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F.A.Q.

Question:
Is an Air Source Heat Pump able to Provide 100% Heating without Supplemental Heat?

Quick Answer:
Yes, provided that the rated heating capacity of the heat pump is more than the design heat loss of the home when the heat pump rating is at a temperature that is lower than the winter outdoor design temperature where the home is located.

Detailed Answer:
Air Source Heat Pumps (ASHP) have traditionally been installed with both supplemental[1] and emergency[2] heat sources, A.K.A. "backup heat". These heat sources are often sized at 100% of the design heat loss of the home. In the not too distant past ASHP capable of operating efficiently at the outdoor temperatures experienced by Canadian homes in the winter were not available. Recently, ASHP capable of operating efficiently at outdoor design temperatures of -25ºC and lower have become available. At the same time, Canadian new home envelopes have improved significantly so that the peak winter heating requirements are significantly lower than in the past. The net result of these two developments is that there are many situations where an ASHP is capable of providing all of the heating for a home without supplemental heating.

There are two conditions as follows:

1) An accurate Heat Loss and Gain calculation according the CSA-F280-12 using verified software is required as a starting point. F280 Verified Software This calculation will also clearly identify the winter outdoor design temperature (ODT).

2) The rated ASHP Heating Capacity must exceed the calculated heat loss of the home at a temperature that is below the winter ODT. While the rated low-temperature heating capacity may be available from manufacturers' literature, an independent source for this information is the NEEP database. It is not sufficient to use rated heating capacity at a certain temperature (say 0ºC) followed by a stateement such as "operates down to -25ºC". In order to be valid there must be a stated heating capacity at the temperature in question.

The above can be seen as the minimum technical, requirements however HVAC Designers may exercise judgement when selecting equipment so that exceptional conditions are accounted for. In particular, Designers may select equipment that is rated somewhat below the winter ODT on the basis that the lower operating temperature limit of an ASHP usually means that the ASHP will stop operating below that temperature limit. This might occur in exceptionally cold conditions in which case emergency heating would be required.

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[1] "Supplemental Heat" is used to denote heating provided when the ASHP is not able to provide all of the heating for the home. Ideally the supplemental heat is controlled together with the ASHP so that the supplemental heat is only provided when the ASHP is not keeping up and provides only enough heat to keep the home up to the set temperature. Historically, less than ideal control strategies such as balance point changeover have been used.
[2] Emergency Heat is used to denote heating that is provided in case of failure of the ASHP. Emergency heat may be controlled by the same control as the ASHP (usually called emergency heat) or it may be controlled independently of the heat pump, such as by a thermostat set at a lower temperature.