Plumbing Compactness (Residential)

The 2021 International Energy Conservation Code (IECC) contains a required amendment for Service Water Heating (Plumbing Compactness) for all residential dwellings as referenced in BUILDING COMPONENT Service Water Heating in TABLE R405.4.2(1). Link to ICC code.

Purpose: To reduce the linear feet of hot water plumbing lines within the residential dwelling, which then reduces the volume of water and the amount of energy and water waste. The waste is associated with heated water that remains in pipes and isn't used at the fixture, which then eventually cools (energy waste) and when heated water is requested again, is wasted, or dumped (water waste), while the user waits until heated water arrives at a fixture.

What must be shown on the plans?

1. A rectangle and its computed square foot area containing the hot water heater and all hot water fixtures that it serves on each floor, with exception noted below in *section d*.
    a. Sources of hot water include water heaters, or in multifamily buildings with central water heating systems, circulation loops or electric heat traced pipes.
    b. The hot water rectangle shall include the source of hot water and the points of termination of all hot water fixture supply piping.
    c. The area of the hot water rectangle shall be computed to the nearest square foot.
    d. Where there is more than one water heater, and each water heater serves different plumbing fixtures and appliances it is permissible to establish a separate hot water rectangle for each hot water distribution system and add the area of these rectangles together to determine the compactness ratio.
    e. The basement or attic shall be counted as a story when it contains the water heater.
2. The square foot area of the dwelling.
3. The hot water distribution system (HWDS) ratio, measured by dividing the area of the hot water rectangle by the area of the dwelling.

TABLE 1. Example (for this 2-story single family dwelling the ration must be less than 30%)

Story	Area of Rectangle (sq. ft.)	Area of Dwelling (sq. ft.)	Compactness Ratio
Basement		1200	
1st Floor		1200	
Total	600	2400	(600/2400) = **0.25 or 25%**

How is Plumbing Compactness Measured?

The factor for the compactness of the hot water distribution system is the ratio of the area of the rectangle that bounds the source of hot water (water heater) and the fixtures of each floor that it serves divided by the floor area of the dwelling.

Table 2. The Required Compactness Ratios percentages are as follows:

1 story	2 or more stories
≤ 60% single family *or* ≤ 70% stacked multi-family units	≤ 30%

The following examples illustrate how to measure the compactness ratio and show on plan set:

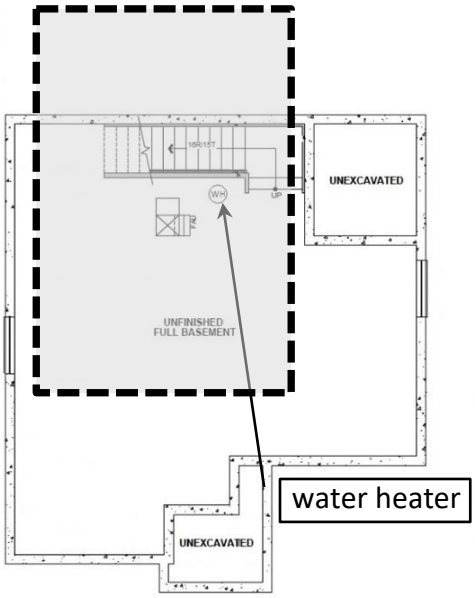
1. Single-family residential dwelling (1 story)
2. Single-family residential dwelling (2 or more stories, with a basement)
3. Stacked multi-family residential dwelling (single floor apartment or condominium)

Example 1. Single-family (1 story) Slab-on-grade - *Requirement ≤ 60%*

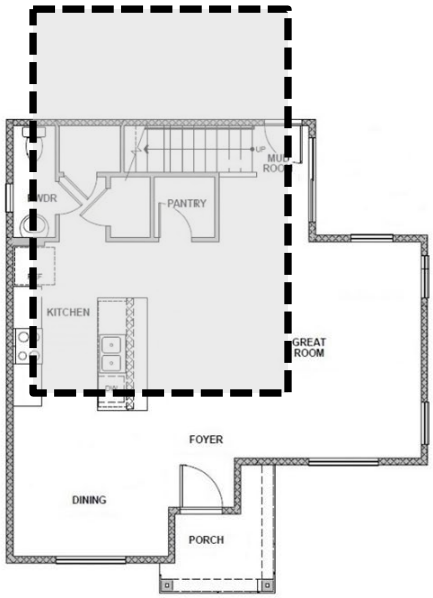
- Square foot of floor area = 1,494
- Hot Water Distribution System (*HWDS*) rectangle = 727 sq ft
- Compactness Ratio (727 sq ft divided by 1,494 sq ft) = 49%
- *HWDS* factor (as referenced in IECC TABLE) = 0.05

Example 2. Single-family w/ BSMT (2 or more stories) - *Requirement ≤ 30%*

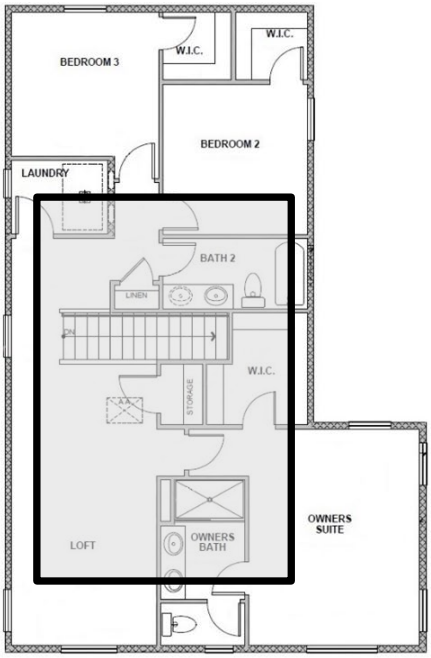
- Square foot of floor area = 2,482
- Hot Water Distribution System (*HWDS*) rectangle = 537 sq ft
- Compactness Ratio (537 sq ft divided by 2,482 sq ft) = 22%
- *HWDS* factor (as referenced in IECC TABLE) = 0.05



UNFINISHED BASEMENT



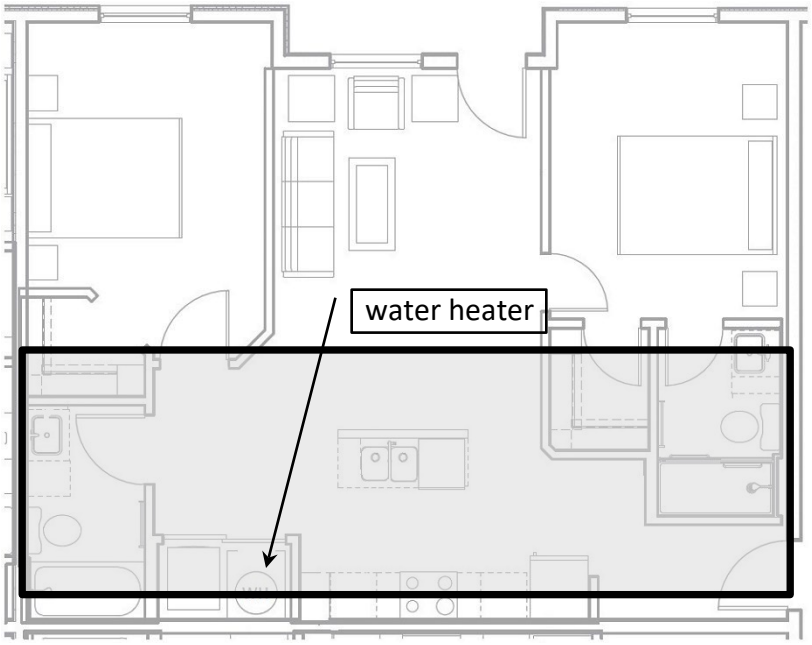
FIRST FLOOR PLAN



SECOND FLOOR PLAN

Example 3. Stacked Multi-family – single floor - *Requirement ≤ 70%*

- Square foot of floor area = 823
- Hot Water Distribution System (*HWDS*) rectangle = 351 sq ft
- Compactness Ratio (351 sq ft divided by 823 sq ft) = 43%
- *HWDS* factor (as referenced in IECC TABLE) = 0.05



Note: Where there is an entry with landing and stairs to the unit on floor above, the entry and landing does not need to be considered a second floor.