

**DEVELOPMENT SERVICES – BUILDING INSPECTION****INSPECTION GUIDELINES:  
JOIST AND UNDERFLOOR COMBO****INSPECTION CODE:** 212, 213**SCOPE:** RESIDENTIAL**CODES ENFORCED:** 2016 CBC, CRC, CPC, CMC, CEC, CALGreen, CEnC, and PAMC

*The information provided in this document is general and intended as a guide only. Each project is unique and additional requirements may be enforced as deemed appropriate.*

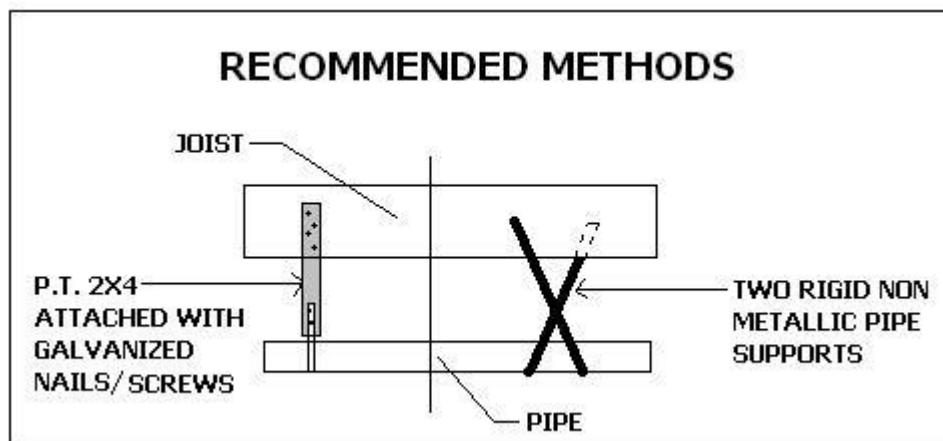
**IMPORTANT**

- Failure to complete the items below prior to the City of Palo Alto (CPA) inspection will result in a re-inspection fee.
- Gas and electric utilities will be removed if found to be unsafe at time of inspection. (CBC 3303.6)
- All structures require joist inspection prior to installation of subfloor including buildings with a crawl space, basement, and joist installed directly on floor/sleepers. DO NOT install the subfloor prior to the joist inspection—NO EXCEPTIONS. Contractor is subject to a Stop Work Order and a \$308.00 re-inspection fee when covering work or joists without inspection. The contractor will be required to provide equipment (i.e., scaffolding) and lighting to do the joist inspection if this step is skipped.

**INSPECTION****BUILDINGS IN FLOOD ZONE AREAS**

- When in a flood zone, contact Public Works Inspector Denis Huegle at 650-496-6929 to schedule an inspection; make sure that you have met all their requirements before scheduling the inspection. Public Works must sign the card before Building Inspectors can verify the work.
- All structural material and members below base flood elevation (BFE) shall be water resistant concrete or pressure treated lumber type. (CRC R322)
- All metal below the BFE shall be corrosion resistant/galvanized, including gas piping. (CRC R322.1.8)

- Mechanical, plumbing, and electrical systems shall be located at or above the BFE. (CRC R322.1.6) This includes any insulation being used.
  - Exceptions:
    - Although not recommended, in unavoidable situations duct systems exposed to flood water must be 20 gage spiral duct, sealed to prevent water entry, and braced for buoyancy effects. They shall have a minimum 4" clearance to grade and shall not block access to underfloor opening(s). The insulation on the duct must be bubble-wrap-type, secured, and sealed with waterproof tape.
    - Plumbing systems and gas piping are permitted below the BFE provided that the systems are rigidly supported to resist buoyancy during the occurrence of flooding (see Figure CPA 030). (CPC 301.4)



**Figure CPA 030 – Plumbing below BFE**

- Where under floor crawl space is less than 18", or if the underfloor area is not accessible or below BFE in a flood zone, all floor materials shall be pressure treated (e.g., joists, girders, plywood). (CBC 2304.12.1.1)

#### **FRAMING**

- Access openings: Min. 18" x 24". Underfloor access openings and crawl area shall not be blocked by duct work or plumbing. See "Mechanical" below. (CRC R408.4)
- Provide solid blocking or squash blocks under all hold-downs in raised floor installations.
- Verify all foundation attachments are per the structural plans and details (e.g., anchor bolts, clips, blocking, screws, nailing, and hold-downs).
- The size of sill plate washers shall be a minimum of 3" x 3" x 1/4". The hole in the washer may be slotted provided a standard cut washer is placed between the plate washer and the nut. (CBC 2308.3.2, CRC R602.11.1)

- Verify sill plate is sized per plan specifications and sealant, adhesive or gasket is installed between slab/foundation and sill plate to limit infiltration and exfiltration. (CEC 110.7)
- Install a minimum of two anchor bolts per sill plate. The minimum distance from end of sill should be 4" and a maximum distance from sill edge 12". (CBC 2308.3.1)
- Hardware and fasteners in contact with pressure-treated wood shall be of approved corrosion resistant material. (CRC R317.3)
- Verify that all forms, stakes, wood debris, Sonotube forms have been removed from under-floor area. (CRC R408.5)
- Air vent openings shall not be located in or below shear walls or at hold-down locations. (Vent openings are typically located under windows and non-shearwall areas.) (CRC R408)
- Post to girder and beam connections shall be closely fitted and positive connections with approved hardware at footing to post, post to girder/beam and girder/beam joints.
- Wooden stakes are not allowed at any foundation inspection when embedded in concrete. (PAMC 16.04.340)
- Wood to earth: Wood framing shall be 8" minimum from exposed ground unless pressure treated. (CRC R317.1)
- I-joist installation: install web stiffeners/backer blocks where hangers are not full height and when I-joist is used as a header. Install squash blocks a min. of 1/16" above I-joist at bearing walls. Install per manufacturer is installation instructions.
- Joist closer than 18" to ground and girders closer than 12" to ground shall be preservative treated (PT) or naturally durable wood, including post and sub-floor. (CRC R317.1)
- Cripple walls with stud height less than 14" shall be sheathed on at least one side with a wood structural panel that is fastened to both the top and bottom plates. Foundation cripple walls shall be framed of studs not smaller than the studs above. (CRC R602.9)
- Verify protection of exposed wood and insulation at foundation and flood vents from water intrusion. Install insulation baffles, apply copper green or automotive undercoat or install non-operable louvered vents to protect structure. (CEC)

**PLUMBING**

- Protect all piping systems within 1-1/2" from top of joist including copper pipes with nail plates 1-1/2" from top of joist. (CPC 312.19)
- Horizontal drain and waste piping systems shall have a minimum 1/4" per foot slope toward the point of disposal. Piping systems less than 1/4" slope needs to be pre-approved. (CPC 708.1)
- Under floor cleanouts shall not be located more than 5' from an access door. (CPC 707.9)
- Maintain an 18" clearance in front of clean out for piping 2" or less. Maintain a 24" clearance in front of the cleanout for piping larger than 2". (CPC 707.9)
- Cleanouts shall extend to or above the finished floor or be extended to the outside of the building where there is less than 18" vertical clearance (allowing for obstructions such as ducts, beams, and piping) and 30" horizontal clearance from the means of access to the cleanout. (CPC 707.9)
- A water test shall be applied to the drainage and vent systems with not less than a 10' head of water; the water shall be kept in the system for not less than 15 minutes. Alternatively, an air test can be done at a pressure of 5 psi for not less than 15 minutes. (CPC 712.2, CPC 712.3)
- Piping support: Per CPC Table 313.3 (see the page that follows).

**GAS**

- Gas piping systems shall be pressure tested not less than 10 psi for at least 15 minutes with not perceptible drop in pressure. (CPC 1213.3) (NOTE: A whole-house gas test will be required at Final Inspection.)
- Gas piping supports shall be per Table 1210.2.4.1.

**TABLE 1210.2.4.1  
SUPPORT OF PIPING  
[NFPA 54: TABLE 72.5.2]**

STEEL PIPE, NOMINAL SIZE OF PIPE (inches)	SPACING OF SUPPORTS (feet)	NOMINAL SIZE OF TUBING SMOOTH-WALL (inches O.D.)	SPACING OF SUPPORTS (feet)
1/2	6	1/2	4
3/4 or 1	8	3/4 or 1	6
1 1/4 or larger (horizontal)	10	3/4 or 1 (horizontal)	8
1 1/4 or larger (vertical)	Every floor level	1 or larger (vertical)	Every floor level

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

**TABLE 313.3  
HANGERS AND SUPPORTS**

MATERIALS	TYPES OF JOINTS	HORIZONTAL	VERTICAL
Cast	Lead and Oakum	5 feet, except 10 feet where 10 foot lengths are installed <sup>1, 2, 3</sup>	Base and each floor, not to exceed 15 feet
	Compression Gasket	Every other joint, unless over 4 feet then support each joint <sup>1, 2, 3</sup>	Base and each floor, not to exceed 15 feet
Cast-Iron Hubless	Shielded Coupling	Every other joint, unless over 4 feet then support each joint <sup>1, 2, 3, 4</sup>	Base and each floor, not to exceed 15 feet
Copper & Copper Alloys	Soldered, Brazed, Threaded, or Mechanical	1½ inches and smaller, 6 feet; 2 inches and larger, 10 feet	Each floor, not to exceed 10 feet <sup>5</sup>
Steel Pipe for Water or DWV	Threaded or Welded	¾ inch and smaller, 10 feet; 1 inch and larger, 12 feet	Every other floor, not to exceed 25 feet <sup>5</sup>
Steel Pipe for Gas	Threaded or Welded	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches and larger, 10 feet	½ inch, 6 feet; ¾ inch and 1 inch, 8 feet; 1¼ inches every floor level
Schedule 40 PVC and ABS DWV	Solvent Cemented	All sizes, 4 feet; allow for expansion every 30 feet <sup>3</sup>	Base and each floor; provide mid-story guides; provide for expansion every 30 feet
CPVC	Solvent Cemented	1 inch and smaller, 3 feet; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
Lead	Wiped or Burned	Continuous Support	Not to exceed 4 feet
Steel	Mechanical	In accordance with standards acceptable to the Authority Having Jurisdiction	
PEX	Cold Expansion, Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
PEX-AL-PEX	Metal Insert and Metal Compression	½ inch } ¾ inch } All sizes 98 inches 1 inch }	Base and each floor; provide mid-story guides
PE-AL-PE	Metal Insert and Metal Compression	½ inch } ¾ inch } All sizes 98 inches 1 inch }	Base and each floor; provide mid-story guides
PE-RT	Insert and Compression	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides
Polypropylene (PP)	Fusion weld (socket, butt, saddle, electrofusion), threaded (metal threads only), or mechanical	1 inch and smaller, 32 inches; 1¼ inches and larger, 4 feet	Base and each floor; provide mid-story guides

For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm

**Notes:**

<sup>1</sup> Support adjacent to joint, not to exceed 18 inches (457 mm).

<sup>2</sup> Brace not to exceed 40 foot (12 192 mm) intervals to prevent horizontal movement.

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

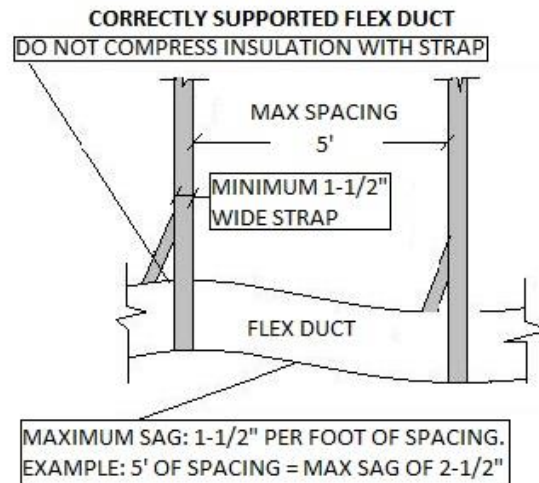
<sup>4</sup> Hangers shall not be placed on the coupling.

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

**MECHANICAL**

- Air ducts installed under a floor in a crawl space shall be installed per the following (CMC 603.2):
  - Shall not prevent access to an area of the crawl space
  - Where it is required to move under ducts for access to areas of the crawl space, a vertical clearance of not less than 18" shall be provided
  
- Ducts shall have at least a 4" clearance to the earth. (CMC 603.3)
  
- Wrap boots with insulation.

- Joints and seams and reinforcements for rigid air ducts shall be listed in accordance with UL 181A; for flexible ducts it shall be in accordance with UL 181B. (CMC 603.10)
- Installers shall provide the manufacturer's installation instructions showing the support requirements and/or per SMACNA HVAC Duct Construction Standards – Metal and Flexible. In no case shall flex duct supports be spaced more than 5' and max sag 2-1/2" or 1/2" max. per foot (see Figure CPA 032). (CMC 603.8)



**Figure CPA 032 – Correctly Supported Flex Duct**

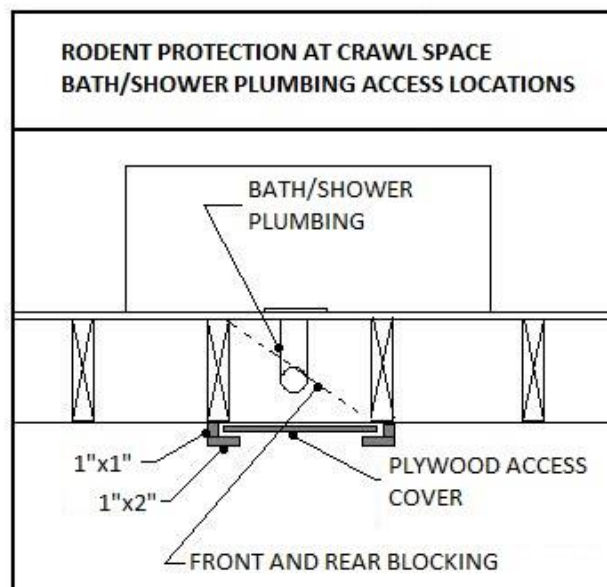
## VENTILATION

- Louvered vents are required when vent openings are above floor. (CEnC)
- The minimum net area of underfloor ventilation openings shall not be less than 1 square foot of each 150 square feet of underfloor area. (CRC R408.1)
- One ventilation opening shall be within 3 feet of each corner of the building. (CRC R408.1).
- Openings for underfloor ventilation shall be not less than 1-1/2 square feet for each 25 linear feet of exterior wall.

- Openings shall be placed so as to provide cross ventilation (and not under shear-walls).
  - Exception: At the discretion of the Building Official and when impractical due to structural features or the arrangement of the structure, the following three exceptions may be used as an alternative to the 1/150 rule as stated above. (CRC R408.2, Exception)
    1. Ventilation openings may be reduced to 1 square feet of each 1,500 square feet of underfloor area where the ground surface is treated with a CPA approved vapor retarder material and required openings are placed so as to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.
    2. Provide continuously operated mechanical ventilation and ground surface covered with CPA approved vapor retarder.
    3. CPA approved vapor retarder, perimeter walls are insulated, and the space is conditioned in accordance with the California Energy Code, Title 24, Part 6.
      - CPA Approved Vapor Retarders: Stego Wrap or Moistop; 6mill or 10 mill Visqueen plastic sheeting is not permitted because it does not comply with a permeability rating, lacks the puncture resistance, and deteriorates over time.

### RODENT PROTECTION

- Tub waste openings in framed construction to crawl spaces shall be protected from rodent intrusion with no openings greater than 1/2". See FIGURE A-3 for an approved method of protection/access. (CPC 313.12)



**Figure CPA 031** – Rodent Protection at Crawl Space Bath/Shower Plumbing Access Locations