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FAMILY DWELLINGS
And
ACCESSORY BUILDINGS

BASIC CODE INFORMATION

GREENE COUNTY
RESOURCE MANAGEMENT DEPARTMENT

Building Regulations Section
940 Boonville, Room 305
Springfield, Missouri

Telephone 417-868-4015
Fax 417-868-4175

Revised January 1, 2014

INTRODUCTION

PERMITS ISSUED OR RENEWED ON FEBRUARY 1, 2013 AND AFTER MUST ABIDE BY THESE REGULATIONS.

THIS INFORMATION IS BASED ON THE 2012 INTERNATIONAL 0NE-AND TWO-FAMILY DWELLING CODE AND OTHER ADOPTED GREENE COUNTY AMENDMENTS.

THIS HANDOUT IS ONLY *PROVIDED* AS A CONVENIENT SOURCE FOR BASIC INFORMATION AND *DOES NOT* ADDRESS ALL THE CODES *NOR DOES* THIS INFORMATION TAKE THE PLACE OF ANY ADOPTED CODE OR AMENDMENTS.

THIS INFORMATION SIMPLY ACTS AS AN INSTRUMENT TO BETTER PRESENT AND CLARIFY SOME OF THE CODE INTERPRETATIONS AND ENFORCEMENT AND DOES NOT REPRESENT THE REQUIREMENTS FOR ANY BUILDING THAT FALLS UNDER THESE OCCUPANCIES; ASSEMBLY, EDUCATION, FACTORY & INDUSTRIAL, HIGH HAZARD, INSTITUTIONAL, MERCANTILE, RESIDENTIAL (other than one and two family), AND THESE USE GROUPS: STORAGE, UTILITY AND MISCELLANEOUS OCCUPANCIES, WHERE THE BUILDINGS ARE NOT AN ACCESSORY TO ONE-AND TWO-FAMILY DWELLINGS AND WOULD NOT BE CLASSIFIED AS AN AGRICULTURAL STRUCTURE.

INSPECTIONS

It is the responsibility of the person and/or agent listed as the owner on the permit to obtain the proper inspections. The failure to obtain the proper inspections could likely result in the uncovering of work.

EXAMPLE: Removal of sheet rock when the rough-ins have not been inspected and approved.

THE PERMIT NUMBER OR ADDRESS IS REQUIRED TO BE POSTED and VISIBLE FROM THE STREET AT ALL TIMES DURING THE CONSTRUCTION. INSPECTIONS WILL NOT BE CONDUCTED IF THIS INFORMATION IS NOT POSTED.

A PERMANENT ADDRESS MUST BE POSTED BEFORE A FINAL INSPECTION IS CONDUCTED.

BEGINNING JANUARY 01, 2014

OFFICE HOURS: 8:00 AM – 4:30 PM

REQUEST FOR INSPECTIONS: All inspections **must** be called in to the Greene County Building Regulation Department at least **ONE DAY** prior to the requested inspection/inspections. **The requested inspection/inspections must be ready by 8:30 AM on the requested day of the inspection/inspections.** ***This scheduling change will include all inspections.*** **Inspections will be conducted according to the inspector's route and schedule.**

If the requested inspection/inspections are not going to be ready on the day requested, please call to cancel and reschedule.

TO SCHEDULE AN INSPECTION: Call ***417-868-4015*****.** To expedite service, have your permit number and address available.

REQUIRED INSPECTIONS	
ON-SITE	**PLUMBING**
IN-GROUND PLUMBING	**MECHANICAL (HVAC)**
FOOTINGS & ELECRICAL GROUND	**METERS (GAS and/or ELECTRIC)**
FRAMING	**SEWER OR SEPTIC**
ELECTRICAL	**FINAL**

***ON-SITE EVALUATION*:** If an accessory structure, septic system or swimming pool is to be located on the property, this inspection is required before any excavation and must be approved before excavation or construction can begin.

***FOOTING INSPECTION*:** Commonly made after the excavation is completed. All property pins must be visible, forms erected and required reinforcing steel in place prior to the placement of concrete.

ELECTRICAL GROUND: Concrete reinforced footings require the electrical grounding conductor to be attached to the rebar. **Must be in place at footing inspection**. See Page 39 for requirements.

***IN-GROUND/BASEMENT PLUMBING INSPECTION*:** All joints and piping in place and visible prior to pouring the concrete.

***ELECTRICAL, MECHANICAL, & PLUMBING ROUGH-IN INSPECTIONS*:** These inspections are required before a framing inspection and prior to insulation or sheet rock installation.

***FRAMING INSPECTION*:** All electrical, mechanical, plumbing rough-ins, and all framing, fire-stopping, draft-stopping, and bracing in place. Inspection conducted before the installation of the insulation or sheet rock.

***SEPTIC and LATERAL, OR SEWER INSPECTION*:** All drain pipe, clean outs and/or septic tank in place prior to the covering of the system or piping.

ELECTRIC METER INSPECTION: Electrical service equipment, service wiring, bonding, main disconnect, grounding in place, before meter will be approved.

GAS METER INSPECTION: Gas service to building must be installed by the gas company. Gas line installed from meter to gas fired equipment or appliance inside of structure, with twenty (20) pounds of air pressure on the line. Furnace must be ready for operation before a gas meter will be released.

FINAL INSPECTION: Building, yard grading and all phases of construction complete. Inspection must be performed before occupancy or items are moved into the structure.

ELEVATION CERTIFICATE: **When an elevation certificate is required, the certification is required to be submitted to Greene County Building Regulations when the finish floor elevation is established. No other inspections will be conducted after the basement floor or foundation walls are constructed until the certification is received and approved.**

BUILDING PLANNING

MINIMUM FLOOR AREAS

MINIMUM AREA: Every dwelling unit is required to have at least one habitable room with not less than 120 square feet of floor area. Additional habitable rooms must have a floor area of not less than 70 square feet and cannot be less than 7 feet in any horizontal dimension. Kitchen areas may be less than these requirements.

Portions of a room with a sloping ceiling measuring less than 5 feet or a furred ceiling measuring less than 7 feet from the finished floor to the finished ceiling can not be considered as part of the required minimum habitable floor area for that room.

CEILING HEIGHT

MINIMUM HEIGHT: All rooms are required to have a ceiling height of not less than 7 feet. The required height is measured from the finish floor to the lowest projection from the ceiling.

Exceptions:

- Only 50% of the required floor area of a room space is permitted to have a sloped ceiling less than 7 feet in height, but no portion of the ceiling height can be less than 5 feet in height.

- Bathrooms are required to have a minimum ceiling height of 6 feet 8 inches over the fixture and for a distance of 21-inches in front of the fixture. A shower or tub equipped with a showerhead must have the same ceiling height with a minimum area of 30 inches by 30 inches under the showerhead**.**

BASEMENTS: Portions of *basements* that do not contain habitable space, hallways, bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches.

Exception: Beams, girders, ducts or other obstructions may project to within 6 feet 4 inches (1931 mm) of the finished floor.

GLAZING

HAZARDOUS LOCATIONS: Safety glazing installed in hazardous locations is required to have a label indicating the type, thickness and the complying safely standard. The following shall be considered specific hazardous locations for the purposes of glazing:

1. In ingress and means of egress door, fixed and sliding panels of sliding or swinging doors, storm doors, side-hinged doors except jalousies and unframed swinging doors.

2. In doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers. Glazing in any part of a building wall enclosing these compartments where the bottom exposed edge of the glazing is less than 60-inches measured vertically above any standing or walking surface.

3. In individual fixed or operable panel adjacent to a door where the nearest vertical edge is within a 24-inch arch of the door in a closed position and whose bottom edge is less than 60-inches above the floor or walking surface.

4. In an individual fixed or operable panel other than locations already mentioned in Items 2 and 3 above, where it meets all of the following conditions:

    4.1. Exposed area of an individual pane greater than 9-square feet.
    4.2. Bottom edge less than 18-inches above the floor.
    4.3. Top edge greater than 36-inches above the floor.
    4.4. One or more walking surfaces within 36-inches horizontally of the glazing.

5. All glazing in railings regardless of an area or height above a walking surface. Included are the structural baluster panels and nonstructural in-fill panels.

(Continued next page)

6. Glazing in walls and fences enclosing swimming pools, hot tubs and spas where the bottom edge of the glazing is less than 60-inches above a walking surface and within 60 inches horizontally of the waters edge. This applies to all single glazing and all panes in multiple glazing.

7. Glazing adjacent stairs and ramps where the bottom exposed edge of the glazing is less than 36 inches above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramp shall be considered a hazardous location.

   Exception: When a rail is installed on the accessible side(s) of the glazing 34 to 38 inches above the walking surface, the rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass and be a minimum of 11/2-inches in cross sectional height.

8. Glazing adjacent to stairways within 60 inches horizontally of the bottom tread of a stairway in any direction when the exposed surface of the glass is less than 60 inches above the nose of the tread.

   EXCEPTION: Safety glazing is not required when the side of the stairway, landing or ramp has a guardrail, including balusters or in-fill panels and the plane of glass is greater than 18 inches from the railing.

BASEMENTS

DEFINITION: When interior walls for separate rooms are framed, these areas shall be considered as finished areas and shall be provided with required branch circuits and smoke detectors. A carbon monoxide alarm may be required if proposed bedrooms are in the basement area. All wiring shall be protected form physical damage by placing the conductors in conduit or placing sheet rock on the walls.

REQUIREMENTS FOR BASEMENTS: Basements are required to have at least one egress window or door exiting directly to the exterior of the structure. When bedrooms are planned, then each bedroom must have an egress window. The egress windows must meet the minimum opening and height requirements as outlined Emergency Escape and Rescue Openings in this document. Window well requirements must meet the requirements as outlined under Window Wells on Page 4.

An egress door in a basement is required to egress at finished yard grade level and at no time shall an exterior door egress into a pit or well located below finish grade.

In an unfinished basement at least one smoke alarm, one light and one receptacle that is ground fault protected is required. Smoke alarm must be interconnected with all the smoke alarms in the dwelling. The switch for the light must be located at the entrance to the area. Proposed bedrooms in the basement will require a carbon monoxide detector installed.

GARAGES AND CARPORTS

OPENING PROTECTION AND SEPARATION REQUIREMENT*:** The door opening between the garage and the residence is required to be a minimum of a solid wood door not less than 1 3/8-inch in thickness, solid or honeycomb core steel door not less than 1 3/8-inches in thickness or 20-minute fire rated doors. ***Panel wood doors do not have the required rating or thickness.

Openings from a garage into a sleeping room are not permitted.

Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage sheet metal or other approved material. ***The ducts are to have no openings in the garage.***

The garage is required to be separated from the residence and its attic area by not less than ½ inch gypsum board applied to the garage side. The attic access door or ladder is required to be a fire rated unit.

When a garage is beneath habitable rooms the garage is required to have 5/8-inch Type X gypsum board applied to the ceiling. The walls supporting this floor/ceiling assembly are required to be protected by not less than 1/2-inch gypsum board.

Access from the garage to the crawl area shall be a minimum of four inches off the floor. The opening will be required to have the same required protection as stated in the previous requirements for separations. ***Access can not be directly under a doorway.***

The surface is to be an approved noncombustible material. The floor area used for the parking of automobiles or other vehicles shall slope towards the main vehicle entry doorway.

CARPORTS: Carports shall be open on at least two sides. Areas not open on two sides is considered a garage.

PATIO HOME DWELLING UNITS

The common wall separating the two dwelling units shall be constructed as a two-hour rated eight-inch masonry block firewall with the following design criteria:

The wall shall be continuous from the foundation to the underside and tight to the roof deck. The small void (no greater that ½ inch) between the top of the block to the underside of the deck shall be sealed solid with safing insulation. On the underside of the rafter and extending a minimum of four feet back from the face of the firewall one layer of 5/8-inch Type "X" gypsum board shall be installed.

1. The wall shall be constructed such that it is totally independent of the adjacent construction and shall resist collapse. It shall not be used as a structural element for the adjoining framing.

2. The wall shall extend tight to a noncombustible exterior wall finish material.

3. In the case where the roof overhang extends beyond the face of the block wall both rafters and ceiling joist located next to and on either side of the firewall shall be covered on both sides with two (2) layers of 5/8 inch Type "X" gypsum board from the fascia board to the firewall.

4. No penetrations of any kind will be allowed in or through the block wall.

MEANS OF EGRESS

EXIT REQUIREMENTS:

1. One required exit door shall provide direct access from the habitable portions of the dwelling to the exterior without requiring travel through a garage.

2. The required exit door shall be a side-hinged door not less than 36 inches in width and 6 feet 8 inches in height. These minimum dimensions do not apply to other exterior doors.

3. All egress doors are required to be opened from the egress side without the use of a key.

4. The minimum width of a hallway or exit access is required to be not less than 3 feet.

EMERGENCY ESCAPE OR RESCUE OPENINGS

WINDOWS (EMERGENCY EGRESS): Every sleeping room, habitable attic and basements, are required to have one (1) egress directly to the exterior of the building, either a door or window. The restrictions to emergency egress windows are as follows;

1. The unit must be operable from the inside to a full clear opening without the use of a key, tool, or special knowledge.

2. The sill height is not to be more than 44 inches measured from the finished floor to the bottom of the clear opening.

3. The net clear opening requirement is to be obtained by normal operation of the window form the inside.

4. Minimum net clear opening shall be 5.7 square feet or 821 square inches for windows located more than 44 inches above the finished grade adjacent to the window. Windows with the sill height 44 inches or less to the finished grade adjacent to the window shall be a minimum net clear opening of 5 square feet or 720 square inches.

5. Minimum window opening height is 24 inches and the minimum opening width is 20 inches.

   EXAMPLE: A window with a height of 24 inches would require a width greater than 20 inches to meet the required opening and a window with a width of 20 inches would require a window with a height greater than 24 inches to meet the required opening.

6. Windows with a finished sill height below the adjacent ground elevation shall be provided with a window well, as defined in this handout.

WINDOW WELLS

Window wells are to be constructed of brick, masonry, galvanized metal, or other material which is impermeable to water.

1. The top of the window well shall extend a minimum of 6 inches above the adjoining grade. The bottom of the window well shall be excavated to the bottom of the footing for the adjoining foundation wall.

2. Window wells are to be backfilled with clean stone or gravel with a minimum size of 1/4 inch. Stone backfill shall extend to a point no higher than 8 inches below the window opening.

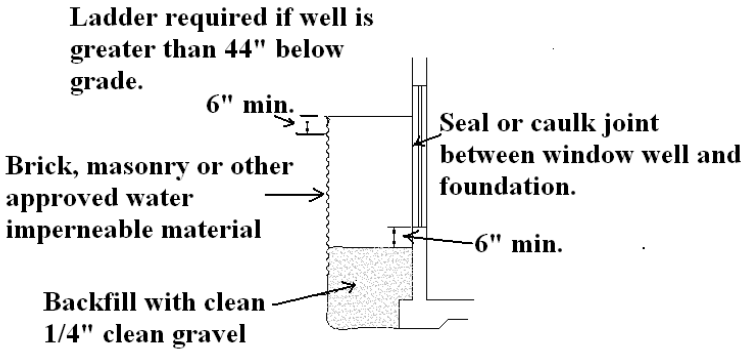
   The joint between the window well and foundation wall shall be sealed or caulked to prevent entry of surface water in the window well.

   The window well shall be designed for proper drainage by connecting to the building's foundation drainage system.

3. The horizontal dimensions of a window well serving an emergency escape or rescue window shall allow the window to be fully opened. The minimum horizontal area of a well is 9 square feet and a minimum horizontal projection width of 36 inches**.**

4. Window wells with a vertical depth greater than 44 inches below the adjacent ground level is required to have a permanently fixed ladder, usable when window is in full open position. Ladder rungs shall have an inside width of at least 12 inches, project from the wall at least 3 inches and shall not be spaced more than 18 inches on center vertically for the full height of the widow well.

Typical Window Well



LANDINGS

LANDING REQUIREMENTS:

1. At the top and bottom of a stairway a floor or landing is required.

2. A floor or landing is required on each side of an exterior door.

   EXCEPTION: Where a stairway of two or fewer risers is located on the exterior side of a door, *other than the required exit door*, a landing is not required for the exterior side of the door.

3. The landing at the exterior doorway, shall not be more than 7 3/4 inches below the top of the inside floor finish, provided that the door, other than an exterior storm or screen door, does not swing over the landing.

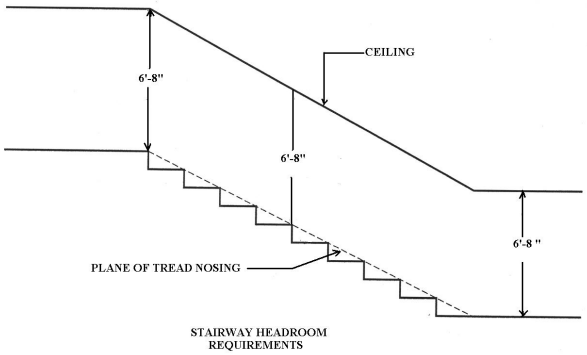
4. When an exit door swings over a landing, the landing can not be more than 1 1/2 inches below the inside floor finish.

5. The landing is required to be not less than the width of the stairway or door it serves and at least 36" measured in the direction of travel.

STAIRWAYS

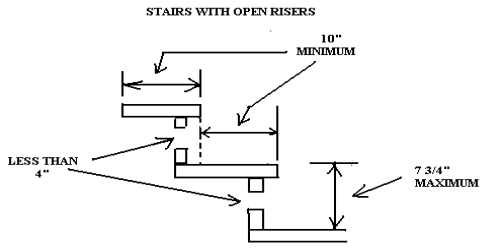
WIDTH REQUIREMENTS: The minimum width of stairways is 36 inches in clear width above the required handrail or guardrail. The minimum clear width of the stairway at and below the handrail height, including treads and landings is 31.5 inches where the handrail is installed on one side and 27 inches where handrails are provided on both sides. This does not apply to spiral stairs (defined under spiral stair section).

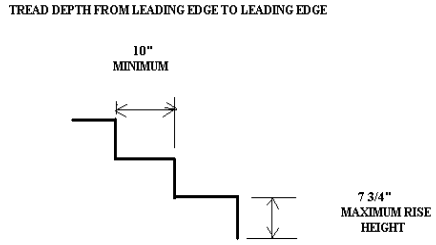
HEADROOM: The minimum headroom in all parts of the stairway is 6 feet 8 inches, measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of landing or platform.



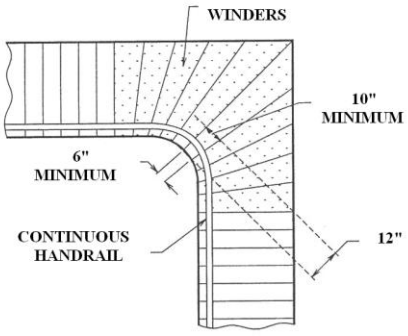
VERTICAL RISE: A flight of stairs can not have a vertical rise greater than 12 feet between floor levels or landings.

TREADS AND RISERS: The maximum riser height is 7 3/4 inches. The minimum tread depth is 10 inches measured from the nose of the tread above to the nose of the tread below. The greatest riser height and the greatest tread depth within any flight of stairs shall not exceed the smallest by more than 3/8 inch respectively. The radius of curvature at the leading edge of the tread is to be no greater than 9/16 inch. The nosing of the tread is not less than 3/4 inch and not more than 1 1/4 inches provided on stairways with solid risers (nosing is not required if the tread depth is a minimum of 11 inches). **Open risers are permitted, provided that the opening between treads does not allow the passage of a 4-inch diameter sphere.**

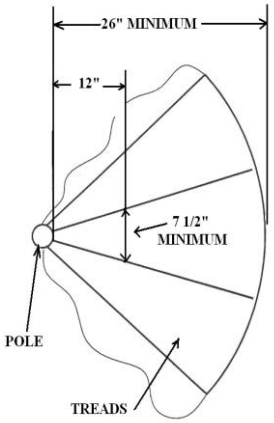


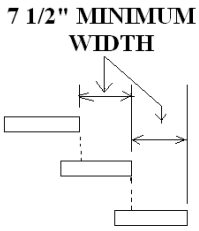


WINDERS: From a point measuring 12" from the side of the stairs where the tread is narrowest must be a minimum of 10 inches and the minimum width of the tread at the narrowest edge is not less than 6 inches. The required continuous handrail is required on the side where the tread is narrower.



SPIRAL STAIRS: The minimum width is 26 inches. Each tread having a 7 1/2 inch minimum tread depth at 12" from the narrow edge measured from the nose above to the nose below. All treads shall be identical, and the rise is to be no more than 9 1/2 inches. The minimum head clearance is 6 feet 6 inches.





UNDER STAIR PROTECTION: Enclosed accessible spaces under stairs are required to have walls, under stair surface and any soffits protected on the enclosed side with 1/2 inch gypsum board**.**

STAIRWAY ILLUMINATION: All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads.

Interior stairways shall be provided with an artificial light source located in the immediate vicinity of each landing of the stairway. A wall switch shall be installed at each floor level to control the lighting outlet where the stairway has six or more risers. Lights that are continuously illuminated or automatically controlled do not require a manual wall switch.

Exterior stairways shall be provided with an artificial light source located in the immediate vicinity of the top landing of the stairway. Exterior stairways providing access to a basement from the outside grade level shall be provided with an artificial light source located in the immediate vicinity of the bottom landing of the stairway. The illumination of exterior stairways shall be controlled from inside the dwelling. Lights that are continuously illuminated or automatically controlled do not require a manual wall switch.

Exception: An artificial light source is not required at the top and bottom landing, provided an artificial light source is located directly over each stairway section.

HANDRAILS-GUARDRAILS-WINDOW FALL PROTECTION

HANDRAILS: Handrails are required on one side of stairs with **4 or more risers**. The minimum height is 34 inches and the maximum height is 38 inches, measured from the nosing of the tread. ***For open side of stairs see requirement for guardrails.*** All required handrails shall be continuous the full length of the stairs from a point directly above the top riser of a fight of stairs to a point directly above the lowest riser of the flight of stairs.

Handrails are required to have the ends return or terminate in newel posts or safety terminals. Decorative handrails that have a termination that does not create a hazard are not required to terminate at a newel post or safety terminal. Handrails are permitted to be interrupted by a newel post at a turn.

Handrail grip size shall have one of the following or provide equivalent ability to grasp:

1. Handrails have a circular cross section with an outside diameter of at least 1 1/4 inches and not greater than 2 inches. If the handrail is not circular, then the perimeter dimension is at least 4 inches and not greater than 6 1/4 inches with a maximum cross section dimension of 2 1/4 inches.

2. Handrails with a perimeter greater than 6 1/4 inches are required to provide a graspable finger recess area on both sides of the rail. The finger recess is required to be within a distance of 3/4 inch measured vertically from the tallest portion of the profile and achieve a depth of at least 5/16 inch within 7/8 inch below the widest profile. This required depth is to continue for at least 3/8 inch to a level that is not less than 1 3/4 inches below the tallest portion of thee profile. The minimum width of the handrail above the recess shall be 1 1/4 inches to maximum of 2 3/4 inches. Edges shall have a radius.

GUARDRAILS: Guards shall be located along open-sided walking surfaces *(See definition of walking surface), including stairs, ramps, landings and retaining walls that are located more than 30 inches measured vertically to the floor or grade below at any point within 36 inches horizontally to the edge of the open side. Guardrail minimum height is 36 inches.

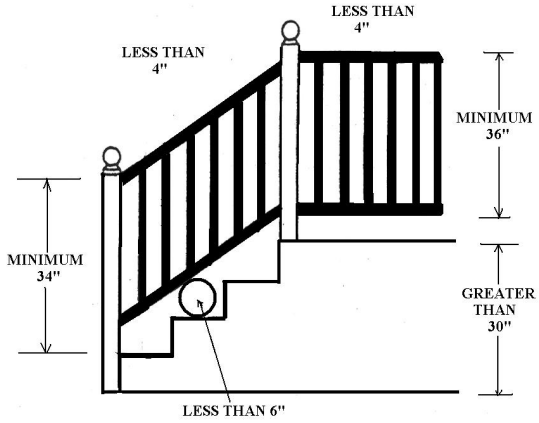
Exception: Retaining walls that measure in height 72 inches or greater requires a guardrail system meeting the minimum code requirements.

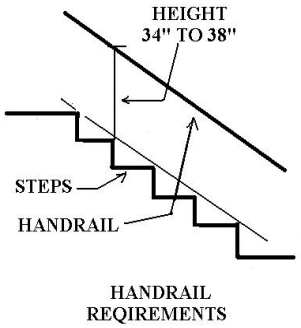
***WALKING SURFACE**: Walking surface shall be defined as paths, stairs, driveways, and sidewalks leading to and from the building unit and are fabricated from common products such as wood, pavers, asphalt, concrete, tile, wood chips and gravel.

Porches and decks which are enclosed with insect screening are to be provided with guards when the walking surface is located more than 30 inches above the floor or grade.

Stairways with open sides or side with a total rise of more than 30 inches above the floor or grade below are required to have guardrails of not less than 34 inches in height measured vertically from the nose of the tread.

The intermediate rails or ornamental closures shall be less than 4 inches apart. The triangular openings formed by the riser, tread and bottom rail should not allow an object of 6 inches in diameter to pass through.





HANDRAIL REQIREMENTS

WINDOW FALL PROTECTION: When the opening of an operable window is located more than 72 inches (1829 mm) above the finished grade or surface below, the lowest part of the clear opening of the window shall be a minimum of 24 inches (610 mm) above the finished floor of the room in which the window is located.

When the window opening is located within 24 inches (610 mm) of the finished floor the operable sections of window shall comply with one of the following requirements:

1. Windows whose openings will not allow a 4- inch-diameter (102 mm) sphere to pass through the opening when the opening is in its largest opened position.
2. Openings that are provided with window fall prevention devices that comply with ASTM F 2090.
3. Windows that have an opening control device complying with ASTM 2090. The window opening control device, after operation, can release allowing the window to fully open. The opening control device shall not reduce the minimum net clear opening area of the window unit to less than the area required for an egress window.

RAMPS

RAMP REQUIREMENTS: All egress ramps shall have a maximum slope of 1 in 12 or 8.3 percent slope unless it is technically infeasible to comply due to site restraints, then the slope can be 1 in 8 slop or 12.5 percent slope.

Handrails are required on one side of the ramp if ramp exceeds a slope of 1 in 12 or 8.33 percent slope placed not less than 34” and not greater than 38” above the finished surface of the ramp. Handrails are to be continuous for the full length of the ramp. The grip size shall be the same as if the handrail is for a set of stairs.

A minimum of a 3 foot by 3 foot landing is required at the top and bottom of the ramp, where doors open onto the ramp and where the ramp changes direction.

SMOKE ALARMS

LOCATION and INSTALLATION REQUIREMENT: Smoke alarms are to be approved and listed.

1. Installed in each sleeping room and outside of each sleeping area in the vicinity of the bedrooms.

2. Installed on each additional story of the dwelling, including basements and habitable attics.

   EXCEPTION: Dwelling units with split levels that are less than 1 full story in height between levels and without an intervening door between the adjacent levels only requires a smoke alarm on the upper level.

3. Smoke alarms are to be interconnected so that when one alarm is activated; all alarms will activate and provide an alarm that is audible in all sleeping areas.

4. Placement of smoke alarms:
   - Located not less than 4" from the sidewall.
   - When installed on the sidewall can not be less than 4 and not greater than 12" from the ceiling.
   - Smoke alarms are not to be installed in a corner.
   - Located not closer than 3 feet from a door to a bathroom or kitchen.
   - Located not less than 3 feet from vent opening or attic fan.
   - Shall not be less than manufacture specifications.

5. Smoke alarms are to receive their primary power source from the building wiring, and have a battery for back up power.

Where a household fire warning system is installed using a combination of smoke detector and audible notification device(s), it shall become a permanent fixture of the occupancy and owned by the homeowner. The system shall be monitored by an approved supervising station and be maintained in accordance with NFPA 72.

Smoke alarms or a combination of smoke detector and audible notification device are required to operate in the event that the fire alarm panel is removed or when the system is not connected to a central station. In the event that the system will not work under these circumstances, then an alternate smoke alarm system must be installed according to the regulations previously outlined.

CARBON MONOXIDE ALARMS

LOCATION and INSTALLATION REQUIREMENT: When fuel-fired appliances are installed in a dwelling or the dwelling has an attached garage and alterations or additions and when one additional bedroom is added, an approved carbon monoxide alarm shall be installed outside each separate sleeping area in the immediate vicinity of the bedrooms.

Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner and shall be monitored by an approved supervising station. In the event that the system will not work under these circumstances then an alternate carbon monoxide system must be installed according to the regulations previously outlined.

GRADING AND STORMWATER DRAINAGE

DRAINAGE EASEMENTS: No new construction will be allowed within drainage easements.

The yard grading on the lot shall not be graded such as to lower the grade below the highest existing grade with a drainage easement located on or adjoining the lot.

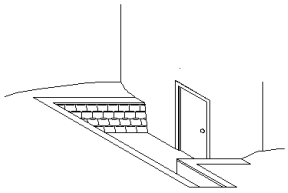
MINIMUM FLOOR ELEVATION: On lots which contain or adjoin a drainage easement, the minimum floor elevation for all new construction or building addition, which is open to the exterior shall be set a minimum of 12 inches above the highest estimated flooding elevation resulting with a 1% annual exceedance probability (100-year storm). Where the minimum floor elevation is specified on the recorded final plat for a subdivision, the minimum elevation specified on the plat shall be used.

Minimum floor elevations must be certified by a land surveyor or engineer registered with the State of Missouri. This certification is required to be submitted to the Greene County Building Regulation Section once the floor elevation has been established and before the framed walls are constructed.

(Continued next page)

Enclosed basements shall be exempt from the minimum floor elevation. At no time shall an exterior door access be permitted into a pit or well, that is located below finish grade. Where window wells are provided for required egress windows, the window wells shall be constructed as indicated.

EXTERIOR DOORS INTO A PIT (BELOW GRADE) NOT ALLOWED



CRAWL SPACE ENTRANCES: Wells for crawl space entrances are required to be excavated to 8 inches below the crawl space opening and extend 6 inches above the finish yard grade. The opening is required to be a minimum of 18 inches by 24 inches. When any portion of the through wall access is below grade, an areaway not less than 16 inches by 24 inches shall be provided. Crawl space access in garages must be a minimum of 4 inches from the garage floor and the opening shall have the same protection as required between the dwelling and garage. Crawl space entrances can not be located under a door.

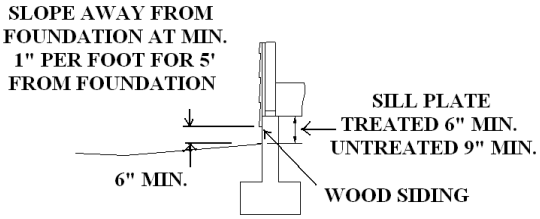
The construction of the crawl space well is required to be constructed of brick, masonry, galvanized metal, or other material which is impermeable to water. The joint between the well and the foundation or wall shall be sealed or caulked to prevent entry of surface water into the crawl space well.

GRADES AROUND BUILDING FOUNDATIONS: The area around the building foundation shall be graded to drain water away from the foundation without ponding of water. Grades adjoining building foundations shall be a minimum of 6 inches below the top of the foundation wall (9 inches if the sill plate is not constructed of treated wood or other approved moisture resistant construction).

Grades adjoining wood siding or foundation vents shall be 6 inches below the vents or wood siding.

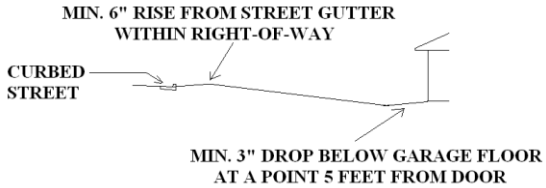
The grade shall slope away from the foundation at a minimum of 1 inch to 12 inches to a point 5 feet from the foundation.

Grades beneath decks are required to meet the same specifications as indicated in this section.

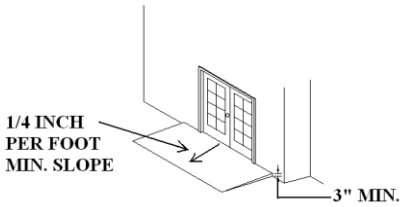


GARAGES: When a garage is built on a lot adjoining a curbed street the garage floor is required to be 6 inches above the top of the curb on the adjoining the street, unless approved in writing by the Director of the Resource Management Department.

Where topography makes it impractical to set the garage floor elevation above the top of curb or top of roadway ditch, the driveway grade at a point 5 feet outside the garage door shall be a minimum of 3 inches below the garage floor.



EXTERIOR PATIOS: Exterior patios are required to slope away from the foundation at a minimum rate of 1/4 inch to 12 inches horizontal. Grade adjoining the patio is required to be a minimum of 3 inches below the patio and slope away from the patio at a minimum of 1/4 inch per foot. (See example next page)



LOT AND YARD GRADING: Grading of the lot or property shall be done in a manner so as not to cause ponding of water, sedimentation or erosion on adjoining property which would not otherwise **have occurred.**

FINAL YARD GRADING: No certificate of occupancy shall be issued until final grading has been completed.

PROTECTION AGAINST DECAY

REQUIRED LOCATIONS: The following locations require the use of pressure treated lumber or decay-resistant heartwood of redwood, black locust, or cedars.

1. Wood joist or bottom of wood structural floor when closer than 18 inches or wood girders when closer than 12 inches to exposed ground in crawl spaces or unexcavated areas located within the periphery of the building foundation.

2. All wood framing members that rest on concrete or masonry exterior foundation walls and are less than 8 inches from the exposed ground.

3. Sills and sleepers on a concrete or masonry slab, unless the slab and ground is separated by an impervious moisture barrier.

4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 1/2 inch on tops, sides and ends.

5. Wood siding, sheathing and wall framing on the exterior of a building having clearance of less than 6 inches from the ground or less than 2 inches from concrete steps, porch slabs, patio slabs, and similar horizontal surfaces.

6. Wood structural members supporting concrete or masonry slabs, unless separated with an impervious moisture barrier.

7. Wood furring strips or wood framing members attached directly on the inside of an exterior masonry or concrete wall below grade, except where an approved vapor retarder is applied between the wall and the wood members.

WOOD COLUMNS: Wood columns are to be approved wood of natural decay resistance or approved pressure treated.

GROUND CONTACT, EXPOSED TO WEATHER or EMBEDDED IN CONCRETE: All wood in contact with the ground or exposed to the weather, wood members which are structural supports of buildings, balconies, decks, porches or similar permanent building components, are required to be pressure preserved wood.

FASTENERS: Fasteners for pressure preservative and fire-retardant-treated wood shall be of hot-dipped galvanized steel, stainless steel, silicon bronze or copper. See deck handout for exterior wood deck requirements.

FOOTINGS, FOUNDATIONS, PIERS AND COLUMNS:

WEATHER CONDITIONS: The placement of concrete for footings and foundations will follow rules as set out by the ACI Standard for concrete construction. Concrete can only be placed in cold weather under the following conditions;

1. Only on frost free surfaces.

2. Placed when the temperature is between 40 degrees Fahrenheit and 30 degrees Fahrenheit, the concrete must be protected from freezing with approved insulation blankets. **Straw will not be allowed.**

3. If placed when temperature is below 30 degrees Fahrenheit, methods to heat the air around the concrete from 55 degrees Fahrenheit to 65 degrees Fahrenheit must be in place for a period of 5 days after the pour.

FOOTINGS: Footings are to be placed on undisturbed natural soils or soils that have been compacted and approved by a registered engineer. The compaction report must be submitted to this department before footings will be approved.

All footings are to be continuous **including across the opening for the garage door (doors)**, the top surface is to be level and bottom surface of footings is not to exceed a 10 percent slope. Footings with the bottom surface exceeding a 10 percent slope are required to be stepped and the step is to be continuous with the footing.

The minimum depth of the footing is 18 inches below the finished grade. A walk out basement or slab on grade is required to have the footing area trenched to obtain the required minimum depth of 18 inches.

The required thickness of the footing is 8 inches minimum, with 2 strands of a minimum 1/2 inch, #4, grade 60, steel reinforcement rebars. The rebar is placed 3 inches from the side of the footing and elevated 4 inches from the bottom of the footing. When the footing is wider than 24 inches then 3 strands of rebar is required to be spaced equally across the width of the footing. **The rebar must be supported with approved chairs or other approved manner (*bricks, rocks or stones will not be approved)***

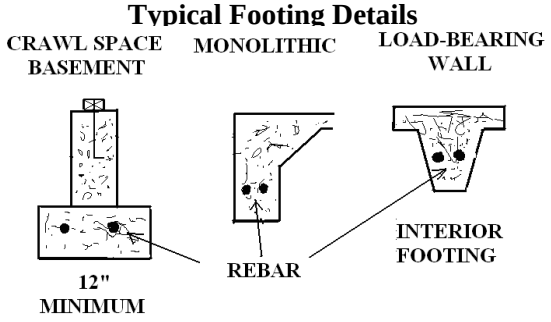
Interior footings for supporting load bearing walls or floors in basement areas requires a minimum thickness of 8 inches with 2 rows of #4 rebar. Pier pads can be placed in the floor when using supporting posts. Pier pads shall be a minimum size as to the depth and width of the perimeter footing. With a mat of 4- #4 rebar running both directions.

Masonry fireplace footings are to be a minimum of 12 inches thick, with steel reinforcement bars.

Brick or masonry unit veneers must be supported by the foundation and the footings. A brick ledge can be formed in the foundation or by concrete masonry units bearing on the footing. Masonry units must be laid off of the footing with full mortared joints and wall ties. Dry stacking and voids between the masonry units are not allowed.

See deck handout for requirements for exterior deck supports.

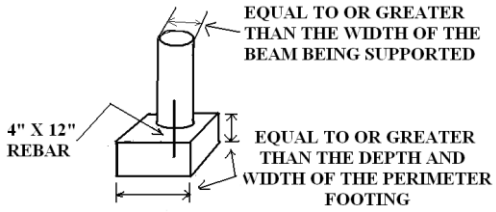
Typical Footing Details



PIERS AND COLUMNS: All concrete pads and piers shall be of sufficient design to accommodate all loads and transmit the resulting loads to the soil within the imitations as determined by the character of the soil.

The concrete piers shall meet the following requirements:

- The pad for the pier shall be a minimum size as to the depth and width of the perimeter footing.
- The pier must be centered on and along the beam centerline.
- The size of the pier shall be equal to or greater than the width of the beam being supported.
- The pier shall be plum and straight.
- The pier shall be attached to the pier pad.
- Shim material used between beam and pier shall be hardwood or metal **(no other material allowed)**.



Masonry piers supporting floor girders shall meet the following requirements:

Masonry piers supporting girders for interior bearing walls shall have a minimum nominal dimension of 12 inches **(double blocks or 12 inch blocks required).** The maximum height is 10 feet from top of footing to bottom of sill plate or girder. Piers supporting girders for exterior bearing walls shall have a minimum nominal dimension of 12 inches (305 mm) and a maximum height of 4 feet from top of footing to bottom of sill plate or girder. Girders and sill plates shall be anchored to the pier or footing. All masonry units shall be mortared together. Hollow masonry piers shall be mortared capped with 4 inches (102 mm) of solid masonry or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout. Shim material between bean and pier shall be hardwood (oak, etc.) or metal, **(no other material will be allowed).**

FOUNDATION WALLS: The top of the foundation walls are to be kept a minimum of 6 inches higher than the surrounding finish grade.

Stemwalls shall be constructed with a minimum of two (2) horizontal No. 4 bars, to be located approximately three (3) inches from the exterior surface of the wall and spaced approximately eighteen (18) inches apart vertically with the top and bottom bars within six (6) inches of the top and bottom of the stemwalls. If the stemwall is taller than three (3) feet, additional bars shall be added such that the spacing between the horizontal bars is not greater than eighteen (18) inches. Vertical No. 4 bars shall be used to adequately support the horizontal reinforcement.

Foundation walls for basement reinforcement requirements shall be addressed according the width of the wall, soil type, amount of back fill against the wall and the height. Contact building inspector for the requirements. Any foundation wall that exceeds 10 feet in height will require a Missouri licensed engineer design.

All wood framing members that rest on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground shall be preservative-treated.

FOUNDATION DRAINS: Foundation drains are required around all concrete or masonry foundations that contain earth and enclosed habitable or usable spaces located below grade. Drains are to be perforated pipe or other approved material having a minimum diameter of 4 inches. Top of pipe is to be located no higher than the bottom of the floor slab for the enclosed space. Drains are to be bedded with ½ inch minimum size clean gravel extending a minimum of 3 inches in all directions around the pipe.

Foundation drains are drain by gravity or mechanical means to the ground surface. Foundation drains shall not be connected to the storm sewer system.

Exterior foundation drains are not to be connected to interior floor drains or sump pumps. Where a sump pump is required to drain exterior foundation drains the sump pump shall be located outside the foundation wall.

FOUNDATION ANCHORAGE: Anchor bolts are required to attach wood sole plate to the foundation wall or monolithic slabs at the exterior walls. The minimum anchor size is 1/2 inch in diameter and extend 7 inches into the foundation. The anchor bolts are to be spaced a maximum of 6 feet on center and 2 bolts are required for each sill plate section. Bolts are to be located a maximum of 12 inches from each end of the plate section.

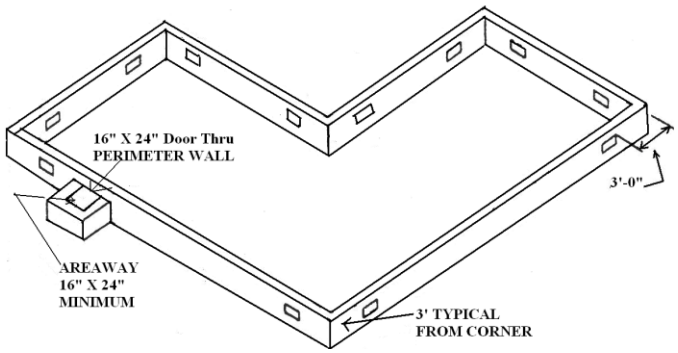
***FOUNDATION DAMPPROOFING*:** Foundation walls enclosing habitable or usable storage space are required to be damp-proofed from the top of the footing to the finished grade.

REMOVAL OF DEBRIS: The under-floor grade is required to be cleaned of all vegetation and organic material. All wood forms used for placing concrete, all construction material and trash are required to be removed from the crawl area.

VENTILATION: Openings for vented crawl spaces are required to be a minimum of 1 square foot for each 150 square feet of crawl space area. One ventilating opening is to measure a maximum of 3 feet of each corner building. Ventilation openings are required to be covered for their height and width with materials that provide at least dimension of covering does not exceed 1/4 inch. If the ground surface under floor is covered with a Class 1 vapor barrier, the ventilation openings can be reduced to 1 square foot per 1,500 square feet of under floor space. A minimum of one vent on each corner of the building. (See example next page)

When combustion air for the HVAC system is obtained from the crawl area the ventilation requirements are required to be increased to provide for both requirements.

TYPICAL
FOUNDATION VENTILATION



Unvented crawl spaces are allowed. Contact a building inspector for the requirements.

RETAINING WALLS: Retaining walls are required when the finish yard grade cannot provide a 3:1 slope. The walls are to be constructed of reinforced concrete, segmental block, stacked native stone or other material that is decay-resistant and structurally sound. The following cases will require a design by a Professional Engineer:

1. Retaining walls exceeding 6 feet in height.
   Exception: The walls are constructed of reinforced concrete and are structurally connected to the reinforced concrete foundations of the dwelling and do not extend more than 10 feet in height or more than 10 feet from the dwelling.

2. Retaining walls supporting or anticipated to support building foundation loads.

3. Terraced walls having a combined height of 20 feet or more and having a slope steeper than 1.5:1.

Retaining walls greater than 30 inches in height are required to have a guardrail installed on top or adjacent to the wall. The guardrail shall be a minimum of 36 inches in height and the intermediate rails or ornamental closures shall not allow the passage of a 4 inch sphere or more in diameter.

COLD-FORM STEEL FRAMING

IDENTIFICATION: Load-bearing steel framing members are required to be labeled with the manufacture's identification; minimum coated steel thickness in inches, minimum coating designation and minimum yield strength in kips per square inch.

MATERIAL: Load-bearing steel members utilized in cold-form steel construction are required to be formed from sheet steel and have a metallic coating complying with the ASTM requirements.

A detailed material list is required to be supplied by the manufacturer or supplier to the Greene County Building Regulations prior to construction.

FLOOR FRAMING

GENERAL: Load-bearing dimension lumber for joists, beams and girders are required to be identified with a grade mark of a lumber grading or inspection agency.

ALLOWABLE SPANS: Joists, girders, and sheathing shall comply with the span tables as indicated in this handout. For lumber and spacing not indicated in these span tables contact a Building Inspector for further information.

(See span chart on page 17)

BLOCKING and SUB-FLOORING: Blocking is required to be a minimum of Utility grade lumber. Sub-flooring may be a minimum of Utility grade or No.4 Common grade boards.

JOIST UNDER LOAD BEARING PARTITIONS: Joist under parallel load-bearing partitions are required to be doubled or a beam of adequate size to support the load. Double joist which are separated to allow for the installation of piping or vents shall be solid blocked, spaced not more than 4 feet on center.

LOAD BEARING: The ends of each joist, beam or girder are required to have a minimum of 1 1/2 inches of load bearing on wood or metal and a minimum of 3 inches on masonry or concrete. Approved joist hangers may be used.

FLOOR SYSTEMS: Floor systems having joists framing from opposite sides over a load-bearing support are required to be tied together by lapping joists a minimum of 3 inches. The joists are required to be nailed together with a minimum of 3 number 10d nails.

JOIST FRAMING: Joists framing into the side of a wood girder or framing member are to be supported with one of the following methods: approved framing anchors (joist hangers), pressure blocking both sides of joist (pressure blocks same size as joist) or ledger strips not less than a nominal 2 inches by 2 inches.

DRAFT-STOPPING REQUIREMENTS: When there is space above and below the concealed space of a floor/ceiling assembly, draft-stopping shall be installed so that the area of the concealed space does not exceed 1,000 square feet. The area is to be divided into equal areas. Draft-stopping shall be installed where the assembly is enclosed by a floor membrane above and a ceiling membrane below. Draft-stopping shall be installed in the following areas:

1. Ceiling is suspended under the floor framing.

2. Floor framing is constructed of truss-type open-web or perforated members.

Draft-stopping materials shall not be less than 1/2-inch gypsum board, 3/8-inch wood structural panels, 3/8 -inch particle board. Draft-stopping shall be installed parallel to the floor framing members. Any penetrations (ducts, pipes, wiring, etc) and joints are required to be sealed, not allowing air movement through the draft-stop

WOOD TRUSSES: Wood trusses are to be designed in accordance with approved engineering practice. The truss design drawings are required to be prepared by a registered engineer licensed by the State of Missouri.

The truss design drawings are required to be provided to the building inspector prior to inspection. The drawings shall include the following:

1. Slope, or depth, span and spacing.

2. Required bearing widths.

3. All design loads which include the live load, top and bottom chord dead loads, bottom chord live load, wind load and concentrated loads with points of application.

4. Lumber size, species and grade for each member.

5. Bracing requirements.

Trusses can not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional.

FLOOR JOIST FOR COMMON LUMBER SPECIES

JOIST SPACING (inches)	SPECIES AND GRADE		Residential Living Area Live Load = 40 psf, L = 360 DEAD LOAD = 10 psf 2x6 Maximum Span (ft - in.)	2x8 Maximum Span (ft - in.)	2x10 Maximum Span (ft - in.)	2x12 Maximum Span (ft - in.)	Residential Sleeping Areas Live Load = 30 psf, L = 360 DEAD LOAD = 10 psf 2x6 Maximum Span (ft - in.)	2x8 Maximum Span (ft - in.)	2x10 Maximum Span (ft - in.)	2x12 Maximum Span (ft - in.)
12	Douglas fir-larch	SS	11- 4	15- 0	19- 1	23- 3	12- 6	16- 6	21- 0	25- 7
	Douglas fir-larch	#1	10-11	14- 5	18- 5	22- 0	12- 0	15-10	20- 3	24- 8
	Douglas fir-larch	#2	10- 9	14- 2	17- 9	20- 7	11-10	15- 7	19-10	23- 0
	Douglas fir-larch	#3	8- 8	11- 0	13- 5	15- 7	9- 8	12- 4	15- 0	17- 5
	Hem-fir	SS	10- 9	14- 2	18- 0	21-11	11-10	15- 7	19-10	24- 2
	Hem-fir	#1	10- 6	13-10	17- 8	21- 6	11- 7	15- 3	19- 5	23- 7
	Hem-fir	#2	10- 0	13- 2	16-10	20- 4	11- 0	14- 6	18- 6	22- 6
	Hem-fir	#3	8- 8	11- 0	13- 5	15- 7	9- 8	12- 4	15- 0	17- 5
	Southern pine	SS	11- 2	14- 8	18- 9	22-10	12- 3	16- 2	20- 8	25- 1
	Southern pine	#1	10-11	14- 5	18- 5	22- 5	12- 0	15-10	20- 3	24- 8
	Southern pine	#2	10- 9	14- 2	18- 0	21- 9	11-10	15- 7	19-10	24- 2
	Southern pine	#3	9- 4	11-11	14- 0	16- 8	10- 5	13- 3	15- 8	18- 8
	Spruce-pine-fir	SS	10- 6	13-10	17- 8	21- 6	11- 7	15- 3	19- 5	23- 7
	Spruce-pine-fir	#1	10- 3	13- 6	17- 3	20- 7	11- 3	14-11	19- 0	23- 0
	Spruce-pine-fir	#2	10- 3	13- 6	17- 3	20- 7	11- 3	14-11	19- 0	23- 0
	Spruce-pine-fir	#3	8- 8	11- 0	13- 5	15- 7	9- 8	12- 4	15- 0	17- 5
16	Douglas fir-larch	SS	10- 4	13- 7	17- 4	21- 1	11- 4	15- 0	19- 1	23- 3
	Douglas fir-larch	#1	9-11	13- 1	16- 5	19- 1	10-11	14- 5	18- 5	21- 4
	Douglas fir-larch	#2	9- 9	12- 7	15- 5	17-10	10- 9	14- 1	17- 2	19-11
	Douglas fir-larch	#3	7- 6	9- 6	11- 8	13- 6	8- 5	10- 8	13- 0	15- 1
	Hem-fir	SS	9- 9	12-10	16- 5	19-11	10- 9	14- 2	18- 0	21-11
	Hem-fir	#1	9- 6	12- 7	16- 0	18- 7	10- 6	13-10	17- 8	20- 9
	Hem-fir	#2	9- 1	12- 0	15- 2	17- 7	10- 0	13- 2	16-10	19- 8
	Hem-fir	#3	7- 6	9- 6	11- 8	13- 6	8- 5	10- 8	13- 0	15- 1
	Southern pine	SS	10- 2	13- 4	17- 0	20- 9	11- 2	14- 8	18- 9	22-10
	Southern pine	#1	9-11	13- 1	16- 9	20- 4	10-11	14- 5	18- 5	22- 5
	Southern pine	#2	9- 9	12-10	16- 1	18-10	10- 9	14- 2	18- 0	21- 1
	Southern pine	#3	8- 1	10- 3	12- 2	14- 6	9- 0	11- 6	13- 7	16- 2
	Spruce-pine-fir	SS	9- 6	12- 7	16- 0	19- 6	10- 6	13-10	17- 8	21- 6
	Spruce-pine-fir	#1	9- 4	12- 3	15- 5	17-10	10- 3	13- 6	17- 2	19-11
	Spruce-pine-fir	#2	9- 4	12- 3	15- 5	17-10	10- 3	13- 6	17- 2	19-11
	Spruce-pine-fir	#3	7- 6	9- 6	11- 8	13- 6	8- 5	10- 8	13- 0	15- 1
19.2	Douglas fir-larch	SS	9- 8	12-10	16- 4	19-10	10- 8	14- 1	18- 0	21-10
	Douglas fir-larch	#1	9- 4	12- 4	15- 0	17- 5	10- 4	13- 7	16- 9	19- 6
	Douglas fir-larch	#2	9- 1	11- 6	14- 1	16- 3	10-1	12-10	15- 8	18- 3
	Douglas fir-larch	#3	6-10	8- 8	10- 7	12- 4	7- 8	9- 9	11-10	13- 9
	Hem-fir	SS	9- 2	12- 1	15- 5	18- 9	10- 1	13- 4	17- 0	20- 8
	Hem-fir	#1	9- 0	11-10	14- 8	17- 0	9-10	13- 0	16- 4	19- 0
	Hem-fir	#2	8- 7	11- 3	13-10	16- 1	9- 5	12- 5	15- 6	17-1
	Hem-fir	#3	6-10	8- 8	10- 7	12- 4	7- 8	9- 9	11- 10	13- 9
	Southern pine	SS	9- 6	12- 7	16- 0	19- 6	10- 6	13-10	17- 8	21- 6
	Southern pine	#1	9- 4	12- 4	15- 9	19-2	10- 4	13- 7	17- 4	21- 1
	Southern pine	#2	9- 2	12- 1	14- 8	17- 2	10- 1	13- 4	16- 5	19- 3
	Southern pine	#3	7- 4	9- 5	11- 1	13- 2	8- 3	10- 6	12- 5	14- 9
	Spruce-pine-fir	SS	9- 0	11-10	15- 1	18- 4	9- 10	13- 0	16- 7	20- 2
	Spruce-pine-fir	#	8- 9	11- 6	14- 1	16- 3	9- 8	12- 9	15- 8	18- 3
	Spruce-pine-fir	#2	8- 9	11- 6	14- 1	16- 3	9- 8	12- 9	15- 8	18- 3
	Spruce-pine-fir	#3	6-10	8- 8	10- 7	12- 4	7- 8	9- 9	11-10	13- 9
24	Douglas fir-larch	SS	9- 0	11-11	15- 2	18- 5	9-11	13- 1	16- 8	20- 3
	Douglas fir-larch	#1	8- 8	11- 0	13- 5	15- 7	9- 7	12- 4	15- 0	17- 5
	Douglas fir-larch	#2	8- 1	10- 3	12- 7	14- 7	9- 1	11- 6	14- 1	16- 3
	Douglas fir-larch	#3	6- 2	7- 9	9- 6	11- 0	6-10	8- 8	10- 7	12- 4
	Hem-fir	SS	8- 6	11- 3	14- 4	17- 5	9- 4	12- 4	15- 9	19- 2
	Hem-fir	#1	8- 4	10- 9	13- 1	15- 2	9- 2	12- 0	14- 8	17- 0
	Hem-fir	#2	7-11	10- 2	12- 5	14- 4	8- 9	11- 4	13-10	16- 1
	Hem-fir	#3	6- 2	7- 9	9- 6	11- 0	6-10	8- 8	10- 7	12- 4
	Southern pine	SS	8-10	11- 8	14-11	18- 1	9- 9	12-10	16- 5	19-11
	Southern pine	#1	8- 8	11- 5	14- 7	17- 5	9- 7	12- 7	16- 1	19- 6
	Southern pine	#2	8- 6	11- 0	13- 1	15- 5	9- 4	12- 4	14- 8	17- 2
	Southern pine	#3	6- 7	8- 5	9-11	11-10	7- 4	9- 5	11- 1	13- 2
	Spruce-pine-fir	SS	8- 4	11- 0	14- 0	17- 0	9- 2	12- 1	15- 5	18- 9
	Spruce-pine-fir	#1	8- 1	10- 3	12- 7	14- 7	8-11	11- 6	14- 1	16- 3
	Spruce-pine-fir	#2	8- 1	10- 3	12- 7	14- 7	8-11	11- 6	14- 1	16- 3
	Spruce-pine-fir	#3	6- 2	7- 9	9- 6	11- 0	6-10	8- 8	10- 7	12- 4

FLOOR CANTILEVERS: Floor cantilevers are permitted when supporting a light-frame bearing wall and roof only. Ratio of back-span to cantilever span is to be a minimum of 3 to 1. The following table is for 3 or more repetitive members.

	Roof Width		
Member and spacing # 2 Grade Material	**24 feet**	**32 feet**	**40 feet**
2 X 8 @ 12 "	**20 "**	**15"**	
2 X 10 @ 16"	**29"**	**21"**	**16"**
2 X 10 @ 12"	**36"**	**26"**	**20"**
2 X 12 @ 16"		**32"**	**25"**
2 X 12 @ 12"		**42"**	**31"**
2 X 12 @ 8"		**48"**	**45"**

Floor cantilevers supporting an exterior balcony are permitted to be constructed in accordance with the following table. A minimum of Number 2 Grade lumber with 3 or more repetitive members and the ratio of back-span to cantilever span is to be a minimum of 3 to 1.

Member Size	**Spacing**	**Span**
2 X 8	**12"**	**42"**
2 X 8	**16"**	**36"**
2 X 10	**12"**	**61"**
2 X 10	**16"**	**53"**
2 X 10	**24"**	**43"**
2 X 12	**16"**	**72"**
2 X 12	**24"**	**58"**

LATERAL SUPPORTS: Joists to be supported laterally at the ends by full-depth solid blocking not less than 2 inches nominal thickness or attached to a header, band, rim joist, adjoining stud. Stiff backs are allowed to be used to prevent joist rotation. The stiff backs must be blocked and nailed at all supporting walls.

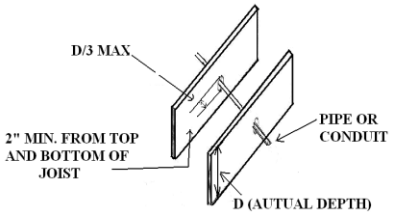
BRIDGING: Joists exceeding a nominal 2 by 12 are required to be supported laterally by solid blocking or diagonal bridging (wood or metal) at intervals not exceeding 8 feet.

DRILLING AND NOTCHING: Notches in solid lumber joists and rafters shall not exceed one-sixth (1/6) the depth of the member, not longer than one-third (1/3) of the depth of the member, and not located in the middle one-third (1/3) of the span. Notches at the ends of the member shall not exceed 0ne-forth (1/4) the depth of the member. The tension side of members 4 inches or greater in nominal thickness shall not be notched except at the ends of the members. **Girders and headers are not allowed to be notched, cut or bored**

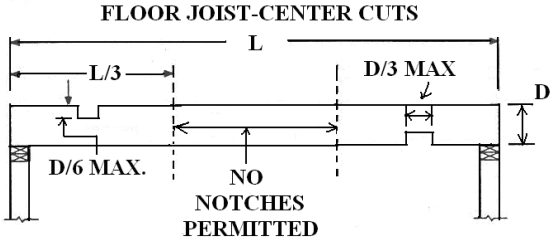
.

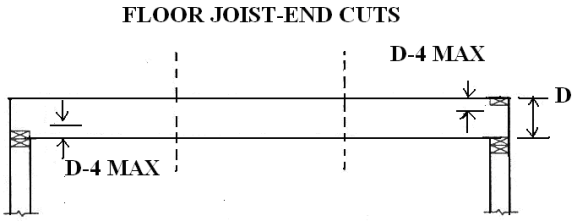
The diameter of the holes bored or cut into members shall not exceed one-third (1/3) the depth of the member. Holes shall not be closer than 2 inches to the top or bottom of the member, or within 2 inches to another hole or notch located in the member.

Cuts, notches, and holes bored in trusses, laminated veneer lumber**,** glue-laminated members or I-joists are not permitted, unless the design of the members allow these penetrations.

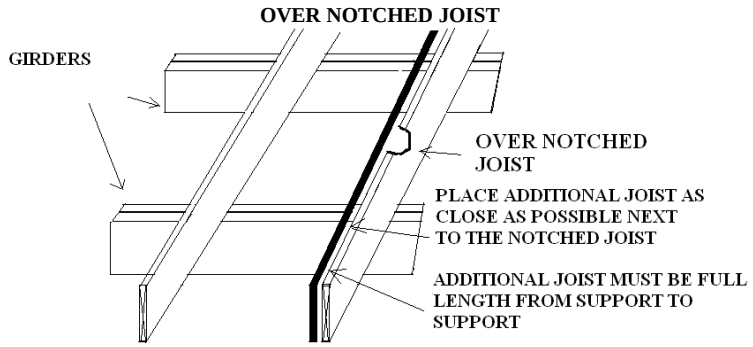


Cuts, notches, and holes bored in trusses, laminated veneer lumber**,** glue-laminated members or I-joists are not permitted, unless the design of the members allow these penetrations.





Over notched joist may be repaired by placing a joist next to the notched joist. The extra joist must run full length from girder to girder and be placed as close as possible to the notched joist. (See diagram). Other type of repairs for notched joist must be designed by an engineer.



GIRDERS: Girders are the horizontal support members for the floor system. Girders are supported by posts, columns, beam pockets and piers. Wood girders can be solid members, built up girders of dimension lumber, oriented strand or micro-laminated wood products. Reference the following tables for girder spans.

Number 2 Grade of lumber is required for girders and header. Notching, cutting, or drilling of girders or headers is not allowed. If your framing methods differ, engineering data must be provided to support the design.

GIRDER AND HEADER SPANS FOR EXTERIOR BEARING WALLS

Building Width in Feet

		20		28		36	
GIRDERS AND HEADERS SUPPORTING THE FOLLOWING	**SIZE**	**SPAN**	**# JACK STUDS**	**SPAN**	**# JACK STUDS**	**SPAN**	**# JACK STUDS**
Roof and ceiling							
	2 - 2 X 4	**3-6**	**1**	**3-2**	**1**	**2-10**	**1**
	2 - 2 X 6	**5-5**	**1**	**4-8**	**1**	**4-2**	**1**
	2 - 2 X8	**6-10**	**1**	**5-11**	**2**	**5-4**	**2**
	2 - 2 x 10	**8-5**	**2**	**7-3**	**2**	**6-6**	**2**
	2 - 2 x 12	**9-9**	**2**	**8-5**	**2**	**7-6**	**2**
	3 - 2 x8	**8-4**	**1**	**7-5**	**1**	**6-8**	**1**
	3 - 2 x 10	**10-6**	**1**	**9-1**	**2**	**8-2**	**2**
	3 - 2 X 12	**12-2**	**2**	**10-7**	**2**	**9-5**	**2**
	4 - 2 X 8	**9-2**	**1**	**8-4**	**1**	**7=8**	**1**
	4 - 2 X 1	**11-8**	**1**	**10-6**	**1**	**9-5**	**2**
	4 - 2 X 12	**13-1**	**1**	**12-2**	**2**	**10-11**	**2**
Roof and ceiling and center-bearing floor							
	2 - 2 X 4	**3-1**	**1**	**2-9**	**1**	**2-5**	**1**
	2 - 2 X 6	**4-6**	**1**	**4-0**	**1**	**3-7**	**2**
	2 - 2 X 8	**5-9**	**2**	**5-0**	**2**	**4-6**	**2**
	2 - 2 X10	**7-0**	**2**	**6-2**	**2**	**5-6**	**2**
	2 - 2 X 12	**8-1**	**2**	**7-1**	**2**	**6-5**	**2**
	3 - 2 X 8	**7-2**	**1**	**6-3**	**2**	**5-8**	**2**
	3 - 2 X 10	**8-9**	**2**	**7-8**	**2**	**6-11**	**2**
	3 - 2 X 12	**10-2**	**2**	**8-11**	**2**	**8-0**	**2**
	4 - 2 X 8	**8-1**	**1**	**7-3**	**1**	**6-7**	**1**
	4 - 2 X 10	**10-1**	**1**	**8-10**	**2**	**8-0**	**2**
	4 - 2 X 12	**11-9**	**2**	**10-3**	**2**	**9-3**	**2**

GIRDER AND HEADER SPANS FOR EXTERIOR BEARING WALLS

Building Width in Feet

		20		28		36	
GIRDERS AND HEADERS SUPPORTING THE FOLLOWING	**SIZE**	**SPAN**	**# JACK STUDS**	**SPAN**	**#JACK STUDS**	**SPAN**	**#JACK STUDS**
Roof, ceiling, and one clear span floor							
	2 - 2 X 6	**3-11**	**1**	**3-5**	**2**	**3-0**	**2**
	2 - 2 X8	**5-0**	**2**	**4-4**	**2**	**3-10**	**2**
	2 - 2 X 10	**6-1**	**2**	**5-3**	**2**	**4-8**	**2**
	2 - 2 X 12	**7-1**	**2**	**6-1**	**3**	**5-5**	**3**
	3 - 2 X 8	**6-3**	**2**	**5-5**	**2**	**4-10**	**2**
	3 - 2 X 10	**7-7**	**2**	**6-7**	**2**	**5-11**	**2**
	3 - 2 X 12	**8-10**	**2**	**7-8**	**2**	**6-10**	**2**
	4 - 2 X 8	**7-2**	**1**	**6-3**	**2**	**5-7**	**2**
	4 - 2 X 10	**8-9**	**2**	**7-7**	**2**	**6-10**	**2**
	4 - 2 X 12	**10-2**	**2**	**8-10**	**2**	**7-11**	**2**
Roof, ceiling and two center-bearing floors							
	2 - 2 X 6	**3-9**	**2**	**3-3**	**2**	**2-11**	**2**
	2 - 2 X 8	**4-9**	**2**	**4-2**	**2**	**3-9**	**2**
	2 - 2 X 1	**5-9**	**2**	**5-1**	**2**	**4-7**	**3**
	2 - 2 X 12	**6-8**	**2**	**5-10**	**3**	**5-3**	**3**
	3 - 2 X 8	**5-11**	**2**	**5-2**	**2**	**4-8**	**2**
	3 - 2 X 10	**7-3**	**2**	**6-4**	**2**	**5-8**	**2**
	3 - 2 X 12	**8-5**	**2**	**7-4**	**2**	**6-7**	**2**
	4 - 2 X 8	**6-10**	**1**	**6-0**	**2**	**5-5**	**2**
	4 - 2 X 10	**8-4**	**2**	**7-4**	**2**	**6-7**	**2**
	4 - 2 X 12	**9-8**	**2**	**8-6**	**2**	**7-8**	**2**
Roof, ceiling and two clear span floors							
	2 - 2 X 6	**3-1**	**2**	**2-8**	**2**	**2-4**	**2**
	2 - 2 X 8	**3-10**	**2**	**3-4**	**3**	**3-0**	**3**
	2 - 2 X 10	**4-9**	**2**	**4-1**	**3**	**3-8**	**3**
	2 - 2 X 12	**5-6**	**3**	**4-9**	**3**	**4-3**	**3**
	3 - 2 X 8	**4-10**	**2**	**4-2**	**2**	**3-9**	**2**
	3- 2 X 10	**5-11**	**2**	**5-1**	**2**	**4-7**	**3**
	3 - 2 X 12	**6-10**	**2**	**5-11**	**3**	**5-4**	**3**
	4 - 2 X 8	**5-7**	**2**	**4-10**	**2**	**4-4**	**2**
	4 - 2 X 10	**6-10**	**2**	**5-11**	**2**	**5-3**	**2**
	4 - 2 X 12	**7-11**	**2**	**6-10**	**2**	**6-2**	**3**

GIRDER SPANS AND HEADER SPANS FOR INTERIOR BEARING WALLS

		Building Width in Feet					
		20		28		36	
HEADER AND GIRDER SUPPORTING	SIZE	SPAN	# JACK STUDS	SPAN	# JACK STUDS	SPAN	# JACK STUDS
One Floor Only							
	2 - 2 X 4	3-1	1	2-8	1	2-5	1
	2 - 2 X 6	4-6	1	3-11	1	3-6	1
	2 - 2 X 8	5-9	1	5-0	2	4-5	2
	2 - 2 X 10	7-0	2	6-1	2	5-5	2
	2 - 2 X 12	8-1	2	7-0	2	6-3	2
	3 - 2 X 8	7-2	1	6-3	1	5-7	2
	3 - 2 X 1 0	8-9	1	7-7	2	6-9	2
	3 - 2 X 12	10-2	1	8-10	1	7-10	1
	4 - 2 X 8	9-0	1	7-8	2	6-9	2
	4 - 2 X 10	10-1	1	8-9	1	7-10	2
	4 - 2 X 12	11-9	1	10-2	2	9-1	2
Two Floors Only							
	2 - 2 X 6	3-2	2	2-9	2	2-5	2
	2 - 2 X 8	4-1	2	3-6	2	3-2	2
	2 - 2 X 10	4-11	2	4-3	2	3-10	3
	2 - 2 X 12	5-9	2	5-0	3	4-5	3
	3 - 2 X 8	5-1	2	4-5	2	3-11	2
	3 - 2 X 10	6-2	2	5-4	2	4-10	2
	3 - 2 X12	7-2	2	6-3	2	5-7	3
	4 - 2 X 8	6-1	1	5-3	2	4-8	2
	4 - 2 X 10	7-2	2	6-2	2	5-6	2
	4 - 2 X 12	8-4	2	7-2	2	6-5	2

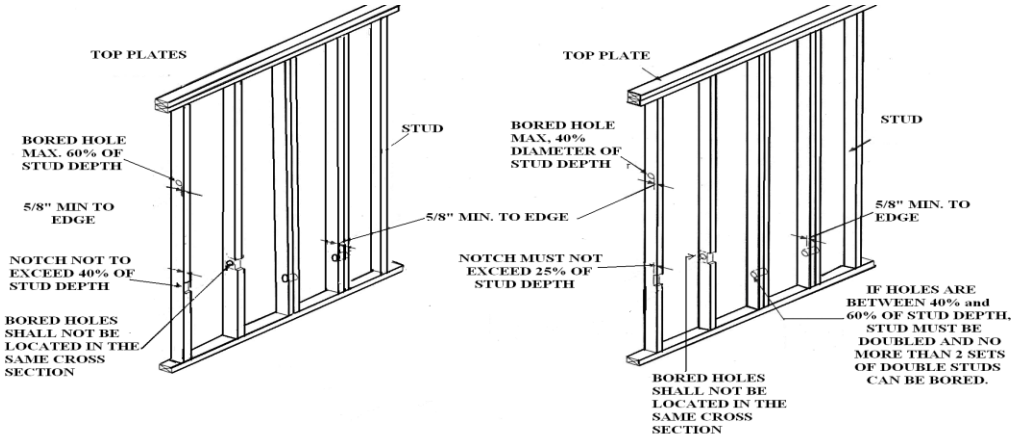
WALL FRAMING

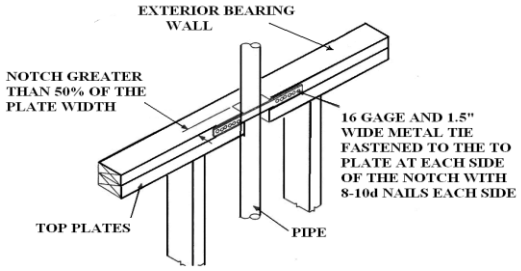
IDENTIFICATION and GRADE: Load-bearing dimension lumber for studs, plates and headers shall be identified by a grade mark of a lumber grading or inspection agency.

DRILLING AND NOTCHING: Studs in exterior and load bearing walls are permitted to be cut or notched to a depth not exceeding 25 percent of the width of the stud. Non-load bearing walls are allowed to be notched no more than 40 percent of the width of the stud.

Studs are permitted to be drilled up to 60 percent of the width of the stud. Studs in load-bearing or exterior walls drilled over 40 percent and up to 60 percent are required to be doubled with no more than 2 successive doubled studs bored. The bored hole can be no closer than 5/8 inch to the edge of the stud and not located in the same section as a cut or notch.

When the top plate in an exterior or load-bearing wall is cut or notched more than 50 percent of its width, a galvanized metal tie not less than 0.054 inch thick (16 gage) and 1.5 inches wide is required to be fastened to each plate across and to each side of the opening with not less than eight 16d nails. (See example on following page)





STUD SPACING: The size, height and spacing of studs shall be based on the following 2 tables with the following requirement.

- Utility grade studs can not be spaced more than 16 inches on center, shall not support more than a roof and ceiling and not to exceed 8 feet in height for exterior walls and load-bearing walls or 10 feet for interior non-load-bearing walls.

STUDS 10 FEET OR LESS IN HEIGHT

	BEARING WALLS					NONBARING WALLS	
Stud size (inches)	Laterally unsupported stud height **(feet)**	Max. spacing supporting roof-ceiling assembly or habitable attic space **(inches)**	Max. spacing supporting one floor, plus roof\ceiling assembly or habitable attic space **(inches)**	Max. spacing supporting two floors, plus roof \ceiling assembly or a habitable attic space **(inches)**		Laterally unsupported stud height **(feet)**	Maximum spacing **(inches)**
2 X 3	-	-	-	-		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

*Habitable attic space supported with 2 X 4 studs is limited to 32 feet. When roof exceeds 32 feet, the wall studs shall be increased to 2 X 6.

Utility, standard, stud and No. 3 grade lumber of any species are not permitted in the following table.

STUDS GREATER THAN 10 FEET IN HEIGHT
ON CENTER
(SPACING IN INCHES)

HEIGHT (feet)	24	16	12	8
Supporting a roof only				
>10	**2 X 4**	**2 X 4**	**2 X 4**	**2 X 4**
12	**2 X 6**	**2 X 4**	**2 X 4**	**2 X 4**
14	**2 X 6**	**2 X 6**	**2 X 6**	**2 X 4**
16	**2 X 6**	**2 X 6**	**2 X 6**	**2 X 4**
18	**NA**	**2 X 6**	**2 X 6**	**2 X 6**
20	**NA**	**NA**	**2 X 6**	**2 X 6**
24	**NA**	**NA**	**NA**	**2 X 6**
Supporting one floor and a roof				
>10	**2 X 6**	**2 X 4**	**2 X 4**	**2 X 4**
12	**2 X 6**	**2 X 6**	**2 X 6**	**2 X 4**
14	**2 X 6**	**2 X 6**	**2 X 6**	**2 X 6**
16	**NA**	**2 X 6**	**2 X 6**	**2 X 6**
18	**NA**	**2 X 6**	**2 X 6**	**2 X 6**
20	**NA**	**NA**	**2 X 6**	**2 X 6**
24	**NA**	**NA**	**NA**	**2 X 6**

STUDS GREATER THAN 10 FEET IN HEIGHT
ON CENTER
(SPACING IN INCHES)

HEIGHT (feet)	24	16	12	8
Supporting two floors and a roof				
>10	2 X 6	2 X 6	2 X 4	2 X 4
12	2 X 6	2 X 6	2 X 6	2 X 6
14	2 X 6	2 X 6	2 X 6	2 X 6
16	NA	NA	2 X 6	2 X 6
18	NA	NA	2 X 6	2 X 6
20	NA	NA	NA	2 X 6
22	NA	NA	NA	NA
24	NA	NA	NA	NA

Note: (NA) Requires design by architect or engineer

HEADERS: The allowable spans for 2-inch double headers in load bearing walls are described the tables for girders and headers located in this handout.

CRIPPLE WALLS: Foundation cripple walls shall be framed of studs not smaller than the studding above. When exceeding 4 feet in height, such walls shall be framed of studs having the size required for an additional story.

Cripple walls with a stud height less than 14 inches (356 mm) shall be continuously sheathed on one side with wood structural panels fastened to both the top and bottom plates or the cripple walls shall be constructed of solid blocking.

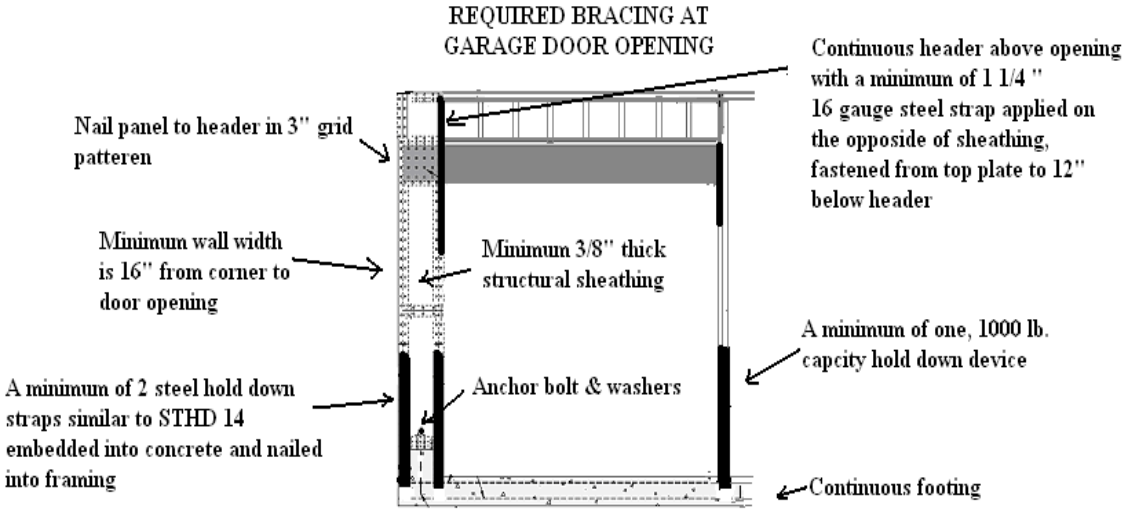
All cripple walls shall be supported on continuous foundations.

WALL BRACING: Wall bracing shall be constructed with continuous wall sheathing on all exterior walls. The structural panel sheathing is required to be installed on one side of the wall including areas above and below openings and gable end walls. The sheathing shall be connected to the top plate of the stud wall to the sill plate located on the foundation wall or slab. **(See garage door bracing section for special requirements)**

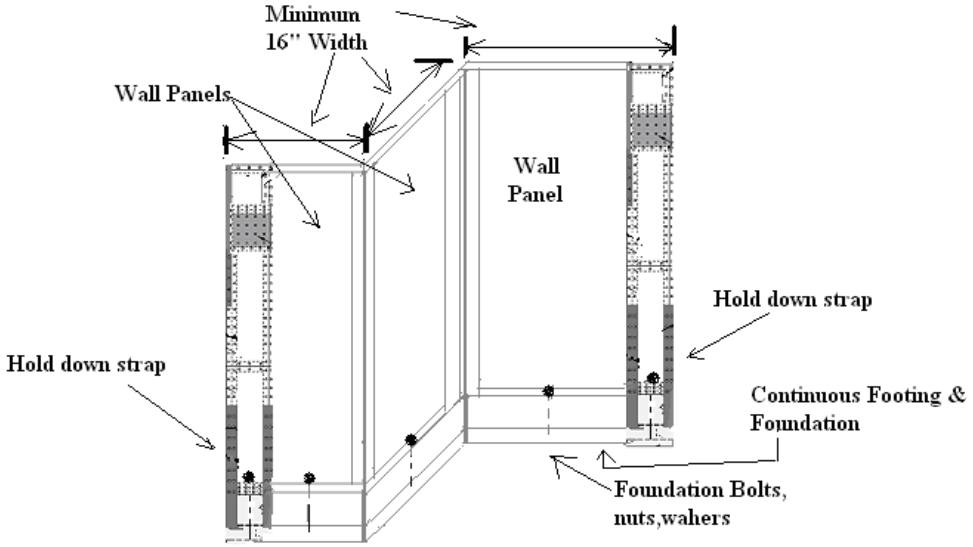
The sheathing span rating, thickness, stud spacing and nailing schedule shall comply with the following table:

Minimum Nail Size	Penetration	Minimum Wood Structural Panel Span Rating	Panel Thickness Inches	Wall Stud Spacing Inches	Nailing Spacing	
					Edges	Field
6d Common	1.5 inches	24/0	3/8	16	6	12
8d Common	1.5 inches	24/16	7/16	16	6	12
				24	6	12

GARAGE DOOR BRACING REQUIREMENTS: The footing for the dwelling is required to be continuous across the garage door opening. The walls on each side of the garage door opening are required to be a minimum of 16 inches wide. For walls 24 inches wide or less the sill plate is required to be connected to the foundation or slab with one anchor bolt that is minimum diameter size of 1/2 inch with washer and nut. A minimum of 2 hold-down steel straps that are equal to or exceed Simpson #STHD 14 Hold-down Strap are required to be embedded into the concrete and nailed to the framing. The garage door header is to continue across the opening to the corner of the structure. A continuous steel strap that is a minimum of 16 gauge and 1 ¼ inch wide is required to be attached the top plate, header and wall together on both sides of the header and opposite side of the sheathing. The straps are to continue 12 inches below the header. The structural sheathing is required to be a minimum of 3/8 inches thick attached from the top plate and down to the sill plate, the spice in the panel shall be in the middle vertical span of the wall and blocked and nailed at the span. The panel shall be nailed to the header with a 3 inch grid pattern. The remainder nailing for the panel shall be nailed with 8D common or box nails at 3 inches on center on all studs.



NARROW OFFSET WALL PANELS
BETWEEN MULTIPLY GARAGE DOORS



FIRE-BLOCKING: Fire-blocking is to be provided to cut off concealed draft openings (both vertical and horizontal) and to form a protective fire barrier between stories, and between the top story and roof space. Fire-blocking in wood-frame construction is required in the following locations:

1. In concealed spaces of stud and partitions, including furred spaces, including furred spaces and parallel rows of studs or staggered studs are to be fire-blocked vertically at the ceiling and floor levels or horizontally at intervals not exceeding 10 feet.

2. All interconnections between concealed vertical and horizontal spaces (soffits, drop ceilings, cove ceilings).

3. Concealed spaces between stair stringers at the top and bottom of the run.

(Continued next page)

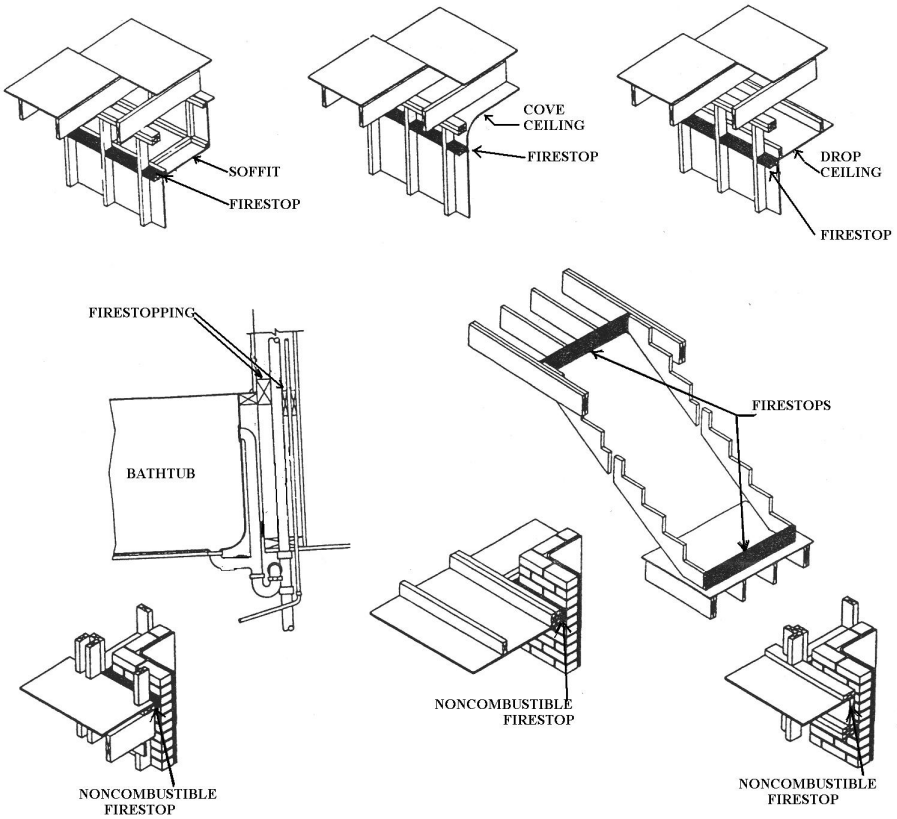
4. Openings around bends, pipes, ducts, cables, wires, chimneys and fireplaces at ceiling and floor level, with noncombustible materials.

5. Fire-blocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

FIRE-BLOCKING MATERIALS: Material for fire-blocking shall consist of 2 inch nominal lumber, or two thicknesses of 1-inch nominal lumber with broken lap joints, or one thickness of 23/32-inch wood structural panels with joints backed by the same, or one thickness of 3/4-inch particleboard with joints backed by the same, 1/2-inch gypsum board, or 1/4-inch cement-based millboard.

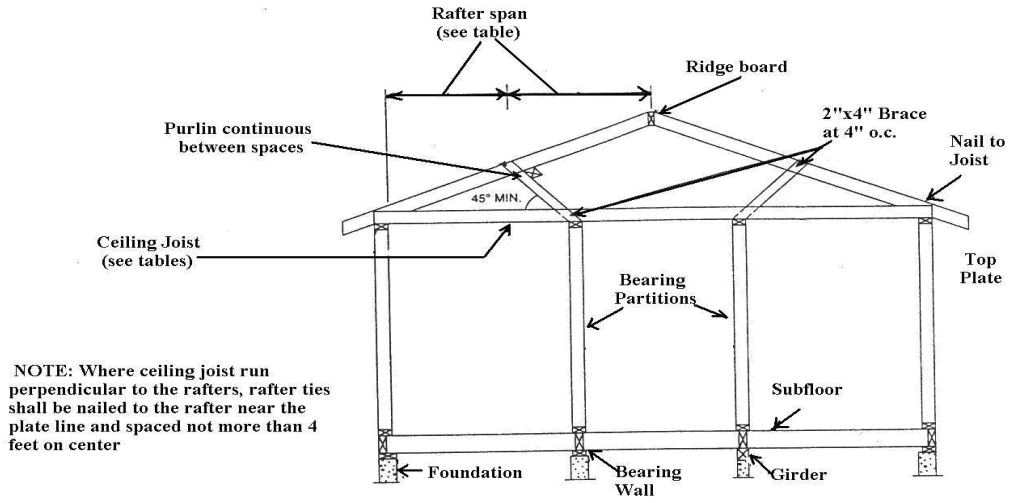
Unfaced fiberglass batt insulation used as fire-blocking shall fill the entire cross section of the wall cavity to minimum height of 16 inches measured vertically. Insulation may be packed tightly around piping, conduit or other obstructions.

Batts or blankets of mineral wool or glass fiber shall be permitted for compliance with the 10 foot horizontal fire-blocking in walls constructed using parallel rows of studs or staggered studs.



ROOF-CEILING CONSTRUCTION

TYPICAL ROOF-CEILING CONSTRUCTION



GENERAL: Load-bearing dimension lumber for rafters, trusses and ceiling joists are required to be identified with a grade mark of a lumber grading inspection agency.

SPANS: **See the following tables in the Roof\Ceiling Construction for the allowable spans.**

CATHEDRAL CEILINGS: When the rafters are used to create a cathedral ceiling, rafter ends shall be supported on load-bearing walls, headers, or ridge beams. The ridge beam must be capable of carrying the roof loads and supported by structural elements which transmit the loads to the foundation.

FRAMING DETAILS: When rafters are parallel to the ceiling joist, they are to be nailed to the ceiling joist to form a continuous tie. When not parallel, rafters shall be tied with a rafter tie. Rafter ties are to be located as near to the plate as practical and spaced no more than 4 feet on center. A ridge board or gusset plate is required to tie rafters together. A ridge board shall be not less than the depth of the rafter and at least 1 inch nominal thickness.

At all valleys and hips there shall be a valley or hip rafter not less than 2-inch nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25-percent slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

Ceiling joists and rafters shall be nailed to each other in accordance with Table R802.5.1(9), and the rafter shall be nailed to the top wall plate in accordance with Table R602.3(1). Ceiling joists shall be continuous or securely joined where they meet over interior partitions and are nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters. Where ceiling joists are not connected to the rafters at the top wall plate, joists connected higher in the attic shall be installed as rafter ties, or rafter ties shall be installed to provide a continuous tie. Where ceiling joists are not parallel to rafters, rafter ties shall be installed. Rafter ties shall be a minimum of 2 inches by 4 inches (nominal). Where ceiling joists or rafter ties are not provided, the ridge formed by these rafters shall be supported by a wall or girder designed in accordance with accepted engineering practice. Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space.

(Continued next page)

Collar ties or ridge straps to resist wind uplift shall be connected in the upper third of the attic space. Collar ties shall be a minimum of 1 inch by 4 inches (nominal), spaced not more than 4 feet) on center.

The ends of ceiling joists shall be lapped a minimum of 3 inches or butted over load bearing partitions or beams and toenailed to the load-bearing member. Where ceiling joist are used to provide resistance to rafter thrust, lapped joist are to be nailed together and butted joist are to be tied together with a gusset plate.

PURLINS: Purlins are allowed to reduce the span of rafters. The size of the purlin can be no less than the size of the rafters that they support. Purlins shall be continuous and be supported by 2-inch by 4-inch braces installed not more than 4 feet on center, not less than 45 degree angle and must be supported off of load-bearing walls. Unbraced length of braces can not exceed 8 feet.

LOAD BEARING: The end of each ceiling joist or rafter must bear not less than 1 1/2 inches on wood or metal and not less than 3 inches on masonry or concrete.

CUTTING AND NOTCHING: Notches are not to exceed 1/6 of the depth of the member, no longer than 1/3 the depth of the member and not located in the middle of the span. Notches at the end of the members can not exceed 1/4 of the depth of the member. The tension side of members 4 inches or greater in thickness can not be notched except at the ends of the member.

Holes bored or cut into members can not exceed 1/3 the depth of the member, no closer than 2 inches to the top and bottom of the member or any other hole located in the member. A hole can be no closer than 2 inches to a notch.

ENGINEERED WOOD PRODUCTS. Cuts, notches and holes bored in laminated veneer lumber, glue-laminated veneer lumber, glue-laminated member or I-joists are not permitted unless the penetrations are specifically considered in the design of the member.

LATERAL SUPPORT: Rafters and ceiling joist having depth-to-thickness ratio exceeding 5 to 1 are required to be provided with lateral support at points of load-bearing to prevent rotation.

BRIDGING: Rafters and ceiling joists having a depth-to-thickness ration exceed 6 to 1 are required to be supported laterally by solid blocking, diagonal bridging, 1-inch by 3-inch wood strip nailed across the rafters or ceiling joist at intervals not exceeding 8 feet.

CEILING JOISTS SPANS: The following span table only addresses the flat ceiling design. Several deviations from the conventional flat ceiling are possible and have proven successful in performing well. More complicated designs and special situations will require you to consult an architect or engineer. The use of stiff-backs will not increase the ceiling span.

FRAMING OF OPENINGS: Openings in ceiling or roof framing are required to be framed with header and trimmer joists.

When the header joist span is 4 feet or less the header may be a single member the same size as the ceiling joist or rafter. A single trimmer joist may be used to carry a single header load when the trimmer is within 3 feet of the bearing point.

When the header joist span exceeds 4 feet, the trimmer joists and the header joist shall be doubled and be sufficient size (see header chart) to support the ceiling joist or rafter framing into the header. Approved hangers are required for the header joist to trimmer joist when the header joist span exceeds 6 feet. Tail joists over 12 feet long shall be supported at the header by framing anchors or ledger strips not less than 2 inches by 2 inches.

CEILING JOIST SPANS
Uninhabitable attics with limited storage
Live load = 10 psf, L = 240

CEILING JOIST SPACING (inches)	Specie and Grade		DEAD LOAD = 10psf			
			2x4	2x6	2x8	2x10
			Maximum Ceiling Joist Span			
			feet -inches	feet-inches	feet-inches	feet-inches
12	Douglas fir-larch	#1	10-0	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	14-10	18-9	22-11
	Douglas fir-larch	#3	7-8	11-2	14-2	17-4
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-7	23-11
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	10-0	15-9	20-10	Note a
	Southern pine	#2	9-10	15-6	20-1	23-11
	Southern pine	#3	8-2	12-0	15-4	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0
	Douglas fir-larch	#1	9-1	13-9	17-5	21-3
	Douglas fir-larch	#2	8-9	12-10	16-3	19-10
	Douglas fir-larch	#3	6-8	9-8	12-4	15-0
	Hem-fir	SS	8-11	14-1	18-6	23-8
	Hem-fir	#1	8-9	13-5	16-10	20-8
	Hem-fir	#2	8-4	12-8	16-0	19-7
	Hem-fir	#3	6-8	9-8	12-4	15-0
	Southern pine	SS	9-4	14-7	19-3	24-7
	Southern pine	#1	9-1	14-4	18-11	23-1
	Southern pine	#2	8-11	13-6	17-5	20-9
	Southern pine	#3	7-1	10-5	13-3	15-8
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1
	Spruce-pine-fir	#1	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#2	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#3	6-8	9-8	12-4	15-0
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-4
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5
	Douglas fir-larch	#2	8-0	11-9	14-10	18-2
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8
	Hem-fir	SS	8-5	13-3	17-5	22-3
	Hem-fir	#1	8-3	12-3	15-6	18-11
	Hem-fir	#2	7-10	11-7	14-8	17-10
	Hem-fir	#3	6-1	8-10	11-3	13-8
	Southern pine	SS	8-9	13-9	18-1	23-1
	Southern pine	#1	8-7	13-6	17-9	21-1
	Southern pine	#2	8-5	12-3	15-10	18-11
	Southern pine	#3	6-5	9-6	12-1	14-4
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-8
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8
24	Douglas fir-larch	SS	8-3	13-0	17-1	20-11
	Douglas fir-larch	#1	7-8	11-2	14-2	17-4
	Douglas fir-larch	#2	7-2	10-6	13-3	16-3
	Douglas fir-larch	#3	5-5	7-11	10-0	12-3
	Hem-fir	SS	7-10	12-3	16-2	20-6
	Hem-fir	#1	7-6	10-11	13-10	16-11
	Hem-fir	#2	7-1	10-4	13-1	16-0
	Hem-fir	#3	5-5	7-11	10-0	12-3
	Southern pine	SS	8-1	12-9	16-10	21-6
	Southern pine	#1	8-0	12-6	15-10	18-10
	Southern pine	#2	7-8	11-0	14-2	16-11
	Southern pine	#3	5-9	8-6	10-10	12-10
	Spruce-pine-fir	SS	7-8	12-0	15-10	19-5
	Spruce-pine-fir	#1	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#2	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#3	5-5	7-11	10-0	12-3

a. Span exceeds 26 feet in length

***RAFTER SPANS*:** The spans indicated in the following tables are for roofs with light roof covering, such as composition shingles and no ceiling finish. ***These spans <u>are not</u> appropriate for vaulted or cathedral ceilings*.** More complicated designs and special situations will require you to contact an architect or engineer.

RAFTER SPAN TABLES

Roof live load = 20 psf, L = 180

(ceiling not attached to rafter)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans[a]									
			(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)	(feet - inches)
12	Douglas fir-larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-5	Note b	Note b
	Douglas fir-larch	#1	1-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	1-10	16-7	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas fir-larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-fir	#1	10 -7	16-8	21-10	Note b	Note b	10-3	14-11	18-11	23-2	Note b
	Hem-fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern pine	#1	11-1	17-4	22-11	Note b	Note b	11-1	17-3	21-9	25-10	Note b
	Southern pine	#2	10-10	17-0	22-5	Note b	Note b	10-6	15-1	19-5	23-2	Note b
	Southern pine	#3	9-1	13-6	17-2	20-3	24-1	7-11	11-8	14-10	17-6	20-11
	Spruce-pine-fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-pine-fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-0	20-3	24-9	Note b
	Douglas fir-larch	#1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas fir-larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-fir	#1	9-8	14-11	18-11	23-2	Note b	8-10	12-11	16-5	20-0	23-3
	Hem-fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine	#1	10-0	15-9	20-10	25-10	Note b	10-0	15-0	18-10	22-4	Note b
	Southern pine	#2	9-10	15-1	19-5	23-2	Note b	9-1	13-0	16-10	20-1	23-7
	Southern pine	#3	7-11	11-8	14-10	17-6	20-11	6-10	10-1	12-10	15-2	18-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-pine-fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
19.2	Douglas fir-larch	SS	9-10	15-5	20-4	25-11	Note b	9-10	14-7	18-6	22-7	Note b
	Douglas fir-larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas fir-larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Southern pine	#1	9-5	14-10	19-7	23-7	Note b	9-3	13-8	17-2	20-5	24-4
	Southern pine	#2	9-3	13-9	17-9	21-2	24-10	8-4	11-11	15-4	18-4	21-6
	Southern pine	#3	7-3	10-8	13-7	16-0	19-1	6-3	9-3	11-9	13-10	16-6
	Spruce-pine-fir	SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-pine-fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas fir-larch	SS	9-1	14-4	18-10	23-4	Note b	8-11	13-1	16-7	20-3	23-5
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas fir-larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-fir	#1	8-4	12-3	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	22-11	Note b
	Southern pine	#1	8-9	13-9	17-9	21-1	25-2	8-3	12-3	15-4	18-3	21-9
	Southern pine	#2	8-7	12-3	15-10	18-11	22-2	7-5	10-8	13-9	16-5	19-3
	Southern pine	#3	6-5	9-6	12-1	14-4	17-1	5-7	8-3	10-6	12-5	14-9
	Spruce-pine-fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

eck sources for availability of lumber in lengths greater than 20 feet.

r SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

Span exceeds 26 feet in length.

ROOF VENTILATION: Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of the roof rafters are required to have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow.

The total net free ventilating area shall be 1/150 of the area of space ventilated. This required area can be reduced to 1/300 provided at least 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet below the ridge or highest point of the space shall be permitted.

UNVENTED ATTIC OR UNVENTED ENCLOSED RAFTER ASSEMBLIES: Contact building inspector for guidance or reference 2012 IRC Section R806.5.

FLASHING: Approved corrosion-resistant flashing is required to be applied shingle-fashion in such a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. The flashing is to extend to the surface of the exterior wall finish. Flashing shall be installed in the following locations:

- Exterior window and door openings extending to the surface of the exterior wall finish or the water - resistive barrier.
- At the intersections of chimneys or masonry construction with frame or stucco copings.
- Under the ends of masonry, wood or metal copings and sills.
- Continuously above all projecting wood trim.
- Where exterior porches, decks, or stairs attach to a wall or floor assembly of wood-framed construction.
- At wall and roof intersections.
- At built-in gutters.
- Against a vertical front wall, soil stack, vent pipe and chimney.

EXTERIOR INSULATED FINISH SYSTEMS (EIFS): All ***EIFS*** shall be installed in accordance with the manufacture installation instructions and the following requirements.

Decorative trim is not allowed to be nailed through the EIFS. The EIFS is required to terminate not less than 6 inches above the finished ground level.

All EIFS is required to have a water-resistive barrier applied between the underlying framing or water-sensitive components and the exterior insulation. A means of draining the water to exterior of the veneer is to be provided. The water-resistive barrier is required to be a Type I asphalt saturated felt or equivalent, applied horizontally with the upper layer lapped over the lower layer by not less than 2 inches. The vertical joints are to be lapped by not less than 6 inches.

ROOF COVERINGS: Roof coverings are to be installed according to manufacturing specifications and the provisions of the building code.

UNDERLAYMENT: **For asphalt, clay and concrete tile roofs,** slopes from 2\12 to 4\12 pitch shall be applied in two layers. For roof slopes of 4\12 and greater in pitch one layer of underlayment is required. **All other roofs according to manufacture specifications.**

ASPHALT SHINGLES: Asphalt shingles are required to be installed on solid decking. Asphalt shingles can only be used on roofs with slopes greater than 2 units vertical to 12 units horizontal. Shingles are required to be fastened with galvanized steel, stainless steel, aluminum or copper roofing nails, with a minimum of a 12 gage shank and a minimum 3\8 inch head.

Drip edge is required at eaves and gables, each piece shall overlap a minimum of 2 inches extend a minimum of ¼ inch below the roof and extend 2 inches up the roof. Underlayment shall be installed over the drip edge.

CLAY and CONCRETE TILE: Clay and concrete tile are required to be installed on solid decking or spaced structural sheathing boards. Roofing may be installed on roofs of 2 1/2 \12 pitch or greater.

METAL ROOF PANELS: Metal roof panel roof coverings can be applied to solid or spaced sheathing, except where the roof coverings are specifically designed to be applied on spaced supports. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be 3\12 pitch. The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be 1/2\4 pitch or 4% slope. The minimum slope for standing seam roof systems shall be 1/4\12 or 2 % slope.

FIREPLACES

MASONRY: Fireplace and chimney details are shown on the following 2 pages. The table does not cover all requirements or aspects of the indicated requirements. For further information feel free to contact a Building Inspector.

FACTORY-BUILT FIREPLACES: Factory build fireplaces consisting of a fire chamber assembly, one or more chimney sections, a roof assembly and other parts listed as an assembly shall be installed according to the listing and manufacturer installation instructions. **A copy of the instructions is to be with the unit at the time of rough-in inspection**. Requirements to watch for; clearance to combustibles from the fire chamber and chimney**,** fire-stops, hearth extensions not less than 3/8 inch-thick noncombustible material and the hearth must extend a minimum of 16 inches in front and minimum of 8 inches on the sides of the fireplace opening.

EXTERIOR AIR SUPPLY: Exterior air supply is required. Exterior combustion air ducts for factory-built fireplaces shall be a listed component of the fireplace and installed according to the manufacturer's specifications. Listed combustion air ducts for masonry fireplaces shall be installed according to their listing and manufacturers specifications.

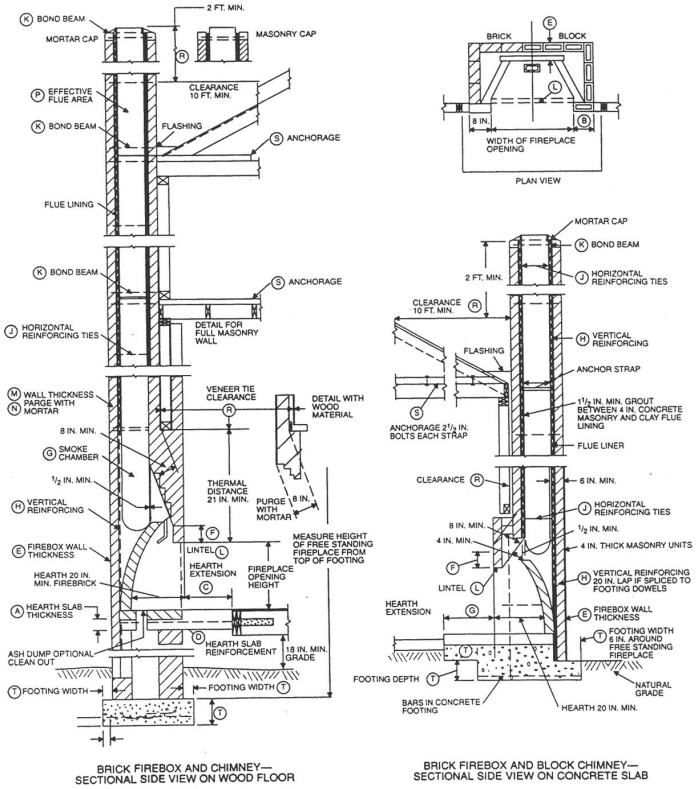
The exterior air is to be provided from the exterior of the building and **can not** be located within the garage, attic, basement or crawl space. Unlisted air ducts shall be installed with a minimum of 1 inch clearances from combustibles for all parts of the duct within 5 feet of the duct outlet. The combustion air opening is to be no less than 6 square inches and no more than 55 square inches. The exterior air outlet may be located in the back of the firebox opening or within 24 inches of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

Item	Letter	Requirements
Hearth slab thickness	**A**	**4"**
Hearth extension (each side of opening)	**B**	**8" fireplace opening < 6 square foot. 12" fireplace opening ≥ 6 square foot.**
Hearth extension (front of opening)	**C**	**16" fireplace opening < 6 square foot. 20" fireplace opening ≥ 6 square foot.**
Hearth slab reinforcing	**D**	**Reinforced to carry its own weight and all imposed loads.**
Thickness of wall of firebox	**E**	**10" solid brick or 8" where a firebrick lining is used. Joints in firebrick ¼" maximum.**
Distance from top of opening to throat	**F**	**8"**
Smoke chamber wall thickness Unlined walls	**G**	**6" 8"**
Chimney Vertical reinforcing	**H**	**Four No. 4 full-length bars for chimney up to 40" wide. Add two No. 4 bars for each additional 40"or fraction of width or each additional flue.**
Horizontal reinforcing	**J**	**1/4" ties at 18"and two ties at each bend in vertical steel.**
Bond beams	**K**	**No specified requirements.**
Fireplace lintel	**L**	**Noncombustible material.**
Chimney walls with flue lining	**M**	**Solid masonry units or hollow masonry units grouted solid with at least 4-inch nominal thickness.**
Distances between adjacent flues		**See Section R1003.13**
Flue area (based on area of fireplace opening)	**P**	**See Section R1003.15.**
Clearances Combustible material Mantel and trim Above roof	**R**	** See Sections R1001.11 and R1003.18. See Section R1001.11, Exception 4. 3" at roofline and 2' at 10'**
Anchorage	**S**	**Two 3/16" X 1" Straps, with 12" hooked around outer bar with 6" extension embedded into chimney fastened to 4 joists with two ½" diameter bolts.**
Footing	**T**	**Thickness 12" min. – Width 6" each side of fireplace wall**

The details as provided in the Summary of Major Requirements for the Construction of Masonry Chimneys and Fireplaces on the previous page correspond to the Fireplace and Chimney Details below. The letter references which shows examples of typical construction. This table does not cover all requirements, nor does it cover all aspects of the indicated requirements. For detail information, contact a building inspector.

FIRPLACE AND CHIMNEY DETAILS



INSULATION REQUIREMENTS*

The R-Value for insulation purposes are R-38 in ceilings, R-13 in wood framed walls and R-5 in mass walls consisting of concrete, block, ICF, brick etc.

Floors extending outside of the foundation walls (cantilevers) are required to be insulated with R-19 insulation.

CEILINGS WITH ATTIC SPACE: When the full height of uncompressed insulation extends over the wall top plate at the eaves the R value requirement can be reduced to R30.

CEILINGS WITHOUT ATTIC SPACES: Where the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation shall be limited to 500 square feet or 20 percent of the total insulated ceiling area, whichever is less.

BASEMENT WALLS: Walls associated with basements shall be insulated from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less.

SLAB-ON-GRADE FLOORS: Slab-on-grade floors with a floor surface less than 12 inches below grade shall be insulated with insulation board with an R-value of 10. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance of 2 feet.

HEATING AND AIR CONDITION DUCTS: Supply and return ducts located in attic or crawl spaces shall be insulated to a minimum of R-8. Ducts in floor trusses shall be insulated to a minimum of R-6.

BUILDING CAVITIES: Building framing cavities can not be used as supply ducts.

* Reference the 2006 International Residential Code, Chapter 11 as adopted and amended in the 2012 International Residential Code

MECHANICAL SYSTEMS

Appliances are required to be listed and labeled for the application that they are being used for. Appliances include heating and air conditioning units, boilers and water heaters.

***ACCESS*:** Appliances are required to be accessible for inspection, service, repair and replacement without removing permanent construction, other appliances, or any other piping or ducts not connected to the appliance being serviced, repaired or replaced. A level working space at least 30 inches deep and 30 inches wide shall be provided in front of the control side to service an appliance.

FURNACES and AIR HANDLERS: Furnaces and air handlers within compartments or alcoves shall have a minimum working space clearance of 3 inches along the sides, back and top with a total width of the enclosing space being at least 12 inches wider than the furnace or air handler. Furnaces having a firebox open to the atmosphere shall have at least a 6-inch working space along the front combustion chamber side.

Gas shut off valve required to be adjacent to the unit in the same area as the furnace.

A disconnect for the electric service wire to the furnace or air handler is required to be adjacent to the unit in the same area as the equipment.

APPLIANCES in ROOMS: Appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24 inches wide and large enough to allow removal of the largest appliance in the space, provided there is a level service space of not less than 30 inches deep and the height of the appliance, but not less than 30 inches, at the front or service side of the appliance with the door open

APPLIANCES LOCATED IN ATTIC: The access door is required to be a minimum of 22 inches by 30 inches and large enough to allow the removal of the largest appliances.

The path from the access hole to the appliance is required to be a minimum of 30 inches high and 22 inches wide and large enough to allow for the removal of the largest appliance.

The walkway to the appliance can be only measure 20 feet from the attic access to the appliance, if the height of the passageway to the appliance is unobstructed and is greater than 6 feet, the length of the walkway can be extended to a maximum of 50 feet. The walkway is required to be continuous flooring 24 inches wide with a level service space at least 30 inches by 30 inches along all sides where access to the unit is required.

A light and electrical receptacle is required near the appliance location. The light is required to be controlled by a switch located at the attic entrance.

APPLIANCES LOCATED UNDER FLOORS: The access door is required to be large enough to allow for the removal of the largest appliance, but no less than 30 inches high and 22 inches wide.

The walkway to the appliance can be only measure 20 feet from the under floor access to the appliance, if the passageway is unobstructed and not less than 6 feet high and 22 inches wide for its entire length, the passageway is not be limited in length. A level service space measuring at least 30 inches by 30 inches along all sides where access to the unit is required.

Equipment or appliances installed at ground level are required to be supported on a level concrete slab or other approved material extending a minimum of 3 inches above the adjoining ground. Appliances suspended from the floor must have a minimum clearance of 6 inches from the ground.

A light and electrical receptacle are required near the appliance location, both light and receptacle are required to be ground fault protected. The light is required to be controlled by a switch located at the attic entrance.

***PROHIBITED LOCATIONS*:** Appliances can not be located in sleeping rooms, bathrooms, toilet rooms, or in a space that opens into these rooms or spaces.

Check with building inspector for the requirements for direct vent appliances and other heating appliances that are allowed in these areas

Water heaters cannot be installed in any room that is designed or used for storage.

***IGNITION SOURCE*:** The ignition source for an appliance is required to be elevated a minimum of 18 inches above the floor of a garage. Any room or spaces that are not part of the living space of the dwelling and have direct access from the garage is considered being part of the garage.

PROTECTION FROM IMPACT: Appliances can not be installed in a location subject to vehicle damage except where protected by approved barriers.

APPLIANCES FOUNDATIONS AND SUPPORTS: Foundations and supports for outdoor mechanical systems are required to be raised at least 3 inches above finish grade and conform to manufacturer's installation instructions.

CONDENSATION DISPOSAL: Condensation from all cooling coils or evaporators is required to drain from the appliance drain pan outlet to an approved place of disposal. Condensation can not drain into the crawl area.

An auxiliary and secondary drain system is required where damage to any building components will occur as a result of overflow from the equipment drain or stoppage of the condensation drain. The auxiliary and secondary drain system shall include an auxiliary drain pan with a minimum depth of 2.5 inches and 3 inches larger than the unit or coil dimensions in width and length. A separate overflow drain line shall be connected from the appliance drain pan into the auxiliary drain pan. The primary drain from the auxiliary drain pan is required to discharge to an approved place, but not into crawl space area. The primary drain to the auxiliary drain pan is to be located at a lower level than the overflow drain from the appliance. The piping is required to be a minimum of 3/4 inch nominal pipe size and have a 1 percent slope to the drain termination. A water level detection device is required to be installed at a point above the primary drain line and below the overflow rim of the auxiliary pan. The water level detection device is required to shut off the equipment in the event the primary drain is blocked.

Down flow units that have no means to install an auxiliary drain pan, a water-leveling device is required to be installed inside the primary drain pan on the unit. The device is required to shut off the equipment in the event that the primary drain becomes restricted. External devises are not permitted.

GAS LOGS OR APPLIANCE: Gas lines installed in masonry fireplaces for gas logs or stubbed out for an appliance must be connected to these units at the time of a final inspection.

GAS SHUTOFF VALVES: A ready accessible gas shutoff valve serving no other appliance is required to be placed in the gas line within 6 feet of the appliance.

Appliance shutoff valves located in the firebox of a fireplace is required to be installed according to the appliance manufacture's instructions.

The appliance shutoff valve located in a manifold shall be ready accessible, permanently identified and within 50 feet of the appliance,

EXHAUST SYSTEMS

BATHROOMS: When the bathroom, water closet compartments, and other similar rooms do not have the required 3 square feet of glazing area in the window, in which one-half can be opened, then mechanical ventilation and artificial light must be provided. Mechanical exhaust is to be terminated by one of the following methods:

- Mechanical exhaust from the bathroom may exhaust in the attic provided the exhaust is terminated not less than 1 foot above the insulation and not closer than 1 foot to any part of the structure.

- The mechanical exhaust from the bathroom may vent to a soffit provided that the duct terminates at the soffit panel with an approved mechanical louver or vent. The adjoining soffit space for a distance of 4 feet on either side of the penetration is required to be solid non-vented material

In a condition attic or crawl space the mechanical exhaust must vent to the exterior of the structure. Duct connected to the mechanical vent must be an approved solid pipe.

***CLOTHES DRYER EXHAUST*:** The exhaust duct is required to terminate to exterior of the structure, not less than 3 feet to any opening and equipped with a back-draft damper. The exhaust system may be installed according to either one of the following requirements:

- The exhaust to a dryer is required to be constructed of a rigid metal duct, having a smooth interior surface and can not be connected with sheet-screws or fastening devices that extend into the duct. The maximum length of a clothes dryer exhaust duct can not exceed 35 feet from the dryer location to the wall or roof termination. The maximum length of a 4 inch exhaust duct is reduced 2.5 feet for each 45-degree bend and 5 feet for each 90-degree bend.

- The size and maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer at the mechanical rough-n inspection. The unit matching the make and model must be in place at the final inspection.

The transition ducts cannot be concealed within construction or exceed 8 feet in length.

FAN ASSISTED DRYER VENTS ARE NOT ALLOWED.

RANGE HOODS or DOWN DRAFT EXHAUST SYSTEMS: Range hoods or down draft exhaust systems for cooking appliances are required to discharge to the exterior of the structure through a single-wall duct. The exhaust **is not** allowed to discharge into a crawl or attic area.

The single-wall duct serving the hood is required to be constructed of galvanized steel, stainless steel, or copper. The duct is required to be a smooth interior service, air tight and be equipped with a back-draft damper.

Down draft systems may be constructed with schedule PVC pipe and fittings. ***Contact a building inspector for the requirements.***

Ductless range hoods are not required to discharge to the exterior of the structure.

GAS PIPING:

***METALLIC GAS PIPING*:** Metallic gas piping in contact with material which will corrode the piping shall be protected with in an approved manner, zinc coatings (galvanizing) **is not** adequate protection. Dissimilar metals joined underground, dielectric fittings or couplings shall be used. Buried steel piping shall be coated and insulated with insulating unions on both ends grade, outside of the building, within 6 inches to 18 inches above grade with 5 pound magnesium anodes installed every 200 feet of buried pipe. Underground gas piping shall be installed a minimum of 18 inches below grade.

Copper tubing is not allowed for gas piping with in a structure.

CORRUGATED STAINLESS STEEL TUBING (CSST): Corrugated stainless steel tubing has the following installation requirements:

- Corrugated stainless steel cannot be used for exterior underground installations.
- All CSST piping located in a wall cavity is required to be protected by installing the CSST inside a metal sleeve made of Schedule 40 steel piping or galvanized steel conduit as provided by the CSST manufacturer.
- All CSST piping grater than 16 inches in length and running horizontally is required to be attached and supported on the support members not less than 6 feet on center.
- At the gas meter location, the CSST piping is required to terminate using the pipe manufacturer's approved meter termination fitting. The termination fitting must be properly attached to structure to support the gas meter. CSST fittings to the gas meter cannot be concealed within the structure.

PROPANE GAS PIPING: Piping for propane **inside of a building** is required to be black pipe or equivalent **(copper tubing not allowed)**. The air test of 20 pounds per square inch must be applied to the piping for a period of 20 minutes. The test is to be installed on the piping by the pipe fitter, owner or contractor and witnessed by a building inspector.

GAS METER: All gas piping at the meter location is required to terminate no greater than 10 feet from the corner of the structure closest to the gas main. Other locations must be approved by the natural gas supplier.

To obtain a gas meter, the following conditions must be followed:

- Gas line must be stubbed out of the building wall no closer than 60 inches to the right or 30 inches to the left of any foundation vents, building vent, fresh air vent, combination vent, door or window.
- All gas meters are to be located at the building wall and the outlet piping of the meter is to enter the building above grade.
- A test on uncoated threaded gas piping shall require the piping to be subject to an air test requiring 20 pounds per square inch for a period of 15 minutes, with no pressure drop. Welded or coated piping is required to have a 90 pound air test for a period of 2 hours, with no pressure drop. The test is to be installed on the piping by the pipe fitter, owner or contractor and witnessed by a building inspector.
- A mechanical inspection is required. This would require the installation of the furnace, proper venting, supply and return air ducts, gas piping, shut off valves and combustion air.

POTABLE WATER SUPPLY

WATER SERVICE: Water service piping shall be installed not less than 30 inches below grade.

Lawn irrigation systems supplied by City of Springfield is required to be protected with a backflow valve in accordance with the City Utilities Backflow Prevention Requirements for Lawn Irrigation Systems.

Lawn irrigation systems located on other water services are required to be protected from backflow with an atmospheric vacuum breaker, pressure vacuum breaker assembly or a reduced pressure backflow prevention assembly. Where chemicals can be introduced into the system the potable water supply shall be protected by a reduce pressure backflow prevention valve.

Potable water supplies are also required to be protected with backflow devices when connected to boilers, heat exchanges, automatic fire sprinkler system when the system is supplied with a fire department connection, solar systems and when systems contain additives or antifreeze or connected to a non-potable source.

WATER PRESSURE: A pressure reducing valve is required on all water services supplied by Springfield City Utilities and Battlefield Water Service. All other water services, public or private, will be required to have pressure reducing valves placed on the water service line whenever the water pressure exceeds 80 pounds per square inch in the water service system.

When the pressure reducing valve allows for an adjustment above 80 PSI, then a water pressure gauge is required to be place adjacent to the pressure reducing valve. The pressure reducing valve is to maintain a setting of 80 PSI or below. If the pressure reducing valve prevents pressure relief through the building supply then a thermal expansion tank is required according to IRC Section P2903.4. The pressure reducing valve is required to be located adjacent to the water heater, accessible from above the floor. The pressure reducing valve is required to be installed prior to the plumbing rough-in inspection.

SANITARY DRAINAGE and VENTS

REQUIRED WASTEWATER DISPPOSAL: All wastewater disposals from structures are required to drain into sanitary disposal systems (public or private). The Greene County Environmental Section will advise you on a case-by-case basis on the required procedures. Foundation drains or sump pumps used to pump out ground or sub-grade water (not sewage or gray water) are required to drain to the daylight.

SEWAGE BACK-FLOW: An accessible backwater valve shall be installed only in branches of the drainage system subject to back-flow. Drainage piping serving fixtures which have flood level rims located below the elevation of the next upstream manhole cover of the public sewer serving such drainage piping shall be protected from the back-flow of sewage by installing an approved backwater valve. Fixtures above the elevation of the next upstream manhole shall not discharge through the backwater valve.

COMBINATION WASTE and VENT SYSTEM: This system can not be use on a kitchen sink connected to a food waste grinder.

AIR ADMITTANCE VALVES: Air admittance valves are permitted on remodeled or existing structures and only in island fixtures in new structures.

ELECTRICAL CONSIDERATIONS:

SERVICES: One and two family dwellings can only be supplied with one service.

Electrical service to the structure must be sized according to the electrical loads applied. In most cases 100 amp electrical services will not be large enough to handle the applied loads.

Service entrance conductors (conductors before the meter) size and installation must be according the utility supplier requirements, but in no case less than the requirements of the 2011 National Electrical Code. Reduced neutrals are not permitted. Aluminum conductors shall be a compacted lay cable comparable to AA-8000 stranded aluminum and can not be smaller than #2 AWG.

Meter sockets located on structures must be a minimum of 5 feet and a maximum of 7 feet from the finish grade.

SERVICE DISCONNECT REQUIRED: Means shall be provided to disconnect all conductors in a building or other structure from the service entrance conductors. Service disconnects shall be permanently marked.

The service disconnecting means shall be installed at a readily accessible location either outside of a building or inside Each occupant shall have access to the disconnect serving the dwelling unit in which they reside.

GROUNDING ELECTRODE SYSTEM: All grounding electrodes that are present in a structure are required to be bonded together to form the grounding electrode system.

All new construction that has reinforced concrete footings shall have a concrete encased electrode. The electrode is required to be encased by at least 2 inches of concrete, located within and near the bottom the footing. The required encased electrode is to be placed in the same area as the electrical panel box. <u>When the location of the electrical panel box is uncertain, then a concrete encased electrode is required on both sides of the structure</u>.

One of the following installations may be used and WILL HAVE TO BE IN PLACE AT THE TIME OF THE FOOTING INSPECTIONS:

1. A number 4 rebar (minimum), which is attached to the horizontal steel in the footing, bent and turned up thru the footing. The turned up rebar can be either on the inside or exterior of the foundation wall. A number 4 copper wire is to be connected, with an approved connector, to the turned up rebar. The connection to the ground will have to be witnessed by the inspector, before an electrical service is approved.

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2. A number 4 copper conductor attached with an approved connector to the footing steel, that is 20 feet (minimum) length or a number 4 copper conductor 20 feet (minimum) in length may be installed in the concrete. The end of the copper conductor then must be turned up in the footing either on the interior or exterior of the foundation wall. The number 4 copper can be stubbed up and bonded at the time the service is set or a length of wire can be coiled up and run to the service at a later date. The connection to the ground will have to be witnessed by the inspector, before an electrical service is approved.

NOTE: AN ADDITIONAL GROUND ROD MAY BE REQUIRED BY YOUR UTILITY COMPANY. THIS GROUND ROD WILL BE REQUIRED TO BE CONNECTED TO THE CONCRETE ENCASED GROUNDING ELECTRODE.

A metal underground gas piping system or aluminum electrodes cannot be used as a grounding electrode.

PANELBOARDS: Panelboards are to be readily accessible, required to be located where the working space is clear and unobstructed from the floor to a height of 6.5 feet or the height of the equipment, whichever is greater. The minimum clear space in front of the panel is 3 feet and at least 30 inches clearance in width.

Panelboards can not be located where they will be exposed to physical damage, in clothes closets, in bathrooms or located over steps of a stairway.

The panelboard is to be installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 6 feet 7 inches above the floor or working platform.

DWELLING UNIT BRANCH CIRCUITS: In addition to the number of branch circuits required by the code, such as lighting, outlets, heating, air conditioning, etc., the following circuits are required.

1. A minimum of two (2), twenty (20) ampere small appliance circuits shall be provided for the kitchen. The small appliance circuits shall have no other outlets.

2. A twenty (20) ampere laundry circuit shall be provided. There shall be no other outlets on the circuit.

3. A minimum of one (20) ampere branch circuit shall be provided to supply bathroom receptacle outlet(s). Such circuits shall have no other outlets, except where the 20-ampere circuit supplies a single bathroom, outlets for other equipment within the same bathroom shall be permitted. Receptacles can not be placed within or directly over a bathtub or shower stall.

BASEMENTS, GARAGES and UNFINISHED AREAS: The following will be required for basements, garages and unfinished areas.

1. A minimum of one GFCI protected receptacle, in addition to laundry receptacle.

2. A minimum of one light, operated by a switch located at the entrance to the area is required.

3. A minimum of one smoke alarm wired from dwelling power source with a battery back up. Must be interconnected to all other smoke alarms in the dwelling.

4. A carbon monoxide detector required outside the sleeping area.

5. Basement finishes requirements. When interior walls for separate rooms are framed, these areas shall be considered as finished areas and shall be provide with required branch circuits and smoke detectors. All wiring shall be protected form physical damage by placing the conductors in conduit or placing sheet rock on the walls.

GROUND FAULT CIRCUIT INTERUPTER: The following locations are required to be GFCI protected.

1. Bathroom receptacles, garage and accessory building receptacles (all 125-volt, single-phase, 15- or 20-ampere receptacles).

2. Exterior receptacles are required in the following locations and required to be GFCI protected:

- A minimum of one receptacle on the front and one receptacle on the rear of the structure.
- One receptacle within 25 feet to air-conditioning equipment.
- All receptacles exposed to wet and damp locations are to have in use covers or commonly called bubble covers.

3. Crawl area – A receptacle and light are required in crawl area, when HVAC, water heater or other equipment are installed in the crawl area. Both light and receptacle required to be GFCI controlled. The light is to be controlled at the crawl entrance.

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4. Kitchen area GFCI receptacle requirements:

- Receptacles required at each wall counter space so that at no point along the wall is more than 24 inches from a receptacle.
- Island counter space requires at least one receptacle when the long dimension is 24 inches or greater and short dimension is 12 inches or greater.
- Peninsular counter space requires at least one receptacle when the long dimension is 24 inches or greater and short dimension is 12 inches or greater.

5. Swimming pools, spas, hot tubs, whirlpools, jacuzzies, and fountains require a separate GFCI protected circuit size according to the amp requirement for the operation of the equipment.

6. All sink receptacles located within 6 feet from the outside edge.

7. Unfinished areas in the basement - These areas would include non-habitable rooms used for storage areas, work areas and the like.

ARC-FAULT CIRCUIT INTERRUPTER: All branch circuits that supply 15 and 20-ampere outlets installed in dwelling unit bedrooms are required to be protected by an arc-fault circuit interrupter that is listed to protect the entire circuit.

LIGHT FIXTURES: The following are restrictions on light fixtures locations.

1. Bathroom areas: ***No part*** of cord connected fixtures, chain-cable-or cord suspended fixtures, lighting track, pendants or ceiling suspended fans can be located in a bathtub or shower areas within a zone measured three (3) feet horizontally and eight (8) feet vertically from the top of the bathtub rim or shower stall threshold. Luminaries within the actual outside dimension of the bathtub or shower to a height of 8 feet vertically from the top of the bathtub rim or shower threshold shall be marked for damp locations and where subject to shower spray, shall be marked for wet locations.

2. Clothes closets: A light fixture can not be located in the storage area of a clothes closet. For the purposes of this section, storage space shall be defined as a volume bounded by the sides and back closet walls and planes extending from the closet floor vertically to a height of 6 feet or the highest clothes-hanging rod and parallel to the walls at a horizontal distance of 24 inches from the sides and back of the closet walls respectively, and continuing vertically to the closet ceiling parallel to the walls at a horizontal distance of 12 inches (305 mm) or the width of the shelf, whichever is greater.

The light fixture is required to be surface-mounted, recessed incandescent or LED luminaries with completely enclosed light sources identified as suitable for installation in clothes closets.

SMOKE DETECTORS AND CARBON MONOXIDE DETECTOR: Every dwelling unit shall have an approved hard wired, battery back-up smoke alarms installed in each sleeping room, outside each sleeping area and on each level of the house. Smoke alarms are to be interconnected.

Every dwelling unit shall have a carbon monoxide alarm installed when fuel-fired appliances are installed in a dwelling or the dwelling has an attached garage, when alterations or additions or when one bedroom is added, an approved carbon monoxide alarm shall be installed outside each separate sleeping area in the immediate vicinity of the bedrooms.

RESIDENTIAL ELECTRICAL UPGRADES: Upgrades or damage to an electrical system will have the following requirements.

1. In all structures used for residential purposes, a service upgrade modification will require the following electric systems improvements.

- The new service shall be sized per the requirements of the adopted electric code or utility provider, whichever is the more restrictive.
- GFCI receptacles in the kitchen(s) and bathroom(s) shall be installed if outlets are in existence at the time of the service upgrade.
- The panel board shall contain a minimum of twenty (20) spaces, including the main breaker.
- Approved hard-wired, battery backed-up, interconnected smoke detectors and carbon monoxide detector shall be installed and located as per the adopted building code.
- All apparent hazards shall be corrected.

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2. If damage occurs to any part of the electrical system within a residential structure as a result of a fire or other similar incident, all systems must be repaired and all hazards within the structure corrected. Additionally, approved hard-wired, battery back up, interconnected smoke detectors shall be installed and located as per the adopted building codes. If the service portion of the electrical system is damaged of upgraded as a result of a fire or other incident, the requirements for service upgrades shall apply.

3. A total or partial upgrade of the electrical systems may be required if, in the opinion of the code official or inspector, the existing electrical system constitutes a potential threat to the safety and welfare of current or future occupants.

OTHER ELECTRICAL, MECHANICAL, AND PLUMBING REQUIREMENTS: Due to the different types of layouts and installations, different aspects of the code may address your condition and may not address others. If a specific problem, condition, or question arises, please feel free to contact a Building Inspector for guidance.

THIS HANDOUT IS ONLY *PROVIDED* AS A CONVENIENT SOURCE FOR BASIC INFORMATION AND *DOES NOT* ADDRESS ALL THE CODES *NOR DOES* THIS INFORMATION TAKE THE PLACE OF ANY ADOPTED CODE OR AMENDMENTS.

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