

# VENTILATION AND AIR CONDITIONING

*Didactic materials*

Contact

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Virtual and Intensive Course  
Developing Practical Skills  
of Future Engineers

**VIPSKILLS**  
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Virtual and Intensive Course Developing

Practical Skills of Future Engineers

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## DESCRIPTION

- Didactic material “*Ventilation and air conditioning*” is one of the learning materials for VIPSKILLS students.
- This didactic material consist of theoretical information for lectures, tasks and examples of tasks.
- The didactic material “*Ventilation and air conditioning*” is written for learning and improving students engineering skills.

# AIR CONDITION AND VENTILATION SYSTEMS

The terms and concepts [10, 5, 8]:

- Mechanical ventilation – ventilation using a fan;
- Natural ventilation – ventilation caused by wind and gravitational forces;
- Air conditioning – air preparation process, when the room is automatically maintained anticipate climatic parameters (air temperature, humidity, etc.);

# AIR CONDITION AND VENTILATION SYSTEMS

The terms and concepts [10, 5, 8]:

- Air barrier – the room the influx of outside air containment equipment ventilation air is blown;
- Transit duct – ventilation duct part, part of system at the served premises;
- Ventilation – indoor air quality and its support by changing indoor air.

# AIR CONDITION AND VENTILATION SYSTEMS

- Ventilation and air-conditioning systems must be selected according to the purpose of the building. These systems needs to create the normative indoor climate and clean air according the outdoor weather conditions [10, 2, 8].

# AIR CONDITION AND VENTILATION SYSTEMS

- Natural ventilation is used in cases where the supply or exhaust air is not clean, and the user, without harming others, can provide microclimate and clean air directly regulating the amount of air entering the room, or when the room enough outside air infiltration [4, 8, 9, 10, 5].

# AIR CONDITION AND VENTILATION SYSTEMS

- Mechanical ventilation is used in cases where there is no natural ventilation or it is not possible to keep the room air normative parameters. The mechanical and natural ventilation could work together [4, 8, 9, 10, 5].

# AIR CONDITION AND VENTILATION SYSTEMS

- Air conditioning is used where necessary to maintain a constant temperature and relative humidity indoors or cool the air supplied, or when there is a special air requirements (medical institutions, clean rooms and so on.) [3, 4, 5, 8, 10].



# AIR CONDITION AND VENTILATION SYSTEMS

- The process of the creation and maintenance of artificial climate within premises or buildings is called **conditioning** [10, 3, 4, 5, 8].
- The air is conditioned when natural and mechanical ventilation systems are not capable to ensure the level of indoor air temperature, relative humidity, circulation and cleanness regulated by the hygiene norms (HN) [10, 4, 5, 8, 1].

# AIR CONDITION AND VENTILATION SYSTEMS

- Depending on the source of pressure and the mode of air transferring ventilation systems can be **natural** or forced (**mechanical**) ventilation [3, 4, 5, 8, 10].
- **Ventilation** is a system which exhausts the air from a room replacing it with the fresh one. The systems of ventilation helps to create the necessary room microclimate, creates a pleasant and healthy environment for people [1, 4, 5, 8, 10].

# AIR CONDITION AND VENTILATION SYSTEMS

If a ventilation system is installed professionally and qualitatively, it helps to [8, 2, 4, 5]:

- preserve the equipment in production premises,
- protects constructions of the building and prolong the exploitation term of many materials.

# AIR CONDITION AND VENTILATION SYSTEMS

## Natural ventilation system

The air is extracted by vertical ducts in natural mode when heated indoor air rises up. They are usually installed in a toilet, bathroom and kitchen [8, 10, 3, 4, 5].

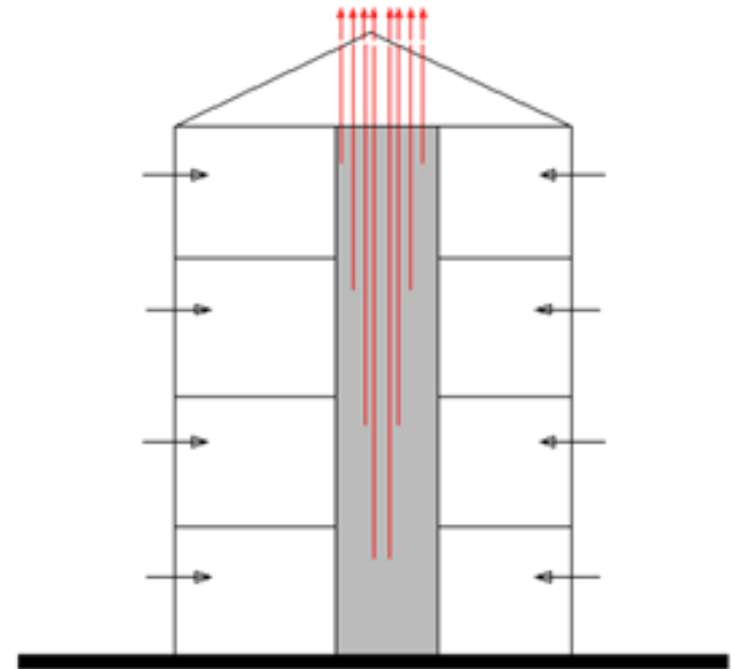


Fig 1. Natural ventilation scheme [10]

# AIR CONDITION AND VENTILATION SYSTEMS

## Natural ventilation system [4, 8, 1]

Natural ventilation is the simplest method to ventilate buildings, when the air comes in through the building cracks, windows, vents, micro-ventilation cavities of windows, doors or special openings.

# AIR CONDITION AND VENTILATION SYSTEMS

## Mechanical ventilation systems

- Into mechanical ventilation systems the air is supplied and extracted by force using a fan [10, 4, 8, 1].

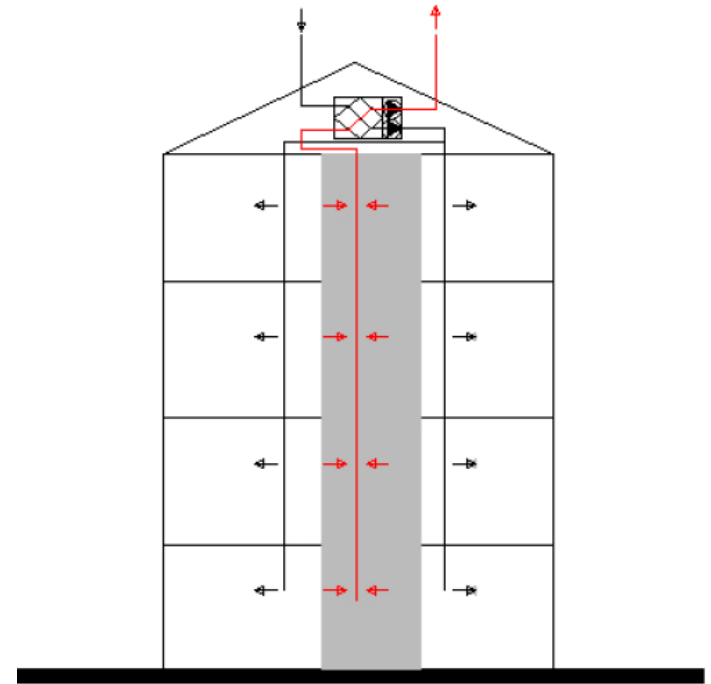


Fig 2. Mechanical ventilation scheme [10]

# AIR CONDITION AND VENTILATION SYSTEMS

## Mechanical ventilation systems classification [3, 4, 5, 8]

Depending on the use of fresh and used air ventilation systems could be:

- straight flow,
- with partial circulation,
- re-circulative.

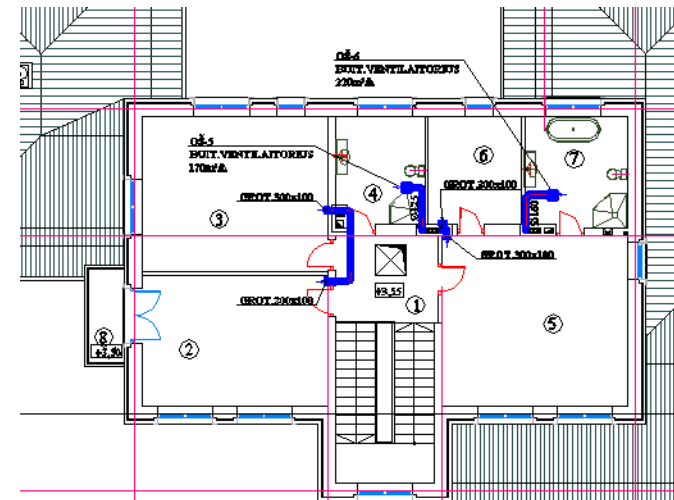


Fig 3. Ventilation systems [13]



# AIR CONDITION AND VENTILATION SYSTEMS

## **Mechanical ventilation systems [3, 4, 5, 8]**

Depending on the purpose mechanical ventilation is:

- extractive systems (that extract the used air);
- supplying systems (that supply fresh air which can be cleaned and heated if necessary).



# AIR CONDITION AND VENTILATION SYSTEMS

- Example of ventilation system [13]:  
Mechanical ventilation system for two floor building.

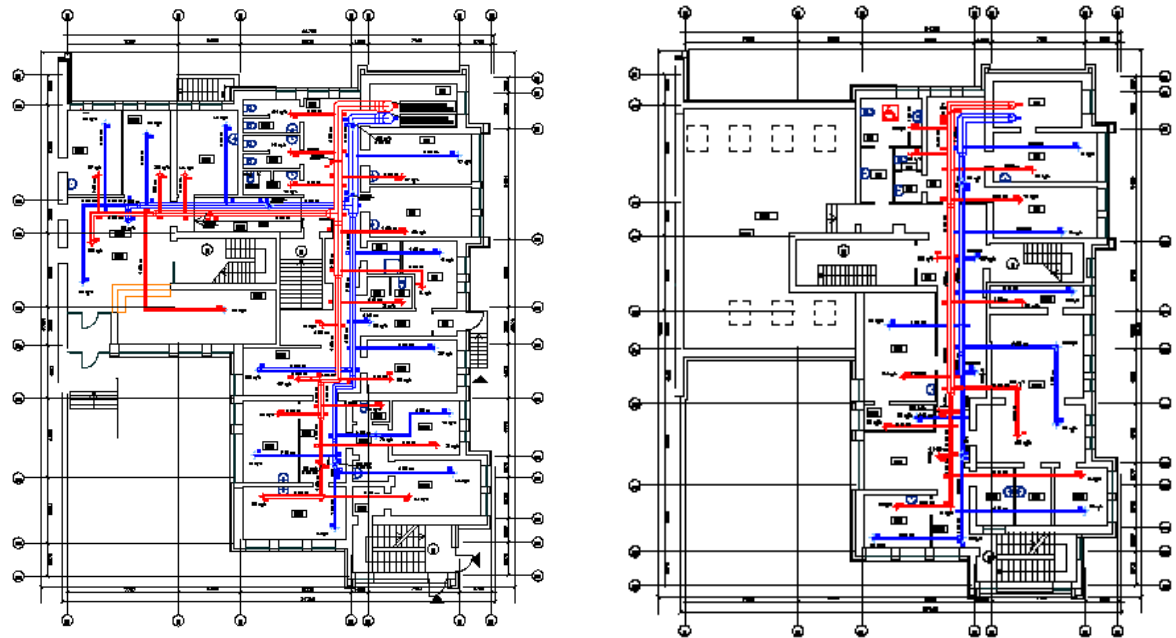


Fig 4. Mechanical ventilation systems [13]

# AIR CONDITION AND VENTILATION SYSTEMS

- Example of ventilation system [13]:  
Mechanical ventilation system for two floor building.

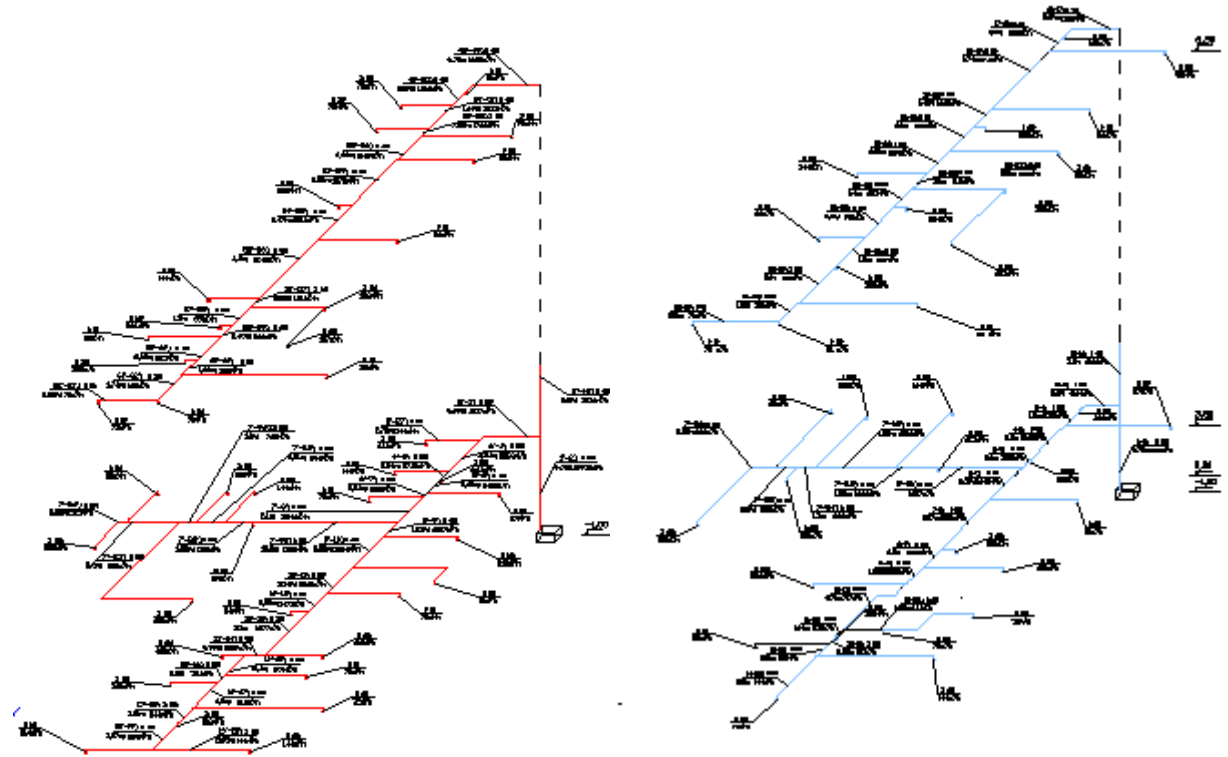


Fig 5. Ventilation system scheme [13]



# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems** [1, 4, 5, 8] equipment

Central air handling unit (*AHU*), its basic functions are:

- to deliver fresh air into the distribution system and the room space;
- to heat the air;

# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems** [3, 4, 5, 8] equipment

Air handling unit (AHU) basic functions are:

- to filter out any solid pollutants;
- to extract stale or polluted air from the room space;
- others.

# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems [3, 4, 5, 8] equipment**

Air handling unit components are:

- fans (to push the air through the distribution system);
- filter (to remove pollutants);



Fig 6. Example of central air handling unit [from personal archive]

# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems** [3, 4, 5, 8] equipment.

Air handling unit components are:

- heating coil;
- heat recovery unit;
- others.





# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems [9, 8, 4, 5, 1] equipment.**

Duct system:

- Round ducts and connections requirements are written at the construction norms [10].

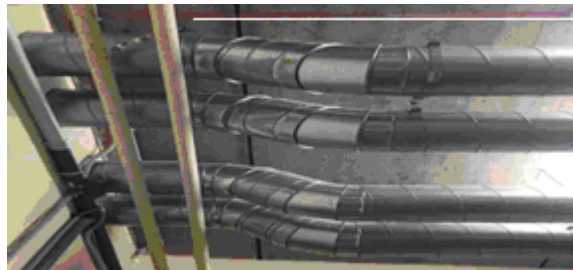


Fig 8. Ventilation system equipment [from personal archive]



# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems [3, 4, 5, 8] equipment.**

Other equipment:

- silencers;
- fire valves;
- filters;
- diffusers;
- others.



Fig 9. Ventilation system equipment [from personal archive]

# AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems** [1, 3, 4, 8] equipment.

Air distribution of ventilation systems:

- The chilled beams;
- The diffusers;
- The other equipment.

# AIR CONDITION AND VENTILATION SYSTEMS

Duct system installation [9, 1, 4, 8]:

- Duct is divided into A, B, C and D classes.
- Ventilation ducts must be constructed of the industrial produced parts or components of the system.
- Ducts are installed according to the instructions of the project.
- Duct installation of the network must be based on the design drawings specified dimensions.



## 3. AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems [9, 8, 2, 4, 5] equipment**

The fan system installation:

- The roof fan must only be installed indoors.
- Fans must be installed in such a way as to avoid direct contact with moving parts.
- The fan should be placed in the direction of air flow.

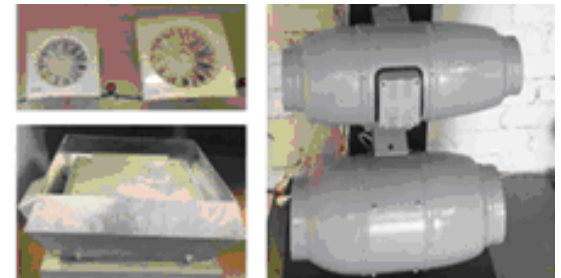


Fig 11. Ventilation system equipment [from personal archive]

## 3. AIR CONDITION AND VENTILATION SYSTEMS

**Mechanical ventilation systems** [9, 8, 2, 4, 5] equipment

The fan systems installation:

- The fan must be positioned so that the vibrations are not transmitted to the duct system or a building foundation.
- Fans must be installed in a way that is easy and safe to maintain.



# 3. AIR CONDITION AND VENTILATION SYSTEMS

System for living house [13]:

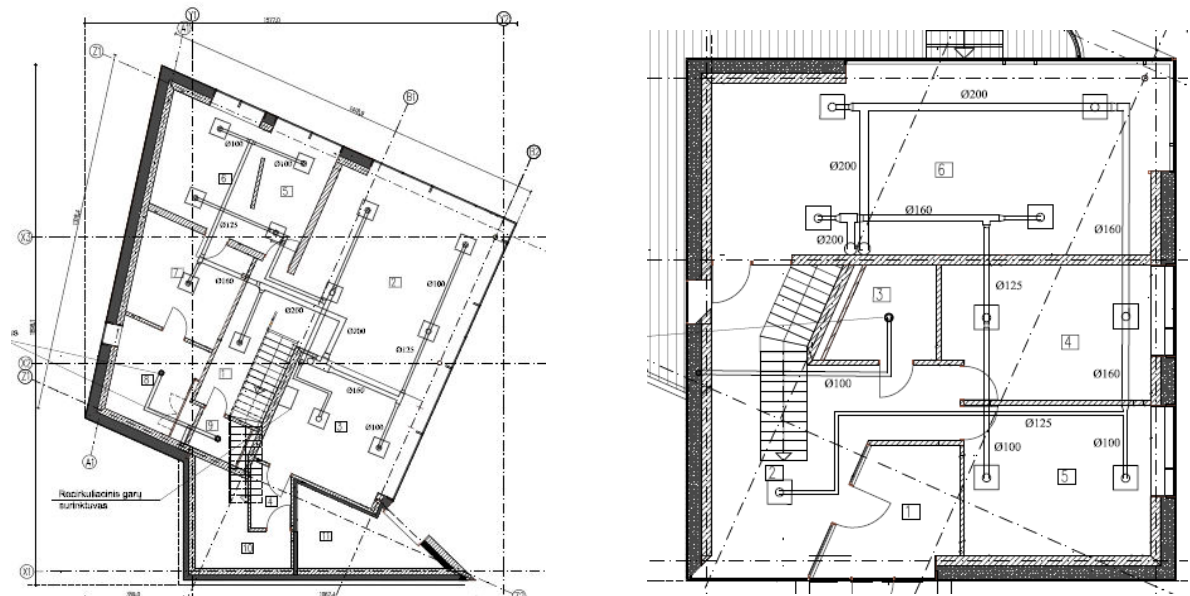
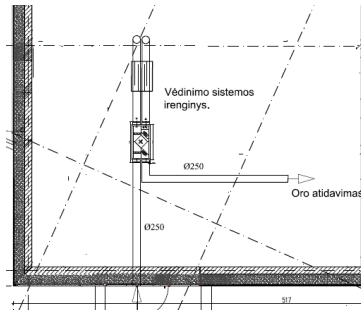


Fig 12. Example of ventilation system [13]

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