

# **Mendocino County Residential Construction Manual**



**2012 Edition**

# RESIDENTIAL CONSTRUCTION IN MENDOCINO COUNTY

## INTRODUCTION

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### **A Building and Development Handbook for Conventional Residential Construction in the County of Mendocino** (First Edition)

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CODE DEVELOPMENT IS AN EVOLUTIONARY PROCESS. BUILDING CODES AND OTHER LAWS AND ORDINANCES REGULATING CONSTRUCTION ARE CONTINUOUSLY REVISED AND UPDATED AT THE LOCAL, STATE, AND FEDERAL LEVELS.

As a result of the process, the Planning and Building Services Department cannot guarantee that the material presented herein will be accurate and applicable to future construction projects. **Information provided is intended to be informative and beneficial and shall be used at the permittee's risk.** Department staff should be consulted if questions arise.

## **THE DEPARTMENT PERFORMS THE FOLLOWING SERVICES:**

- Regulates model construction codes and a variety of State regulations including: energy, conservation, disabled access, sound attenuation, historical building code, fault zone and geotechnical reports, and flood plain management provisions.
- Evaluates and processes applications for development projects involving plan amendments, zone changes, subdivisions, use permits, zoning permits and recognition of older, historic subdivisions and parcelizations.
- Reviews plans and related documents, issues permits, and provides construction inspection services in the unincorporated area of the County of Mendocino and for County-owned buildings within the incorporated cities.
- Provides environmental review.
- Evaluates all public agency and private projects for consistency with the adopted General Plan and ensures compliance with State law regarding housing, noise, coastal protection, airport protection areas and surface mining and reclamation.
- Provides staff support for the Planning Commission, the Airport Land Use Commission, and numerous public committees which advised these commissions or the Board of Supervisors on various land use issues.
- Provides the services for the Mendocino County Abandoned Vehicle Abatement Program.
- Enforces the various provisions of the Zoning Ordinance and Subdivision Map Act.

## **Acknowledgments**

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## **SECTION 1- RESIDENTIAL BUILDING PERMITS**

The mission statement of the Planning & Building Services Department (PBS) is to effectively manage existing and future development by facilitating the availability of adequate services and facilities, advocating the wise use of our natural resources, promoting an awareness and consideration of cultural resources, and facilitating the protection and enhancement of the quality of life in Mendocino County. While recognizing it is not always possible to reconcile the often-diverse interests of our clients (private applicants, interested citizens, general public, decision-makers, other agencies) we will strive to:

1. Provide precise, up-to-date and innovative advice and technical expertise.
2. Be problem solvers seeking solutions to issues within the framework of the regulations.
3. Treat all members of the public, applicants, decision-makers and co-workers in a courteous, respectful and professional manner.
4. Improve and maintain effectiveness and efficiency by forging working relationships within, and external to the County organizations.
5. Develop and maintain a work environment that strives for excellence and exemplary customer service through teamwork, continuous training, career advancement, innovation, and a culture that encourages creative change.

This Residential Construction Handbook was compiled to assist the public in the permitting process and provide as much technical information as possible in one reference manual. The Planning & Building Services Department has worked diligently on the Residential Construction Handbook striving to maintain the goals set forth in our mission statement. We believe that the Residential Construction Handbook provides the public with valuable information and assistance. This edition is published to incorporate the 2010 California Building Codes.

### **PERMITS REQUIRED:**

1. **Building Permit:** Unless otherwise exempt (see Work Exempt from Building Permits below), a building permit is required to construct, alter, enlarge, repair, move, improve, convert or demolish a building or structure. In addition to a building permit, plumbing, mechanical and electrical permits may also be required. Call (707) 463-4281 for building permit related questions.
2. **Grading Permit and Drainage Review:** A grading permit and drainage review may be required depending upon the location of the project and scope of work. Grading and drainage plans which depict original grade contours, finished grade contours and drainage configuration and devices must be submitted for a grading permit. See Section 5 for more detailed information. Call (707) 463-4281 for grading permit and drainage review questions.
3. **Site Evaluation:** A site evaluation may be conducted by PBS staff prior to building or grading plan review to determine site conditions that could affect a proposed new building, additions to buildings and grading. Site conditions that may require further review and/or affect the design of the proposed building or grading project include, but are not limited to, flood zones, steep slopes, slides, soft, liquefiable, or expansive soils, overhead power lines, wind exposure, seismic design categories, and areas of poor drainage. After the site evaluation is conducted, PBS will determine whether additional reports or studies are required. Applications for site evaluations may be submitted prior to finalizing the design of the proposed building or grading plan. A complete site plan is required for all site evaluation applications. The building site location must be staked and the site address must be posted



or displayed at the road, visible from both directions. Application fees are paid at the time of application or when the building or grading plans are submitted. Additional fees may be charged if the inspector is unable to locate the site or staked area of the project. Call (707) 463-4281 for questions related to site evaluations.

4. **Temporary Electric, Gas and Occupancy:** With inspector approval, temporary electric for construction purposes and temporary electric meter or gas is allowed when a building permit is issued with temporary power. A separate permit is not required, unless the building permit was issued without temporary power. A special inspection fee is required to obtain a temporary occupancy inspection and approval prior to final.
5. **Septic Permit:** If public sewer is not available for the property proposed for development, the installation of a private sewage disposal system (septic system) is required. Prior to septic permit application, a pre-perc evaluation, soils test, and percolation test must be performed by a septic consultant and confirmed by Environmental Health Well and Septic staff. In addition, a groundwater determination (a test conducted during the rainy season at a specific time period) may be required. If these tests are approved, a septic permit application can be submitted to Environmental Health.

Other than minor repairs, such as replacement of roofing or siding, a septic clearance is required for alteration or modification of any structure connected to a septic system. Contact the Environmental Health Well & Septic Section staff at (707) 463-4466 to discuss septic requirements prior to building plan preparation and prior to commencing any work, or any other septic related questions.

6. **Well Permit:** Well permits are required to drill, abandon, or deepen wells and can only be issued to C-57 Well Drilling Contractors. Call (707) 463-4466 for well permit questions
7. **Sewer Permit:** A sanitary sewer inspection permit is required for any sewer work performed, including but not limited to, connection to a house, a commercial building, or apartments. The work must be inspected and approved before occupancy, and/or use of the sewer is allowed. Call your local sewer district for sewer permit related questions.
8. **Planning Permit:** Planning permits such as use permits, variances and coastal permits may be required prior to the issuance of a building permit. Zoning clearances are required for building permits issued for new buildings, structures, or additions to existing buildings or structures. There may be additional setback requirements for a building depending upon the location near a roadway or waterway. Contact a planner at the PBS Office to discuss zoning regulations prior to preparing building plans or call (707) 463-4281 and ask to speak with a planner for planning permit related questions and zoning information.
9. **Encroachment Permit:** Work within the County maintained road or right-of-way, such as upgrading or paving a driveway, installing utilities, drainage, landscaping and mailbox structures, requires an encroachment permit. Call (707) 463-4363 for encroachment permit related questions.
10. **Agricultural Building Permit Exemption:** A request for an agricultural building permit exemption may be submitted to PBS for a building designed and constructed for the use of housing, horses, goats, cattle, sheep, poultry, hay or feed. Call (707) 463- 4281 for questions regarding the permitting process.
11. **Pond exemption:** An exemption from the grading permit to construct a Mendocino County jurisdictional pond.
12. **Flood Elevation Certificate:** The habitable finished floor level of a new or substantially improved residence, which is located within the limits of a 100 year flood zone, must be located at least one foot above the determined Base Flood Elevation (B.F.E. - 100 year flood level). A Flood Elevation Certificate is required and the finished floor elevations must be

verified by PBS inspection staff. Call (707) 463- 4281 for questions related to flood elevation certificates. A Residential Construction Guidelines and Limitations handout is available from FEMA (Federal Emergency Management Agency).

13. **Demolition Permit:** A demolition permit is required to demolish a building or structure. The demolition permit will specify the type and size of building which is necessary to receive potential credit for some development fees. In addition, there are asbestos notification requirements for the Air Quality Management District (AQMD) that must be met prior to issuance of a demolition permit. Notification forms are available at PBS or Mendocino County Air Pollution District at (707) 463-4354. If the structure is connected to a septic system, the septic tank may need to be properly destroyed under a separate permit. Call (707) 463-4281 with demolition permit related questions.

### **WORK EXEMPT FROM BUILDING PERMITS:**

The following is a list of work that may be performed without a building permit. If your project does not appear on this list of exempt work, you should assume that a building permit is required.

**Note:** Although some work is exempt from a building permit, additional permits or review may be required. Before a building or structure is erected, constructed, enlarged, altered, repaired, moved, improved, removed, converted or demolished, it is important to contact the appropriate staff at the Planning & Building Services Department (PBS) to determine if any other permit or technical review is required.

Although work may be exempt from a building permit, it may be subject to other county regulations (Well and Septic, Zoning, Drainage, Sewer, etc.). Although a building permit is not required, the exempt construction/work must be code compliant. For example, re-striping a commercial parking lot is exempt from a building permit; however, the striping must conform to building code standards for accessibility and Zoning standards for parking lot design. Failure to comply with code requirements may constitute a violation.

### **BUILDING:**

#### **1 Accessory Structures:**

One-story detached accessory structures used as tool or storage sheds, playhouses or similar uses when located on a parcel which contains an existing single family dwelling or other permitted primary use or structure. Such structures shall not have a floor area that exceeds 120 square feet and the height above grade shall not exceed 12 feet.

**Note:** Electrical, plumbing, or mechanical work in connection with such structures requires an electrical, plumbing or mechanical permit even though a building permit is not required for the structure itself.

#### **2. Fences:**

Fences six (6) feet or less in height do not require a building permit

**Note:** While some fences may be exempt from a building permit, they are limited to (31/2) three and one half feet in height within the front yard setback if view obscuring.

#### **3. Retaining Walls:**

Retaining walls, which retain not more than 3 feet of material unless supporting a surcharge or impounding class I, II, II IA liquids. For the purpose of this section, a retaining wall is considered to be supporting a surcharge if:

- a. The wall retains more than one foot of material and the retained material slopes more than two units horizontal to one vertical within a distance equal to twice the height of the wall

above the lowest existing grade.

- b. The wall retains more than one foot of material and any road or structure is located on the retaining material within a distance equal to twice the height of the wall above the lowest existing grade

**4. Water tanks:**

That are supported directly upon grade if the capacity does not exceed 5,000 gallons and the ratio of height to diameter or width does not exceed 2 to 1.

**5. Sidewalks and Driveways.**

Not more than 30 inches above grade, and not over any basement or story below and not part of an accessible route.

**6. Interior Finish Work:**

Painting, interior papering, carpeting, cabinets, tiling and similar finish work.

**7. Prefabricated Swimming Pools:**

Pools that are less than 24 inches deep.

**8. Swings and other playground equipment:**

When associated with a Single family residence.

**9. Window Awnings:**

When supported by an exterior wall which do not project more than 54 inches from the exterior wall and do not require additional support.

**10. Decks:**

Not exceeding 200 square feet in area, not more than thirty (30) inches above grade (measured to the lowest adjacent grade within 3 feet from the edge of the walking surface), not attached to a dwelling unit, not serving the required exit door, and not over any basement or story below.

**11. Temporary:**

Motion picture, television and theater stage sets and scenery.

**12. Oil Derricks.**

**13. Non-fixed and movable:**

Fixtures, cases, racks, counters and partitions not over 5 feet 9 inches in height.

**ELECTRICAL:**

1. Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.
2. Electrical equipment used for radio and television transmissions.
3. Installation of temporary systems required for the testing or servicing of electrical equipment or apparatus.
4. Listed cord and plug connected temporary decorative lighting.
5. Reinstallation or replacement of attachment plug receptacles, but not the outlets.
6. Repair or replacement of branch circuits or overcurrent devices of the required capacity in the same location.

7. Installation or maintenance of communications wiring, devices, appliances, apparatus or equipment.

#### **GAS:**

1. Portable heating appliances and the replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

#### **MECHANICAL:**

1. Portable heating appliances, portable ventilation equipment, portable cooling units, and portable evaporative coolers.
2. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code. Self-contained refrigeration system containing 10 pounds or less of refrigerant and actuated by motors of 1 horsepower or less.
3. The replacement of any part that does not alter the equipment's approval or make it unsafe.

#### **PLUMBING:**

1. The stopping of leaks in drains, water, soil, waste or vent piping. However, if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, a permit shall be obtained and inspections made.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

#### **THE PERMIT APPLICATION PROCESS:**

Building permits for a new house, addition/remodel to an existing house, a new garage or other new residential accessory building(s) are issued by PBS for any property located within the unincorporated areas of Mendocino County including the City of Ft. Bragg and Pt. Arena. If the property is located within the City of Ukiah or Willits, the appropriate city building or planning department should be contacted for assistance. Ukiah – (707) 463-6200 and Willits – (707) 459-4601.

Building permits may be issued to the owner of the property, a California licensed contractor, architect or engineer, or agent of the property owner who has a signed letter of authorization from the property owner. Building permits for minor work, such as a re-roof, new water heater, electric upgrade or other work that does not involve any structural modification, can be issued over the counter. For building contractors, these permits are also available online. Building permits for new additions, extensive remodeling and new buildings require construction plans and plan review. This manual provides information to help guide applicants through the building permit process for those projects that require construction plans.

The building permit process involves a number of steps that are required to ensure compliance with a variety of development regulations. Some regulations may significantly impact the design, location or feasibility of a new building, or addition/remodel of an existing building. Therefore, it is very important to understand the applicable regulations in advance of designing building plans.

1. **Gather information before designing building plans.** Bring the Assessor's Parcel Number (APN) or street address to PBS and consult with staff in advance of designing building plans.
  - a. **Zoning.** A planner will identify the zoning of the property and explain the applicable zoning regulations such as required setbacks from property lines, building envelopes, building height, parking standards and if a zoning permit or other review is required.

- b. **Building.** A building inspector or building plans examiner will answer questions about building codes, building plan requirements, and determine if a site evaluation is required. (See Site Evaluation below).
- c. **Public Sewer and Road Encroachment.** If the property is served by a public sewer system, (not a private septic system) you must visit the sewer district for connection approvals. A utility certificate is issued by the applicable city and must be submitted prior to the issuance of a building permit. The applicant will also be advised of the amount of sewer fees that must be paid prior to the issuance of a building permit. If the project requires the creation of a new or alteration to an old road encroachment you must contact either the State or County Department of Transportation. State Cal Trans 707-445-6600 or Mendocino County 707-463-4363.

**Well and Septic.** If the property is served by a private sewage disposal system (septic system), a registered environmental health specialist will explain the septic regulations that will affect the design, location and feasibility of your project.

Depending upon the scope of work, an addition/remodel to an existing residential structure may significantly impact the septic system. Therefore, upgrades to residential structures may require varying levels of upgrade to the septic system. In many cases, the extent of remodeling may be limited by the classification of the existing septic system.

**Pre-Application Conference.** A Pre-Application Conference is available to assist customers with both minor and more complex building projects, whether commercial or residential. This process allows for a preliminary review of the proposed project by PBS and other relevant County Department staff in a meeting format with the applicant and the applicant's representative(s). The applicant is able to ask questions of staff and receive information early on with respect to a project. Participation in a Pre-application Conference can significantly streamline the permitting process. Call (707) 463-4281 for more information.

- 2. **Consider applying for a building site evaluation prior to finalizing the design of the proposed new building or addition to an existing building.** A building site evaluation is required for all new buildings and additions to existing buildings. To minimize delays, it is often better to complete the site evaluation process before submitting building plans. The purpose of the building site evaluation is to determine if there are site conditions that need further review. These site conditions include, but are not limited to, flood zones, steep slopes, slides, soft or expansive soils, overhead power lines, wind exposure, seismic design categories and areas of poor drainage. The review is conducted by a PBS building inspector in advance of the building plan review process. An application for a building site evaluation is not required to be submitted in advance of submitting building plans; however, depending upon the scope of work and location of the building, it may be important to review the results of the site evaluation before designing the building or addition.

It is very important to follow the procedures for a building site evaluation. The building inspector must be able to locate the property and the area on the property where the new building or addition to existing building will be constructed. Therefore, the address must be posted at the road, visible from both directions, at any forks in the road and at the site. The area of proposed new construction must be staked out. If the building inspector cannot locate the property and the area of new construction, an additional fee will be charged for the inspector to re-visit the property and the building project may be delayed. After the site evaluation is completed, the building inspector will determine whether additional reports or studies are required (i.e., a soils investigation) and the applicant will be notified of the results in writing. The building site evaluation is valid for one year.

- 3. **Prepare the site and building plans for the proposed building or addition.** It may not be necessary to hire a professional to design and draw building plans. However, the plan preparer

shall be familiar with building codes, county regulations, and the preparation of house plans. Ask for a checklist of required items to be included in the proposed building plans and construction documents. Plans must be prepared to an architectural standard and be drawn to a common, commercially available scale (i.e. 1/4"=1'). The Building Plans Examiner may require that a licensed professional be obtained to assist in the preparation of building plans and construction documents.

4. **Submit the application for a building permit.** Applications for building permits that require plans are accepted Monday through Friday from 8:00 am to 4:30 pm. The application package must be complete or it will not be accepted. The following materials must be included:
  - a. The completed building permit application signed by either the property owner of record, a licensed building contractor or other licensed professional. PBS staff will verify that a contractor has a valid license and proof of insurance prior to issuing a building permit to a contractor. Other individuals may submit the application on behalf of the property owner if a letter of authorization signed by the property owner is attached.
  - b. **Three (3)** Complete sets of building plans that must include the following:
    - Site plan (NOTE: Must include contours)
    - Floor plan (electrical, plumbing and mechanical)
    - Foundation plan (footing details)
    - Elevations
    - Framing plan
    - Cross sections
    - Structural details
    - Signature of plan preparer (sheets prepared by licensed Architect or Engineer shall include the applicable stamp and signature.)**Two (2)** sets of the following:
    - Title 24 energy calculations (signed)
    - Engineering calculations (if engineered) (signed and stamped)
    - Geotechnical report (if required) (signed and stamped)
    - CalGreen residential checklist (if required)
  - c. Other items that may be required:
    - Geotechnical foundation approval letter
    - Truss calculations and layout (2 signed, stamped sets)
    - Flood elevation certificate
    - Letter of authorization
    - Installation Manuals (2 sets for manufactured homes)
    - Special inspection form
5. **Site evaluation and plan review.** Unless a building site evaluation was completed in advance of submitting building plans, (See number 2 above), a PBS building inspector will conduct a site evaluation of the property within approximately 15 days. After the building site evaluation has been completed, a PBS building plans examiner will begin the building plan review

process. During the course of the building plan review, the applicant will be advised in writing of any necessary corrections or “redlines” that need to be made. It is the responsibility of the applicant, or the design professional, to respond adequately to any notice of corrections so that the building plan review process is not delayed. After the building plan review process, the plans will be routed back to a permit technician and the applicant will be contacted in regard to issuing the building permit.

**NOTE:** A building permit application package is valid for one (1) year. If the building permit is not issued within that one year time period, the permit application will expire. An extension of 90 days may be obtained with a written request showing justifiable cause why the application can not be approved and submitted to the building official prior to the application expiring. The building official may approve one or more extensions.

6. **Issuance of the building permit.** After building plan review, a permit technician will review the application and building plans to verify that all required PBS approvals have been issued (e.g. Well & Septic, Zoning, etc.). If there are any outstanding approvals, the permit technician will work with the applicant and PBS staff to facilitate the issuance of those approvals. A permit technician will contact the applicant by telephone to inform the applicant that the building permit is ready to be issued, or what approvals are still required to get the building permit issued. The applicant will also be reminded to bring the verification of payment of school fees. When the applicant returns to PBS for the building permit, an invoice will be given listing each of the required building permit and development fees left to be paid and directed to the cashier for payment. Permit fees may be paid by check or credit card. After payment of fees, the applicant will be given one set of building plans to be kept at the job site for use by the PBS building inspector, a field inspection record card and instructions detailing PBS’s automated inspection system.
7. **Complete the work in stages and call for inspections.** All work must be inspected by PBS throughout the course of construction. The responsible party must be sure to call for an inspection before concealing any work, (e. g., call for inspection prior to pouring concrete for the foundation.) If the building inspector identifies work that needs to be corrected, a “correction notice” detailing the corrections that need to be done will be issued. After the corrections are made, an inspection shall be completed so that the corrected work can be verified. Building permits are valid for one (1) year from the date of issuance. If the work is not started and an inspection sign-off or an extension granted by the building official the permit will expire. To renew action on the permit a reinstatement fee established by the department will have to be paid. For extension request, call the department for information regarding the process.



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790 SOUTH FRANKLIN · FORT BRAGG, CA 95437  
PHONE (707) 964-5379

APPLICATION NUMBER _____		ACCEPTED BY _____		DATE _____	
<b>TO BE COMPLETED BY APPLICANT</b>					
PROJECT STREET ADDRESS:		ASSESSOR'S PARCEL NUMBER:		PARCEL SIZE: _____ ACQ. FT.	
CITY:	STATE:	ZIP CODE:	UNDER 1 ACRE: <input type="checkbox"/> YES <input type="checkbox"/> NO		
OWNER'S NAME:			CHECK APPROPRIATE BOXES:		
MAILING ADDRESS:			<input type="checkbox"/> NEW <input type="checkbox"/> ADDITION <input type="checkbox"/> ALTERATION/REPAIR <input type="checkbox"/> DEMOLISH <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> SINGLE FAMILY <input type="checkbox"/> MIXED <input type="checkbox"/> MULTIFAMILY <input type="checkbox"/> ACCESSORY BUILDING <input type="checkbox"/> CLASS X <input type="checkbox"/> GRADING <input type="checkbox"/> MOBILE HOME <input type="checkbox"/> INFILTRATION <input type="checkbox"/> OCCUPANCY CHANGE <input type="checkbox"/> AG EXCEPT OTHER _____ (Please Specify)		
TELEPHONE NUMBER:			IF MOBILE HOME, STATE: _____ YEAR _____		
CONTRACTOR'S NAME:			MADE: _____		
MAILING ADDRESS:			SIZE (LENGTH x WIDTH): _____		
CITY:	STATE:	ZIP CODE:	SQUARE FOOTAGE: _____		
TELEPHONE NUMBER:			NUMBER OF STRUCTURES ON 1 LOT: _____		
LICENSE NUMBER:			TYPE OF LICENSE: _____		
DESIGNER'S NAME:			ALL INFORMATION MUST BE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT I HAVE 6 MONTHS FROM THE DATE OF SUBMISSION TO OBTAIN A BUILDING PERMIT. AFTER 6 MONTHS THE APPLICATION WILL BE CANCELLED AND THE APPLICANT WILL BE RESPONSIBLE FOR PAYING ANY PLANCHER FEE. PLANS LEFT WITH THE BUILDING DEPARTMENT IN EXCESS OF 1 YEAR ARE DESTROYED.		
MAILING ADDRESS:			SIGNATURE: _____		
CITY:	STATE:	ZIP CODE:	DATE: _____		
TELEPHONE NUMBER:			LIST ADJACENT PROPERTIES OR PROJECTS UNDER YOUR OWNERSHIP:		
CONTRACT 1:			THE INFORMATION PROVIDED ABOVE IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT I HAVE 6 MONTHS FROM THE DATE OF SUBMISSION TO OBTAIN A BUILDING PERMIT. AFTER 6 MONTHS THE APPLICATION WILL BE CANCELLED AND THE APPLICANT WILL BE RESPONSIBLE FOR PAYING ANY PLANCHER FEE. PLANS LEFT WITH THE BUILDING DEPARTMENT IN EXCESS OF 1 YEAR ARE DESTROYED.		
MAILING ADDRESS:			PLANCHER FEE PAGE 1: _____ PLANCHER # _____		
CITY:	STATE:	ZIP CODE:	OTHER INFORMATION: SUBMITTAL NO. _____ SUBMITTAL AREA NO. _____ APPROVED OFFICE: _____ FEE CONTACT: _____ APPROX. DEDUCT: _____		
TELEPHONE NUMBER:			FOR OFFICE USE ONLY CITY: _____ STATE: _____ ZIP CODE: _____ DATE: _____		

## **BUILDING CODES & ORDINANCES:**

The following codes shall be used in the preparation of construction documents:

- **CALIFORNIA BUILDING CODE, 2010** edition, as modified from the “2009 International Building Code”
- **CALIFORNIA RESIDENTIAL CODE, 2010** edition, as modified from the “2009 International Residential Code”
- **CALIFORNIA GREEN BUILDING STANDARDS CODE, 2010** edition  
**CALIFORNIA RESIDENTIAL ENERGY STANDARDS, 2008** edition
- **CALIFORNIA PLUMBING CODE, 2010** edition, as modified from the “2009 Uniform Plumbing Code”
- **CALIFORNIA MECHANICAL CODE, 2010** edition, as modified from the “2009 Uniform Mechanical Code”
- **CALIFORNIA ELECTRICAL CODE, 2010** edition, as modified from the “2008 National Electrical Code”
- **CALIFORNIA FIRE CODE, 2010** edition; 2009 International Fire Code
- **STATE OF CALIFORNIA TITLES 24 AND 25**

There are five major sets of national standards designed to safeguard health and safety in every building. They are the CALIFORNIA BUILDING CODE, CALIFORNIA MECHANICAL CODE, CALIFORNIA PLUMBING CODE, CALIFORNIA ELECTRICAL CODE and the UNIFORM HOUSING CODE. Also, the State of California has adopted energy regulations which will affect the design of a building.

It may be worthwhile to research the codes in a library. These codes are used by plan examiners to approve building plans and by building inspectors to approve construction methods. PBS staff is available to answer code questions in the office and in the field.

The **CALIFORNIA BUILDING AND RESIDENTIAL CODES**: Prescribe minimum health and safety requirements for the construction of dwellings. These include the design and construction of foundations, floor systems, walls and roofs, including minimum sizes for rafters, joists, lintels, headers and stud wall framing.

The **CALIFORNIA MECHANICAL CODE**: Consists of a series of rules of safe practice involving heating systems, ventilating systems, cooling systems, combustion air requirements, and venting of appliances. The safeguards provide protection against fire hazard and air contamination.

The **CALIFORNIA PLUMBING CODE**: Provides safety by means of safeguarding the potable water system within the building and insuring a safe means of collection and disposal of waste waters and sewage. This is accomplished by means of proper installation, adequate sizing, backflow prevention, air gaps, drain gaps, sanitary fixtures, and by traps, indirect wastes, and venting. This code also provides the regulations that govern the installation, sizing, and placement for gas piping serving residential appliances.

The **CALIFORNIA ELECTRICAL CODE**. Deals with safe electrical installations encompassing those items pertaining to safe workmanship standards and practices, isolation of live parts and conductors, insulation of conductors, circuit protection, and grounding. A safe installation will provide life safety by minimizing fire and shock hazards.

**Equivalency Performance.** All of the model codes are both prescriptive and performance codes that make provisions for alternate materials and methods of construction.

**Volume 2 of the CALIFORNIA BUILDING CODE** makes provisions for the use of alternate materials and methods of construction through engineering analysis and design which substantiate compliance with vertical and lateral (wind and earthquake) loads occurring within the appropriate geographical area.

The other model codes have similar provisions to allow the use of alternate materials and methods of construction by utilizing tests and/or engineering analysis to substantiate equivalency based on safety, durability, effectiveness, strength, sanitation and quality.

The Codes allow the designer latitude in selecting construction methods, structural systems, materials of construction, physical layouts and unusual shapes provided that they can demonstrate that the material, method, or work offered is equivalent to that prescribed in the code in quality, strength effectiveness, fire resistance, durability, and safety. This makes the CALIFORNIA BUILDING CODE a performance code.

The Codes also provide specification standards that are historically known to satisfy the code requirements. The standard or conventional residential construction methods are, for the most part, covered in this handbook by details demonstrating acceptable code conforming practices.

The following safety items will serve to describe some of the requirements of the codes.

## **BUILDING CODE DESIGN REQUIREMENTS:**

**WIND LOADS.** (Chapter 16 2010 CALIFORNIA BUILDING CODE). Wind pressure varies for different geographical locations. Code requirements have been developed utilizing tabulated weather data. Wind forces which act on structures are considered to move laterally in a horizontal plane. This level movement creates “pushing forces” on the windward side of upright or inclined surfaces, as well as causing “suction forces” on the leeward side. Horizontal surfaces can have “suction” or “uplift forces” as a result of horizontal wind action.

Most of Mendocino County is considered to be Wind exposure “C”, 85 mph. Some protected sites might be exposure “B”, 85 mph, and ocean frontage would be exposure “D”, 85 mph.

**SEISMIC LOADS.** For Mendocino County, the earthquake lateral force requirements for buildings is derived from the CALIFORNIA BUILDING CODE. This uses the weight of the building along with coefficients which take into account the strength of the building, its vibrational characteristics, as well as the soil effect.

Mendocino County is within Seismic Design Categories D and E as determined by Chapter 16 of the California Building Code and D<sub>1</sub>, D<sub>2</sub>, and E as determined by Section R301 of the California Residential Code.

**APPLICATION OF WIND AND EARTHQUAKE FORCES.** Wind and earthquake forces are applied independent of each other. They are applied parallel to two major perpendicular axis of the building, one axis at a time.

**FOUNDATION LOADS AND SOIL PRESSURES.** Foundations serve to support the total load of building and structures. Table 1806.2 of the CALIFORNIA BUILDING CODE provides for classification of soils. Identification of soil type must be by a soils engineer if bearing capacity values greater than 1,500 pounds per square foot are used (Mendocino County assumes Class 5 soil). Sizing of foundations should distribute loads to minimize differential settlement. Caisson (piles) should not be mixed with spread footings or continuous footings due to settlement considerations.

**RETAINING WALLS.** A retaining wall must hold back the soil mass and any surcharge on it. For a level backfill without any surcharge, the assumed lateral soil loads shall be a minimum of 60 pounds per square foot per foot of depth for active pressure and 100 pounds per square foot per foot of depth for at-rest pressure or shall be taken from a geotechnical report. Retaining walls need to be well drained (unless designed for the buoyant weight of soil plus hydrostatic loads) and backfilled with non-expansive, inorganic soils.

## **REQUIRED APPLICATION DOCUMENTS:**

**DRAWINGS, CALCULATIONS, SPECIFICATIONS.** Plans and specifications shall be drawn to scale upon sheets of uniform size, 24" x 36" minimum. Plans and supporting documentation should adequately define the location, nature, and extent of all work proposed, and demonstrate compliance to current codes and regulations. The use of a scale of  $\frac{1}{4}''=1'$  is encouraged.

Three (3) sets of drawings must be submitted to the Planning & Building Services Department. These sets must also include two (2) copies of Title 24 Energy Calculations, two (2) copies of the CalGreen Checklist, two (2) copies of structural calculations, and two (2) copies of geotechnical reports, where applicable. Please note that most geotechnical reports require that the foundation design be reviewed and approved by the geotechnical engineer.

An unlicensed person is limited to the design of:

- a) Single-family dwellings of light woodframe conventional construction not more than two stories and a basement in height.
- b) Multiple dwellings containing no more than four dwelling units of conventional woodframe construction, not more than two stories and a basement in height. Not more than four dwelling units per lot.
- c) Garages or other structures appurtenant to dwellings of conventional woodframe construction not more than two stories and a basement in height.
- d) Agricultural and ranch buildings of conventional woodframe construction.

An unlicensed person may **not** design the following:

- a) Any non-conventional component that affects the safety of any building or its occupants, including but not limited to structural or seismic components.
- b) All commercial structures.
- c) Any building that the building official deems an undue risk to the public health, safety or welfare.

All structures designed by an architect or engineer must include plans with appropriate stamps and signatures, on all appropriate sheets and any structural calculations.

The following list of items should be considered at the earliest possible time to facilitate the design of your project:

1. Land use limitations - Zoning Section
2. Earthquake faults - Alquist/Priolo Zones
3. Geological hazards - Landslides, geo-soil report
4. Flood zones, waterways, creeks, etc.

**ENGINEERING CALCULATIONS.** Computations, stress diagrams, and other data sufficient to justify the design shown in the plans shall be provided (two originals) by the responsible licensed professional. Engineering calculations are required for light-frame residential construction of unusual shape, size or framing, or other structural irregularities listed in Section 19 of this manual (and Sections 2308.2, 2308.11, & 2308.12 of the California Building Code), and shall be designed to resist vertical loads as well as lateral loads from wind and earthquake.

**SITE PLAN.** The site plan must include all elements of the PBS Standard Site Plan. It is recommended that the owner and/or applicant meet with PBS staff and understand septic and zoning regulations before preparing a site plan. The site plan must include the location of proposed new construction and location of all existing structures; front side, and rear setback distances between

structures and between recorded easements, septic tank, leach field, expansion area, well location, creeks, ponds, streams and drainage ways. The site plan must be accurately drawn to scale, no smaller than 1 inch = 20' and include a North arrow. A vicinity map is also helpful for larger parcels.

**GRADING PLAN.** A topographic map, showing existing and proposed finish grades, is required. Five sets of grading plans must be submitted for grading permit applications. Culverts require a hydrology calculation.

**SITE DRAINAGE.** The site plan should reflect the existence of any slopes at (or proposed at) the building site, including existing and proposed drainage flow patterns. Natural water flow must be diverted away from the foundations. Surface water must enter and leave the property in the same manner before and after construction, unless carried to an approved storm drain.

**FLOOR PLAN.** Show (existing and proposed) location, size, dimensions, and use of all rooms, and location, size, and type of windows and doors. Show plumbing fixtures, electrical outlets, Title 24 compliant lighting controls, and heat source. (Recommended 1/4" scale).

**FOUNDATION PLAN AND DETAILS.** Provide adequate details to demonstrate type, location, extent and construction of foundation. Show all dimensions and spacing of footings, piers, stem-walls, posts, and girders. Provide size and spacing of anchor bolts, hold downs, etc. Specify type and size of mudsill. Use and identify stepped footings when bottom of footing slope will be steeper than one vertical to ten horizontal. Provide and accurately cross-reference details and elevation views showing steps, offsets, dimensions, reinforcement sizes, clearances, placement, and lap splices. Locate and specify size of under-floor and access vents.

**FRAMING PLANS.** Provide plans for all floors and roof framing. Indicate size, material type, grade, and spacing of members. Clearly indicate member lengths and their supports and connections. Provide and cross reference section cuts and details to clarify construction and load paths. Framing may be placed on architectural floor plan and foundation plan only if it can be done adequately and without confusion.

**STRUCTURAL DETAILS.** Provide sufficient details to clearly indicate method of construction, attachment of framing members, nailing, specific notching conditions, bolt spacing and location, etc. When attaching new to existing construction, provide adequate information pertaining to the existing structure to justify new loadings and the load transfer into the foundation-soil interface. Submit pre-manufactured truss design and layout (with approval from the Engineer or Architect of Record, if applicable), and obtain approval prior to calling for underfloor or slab inspection. Specify all flood resistant materials.

**CROSS SECTION.** Show a minimum of two true cross sections of the building, at least one in each direction, indicating the structural elements and materials, size, and spacing of framing members, lateral and vertical force transfers, insulation, vertical dimensions, roof slope, underfloor clearances, flashings, etc. (<sup>3</sup>/<sub>8</sub>" scale, minimum). For houses in flood zones being raised indicate BFE (Base Flood Elevation) and the FFE (Finished Floor Elevation).

**ELEVATIONS.** Provide a minimum of four exterior building elevations, indicating materials, bracing, actual slope of ground, type of roofing, railings, foundation subdrains, and stepped footings. Show natural and finish grade <sup>1</sup>/<sub>4</sub>" scale is preferred.

**ENERGY CONSERVATION DOCUMENTATION.** (see Section 3 of this handbook.)

The following minimum information must be provided on all plans submitted for plancheck:

1. Heat source location, type, efficiency, and output capacity. (Must be capable of maintaining 68 degrees at three feet above the floor.)
2. Water heater type, location, fuel, and size.
3. Insulation location, type, and R-value.
4. Window and skylight type, location, and area.

5. Location and details for any other energy conservation feature such as vented attic spaces and thermal mass.
6. All “Mandatory Features” as required by the State Energy Regulations, including compliant lighting controls on incandescent fixtures.
7. A copy of the CF-1 R Form and MF-1 R Form, signed by the document author and building designer or building owner **shall** be **part of** the plans. Also provide two (2) sets of the **complete** Energy Report documentation.

**CALGREEN CHECKLIST.** For all new residential structures, provide a Green Building Checklist outlining all required mandatory and elective green building features in order to achieve compliance. Identified green building features must also be indicated on the affected sheets of the proposed plans.

**BRACED WALL PLAN.** Provide a braced wall plan showing location size and description of all braced wall panels including anchor bolt size and spacing, holdown locations, mechanical strapping, and sole plates in accordance with CBC 2308.3 and CRC R602.10.

**OTHER.** Other documentation may be required to clearly show the intent of the improvements or proposed development. As an example, when presenting remodel or addition plans, show features of the existing structures which adjoin, affect, or will be affected by the improvement.

**MISCELLANEOUS.** An inspection sign-off must be obtained every 180 days to ensure an active status on a permit. Requests for extension of time to start work due to inclement weather or other hardship should be made in writing addressed to the Building Official and should be made during the time the permit is valid and has not expired due to either no-start or abandonment. Progress inspections **can not** be utilized to avoid permit expiration. If construction cannot start within 1 year after the issuance of a permit, the permit will expire, and a reinstatement fee paid to renew action on the permit. If no work is to be done and the project abandoned, a request for a refund is allowed within 180 days from the date of issuance of the permit. All requests for refunds are processed by the Planning & Building Services Department and will be refunded by mail from the Auditor’s Office.

A temporary power pole for construction purposes may be installed with an issued building permit. Under certain conditions, a temporary gas and/or electric meter set may be approved.

A Temporary Occupancy Permit may be obtained before final inspection when all required PBS approvals have been issued and the building inspector determines that the structure can be occupied with no danger to life, limb, or public health.

**POST HOUSE NUMBERS, AND MARK JOB SITE WITH OWNER’S NAME.** Identification of the location or work (job site) is not only necessary to ensure delivery of materials, but also to ensure inspections. Further, a street address in conformance with the Fire Safe Regulations allows an effective emergency response in case of fire or accident.

**BUILDING INSPECTION PROCEDURES.** See Appendix page 1.3 for “Building Inspection Procedures” and Appendix page 1.5 for “Revisions to Building Permits”. Final inspections must be called for and approved before occupancy can be allowed.

## **SECTION 2- GENERAL REQUIREMENTS FOR SINGLE FAMILY DWELLINGS**

**GENERAL.** All residential construction in Mendocino County must meet the minimum requirements of the **2010 CALIFORNIA BUILDING CODE (2009 INTERNATIONAL BUILDING CODE** as amended by the state) or the **2010 CALIFORNIA RESIDENTIAL CODE (2009 INTERNATIONAL RESIDENTIAL CODE** as amended by the state).

- ENERGY COMPLIANCE.
- FIRE SAFE STANDARDS.
- STRUCTURAL COMPONENTS AND BUILDING FINISHES.
- PLUMBING AND SANITARY FACILITIES. Section  
MECHANICAL AND ELECTRICAL SYSTEMS. Section
- MISCELLANEOUS COMPONENTS.  
CONSTRUCTION IN FLOODZONES.
- CONVENTIONAL (NON-ENGINEERED) CONSTRUCTION.
- CALIFORNIA RESIDENTIAL CODE.

**CONVENTIONAL CONSTRUCTION.** All non-engineered structural systems shall be designed and built in compliance with CBC Chapter 23 Section 2308 - Conventional Light-Frame Construction, or CRC Chapters 3-9. When portions of a building of otherwise conventional construction exceed the limits of CBC Section 2308.2 or CRC Section R301, these portions and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of the CBC. The term "portions" shall mean parts of buildings containing volume and area such as a room or a series of rooms. Any structural system components that do not meet conventional construction criteria must be designed by an Architect or Engineer licensed in the State of California. The portions of the plans and the design calculations prepared by the architect or engineer must be stamped and signed in accordance with the provisions of the state business and professions code ("wet stamp and signature").

For a more in-depth discussion of what constitutes "Conventional Construction" see Sections 20 and 21 of this manual or CBC Chapter 23 Section 2308 or CRC Section R301.

### **MINIMUM REQUIREMENTS FOR HABITABLE SPACE:**

**ESCAPE OR RESCUE WINDOWS.** - Every sleeping room and any basement must have at least one openable window or door approved for emergency rescue with a minimum net clear opening of 5.7 square feet, except that windows at the grade floor shall have a minimum net opening of 5 square feet.

The minimum net clear opening height dimension shall be 24". The minimum net clear opening width dimension shall be 20". The bottom of the clear opening shall be no more than 44" from the floor.

**FIRE SPRINKLERS.** New single family dwellings must be provided with automatic fire sprinkler systems.

**SMOKE ALARMS.** Smoke alarms are required in all sleeping rooms and on the ceiling or wall outside of each separate sleeping room. When the dwelling unit has more than one story and in dwellings with basements, a smoke alarm shall be installed on each story and in the basement. Smoke alarms are also required to be installed when any alteration or repair exceeds \$1,000, and a permit is required. If the alteration is less than \$1,000, but a sleeping area is added or created, a smoke alarm is required.

**CARBON MONOXIDE ALARMS.** For new construction an approved carbon monoxide alarm shall be installed in dwelling units and in sleeping units within which fuel burning appliances are installed; and in dwelling units that have attached garages. Carbon Monoxide alarms are also required to be installed when any alteration or repair exceeds \$1,000, and a permit is required.



**LIGHT AND VENTILATION.** Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings or shall be provided with artificial light. Spaces intended for human occupancy are spaces designed for living, sleeping, eating or cooking. Bathrooms, closets, halls, storage and utility spaces are not included. Natural ventilation of an occupied space shall be through windows, doors, louvers, or other openings to the outdoors. Such openings shall be provided with ready access or shall otherwise be readily controllable by the building occupants.

The minimum net glazed area for natural light shall be not less than 8 percent of the floor area of the room served, or artificial light shall be provided that is adequate to provide an average illumination of 10 foot-candles over the area of the room at a height of 30 inches.

Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 foot-candle.

The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated.

Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated. Rooms containing a water closet shall have an exhaust fan with a minimum rating of 50 cfm.

**CEILING HEIGHTS AND FLOOR AREA .** Habitable rooms and corridors shall have a ceiling height of not less than 7' 6". Bathrooms, kitchens, storage rooms and laundry rooms shall have a ceiling height of not less than 7' measured to the lowest projection from the ceiling.

Habitable spaces other than kitchens shall not be less than 7 feet in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet between counter fronts and appliances or counter fronts and walls. At least one habitable room in the dwelling must have a floor area of at least 120 square feet. The minimum required floor area for a habitable room is 70 square feet, except that kitchens shall have not less than 50 square feet of gross floor area.

If any room in a building has a sloping ceiling, the prescribed ceiling height for the room is required in only one-half the area thereof. No portion of the room measuring less than 5' from the finished floor to the finished ceiling shall be included in any computation of the minimum area thereof.

If any room has a dropped or furred ceiling, the prescribed ceiling height is required in two-thirds the area thereof, but in no case shall the height of the furred ceiling be less than 7'.

**PLUMBING FIXTURES.** Each building shall be provided with sanitary facilities. In a single family dwelling a water closet, lavatory, and a bathtub or shower are required. There must be a kitchen equipped with a kitchen sink.

**HEATING.** Dwelling units shall be provided with heating facilities capable of maintaining a room temperature of 68 F at a point 3' above the floor in all habitable rooms.

**EXTERIOR WALL OPENINGS.** For group U and R-3 occupancies the exterior walls shall not be required to be fire-protected and the area of openings shall be unlimited if the distance from the exterior wall to a property line (or assumed property line between structures) is 5 feet or more. For group U and R-3 occupancies no openings are permitted from 0 to 3 feet from a property line. At a distance between 3 to 5 feet from a property line an exterior wall of a group U is permitted to have protected openings for up to 15% of the wall area, with group R-3 occupancies allowed a maximum of 25% total protected and unprotected openings of the wall area. Always verify with the planning department actual required property line setback requirements for the particular parcel to be built upon. For exterior wall fire-resistant construction requirements under the provisions of the CRC see Section 20 or this manual.

## **SECTION 3- RESIDENTIAL ENERGY STANDARDS**

### **(TITLE 24, PART 6, CALIF. ADMIN. CODE)**

All new buildings, additions and alterations to existing buildings in California must meet the Energy Efficiency Standards contained in Title 24, Part 6 of the California Code of Regulations. Alterations that do not increase both the floor area and volume of the building need only meet the minimum mandatory measures. Compelling reasons exist for more energy efficient buildings including increased comfort, lower utility bills, reduction of environmental damage, and contributing to the reduction of greenhouse gases.

To comply with the Title 24 California Administrative Code Residential Standards, a building must be shown to meet two basic requirements:

Installation of mandatory measures representing minimum conservation features and devices; and demonstration that the building's predicted annual energy use meets the designated energy budget for space heating and cooling and water heating. In order to comply with the budget, additional requirements above the minimum mandatory measures may be necessary.

### **WHERE TO GET HELP:**

Copies of the **2008 Residential Compliance Manual** are available as a free download at the California Energy Commission's (CEC) website:

[http://www.energy.ca.gov/title24/2008standards/residential\\_manual.html](http://www.energy.ca.gov/title24/2008standards/residential_manual.html)

Questions regarding the **2008 Building Energy Standards** may be directed to the Energy Hotline at (800) 772-3300 or (916) 654-5106.

### **HOW TO COMPLY WITH THE RESIDENTIAL STANDARDS:**

To comply with the Residential Standards, the following requirements shall be adhered to:

1. Verify that the Residential Standards apply and that the correct climate zone is used for the building location.
2. Demonstrate that the building meets the Standards with one of two compliance options: Prescriptive Packages or Approved Computer Method.
3. Document and coordinate all calculations, plans, and specifications. This includes completing a Certificate of Compliance (CF-1 R). The designer or owner must sign the Certificate of Compliance. A blank copy of the recommended Certificate of Compliance (CF-1 R) form is available for review at PBS or as a download at the CEC's website.
4. Provide a lighting control diagram on the electrical pages of the plans submitted. The diagram shall include location of dimmer switches, occupant sensors, etc. per lighting mandatory measures section below.
5. Include all appropriate mandatory features and provisions applicable to the building design and install all specified conservation measures in the building. The equipment installer is responsible for verifying and complying with the efficiencies used to achieve compliance. A copy of the form CF-6R shall be posted near the building permit.

Each page of the CF-6R shall be signed by the installing subcontractor, the general contractor, or the owner. Not all pages of the CF-6R shall apply to all jobs, only pages reflecting work on the building permit need be submitted.

If required by the compliance calculations, a field verification and/or diagnostic testing form CF-4R must be completed by a certified HERS rater and submitted to the building department.

6. With the construction of a new dwelling unit, California Green Building Standards must be incorporated. See Appendix 5 for specific requirements which may affect the Energy Efficiency documentation.

**MENDOCINO COUNTY CLIMATE ZONES.** Since energy use depends partly upon weather conditions which differ throughout the state, the California Energy Commission has established 16 climate zones representing distinct microclimates within California. The following Mendocino County areas are located in Climate Zone 1: Rockport, Westport, Ft. Bragg, Casper, Mendocino, Little River, Albion, Elk, Manchester, Pt. Arena, Anchor Bay, Gualala. Other areas of the county are located in Climate Zone 2 except the very north east tip of the County which is Climate Zone 16. More detailed information on zone boundaries is available at the PBS.

**COMPLIANCE WITH THE ENERGY BUDGET.** There are two general options for demonstrating that a residential building meets the energy budget with any of these compliance paths, mandatory measures must be met.

- Prescriptive Packages (“Alternative Component Packages”)
- Computer Methods (Alternative Calculation Method)

Detailed information on each of the methods is available in the 2008 edition of the Residential Energy Manual, published by the California Energy Commission. Compliance forms for the Prescriptive Packages are available at PBS and as a free download at the CEC’s website.

**PRESCRIPTIVE PACKAGES.** The Standards provide a prescriptive approach to compliance using an “alternative component package” or prescriptive package of building conservation features. This approach is the simplest and least flexible compliance path. It is simple because an applicant need only show that a building meets each minimum or maximum level prescribed in the set of requirements contained in a package and because few calculations are needed to demonstrate compliance. Buildings constructed according to Package D, Alternative to Package D, or in certain circumstances Package C are deemed to meet the energy budget. Packages C & D require that a HERS rater come to the building and perform diagnostic testing to verify that the air distribution ducts are properly sealed and that split system air conditioners or heat pumps either have the proper refrigerant charge and the proper airflow across the evaporator coil or have a thermostatic expansion valve.

Compliance documentation to be submitted with this approach:

- CF-1 R, Certificate of Compliance (required)
- MF-1 R, Mandatory Measures Checklist (required)
- WS-5R, Kitchen Lighting Worksheet
- HVAC sizing calculations
- These forms may be required:
  - CF-SR, Solar Water Heating Calculation Form
  - WS-1 R, Thermal Mass Worksheet
  - W2-2R, Area Weighted Average Calculation Worksheet
  - WS-3R, Solar Heat Gain Coefficient (SHGC) Worksheet
  - WS-4R, Fenestration - Maximum Allowed Worksheet

These additional forms are required during construction:

- CF-4R, Field Verification and Diagnostic Testing (if applicable)
- Installation Certificate (CF-6R)

**COMPUTER METHODS.** State-approved “alternative calculation methods” or computer methods represent the most detailed and sophisticated performance approach to compliance. This method provides the greatest flexibility in design.

To comply with the Standards, the predicted combined energy use of the proposed design cannot exceed the combined energy budget of the standard design which is based on the building having all the conservation features of the Package D Prescriptive Method.

Compliance documentation to be submitted with this approach includes:

- CF-1 R, Certificate of Compliance (required)
- MF-1 R, Mandatory Measures Checklist (required)
- WS-5R, Kitchen Lighting Worksheet
- HVAC sizing calculation

These additional forms are required during construction:

- Installation Certificate (CF-6R)
- Form CF-4R, Field Verification and Diagnostic Testing (if applicable)

### **LIGHTING MANDATORY MEASURES:**

**KITCHEN LIGHTING.** At least 50% of the total rated wattage of permanently installed luminaires in the kitchen must be in luminaires that are high efficacy luminaires as defined in Table 150-C of the Energy Code. The quantity and type of fixtures should match what has been documented on the form CF-6R-LTG-01.

To comply with this requirement, high-efficacy lighting may not be screwed into medium base incandescent sockets. High efficacy lighting shall be on separate switches from any incandescent lighting.

**BATHROOMS, GARAGES, LAUNDRY ROOMS, CLOSETS, AND UTILITY ROOMS.** Lighting in bathrooms, garages, laundry rooms, closets and utility rooms must be high efficacy, or must be controlled by a manual-on occupant sensor.

Exception 2 to §150 (k) 10 specifies that permanently installed luminaires that are not high efficacy luminaires can be allowed in closets less than 70 square feet. These luminaires may be controlled by a simple toggle switch, manual-on occupant sensor, or an automatic-on occupant sensor.

**OTHER ROOMS.** Permanently installed lighting in other rooms must be high efficacy, or a manual-on occupant sensor or a dimmer must control it. “Other rooms” includes hallways, dining rooms, family rooms, club house, home office and bedrooms-the rooms in which people are most aware of interior design both in terms of fashion and the usability of their living space.

**OUTDOOR LIGHTING.** Outdoor lighting attached to a building must be high efficacy, or controlled by a motion sensor with integral photocontrol. Motion sensors used in conjunction with outdoor lighting luminaires should have the capability of turning the lights on automatically. Light around swimming pools, water features, or other locations subject to Article 680 of the California Electric Code are exempt.

Decorative landscape lighting that is not permanently attached to buildings is not regulated by the Standards.

**HIGH EFFICACY LAMPS.** High Efficacy Lamps. A high efficacy luminaire is one that contains only high efficacy lamps or high efficacy LED lighting, and must not contain a conventional (medium) screw-based socket. There are two qualifying requirements for a high efficacy luminaire: that the lumens per watt are above a specified threshold and that electronic ballasts are used for all lamps that are 13 watts or greater. The lumens per watt requirement is also based on wattage. Lamps less than 15 watts may be 40 lumens/watt, lamps 15-40 watts must be at least 50 lumens/watt and lamps greater than 40 watts must be at least 60 lumens per watt in order to be considered high efficacy.

Currently lamps with electronic ballasts have four-pin lamp holders rather than the two-pin holders found on lamps with magnetic ballasts. There are other lamp holders that are being considered by the lighting industry for the future.

**RESIDENTIAL MANUAL-ON OCCUPANT SENSORS.** In bathrooms, garages, laundry rooms, and utility rooms, manual-on/automatic-off occupant sensors are allowed as an alternate compliance option to high efficacy lighting. Manual-on/automatic-off occupant sensors automatically turn lights off if an occupant forgets to turn them off when a room is unoccupied. Additionally, these sensors should readily provide the occupant with the option of turning the lights off manually upon leaving the room.

Occupant sensors must be “manual-on”, i.e., the sensors must not have the ability to turn the lights on automatically and must not have a setting that can leave the lights in a permanent-on position.

Some models of occupant sensors have the capability to be changed by the occupant to “automatic-on” by removing the switch plate or touch plate and changing switch settings. These occupant sensors are acceptable as long as the mechanism to switch settings is not visible to the occupant, cannot be easily accessed without the removal of a switch plate or touch plate, and as long as they are delivered to the building site and installed with the “manual-on” setting.

**RECESSED LIGHTING.** Luminaires recessed in insulated ceilings must meet three requirements:

- Luminaires must be rated for direct insulation contact (IC).
- Luminaires must be certified as airtight construction.
- Luminaires must have a sealed gasket or caulking between the housing and ceiling to prevent the flow of heated or cooled air out of the living areas and into the ceiling cavity.

**WINDOW LABELS.** The Standards require that manufactured windows have both temporary and permanent labels that show the NFRC performance characteristics. The temporary label shows the U-factor and SHGC, for each rated window. The label must also show that the window meets the air infiltration criteria. The temporary label must not be removed before inspection by the enforcement agency. The inspector will verify that the installed product meets or exceeds the efficiencies assumed by the energy documentation.

**RADIANT BARRIERS.** The prescriptive requirements call for a radiant barrier in climate zones with significant cooling loads (2, 4 and 8 through 15). A radiant barrier is a reflective material that reduces radiant heat transfer caused by solar heat gain in the roof. Radiant barriers reduce the radiant gain to air distribution ducts and insulation located below the radiant barrier. In the performance approach, radiant barriers are modeled as separate adjustments to the heating U-factor and the cooling U-factor. The duct efficiency is also affected by the presence of a radiant barrier, with the performance approach.

Radiant barriers must meet installation criteria as specified in Appendix D of the 2008 *Residential Compliance Manual*.

The most common way of meeting the radiant barrier requirement is to use roof sheathing that has a radiant barrier bonded to it in the factory. Oriented strand board (OSB) is the most common material available with a factory-applied radiant barrier. The sheathing is installed with the radiant barrier (shiny side) facing down toward the attic space. Alternatively, a radiant barrier material that meets the same ASTM test and moisture perforation requirements that apply to factory-laminated foil can be field-laminated. Field lamination must use a secure mechanical means of holding the foil to the bottom of the roof decking such as staples or nails that do not penetrate all the way through the roof deck material.

Other acceptable methods are to drape a foil type radiant barrier over the top chords of the trusses before the sheathing is installed, and stapling the radiant barrier to the underside of the truss/rafters (top chord). For these installation methods, the foil must be installed with spacing requirements as described in Appendix D of the *Residential Compliance Manual*. The minimum spacing requirements do not apply to this installation since it is considered a “laminated” system.

Installation of radiant barriers is somewhat more challenging in the case of closed rafter spaces when sheathing is installed that does not include a laminated foil. Foil may be field-laminated after the sheathing has been installed by “laminating” the foil as described above to the roof sheathing between framing members. This construction type is described in the *Residential Compliance Manual*, Appendix D, which can be found at the following link

[http://www.energy.ca.gov/title24/2008standards/residential\\_manual.html](http://www.energy.ca.gov/title24/2008standards/residential_manual.html)

## **SECTION 4- CODE ENFORCEMENT**

**CONSTRUCTION WITHOUT PERMITS AND INSPECTIONS.** The Planning & Building Services Department's mission is to provide quality customer service and facilitate the permit process. Although it is recognized that there are situations in which permits are not obtained prior to the construction or remodeling of a building or structure. To this end, it is important to provide an explanation of the enforcement and abatement procedures for construction without a permit.

The Code Enforcement Division of the Planning & Building Services Department is responsible for the enforcement of violations of zoning, building and certain health codes. Pursuant to the Mendocino County Code, and the referenced codes incorporated therein, unless exempt as specified below, no building or structure regulated by the California Building Code shall be erected, constructed, enlarged, altered, repaired, moved, improved, removed, converted or demolished unless a separate permit for each building or structure has first been obtained. In the absence of a building permit, such work is a violation of County and State Codes and subject to abatement, penalties and costs.

See page 1.3 for a list of work exempt from permits.

**NOTICE OF A VIOLATION.** When construction without a permit is verified by a site inspection, the property owner is advised by letter of the violation. A "Stop Work" notice may be posted on the property to prevent further construction until required permits are obtained.

The "Notice of Violation" letter to the property owner includes a description of the work observed and provides the opportunity to remove the unlawful construction within thirty (60) days thereby avoiding substantial penalties and costs of abatement. A demolition permit will be required if the owner elects to remove the unpermitted improvements. In all cases, property owners are encouraged to contact the Code Enforcement Division and seek a resolution to the violation. The primary goal is to achieve compliance.

**CIVIL PENALTIES.** Permits submitted to legalize construction without a permit are subject to penalties calculated at a minimum of one (1) times and a maximum of three (3) times the required permit fees. However, if the construction cannot be permitted and the owner does not respond to our notices in a timely manner, the county has the ability to impose a daily civil penalty anywhere between \$25 to \$500 for each day the violation exists. The determination of charges by the enforcing officer will take into account the facts and circumstances of the violation including, but not limited to, the length of time the violation has existed; the culpability of the person in violation or the willfulness of the violation; the extent of the violation and its effect on adjoining properties; attempts, if any, to comply with the applicable ordinances; and any other information which might be relevant to the determination of penalties to be imposed.

At the discretion of the enforcing officer, or his/her designee, or upon the appeal of the property owner, the determination of penalties may be referred to a hearing officer.

**INVESTIGATION FEES.** Under the California Building Code, a investigation fee equal to the amount of the building permit shall be paid whether or not a permit is issued prior to the issuance of a permit for any work done without a permit. The investigation fee may be imposed independently from the civil penalties as noted above.

**OBTAINING PERMITS.** Permits submitted to legalize unlawful construction are subject to standard permit requirements including but not limited to well and septic, zoning, fire safe standards and road encroachment clearances, the payment of development fees and verification of construction standards.

If plans are required for permit issuance, plans and specifications shall be drawn to scale and should clearly indicate the location, nature, and extent of all as-built construction and show in detail all existing construction and how it conforms to current codes and regulations.

If required clearances cannot be obtained, permits cannot be issued and the unlawful construction shall be removed with a demolition permit and inspection.

**ABATEMENT PROCEDURES.** If the property owner fails to respond to the notice of violation, or if the situation warrants, a Notice and Order to abate will be issued and posted on the property. The Notice and Order to Abate provides the right to appeal the Department's finding of a violation to a Hearing Officer and provides another opportunity to either remove or legalize the unlawful construction.

The Code Enforcement Division will continue to work with the property owner to gain voluntary compliance. However, if that is not possible, a second Notice and Order to Abate will then be issued at an elevated civil penalty. Further Notice and Orders to Abate can be issued at elevated civil penalties up to \$500.00 a day if compliance is not obtained.

It is always important that you stay in touch either by e-mail or phone with the code enforcement officer regarding your progression to help eliminate further fines.



## **SECTION 5- GRADING & STORM WATER MANAGEMENT**

Grading regulations have evolved over the years and started off being directed towards earth moving as it related to building pads and the modification of slopes above and below buildings. These regulations also covered dams, roads, golf courses, landscaping, parking lots, and so on. Grading regulations today also address reducing soil loss or soil erosion and preventing other pollutants from entering local streams and waterways both during and after construction.

Storm water management has evolved as well. Starting with flood control projects to prevent or control large scale flooding (levees and dams), followed by the review of localized drainage systems to prevent nuisance and/or localized flooding by moving the storm water off the project as fast as possible. Most recently, storm water management included the environmental aspects of storm water carrying pollutants to streams and excess storm water created by projects altering the runoff patterns, impacting streams.

This section presents the five main aspects of earth moving: grading, setbacks, drainage, flooding, and storm water quality. These aspects are inter-related to the project as a whole, but need to be discussed separately.

**GRADING.** Grading is the movement of earthen material (soil, rock or combination), generally by mechanical means, either as a cut (removal of the earthen material) or as a fill (placement of earthen material). Commonly, a cut is made into a hillside to make a flat area. The cut material or spoils are then either removed from the site or placed on-site just below the cut area making a larger flat area – typically the building site. Cut and fills might also be done to create a road to a subdivision or to a building site.

In addition to flat areas being created, cuts and fills also create graded slopes. Once a graded slope is created, it must be stable, protective of structures, and secure from slides, erosion, and adverse drainage/storm water impacts. There is the real need to protect the slope from flowing water. Water may infiltrate into a graded area making the soil heavier and more likely to slide. Water may also flow across a slope's surface or face, potentially causing erosion which may create a stability issue or discharge soil into a local drainage or stream. This requires drainage control at the top of graded (cut and fill) slopes to prevent erosion and slope failures.

There is a distinction between natural and graded slopes. Grading regulations do not apply to natural slopes even if they contain natural land slides or soil movement. Proposed repairs or work on natural slopes is subject to a permit. A land owner may allow a natural land slide to remain, however, once the owner chooses to repair the slide in any fashion, the work is considered a graded slope and not a natural slope.

In residential construction a grading permit is not always required. Often the amount of earth moved is below the grading thresholds and is exempt from needing a grading permit.

If a grading permit is required, a grading application is required. The application consists of the PBS standard application form, grading plans, and any required reports or studies, which might include a hydrology study, hydraulic analysis, compaction report, geotechnical or soils report, liquefaction study, wetlands assessment, wetlands delineation or stream setback determination, depending on the project and/or location. Certain types of grading are classified as engineered grading. In this case the plans must be prepared by a registered civil engineer.

The grading plans must reflect the site both before the work is begun and also show the site in its proposed form. A list of plan requirements is available at the PBS. While

individual conditions often vary, grading plans must always be clear and completely show the proposed work. The existing drainage and proposed drainage patterns must be indicated. All grading permits must be reviewed by PBS staff.

After the initial site evaluation, the grading plans and permit application are checked for compliance with the code requirements; just as plans for any new building are processed. If the grading permit includes a road, access for emergency and fire vehicles is also checked. If any road establishes a new entry onto a public road, an encroachment permit will be required. If access to the project is by an existing road or driveway and the entry onto the public road is not up to current standards, the applicant will likely be required to improve the entry and obtain an encroachment permit to do so.

If the project is complex, the PBS staff may add a list of required inspections to the approved plans to clarify which inspections are required during construction.

**SETBACKS.** Grading activities must be set back from streams, ponds, lakes and wetlands. The grading setback from streams is dependent on the slope of the terrain being graded and the erodibility of the soil.

**LOCALIZED DRAINAGE.** Drainage review is one component of storm water management which addresses the collection and conveyance of storm water and the design of drainage facilities to prevent localized flooding and nuisance conditions. Storm water runoff is calculated as a flow rate which is then used for the design of storm drain systems, sizing of culverts or storm drain pipes, stream crossings using bridges, constructed V-ditches and drainage swales. Hydrology maps and calculations are developed to determine the amount of water anticipated at a specific location or locations. Hydraulic calculations are performed to ensure the amount of water can flow through the pipe or system being specified. Drainage review overlaps into such areas as grading, building, erosion prevention, flood prone areas, above grade septic systems, or any development that obstructs or redirects storm water runoff.

Installations of most drainage systems require a permit, unless exempt.

All grading, building and above grade septic permits require drainage review and clearance. Building permits that require drainage review are those in a floodway (new construction is not allowed in a floodway), in a flood plain or in the flood prone urban area, and buildings relatively close waterways. Drainage review is also required if the proposed development prompts a drainage or erosion concern.

**FLOODING.** Grading in special flood hazard areas or flood plains needs special attention. The placement of fill within a flood plain displaces flood waters and shifts the flooding to a different location. This has the potential to create flooding impacts to structures that did not or would not have been impacted prior to a proposed project bringing fill into a flood plain. The County is charged with ensuring that development within the flood plains does not increase the risk of flooding to neighboring parcels or communities. This requires there be no decrease in the flood carrying capacity of the flood plains. Simply stated, if you place fill in a flood plain, you need to have an equal amount removed. This is the concept of no net fill. Of course, it's not that simple. The project must also allow the water to flood and recede as naturally as possible. Simply balancing the cut and fill volumes, alone, might still impact the flood event. How one balances the cut and fills also matters.

The Federal Emergency Management Agency (FEMA) has produced a Flood Insurance Study that defines special flood hazard areas. These areas are depicted on flood maps known as the Flood Insurance Rate Maps (FIRMs) and it is these defined areas that are subject to the no net fill provision. Other provisions in the Mendocino County Code pertain to protecting structures placed in the flood plain such as elevating the structures

above the flood level and flood proofing the structures (non-living areas) below the flood level.

Drainage patterns and create local drainage or nuisance flooding conditions. To address this ongoing concern, requires any fill placement be evaluated and demonstrated that no adverse impact to drainage will result.

**STORM WATER QUALITY.** Storm water quality is a major concern in Mendocino County. Many waterways in our area are impaired due to excessive amounts of sediment, nutrients and/or fecal coliform. The land disturbing activity common to grading is associated with soil loss. Soil discharges adversely affects or impairs the streams by several methods: covering the spawning habitat for aquatic species; creating stream bank erosion; creating wider, shallower and hotter streams; and brings additional nutrients to the streams.

The main method of soil erosion is through rain events. Unprotected areas are easily eroded and storm water runoff carries the soil and nutrients to local drainage systems and/or directly to local streams. Additional pollutants such as oil, diesel, gasoline, lime, and construction debris are also present at construction sites and can be discharged as well.

After construction, the new impervious surfaces change the runoff patterns which can have adverse impacts on local waterways as well. Rainfall is not allowed to infiltrate as it would have prior to the project and runs off. This creates more “channel forming discharges” than would have occurred and increasing the frequency of these events adversely affect the stream channels.

As such, there are many regulatory efforts to reduce and/or eliminate the discharge of soil from land disturbing activities and to mimic the natural drainage patterns. These include the federal National Pollutant Discharge Elimination System permits, the state’s municipal storm water permit issued to the County of Mendocino, as well as local regulations contained in the Mendocino County Code. These regulations are all intended to prevent and/or minimize the discharge of pollutants or waste from the project site during and after construction.

The County implements these regulations by requiring construction plans to include structural and non-structural best management practices (BMPs) prior to permit issuance. The BMPs must be on the construction plans before a grading permit is issued. There are many BMPs that can be used in endless combinations to accomplish this goal. The BMPs include, but are not limited to, silt fencing; straw wattles; erosion blankets/fabrics; check dams; rip-rap; construction entrances to control soil discharges; primary and secondary containment for petroleum products; paints; lime and other materials of concern; permanent measures such as infiltration galleries, rain gardens and storm water treatment systems that address post-construction storm water runoff.

The County does not dictate one BMP over another; however, there must be an effective combination of BMPs to meet the intent of preventing and/or minimizing the discharge of pollutants. There are several BMP manuals approved for use in Mendocino County.

Timing is critical when dealing with storm related discharges. Mitigation measures or BMPs must be installed per approved plans and specifications, and working properly prior to each rainy season (October 15<sup>th</sup> of each year) and remain functional throughout the rainy season. PBS will verify BMP installation and functionality, through inspections, throughout the life of the construction permit(s). We do not prohibit work during the rainy season; however, it should be avoided when possible and if conducted will be scrutinized more closely.

## **SECTION 6- FOUNDATIONS**

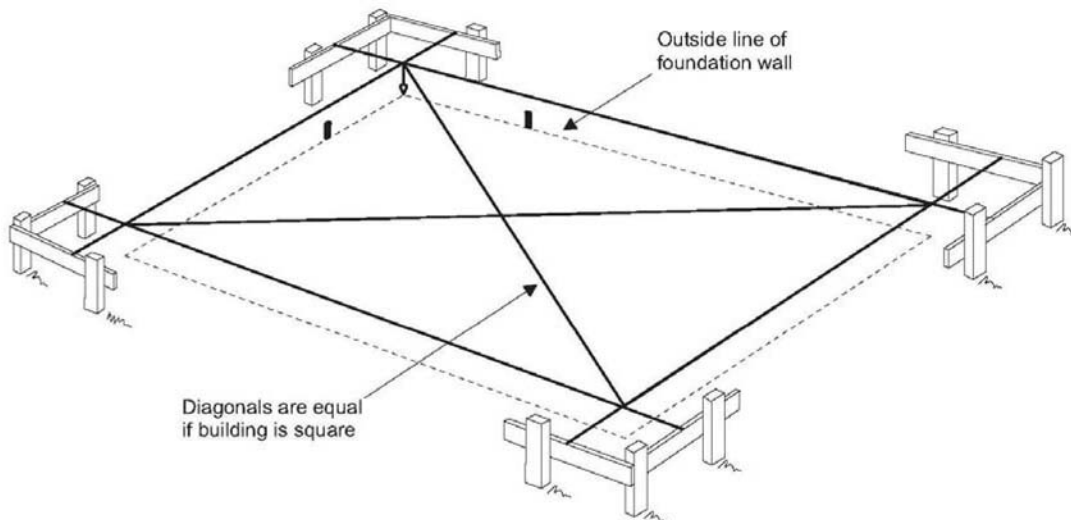
**TYPICAL CONSTRUCTION METHOD.** Before any new building is erected, remove all stumps and roots from the soil to a depth of at least 12" below the surface of the ground in the area to be occupied by the building.

Remove all wood from the area between the foundation and the surrounding ground including areas under the sub-floor.

To prevent termite infestation, it is desirable to treat the soil under a concrete-slab- and- wood-floor construction.

Laying out a foundation is the critical beginning in house construction. If the foundation is square and level, all later jobs, from rough carpentry through finish construction, will be much easier.

Lay out the outside foundation lines. Locate each outside corner of the house and drive small stakes into the ground. Drive nails into two of these stakes to indicate the outside line of the foundation wall. Check squareness of the house by measuring the diagonals, corner to corner, to see that they are equal.



**Foundation Layout**

Not to Scale

After corners are located and squared, drive three 2 x 4 stakes at each corner. Locate these stakes 3 foot to 4 foot outside the actual foundation line. Then nail 1 x 6 batter boards horizontally so that their top edges are all level and at the same grade.

Hold a string line across tops of opposite batter boards at two corners and, using a plumb bob, adjust so that it is exactly over the tacks in the two corner stakes. Cut saw kerfs  $\frac{1}{4}$ " deep where the line touches the batter boards so that string lines may be easily replaced if broken or disturbed.

### **FOUNDATION DESIGN CRITERIA:**

**FOUNDATION REQUIREMENTS.** Continuous reinforced concrete footings are required under exterior walls, bearing walls, at garage door openings, and around any exterior covered floor area. Individual footing pads may be used when justified by calculations. Interior bearing walls on girders may be supported by isolated footings.

**EXPANSIVE OR LIQUEFIABLE SOILS.** When expansive or liquefiable soils are present, the building code requires that special provisions be made in the foundation design and construction to safeguard against damage due to these potentially damaging soil conditions. The building code requires a special investigation and report to provide design and construction criteria for foundations located in expansive or liquefiable soils.

**STEPPED FOOTING.** Foundations for all buildings where the bottom of the footing trench slopes more than 1' in 10' shall be stepped so that both top and bottom of such foundation are level.

**PIER AND GRADE BEAM.** The use of a pier and grade beam system requires the submission of engineer or architect's design calculations, including required reinforcing bars.

Special inspections are required for drilled cast-in-place piers or caissons.

**CONCRETE.** Minimum strength of concrete for foundation construction shall be 3,000 psi at 28 days (May be reduced to 2,500 psi if licensed design professional documents classes for exposure categories of F0, S0, P0, and C0 in accordance with Table 4.2.1 of ACI 318-08).

**REINFORCING.** Concrete stem walls shall have one bar of #4 (1/2" diameter) rebar 3" from the top and one bar of #4 rebar 3" from the bottom of the footings. Additional reinforcement must be provided if these bars are over 18" apart so that maximum spacing between horizontal bars is no greater than 18". Use #4 vertical bars at 18" o.c. if the stem wall is over 2 feet above footing, or if cold joint occurs in construction. Lap rebar 30 bar diameters (15" min).

Concrete stem walls designed under the CRC shall have a minimum of one #4 bar located within 12" of the top of the wall and one #4 bar located 3"-4" from the bottom of the footing. See drawing on page 7.5 for sample rebar layouts.

**FOUNDATION PLATES OR SILLS.** All foundation plates or sills and sleepers which rest on concrete or masonry shall be pressure-treated. When shear nailing spacing requirement is less than 4 inches, then foundation plate/sill shall be 3-inch nominal thicker or wider and nailing shall be staggered. When 3-inch nominal or greater foundation plate/sill are used then anchor bolt length will need to be increased.

Foundation plates or sills shall be bolted to the foundation wall using anchor bolts. Anchor bolts shall be a minimum 1/2-inch diameter in Seismic Design Category (SDC) D or 3/4-inch diameter in SDC E (SDC E shall be assumed unless it can be documented that the proposed structure is in SDC D). Anchor bolts shall be embedded at least 7" into the concrete and spaced not more than 6' on center. Anchor bolt spacing shall be designed by a licensed architect or engineer for buildings three stories or greater. A minimum of 2 bolts for each sill with 12" maximum distance from the ends of each sill is required. Steel plate washers a minimum of 3" by 3" by 0.229 inches thick shall be used on each bolt.

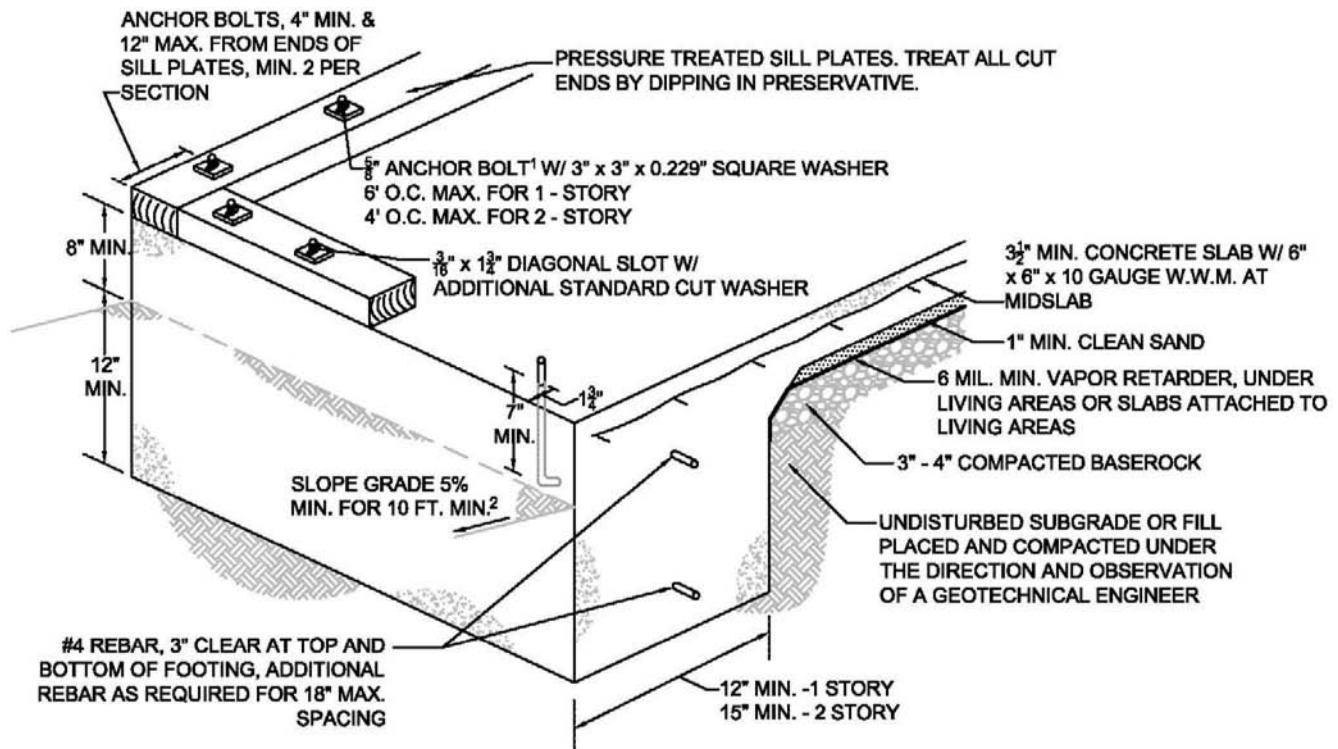
**FOUNDATION VENTILATION.** Foundation ventilation requirements can be met by providing a net area of not less than one square foot for each 150 square foot of underfloor area, with openings as close to corners as practical on at least two opposite sides for full cross ventilation. Openings shall be screened with corrosion-resistant wire mesh with mesh openings of 1/4" to 1/2" in dimension.

**FOUNDATION ACCESS.** Underfloor areas shall be provided with a minimum 18" by 24" access opening unobstructed by pipes, ducts, and similar construction. Underfloor plumbing cleanouts must be within 20' of a foundation or underfloor access.

**CONCRETE SLABS.** Concrete slabs require footings reinforced with two #4 (1/2" diameter) bars of reinforcing steel under bearing walls and garage opening.

Slabs must be a minimum of 3 1/2" thick. Slabs under a living area and in garages shall be reinforced with wire mesh or rebar. Separate slab from soil with a minimum 6 mil waterproof membrane under living areas.

## FOUNDATION AND CONCRETE SLAB CONSTRUCTION:



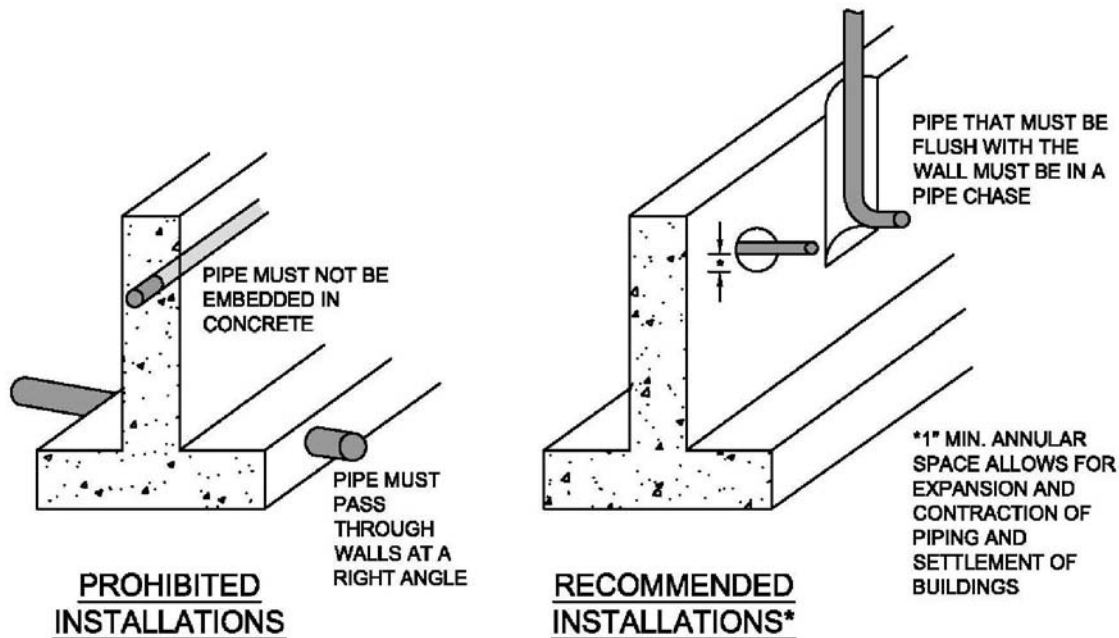
- NOTES: 1. ANCHOR BOLT SIZING BASED ON ASSUMED SEISMIC DESIGN CATEGORY (SDC) E.  $\frac{1}{2}$ " ANCHOR BOLTS MAY BE USED IF DOCUMENTATION IS PROVIDED DEMONSTRATING THAT THE PROPOSED STRUCTURE IS IN SDC D.
2. IF PHYSICAL OBSTRUCTIONS OR LOT LINES PROHIBIT 10 FT. OF HORIZONTAL DISTANCE THE GRADE SHALL BE SLOPED 5% TO AN APPROVED ALTERNATIVE METHOD OF DIVERTING WATER AWAY FROM THE FOUNDATION. WITH IMPERVIOUS SURFACES, OR IF CLIMATIC OR SOIL CONDITIONS WARRANT, A 2% SLOPE FOR 10 FT. MIN. WILL BE ACCEPTABLE.
3. ALL CONCRETE SHALL BE 2500 PSI MIN. PROVIDE PROPER CURING CONDITIONS.

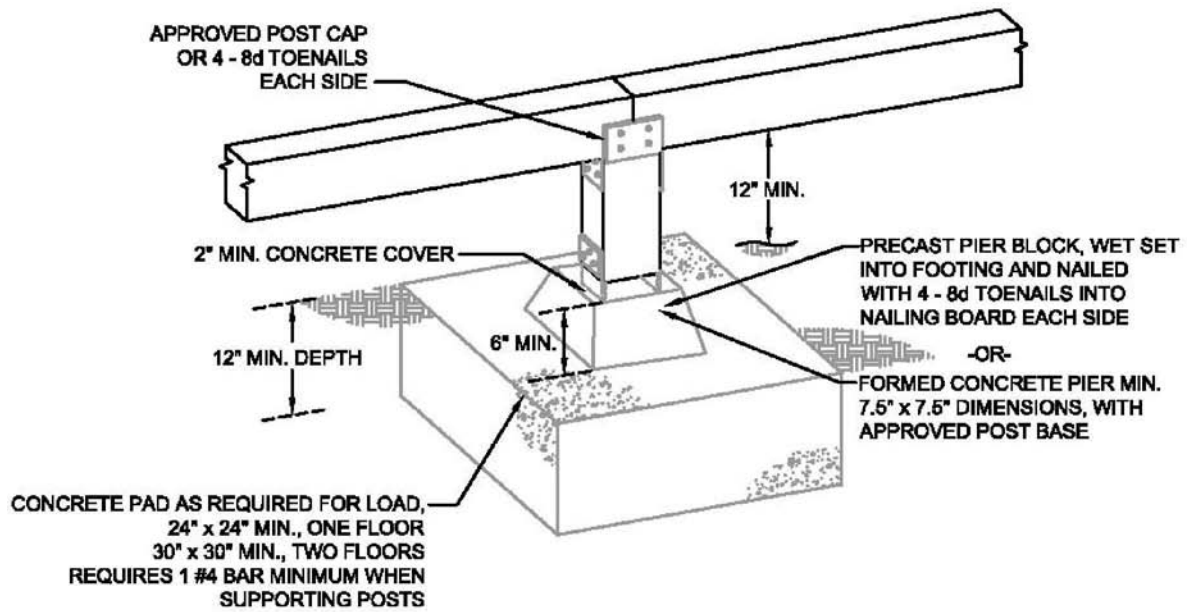
**GROUNDING ELECTRODE IN FOUNDATION.** An electrode encased by at least 2" of concrete, located within and near the bottom of a concrete foundation or footing that is in direct contact with the earth, consisting of at least 20' of one or more steel reinforcing bars or rods of not less than  $\frac{1}{2}$ " diameter, or consisting of at least 20' of bare solid copper conductor not smaller than #4 AWG. (See Section 17, Electrical) is required to ensure proper grounding.

## FOUNDATIONS FOR STUD BEARING WALLS – MINIMUM REQUIREMENTS<sup>1,2,3,4,5</sup>

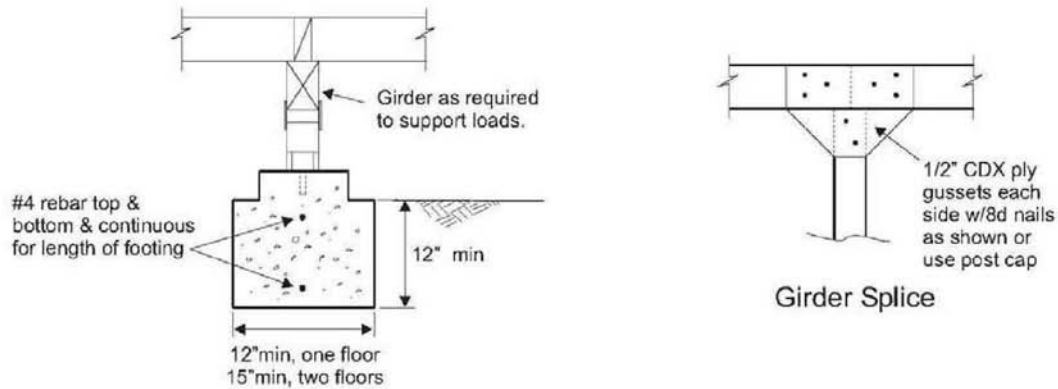
NUMBER OF FLOORS SUPPORTED BY THE FOUNDATION	THICKNESS OF CONCRETE FOUNDATION WALL <sup>6</sup> (inches)	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)	DEPTH BELOW UNDISTURBED GROUND SURFACE (inches)
1	6	12	6	12
2	6	15	6	12

1. Source: 2010 CBC, 2010 CRC
2. The ground under the floor may be excavated to the elevation of the top of the footing.
3. Interior stud bearing walls are permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and the footings shall be spaced not more than 6 feet on center.
4. Footings are permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
5. Freestanding accessory structures not used for human occupancy and not over 400 square feet in floor area with an eave height of 10 feet or less may be constructed with walls supported on wood or metal foundation plate(s).
6. Foundation walls exceeding 4'6" height shall be 7.5" minimum thickness.

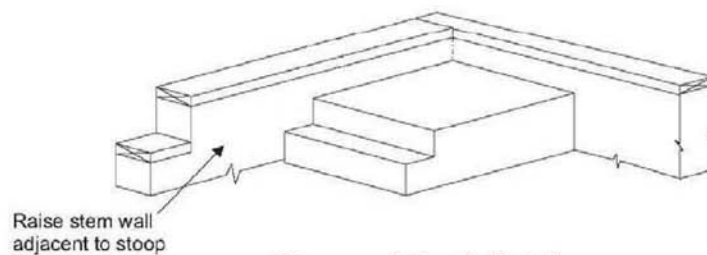




### TYPICAL GIRDER SUPPORT



### Continuous Grade Beam & Girder (interior footings only)



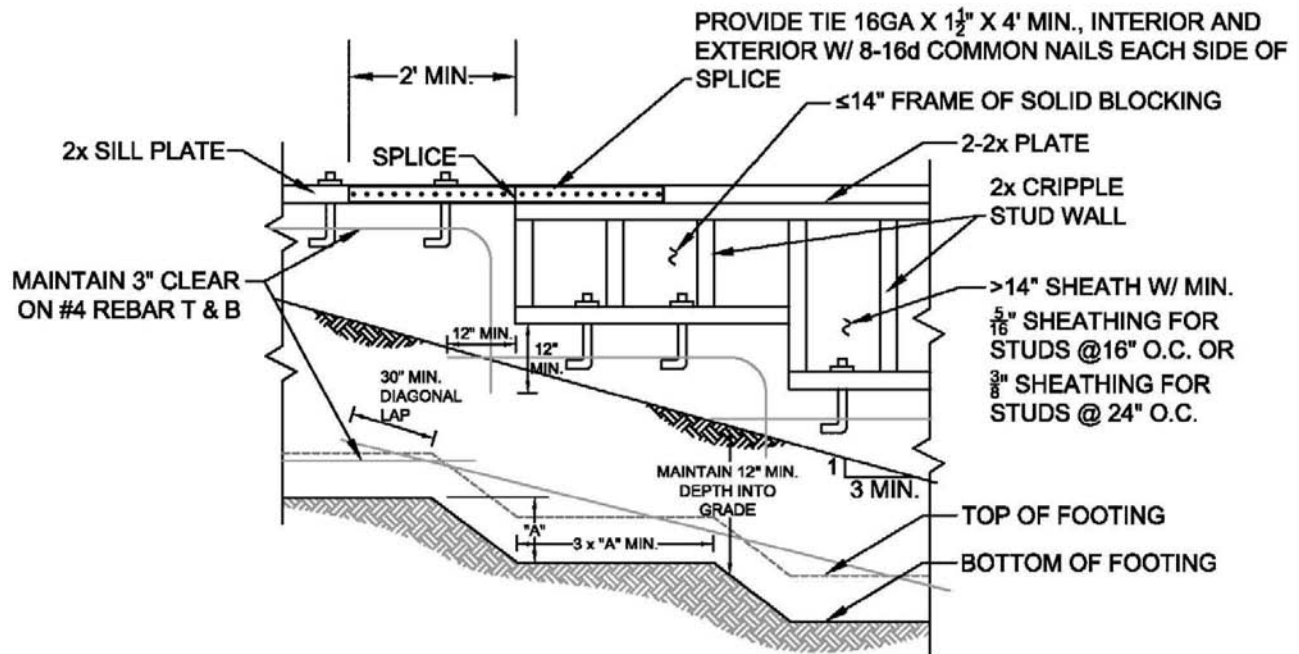
### Stoop and Porch Detail

### Interior Foundations



## STEPPED FOOTINGS:

A stepped footing is required if the bottom of the footing slopes more than 10% (10 units horizontal to 1 unit vertical).



If the earth slope is steeper than  $33\frac{1}{3}\%$  (3 units horizontal to 1 unit vertical), a detail prepared by a licensed professional (architect/engineer) is required. A soils report may also be required.

Where the bottom of a footing is stepped and cripple wall height varies more than 4 feet along a wall line strapping is required at the joint between the area where the lowest floor framing rests directly on a sill bolted to a footing and the cripple wall. The double plate of the cripple stud wall shall be spliced to the sill plate with metal tie strapping, one on the interior and one on the exterior as shown in the diagram above.

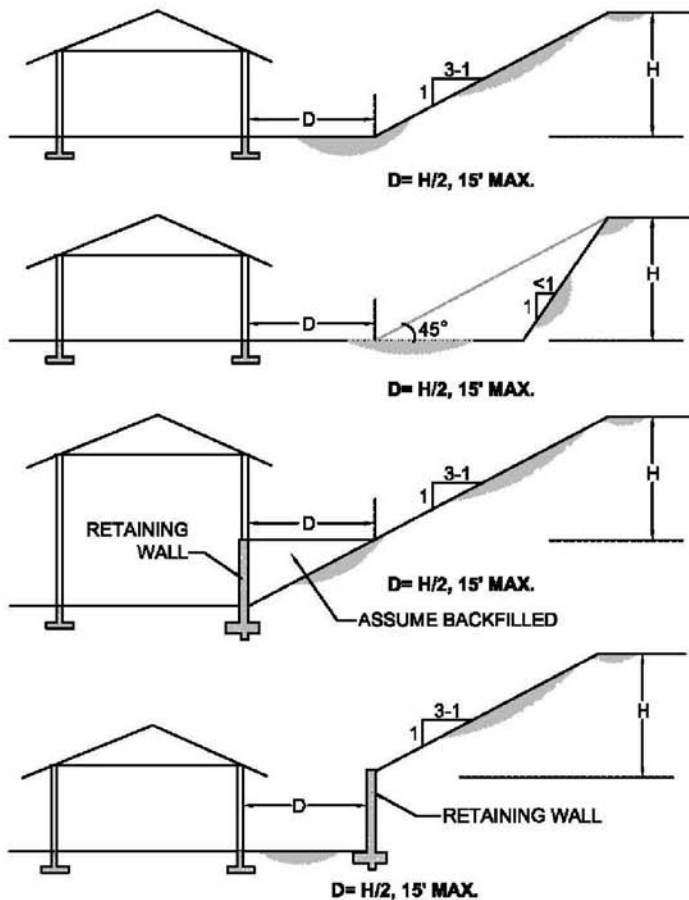
Non-engineered foundation walls shall not exceed 8 feet in height nor extending above the floor framing for the first floor. A maximum of 4 feet of unbalanced fill is permitted for non-engineered foundation walls. Width of concrete foundation walls shall be as shown in the table on Page 7.4.

Sleepers and sills on concrete that is in direct contact with earth shall be pressure treated, or heartwood of Redwood or Eastern Red Cedar.

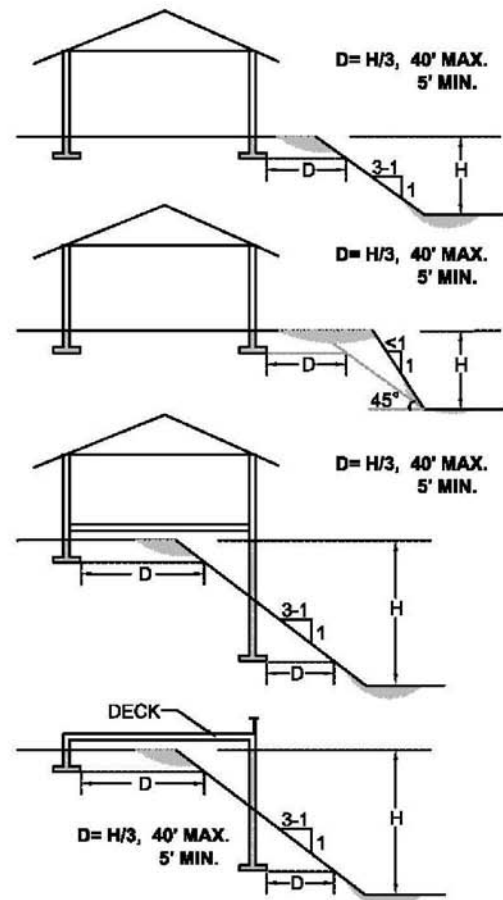
## FOUNDATION SETBACKS FROM SLOPES:

These drawings supplement Section 1808.7 in the California Building Code. The figures apply to slopes from 3 horizontal and 1 vertical (3:1 or 33% slope) to 1 horizontal and 1 vertical (1:1 or 100% slope). These requirements are designed to provide protection from slope drainage, erosion and shallow failures. In cases where adequate setback cannot be provided PBS may require that a geotechnical investigation report be provided. In all cases footings must extend a minimum of 12 inches below undisturbed ground surface. The ground adjacent to the foundation shall be sloped 20:1 (5%) for 10 feet or if not physically possible provide 5% slope to an approved alternative method for diverting water. Swales used for this shall be min. 2% when within 10 feet of the building. Minimum slope for paved surfaces shall be 2%.

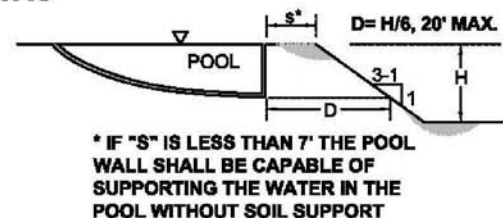
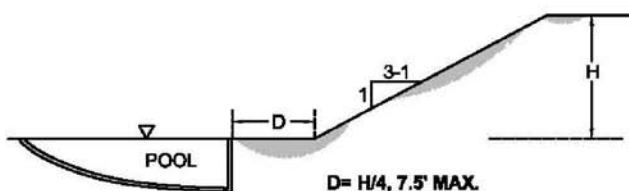
### SECTION 1808.7.1



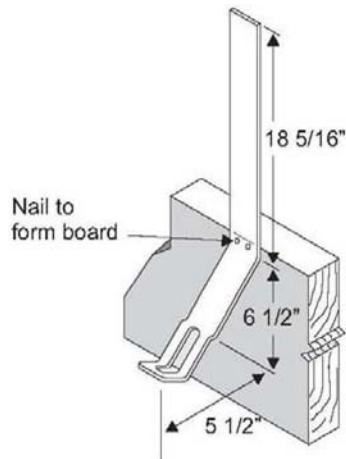
### SECTION 1808.7.2



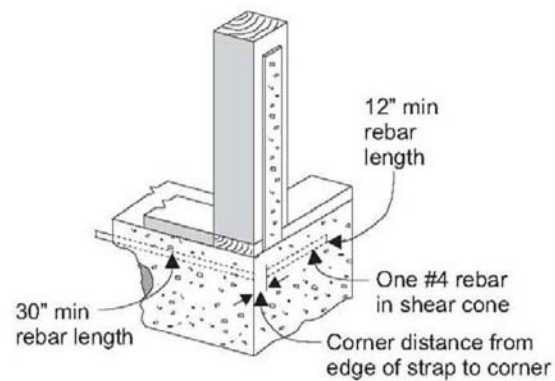
### SECTION 1808.7.3



## HOLDOWN DETAILS:



Typical PAHD42  
before the concrete  
pour (HPAHD22-2P  
and HPAHD similar)

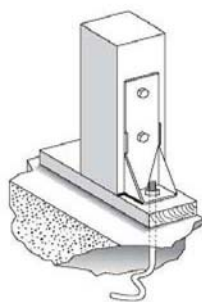


Typical HPAHD  
single pour corner  
and endwall installation

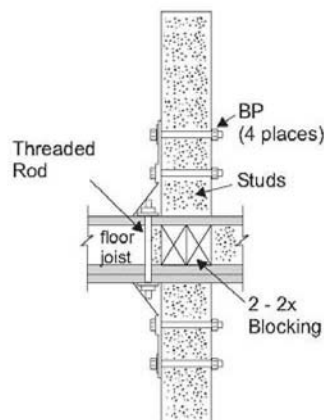
Holdown sizes HD2A, PHD2, HD5A Stemwall minimum thickness 7 1/2" Concrete  
2500 psi minimum

	Bolt	Minimum Embedment Depth
Mono Pour	SSTB 16	12-5/8"
Two Pour	SSTB 20	16-5/8"

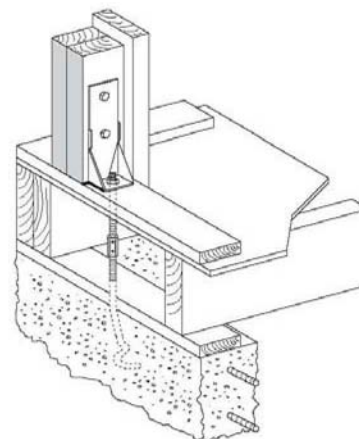
Please consult the catalog of the specific holddown manufacturer for approved installation instructions. Simpson, USP, KC Metal, and other firms all provide installation instructions.



Typical HD5A Holddown  
Installation with  
SSTB anchor bolt.  
Washers not required  
at the base



Typical HD5A  
tie between floors



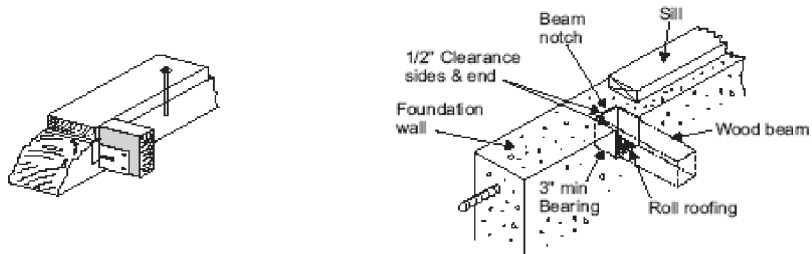
Typical CNW  
rim joist  
installation

## **SECTION 7- F R A M I N G**

### **SUBFLOOR, FLOOR FRAMING, AND FLOOR SYSTEMS**

Girders shall be designed to support the loads specified in the CALIFORNIA BUILDING CODE. Girder end joints shall occur over supports. When a girder is spliced over a support, an adequate tie shall be provided. Metal post caps work well or 1/2" plywood gussets on each side may be used.

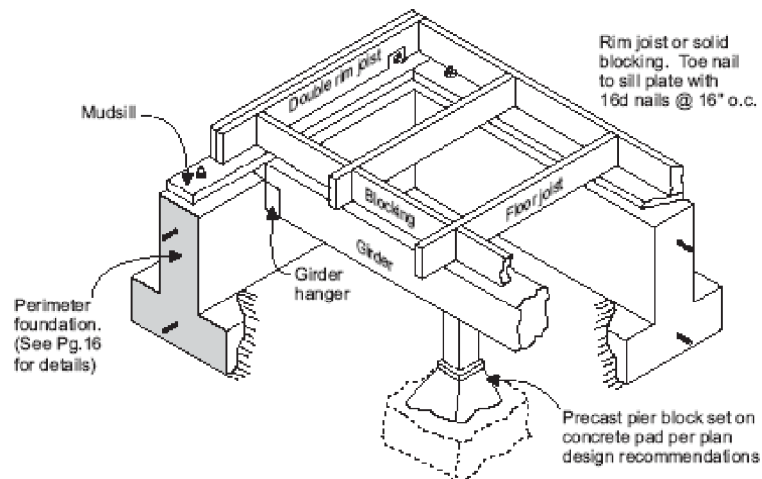
The end of beams or girders supported on masonry or concrete shall have not less than 3" of bearing with a 1/2" air space at sides and end. In lieu of the 1/2" air space, a full galvanized iron envelope shield or a 90# felt envelope may be used. As another alternative, metal girder hangers are available to meet most framing requirements.



### **SUBFLOOR FRAMING:**

The ends of each joist shall have not less than 1 1/2" of bearing on wood or metal.

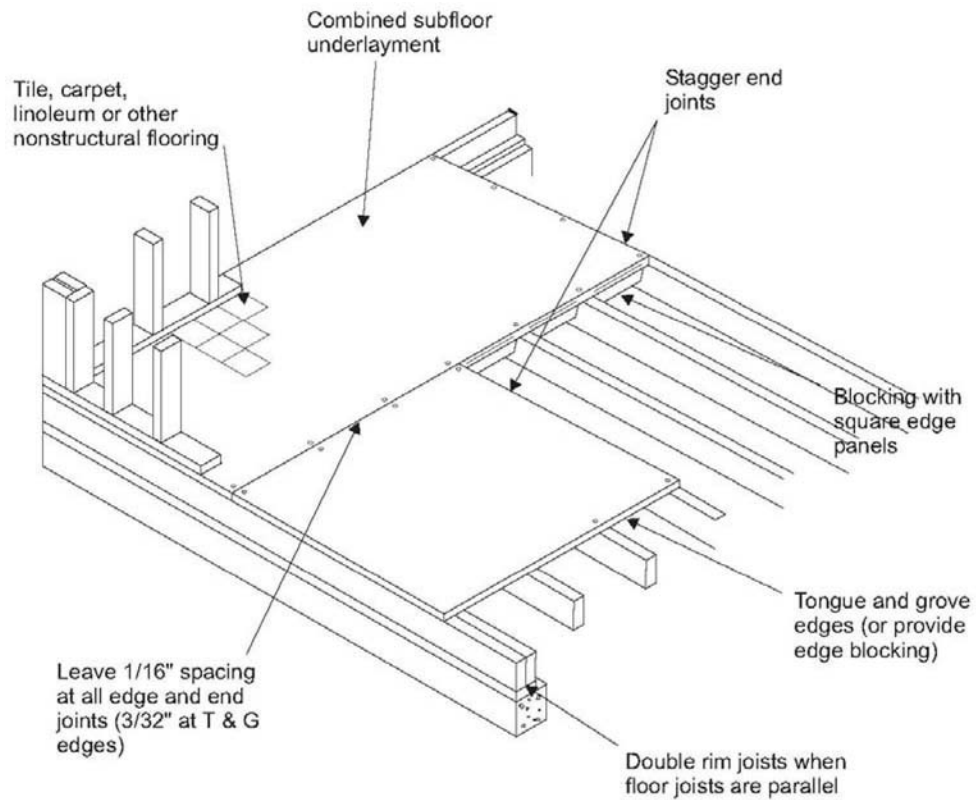
Joists shall be supported laterally at the ends and at each support by solid blocking, except where the ends of joists are nailed to a header, band, or rim joist, or to an adjoining stud or by other approved means. Solid blocking shall be not less than 2" in thickness and the full depth of the joist (refer to Sec. 2308.8.5 CBC for lateral support requirements). Joists framing from opposite sides of a beam, girder, or partition shall be lapped at least 3" or the opposing joists shall be tied together in an approved manner.



### **Floor Framing**

## **FLOOR SYSTEMS:**

**CONVENTIONAL FLOOR JOIST SYSTEMS.** A conventional floor joist system typically consists of floor joists placed up to 24" on center with e" T & G plywood used as a subfloor.



**Conventional Floor Joist Systems**

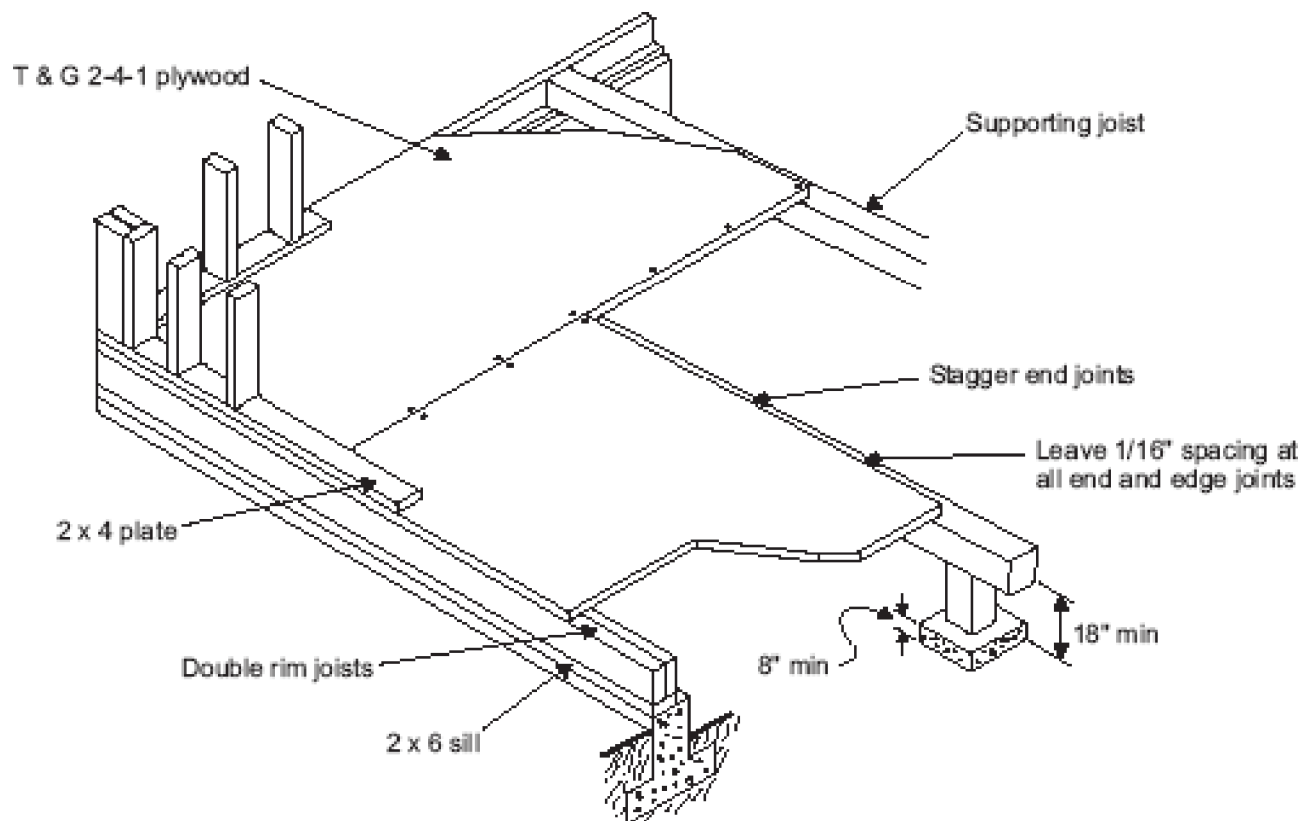
**2010 CALIFORNIA BUILDING CODE**  
**ALLOWABLE SPANS FOR RAFTER & JOISTS**  
**(Feet-inches)**

DF/Larch #2 or Better Nominal Size (in)	Spacing Inches on Center	Floor Joist E = 1.6 M LL = 40 DL = 10	Floor Joist Sleeping Areas E = 1.6 M LL = 30 DL = 10	Ceiling Joist Attics w/o Storage E = 1.6 M LL = 10 DL = 5	Ceiling Joist Attics w/ Limited Storage LL = 20 DL = 10	Rafters Heavy Roof* w/o Ceiling LL = 20 DL = 20*	Rafters Light Roof w/o Ceiling LL = 20 DL = 10
2x4	12			12-5	9-10	9-10	9-10
Fb = 1510 psi	16			11-3	8-9	8-6	8-11
	19.2			10-7	8-0	7-9	8-5
	24			9-10	7-2	6-11	7-10
2x6	12	10-9	11-10	19-6	14-10	14-4	15-6
Fb = 1310 psi	16	9-9	10-9	17-8	12-10	12-5	14-1
	19.2	9-1	10-1	16-7	11-9	11-4	13-1
	24	8-1	9-1	14-10	10-6	10-2	11-9
2x8	12	14-2	15-7	25-8	18-9	18-2	20-5
Fb = 1210 psi	16	12-7	14-1	23-0	16-3	15-9	18-2
	19.2	11-6	12-10	21-0	14-10	14-4	16-7
	24	10-3	11-6	18-9	13-3	12-10	14-10
2x10	12	17-9	19-10		22-11	22-3	25-8
Fb = 1105 psi	16	15-5	17-2		19-10	19-3	22-3
	19.2	14-1	15-8	25-8	18-2	17-7	20-3
	24	12-7	14-1	22-11	16-3	15-8	18-2
2x12	12	20-7	23-0			25-9	
Fb = 1005 psi	16	17-10	19-11			22-4	25-9
	19.2	16-3	18-3			20-4	23-6
	24	14-7	16-3			18-3	21-0

\*Roofs with a Dead Load > 15 psf are not considered conventional construction.

## **HEAVY JOIST FLOOR SYSTEMS (4 X 6 FLOOR JOISTS):**

A joist floor system consists of 4 x 6 joist at 4' on center supported with piers at 6' on center. 2 x 6 or 2 x 8 tongue- and-groove subfloor is placed perpendicular to girders. In the 2- 4-1 system, 1<sup>1</sup>/<sub>8</sub>" thick plywood is placed perpendicular to 4 x 6 joists and serves as the subfloor.



**Heavy Floor Joist Systems**  
(4 x 6 floor joists)

**TABLE 2304.9.1 - FASTENING SCHEDULE:**

CONNECTION	FASTENING <sup>a,m</sup>	LOCATION
1. JOIST TO SILL OR GIRDER	3 - 8d COMMON (2" x 0.131") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL
2. BRIDGING TO JOIST	3 - 8d COMMON (2" x 0.131") 2 - 3" x 0.131" NAILS 2 - 3" 14 GAGE STAPLES	TOENAIL EACH END
3. 1" x 6" SUBFLOOR OR LESS TO EACH JOIST	2 - 8d COMMON (2" x 0.131")	FACE NAIL
4. WIDER THAN 1" x 6" SUBFLOOR TO EACH JOIST	3 - 8d COMMON (2" x 0.131")	FACE NAIL
5. 2" SUBFLOOR TO JOIST OR GIRDER	2 - 16d COMMON (3" x 0.162")	BLIND & FACE NAIL
6. SOLE PLATE TO JOIST OR BLOCKING SOLE PLATE TO JOIST OR BLOCKING AT BRACED WALL PANEL	16d (3" x 0.135") @ 16" O.C. 3" x 0.131" NAILS @ 8" O.C. 3" 14 GAGE STAPLES @ 12" O.C. 3 - 16d (3" x 0.135") PER 16" 4 - 3" x 0.131" NAILS PER 16" 4 - 3" 14 GAGE STAPLES PER 16"	TYPICAL FACE NAIL BRACED WALL PANELS
7. TOP PLATE TO STUD	2 - 16d COMMON (3" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	END NAIL
8. STUD TO SOLE PLATE	4 - 8d COMMON (2" x 0.131") 4 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES 2 - 16d COMMON (3" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL END NAIL
9. DOUBLE STUDS	16d (3" x 0.135") @ 24" O.C. 3" x 0.131" NAIL @ 8" O.C. 3" 14 GAGE STAPLE @ 8" O.C.	FACE NAIL
10. DOUBLE TOP PLATES DOUBLE TOP PLATES - LAP SPlice	16d (3" x 0.135") @ 16" O.C. 3" x 0.131" NAIL @ 12" O.C. 3" 14 GAGE STAPLE @ 12" O.C. 8 - 16d COMMON (3" x 0.162") 12 - 3" x 0.131" NAILS 12 - 3" 14 GAGE STAPLES	TYPICAL FACE NAIL LAP SPlice -FACE NAIL <b>EACH SIDE</b>
11. BLOCKING BETWEEN JOISTS OR RAFTERS TO TOP PLATE	3 - 8d (2" x 0.131") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL
12. RIM JOIST TO TOP PLATE	8d (2" x 0.131") @ 6" O.C. 3" x 0.131" NAILS @ 6" O.C. 3" 14 GAGE STAPLES @ 6" O.C.	TOENAIL



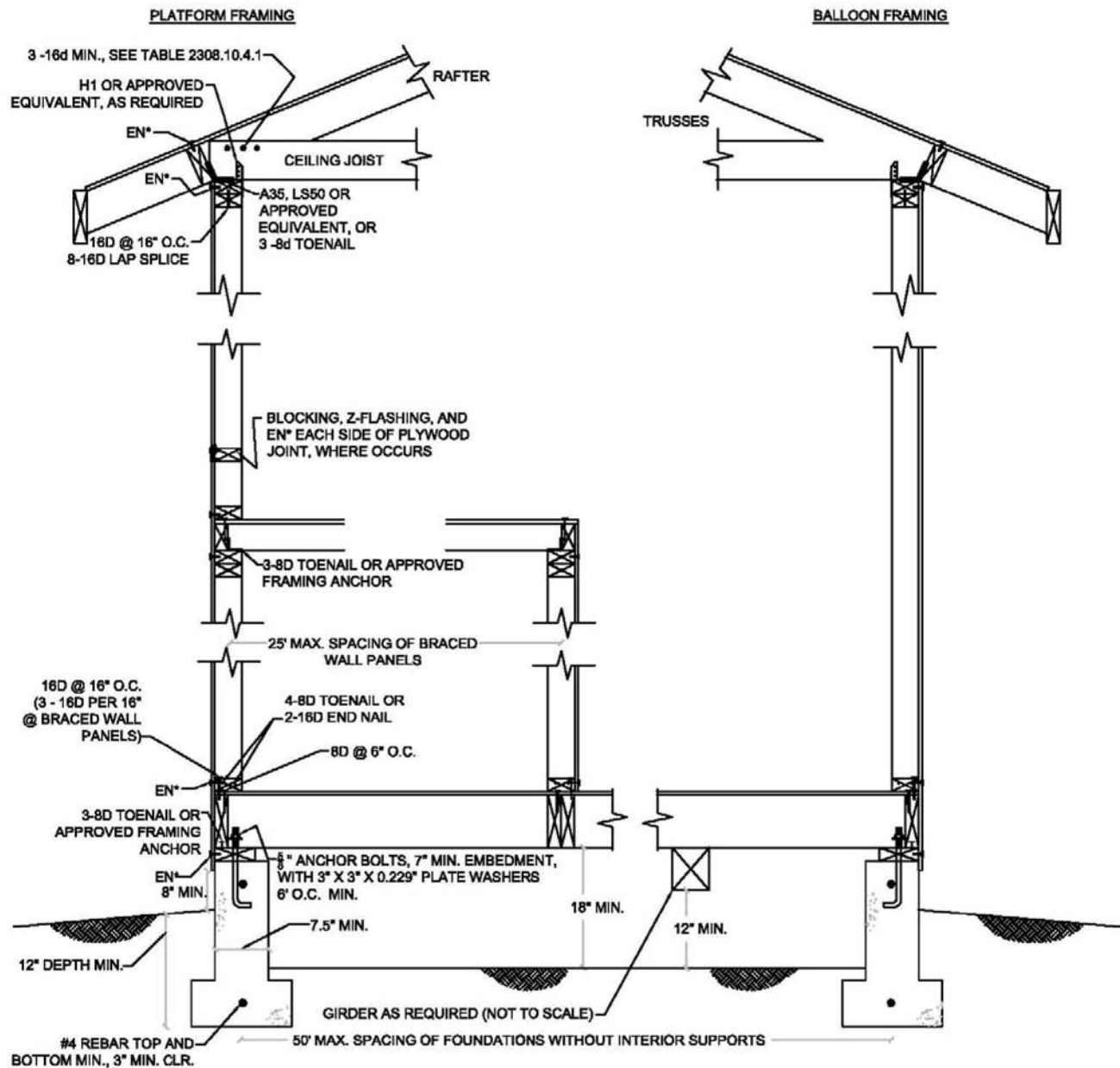
CONNECTION	FASTENING <sup>a,m</sup>	LOCATION
13. TOP PLATES, LAPS AND INTERSECTIONS	2 - 16d COMMON (3%" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	FACE NAIL
14. CONTINUOUS HEADER, TWO PIECES	16d COMMON (3%" x 0.162")	16" O.C. ALONG EDGE
15. CEILING JOISTS TO PLATE	3 - 8d COMMON (2%" x 0.131") 5 - 3" x 0.131" NAILS 5 - 3" 14 GAGE STAPLES	TOENAIL
16. CONTINUOUS HEADER TO STUD	4 - 8d COMMON (2%" x 0.131")	TOENAIL
17. CEILING JOISTS, LAPS OVER PARTITIONS	<b>SEE TABLE 2308.10.4.1</b>	FACE NAIL
18. CEILING JOISTS TO PARALLEL RAFTERS	<b>SEE TABLE 2308.10.4.1</b>	FACE NAIL
19. RAFTER TO PLATE	3 - 8d COMMON (2%" x 0.131") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL & <b>MECHANICAL CONNECTION FOR UPLIFT</b>
20. 1" DIAGONAL BRACE TO EACH STUD AND PLATE	2 - 8d COMMON (2%" x 0.131") 2 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	FACE NAIL
21. 1" x 8" SHEATHING TO EACH BEARING	3 - 8d COMMON (2%" x 0.131")	FACE NAIL
22. WIDER THAN 1" x 8" SHEATHING TO EACH BEARING	3 - 8d COMMON (2%" x 0.131")	FACE NAIL
23. BUILT UP CORNER STUDS	16d COMMON (3%" x 0.162") 3" x 0.131" NAILS 3" 14 GAGE STAPLES	24" O.C. 16" O.C. 16" O.C.
24. BUILT UP GIRDER AND BEAMS	20d COMMON (4" x 0.192") 32" O.C. 3" x 0.131" NAIL @ 24" O.C. 3" 14 GAGE STAPLE @ 24" O.C. 2 - 20d COMMON (4" x 0.192") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	FACE NAIL AT TOP AND BOTTOM STAGGERED ON OPPOSITE SIDES FACE NAIL AT ENDS AND AT EACH SPLICE
25. 2" PLANKS	16d COMMON (3%" x 0.162")	AT EACH BEARING
26. COLLAR TIE TO RAFTER	3 - 10d COMMON (3" x 0.148") 4 - 3" x 0.131" NAILS 4 - 3" 14 GAGE STAPLES	FACE NAIL

CONNECTION	FASTENING <sup>a,m</sup>	LOCATION
27. JACK RAFTER TO HIP	3 - 10d COMMON (3" x 0.148") 4 - 3" x 0.131" NAILS 4 - 3" 14 GAGE STAPLES 2 - 16d COMMON (3%" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL FACE NAIL
28. ROOF RAFTER TO 2x RIDGE BEAM	2 - 16d COMMON (3%" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES 2 - 16d COMMON (3%" x 0.162") 3 - 3" x 0.131" NAILS 3 - 3" 14 GAGE STAPLES	TOENAIL FACE NAIL
29. JOIST TO BAND JOIST	3 - 16d COMMON (3%" x 0.162") 4 - 3" x 0.131" NAILS 4 - 3" 14 GAGE STAPLES	FACE NAIL
30. LEDGER STRIP	3 - 16d COMMON (3%" x 0.162") 4 - 3" x 0.131" NAILS 4 - 3" 14 GAGE STAPLES	FACE NAIL
31. WOOD STRUCTURAL PANELS AND PARTICLEBOARD - SUBFLOOR, ROOF, AND WALL SHEATHING (TO FRAMING) SINGLE FLOOR (COMBINATION SUBFLOOR-UNDERLAYMENT TO FRAMING)	6d <sup>c,l</sup> 2%" x 0.113" NAIL <sup>n</sup> 13/4" 16 GAGE STAPLE <sup>o</sup> 8d <sup>d</sup> OR 6d <sup>e</sup> 2 <sup>3</sup> / <sub>8</sub> " x 0.113" NAIL <sup>p</sup> 2" 16 GAGE STAPLE <sup>p</sup> 8d <sup>c</sup> 10d <sup>d</sup> OR 8d <sup>d</sup> 6d <sup>e</sup> 8d <sup>e</sup> 10d <sup>d</sup> OR 8d <sup>e</sup>	1/2" AND LESS 19/32" TO 3/4" 7/8" TO 1" 1 1/8" TO 1 1/4" 3/4" AND LESS 7/8" TO 1" 1 1/8" TO 1 1/4"
32. PANEL SIDING (TO FRAMING)	6d <sup>f</sup> 8d <sup>f</sup>	1/2" OR LESS 5/8"
33. FIBERBOARD SHEATHING <sup>g</sup>	NO. 11 GAGE ROOFING NAIL <sup>r</sup> 6d COMMON NAIL (2" x 0.113") NO. 16 GAGE STAPLE <sup>i</sup> NO. 11 GAGE ROOFING NAIL <sup>r</sup> 8d COMMON NAIL (2%" x 0.131") NO. 16 GAGE STAPLE <sup>i</sup>	1/2" 25/32"
34. INTERIOR PANELING	4d <sup>j</sup> 6d <sup>k</sup>	1/4" 3/8"

- a. Common or box nails are permitted to be used except where otherwise stated.
- b. Nails spaced at 6 inches on center at edges, 12 inches at intermediate supports except 6 inches at supports where spans are 48 inches or more. **For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305.** Nails for wall sheathing are permitted to be common, box or casing. Nails for shear walls shall be common or galvanized box.
- c. Common or deformed shank (6d - 2" x 0.113"; 8d - 2 1/2" x 0.131"; 10d - 3" x 0.148").
- d. Common (6d - 2" x 0.113"; 8d - 2 1/2" x 0.131"; 10d - 3" x 0.148").
- e. Deformed shank (6d - 2" x 0.113"; 8d - 2 1/2" x 0.131"; 10d - 3" x 0.148").
- f. Corrosion-resistant siding (6d - 1 7/8" x 0.106"; 8d - 2 3/8" x 0.128") or casing (6d - 2" x 0.099"; 8d - 2 1/2" x 0.113") nail.
- g. Fasteners spaced 3" on center at exterior edges and 6" on center at intermediate supports, when used as structural sheathing. Spacing shall be 6" on center on the edges and 12" on center at intermediate supports for nonstructural applications.
- h. Corrosion-resistant roofing nails with 7/16" diameter head and 1 1/2" length for 1/2" sheathing and 1 3/4" length for 25/32" sheathing.
- i. Corrosion-resistant staples with nominal 7/16" crown and 1 1/8" length for 1/2" sheathing and 1 1/2" length for 25/32" sheathing. Panel supports at 16" (20" if strength axis in the long direction of the panel, unless otherwise marked).
- j. Casing (1 1/2" x 0.080") or finish (1 1/2" x 0.072") nails spaced 6" on panel edges, 12" at intermediate supports.
- k. Panel supports at 24". Casing or finish nails spaced 6" on panel edges, 12" at intermediate supports.
- l. For roof sheathing applications, 8d nails (2 1/2" x 0.113") are the minimum required for wood structural panels.
- m. Staples shall have a minimum crown width of 7/16".
- n. For roof sheathing application, fasteners spaced 4" on center at edges, 8" at intermediate supports.
- o. Fasteners spaced 4" on center at edges, 8" at intermediate supports for subfloor and wall sheathing and 3" on center at edges, 6" at intermediate supports for roof sheathing.
- p. Fasteners spaced 4" on center at edges, 8" at intermediate supports.

## PLATFORM FRAMING

In California modern conventional construction, platform framing is predominantly used, consisting of a subfloor which serves as a "platform" upon which the carpenter assembles wall sections that are easily raised into place. When you are working alone, the wall lengths should be limited to 12 foot sections. Long heavy headers and boundary studs can be installed after the wall is in place.



\*ACTUAL SPACING AND NAIL SIZE  
WILL EQUAL NAIL SIZE AND PANEL  
EDGE SPACING OF SHEAR WALL

**TABLE 2308.9.1 - SIZE, HEIGHT AND SPACING OF WOOD STUDS**

STUD SIZE (inches)	Bearing Walls				Non Bearing Walls	
	Laterally unsupported stud height <sup>a</sup> (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Laterally unsupported stud height <sup>a</sup> (feet)	Spacing (inches)
		Spacing (inches)				
2 X 3 <sup>b</sup>	--	--	--	--	10	16
2 X 4	10	24	16	--	14	24
3 X 4	10	24	24	16	14	24
2 X 5	10	24	24	--	16	24
2 X 6	10	24	24	16	20	24

a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by an analysis.

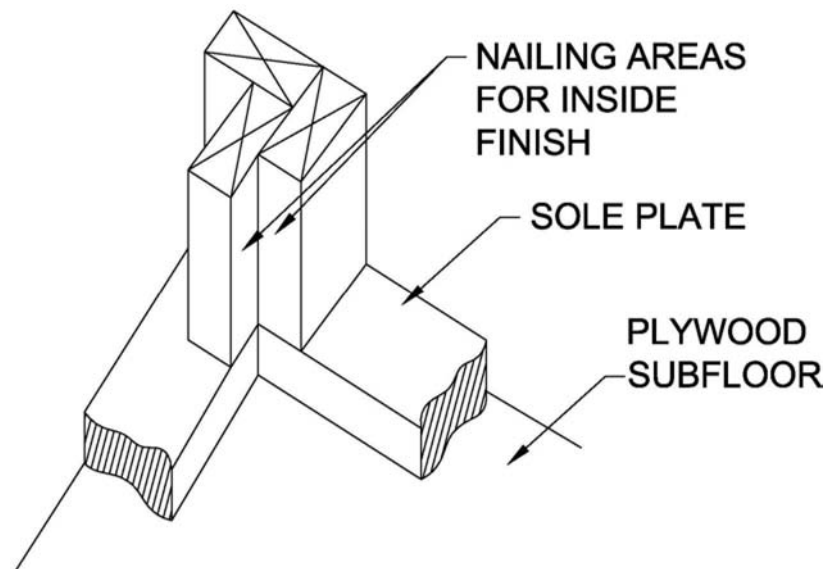
b. Shall not be used in exterior walls.

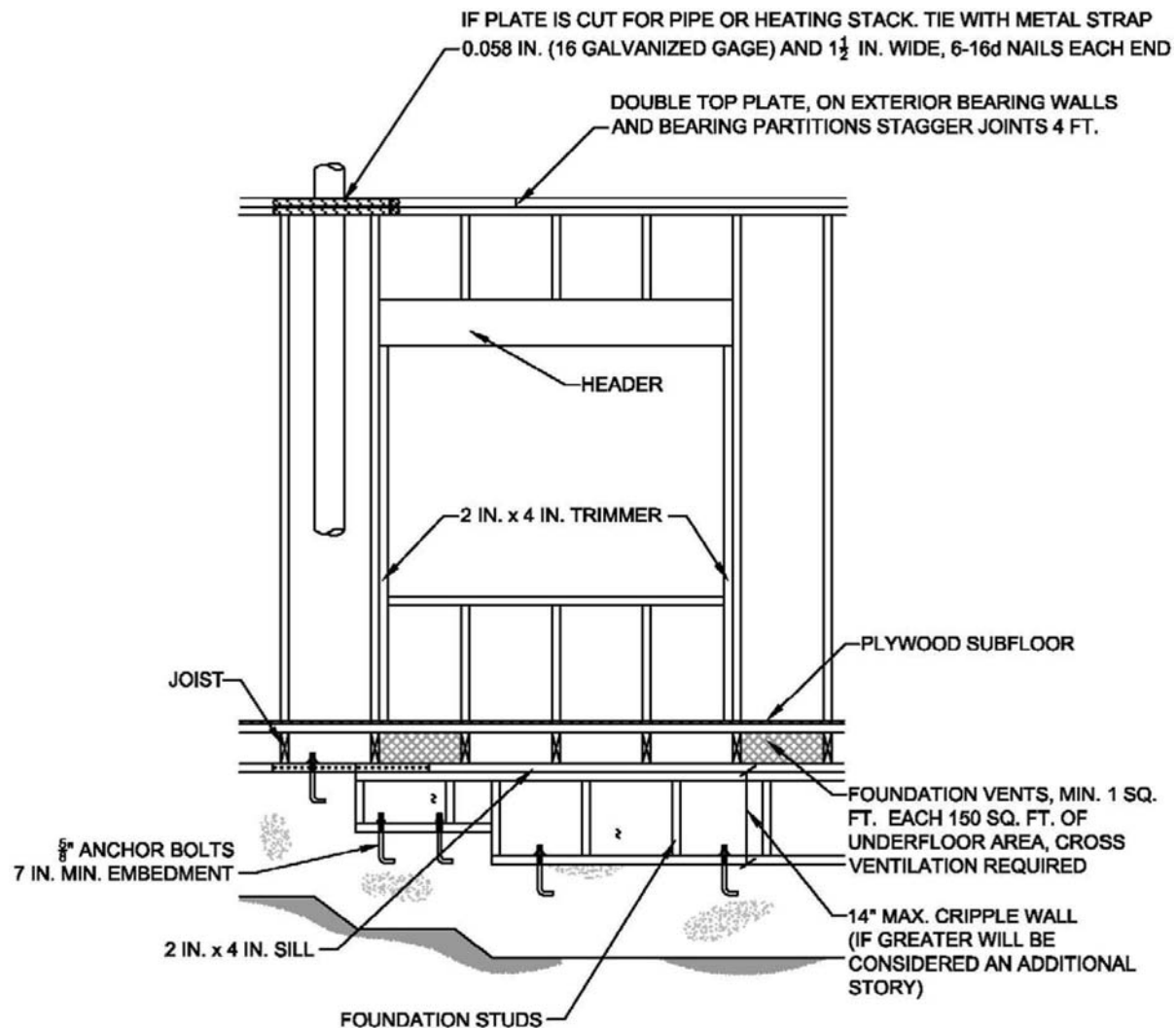
Not less than three studs shall be installed at each corner of an exterior wall.

**EXCEPTION:** At corners, a third stud may be omitted through the use of wood spacers or backup cleats of  $\frac{3}{8}$ " thick plywood, 1" thick lumber, or other approved devices which will serve as an adequate backing for the attachment of facing devices.

Studs shall be continuous from floor to floor, from floor to ceiling, or from floor to roof level above. Blocking at mid height keeps twisting of studs to minimum.

Diagonal bracing is for construction stability only. Bracing of exterior walls shall be through use of plywood, gyp board, or other approved systems.



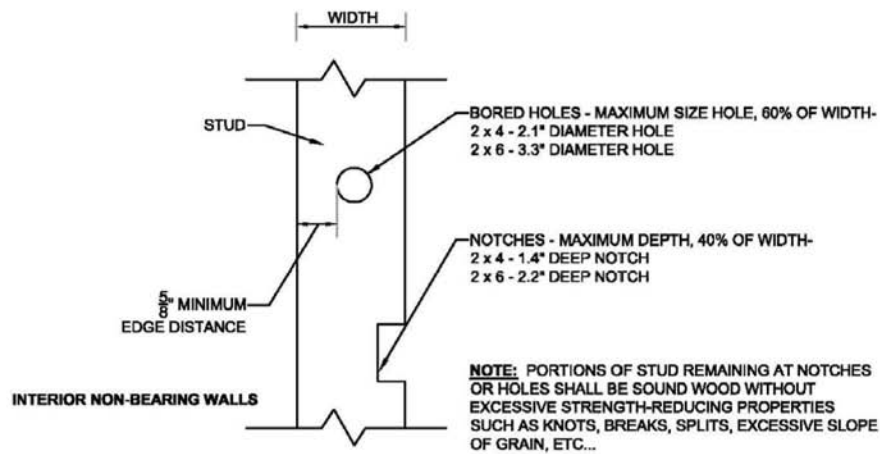
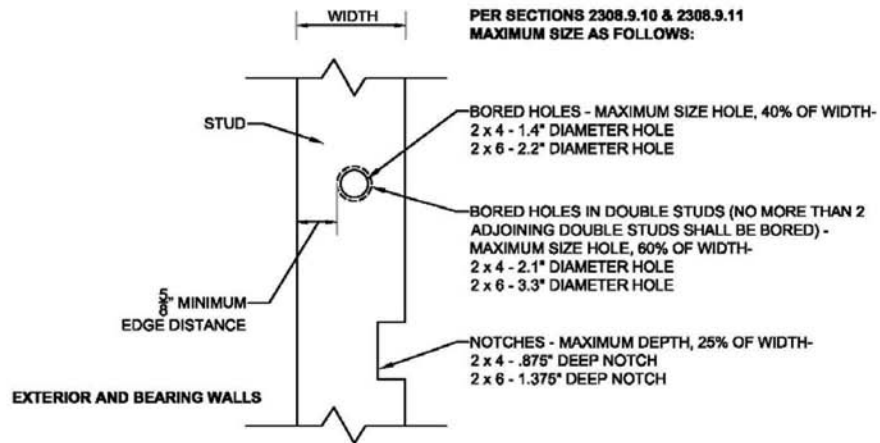


### **BASIC WALL FRAMING SYSTEM -- SINGLE STORY:**

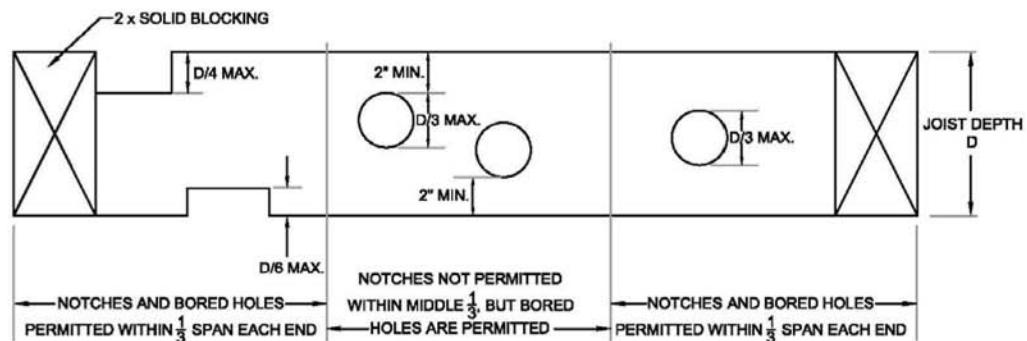
**HEADERS.** All openings 4' wide or less in bearing walls shall be provided with headers consisting of either two 2 x 6 DF #2 placed on edge and securely fastened together or 4 x 6 DF #2. All headers or lintels shall have not less than 1 1/2" solid bearing at each end to the floor or bottom plate, unless other approved framing methods or joint devices are used.

Minimum header sizes for one-story house, supporting a roof only, with standard light framing using No. 2 DF or better: 4 x 6 up to 4' span; 4 x 10 for up to 6' span; 4 x 12 for up to 8' span. For support of second story and roof: 4 x 8 for 4' span; 4 x 12 for 6' span. (Longer spans will require structural calculations)

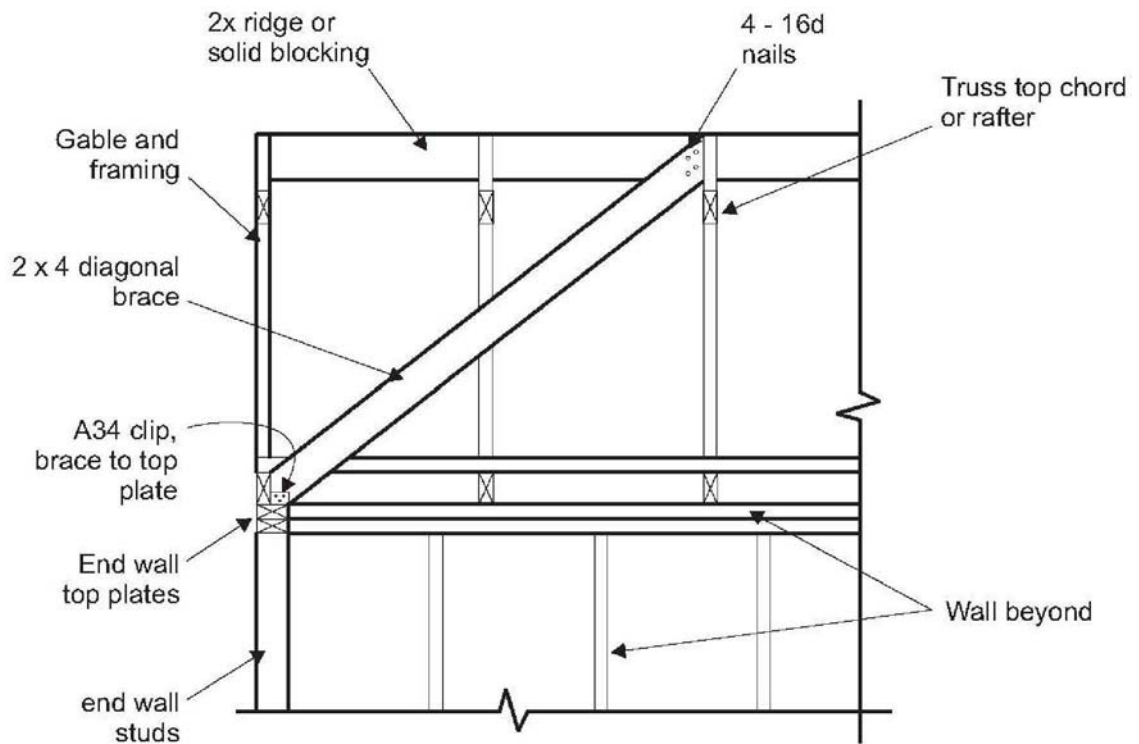
## CUTTING, NOTCHING AND BORING OF STUDS AND FLOOR JOISTS:



### NOTCHING AND BORING OF STUDS



### NOTCHING AND BORING OF FLOOR JOISTS



### **Softwall Brace Detail**

For bracing gable end walls without full height studs or ceiling finish at plate line



**FIRESTOPPING.** Firestopping must be provided to cut off all concealed draft openings (both vertical and horizontal) and must form an effective barrier between stories, and between a top story and roof space. It must be used in specific locations, as follows.

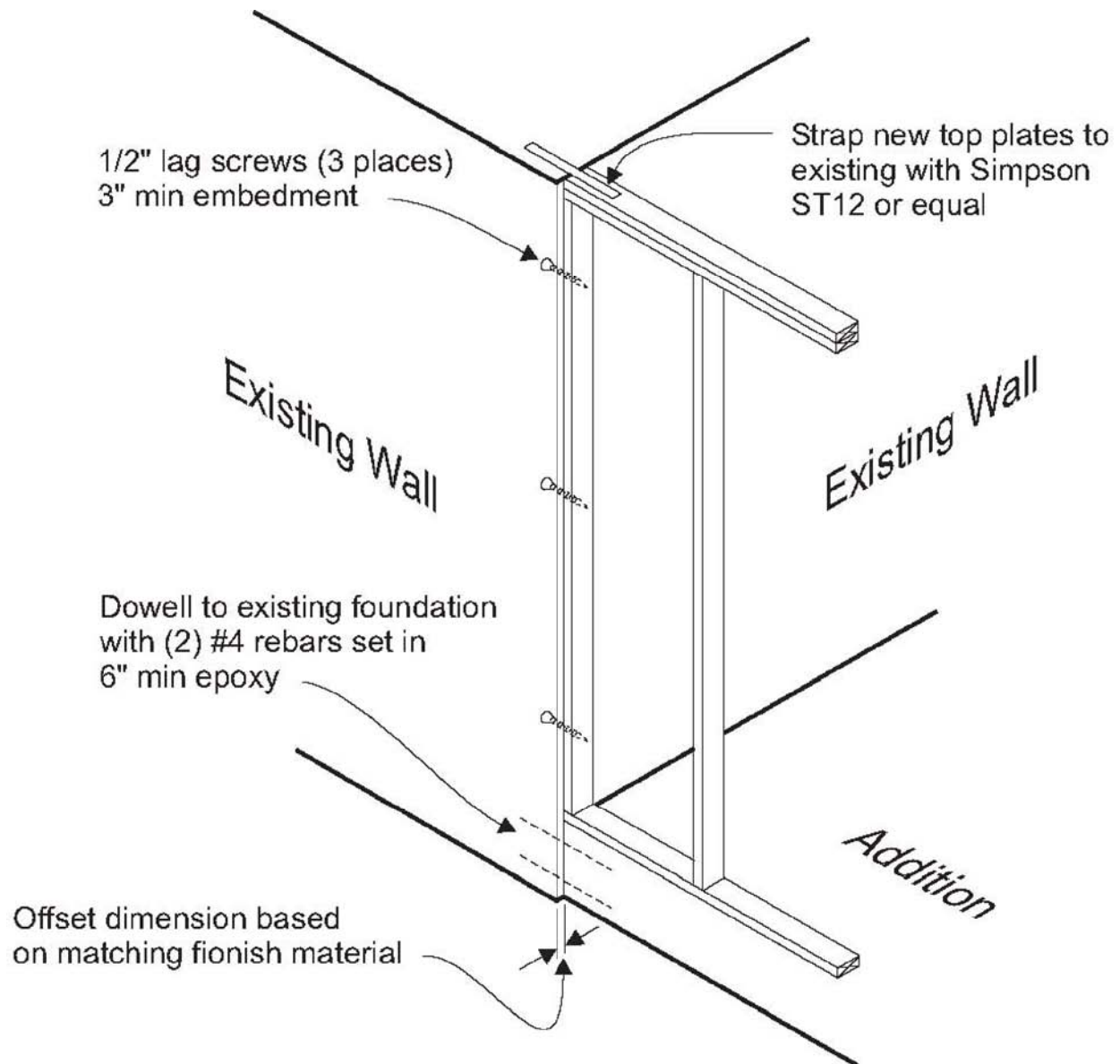
1. In exterior or interior stud walls, at ceilings and floor levels.
2. In all stud walls and partitions, including furred spaces, at the ceiling and floor levels, at 10 foot intervals, both vertical and horizontal.
3. Between stair stringers at top and bottom and between studs along and in line with run of stair adjoining stud walls and partitions.
4. Around top, bottom, sides, and ends of sliding door pockets.
5. In spaces between chimneys and wood framing, loose noncombustible materials shall be placed in noncombustible supports, or a metal collar tightly fitted to the chimney and nailed to the wood framing.
6. Around tubs and showers, furred down ceilings, soffits, holes for pipes, and similar places which could afford a passage for flames.

Firestops, when made of wood, shall be 2" nominal thickness.

Firestops may also be made of gypsum board. Firestops shall be securely fastened in place.

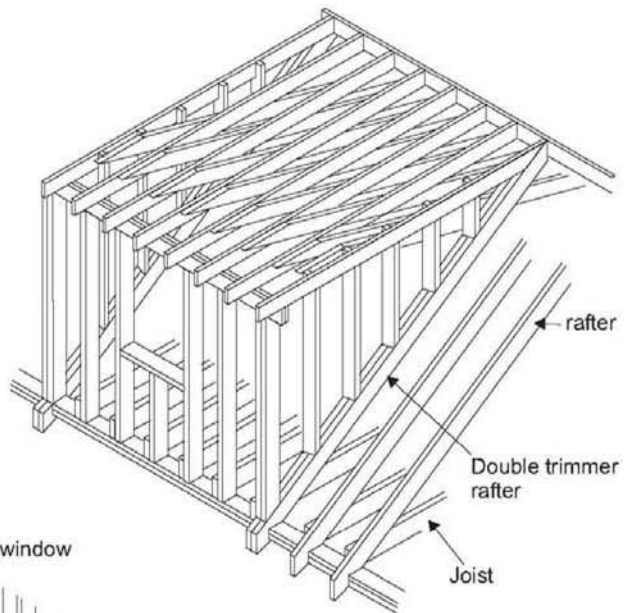
**EXTERIOR PLYWOOD SIDING PANELS:**

To be installed and nailed per manufacturer's product listing.

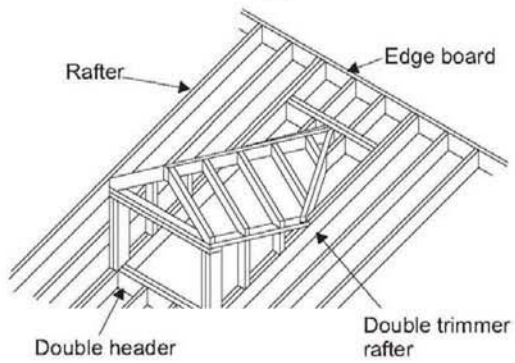


### **Addition to Existing Dwelling: Connect to Existing Structure**

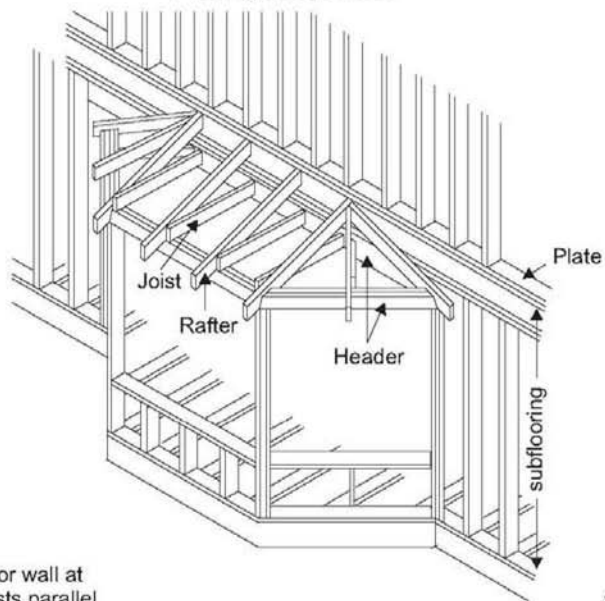
Method of framing shed-type dormer



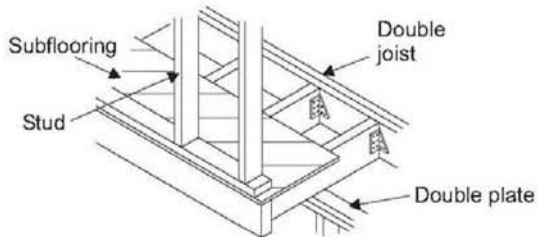
Method of framing gable dormer



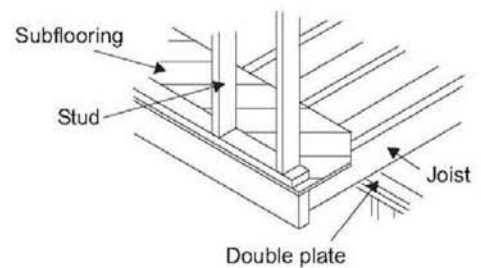
Framing of bay window



Overhang of exterior wall at second floor with joists parallel to wall below



Overhang of exterior wall at second floor with joists parallel at right angles to wall below



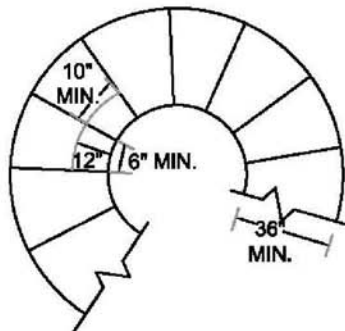
### **Conventional Framing Details**

## **STAIRWAYS:**

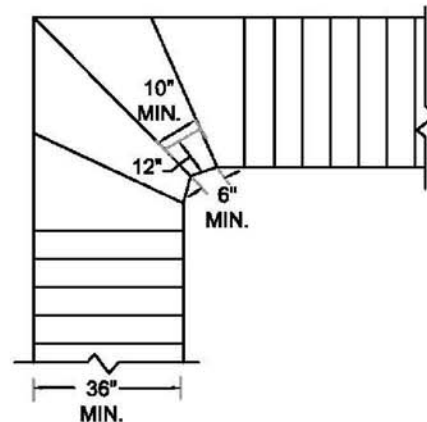
**STAIRWAY REQUIREMENTS.** Stairways in dwellings must be a minimum of 36" wide. The rise of every residential step shall not exceed 7.75" and the tread depth shall not be less than 10". Winders shall have a tread depth of 10" at the walk line and a minimum tread depth of 6". The largest tread width or riser height within any flight of stairs shall not exceed the smallest by more than .375" measured at the walk line.

Stairways shall have a headroom clearance of 80 inches measured vertically from a line connecting the nosings. Clearance shall extend one tread depth past the bottom riser.

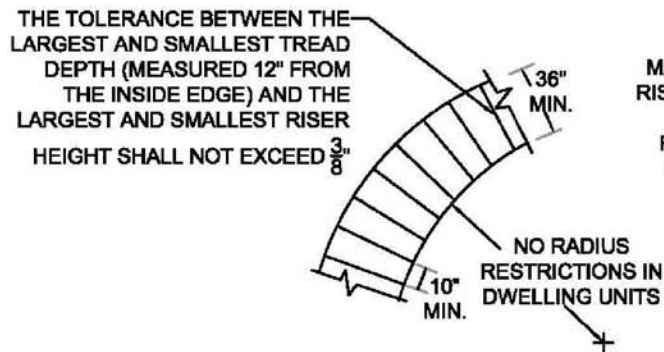
Spiral stairs shall have a minimum tread depth of 7.5" at the walk line, a riser height maximum of 9.5 inches, a minimum width of 26 inches and a headroom clearance of 78 inches.



**WINDING STAIRWAY**

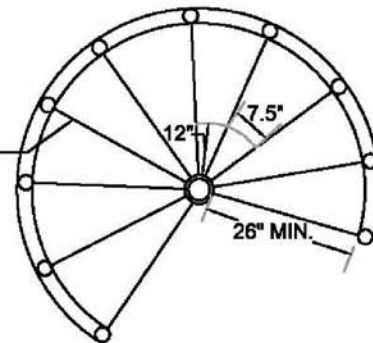


**ALTERNATE USE OF WINDERS**



**CIRCULAR STAIRWAY**

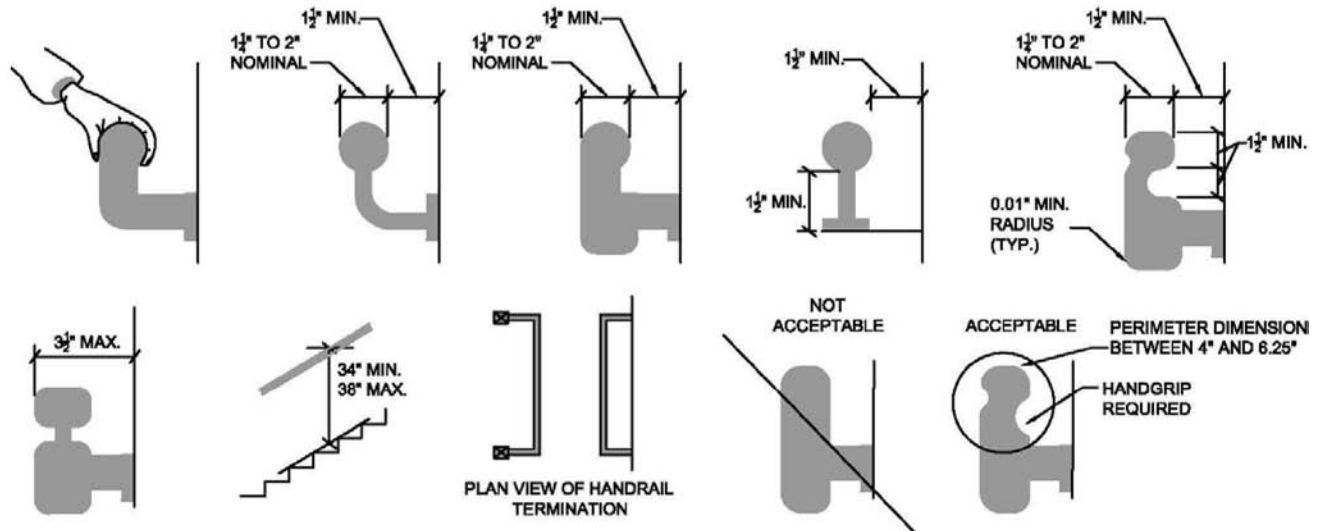
MAXIMUM 9.5" RISER HEIGHT, AND SHALL PROVIDE 78" HEADROOM



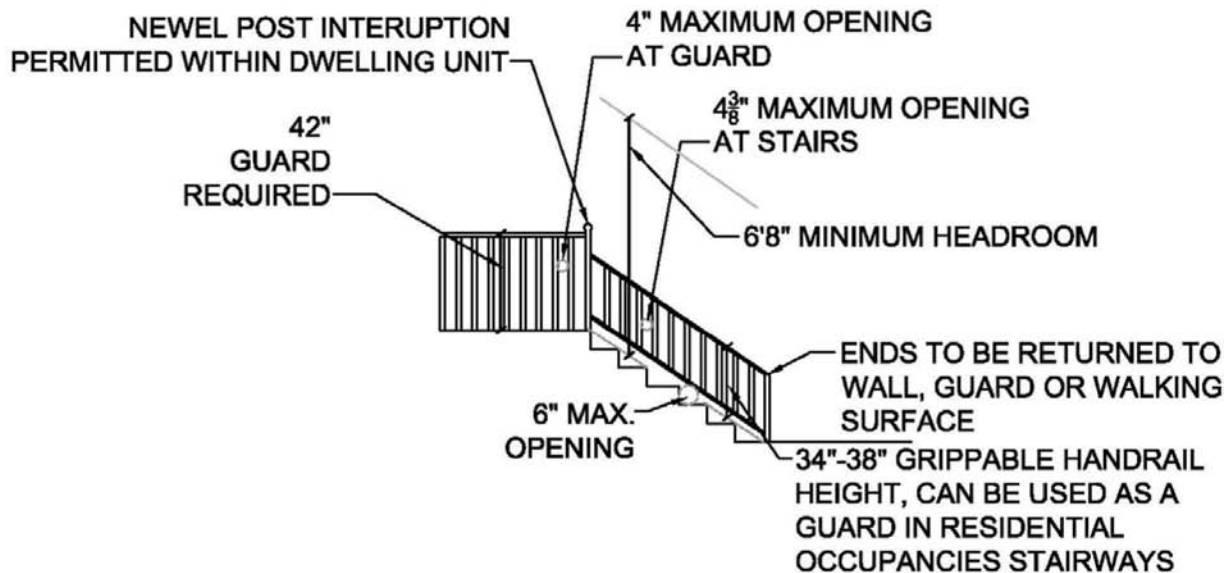
**SPIRAL STAIRWAY**

**NOTE:** DIMENSIONS AND STAIR REQUIREMENTS APPLY ONLY TO INDIVIDUAL DWELLING UNITS IN RESIDENTIAL OCCUPANCIES. HANDRAILS NOT SHOWN FOR CLARITY. DETAILS NOT DRAWN TO SCALE

**HANDRAILS.** Handrails shall be placed not less than 34" nor more than 38" above the nosing of the treads. The handgrip portion of handrails shall not be less than 1 1/4" nor more than 2" in cross-sectional dimension and the handgrip shall be smooth. Ends shall be returned or shall terminate in newel posts or safety terminals.

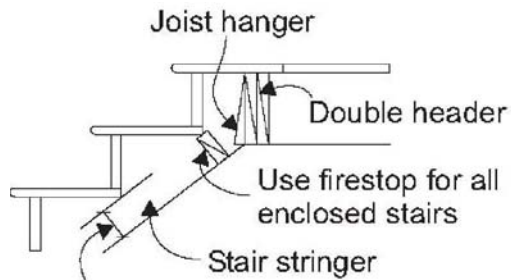


Stairways greater than 30" in height must have guards on any open side and all stairways with more than three risers shall have at least one handrail. Open stair railings shall have intermediate rails of an ornamental pattern such that a sphere 4 3/8" in diameter cannot pass through.



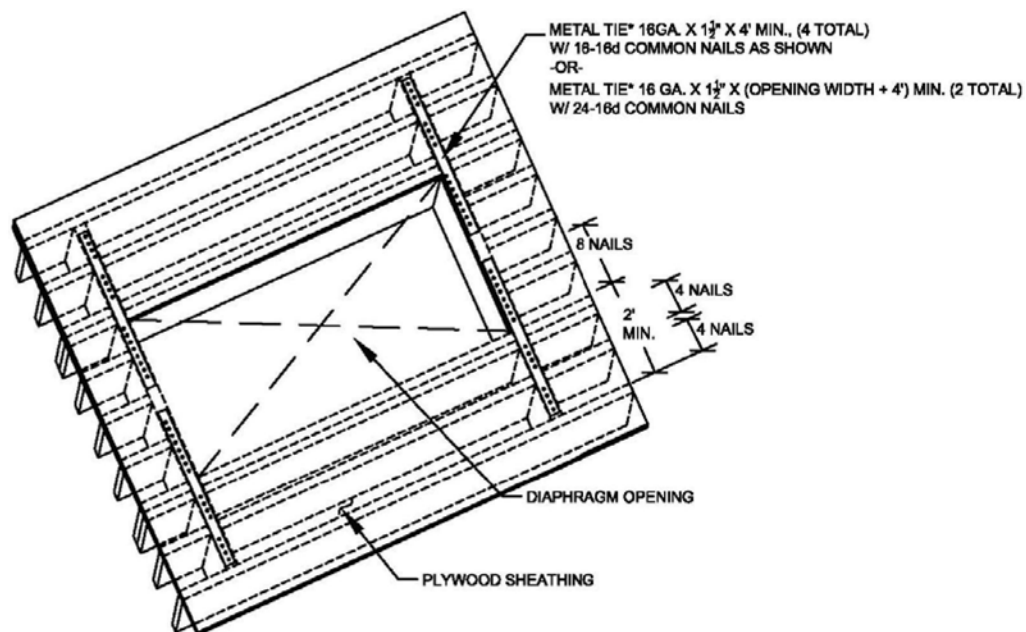
Where there is enclosed usable space under stairs, the walls and soffits of the enclosed space shall be protected on the enclosed side by 1/2" gypsum board.

**HORIZONTAL OPENING.** Provide fireblocking between stair stringers at top and bottom and between studs along and in line with run of stair, adjoining stud walls and partitions.



For notched stringers, use allowable stresses for lumber 2 grades lower than specified member. Size and capacity of all stringers shall be calculated using 100 P.S.F. live load.

There shall be a floor or landing at the top and bottom of each stairway. The width and length of the landings shall be not less than the width of the stairway. Interior stairs from the house to the garage need not have a landing provided the door does not swing over the stairs. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. Doors in the fully open position shall not reduce a required dimension by more than 7". There shall not be more than 12' vertically between landings.



BLOCKING SHALL BE PROVIDED BEYOND HEADERS

\* MINIMUM YIELD OF 33,000 PSI

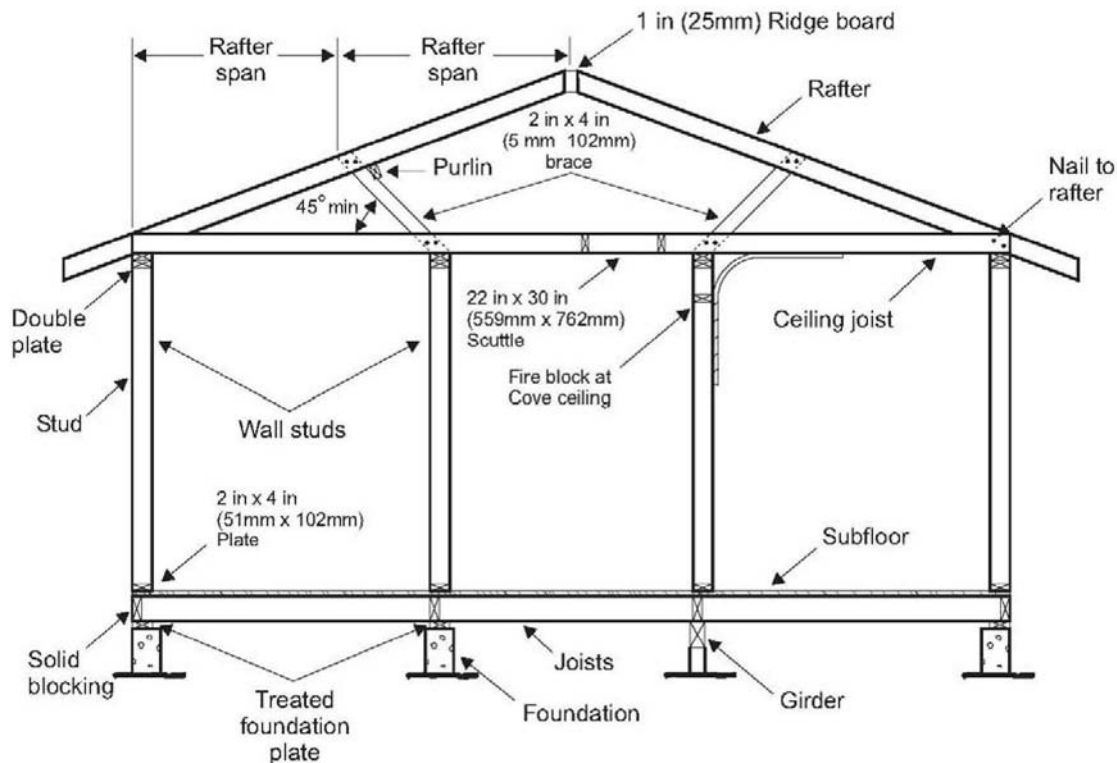
## **ROOF AND CEILING FRAMING:**

The following requirements apply to roofs having a minimum pitch of 3:12 or greater. When the roof pitch is less than 3:12, members supporting rafters and ceiling joists such as ridge boards, hips, and valleys shall be designed as beams.

Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board at least 1" nominal thickness at all ridges and not less in depth than the cut end of the rafter. Ridge boards are not required where trusses are used or where special roof design is utilized to effect the transverse continuous tie of roof members at peak. At all valleys and hips, there shall be a single valley or hip rafter not less than 2" nominal thickness and not less in depth than the cut end of the rafter.

Rafters shall be nailed to adjacent ceiling joists to form a continuous tie between exterior walls when such joists are parallel to the rafters. Where not parallel, rafters shall be tied to 1" x 4" (nominal) minimum sized cross ties. Rafter ties shall be spaced not more than 4' on center.

Purlins to support roof loads may be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls. The maximum span of 2" x 4" purlin shall be 4'. The maximum span of the 2" x 6" purlin shall be 6', but in no case shall the purlin be smaller than the supported rafter. Struts shall be not smaller than 2" x 4" members. The unbraced length of struts shall not exceed 8' and the minimum slope of the struts shall be not less than 45 degrees from the horizontal.

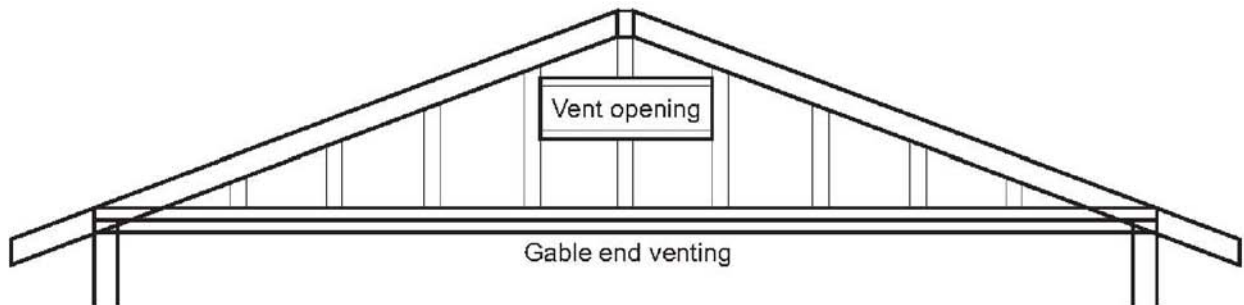


**Roof Framing Detail**

### **ATTIC VENTILATION AND ACCESS:**

Enclosed attics and enclosed rafter spaces shall have cross-ventilation for each separate space by openings protected against the entrance of rain. The open area shall not be less than 1/150th of the area of the space ventilated, however the area may be 1/300th where 50% of the required area is provided by ventilators located in the upper portion of the space to be ventilated at least 3' above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. The openings shall be covered with corrosion-resistant wire mesh with openings  $\frac{1}{8}$ " to  $\frac{1}{4}$ ".

NOTE: Much of Mendocino County is in the SRA where the use of eave vents may be restricted. See Appendix 5 of this manual or CBC Chapter 7A for more information.



### **Attic Ventilation and Access**

#### **ATTIC ACCESS**

Dwellings must have access to attics by scuttle or other means not less than 20" x 30" with 30" of clear headroom at access openings. (Access is not required if the maximum vertical height is less than 30".) All areas with vertical height greater than 30" must have access



## **SECTION 8 - INSULATION:**

### **BUILDING ENVELOPE MEASURES.** (See Section 3, "Residential Energy Standards")

The building envelope includes the foundation, floor, walls, doors, windows, roofs and skylights. An energy efficient building envelope will minimize the heat losses out of and heat gains in to the dwelling. As a result, the space conditioning system will use less energy to control indoor temperature and the indoor environment will be more comfortable. This section discusses the insulation and ventilation features needed to comply with the California Building Code and the Energy Efficiency Standards.

### **CEILING INSULATION.** [Appendix B section. 150(a) and 150(b), 2008 Energy Efficiency Standards].

The opaque portions of ceilings separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either Item 1 or 2 below:

1. Ceilings shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-19 or greater for the insulation alone.

ALTERNATIVE to Section 150(a) 1: Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-19 insulation between wood-framing members and accounting for the thermal effects of framing members.

2. The weighted average U-factor of ceilings shall not exceed the U-factor that would result from installing R-19 insulation between wood-framing members in the entire ceiling and accounting for the effects of framing members.

The insulation may be of greater insulating value in certain areas of the ceiling and of lesser insulating value in other areas of the ceiling provided that the overall weighted average U-factor does not exceed the equivalent R-19 wood framed value of 0.049 or the equivalent value for the package or performance analysis used.

Although R-19 insulation between wood framing members is the minimum mandatory level, the package or performance computation may require a higher R value.

Ceiling insulation should not block eave vents in attics or rafter cavities formed when the ceiling finish is applied directly to the underside of the rafters. A minimum of 1" air space shall be provided between the insulation and the roof sheathing. If the flow of air is blocked, water vapor may condense on the underside of the roof, reducing the effectiveness of the insulation and causing dryrot and fungus to grow on and damage the building materials.

To meet the intent of the ceiling insulation requirements, ceiling insulation should extend far enough to the outside walls to cover the top plate. However, insulation may be tapered at the wall where a roof slopes down; an elevated truss or similar treatment for full insulation depth at the outside of the wall is not required but may be desirable. If insulation is tapered for more than three feet from the outside wall, this must be reflected in a weighted average U-value calculation.

### **LUMINAIRES IN INSULATED CEILINGS** [Sec 150 (k)12 2008 Energy Efficiency Standards] Luminaires recessed in insulated ceilings must meet three requirements.

1. Fixtures must be approved for zero-clearance insulation cover ("I.C. rated").
2. The fixture housing must be labeled as a certified airtight luminaire to prevent air movement between conditioned and unconditioned spaces.
3. Luminaires shall be sealed with a gasket or caulking between the luminaire housing and ceiling. All air leak paths between conditioned and non conditioned spaces shall be sealed with a gasket or caulk.

**INSTALLATION OF INSULATION IN EXISTING ATTICS:** [Sec. 118(d)1, 2008 Energy Efficiency Standards] Insulation being installed in an existing, accessible attic must meet or exceed:

- R-30 if the building is located in climate zone 2, or
- R-38 if the building is located in climate zone 1 (coastal areas).

In addition, the Standards state “where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 1203.2 of the 2010 CBC and Section R806.1 of the 2010 CRC.”

**LOOSE FILL INSULATION.** [Sec. 150(b), 2008 Energy Efficiency Standards]

Loose fill insulation should be blown in evenly and documented in the Installation Certificate (CF6R). Insulation levels can be verified by checking that the depth of insulation conforms to the manufacturer’s coverage chart for the listed R-value. The insulation must also meet the manufacturer’s specified minimum weight per square foot for the corresponding R-value. Additionally, three criteria the installer must consider are: 1) roof slope, 2) ceiling slope and 3) clearance.

Where ceiling insulation is installed next to eave or soffit vents, a rigid baffle should be installed at the top plate to direct ventilation air up and over the ceiling insulation. The baffle should extend beyond the height of the ceiling insulation and should have sufficient clearance between the baffle and roof deck at the top. Baffles shall be in place at the time of the framing inspection.

**WALL INSULATION.** [Section 150 (c), 2008 Energy Efficiency Standards]

The opaque portions of frame walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of either Item 1 or 2 below:

1. Wood-framed walls shall be insulated between framing members with insulation having an installed thermal resistance of R-13 or greater. Framed foundation walls of heated basements or heated crawl spaces shall be insulated above the adjacent outside ground line with insulation having an installed thermal resistance of at least R-13.

ALTERNATIVE to Section 150 (c) 1: Insulation which is not penetrated by framing members may meet an R-value equivalent to installing R-13 insulation between wood-framing members and accounting for the effects of framing members.

2. The weighted average U-factor of walls shall not exceed the U-factor that would result from installing R-13 insulation between wood-framing members and accounting for the effects of framing members.

The insulation may be of greater insulating value in certain areas of the wall and of lesser insulation value in other areas of the wall provided that the overall weighted average U-value does not exceed the equivalent R-13 wood framed value (0.102). Metal framed walls will require rigid insulation to achieve a maximum U value of 0.102.

Unframed walls such as concrete or masonry are not required to meet this minimum but may have other insulation requirements.

The package or performance calculation method may require the use of greater R value insulation. If a vapor barrier is required it must face the conditioned space.

NOTE: Rim joists between the stories of a multi-story building are part of the wall and must be insulated to the same level as the wall.

**RAISED FLOOR INSULATION.** [Sec. 150 (d), 2008 Energy Efficiency Standards]

Raised floors separating conditioned space from unconditioned space shall meet the requirements of either Item 1 or 2 below:

1. Floors shall be insulated between wood-framing members with insulation having an installed thermal resistance of R-13 or greater.
2. The weighted average U-factor of floor assemblies shall not exceed the U-factor that would result from installing R-13 insulation between wood-framing members and accounting for the effects of framing members.

ALTERNATIVE to Section 150 (d) 1 and 2: Raised floor insulation may be omitted if the foundation cripple walls are insulated to meet the wall insulation minimums R-21 in Zone 1 or R-13 in Zone 2), a vapor barrier is placed over the entire floor of the crawl space, and vents are fitted with automatically operated louvers that are temperature actuated.

The insulation may be of greater insulation value in certain areas of the raised floor and of lesser insulating value in other areas of the raised floor provided that the overall weighted average U-value does not exceed the equivalent R-13 framed value (that is,  $U\text{-value} = 0.045$ ).

See the 2008 Residential Compliance Manual for the method to be used to document the insulation equivalency of any proposed alternate design.

The package or performance calculation may require the use of insulation with a higher R value.

Note: The computer methods provide a thermal credit equivalent to R-6 insulation in raised floors over crawl spaces. The maximum raised floor U-value of 0.045 cannot be met by including the effects of the R-6 crawl space.

**SLAB EDGE INSULATION.** [Sec. 118(g), 2008 Energy Efficiency Standards]

Slab edge insulation reduces heat loss through the slab perimeter. When slab edge insulation is installed, the material used must meet the following minimum specifications:

- A water absorption rate no greater than 0.3 percent when tested according with Test Method A – 24-Hour-Immersion of ASTM-C-272; and,
- A water vapor permeance no greater than 2.0 perm/inch when tested according to ASTM-E-96; and,
- Concrete slab perimeter insulation must be protected from physical damage and ultraviolet light deterioration.

Slab edge insulation must be installed with heated slabs. This is not part of the mandatory requirements of the *Standards*, but rather is an eligibility criterion for hydronic heating systems with coils in the slab. Slab edge insulation installed with hydronic heating systems is considered energy neutral and is not modeled in performance calculations.

**PIPE INSULATION.** [Sec 150 (j) and 151 (f) 8 d, 2008 Energy Efficiency Standards]

Both hot and cold water lines within 5' of the water heater must be insulated to R-4, minimum. All 3/4" or larger hot water lines between the water heater and kitchen must be insulated to R-4. All recirculating water lines must be insulated. One inch thick insulation will provide the required R value.

If required by the energy compliance calculations, all other hot water lines may also need insulation.

**DUCT INSULATION.** [ Sec. 150 (m), 2008 Energy Efficiency Standards]

Unless ducts are enclosed entirely in conditional space, the minimum allowed duct insulation value is R-4.2. When using the prescriptive method of compliance, the minimum value is R-6.

**INSTALLATION OF CERTIFIED INSULATING MATERIAL..** [Sec. 118, 2008 Energy Efficiency Standards]

Any insulation of the type and form listed below may be installed only if the manufacturer has certified that the insulation complies with the California Code of Regulations, Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.

TYPE	FORM
Aluminum foil	Reflective foil
Cellular glass	Board form
Cellulose fiber	Loose fill and spray applied
Mineral aggregate	Board form
Mineral fiber	Blankets, board form, loose fill
Perlite	Loose fill
Phenolic	Board form
Polystyrene	Board form, molded extruded
Polyurethane	Board form and field applied
Polyisocyanate	Board form and field applied
Urea formaldehyde	Foam field applied
Vermiculite	Loose fill

California Quality Standards for Insulating Materials also require that all exposed installations of faced mineral fiber and mineral aggregate insulation must use fire retardant facings. Exposed installations are those where the insulation facings do not touch a ceiling, wall or floor surface, and faced batts on the underside of roofs with an air space between the ceiling and facing. These installations require insulation that has been tested and certified not to exceed a flame spread of 25 and a smoke density rating of 450.

Flame spread ratings and smoke density ratings are shown on the insulation or packaging material or may be obtained from the manufacturer.

**FOAM PLASTIC INSULATION.** [Sec 2603, 2010 CBC]

Foam plastic insulation may only be installed in buildings when in conformance with Section 2603 of the 2010 CBC and the California Energy Efficiency Standards. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to job sites shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information to show that the end use will comply with the code requirements.

Foam plastic insulation used in building construction shall have a flame-spread rating of not more than 75 and a smoke-developed rating of not more than 450 when tested in the maximum thickness intended for use according to ASTM E 84 or UL 723.

The interior of the building shall be separated from the foam plastic insulation by an approved thermal barrier of 1/2" thick gypsum wallboard. Other materials may be used only if documentation

is provided to show that the material will limit the average temperature rise of the unexposed surface to not more than 250°F after 15 minutes of fire exposure under test method ASTM E 119 or UL 263. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on approved diversified tests.

Note: This thermal barrier is not required on a wall if ALL of the following conditions are met:

1. it is an exterior wall, and
2. the building is one story, and
3. the flame spread index of the insulation is 25 or less, and the thickness of the insulation is 4" or less, and
4. the insulation is covered with min. 0.032" thick aluminum or 0.016" thick corrosion-resistant steel, or
5. the building is equipped with fire sprinklers.

Foam plastic insulation may be used as part of a roof-covering assembly provided the assembly with the foam plastic insulation is a Class A roofing assembly tested according to FM 4450 or UL 1256. If foam plastic insulation is installed under a roof assembly or roof covering installed in accordance with the code and manufacturer's instructions, it shall be separated from the interior of the building by wood structural panel sheathing not less than 1/2" in thickness, bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent material. The thermal barrier requirement is waived.

Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition with min. 1.5" thick mineral fiber insulation, 0.25" thick wood structural panel or particleboard, 3/8" gypsum wallboard, or 0.016" corrosion-resistant steel.

#### **ATTIC VENTILATION AND VENTILATION OF INSULATED ENCLOSED RAFTER AND JOIST CAVITIES.** [Sec 1203, 2010 CBC]

All enclosed attics and enclosed rafter spaces shall have cross-ventilation by eave vents. The net clear open area of these vents shall be 1/300 of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3' above the eave vents with the balance of the required ventilation provided by eave vents. Providing this required ventilation in enclosed insulated rafter and joist cavities becomes more difficult. The required net clear open area must be provided for the full width and length of the rafter or joist space between the insulation and the roof sheathing to prevent condensation. The minimum depth of this open space is 1".

Many insulation manufacturers supply cathedral batt insulation designed to be used in these rafter and joist cavities without as much ventilation. The manufacturers of these special cathedral batts have published data that recommends allowing a reduced ventilation space between the batts and the roof sheathing.

Alternatively, rafter cavities and joist cavities that are completely filled by closed cell foam insulation shall be allowed to be unvented. Unvented rafter cavities should be constructed using fully dried lumber and not be exposed to rain or inclement weather during construction in order to assure that moisture will not be trapped in these cavities. Also, be aware that foam insulation is tested and approved with a maximum allowed thickness. Check this limitation before specifying that "rafter cavities are to be filled". See the section on Foam Plastic Insulation in this manual for a complete discussion on using this material.

See Appendix 5 of this manual or CBC Chapter 7A for a discussion on the limitations on attic vent locations within the Wildland Urban Interface.

## **SECTION 9-ROOF COVERINGS**

**ROOFING ASSEMBLY.** Includes the roof deck, substrate or thermal barrier, insulation, vapor retarder, underlayment, interlayer, base plies, roofing plies, and roof covering that is assigned a roofing classification.

Due to local climatic and geographic conditions Mendocino County requires a fire safe roofing standard. Sections 1505.1 of the 2010 California Building Code and R902.1 of the California Residential Code have been amended as follows:

Except as otherwise provided below, the minimum roof covering installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

**Exceptions:** Skylights and sloped glazing that comply with Chapter 24 or Section 2610, greenhouses, patio covers, residential car covers, sod roofs, and fabric membrane structures.

The roof covering on the below specified structures shall be not less than a **Class A** roof covering assembly:

As defined in Section 1505.2 of the 2010 CBC, a Class A roof covering is any assembly that has been tested and listed by an approved testing agency as meeting Class A requirements. It also includes roof coverings of slate, clay, concrete, or metal.

In general, wood shakes and shingles do not meet Class A standards. Certain proprietary brands of wood shakes, treated and used with special underlayments, have qualified as a Class A assembly. Ask the supplier to provide proof of Class A rating before purchasing wood shakes.

**For roof assembly requirements that are to comply with the 2010 California Green Building Standards Code.**

## **SECTION 10 - ROOF DRAINAGE**

**GENERAL** Roofs shall be sloped a minimum of 1 unit vertical in 48 units horizontal (2% slope) for drainage unless designed for water accumulation in accordance with CBC Section 1611 and approved by the building official. Roof drains and overflow drains shall be designed to comply with Chapter 11 of the 2010 California Plumbing Code.

**ROOF DRAINS.** Unless roofs are sloped to drain over roof edges or are designed to support accumulated water, roof drains shall be installed at each low point of the roof.

Roof drains shall be adequate in size to convey the water tributary to the roof drains. Roof drains shall be sized according to CPC Tables 11-1 and 11-2, assuming a minimum four inch (4") per hour rainfall.

Roof drains shall be equipped with strainers extending not less than four inches (4") above the surface of the roof immediately adjacent to the drain. Strainers shall have a minimum inlet area one and one-half (1-1/2) times the pipe to which they are connected. Roof deck strainers for use on sun decks, parking decks, and similar occupied areas may be of an approved flat-surface type which is level with the deck. Such flat-surface drains shall have an inlet area not less than two (2) times the area of the pipe to which the drain is connected.

**OVERFLOW DRAINS AND SCUPPERS.** Where roof drains are required, overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2" above the low point of the roof. Alternately, overflow scuppers at least 4" high and having a width equal to the circumference of the roof primary drain may be installed in the adjacent parapet walls with the inlet flow line located 2" above the low point of the adjacent roof.

Overflow drains shall discharge to an approved location. Overflow drains are allowed to connect to the vertical piping of the primary storm drain downstream of any horizontal offset below the roof. The combined drain system shall be sized to accommodate a doubled rainfall rate.

Roof drains passing through the roof into the interior of a building shall be made water tight at the roof line by the use of a suitable flashing material. Flashing and counter-flashing in walls shall be provided as required in 2010 CBC Section 1405.4 and 2010 CRC Section R703.8; for roof valley flashing and all other roof penetrations, see 2010 CBC Section 1503.2. and 2010 CRC Section R903.2.

<b>Sizing of Roof Drains and Rainwater Piping</b> Based on Horizontal Projected Roof Area in Sq. Ft. and Four Inch Rainfall (see table on next page)			
Size of Drain or Leader in Inches*			
2	3	4	5
Maximum Area in Square Feet			
544	1610	3460	6280

\* Round, square, or rectangular rainwater pipe may be used and are considered equivalent when enclosing a scribed circle equivalent to the leader diameter. **Roof drains should not discharge on or above any leachfield or septic tanks.**

**Materials.** Roof drains and overflow drains shall be constructed of cast iron, copper, lead, schedule 40 ABS or PVC, or other approved corrosion-resisting materials.

**TABLE 11-1**  
**Sizing Roof Drains, Leaders, and Vertical Rainwater Piping**<sup>1,2,3</sup>

Size of Drain, Leader, or Pipe, Inches	Flow, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
2	23	2,176	1,088	725	544	435	363
3	67	6440	3,220	2,147	1,610	1,288	1,073
4	144	13,840	6,920	4,613	3,460	2,768	2,307
5	261	25,120	12,560	8,373	6,280	5,024	4,187
6	424	40,800	20,400	13,600	10,200	8,160	6,800
8	913	88,000	44,000	29,333	22,000	17,600	14,667

**TABLE 11-2**  
**Sizing of Horizontal Rainwater Piping**<sup>1,2</sup>

Size of Pipe, Inches	Flow at 1/8 in./ft. Slope, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
3	34	3,288	1,644	1,096	822	657	548
4	78	7,520	3,760	2,506	1,880	1,504	1,253
5	139	13,360	6,680	4,453	3,340	2,672	2,227
6	222	21,400	10,700	7,133	5,350	4,280	3,566
8	478	46,000	23,000	15,330	11,500	9,200	7,670
10	860	82,800	41,400	27,600	20,700	16,580	13,800
12	1,384	133,200	66,600	44,400	33,300	26,650	22,200
15	2,473	238,000	119,000	79,333	59,500	47,600	39,650



## **SECTION 11 - EXTERIOR WALL COVERINGS**

**WATER-RESISTIVE BARRIER** (2010 California Building Code Chapter 23 and 2010 California Residential Code Chapter 7).

A minimum of one layer of No. 15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the studs or sheathing, with flashing in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

**WOOD BOARD & PANEL SIDING.** Wood board sidings applied horizontally, diagonally or vertically shall be fastened to studs, nailing strips or blocking set at a maximum 24" (610mm) on center. Fasteners shall be nails or screws with a penetration of not less than 1-1/2" into studs or blocking. Plywood panel siding shall have a minimum thickness of 3/8" and must be of Exterior type.

**TABLE 2308.9.3(5)  
HARDBOARD SIDING**

SIDING	MINIMUM NOMINAL THICKNESS (inch)	2 × 4 FRAMING MAXIMUM SPACING	NAIL SIZE <sup>a,b,d</sup>	NAIL SPACING	
				General	Bracing panels <sup>c</sup>
1. Lap siding					
Direct to studs	3/8	16" o.c.	8d	16" o.c.	Not applicable
Over sheathing	3/8	16" o.c.	10d	16" o.c.	Not applicable
2. Square edge panel siding					
Direct to studs	3/8	24" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	3/8	24" o.c.	8d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
3. Shiplap edge panel siding					
Direct to studs	3/8	16" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	3/8	16" o.c.	8d	6" o.c. edges; 12" o.c. At intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

a. Nails shall be corrosion resistant.

b. Minimum acceptable nail dimensions:

c. Where used to comply with Section 2308.9.3.

d. Nail length must accommodate the sheathing and penetrate framing 1 1/2 inches.

	Panel Siding (inch)	Lap Siding (inch)
Shank diameter	0.092	0.099
Head diameter	0.225	0.240

**TABLE 2308.9.3(2)**  
**EXPOSED PLYWOOD PANEL SIDING**

MINIMUM THICKNESS <sup>a</sup> (inch)	MINIMUM NUMBER OF PLIES	STUD SPACING (inches) Plywood siding applied directly to studs or over sheathing
$\frac{3}{8}$	3	16 <sup>b</sup>
$\frac{1}{2}$	4	24

For SI: 1 inch = 25.4 mm.

- a. Thickness of grooved panels is measured at bottom of grooves.
- b. Spans are permitted to be 24 inches if plywood siding applied with face grain perpendicular to studs or over one of the following: (1) 1-inch board sheathing, (2)  $\frac{7}{16}$ -inch wood structural panel sheathing or (3)  $\frac{3}{8}$ -inch wood structural panel sheathing with strength axis (which is the long direction of the panel unless otherwise marked) of sheathing perpendicular to studs.

**TABLE 2308.9.3(3)**  
**WOOD STRUCTURAL PANEL WALL SHEATHING<sup>b</sup>**  
**(Not Exposed to the Weather, Strength Axis Parallel or Perpendicular to Studs Except as Indicated Below)**

MINIMUM THICKNESS (inch)	PANEL SPAN RATING	STUD SPACING (inches)		
		Siding nailed to studs	Nailable sheathing	
			Sheathing parallel to studs	Sheathing perpendicular to studs
$\frac{5}{16}$	12/0, 16/0, 20/0 Wall-16" o.c.	16	—	16
$\frac{3}{8}$ , $\frac{15}{32}$ , $\frac{1}{2}$	16/0, 20/0, 24/0, 32/16 Wall-24" o.c.	24	16	24
$\frac{7}{16}$ , $\frac{15}{32}$ , $\frac{1}{2}$	24/0, 24/16, 32/16 Wall-24" o.c.	24	24 <sup>a</sup>	24

For SI: 1 inch = 25.4 mm.

- a. Plywood shall consist of four or more plies.
- b. Blocking of horizontal joints shall not be required except as specified in Sections 2306.4 and 2308.12.4.

**TABLE R703.4  
WEATHER-RESISTANT SIDING ATTACHMENT AND MINIMUM THICKNESS**

SIDING MATERIAL		NOMINAL THICKNESS <sup>a</sup> (inches)	JOINT TREATMENT	WATER-RESISTIVE BARRIER REQUIRED	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS <sup>b, c, d</sup>					Number or spacing of fasteners
					Wood or wood structural panel sheathing	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud	Direct to studs	
Horizontal aluminum <sup>e</sup>	Without insulation	0.019 <sup>f</sup>	Lap	Yes	0.120 nail 1 1/2" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail <sup>g</sup>	Not allowed	Same as stud spacing
		0.024	Lap	Yes	0.120 nail 1 1/2" long	0.120 nail 2" long	0.120 nail 2" long	0.120 nail <sup>g</sup>	Not allowed	
	With insulation	0.019	Lap	Yes	0.120 nail 1 1/2" long	0.120 nail 2 1/2" long	0.120 nail 2 1/2" long	0.120 nail <sup>g</sup>	0.120 nail 1 1/2" long	
Anchored veneer: brick, concrete, masonry or stone		2	Section R703	Yes	See Section R703 and Figure R703.7 <sup>h</sup>					
Adhered veneer: concrete, stone or masonry <sup>i</sup>		—	Section R703	Yes Note w	See Section R703.6.1 <sup>k</sup> or in accordance with the manufacturer's instructions.					
Hardboard <sup>j</sup> Panel siding-vertical		7/16	—	Yes	Note m	Note m	Note m	Note m	Note m	6" panel edges 12" inter. sup. <sup>n</sup>
Hardboard <sup>j</sup> Lap-siding-horizontal		7/16	Note p	Yes	Note o	Note o	Note o	Note o	Note o	Same as stud spacing 2 per bearing
Steel <sup>b</sup>		29 ga.	Lap	Yes	0.113 nail 1 3/4" Staple-1 3/4"	0.113 nail 2 3/4" Staple-2 3/4"	0.113 nail 2 1/2" Staple-2 1/4"	0.113 nail <sup>r</sup> Staple <sup>r</sup>	Not allowed	Same as stud spacing
Particleboard panels	3/8 - 1/2	—	—	Yes	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	box nail <sup>r</sup>	6d box nail (2" x 0.099"), 3/8 not allowed	6" panel edge, 12" inter. sup.
	5/8	—	—	Yes	6d box nail (2" x 0.099")	8d box nail (2 1/2" x 0.113")	8d box nail (2 1/2" x 0.113")	box nail <sup>r</sup>	6d box nail (2" x 0.099")	
Wood structural panel siding <sup>g</sup> (exterior grade)		3/8 - 1/2	Note p	Yes	0.099 nail-2"	0.113 nail-2 1/2"	0.113 nail-2 1/2"	0.113 nail <sup>r</sup>	0.099 nail-2"	6" panel edges, 12" inter. sup.
Wood structural panel lapsiding		3/8 - 1/2	Note p Note x	Yes	0.099 nail-2"	0.113 nail-2 1/2"	0.113 nail-2 1/2"	0.113 nail <sup>r</sup>	0.099 nail-2"	8" along bottom edge
Vinyl siding <sup>j</sup>		0.035	Lap	Yes	0.120 nail (shank) with a 0.313 head or 16 gauge staple with 3/8 to 1/2-inch crown <sup>u, v</sup>	0.120 nail (shank) with a 0.313 head or 16 gauge staple with 3/8 to 1/2-inch crown <sup>u</sup>	0.120 nail (shank) with a 0.313 head or 16 gauge staple with 3/8 to 1/2-inch crown <sup>u</sup>	0.120 nail (shank) with a 0.313 head per Section R703.11.2	Not allowed	16 inches on center or specified by the manufacturer instructions or test report
Wood rustic, drop		3/8 Min	Lap	Yes	Fastener penetration into stud-1"				0.113 nail-2 1/2" Staple-2"	Face nailing up to 6" widths, 1 nail per bearing; 8" widths and over, 2 nails per bearing
Shiplap		19/32 Average	Lap	Yes						
Bevel		7/16	Lap	Yes						
Butt tip		7/16	Lap	Yes						
Fiber cement panel siding <sup>h</sup>		7/16	Note q	Yes Note u	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant (12" x 0.113") nail <sup>u, v</sup>	4d common corrosion-resistant nail <sup>r</sup>	6" o.c. on edges, 12" o.c. on intermed. studs
Fiber cement lap siding <sup>g</sup>		7/16	Note s	Yes Note u	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant nail <sup>r</sup>	6d common corrosion-resistant (12" x 0.113") nail <sup>u, v</sup>	6d common corrosion-resistant nail or 11 gage roofing nail <sup>r</sup>	Note t

For SI: 1 inch = 25.4 mm.

- Based on stud spacing of 16 inches on center where studs are spaced 24 inches, siding shall be applied to sheathing approved for that spacing.
- Nail is a general description and shall be T-head, modified round head, or round head with smooth or deformed shanks.
- Staples shall have a minimum crown width of 1/4-inch outside diameter and be manufactured of minimum 16 gage wire.
- Nails or staples shall be aluminum, galvanized, or rust-preventative coated and shall be driven into the studs for fiberboard or gypsum backing.
- Aluminum nails shall be used to attach aluminum siding.
- Aluminum (0.019 inch) shall be unbacked only when the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
- All attachments shall be coated with a corrosion-resistant coating.
- Shall be of approved type.
- Three-eighths-inch plywood shall not be applied directly to studs spaced more than 16 inches on center when long dimension is parallel to studs. Plywood 1/2-inch or thinner shall not be applied directly to studs spaced more than 24 inches on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.
- Wood board sidings applied vertically shall be nailed to horizontal nailing strips or blocking set 24 inches on center. Nails shall penetrate 1 1/4 inches into studs, studs and wood sheathing combined or blocking.
- Hardboard siding shall comply with CPA/ANSI A135.6.
- Vinyl siding shall comply with ASTM D 3679.
- Minimum shank diameter of 0.092 inch, minimum head diameter of 0.225 inch, and nail length must accommodate sheathing and penetrate framing 1 1/4 inches.
- When used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
- Minimum shank diameter of 0.099 inch, minimum head diameter of 0.240 inch, and nail length must accommodate sheathing and penetrate framing 1 1/4 inches.
- Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
- See Section R703.10.1.
- Fasteners shall comply with the nominal dimensions in ASTM F 1667.
- See Section R703.10.2.
- Face nailing: one 6d common nail through the overlapping planks at each stud. Concealed nailing: one 11 gage 1 1/4 inch long galv. roofing nail through the top edge of each plank at each stud.
- See Section R703.2 exceptions.
- Minimum nail length must accommodate sheathing and penetrate framing 1 1/4 inches.
- Adhered masonry veneer shall comply with the requirements of Section R703.6.3 and shall comply with the requirements in Sections 6.1 and 6.3 of ACI 530/ASCE 5/TMS-402.
- Vertical joints, if staggered shall be permitted to be away from studs if applied over wood structural panel sheathing.
- Minimum fastener length must accommodate sheathing and penetrate framing .75 inches or in accordance with the manufacturer's installation instructions.
- Where approved by the manufacturer's instructions or test report siding shall be permitted to be installed with fasteners penetrating not less than .75 inches through wood or wood structural sheathing with or without penetration into the framing.

**FLOOD RESISTANCE.** For buildings in flood hazard areas, exterior walls extending below the design flood elevation shall be resistant to water damage. (SECTION 19 RESIDENTIAL CONSTRUCTION IN FLOODZONES).

**EXTERIOR LATH** ( 2010 California Building Code Chapter 25 and 2010 California Residential Code Chapter 7 ).

All lath and lath attachments shall be of corrosion-resistant material backing of a lath shall provide sufficient rigidity to permit plaster application.

Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

Where no external corner reinforcement is used, lath shall be furred out and carried around corners at least one support on frame construction.

A minimum 0.019" (No. 26 gauge) corrosion-resistant weep screed with a minimum vertical attachment flange of 3-1/2" shall be provided at or below the foundation plate line on all exterior stud walls. The screed shall be placed a minimum of 4" above the earth or 2" above paved areas and shall be of a type which will allow trapped water to drain to the exterior of the building. The weather-resistive barrier shall lap the attachment flange, and the exterior lath shall cover and terminate on the attachment flange of the screed.

When lath is installed over wood sheathing, there shall be a minimum of 2 layers of Grade D paper between the lath and the wood sheathing.

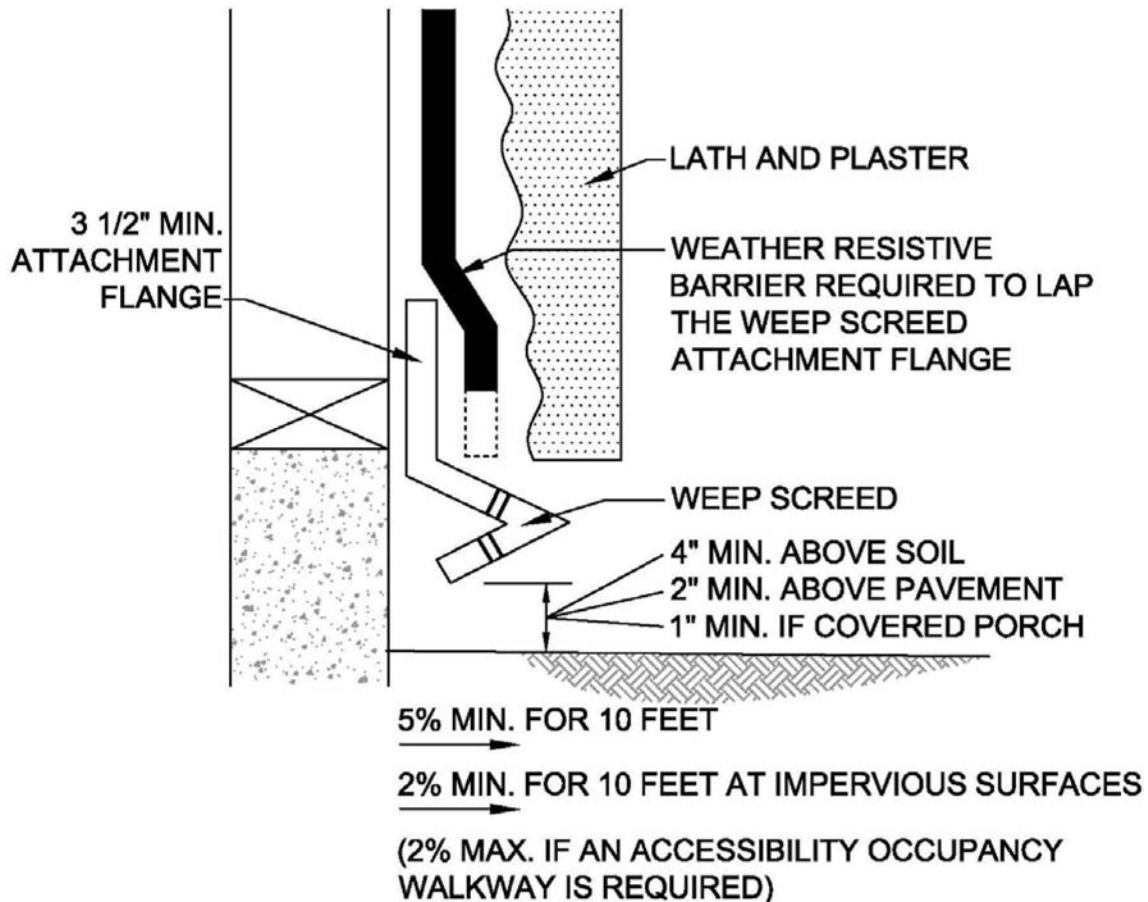
**EXTERIOR PLASTER.** (2010 California Building Code Chapter 25 and 2010 California Residential Code Chapter 7).

Plastering with portland cement plaster shall not be fewer than three coats when applied over metal lath or wire fabric lath and shall not be less than two coats when applied over masonry, concrete or gypsum backing.

The first coat shall be applied with sufficient material and pressure to fill solidly all openings in the lath. The surface shall be scored horizontally sufficiently rough to provide adequate bond to receive the second coat.

The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for finish coat. The second coat shall have no variation greater than 1/4" in any direction under a 5' straight edge.

The finish coat shall be applied with sufficient material and pressure to bond to and cover the brown coat and of sufficient thickness to conceal the brown coat.



### WEEP SCREED DETAIL

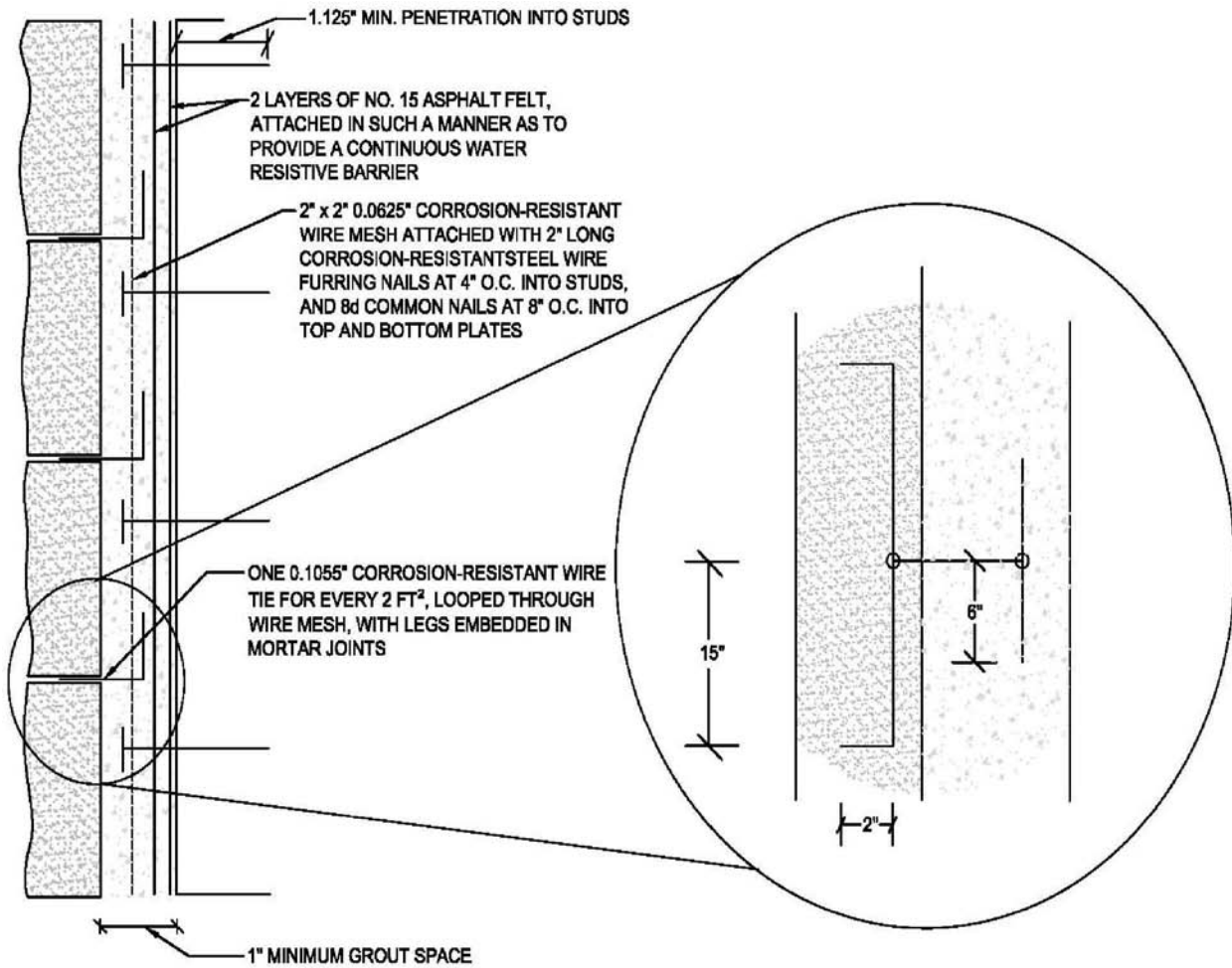
**VENEER.** (See CBC Sections 1405.5 and 2308.12.2).

Exterior veneer is permitted to be used in the first story above grade plane, provided the following criteria are met:

- 1) The bracing, per Section 2308.9.3, consists of wood structural panel sheathing not less than 5/16" thick, on studs 16" o.c.
- 2) The bracing of the first story shall be located at each end and at least 25 feet o.c., but not less than 45% of the braced wall line.
- 3) Hold-down connectors shall be provided at the ends of braced walls for the first floor to foundation with an allowable load of 2,100 pounds.
- 4) Cripple walls are not permitted.
- 5) The structure is not in Seismic Design Category E.

Stone veneer units, not exceeding 10 inches in thickness, shall be anchored directly to the stud construction by the method illustrated below:

## ANCHORING OF MASONRY VENEERED WALL



## **SECTION 12 - INTERIOR GYPSUM WALLBOARD**

Interior sheetrock, or gypsum wall board, shall not be installed until weather protection for the installation is provided.

Wallboard shall not be installed on exterior surfaces. It may be used as backing for metal lath or wire fabric lath and cement plaster.

Where 5/8" fire code gypsum board is used to qualify as a one-hour fire resistive wall or ceiling assembly, wood framing must be spaced on 16" centers.

All edges and ends of gypsum wallboard shall occur on the framing members except those edges and ends which are perpendicular to the framing members. All edges and ends shall be in moderate contact except in concealed spaces where fire-resistive construction or diaphragm action is not required. Water resistant gypsum board shall not be used on ceilings where frame spacing exceeds 12" on center.

### **GYPSUM PANEL PRODUCTS TYPES, USES, SIZES, AND STANDARDS (GA-223-04)**

<b>PRODUCT</b>	<b>DEFINED USE</b>	<b>ASTM STANDARD<sup>††</sup></b>	<b>INSTALLATION</b>	<b>TYPE<sup>†††</sup></b>
1. Gypsum Wallboard	Interior Walls & Ceilings	C 1396, C 36	GA-216	1, 2, 3
2. Gypsum Ceiling Board	Interior Ceilings	C 1396, C 1395	GA-216	1, 2, 3
3. Fiber Reinforced Gypsum Panels	Interior & Exterior Walls & Ceilings, & Tile Base	C 1278	†	1, 2
4. Gypsum Sheathing	Exterior Walls, Roof Systems	C 1396, C 79	GA-253	1, 2
5. Glass Mat Gypsum Substrate for Use as Sheathing	Exterior Walls & Ceilings	C 1177	†	1, 2
6. Gypsum Soffit Board	Exterior Soffits & Ceilings	C 1396, C 931	GA-216	1, 2
7. Water-Resistant Gypsum Backing Board	Tile Base	C 1396, C 630	GA-216	1, 2
8. Glass Mat Water-Resistant Gypsum Backing Board	Tile Base	C 1178	†	1, 2
9. Gypsum Backing Board	Base for Multi-Ply Systems	C 1396, C 442	GA-216	1, 2, 3
10. Gypsum Lath	Base for Gypsum Plaster (C 28)	C 1396, C 37	ASTM C 841	1, 2, 3
11. Gypsum Plaster Base	Base for Veneer Plaster (C 587)	C 1396, C 588	ASTM C 844	1, 2, 3
12. Gypsum Shaft Liner Board	Shaft, Stairway, Duct Enclosures, Area Separation Walls, Base for Solid or Semi-Solid Partitions	C 1396, C 442	GA-216, †	1, 2
13. Predecorated Gypsum Board	Accent Walls, Office & Movable Partitions	C 1396, C 960	GA-224	1, 2, 3
14. Gypsum Board for Manufactured Housing	Manufactured Housing Walls & Ceilings	C 1396, C 36, & C 960	GA-216	1, 2, 3

† See Manufacturer's specifications and recommendations.

†† ASTM C 1396 is the preferred reference; C 36, C 37, C 79, C 442, C 588, C 630, C 931, C 960, & C 1395 are being phased out.

††† Types: 1 = Regular  
2 = Type X  
3 = Foil Backed

#### **CANADIAN STANDARDS ASSOCIATION (CSA) STANDARD**

Products 1, 4, 6, 7, 9-12, 14, and 15 comply with CAN/CSA-A82.27-M

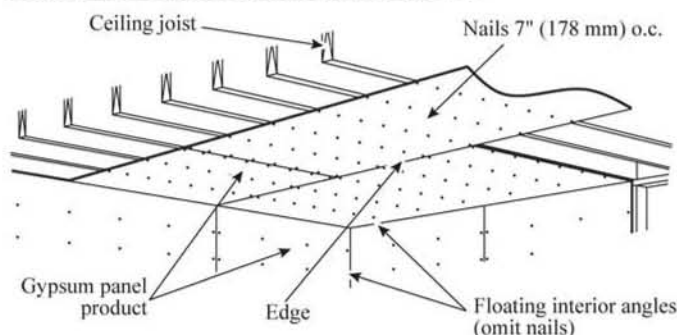
THICKNESS	TYPICAL USES
1/4" (6.4 mm)	remodeling, double layer walls, curved surfaces, sound attenuation systems
5/16" (7.9 mm)	manufactured housing walls and ceilings
3/8" (9.5 mm)	remodeling, base for rigid panels, double layer walls/ceilings, curved surfaces
1/2" (12.7 mm) & 5/8" (15.9 mm)	any interior and some protected exterior uses
3/4" (19.0 mm) 1" (25.4 mm)	interior walls; shaft walls, area separation walls, party walls, fire walls, stairways, duct enclosures

WIDTH, in. (mm)		24 (610)	24 (610)	24 (610)	24 (610)	48 (1220)	48 (1220)	48 (1220)	48 (1220)	48 (1220)	48 (1220)	54 (1370)
LENGTH, ft (mm)		8 (2440)	9 (2745)	10 (3050)	12 (3660)	8 (2440)	9 (2745)	10 (3050)	12 (3660)	14 (4270)	16 (4880)	12 (3660)
THICKNESS <sup>2</sup>	1/4" (6.4 mm)					■	■	■				
	5/16" (7.9 mm)					■	■	■	■			
	3/8" (9.5 mm)					■	■	■				
	1/2" (12.7 mm)					■	■	■	■	■	■	■
	5/8" (15.9 mm)					■	■	■	■	■	■	■
	3/4" (19.0 mm)	■	■	■	■	■	■	■	■			
	1" (25.4 mm)	■	■	■	■							

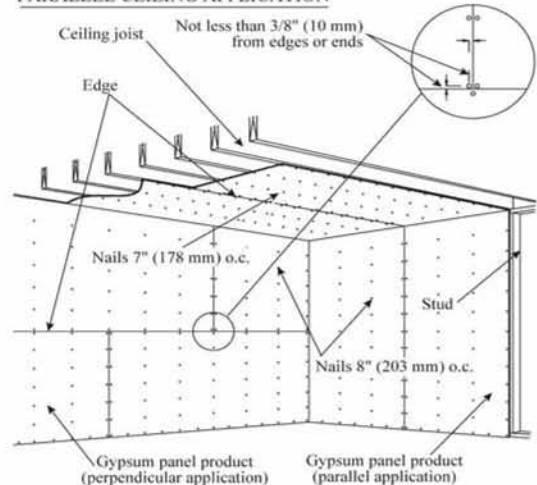
- 1 Not all types of gypsum panel products are available in all lengths, widths, and thicknesses.
- 2 Metric (SI) thicknesses are the industry accepted metric designations for gypsum panel product thicknesses. Contact the manufacturer for the availability of gypsum panel products in hard metric (SI) widths and lengths.

**NOTE:** For fire and sound rated systems, see G A-600, *Fire Resistance Design Manual*

#### PERPENDICULAR CEILING APPLICATION



#### PARALLEL CEILING APPLICATION



### ADHESIVES

Gypsum wallboard may be applied to wood framing members with an approved adhesive. A continuous bead of the adhesive shall be applied to the face of all framing members, except top and bottom plates, of sufficient size as to spread to an average width of 1" and thickness of 1/16" when the wallboard is applied. Where the edges or ends of 2 pieces of wallboard occur on the same framing member, 2 continuous parallel beads of adhesive shall be applied to the framing member.



<b>Table 3</b> <b>Fastener Lengths for Gypsum Panel</b> <b>Product Application to Wood Framing<sup>A</sup></b>			
Gypsum Panel Product Thickness <sup>B</sup> in. (mm)	Minimum Nail Length in. (mm)	Minimum Screw Length in. (mm)	Minimum Staple <sup>C</sup> Length in. (mm)
1/4 (6.4)	<i>D</i>	<i>D</i>	<i>D</i>
3/8 (9.5)	1 1/4 (32)	1 (25)	1 (25)
1/2 (12.7)	1 3/8 (35)	1 1/8 (28)	1 1/8 (28)
5/8 (15.9)	1 1/2 (38)	1 1/4 (32)	1 1/4 (32)

<sup>A</sup> Where fire resistance is required for gypsum panel product systems, fasteners of the same or larger length, shank diameter, and head bearing area as those described in the fire-rated design shall be used.

<sup>B</sup> For other thicknesses, for multi-layer applications, or for application over rigid foam insulation fasteners shall be of sufficient length to penetrate framing not less than 3/4 in. (19 mm) for nails, 5/8 in. (15 mm) for screws, and 5/8 in. (16 mm) for staples.

<sup>C</sup> Staple attachment is restricted to base layers of multi-layer systems only. (See Section 4.8.4.)

<sup>D</sup> For application over existing solid surfaces or in multi-layer applications, fastener shall be of sufficient length to penetrate framing not less than 3/4 in. (19 mm) for nails, 5/8 in. (16 mm) for screws.

<b>Table 1</b> <b>Maximum Framing Spacing</b> <b>For Single-Layer Gypsum Panel Product</b>		
Gypsum Panel Product Thickness in. (mm)	Gypsum Panel Product Orientation to Framing	Maximum Framing Spacing in. (mm) o.c.
<b>Ceilings:</b>		
3/8 (9.5) <sup>A</sup>	Perpendicular <sup>B</sup>	16 (406)
1/2 (12.7)	Parallel <sup>B</sup>	16 (406)
1/2 (12.7)	Perpendicular <sup>B</sup>	24 (610)
5/8 (15.9)	Parallel	16 (406)
5/8 (15.9)	Perpendicular	24 (610)
<b>Walls:</b>		
3/8 (9.5)	Perpendicular or Parallel	16 (406)
1/2 (12.7)	Perpendicular or Parallel	24 (610)
5/8 (15.9)	Perpendicular or Parallel	24 (610)

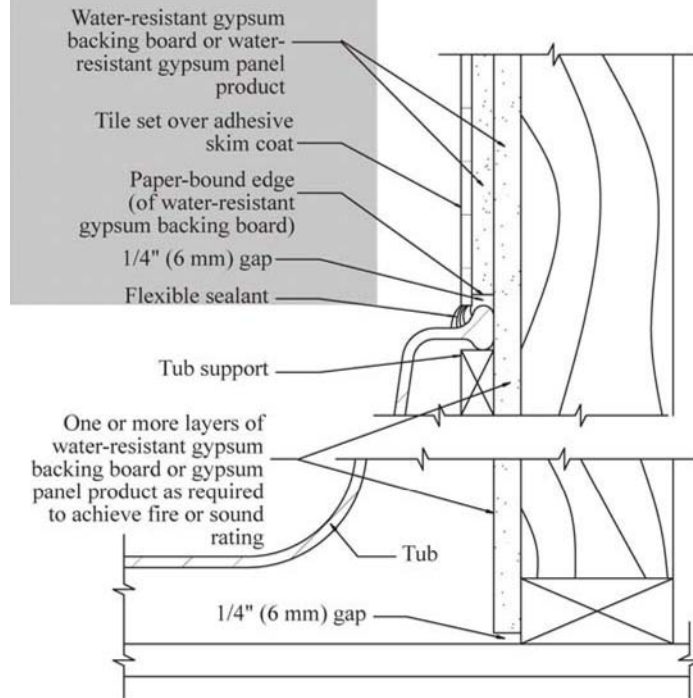
<sup>A</sup> Shall not support thermal insulation.

<sup>B</sup> On ceilings to receive hand or spray-applied water-based texture material either i) 1/2 in. (12.7 mm) gypsum ceiling board (ASTM C 1396/C 1396M shall be applied perpendicular to framing; or ii) other gypsum panel products shall be applied perpendicular to framing and board thickness shall be increased from 3/8 in. (9.5 mm) to 1/2 in. (12.7 mm) for 16 in. (406 mm) o.c. framing and from 1/2 in. (12.7 mm) to 5/8 in. (15.9 mm) for 24 in. (610 mm) o.c. framing. See Appendix A.2.

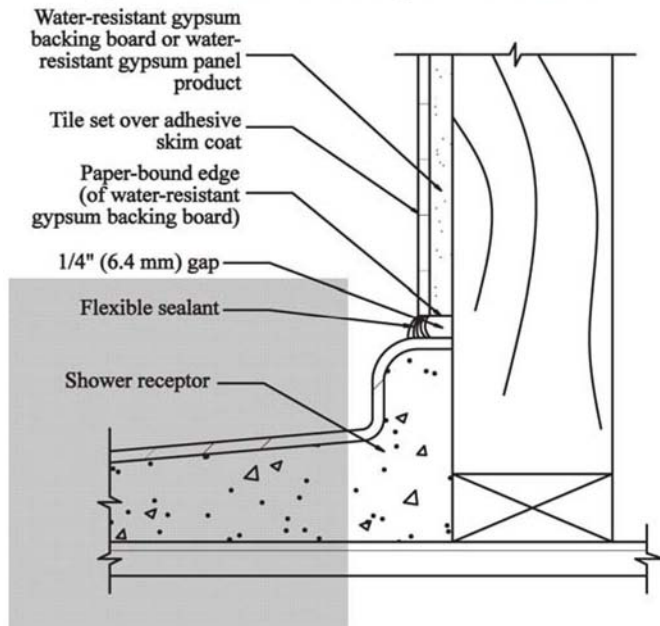
<b>Table 6</b> <b>Base Layer Fastener Spacing for Multi-Layer Gypsum Panel Product Application*</b>							
Location	Framing Spacing in.(mm)	Base Layer Nail Spacing in. (mm)		Base Layer Screw Spacing in. (mm)		Base Layer Staple Spacing in. (mm)	
		Where Face Layer is	Where Face Layer is Mechanically Attached	Where Face Layer is	Where Face Layer is Mechanically Attached	Where Face Layer is	Where Face Layer is Mechanically Attached
		Laminated	Attached	Laminated	Attached	Laminated	Attached
Walls	16 (406)	8 (203)	24 (610)	16 (406)	24 (610)	7 (178)	16 (406)
	24 (610)	8 (203)	24 (610)	12 (305)	24 (610)	7 (178)	16 (406)
Ceilings	16 (406)	7 (178)	16 (406)	12 (305)	24 (610)	7 (178)	16 (406)
	24 (610)	7 (178)	16 (406)	12 (305)	24 (610)	7 (178)	16 (406)

\* Fastener spacing for the face layer in multi-layer systems shall be as specified in Sections 5.5 through 5.8 for single-layer systems.

**Figure 14**  
**Typical details - tub installation in**  
**fire-rated or sound-rated system**



**Figure 13**  
**Typical details - shower pan installation**



## **SECTION 13 – PLUMBING**

### **DRAINAGE PIPING.** (California Plumbing Code Chapter 7).

Drainage piping shall be cast iron, galvanized steel, galvanized malleable iron, copper, brass, stainless steel 304 or 316L, Schedule 40 ABS DWV, Schedule 40 PVC DWV, extra-strength vitrified clay pipe, or other approved materials having a smooth and uniform bore, except that:

1. No galvanized wrought iron, stainless steel 304 or galvanized steel pipe shall be used underground and shall be kept at least six (6) inches (152.4 mm) above ground.
2. CPC Chapter 7- ABS and PVC installations are limited to residential construction not more than two(2) stories in height.

**SIZE** To size drainage piping, determine the number of units as follows: **Units**

**TABLE 7-3**

#### **Kind of Fixture Minimum Trap and Trap Arm Size**

RESIDENTIAL: (inches)(mm)

Bathtubs	1-1/2	38.1	2
Bidets	1-1/4	38.1	1
Laundry tubs	1-1/2	38.1	2
Clothes washers	2	50.8	3
showers	2	50.8	2
Sinks, bar (1-1/2 min. waste)	1-1/2	38.1	1
Sinks, and/or Dishwashers (2" min. waste)	1-1/2	38.1	2
Floor Drains	2	50.8	2
Lavatories, single	1-1/4	31.8	1
Lavatories, sets	1-1/2	38.1	2
Water Closet (Tank)	3	76.2	3

Now use the following table to determine pipe size and maximum lengths. **PIPE HANGERS AND SUPPORTS (California Plumbing Code Chapter 3)**

**TABLE 7-5**  
**MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING**

SIZE OF PIPE, inches (mm)	1¼ (32)	1½ (40)	2 (50)	2½ (65)	3 (80)	4 (100)	5 (125)	6 (150)	8 (200)	10 (250)	12 (300)
<b>Maximum Units</b>											
Drainage Piping <sup>1</sup>											
Vertical	1	2 <sup>2</sup>	16 <sup>3</sup>	32 <sup>3</sup>	48 <sup>4</sup>	256	600	1380	3600	5600	8400
Horizontal	1	1	8 <sup>3</sup>	14 <sup>3</sup>	35 <sup>4</sup>	216 <sup>5</sup>	428 <sup>5</sup>	720 <sup>5</sup>	2640 <sup>5</sup>	4680 <sup>5</sup>	8200 <sup>5</sup>
<b>Maximum Length</b>											
Drainage Piping											
Vertical, feet	45	65	85	148	212	300	390	510	750		
(m)	(14)	(20)	(26)	(45)	(65)	(91)	(119)	(155)	(228)		
Horizontal (unlimited)											
<b>Vent Piping</b>											
Horizontal and Vertical											
Maximum Units	1	8 <sup>3</sup>	24	48	84	256	600	1380	3600		
Maximum Lengths, feet	45	60	120	180	212	300	390	510	750		
(m)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)	(14)		

<sup>1</sup> Excluding trap arm.

<sup>2</sup> Except sinks, urinals, and dishwashers – exceeding one (1) fixture unit.

<sup>3</sup> Except six-unit traps or water closets.

<sup>4</sup> Only four (4) water closets or six-unit traps allowed on any vertical pipe or stack; and not to exceed three (3) water closets or six-unit traps on any horizontal branch or drain.

<sup>5</sup> Based on one-fourth (¼) inch per foot (20.8 mm/m) slope. For one-eighth (⅛) inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of eight-tenths (0.8).

**Note:** The diameter of an individual vent shall be not less than one and one-fourth (1¼) inches (32 mm) nor less than one-half (½) the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Tables 7-3 and 7-4. Not to exceed one-third (⅓) of the total permitted length of any vent may be installed in a horizontal position. When vents are increased one (1) pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table complies with the requirements of Section 901.2.

### 314.0 Hangers and Supports.

**314.1** Suspended piping shall be supported at intervals not to exceed those shown in Table 3-2.

**314.2** All piping shall be supported in such a manner as to maintain its alignment and prevent sagging.

**314.3** Piping in the ground shall be laid on a firm bed for its entire length; where other support is otherwise provided, it shall be approved per Section 301.0 of this code.

**314.4** Hangers and anchors shall be of sufficient strength to support the weight of the pipe and its contents. Piping shall be isolated from incompatible materials.

**314.5** All piping, fixtures, appliances, and appurtenances shall be adequately supported in accordance with this code, the manufacturer's installation instructions, and as required by the Authority Having Jurisdiction.

**314.6** Hanger rod sizes shall be no smaller than those shown in Table 3-1.

**314.7** All gas piping shall be supported by metal straps or hooks at intervals not to exceed those shown in Table 3-2.

**TABLE 3-1**  
**Hanger Rod Sizes**

Pipe and Tube Size		Rod Size	
Inches	mm	Inches	mm
1/2 – 4	12.7 – 102	3/8	9.5
5 – 8	127 – 203	1/2	12.7
10 – 12	254 – 305	5/8	15.9

## Hangers & supports, continued

**TABLE 3-2**  
**HANGERS AND SUPPORT**

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet (1524 mm), except 10 feet (3048 mm) where 10 foot lengths (3048 mm) are installed <sup>1,2,3</sup>	Base and each floor not to exceed 15 feet (4572 mm)
	Compression Gasket	Every other joint, unless over 4 feet (1219 mm), then support each joint <sup>1,2,3</sup>	Base and each floor a maximum of 15 feet (4572 mm)
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet (1219 mm), then support each joint <sup>1,2,3,4</sup>	Base and each floor a maximum of 15 feet (4572 mm)
Copper Tube and Pipe	Soldered or Brazed	1½ inches (40 mm) and smaller, 6 feet (1829 mm), 2 inches (50 mm) and larger, 10 feet (3048 mm)	Each floor, a maximum of 10 feet (3048 mm) <sup>5</sup>
Steel and Brass Pipe for Water or DWV	Threaded or Welded	¾ inch (20 mm) and smaller, 10 feet (3048 mm), 1 inch (25 mm) and larger, 12 feet (3658 mm)	Every other floor, a maximum of 25 feet (7620 mm) <sup>5</sup>
Steel, Brass, and Tinned Copper Pipe for Gas	Threaded or Welded	½ inch (15 mm), 6 feet (1829 mm), ¾ inch (20 mm) and 1 inch (25 mm), 8 feet (2438 mm), 1¼ inch (32 mm) and larger, 10 feet (3048 mm)	½ inch (15 mm), 6 feet (1829 mm), ¾ inch (20 mm) and 1 inch (25 mm), 8 feet (2438 mm), 1¼ (32 mm) every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet (1219 mm). Allow for expansion every 30 feet (9144 mm). <sup>3,6</sup>	Base and each floor. Provide mid-story guides. Provide for expansion every 30 feet (9144 mm). <sup>6</sup>
CPVC	Solvent Cemented	1 inch (25 mm) and smaller, 3 feet (914 mm), 1¼ inch (32 mm) and larger, 4 feet (1219 mm)	Base and each floor. Provide mid-story guides. <sup>6</sup>
Lead	Wiped or Burned	Continuous Support	A maximum of 4 feet (1219 mm)
Copper	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
Steel and Brass	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
PEX	Metal Insert and Metal Compression	32 inches (813 mm)	Base and each floor. Provide mid-story guides.
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch (15 mm) ¾ inch (20 mm) 1 inch (25 mm) } All sizes 98 inches (2489 mm)	Base and each floor. Provide mid-story guides.
PE-AL-PE	Metal Insert and Metal Compression	½ inch (15 mm) ¾ inch (20 mm) 1 inch (25 mm) } All sizes 98 inches (2489 mm)	Base and each floor. Provide mid-story guides.
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical	1 inch (25 mm) and smaller, 32 inches (813 mm); 1¼ inches (32 mm) and larger, 4 feet (1219 mm)	Base and each floor. Provide mid-story guides.

<sup>1</sup> Support adjacent to joint, a maximum of eighteen (18) inches (457 mm).

<sup>2</sup> Brace at a maximum of forty (40) feet (12 192 mm) intervals to prevent horizontal movement.

<sup>3</sup> Support at each horizontal branch connection.

<sup>4</sup> Hangers shall not be placed on the coupling.

<sup>5</sup> Vertical water lines shall be permitted to be supported in accordance with recognized engineering principles with regard to expansion and contraction, when first approved by the Authority Having Jurisdiction.

<sup>6</sup> See the appropriate IAPMO Installation Standard for expansion and other special requirements.

**SUPPORT OF PIPING -- HORIZONTAL.** Cast iron soil pipe -- every 5'. ABS -- every 4' horizontal, at end of branches and at change of direction or elevation. Supports shall allow free movement, but shall restrict upward movement of lateral runs so as not to create reverse grade. Support trap arms in excess of 3' as close as possible to the trap. Closet rings shall be securely fastened with corrosion resistant fasteners to the floor with top surface 1/4" above finish floor. Copper tubing -- 1-1/2" and smaller - every 6'. 2" and larger - every 10'.

**SUPPORT OF PIPING -- VERTICAL.** Cast iron soil pipe -- at floor and each floor not to exceed 15'. Screwed water pipe (IPS) -- not less than every other story height, not to exceed 25'. ABS -- shall be maintained in straight alignment. Copper tubing -- at each floor, not to exceed 10'.

**GRADE OF HORIZONTAL DRAINAGE PIPING.** Must be run in practical alignment at a uniform slope of at least 1/4" per foot toward the point of disposal.

**TESTING.** (California Plumbing Code Chp.7). At under floor/slab: Tightly plug each opening and fill with not less than a 10' head of water or an air test of 5 PSI for at least 15 minutes before inspection starts. At close-in, fill entire system with water to roof, to the point of overflow, or cap off all vents and provide a 5 PSI air test for 15 minutes.

**NOTE: Be sure that waste plumbing does not go deeper than the planned depth of any septic tank inlet.**

**CHANGES IN DIRECTION OF DRAINAGE FLOW.** In a drainage system, the flow of liquid waste and sewage is constantly changing direction on its way to the public sewer or private sewage disposal system. The flow is subject to the laws of gravity, so in vertical piping the flow will be at a much faster rate than the flow in a horizontal pipe of the same size. For efficient operation, it is necessary to make changes of direction so as to avoid any interruption to this flow.

The plumbing code makes provisions for three possible conditions: a flow from a vertical pipe into a horizontal pipe; a flow from a horizontal pipe into a vertical pipe; and a flow from a horizontal pipe into a horizontal pipe.

Each has its particular problem, and the most serious is the flow from a vertical pipe into a horizontal pipe. In a vertical pipe, the flow is subject to the laws of gravity and usually continues to accelerate until terminal velocity is reached. The transition from vertical to horizontal has to be made as smooth as possible to convert the rapid vertical flow to a smooth slower flow in a horizontal direction.

Horizontal drainage lines connecting with a vertical stack present the fewest problems because when the flow changes from a horizontal direction to a vertical direction, it is going into a direction in which the flow will be faster.

## HORIZONTAL TO VERTICAL.

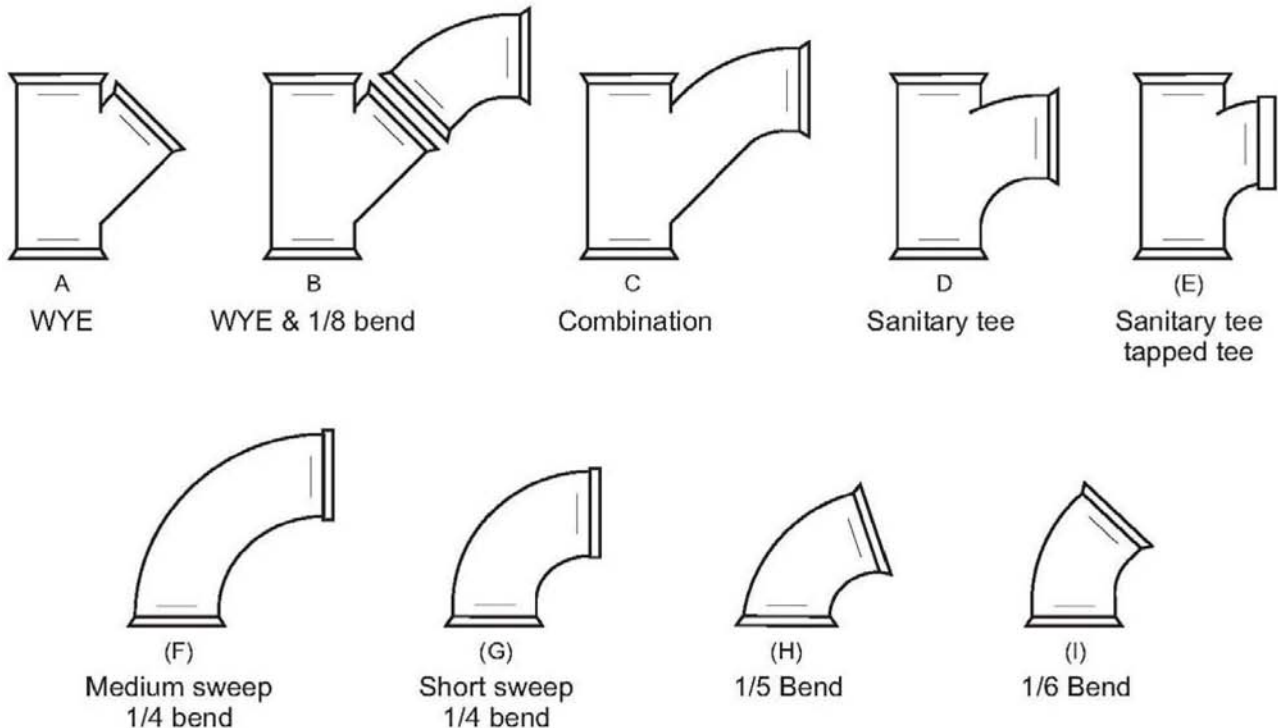
"A" through "E" may be used for vertical drain piping picking up horizontal branches:

## VERTICAL TO HORIZONTAL.

"F" through "I" may be used for horizontal drain piping changing to a vertical direction:

## HORIZONTAL TO HORIZONTAL.

Fittings "A" through "F" except "D" and "E" may be used for this type of change in direction. \*



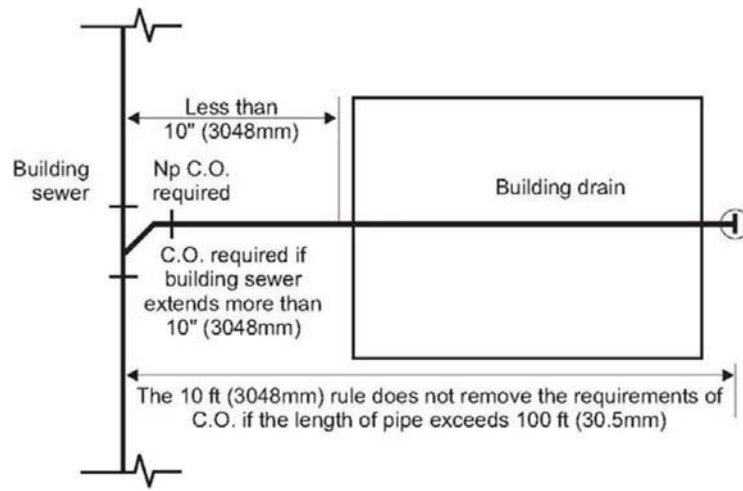
**CLEANOUTS.** Each horizontal drainage pipe shall be provided with a cleanout at its upper terminal, and each run of piping, that is more than one hundred (100) feet in total developed length, shall be provided with a cleanout for each one hundred (100) feet, or fraction thereof, in length of such piping.

\*An additional cleanout shall be provided in a drainage line for each aggregate horizontal change of direction exceeding one hundred and thirty five (135) degrees.

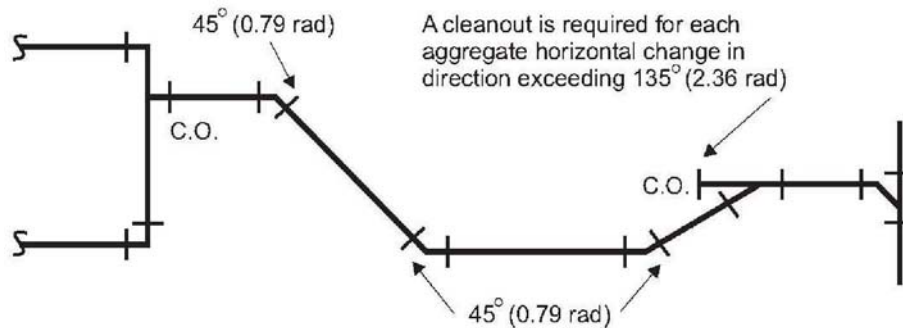
### Exceptions:

1. Cleanouts may be omitted on a horizontal drain line less than five (5) feet (1.5 m) in length unless such line is serving sinks or urinals.
2. Cleanouts may be omitted on any horizontal drainage pipe installed on a lope of 72 degrees or less from the vertical angle (angle of one-fifth (1/5) bend).
3. Excepting the building drain and its horizontal branches, a cleanout shall not be required on any pipe or piping which is above the first floor of the building.
4. An approved type of two-way cleanout fitting, installed inside the building wall near the connection between the building drain and building sewer or installed outside of a building at the lower end of a building drain and extended to grade, may be substituted for an upper terminal cleanout.

Cleanouts and underfloor piping shall be extended to or above the finish floor or shall be extended outside the building when there is less than eighteen (18) inches (0.5 m) and thirty (30) inches (0.8 m) horizontal clearance from the means of access to such cleanout. No underfloor cleanout shall be located more than twenty (20) feet (6.1 m) from an access door, trap door or crawl hole.



#### **Location of Cleanouts for Changes in Direction**



#### **Cleanout Requirements for a Building Sewer**



# Plastic Drain, Waste & Vent Fittings

## Drain Fittings



Cleanout Tee



Sanitary Tee



Double  
Sanitary Tee



Wye



1/4 Bend



1/4 Bend  
w/ low heel inlet



Long Sweep  
1/4 Bend



1/8 Bend



1/8 Bend



1/16 Bend



Combination Wye  
& 1/8 Bend



Upright Wye



Long Turn  
Tee Wye



Double Fixture  
Fitting



Double Wye



'P' Trap



Closet Bend



Closet Flange



Shower Drain  
Assembly



Roof Drain



Floor Drain

## Vent Only Fittings



Vent Tee



Vent Cross



1/4 Bend Vent



3 Way Elbow

## Prohibited Fittings



Sanitary Tee,  
Side Inlet

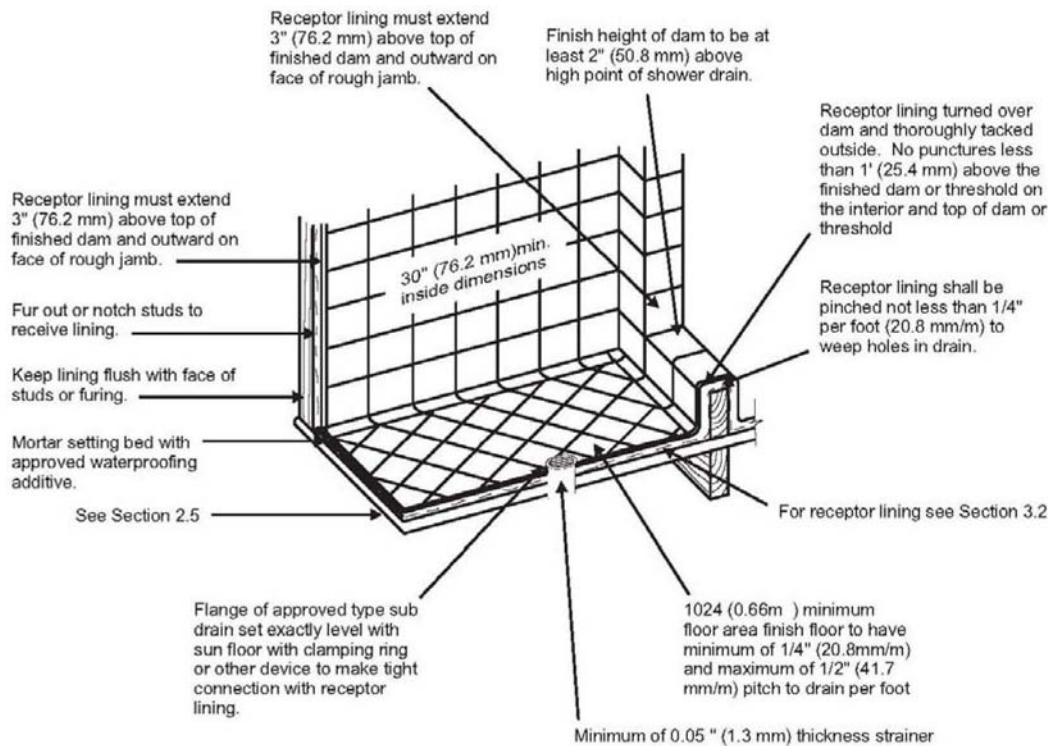


Double Sanitary Tee  
Side Inlet



'P' Trap  
w/ Cleanout

# **APPROVED CONSTRUCTION OF TILE-LINED SHOWER RECEPTORS** **STANDARD SPECIFICATION FOR THE INSTALLATION OF TILE-LINED SHOWER RECEPTORS**



Special use shower compartments for wheelchair use may eliminate the curb or threshold. The required slope and depth shall be maintained from the door entry to the drain opening. The minimum distance between the door or entry to the drain opening shall be 4 feet. When a threshold or recessed drop is permitted, it shall be a maximum of 1/2 inch in height and shall be beveled or sloped at an angle not exceeding 45 degrees from the horizontal.

**Provisions shall be made at the sub-floor.**

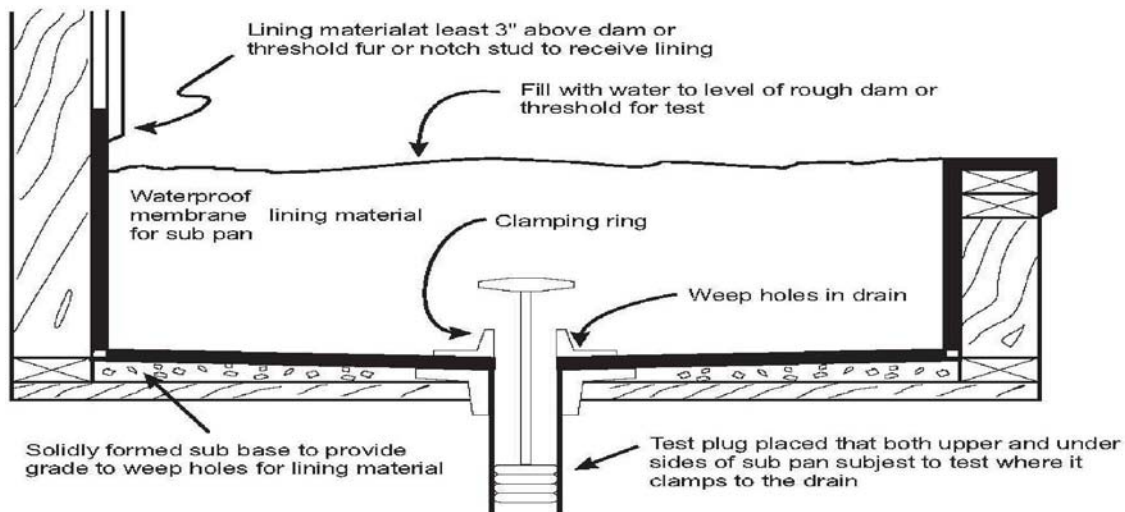
**Note: Shower opening at**

**Tests** Upon installation, all linings shall be tested for water tightness by being filled to the top of the rough threshold with water for a period of time sufficient to establish their water tightness.

A test plug shall be so placed that both the upper and under sides of the lining shall be subjected to test at it's point of contact with the sub drain.

When the test plug is removed, all of the test water shall drain out by gravity through the weep holes. A ring of absorbent material must be placed around the weep holes to keep them open when the finish materials are installed

threshold shall be of sufficient width to accommodate a min. 22" door.





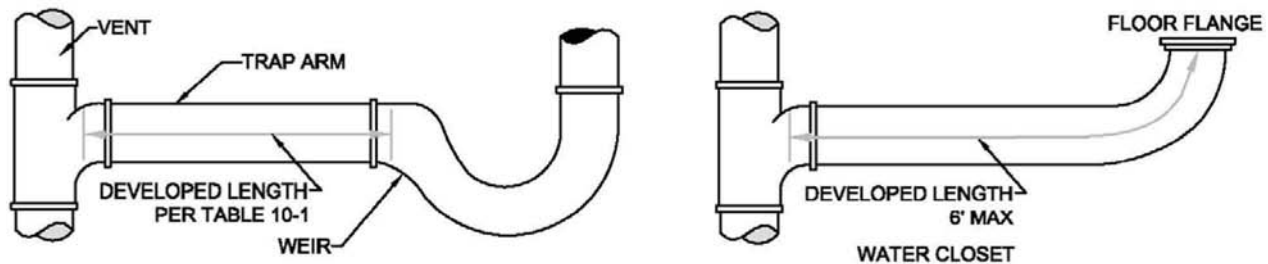
## TRAPS AND INTERCEPTORS. (California Plumbing Code Chapter 10).

**Traps required:** each plumbing fixture excepting those having integral traps must be separately trapped.

Each domestic clothes washer and each laundry tub shall be connected to a separate and independent trap, except that a trap serving a laundry tub shall be permitted to also receive the waste from a clothes washer set adjacent thereto.

The vertical distance between a fixture outlet and the trap weir shall be as short as practicable, but in no case shall the tail piece exceed 24".

Each fixture trap shall have a protecting vent so located that the developed length of the trap arm is within the distance given in Table 10-1 below.



**TABLE 10-1**  
**HORIZONTAL LENGTHS OF TRAP ARMS**  
**(EXCEPT FOR WATER CLOSETS AND SIMILAR FIXTURES)\***

TRAP ARM PIPE DIAMETER	DISTANCE TRAP TO VENT MINIMUM	LENGTH MAXIMUM	TRAP ARM PIPE DIAMETER	DISTANCE TRAP TO VENT MINIMUM	LENGTH MAXIMUM
1/4"	2 1/2"	30" (2'-6")	32 mm	64 mm	762 mm
1/2"	3"	42" (3'-6")	40 mm	76 mm	1,067 mm
2"	4"	60" (5'-0")	50 mm	102 mm	1,524 mm
3"	6"	72" (6'-0")	80 mm	152 mm	1,829 mm
4"	8"	120" (10'-0")	100 mm	203 mm	3,048 mm
Exceeding 4"	2 x Diameter	120" (10'-0")	Exceeding 100 mm	2x Diameter	3,048 mm

Maintain one-fourth (1/4) inch per foot slope (20.8 mm/m)

\*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 six (6) feet (1,829 mm)

A trap arm may change direction without the use of a cleanout when it is accomplished by the use of not more than two 45 degree fittings or one long sweep 90 degree fitting of approved radius.

The vent pipe opening from a soil or waste pipe must not be below the weir of the trap.

## VENTING. ( California Plumbing Code Chapter 9 ).

Each plumbing fixture trap shall be protected against siphonage and back pressure, and air circulation shall be assured throughout all parts of the drainage system by means of vent pipes.

**Size:** The size of vent piping is determined from its length and the total number of fixture units to be connected using Table 7-5 on page 14.2. In addition, the drainage piping of each building and each connection to a public sewer or a private sewage disposal system shall be vented by means of one or more vent pipes. The main vent must be the same size as the largest house drain or a combination of vents equal in cross-sectional area. Exception: when two or more structures on the same property and under one ownership are connected to a common building sewer, the drainage piping may be sized in accordance with Table 7-5 provided the aggregate cross-sectional area of all vents is not less than that of the largest required house drain.

A vent may exceed one-third of the maximum horizontal length as limited by Table 7-5 provided the vent is increased one pipe size for its entire length.

The following table will be helpful in determining the required aggregate cross-sectional areas of vent piping.

Areas of Circles	
Diam. (in.)	Area (sq. in.)
1/8	.01227
1/4	.04909
3/8	.11045
1/2	.19635
3/4	.44179
1	.7854
1 1/4	1.2272
1 1/2	1.7671
2	3.1416
2 1/2	4.9087
3	7.0686
4	12.566

Each vent shall terminate no fewer than 10' horizontally from or at least 3' above any window, door opening, air intake, or vent shaft.

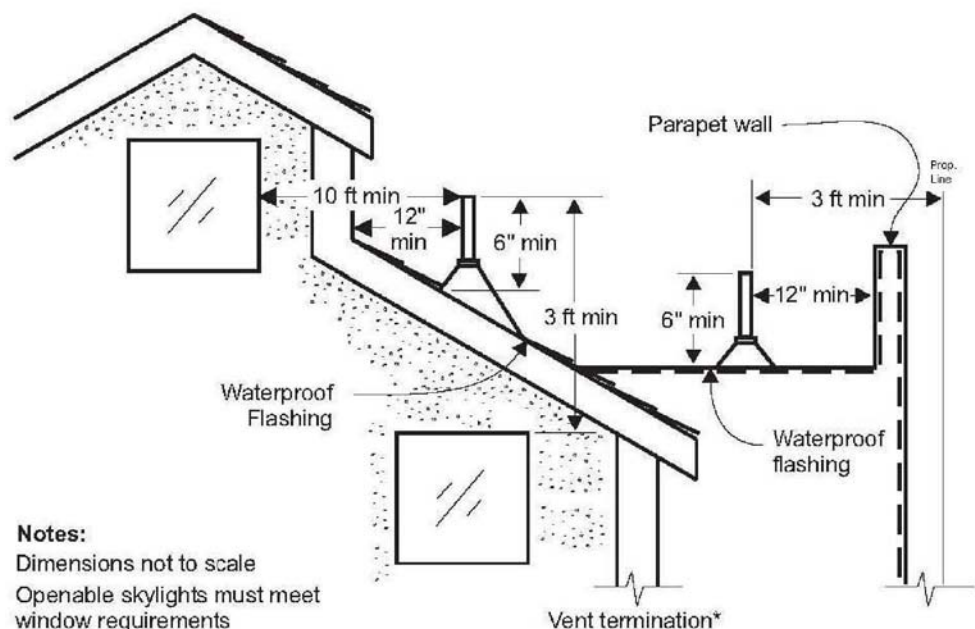
### Testing of Venting System

Venting systems shall be tested at close-in inspection. Tightly plug each opening and fill with not less than a 10 foot head of water for at least 15 minutes before inspection starts. A 5 lb. air test is acceptable.

**Note:** The use of ABS or PVC vent piping is limited to residential construction not more than two stories in height. Do not expose ABS pipe to sunlight.

#### \*Vent Termination

Each vent pipe or stack shall extend through it's flashing and shall terminate vertically not less than six (6) inches (152.4mm) above the roof and one (1) foot (0.3m) from any vertical surface.





**PLUMBING FIXTURES.** ( California Plumbing Code Chapter 4 ).

No water closet shall be set closer than 15" from its center to any side wall or obstruction nor closer than 30" center to center to any similar fixture. The clear space in front of the water closet shall not be less than 24".

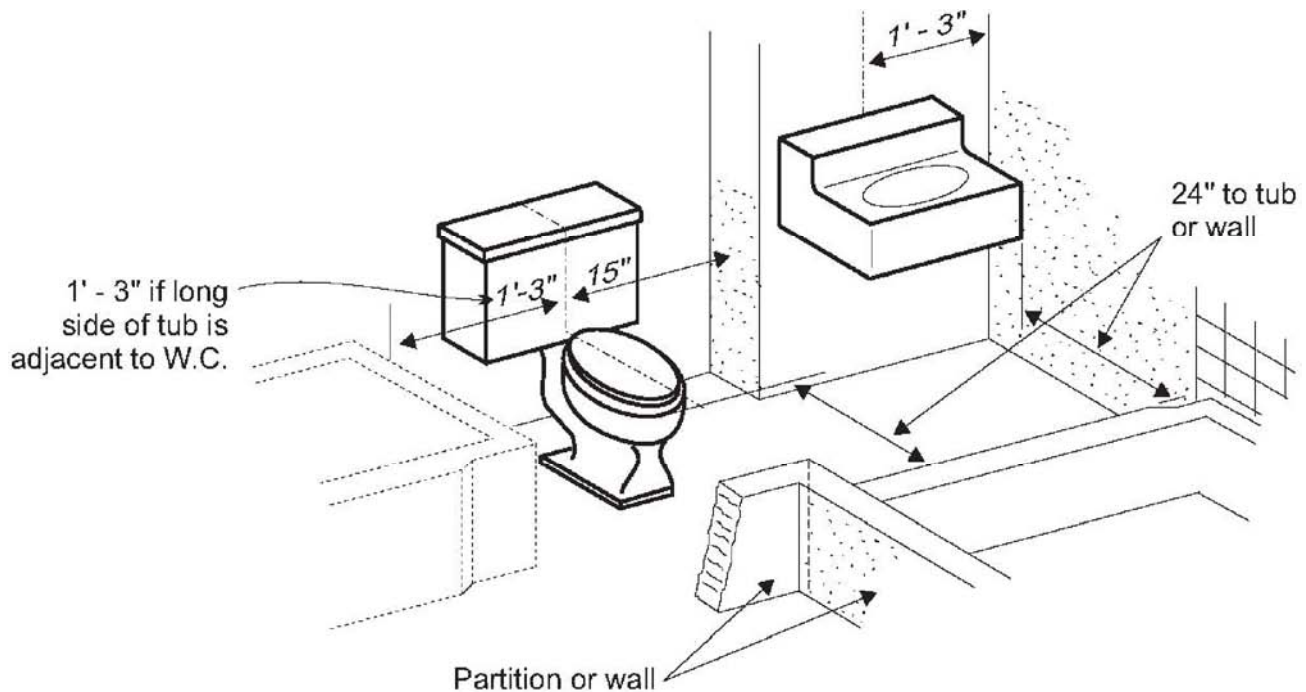
Each shower stall must have a finished dam, curb, or threshold which is at least 1" lower than the sides and back. The finished dam or threshold must not be less than 2" or more than 9" in depth when measured from the top of the dam to the top of the drain. \*

The finished floor of a shower must slope uniformly from the sides toward the drain not less than 1/4" per foot, nor more than 1/2" per foot.

Shower stalls, regardless of shape, shall have a minimum finished interior 1,024 square inches and shall also be capable of encompassing a 30" circle. The required area dimensions shall be measured a height equal to the top of the threshold and at a point tangent to its centerline. The required area and dimensions shall be maintained to point not less than 70" above the shower drain outlet with no protrusions other than fixture valve(s), shower heads, soap dishes, shelves, and safety grab bars or rails.

All shower enclosures must have a minimum clear opening of 22" wide and doors shall open outward.

\* Except for disabled accessibility installations.



**Plumbing Fixtures**

Not to Scale

## **SPECIAL VENTING FOR ISLAND FIXTURES.** ( California Plumbing Code Chapter 9 ).

Traps for island sinks and similar equipment shall be roughed in above the floor and may be vented by extending the vent as high as possible, but not less than drain board height. The vent is then returned downward and connected to the horizontal sink drain immediately downstream from the vertical fixture drain. The figure below illustrates the construction of the completed island venting system.

The return vent shall be connected to the horizontal drain through a Y-branch fitting, (see "b") and shall in addition be provided with a foot vent taken off the vertical fixture vent by means of a Y-branch fitting immediately below the floor. This foot vent extends to the nearest partition and thence through the roof to the open air, or may be connected to other vents at a point not less than 6" (152.4 mm) above the flood level rim of the fixture served.

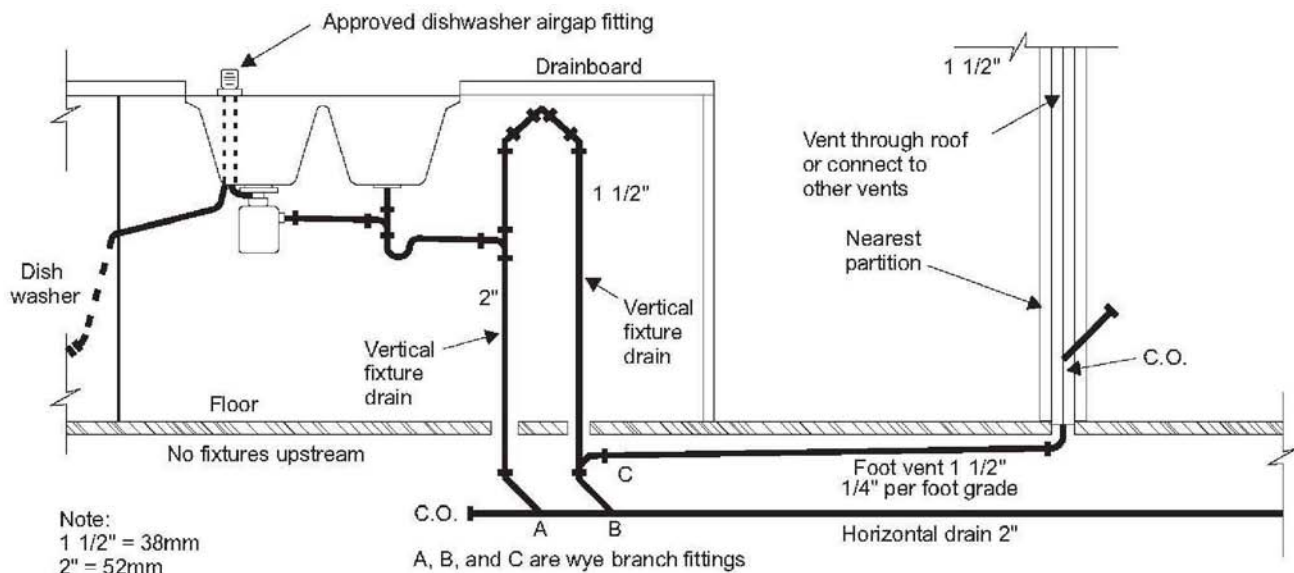
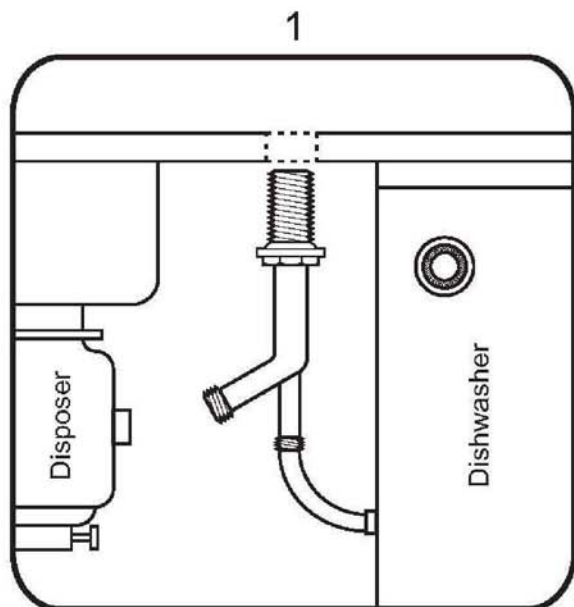


Figure 9-25

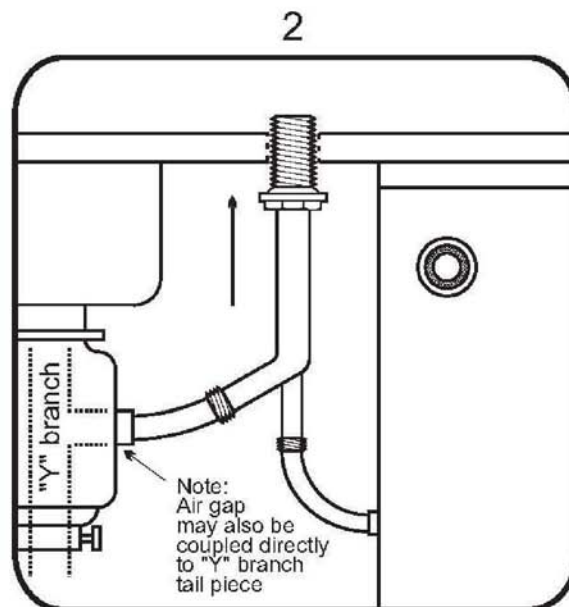
### **Special Venting For Island Fixtures**

Drainage fittings shall be used on all parts of the vent below the floor line. This includes fittings noted as a, b, c and d in the illustrations. The foot vent shall maintain a minimum slope of one-quarter (1/4) inch per foot back to the drain. The return bend used under the drainboard shall be a one (1) piece fitting, or an assembly of a forty-five (45) degree, a ninety (90) degree, and a forty-five (45) degree elbow in the order named. Pipe sizing shall be as elsewhere required in the code. The above drawing notes the minimum pipe size required. The island sink drain, upstream of the returned vent, shall serve no other fixtures. An accessible cleanout shall be installed in the vertical portion of the foot vent.

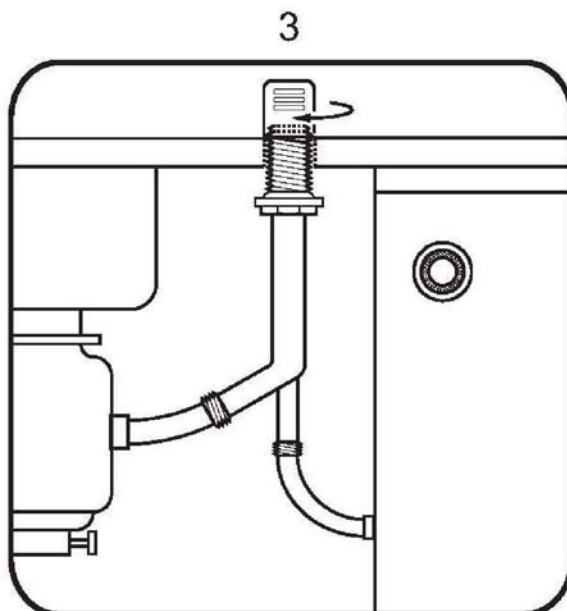
## Dishwasher Air Gap Installation



To install the air gap, simply adjust the hex nut to allow for sink top thickness, and connect the inlet tube to the dishwasher



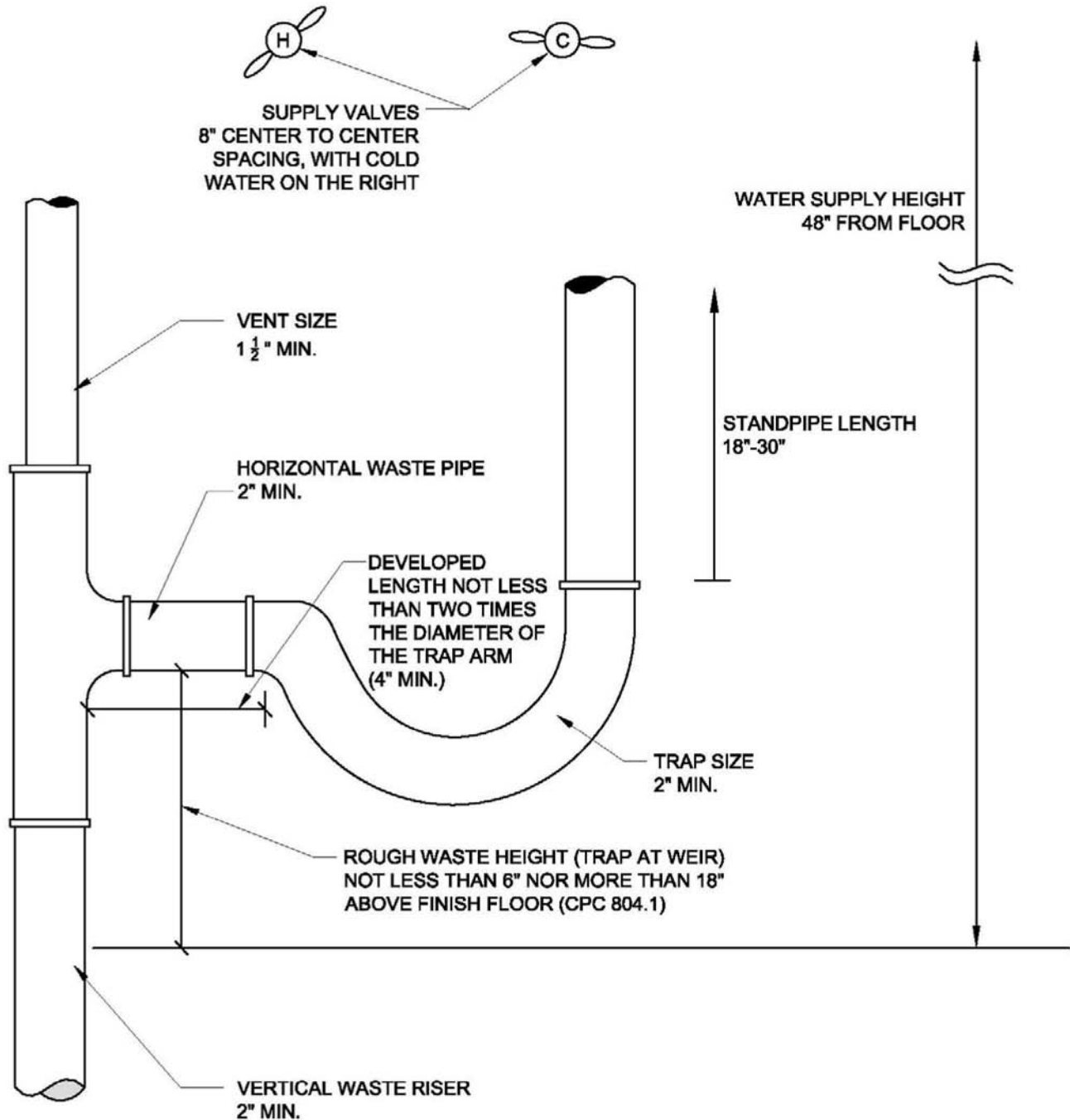
Push the stem through the sink-hole. (Allow approximately 1/4" of threaded section to project above the sink top.) Connect the 3/4" elbow end to either the waste line or disposer head.



Screw on plastic capm then press on metal cover.



**CLOTHES WASHER INSTALLATION MINIMUMS:** ( California Plumbing Code Chapter 8 )



**NOTE: NEVER LOCATE TRAP FOR CLOTHES WASHER UNDER THE FLOOR.**

## WATER DISTRIBUTION. (California Plumbing Code Chapter 6).

**MATERIALS.** Water pipe and fittings carrying water used in potable water systems intended to supply drinking water shall meet the requirements of the Referenced Standards NSF 61, *Standard for Drinking Water System Components*, as found in Table 14-1 of the California Plumbing Code. Materials used in the water supply system, except valves, and similar devices, shall be of like material.

Materials for building water piping and building supply piping shall be in accordance with the applicable standards referenced in Table 6-4 below.

**TABLE 6-4**  
**MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS**

MATERIAL	BUILDING SUPPLY PIPE AND FITTINGS	WATER DISTRIBUTION PIPE AND FITTINGS	REFERENCED STANDARD(S) PIPE	REFERENCED STANDARD(S) FITTINGS
Asbestos-Cement	X <sup>1</sup>		ASTM C 296, AWWA C400	
Brass	X	X	ASTM B 43, ASTM B 135	
Copper	X	X	ASTM B 42, ASTM B 75, ASTM B 88, ASTM B 251, ASTM B 302, ASTM B 447	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.26
CPVC	X	X	ASTM D 2846, ASTM F 441, ASTM F 442	ASTM D 2846, ASTM F 437, ASTM F 438, ASTM F 439, ASTM F 1970
Ductile-Iron	X	X	AWWA C151	ASME B16.4, AWWA C110, AWWA C153
Galvanized Steel	X	X	ASTM A 53	
Malleable Iron	X	X		ASME B16.3
PE	X <sup>1</sup>		ASTM D 2239, ASTM D 2737, ASTM D 3035, AWWA C 901, CSA B137.1	ASTM D 2609, ASTM D 2683, ASTM D 3261, ASTM F 1055, CSA B137.1
PE-AL-PE	X	X	ASTM F 1282, CSA B137.9	ASTM F 1282, ASTM F 1974, CSA B137.9
PEX <sup>3,4</sup>	X	X	ASTM F 876 , ASTM F 877, CSA B137.5	ASTM F 877, ASTM F 1807, ASTM F 1960, ASTM F 1961, ASTM F 2080, ASTM F 2159, CSA B137.5
PEX-AL-PEX <sup>2</sup>	X	X	ASTM F 1281, ASTM F 2262, CSA B137.10	ASTM F 1281, ASTM F 1974, ASTM F 2434, CSA B137.10
PVC	X <sup>1</sup>		ASTM D 1785, ASTM D 2241, AWWA C900	ASTM D 2464, ASTM D 2466, ASTM D 2467, ASTM F 1970
Stainless Steel	X	X	ASTM A 269, ASTM A 312	

<sup>1</sup> For Building Supply or cold-water applications.

**||** <sup>2</sup> [BSC, DSA-SS, DSA-SS/CC, and HCD] The use of PEX-AL-PEX in potable water supply systems is not adopted.

<sup>3</sup> [BSC, DSA-SS, DSA-SS/CC, HCD, AGR, and DPH] When PEX tubing is placed in soil and is used in potable water systems intended to supply drinking water to fixtures or appliances, the tubing or piping shall be sleeved with a material approved for potable water use in soil or other material that is impermeable to solvents or petroleum products.

<sup>4</sup> [BSC, DSA-SS, DSA-SS/CC, HCD, AGR, and DPH] PEX tubing shall meet the requirements of NSF P171 CL-R, ASTM F 876-08 or an equivalent or more stringent standard when used in continuously recirculating hot water systems where chlorinated water is supplied to the system and the PEX tubing is exposed to the hot water 100% of the time.

Asbestos- cement, PE or PVC water pipe manufactured to recognized standards may be used for **cold water distribution systems outside a building**.

Copper tubing for water piping comes in three different types and are used in different applications. Strength, bendability, and other mechanical factors will frequently influence your choice.

Type K copper water tubing has green markings.

Type L copper water tubing has blue markings.

Type M copper water tubing has red markings.

In water distribution piping, whenever the allowable pressure for a soldered joint is less than that for Type M, and if allowable pressure is the only consideration, any Type K, L, or M may be used. Where the quality of the water is the basis for selection, use Type M with ordinary water for above-ground installation. Use Type L for below-ground installation and for above-ground where the water conditions are more severe.

**INSTALLATION.** Water pipes shall be 12" minimum below finish grade. Water service pipes or any underground water pipes may be laid in the same trench with building sewer or drainage piping if the bottom of the water pipe, at all points, is at least 12" above the top of the sewer line, and the water pipe is placed on a solid shelf excavated at one side of the common trench.

Ferrous water piping **installed within a building and in or under a concrete floor slab resting on the ground** shall have a protective coating of an approved type, machine-applied and conforming to recognized standards. Field wrapping shall provide equivalent protection and is restricted to those short sections and fittings necessarily stripped for threading. Approved non-ferrous piping need not be wrapped. Copper tubing shall be installed without joints where possible. Where joints are permitted, they shall be brazed and fittings shall be wrought copper.

**TESTING.** Both hot and cold water piping must have a full working water pressure test from the street main or other source of water supply, **or** an air pressure test of not less than 50 pounds per square inch for not less than 15 minutes.

**SIZING.** The size of each water piping system must be determined according to the following methods and procedures:

Count the number of fixture units (Table 6-5) to be installed; determine the developed length of supply pipe from meter and the highest fixture or outlet. Determine the difference in elevation between the meter and the highest fixture or outlet and the pressure in the street main or other source of supply. Subtract 1/2 pound per square inch pressure for each foot of difference in elevation between source of supply and the highest water supply outlet in the building. Using Table 6-6, on the next page, select the applicable "pressure range" group, select the "length" column which is equal to or longer than the required length. Follow down the column to a fixture unit value equal to or greater than the total number of fixture units required by the installation. The sizes of meter and building supply pipe will be found in the two left-hand columns.

Inch	mm
1/2	15
3/4	20
1	25

**TABLE 6-5**  
**Water Supply Fixture Units (WSFU) and Minimum Fixture Branch Pipe Sizes<sup>1</sup>**

Appliances, Appurtenances or Fixtures <sup>2</sup>	Minimum Fixture Branch Pipe Size <sup>1,4</sup>	Private	Public	Assembly <sup>6</sup>
Bathtub or Combination Bath/Shower (fill) .....	1/2"	4.0	4.0	
3/4" Bathtub Fill Valve .....	3/4"	10.0	10.0	
Bidet .....	1/2"	1.0		
Clothes washer .....	1/2"	4.0	4.0	
Dental Unit, cuspidor .....	1/2"		1.0	
Dishwasher, domestic .....	1/2"	1.5	1.5	
Drinking Fountain or Watercooler .....	1/2"	0.5	0.5	0.75
Hose Bibb .....	1/2"	2.5	2.5	
Hose Bibb, each additional <sup>8</sup> .....	1/2"	1.0	1.0	
Lavatory .....	1/2"	1.0	1.0	1.0
Lawn Sprinkler, each head <sup>5</sup> .....		1.0	1.0	
Mobilehome, each (minimum) <sup>9</sup> .....		12.0		
<b>Sinks</b>				
Bar .....	1/2"	1.0	2.0	
Clinic Faucet .....	1/2"		3.0	
Clinic Flushometer Valve .....				
with or without faucet .....	1"		8.0	
Kitchen, domestic .....	1/2"	1.5	1.5	
Laundry .....	1/2"	1.5	1.5	
Service or Mop Basin .....	1/2"	1.5	3.0	
Washup, each set of faucets .....	1/2"		2.0	
Shower, per head .....	1/2"	2.0	2.0	
Urinal, 1.0 GPF Flushometer Valve .....	3/4"	See Footnote <sup>7</sup>		
Urinal, greater than 1.0 GPF Flushometer Valve .....	3/4"	See Footnote <sup>7</sup>		
Urinal, flush tank .....	1/2"	2.0	2.0	3.0
Washfountain, circular spray .....	3/4"		4.0	
Water Closet, 1.6 GPF Gravity Tank .....	1/2"	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank .....	1/2"	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve .....	1"	See Footnote <sup>7</sup>		
Water Closet, greater than 1.6 GPF Gravity Tank .....	1/2"	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve .....	1"	See Footnote <sup>7</sup>		

**Notes:**

- <sup>1</sup> Size of the cold branch pipe, or both the hot and cold branch pipes.
- <sup>2</sup> Appliances, Appurtenances or Fixtures not included in this Table may be sized by reference to fixtures having a similar flow rate and frequency of use.
- <sup>3</sup> The listed fixture unit values represent their load on their cold water service. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections may each be taken as three-quarter ( 3/4 ) of the listed total value of the fixture.
- <sup>4</sup> The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.
- <sup>5</sup> For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (GPM), and add it separately to the demand (in GPM) for the distribution system or portions thereof.
- <sup>6</sup> Assembly [Public Use (See Table 4-1)].
- <sup>7</sup> When sizing flushometer systems, see Section 610.10.
- <sup>8</sup> Reduced fixture unit loading for additional hose bibbs is to be used only when sizing total building demand and for pipe sizing when more than one hose bibb is supplied by a segment of water-distributing pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.
- <sup>9</sup> For fixture unit values related to manufactured housing (mobilehomes) in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2, Article 5, Section 1278. For fixture unit values related to Special Occupancy Parks in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2.2, Article 5, Section 2278.

**TABLE 6-6**  
**Fixture Unit Table for Determining Water Pipe and Meter Sizes**

Inch	mm
1/2	15
3/4	20
1	25
1-1/4	32
1-1/2	40
2	50
2-1/2	65

**Pressure Range – 30 to 45 psi (207 to 310 kPa)\*\***

Meter and Street Service, Inches	Building Supply and Branches, Inches	Maximum Allowable Length in Feet (meters)														
		40 (12)	60 (18)	80 (24)	100 (30)	150 (46)	200 (61)	250 (76)	300 (91)	400 (122)	500 (152)	600 (183)	700 (213)	800 (244)	900 (274)	1000 (305)
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	19	17	14	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

**Pressure Range – 46 to 60 psi (317 to 414 kPa)\*\***

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	32	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

**Pressure Range – Over 60 psi (414 kPa)\*\***

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

\*\*Available static pressure after head loss.

\*\*\*Building supply, three-quarter (3/4) inch (20 mm) nominal size minimum.

**GAS PIPING.** ( California Plumbing Code Chapter 12 ).

**MATERIALS.** Steel and wrought-iron pipe shall not be less than Standard-weight (Schedule 40) and shall comply with one of the following standards: ASME B36.10, ASTM A 53, or ASTM A 106.

- Copper or brass pipe shall not be used if the gas contains more than an average of 0.3 grains of hydrogen sulfide per 100 scf of gas.
- Threaded copper, brass, or aluminum alloy pipe shall not be used with gases corrosive to such material.
- Aluminum alloy pipe shall comply with ASTM B 241 and be marked at each end of each length indicating compliance. The pipe shall be coated to protect against external corrosion where it is in contact with masonry, plaster, insulation or is subject to repeated wettings by water, detergents or sewage. Aluminum pipe shall not be used in exterior locations or underground.
- Plastic pipe, tubing and fittings used to supply fuel shall conform with ASTM D 2513. The pipe used shall be marked "GAS" and "ASTM D 2513"
- Corrugated stainless steel tubing shall be tested and listed in compliance with the construction, installation, and performance requirements of Standard for Fuel Gas Piping Systems.

**INSTALLATION.** Where the installation of gas piping underground beneath buildings is unavoidable, the piping shall be encased in an approved conduit designed to withstand the superimposed loads. The conduit shall extend into a normal usable and accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping shall be sealed to prevent the possible entrance of any gas leakage. The conduit shall extend at least 4 inches outside the building, be vented above grade to the outside, and be installed so as to prevent the entrance of water and insects.

Underground gas piping in exterior locations must be protected by approved coatings or wrapping materials and shall have at least 18" of earth cover.

Black iron pipe above ground, in exposed exterior locations, must be painted for protection.

A #14 AWG copper tracer wire or tape shall be buried with plastic pipe to facilitate locating, with one end brought above ground at a building wall or riser. Plastic pipe shall be permitted to terminate aboveground where an anodeless riser is used.

**TABLE 12-3  
SUPPORT OF PIPING**

STEEL PIPE, NOMINAL SIZE OF PIPE (in.)	SPACING OF SUPPORTS (ft.)	NOMINAL SIZE OF TUBING SMOOTH-WALL (In. O.D.)	SPACING OF SUPPORTS (ft.)
1/2	6	1/2	4
3/4 or 1	8	5/8 or 3/4	6
1 1/4 or larger (horizontal)	10	7/8 or 1 (horizontal)	8
1 1/4 or larger (vertical)	every floor level	1 or larger (vertical)	every floor level

For SI units: 1 ft. = 0.305 m. [NFPA 54: Table 7.2.6.2]

Water-Heating Appliances		Cooking Appliances	
Water heater, automatic storage 30 to 40 gal. tank	35,000	Range, freestanding, domestic	65,000
Water heater, automatic storage 50 gal. tank	50,000	Built-in oven or broiler unit, domestic	25,000
Water heater, automatic instantaneous		Built-in top unit, domestic	40,000
Capacity at 2 gal./minute	142,800	Other Appliances	
Capacity at 4 gal./minute	285,000	Refrigerator	3,000
Capacity at 6 gal./minute	428,400	Clothes dryer, Type 1 (domestic)	35,000
Water heater, domestic, circulating or side-arm	35,000	Gas fireplace direct vent	40,000
		Gas log	80,000
		Barbecue	40,000
		Gaslight	2,500

For SI units: 1 Btu per hour = 0.293 W  
[NFPA 54: Table 5.4.2.1]

**TABLE 12-1**  
**Approximate Gas Input for Typical Appliances**

Appliance	Input Btu/h. (Approx.)
<b>Space Heating Units</b>	
Warm air furnace	
Single family	100,000
Multifamily, per unit	60,000
Hydronic boiler	
Single family	100,000
Multifamily, per unit	60,000
<b>Space-and Water-Heating Units</b>	
Hydronic boiler	
Single family	120,000
Multifamily, per unit	75,000

Gas piping supplying more than one building on any one premises shall be equipped with separate shut-off valves to each building, located outside the building it supplies and readily accessible at all times.

An accessible, approved manual shut-off valve must be installed within 6 feet of each appliance.

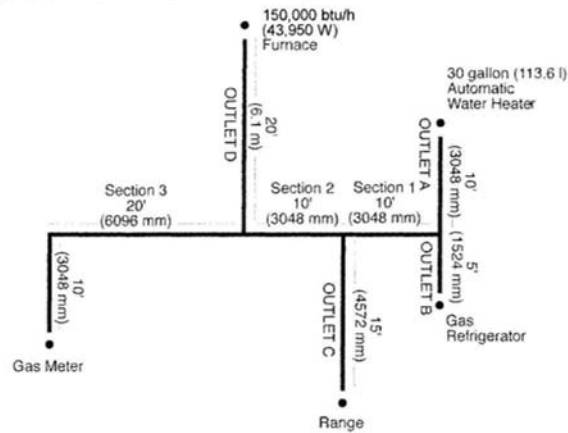
**TESTING.** Mechanical gauges used to measure test pressures shall have a range such that the highest end of the scale is not greater than 5 times the test pressure. The test pressure to be used shall be no less than 1-1/2 times the proposed maximum working pressure, but not less than three (3) psi irrespective of design pressure (Natural gas) for 15 minutes. For welded piping or plastic piping, the test pressure shall be not less than 60 pounds per square inch (LPG) for 30 minutes.

**REQUIRED GAS SUPPLY.** All natural gas regulations and tables are based on the use of gas having a specific gravity of 0.60 supplied at 6" to 8" water column pressure at the outlet of the meter.

The hourly volume of gas required at each piping outlet shall be taken at not less than that specified by the manufacturer of the appliance. Where the gas appliances to be installed have not been definitely specified, the following table may be used as a reference to estimate requirements of typical appliances.

**Figure 12-2 Example Illustrating Use of Tables 12-1 and 12-7**

**Problem:** Determine the required pipe size of each section and outlet of the piping system shown in Figure 12-2. Gas to be used has a specific gravity of sixty hundredths (0.60) and eleven hundred (1,100) Btu per cubic foot (11.4 Watt-hour/L), delivered at eight (8) inch (203 mm) water column pressure.



**Solution:**

- (1) Maximum gas demand of outlet A —  
32 cubic feet per hour (0.21 L/sec.) (from Table 12-1).  
Maximum gas demand of outlet B —  
3 cubic feet per hour (0.02 L/sec.) (from Table 12-1).  
Maximum gas demand of outlet C —  
59 cubic feet per hour (0.46 L/sec.) (from Table 12-1).  
Maximum gas demand of outlet D —  
136 cubic feet per hour (1.1 L/sec.) (150,000 Btu/hour [43,950 W])  
divided by 1,100 Btu per cubic foot (11.4 Watt-hour/L)
- (2) The length of pipe from the gas meter to the most remote outlet (outlet A) is 60 feet (18,288 mm).
- (3) Using the length in feet column row marked 60 feet (18,288 mm) in Table 12-7:  
Outlet A, supplying 32 cubic feet per hour (0.21 L/sec.), requires one-half (1/2) inch (15 mm) pipe. Section 1, supplying outlets A and B, or 35 cubic feet per hour (0.24 L/sec.) requires one-half (1/2) inch (15 mm) pipe.  
Section 2, supplying outlets A, B, and C, or 94 cubic feet per hour (0.7 L/sec.) requires three-quarter (3/4) inch (20 mm) pipe.  
Section 3, supplying outlets A, B, C, and D, or 230 cubic feet per hour (1.8 L/sec.), requires one and one quarter (1-1/4) inch (32 mm) pipe.
- (4) Using the column marked 60 feet (18288 mm) in Table 12-7 (no column for actual length of 55 feet [16,764 mm]):  
Outlet B supplying 3 cubic feet per hour (0.02 L/sec.), requires one-half (1/2) inch (15 mm) pipe.  
Outlet C, supplying 59 cubic feet per hour (0.46 L/sec.), requires one-half (1/2) inch (15 mm) pipe.
- (5) Using the column marked 50 feet (15,240 mm) in Table 12-7:  
Outlet D, supplying 136 cubic feet per hour (1.1 L/sec.), requires (1) inch (25 mm) pipe.

## PIPE SIZING METHODS: (California Plumbing Code Chp. 12)

To obtain the cubic-feet per hour of gas required, divide input of appliances by the average BTU heating value per cubic foot of the gas. The average BTU per cubic foot of the gas in the area of the installation may be obtained from the serving gas supplier.

## LPG -- LIQUIFIED PETROLEUM GAS FACILITIES AND PIPING:

In addition to the requirements for gas piping, the facilities and piping shall conform to the following requirements:

All LPG facilities shall be readily accessible for inspection, reading, testing, and shutting off the gas supply at all times. All service piping and main supply shut-off valves shall be outside the building.

LPG facilities shall not be located in any pit or basement or similar locations where heavier-than-air gas may collect. (See Section 16, page 16.11 for drain detail).

Discharge from relief valves shall be into open air and shall not be less than 5' horizontally away from any opening into a building which is below such discharge.



Use of plastic pipe for LPG facilities and piping is not allowed. Only approved metallic pipe or PVC or PE pipe specifically approved for use in exterior buried piping systems may be used.

## INSTALLATION OF LPG STORAGE TANKS

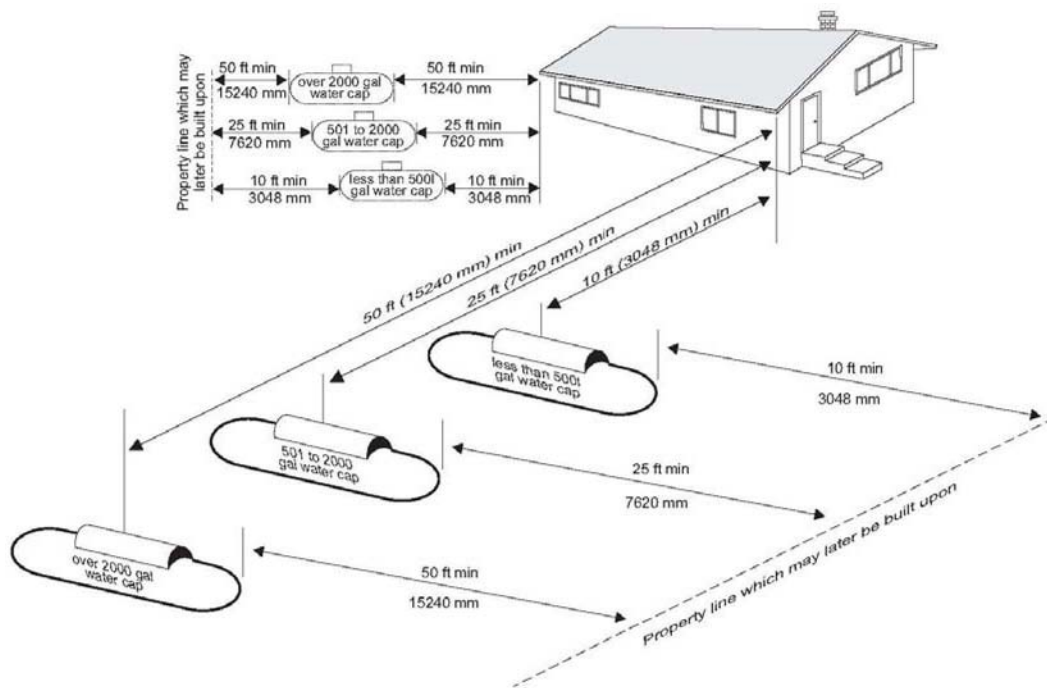


Figure 12-14

### Installation of LPG Storage Tanks

Note: All tanks shall be secured for seismic and flooding considerations. All new tanks require seismic valves designated to activate at 6.0 Richter scale. (California Fire Code Section 3804.1)

**TABLE 3804.3  
LOCATION OF LP-GAS CONTAINERS**

LP-GAS CONTAINER CAPACITY (water gallons)	MINIMUM SEPARATION BETWEEN LP-GAS CONTAINERS AND BUILDINGS, PUBLIC WAYS OR LOT LINES OF ADJOINING PROPERTY THAT CAN BE BUILT UPON		MINIMUM SEPARATION BETWEEN LP-GAS CONTAINERS <sup>b, c</sup> (feet)
	Mounded or underground LP-gas containers <sup>a</sup> (feet)	Above-ground LP-gas containers <sup>b</sup> (feet)	
Less than 125 <sup>c, d</sup>	10	5 <sup>e</sup>	None
125 to 250	10	10	None
251 to 500	10	10	3
501 to 2,000	10	25 <sup>e, f</sup>	3
2,001 to 30,000	50	50	5
30,001 to 70,000	50	75	(0.25 of sum of diameters of adjacent LP-gas containers)
70,001 to 90,000	50	100	
90,001 to 120,000	50	125	

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

- a. Minimum distance for underground LP-gas containers shall be measured from the pressure relief device and the filling or liquid-level gauge vent connection at the container, except that all parts of an underground LP-gas container shall be 10 feet or more from a building or lot line of adjoining property which can be built upon.
- b. For other than installations in which the overhanging structure is 50 feet or more above the relief-valve discharge outlet. In applying the distance between buildings and ASME LP-gas containers with a water capacity of 125 gallons or more, a minimum of 50 percent of this horizontal distance shall also apply to all portions of the building which project more than 5 feet from the building wall and which are higher than the relief valve discharge outlet. This horizontal distance shall be measured from a point determined by projecting the outside edge of such overhanging structure vertically downward to grade or other level upon which the LP-gas container is installed. Distances to the building wall shall not be less than those prescribed in this table.
- c. When underground multicontainer installations are comprised of individual LP-gas containers having a water capacity of 125 gallons or more, such containers shall be installed so as to provide access at their ends or sides to facilitate working with cranes or hoists.
- d. At a consumer site, if the aggregate water capacity of a multicontainer installation, comprised of individual LP-gas containers having a water capacity of less than 125 gallons, is 500 gallons or more, the minimum distance shall comply with the appropriate portion of Table 3804.3, applying the aggregate capacity rather than the capacity per LP-gas container. If more than one such installation is made, each installation shall be separated from other installations by at least 25 feet. Minimum distances between LP-gas containers need not be applied.
- e. The following shall apply to above-ground containers installed alongside buildings:
  1. LP-gas containers of less than a 125-gallon water capacity are allowed next to the building they serve when in compliance with Items 2, 3 and 4.
  2. Department of Transportation (DOTn) specification LP-gas containers shall be located and installed so that the discharge from the container pressure relief device is at least 3 feet horizontally from building openings below the level of such discharge and shall not be beneath buildings unless the space is well ventilated to the outside and is not enclosed for more than 50 percent of its perimeter. The discharge from LP-gas container pressure relief devices shall be located not less than 5 feet from exterior sources of ignition, openings into direct-vent (sealed combustion system) appliances or mechanical ventilation air intakes.
  3. ASME LP-gas containers of less than a 125-gallon water capacity shall be located and installed such that the discharge from pressure relief devices shall not terminate in or beneath buildings and shall be located at least 5 feet horizontally from building openings below the level of such discharge and not less than 5 feet from exterior sources of ignition, openings into direct vent (sealed combustion system) appliances, or mechanical ventilation air intakes.
  4. The filling connection and the vent from liquid-level gauges on either DOTn or ASME LP-gas containers filled at the point of installation shall not be less than 10 feet from exterior sources of ignition, openings into direct vent (sealed combustion system) appliances or mechanical ventilation air intakes.
- f. This distance is allowed to be reduced to not less than 10 feet for a single LP-gas container of 1,200-gallon water capacity or less, provided such container is at least 25 feet from other LP-gas containers of more than 125-gallon water capacity.

**TABLE 3809.12  
SEPARATION FROM EXPOSURES OF CONTAINERS AWAITING USE, RESALE OR EXCHANGE  
STORED OUTSIDE OF BUILDINGS FROM EXPOSURES**

QUANTITY OF LP-GAS STORED (pounds)	MINIMUM SEPARATION DISTANCE FROM STORED CYLINDERS TO (feet):						
	Nearest important building or group of buildings or line of adjoining property that may be built upon	Line of adjoining property occupied by schools, places of religious worship, hospitals, athletic fields or other points of public gathering; busy thoroughfares; or sidewalks	LP-gas dispensing station	Doorway or opening to a building with two or more means of egress	Doorway or opening to a building with one means of egress	Combustible materials	Motor vehicle fuel dispenser
720 or less	0	0	5	5	10	10	20
721 - 2,500	0	10	10	5	10	10	20
2,501 - 6,000	10	10	10	10	10	10	20
6,001 - 10,000	20	20	20	20	20	10	20
Over 10,000	25	25	25	25	25	10	20

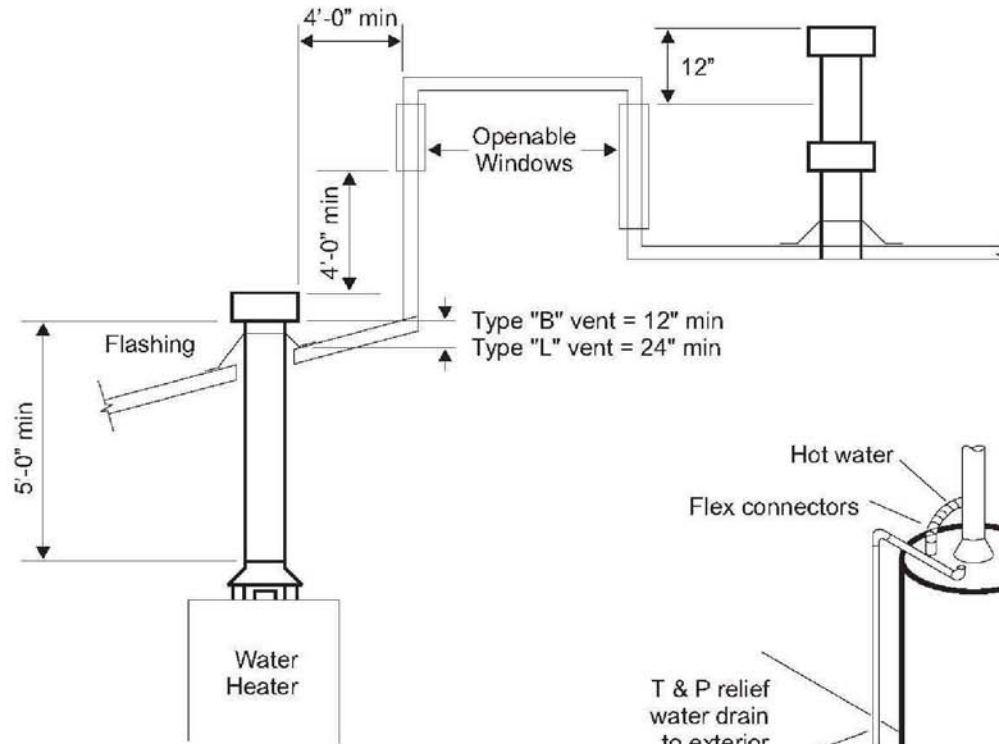
For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

### **SECURING PROPANE TANKS FOR FLOODING CONSIDERATIONS:**

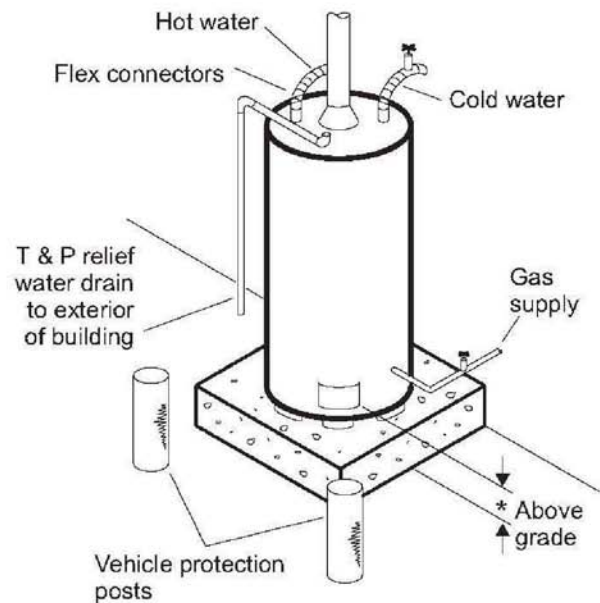
All liquefied petroleum containers in areas of Special Flood Hazard shall be secured as provided in Section 3804 of the California Fire Code/Sonoma County Fire Code. The securing system shall meet the engineering standards as indicated below.

- 1** Prior to installing the earth auger anchors, check for underground utilities.
- 2** Earth augers and straps shown hereon are designed to resist the buoyancy forces from an empty tank fully submerged, and the lateral forces generated from Seismic Design Category D or E activity.
- 3** Earth auger types and lengths required are dependant upon the existing soil conditions:
  - a.** All Class 5 soils (clay, sandy clay, silty clay and clayey silt) and sand, silty sand & clayey sand of the Class 4 soils require earth augers a minimum of 48 inches in length and one 6" diameter helix.
  - b.** Class 4 and better soils with the exception of sand, silty sand & clayey sand require earth augers a minimum of 32" in length and two 4" diameter helixes.
  - c.** Earth augers shall have a tested minimum pull out value of 6,000 lbs.
- 4.** Straps shall be one of the following:
  - a.** 1-1/4" x 0.031" stainless steel, 301-1/4 hard, minimum tensile strength of 4,750 lbs.
  - b.** 1-1/4" x 0.031" galvanized steel, Class B, Grade 1, minimum tensile strength of 4,750 lbs.
- 5.** In the event earth augers are precluded from installation, alternate tethering designs can be submitted for consideration.
- 6.** In all cases, when tanks up to 350 gallons are placed in areas of soil types as described in note 3-a, 2 straps and 4 earth augers are required.

## WATER HEATER VENTING



Roof Slope	Minimum Height from Roof to Lowest Discharge Opening, Feet--Inches
Flat to 7/12	1--0
Over 7/12 to 8/12	1--6
Over 8/12 to 9/12	2--0
Over 9/12 to 10/12	2--6
Over 10/12 to 11/12	3--3
Over 11/12 to 12/12	4--0
Over 12/12 to 14/12	5--0
Over 14/12 to 16/12	6--0
Over 16/12 to 18/12	7--0
Over 18/12 to 20/12	7--6
Over 20/12 to 21/12	8--0



\* Residential garage = 18"  
Commercial garage = 8'-0"

## Water Heating Venting

## **SECTION 14 - WELL & SEPTIC**

This highlights only some of the most commonly requested information. It is not an attempt to cover exhaustively all issues which may affect a project. Other handouts, and District Environmental Health Specialists, are available to assist applicants with their projects. A free booklet is available that explains septic systems, their functions and maintenance.

**WELLS.** (see Figure 15 A, page 15.3).

**Permits.** Permits are required to drill, abandon, or deepen wells, and only C-57 well drilling contractors may take out such permits.

**Water Scarce Areas.** Maps are available for review at the Environmental Health Department, and display four zones (1-4) of ground water availability. Zone #4 is a low water yield area and requires an 8-12 hour well pump test during the period of July 15 - October 1. The test must be performed by a licensed well or pump contractor or Registered Civil Engineer and is required prior to a building permit issuance. At least 1 gallon per minute must be demonstrated for each dwelling unit. The test period may be extended for some wells if dry weather conditions extend beyond October 1. For springs, the test is only run long enough to demonstrate a continuous gallon-per-minute flow. No spring testing is allowed beyond October 1.

**Setbacks.** Wells must be at least 5' from property lines, 100' from septic systems, and 25'-50' respectively from approved sewage waste lines or mains and 150' from seepage pits or cesspools.

**SEPTIC SYSTEMS.** (see Figures 15 B & C, page 15.3).

**Permits.** Permits are required to install, repair, or replace septic tanks, leach fields, and related sewage disposal components. Homeowners may design and install their own standard, gravity septic systems. Pump and non-standard systems require a specific license (Civil Engineer or Registered Environmental Health Specialist) for design.

For most homeowners, licensed design and installation are recommended.

**The Process.** For new homes and substantial remodeling or addition, a soils analysis is needed. A "pre-perc" evaluation is done through review of soil profiles dug in the proposed leach field area by a licensed consultant. If these appear suitable, percolation (perc) tests are completed to determine the size of the system needed. Poor soils require a larger disposal field; well drained soils allow a smaller disposal field. Satisfactory perc tests allow a septic system design to be drawn. The design may be approved by itself or with a permit to install the system. Designs must be a 1:20 scale, and include structures, driveways, wells, property lines, easements, septic tanks and leach fields, creeks, drainage ways, ponds and flood zones. A handout is available for plot plan requirements.

**Wet Weather Testing.** There are two types of wet weather testing: ground water tests and wet weather percs. Groundwater (depth) tests are required on all parcels where the slope is less than 5%, and where ground water is suspected to be a problem. Wet weather perc tests are required where the soils appear expansive (high clay and/or silt content). Soil hydrometer tests may be used to determine the silt and clay content of a soil sample, and other lab tests may be done to determine the expansiveness of the soil and avoid the need for a wet weather perc test.

**Remodels and Additions.** For substantial remodels and additions, a Well & Septic Section clearance is required. A policy is available explaining what levels of remodeling trigger the need for septic system upgrade or replacement. No remodeling can be approved when a living unit is served by a cesspool (one sewage disposal box by itself). Prior to demolition of a home, the owner is advised to consult with the Well & Septic Division.

**Gray Water Systems.** As of January 1, 1996, subsurface gray water systems are approved for use with a permit. This system should be discussed with Well & Septic Division staff.

**Septic System Repairs.** If a septic system fails and the home is within a sewer district, and sewer is within 200', hookup to the public sewer is required. The septic tank must be abandoned under permit. If sewer is not available, well and septic staff will work with the owner to provide the best repair or replacement, taking into account site constraints and economics.

**General Information.** District Environmental Health Specialists of the Well & Septic Section are available by appointment only between 8:00a.m. - 9:00 a.m., and a general counter representative is available most days from 8:00a.m. - 5:00 p.m, except on Saturday and Sunday when Environmental Health is closed to the public.

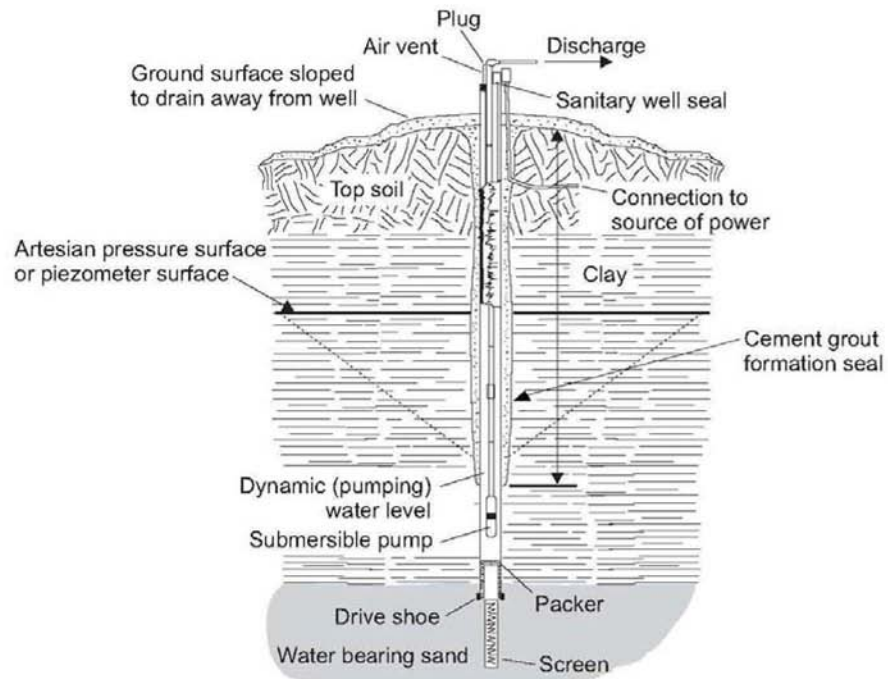


Figure 15A  
**Drilled Well With Submersible Pump**

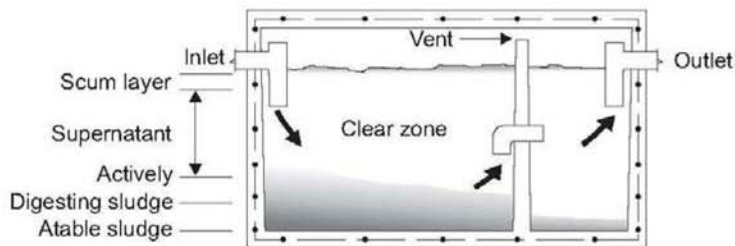


Figure 15B  
**Septic Tank Sideview**

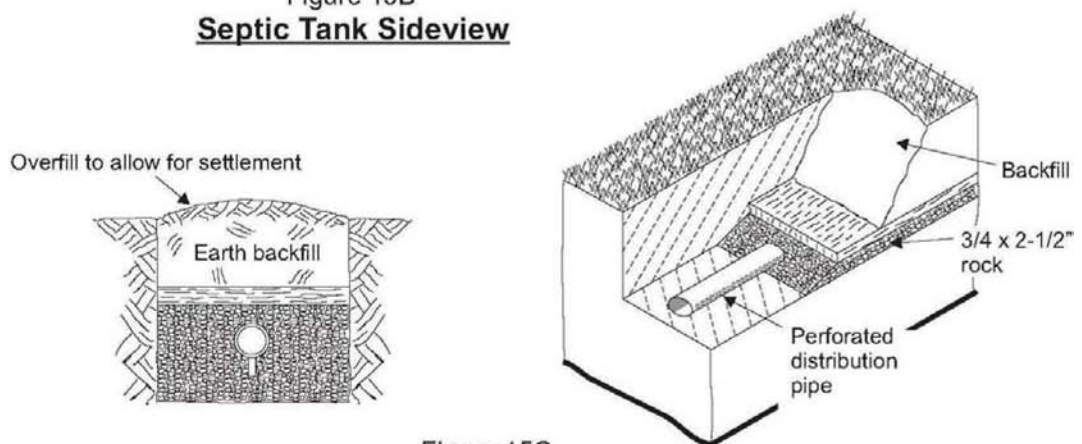


Figure 15C  
**Typical Trench-type Soil Absorption System**

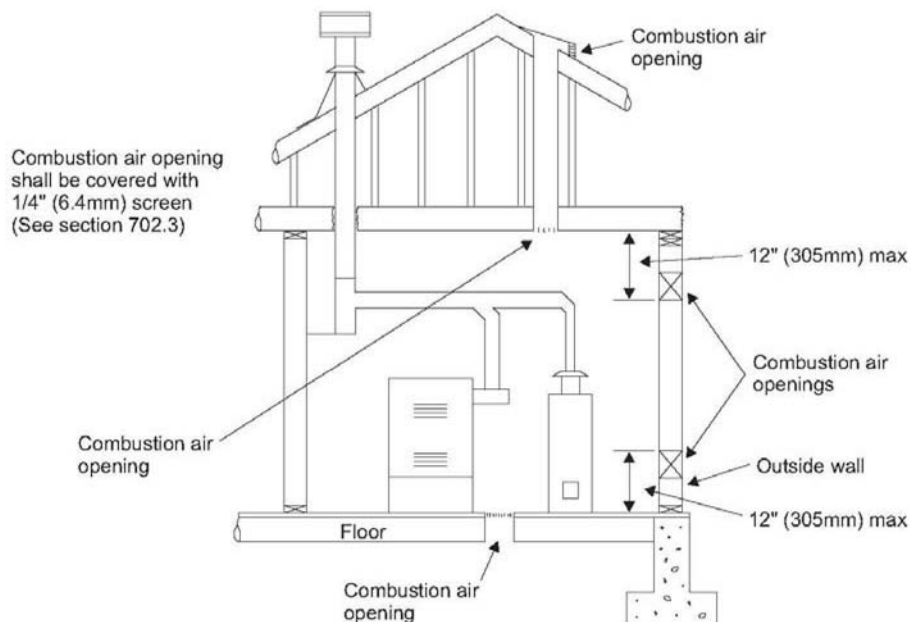
## **SECTION 15 - MECHANICAL**

### **COMBUSTION AIR REQUIREMENTS.** (California Mechanical Code Chapter 7).

The minimum required volume of a room containing a fuel burning (gas) appliance shall be 50 cubic feet for each 1000 BTU/hr (based on the maximum hourly fuel input rate of the appliance). When this minimum volume is not met, provisions must be made to supply the deficiency in combustion and ventilating air as follows:

One half of the required air supply opening must be located within the upper 12" of the enclosure and one half not more than 12" above the base of the lowest appliance within the enclosure.

**EXCEPTION:** When all air is taken from the outdoors for an appliance with a minimum clearance of 1" [25 mm] on the sides and back and 6" [152 mm] on the front, one opening shall be permitted and located within the upper 12" of the enclosure.



Combustion air may be obtained from outside the appliance enclosure:

1. Through the floor, roof, or walls of the enclosure, or
2. Through ducts from the enclosure to the outside of the building.
3. Combustion openings shall be screened with 1/4" galvanized mesh.

Combustion air may be obtained from an attic area if the attic has at least 30" vertical clear height at its maximum point, and the ventilation is sufficient to provide the required volume. The opening to the attic must be 26 gauge galvanized steel extending at least 6" above the top of the ceiling joists and insulation. Upper opening of sleeve shall not be screened.

Combustion air may be obtained from underfloor area if the underfloor ventilation area is doubled.



Adequate combustion air **may** be available if interior space/volume is adequate. See the following diagram which illustrates an example of insufficient interior volume for gas and liquid-fired appliances:

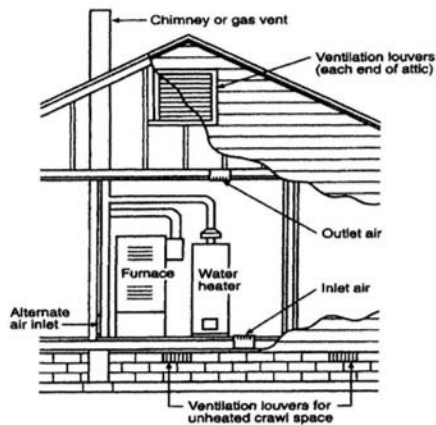


FIGURE 7-2 All Combustion Air from Outdoors—Inlet Air from Ventiladed Crawl Space and Outlet Air to Ventiladed Attic. [NFPA 54: A.8.3.3.(1) (A)]

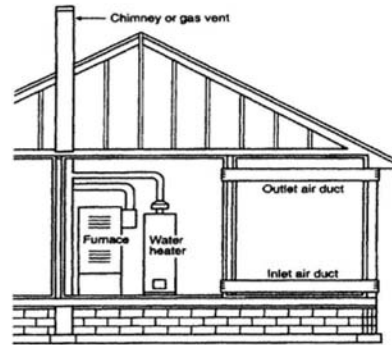


FIGURE 7-4 All Combustion Air from Outdoors Through Horizontal Ducts. [NFPA 54: A.8.3.3.1(2)]

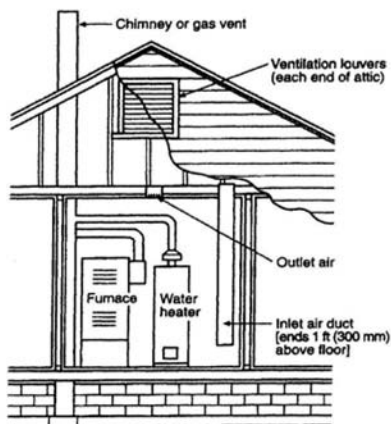


FIGURE 7-3 All Combustion Air from Outdoors Through Ventiladed Attic. [NFPA 54: A.8.3.3.1(1)(b)]

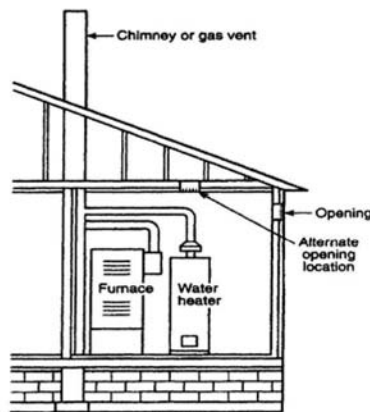


FIGURE 7-5 All Combustion Air from Outdoors Through Single Combustion Air Opening. [NFPA 54:A.8.3.3.2]

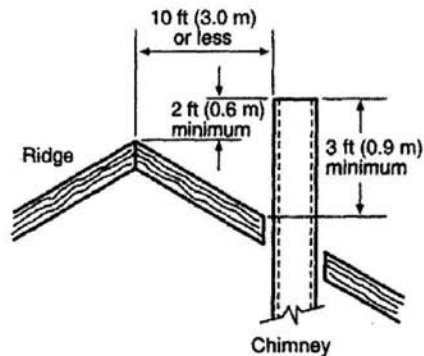
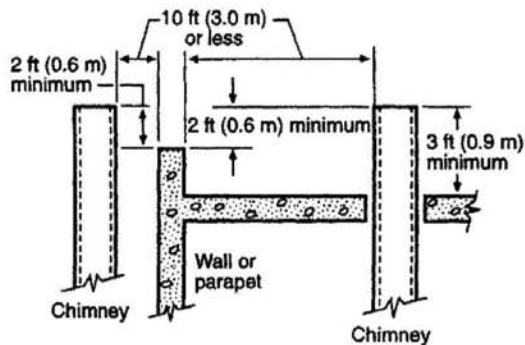
## COMBUSTION AIR DUCTS:

Combustion air supply ducts shall comply with the following:

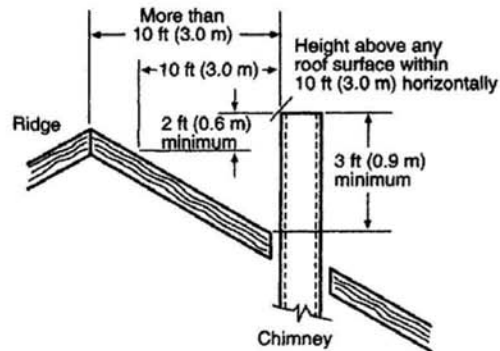
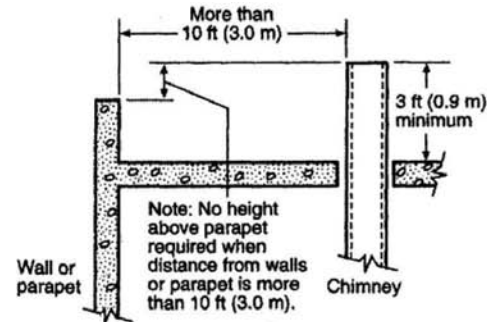
1. Ducts shall be of galvanized steel or material with equivalent corrosion-resistant, strength and rigidity. In dwellings, unobstructed stud and joist spaces may be used to convey combustion air, provided not more than one required firestop is removed.
2. Ducts shall terminate in and an unobstructed space the allows the free movement of air to the appliances.
3. Ducts shall serve a single space.
4. Ducts shall not serve upper and lower combustion air openings where both openings are used. Separation of ducts shall be maintained to the source of combustion.
5. Ducts terminating in attics shall not be screened.
6. Exterior intakes for combustion air shall have the lowest side of the opening located at least

12" vertically from the adjoining grade level.

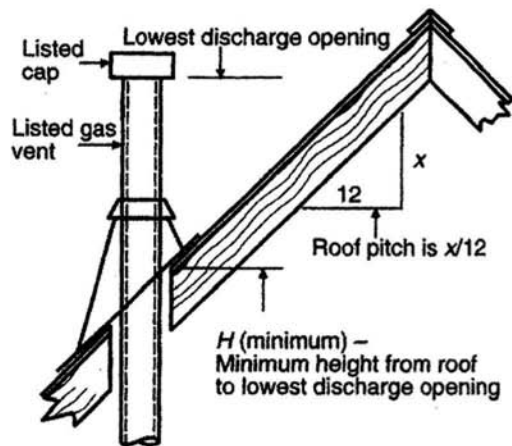
7. Horizontal upper combustion ducts shall not slope towards the source of combustion.



(a) Termination 10 ft (3.0 m) or Less from Ridge, Wall, or Parapet



(b) Termination More Than 10 ft (3.0 m) from Ridge, Wall, or Parapet



Roof pitch	H (minimum) ft	m
Flat to 6/12	1.0	0.30
6/12 to 7/12	1.25	0.38
Over 7/12 to 8/12	1.5	0.46
Over 8/12 to 9/12	2.0	0.61
Over 9/12 to 10/12	2.5	0.76
Over 10/12 to 11/12	3.25	0.99
Over 11/12 to 12/12	4.0	1.22
Over 12/12 to 14/12	5.0	1.52
Over 14/12 to 16/12	6.0	1.83
Over 16/12 to 18/12	7.0	2.13
Over 18/12 to 20/12	7.5	2.27
Over 20/12 to 21/12	8.0	2.44

**FIGURE 8-2**  
**GAS VENT TERMINATION LOCATIONS FOR LISTED CAPS**  
**12 IN. (300 MM) OR LESS IN SIZE AT LEAST 8 FT. (2.4 M)**  
**FROM A VERTICAL WALL.**

## **VENTING OF APPLIANCES.** (California Mechanical Code Chapter 8).

**VENT TERMINATION:** Installation and venting of appliances shall be installed in accordance with their listings and the Manufacturers instruction.

**General.** Vents shall extend above the roof surface, through a flashing, and terminate in a listed vent cap installed in accordance with its listing and the manufacturer's installation instructions.

**Gravity-type Venting Systems.** Gravity-type venting systems, other than a Type BW gas-venting system or a venting system which is an integral part of a listed appliance shall terminate not less than 5 feet (1524 mm) above the highest vent collar which it serves.

**Wall Furnace.** Type BW gas vent serving a vented wall furnace shall terminate at least 12 feet (3658 mm) in vertical height above the bottom of the furnace.

**Type B or BW Gas Vents.** Type B or BW gas vents with listed vent caps 12" in size or smaller shall be permitted to be terminated in accordance with Figure 8-2 as shown above, provided they are located at least 8 feet (2438 mm) from a vertical wall or similar obstruction. All other Type B gas vents shall terminate not less than 2 feet (610 mm) above the highest point where they pass through the roof and at least 2 feet (610 mm) higher than any portion of a building within 10 feet (3048 mm).

**Type L Venting Systems.** Type L venting systems shall terminate not less than 5 feet (610 mm) in vertical height above the highest connected appliance hood or flue collar.

**Vent Terminals.** Venting systems shall terminate not less than 4 feet (1219 mm) below or 4 feet (1219 mm) horizontally from, and not less than 1 foot (305 mm) above a door, an openable window or a gravity air inlet into a building.

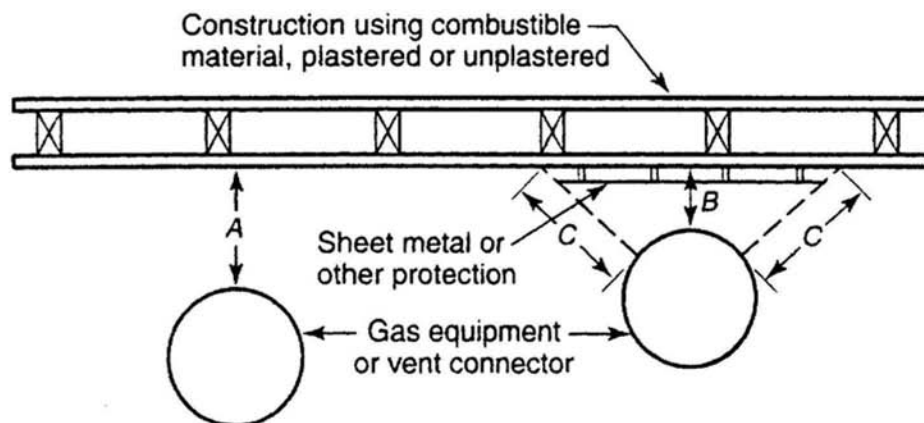
**EXCEPTION:** Vent terminals of direct-vent appliances with inputs of 50,000 Btu/h (14.7kW) or less shall be located at least 9 inches (229 mm) from an opening through which combustion products could enter a building. Appliances with inputs exceeding 50,000 Btu/h (14.7kW) but not exceeding 65,000 Btu/h (19kW) shall require 12-inch (305 mm) vent termination clearances. The bottom of the vent terminal and the air intake shall be located at least 12 inches (305 mm) above grade.

**Separation from inlets.** Venting systems shall terminate at least 3 feet (914 mm) above an outside-or makeup-air inlet located within 10 feet (3048 mm) and at least 4 feet (1219 mm) from a property line except a public way.

**Outdoor Appliances with Integral Vents.** Appliances listed for outdoor installation incorporating integral venting means shall be considered as being properly vented when they are installed in accordance with their listings and the manufacturer's instructions. Venting systems shall terminate at least 4 feet (1219 mm) below or 4 feet (1219 mm) horizontally from, and at least 1 foot (305 mm) above a door, an openable window or a gravity-air inlet into building. Venting systems shall terminate not less than 3 feet (914 mm) above a forced-air inlet located within 10 feet (3048 mm) and at least 4 feet (1219 mm) from a property line, except a public way.

**Installation of Ducts.** Air ducts installed under a floor in a crawl space shall be installed so as to maintain a vertical clearance of eighteen (18) inches for all portions of the duct that would obstruct access to any part of the crawl space.

## INSTALLATION OF SPECIFIC EQUIPMENT:

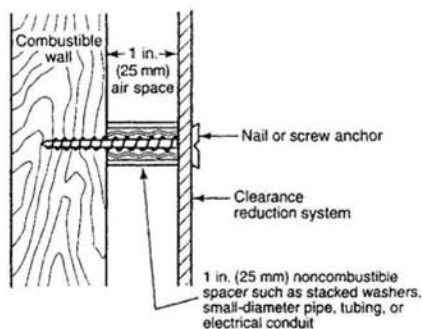
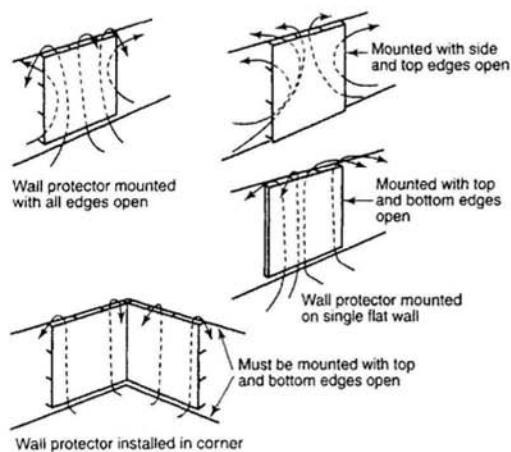


### Notes:

A equals the clearance with no protection.

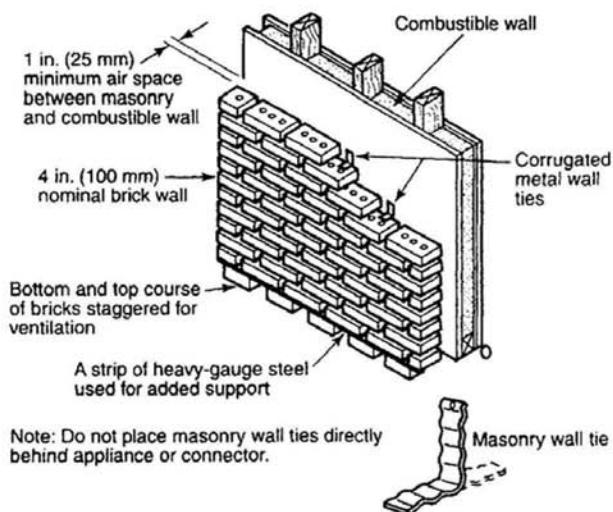
B equals the reduced clearance permitted. The protection applied to the construction using combustible material shall extend far enough in each direction to make C equal to A.

**FIGURE 9-1(a) Extent of Protection Necessary to Reduce Clearance from Gas Equipment or Vent Connectors.**



Masonry walls can be attached to combustible walls using wall ties. Spacers should not be used directly behind appliance or connector.

**FIGURE 9-1(b) Wall Protector Clearance Reduction System.**



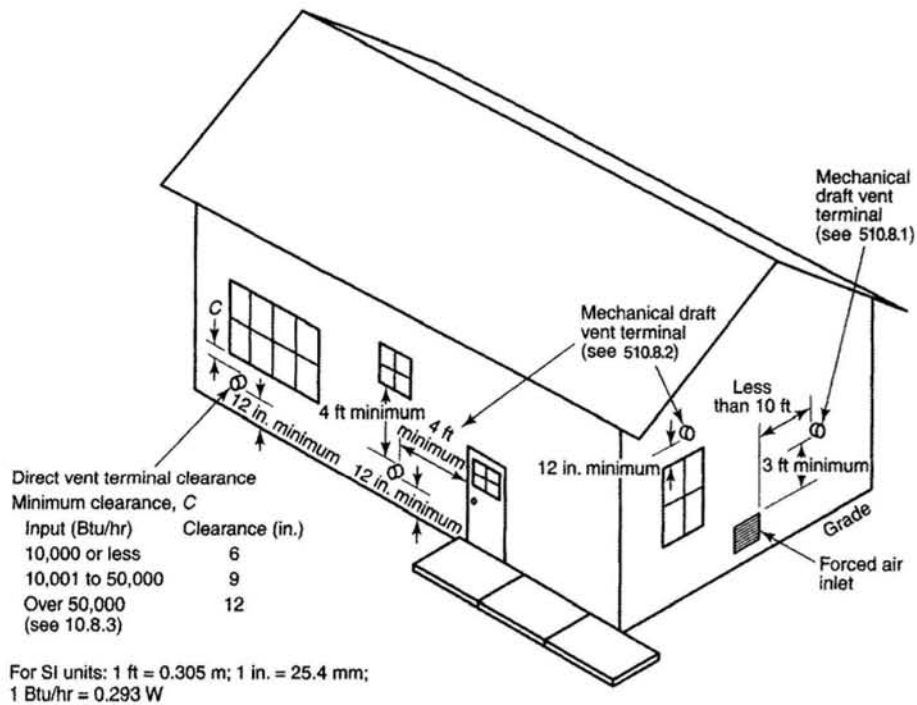
**FIGURE 9-1(c) Masonry Clearance Reduction System.**

**TABLE 8-2**  
**Clearance for Connectors**

Equipment	Minimum Distance from Combustible Material			
	Listed Type B Gas Vent Material	Listed Type L Vent Material	Single-Wall Metal Pipe	Factory-Built Chimney Sections
Listed equipment with draft hoods and equipment listed for use with Type B gas vents	As listed	As listed	6 in.	As listed
Residential boilers and furnaces with listed gas conversion burner and with draft hood	6 in.	6 in.	9 in.	As listed
Residential appliances listed for use with Type L vents	Not permitted	As listed	9 in.	As listed
Residential incinerators	Not permitted	9 in.	18 in.	As listed
Listed gas-fired toilets	Not permitted	As listed	As listed	As listed
Unlisted residential appliances with draft hood	Not permitted	6 in.	9 in.	As listed
Residential and low-heat equipment other than those above	Not permitted	9 in.	18 in.	As listed
Medium-heat equipment	Not permitted	Not permitted	36 in.	As listed

For SI units, 1 in. = 25.4 mm.

Note: These clearances shall apply unless the listing of an appliance or connector specifies clearances, in which case the listed clearances shall apply. [NFPA 54: Table 10.7.4.4]



**Figure 8-21**  
**Exit Terminals of Mechanical Draft and Direct-Vent Venting Systems**

## **GAS VENTING THROUGH EXISTING MASONRY CHIMNEYS.** (California Mechanical Code Ch. 8).

**Design.** Masonry chimneys shall be designed, anchored, supported and reinforced as required in Chapters 21 of the 2010 CBC and Chapter 10 of the 2010 CRC.

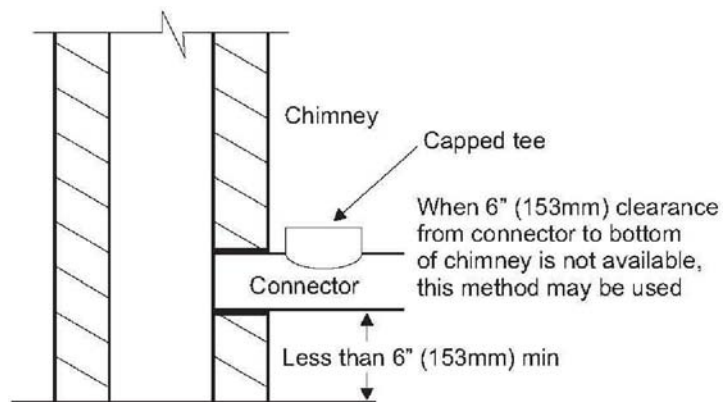
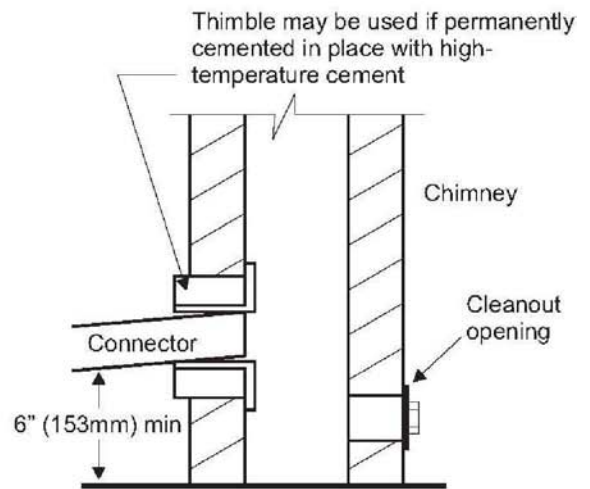
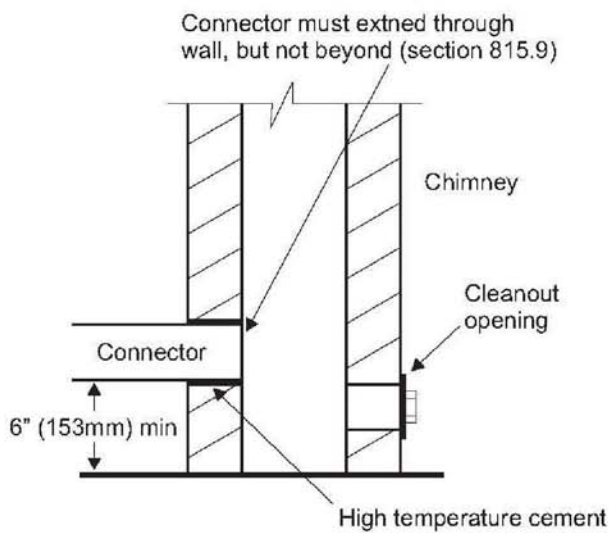
**Gas Venting into Existing Masonry Chimneys.** Existing lined masonry chimneys and unlined chimneys with not more than one side exposed to the outside may be used to vent gas appliances, provided:

1. An approved liner shall be installed in an existing unlined masonry chimney when deemed necessary by the building official considering local problems of vent gas condensate.
2. The effective cross-sectional area is not more than four times the cross-sectional area of the vent and chimney connectors entering the chimney.
3. The effective area of the chimney when connected to more than one appliance shall not be less than the area of the largest vent or chimney connector plus 50 percent of the area of the additional vent or chimney connectors.
4. Automatically controlled gas appliances connected to a chimney which also serves equipment burning liquid fuel shall be equipped with an automatic pilot. A gas appliance vent connector and a chimney connector from an appliance burning liquid fuel may be connected into the same chimney through separate openings, provided the gas appliance is vented above the liquid fuel-burning appliance, or both may be connected through a single opening if joined by a suitable fitting located at the chimney.
5. The chimney passageway shall be examined to ascertain that it is clear and free of obstructions and shall be cleaned if previously used for venting solid-or liquid-fuel-burning appliances.
6. The vent or chimney connector shall enter the chimney at least 6 inches (152 mm) from the bottom of the chimney. The chimney shall be provided with a cleanout. If 6 inches (152 mm) are not available, a cleanout shall be provided by installing a capped tee in the vent connector next to the chimney.

Unlined chimneys with more than one side exposed to the outside shall be lined with an approved liner unless otherwise approved by the building official.

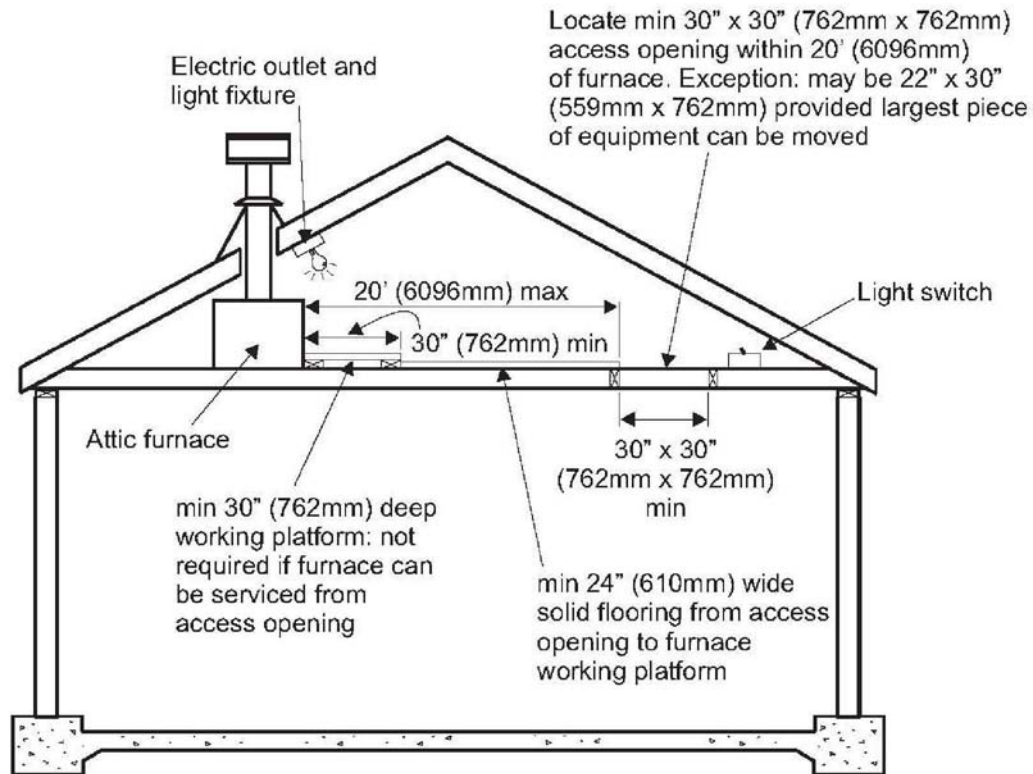
When inspection reveals that an existing chimney is not safe for the intended application, it shall be rebuilt to conform to chimney standards of the Building Code or replaced with an approved gas vent or factory-built chimney.

See diagrams on following page:

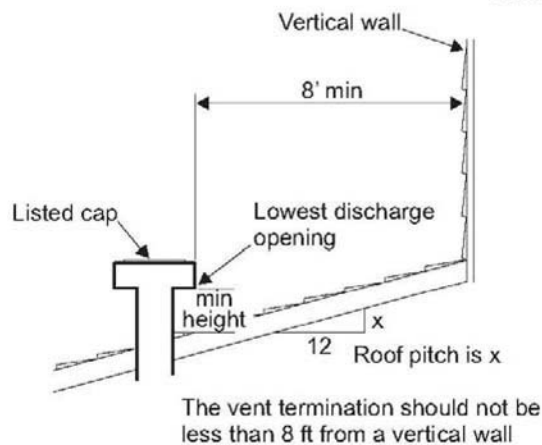


### **Entering a Masonry Chimney**

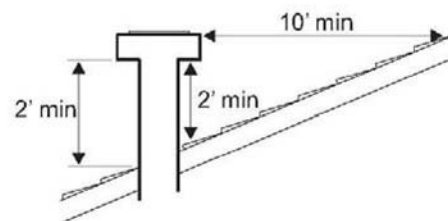
**FURNACES, ATTIC INSTALLATIONS.** Central warm-air furnaces installed in an attic must be accessible for routine inspection and maintenance by the owner/occupant and for service and repair as needed. Changing filters, lubricating motor and fan bearings, checking belt tension, and relighting the pilot following a service interruption are normal owner functions. Adequate light, an electrical outlet, safe access way and sufficient working space on the control side all encourage and facilitate maintenance and also enable rapid egress in an emergency.



### Roof Vent Caps



**Vent Caps 12" or Smaller**



**Vent Caps Larger Than 12"**



## CLEARANCES ABOVE COOKING TOPS:

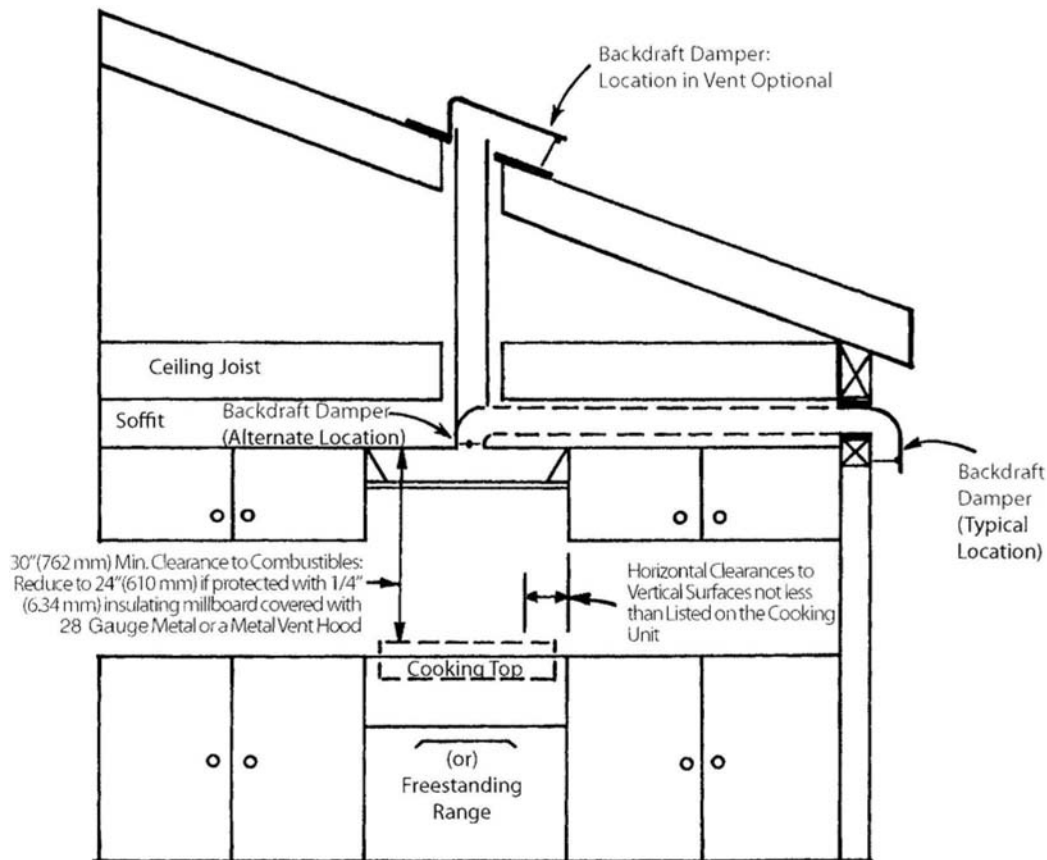


Figure 9-15  
Kitchen Range Hood and Duct

### Built-In Units

- (A) **Installation.** Listed built-in household cooking appliances shall be installed in accordance with their listing and the manufacturers' instructions. The installation shall not interfere with combustion air, accessibility for operation, and serving. Unlisted built-in household cooking appliances shall not be installed in or adjacent to combustible material.
- (B) **Vertical Clearance.** Built-in top (or surface) cooking appliances shall have a vertical clearance above the cooking top of not less than 30 inches to combustible material or metal cabinets. A minimum clearance of 24 inches is permitted when one of the following is installed:
- (1) The underside of the combustible material or metal cabinet above the cooking top is protected with not less than 1/4 inch insulating millboard covered with sheet metal not less than 0.0122 inch thick.
  - (2) A metal ventilating hood of sheet metal not less than 0.0122 inch thick is installed above the cooking top with a clearance of not less than 1/4 inch between the hood and the underside of the combustible material or metal cabinet, and the hood is at least as wide as the appliance and is centered over the appliance.
  - (3) A listed cooking appliance or microwave oven is installed over a listed cooking appliance and will conform to the terms of the upper appliance's listing and the manufacturers' instructions.

**HORIZONTAL.** The minimum horizontal distance from the center of the burner head(s) of a stove top to adjacent vertical combustible surfaces extending immediately above the counter top shall be not less than the distance specified by the permanent marking on the unit.

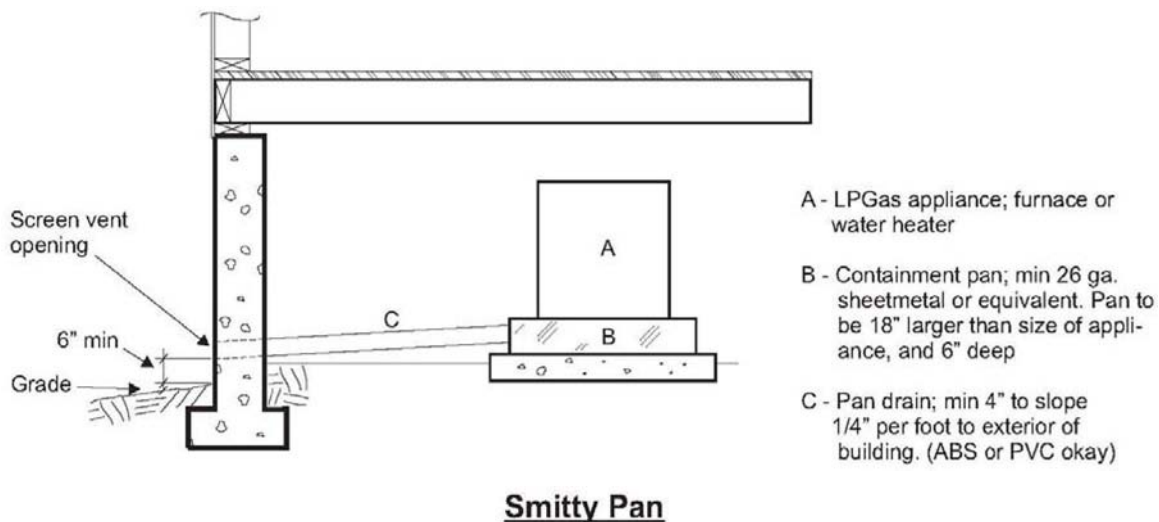
**WOOD-FIRED APPLIANCES.** All wood-fired appliances, new or used, are subject to the emission standards set forth in Regulation 4 of the Northern Sonoma County Air Pollution Control District (N.S.C.A.P.C.D.), effective on July 8, 1993. Masonry fireplaces do not comply with the emission standards. Questions regarding the enforcement of this regulation should be directed to the N.S.C.A.P.C.D. office in Healdsburg (listed under "Air Pollution" in county government section of phone book).

All wood-burning stoves with a testing laboratory label **must be installed** according to the manufacturer's installation instructions. The stove should be set on a hearth per appliance listing.

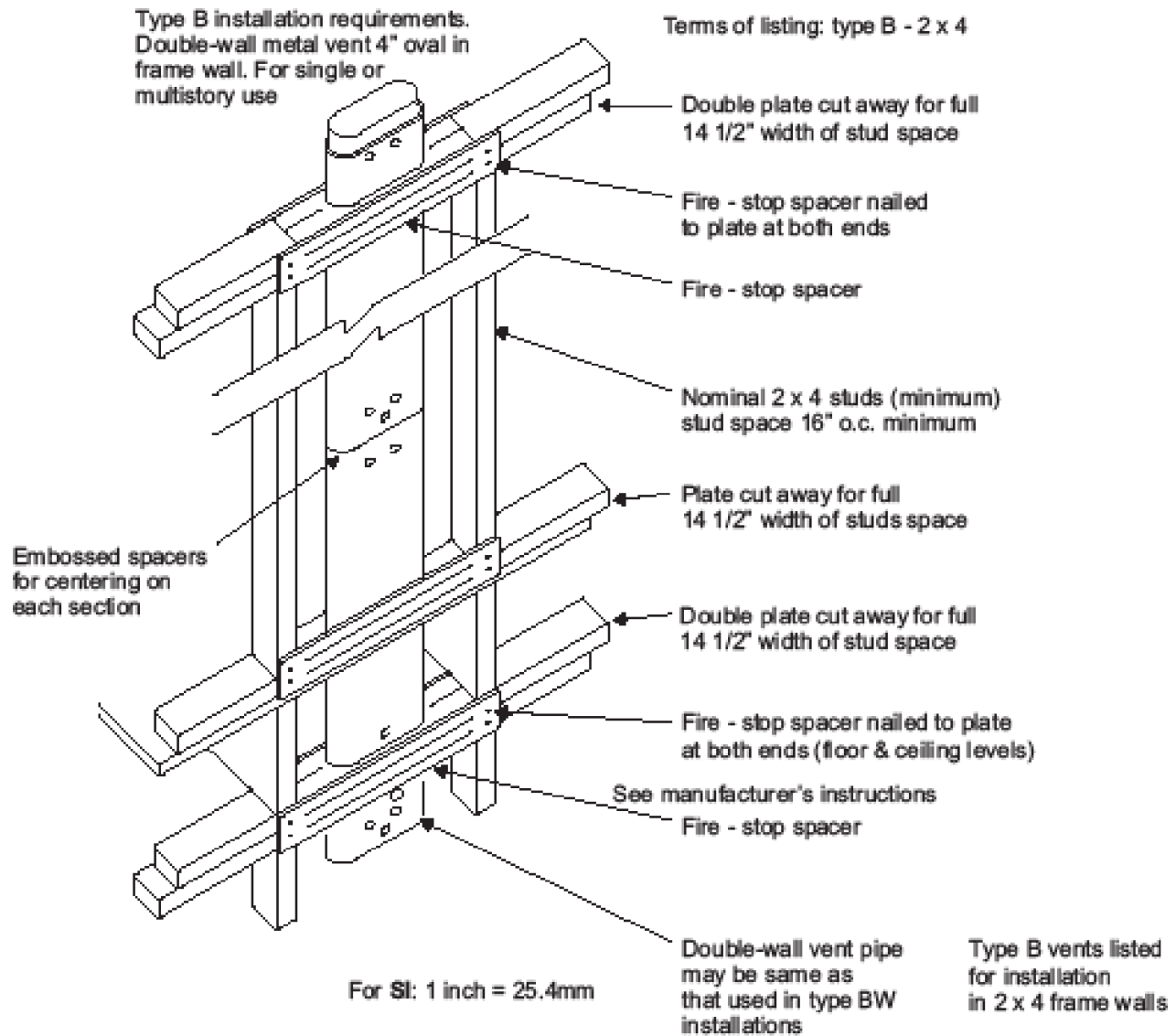
In addition to meeting the requirements of the Bay Area Air Quality Management District and related codes and policy guidelines adopted by the state, the installation, replacement, or relocation of an existing wood-burning appliance shall meet the following requirements:

- (a) It shall be unlawful to install a wood-burning appliance unless it is one of the following:
  - (1) A pellet-fueled wood heater;
  - (2) An EPA certified wood heater; or
  - (3) A wood-burning appliance approved for use by the Northern Sonoma County Air Pollution Control District.
- (b) Any person who plans to install a new wood-burning appliance, or relocate an existing wood burning appliance, shall submit documentation to the permit and resource management department and obtain a permit to certify that the appliance meets the requirements of this chapter.

**LIQUID PETROLEUM APPLIANCES.** Liquefied petroleum gas burning appliances shall not be installed in a pit, basement, or similar location where heavier than air gas might collect. Appliances so fueled shall not be installed in an above-grade under-floor space or basement unless such location is provided with an approved means for removal of unburned gas. This installation must be approved by the Building Official.

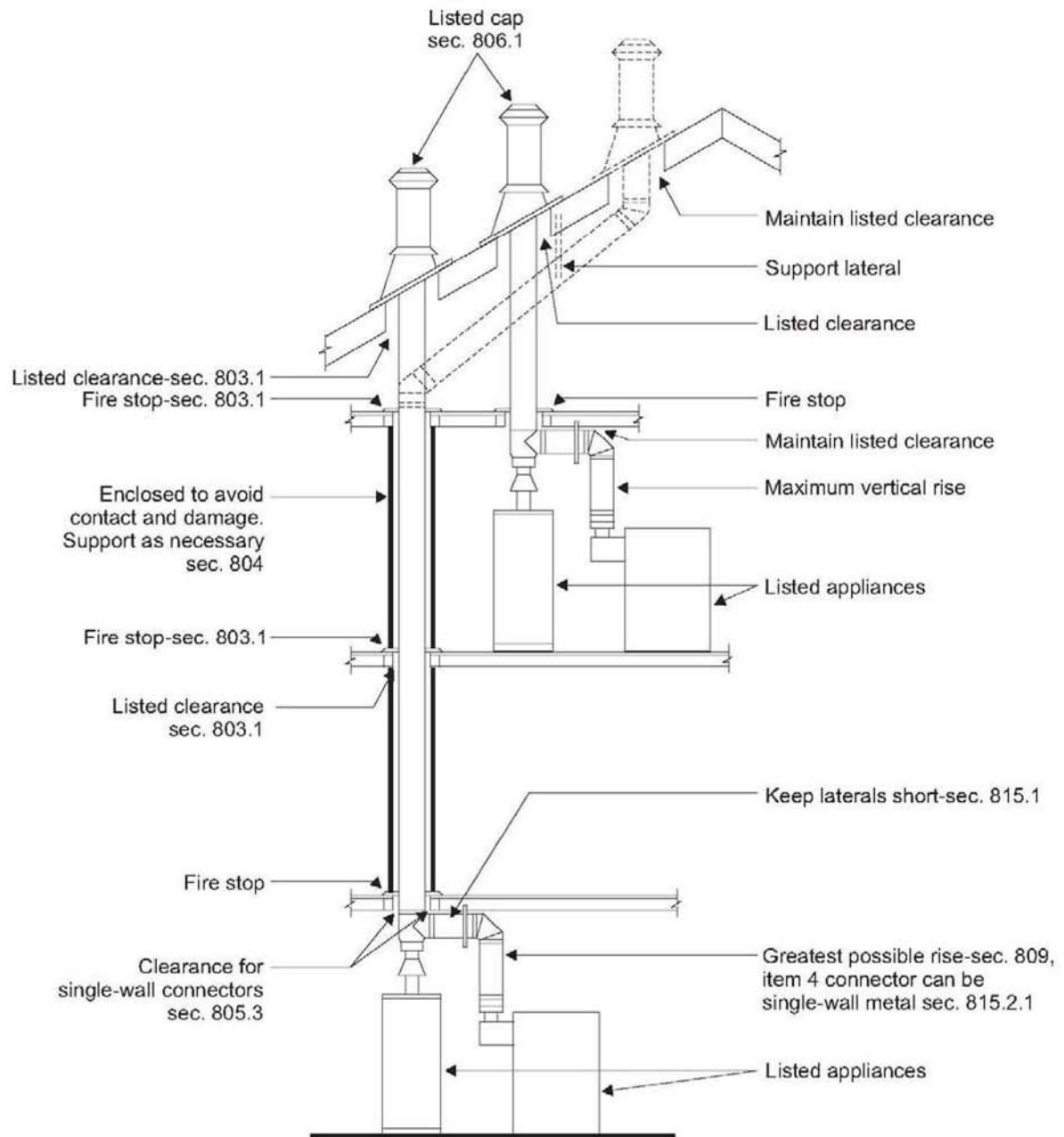


## MISCELLANEOUS VENT & FLUE DETAILS



Typical Type B Oval Venting System

Terminate in Accordance With Sec. 806



Note: Building occupancy could require fire-resistive shaft construction. See U.B.C. section 711

### **Type B and Type L vents Serving Multiple Appliances**

## **CLOTHES DRYER INSTALLATION.** (California Mechanical Code, Section 504.3).

### **504.3 Clothes Dryers:**

**504.3.1 Moisture Exhaust Ducts.** Moisture exhaust ducts shall terminate on the outside of the building and shall be equipped with a back-draft damper. Screens shall not be installed at the duct termination. Ducts for exhausting clothes dryers shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the flow. Clothes dryer moisture exhaust ducts shall not be connected to a gas vent connector, gas vent, or chimney, and shall only serve clothes dryers. Clothes dryer moisture exhaust ducts under positive pressure shall not extend into or through ducts or plenums.

**504.3.2 Domestic Clothes Dryers.** When a compartment or space for a domestic clothes dryer is provided, a minimum 4 inch diameter moisture exhaust duct of approved material shall be installed in accordance with this section and Section 504.0.

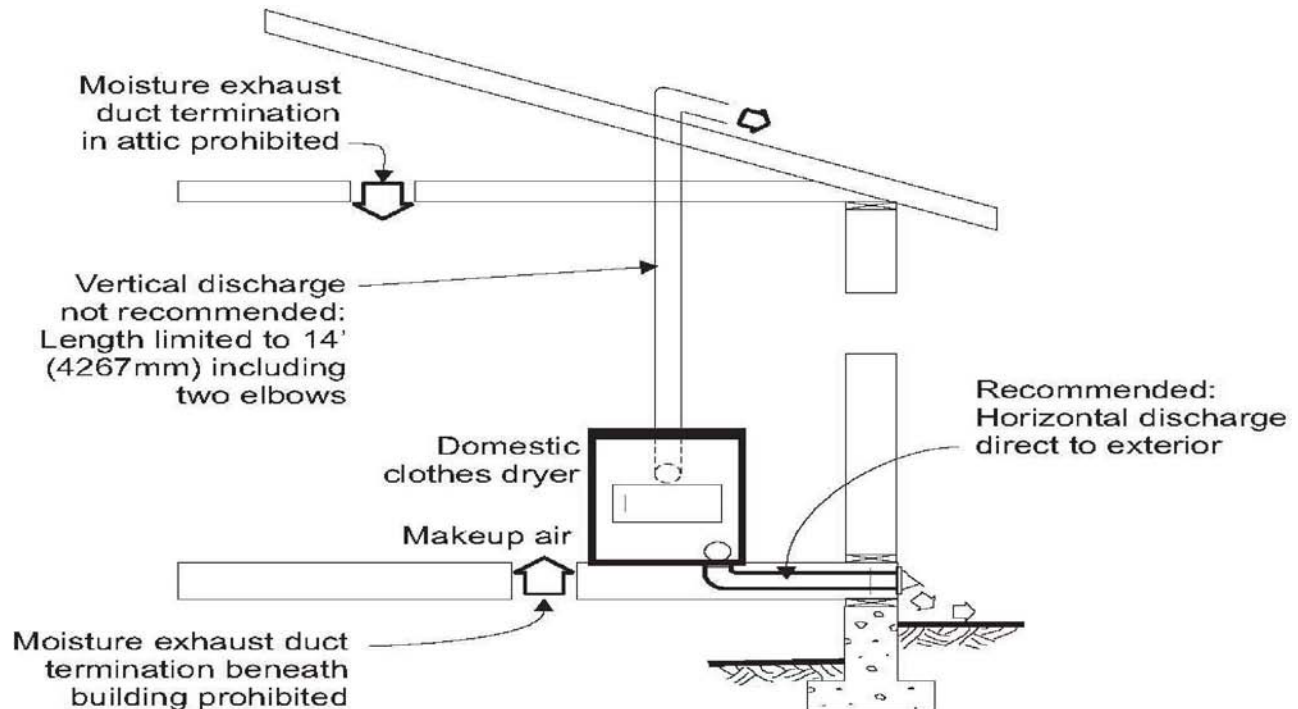
When a closet is designed for the installation of a clothes dryer, a minimum opening of 100 square inches for makeup air shall be provided in the door or by other approved means.

**504.3.2.1 Domestic Dryer Vents.** Domestic clothes dryer moisture exhaust ducts shall be of metal and shall have smooth interior surfaces.

**Exception:** Listed clothes dryer transition ducts not more than 6 feet in length may be used in connection with domestic dryer exhausts.

Flexible clothes dryer transition ducts shall not be concealed within construction.

**504.3.2.2 Length Limitation.** Unless otherwise permitted or required by the dryer manufacturer's installation instructions and approved by the Authority Having Jurisdiction, domestic dryer moisture exhaust ducts shall not exceed a total combined horizontal and vertical length of 14 feet, including (2) 90 degree elbows. 2 feet shall be deducted for each 90 degree elbow in excess of 2.



### **Clothes Dryer Installation**

## **SECTION 16 – ELECTRICAL**

### **ELECTRICAL SYSTEMS FOR SINGLE FAMILY DWELLINGS** (2010 California Electrical Code) ALL WIRING MATERIALS FOR ELECTRICAL INSTALLATIONS MUST BE NEW.

Previously installed materials may be considered for reuse only after they have been examined and approved by the Department of Planning and Building Services.

**GENERAL LIGHTING.** General lighting includes all lighting and general-use receptacle loads in the habitable portion of the building. Branch circuits serving these loads shall be calculated at not less than 3 volt amps (watts) per square foot of living area.

- 15 ampere branch circuits shall not be smaller than #14 copper installed as part of any approved wiring method.
- 20 ampere branch circuits shall not be smaller than #12 copper installed as part of any approved wiring method.

The general lighting circuits may supply all lighting outlets, plus the receptacles in living rooms, libraries, sun rooms, hallways, basements, garages, and outdoor outlets.

**ARC-FAULT CIRCUIT-INTERRUPTER PROTECTION.** All 120 volt, single phase, 15- and 20-ampere branch circuits supplying outlets installed in dwelling unit family rooms, dining rooms, living rooms, parlors, libraries, dens, bedrooms, sunrooms, recreation rooms, closets, hallways, or similar rooms or areas shall be protected by a listed arc-fault circuit interrupter, combination-type, installed to provide protection of the branch circuit.

**BATHROOM BRANCH CIRCUITS.** At least one 20-ampere branch circuit shall be provided to supply the bathroom receptacle outlet(s). Such circuits shall have no other outlets (including bathroom lighting and fans). Exception: when only one bathroom is supplied from the branch circuit.

**SPECIFIC APPLIANCE REQUIREMENTS.** At least 2 branch circuits for small portable appliances shall be installed for the kitchen. These circuits shall be of 20 amp rating and wired with a minimum of #12 copper. The breakers or fuses shall have 20 amp branch circuit wiring for the required receptacles in the dining room or dining area, or breakfast room, pantry, and family room. The above-mentioned receptacles should be evenly divided among the circuits. No other outlets are permitted on the small appliance branch circuits or the laundry circuit except for clock outlets, kitchen hoods, or lights, clocks, ignition devices for ranges, ovens, dining rooms, or cooktops.

- Refrigeration equipment may be served by either one of the above 20 amp small appliance branch circuits or from an individual (dedicated) 15 amp min. rated branch circuit.
- A separate 20 amp branch circuit shall be installed for laundry equipment. The receptacle or receptacles shall be installed within 6' of the equipment location. If only one duplex receptacle is used at this outlet, it must be rated at 20 amps min.

Where a **dishwasher** or **garbage disposal** is to be installed, a separate branch circuit sized at 15 amp min. is required for each. (Check the appliance's amperage for the correct sizing.) Wiring for electrical garbage disposals and dishwashers may use Type SJ cord and cap with the cord plugged into an approved receptacle. The cord length for disposals shall be min. 18" to max. 36", and 3 to 4 feet for dishwashers. If a multi-wire branch circuit is utilized for this receptacle, it shall have the circuit breakers handles tied together.

A separate circuit is required for an **electric range**. Refer to the manufacturer's load requirements or see the minimum required wire sizes per CEC Table 310-16 (below).

Detached residential garages with electrical power and accessory buildings shall be supplied with a

separate circuit. If supplied by more than one branch circuit, the detached garage or accessory building shall have a grounding electrode with conductor sized in accordance with CEC Table 250.66.

**Electric water heaters** are to be wired on separate circuits, whose rating shall depend on the rating shown on the name plate; check the manufacturer's brochure (Min. 5,000 watts). If not within sight of the panel which feeds the appliance, a switch located at the appliance which simultaneously opens both phase conductors, (hots), shall be installed.

**Electric dryers** are to be wired on a separate circuit and require a minimum of 3 - #10 current carrying conductors (hots and neutral) supplied by a 30 amp over current device and a separate #10 grounding conductor. Check the rating of the dryer.

**Air conditioners** are to be on separate circuits of a capacity recommended by the manufacturer. This information is to be supplied at the time of application for an electric permit. Voltage drop at 3% maximum should be considered when selecting conductor sizing.

**NOTE:** Air conditioners and electric heating systems and heat pumps require a branch circuit disconnecting means adjacent to and within sight of the units. Circuits may not be loaded in excess of 80% of circuit rating. Double pole switches, thermostats, and circuit breakers must be used on 240 volt circuits per CEC Article 422.30.

The wiring amperage varies greatly for **water pumps**. Check with the supplier before applying for an electrical permit. The minimum information required is the horsepower of the pump motor, or rating in full load amps. A separate circuit is required, and a branch circuit disconnecting means shall be installed within sight of, and not more than 50 feet from, the controller. Sonoma County recommends limiting voltage drops to within 3%.

### Wire Size Recommendations for Major Appliance Circuits

#### Based on CEC Table 310-16

High Speed Dryer	120/240 volts	3 - #6	50 amp circuit
Standard Dryer	120/240 volts	3 - #10	30 amp circuit
Free-Standing Electric Range	120/240 volts	3 - #6	50 amp circuit
Built-in Range, not over 12KW	120/240 volts	3 - #8	40 amp circuit
Built-in Surface Units	120/240 volts	3 - #8	40 amp circuit
Built-in Single Oven	120/240 volts	3 - #10	30 amp circuit
Dishwasher - Disposal	120 volts	2 - #12	20 amp circuit
Fixed Bathroom Heater (1920 Watt Max)	120 volts	2 - #12	20 amp circuit
Air Conditioners	Depends on actual rating		
Water Heaters	Depends on actual rating	Typical 240V	
Electric Heating System	Depends on actual rating	2 - #10	
Heat Pumps	Depends on actual rating		

**RECEPTACLE OUTLETS IN DWELLINGS.** All receptacles shall be of the grounding type. Boxes shall be flush with the finished surface of walls or ceilings.

Receptacle outlets rated as 115 or 120 volt single phase, 15 or 20 amp., where installed outdoors, in garages, in bathrooms, in crawl spaces or unfinished basements, or serving counter tops in a kitchen, and within 6' of wet bar sinks, shall have approved ground-fault-circuit protection (GFCI). This can be done by installing receptacles on branch circuits protected by an approved GFCI breaker or by approved GFCI receptacles. All GFCI protected receptacle outlets shall be labeled.

All outside receptacles shall be provided with weather-proof covers. If located in wet locations—such as those that are directly exposed to rain—receptacles shall have enclosures that are weatherproof weather or not the attachment plug is inserted. At least two outside receptacle outlets, accessible at grade level, shall be installed - one at the front and one at the rear of the dwelling. Balconies, decks and porches that are accessible from the inside of the dwelling shall have at least one receptacle outlet installed within the perimeter of the balcony, deck, or porch. The receptacle shall not be located more than 6' 6" above the finished surface.

In every kitchen, family room, dining room, breakfast room, living room, parlor, den, sun room, recreation room, and bedroom, receptacle outlets shall be installed so that no length along the floor line in any wall space is more than 6', measured horizontally, from an outlet in that space, including any wall space 2' wide or greater. The wall space occupied by sliding panels in exterior walls will, in general, require a receptacle near both sides of the opening. The wall space afforded by fixed room dividers, free-standing bar type counters, and the fixed portion of exterior sliding doors, shall be included in the 6' measurements. Floor outlets shall be within 18" of the wall to count as required receptacles. For hallways of 10' or more in length, at least one receptacle outlet shall be required.

At least one 20 amp receptacle outlet shall be installed within 6' of laundry equipment where there is a provision for such equipment. If only one single or duplex receptacle is installed to meet this requirement, it shall be a 20 amp rated device. (Denoted by a horizontal slot integral to the receptacle's neutral vertical slot.)

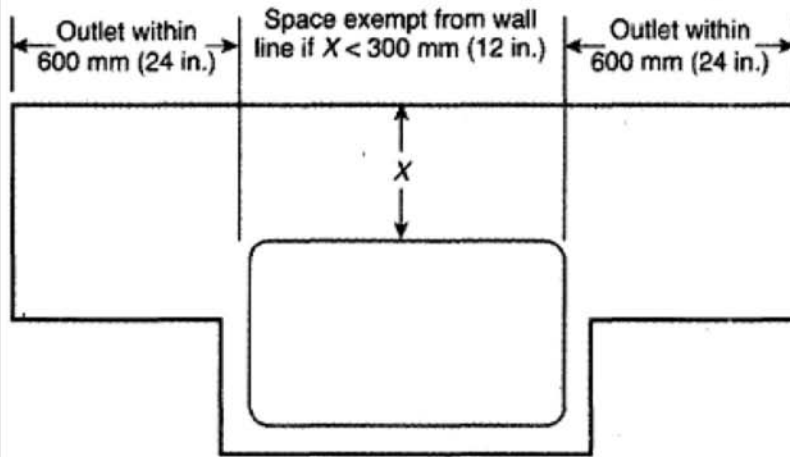
A GFCI receptacle shall be installed in the bathroom within 36" of the outside edge of each basin.

In all area specified above, all 125-volt, 15- and 20- ampere receptacles shall be listed tamper-resistant receptacles.

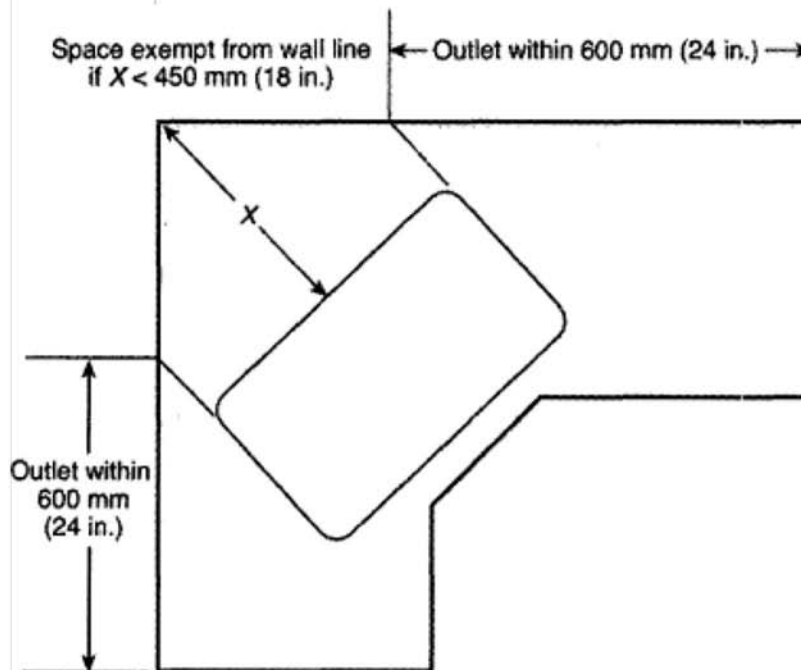
**Countertops.** Countertop spaces at kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, shall have a receptacle installed for each counter top space wider than 12" and for each 4' of counter space, with no point along the wall line more than 2' from a receptacle. (Except behind a sink or range in most situations.) The outlet shall be located no more than 20" above the counter top. Island and peninsula counters are required to have at least one receptacle for each. These outlets may be located not more than 12" below the counter top provided that the counter top does not extend more than 6" beyond the side of the cabinet. Counter top spaces separated by ranges or range tops, refrigerators or sinks shall be considered as separate counter-top spaces (see note below); this includes island and peninsula counters. Receptacles rendered inaccessible by the installation of stationary appliances will not qualify as a required outlet.

**Note:** Where a range, counter-mounted cooking unit, or sink is installed in an island or peninsular countertop and the width of the countertop behind the range, counter-mounted cooking unit, or sink is less than 12", the range, counter-mounted cooking unit, or sink is considered to divide the countertop space into two separate countertop spaces and receptacle requirements shall apply to both areas.





**Range, counter-mounted cooking unit extending from face of counter**



**Range, counter-mounted cooking unit mounted in corner**

**Figure 210.52(C)(1) Determination of Area Behind a Range, or Counter-Mounted Cooking Unit or Sink.**

**WIRING INSTALLATION METHODS.** All receptacle outlets shall be of the grounding type. All metal boxes shall be grounded. When only one cable enters a metal box, the ground conductor shall be secured directly to the box by means of an approved grounding screw or clip. When a receptacle is to be installed in this box, the grounding conductor may be secured to the box by an approved grounding screw and the wire continued unbroken to the green screw of the receptacle, or a bonding wire must be connected from the metal box to the green screw of the receptacle. This connection to the box shall be made by the use of an approved grounding screw or clip.

When more than one cable enters a box, all grounding conductors are to be spliced within the box by means of a wire nut or pressure sleeve connection. When a receptacle is to be installed in the box, a bond wire is required from the splice or from the box by means of an approved grounding screw or clip, made up at the time of rough inspection, including the pig tail for later connection to the green screw of the receptacle. Where nonmetallic boxes are used, all grounding conductors shall be spliced, with one serving as a pigtail connecting the receptacle outlet or switch.

All metallic boxes or metallic enclosures installed in a nonmetallic sheathed-cable wiring system shall be grounded with a separate ground wire (manufactured in the cable). Ground wire connections shall be made within the outlet box or enclosure.

**LIGHTING OUTLETS.** At least one wall switch controlled lighting outlet shall be installed in every habitable room; in bathrooms, hallways, stairways, attached garages, and detached garages with electric power; and at outdoor entrances or exits.

At least one lighting outlet controlled by a light switch located at the point of entry to the attic, underfloor space, utility room, and basement shall be installed where these spaces are used for storage or contain equipment requiring servicing. Where lighting outlets are installed in interior stairways, there must be a wall switch at each floor level to control the lighting outlet where the difference between floor levels is six steps or more.

**Exceptions:** In habitable rooms, other than kitchens or bathrooms, one or more receptacles controlled by a wall switch is permitted in lieu of lighting outlets. In hallways, stairways, and at outdoor entrances, remote, central, or automatic control of lighting is allowed.

Surface-mounted incandescent fixtures above the door or on the ceiling of clothes closets must have at least 12" of clearance from the fixture to the storage space. Surface mounted fluorescents and any recessed fixtures (fluorescent and incandescent) must have 6" of clearance. All bulbs must be enclosed, bare bulbs are not permitted. Storage space is defined as 12" of width for areas above shelves and 24" of width below shelves. See Page 17.16 for illustrated detail.

If low voltage lighting systems with a centrally located transformer are used, all system wiring in concealed locations or through a building wall shall be an approved wiring method (i.e. Non-Metallic Conduit or conductors in conduit) or raceways.

**GENERAL:**

1. Every outlet shall be provided with a cover unless covered by a fixture, receptacle, or similar device.
2. Screw-shell lamp-holders shall be used only as lamp-holders, not as receptacles.
3. Fixtures, lamp-holders, lamps, or receptacles shall not have any electrically charged part exposed to physical contact. The neutral conductor shall connect to the screw-shell of the lamp socket.
4. Cords shall not be used for permanent wiring, within or on a structure. Cords shall not be used to connect hoods or recessed lights or luminous ceiling fixtures.
5. Cords shall not pass through walls, floors, or ceilings.

6. Switches and receptacles must be flush with their covers. Covers must be snug against the wall.
7. Approved weatherproof equipment and material shall be used whenever an electrical installation is directly exposed to the weather.
8. Where a neutral conductor is required, it shall be white or gray in color or, when permitted by code, identified by white paint or white tape, at terminations and all accessible locations.

**NONMETALLIC SHEATHED CABLE (ROMEX).** All wire splices shall be connected in approved boxes. At least 6" of free wire must be left at the outlet for future use.

A box shall be installed for each outlet, receptacle, switch, or light fixture. Splice boxes shall be accessible without dismantling the structure. Metal boxes shall be equipped with loom clamps or cable box connectors.

Cables shall be stapled within 12" of electrical panels and outlet boxes with integral cable clamps, or within 8" of plastic boxes without clamps. Runs of cable shall be stapled at a minimum of 4-1/2' intervals. All cables in multi-gang boxes shall be clamped. There shall be a maximum of 2 cables secured under each staple. When more than two cable assemblies are to be run on the side of a 2" X 4" stud, backer blocks or an approved "wire stacker" device shall be used.

Electrical equipment and wiring shall be installed neatly and all unnecessary wiring avoided. Everything shall be securely fastened and supported. Wires shall be securely joined mechanically. Soldering is not permitted for grounding conductors. Insulation on joints, splices, and free ends shall be equal to that on conductors.

All cables shall have a grounding conductor built in the cable. The cable must be totally enclosed within the structure to prevent tampering. Cable is not approved for use where subject to physical damage or exposed to the weather.

Cable must be continuous from outlet to outlet. All splices must be made up in a light box, junction box, receptacle box, or switch box.

The grounding conductor manufactured in nonmetallic sheathed cable is not permitted for use as a neutral conductor. It is to be used for equipment grounding purposes only.

Nonmetallic sheathed cables in unfinished garages shall closely follow joists, rafters, or studs. It is suggested that nonmetallic sheathed cable be installed so that it will not interfere with any future wall covering that may be installed. Cable must be protected to at least 7' above floors. Where passing through a floor, cable shall be enclosed in an approved raceway (or other approved means) extending at least 6" above floor.

Nonmetallic sheathed cable installed in accessible attic spaces shall be run through bored holes or shall be protected by running boards or guard strips where installed within 6' of the nearest edge or scuttle hole or attic entrances and along equipment access walkways.

Oxidation preventative compound must be applied to all aluminum connections.

When cable is installed in slots, the slot must be covered by at least a 1/16" metal strip to prevent nails from piercing the cable. Holes drilled in studs or joists must be as nearly in the center as possible, or at least 1 1/4" (nominally) from the nearest edge. A listed stand off clamp may be used at side of stud.

Where cables enter or leave a metal box or metal enclosure for panels, cable box connectors shall be used to secure the cable entering the metal box or metal enclosure cables must be secured to the panel with clamps used in accordance with their listing.

**ELECTRICAL METALLIC TUBING.** Electrical metallic tubing (EMT) may be placed in concrete when completely surrounded and covered by concrete to a depth of at least 2". EMT may be used in ground floor slabs above a membrane. EMT may be used for exposed or concealed wiring in or on a structure. Where EMT is installed on the exterior and is exposed to the weather, rain-tight couplings, box connectors, and boxes are required. EMT shall be securely fastened in place at least every 10' and within 3' of each outlet box, junction box, cabinet, coupling, or fitting. EMT shall not be used for underground raceways.

**DIRECT BURIAL CABLE.** Two types of direct burial cable are approved, UF and USE.

The minimum depth of burial is 24". Where leaving the trench, rigid metal conduit, or Schedule 80 PVC nonmetallic conduit is required, from the bottom of the trench to the enclosure located at each end of the circuit. An equipment bonding wire is to be run with the circuit conductors to connect the terminating enclosures together. Where the underground circuit terminates at a receptacle, the bonding wire also connects to the grounding terminal of the receptacle. A residential branch circuit of 120V or less, with GFCI protection and on a maximum 20 amp circuit may be buried 12" or more in soil.

**RIGID NONMETALLIC CONDUIT.** Schedule 40 PVC (UL approved) is suitable for direct burial at a minimum depth of 18" under driveways. When leaving the trench the ends of the conduit shall terminate with Schedule 80 PVC or rigid steel conduit. A bonding conductor shall be run with the circuit conductors. PVC conduit shall not be run within structural concrete or concrete foundation walls unless structural calculations are provided to verify that the structural strength of the concrete is not impaired.

**CONNECTION OF UTILITIES.** Permanent utilities shall not be connected to electrical equipment until all requirements have been met.

Temporary use of utilities may require a separate permit for construction and may be approved where no hazard to life or property exists or may be created. Restrictions upon temporary use of utilities are necessary to secure full code compliance.

The use of utilities for the temporary occupancy of a building or structure may be granted and subject to the Building Inspector's approval. If the improvements necessary are not completed within the time specified, the inspector shall order the utilities to be disconnected by the serving utility company.

No person shall connect any utility without receiving approval.

**ELECTRICAL SERVICE REQUIREMENTS.** It is recommended that the electric utility company be contacted prior to the installation of a new or replacement electric service.

**Residential only**  
**Service Entrance Conductors: Conductor Types and Sizes**  
**RH-RHH-RHW-TH HW-THW-THWN-THHN-XHHW-USE**  
**From NEC Table 310.15 (B) (6)**

Copper AWG	Aluminum and Copper-clad AWG	Service Rating in AMPS
4	2	100
2	1 /0	125
1	2/0	150
2/0	4/0	200

For services above 200 amps, check with PBS, or use Table 310-15(B)(6) CEC. The area location of all services shall be illuminated.

**NOTE:** Where aluminum or copper-clad aluminum conductors are used as any part of an electrical system, the equipment and associated materials shall be listed and approved (AL-CU). Split bolts, lugs, and wire nuts are available for this purpose.

**GROUNDING OF ELECTRICAL SERVICES.** A grounding electrode is required to be connected to a neutral bus bar inside the service panel.

**COMMON GROUNDING ELECTRODES:**

1. Concrete-encased electrodes. Not less than 20' of bare copper conductor not smaller than #4 or 20' of one or more bars of #4 steel reinforcing rebar encased by at least 2" of concrete and located horizontally near the bottom or vertically and with a concrete foundation footing that is in direct contact with the earth. (See CEC sec. 250.52(A)(3).)
2. Driven rods must be at least 8' in length; consisting of stainless steel, copper or zinc coated steel and must be at least 1/2" in diameter; listed grounding electrodes shall be at least 1/2" in diameter. Rod electrodes that cannot be verified to have 25 ohms or less resistance to ground shall be augmented by an additional electrode of any approved type. (CEC 250.56.)

**BONDING:**

1. Bonding of cold water piping is required and the conductor utilized shall be sized per NEC Table 250.122. Note: bond around the dielectric fittings at the water heater.
2. Bonding of other piping systems. Other interior metal gas and water piping that may become energized shall be bonded together and made electrically continuous. An equipment bonding jumper, or other equivalent means, sized in accordance with NEC Table 250.122 shall be connected between the bonded piping system(s) and the grounding electrode conductor at the service-disconnecting means.

For minimum size of service grounding electrode conductor for the above condition see NEC Table 250.66/250.122.

**PROTECTION OF GROUNDING ELECTRODE CONDUCTOR:**

1. #8 conductors shall be in rigid metal conduit, intermediate metal conduit, rigid nonmetallic conduit, electrical metallic tubing, or cable armor. These are the methods of protection.
2. #6 conductors that are not exposed to physical damage may be run along the surface of the building construction without metal protection where it is securely fastened to the construction; otherwise, it needs to be protected as for #8 above.
3. #4 conductors need not be protected unless they're exposed to severe physical damage.
4. When used outside, aluminum or copper-clad aluminum grounding electrode conductors shall not be installed within 18" of earth. Aluminum or copper-clad aluminum grounding conductors shall not be used where in direct contact with masonry or earth or where subject to corrosive conditions. (NEC Table 250.64 (A))

**SERVICE RISERS.** Service conduit and compatible wire sizes shall be in accordance with the tables in Annex C, Chapter 9 of the CEC. Typically, 1-1/4" Rigid Metal conduit will accommodate most conductor types for services rated up to 175 amps; 2" Rigid will accommodate services up to 300 amps.

Electrical service equipment shall be provided with a main disconnecting means when more than 6 disconnects are required to turn off all the power. Circuit breaker types shall be installed per panel listing.

The electric-service disconnecting means shall be located at a readily accessible point, nearest to the entrance of the conductors, either inside or outside the building or structure.

Metering equipment must be installed on the exterior or an approved indoor location. Minimum height to center of socket is 48". Maximum height to center of socket is 66".

Individual branch circuits must be identified and labeled in the main electric distribution panel to indicate the equipment they serve. Examples: light receptacles, range, oven, dishwasher, etc.

A branch circuit disconnecting means is required adjacent to, and within sight of, fixed electrical heating or air conditioning equipment for each required circuit.

Detached residential garages and accessory buildings shall be supplied with a separate circuit when provided with power.

Electrical panels, metering equipment, or disconnecting means shall not be installed in clothes closets, in dwelling unit bathrooms, over plumbing fixtures, appliances, doors, windows, stairs, gas meters, pumps, or any item that would interfere with its accessibility. Water piping or drain piping shall not be installed unprotected above service distribution panels.

Electrical equipment such as panel boards, disconnects, or items that may require servicing or repair, are to be accessible with a minimum of 36" clearance in front and 30" in width, or the width of the equipment (whichever is greater) and a minimum headroom of 6 1/2 feet, or the height of the equipment (whichever is greater).

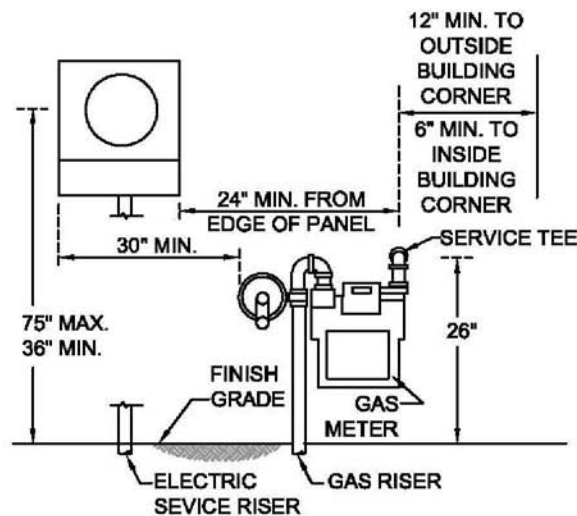
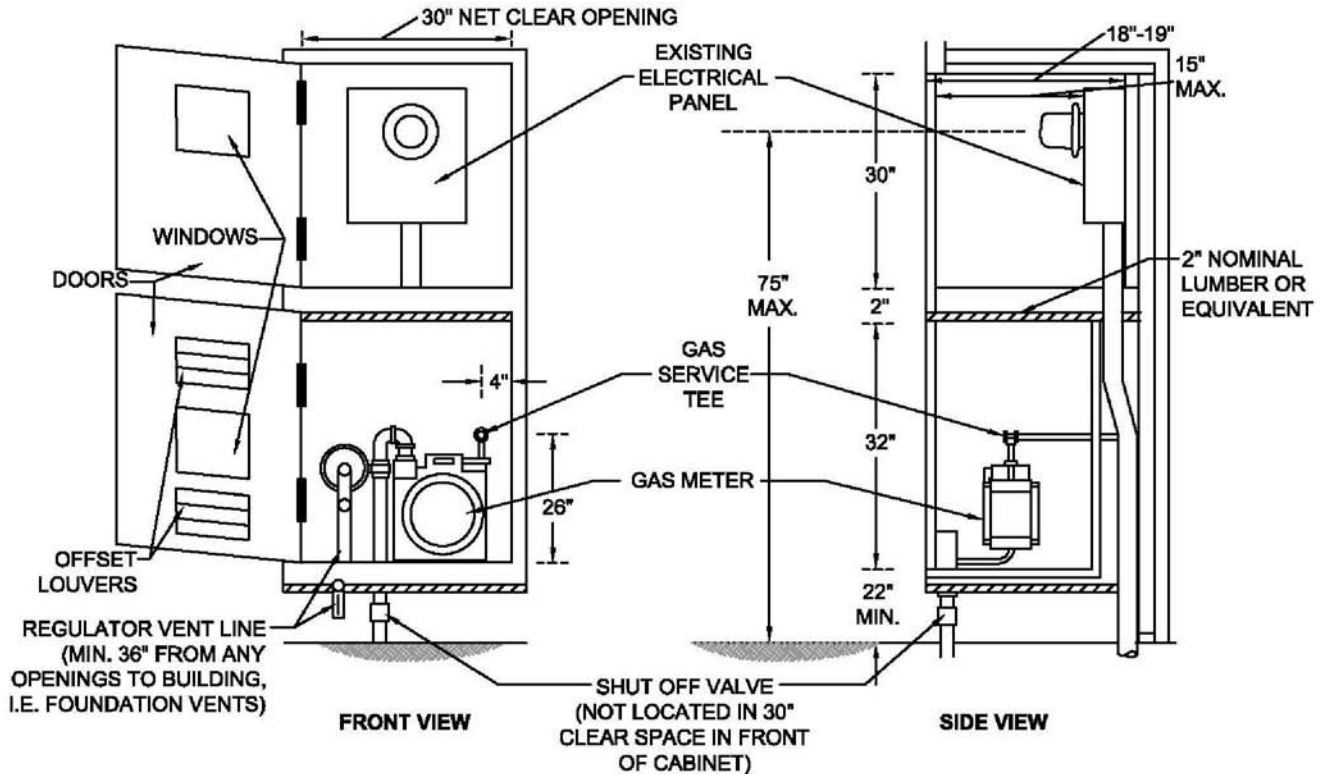
**OVERHEAD SERVICE DROPS.** The point of attachment of a service drop to a building shall not be less than ten feet above finished grade and shall be at a height to permit a minimum clearance for service drop conductor of 12' above private driveways and 18' above private or public roads, parking areas subject to truck traffic, and areas accessible to agricultural equipment.

Service conductors shall extend a minimum of 18" beyond the service head. They shall maintain a minimum of 8' clearance above the roof surface unless the roof slope is 4:12 or greater, in which case they shall maintain 3' of clearance. Service conductor clearance may be further reduced to 18" above the overhanging portion of the roof provided no more than 6' of conductor length measured 4' horizontally pass over the roof overhang.

Periscope landings (service riser masts) that extend more than 30" above the roof shall be braced per utility company requirements. The minimum conduit size for periscope landings is 1 1/4" for schedule 40 rigid steel conduit and 2" for schedule 40 rigid aluminum conduit.

**UNDERGROUND SERVICES.** The underground riser must be sized per utility company requirements. The 90degree riser material shall be rigid conduit or Schedule 80 PVC where PVC is not subject to physical damage. For the sizing and installation of conductors, use the following table on page 17.14.

## CABINET INSTALLATION FOR ELECTRICAL SERVICE UPGRADES AT EXISTING NONCOMPLYING LOCATIONS



**TABLE 110.26(A)(1) WORKING SPACES**

NOMINAL VOLTAGE TO GROUND	CONDITION 1	CONDITION 2	CONDITION 3
0-150	900 mm (3 ft.)	900 mm (3 ft.)	900 mm (3 ft.)
151-600	900 mm (3 ft.)	1.1 m (3½ ft.)	1.2 m. (4 ft.)

**CONDITION 1** - Exposed live parts on one side of the working space and no live or grounded parts on the other side of the working space, or exposed live parts on both sides of the working space that are effectively guarded by insulating materials.

**CONDITION 2** - Exposed live parts on one side of the working space and grounded parts on the other side of the working space. Concrete, brick, or tile walls shall be considered as grounded.

**CONDITION 3** - Exposed live parts on both sides of the working space. SUFFICIENT SPACE SHALL BE PROVIDED AND MAINTAINED ABOUT ELECTRICAL EQUIPMENT TO PERMIT READY AND SAFE OPERATION AND MAINTENANCE OF SUCH EQUIPMENT.

THE **WIDTH** OF THE WORKING SPACE IN FRONT OF THE ELECTRIC EQUIPMENT SHALL BE THE WIDTH OF THE EQUIPMENT OR 30 IN. WHICHEVER IS GREATER.

THE **DEPTH** OF THE WORKING SPACE SHALL BE PER TABLE 110.26(A)(1) WITH A 3 FT. MIN. CLEARANCE.

THE **HEIGHT** CLEARANCE FROM THE FLOOR, TO BE 6½ FT. OR TO THE HEIGHT OF THE EQUIPMENT, WHICHEVER IS GREATER.

ALL DIMENSIONS GIVEN ARE MINIMUM DIMENSIONS UNLESS NOTED OTHERWISE.

## **SMOKE DETECTORS:**

**General.** Dwelling units, congregate residences and hotel or lodging house guest rooms and residential care facilities that are classified as Group R Division Occupancies that are used for sleeping purposes shall be provided with smoke detectors or multiple-station smoke detectors. Smoke detectors shall be installed in accordance with CBC Section 907.2.11.2 and CRC Section R314, comply with UL 217, provisions of NFPA 72 11.5.1 and the approved manufacturer's instructions.

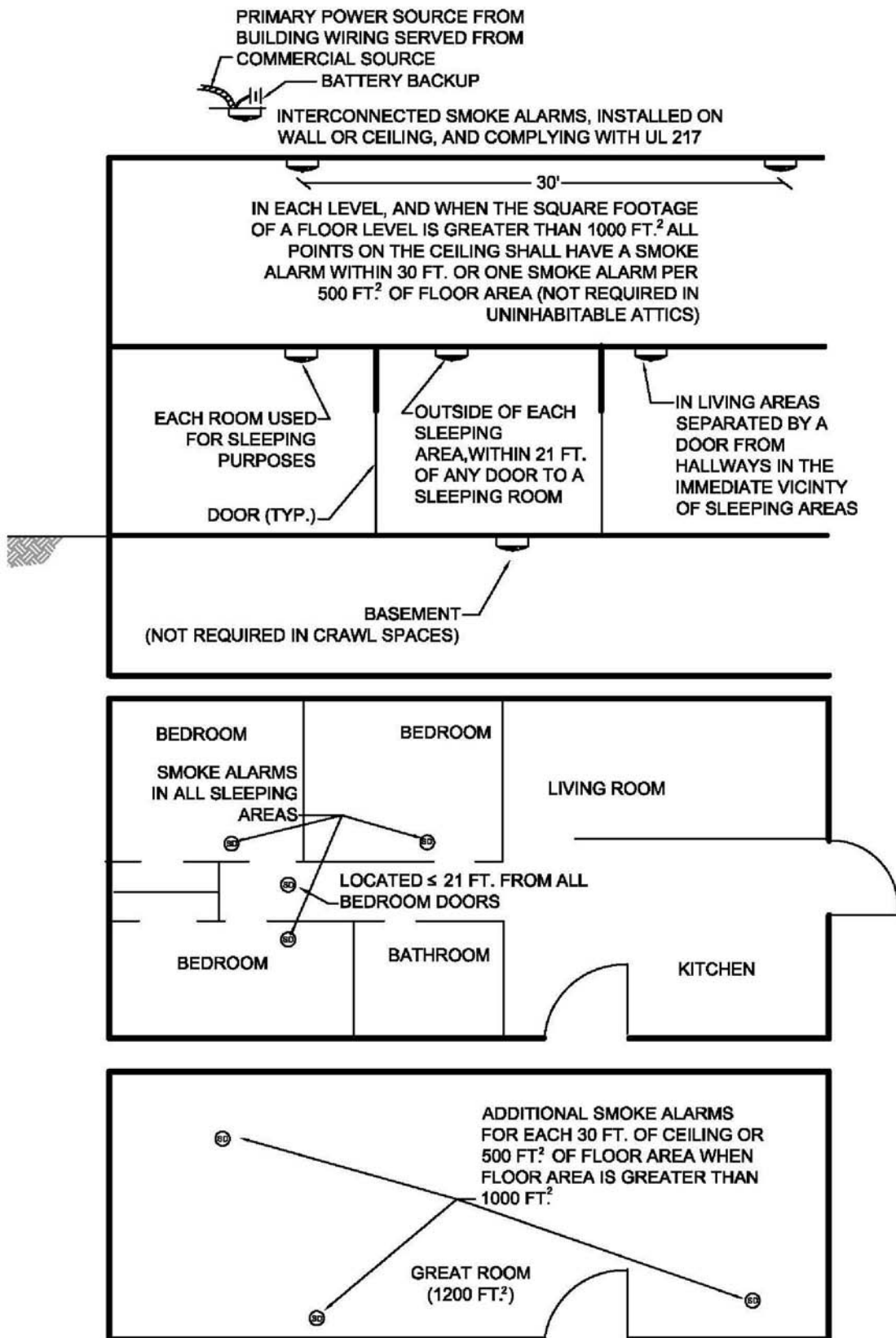
**Additions, alterations or repairs to Group R Occupancies.** When the valuation of an addition, alteration or repair to a Group R Occupancy exceeds \$1,000 and a permit is required, or when one or more sleeping rooms are added or created in existing Group R Occupancies, smoke detectors shall be installed in accordance with CRC Section R314.6.2

**Power source.** In new construction, required smoke detectors shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. The smoke detector shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than those required for over-current protection. Smoke detectors may be solely battery operated when installed in existing buildings; or in buildings without commercial power, or in buildings which undergo alterations, repairs or additions regulated by CBC Section 907.2.11.4 and CRC Section R314.4.

**Location within dwelling units.** In dwelling units, a smoke alarm shall be installed in each sleeping room and on the ceiling or wall outside each separate sleeping area in the vicinity of bedrooms. When the dwelling unit has more than one story including dwellings with basements and habitable attics, a smoke detector shall be installed on each story, in the basement and in the habitable attic. In dwelling units where a story or basement is split into two or more levels and without an intervening door between the adjacent levels, the smoke detector shall be installed on the upper level, except that when the lower level contains a sleeping area, a smoke detector shall be installed on each level. Smoke detectors shall sound an alarm audible in all sleeping areas of the dwelling unit in which they are located. CBC Section 907.2.11.2 and CRC Section R314.3

**Location In efficiency dwelling units, congregate residences and hotels.** In efficiency dwelling units, hotel suites, and in hotel, motel or lodging house and congregate residence and residential care and group care facility sleeping rooms, smoke detectors shall be located on the ceiling or wall of the main room or each sleeping room. When sleeping rooms within an efficiency dwelling unit or hotel suite are on an upper level, the smoke alarm shall be placed at the ceiling of the upper level in close proximity to the stairway. When actuated, the smoke detector shall sound an alarm audible within the sleeping area of the dwelling unit or congregate residence, hotel suite, or sleeping room in which it is located. CBC Section 907.2.11.2





### **REQUIRED SMOKE ALARM LOCATIONS**

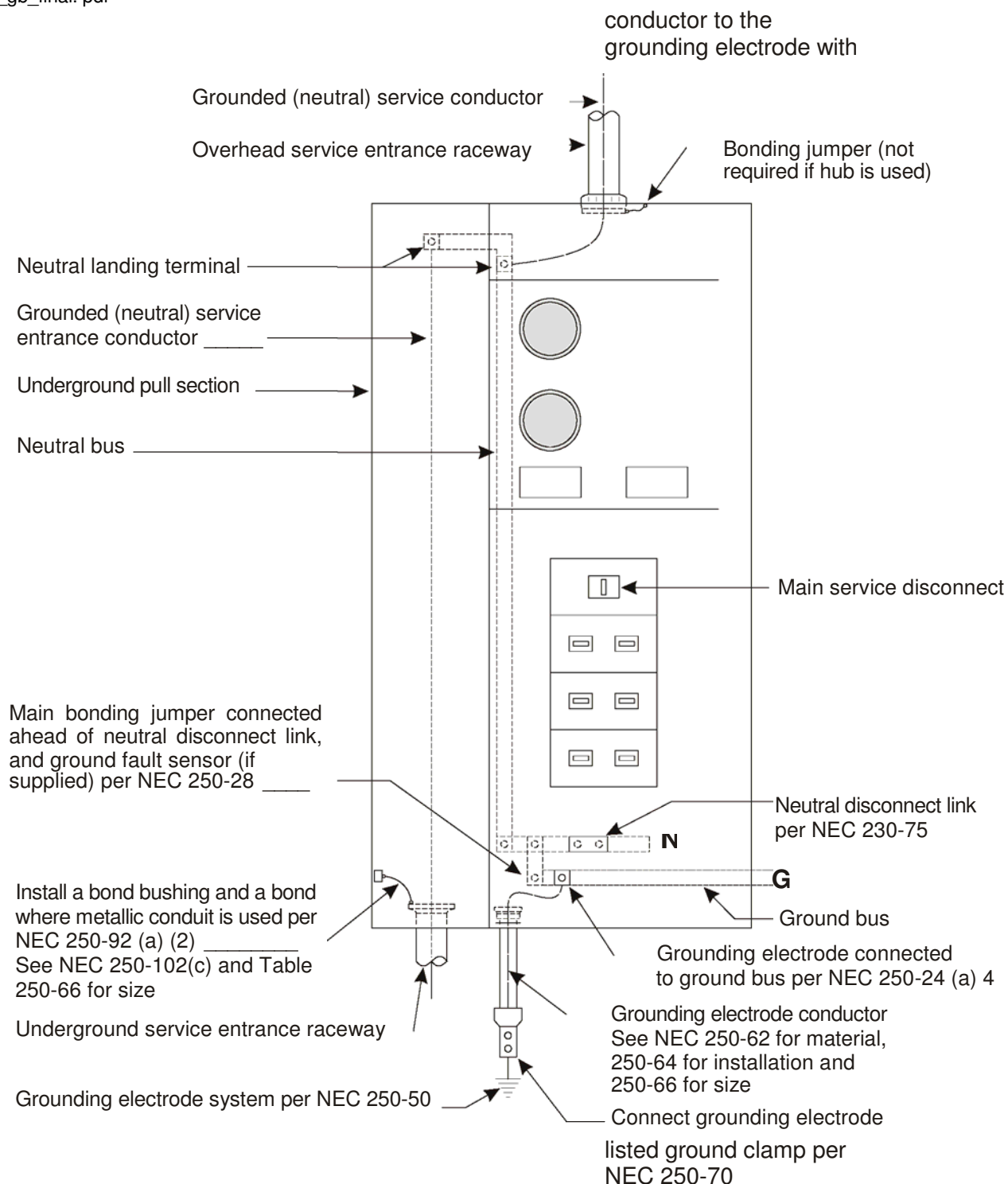
**Allowable Ampacities of Insulated Conductors  
Rated 0 Through 2000 Volts, 60°C Through 90°C  
(140°F), Not More Than Three Current-Carrying Conductors in Raceway,  
Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)  
From NEC Table 310.16**

Temperature Rating of Conductor (see NEC Table 310.13.)							
Size AWG or kcmil	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	Size AWG or kcmil
	Types TW, UF	Types, RHW, THHW, THW, THW N, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, TWH-2, THWN-2, USE-2, XHH, XHHw, XHHW- 2, ZW-2	Types TW, UF	Types, RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHW-2, USE-2, XHH, XHHw, XHHW-2, ZW-2	
COPPER				ALUMINUM OR COPPER-CLAD ALUMINUM			
18	--	--	14	--	--	--	--
16	--	--	18	--	--	--	--
14*	20	20	25	--	--	--	--
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	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	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

CORRECTION FACTORS							
Ambient Temp (°C)	For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities shown above by the appropriate factor shown below.						Ambient Temp. (°F)
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	--	0.58	0.71	--	0.58	0.71	132-140
61-70	--	0.33	0.58	--	0.33	0.58	141-158
71-80	--	--	0.41	--	--	0.41	159-176

Previous versions of this manual referenced requirements for customer owned poles, overhead electrical

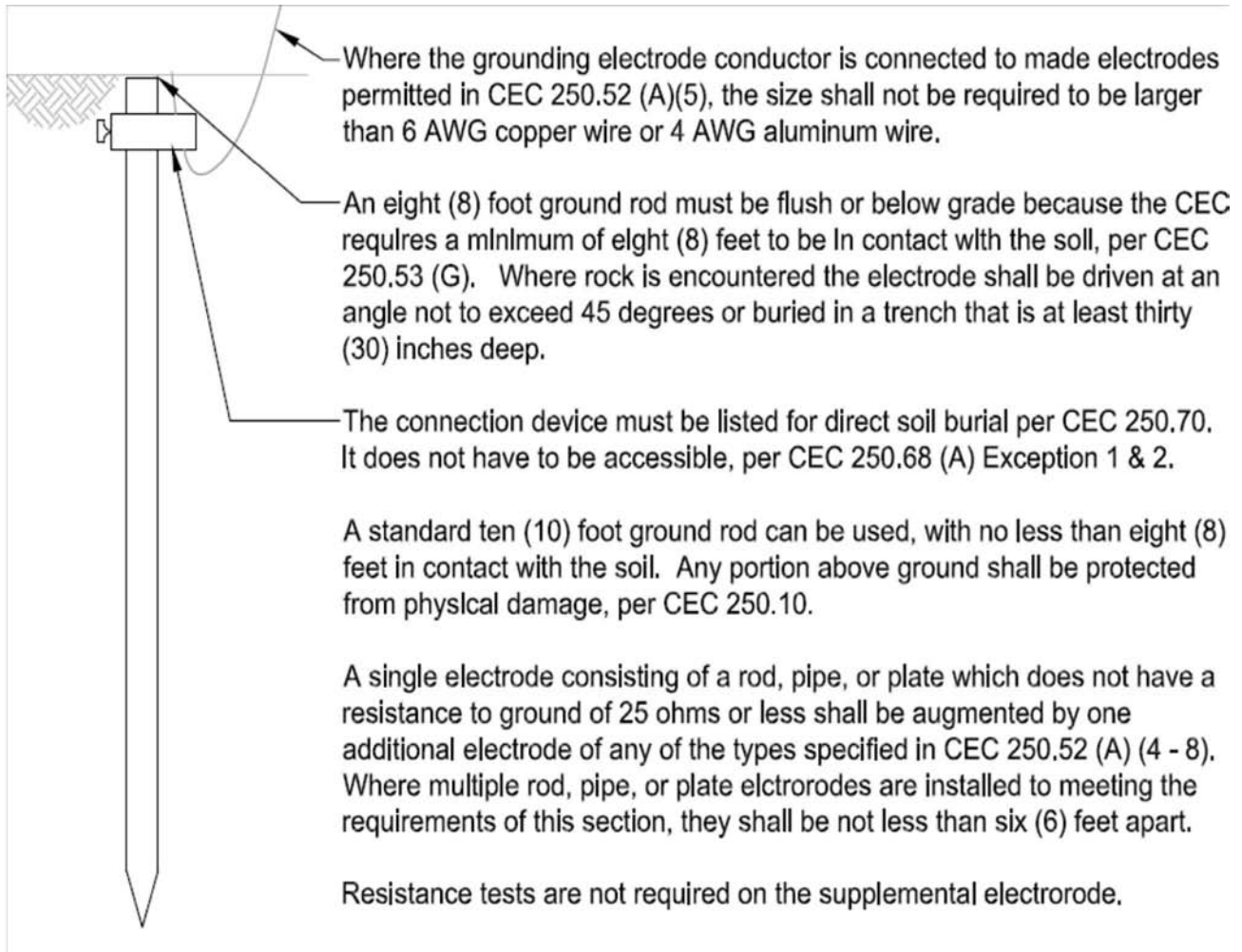
\* See 240.4 (D). 2010 California Electrical Code service installation and service clearances. These requirements can be found in the current version of the PG&E's publication "Electric & Gas Service Requirements" (also known as "The Greenbook"). This document is available at;  
[http://www.pge.com/includes/docs/pdfs/mybusiness/customerservice/startstop/newconstruction/greenbook/servicerequirements/2010\\_gb\\_final.pdf](http://www.pge.com/includes/docs/pdfs/mybusiness/customerservice/startstop/newconstruction/greenbook/servicerequirements/2010_gb_final.pdf)

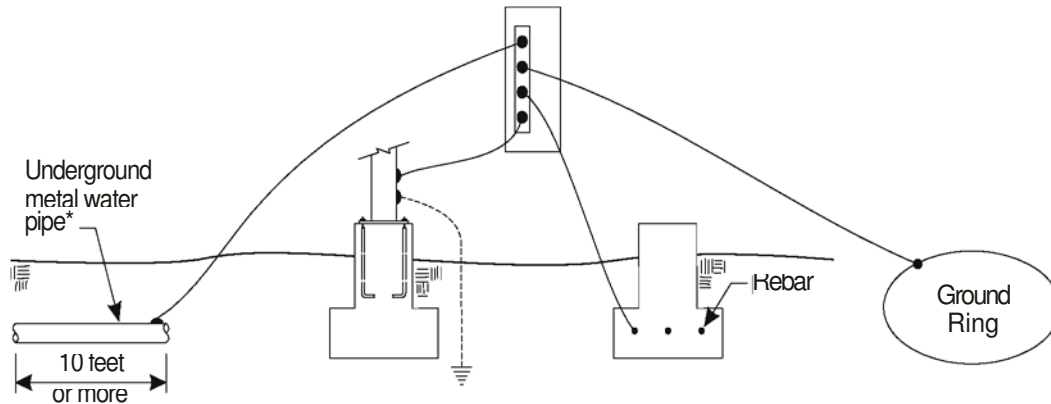


Service Entrance Grounding and Bonding Diagrams

**JOB CONSTRUCTED (MADE) AND OTHER ELECTRODES.** Where none of the electrodes specified in 2010 CEC Article 250.50 are available, one or more of the electrodes specified in Article 250.52(A)(4) through (A)(8) shall be installed and used. The most commonly used electrode is the ground rod.

If available, all the electrodes specified in NEC 250-50 and any made electrodes per NEC 250-52(A)(4) through (A)(8) shall be bonded together to form the grounding electrode system. Interior metal water piping located more than 5 feet from the point of entrance to the building shall not be used as part of the grounding electrode system or as a conductor to interconnect electrodes that are part of the grounding electrode system.





Connection must be made within 5 feet of point of entrance of piping per

Metal frame must be effectively grounded per NEC 250-50 (b)

At least 20 feet of #4 rebar (1/2") or #4 (min.) AWG bare copper conductor. Rebar or conductor must be encased in no less than 2" of concrete. Epoxy coated rebar is not acceptable as electrode per NEC 250-50(c)

At least #2 bare copper conductor, which must encircle the building and be at least 20 feet long per NEC 250-50(d)

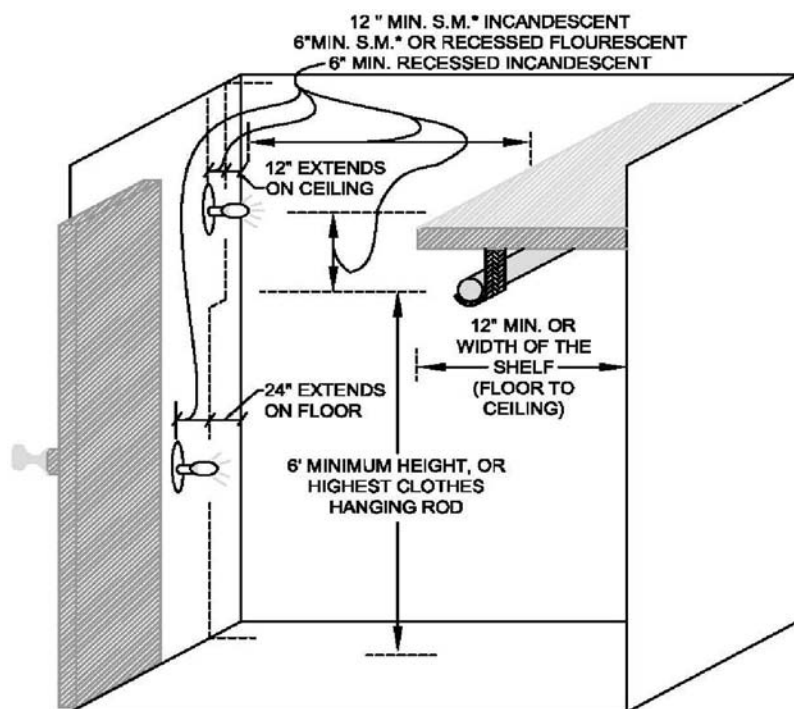
\* If ten feet of metal underground water pipe is available, it must be used as a grounding electrode and be supplemented by an additional electrode.

NEC 250-50 (a)

### KITCHEN, BATHROOM & RECESSED LIGHTING. Refer to Section 3 Residential Energy Standards

**CLOSET STORAGE SPACE.** For a closet that permits access to both sides of a hanging rod, the storage space shall include the volume below the highest rod extending 12 in. on either side of the rod on a plane horizontal to the floor extending the entire length of the rod. See figure below.

- (a). **Fixture Types Permitted.** All Luminaires shall be listed. Listed fixtures of the following types shall be permitted to be installed in a closet storage space:
  - (1) A surface-mounted or recessed incandescent fixture with a completely enclosed lamp
  - (2) A surface-mounted or recessed fluorescent fixture
  - (3) A Surface-mounted fluorescent or LED fixture identified as suitable for installation within the closet storage area.
- (b). **Fixture Types Not Permitted.** Incandescent fixtures with open or partially enclosed lamps and pendant fixtures or lampholders shall not be permitted.
- (c). **Location.** Fixtures in clothes closets shall be permitted to be installed as follows.
  - (1) Surface-mounted incandescent or LED fixtures installed on the wall above the door or on the ceiling, provided there is a minimum clearance of 12 in. between the fixture and the nearest point of a storage space.
  - (2) Surface-mounted fluorescent fixtures installed on the wall above the door or on the ceiling, provided there is a minimum clearance of 6 in between the fixture and the nearest point of a storage space.
  - (3) Recessed incandescent or LED fixtures with a completely enclosed lamp installed in the wall or the ceiling, provided there is a minimum clearance of 6 in between the fixture and the nearest point of a storage space.
  - (4) Recessed fluorescent fixtures installed in the wall or on the ceiling, provided there is a minimum clearance of 6 in. between the fixture and the nearest point of the storage space.



\* S.M. = SURFACE MOUNTED

IF A CLOSET PERMITS ACCESS TO BOTH SIDES OF THE HANGING ROD STORAGE SPACE VOLUME SHALL EXTEND BELOW THE ROD TO THE FLOOR 12" ON EITHER SIDE OF THE HIGHEST CLOTHES HANGING ROD

## **GROUNDING ELECTRODE CONDUCTOR FOR ALTERNATING-CURRENT SYSTEMS**

From NEC Table 250.66

Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors <sup>a</sup> (AWG/kemil)		Size of Grounding Electrode Conductor (AWG/kemil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-clad Aluminum <sup>b</sup>
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 50	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

1. Where multiple sets of service-entrance conductors are used as permitted in 230.40, Exception No. 2, the equivalent size to the largest service-entrance conductor shall be determined by the largest sum of the areas of the corresponding conductors of each set.
2. Where there are no service-entrance conductors, the grounding electrode conductor size shall be determined by the equivalent size of the largest service-entrance conductor required for the load to be served.

<sup>a</sup> This table also applies to the derived conductors of separately derived ac systems.

<sup>b</sup> See installation restrictions in NEC 250.64(A).

**WORKING SPACES**  
**FROM NEC TABLE 110.26 (A)(1)**

Nominal Voltage to Ground	Minimum Clear distance		
	Condition 1	Condition 2	Condition 3
0 - 150	914 mm (3 ft)	914 mm (3 ft)	914 mm (3ft)
151-600	914 mm (3 ft)	1.07 m (31/2 ft)	1.22 m (4 ft)

Where the conditions are as follows:

- Condition 1 – Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 300 volts to ground shall not be considered live parts.
- Condition 2 – Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls shall be considered as grounded.
- Condition 3 – Exposed live parts on both sides of the work space (not guarded as provided in Condition 1) with the operator between.

**Minimum size Equipment Grounding Conductors for Grounding Raceway and Equipment.**

**From NEC Table 250.122**

Rating or Setting or Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc, Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad 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

800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	800
5000	700	1200
6000	800	1200

**Note:** Where necessary to comply with NEC 250.4 (A)(5) or 250.4 (B)(4), the equipment grounding conductor shall be sized larger than given in this table.



**METAL BOXES**  
**From NEC Table 314.16(A)**

Box Trade Size	Minimum Volume		Maximum Number of Conductors*							
	cm <sup>3</sup>	in. <sup>3</sup>	18	16	14	12	10	8	6	
100 x 32 (4 x 11/4) round/octagonal	205	12.5	8	7	6	5	5	5	2	
100 x 38 (4x11/2) round/octagonal	254	15.5	10	8	7	6	6	5	3	
100 x 54 (4 x 2-1/8) round/octagonal	353	21.5	14	12	10	9	8	7	4	
100 x 32 (4 x 1-1/4) square	295	18.0	12	10	9	8	7	6	3	
100 x 38 (4 x 1-1/2) square	344	21.0	14	12	10	9	8	7	4	
100 x 54 (4 x 2 1/8) square	497	30.3	20	17	15	13	12	10	6	
120 x 32 (4-11/16 x 1-1/4) square	418	25.5	17	14	12	11	10	8	5	
120 x 38 (4-11/16 x 1-1/2) square	484	29.5	19	16	14	13	11	9	5	
120 x 54 (4-11/16 x 2-1/8) square	689	42.0	28	24	21	18	16	14	8	
75 x 50 x 38 (3 x 2 x 1-1/2) device	123	7.5	5	4	3	3	3	2	1	
75 x 50 x 50 (3 x 2 x 2 ) device	164	10.0	6	5	5	4	4	3	2	
75 x 50 x 57 (3 x 2 x 2-1/4) device	172	10.5	7	6	5	4	4	3	2	
75 x 50 x 65 (3 x 2 x 2-1/2) device	205	12.5	8	7	6	5	5	4	2	
75 x 60 x 70 (3 x 2 x 2-3/4) device	230	14	9	8	7	6	5	4	2	
75 x 50 x 90 (3 x 2 x 3-1/2) device	295	18.0	12	10	9	8	7	6	3	
100 x 54 x 38 (4 x 2-1/8 x 1-1/2) device	169	10.3	6	5	5	4	4	3	2	
100 x 54 x 48 (4 x 2-1/8 x 1-7/8) device	213	13.0	8	7	6	5	5	4	2	
100 x 54 x 54 (4 x 2-1/8 x 2-1/8) device	238	14.5	9	8	7	6	5	4	2	
95 x 50 x 65 (3-3/4 x 2 x 2 1/2) masonry box/gang	230	14.0	9	8	7	6	5	4	2	
95 x 50 x 90 (3-3/4 x 2 x 3 1/2)masonry box/gang	344	21.0	14	12	10	9	8	7	2	
min. 44.5 depth FS - single/cover/gang (13/4)	221	13.5	9	7	6	6	5	4	2	
min. 60.3 depth FD - single cover/gang (23/8)	295	18.0	12	10	9	8	7	6	3	
min. 44.5 depth FS - multiple cover/gang (13/4)	295	18.0	12	10	9	8	7	6	3	
min. 60.3 depth FD - multiple cover/gang (2-3/8)	395	24.0	16	13	12	10	9	8	4	

\*Where no volume allowances are required by NEC 314.16(B)(2) through 314.16(B)(5).

**SUPPORTS FOR RIGID NONMETALLIC CONDUIT (RNC)**  
**From NEC Table 352.30**

Conduit Size Metric Designator	Trade Size	Maximum Spacing Between Supports	
		mm or m	ft
16 - 27	1/2 - 1	900 mm	3
35 - 53	1-1/4 - 2	1.5 m	5
63 - 78	2-1/2 - 3	1.8 m	6
91 - 129	3-1/2 - 5	2.1 m	7
155	6	2.5 m	8

**SUPPORTS FOR RIGID METAL CONDUIT**  
**Table 344.30 (B)(2)**

Conduit Size Metric Designator	Trade Size	Maximum Distance Between Rigid Metal Conduit Supports	
		m	ft
16-21	1/2-3/4	3.0	10
27	1	3.7	12
35-41	1 1/4-1 1/2	4.3	14
53-63	2-2 1/2	4.9	16
78 and larger	3 and larger	6.1	20

**RADIUS OF CONDUIT BENDS**  
**From NEC Table 2 Chapter 9**

Metric Designator	Conduit Size	One Shot and Full Shoe Benders		Other Bends	
	Trade Size	mm	in.	mm	in.
16	1/2	101.6	4	101.6	4
21	3/4	101.6	4 1/2	127	5
27	1	140.05	5 3/4	152.4	6
35	1 1/4	184.15	7 1/4	203.2	8
41	1 1/2	209.55	8 1/4	254	10
53	2	241.3	9 1/2	304.8	12
63	2 1/2	266.7	10 1/2	381	15
78	3	330.2	13	457.2	18
91	3 1/2	381	15	533.4	21
103	4	406.4	16	609.6	24
129	5	609.6	24	762	30
155	6	762	30	914.4	36

**VOLUME ALLOWANCE REQUIRED PER CONDUCTOR**  
**From NEC Table 314.16 (B)**

Size of Conductor (AWG)	Free Space Within Box for Each Conductor	
	cm <sup>3</sup>	in <sup>3</sup>
18	24.6	1.5
16	28.7	1.75
14	32.8	2.00
12	36.9	2.25
10	41.0	1.50
8	49.2	3.00
6	81.9	5.00

**MAXIMUM CORD-AND PLUG-CONNECTED LOAD TO RECEPTACLE**  
**From NEC Table 210.21 (B)(2)**

Circuit Rating (Amperes)	Receptacle Rating (Amperes)	Maximum Load (Amperes)
15 or 20	15	12
20	20	16
30	30	24

**RECEPTACLE RATINGS FOR VARIOUS SIZE CIRCUITS**  
**From NEC Table 210.21 (B)(3)**

<b>Circuit Rating (Amperes)</b>	<b>Receptacle Rating (Amperes)</b>
15	Not over 15
20	15 or 20
30	30
40	40 or 50
50	50

## **SECTION 17 – MISCELLANEOUS**

**SWIMMING POOLS.** For purposes of this Section, “private swimming pool” shall include any structure, whether in-ground or above ground, designed or used for swimming or recreational bathing that contains water in excess of 18" deep.

Whenever a construction permit is issued for construction of a new swimming pool at a private, single-family home, it shall be equipped with at least one of the following safety features:

1. The pool shall be isolated from access to a home by an enclosure that has **all** of the following characteristics:
  - a. Any access gates through the enclosure open away from the swimming pool, and are self-closing with a self-latching device placed no lower than 60" above the ground.
  - b. A minimum height of 60".
  - c. A maximum vertical clearance from the ground to the bottom of the enclosure of 2".
  - d. Gaps or voids, if any, do not allow passage of a sphere equal to or greater than 4" in diameter.
  - e. An outside surface free of protrusions, cavities or other physical characteristics that would serve as handholds or footholds that could enable a child below the age of five (5) years to climb over.
2. During construction of the pool, the pool shall incorporate removable mesh fencing that meets American Society for Testing and Materials (ASTM) Specification F 2286 standards in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device
3. The pool is equipped with a manually or power-operated safety pool cover that meets all of the performance standards of the ASTM, in compliance with standard F 1346. If the safety pool cover is electrically operated, the control for the pool cover shall be mounted at least 60" above grade or above the floor.
4. All doors providing direct access from the home to the pool are equipped with exit alarms, either battery operated or connected to the electrical wiring of the residence, that make audible, continuous alarm sounds when the door is opened or left ajar. The exit alarms shall produce sounds at or exceeding sound pressure of 80 dB at a distance of 10' from the alarm emitter.
5. All doors providing direct access from the home to the pool are equipped with a self-closing, self-latching device with a release mechanism placed no lower than 54" above the floor.
6. Swimming pool alarms that, when placed in pools, will sound upon detection of accidental or unauthorized entrance into the water. These alarms shall meet ASTM Standard F 2208 and include surface motion, pressure, sonar, laser, and infrared type alarms.
7. Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the devices set forth in items 1-6 above as determined by the building official.

New pools and spas shall have at least two circulation drains per pump that shall be hydraulically balanced and symmetrically plumbed through one or more “T” fittings, and that are separated by a distance of at least three feet in any dimension. Suction outlets that are less than 12" across shall be covered with anti-entrapment grates, as specified in ASME/ANSI Standard A 112.19.8, that cannot be removed except with the use of tools.

Remodeled or modified pools and spas are required to have the suction outlet of the existing pool/spa upgraded to be equipped with an anti-entrapment cover meeting the current standards.

Spas that are equipped with locking safety covers that comply with ASTM-ES 13-89 shall be exempt from these regulations.

All plans submitted to the county for swimming pools to be constructed shall show compliance with the following requirements.

1. Pool plans, specifications and design calculations shall be prepared by a civil or structural engineer, licensed to practice in the State of California. Design criteria may include, but not necessarily be limited to, considerate of geologic, geographic and topographic features of a pool site, groundwater, soil conditions performance standards and maintenance requirements. The building official may require whatever information he deems necessary to satisfy himself that a pool design protects the public health and safety.
2. All plans shall have a plot plan and at least one cross-section through the foundation.
3. A detail of proposed fencing to be used will be required for plan checking. A specification of the approved safety features in lieu of an enclosure (fence) will be required for plan checking.
4. For pool design and construction, soils in Mendocino County shall be assumed to be expansive unless the owner can show by actual soil tests, performed by a recognized soil testing laboratory, that the soils are not expansive. The soil around the pool shall slope away from it to prevent surface waters from draining into the pool and to prevent ponding, or a drainage system shall be provided to collect surface water.
5. Final inspection, approval and use of all pools constructed shall be withheld until all of the necessary requirements have been complied with.

**NOTE:** Public or semi-public swimming pool plans shall be approved by the County public health officer.

#### **ADJACENT RECEPTACLES TO POOLS:**

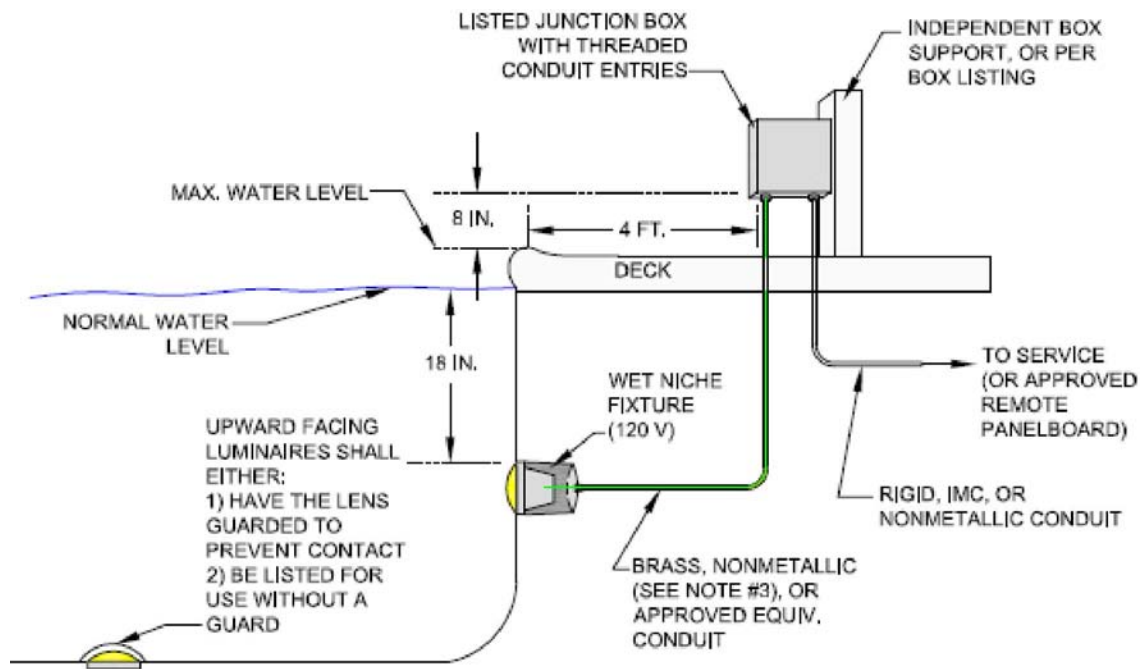
Receptacles that provide power for water-pump motors or for other loads directly related to the circulation and sanitation system shall be located at least ten (10) feet from the inside walls of the pool, but may be reduced to six (6) feet provided the receptacles meet all of the following provisions:

1. Consist of a single receptacle
2. Employ a locking configuration
3. Are of the grounding type
4. Have GFCI protection

No fewer than one 125-volt, 15- or 20-ampere receptacle on a general purpose branch circuit shall be located not less than six (6) feet from, and not more than twenty (20) feet from, the inside wall of the pool. This receptacle shall be located not more than six (6) feet, six (6) inches above the floor, platform, or grade level serving the pool.

All receptacles located within twenty (20) feet of the inside walls of a pool shall be protected by a ground-fault circuit interrupter. No receptacles shall be within six (6) feet of the inside walls of a pool. All measurements shall be taken as the shortest path an appliance cord connected to the receptacle would take without piercing any permanent barriers.

## WET-NICHE LIGHT FIXTURES:

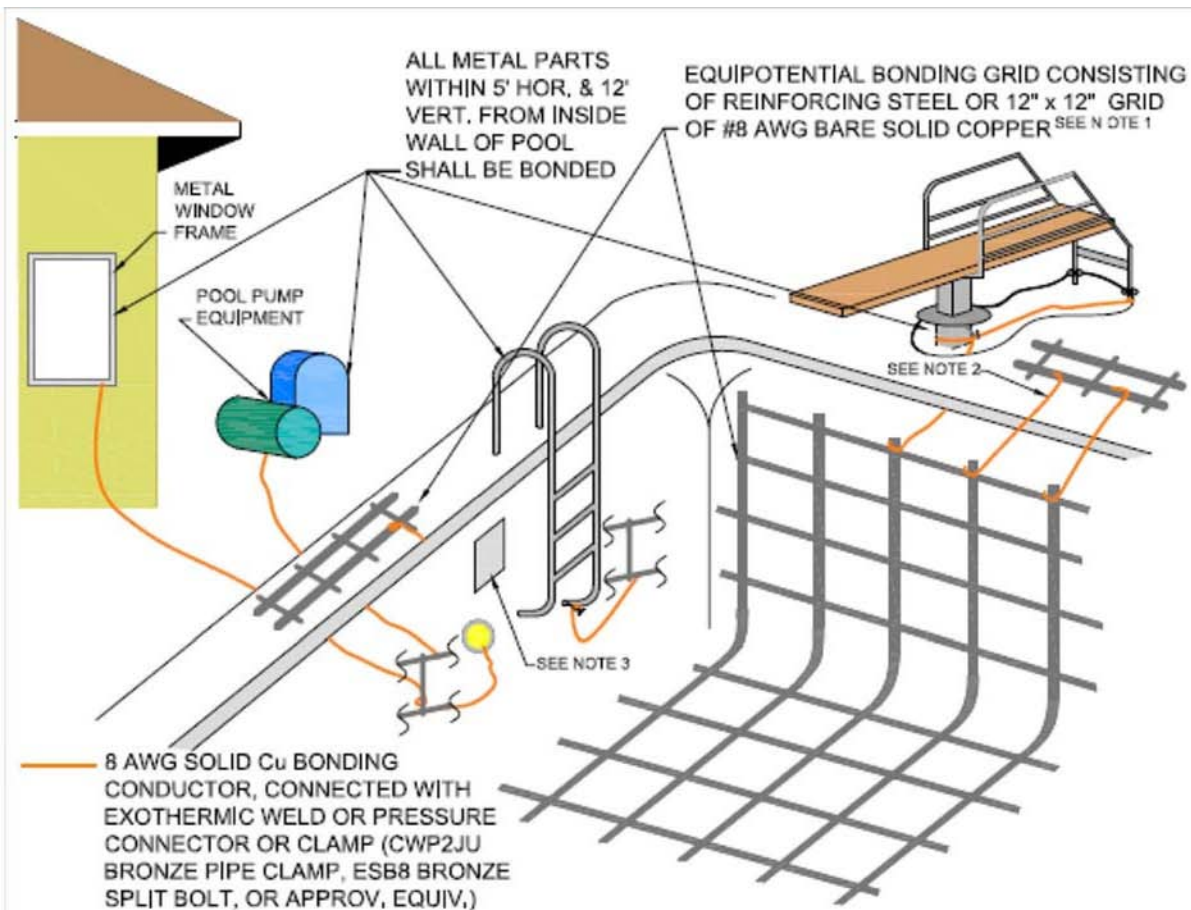


### NOTES:

- 1) ALL DIMENSIONS SHOWN ARE MINIMUMS
- 2) NOT TO SCALE
- 3) NONMETALLIC CONDUIT REQUIRES #8 GREEN INSULATED EQUIPMENT GROUNDING CONDUCTOR

- Revised February 10, 2012





**NOTES:**

- 1) EXTENDING 3' HORIZONTALLY BEYOND THE INSIDE WALLS OF THE POOL WHICH INCLUDES UNPAVED SURFACES AS WELL AS POURED CONCRETE AND OTHER TYPES OF PAVING (i.e. STONE, TILE, PAVERS).
- 2) BONDING TO THE PERIMETER SURFACES SHALL BE ATTACHED TO THE POOL REINFORCING STEEL OR COPPER CONDUCTOR GRID AT A MINIMUM OF 4 POINTS UNIFORMLY SPACED AROUND THE PERIMETER OF THE POOL.
- 3) AN INTENTIONAL BOND OF A MINIMUM CONDUCTIVE SURFACE OF 9 SQUARE INCHES SHALL BE INSTALLED IN CONTACT WITH THE POOL WATER. THIS BOND SHALL BE PERMITTED TO CONSIST OF PARTS THAT ARE REQUIRED TO BE BONDED.

**RESIDENTIAL GARAGES AND CARPORTS.** The common wall between a dwelling and an attached garage shall have 1/2" gypsum wallboard on the garage side. Any opening between the dwelling and the attached garage must be protected with a self-closing, tight-fitting, solid wood door not less than 1<sup>3</sup>/<sub>8</sub>" in thickness or a 20 minute rated assembly.

If there is living area above the garage, the ceiling common walls and bearing walls must be of e" type X gypsum wallboard.

All support posts less than 8" x 8" must be protected with e" Type "X" gypsum wallboard.

Any steel posts must be covered to comply with a required one-hour fire resistive construction. Any beams less than 6" x 10" must be protected with 1/2" Type "X" gypsum wallboard.

Electrical receptacles on firewall boxes must be one-hour rated. Electrical panels must not be located in a firewall unless protected with one-hour fire resistive construction.

Receptacles located in a garage must be at least 18" above the floor level and have approved ground fault circuit protection. GFCI's are not required on outlets dedicated for a single, specific appliance. Water heaters generating a glow, spark, or flame capable of igniting flammable vapors may be installed in a residential garage, provided the pilots and burners, or heating elements and switches, are at least 18" above the floor level.

Water heaters or furnaces installed in areas where they may be subjected to mechanical damage shall be suitably guarded against such damage.

A carport with no enclosed uses above and entirely open on two or more sides attached to a single family dwelling need not be separated from the dwelling by fire-resistive construction.

Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit from the garage shall be constructed of a minimum 0.019-inch sheet steel and shall have no openings into the garage.

**RETAINING WALLS.** ("generic design" not intended to be used in place of retaining wall designed by an engineer or architect.) Can be used in place of design by engineer for walls retaining up to 4 feet of material with or without a surcharge except when surcharged by a structure or driveway.

**A. POURED CONCRETE RETAINING WALL NOTES:**

1. All concrete shall be 3000 psi minimum at 28 days.
2. Steel to be deformed bars conforming to ASTM A 615, grade 40 minimum.
3. Minimum Cover requirements for reinforcement:
  - a. cast against and exposed to earth: 3"
  - b. formed and exposed to earth or weather: 2"
4. 4" perforated pipe shall drain to daylight away from structures.
5. All reinforcing steel bars shall be securely tied at each end or as near thereto as possible. All steel shall be lapped 24" where splices occur.
6. Provide waterproof covering on soil side of retaining wall, if wall adjoins living space.

**B. MASONRY BLOCK RETAINING WALL NOTES:**

1. Concrete block shall be Grade N conforming with specification ASTM C 90-86.
2. All cells shall be fully grouted. Grout shall be 2000 psi minimum at 28 days.
3. Mortar shall be Type S conforming to UBC Standard 21-14.
4. Steel to be deformed bars conforming to ASTM A 615, grade 40 minimum.

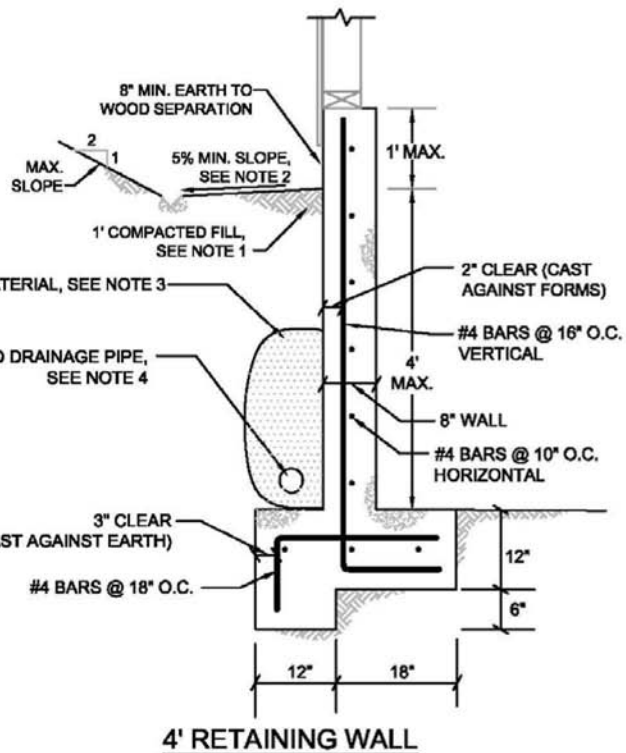
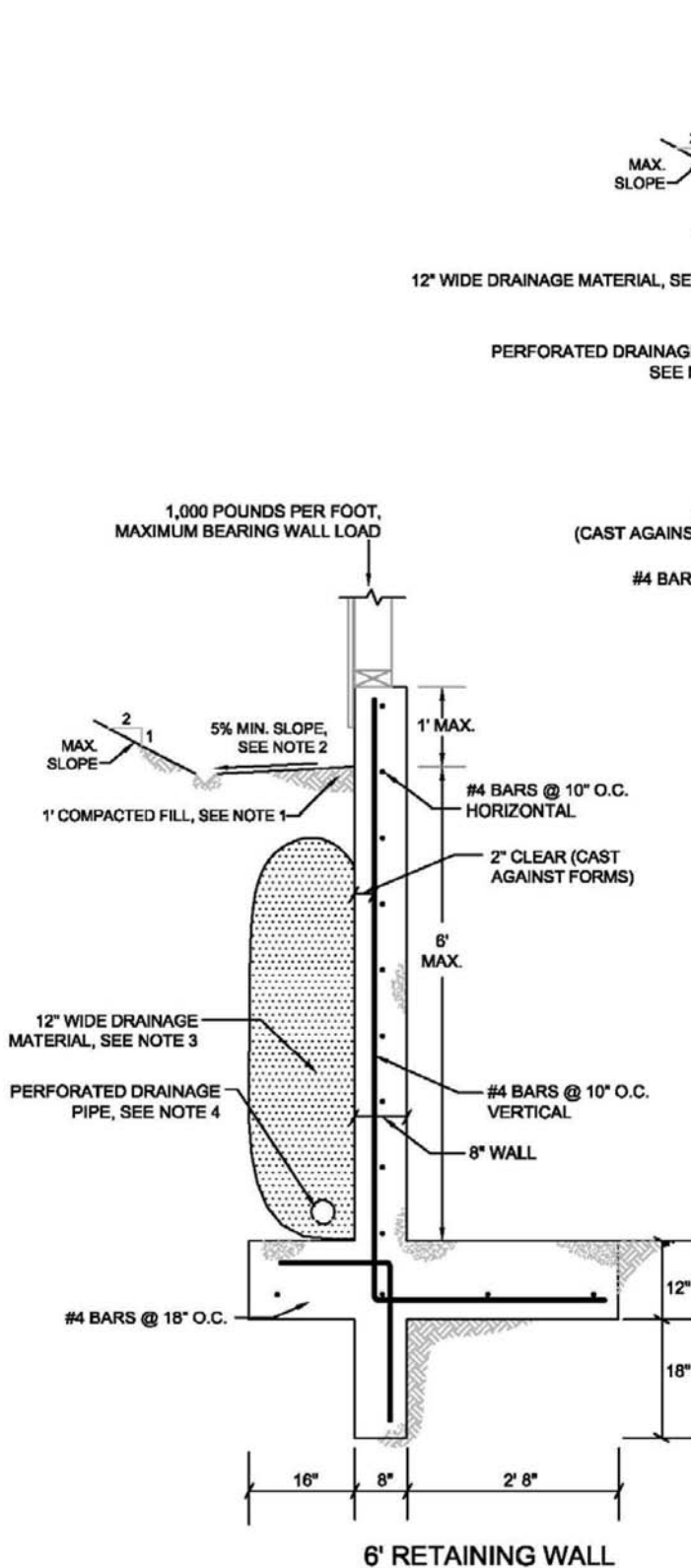
- 5 All horizontal steel to be placed in bond beam block.
- 6 Minimum cover requirements for reinforcement:
  - a. cast against and exposed to earth: 3"
  - b. formed and exposed to earth or weather: 2"
7. 4" perforated pipe shall drain to daylight away from structures.
- 8 All reinforcing steel bars shall be securely tied at each end or as near thereto as possible. All steel shall be lapped 27" or more where splices occur.
- 9 Provide waterproof covering on soil side of retaining wall, if wall adjoins living space.
10. Rebar must be at or on retained material side of the centerline of the cell.

**C. WOOD WALL STANDARD DETAILS**

1. Minimum 6" x 6" or 6" round pressure treated posts max 4' on center.
2. Minimum 2500 psi concrete with minimum 3 inch clearance around post.
3. Minimum 4" by 12" nominal pressure treated horizontal members with 1/4 inch to 1/2 inch spaces for drainage attached to post with minimum two 20 d galvanized fasteners per post.

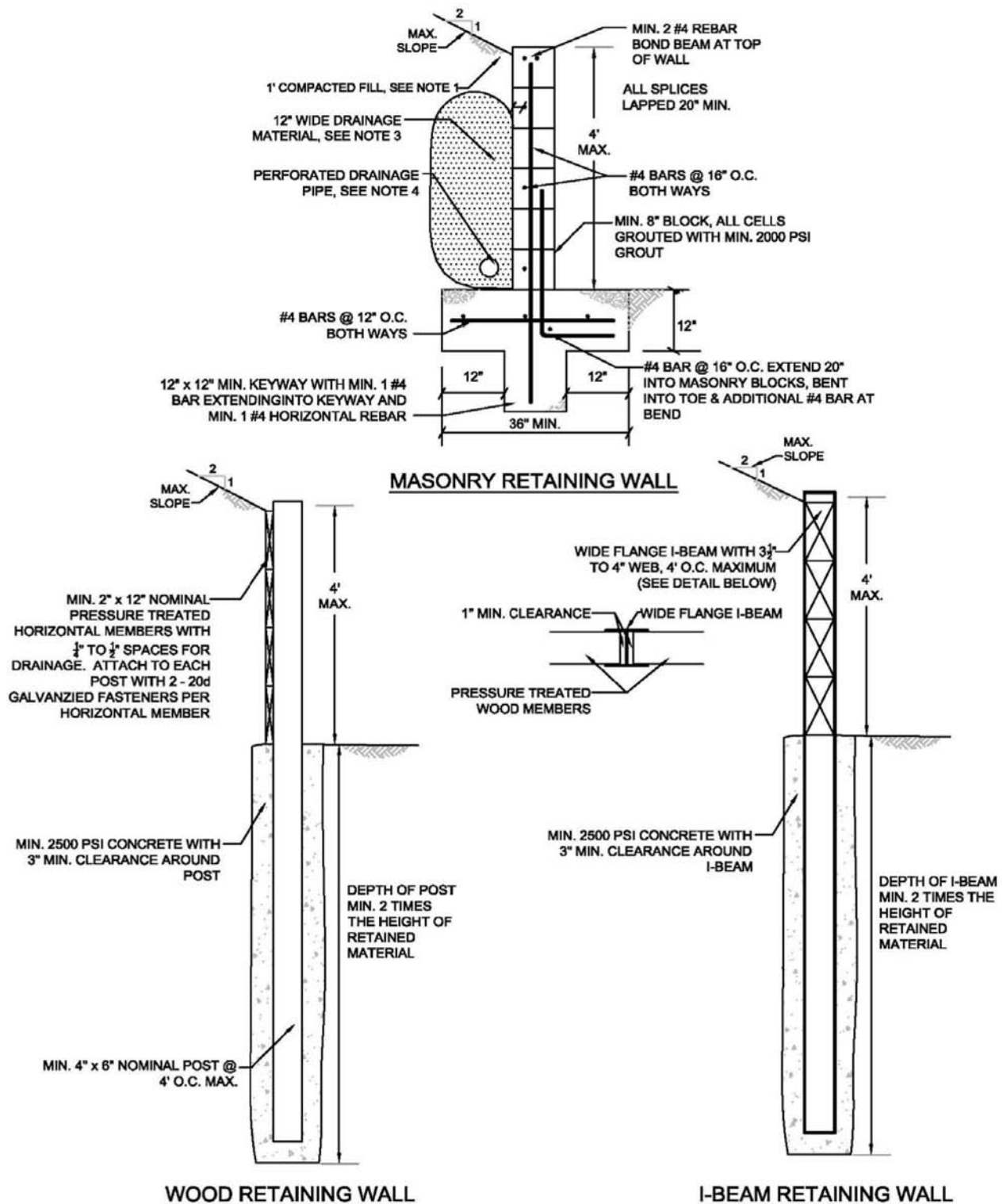
**D. I-BEAM STANDARD DETAILS**

1. Minimum 4" by 12" nominal pressure treated horizontal members between flanges. Provide 1/4 inch to 1/2 inch spaces for drainage with maximum 1 inch clearance between wood member and web.
2. Minimum 2500 psi concrete with minimum 3 inch clearance around I-beam.



#### NOTES:

1. 1' minimum compacted fill soil cap shall be moisture conditioned to near optimum moisture content, and compacted in 8" maximum lifts to provide an impermeable barrier to surface water infiltration.
2. Per CBC 1803.3, the ground adjacent to a building foundation must slope away from the building at 5% minimum for at least 10 feet, or to approved alternative method for diverting water away. Impervious surface within 10' of the foundation must be sloped 2% minimum.
3. Minimum 12" wide, Class 2 Aggregate Baserock, or  $\frac{3}{4}$ " crushed rock wrapped in an approved non-woven filter membrane). A minimum of 2" must be below the drainage pipe and 6" minimum above the pipe.
4. Minimum 4" Schedule 40 perforated pipe, holes placed down, sloped 2% minimum to an approved outlet location. Cleanouts shall be provided as necessary. All 90° bends shall be made with (2) 45° pieces or additional cleanouts may be required.



**WOOD DECK CONSTRUCTION.** Open, uncovered wood decks not more than 200 square feet in area, not more than thirty (30) inches above grade (measured to the lowest adjacent grade within 3 feet from the edge of the walking surface), not attached to a dwelling unit, not serving the required exit door, and not over any basement or story below, do not require building permits or guards. (Stairways having more than three risers do require handrails).

All framing materials exposed to weather must be preservative-treated or naturally durable wood. Hardware and fasteners must be hot-dipped galvanized, stainless steel, silicon bronze or copper.

Typical wood decks under 10' high may be constructed of 2 x 6 open decking, supported by 2 x 6, #2 or better pressure-treated doug fir (PTDF) joists spaced 24" on center.

Joists shall span from a 2 x 8 ledger applied to the side of the residence to 4 x 8 beams, #2 PTDF, or better, spaced 8' on center. Use joist hangers at the ledger and provide solid blocking between joists over beams.

The ledger must be securely fastened to the rim joist or blocking within the residence floor joist system. Ledgers at decks shall be secured with 3-16d common nails at 2' o.c., minimum. Deck joists shall be positively attached to residence framing at 8' o.c. with connectors not subject to withdrawal, typically LTT19's.

Beams shall be supported by pressure treated 4 x 4 posts at 8' o.c., which shall be supported by 24" x 24" concrete footing pads, 12" deep into undisturbed soil.

Posts shall have PC44 or EPC44 post caps and PBS44A, or equivalent, standoff bases cast into the footing. (Alternate systems may be used upon review and approval by PRMD)

Decks over 30" high must be cross braced between at least two opposed posts parallel with the ledger. Decks over 10' high must be submitted with justifying calculations.

Guards must be at least 42" high, containing no openings over 4" wide or high. Guards shall be supported by 4" x 4" posts at 4' o.c., bolted to the joist/beam system below.

#### **NOTES:**

1. Joist sizes provided above are examples of approved conventional construction. Please consult CBC span tables on page 8.3 for longer spans.
2. Refer to Appendix 5 for allowable decking materials in Wildland Urban Interface Areas.

**GLASS AND GLAZING.** Glass shall be firmly supported on all four edges. Glazing subject to human impact loads, as defined below by CBC Section 2406.1 and CRC Section R308.3, shall be of Category I Glazing (9 square feet or less) or Category II Glazing (greater than 9 square feet and all glazing in item 5 below and all glazing in sliding patio type doors), Plastic Glazing, Glass Block, or Louvered Windows or Jalousies.

#### **CBC Section 2406.4 and CRC Section R308.4 Hazardous Locations**

The following shall be considered hazardous locations for the purpose of glazing.

1. Glazing in swinging doors, except jalousies.
2. Glazing in fixed and sliding panels of sliding door assemblies and panels in sliding and bifold closet door assemblies.
3. Glazing in storm doors.
4. Glazing in all unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs, and showers. Glazing in any portion of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60" (1525 mm) above a standing surface.

6. Glazing in an individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24 inches (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1525 mm) above the floor or walking surface.

**Exceptions:**

1. Panels where there is an intervening wall or other permanent barrier between the door and glazing.
2. Where access through the door is to a closet or storage area 3 feet or less in depth. Glazing in this application shall comply with Section 2406.4 Item 7.
3. Glazing in walls perpendicular to the plane of the door in a closed position, other than the wall towards which the door swings when opened.
4. Decorative glazing
5. Glazing that is adjacent to the fixed panel of patio doors.
6. Glazing in an individual fixed or operable panel, other than those locations described in Items 5 and 6, above, that meets all of the following conditions:
  - Exposed area of an individual pane greater than 9 square feet (0.84 m<sup>2</sup>).
  - Exposed bottom edge less than 18 inches (457 mm) above the floor.
  - Exposed top edge greater than 36 inches (914 mm) above the floor.
  - One or more walking surfaces within 36 inches (914 mm) horizontally of the plane of the glazing.

**Exceptions to Item 7:**

1. When a protective bar is installed on the accessible sides of the glazing 34 inches (864 mm) to 38 inches (965 mm) above the floor. The bar shall be capable of withstanding a horizontal load of 50 pounds per linear foot (729 N/m) without contacting the glass and be a minimum of 1- 1/2" (38.1 mm) in height.
2. Outboard pane in insulating glass units and in other multiple glazed panels in Item 7 when the bottom exposed edge of the glass is 25' (7620 mm) or more above any grade, roof, walking surface, or other horizontal or sloped (within 45 degrees of horizontal) surface adjacent to the glass exterior.
3. Decorative Glazing
4. Glazing in railings regardless of height above a walking surface. Included are structural baluster panels and nonstructural in-fill panels.
5. Glazing in walls and fences used as the barrier for indoor and outdoor swimming pools and spas when all of the following conditions are present:
  - The bottom edge of the glazing on the pool or spa side is less than 60" (1525 mm) above a walking surface.
  - The glazing is within 60" (1525 mm) of a swimming pool or spa water's edge.
6. Glazing adjacent to stairways, landings and ramps within 36" horizontally of a walking surface; when the exposed surface of the glass is less than 60" above the plane of the adjacent walking surface.
7. Glazing adjacent to stairways within 60" horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60" above the nose of the tread.

**Exception to Items 10 & 11.** The side of a stairway, landing or ramp which has a guardrail or handrail, including balusters or in-fill panels, where the glazing is designed to resist a load of 200 lbs at the top, applied from any direction, and the plane of the glass is greater than 18" from the railing.

**EXCEPTIONS:** The following products, materials and uses shall not be considered specific hazardous locations:

1. Openings in doors though which a 3" sphere is unable to pass.
2. Decorative glass in Items 1,6 or 7.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.
5. Glass-block panels complying with CBC 2101.2.5
6. Louvered windows and jalousies complying with the requirements of CBC 2403.5.
7. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

**SLOPED GLAZING AND SKYLIGHTS.** This section applies to the installation of glass or other transparent, translucent, or opaque glazing material installed at a slope of 15 degrees or more from the vertical plane, including glazing materials in skylights, roofs, and sloped walls. Sloped glazing and skylights shall be designed to withstand the loads specified in the California Building Code Sections 1609 & 2404.2.

**ALLOWABLE GLAZING MATERIALS.** Sloped glazing shall be of any of the following materials, subject to the limitations in this section.

1. Laminated glass with a minimum .38-mil polyvinyl butyral interlayer for glass panes 16 square feet or less is area located such that the highest point of the glass is not more than 12 feet above the walking surface or other accessible area; for higher or larger sizes, the minimum thickness shall be .76 mm.
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics meeting the requirements of Section 2607.

For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified above.

**HEAT-STRENGTHENED GLASS.** Heat-strengthened glass is glass which has been reheated to just below its melting point and then cooled. This process forms a compression on the outer surface and increases the strength of the glass. However, heat-strengthened glass has the unsatisfactory characteristic of breaking into shards, as does annealed glass. Thus, heat-strengthened glass requires screen protection below the skylight to protect the occupant from falling shards.

**TEMPERED GLASS.** Tempered glass is glass which has been specially heat treated or chemically treated to provide high strength. When broken, the entire piece of glass immediately breaks into numerous small granular pieces. Because of its high strength and manner of breakage, tempered glass had been considered in the past to be a desirable glazing material for skylights without any protective screens. However, as a result of studies by the industry which show that tempered glass is subject to spontaneous breakage, such that large chunks of glass may fall under this condition, the CBC and CRC now requires screen protection below tempered glass.



**IDENTIFICATION.** Each light shall bear the manufacturer's label designating the type and thickness of glass. When approved by the building official, labels may be omitted, provided an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved plans and specifications. Identification of glazing in hazardous locations shall be in accordance with CBC Section 2406 and CRC Section R308

Each pane of tempered glass shall be permanently identified by the manufacturer. The identification shall be etched or ceramic fired on the glass and be visible when the unit is glazed. Tempered spandrel glass is exempted from permanent labeling, but such glass shall be identified by the manufacturer with a removable paper label.

**SCREENING.** Heat-strengthened glass and fully-tempered glass when used in single-layer glazing systems shall have screens installed below glazing. The screens shall be capable of supporting twice the weight of the glazing, be firmly and substantially fastened to the framing members, and installed within 4" of the glass. They shall be constructed of a noncombustible material not thinner than 12 gauge wire (0.0808") with a mesh not larger than 1" by 1 ". Heat-strengthened glass, fully tempered glass and wired glass, when used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening.

**Exception:** Screens need not be provided within individual dwelling units when fully tempered glass is used as single glazing or in both panes of an insulating glass unit when all of the following conditions are met:

1. The area of each pane (single glass) or unit (insulating glass) shall not exceed 16 square feet. The highest point of the glass shall not be more than 12' above any walking surface or other accessible area. The nominal thickness of each pane shall not exceed 3/ 16 ". And (For multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
2. Glass greater than 16 square feet. Glass sloped 30 degrees or less from vertical, and highest point of glass not more than 10 feet above a walking surface or other accessible area.

**FRAMING.** Skylights installed in a roof with a pitch less than 3:12 shall be mounted at least 4" above the plane of the roof on a curb constructed of materials as required for the frame unless otherwise specified in the manufactures installation instructions. Skylights may be installed in the plane of the roof when the roof slope is greater 3:12. (For other than single family dwellings construction curbs are required for pitches less than 12:12).

**MASONRY FIREPLACES & CHIMNEYS.** Masonry fireplaces do not comply with current emission standards. Please see the section on Wood-Fired Appliances in section 16 for additional information.

**MANUFACTURED HOME, COMMERCIAL COACHES, SET-UP OR PERMANENT FOUNDATION.** A manufactured home is a structure licensed by the State of California and built to state standards contained in Title 25, California Administrative Code and the model codes.

1. Customer Services Provides the Following:
  - a. Building Permit Application
  - b. Submittal Checklist
  - c. School District Certificate of Compliance
  - d. Housing and Community Development form HCD-433A
  - e. Housing and Community Development's User Guide (if requested)
  - f. Permit History
2. Documents Required from the Applicant:
  - a. Completed forms provided in Step 1.

- b. Three (3) sets of site plans dimensioned with setbacks to property lines showing the proposed structure and any existing structures, access to property, driveway location (Fire Safe Standards), Septic System, Well, etc.
  - c. Three (3) sets of floor plans.
  - d. Three (2) sets of tie down layout plans.
  - e. Three (3) sets of elevation plans.
  - f. Two (2) sets of set-up manuals:
    - 1. Coach to have state approval documentation for occupancy use. 15psf is the minimum acceptable wind load rating.
    - 2. If using standard sheet with multiple installation options, applicant shall **void all details that do not apply to their specific installation.**
  - g. Two (2) sets of foundation plans and details by one of the following:
    - 1. State-approved manufacturer's plans
    - 2. Engineer or architect prepared plans with calculations and stamped and signed drawings,
    - 3. State-approved generic plans, stamped and signed.
  - h. If this is a commercial coach, applicant must provide plans to meet accessibility requirements.
3. Clearances from Other Sections
- a. Code Enforcement will review project when a violation exists on property.
  - b. Zoning will review for setbacks, land use and other related zoning items.
  - c. Well & Septic must review all permits where sewage disposal is by a septic system and/or water supply is from a private well.
  - d. Building will review commercial coaches and residential projects.
  - e. Storm water will review the project for issues related to the drainage features on the building site.
4. Calculate Plan Check and Site Review Fees.
- a. At intake, inform applicant of general plan check procedures, time frames and fees.
5. Permit May Be Issued When Plan Check Is Completed and All Clearances Have Been Obtained as Indicated on the Check List:
- a. The Permit Technician calculates all fees and verifies School Fee Receipt.
6. Certificate of Occupancy: after the Installation Is Completed and Before a Certificate of Occupancy May Be Issued When a Permanent Foundation Has Been Installed:
- a. A check payable to State of California for \$11.00 per unit must accompany completed form HCD-433(a) prior to issuance of certificate of occupancy.
  - b. A check payable to the County Recorder for \$8.00 will be collected for recordation of form HCD-433(a) prior to issuance of certificate of occupancy.
  - c. The owner will be provided with a completed certificate of occupancy form HCD-513(c) and for HCD-433(b) to complete and file with the County Recorder, prior to Final Inspection

## **SECTION 18 - RESIDENTIAL CONSTRUCTION IN FLOOD ZONES**

These procedures have been in place since January, 1982, when the department first received flood insurance rate maps, floodway maps and the attendant certification requirements. Procedures have remained primarily unchanged to present, however, policy and documents have evolved to reflect known legal interpretations and clarifications necessary to more effectively apply ordinance provisions.

The documents provided in this appendix are samples of current usage and are not intended to reflect the evolution of changes.

If you have questions, contact the Department of Planning and Building Services at (707) 463-4281.

### **GLOSSARY OF TERMS USED IN THIS SECTION:**

- ❖ Base Flood Elevation (BFE) - The flood elevation having a one-percent chance of being equaled or exceeded in any given year. The BFE is determined by statistical analysis for each local area and designated on the Flood Insurance Rate Maps.
- ❖ Flood Insurance Rate Maps (FIRM) - The official map of a community issued by FEMA, that shows the Base Flood Elevation (BFE), along with the Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community.
- ❖ Flood Vents - A system designed to allow floodwaters to enter an enclosure, usually the foundation walls, so that the rising water does not create a dangerous differential in hydrostatic pressure.
- ❖ Floodway - The central portion of the floodplain that carries the greatest portion of the waterflow in a flood. Obstructions in the floodway will result in increased flood levels upstream.
- ❖ Lowest Floor - The lowest floor of the lowest enclosed area, including basements; however, an un-finished or flood-resistant enclosure used solely for parking, building access, or storage shall not be considered the lowest floor.
- ❖ National Flood Insurance Program (NFIP) - The federal program created by an act of Congress in 1968 that makes flood insurance available in communities that enact satisfactory floodplain management regulations.

### **RESIDENTIAL CONSTRUCTION IN FLOODZONES:**

#### **1. Adopted Flood Map & Floodplain Management Regulations:**

Floodplain management regulations are contained in Chapter of the Mendocino County Code. These regulations were enacted when Mendocino County voluntarily elected to participate in the National Flood Insurance Program. This program allows reasonably priced flood insurance to be offered. The flood level referred to is the Base Flood Elevation (BFE), as published on the Flood Insurance Rate Maps (FIRM) by the Federal Emergency Management Agency (FEMA).

#### **2. Application:**

The lowest floor for all new construction and substantial improvements of residential living areas, utility areas, or any enclosed area including basement must be at least one foot above the BFE. Only non-habitable spaces such as garages, carports and building access areas **that are not subject to flood damage** may be allowed below the base flood elevation and must be clearly labeled as such on the drawings submitted for building permits.

### **3. Flood Resistant Materials:**

All building materials and assemblies located below the BFE must be resistant to flood damage. Materials that are approved for use below the base flood elevation include masonry, concrete, pressure treated heavy timber, pressure treated wood or some combination. Connectors and fasteners in contact with pressure treated wood products must be either hot-dipped galvanized or stainless steel. No enclosed stud spaces or cavities will be approved below the base flood elevation. All building components below the BFE must be designed to be rinsed clean of sediment after a flood. Similarly, joist spaces enclosed by plywood or sheetrock on top and bottom will not be approved. FEMA Technical Bulletins 1-93, 2-93, 5-93, 8-96 and 11-01 (available on the FEMA website) provide additional information on the acceptability of various materials and construction methods used below the BFE.

### **4. Assemblies:**

Assemblies, other than wood stud frame, such as pole buildings, may be brought to PBS for preliminary plan check review prior to an application for a building permit being submitted. Conformance with flood regulations may be discussed before design time is expended on concepts that may not be approved. In general braced post and beam construction, with no enclosed stud space, is an acceptable type of construction.

New dwellings, located in the State Responsibility Area (SRA), must maintain the ignition-resistant integrity of the exterior walls, on the underside of the floors, or the entire underfloor area shall be enclosed to grade.

Where enclosed space occurs below the BFE, openings are required to allow for automatic entry and exit of floodwaters. These openings are also referred to as flood vents and shall meet the following minimum requirements:

- a. A minimum of two openings on different sides of each enclosed area. If a structure has more than one enclosed area below the BFE, each area shall have openings on exterior walls.
- b. The total net area of all openings shall be at least one square inch for each square foot of enclosed area.
- c. The bottom of each opening shall be no more than one foot above the adjacent ground level.
- d. Openings shall not be less than three inches in diameter.
- e. Louvers, screens, or other opening covers shall not block or impede the automatic flow of floodwaters into and out of the enclosed areas.
- f. Openings meeting the requirements of a through e above may be installed in doors and windows. Doors and windows by themselves do not meet the flood venting requirements.

### **5. Design Loads:**

Construction must be designed for all vertical and lateral loads. When a building site is subject to flowing water, the structure must be designed to resist those forces.

Structures located in Special Flood Hazard zones, where the water velocity exceeds 5 feet per second, must be designed to resist the hydrodynamic force of moving water. PBS will use the FIRM to determine if moving water design is required for a building site.

Most people assume that the velocity in the fringe is lower than the velocity in the floodway; however, this may not always be correct. We recommend that you design for Floodway Velocity. Please refer to FEMA technical literature on "Design for Hydrodynamic Forces."

## **6. Fire-Resistance Construction Required by the California Building Code (CBC):**

A common residential design for the Sonoma County flood zone is a garage or carport located below the BFE that supports living space located above the base flood elevation.

Fire-resistant construction is required by CBC between R-3 and U occupancies. Floor-ceiling construction must use 5/8" Type "X" sheetrock on the ceiling of the garage, if there's a living space above the garage. The *entire* assembly must be above the base flood elevation. The use of moisture resistant 5/8" Type "X" sheetrock for fire-resistant construction located below the BFE will *not* be approved.

Please also review the discussion of the reference level on the attached "Elevation Certificate Procedure".

## **7. Electrical Limitations:**

PG&E must approve the location of all electrical meter locations. Both electrical meter sockets and load centers must have 30 inch wide and 36 inch deep working clearances. If located on an exterior platform, this platform must be safe and conform to the current version of the California Building Code. If the load center is located inside the building it may not be located in a closet used to store combustible materials and must conform to the current version of the National Electrical Code in every respect.

All electrical equipment must be located above the BFE. "Electrical equipment" includes electrical load centers, subpanels, circuit breakers, ground fault interrupting devices, motors, etc. Therefore, load centers with circuit breakers must be located above the BFE.

Electrical branch circuits may extend below the BFE only if protected by a ground fault interrupting device which is located above the BFE. Since no enclosed stud spaces may be approved below the BFE, protection of electrical conductors must usually be done with approved conduit.

An electrical meter socket may be located below the BFE. If this option is chosen, PG&E will require a main disconnect located within four feet of the meter. A main disconnect located below the BFE may not be a circuit breaker. The remaining components of the service equipment must be located above the BFE.

## **8. Plumbing & Mechanical Limitations:**

All plumbing and mechanical equipment must be located above the BFE. "Plumbing and mechanical equipment" includes all heaters, furnaces, air conditioners, compressors, fans, water heaters, laundry facilities, plumbing fixtures, etc. Toilets and therefore toilet rooms are also prohibited below the BFE.

## **9. Limitations on Storage:**

**In general the lowest floor of all enclosed storage rooms and areas must be located one foot above the BFE.** The enclosed storage or parking space that may be permitted below the BFE is only that which is incidental and accessory to the principal use of the structure and used only to store damage resistant items that can not be stored above the base flood elevation. For instance, if the structure is a residence, storage in the enclosure should be limited to items such as lawn and garden equipment, snow tires, canoes, and other low damage items that cannot be stored in the elevated portion of the structure. The term "low damage items" is a good test of acceptability. If an item may be stored outdoors during bad weather or immersed under water without damage, it might be acceptable to store it in an enclosed area below the base flood elevation. The occupant should note that no flood insurance coverage is available for these items under most circumstances.

**Plans submitted for plan check must include the following statement limiting the use of storage space or garages located below the base flood elevation:**

Use of enclosed storage areas or garages below the Base Flood Elevation must meet all the following limitations:

- a. Use of this storage area must be incidental & accessory to the principal use of the structure, **and**
- b. Storage is limited to damage resistant items only, **and**
- c. Storage is limited to items that can not be stored above the base flood elevation.

**10. Floodways:**

Located within the SFHA are areas designated as floodways. Since the floodways are extremely hazardous due to the velocity of flood waters that carry debris, potential projectiles, and erosion potential, building and grading permits are extremely restricted. New construction is not allowed within a floodway, however elevation of existing structures is allowed when design provisions for moving water are provided. Please contact PBS for additional information.

**11. Other Information:**

Information on flood insurance is available from the NFIP by phone or on their Internet site. (<http://www.fema.gov/business/nfip/>). Elevation Certificates (FEMA form 81-31) can be obtained online at <http://www.fema.gov/pdf/nfip/elvcert.pdf>

Technical questions about flood regulations may be answered by FEMA, Region IX.

**ELEVATION CERTIFICATE PROCEDURE:**

**1. Site Review & Notice to Applicant:**

When an application for the construction of a building or a manufactured home (mobile home) installation is received by PBS, a site evaluation is made to identify any known hazard. If the building site is within the SFHA as shown on the FIRM, an Elevation Certificate (FEMA Form 81-31) will be required. After the site evaluation, the applicant will be notified of this requirement.

**2. Site Plan & Survey Information:**

The applicant must retain a registered civil engineer or licensed surveyor to determine the actual reference elevation of the site where the building is proposed. A benchmark indicating the elevation above the North American Vertical Datum 1988 (NAVD) must be placed at the site for use during construction. The elevation of the benchmark and the building pad must be determined by running a survey line using a closed loop level circuit from an established and approved benchmark.

Before the building plans can be approved and a permit issued, the site plan submitted must include the following information:

- a. The location and elevation of the benchmark.
- b. The elevation of the building pad.
- c. The proposed elevation of the "lowest floor" or the reference level.
- d. The wet signature, date, and license or registration number of the surveyor or civil engineer.

Sections must also be submitted before the plans can be approved. These sections must indicate:

- ✓ The location of the BFE as read from the most recently adopted FIRM.
- ✓ The reference level elevation. This is the top of the lowest floor of a building that is not flood resistant. In most cases this is the lowest finish floor of the building. (A common design

includes a garage floor below the BFE, garage walls made of flood resistant materials such as heavy timber or concrete or masonry, a one-hour rated sheetrock ceiling in the garage, and the habitable space located above the garage.) The reference level may have to be defined with notes as well as indicated graphically on the sections. **In all cases the reference level must be at least one foot above the base flood elevation.**

- ✓ All plumbing, electrical, and mechanical equipment must be shown on the plans and installed above the BFE.

### **3. Verification of Floor or Reference Level Elevation:**

After the building permit is issued, the builder uses the benchmark on site to construct the building floor or reference level to the correct elevation. When the floor framing is complete, the surveyor or engineer must survey the floor or reference level and complete their sections of the FEMA Elevation Certificate. Section B will already have been completed by PBS staff. If the reference level is not the lowest floor, this should be noted or explained on the plans or Elevation Certificate or both. The partially completed Elevation Certificate shall be available on-site for the Inspector's review at the time of the close-in inspection. The fully completed Elevation Certificate shall be provided to the Inspector at the time of the final inspection. This **must** be done before occupancy of the building.

**IMPROVEMENTS/REPAIRS TO BUILDINGS IN FLOOD HAZARD AREAS.** This section is intended to acquaint property owners with the specific code regulations that relate to additions, remodeling and repairs to existing buildings located in flood hazard areas. Call PBS for any questions.

### **GENERAL PROVISIONS FOR CONVENTIONAL (NON-ENGINEERED) RESIDENTIAL CONSTRUCTION FOR MENDOCINO COUNTY:**

The following information pertains to the requirements for wall bracing based on the 2010 California Building Code (CBC). This section contains the provisions for conventional wall bracing based on Chapter 23 of the 2010 CBC. For conventional bracing requirements applicable to projects that must comply with the requirements under the 2010 California Residential Code (CRC) see Section 21 in this manual.

#### **Chapter 23 2010 CBC:**

The following provisions apply to residential conventional construction in Seismic Design Categories D and E (Mendocino County). Conventional construction is a prescriptive method of design that does not require engineering. It may be possible to use conventional construction for most of a design and have engineering performed for a specific element or elements. For structures that do not meet the requirements of conventional construction, complete sets of engineering calculations will be required.

#### **REQUIREMENTS:**

**The following is a partial list of requirements for a residence to fall within the guidelines for conventional construction:**

Buildings shall be one or two family residences, private garages, or barns.

Buildings shall be limited to a maximum of **one** story above grade. For purposes of this section cripple walls shall not exceed 14 inches.

Bearing wall floor-to-floor heights shall not exceed a stud height of 10 feet plus a height of floor framing not to exceed 16 inches.

Roof trusses and rafters shall not span more than 40 feet between points of vertical support. Braced wall lines shall not be separated by more than 25 feet.

Spans for floor joists shall be in accordance with CBC Table 2308.8(2).

Conventional construction shall not be permitted with the following structural irregularities:

- Roofs or floors not supported on all four sides, except that roofs may have an overhang not to exceed six feet.
- Floors offset in height such that framing members cannot be lapped or tied together, unless all floor framing is directly supported on the foundation.
- Openings in floor and roof diaphragms having a maximum dimension greater than 50 percent of the distance between lines of bracing or an area greater than 25 percent of the area between perpendicular pairs of braced wall lines.

### **PROVISIONS:**

**Following are some of the provisions for building a conventionally framed building:**

**BRACED WALLS** - Braced wall lines shall occur in perpendicular directions and be spaced not more than 25 feet on center in either the longitudinal or transverse directions. Braced wall lines must be in line or offset from each other no more than 4 feet. Braced wall panels shall be distributed along the length of the braced wall line and start at not more than 8 feet from each end of the braced wall line. Braced wall panels shall be a minimum of 4 feet in length or one half of the floor to ceiling height whichever is greater. The sum of lengths of braced wall panels at each braced wall line shall conform to the wall bracing table below, or see California Building Code (CBC) table 2308.12.4. For wall lengths greater or lesser than 25 feet the total length of required bracing shall be at the same ratio as the table below, except that the requirements earlier this paragraph shall still apply.

All vertical joints of panel sheathing shall occur over studs and adjacent panel joints shall be nailed to common framing members. Horizontal joints shall occur over blocking or other framing equal in size to the studding except where waived by the installations requirements for the specific sheathing materials.

Braced wall panel top and bottom plates shall be fastened to joists, rafters or full-depth blocking. Braced wall panels shall be extended and fastened to roof framing at intervals not to exceed 50 feet between parallel braced wall lines.

Bottom plate fastening to joist or blocking below shall be with not less than 3-16d nails at 16 inches o.c. Blocking shall be nailed to the top plate below with not less than 3-8d toenails per block. Joists parallel to the top plates shall be nailed to the top plate with not less than 8d toenails at 6 inches o.c.

Braced wall lines shall be in the same plane vertically from the foundation to the uppermost story. Except that floors may have a cantilever or setback not to exceed four times the nominal depth of the floor joists provided:

- Floor joists are 2 by 10 or larger
- The ratio of the back span to the cantilever is at least 2:1
- Floor joists at ends of braced wall panels are doubled
- A continuous rim joist is connected to the ends of cantilevered joists. The rim joist may be spliced using a metal tie not less than 1.5 inches wide, 16 gauge galvanized with 6-16d common nails on each side
- Joists at setbacks or the end of cantilevered joists shall not carry gravity loads from more than a single story, nor carry the reactions from headers over 8 feet long

Where interior braced wall lines occur without a continuous foundation below, the length of required parallel exterior cripple wall bracing shall be multiplied by 1.5. Where this additional cripple wall bracing cannot be provided the edge nail spacing shall be decreased to 4 inches.



Where joists are perpendicular to braced wall lines above blocking shall be provided under and in line with the braced wall panels.

Adequate dimensions shall be provided on the braced wall plan in order to clearly locate all braced, alternately braced, and portal wall panels without scaling the plans.

#### WALL BRACING TABLE

(Minimum Length of Wall Bracing per each 25 Linear Feet of Braced Wall Line)

CONDITION	SHEATHING TYPE	$0.50 < \text{SDS} < 1.00$	$\text{SDS} > 1.00$
One Story	Gypsum Board	18 feet 8 inches	25 feet 0 inches
	Wood Structural Panels	9 feet 4 inches	12 feet 0 inches

NP = Not Permitted

Wood structural sheathing may be applied to both sides of a wall to reduce the required length of wall bracing by one-half.

Buildings shall be assumed to fall within the right farthest column of the bracing table unless documented otherwise. If you have the latitude and longitude of the building site, in decimal degrees, you can go to the USGS website and get a site specific value for SDS. Most sites within Mendocino County will have an SDS greater than 1.00 but there are areas that will fall into the less restrictive column of the bracing table. The following is the link to the USGS website:

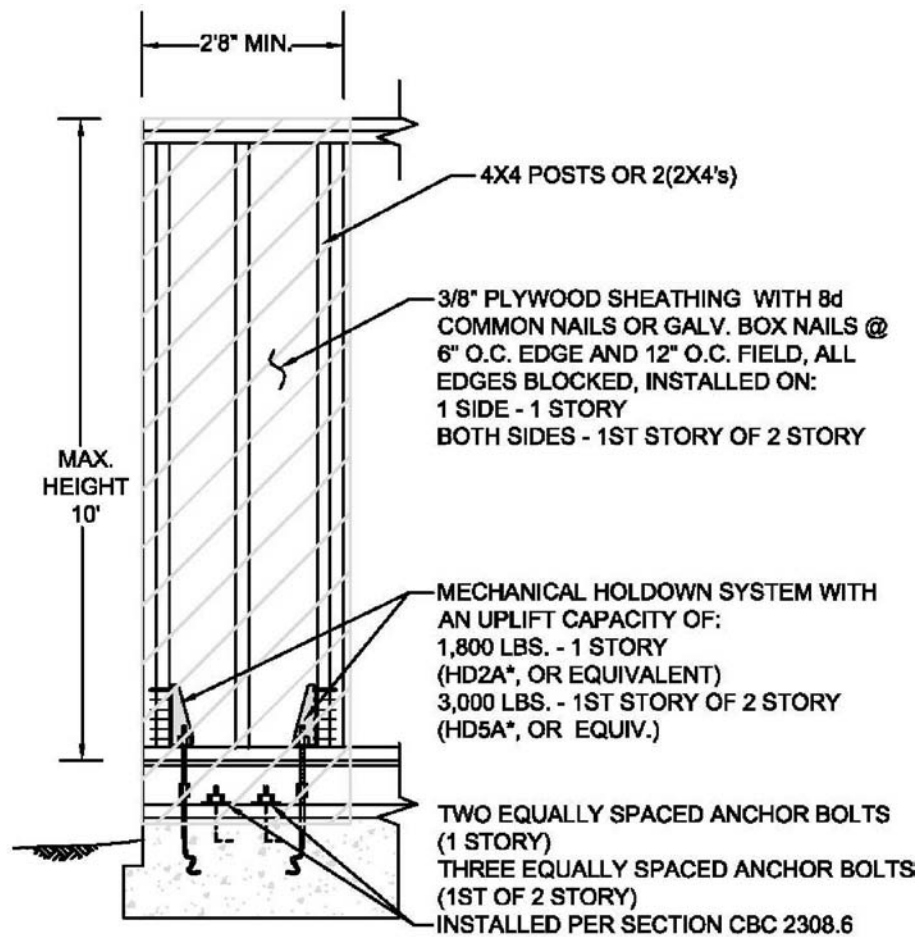
<http://earthquake.usgs.gov/research/hazmaps/design/>

Click on the ground motion parameter calculator. Assume a soil classification of D. The program will calculate several values. At the bottom of the printout will be a value for SDS with a soil class of D. This is the number to determine where you are in the wall bracing chart.

**ALTERNATE BRACED WALLS.** Alternate Braced Walls may be used in place of standard bracing at the rate of (one) - 2 foot 8 inch alternate braced wall panel for each four foot of required wall bracing.

Alternate braced panels shall be sheathed on one face with minimum  $\frac{1}{2}$ " wood structural panel sheathing nailed with 8d common or galvanized box nails per standard nailing table and blocked at wood structural panel edges. Two anchor bolts shall be installed in each panel. Each panel end stud shall have a tie-down device capable of providing an uplift capacity of not less than 1800 pounds (HD2A or better).

Alt braced panels shall be supported directly on a continuous foundation or on floor framing supported directly on a continuous foundation. Alt braced panels shall not be supported on a cripple wall.

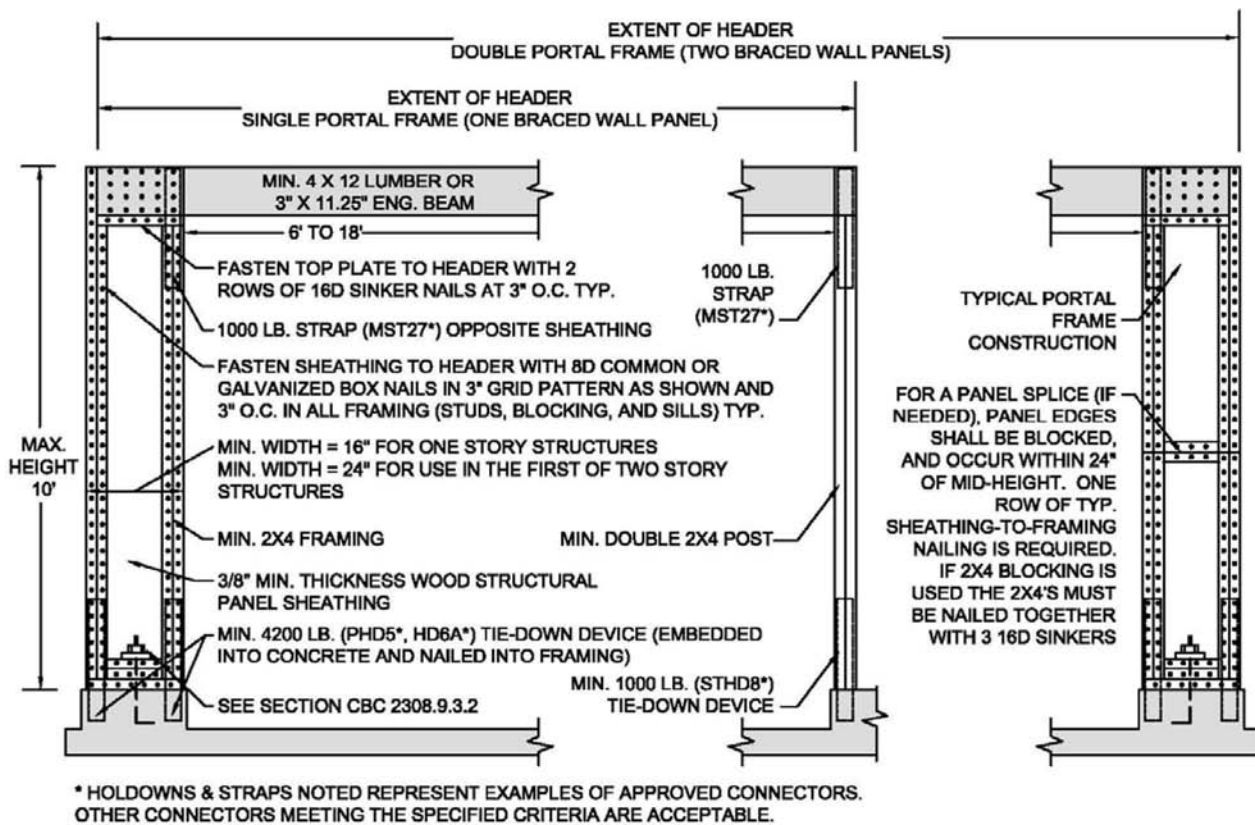


**ALTERNATE BRACED WALL - 1-STORY  
AND 1ST STORY OF 2-STORY STRUCTURE**

**PORTAL FRAME.** The following may be used adjacent to a door or window opening with a full-length header. Each panel shall have a length of not less than 16 inches and a height of not more than 10 feet.

Each panel shall be sheathed on one face with minimum  $\frac{3}{8}$ " wood structural panel sheathing nailed with 8d common or galvanized box nails per standard nailing table. The panel sheathing shall extend up over the solid sawn or glu-lam header and shall be nailed in accordance with the figure below. The header shall extend between the inside faces of the first full-length outer studs of each panel. The clear span of the header between the inner studs of each panel shall be not less than 6 feet and not more than 18 feet in length. A strap with an uplift capacity of not less than 1,000 pounds (MST27) shall fasten the header to the inner studs opposite the sheathing. One  $\frac{3}{4}$ " anchor bolt shall be provided in the center of each sill plate. Each panel end stud shall have a tie-down device capable of providing an uplift capacity of not less than 4,200 pounds (PHD5, HDA6)

Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening. The bearing studs shall also have a tie-down device with an uplift capacity of 1,000 pounds (STHD8).



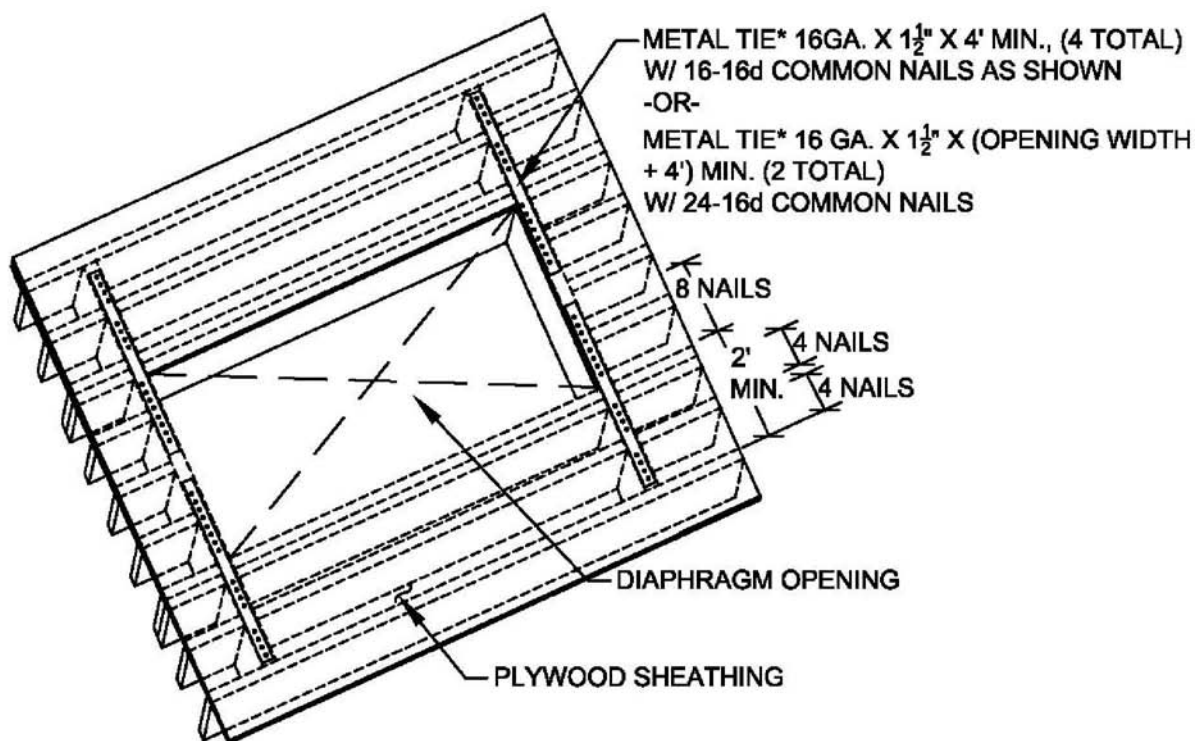
### **ALTERNATE BRACED WALL PANEL ADJACENT TO A DOOR OR WINDOW OPENING**

**GIRDERS** - Girders shall not be less than 4 X 6 inches for spans 6 feet or less, provided that girder are spaced not more than 8 feet o.c. Girder end joints shall occur over supports. The ends of beams or girders supported on masonry or concrete shall not have less than 3 inches of bearing. Other girders shall be engineered.

**TOP PLATES** - End joints in double top plates shall be offset at least 48 inches, and shall be nailed with not less than eight 16d nails on each side of the joint. Plates shall be a nominal 2 inches in depth and have a width at least equal to the width of the studs.

**WIND UPLIFT** - Roof assemblies shall have rafter and truss ties to the wall below. Using the limitations at the beginning of this section a hurricane tie with an uplift capacity of 490 pounds (H1/H2.5 or H2.5A at wind exposure D) at each rafter will meet this requirement. **Note:** The nailing schedule must still be used for ceiling joist to rafter and rafter to plate connections.

**OPENINGS IN HORIZONTAL DIAPHRAGMS** - Trimmer and header joists shall be doubled when the header span exceeds 4 feet. The ends of header joists exceeding 6 feet shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall.



**BLOCKING SHALL BE PROVIDED BEYOND HEADERS**

## **REQUIREMENTS FOR HORIZONTAL OPENINGS**

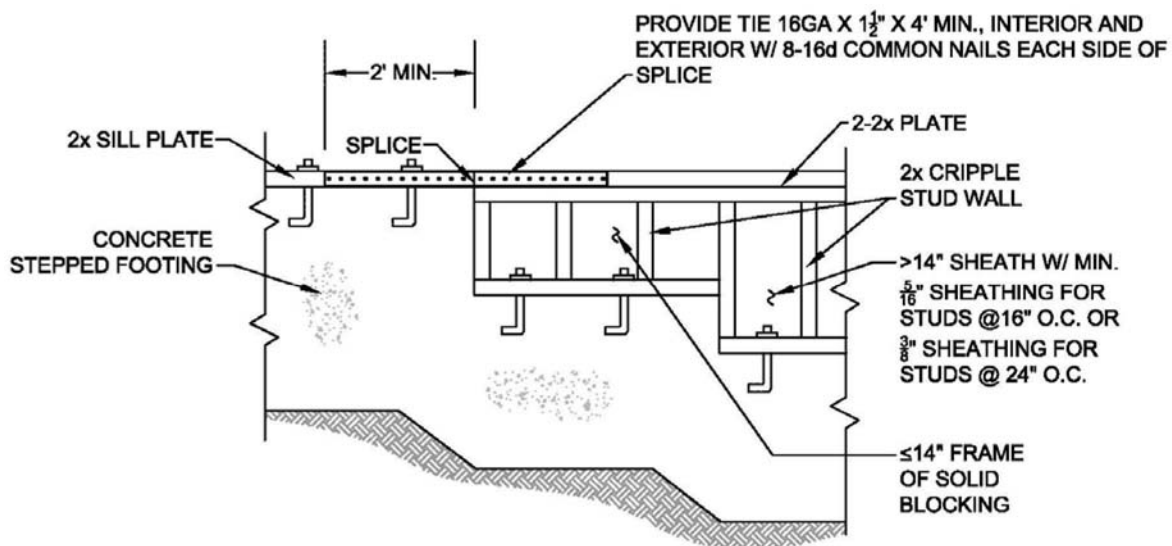
For additional framing details see Section 8 of this manual or the CBC Volume 2. **SILL ANCHORAGE** - Foundation plate or sills shall be bolted to the foundation. Bolts shall be embedded a minimum of 7 inches into concrete or masonry and spaced not more than 6 feet apart. There shall be a minimum of two bolts per piece with one bolt located not more than 12 nor less than 4 inches from each end of the piece.

Anchor bolts shall be  $\frac{5}{8}$  inch minimum in Seismic Design Category (SDC) E and  $\frac{1}{2}$  inch minimum diameter in SDC D (SDC E shall be assumed unless it can be documented that the proposed structure is in SDC D.)

All anchor bolts shall have steel plate washers a minimum of 3 inch by 3 inch by 0.229 inch thick. Plate washers shall be permitted to be diagonally slotted with a width of up to  $\frac{3}{16}$ " larger than the bolt diameter and a slot length not to exceed  $1\frac{3}{4}$  inches provided a standard cut washer is placed between the plate washer and the nut.

**FOUNDATION WALLS.** Concrete foundation walls are permitted up to 8 feet in height with a maximum of 4 feet of unbalanced fill. Concrete foundation walls shall be a minimum of 7.5 inches in width. Non-Engineered concrete walls shall not extend above the floor framing for the first floor. Foundation walls shall have a minimum of one number four rebar at the top of the wall and bottom of the footing with three inches clear. Foundation walls not meeting this criteria shall be engineered. At this point in time there are no provisions for non-engineered masonry foundation walls in our seismic design categories.

**STEPPED FOOTINGS.** Where the bottom of a footing is stepped and cripple wall height varies more than 4 feet along a wall line strapping is required at the joint between the area where the lowest floor framing rests directly on a sill bolted to a footing and the cripple wall. The double plate of the cripple stud wall shall be spliced to the sill plate with metal ties, one on the interior, one on the exterior. The metal ties shall not be less than 16 gage galvanized by 1.5 inches wide by 48 inches long with eight 16d common nails on each side of the splice location.



**CRIPPLE WALLS.** Foundation cripple walls shall be framed of studs not less in size than the studs above. Cripple walls exceeding 14 inches in height shall be considered a story and shall be braced according to the braced wall table. Cripple walls 14 inches or less in height shall be framed of solid blocking.

For additional foundation details please see Section 7 of this manual or the CBC Volume 2.

**ANCHORAGE OF EXTERIOR MEANS OF EGRESS.** Exterior balconies, decks, stairways, or similar means of egress shall be positively anchored to the primary structure at not over 8 feet o.c. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal. (The use of LTT19's would be a typical option).

**veneer.** All masonry veneer shall be required to be engineered in SDC E. Masonry veneer shall be permitted to be installed at the first story only in SDC D subject to the following limitations:

- Walls must be braced with structural panels rather than gypsum board.
- A minimum of 45 percent of each wall line shall be braced panels.
- Hold-downs shall be provided at the ends of braced walls on the first story with an allowable design of 2,100 pounds (HD2A w/double 2x).
- Cripple walls shall not be permitted.

The provisions of this section (20) generally reflect minimum code requirements. However, in some instances more conservative values were taken to simplify complex code sections. For the exact code language the reader should refer to the California Building Code Volume 2. For code interpretations building division staff are available at PBS.

## **WALL BRACING USING THE 2010 CALIFORNIA RESIDENTIAL CODE (CRC)**

Projects that have been determined to be within the D2 seismic design category (SDC) or that have been recategorized to SDC D2 and have no features that would cause them to be considered "irregular" may use the prescriptive wall bracing methods of the CRC. All other projects must use the California Building Code (CBC).

A building or portion of a building shall be considered irregular when the following conditions exist:

1. Floors that are not stacked directly above each other creating a cantilever or setback condition, unless meeting all of the following conditions:
  - a. Floor joists are nominal 2" X10" or larger and spaced no more than 16" o.c. (9.5" I joists meet this condition)
  - b. Cantilever or setback shall not exceed 4 x the nominal depth of joists
  - c. The ratio of the back span to cantilever is at least 2 to 1
  - d. Floor joists at the ends of braced wall panels are doubled
  - e. A continuous rim joist is connected to the ends of all cantilevered joists
  - f. Gravity loads at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers with a span of 8' or less

Note: Buildings located in SDC E using this code shall have no cantilevers

2. Roofs or floors that are not supported on all four sides by braced wall lines, except that roof overhangs and/or balconies may extend up to 6' beyond a braced wall line.
3. When the end of a braced wall panel extends more than one foot over an opening below unless supported by a header per Table. In no case may the entire braced wall panel be over an opening.

4. When an opening in a floor or roof exceeds the lesser of 12' or 50% of the least floor or roof dimension.
5. When portions of a floor level are vertically offset from each other, unless all floor framing members are supported by continuous perimeter foundations, or when floor framing is lapped and tied together.
6. When braced wall lines do not occur in two perpendicular directions.
7. When braced wall lines include concrete or masonry construction.

**Table**  
Header size for openings below braced wall panels

Width of opening below braced wall panel	Required header size
4'	(1) 2x12 or (2) 2x10
6'	(2) 2x12 or (3) 2x10
8'	(3) 2x12 or (4) 2x10

**FOUR MAJOR FACTORS TO CONSIDER WHEN DESIGNING FOR BRACED WALL LINES ARE:**

1. Type of Bracing – gypsum board, wood structural panel, others
2. Placement of braced wall panels with respect to corners
3. Maximum spacing allowed between braced wall lines and between braced panels within a braced wall line
4. Required length of wall bracing per braced wall line and minimum required dimensions

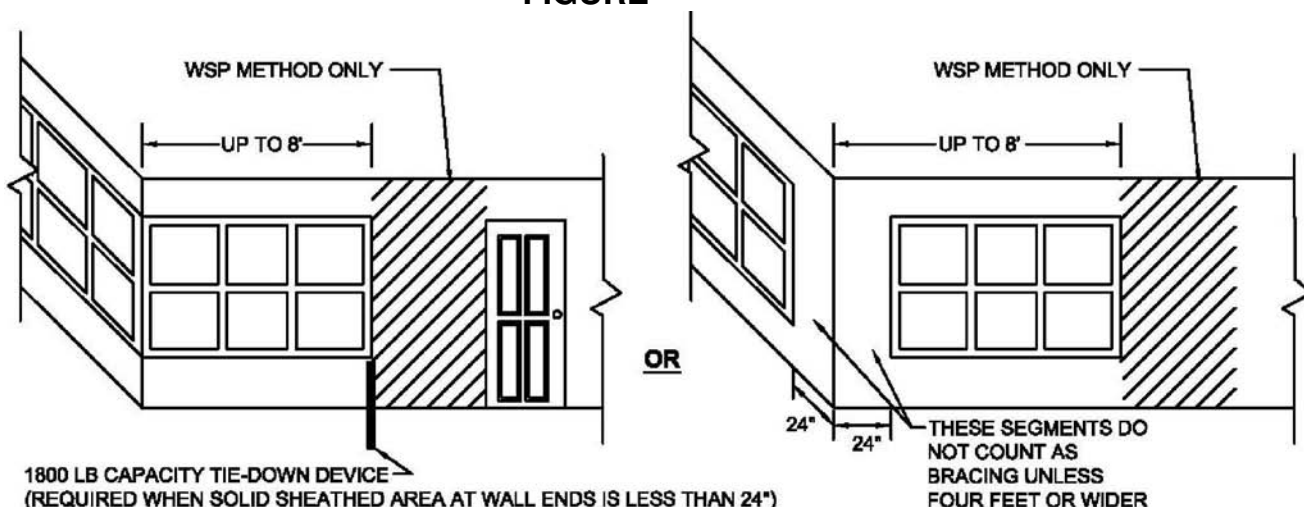
**TYPE OF BRACING.** The CRC allows a number of types of wall siding, including wood structural panel (**WSP**), double-sided gypsum wallboard (**GB**), structural fiberboard sheathing (SFB), Portland cement plaster (PCP), and others to be used as wall bracing material. This manual addresses the more commonly used methods of bracing: WSP and GB as well as Alternate Braced Walls (**ABW**) and Garage Portal Frames (**PFH**) only. These aforementioned methods are all considered types of intermittent bracing. The code allows for the use of a continuous bracing method, however that method is outside of the scope of this chapter. Any of the methods listed in the CRC for use in SDC D2 are permissible even if not addressed in this manual.

WSP, which is typically plywood or oriented strand board (OSB), shall be a minimum W" thickness and shall be nailed with 6d common for W" board and 8d common for 7/16" thickness. In each case nail spacing shall be 6" at the edges and 12" in the field.

GB shall be a minimum of 1/2" thick and shall be attached with nails or screws at 7" spacing at panel edges, with nails spaced at 8" in the field and screws spaced at 12" or 16" in the field for framing members spaced at 24" and 16" respectively, for interior applications. For gypsum board applied to the exterior of walls all faster spacing shall be 7". Nails shall be 1 1/2" galvanized for 1/2" gyp board and 1 1/4" for 3/4" gyp board. Screws shall be type W or S, 1 1/4" for 1/2" board and 1 3/8" for 3/4" board.

**PLACEMENT OF BRACED WALL PANELS.** Braced wall lines at exterior walls shall have a braced wall panel at each end of the braced wall line unless meeting the following conditions: For the WSP method braced panels may begin no more than 8' from ends as long as there are minimum 2' wide panels on each side of the corner in question (these will not be counted towards the required bracing lengths unless they are at least four feet in length). Or, the 2' sections may be omitted if a tie-down device with a minimum capacity of 1800 lbs is fastened to the stud at the end of the braced panel closest to the corner and attached to the foundation or framing below. See Figure 21-1.

**FIGURE**



### BRACED WALL PANELS ADJACENT TO CORNERS

**MAXIMUM SPACING.** Maximum spacing has two components: maximum spacing separating two braced wall lines and maximum spacing from one braced panel to the next within a given wall line.

Within a braced wall line there must be braced panels that do not exceed 25' separation when measured from the center line of each panel. For panels greater than four feet in length the measurement can be taken two feet into the panel such that the maximum spacing between the panels does not exceed 21'.

The maximum distance between two parallel braced wall lines is 25'. There are two exceptions that allow the spacing to be increased to 35':

- The first exception allows for one pair of braced wall lines to be increased to a maximum of 35' for one room in a dwelling not to exceed 900 square feet overall. No adjustments are required and all other braced wall pairs may not exceed 25' spacing.
- The second exception allows an increase up to 35' providing the length of bracing is increased in accordance with Table 21-2, the aspect ratio of the floor/roof above does not exceed 3:1, and the top plate is spliced with (12) 16d nails on each side of the splice. This option must be used if there will be more than one set of braced wall lines with greater than 25' separation.

**Table**  
Adjustment for wall lines where spacing exceeds 25'

Braced Wall Line Spacing (feet)	Multiply Required Bracing Length by
25	1.0
30	1.2
35	1.4

- Values may be interpolated
- Where a braced wall line has a parallel braced wall line on both sides, the larger adjustment factor shall be applied.



**REQUIRED LENGTH OF WALL BRACING.** The minimum required length of wall bracing in a braced wall line shall be the greater of: the calculated minimum for wind, the calculated minimum for seismic, or the minimum required panel size.

The minimum wind requirement is calculated by taking the greater of the distances between a braced wall line and the next parallel braced wall line and looking up the base number in Table 21-3, then multiplying that number by the wind adjustment factors one by one as they apply.

The minimum seismic requirement is calculated by taking the full length of each braced wall line, using that length to look up the base number in Table 21-4 and then multiplying by any seismic adjustments that apply.

The minimum length of wall line that can be counted towards meeting the braced wall requirement is 4' for WSP and 8' for GB. ABW & PFH have their own specific minimums and are each allowed to be substituted for 4' of required wall bracing despite the fact that they are both shorter in length.

**Example 1:** Calculating the required length of wall bracing for an individual wall line.

For line C Example Problem 21-1 (see Fig 21-2 p 21-7) the spacing between wall lines B & C is 25' and the length of wall line C is 20'.

In the wind table the basic value for wall line spacing 25', WSP, single story is 4.3. The adjustment factor for exposure C, single story is 1.2, for eave-to-ridge height rounding up from 8' to 10' gives a factor of 1.0, there are 3 braced lines in the direction of line C for a factor of 1.3. Multiplying the result is:  $4.3 \times 1.2 \times 1.0 \times 1.3 = 6.7'$  for required bracing for wind.

For seismic the length of line C is 20' so the minimum wall bracing required without adjustments is 5.0'. In this example the wall height and wall and roof/ceiling loads are all standard and no adjustments need be applied.

The calculated wind minimum is 6.7'; the calculated seismic minimum is 5.0'. The 4' panels that are required at each end of the wall line exceed the calculated wind and seismic minimums therefore the (2) 4' panels govern and this wall will meet the wall bracing requirement with 8' of wall bracing.

**Table**

**BRACING REQUIREMENTS FOR WIND**

85 mph wind speed, Exposure B, 10' eave-to-ridge height, 10' wall height, 2 braced wall lines.  
(Measurements in Feet) See below for adjustment factors.

Story Location	Braced Wall Line Spacing (between wall lines)	Gypsum Board (Double Sided)	Wood Structural Panel
One story or top of a two story	10	3.5	2.0
	15	4.8	2.8
	20	6.0	3.5
	25	7.3	4.3
	30	8.5	5.0
	35	10.0	5.8
Bottom story of a two story	10	6.5	3.5
	15	9.0	5.0
	20	11.5	6.5
	25	14.0	8.0
	30	16.5	9.5
	35	19.0	11.0

This table and the adjustment factors tables may be interpolated. For ease of use it may be simpler to round up. For instance if your eave-to-ridge height is 8' you may elect to use the value in the table for the eave-to-ridge height of 10', likewise for a wall spacing of 23' you may elect to use the value based on a 25' spacing.

NUMBER OF STORIES	EXPOSURE/HEIGHT FACTORS		
	Exposure B	Exposure C	Exposure D
1	1.0	1.2	1.5
2	1.0	1.3	1.6

SUPPORT CONDITION	ROOF EAVE-TO-RIDGE HEIGHT			
	5 ft or less	10 ft	15 ft	20 ft
Roof only	.7	1.0	1.3	1.6
Roof + floor	.85	1.0	1.15	1.3

NUMBER OF BRACED WALL LINES	ADJUSTMENT FACTOR
3	1.30
4	1.45
5 or more	1.60

For WSP & GB (& other) bracing methods the values are based on the application of gypsum board to the opposite face. If that is omitted a factor of 1.4 must also be applied (to the calculated minimum for wind). This does not apply t o A B W & P F H s y s t e m s .

**Table**  
**BRACING REQUIREMENTS FOR SEISMIC**  
**(AS A FUNCTION OF BRACED WALL LINE LENGTH)**

Seismic Design Category D2, 10' Wall Height,

10 PSF Floor dead load, 15 PSF roof/ceiling dead load		Minimum total length (feet) of braced wall panels required along each wall line	
Story Location	Braced wall line length	Gypsum Board (Double Sided)	Wood Structural Panel
One story or top of a two story	10	4.0	2.5
	20	8.0	5.0
	30	12.0	7.5
	40	16.0	10.0
	50	20.0	12.5
Bottom story of a two story	10	7.5	5.5
	20	15.0	11.0
	30	22.5	16.5
	40	30.0	22.0
	50	37.5	27.5

Adjustment factors to the length of required seismic wall bracing.

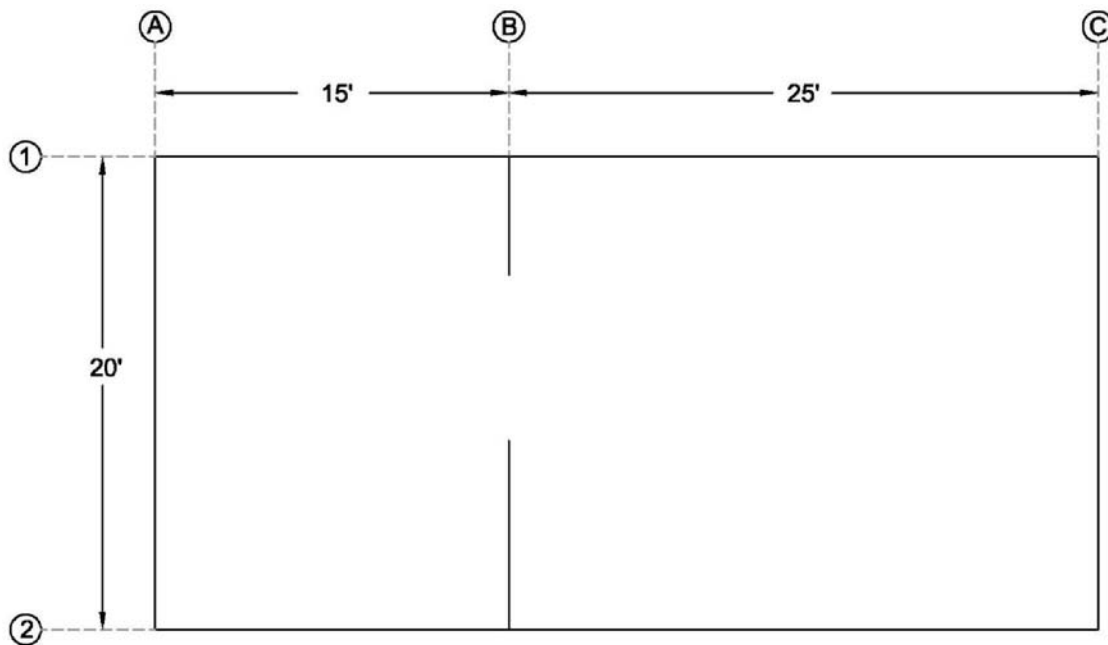
Adjustment based on:			Adjustment Factor
Story Height	< 10'		1.0
	> 10' < 12'		1.2
Wall Dead Load	> 8 < 15 psf		1.0
	< 8psf		0.85
Roof/ceiling dead load for wall supporting	Roof only story of and 1	< 15psf	1.0
	Roof only	< 15 psf < 25 psf	1.1
	Roof plus 1 story	< 15 psf < 25 psf	1.2

For WSP & GB (& other) bracing methods the values are based on the application of gypsum board to the opposite face. If that is omitted a factor of 1.5 must also be applied (to the calculated minimum for seismic). This does not apply to ABW & PFH systems.

**MATERIAL WEIGHTS – DEAD LOADS.** There are assumptions made in the seismic bracing table regarding material weights. A standard wood framed wall has a dead load of approximately 11 to 12 pounds per square foot (psf). The seismic table assumes a wall material weight of 8–15 psf. Similarly a standard wood framed roof/ceiling with comp or wood shingles has a weight that varies from 10 to 15 psf. If 15 psf is exceeded an adjustment factor must be applied.

In general, walls that exceed 15 psf and roof/ceilings that exceed 25 psf must have an engineering design and may not use standard wall bracing methods, although there are provisions for adding veneer to a first story that are outside the scope of this document.

**Figure**  
(Example Problem)



ONE STORY, EXPOSURE C, 8' EAVE TO RIDGE HEIGHT, 9' WALL HEIGHT,  
COMPOSITION ROOF, WOOD SIDING, WSP METHOD

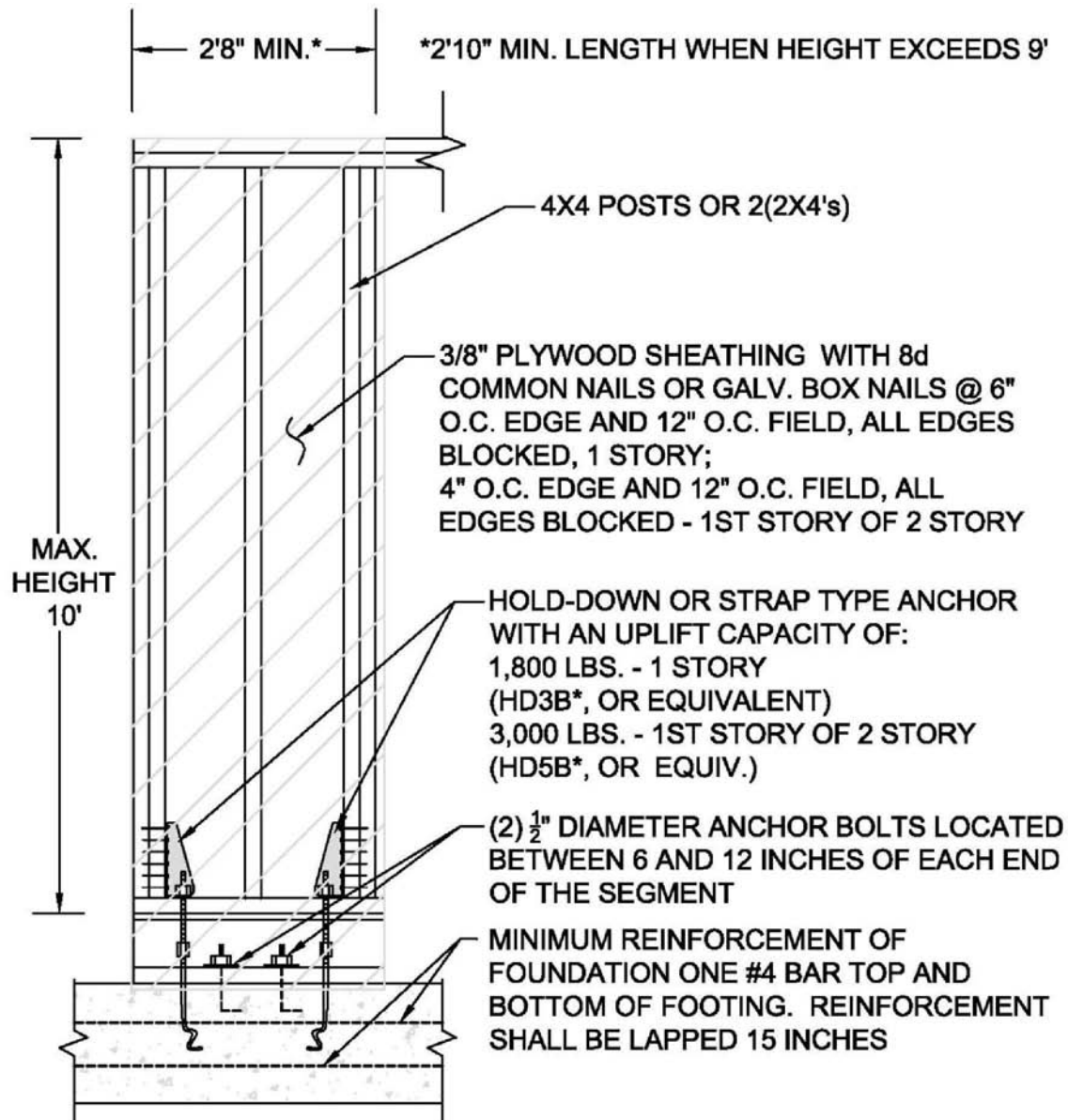
**ALTERNATE BRACED WALLS (ABW) AND PORTAL FRAMES WITH HOLD-DOWNS (PFH).**

Two alternatives to standard wall bracing are ABW and PFH. Both of these alternatives allow for a section of wall that is less than 4' in width to be substituted for a 4' width. The PFH is designed to be used next to a large opening, typically a garage door, and the ABW is a more general application.

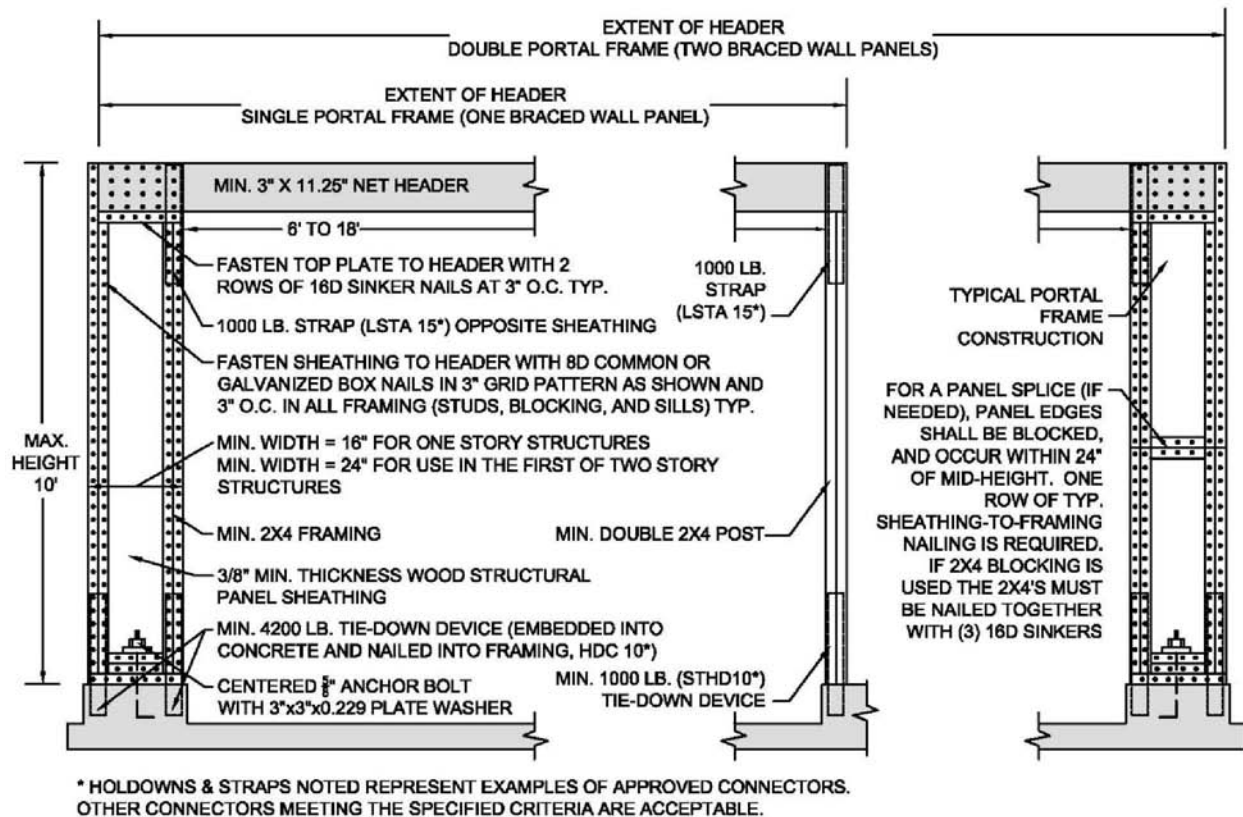
ABWs and PFHs may be used in a one story or on the first story of a two story only. ABWs must be supported directly on a foundation or on floor framing supported directly on a foundation which is continuous the entire length of the braced wall line. PFHs shall be supported directly on a continuous foundation. PFHs may not be used in a raised application.

ABWs shall be sheathed on one side with minimum ~" thick sheathing attached with 8d nails at 6" o.c. at edges and 12" o.c. in the field for single story construction. Edge nailing shall be reduced to 4" o.c. for ABWs on the first floor of two story construction. See Figure 21-2 for complete attachment information.

Portal frames with hold-downs shall be sheathed on one side with a minimum of ~" thick sheathing with 8d nails at 3" o.c. at all framing members and in a 3" grid at the header. See Figure 21-3 for complete attachment information.



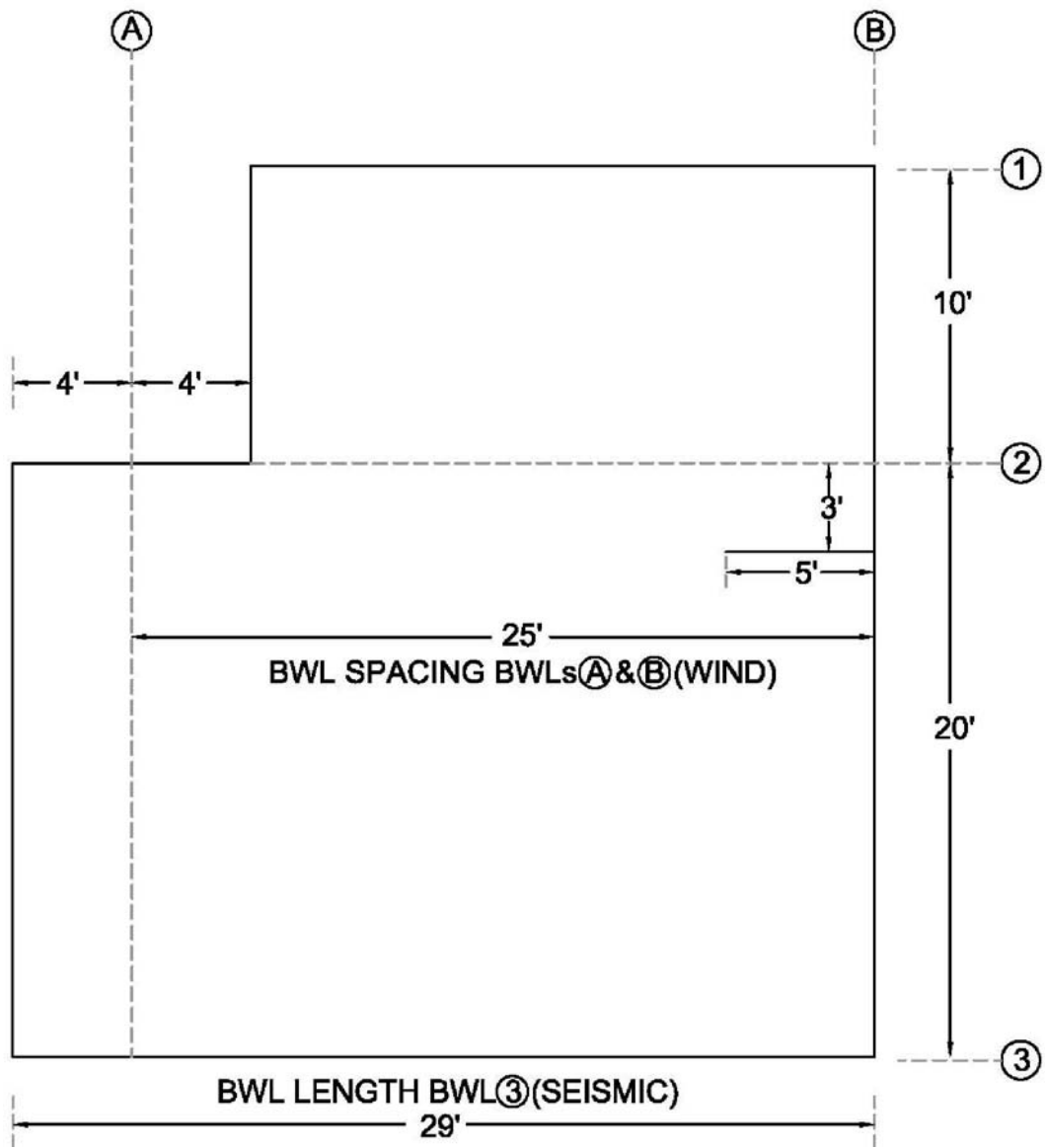
## **ALTERNATE BRACED WALL (ABW)** **1-STORY AND 1ST STORY OF 2-STORY STRUCTURE**



### **PORTAL FRAME WITH HOLD-DOWNS (PFH)**

**ASSUMED (IMAGINARY) BRACED WALL LINES.** A new addition to bracing design is the concept of an assumed braced wall line. When there are minor offsets along the length of a braced wall line, or in the case of a cutout corner it is possible to use an imaginary or assumed braced wall line. In order to use assumed braced wall lines the offset from an actual line to an assumed line may not exceed 4'. See Figure 21-4 for an example of an assumed wall line. Notice that braced wall line (BWL) A is chosen such that the lines in parallel with it are offset no more than 4' from the assumed line. In the other direction it is not possible to choose an assumed line between BWLs 1 and 2 that would not exceed the 4' offset for one or both lines. In this instance BWL 1 and 2 must correspond to the actual wall lines.

It is not permissible to choose assumed lines 4' inside of all the actual lines in an effort to reduce the overall bracing requirements.



In Figure 21-5 notice that the separation distance between BWLs A and B is the distance between an assumed line and an actual line. However when calculating seismic requirements the entire length of line C must be used, corner to corner.

The 5' segment that is offset from line 2 may be used towards the required bracing amount for line 2 because the offset is less than 4'. Also, because the segment is less than 8' it must be WSP method rather than GB which would require a minimum 8' length.

**CRIPPLE WALLS.** Cripple walls shall be sheathed with the same type of sheathing as the wall above (typically WSP). The minimum length of bracing shall be the length of bracing required for the wall above multiplied by 1.15.

The maximum distance between braced panels within a wall line in a cripple wall is 18 feet measured center to center, such that the maximum permitted length of unbraced wall line in a cripple wall is 14 feet.

Additionally, in the case where an interior braced wall line occurs without a continuous foundation below, the length of cripple wall bracing in the walls parallel to the interior braced wall line shall be the required length of bracing of the wall above multiplied by 1.5 . Where that number results in an amount that cannot be achieved the capacity of the cripple wall bracing may be increased by decreasing the edge nailing to 4 feet o.c in lieu of the 1.5 multiplier.

Cripple walls that exceed 4' shall be framed of studs as if for an additional story.

**STORY HEIGHT, STORY HEIGHT LIMITS, AND MAXIMUM STUD HEIGHT.** Story height is measured from the top of the floor framing to the top of the ceiling joists or floor framing of floor above. The story height limit is the sum of the allowable maximum stud height plus up to 16" of floor/ceiling framing. Adding in 1" for floor sheathing results in a maximum story height limit of 11' 7" for 10' wall studs.

Stud height may be increased up to 12' by applying additional factors to the required wall bracing lengths. For studs greater than 10' in height apply a factor of 1.1 to the required wall bracing for wind and a factor of 1.2 to the required wall bracing for seismic. Adding in the floor framing and sheathing allowance increases the maximum story height to 13' 7" for 12' studs.

**Table**

Maximum Stud Height	Bracing Increase Factor	Maximum Story Height
10'	N/A	11' 7"
12'	1.1 for wind; 1.2 for seismic	13' 7"

While the story height is limited per Table 21-5 it is possible to have taller studs to provide balloon framing at gable end walls and entry foyers. Wall sections with studs that exceed the maximum story height must be placed between braced wall panels and will not be counted towards the minimum required length of wall bracing.

Maximum stud height for non braced wall sections in gable end walls and entry foyers shall be per Table 21-6.

**Table 21-6**

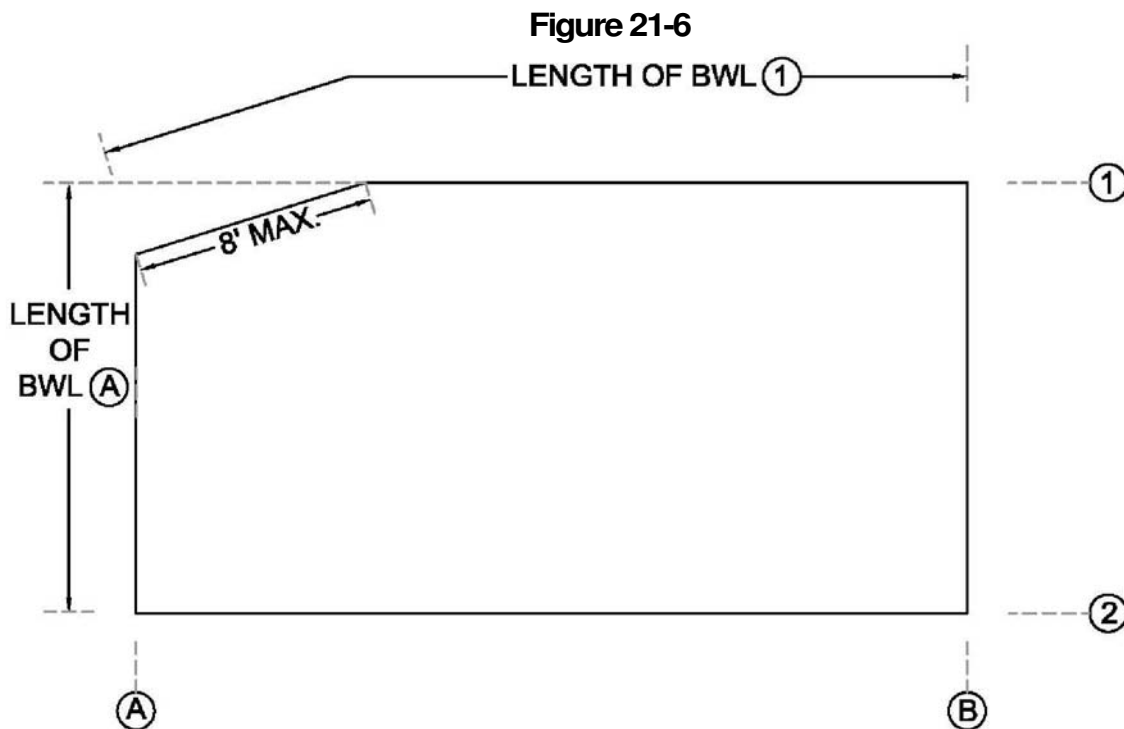
Height (feet)	24" stud spacing	16" stud spacing	24" stud spacing	16" stud spacing
	Supporting roof only		Supporting one floor & roof	
10	2 x 4	2 x 4	2 x 6	2 x 4
12	2 x 6	2 x 4	2 x 6	2 x 6
14	2 x 6	2 x 6	2 x 6	2 x 6
16	2 x 6	2 x 6	NA	2 x 6
18	NA	2 x 6	NA	2 x 6

Utility, standard, stud and No. 3 grade lumber is not permitted. This table assumes eaves not over 2'.



**DIAGONAL WALL SEGMENTS –ANGLED CORNERS.** In order to be considered a 'regular' building and to use the CRC bracing provisions braced wall lines must occur in perpendicular directions. However, it is possible to have an angled line at the corner of the building and still be considered 'regular'. A wall segment of up to 8' in length and no more than 45 degrees is permissible. The wall segment would be counted as a continuation of the adjacent wall and its length would be added to the length of the adjacent wall when determining the amount of required wall bracing. If the wall segment is exactly at 45 degrees it may be counted with either but not both of the adjacent wall lines. See Figure 21-6

The wall segment is subject to the standard requirements for wall bracing. It may have wall bracing at the corner or if it contains the entryway for the house and there is not room for bracing than the 8' rule applies.

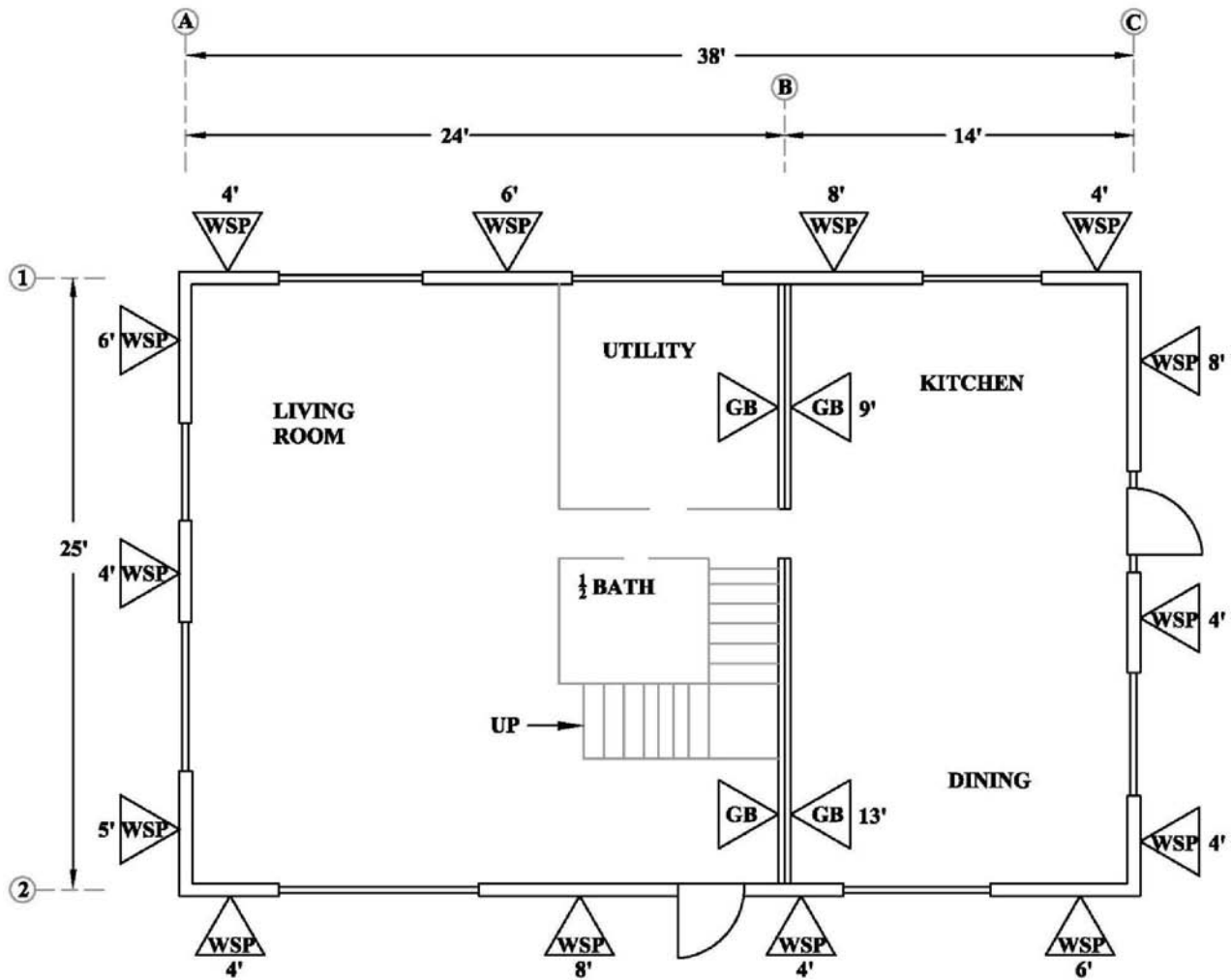


**MIXING OF BRACING METHODS.** Braced wall methods may be mixed between floors of a house and between wall lines but not within a wall line. For instance, exterior wall lines will typically be braced with WSP while interior wall lines may be braced with GB or WSP. They may not contain both bracing methods within an individual braced wall line. The alternate bracing methods ABW and PFH are substitutions and may be used within a wall line that is braced with WSP.

**Example 2 – How to calculate and document a wall bracing plan:**

Example 2 is the lower floor of a 2 story residence. Exposure B, eave-to-ridge height 8', wall height 10', gypsum board on the interior walls, and foundation under the interior braced wall line.

**Figure 21-7 (Example 2)**



The wind value is obtained by looking up the value in the wind chart and applying all relevant adjustment factors. Notice that there are parallel lines on either side of line B, the larger distance of 24' is used in determining the spacing between braced wall lines.

Similarly the seismic value is obtained from the seismic table and any relevant adjustment factors are applied. Standard light framed wood construction with 8-10' ceilings will infrequently have seismic adjustment factors. Values are then displayed in a tabular form. The actual length of bracing provide for each line is compared to the required amounts for both wind and seismic.

Wind Adjustments	Numbered Lines	Lettered Lines
Wind Exposure	1.0	1.0
Eave-to-Ridge Height *	0.94	0.94
Number of Braced Wall Lines	1.0	1.0
No Gyp on Interior	N/A	N/A
Cripple Wall Adj	N/A	N/A
<b>Total Wind Adjustment</b>	<b>0.94</b>	<b>1.22</b>

\* For simplicity this adjustment factor may be taken as 1.0

Seismic Adjustments	All Wall Lines
Story Height	1.0
Wall Dead Load	1.0
Roof/Ceiling Dead Load	1.0
No Gyp on Interior	N/A
Cripple Wall Adj	N/A
<b>Total Seismic Adjustment</b>	<b>1.0</b>

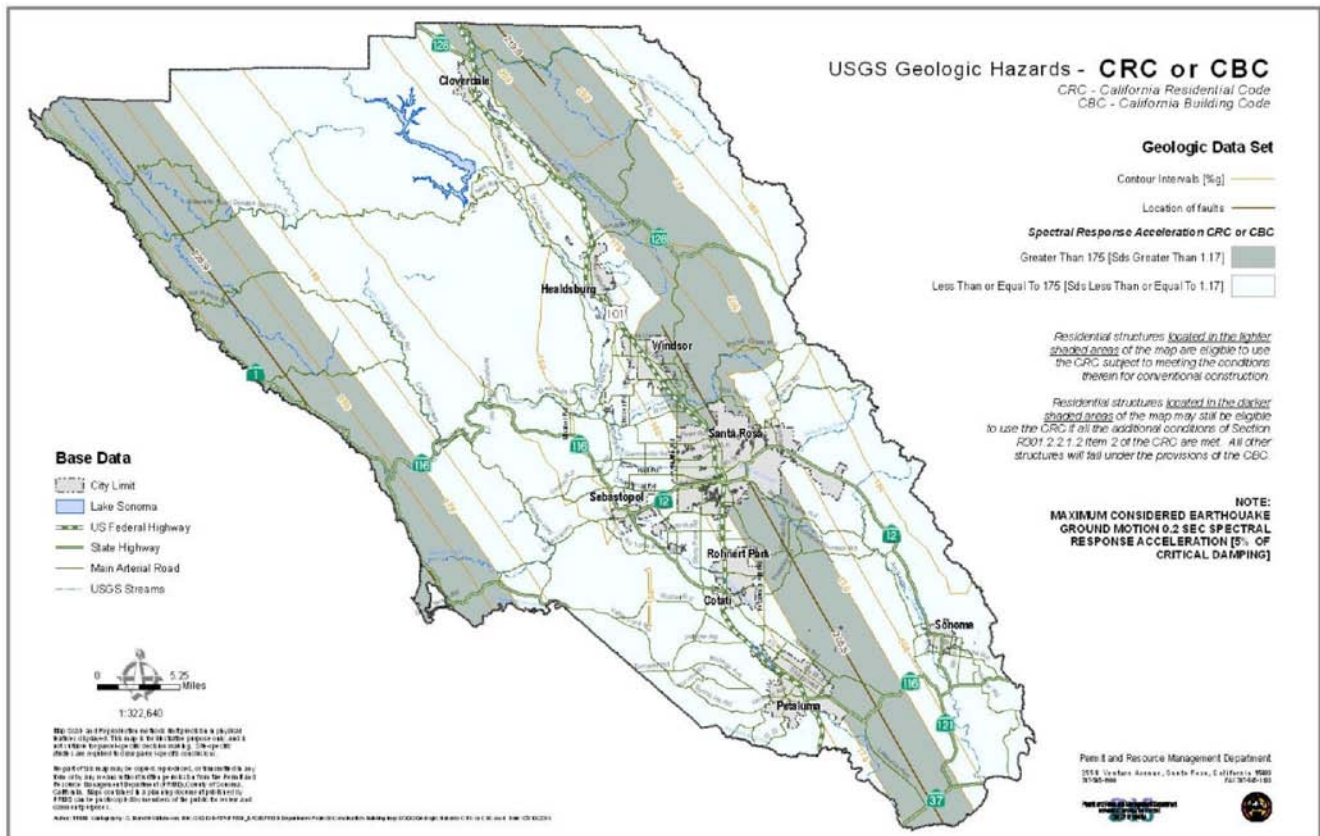
The above adjustments are presented in a table format for ease of understanding. They may be presented as a list or any format that is easily readable. The following table or one similar should be provided for all braced wall plans with a wall bracing diagram similar to Figure 21-7. In the table below seismic adjustment factor has been omitted as it is 1.0 throughout. In the event that the seismic adjustment factor varies it shall be incorporated in the table.

Braced Wall Line	Bracing Type	Wind Table Value	Wind Adjustment Factor	Wind Requirement	Seismic Table Value	Bracing Length Provided	Status
1	WSP	8.0	.94	7.52	20.9	22	✓
2	WSP	8.0	.94	7.52	20.9	22	✓
A	WSP	7.7	1.22	9.40	13.75	15	✓
B	GB	13.5	1.22	16.47	18.75	22	✓
C	WSP	4.7	1.22	5.73	13.75	16	✓

Bracing has been shown to be adequate for this floor. The same process is repeated for the upper floor and two tables should be presented for a two story project.

**SEISMIC DESIGN CATEGORIES.** In the map of Figure 21-8 the lighter colored areas represent SDC D2. The darker colored areas represent SDC E. For a project that is located in SDC E there are some conditions that may allow a project to use the CRC as if it was in D2. Information about these conditions is available in the 2010 CRC and by contacting PBS Building Plan Check Staff.

### Figure 21-8



### **Additional Available Resources**

2010 California Residential Code

2009 International Residential Code &amp; Commentary

## 2009 IRC Wood Wall Bracing Provisions



## **SECTION 19 – GENERAL**

**CONSTRUCTION INSPECTION PROCEDURES.** Under the Building Code, all construction or work that requires a building permit shall be subject to inspection and approval by the County Building Inspector and all such construction or work shall remain accessible and exposed for inspection purposes until approved. It is the responsibility of the permit holder to call for inspection for each phase of construction.

### **1. When you are ready for an inspection.**

- A. Telephone your request for inspection one day in advance using the Automated Inspection Request System at 707-463-4281. The use of a cell phone to access the answering service is not recommended as there are many areas in the County with insufficient signal strength to communicate properly with the system.
- B. You may call up to 7:30 am to schedule an inspection for that day. Be sure to have your permit number, job address and inspection type ready. Be sure to leave a telephone number where you can be reached.
- C. If you do not have a touch tone telephone, call 463-4281 between 8:00 am and 5:00 pm to schedule an inspection.
- D. Building inspectors **cannot** make inspections at a specific time, but will make every attempt to conduct the inspection in either a morning, mid-day or afternoon time frame. You may call 463-4281 after 8:00 am on the day of the inspection to get an approximate time of inspection.
- E. A pre-construction meeting with a building inspector prior to the foundation inspection phase is recommended on commercial projects and may be requested for complex residential projects.
- F. Building inspectors are available by telephone from 8:00 am to 9:00 am on weekdays. Contact your inspector during this time with any questions you may have concerning your project. General building code questions can be answered by staff on duty during normal duty hours. Please call 707-463-4281.
- G. Given the particular construction project, and to the extent possible, inspection requests should be grouped into inspection categories listed under #3 below.
- H. If the building permit was obtained to legalize construction started or completed without a permit, you should call for an inspection immediately after issuance of the permit.

### **2 Before the County building inspector arrives at the site.**

- A. Post the job address at the job site. Be sure that the address posted is the same as the address on the building permit. Fire Safe Standards require address numbers to be at least 4 inches high with a <sup>3</sup>/<sub>8</sub>" stroke, reflectorized and on a contrasting background. Addresses shall be posted at the beginning of the driveway, (where the driveway intersects with the road), and must be visible from both directions of travel. Driveways serving multiple addresses shall have each address mounted on a single post at the beginning and at each Y or intersection in the driveway. Post height should be a minimum of 42" with a minimum 8"x10" placard.
- B. Maintain the approved plans and job card on the job site at all times.
- C. Make sure the owner, contractor or owner's agent is present at the site for inspections in an occupied residence. Inspectors cannot enter a residence with unattended minor children present.
- D. Make sure all work to be inspected is completed and accessible. A sturdy ladder of sufficient length must be available, if necessary, for the requested inspection.
- E. If you fail to meet these requirements, a re-inspection fee will be assessed. You will not be able to call for another inspection until the re-inspection fee is paid.

- F. In general, inspections should be grouped in the following categories and requested in the following order. Depending on each project, additional inspections may be required for items such as; masonry fireplaces, shear walls, roof diaphragm nailing and roof covering installation. Requesting additional inspections should be discussed with the building inspector.
- a) **FOUNDATION:** Request foundation inspection after trenches are excavated, forms are erected, UFER ground, seismic restraints and reinforcing steel are in place and, **before**, pouring concrete. Fire Safe Standards (FSS) also require that the emergency all-weather access road, water supply and required hydrant are in compliance **prior** to the foundation inspection.
  - b) **CONCRETE SLAB:** Request concrete slab inspection after drain/waste plumbing, water lines, mechanical ducts, and hydronic systems are installed, under test and exposed for the building inspector.
  - c) **UNDERFLOOR INSPECTION:** Request underfloor inspection after rough plumbing (sanitary drain lines) and rough mechanical (water and gas piping) are installed, strapped and under test; and after heat ducts are installed, supported and insulated **before** the subfloor is installed. Subfloor and insulation are **not** to be installed until inspection of underfloor has been approved.
  - d) **STRUCTURAL INSPECTION:** Request structural inspection after bracing; shear panels at walls, floors and roof; straps and holdowns; fire blocking and all other framing and structural connections are in place.
  - e) **CLOSE-IN INSPECTION:** Request close-in inspection after roof sheathing/nailing inspection and approval, exterior walls and sub-roof underlayment, and exterior siding or lath have been installed; all framing, fire blocking and bracing are in place; rough plumbing is completed and under test; rough electrical and rough mechanical are complete, **before** the building is insulated and drywall is applied.
  - f) **INSULATION INSPECTION:** Request insulation inspection after insulation is in place. If prior arrangements are made with the building inspector, a certificate of insulation installation may be accepted in lieu of an inspection.
  - g) **WALLBOARD INSPECTION:** Request wallboard inspection after all lathing or gypsum board (interior and exterior) is in place, but **before** taping, plaster, or stucco is applied.
  - h) **SPECIAL INSPECTIONS:** All special inspections must be completed with daily reports available.
  - i) **FINAL INSPECTION:** Request final inspection after construction is completed, including all grading, drainage and site work, and **before** the building is occupied. The building must be unlocked, or prior arrangements made for the inspector to access the building. All appliances, electrical fixtures, convenience outlets, switches and plates must be in place. The following is also required to receive a final on the building permit and a certificate of occupancy:
    - i. All required approvals for occupancy which include but not limited to: Environmental Health, Sanitation District, Planning, Encroachment and Fire.
    - ii. The following completed documents must be available at the job site: a) CF6R form for energy regulation compliance; b) final special inspection summary report, if applicable and c) structural engineer's final report, if applicable.

**REVISIONS TO BUILDING PERMITS.** If a construction project is revised, for example by altering floor plans or adding additional square footage, the revisions must be reviewed and approved by PBS prior to making those changes in the field. A resubmittal form must be filled out for all revisions to construction plans or other documents which comprise the approved permit documents under an issued building permit. The applicant will receive an approved set of the revised plans for the job site after approval by plan review staff and payment of any additional fees.

**1 SUBMITTAL REQUIREMENTS:**

- A. A completed resubmittal form with the applicant and contact person's name, address, and phone number; the job address and permit number.
- B. Two (3) copies of the drawing sheets or document pages affected by the revision(s) with changes clearly highlighted or delineated with date of revision. Documents must be signed/sealed by the person who prepares or is responsible for them.
- C. Three (3) copies of the drawing sheets or document pages affected by the revision(s) if there are floor plan changes.

**2 PROCEDURE:**

- A. In addition to building plan check review, revisions to building plans or permits may also need to be reviewed and approved by multiple PBS divisions/sections, including but not limited to, Planning/Zoning, Well and Septic and Drainage Review. When submitting revised plans, it is necessary that applicants meet with a permit technician to identify the required approvals so that applicants can meet with applicable staff prior to submitting the revised plans for building plan check. Common revisions that require additional review and approval include but are not limited to:
  - Changing (increase or decrease) the size of the building
  - Changing the building height
  - Changing the scope of work
  - Changing the building location
  - Changing the occupancy (e.g. storage to habitable space)
- B. Revisions to plans may also result in an increase or decrease in applicable development fees such as school, traffic and affordable housing. A permit technician can explain these fees.
- C. If additional square footage is being added to a building under construction, an additional plan review and building permit is required. The application and plan review fees are collected upon submittal to PBS. After the plan review is complete, the applicant will be notified and pay applicable building permit fees. In some cases, the plan review can be done on the same day by the plans examiner.
- D. If no additional square footage is proposed and the revisions include internal alterations to the permitted structure, an hourly rate taken from the current PBS fee schedule will be charged. In some cases, the plan review can be done on the same day by plan check staff.



## **PERMIT RELATED AGENCIES - COUNTY OF MENDOCINO**

Planning & Building Services Department  
501 Low Gap Road, Room 1440  
Ukiah, CA. 95482  
(707) 463-4281

Department of Transportation  
340 Lake Mendocino Drive  
Ukiah, CA 95482  
(707) 463-4363

Environmental Health Department  
501 Low Gap Road  
Ukiah, CA 95482  
(707) 463-4466

Air Quality Management District  
306 East Gobbi Street  
Ukiah, CA. 95482  
(707) 463-4354

## **CITY OF UKIAH**

Building Department (707) 463-6200  
Planning Department (707) 463-6203  
300 Seminary Avenue  
Ukiah, CA 95482

Water and Sewer (707) 463-6388  
1320 Airport Road  
Ukiah, CA 95482

## **SANITATION/COMMUNITY SERVICE DISTRICTS**

City of Ukiah  
1320 Airport Road  
Ukiah, CA 95482  
(707) 467-2812

Hopland Public Utilities District  
25 Center Street  
Hopland, CA 95449  
(707) 744-1522

City of Ft. Bragg  
416 North Franklin Street  
Fort Bragg, CA 95437  
(707) 961-2823

Anderson Valley Community Service District  
14281 Highway 128  
Boonville, CA 95415  
(707) 895-2020

City of Willits  
111 East Commercial Street  
Willits, CA. 95490  
(707) 459-5028

Covelo Community Services District  
76270 Grange Street  
Covelo, CA 95428  
(707) 983-6888

## **OTHER AGENCIES**

Bay Area Air Quality Management District  
939 Ellis Street  
San Francisco, CA 94109  
(415) 771-6000

California Energy Commission  
1516 Ninth Street  
Sacramento, CA 95814  
(916) 654-4287

Contractors State License Board  
50 D Street, Suite 105  
Santa Rosa, CA 95404  
(707) 576-2192  
(800) 321-2752 (Information)

Division of the State Architect  
1300 I Street, 8th Floor  
Sacramento, CA 95814  
(916) 445-7627

## **PERMIT RELATED AGENCIES – (CONTINUED)**

State Compensation Insurance Fund  
1450 Neotomas Avenue  
Santa Rosa, CA 95405  
(707 ) 573-6300

State Dept of Housing & Comm. Dev.  
Division of Codes & Stds. - No. Area  
8911 Folsom Boulevard  
Sacramento, CA 95826  
(916) 255-2501

Department of Toxic Substance Control  
700 Heinz Avenue, Suite 200  
Berkeley, CA 94710-2737  
(510) 540-3739  
(800) 698-6942

Regional Water Quality Control Board  
San Francisco Bay Region  
1515 Clay Street, Suite 1400  
Oakland, CA 94612  
(510) 622-2300

Department of Fish and Game - Regional HQ  
7329 Silverado Trail  
Napa, CA 94558  
(707) 944-5500

Regional Water Quality Control Board  
North Coast Region  
5550 Skylane Blvd  
Santa Rosa, CA 95403

State Lands Commission - Division of Lands  
Com.  
100 Howe Avenue, Suite 100 South  
Sacramento, CA 95825  
(916) 574-1900

S. F. Bay Conserv. & Dev. Comm.  
50 California Street, Suite 2600  
San Francisco, CA 94111  
(415) 352-3600

Dept. of Industrial Relations - Cal/OSHA  
1221 Farmers Lane  
Santa Rosa, CA 95405  
(707) 576-2388

Cal/Trans - Dept. of Transportation  
111 Grand Avenue / P O Box 23660  
Oakland, CA 94623  
(510) 286-4444

Department of Consumer Affairs  
400 R Street  
Sacramento, CA 95814  
(916) 952-5210  
U. S. EPA  
(415) 744-1500

OSHA - Federal  
455 Golden Gate Avenue  
San Francisco, CA 94102  
(415) 703-5100

## **RESIDENTIAL SPECIAL INSPECTION**

**INTRODUCTION.** The purpose of this section is to clarify the requirements for special inspection of Group R-3 and U occupancies, based on Chapter 17 of the CBC. The requirements and procedures have changed significantly in this edition of the code.

**TECHNICAL DETAILS.** Structures Subject to Special Inspection The CBC states:

“Unless otherwise required by the building official, special inspections are not required for occupancies in Group R-3 and occupancies in Group U that are accessory to a residential occupancy...”

Based upon the above, special inspections are not required for these occupancies, EXCEPT that special inspections shall be required for:

1. “Drill and pour” pier foundations where piers must be drilled and poured one at a time due to soil conditions. “Drill and pour” must be approved in advance by PBS Building Division staff.
2. Steel moment frames which are designed to resist lateral forces.
3. Items where the product listing specifically requires special inspection, such as epoxy anchors.
4. When the registered design professional who prepares the plans states that special inspection is required or recommended.
5. Other cases when specifically required by the building official. **Residential Pier Foundations**

Based upon the above, most residential pier foundations will not require special inspection. Inspection procedures for such foundations are as follows:

1. Pier foundations without special inspection must be constructed under the supervision of a contractor licensed by the state of California to perform such work. The building inspector may ask for verification of this requirement during the foundation inspection.
2. In most cases, there will be a soils report, which states that a representative of the soils firm shall observe the excavations prior to placing concrete. Verification that this observation has been done and the excavations approved must be on site prior to the foundation inspection by the building inspector.
3. For prescriptive piers with no soils report, a geotechnical engineer shall inspect the pier excavations and provide a report. This verification must be on site prior to the foundation inspection by the building inspector.
4. The building inspector will check the setbacks, reinforcing steel, pier holes, ufer ground installation, and any other necessary foundation elements.
  - a. Pier reinforcing steel may be approved when two thirds of the steel is in place according to the approved plans, and the rest of the steel is assembled according to the approved plans on site.
  - b. If water in piers, collapsing soil, or other similar deficiencies are encountered, the building inspector may require structural observation of the measures taken to correct the deficiencies.
5. For “drill and pour” piers, continuous special inspection is required during the drilling and placement reinforcing steel and concrete. Samples and strength tests are not required.

**STRUCTURAL OBSERVATION.** Structural observation is typically performed by the design professional in responsible charge, although it can be performed by another registered professional if the registered design professional in responsible charge is not available. Structural observation will be required

1. When required by the building official.
2. When the registered design professional who prepares the plans state that structural observation is required or recommended.
3. When required by the California Building Code. **REFERENCES, CBC Chapter 17.**

## **SECTION 20 – SUMMPLEMENTARY DESIGN INFORMATION**

### **MENDOCINO COUNTY CLIMATE ZONES**

(for energy compliance calculations)

<b>Zone</b>	<b>City</b>	<b>Zone</b>	<b>City</b>
1	Albion	2	Willits
1	Anchor Bay	2	Yorkville
2	Boonville		
2	Calpella		
1	Cleone		
2	Comptche		
2	Covelo		
1	Elk		
1	Fort Bragg		
1	Gualala		
2	Hopland		
2	Laytonville		
2	Leggett		
1	Little River		
1	Manchester		
1	Mendocino		
2	Navarro		
2	Philo		
2	Piercy		
1	Point Arena		
2	Potter Valley		
2	Redwood Valley		
1	Rockport		
2	Talmage		
2	Ukiah		
2	Westport		

## **SECTION 21 - RESIDENTIAL PLAN CHECKLIST**

Note: The following is only a partial list of required checklist items. Full compliance is required by reference to the following:

Mendocino County Ordinances (Building Code & Fire Code adoptions):

### **Adopted Codes:**

2010 California Residential Code (CRC)  
2010 California Building Code (CBC)  
2010 California Mechanical Code (CMC)  
2010 California Electrical Code (CEC)  
2010 California Plumbing Code (CPC)  
2008 California Energy Standards

### **Source Documents:**

2009 International Residential Code (IRC)  
2009 International Building Code (IBC)  
2009 Uniform Mechanical Code (UMC)  
2008 National Electrical Code (NEC)  
2009 Uniform Plumbing Code (UPC)  
Other Local and State Laws

### **\*\*PLEASE NOTE\*\***

Sections 2-7 of this document are considered Life-Safety sections. They apply to all one and two family dwellings and their accessory structures as defined by CRC R202.

Sections 8-11 address building structural design and are applicable to non-engineered structures and non-engineered elements of partially engineered structures. Some residential structures in close proximity to known earthquake faults may not be eligible to use the CRC for the structural portion of their design.

Resources available to assist with questions about the applicability of the CRC are: The CRC, the PBS website, PBS's Residential Manual, and PBS plan check staff members.

### **1.0 – GUIDELINES FOR ALL SUBMITTALS**

Items to be considered at earliest possible stage of project development which could affect project:

1. Land use limitations – County zoning ordinances
2. Earthquake faults – Alquist/Priolo Zones
3. Geological hazards – landslides, geo-soil report
4. Flood zone, waterways, creeks, etc.

Submit four sets of all drawings, and two sets of all supporting documentation such as structural calculations, energy compliance forms, soil reports, etc.

Preliminary review with staff is encouraged to ensure complete applications. Omission of any items in the following list may result in delay of plan check, requiring resubmission of documents or information. All documents must be signed by the person responsible for preparing them. Residences which are conventionally wood framed and up to two stories in height may not need to be prepared by a licensed design professional. Drawing sheets shall be large enough to accommodate a drawing scale of 1/4" per foot. All drawing sheets shall be the same size.

- 1.1 PLOT PLAN (or Site Plan):** Show property lines, easements and new and existing building locations. Dimension front, side and rear distances to property lines and between structures. Indicate finished and existing ground slope grades. Provide drainage information. Show other relative information such as driveways, wells, septic systems, and source of emergency water supply and access. Provide North Arrow and drawing scale. Print job title or description, address and assessor's parcel number and drawing index on the cover sheet.

- 1.2 FLOOR PLAN:** Show all dimensions and label use of each room as well as location and size of windows and doors, show electric outlets, plumbing and heating fixtures. Show location and type of all braced panels or shear walls. List floor area (itemize garage and porch areas), window sizes and furnace size on plans. Show north arrow and drawing scale on plan.
- 1.3 FOUNDATION PLAN:** Completely dimension plan including interior footings. Label and locate porches, patios, decks, garage, etc. Locate and note size and spacing of anchor bolts, straps and tie downs on plan. Note size, number and position of crawl space vents.
- 1.4 EXTERIOR ELEVATIONS:** Provide a minimum of four elevation views showing all openings, wall and roof finish materials, original and finished grades, stepped footing outline, underfloor vents and roof pitch.
- 1.5 FRAMING PLANS:** Note framing members and sheathing for floor and roof & ceiling plans. Show size and spacing of joists, rafters and beams with grade of lumber to be used. Show how all gravity and lateral loads are carried to foundation.
- 1.6 WALL BRACING:** Provide a diagram of all braced wall lines for non-engineered plans.
- 1.7 CROSS SECTIONS:** Provide sections through building showing structural elements, and other sections as needed, including earth to wood clearances, floor to ceiling heights, roof slopes, etc. Note typical finishes; call out insulation type and value.
- 1.8 DETAILS:** Submit foundation, floor and roof details, beam connections, special framing and flashing details as necessary for construction.
- 1.9** Provide engineer's design calculations for engineered plans.
- 1.10** The job address must be posted at the job site and at the county road, and the building location shall be staked prior to submitting the permit application.
- 1.12** Specific County of Mendocino Design Requirements:
  - A. Wind: Velocity is 85 mph. Most sites will be exposure C. Exposure D shall be used close to the coast and Exposure B may be used with justification.
  - B. Seismic: Seismic Design Category is site specific and will typically be D2 or E.
  - C. Allowable soil bearing pressure for sites not requiring a geotech report is 1500 psf.

## **2.0 – LIGHT, VENTILATION, ROOM DIMENSIONS:**

- 2.1** Required window area for light shall be not less than 8 percent of the floor area of the room served; the minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated. (R303.1)
- 2.2** Every sleeping room and any basement must have at least one openable window or door approved for emergency rescue with a minimum net clear opening of 5.7 square feet, except the windows at the grade floor shall have a minimum net area of 5.0 square feet. The minimum net vertical opening dimension shall be 24". The minimum net clear opening width dimension shall be 20". The bottom of the clear opening shall be no more than 44" from the floor. (R 310.1)
- 2.3** Bathrooms, water closet compartments and similar rooms shall have window at least 3 sq feet in area, half of which must be openable, or mechanical ventilation must be provided. (R303.3)
- 2.4** Provide ventilation for products of combustion to outside air. (CMC 801.1)
- 2.5** Attic ventilation: 1/150 of attic area. If a Class I or II vapor barrier is applied to warm-in winter side of ceiling, or, if 50% - 80% of the vents are at least 3' above the eaves and the remaining vents are in the eaves then the ratio may be reduced to 1/300. (R806.2) Unvented attics may be allowed if meeting the requirements of R806.4.
- 2.6** Enclosed rafter spaces shall have cross ventilation (min. 1" clear) (R806.3)

- 2.7 Underfloor space shall have a ventilation opening area of 1/150 square feet of underfloor area. If a Class I vapor retarder is used the ratio may be reduced to 1/1500. One opening shall be placed within 3 feet of each building corner. Openings shall be covered with a covering having openings no greater than 1/4". (R408.2)
- 2.8 Heating system is required to maintain 68 degrees at 3 ft above floor level in all habitable room (R303.8)
- 2.9 Air infiltration, insulation, space heating, space cooling, water heating, etc shall meet CA Energy Commission Standards.
- 2.10 Minimum Room Sizes: (R304/R305). All habitable rooms except kitchens shall be at least 70 square feet in area and shall have a width of at least 7'. In addition there shall be at least one room with a minimum of 120 square feet in each dwelling.

Minimum ceiling height shall be 7 feet. See CRC for exceptions.

### **3.0 – DOORS, STAIRWAYS AND LANDINGS (INCLUDING DECKS):**

- 3.1 Required egress door shall be side hinged and have a minimum net clear width of 32" and a minimum height of 78". (R311.2)
- 3.2 There shall be a landing at each side of all doors. The landing shall be at least as wide as the door served and 36" min length measured in the direction of travel. There may one step down of no more than 7.75" provided the door does not swing over the landing. (R311.3)
- 3.3 Stairway rise shall be 4" min and 7.75" max. Run shall be 10" min. Headroom shall be 80" min. Width shall be 36" min. Handrails shall be 34" - 38" above tread nosing with openings less than 43" clear. (R 311.7 & R312.3)
- 3.4 Enclosed useable space under interior stairs shall be finished with 1/2" gypsum board (R302.7)
- 3.5 Fireblocking is required in concealed spaces between stair stringers at the top and bottom of the run (R302.11).
- 3.6 There shall be a floor or landing at the top and bottom of each stairway. Width and length of landings shall be not less than the width of the stairway and shall be at least 36" in the direction of travel. A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs. (R311.7.5)
- 3.7 Guards shall be located along open sided walking surfaces, including stairs, ramps, landings, and decks, that are more than 30" above the floor or grade. Required guards shall be not less than 42" above the adjacent walking surface. Except that handrails may be considered as guards at stairways. Openings in guards shall not exceed 4". (R312)
- 3.8 Exterior deck support posts shall be cross braced in two directions for lateral stability.
- 3.9 For posts over 30" in height provide mechanical connection at post base.
- 3.10 Provide detail at junction of exterior decking, wall and interior floor framing. Show elevations, flashing, and anchorage. Deck framing shall be positively attached to building framing at a minimum of 2 locations with connectors not using nails in withdrawal. (R502.2.2)
- 3.11 Deck framing and support posts to be of preservative treated or naturally durable lumber. R317.1) Hardware and fasteners shall be hot-dipped galvanized, stainless steel, silicon bronze, or copper. (R317.3.1)



#### **4.0 – WEATHER AND CORROSION DAMAGE PREVENTION MEASURES:**

- 4.1** Naturally durable wood or preservative treated wood shall be required in the following locations (R317.1):
- a. Wood joists and girders closer than 18" or 12" respectively, to the exposed ground.
  - b. Wood framing members that rest on concrete or masonry and are less than 8" from the exposed ground.
  - c. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated by an impervious moisture barrier.
  - d. Wood siding, sheathing and wall framing on the exterior of the building having a clearance of less than 6" from the ground or less than 2" from a horizontal concrete surface.
  - e. All wood in contact with the ground
  - f. All wood embedded in concrete that is in direct contact with the ground or exposed to weather and that supports structures intended for human occupancy.
- 4.2** Exposed glu-lams shall be preservative treated or made from naturally durable wood.
- 4.3** Weatherproofing of exterior surfaces above and below grade is required. (R 406 & R 703)
- 4.4** Concrete slabs shall be separated from earth by a minimum 6" vapor retarder. This may be omitted if the space above is not heated and is not likely to become heated in the future. (R506.2.3)
- 4.5** The ground adjacent to the foundation shall be sloped so that the grade shall fall a minimum of 6" within the first 10'. Hardscape may be sloped at 2%. (R401.3)
- 4.6** All fasteners used for attachment of siding shall be corrosion-resistant. (R703.4)
- 4.7** Corrosion resistant flashing shall be provided at openings and intersections/attachments as listed in R703.8.
- 4.8** Provide adequate roof slope for drainage (1/4" per foot, min.) or submit deflection and ponding calculations. Provide gutters or roof drains. (CPC 1101.1).

#### **5.0 – GARAGE & CARPORT:**

- 5.1** Common wall between garage and dwelling shall have 1/2" gypsum board applied on the garage side. Garage ceiling with habitable space above shall have 5/8" type X gyp board applied to the ceiling. Carports with no enclosed uses above do not need protection. (R302.6)
- 5.2** No openings may be provided between a garage and a sleeping room. Other openings shall be equipped with solid wood or steel doors 1 3/4" in thickness and shall be self-closing and self-latching. (R302.5.1)
- 5.3** Garage and carport floor surfaces shall be of approved noncombustible material. Asphaltic surfaces shall be permitted at ground level in carport. (R309)
- 5.4** Appliances and receptacles installed in garages and carports generating a glow, spark, or flame shall be located 18" min. above the floor. Provide protective bollard or other impact barrier. (CMC 307.1)

#### **6.0 – ELECTRICAL:**

- 6.1** Do not install electrical panels larger than 16 square inches in rated fire walls. Garage to dwelling unit separation is not a rated fire wall. (R302.4.2) Never install electrical panels in closet. Maintain a clearance of 36" in front of the panels. (CEC 110.26)

- 6.2 Provide a minimum of one 20 Amp receptacle in laundry areas. (CEC 210.52(F))
- 6.3 Kitchens and dining areas must have a minimum of two 20 Amp circuits. Kitchen counter outlets must be installed in every counter space 12" or wider, not greater than 4' o.c. and within 24" of the end of any counter space. (CEC 210.52)
- 6.4 GFCI outlets are required for all kitchen receptacles that are designed to serve countertop surfaces, in bathroom, in underfloor spaces or below grade level, in exterior outlets, and in all garage outlets not dedicated to a single device or appliance. (CEC 210.8) All dwellings must have at least one exterior outlet at the front and the back of the dwelling. (CEC 210.52(E))
- 6.5 Receptacles must be installed at 12' o.c. maximum in walls. Walls longer than 2 feet and halls longer than 10' must have a receptacle. A receptacle must be provided within 3' of bathroom sinks. (CEC 210.52)
- 6.6 Bond all metal gas and water pipes to ground. All ground clamps must be accessible and of an approved type. (CEC 250.104)
- 6.7 Furnaces installed in attics and crawl spaces must have an access platform (catwalk in attics), light, light switch, and receptacle in the space. (CMC 904.11)
- 6.8 New dwellings must have a 120V powered smoke alarm in every sleeping room, outside each sleeping room, on every story of the dwelling, including basements and habitable attics, but not including crawl spaces or uninhabitable attics. When more than one smoke alarm is required the alarm devices shall be interconnected. (R314.3)
- 6.9 When alterations, repairs, or additions require a permit smoke alarms shall be installed where required in new dwellings. (R314.3.1)
- 6.10 For new construction & work in an existing dwelling where the value of the work exceeds \$1000 carbon monoxide alarms shall be installed in all dwelling units and in sleeping rooms within which fuel-burning appliances are installed and in dwelling units that have attached garages. (R315.1; R315.2)
- 6.11 All 120-volt 15 & 20 amp branch circuits in dwelling units except those in kitchens, bathrooms, unfinished basements, garages and outdoors shall have AFCI protection. (CEC 210.12)
- 6.12 Receptacles on 120- volt 15 & 20 amp circuits shall be listed tamper resistant. (CEC 406.11) Except when located more than 5.5' above the floor; within cabinets or cupboards; or when part of a luminaire or appliance.

## **7.0 – MISCELLANEOUS LIFE-SAFETY:**

- 7.1 Provide pressure relief valve with drain to outside for water heater. (CPC 608.5) Provide seismic strapping (CPC 508.2)
- 7.2 Liquefied petroleum gas (LPG) appliances shall not be installed in a pit, basement or similar location. LPG appliances shall not be installed in an above grade underfloor space or basement unless such location is provide with an approved means for removal of unburned gas (CMC 303.7.1)
- 7.3 Provide combustion air for all gas fired appliances. (CMC Chapter 7)
- 7.4 Fuel burning water heater is not allowed in bedroom or bathroom unless direct vent type or complying with CPC 505.1.
- 7.5 Vent dryer to outside of building (not to underfloor area). Vent length shall be 14' maximum or vent size shall be increased. (CMC 504.3)
- 7.6 Water closet shall be located in a space not less than 30" in width with 24" minimum clearance in front. (CPC 407.5)

- 7.7** Showers and tubs with showers require a non-absorbent surface up to 72" above the floor. (R307.2). Provide curtain rod or approved enclosure material.
- 7.8** Provide anti-siphon valves on all hose bibs. (CPC 603.4.7)
- 7.9** Safety glazing shall be required within 24" of a door edge or within 36" of a stairway, landing or ramp when the bottom edge of the glazing is less than 60" from the floor or walking surface. (R308.4)
- 7.10** Safety glazing is required in all fixed and operable panels of swinging, sliding and bifold doors. (R308.4)
- 7.11** Safety glazing is required in enclosures and walls facing hot tubs, saunas, steam rooms, showers and tubs where the bottom edge of the glazing is less than 60" from any standing or walking surface. (R308.4)
- 7.12** Wood burning appliances shall be EPA phase II certified. (Sonoma County Ordinance) **7.13** Provide 18" x 24" foundation access within 20' of plumbing cleanout. (R408.4; CPC 707.9)
- 7.14** Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs; vertically at floor and ceiling levels, horizontally at intervals not to exceed 10'. (R302.11)
- 7.15** Show minimum 22" x 30" access opening to attic. (R807.1) In attics which an appliance is installed, an opening and passageway at least as large as the largest component of the appliance shall be required. (CMC 904.11)
- 7.16** Roof construction and covering shall comply with R905.

## **8.0 - FOUNDATIONS AND CONCRETE:**

- 8.1** Concrete shall be 3000 psi min for foundation and retaining walls (including stem walls) and 2500 psi min for all other concrete (R404.1.2.3.1; Table R402.2)
- 8.2** Conventional Residential Foundation Requirements (R404.1.4.2; Table R403.1)

### **Foundations for Stud Bearing Walls – Min. Requirements**

No. of stories	Thickness of stem wall concrete *	Width of footing	Thickness of footing	Depth below undisturbed ground surface
1	6.0"	12"	6"	12"
2	6.0"	15"	6"	12"

\* Foundation walls exceeding 4'6" shall be minimum 7.5" thick.

- 8.3** Horizontal reinforcing at footing and stem wall: one number 4 rebar within top 12" of stem wall and one number 4 rebar 3-4 inches from bottom of footing (R403.1.3.1)
- 8.4** When the stem wall and footing are not poured monolithically a number 4 rebar shall be installed vertically at 4' o.c. The vertical bar shall extend to 3" clear from the bottom of the footing, have a standard hook, and extend a minimum of 14 inches into the stem wall. (R403.1.3)
- 8.5** Stepped footings shall be used when slope of footing bottom is greater than 10:1 (H:V) Step footing detail shall be shown on building elevations and foundation plan. (R403.1.5)
- 8.6** Concrete slabs shall be minimum 3.5" thick (R506.1).
- 8.7** Provide setbacks from slopes greater than 33% (R403.1.7).

- 8.8** Anchor bolts shall be minimum 1/2" x 10" placed at 6' o.c. maximum. Embed bolts 7" min. Locate end bolts neither less than 3.5" nor more than 12" from ends of sill members. (R 403.1.6) Provide 3" x 3" x 0.229" plate washers on each bolt. (R602.11.1)

## **9.0 – FLOORS:**

- 9.1** Floor joist size, spacing and grade shall conform to Table R502.3.1; or shall be designed by a licensed professional.
- 9.2** Joists under and parallel to bearing partitions shall be doubled. (R502.4)
- 9.3** Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth. (R502.4)
- 9.4** Girders for single-story construction or supporting one floor shall be 4" x 6" for spans 6' or less, with girders spaced at 8" o.c. For other sizes and spans see Table R502.5(1) & Table R502.5(2).
- 9.5** Nail spacing for floor plywood sheathing: 6" o.c. at edges, 12" o.c. in field (unless closer nailing is specified). Table R602.3(1)
- 9.6** Provide detail of connection of floor girder at foundation wall.
- 9.7** Solid block all joists at ends and intermediate supports with full-depth solid blocking not less than 2" nominal thickness. (R502.7)
- 9.8** At floor openings where header joist span exceeds 4' show double trimmer joists and headers. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6'. (R502.10).

## **10.0 – WALLS:**

- 10.1** Show stud size, height, grade and spacing. (Table R602.3(5)) Exterior and interior studs shall be continuous floor to roof unless braced at ceiling shall not exceed 25' (interior & exterior) unless complying with the exception of R602.10.5.
- 10.2** Balloon frame gable end walls or provide softwall bracing detail. **10.3** Minimum header sizes shall be according to Table R502.5.
- 10.4** Double top plates shall have a minimum lap of 24". Nail with eight 16d nails on each side of the joint, unless additional nailing is specified. Lap plates at intersections and corners. (Table R602.3)
- 10.5** Sole plate to joist or blocking shall be 16d at 16" o.c. and 3-16d at 16" at braced wall panels. (Table 602.3)
- 10.6** Foundation cripple walls shall be framed of studs not less in size than the studs of the wall above. Cripple walls exceeding 4' in height shall be framed of studs as required for an additional story. Cripple walls shall be sheathed per R602.10.9 & R602.10.9.1. Cripple walls less than 14" in height shall be fully sheathed or constructed of solid blocking. (602.9)
- 10.7** Minimum wood structural panel sheathing nailing: 6" o.c. at edges and 12" o.c. in field. (Table R602.3) Nailing shall be inspected prior to covering.
- 10.8** Provide one layer of 15# felt or other approved material under exterior siding. Material shall have upper layer lapped 2" min over lower layer with 6" min laps at joints. (R703.2) Provide 2 layers of Grade D paper or equivalent between wood sheathing and stucco lath. (R703.6.3)
- 10.9** Braced wall lines shall be sized and configured in accordance with section R602.10 in its entirety. Provide and label a layout of all braced wall lines complete with required values for wind and seismic for the specified wall type.
- 10.10** Spacing of braced wall lines

## **11.0 – ROOF**

- 11.1** Show roof rafters and ceiling joists. Spans shall be per Tables R802.4(1) & (2) for joists and Tables R802.5.1(1) & (2) for rafters. Include the size, spacing and grade of all members.
- 11.2** Nail rafters to adjacent parallel ceiling joists. Where not parallel, use rafter ties at 4' o.c. max. (R802.3.1) Connect ties per Table R802.5.1(9). Rafter ties shall use adjustment factor in footnote h for height above supporting wall and must be in lower third of attic space.
- 11.3** Where ceiling joists or rafter ties are not provided trusses shall be used or engineering shall be provided. R802.3.1
- 11.4** Solid block all rafters and trusses at exterior walls. (R602.10.6.2) Nail blocking to top plate with (3) 8d toe nails per block or provide clips.
- 11.5** For roofs shallower than 3:12 ridges, hips and valleys shall require engineering. (R802.2)
- 11.6** Wood structural panel sheathing shall be bonded by exterior glue. (R803.2) Minimum nailing per Table R602.3(1) is 6" at edges and 12" in the field, 8d common, box or casing. Nail panels to blocking between rafters.

## **FIRE RESISTIVE WALL COVERINGS**

### **DEFINITIONS:**

**Gypsum Sheathing.** Is used as a protective, fire resistive membrane under exterior wall surfacing materials such as wood siding, masonry veneer and stucco. The non-combustible core is surfaced with firmly bonded water repellant paper; in addition may also have a water resistant core. It is available with type X core.

**Type X Gypsum Board.** Similar to regular gypsum board. It has an improved fire resistance made possible through the use of special core additives. Type X gypsum board is used in most fire rated assemblies.

When the one-hour rated fire-resistive exterior wall requirement for the Fire Safe Standards (Section 4) applies there has been some confusion in the industry over specific construction details. Chapter 7 of the 2010 California Building Code (Code) details the construction requirements for fire resistive construction in Tables 720.1(1), 720.1(2), and 720.1(3). Footnotes to the table allow for the installation of structural sheathing to the face of the studs under the fire-resistive elements and to fire-resistive rating in the "Fire-Resistive Design Manual" published by the Gypsum Association. In an effort to aid in design, construction and inspection of these fire-resistive assemblies, the attached diagrams are offered for review. Double layer floor ceilings are also detailed in this section. If approved, these diagrams can be formulated into an attachment for plan review.

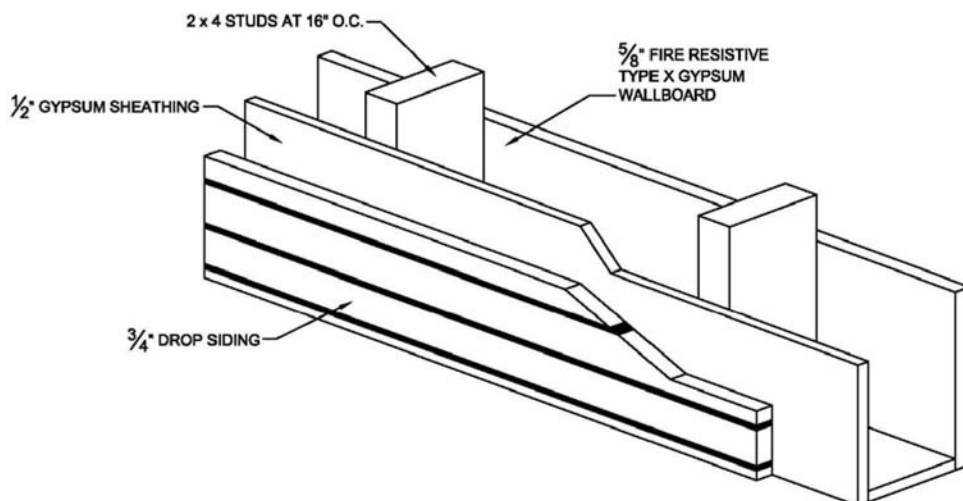
There is a special provision in the code regarding fire separation between a private garage and an attached dwelling unit. Residential construction allows for a modified fire separation between a private garage up to 3,000 square feet and an attached dwelling unit consisting of a minimum 1/2-inch gypsum board applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than a 1/2-inch Type X gypsum board or equivalent. Note that these construction details are not appropriate for occupancy and area separation nor for the one-hour fire resistive exterior wall required under the provisions of Table 13-55, Protection Requirements of the Fire Safe Standards.

It should be noted that these details are general in nature. Proprietary assemblies of the Fire-Resistive Design Manual, other listed fire-resistive assemblies (UL, etc) or those approved under the provisions of alternate materials construction section of the CBC are also acceptable.

The full one-hour rated fire-resistive exterior wall should not be confused with the noncombustible or ignition resistant exterior wall requirements prescribed in Chapter 7A of the Code for new buildings located within the Wildland Urban Interface Area. Constructing a one-hour rated wall will not comply with the noncombustible or ignition resistant exterior wall requirements if the outer wall material or wall assembly is not listed as an approved material or assembly by the State Fire Marshall or is not noncombustible material. More information on the requirements of new buildings constructed within the Wildland Urban Interface Area may be found in Appendix 5 of this manual.

## WALL SYSTEMS:

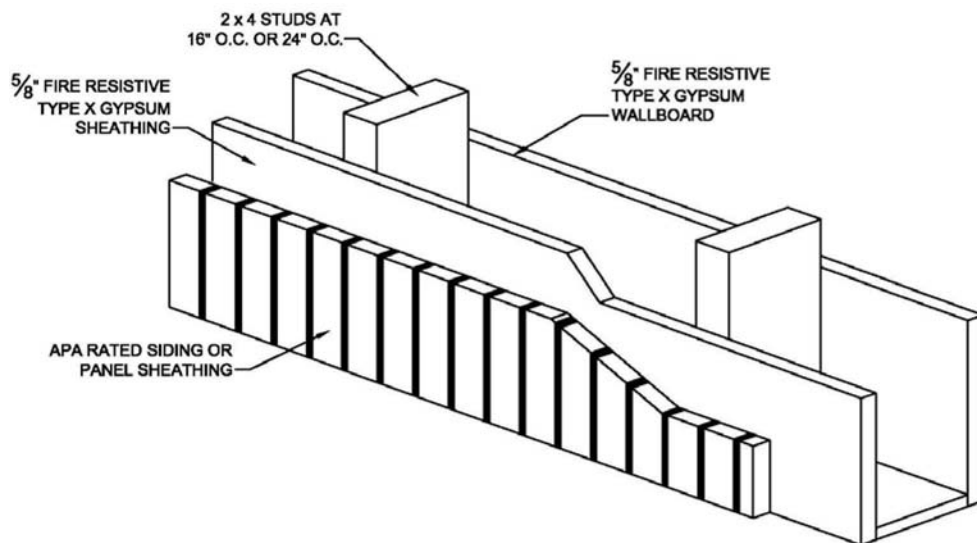
Either of the following details meets the 1-hour fire requirement.



### CBC Table 720.1(2) 15-1.1

1. **Interior Side:** One layer 5/8" type X gypsum wallboard applied vertically or horizontally to 2x4 wood studs 24" on center with 6d cooler or wallboard nails at 7" on center with end joints on nailing members. Stagger joints each side.
2. **Exterior Side:** %" drop siding over 1/2" gypsum sheathing on 2x4 wood studs, 16" on center with 1%" No. 11 gage by 7/16" head galvanized nails at 8" on center. Siding nailed with 7d galvanized smooth box nails.

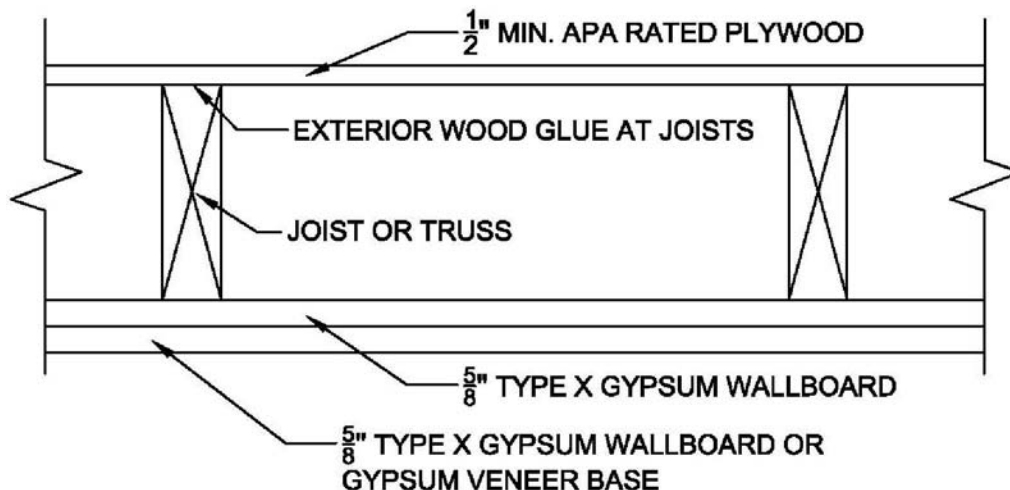
If installing structural sheathing to face of studs, increase the length of the fasteners for the gypsum sheathing by the thickness of the structural sheathing.



### GA File No WP 8105

1. **Interior Side:** One layer 5/8" type X gypsum wallboard, water resistant gypsum backing board or gypsum veneer base applied parallel or at right angles to studs with 6d coated nails, 1-7/8" long, 0.0915" shank, 1/4" heads, 7" on center. (Load Bearing)
2. **Exterior Side:** One layer 48" wide %" type X gypsum sheathing applied parallel to 2x4 wood studs 24" on center with 1%" galvanized roofing nails 4" on center at vertical joints and 7" on center at intermediate studs and top and bottom plates. Joints of gypsum sheathing may be left untreated. Exterior cladding to be attached through sheathing to studs.

### FLOOR-CEILING SYSTEM:



#### **GA File No FC 5406**

1. **Ceiling Side (bottom):** The base layer is 5/8" type X gypsum wallboard applied at right angles to 2 x 10 wood joists 24" on center with 1 1/4" Type W or S drywall screws 24" on center. The face layer is 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1 7/8" Type W or S drywall screws 12" on center at joints and intermediate joists and 1 1/2" Type G drywall screws 12" on center placed 2" back on either side of end joints. Joints offset 24" from base layer joints.
2. **Floor Side (top):** Minimum 1/2" plywood with exterior glue applied at right angles to joists with 8d nails.

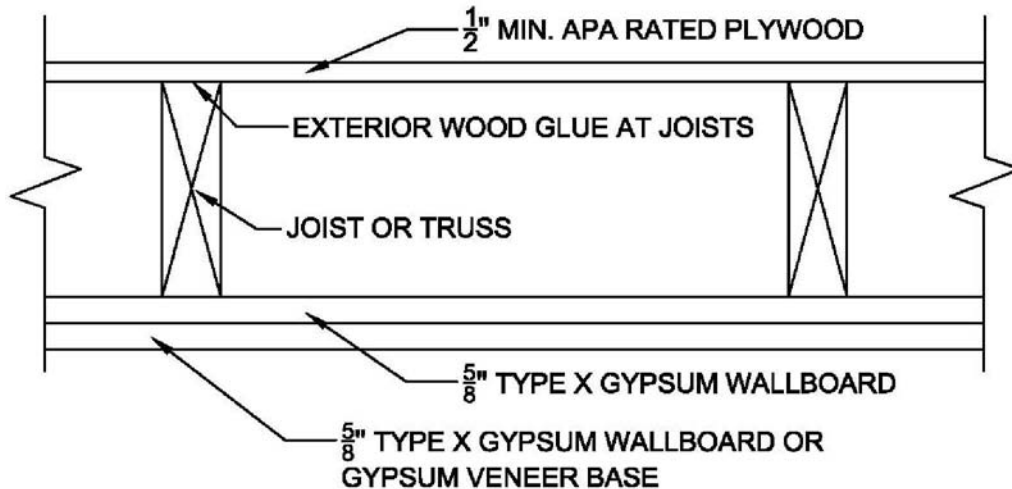
NOTE: Ceiling provides one hour fire resistance protection for framing, including trusses.

#### **CBC Table 720.1(3) 21.**

1. **Ceiling Side (bottom):** The base layer is 5/8" type X gypsum wallboard applied at right angles to joist or truss 24" on center with 1 1/4" Type W or Type S drywall screws 24" on center. The face layer is 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to joist or truss through base layer with 1 7/8" Type W or Type S drywall screws 12" on center at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2" back on either side of face layer end joints, 12" on center.
2. **Floor Side (top):** Minimum 1/2" wood structural panels with exterior glue applied at right angles to joists with No. 8 screws.



### ROOF-CEILING SYSTEM



#### **GA File No RC 2601**

1. **Ceiling Side (bottom):** The base layer is e" type X gypsum wallboard applied at right angles to 2 x 10 wood joists 24" on center with 1'<" Type W or S drywall screws 24" on center. The face layer is e" type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1f" Type W or S drywall screws 12" on center at joints and intermediate joists and 1'z" Type G drywall screws 12" on center placed 2" back on either side of end joints. Joints offset 24" from base layer joints.
2. **Roof Side (top):** Minimum z plywood with exterior glue applied at right angles to joists with 8d nails. Appropriate roof covering.

NOTE: Ceiling provides one hour fire resistance protection for framing, including trusses.

#### **CBC 720 15-1.1**

1. **Ceiling Side (bottom):** The base layer is e" type X gypsum wallboard applied at right angles to 2 x 10 wood joists 24" on center with 1'<" Type W or S drywall screws 24" on center. The face layer is e" type X gypsum wallboard or gypsum veneer base applied at right angles to joists with 1f" Type W or S drywall screws 12" on center at joints and intermediate joists and 1'z" Type G drywall screws 12" on center placed 2" back on either side of end joints. Joints offset 24" from base layer joints.
2. **Roof Side (top):** Minimum z plywood with exterior glue applied at right angles to joists with 8d nails.

#### **NOTES:**

**Structural Sheathing.** May be installed to face of studs with fire resistive membrane applied over the sheathing. Increase fastener length for thickness of structural sheathing.

**Fasteners.** Screws may be substituted for proscribed nails, one for one, when equal to or exceeding the requirement for the nails used in the tested system.

For properties of cooler or wallboard nails, see ASTM C514, ASTM C547, or ASTM F1667.

**Studs.** Indicated stud spacings are maximums. Greater stud sizes (depths) shall be permitted to be used.

**Outlet Boxes.** Outlet boxes shall be permitted to be installed in 2 hour or less systems. The surface area of individual boxes shall not exceed 16 square inches. The aggregate surface of the boxes shall not exceed 100 square inches in any 100 square feet. Metallic or approved non-metallic outlet boxes shall

be permitted.

**Shower or Tub.** The gypsum board required for the fire resistive rating shall extend down to the floor behind fixtures. Other wall finishes may be applied for required fire resistive systems.

### **WILDLAND URBAN INTERFACE REQUIREMENTS (WUI)**

The following requirements apply to new single family dwellings, guest houses, and second units, in accordance with CRC Section R327. New buildings include newly constructed buildings and replacement buildings when the entire structure is replaced, including the foundation. At this time manufactured homes are exempt.

Accessory structures such as detached garages, pool houses, storage buildings, barns, etc shall comply with these regulations when the accessory building is constructed in conjunction with an applicable building or if the applicable building was constructed under the requirements of Chapter 7A.

#### **EXCEPTIONS:**

1. Accessory buildings classified as Group U occupancy and not exceeding 120 square feet in floor area, when located at least 30 feet from an applicable building.
2. Accessory buildings classified as Group U occupancy of any size located at least 50 feet from an applicable building.
3. Additions to and remodels of buildings originally constructed prior to the applicable application date.

WUI requirements went into effect in two phases with the first phase becoming effective on December 1, 2005. **Additions to any structure originally constructed under these provisions must also conform to the requirements of this section.**

#### **Phase one included:**

- Roof coverings, valleys and gutters Attic and rafter bay ventilation

#### **Phase two (Jan 2008) included the items in phase one and the following:**

- Eave and soffit protection
- Exterior wall and opening protection Decking
- Appendage and underfloor protection

**Roof Coverings, Valley and Gutters.** Roof coverings shall be Class 'A'. Valley flashings when provided shall be minimum 26 gauge galvanized sheet metal installed over 36" wide underlayment of #72 cap sheet running the full length of the valley. Gutters shall be provided with screens to prevent accumulation of leaves and debris.

**Attic and Rafter Bay Ventilation.** Roof and attic vents shall resist the intrusion of flame and embers into the attic area or shall be protected by corrosion-resistant, noncombustible wire mesh with 1/16" minimum and not exceeding 1/8".

Vents shall not be installed in eaves and soffits unless one of the following exceptions are met:

1. The eave and cornice vents resist the intrusion of flame and burning embers.
2. The attic space being ventilated is fully protected by an automatic sprinkler system.
3. The vent is located more than 12 feet above grade, and the exterior wall and exposed underside of the eave are of noncombustible, or ignition resistant material.

**Open Roof Eaves.** The exposed roof deck on the underside of unenclosed roof eaves shall be protected by ignition-resistant or noncombustible material, consist of 5/8" Type X gypsum sheathing applied behind an exterior covering on the underside of the roof deck, or the exterior portion of a 1-hour assembly on the exposed underside.

The following materials do not require protection:

1. Solid wood rafter tails having a minimum nominal dimension of 2 inch.
2. Solid wood blocking between rafter tails having a minimum nominal dimension of 2 inch.
3. Gable end overhangs and roof assembly projections beyond an exterior wall other than at the lower end of the rafter tails.
4. Fascia and other architectural trim boards.

**Enclosed Roof Eaves and Roof Eave Soffits.** The exposed underside of enclosed roof eaves having either a boxed-in roof eave soffit with a horizontal underside, or sloping rafter tails with an exterior covering applied to the underside of the rafter tails, shall be protected by ignition-resistant or noncombustible material, consist of 5/8" Type X gypsum sheathing applied behind an exterior covering on the underside of the rafter tails or soffit, the exterior portion of a 1-hour assembly applied to the underside of the rafter tails or soffit, or meet the performance requirements set forth in SFM Standard 12-7A-3.

**Exterior Porch Ceilings.** The exposed underside of exterior porch ceilings shall be protected by ignition-resistant or noncombustible material, consist of 5/8" Type X gypsum sheathing applied on the underside of the ceiling, the exterior portion of a 1-hour assembly applied to the underside of the ceiling, or meet the performance requirements set forth in SFM Standard 12-7A-3.

**Exterior Wall and Opening Protection.** Exterior walls shall be approved noncombustible or ignition-resistant material, heavy timber, log wall construction, meet SFM Standard 12-7A-1, include one layer of 5/8" Type X gypsum sheathing applied behind the exterior covering on the exterior of the framing, or the exterior portion of a 1-hour assembly. Exterior wall coverings shall extend from the top of the foundation to the roof, and terminate at 2" nominal solid wood blocking between rafters at all roof overhangs or eave enclosures.

Exterior wall vent openings shall be protected by corrosion-resistant, noncombustible wire mesh with openings of 1/8" to 1/4".

Exterior glazing and glazed openings in exterior doors shall have a minimum of one tempered pane, or have a fire resistive rating of 20 minutes, or be of glass block.

Exterior doors shall be of approved noncombustible construction, or solid core wood having stiles and rails not less than 13/8" thick with interior field panel thickness not less than 1 1/4" thick, or have a minimum 20 minute fire resistive rating.

Garage vehicle doors may be noncombustible or fire-retardant treated wood.

**Decking.** Decking surfaces, stair treads, risers, and landings of decks, porches, and balconies where any portion of such surface is within 10' of the dwelling unit shall be constructed of: heavy timber, exterior fire-retardant-treated wood or approved noncombustible materials. Alternatively decking materials shall pass the performance requirements listed in CBC Chapter 7A or CRC Chapter 3 Section R327.

**Appendage and Under-Floor Protection.** The underside of cantilevered and overhanging appendages and floor projections shall be protected in a similar manner to enclosed soffits, or the projection shall be enclosed to grade.

Buildings shall have all under-floor areas enclosed to grade with exterior walls that comply with this code. The complete enclosure of under-floor areas may be omitted where the underside of exposed

floors, structural columns, beams and supporting walls are protected as required with exterior ignition-resistant material construction or be of heavy timber.

**PERFORMANCE METHODS.** The materials and methods listed above are not the complete list of options. For each category there are performance tested materials and methods that may be substituted. For additional information see CBC Chapter 7A or CRC Chapter 3 Section R327 or visit the CalFire website at: <http://www.fire.ca.gov/>

For information on approved products CalFire has a booklet entitled Wildland Urban Interface (WUI) Products available at:

<http://www.osfm.fire.ca.gov/strucfireengineer/pdf/bml/wuiproducs.pdf>

**GREEN BUILDING STANDARDS:** January 1, 2011 the 2010 California Green Building Standards Code (CALGreen) became effective throughout California. The County of Mendocino has not amended the CALGreen Code as it applies to a new structure.