

HEATING

Didactic materials

DESCRIPTION

- Didactic material “*Heating*” 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 “*Heating*” is written for learning and improving students engineering skills.

DESCRIPTION

Didactic material of lectures “*Heating*” is written by information sources and EU standards.

EU standards for HVAC systems:

Standard	Title
EN 12828	Heating systems in buildings. Design for water based heating systems
EN 1264	Water based surface embedded heating and cooling systems
EN 12831	Heating systems in building. Method for calculation of the design heat load
EN 15316	Heating systems in buildings

Fig 1. List of standarts

DESCRIPTION

EU standards for HVAC systems:

Standard	Title
EN 14037	Free hanging heating and cooling surfaces for water with a temperature below 120°C
EN ISO 11855	Building environment design. Design, dimensioning, installation and control of embedded radiant heating and cooling systems
EN 14337	Heating Systems in buildings. Design and installation of direct electrical room heating systems
EN 442	Radiators and convectors

Fig 2. List of standarts

DESCRIPTION

EU standards for HVAC systems:

Standard	Title
EN 16430	Fan assisted radiators, convectors and trench convectors
EN 13831	Closed expansion vessels with built in diaphragm for installation in water
EN 215	Thermostatic radiator valves
EN 15378	Heating systems in buildings. Inspection of boilers and heating systems

Fig 3. List of standarts

DESCRIPTION

EU standards for HVAC systems:

Standard	Title
EN 15450	Heating systems in building. Design of heat pump heating systems
EN 60335	Household and similar electrical appliances. Particular requirements for stationary circulation pumps for heating and service water installations
EN 834	Heat cost allocators for the determination of the consumption of room heating radiators. Appliances with electrical energy supply
EN 14336	Heating systems in buildings. Installation and commissioning of water based heating systems

Fig 4. List of standarts

HEATING SYSTEMS

The terms and concepts [10, 11]:

- **Heating system** is a complex of equipment, which is used to generate and transfer the heat to all heated devices.
- The power of heating system depends on indoor **heat losses** calculation results.

HEATING SYSTEMS

Heating systems main **components** [1, 4, 5, 8]:

- heat centre of the building;
- generator (a device where the heat is obtained while burning fuel or heat is transferred from one agent to another);
- heating devices (to transfer heat from a heating agent to premises);

HEATING SYSTEMS

Heating systems main **components** [1, 4, 5, 8]:

- pipelines (which the heating agent transfers heat from the generator to heating devices);
- The another equipment.

HEATING SYSTEMS

Heating systems classification [1, 4, 5, 8, 9] :

- *Water heating systems.*
- *Steam heating systems.*
- *Air heating systems.*
- *Electric heating systems.*
- *Gas heating systems.*

HEATING SYSTEMS

Heating systems classification [4, 5, 8, 9] depending on heat generation mode:

- Central heating (the heat is supplied from the city heating networks);
- Gas fuel (natural and liquid gas);
- Solid fuel (coal, wood, pellets, briquettes);
- Liquid fuel (diesel fuel, heating oil, fuel oil);

HEATING SYSTEMS

Heating systems classification [4, 5, 8, 9] depending on heat generation mode:

- Electrical sources for heating system;
- Renewable energy sources – geothermal, solar energy, others.

HEATING SYSTEMS

Heating systems classification [8, 9] depending on heat generation and users:

- Local (direct) – when all the three elements of the heating system (boiler, pipes, heating device) are in a single user.
- Central heating (indirect) – when this equipment is separated – the heat is generated in a boiler and then is distributed to several heating users.

HEATING SYSTEMS

Heating systems classification depending on the mode of heating flow through a heating device [4, 5, 6]:

- double-pipe heating systems;
- single-pipe systems:

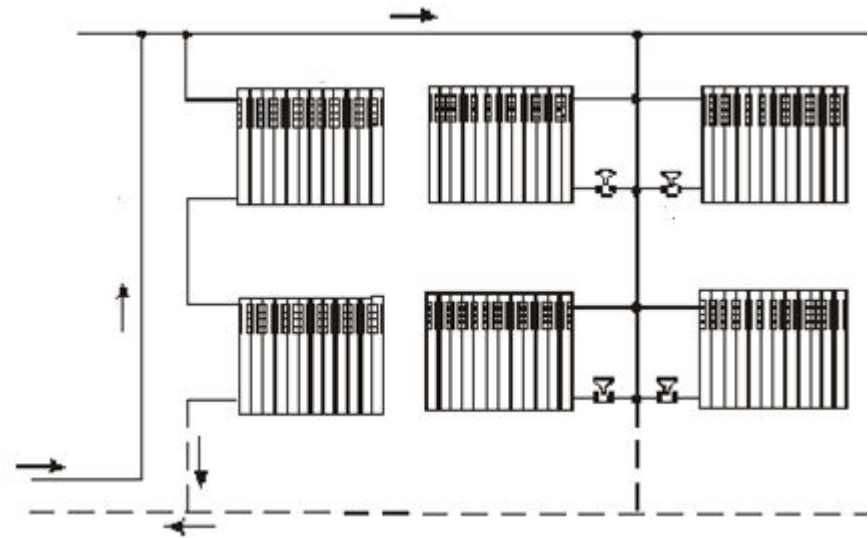


Fig 5. Heating systems scheme [4]

HEATING SYSTEMS

Heating systems classification [4, 5, 6]:

- single-pipe heating systems:

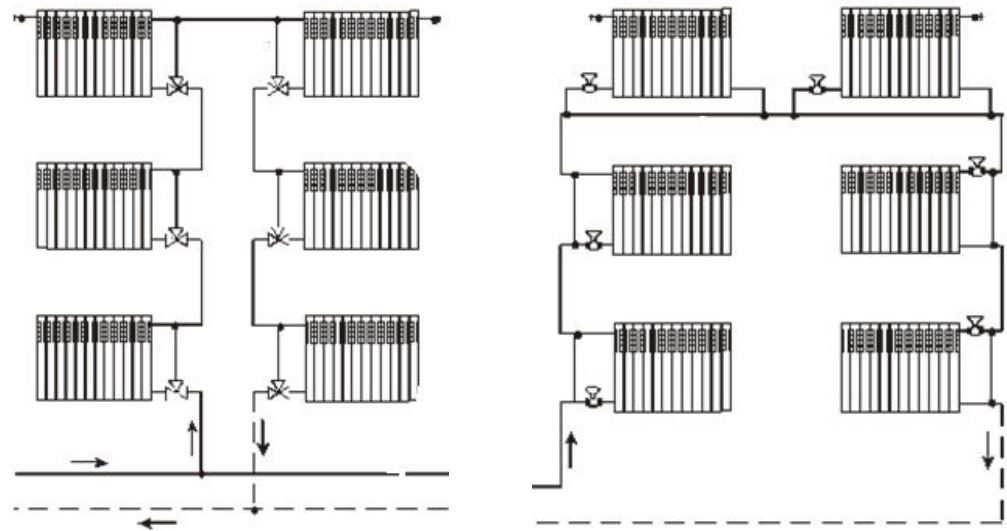


Fig 6. Heating systems scheme [4]

HEATING SYSTEMS

Heating systems classification [1, 4, 5, 6, 8].

Depending on the place of the main pipe, water heating systems can be divided into:

- upper distribution (over the heating devices) heating systems (Fig. 5, 7);
- lower or bottom (under the heating devices) distribution heating systems (Fig. 6, 8).

HEATING SYSTEMS

Heating systems classification [4, 5, 6]:

- double-pipe heating systems:

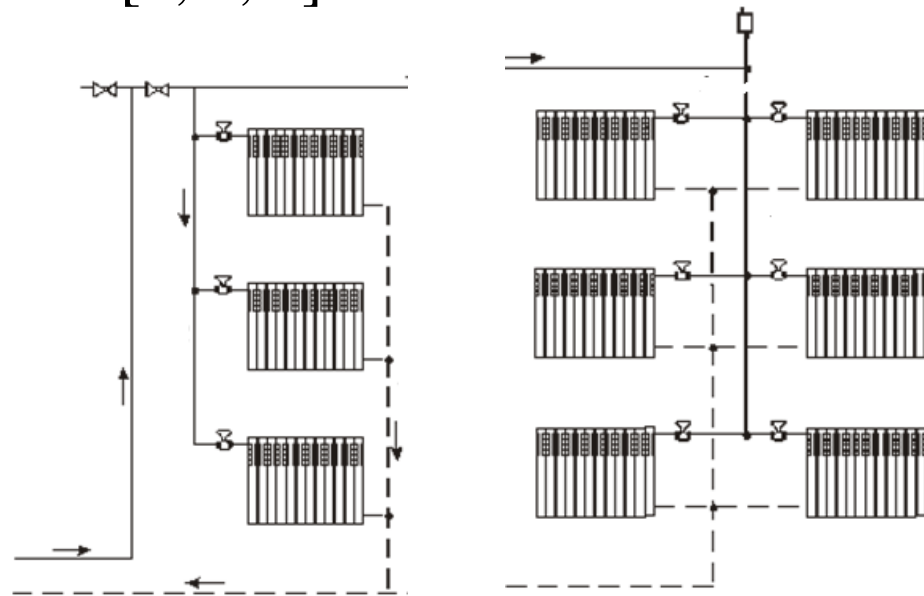


Fig 7. Heating systems scheme [4]

HEATING SYSTEMS

Heating systems classification [4, 5, 6]:

- double-pipe heating systems:

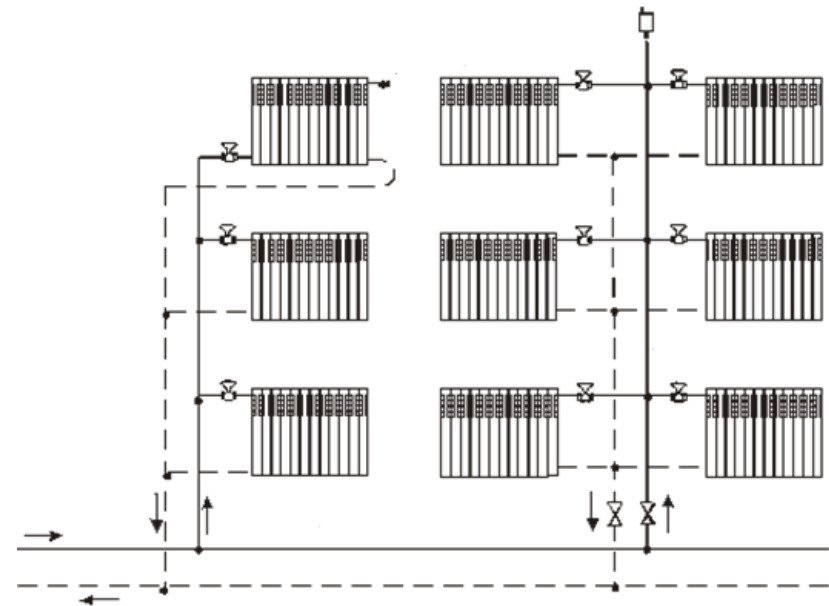


Fig 8. Heating systems scheme [4]

HEATING SYSTEMS

Heating systems classification [4, 5, 6]:

- double-pipe heating systems:

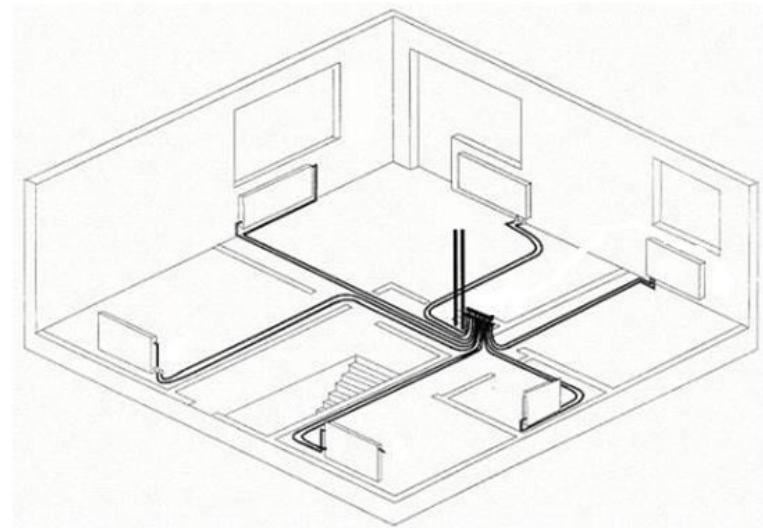


Fig 9. Heating systems scheme [4]

HEATING SYSTEMS

Heating systems classification [4, 5, 6, 8, 9] depending on heating devices installation, heat transfer method to the room:

- floor (or ceiling) heating systems;
- radiators (or convectors) systems.

HEATING SYSTEMS

- Floor heating system [13, 14]:
project example of living house.

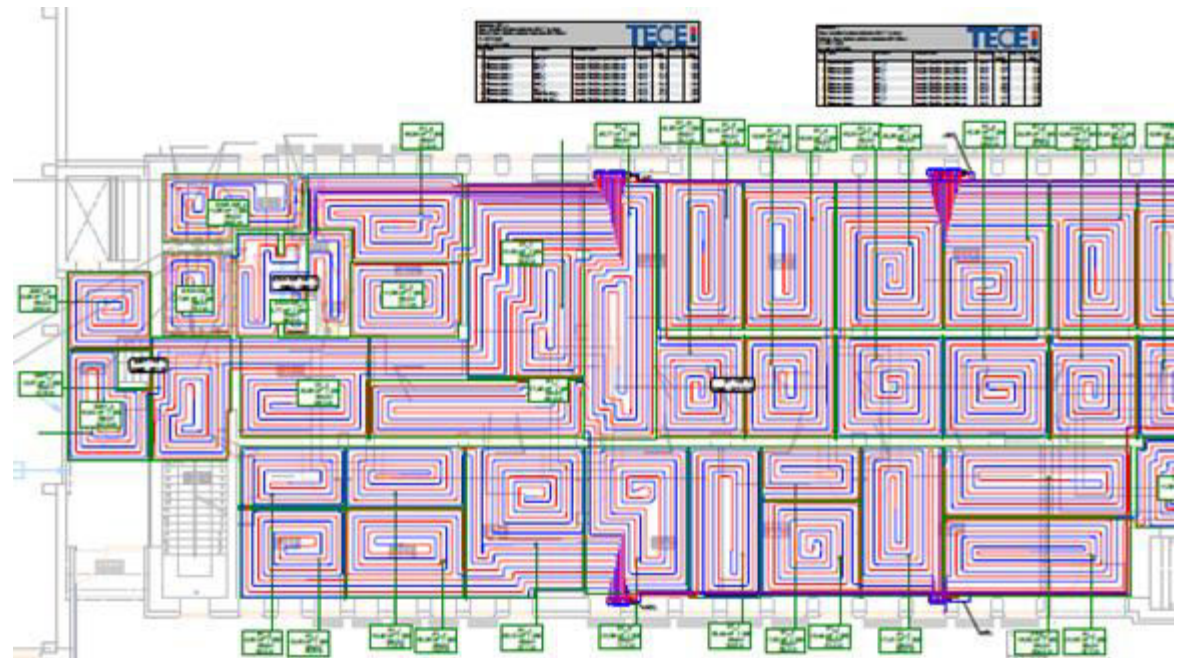


Fig 10. Floor heating systems [13]

HEATING SYSTEMS

- Floor heating system [13, 14]:
Example for non-residential building.

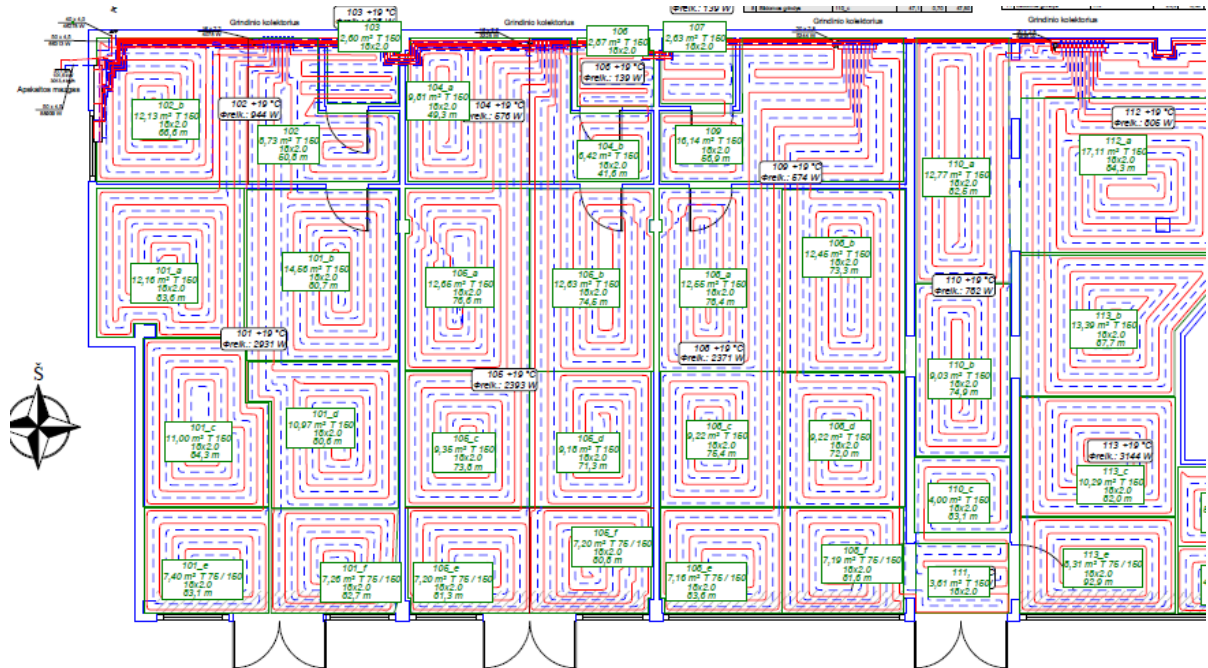


Fig 11. Floor heating systems example [13]

HEATING SYSTEMS

- Heating system with radiators [13]:
Plan of living building with heating system.
Example of the project.

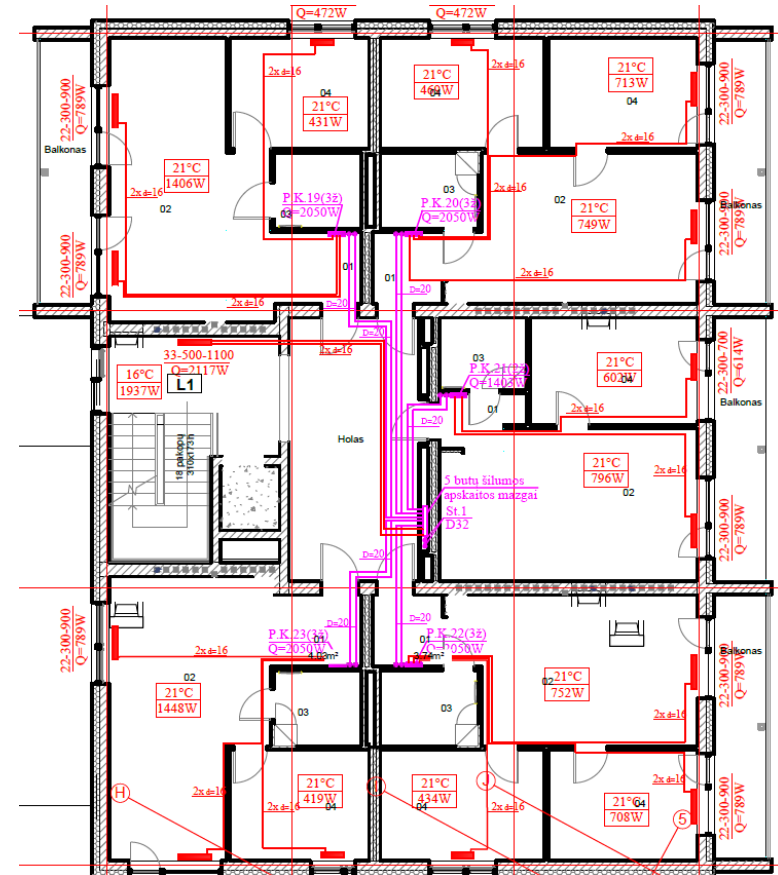


Fig 12. Heating systems example[13]

HEATING SYSTEMS

Heating systems equipment [4, 5, 8, 9, 10]:

The heating devices:

- There are a lot of forms and colours of heating devices.
- Power of a heating device has to compensate transmission heat loss of a given room space.



HEATING SYSTEMS

Heating systems equipment [4, 5, 7, 8, 9]:

- Radiators could be manufactured sectional (mostly from metal elements that can be assembled to the desired size) and panel (two welded stamped steel panels).

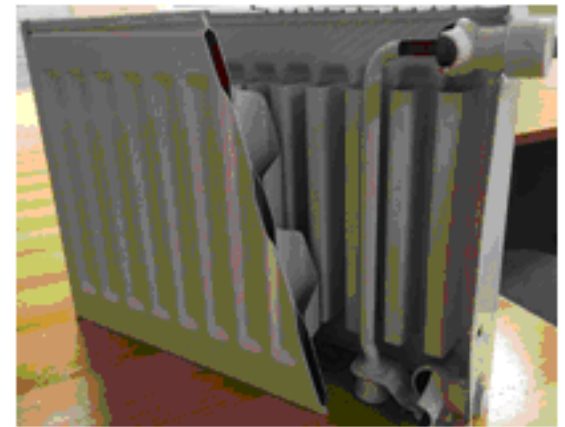


Fig 13. Heating systems devices
[from personal archive]

HEATING SYSTEMS

Heating systems equipment [4, 5, 8, 9, 12]:

- Convectors are made of finned tubes connected in parallel, which the heated air passes through.
- Floor convection heaters for mounting into the floor, especially in places where it is not possible to install high radiator.

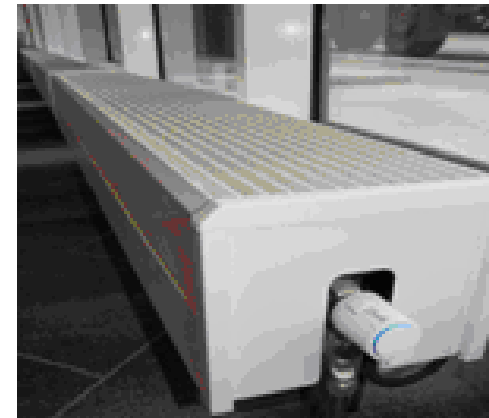


Fig 14. Heating systems devices

[from personal archive]

HEATING SYSTEMS

Heating systems equipment [4, 5, 8, 9, 12]:

Convectors:

- Floor convection heaters with fan.

These convection heaters can be installed in rooms with high heat loss.

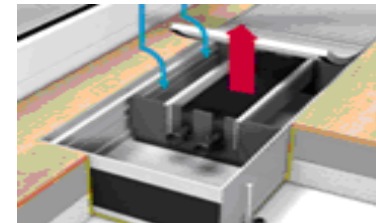
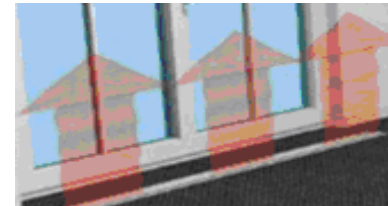


Fig 15. Heating systems devices [8, 9, 19]

HEATING SYSTEMS

Heating systems equipment [4, 5, 8, 9, 12]:

Convectors:

- Freestanding convection heaters are adapted in low spaces with high large area windows.

They are used for individual interiors.



Fig 16. Heating systems devices [from personal archive]

HEATING SYSTEMS

Heating systems equipment [4, 5, 9]:

Heating device selection:

- To find in manufacturers catalogue a device (esthetical and hygiene requirements, shape, width, height); this device has to be accompanied by heat emission tables;
- To find in the tables heat emission of the selected type of hot water supply and return temperatures;
- may be you are about to hide a device in the floor, to cover it with grills, then heat emission is smaller (enlargement coefficients).

HEATING SYSTEMS

Heating systems equipment [4, 6, 8]:

Pipelines:

- Heating pipes are made from different materials: plastic and composition plastic multilayer pipes, copper and steel.

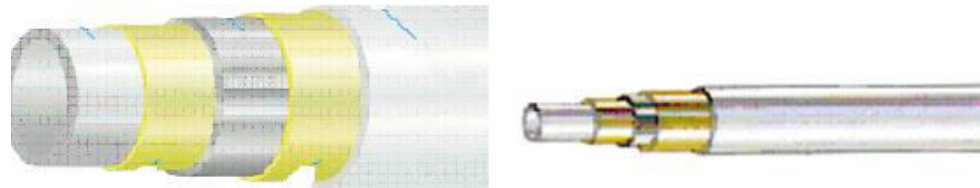


Fig 18. Heating systems pipes [4, 6, 8, 14]

HEATING SYSTEMS

Systems
project
example
[13]:
radiators and
floor heating
systems.

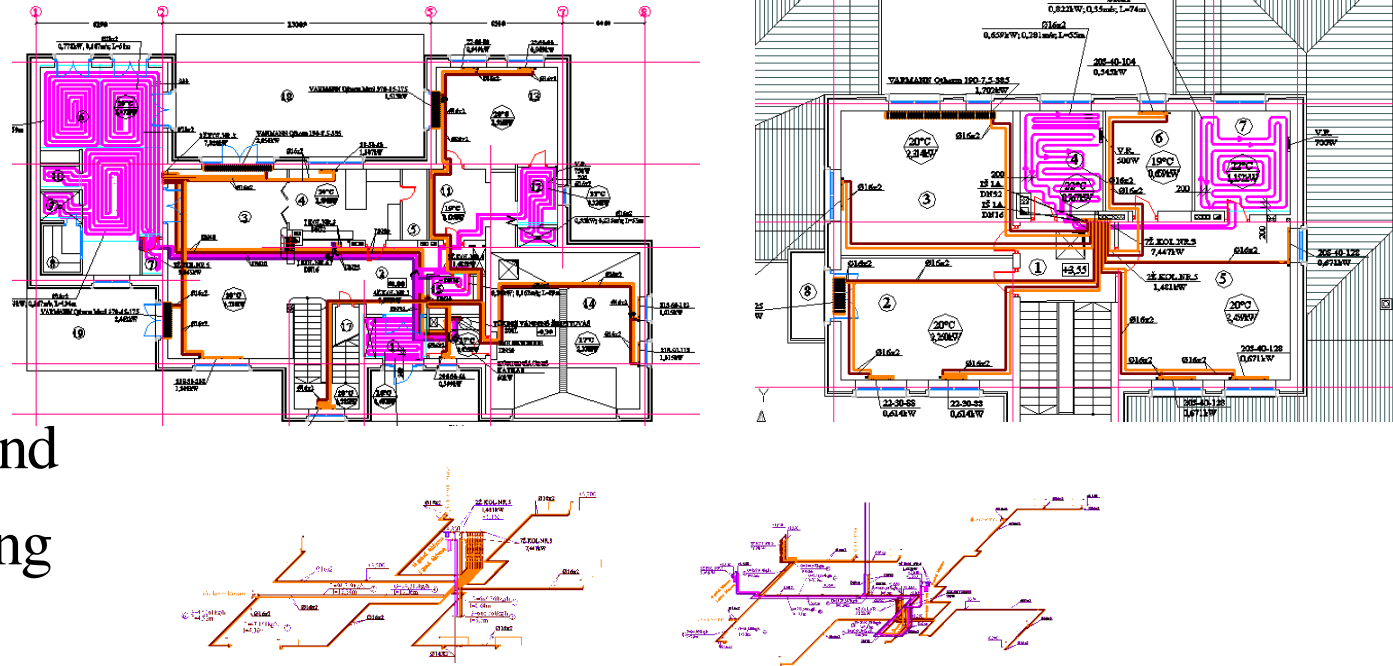


Fig 19. Example of small house heating system [13]

References

1. Bilinskienė R., Graudinytė J. *Statinių šildymas. Paskaitų konspektas. (Building heating. Lectures conspectus)*. Vilnius, Vilniaus technologijų ir dizaino kolegija, 2012.
2. Bilinskienė R., Budreika A., Graudinytė J. *Statinių šildymas. Praktiniai darbai. (Building heating. Practical works)*. Vilnius, Vilniaus technologijų ir dizaino kolegija, 2012.
3. Bilinskienė R., Graudinytė J., Budreika A. Statinių šildymas. Mokymo(si) medžiaga. (*Building heating. Methodical learning material*). CD. Vilnius, Vilniaus technologijų ir dizaino kolegija, 2012.
4. Lapinskienė V., Laukys A. Statinių inžinerinės sistemos: Šildymas. Mokomoji knyga 1 dalis. (*Building engineering system: Heating. Book. Part 1*). Vilnius, Vilniaus technologijų ir dizaino kolegija, 2011. ISBN 978-9955-926-47-4.
5. Juodis, E. Energy efficient building. Study material for architecture students. Vilnius, Technika, 2009.
6. Mamajeva T. Inžinerinių sistemų montavimas. Paskaitų konspektas. (Building engineering system installation. Methodological guidance for lectures). Vilnius, Vilniaus technologijų ir dizaino kolegija, 2012.
7. Mamajeva T. Inžinerinių sistemų laboratoriniai darbai. (Building engineering system laboratory works). CD. Vilnius, Vilniaus technologijų ir dizaino kolegija, 2012.
8. Šarupičius R. Engineering equipment. Summary of lectures. Vilnius, Vilnius College of Technologies and Design, 2012.
9. Learning material for Erasmus students. *Subject: Engineering systems*. Lecturer: Bilinskiene R. Vilnius, Vilniaus technologijų ir dizaino kolegija, 2017.
10. STR 2.09.02:2005 *Šildymas, vėdinimas ir oro kondicionavimas. (Heating, ventilation, air condition. Technical requirements)*. Nr. D1-289, 2005 m. birželio 9 d. Aktuali redakcija 2015-03-27.
11. Statinio šildymo inžinerinių sistemų įrengimas. Statybos taisyklės. (Rules of building heat supply system installation).
12. Solutions of Heating systems. Internet source: < <http://heating.danfoss.lt/> >.
13. Personal project archive. Project manager: R. Bilinskiene (Certificate No. 19764).
14. Equipment of Heating systems. Internet source: < <https://www.tece.com/lt> >.

The presentation is available on license
Creative Commons Attribution-ShareAlike 4.0 International



Rūta Bilinskienė
Vilnius College of Technologies and Design

EN	<p>This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.</p>
PL	<p>Publikacja została zrealizowana przy wsparciu finansowym Komisji Europejskiej. Publikacja odzwierciedla jedynie stanowisko jej autorów i Komisja Europejska oraz Narodowa Agencja Programu Erasmus+ nie ponoszą odpowiedzialności za jej zawartość merytoryczną.</p>
ES	<p>El presente proyecto ha sido financiado con el apoyo de la Comisión Europea. Esta publicación (comunicación) es responsabilidad exclusiva de su autor. La Comisión no es responsable del uso que pueda hacerse de la información aquí difundida.</p>
LT	<p>Šis projektas finansuojamas remiant Europos Komisijai. Šis leidinys [pranešimas] atspindi tik autoriaus požiūrį, todėl Komisija negali būti laikoma atsakinga už bet kokį jame pateikiamos informacijos naudojimą.</p>