

## 4. Heating and ventilation

When designing the heating and ventilation systems of the buildings of stay-in-place forms system «Dobeles panelis» the requirements of the Latvian Building standards LBN 211-98 «Multi storied residential buildings » [1], LBN 208-00 «Public buildings and constructions » [2], LBN 231-03 «Ventilation and heating of residential and public buildings » [3], LBN 201-96 «Fire safety standards» [4] have been considered. All the above listed building standards can be found on Internet [5].

### 4.1. Heating of the buildings of the system «Dobeles panelis»

The buildings of the system «Dobeles panelis» are ideal for utilisation of all kinds of heating systems, and the only difference is that thanks to the good heat insulation of the limiting structures heating systems with less capacity are required for ensuring the feeling of comfort in the premises.

These buildings have a very high class of density which practically excludes the possibility of excessive (inadequate) heat losses in winter due to infiltration of the cold air. As soon as the European Parliament and Council Directive 2002/91/EC (December 16, 2002) «On the major energy parameters of buildings and their standards” gets into force the buildings of the system «Dobeles panelis» will comply with all the energy certification requirements of this directive [6].

The system «Dobeles panelis» provides the possibility to place the forward and backward heating pipelines in the internal heat insulation layer of the external walls as well as in the channels of the ceiling panels. Thus the heating pipelines have good insulation at the same time and it is also important that they are not seen in the rooms and do not harm a pleasant interior design.

### 4.2. Ventilation of the buildings of the system «Dobeles panelis»

Taking into consideration the air tightness of the limiting structures of premises and the air tightness of the windows and doors used in the building it is not recommended to design room without ventilation appliances. It is because in the rooms without corresponding ventilation the polluted air and humidity starts to accumulate and this may cause the feature of «sick buildings syndrome» (condensation of humidity, mould formation, formation of hazardous bacteria, smells. etc.).

It is recommended to design rooms with windows that can be opened to provide the possibility to perform periodic venting of rooms by opening windows. Still it should be noted that this type of venting of premises has a range of drawbacks:

- It is not possible to control the volume of the air exchange and this can cause excessive heat losses and cooling of rooms;
- Dust, pollen, chemical substances, etc. get into the rooms polluting the environment there and possibly causing allergic reaction of the residents;
- When a window is open the external noises have negative impact upon the room;
- If a window is forgotten open precipitation water may enter rooms when the weather conditions change or a storm begins;
- Open windows increase the risk of unauthorised entry.

Adjustable ventilation openings that are inbuilt in the windows partially solve the above problems providing for regulation of air flows, noise elimination, separation of dust or even automated opening of them when the humidity level in a room increases and automatic closing when a storm begins.

Air flows can be regulated and the noises eliminated and dust separated also by different ventilation devices that are inbuilt in the external walls.

Still it should be noted that all the above listed ventilation methods depend on the climatic conditions to a large extent and not always they will be able to ensure exchange of air in the rooms in compliance to the standards. LBN 231-03 stipulates that the minimum supply of fresh air when it is assumed that people are the only source of pollution of air in a room amounts to 15 m<sup>3</sup>/h per person, and LBN 211-98 «Multi storied apartment buildings » define special requirements on air exchange for a separate types of premises: in living rooms and bedrooms – at least 3 m<sup>3</sup>/h, in kitchens – at least 60 m<sup>3</sup>/h, in bathrooms and toilets – at least 25 m<sup>3</sup>/h.

For the purpose of ensuring the air exchange in premises in accordance with the standards mechanical ventilation systems are designed. In the simplest way extraction ventilators are installed in kitchens, bathrooms and toilets providing for formation of rare air in these rooms and the fresh air enters the room via untight areas in the limiting structures of the building, via special openings in the window frames or ventilation devices in the external walls.

Still it should be remembered that ventilation systems based upon mechanical extraction take away humid and warm air from the rooms, and the heat required for heating the incoming air must be provided by the heating system. Therefore corresponding capacity reserve both for the boiler and the radiators must be envisaged when designing the heating system. It should be noted that the rare air conditions caused by the mechanical extraction systems may disturb the operation of fire places or stoves if such are installed in a building.

When only the system of ventilation channels of natural ventilation is provided for rooms it should be taken into consideration that in this case the heat lost via such ventilation channels must be compensated by the heating system. It should also be noted that sufficient or even exceeded draught in such ventilation channels can be seen only in winter, however, in spring/ autumn period and moreover in summer the draught is not sufficient for ensuring the air exchange compliant to the standards.

Mechanical supply/ extraction ventilation systems in which recovery of the polluted air flowing out of the building is possible conform best to the modern requirements on environment preservation and energy saving. In this case mechanical supply/ extraction ventilation system must be installed in a building, a room for placing an air processing ventilation equipment must be found and supply/ extraction system of air pipelines must be constructed.

When any of the above ventilation systems is selected a project of the system must be developed defining the diameter and location of air pipelines, air distribution grilles, capacity of the ventilation equipment and the control principles.

When the technical design of the ventilation system of a building has been developed, the air pipelines to be connected for the formation of a joint system are installed in the forms of bearing walls and ceilings in between the strands during the installation of the forms of the stay-in-place forms system «Dobeles panelis» prior to concreting. It is possible to place the air pipelines of the ventilation system the same as pipelines of the heating system quite easy in the channels of the panels. If the diameters of air pipelines do not permit their placement in the channels of the panels, wider channels must be formed in the expanded polystyrene foam following the consolidation of the concrete where it is then possible to install air pipelines of higher diameter as well as sewage and water supply pipelines.

The diameter of air pipelines must be determined based upon aerodynamic calculations. The approximate estimation shows that an air pipeline of 100 mm diameter can transport not more than 150 m<sup>3</sup>/h in mechanical ventilation systems and not more than 25 m<sup>3</sup>/h in the vertical air pipeline of the natural ventilation. However, when a geometrical space is found for placing an air pipeline with the diameter of 200 mm there is a possibility to transport up to 600 m<sup>3</sup>/h in mechanical ventilation systems and up to 100 m<sup>3</sup>/h in the pipelines of the natural ventilation.

### 4.3. Air conditioning in the buildings of the system «Dobeles panelis»

The buildings of the system «Dobeles panelis» are perfectly suited for installation of all kinds of air cooling systems for the provision of comfort conditions in rooms in summer time.

It is recommended to place all the required inserts in the forms prior to concreting the walls and ceilings to make the installation of air conditioning equipment easier during the finishing works stage.

It should be remembered that the so called window air conditioners can easily be installed also in the external walls of the buildings when the necessary openings suitable for the relevant equipment are left in the external walls. Such a method of installation of window air conditioners does not cover windows and it can be successfully used when arranging the interior design of rooms.

When it is planned to use mobile air conditioners installed on the floor or split air conditioners installed on the wall for cooling the rooms comparatively small openings of 100 mm diameter will be necessary in the external walls. Such small openings can be made in the external walls also following the concreting, however, in the best case the insert (for example, a piece of plastic sewage pipe) is placed at the required places in the form prior to the concreting works.

Air conditioners must be installed by a special company that will evaluate the necessary cooling capacity for every room and recommend the most suitable air conditioner or cooling system.

#### Sources

1. Latvian Building Standard LBN 211-98 «Multi storied apartment buildings».
2. Latvian Building Standard LBN 208-00 «Public buildings and constructions».
3. Latvian Building Standard LBN 231-03 «Heating and ventilation of residential and public buildings».
4. Latvian Building Standard LBN 201-96 «Fire security standards».
5. [www.likumi.lv/pdf](http://www.likumi.lv/pdf)
6. European Parliament Directives 2002/91/EC (December 16, 2002; in Latvian –TK.doc; Directive EPB.pdf).