

TECHNICAL DESCRIPTION

Description and the content of the facility

The facility consists of three functional units, each with its own entrance, as follows:

- Part of fire department with a sitting room, cloakroom, sanitary facility and the garage for fire truck,
- Event hall with supporting premises, kitchen, lavatories and cloakroom,
- General – office area with five offices, lavatories and communications.

Within the facility, there the area designated for a boiler room, the area of about 14m², with the brick chimney.

All three units operate in different regime:

- Fire department mainly night duty,
- Event hall in the afternoon and non-working days,
- Office part (local administration office) working days – office hours.

It is necessary to have the system separated to save energy.

Facility heating

Heat source

The main heat source is the hot water boiler nominal capacity of 70 kW, with the combined solid fuel (cut wood), with manual feeding and pellet automatic feeding. There is not enough room within the disposition of the facility to provide heating by using other types of fuels such as waste bio-fuel. The boiler has its own automation of maintaining a constant temperature in the use of fuel in pieces and in a sliding when burning pellet; a minimum inlet temperature to the boiler is a requirement for turning on the branch circulation pumps. The condition for operation of the boiler is operation of a circulating pump of the boiler circuit.

Beside the boiler there are a daily storage-tank for pellet, closed expansion system and necessary safety fittings.

There is a direct substation with the necessary pumps and fittings for each branch of the consumer in the boiler room:

- Boiler circuit with a constant initial temperature with a capacitor and collector without significant change in pressure. Boiler circuit of constant initial temperature also provides maintenance of sufficiently high temperature at the boiler inlet to prevent low-temperature corrosion; the boiler automation is much simpler - maintenance of constant temperature. Between boiler and secondary circles there is the hydraulic switch capacity up to 7m³/h.
- Circle of radiator heating of the office part with the injection circular pump and three-way control valve. Temperature control per flexible diagram depending on the outside temperature in three operation modes (protective, stand-by (lowered) and full heating (when that part is used) according to the previously defined time diagram and calendar.
- Circle of radiator heating of the fire department, with the same content and operations as the above one.

- Circle of floor heating of the event hall and the supporting premises with the injection circular pump and three-way control valve. Temperature control per flexible diagram for floor heating depending on the outside temperature in two operation modes:
 - o Stand-by heating of all premises except for the lavatories at 5°C, lavatories at 7°C
 - o Intensified heating of all premises except for lavatories at 18-20°C, lavatories at 12-15°C when the hall is used, according to the timer. Turning on of the system is manual and one should enter the expected duration in hours.
 - o Air heating (ventilation) of the garage with the circular pump.

Storage for wood/pellet is outside the boiler room, only daily reserves for heating can be placed in the boiler room.

There is a possibility of using coal but it must not be stored in the boiler room. The boiler room also includes the designed water connection and floor outlet with a smaller outlet drain.

The system is filled with the softened water; according to the design there is also one mono ion-exchanging filter of neutral exchange for the flow of about 200l/h.

Heating of the fire department part of the facility

Sub-parapet cast aluminum radiators size 600 are planned for the offices, cloakroom and corridor at the upper floor and size 800 for the lavatories and shower and the garage. These eight radiators make a separate branch of radiator heating. The radiators are provided with thermostatic valves with pre-control and closing valve or regulatory closing valve for balancing system if the thermostatic valves have no pre-control. Thermostat heads are with the strengthened mechanical resistance "anti-vandal resist" such as HERZ-HERZCULES or similar brands of the renowned producers.

The pipe network is visible under the ceiling of the ground floor and radiators on the ground floor (two) are "sunk". Venting network is shared with the radiator heating of the local administration offices. The highest point of the pipe network is provided with air vent dispenser lowered to the boiler room.

Heating for the garage for the fire truck is air heating – there is a calorifier and radiator during duty, with fan and temperature control in a room by changing the air flow. There are two operation modes:

- Constant heating to the positive temperature at about 5°C
- Occasional intensified heating at about 12-15°C when there are works on the vehicle.

Calorifier is in the zone of the garage door – it is placed high and the pipe network is insulated.

Heating of the hall and the supporting premises

- Toilets of the hall – the total of 6 premises are heated by two branches of the floor heating. The cabinet for floor heating is placed on the wall between the toilet and the boiler room, with the access from the boiler room.
- Besides the area belonging with the hall, the floor heating is also in the main entrance area to avoid placing of the visible heating devices. The entrance area, kitchen and part of the staircase are heated from the two branches of the floor heating. The cabinet for

floor heating is placed on the wall between the kitchen and the staircase, with the access from the staircase.

- The hall is heated from nine branches, two of which are not used when the stage is placed in the hall. Cloakroom of the hall and the supporting toilet are heated from two branches, the total of eleven branches. The cabinet for floor heating is placed on the wall between the cloakroom and the hall, with the access from the cloakroom.
- The required cabinets of the floor heating are near the floor with the metal doors while the access (the cabinet door) is from the area that can be controlled (without visitors).
- The pipe network for the floor heating is under the ceiling of the ground-floor and is insulated at the passage through the non-heated entrance of the hall. The plumb line of the pipe network is visible (boiler room, staircase and cloakroom) and there is no need to insulate or hide it.
- The highest parts of the pipe network should be provided with the venting containers with reducing vent pipes in the boiler room, and if that is not possible with automatic air pots. According to the project, it is possible to construct the network without vents outside the boiler room.
- The heating of this "public" part of the facility designed in this way is without the "visible" and accessible devices and equipment to the visitors, so that the potential unauthorized handling is reduced to the lowest possible level.

Heating of the office area

Sub-parapet cast aluminum radiators size 600 – total of 5 radiators, one of which is size 350 are planned for the office area. Total of 3 radiators size 800 are planned for the gallery and lavatories. Three radiators in communications and toilets must be double-fixed with carriers and wall consoles.

According to the design, the radiator valves in the offices are the same as in the fire department part of the building; in the toilets and the gallery on the first floor there are thermostatic valves in an inaccessible place placed on the pipe connections of the radiators- by the ceiling of the ground floor with a dislocated temperature sensor.

The pipe network is visible and not insulated by the ceiling of the ground floor and one of the radiators on the ground-floor is "sunk". According to the design, there is the vent pipeline and vent dispenser while the air-overflow pipeline leads to the boiler room.

Ventilation - venting out of the facility

Almost whole facility is ventilated naturally except:

- Façade axial ventilator on the wall of the garage for the fire truck. It is used only in case when there are works on maintenance of the vehicle; in that case all the smoke exhaust gas from the vehicle must be taken out by the portable pipeline – hose,
- For venting out of the kitchen, use the connection of the kitchen hood. According to the construction design, there is the steel pipeline leading straight to the roof of the facility, dimension Ø 159x4.0 mm, which is, on its way through the office on the upper floor thermally insulated and bricked by the solid brick. Instead of the pipeline, one can use the smooth prefabricated ceramic canals. The designed venting capacity is up to 500m³/h.
- For venting out of the lavatory and the shower bath of the fire department part, use the ventilator leading to the façade of the facility above the toilet window on the upper

floor with the shutter on the façade (two shutters). The ventilator Ø100 mm is connected to the separate switch.

Cooling of the facility – air-conditioning

According to the design, there are two split-system air-conditioners in the fire department part of the facility – in the office and cloakroom above the window with the outside unit under the window. The air-conditioning zone should be provided with the two switches for power supply of the air-conditioners. Water condensate is placed in the wall of the toilet through water PE tubes (PVC sewer tubes and even copper pipes can be used instead, but not a ribbed hose), and is joined with the flexible connection above the sink siphon – to the connection with the “dishwashers”.

An air-conditioner is installed in each office at the office part of the facility. Total number of air-conditioners is 5. On the upper floor, the outside unit is placed under the window, and at the ground-floor-room 002 high by the window Water condensate is taken to the nearest lavatory just like at the fire department part, and a power socket outlet is designed above each window.

According to the design there are six air-conditioners in the event hall – three per a side wall. The inside units are placed high at about 3-3.5 m of the finished floor, and in the stage zone at about 3.5 to 4 m of the finished floor. The outside units on the “western” side wall are min. about 3 m away from the field, and, on the “eastern” wall on the higher parts of the outside wall, accessible from the terrace, placed at the min. height 0.6 m of the terrace floor.

Water condensate from the “eastern” wall is placed in the wall to the washbasin in cloakroom toilet. Water condensate from the “western” wall goes vertically outside to the bottom level of the window and the horizontally to the gutter toward the next structure. It is not connected to the gutter, it goes by it. The entire water condensate to the gutter is within the insulation thickness, except vertical length about 1, by the gutter of the facility that is visible.

Air-conditioner in room 005 kitchen is installed above the outside exit door and the outside unit and water condensate are installed in the same way as for the room 002 at the ground-floor.

All “split” air-conditioners are, for the unification purposes, selected of the same type: 12000 BTU/h, popularly known as size 12.

Reserve heating systems

All premises intended for people’s activities are equipped with the air-conditioners that can operate in the regime of thermal pump, and in terms of thermal system – boiler and installations, there is no need for any reserve heating systems.

During “inter-seasons” it is more viable so use air-conditioners rather than to start a boiler.

Automatic control

The boiler is provided with its own “prefabricated” automation, preferably BACnet protocol, but is not a must. The basic condition for operation of the boiler is operation of primary circular pumps.

Automation for four branches can be individual one with 3 programmable controllers (regulators) that are parametered or one is bigger programmable controller which is programmed in standard LD diagram. With the variant of one PLC, BACnet protocol is a must. Complete wiring and the required electric cabinets are within automatic regulation;

according to the design, power supply of the automation cabinet in the boiler room only is planned. The condition for the operation of the secondary circulation pumps of the four branches is the temperature at the inlet of the boiler and outside temperature.

Heat consumption measurement

Regardless of the three functional units, the owner and the user of the structure is one, therefore there is no need to measure individual consumption of energy for heating; nevertheless, four (4) places for installation of calorimeter are planned in case any change occur. Sufficiently long straight pipe sections without changing the cross section for any subsequent installation of calorimeters are also planned.

Energy saving

Passive energy savings is envisaged by AG project. Zoning of the building and thermostatic valves provide active savings - preventing energy waste. Floor heating in the hall do not directly save thermal energy, but the pleasant atmosphere is achieved with a lot lower internal temperature which leads to energy savings. During inter-season periods, air conditioners are used as heat pumps, and no energy is lost in the operation of the boiler with a very low capacity and a low degree of utilization.

The project was designed according to the terms of reference, the applicable laws, regulations, standards and rules of the profession.

Responsible designer:
Aleksandar Podunavac,
B.Sc. in Mechanical Engineering
License No. 330607903