Seattle Department of Construction and Inspections

sdci

Tip 425

Seattle Permits

— part of a multi-departmental City of Seattle series on getting a permit

HVAC Total System Performance Ratio

Updated August 3, 2022

Most new commercial and multifamily buildings in Seattle are required to comply with the HVAC Total System Performance Ratio (TSPR) requirements in the Seattle Energy Code. You can find this code requirement in Section C403.1.1 of the 2018 Seattle Energy Code.

What is TSPR?

TSPR applies specifically to a building's HVAC system. It is the ratio of the annual heating and cooling provided for a building, to the carbon emitted in the process of generating and distributing the building's heating, cooling, and ventilation. Higher TSPR values are better, indicating more heating and cooling is delivered for each unit of energy.

The purpose of TSPR is to ensure that the entire HVAC system, not just the individual components, meet a high efficiency standard.

The TSPR provides a minimum standard for the overall efficiency of a building's HVAC system for the first time, without limiting the technical means of achieving that level of efficiency.

TSPR Definition (from Section C202):

HVAC TOTAL SYSTEM PERFORMANCE RATIO (HVAC TSPR). The ratio of the sum of a building's annual heating and cooling load in thousands of Btus to the sum of annual carbon emissions in pounds from energy consumption of the building HVAC systems. Carbon emissions shall be calculated by multiplying site energy consumption by the carbon emission factors from Table C407.3(1).

Is TSPR in the Washington State energy code different from the Seattle Energy Code?

Yes. While TSPR is a Washington state code requirement, the Seattle code adds multifamily buildings and medical office buildings to the scope, and adds two new exceptions. In general the State and Seattle codes use the same language. One Seattle exception is for certain utilitarian spaces like kitchens, laundries and electrical rooms, while the other is for surgical centers and certain other medical office spaces.

Is TSPR required for projects using the C407 (Total Building Performance) compliance path?

No. TSPR is not one of the mandatory provisions for Section C407 Total Building Performance energy modeling compliance, nor is it required for the Target Performance Path in Section C401.3.

Where does the code require TSPR?

You can find TSPR requirements in Section C403.1.1. They apply to several building types, listed below, but not to all building types. Any mixed-use buildings with HVAC systems serving occupancies that are listed below must comply with the TSPR requirements.

You must comply with the TSPR requirements for:

- Office
- Education
- Retail
- Library
- Medical offices (but see exception 11)
- Dwelling units and residential common areas within multifamily buildings

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What exactly is the requirement in Section C403.1.1?

You must perform the TSPR calculation for HVAC systems serving any of the occupancies listed above. The resulting TSPR of the "proposed design" must be equal to or greater than the TSPR of the "standard reference design."

Are there exceptions to the TSPR requirement?

There are 11 exceptions to the requirement listed in Section C403.1.1, mostly for specific HVAC system types, but also including buildings smaller than 5,000 square feet and certain medical office buildings.

Do projects have to comply with the other HVAC code requirements, if they comply with TSPR?

Along with doing the TSPR calculations, you must also meet all of the other requirements in Section C403 (HVAC systems).

Free online calculation tool

The TSPR calculation ruleset is shown in Appendix D, and is highly technical language. We advise that you use the free online calculation tool (account required) provided by the Pacific Northwest National Laboratory (PNNL). The TSPR calculation is a simplified form of energy modeling, but instead of taking a few days to create this model, it takes only a few hours for a design engineer to complete.

- There's a "quick start guide" on the PNNL's website. It makes sense to try out an imaginary project just to get the hang of it.
- Educational how-to videos are also available.
- You can find additional helpful documents, including a sample report and explanatory graphics by using the HVAC System Performance Tool.

Electricity is not "zero-carbon" in TSPR

The TSPR calculation assumes that electricity production produces carbon emissions of 0.70 pounds of CO2 per kilowatt-hour of electricity in order to account for the carbon impact of Seattle's interactions with other parts of the Western Interconnection where power is often produced from coal and gas. Fossil gas is assumed to produce 11.7 pounds of CO2 per therm. These values are found in Table C407.3(1) and match the values used in the state energy code.

Do I have to calculate TSPR for alterations to existing buildings?

Not for partial HVAC alterations. Exception #8 in Section C403.1.1 reads: "Alterations to existing buildings that do not substantially replace the entire HVAC system." This clarifies that an alteration that does replace the entire HVAC system, or substantially all of it, does have to comply with TSPR. In addition, there are three types of major changes to a building that do require TSPR:

- "Substantial alterations," defined in Chapter 2 of the energy code.
- Change of space conditioning, when a building or space changes from unheated or semi-heated to fully conditioned.
- Change of occupancy, when a building or space changes from a F, S, or U (factory, storage, or utility) occupancies to another occupancy such as retail, or changes from non-residential to residential.

Note: The table on page 3, from Appendix D, is referenced in Section C403.1.1, Exception 3, which reads: "HVAC systems not included in Table D601.11.1." An HVAC system that is not listed in this table is not required to comply with TSPR.

Access to Information

Links to electronic versions of SDCI Tips, Director's Rules, and the Seattle Municipal Code are available on the Resources page of our website at **www.seattle.gov/scdi**.

Table D601.11.1

PROPOSED BUILDING HVAC SYSTEMS SUPPORTED BY HVAC TSPR SIMULATION SOFTWARE

System No.	System Name	Abbreviation
1	Packaged Terminal Air Conditioner	PTAC
2	Packaged Terminal Air Heat Pump	PTHP
3	Packaged Single Zone Gas Furnace	PSZGF
4	Packaged Single Zone Heat Pump (air to air only)	PSZHP
5	Variable Refrigerant Flow (air cooled only)	VRF
6	Four Pipe Fan Coil	FPFC
7	Water Source Heat Pump	WSHP
8	Ground Source Heat Pump	GSHP
9	Packaged Variable Air Volume (DX cooling)	PVAV
10	Variable Air Volume (hydronic cooling)	VAV
11	Variable Air Volume with Fan Powered Terminal Units	VAVFPTU
12	Dedicated Outdoor Air System (in conjunction with systems 1-8)	DOAS