Technologies in balanced ventilation systems to maintain optimal performance in energy and comfort

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SUMMARY

Measurements of the installed base of balanced ventilation systems in houses often show that optimal performance is not achieved. The installed base however, is a mix of various generations of units that have been developed over the years, starting in 1980. As a result, energy benefit and perceived comfort for residents is underestimated. Since 2015, improved knowledge has led to new technologies that have been implemented in the newest generation balanced ventilation units. In the following paragraphs, seven technologies are described that guarantee the fresh air flow as well as the balance between the supply and return air stream. This ensures a constant refreshment, an optimal energy benefit of recovery and resultingly a better comfort of the supplied fresh air flow for occupants.

KEYWORDS

Balanced ventilation, optimal heat recovery, adaptive comfort, modulating bypass, season detection

1.1 Automated fan speed adjustment during commissioning

For older units, produced before 2015, the factory-default fan speeds of supply and return fans should be adjusted to the resistances in the supply and return ducts during commissioning. This ensures the flow rates match the desired values. Adjusting the fan speeds is often omitted, forgotten, or done incorrectly by installers. In the contrary, newer units have an automated calibration cycle that 'senses' the resistances. Fan speeds are then automatically adjusted so that both airflows have the desired flow rate, and are balanced. This technology prevents incorrect settings, and therefore unnecessary noise, as well as unbalance and cold supply temperatures in winter.

1.2 Balance in mass flow rate rather than volume flow rate

In older units, airflow balance depends on the installer's measurements and fan speed settings. When temperature differences occurred between supply airflow and return airflow, the installer's measurement was not precise enough to balance the mass flow. Newer units continuously adjust mass airflow rates. This takes into account temperature differences. As a result, the mass flow is always balanced and there is optimal energy exchange between the airflows. This prevents varying recovery efficiency with varying temperature differences.

1.3 Automated fan speed correction (Flow Control)

In older units, the fan speed does not change over time. New units have a control for constant mass flow rate with changing system resistances. The resistance may change with condensation in the exchanger (medium-term) and with filter degradation (long-term). To avoid unwanted noise changes, short-term resistance changes due to for example wind pressure are not

corrected. This automatic speed control maintains optimal recovery efficiency (and thus prevents draughts) even if outdoor temperatures get colder and/or filters get dirty.

1.4 Comfort levels instead of values

Older units have a "comfort temperature" setting. This setting makes sure passive cooling by activation of a bypass comes into effect when the return temperature rises above the comfort temperature. The value of this comfort temperature can be adjusted by a resident, but is often misunderstood, leading to excessively low or high values. Newer units use a temperature profile (COOL, NORMAL or WARM). In COOL, the bypass is activated more often for passive cooling. With WARM, on the other hand, the bypass is activated less. This prevents incorrect settings by residents and is consistent with a resident's psychological well-being.

1.5 Adaptive comfort technology

Older units have a "comfort temperature" setting that does not change over time unless manually adjusted by the resident. Throughout the year, therefore, the comfort temperature is always the same. Newer appliances use three temperature profiles (COOL, NORMAL and WARM), within which the "comfort temperature" adapts to prevailing outdoor temperatures. This makes use of adaptive comfort, where people accept a slightly higher indoor temperature when outdoor temperatures are high. This prevents incorrect adjustment of the comfort temperature and therefore incorrect deployment of the bypass. In short, automatically more comfort for the resident.

1.6 Modulating bypass technology

Older units had a bypass that alternated between fully closed (maximum recovery) or fully open (maximum passive cooling). At outdoor temperatures below 13°C, the bypass could not open because condensation could occur directly on the outside of the supply ducts. Newer units have a bypass that can be continuously controlled from maximum recovery to full passive cooling. This controls the supply temperature between the outdoor and indoor temperatures. This allows passive cooling to be applied in well-insulated houses, even at outdoor temperatures lower than about 13°C, without condensation forming on the outside of the supply ducts. This prevents unnecessary and unwanted heat recovery in well-insulated houses in the mid-season and summer seasons.

1.7 Season detection

Older units assumed a fixed limit for the start of the heating season, regardless of the location of the house, its orientation to the sun, the degree of insulation and the resident's wishes. Newer units have settings for heating and cooling season limits. The default value for these limits can be adjusted according to the specific conditions of the home and the resident's wishes. In better-insulated houses, this prevents the bypass from being unused for a long time because the unit thinks that heating is still going on in the house.