TECHNICAL REPORT ON THE HEATING PROJECT

PROJECT: Drafting the implementation project for the facility: Reconstruction of Pustec municipality.

Municipality of Pustec

TIRANA, March 2022

1. Directives and Standards

European Directive

EU 2281	2016	Lot21
EU 327	2011	Lot 11
EU 1253	2014	EU 2014/1253 for HVAC systems
ErP Directive / 125 / EC	2009	Energy-related Products Directive

European standards

DIN EN ISO 1632	2000	Acoustics - Measurement of noise levels from equipment installed in the building
DIN 4755	2001	Installations of diesel heating systems, safety requirements
DIN EN 303	2003	Heating boilers
DIN EN 442	2003	Radiators and convectors
DIN EN 12170	2002	Heating systems of buildings
DIN EN 12828	2003	Heating systems, technical safety
DIN EN 13831	2000	Expansion vessels
DIN EN 14336	2002	Installation of heating systems
VDI 2035	1996	Technical safety in water heating systems
DIN EN 1057	1996	Copper pipes in heating systems and hot water supply systems
DIN EN 12449	1999	Use of copper pipes
DIN 16892	2000	High density polyethylene pipes (PE-X)
DIN 16893	2000	High density polyethylene pipes (PE-X); Dimensions

2. Criteria for selection of Mechanical Plants

The selection of projects and mechanical installations is based on the application and design of relevant technological systems with maximum efficiency to realize modern technical solutions based on European norms and technical conditions, with minimum values of investment costs by providing an investment on the basis of sustainable development, as well as in compliance with the requirements of the terms of reference in the design task.

In the following, we briefly describe the criteria that were taken into account during the design as an essential reference for the qualification of mechanical implant solutions:

- Adherence to technical norms
- Service comfort,
- Functional reliability,
- Inspection,
- Hygiene and safety,
- Partialization of use,
- Low energy use costs,
- Low initial investment cost,
- Low maintenance costs,
- Standardization of plant components,
- Maximum respect for ecological and environmental conditions,

In general, we can say that the heating system is realized in accordance with the respective European norms and Albanian standards.

3. General

The heating system aims to create climatic conditions in accordance with comfort in different environments of the building, which means creating and controlling the necessary temperature, humidity and air quality. Since in the building we have facilities which are intended as apartments for students and as a result the air conditioning system will be adapted to the features that these facilities have.

So in this context the flexibility of plants and facilities in supply, maintenance, administration, etc., are determining factors that in complex determine the selections of the typology of heating plants for each environment.

4. Selection of cost-effective energy systems

The central heating plant that will be realized will have all the characteristics of a modern plant where the maximum standards for a functioning according to the requirements with minimum costs of use, consumption and maintenance are perfectly harmonized. This is made possible by choosing the most advanced technologies in both the type of equipment and the control system.

The works that will be carried out, in a general way are summarized in the construction of the Thermal Power Plant, the realization of the new network of pipes and radiators for heating the premises of the municipality, and the realization of a control system of the thermal power plant through the panel, which will to enable the operation and monitoring of the parameters of the plant and the equipment of the Thermal Power Plant.

5. Design conditions

The conditions of thermohygrometric comfort (physiological well-being) that we can provide inside the premises of the building depend on the destination of the use of the premises. The following data is used as a reference for the project.

Location Korca

For the heating Period-Winter

Calculated internal temperature 20 -22 ° C

Corridors + auxiliary facilities 18 ° C

Indoor relative humidity 45–55%

Air movement in working environments 0.13-0.15m / sec

Internal circulation min 2Vol / hour

Outdoor design temperature -8 ° C

Relative humidity 90%

6. Noise level

The maximum noise levels allowed inside the premises are determined by the UNI8199 norm and are 35 dB (A).

7. Air quality

Air quality has to do with specific specifications of the premises, their destination and activity, supply, etc. In order to maintain the air quality in the premises of the municipality, natural ventilation will be used through the windows which will be open in order to enable this process.

8. Heat losses

To carefully analyze the heat losses are considered all the influencing factors due to the orientation to the horizon, proximity to certain environments, thermophysical characteristics of the surrounding walls, windows, floors, ceiling, etc.

The main factors that have the largest contribution to heat loss are:

- Heat transfer coefficient in wall structures.
- Heat transfer coefficient in window structures.
- Heat transfer coefficient in door structures.
- Heat transfer coefficient in floor and roof structures.
- Infiltration factor (natural ventilation)

Heat loss is also influenced by the population of the premises, lighting, natural air ventilation, etc., which are considered in terms previously discussed with the architect.

Thermal charges based on the nature of the factor and influence on the thermal balance are calculated as losses or as thermal additions, but nevertheless those that directly influence are:

- number of persons present;
- their physical activity;
- lighting level and electrical appliances installed;
- level of solar radiation;
- door-window air infiltrations (natural ventilation)

9. System description

The heating system of the building is realized through the hydronic system with radiators. Heating terminals will be supplied through lines that will be laid on the floor which will be supplied by several distribution manifolds, where the latter are supplied through a circulating pump which is installed in the technical environment where the production of thermal energy is possible.

The energy source will be provided through the boiler which will be with wood fuel or pressed sawdust (pellets). The heat carrier will be hot water and will be distributed by the pipeline network that will supply all collectors.

The operating conditions of each indoor unit will be selected individually by each user and will be supervised by a central control system.

9.1. Thermal Power Plants

The main distribution pipes, circulating pumps and electric panel will be placed in the technical room. All connections will be made in such a way as to allow the interruption of each part of the plant, the control of vibrations and the control of hydraulic and thermal parameters during operation.
With the term Central Thermal, we have considered the whole complex of components that will be installed, which serves to heat and circulate the water that transports the thermal energy produced by the heat generator, the boiler.
In order to achieve a better distribution and circulation of water through the radiators of the system, the plant as a whole will be realized with "Closed expansion vessels".
The boiler will have useful power according to the calculations for the building, high efficiency and will be of wood or pellet type.

Boiler type		PLC 25	PLC 35	PLC 50	PLC 80	PLC 150	PLC 250
Nominal power	*kW*	25	35	50	80	150	250
Furnace power	*kW*	27	38	55	88	165	275
Efficiency	%	91					
Boiler class[2]		5					
Max working pressure	*bar*	3					
Test pressure	*bar*	4,5					
Max working temperature	°C	90					
Exhaust gas temperature	°C	180-220					
Fuel consumption at max work[3]	*kg/h*	5,51	7,76	11,22	17,96	30,61	51,02
Water pressure drop (ΔT 20K)	*mbar*	20	24	32	48	70	80
Water contents	*l*	80	100	140	220	810	850
Weight (empty)	*kg*	230	280	455	510	980	1485
Total power consumption (without optionals)	*kW*	0,45	0,45	0,50	0,53	0,69	0,69
Electrical connections	*V/Hz*	230 / 50					

Consumption table

9.1. Determination of boiler elements

The necessary capacity for heating the building is calculated referring to the standards in force in Albania, and European standards for heating plants. Outdoor temperature
design refers to the city of Korca -8 ° C. The boiler must be able to withstand thermal losses due to transmission in opaque structures, natural ventilation, possible energy losses in the delivery-return pipes in the distribution lines in the terminals. The above factors are considered considering that the impact on pipeline insulation can vary in 5 -10% of capacity. The peak load for the thermal energy producer (boiler) is determined based on the data in the tables for the loads determined for heating. The load of the heating unit according to the calculations, as well as the inertia of the system result in 150 kW in total. This heating capacity will be generated through wood fuel or wood by-products such as pressed sawdust, etc. The regulation of thermal power will be provided through the boiler

components by modulating the temperature of the water in delivery as a function of the ambient temperature.

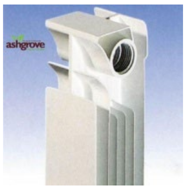
The necessary equipment that will be installed in the technical room will be as follows:

- Heating boiler.
- Expansion vessel for hot water of terminals.
- Circulating pumps for the primary circuit,
- Hydraulic divider.
- Collectors and pumps for circulating hot water in the secondary circuit.
- Thermal regulation groups
- Exhaust chimney, modular, double wall thermally insulated.

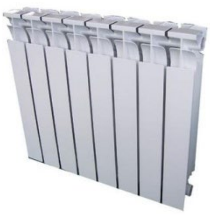
The boiler must produce a thermal capacity which must meet all existing thermal requirements. Specifically, the supply with thermal energy necessary for the preheating of the system (overcoming thermal inertia) at a predetermined time, so that the plant enters the full operating mode in the shortest possible time. This factor is predicted to be estimated by the coefficient of temporality of the system. The estimation of this coefficient (in our case = 30%) is taken into consideration assuming that within 1 hour the heating elements should give the maximum potential of thermal energy. For the water plant, the correction coefficient is determined based on the hourly operation of the plant, which in our case is 4 ÷ 6 hours. And Kn = 30%. The boiler that will be installed in the facility must meet the norms of production and certification.

9.2. Heating terminals

With this term we have considered the final component of the central heating system, which transmits to the environment the thermal energy produced in the thermal power plant and transported by the hydraulic circuit. In our case the terminal elements will be radiators of aluminum elements.



Each radiator will be equipped with a thermostatically adjustable valve, detonator and air vent valve. Radiators will _ formed from elements to aluminum to type C800 with power thermal 185 watts / element.



Their placement will be done near structures in which thermal losses are greater. Architectural conditions, furniture, windows, etc. should be taken into account when installing radiators. The radiator must be completed with all the necessary accessories for installation. As well as must meet the requirements of UNI EN 442 norms.

9.3. Distribution network

The heating system consists of three main elements:

1. Power Generator - Boiler

2. The amount of water that serves as a working body which makes possible the transmission of this energy to the terminals.

3. Distribution network (pipes, collectors, pumps) as well as radiators.

The distribution system in the terminals will serve to transfer heat from the stove to the terminals and

Diameter of External	mm	14	16	18	20	26	32
Diameter of interior	mm	10	12	14	16	20	26
thickness	mm	2	2	2	2	3	3
Height e wrapping	m	50	50	50	50	50	25
Density	Kg / m^3	33					
Resistance we withdraw	N / mm^2	> 0.18					
Elongation of layer insulation	%	> 80					
Descriptiveness e vapor we layer	mg / Pa	<0.15					
broadcasting of heats we layer insulation	W / mK	0.0397					

will return it back to the boiler with the help of circulating pumps.

Heating system pipes must meet the requirements of standards / norms.

During the design phase the pipes are determined by referring to the respective norms as well as the destination they receive.

Heating system pipes can be divided according to the material:

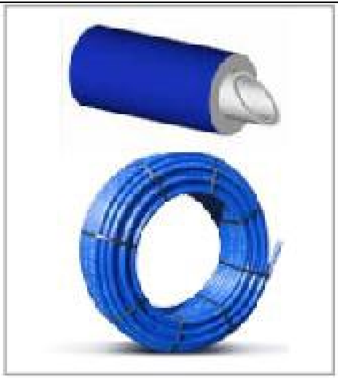
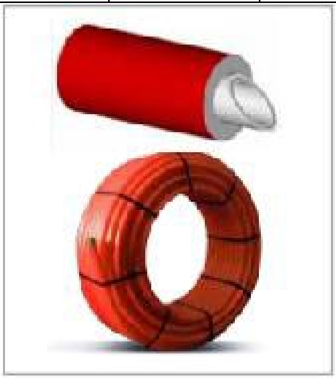
i. Steel pipe without seam

ii. Multi-layer PeXal pipe (thermally insulated δ = 6 mm)

9.3.1 Multi-layer PeXal pipe

High density mesh polyethylene pipe with antioxidant barrier, easily flexible, thermally insulated with high durability for normal working conditions and pressures and working temperatures -40 ° C ÷ 95 ° C according to UNI EN 53961 standard

broadcasting of heat we pipe	W / mK	0.066

These pipes are installed article floor or in the walls of the walls AND play the role of magicians, in corridors like AND distributors in terminals indoors. _ _ _ layer protection is the same as them to Duct zinc but these pipes can have used for temperatures with it high than 60 ° C. These pipes are distributed in the premises through joints collectors from material bronze to which are placed on tapes metal AND to equipped with _ all necessary accessories (valves _ circuit breakers, ventilators, mini valve, fitting Footbridge etc.).

9.3.2 Steel pipes

Supply and installation of the pipeline should include fixing, special fittings, surface painting against rust, threaded type connections, with flanges or welded according to the nominal diameters or technical-functional characteristics of the system.

9.4. Calculation of the pipeline network

determined by considering the amount of water they have to transport to the system terminals, facing the longitudinal losses and at the same time maintaining the recommended speed.

Speed e recommended for types to MISCELLANEOUS pipeline given we table e the following :

velocities according to NORMS (m / s)			
Business of	*pipelines The main*	*pipelines*	*terminals plants*
tubes steel	1.2 ÷ 2.5	0.5 ÷ 1.5	0.2 ÷ 0.7
tubes PeXa l	0.7 ÷ 1.2	0.5 ÷ 0.9	0.2 ÷ 0.5

9.4.1 Calculation e losses longitudinal

loss longitudinal (continuous) to pressure They are we dependence to Box to velocity that water. for plants e air conditioning They are to mandatory oxen these losses to limited between:

Hgj = (20 ÷ 30) mm K.H2O / ml.

Following _ the above table AFTER HAVE ELECTED the type of pipeline, which in our case is Steel pipe or PeXal AND working water temperature _ _ heating is 80 ºC as and recognizing _ quantities and predetermined to water to require in l / h (in function to LABOR thermal to TERMINAL oxen tube supplies with water), we calculate for each case to specific pipe diameters in function _ to accelerators AND losses to allowed for each magisterial and distribution pipe.

Also knowing _ pipe lengths, for the network with it disadvantaged, we find ALSO absolute value of losses longitudinal for each distribution pipe, multiplying it its length with losses per 1 m in length to defined in the tables calculations.

In this way HAVE defined:

- Your nominal diameter tube: DN (mm)
- Pressure losses per meter: Hgj (mmK.H2O / ml)
- Water velocity: V (m / sec)

What a base to their knowing _ length L (will understood the total = sending + return) to each tube we calculate absolute value of losses longitudinal:

According to calculation to above in the pipeline distribution plan _ marked quantities respective to water oxen circulates (l / h) and pipe diameters D in mm (in our case PeXal pipe).

9.4.2 Calculation e losses cafeteria

These losses are determined in terms of random obstacles that water encounters during its passage in the heating process. Each identified obstacle has according to the compiled tables a specific coefficient (k) dimension depending on the type of obstacle. Table methods are used to calculate this coefficient. In this way the value of (k) is determined as a function of the obstacle, as well as as a function of the selected speed and the sum of the coefficients for each particular obstacle ($\sum$ k) determines in mm K.H2O the local losses. For the calculation of local losses, we will consider the most unfavorable case when we assume that we have set as radiator terminals.

9.4.2 Isolation HEATING

Thermal insulation requirements of heating system pipes must be met according to the requirements of norms / standards. The main purpose of using insulation for distribution pipes is to enable energy losses to be minimal. It is forbidden to install pipes without proper insulation. For insulation of hot water pipes, which pass through cold / unheated rooms / rooms, are the following norms:

tubes AND couplings e SYSTEM heating must to isolated we this menyre :	
Diameter of External of tube	TILE e INSULATION (0.035 W / m ° C)
< 20 mm	3 - 20 mm
22 - 35 mm	4- 30 mm
40 - 100 mm	6- 50 mm
> 100 mm	9- 100 mm

The above table applies to an insulating material with the above characteristic (0.035 W / m ° C). In case another material is used, it must be calculated in such a way as to meet the same requirement, for maintaining the water temperature.

9.5. Circulating pumps

These pumps enable the distribution of hot water in the direction of the terminals and vice versa. Circulating pumps are mounted in the technical environment in the main distribution manifold in the delivery line.

These are put to work through electricity, which are not noisy during operation. The pumps help the hot water to circulate through the pipes, although their use increases the speed of the water and with it increases the resistance of the pipes for transporting water. With the help of pumps, the diameters of the pipes can be kept low. They result in saving pipe costs as well as saving pipe insulation, due to the placement of pipes with smaller diameters.

The calculation of circulating pumps is done taking into account the closed circuit in which they work, as well as the hydraulic properties of the system in which it is mounted. Longitudinal losses, local losses, as well as equipment losses are taken into account when calculating them. The main parameters of a pump are the pump flow, as well as the pressure drop in the network. These parameters are calculated as follows.

$$V^P = \frac{Q_{Tot} \ * 860\ lit/h}{t}$$

V^P - flow e pump

Q_{Tot} - loads thermal total

t - Difference e temperature that water to hot we dispatch AND relapse

Fall e pressure: H P H gj HL HP mm KH 2O or IAC

H^P Losses of pressure oxen must to bear pumps

H_{gj} Losses of pressure longitudinal we line

H_L Losses of pressure cafeteria we line

H_P Losses of pressure we equipment

with use e pumping distributor, need with slightly water AND system heating done with of QUICK AND with of regular. Distribution e HEAT done with e sure. For assembly e pumping must to respected with strictly scheme principal e AND we charting to heat implant.

10. Technical specifications on Installation rates.

10.1 Installation of Radiators

for to PROVIDED performance maximum we emissions e heat must to respected distances from wall 30 mm AND from floor 120mm.
we RATE oxen POSITION of fitting COVERED part upper to radiators, must have at minimum 100mm space clean ABOUT radiator.
must to PROVIDED a speeds of water we entry of 0.6 m / s AND a pressure not higher than 10 bar.
water oxen WILL to used we NETWORK must to fulfill these criteria, hardness from not more _15 ° fr AND a ph middle 7 AND 8.
ABOUT of PROVIDED functioning optimum of SYSTEM AND ABOUT of PREVENT occurrences e corrosion, it is recommended THAT conditions CHEMICAL to water must respect recommendation NORMS self-8065 (Treatment of water IN system e HEAT ABOUT USER civil).

10.2 Expansion Vessels

specification TECHNICAL to vessels to expansion.

Expansion vessels must to be to constructed with tin steel to strong would be designed for be too long.

Membrane fixed SBR with characteristics THAT offer performance more of good AND BE of long.

statement e conformity with requests elemental of security 97/23 / EC Directive equipment below pressure (PED).
Temp. min./max. -10 ° ÷ + 99 ° C

Pressure max. 8 bar - Pressure of working 1.5 bar

10.3 Valves

Valles actuators with sphere
Supply AND mounting of valve actuators with sphere, to type with crossing total, provided for conjunction with fillet for diameters from 3/8 " - 2” AND 2 ½ " - 3 " with flange. body of valve WILL to be from bronze, spheres from bronze to extruded AND to chrome plated, seals from PTFE, leva from duralumin to laminated.

10.3 Chimney

The chimney will be Stainless steel with double walls between the 2 walls to have glass wool with a thickness of not less than 25mm with diameter Φ = 250mm.
The inner surface must have a coefficient of friction not more than 0.4 in order to ensure the perfect functioning of the system without impeding the movement of air masses.

Corrosion resistance.

Be made of 304 stainless steel which is corrosion resistant and ensures efficient evacuation of combustion products. This ensures the longevity of the plant and reduces pollution emissions.

Have low thermal inertia.

Due to the ease of absorbing heat, the steel chimney allows at high temperatures to have air mass movement in minimal time. This means better gas discharge from the chimney while reducing energy costs and consumption.

The steel chimney is completely waterproof preventing the formation of moisture between the inner and outer wall.

Thermal insulation.

The insulation maintains the ideal temperature enabling the correct operation of the installation.

Insulation between interior and exterior walls minimizes condensation and keeps the outside temperature to a minimum

11. System testing

commissioning of who must provide for in the chord to complete with the investor AND works manager _ to APPOINTED from investor, should to comprehend three GROUPS operations:

1 - **Verification qualitative AND quantitative** through to whom clarified THAT materials in the supply phase of the answer from salt QUANTITATIVE AND qualitative Interdepartmental to project, and obligations to contract.

2 - **Tests PREVIEW** to WHAT include the hydraulic test in it chilly and swelling test thermal in it hot. evidence hydraulic, which performed before thermal insulation AND channel closure _ to transition to piping, consists of filling with water to piping AND retention article a pressure 2 times with you greater than normal pressure i functioning to plant for the period of 12 hours. Pressure value in the case of the plant in question is 3.0 bar, which must to store for the above period without request any contact intervention. outcome considered positive when not verified losses or variations permanent to pressure value.

Swelling test _ thermal in it hot performed at temperature maximum to functioning to PLANT AND kept at a temperature of such tall all time oxen needed for pipeline inspection, to _ radiator AND to expansion vessel. After _ temperature drop in a value as much as 2/3 of the test value is repeated test at temperature maximum to operation. outcome of proof is considered positive when inflation of AND contractions not cause deformations, leaks AND not verified deformations to a nature or intensity to which, by repeating, can to cause damage to the plant or the environment.

3 - **Testing final** AND effectiveness of functioning to HIS AND to part that make it up must have performed after finishing to WORK and in terms climate to suitable.

In the end to any test or probation must compiled a verbal process i who describe operations performed _ AND the result achieved.