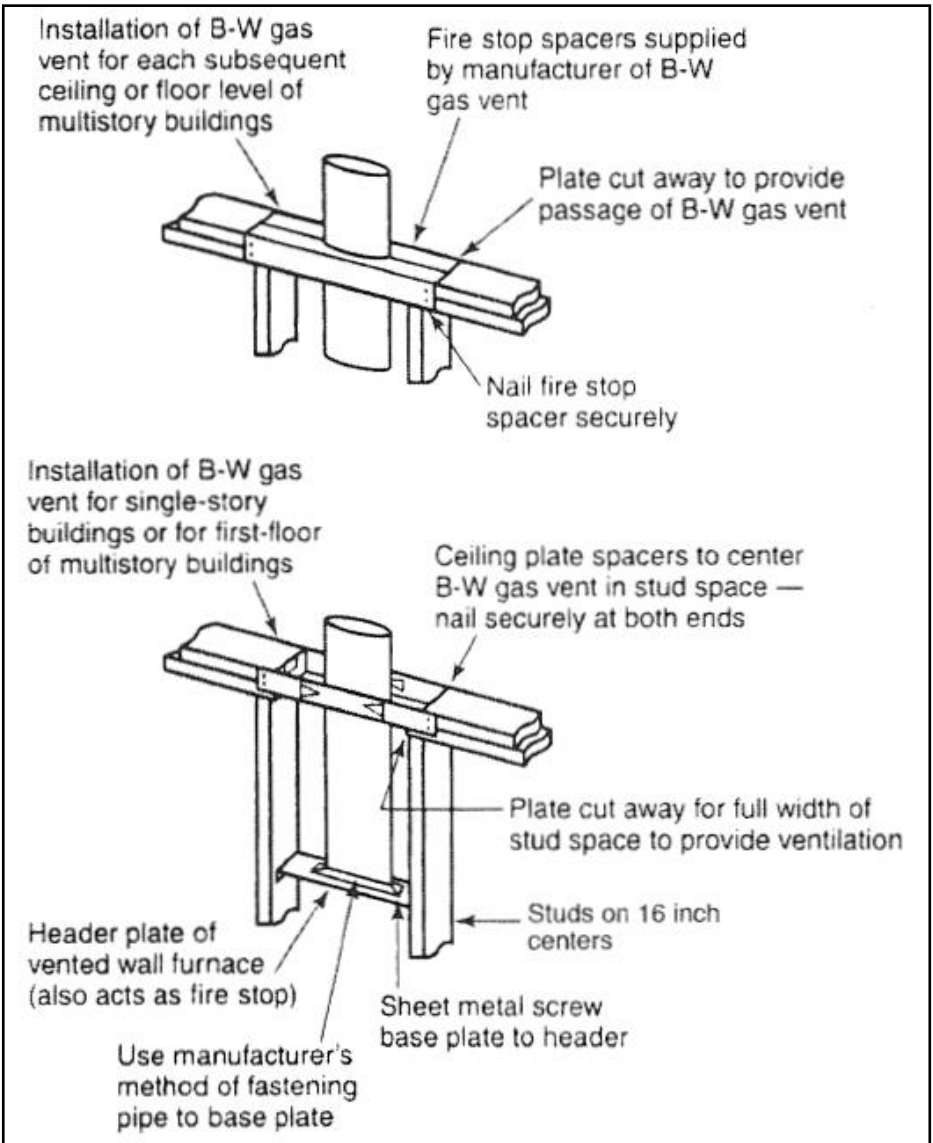


FIGURE 907.1.2
INSTALLATION OF TYPE B-W GAS VENTS FOR VENTED WALL FURNACES
[NFPA 54: FIGURE 10.26.1.3]

Central Forced Air Furnace 904

Locate in bedrooms or bathrooms 904.1

- In a closet located in the bedroom or bathroom with a listed self-closing and gasketed door assembly and combustion air obtained from the outdoors, or
- Direct-vented type ❑□Clearance 904.2
- Listed central heating furnaces per manufacturer's instruction
- Unlisted central-heating furnaces from combustible materials per Table 904.2 unless manufacturer's instruction allows reduction
- Listed & unlisted heating furnaces are permitted to reduce clearances to combustible material provide that the combustible material or appliance is protected per Table 303.10.1
- Where the furnace plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is ≤ 2".
- The clearance to these appliances shall not interfere with combustion air, draft hood clearance and relief, and accessibility for servicing
- Supply air ducts connecting to listed central heating furnaces shall have the same minimum clearance to combustibles as required for the furnace supply plenum for a distance of min. 3 'from the supply plenum.
- Supply air ducts connecting to unlisted central heating furnaces equipped with temperature limit controls with a max. setting of 250°F shall have a min. 6" clearance to combustibles for a distance of min. 6 'from the furnace supply plenum.
- Central heating furnaces other than those listed in Section 904.2(7) or Section 904.2(8) shall have clearances from the supply ducts of min. 18" from the furnace plenum for the first 3', then 6" for the next 3 'and 1" beyond 6'.
- Central heating furnaces not listed for closet or alcove require a room or space with min. 12x the total volume of the furnace and a 8 'ceiling height, where ceiling height >8', the volume shall be calculated on the basis of an 8 'ceiling. 303.2

Locate in Attic

- Opening allowing the largest component of the appliance and not less than 22” x 30”
- Passageway
  - When passage height is < 6’, the access to appliance at max. 20 ’in length
  - Min. 24” wide unobstructed solid flooring from access to the appliance
  - Min. 30” x 30” level working platform or grade surface in front of the service side of the appliance unless it can be serviced from the access within 12” of the appliance
  - Provide a permanent receptacle outlet within 25 ’of furnace and a lighting fixture near the appliance with switch controlling the light fixture located at the access entrance
  - Disconnect located adjacent to and within sight of furnace
  - Verify manufacturer’s instruction for spark shield in front of fire box on horizontal installation
  - Vertical installation requires min. 5 ’headroom in attic

Equipment and appliances on Roofs 303.8

- Listed or protected with enclosure that withstand climatic conditions
- Min. 30” clearance between the entire service access panel of the equipment and the enclosure walls
- Min 30”x30” level area at the service side of equipment where roof slope 4:12 or more. (304.2)
- Load Capacity (Roof Support) 303.8.1
  - Structure shall be capable to support the additional load
  - Or reinforced to support the additional load ❑ Fasteners 303.8.2
  - Access locks, screws, and bolts shall be corrosion-resistant material.
- Clearance 303.8.4
  - Well-drained roof surface is required
- Guards and Rails:

Provide min 42” high rail, constructed to prevent passage of 21” ball, and shall extend min 30” beyond each side of the appliance, when:

- Clearance between equipment, or open end of an equipment platform, and roof edge is less than 6
- The open end of equipment platform is located more than 30” above surrounding surfaces.

Exception:
when anchorage for a fall arrest system listed to ASSE Z359 is in placed

- Electrical Power
  - Provide a readily accessible disconnect within sight
  - Provide a GFCI receptacle on the roof adjacent to the equipment on the supply side of the disconnect switch
  - Access to equipment on roof 304.3
    - Buildings over 15 ’in height shall have an inside means of access to the roof 304.3.1
      1. Door or scuttle—Min. 22” x 24” opening
      2. Permanent ladders
      - Min. 30” extension of side railing above roof or parapet wall
      - Landings: max. 18 ’apart measured from the finish grade
      - Min. 14” wide on center
      - Rungs are max. 12” oc.
      - Min. 6” toe space
    - Permanent lighting

A permanent lighting at roof access
Switch for such lighting shall be located inside the building near the access

- Standing water
  1. Water sealed walkway, platform or both shall be elevated above waterline located adjacent to the equipment and control panels

Appliances Located in Garages 305.1

- Protect against damages
  - Burners & burner-ignition devices shall be min. 18” above floor unless the equipment is listed as flammable vapor ignition resistant
  - Install protective barriers or elevate or locate equipment out of the vehicle path against physical damage
  - When the equipment is compartmented with an outside access, the equipment is permitted to be installed at floor level as long as adequate combustion air is provided and exhaust to the exterior

Air Conditioning Compressors

- Location & Supports
  - Not allowed in required side-yard setback or front-yard setbacks or easements, and not within 5 ’of rear-yard property line (Zoning Ordinance 20.30.400)
  - Supported from ground shall rest on a 3” concrete or approved base 1105.2
  - Locate at or above flood elevation in flood zones 305.2
  - Secure piping and tubing for permanent installation. 1111.2
    - Within 6 ’following the first bend from the compressor
    - Within 2 ’of each subsequent bend or angle
    - Max. 15 ’between supports

Decorative Appliances in Vented Fireplaces 911.0

- Prohibited locations 911.1
  - Bathrooms or bedrooms unless listed for such locations with the required volume of combustion air
- Installation
  - Required a working noncombustible chimney flue
  - Shall not be thermostatically controlled
  - Install per manufacturer’s installation instruction
  - Unlisted appliance installed in a vented fireplace requires permanent free opening based on appliance input rating and chimney height per Table 907.2

- ❑ Fireplace screen is required

Vented Gas Fireplaces 912.0

Any newly installed gas fireplace shall be direct-vent, sealed combustion type. (HCD1, HCD2)

- ❑ Installation
  - Listed vented gas fireplaces install per manufacturer's installation instructions
  - Unlisted vented gas fireplaces shall be installed min. 18" from combustible material on sides and rear. Protect combustible floor under unlisted appliances. Draft hood and venting accordance with Section 802 are required. Metal, asbestos, or ceramic material to direct radiation to the front of the appliance shall have 36" in front and, where constructed with a clearance of min. 18" at the sides and 12" at the rear.
  - Panels, grilles, and access doors that are required to be removed for normal servicing operations shall not be attached to the building.
  - Direct-vent gas fireplaces shall be installed with the vent air intake terminal in the outdoors and per manufacturer's instructions.

Vent connector

Category 1 Equipment (CMC 802.10)

- Minimum 26g (CMC Table 802.10.1.3) and located in same room as appliance 802.10.12
- Vent Connector clearances 802.10.4 & Table 802.7.3.3
  - 6" for single wall connector. B-vent, as listed, 1"
- Min ¼ per foot slope upward

- ❑ Length of Vent connector:
  - Horizontal run not to exceed 75% of vertical height of chimney or vent for single wall (802.10.7.1) NOR 100% of vertical height of a type B, double wall vent connector. But not to exceed 18" per inch of connector diameter in total length. (803.2.1)
- ❑ Size of vent connector- single appliance: 802.10.2.2
  - Not less than area of the draft hood of the appliance to which it is connected.

- Size of vent connector- multiple appliances: 802.10.2.2

  - Common vent connector for 2 appliances shall not be less than area of the larger vent connector + 50% of the area of the smaller flue collar outlet.

Vent connectors for Category II, III, and IV

- Shall comply with 802.4 and 802.4.3 and manufacturer of listed appliances

Vent

- Type B vents shall terminate not less than 5' above the highest connected draft hood or connector (802.6.1.1)
- Vent offsets 802.6.2.2 shall extend vertically with offset not exceeding 45 degrees from vertical except that a vent system having not more than one 60 degrees offset shall be permitted, any angle greater than 45 degree from vertical is considered horizontal.
- Maximum vent size, not larger than 7x the area of the smallest draft hood outlet area.
- Gas vents shall be sized in accordance with 803.0
  Use tables 803.1.2(1)-803.1.2(6) for single appliance
  Use tables 803.2(1)-803.2(9) for multiple appliances
- Plastic vent materials shall be in accordance with the manufacture's instruction OR listed UL 1738 material. UL 1738 system shall use pipe, fittings, primer, and cement from the same producer, unless proof of compatibility is provided. Each component shall have UL lablel.

Vent terminations: 802.6.1

- Vent termination clearances from openings into the buildings 802.6.2
  - Forced air inlets—min. 3 'above inlets within 10 '802.6.1.6
  - Any air inlets—min. 10 'from operable ventilation openings ASHRAE 62.2-6.8
  - Min 10' from opening(s) of adjacent building

- Mechanical draft system vent termination clearances
  - Min. 7 ’above public walkway 802.3.3.5
  - Min. 3 ’above forced air inlets located within 10 ’802.8
    Exceptions:
    - Combustion-air intake of a direct-vent appliance
    - Separate outdoor-air inlet and flue gas discharge of listed outdoor appliance
  - Min. 4 ’below, 4 ’horizontally from, or 1 ’above a door, operable window, or gravity air inlet into a building and min. 1 ’above grade for other than direct-vent appliance 802.8.1

Combustion Air Requirements 701.1

- Indoor opening size & location 701.5
  - Combining spaces on the same story
    - Min. 1 in^2 per 1000 Btu/h of total input rating for appliances in the spaces but not less than 100 in^2 for each opening
    - Top opening to commence within 12” of the top of enclosure
    - Bottom opening to be within 12” of the bottom of the enclosure
  - Combining spaces in different stories
    - Min. 2 in^2 per 1000 Btu/h of total input rating of appliances by openings in doors or floors
  - Unconfined spaces
    - Rooms communicating directly through openings not furnished with doors 701.4
    - Space volume has 50 ft^3 or more per 1000 Btu/h of the aggregate input rating of all fuel-burning appliances installed in that space.
  - Confined spaces 205
    - Space volume is less than 50 ft^3 per 1000 Btu/h of the aggregate input rating of all fuel-burning appliances installed in that space
- 2 permanent openings method for outdoor combustion air 701.6.1
  - 1 commencing within 12” of the top of the enclosure
  - 1 commencing within 12” of the bottom of the enclosure

- Directly communicating with the outdoors or through vertical ducts that communicating with the outdoors, each opening shall have free area of min. 1in^2 per 4000 Btu/h of input for the appliances in the enclosure
- Through horizontal ducts communicating with the outdoors and each opening shall have a free area of min. 1 in^2 per 2000 Btu/h of input for appliances in the enclosure

- 1 permanent opening method 701.6.2
  - Commencing within 12" of the top of the enclosure
  - Clearances to the appliance
    - Min. 1" from the sides & back
    - Min. 6" from the front
  - Opening shall be directly communicating with the outdoors with either a vertical or horizontal duct
    - 1 in^2 per 3000 Btu/h of total input rating of appliances in the enclosure
    - Min. sum of the areas of vent connectors in the space
- Screen at openings 701.10.1
  - Min. 1/4" mesh
  - Except in attics where screen is not permitted a duct termination, instead provide a sheet metal insulation barrier extends min. 6" above the attic insulation - CSJ
- Combustion air ducts 701.11
  - Min. 3" cross-sectional dimension 701.6
  - Ducts shall be corrosion resistant rigid material
  - Duct openings to be unobstructed
  - Serve a single space
  - Separate ducts for upper and lower combustion air openings
  - Horizontal upper combustion-air ducts shall not slope downward toward the source of combustion air
- Clothes dryers with required make up air is not required to provide combustion air 701.1 exception (2)

Bathroom, Toilet Room & Laundry Room Ventilation

- ❑ Bathrooms with showers, spas and/or tubs require mechanical ventilation at min. 50 cfm intermittent ventilation exhaust airflow or 20cfm for continuous airflow. ASHRAE 62.2 Section 5, CMC 402.5, CRC R303.3
- ❑ Toilet rooms other than part of bathrooms and laundry rooms <u>without</u> dryer duct ASHRAE 62.2-6.7
- ❑ Min. 4% of the room floor area and
  - Not less than 1.5 ft^2 openable ventilation area
  - Or mechanical ventilation at min. 50 cfm intermittent ventilation exhaust airflow or min. 20 cfm continuous ventilation exhaust airflow
- ❑ Back-draft dampers are required except when running continuously 504.1.1
- ❑ Duct termination 502.2.2
  - Extend to the exterior of building 504.1
  - Min. 3 'from the property line & openings into the building 502.2.1 and 10' from a forced air inlet

Kitchen Ventilation ASHRAE 62.2-6.6.1

- ❑ Mechanical local ventilation (Natural ventilation is exempted)
  - 100 cfm intermittent local exhaust or
  - 50 cfm with continuous exhaust

Domestic Range Vents 504.3

- ❑ Refer to the manufacturer instructions
- ❑ Verify duct size per listing
- ❑ Smooth interior metal ducts with exception of a down-draft system where PVC is allowed
- ❑ Screw and seal joints 504.1 & 603.10
- ❑ Equip with a back-draft damper except when the exhaust must operate continuously.

Whole-Building Ventilation ASHRAE 62.2-4.1

- Required in new constructions & when additions greater than 1000 ft^2 CSJ
  - Required cfm based on number of bedrooms and floor area ASHRAE 62.2-Tables 4.1a & b

Condensate Wastes 310.0

- Plastic condensate lines may only serve up to 2-story per CPC
- Secondary drain shall be piped to a readily observable location, or a water detecting device that will shut off the equipment or appliance in the event the primary drain is blocked.

FINAL INSPECTION

Review records to verify all U/G, U/F, and rough inspections have been approved.

Gas Lines

- ❑ Listed gas shut off valve at each appliance on supply side of union
- ❑ Length of gas flex connectors
  - Max. 6 ’for ranges and dryers
  - Max. 3 ’for all other appliances
- ❑ Gas Test

All valves & connectors on site

Gas gauge is set at min. 10 psi on a max. 15-pound gas gauge with 1/10th of a pound increment for 15 minutes

- ❑ Sediment trap
  - Installed between shut-off valve and before flex connector at water heaters and Central Forced Air Furnaces (not wall furnaces)

Ventilation

- Bathrooms
- Toilet and laundry rooms
- Kitchens

Domestic Ranges & Cooktops

- ❑ Exhaust and back-draft damper installed, with smooth wall ducting, min 3 screws evenly spaced at each joint.
- ❑ Exhaust to be ducted to exterior, recirculation shall not be permitted
- ❑ Clearance from top of range to combustibles
  - Min. 30” vertical clearance, unless hood is protected with sheet metal or listed microwave combo per code can be reduced to 24” 921.3, 921.4

- Size of gas connector to meet appliance BTU demand, or per manufacture. Flex gas connector shall not go through cabinet walls
- Verify anti-tip device in place, installed per manufacture specifications.

Domestic Clothes Dryers 504.3

- ❑ Vent
  - Min. 4" diameter duct max. 6 'of listed connector 504.4.2.2
  - Max. 35 'of smooth rigid duct without screws and deduct 5 'for every elbow in place CSJ - placard required.
  - Back-draft damper without screen at termination 504.4
  - Min. 3 'at termination to property line and house openings 502.2.1
- ❑ Make up air
  - Min. 100 in^2 when enclosed in a closet or similar environment 701.5

Furnaces

- ❑ Single wall flue and unlisted vent connectors are not allowed in concealed spaces 802.7.3.2
- ❑ Verify manufacturer's instruction for clearances and type of flues and sheet metal in front of the firebox
- ❑ Verify condensate trap, vent drain, and dry well or other approved indirect waste method 310
- ❑ Protection against damage when the unit is installed in garage 305.1
- ❑ Min. R-8 insulation for ducts in un-condition spaces
- ❑ Unit to be elevated when there is no guard or in a flood zone
- ❑ Verify combustion air for unit
- ❑ Penetration through firewalls or ceilings with hard ducts and necessary fire caulking or fire stops

Whole-Building Ventilation

- ❑ Continuous running fan sized Per T-24 Title 24's IAQ requirement

- Manual switches for IAQ ventilation systems to have a label clearly displaying the following (or equivalent) text: "**This switch controls the indoor air quality ventilation for the home. Leave it on unless the outdoor air quality is very poor.**" ASHRAE 62.2 Sect. 4.4

- For required whole-house fans, only those listed in the Appliance Efficiency Directory may be installed. Footnote 8, Table 150.1A Energy Code.

Air Conditioning Compressors

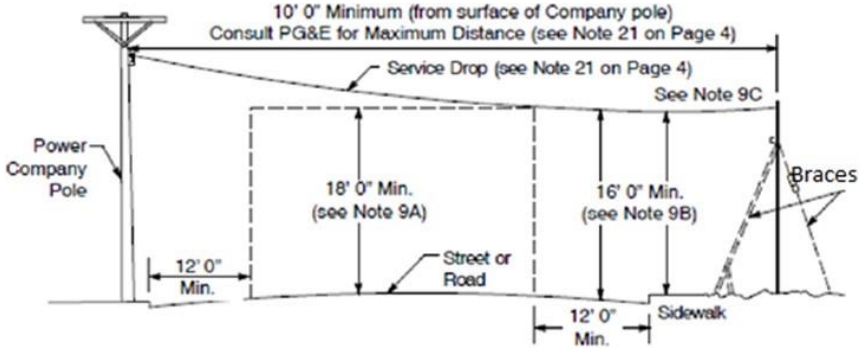
- Shall not locate within 5 'of property line CSJ
- Equipment is elevated on a min 3" base per 1105.2
- Verify fall protections when equipment is on roof
- Line-set insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. (Energy code 120.3)
- Air conditioning refrigerant circuit access ports located outdoors shall be protected from unauthorized access with locking-type tamper-resistant caps (CMC 1105.11)

Part IV
ELECTRICAL REQUIREMENTS

2022 California Electrical Code
Based on the 2020 National Electrical Code

TEMPORARY POWER POLES

- Must comply with the provisions found in Service Inspection of this Guidebook.
- Locate permit and inspection record, permit shall be independent of construction permit.
- Verify address is permanently marked on service.
- Verify support and bracing of pole (Min. 2 x 4 wood braces). PG&E Greenbook Manual
- Verify grounding and bonding of pole, i.e., two ground rods.
- Verify the main disconnect at service and remote panelboards. 225.33 & 230.71
- Reused breakers must be examined to ensure there's no impeding failure.590.8(A)
- Verify GFCI protection of all receptacles. 590.6(A) & (B)
- Verify "extra-duty" hood cover is installed at all receptacles. 406.9(B)
- Verify size of service entrance conductors. 310.15 & Table 310.16
- Verify weatherproof equipment (i.e. receptacles & panelboards in wet locations). 406.8(B) & 408.37
- Issue temporary power meter release upon approval.



SERVICE INSPECTION

For Service sizes of 100 through 400 amperes.

- Service Drop. PG&E Greenbook Manual
  - Min. ½" above roofs
  - Min. 12’ above walkways and driveways
  - Min. 18’ above streets
  - Min. 22.5’ over swimming pool. 680.9(A)
- Meter Height. PG&E Greenbook Manual
  - Exterior non-pole-mounted min. 48” & max. 75” from standing surface to center of meter.
  - Enclosed or indoor installation min. 36” & max. 75” from standing surface to center of meter.
  - Min. 9” clear from obstruction above the meter or enclosure measuring at center of meter to bottom of obstruction or enclosure.
- Splices and taps to service entrances conductors made with device listed and marked for “Suitable for use on line side of service disconnect”. 230.46
- Factory or field installed Type 1 or Type 2 surge protection devices at service. 230.67
- Single service disconnecting means required. Hot bus no longer permitted. Permitted service disconnects 2 through 6 must be in separate enclosures with a main in each. 230.71
- Disconnects must have short-circuit current rating ≥ available fault current and at readily accessible outdoor location. 230.85
  - Must be marked: EMERGENCY DISCONNECT, SERVICE DISCONNECT
  - Other listed disconnects on the supply-side must be marked: EMERGENCY DISCONNECT, NOT SERVICE DISCONNECT
- Max. breaker height 6’7” above standing surface to center of handle. 240.24(A) & 404.8(A)
- Working Clearance. 110.26(A) & Table 110.26(A)
  - Min. 30” W x 36” D x 78” H in front of service
  - Exception: Existing dwelling units permitted to have reduced height when service is ≤ 200 amp
  - Doors and hinged covers must be able to swing open 90°

Optional Method Load Calculation. (220.82 & 220.83)

Step1:

General light, power _____SF x 3 volt-amperes = ___VA Two
kitchen appliance circuits @ 1,500 VA = 3,000 VA
Laundry circuits = 1,500 VA
Electric range (name plate (NP) rating) = _____VA
Wall mounted oven (NP rating) = _____VA
Water heater (NP rating) = _____VA
Dishwasher (NP rating) = _____VA
Disposal (NP rating) = _____VA
Dryer (NP rating) = _____VA
Other_____ = _____VA

Subtotal _____VA
New SFR (First 10 kVA@ 100%)
Or Existing SFR (First 8 kVA@100%)

Remaining VA@ 40% = _____VA

Step 2:

Heating and Air-Conditioning (The Largest of the following shall be included):

1. Air conditioning and cooling (100% NP rating) = _____VA
2. Heat pump without supplemental heating (100% NP rating) = _____VA
3. Heat pump with supplemental electric heating (100% NP rating plus 65%) = _____VA
4. Electrical space heating < 4 separate units (65% NP rating) = _____VA
5. Electrical space heating ≥ 4 separate units (40% NP rating) = _____VA
6. Electrical thermal storage and other (100% NP rating) = _____VA

Step 3:

Electric Vehicle Ready at 9,600VA or actual Electric Vehicle Supply Equipment (EVSE), whichever larger = VA

Step 4:

Total VA ÷ 240 = amps
(Ampacity and rating for service-entrance conductors and panel)

- Service-Entrance Conductor Size. 230.42, Tables 310.16, & 310.12

New construction: 225-amp min. busbar rating for single-family services with one and two units per California Energy Code 150.0(s). See next page for useful diagrams.

- For 100 to 400 amp. service, the service conductors supplying the **entire** load associated with a one-family dwelling, or multifamily dwelling, shall be permitted to have an ampacity not less than 83 percent of the service rating as seen in Table 310.12.

- Service Riser Size. See pie chart and Annex C
- Service Riser Bond. 250.92(A) & (B)

- Listed hub secured by threaded machine screws, or bushing with a bonding jumper at concentric & eccentric knock-outs.
- Grounding locknut, grounding wedge, or Meyers hub permitted at knock-outs sized to fitting, i.e., fully sized knock-outs.
- Self-tapping screws not allowed. 250.8

- Grounding Electrode. 250.52

- Metallic underground water pipe in contact with earth for 10'. 250.52(A)(1)
    - Bonded outside or within 5' of entering building. 250.68(C)(1)
    - Must be supplemented, e.g., rod electrode. 250.53(D)(2)
- Concrete-encased electrode, i.e., Ufer. 250.52(A)(3)
    - Min. 20' long 1/2" (#4) continuous rebar or min. 20' long.
    - 4AWG copper conductor within footing, not stem wall.
    - Rebar must not be used to interconnect grounding electrodes. 250.68(C)(3)
- Rod or pipe in contact with earth for 8'. 250.52(A)(5)
    - Min. 8' long 3/4" steel, galvanized or metal-coated for corrosion protected pipe or conduit.
    - Min. 8' long 5/8" steel, copper or zinc coated steel ground rod.

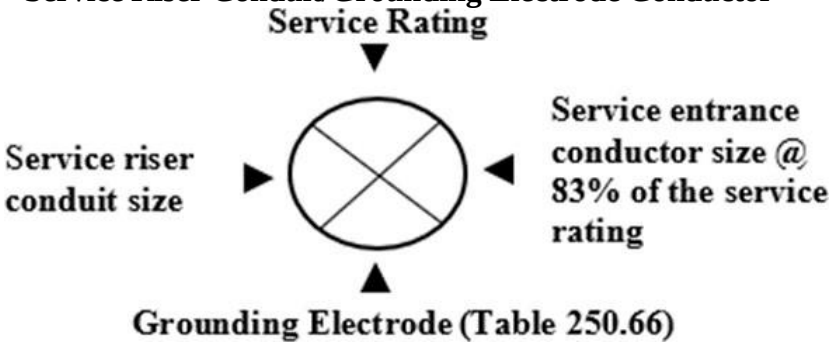
Note: See SJC Bulletin 260 and CEC 250.53(A)&(D). Where a rod is the sole electrode or supplement to a metallic water main pipe, another rod is required min. 6' apart with minimum 6 AWG bonding jumper unless resistance to earth max. 25 ohm.

- Grounding Electrode Conductor Installation (250.64)
  - Grounding electrode conductor smaller than No. 6 shall be in RMC, IMC, SCH 80 PVC, EMT, RNC, or Cable Armor. Metal flex conduit not to be used.
  - Ferrous metal raceway, enclosures, and cable amor shall be bonded at each end to GEC.
- Separate Building or Structures Supplied by a Feeder or Branch Circuit. 225.32 & 250.32(A)
  - Max. one feeder unless supplied from common equipment with not more than 6 feeders with disconnects grouped together.
  - Feeder or branch circuit requires a disconnect switch.
  - Disconnect is required at a readily accessible location outside or inside near the point of entrance of the conductors.
  - Back-fed breaker requires a fastener (hold-down kit).
  - A structure supplied by a feeder must have a grounding electrode system (GES) and the GES must connect to the feeder equipment grounding conductor. 250.32
  - Grounded (neutral) conductor and equipment grounding conductor must be isolated from each other after service equipment. 250.24(A)(5) & 250.32(B)

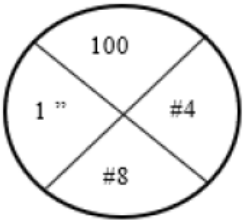
Note: GES not required if fed with a single branch circuit.

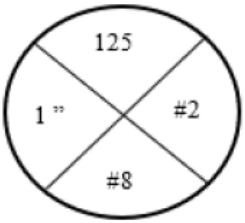
- Panelboard. (408)
  - OCPDs not permitted over steps, bathrooms, and closets. 240.24(D) through (F)
  - Installed vertically unless when install horizontally up is "on" position. 240.33

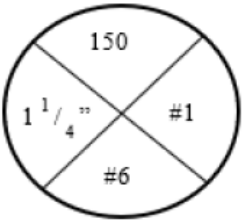
Sizing chart for Service/Feeder Conductor 310.12
Service Riser Conduit/Grounding Electrode Conductor

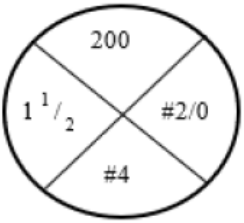


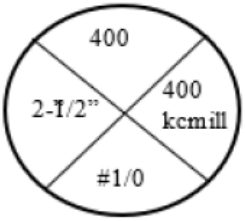
Copper



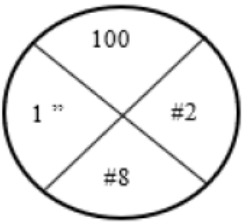


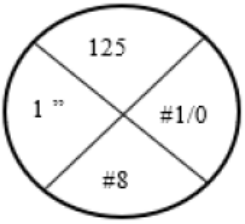


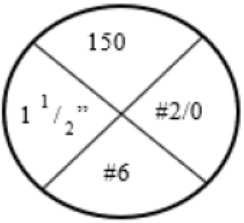


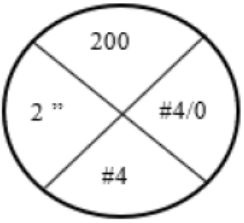


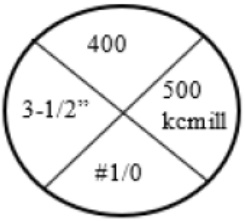
Aluminum











- Bonding. 250 Part IV
  - See next page for bonding of water piping systems.
  - Bond metallic piping systems to sub-panel enclosure, equipment grounding conductor, or grounding electrode. 250.104(A)(3)
  - Grounded conductor (neutral) bonded at main service equipment with main bonding jumper. 250.24(B)
    - Wire type jumper sized to Table 250.102(C)
  - Sub-panel neutral bar shall not be bonded to enclosure and equipment grounding conductor. 250.24(A)(5)
- Available Fault Current. SJC Bulletin #260
  - When installing a service rating 225Amp or greater, a PG&E **Maximum Available Short-Circuit Current Letter** stating the available fault current (AFC) will be required and system shall be configured to provide Interruption Rating (kAIC) not less than stated AFC prior to being released and energized.
- An intersystem grounding termination at the service equipment. 250.94

Installation	Metallic Piping	Non-metallic Piping
Water Service: Galvanized to copper.	Verify re-connect of accessible ground clamp to metallic water piping service.	Does not apply.
Water Service: Non-metallic to metallic piping system.	1. GEC to new metallic water service within 5' of entering building. 2. Ufer present or install two ground rods six feet apart.	Does not apply.
Water Service: Metallic to non-metallic piping system. See CPC 604.10 Exception.	Does not apply.	1. Ufer present or install two ground rods six feet apart. 2. Verify existing bonding jumper to interior metal water pipe system.
Re-pipe Interior: Galvanized to copper	Verify re-connect of accessible ground clamp to metallic water piping service.	Verify existing connection to interior metal water pipe system.
Re-pipe Interior: Non-metallic to metallic piping system.	Verify re-connect of accessible ground clamp to metallic water piping service.	Bond interior metal water pipe system, at any convenient accessible location.
Re-pipe Interior: Metallic to non-metallic piping system.	1. Verify re-connect of accessible ground clamp to metallic water piping service. 2. Verify equipment ground at grounding-type receptacles (U-slot).	Does not apply.
Electrical Service: New structure with electrical service.	1. Ufer with min. 4 AWG copper wire or #4 rebar. 2. GEC to new metallic water service within 5' of entering building.	Verify connection to interior metal water pipe system.
Electrical Service: Electrical service up- grade or service panel relocation.	1. Ufer present or install two ground rods six feet apart. 2. GEC to new metallic water service within 5' of entering building.	1. Ufer present or install two ground rods six feet apart. 2. Verify connection to interior metal water pipe system.

TABLE 310.16 Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C - 90°C (140°F-194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried)							
Temp. Rating of Conductor Based on Ambient Temperature of 30°C (86°F)							
Size AWG or kcmil	60°C (140°F) Types TW UF	75°C (167°F) Types RHW THHW THW XHHW	90°C (194°F) Types RHH THHN XHH XHHW	60°C (140°F) Types TW UF	75°C (167°F) Types RHW THHW THW XHHW	90°C (194°F) Types RHH THHN XHH XHHW	Size AWG or kcmil
	Copper			Aluminum			
18	----	----	14	----	----	----	----
16	----	----	18	----	----	----	----
14	15	20	25	----	----	----	----
12	20	25	30	15	20	25	12
10	30	35	40	25	30	35	10
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400

TABLE 250.66 Grounding Electrode Conductor for Alternating-Current Systems			
Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounding Electrode Conductor (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0

TABLE 250.122: Min. Equipment grounding conductor size		
Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equip, Conduit, etc., Not Exceeding (Amps)	Size (AWG or kcmil)	
	Copper	Aluminum
15	14	12
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0

Minimum Cover Requirements Table 300.5

LOCATION OF WIRING METHOD OR CIRCUIT	TYPE OF WIRING METHOD OR CIRCUIT			
	Direct burial cables	RMC or IMC	Nonmetallic direct burial raceways	Max 20A-120v with GFCI
All locations not specified	24	6	18	12
In trench below 2" Of concrete or equivalent	18	6	12	6
Under a building	0 (In raceway only or Type direct burial MC)	0	0	0 (In raceway or Direct burial MC)
Under min. of 4" of concrete exterior slab with no vehicular traffic and the slab extending not less than 6" beyond the underground installation	18	4	4	6 (Direct burial) 4 (In raceway)
Under streets, highways, roads, alleys, driveways and parking lots	24	24	24	24
One/two-family dwelling driveways and outdoor parking areas, and used only for dwelling-related purposes	18	18	18	12

ROUGH INSPECTION

Verify building is weather tight.

Receptacle Outlet Requirements. (210.52)

- ❑ General Receptacle Locations & Spacing. 210.52 (A)
  - Max. 6’ measured horizontally along wall surface to a receptacle outlet. 6’ and 12’ Rule.
  - ≥ 2’ wide wall requires min. 1 receptacle outlet.
  - Max. height of 5’6” from floor to be count as part of the required receptacles.
  - Max. 18” from wall for floor receptacle outlet to be counted as part of the required receptacles.
- ❑ Kitchen Receptacles. 210.52 (C)
  - Max. 24” measured horizontally along countertop wall surface to a receptacle outlet. 2’ and 4’ Rule.
  - ≥ 12” countertop requires min. 1 receptacle outlet.
  - Each 12” multioutlet assembly length with two or more receptacles is counted at 1 receptacle outlet.
  - Max. height of 20” above the countertop surface to be counted as part of the required receptacles.
  - Island and peninsular counters require the following receptacle outlets for first 9 sq.ft. and every 18 sq.ft. after.
    - One receptacle required up to 9 sq.ft.
    - Two receptacles from 9.1 sq.ft. up to 27 sq.ft.
    - Three receptacles from 27.1 sq.ft. up to 45 sq.ft.
    - Four receptacles from 25.1 sq.ft. up to 63 sq.ft.
  - One receptacle outlet located within 2’ of outer end of peninsula counter.
  - Max. 12” below countertop and max. 6” overhang.
  - Countertop or work surface receptacles must be listed for the use.
- ❑ Bath Receptacles. 210.52 (D)
  - Max. 3’ from the outside edge of each basin.
  - Max. 12” below top of basin or basin countertop
- ❑ Outdoor Receptacles. 210.52 (E)
  - Min. 1 receptacle at the front and back of the dwelling
  - Max. 6’6” above grade
  - Requirement applies to each unit for a duplex.
  - Min. 1 receptacle at balcony, deck, and porch when accessible from inside and within 4” of the dwelling.

- Laundry Area. 210.52(F)
  - Min. 1 receptacle for the laundry.
- Basements, Garages and Accessory Buildings. 210.52(G)
  - Min. 1 receptacle in addition to dedicated circuits for equipment in each basement, attached or detached garage, and accessory building with electric power.
  - Min. 1 receptacle in each unfinished portion of a partially finished basement.
  - Min. 1 receptacle outlet for each vehicle bay in garage, 5.5' max above finished floor supplied from dedicated 120-volt, 20-amp circuit.
  - New construction: Min. 1 EV Ready outlet. 40-amp circuit breaker, 8 AWG to outlet box.
- Hallways. 210.52(H)
  - Min. 1 receptacle when hallways are more than 10' long.
  - Foyer is not part of a hallway, when it's greater than 60 ft2 a receptacle is required in each wall space ≤ 3' wide.
- Underfloor. 334.15(C)
  - Cables smaller than 6 AWG/2 conductor or 8 AWG/3 conductor must be routed through bored holes or secured to running board.
  - Cable secured/supported at 12' from enclosures and every 4-1/2" after. 334.30
  - Installation within the flood elevation must be suitable for wet locations. CRC R322.1.6 Ex.
  - Verify service receptacle and lighting outlet with switch if equipment is installed.
- Attics. 320.23
  - Provide guard strips if cable is run on top of joist within 6' of attic entrance.
  - Cable secured/supported at 12' from enclosures and every 4-1/2" after. 334.30.
  - Verify service receptacle and lighting outlet with switch if equipment is installed.
- New construction: Max. 48" to top of box and min. 15" to bottom of box for general receptacles, switches and controls.

Note: See CRC R327 Aging-in-Place Design requirements as receptacle, switches, controls must be accessible.

Switched Lighting Outlets Requirement. (210.70)

- ❑ Habitable rooms
  - Min. 1 lighting outlet controlled by listed wall-mounted control device in every habitable room, kitchen, and bathroom.
    - ∗ Can be switched receptacle except kitchen and bathrooms.
- ❑ Hallways, Stairways, Garages with Power
  - Lighting outlet controlled by listed wall-mounted control device.
  - Outdoor entrances or exits with grade level access.
  - Stairway with 6 risers or more at each floor level.
- ❑ Attics, Basements, Storage or Equipment Spaces
  - Min. 1 lighting outlet controlled by listed wall-mounted control device at each entry.
  - Lighting outlet must be located near equipment.
  - Switches and metal plates must be grounded. 314.28(C)

Indoor Lighting. (150.0(k)1.)

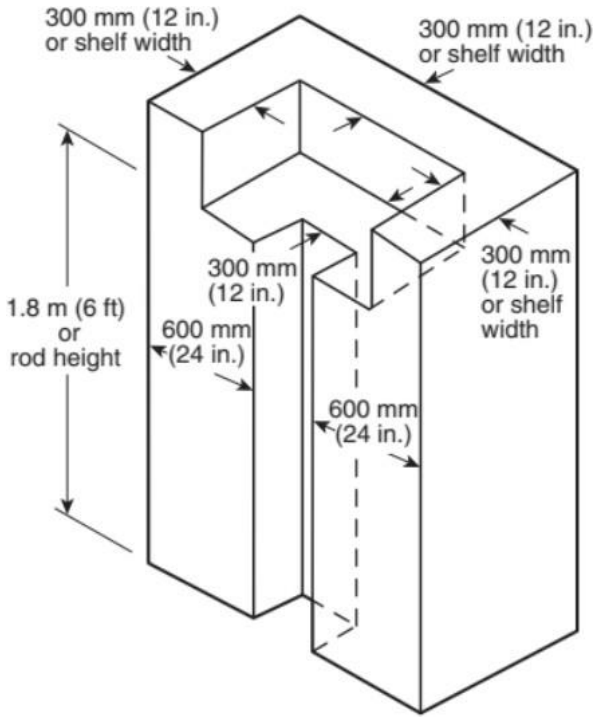
- ❑ All installed luminaires shall be high efficacy.
- ❑ Blank electrical boxes that are more than 5 feet above the finished floor shall be no greater than the number of bedrooms and must be served by a dimmer, vacancy sensor control, or fan speed control.
- ❑ Recessed Luminaires:
  - Shall be IC rated and labeled that certifies the luminaire is airtight with air leakage less than 2.0 CFM at 75 Pascals.
  - Sealed with a gasket or caulk between the luminaire housing and ceiling,
  - Shall not contain screw base sockets; and shall contain light sources that are marked "JA8-2016-E" as specified in Reference Joint Appendix JA8.
- ❑ Navigation lighting such as night lights, step lights, etc. rated < 5W per luminaire not required to be high efficacy or controlled by dimmer.
- ❑ Screw based luminaires with installed lamps shall be marked with "JA8-2016" or "JA8-2016-E".

NOTE: Light sources that are not marked "JA8-2016-E" shall not be installed in enclosed luminaires.

Luminaires in Clothes Closets. (410.16)

- Min. clearance between luminaire and clothes closet storage space:
  - 12” for surface-mounted enclosed incandescent or LED luminaries.
  - 6” for surface-mounted fluorescent luminaries.
  - 6” for enclosed recessed incandescent or LED luminaries.
  - 6” for recessed fluorescent luminaries.
  - Surface-mounted fluorescent or LED luminaries identified to be installed within the closet storage space is allowed.

Clothes Closet Storage Space



Outlet Boxes. (314)

- Boxes must be made up for rough inspection per City Policy.
- Boxes must be accessible to access wiring. 314.29
- Surface mounted luminaires concealing box and not solely supported by box must have opening in back of luminaire to allow access to box. 410.24(B)
- Receptacle outlets not permitted face-up on counters/work surfaces and under sink. 406.5(G)
- Metal boxes and non-metal light boxes shall be grounded. 250.148 (C) & (D) & 314.4
- Box fill—light junction box fill Table 314.16(B)
- Unused opening must be closed 314.17(A)
- Boxes supporting paddle fans must be listed and marked fans not more than 70 lbs. 314.27(C) (Note on correction notice for number of fan boxes installed and their locations.)
- Nonmetallic boxes require nonmetallic conduit or cable. 314.3
    - Exception: Internal bonding means required between all entries when metallic conduit or cable is used.

Table 314.16(B) Volume Allowance Required per Conductor	
Size of Conductor (AWG)	Free Space Within Box for Each Conductor - in^3
14	2.00
12	2.25
10	2.50
8	3.00
6	5.00

Nonmetallic-sheathed Cable. (Type NM 334)

- Cable and fittings must be listed.
- Ampacity based 60°C for sizing, 90°C permitted for adjustment factor (derating).
- Prohibited Use 334.12
  - Embedded in cement, concrete, or aggregate, masonry, adobe, fill, or plaster
  - Wet or damp locations
- Support 334.30
  - Staples, cable ties, straps, hangers
  - Max. 12" from enclosure and at 4-1/2' intervals.
  - Unsupported permitted when fished through finished spaces.
- Protection from damage
  - Min. 1-1/4" from edge of framing member.
  - Min. 1-1/4" from bored holes & notches, otherwise provide a nail plate. 300.4(A)(1)
- Length of free conductor at box
  - Min. 6" from the point of entry into the box. 300.14

Hydro-massage Bathtubs. (680.70)

- Individual branch circuit
- All 125-volt, up to 30-amps, located within 6' of inside wall of a hydro-massage tub must be GFCI protected.
- Equipment and supply receptacle must be accessible through a service opening, receptacle faced with direct view within 1' of the opening.
- Min. 8 AWG bonding wire must bond the following (not required to terminate in panelboard, main panel, or electrode.):
  - Metal fittings attached to tub structure
  - Metal part of equipment, i.e. pumps and blowers
  - Metallic cables, raceways, and piping within 5' of tub
  - Exposed metal surfaces within 5' of tub
  - Non-current carrying metal parts of electrical equipment within 5' of tub

Required Circuits. (210, 220, 422, Muni Code

- ❑ Min. 120-volt, 15- or 20-amp general lighting and receptacle circuits based on floor area
  - One 15-amp circuit for every 600 sq.ft. or one 20-amp circuit for every 800 sq.ft.
- ❑ Min. two 120-volt, 20-amp small appliance circuits
- ❑ Min. one 120-volt, 15- or 20-amp range hood/micro. hood
- ❑ Electric range, cooktop, and/or oven (nameplate)
- ❑ Separate 120-volt, 15-amp garbage disposals (typ.)
- ❑ Separate 120-volt, 15-amp dishwasher (typ.)
  - Or 120-volt, 20-amp garbage disposals and dishwasher circuit if no single load exceeds 50% of circuit rating.
- ❑ Separate 120-volt, 15- or 20-amp refrigerator (typ.)
- ❑ Min. one 120-volt, 20-amp laundry
- ❑ Min. one 240-volt, 30-amp dryer
- ❑ Min. one 120-volt, 20-amp bathroom
  - If 20-amp circuit supplies all loads in bathroom, separate 20-amp is required for each bathroom.
- ❑ Min. one 120-volt, 20-amp garage
- ❑ Electric Space-conditioning equipment (nameplate)
- ❑ Electric water heater (nameplate)
- ❑ Min. one 240-volt, 40-amp electric vehicle ready space (new construction)

FINAL INSPECTION

Verify rough inspection approval.

- ❑ All receptacles, switches, plates, light fixtures installed with correct trims.

Outlet Boxes. (314)

- ❑ Ceiling paddle fan support (see rough correction notice if fan boxes were installed at rough). 422.18
- ❑ Boxes flush with combustible finishes, or max. 1/4" back from non-combustible finishes. 314.20
- ❑ Gaps > 1/8" around boxes and panelboard cabinets must be repaired. 314.21

Receptacles. (406)

- ❑ Verify correct receptacle installation and polarity with tester.
- ❑ Verify tamper-resistant receptacles. 406.12
  - Not required at height over 5'6".
- ❑ Verify weather resistant receptacles and weather-proof "extra-duty" covers for wet locations. 406.9(B)
- ❑ Listed splice devices shall be used at AL-CU connection. 110.14
- ❑ Receptacles with USB Charger must have integrated class 2 circuitry. 406.3(F)

Appliances. (422)

- ❑ Central vacuum outlet assemblies and all metal parts shall be grounded. 422.15
- ❑ Appliance with disconnect within sight or lockable at breaker. 422.30
- ❑ Verify appliance cord length per 422.16:
  - Trash compactors—min. 3' & max. 4' Dishwasher—min. 3' & Max. 6.5'
  - Garbage disposals—min. 18" & max. 36"
  - Range Hood—min. 18" & max. 4.0'

HVAC Equipment. (440)

- Verified min circuit ampacity (MCA) and max. overcurrent protection (MOCP).
- Rated disconnect within sight of equipment.
- GFCI protected service receptacle within 25' supplied by separate circuit from central heating equipment. 210.63 (A)

GFCI Protected Receptacle Requirements. (210.8(A))

- ❑ GFCI protection - test at receptacles or breakers.
- ❑ 120-volt and 240-volt receptacles must be GFCI protected in the following areas. GFCI shall be in readily accessible locations. GFCI is measured the shortest path a cord can take.
  - Bathrooms
  - Kitchens countertops
  - Garages and accessory buildings at or below grade
  - Outdoors except not readily accessible and dedicated circuits for equipment.
  - Crawl space at or below grade
  - Basements except for supply to a permanent fire alarm or burglar alarm system.
  - Within 6’ of sinks, bathtub, or shower stall
  - Boathouse
  - Laundry area

GFCI Protected Outlet Requirements. (210.8(C) through (F))

- ❑ Crawl space lighting outlet
- ❑ Sump pumps
- ❑ Dishwashers
- ❑ Equipment service receptacles (mechanical equipment)
- ❑ Outdoor outlets 240-volt, up to 50-amps (EVC, etc.). AC condensers are exempt until Sept. 1 2026.

AFCI Protected Outlet Requirements. (210.12(A))

- ❑ AFCI protection - test at breakers.
- ❑ All 120V, 15A and 20A circuits less bathroom and garage.
  - Except individual circuit to a fire alarm system installed in RMC, IMC, EMT, MC or Steel Armored Cable.
- ❑ AFCI protection required if branch circuit wiring extended more than 6’ or modified to include any additional outlets or devices in existing installations. 210.12 (B)
- ❑ See next page for protection methods.

AFCI Protection Method	Additional Installation Requirements
210.12(A)(1) Combination type AFCI Circuit Breaker installed at the origin of branch circuit.	No additional requirements
210.12(A)(2) Branch/feeder type AFCI circuit breaker installed at origin of branch circuit, AND, Outlet branch circuit type AFCI device installed at first outlet in branch circuit	Marking of first outlet box in branch circuit
210.12.(A)(3) Supplemental arc pro- tection type circuit breaker installed at origin of branch circuit PLUS, Outlet branch circuit type AFCI device installed at first outlet in branch circuit	1. Continuous branch circuit wiring; 2. Home run conductor length to the first AFCI outlet restricted (14 AWG-50 ft, 12 AWG-70ft) 3. Marking of the first outlet box in branch circuit.
210.12.(A)(4) Branch Circuit Overcurrent Protective device, plus, Outlet branch circuit type AFCI device installed at first outlet in branch circuit The combination of devices must be listed and identified to provide *system combination type arc-fault protection for the "home run" conductors.*	1. Continuous branch circuit wiring; 2. Home run conductor length to the first AFCI outlet restricted (14 AWG-50 ft, 12 AWG-70ft) 3. Marking of the first outlet box in branch circuit.
210.12.(A)(5) Outlet branch circuit type AFCI device installed at first outlet in branch circuit	Branch circuit conductors installed in RMC, IMC, EMT, Type MC,or steel-armored type AC cables and metal outlet and junction boxes to the first AFCI outlet
210.12.(A)(6) Outlet branch circuit type AFCI device installed at first outlet in branch circuit	Branch circuit conduit, tubing or cable encased in min 2" of concrete from origin to the branch circuit to the first outlet

Luminaires. (410)

- ❑ Closet light clearance. See Electrical Rough Inspection.
- ❑ Lighting tracks are not installed in prohibited locations. 410.10(D)
  - Min. 3'horizontally and 8' vertically from the top of threshold of bathtub rim or shower stall.

Indoor Light Switching Devices and Controls. (150.0(k)2.)

- ❑ Unless otherwise noted, lighting in habitable spaces, i.e. living rooms, kitchens, dining rooms, bedrooms, etc., will require dimming controls.
  - An Energy Management Control System (EMCS) may be used to comply with dimmer requirements in Section 150.0(k).
- ❑ Controlled receptacle okay with manual on/off switch
- ❑ Bathrooms, garages, laundry rooms, utility rooms, and walk -in closets requires at least one luminaire be controlled by occupancy or vacancy sensor.
- ❑ Exhaust fans shall be switched separately from lighting systems.
- ❑ Undercabinet, undershelf, display cabinets, and switched outlets shall be switched separately from other lighting systems.

Residential Outdoor Lighting. (150.0(k)3.)

- ❑ All luminaires shall be high efficacy or JA8-2016 listed, and meet one of the followings:
- ❑ Controlled by photocell and motion sensor. With manual ON/OFF switch that does not override to ON unless the override automatically reactivates the motion sensor within 6 hours.
- ❑ Controlled by photocell and time switch control With manual ON/OFF switch that does not override to ON unless the override automatically reactivates the photocontrol and time switch within 6 hours.
- ❑ Controlled by Astronomical timer. With manual ON/OFF switch that does not override to ON unless programmed to automatically turn the outdoor lighting OFF during daylight hours.
- ❑ Energy management control system 150.0(k)

Electrical Vehicle Chargers. (625 & Muni Code)

- Verify load calculations for services rated 125 amps or less.
- Verify manufactures installation instructions.
- Dedicated EV circuit. 625.40
- Branch circuit OCPD and conductors sized 125% of max. load. 625.41
- Adjustable setting permitted for equip. rating with restricted access and new durable label with adjusted rating. 645.42
- A readily accessible lockable disconnect is required for EV charger rated more than 60 amps or over 150 volts to ground. 625.43

Main Panel and Subpanel. (408)

- Verify breakers are installed and conductors terminated. No more than one conductor terminated unless listed. 110.14(A)
- Verify neutral and ground conductor terminations. No more than one neutral conductor terminated unless listed.
- Proper phasing of three wire circuits.
- Circuit breakers in panels are identified. 408.4
- Circuit Breaker Height—Max. 6'-7" above standing surface. 404.8(A)
- OCPD not permitted in over steps, bathrooms, and closets. 240.24(D) through (F)
- Installed vertically unless when install horizontally up is "on" position. 240.33
- Back-fed devices to be secured in place. 408.36(D)
- Handle tie/grouping for multi-wire circuits. 210.4(B) & (D)
- The standard ampere ratings for fuses and breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350 and 400 amperes. 240.6

SOLAR PHOTOVOLTAIC SYSTEMS

Calculating Solar PV System. (690.7 - 690.9)

- All equipment datasheets must be present for plan check.
- Calculate max. voltage for PV source and output circuit– 690.7
- Temp correction factor of 1.12 for CSJ applied to module Voc
- PV system max. 600 volts for one- and two-family dwelling.

Note: Voltage is additive in series.

- Voltage after correction factor not to exceed max. input voltage of inverter, micro-inverter or DC-to-DC converter.
- Calculate max. current and min. PV circuit size–690.8
- Adjustment factor of 1.56 applied to module Isc for PV source circuit sizing (conductors from module to mirco-inverter or DC-to-DC converter).
- Applying a 125% to the inverter max. continuous output current for minimum conductor sizing and OCPD.

Note: Current is additive in parallel.

Point of Interconnection. (705.11-13)

- Supply-side connection. 705.11
  - Permitted PV connection = sum of all output current ≤ service conductor ampacity.
  - Conductor min. 6 AWG Cu./8 AWG Al. or output current at 125%, whichever larger.
  - Altering or modifying service equipment may void listing requiring field evaluation from approved 3rd Party field evaluating body.
  - Grounded conductor and main bonding jumper required at first disconnect. 250.24 & 250.25
- Load side connection. 705.12
  - 100% Option. CEC 705.12(B)(3)(1)
    - Busbar Rating ≥ (1.25 x PV Output Current) + Busbar OCPD
  - 120% Option. CEC 705.12(B)(3)(2)
    - (120% x Busbar Rating) ≥ (125% x PV Output Current) + Busbar OCPD

- Loads must be located at the at interconnection.
- Label at breaker stating the following:

WARNING:
POWER SOURCE OUTPUT CONNECTION —
DO NOT RELOCATE THIS OVERCURRENT DEVICE.

- Breaker Sum Option. CEC 705.12(B)(3)(3)
  - Busbar Rating ≥ OCPD 1 + OCPD 2 + OCPD 3...
  - Label at breaker stating the following:

WARNING:
THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE SHALL NOT EXCEED AMPACITY OF BUSBAR.

- Center-fed Panel Option. CEC 705.12(B)(3)(4)
  - (120% x Busbar Rating) ≥ (125% x PV Output Current) + Busbar OCPD
  - Permitted at either end.

- Power Control Systems. 705.13
  - Must be listed and evaluated to control output current to conductor or busbar ampacity.
  - OCPD for PV system ≤ interconnected busbar or conductor.
  - Access to setting restricted to qualified personnel. See 240.6(C).

Environmentally Durable Labeling and Marking.

- Service equipment plaque with site diagram denoting each power source disconnect location and the following:

CAUTION: MULTIPLE SOURCES OF POWER

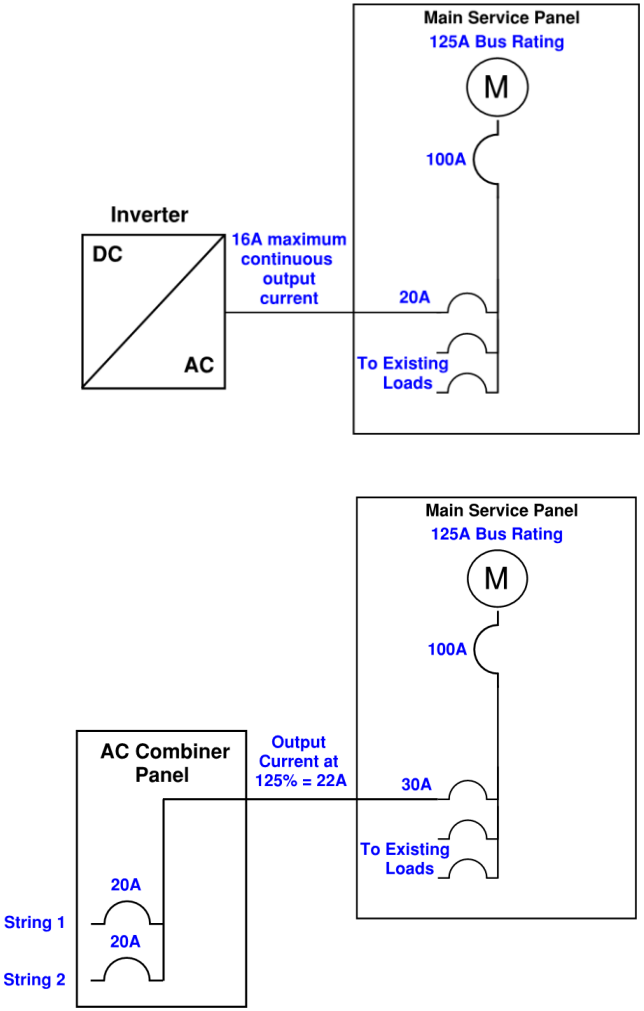
- Conduit with DC circuits:

PHOTOVOLTAIC POWER SOURCE
Or, SOLAR PV DC CIRCUIT

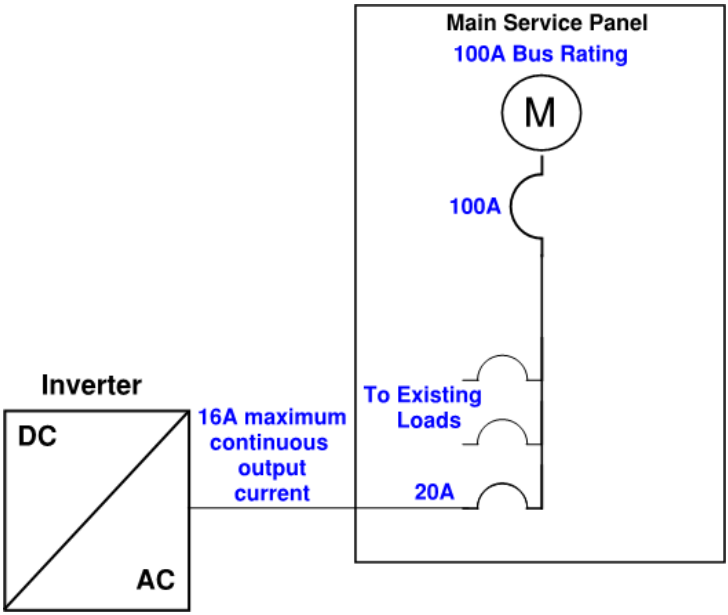
- PV system disconnect marked “PV SYSTEM DISCONNECT” and include the following:

WARNING ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

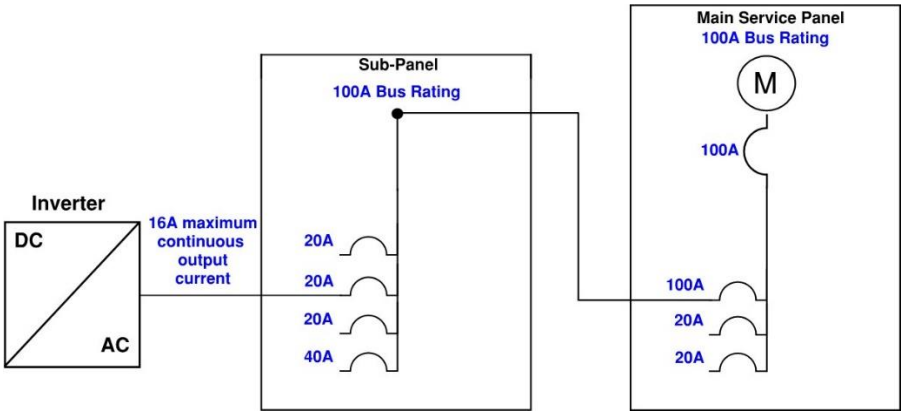
100% Option. CEC 705.12(B)(2)(3)(a) Example



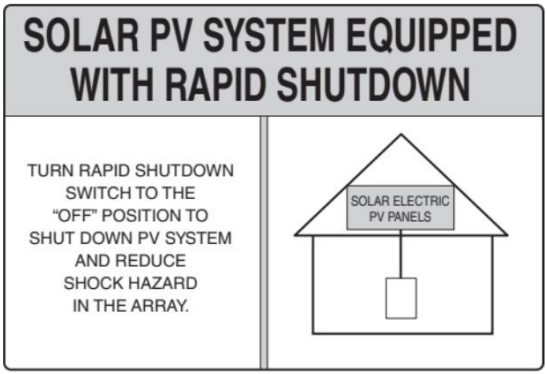
120% Option. CEC 705.12(B)(2)(3)(b) Example



Breaker Sum Option. CEC 705.12(B)(2)(3)(c) Example



- Service equipment shall indicate location of rapid shutdown initiation device and the following label:



Installation Requirements. 690 Part I, III, & IV

- PV equipment shall be listed and equipped with arc-fault and ground-fault detection. 690.4(B), 690.11, & 690.41(B)
- Listed rapid shutdown devices installed at array boundary. 690.12
- Disconnecting Means. 690.13
  - Installed in readily accessible location.
  - Enclosure must be locked or require tool to open if accessible to unqualified persons.
  - No more than 6 disconnects in enclosure or 6 disconnects in separate enclosures grouped together.
- Wiring Methods. 690.31
  - PV DC circuits not permitted in same raceway or enclosure with inverter output circuits and non-PV circuits without a barrier or partition. 690.31(B)
    - Okay in pull can, wireway, or gutter when installed inside a mechanically continuous nonmetallic raceway.
  - PV circuits routed inside building must be installed in metal raceway, MC cable or metal enclosures unless part of listed PV hazard control system. 690.31(D)
- Modules, array, and racking system must be connected to an equipment grounding conductor which is connected to the grounding electrode system. 690.42

- Roof Access and Pathways. CRC R324.6 & SJFD
  - Not permitted in portion of roof below emergency escape and rescue opening. 3’ clearance required unless building-integrated PV.
  - Roof access and pathways not req’d for uninhabitable such as detached garage or accessory structured.
  - Two pathways, on separate roof planes from lowest edge to ridge, min. 36”.
  - One pathway on street/driveway side, min. 36”.
  - Min. 18” at ridge for arrays not occupying up to 33% of total roof area. Min. 36” when more than 33%.
    - Exception: When sprinklers are installed, 18” at ridge okay up to 66% of total roof area.