STATE BUILDING CODE OPINION 24-Nov04a

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C404.2.1

QUESTION 1**:** Section C404.2.1.1 requires 50% of the service hot water demand to be met by a heat pump system complying with this section and allows up to 50% to be fossil fuel or electric resistance. In a project that is 40% heat pump and 60% fossil fuel is the intent of the code that the non-compliant portion of total capacity is 10%, basically assuming non-heat pump allowance is always 50% of overall capacity?

ANSWER 1: No.

QUESTION 2**:** If the above answer is no, then is it the intent that the non-compliant portion of total capacity is 20%, assuming non- heat pump allowance is limited to the amount of heat pump capacity installed?

ANSWER 2: Yes.

QUESTION 3**:** Is code intent that the non-compliant portion of total capacity is 60%, assuming non- heat pump allowance only exists if the heat pump system attains 50%, i.e. meet requirements totally or lose the 50% allowance?

ANSWER 3: No.

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04b

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C404.2.1 and C401.3.3.2

Background: Section C404.2.1.1 allows up to 50% of the primary water heat capacity to be met with non-heat pump sources. The question is what happens if the project does not attain 50%. Critically, the C401 and C406 equations for the fossil fuel do not make allowances for this 50% allowance. One interpretation, probably the most likely one, of the equations as currently written will require a project that has an otherwise C404.2.1.1 compliant heat pump but that only delivers 49% of peak demand to lose any allowance for fossil fuel and require 51% of the C401 credits despite only missing the required heat pump capacity by 1% (or 2% of 50%).

The B terms in the equations sum the fossil fuel capacity complying with the exceptions to C403.1.4 and C404.2 and removes it from the total fossil fuel capacity so that code compliant fossil fuel is not required to add extra credits. The definition of B does not extend this treatment to fossil fuel or electric resistance allowed by C404.2.1.1.

One possible interpretation is that C404.2.1 requires service hot water to be provided by an electric air-source heat pump water heating (HPWH) system ”meeting the requirements of this section” and that the non-HP allowance is part of this system.

QUESTION 1**:** Is the installed fossil fuel or electric resistance capacity allowed by C404.2.1 considered to be part of the heat pump system (non-fossil fuel) capacity in Section C401.3.3.2 and C406.2 equations?

ANSWER 1: Yes. The 50% fossil fuel allowance is part of a C404.2.1.1 compliant heat pump system. (This makes the equations work).

QUESTION 2**:** Is the intent of the equations in Section C401.3.3.2 to reduce the required additional credits so that they are proportional to the fraction of total heating capacity that complies with C401.3 but doesn’t comply with C404.2 without the language in C401?

ANSWER 2: Yes.

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04c

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C406.2 and C401.3

QUESTION **:** Is the intent of C406.2 equation for Cwh that the fossil fuel table credits will be weighted proportional to the fraction of total heating capacity that complies to C401.3 but doesn't comply with C404.2 without the language in C401?

ANSWER : **Yes..**

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04d

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C401.3

Background: As written the fossil fuel path is a loophole that allows heat pump compliant and largely heat pump compliant projects to avoid the C406.2.5 limit on the renewables contribution to C406 credits.

QUESTION**:** Can any project follow the fossil fuel pathway or must some installed space or water heating equipment be non-compliant with C403 or C404 respectively?

ANSWER: **No. Projects must contain some system that is not compliant with C403 and/or C404 to utilize C401.3.3.1 and/or C401.3.3.2, respectively.**

Or alternatively:

Yes. The fossil fuel path is an alternate path that is available to all projects.

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04e

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C404.2.1.1

Background: Group R with 100% heat pump hot water (300,000 Btu/h) over first floor retail doing an initial tenant improvement. The initial tenant improvement is proposing to install a 200,000 Btu/h fossil fuel hot water system.

QUESTION**:** Can the initial tenant improvement take account of the building heat pump system and claim their system qualifies as part of the up to 50% allowed gas?

ANSWER: **Yes. The initial tenant improvement can take account of all other water systems in the building when qualifying the new system.**

Or alternatively:

No. Projects must comply on a stand-alone basis, there is no way for code officials to tract the possible simultaneous tenant improvements.

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04f

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C401.3.3.2 and C406.2

Background: The sections are silent on whether output or input capacity is the desired quantity, but the goal of the equations is to offset efficiency lost from non-heat pump systems based upon their overall contribution to meeting the building demand for the end use. Output capacity most clearly aligns with this.

Example: A C404.2.1 heat pump compliant system provides 40% of the hot water at a COP of 2.5 and 60% is proved by a 90% efficient gas system. Using output capacity would require the project to meet 60% of the additional credits. Using input capacity the heat pump system only represents 19% of the input energy [(0.4 / 2.5) / (0.4 / 2.5 + 0.6 / 0.9)] meaning a project with compliant systems delivering 40% would need to meet 81% of the additional credits.

QUESTION**:** Is the capacity specified in the C401.3.3.2 and C406.2 equations intended to be the output capacity?

ANSWER: **Yes.**

SUPERSEDES: None

REQUESTED BY: King County

STATE BUILDING CODE OPINION 24-Nov04g

CODE: 2021 Washington State Energy Code-Commercial

SECTION: C404, C401.3.3.2 and C406.2

Background: For hybrid water heaters there is no official published output capacity in kBtu or Btu. The only official AHRI listing capacity like number is the input rating. Additionally, the product literature often includes some of the following: the first hour rating, the recovery in GHP with a 90°F rise, the resistance supplemental capacity, and sometimes the compressor input or output capacity.

Using input capacity will slightly under-weight heat pumps and if used for gas water heaters would slightly over-weight them. Either will require higher additional credit requirements so this is an undesirable outcome for the project in most situations but may be the most available number. Most hybrid water heaters combine a small heat pump (4000 Btu output) with a relatively large electric resistance heater (15000 Btu output). The electric resistance is typically designed to run in parallel with the heat pump in high draw conditions. The AHRI listed input is the total input for these sources. Since the electric resistance is at 100% efficiency and the compressor is so small, the difference using input capacity rather than a true output capacity is in the 10% to 20% range.

QUESTION 1**:** Section C404 specifically delineates primary and supplemental capacity with different treatments, but the equations in Sections C401.3.3.2 and C406.2 do not. Does capacity in the Section C401.3.3.2 and C406.2 equations refer to the primary capacity as discussed in C404?

ANSWER 1: Yes.

QUESTION 2**:** Is it acceptable to calculate the output capacity for AHRI listed hybrid water heaters based upon the one-hour recovery rate in product literature?

ANSWER 2: Yes. Since there is no published output capacity, calculating the capacity based upon the recovery rate is acceptable. Output capacity kBtu = Recovery Rate (GPH) X Temp. Rise X 8.25) / 1000.

SUPERSEDES: None

REQUESTED BY: King County