Introduction to demand controlled ventilation in France

Fabrice Lamarre*[1], Laure Mouradian[2]

1 Uniclima
11-17 rue de l'Amiral Hamelin
75783 Paris Cedex, France
Corresponding author: fabrice.lamarre@uniclima.fr

2 CETIAT
25 avenue des Arts, BP 52042
69603 Villeurbanne Cedex, France

SUMMARY

Demand controlled ventilation systems are representing a large majority of installations in France. They are commonly used for more than 35 years. The strong development of these systems can be explained by the French regulatory framework for air renewal. These demand controlled systems have been developed in order to optimise the energy consumption and at the same time to ensure indoor air quality and building durability. In residential buildings, demand control is based mainly on humidity whereas in commercial buildings it is based on occupancy and/or CO2 levels. Research is still in progress to guarantee that the indoor air quality is ensured at design stage and maintained during the building life.

KEYWORDS

Demand Controlled Ventilation (DCV), Regulation, Technical rules, Assessment, France

1 DEMAND CONTROLLED VENTILATION SYSTEMS IN FRANCE

To face contemporary energy challenges, the requirements in terms of energy consumption of buildings have hardened throughout the years. Ventilation is an important part of building consumption and can be one of the ways to reduce this energy consumption. However ventilation is essential for Indoor Air Quality (IAQ) of buildings.

The French regulatory framework for ventilation airflows relies on three major regulations:
- "Arrêté du 24 mars 1982", modified by "Arrêté du 28 octobre 1983": this bylaw includes requirements on air renewal in each dwelling built after 1982;
- "Code du Travail" (Work Code) for buildings occupied by workers;
-"Réglement Sanitaire Départemental Type" (typical local health regulation, known as "RSDT"), linked to the "Code de la Santé Publique" (Public Health Code) for buildings receiving public, including offices receiving public.

Mechanical ventilation appeared in France in the early 1960s, and became commonly installed in dwellings since publication of the 1982 bylaw which imposes minimum extract airflow rates. Demand controlled ventilation appeared in France in the early 1980s as a solution to answer the need of less energy consumption while maintaining IAQ. Today demand controlled ventilation for both residential and non-residential applications is still the reference.

The principle is simple: adjust continuously air renewal to the need. Airflows vary regarding activities, and/or presence of occupants. During indoor peak pollution, the air change is much higher than the average fixed flow required by the laws. During periods of low activity, flow rates drop to the lowest. In residential buildings, a minimum airflow is required in order to

treat permanent pollution emitted from the building and furniture materials. In office building, the system can be stopped during unoccupied periods (nights, weekends ...).

The continuous adjustment of airflow rates reduces heating and cooling needs by reducing the average rate of air renewal. Similarly, annual fan consumption is reduced due to part-load operation. The following demand controlled systems have been chosen as the reference for building energy performance calculations:

- For residential buildings: centralised mechanical exhaust demand controlled systems based on humidity sensors. These systems equip 95% of new residential buildings in France (Savin, 2009).
- For non-residential buildings: demand controlled ventilation by CO_2 sensors and presence detection.

In order to verify that the DCV system will provide satisfying indoor air quality, a French Technical Assessment (Avis Technique, delivered by CSTB) is required to put the product on the market.

2 ASSESSMENT PROCESS

The validation process of demand controlled systems relies on a Technical Appraisal procedure called « Avis Techniques », which implies IAQ and energy performance assessment.
For residential applications, annual dynamic simulation estimates the risk of insufficient air renewal using CO_2 concentrations and risk of condensation (Demouge, 2018). The annual equivalent average airflow and energy consumption of fans are calculated and used for EPB calculations. In parallel, the evaluation procedure relies on a certification to assess the quality of individual units and controlled air terminal devices (inlet and outlet). The Technical Assessment delivered to each system specifies design rules, installation, commissioning and maintenance procedures.
For non-residential applications, the equivalent flow reduction coefficients are calculated on the basis of on-site experiments, sensors accuracy, and control strategies. Airflow control sensors are tested in laboratory according to a specific methodology for CO_2 and optical sensors, and according to EN 13141-9 and EN 13141-10 for humidity sensors. Results of the test for optical sensors have an impact on design rules. The Technical Assessment delivered with each system specifies design rules, installation, commissioning and maintenance procedures.

3 CONCLUSION

Demand controlled ventilation systems are still the subject of research for sustainability aspects, compliance check, finding new indicators, components, strategy. The objectives are to improve their sensitivity and robustness in order to better meet the need for ventilation in the right place at the right time.

4 REFERENCES

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