TECHNICAL SPECIFICATIONS 9 YEARS SCHOOL, KINDERGARDEN AND GYM "RAMAZAN KARAJ", NIKEL

I. MECHANICAL INSTALLATION WORKS

1. FIRE FIGHTING SYSTEM

1.1 Introduction

The firefighting system is being designed to handle the emergency to extinguish the fire in two ways.

Active protection:

Has to do with installing the extinguisher as internal and external hydrants, fixed gas powder foam, sprinkler, smoke and fire detectors, etc...

Passive protection:

Has to do with the materials of the building structures, which are assessed on the basis of resistance you submit against fire divisions sections, emergency exit system, smoke ventilation, etc...

In this section shall be treated only active part of the fire protection system without automatic intrusion detection part.

Fire protection system will be implemented on the basis of:

Dimensions, specifications and quality of the materials specified in the drawing instructions of Engineer representatives, local norms and standards as well as those of the countries of the European Community.
Firefighting system comply with all mandatory requirements state that have to do with the norms / standards that are currently in force in Albania and Italian rates CNVVF/CPAI UNI 9485.
During the design process and application of the system is a good idea to contact with local authorities MKZSH to provide a testing and approval of this installation.

1.2 Fire classification

To use appropriate extinguisher agents in the process of firefighting, in view of matter that can take flake, should definitely take into consideration fire class.
On the basis of contemporary standards the extinguishing equipments are classified as below:

The European standard DIN EN for those extinguishers:

Class 

used for fires originating from solid materials such as board, paper, plastic, textile, etc.

Class 

Used for fires originating from liquid materials as benzene, benzene, diesel, alcohol, oils, etc.

Class  Used for fires originating from gaseous materials as methane, propane, butane GPL etc.

Class  Used for fires that originate from materials such as metal aluminum, magnesium, sodium, etc.

Class  used for electrical equipment under power

In the drawings are defined exactly which areas related to fire classes and the countries where they are located and fixed fire hydrants.

1.3 Fire extinguishing substances

Taking into account the characteristics of the building and the activities that take place, will be used in substances as follows:

- Water: (solid materials);
- Powder or halogen hydrocarbons: (electrical materials).

1.4 Fire extinguishing equipment

Fixed types

- Hydrants inside the building (is applied)
- Hydrants outside the building (are not applied)
- Sprinkler system (are not applied)

Portable extinguisher (foam cylinder, powder cylinder), (is applied).

1.5 General designing criteria

1.5.1 Water Reservoir

Water Reserve will be in vertical circular tanks, which was installed in the technical area and you should be in accordance with the dimensions and definitions in the drawing, including connections, water supply mode, connecting pipelines, overflow, mechanical switch float as well as all requests to ensure a normal operation.

Reservoir above should provide the necessary amount of water according to the definitions above. Its volume and other technical specifications are presented in the respective drawings.

Quantity and volume of the reservoir is calculated depending on the special requirements for firefighting system, as the number of entries in specific environments, protected surfaces, specific rates etc...

Reservoir material will be in galvanized metal sheet steel, Form and its dimensions shall be as specified in technical drawing.

Water tank will be composed as follows:

- Water supply pipeline, at the entrance of the pipeline will be assembled group of measurement and control of water from the network;
- Suction pipelines for fire pump, water, drainage and discharge, in these pipes will be installed on-off valves and non-return valves;
- Discharge pipes to be installed for drainage pump and emptying the tanks;
- Pomp drainage for any eventuality or groundwater infiltration from the outside;
- Pomp tank emptying or cleaning occasions Disinfection;
- Mechanical switch, filters, valves, etc.

Diameters and lengths of pipes to the above will be in addition to the volume of water. All links and internal network is dimensioned as shown in the drawing. All pipes in this case will be prepared to galvanized steel.

Water tank as defined above will be concrete and its placement plan will be in the side part of the building. His constructive Building will be on the basis of drawings and specifications constructor engineer.
All installation work must be carried out in a perfect way and in accordance with the technical requirements in the project. Prior to construction of the reservoir, the contractor must present for approval shipyard drawings, catalogs necessary technical equipment, quality certificate, the origin of the goods, as well as a guarantee of 3 to 5 years.

1.5.2 Distribution pipelines and connections

Diameters and lengths of pipes as mentioned above will be in addition to the volume of water and all network connections to domestic water supply will be calculated with the same methodology as those sanitary water supply.
The entire internal network will be prepared of seamless steel pipes and thick walls. Threading pipes should be avoided. Without welding steel alloys as well as those of other non-combustible materials may be used.

Contractor shall make available all enforcement engineering working drawings in which is shown lay-out of the pipes throughout building and their axonometric.
This lay-out should show all the quotes, gradients, bends etc. In this case the designer must take into account to project pipeline network with a minimum number of bending and binding curves, but at the same time must provide at least one flexion for thermal expansions and contractions. Minimum turning radius pipes should be three times the diameter of the tube. Pipes should be anchored and secured to minimize damage and vibration. Suportet should also provide a normal thermal expansion of the pipes.

All pipes will be covered after the completion of all works masonry. Pipes must be connected and placed in the winding when it should be necessary. Pipes will never be recovered without the approval of supervisor engineer. In all cases must be protection from corrosion.
After completion of piping installation works they must undergo the test at a pressure of 8 times larger than that of labor for a period of 4 hours. Any leaks found shall be repaired by repeating the above testing again.
All internal pipelines must have circular internal section and a uniform shim and all interior and exterior surfaces must be free of defects and scratches.

1.5.3 Pumping station

Fire pumps should be united in a Diesel engine fuel pump, one Electrical pump and one Jockey Pump. The Station Fire Protection Pump must be composed in accordance with the requirements of the project and in accordance with EN 12845: 2005. This unit consists of electrical part consisting of three fire pumps engines with electric service panel command and their accessories. The construction of the pumps will be horizontal in which pressure applied constructively with centrifugal action.

Pumping station is equipped with control panel which commands each pump and where their command in the stated manner, such as starting, stopping and monitoring at the same time pump the necessary signals defining thus the status and conditions of pump station.

Before leaving the factory, every pump should be hydraulic tested by this factory for a period of at least 5 minutes. Pressing test will not be performed with less than 16 bars. During the pressing need not have flow performances as a copy of the test must accompany the group during disbursement.

The source of water that must have pumps and available network must be adequate in quality and quantity. These features should be determined before selecting the pumps after they provide the technical data permissible for pumping water quality. During the calculation of the prevalence of the pump (pressure required) should take into consideration the height of the building, the pressure at the exit of the further hydrant and local lost longitudinal.

Each pump shall be equipped with safety valve and a closing valve if you have a lack of pressure in its suction. This valve is placed in the section of sending the control valve before sending. It is preventive valve in case of lack of water in the network for preventing overheating of pomp while working in a vacuum. Predictions to be made for discharging water into manholes Minimum discharge valve dimensioning will be 3/4 ".

Fire pumps and control panel must be protected against interruption in service when there are explosions, fires, earthquakes, storms, freezing, vandalism and other similar cases. Consideration should be made for ventilation of pump rooms.

Fire pumps should be installed in separate parts of the building, which should be suitable for maintenance and occasional services. Depending on the selected scheme they can be installed in the basement of the building.

In addition, they should be established and be stuck in the metal support that is stuck in the basement of the building. These metal Supporter should not be on walls or building foundations. Associated with rubber washer pumps and sand cushion or wood or wood binary to avoid noise while working.

Firefighting pump

Three pumps connected to the delivery collector and suction centrifugal type, horizontal with flange connection and ant vibrating joint.
Body pump and motor are painted ipoxide resin.

Materials

Base frame	Steel galvanized
Joint tubings	Painted steel
Wear rings	Bronze (CuSn5Pb20)

Electric pump

Fluid:	Water pure
Flow:	7.5 m³/h
Power	7.5 kW
Rated current	14.8 A
Winding:	3~400V/50Hz
Speed:	2900 1/min
Pressure:	50 m or 500 kPa
Fluid Temperature:	(-10 to + 120°C)
Head:	(max. 10 bar)
Degree of protection	IP 54
Insulation class	F

Diesel pump

Fluid:	Water pure
Flow:	7.5 m³/h
Power	10.2 kW
Cooling method	Air
Air volume flow cooling	711 m3/h
Gross volume	26 lit

Jockey pump

Nominal power	0.75 kW
Rated current	1.83 A
Gross volume	20 lit

Fitting dimensions	
Flange connection:	DN 65 / PN10

Concrete flooring technical environment should be equipped with drainage system to cope with the removal of water that comes out of critical equipment such as pumps, hydrants, etc... All installation work must be carried out in a perfect way and in accordance with the technical requirements in the project. Before the installation of the pumps, the contractor shall present for approval with the necessary technical data catalog, certificate of quality, origin of the goods, as well as a guarantee of 3 years. Pumping installation scheme is given in the technical drawings.

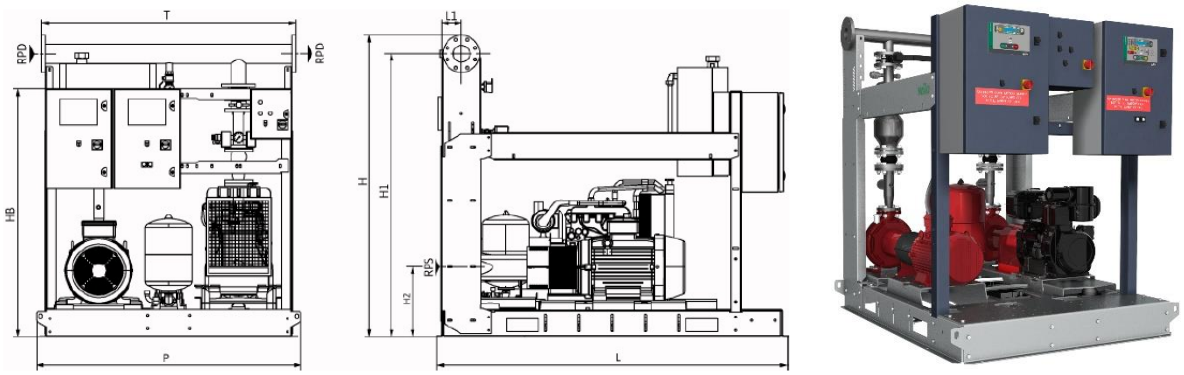


Figure 1 : Firefighting Pump

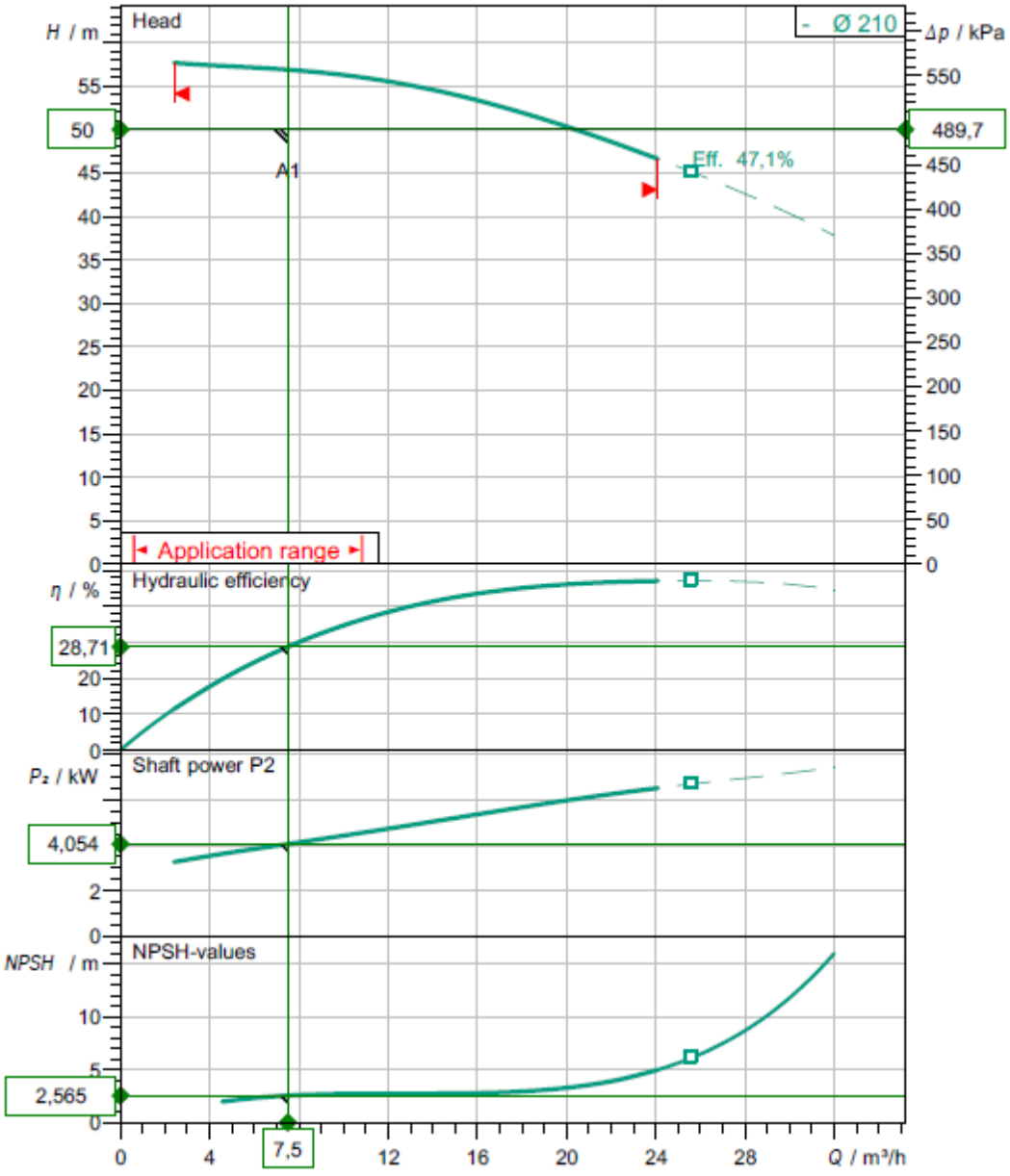


Figure 2 : Technical Data for Firefighting Pump

1.5.4 Hydrants and fire extinguishers

Fire extinguishers are classified as below:

- Hydrants inside the building;
- Hydrants outside the building;
- Sprinkler system;
- Mobile extinguisher;
- Fixe type extinguisher

Water fire extinguishers are selected as the active components in the selected system extinguished the fire. They are estimated to have available for the entire amount of water required in the case of the play that fire. This is made possible with the forecast in the project of installation of hydrants on the inside and outside of the building.

In order hydrants have the necessary amount of water and a sufficient pressure project has been prepared in accordance with the norms that dimension type hydrants must be installed in the building. They are installed on each floor near lances potential fire risk and are placed in enamelled steel box and painted with red paint and glass on the front page.

Hydrants are composing with valve, water flexible pipe with a length of 30 m, and lances. All these devices are located in the box of galvanized steel, which is placed inside the wall and has a level surface.

Figure 3 : Firefighting Hydrant

Wall-mounted Firefighting Hydrant DN 45

Fluid	Water	
Fluid temperature	0 until + 50	ºC
Hydrant		
Dimensions		
- Frame	560 x 360 x 160	mm
- Hydrant valve	1 ½”	DN 40
- Pipe outlet	1 ½”	DN 40
- Outlet nose	12	mm
- Material		Cast iron
- Frame	Galvanized steel	Polyester red color RAL 3000
- Frame	Aluminum grey	Anodized
- In front view	Glass	Without color
- Outlet pipe and nose		brass
- Hose	Red	Pipe extension polyurethane

Firefighting brigade connection DN 65

Fluid	Water	
Fluid temperature	0 until + 50	ºC
Hydrant		
Dimensions		
- Frame	600 x 500 x 300	mm
- Hydrant valve	2 ½"	DN 65
- Pipe outlet	2 ½"	DN 65
- Material		Cast iron
- Frame	Galvanized steel	Polyester red color RAL 3000
- Frame	Aluminum grey	Anodized
- In front view	Glass	Without color

Figure 4: Firefighting brigade connection

Fire extinguisher movable

The number and dimensions of the cylinders for fire extinguishing is determined in accordance with the norms / existing standards. They have maintained the controlled at least every two years, had the Government of licensed.

Types of cylinders used for extinguishing fires and their use in accordance with the fire source material, are presented in the table here below:

	Classes:	A	B	C	D
Name of the cylinder (fire extinguisher) anti fire					
Powder extinguisher	PG	✓	✓	✓	
Powder extinguishers (for fires caused by metals)	PM				✓
Fixed powder (special powder)	P		✓	✓	
Dioxide extinguisher carbon (CO2)	K		✓		
Foam extinguisher	S	✓	✓		

Figura 5: Fire extinguishers according to fire protection classes

Figure 6 : Powder extinguisher

2. WATER (COLD & HOT SANITARY) SUPPLY SYSTEM

1.1 DIMENSIONING

The dimensioning and projecting of all components and accessories of the hydro – sanitary distribution net are performed by taking in to consideration of the relevant element as bellow:

- Distribution sketch
- Determination of nominal flow for each sanitary apparatus and connected tubes
- Dimensioning of magisterial pipe
- Total Nominal flow
- Project flow
- Project pressure
- Unit longitudinal pressure loss
- Max. velocity permitted
- Dimensioning of electric boilers in toilets and labs space.

1.2 PUMPING STATION

This system is equipped with group pressure booster water pump and will install in accordance with requirements of project as an automatic sanitary water pumping station.

The sanitary pump is foreseen to ensure one considerable water quantity approximately for about 48 hours autonomy, deposited in calculated reservoirs. The station is foreseen for pumping the cold sanitary water in all sanitary device installed in the buildings. According the selected scheme, must be installed on the ground outside the building.
The water pump is placed in the galvanized sheet iron base complete on the metallic special plates with rubber ant vibration feet to eliminate the sound during the works of pumps. The metallic plate is not connecting with foundation or walls of building.
They have water meter, manometer, and the connection pipes with water supply system, electric panel, the electric protection system, automatic thermal protection system and automatic control system.

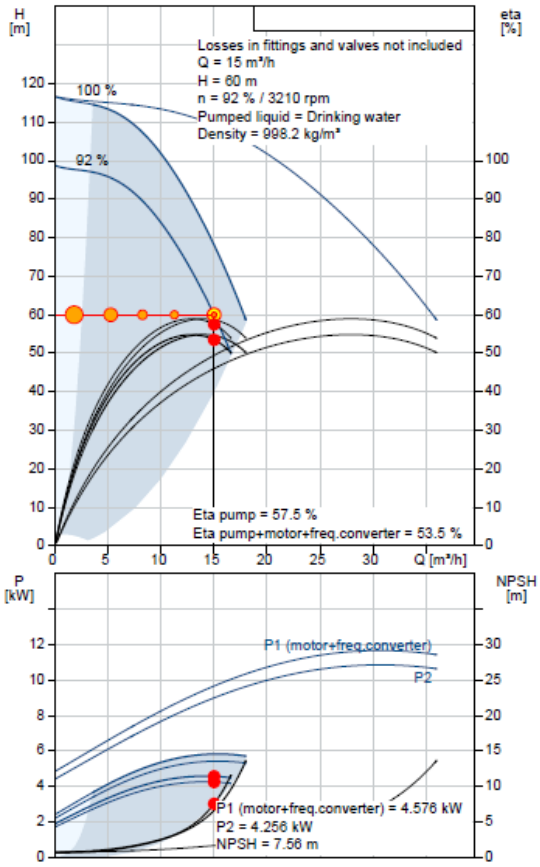
Speed-controlled Vario pressure booster set

Water-supply unit as compact unit for pressure boosting or as water supply for connecting to break tank/mains network. Consists of: non-self-priming, horizontal multistage stainless steel high-pressure centrifugal pump with electric motor. Shaft sealing with bidirectional mechanical seal.

Motor with built-in air-cooled frequency converter for variable speed control between 24 Hz and max. 60 Hz. Set up on galvanised base frame with height-adjustable vibration absorbers with diaphragm pressure vessel (volume 8 l) including flow fitting in accordance with DIN 4807, integrated non-return valve, pressure sensor (4 - 20 mA) and pressure gauge for the automatic system control with p = constant function. Delivery head set point infinitely variable by means of one-button operation available on the frequency converter. Automatic zero-volume detection and deactivation. Built-in motor protection by means of electronic current monitoring. With LCD display for status and actual pressure display, as well as one-button operation for configuring the pressure level and all set point defaults, as well as potential-free contacts for the collective fault and collective run signals. Wired so it's ready for connection and furnished with gear-operated ball cocks on the pressure side.

Fluid:	Water, pure
Fluid temperature (max. 60 °C) :	20 °C
Flow rate :	15 m³/h
Total head :	60 m
Motor	
-Rated power (P2) :	5.5 kW
-Mains power :	3~400V/50Hz
Overall degree of protection:	IP 54

Description	Value
General information:	
Technical:	
Actual calculated flow:	15 m³/h
Max flow:	36 m³/h
Resulting head of the pump:	60.01 m
Head max:	116 m
Number of pumps:	2
Materials:	
Pump housing:	Stainlees Steel
Manifolds:	Stainless steel
Installation:	
Maximum operating pressure:	1600 kPa
Maximum permissible inlet pressure:	PN 16 bar
Flange standard:	ISO 7/1
Manifold inlet:	R 2 1/2
Manifold outlet:	R 2 1/2
Liquid:	
Pumped liquid:	Drinking water
Liquid temperature range:	278 .. 333 K
Density:	998.2 kg/m³
Electrical data:	
Power (P2) main pump:	5.5 kW
Mains frequency:	50 Hz
Rated voltage:	3 x 380-415 V
Start. method:	electronically
Enclosure class (IEC 34-5):	IP54
Tank:	
Volume of pressure tank:	25 l
Diaphragm tank:	Yes
Others:	
Net weight:	177 kg
Gross weight:	194 kg
Language:	GB
Product range:	South Europe
Country of origin:	IT
Custom tariff no.:	84137075



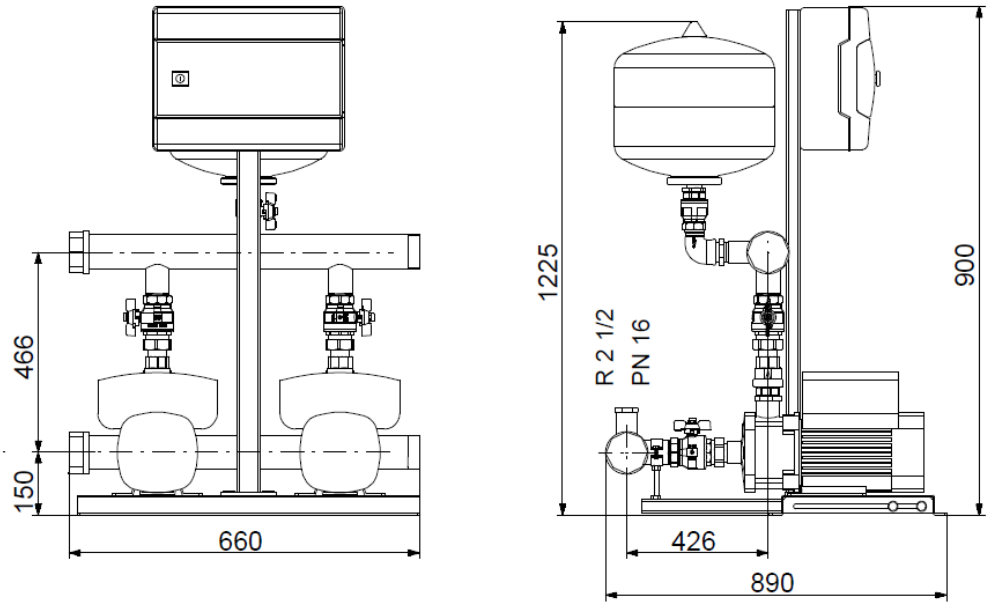


Figure 7 : Technical Data for Sanitary Water Pumps

1.3 Booster

Booster is a device which is mounted in front of the sanitary water pump, which serves to increase the water pressure in the building.
Water pressure can vary throughout the day based on consumption, the presence of any leaks in pipes and pressure at the point of erogation. In general, the water pressure is a little bar. A bar (1 km/cm^2) can exert enough pressure to raise the water to a column height of about 10 meters. Water flow can be inefficient and unstable in high places, and in such cases, it is necessary to use an autoclave.

Booster is a pressurized container, where pumps charge it according to number of switching off to get a greater pressure than the water network. Once the desired pressure is reached, the pump turns off and keeps charging system itself booster.

Booster material is pre-carbon steel, protected by a layer epoxide blue RAL 5015, polymerized.

Technical data are presented as follows:

Max. Working pressure:	16 bar
Charging pressure:	2.5 bar
Capacity:	300 lit
Diameter:	630 mm
Head:	1365 mm
Connection:	1 ½” (DN 40)

Figure 8 : Autoclave for cold water sanitary

1.4 Water Reservoirs

The water reservoirs are calculated and dimensioned to provide the pressure and quantity of water in the centre during the day for required autonomy of 48 hours. Specification (pressure, quantity, measurement etc) are given by the designer depending from daily water consumes.

The volume of water reservoir should be calculated depending from scheme of project and required autonomy.

The water reservoir is projected from hot dipped zinc coated carbon steel, or stainless steel. Are chosen the zinc coated steel as a proper low-cost material because the reservoirs preliminary is

festinated outdoor. Their form is circular and placing is as an aboveground vertical tank. This form is depending from the installation place and requirement of project. The calculation of thickness for reservoir materials will be depending by the volume of reservoir and their forms but the thickness cannot be less than 1 mm.

The water reservoir is composed as follows:

- Pipe of water supply 2", in this pipe will be installed a swimming non-return valve
- Distribution pipe 2". In this pipe will be installed a non-return valve.
- Overthrow pipe will be installed not less than 150 mm from the cover of reservoir.
- Discharge pipe 2" will be installed in lowest part of reservoir. It will have a control valve.
- Signal pipe will be installed 20 – 30 mm under the overthrow pipe.
- Swimming Gallant 1½ ".

Water tank, capacity 5 000 lit

Diameters and lengths of above pipes will be depending by the water volume and the connection with internal water supply network is given in technical drawings. All pipes should be made up to galvanized steel pipes (in the case of metallic reservoir).

The water reservoir will be on technical space ground installed on the special part of lay out of building. And depending by the selected scheme, they can be installed on basement of building. They will be installed on the wooden special parts that are connected with a stainless-steel sheet with minimum thickness 2mm. This basement of reservoir will protect the slab or other part of building against moisture, leakage or condensation of water.

All works of installation should be perfect and in accordance with technical requirements of project a catalogue with technical data of water reservoir, quality certificate, origin certificate and warranty certificate with minimum 1 year must be previously submitted for approval before installation of the reservoir on the object.

1.5 COLD SANITARY WATER SYSTEM

The cold water is coming from the main network where the building is connected with a concrete pit and all necessary accessories like; valve, flow meter and filter. The system of supply for the cold water is with plastic pipe, type HDPE.

1.6 HOT SANITARY WATER SYSTEM

Solar hot water is water heated by the use of solar energy. Solar water heating systems are generally composed of solar thermal collectors, a water storage tank or another point of usage, interconnecting pipes and a fluid system to move the heat from the collector to the tank. It will also install the electric boiler 80 lit.

***Electric boiler* (*heat exchanger*)**

Figure 9 : Electric Vertical Boiler cap. 80 lit.

The producer of sanitary hot water has been selected to provide supply throughout the day. Its size is calculated according to the needs for sanitary water and its characteristics must be clearly defined in the quality certificate issued by the manufacturer. The main technical characteristics are presented below:

Electric Vertical Boiler cap. 80 lit

Type :	Thermally insulated vertical boiler with removable stainless steel exchangers;
isolation:	Flexible layer of polyurethane foam 50 mm thick;
Casing:	Carbon steel, protected by a white polymerized epoxy coating;
Protection:	Cathodic protection system, simple magnesium anode;
Kapacity :	80 lit, Pmax 8 bar, Tmax 95 ^{0}C.

Solar energy

Technical specifications of the storage tank:

- External casing: anodized aluminum
- Tank's insulation: polyurethane foam 40-55 mm
- Cylinder's material: galvanized sheeting 3mm
- Jacket's material: low carbon steel 1,5 mm
- Cylinder's internal Protection: durosmalt 80-120 microns
- Additional protection: magnesium rod
- Electric resistance: copper
- Thermostat: bipolar of four contacts
- Power rate: available from 0,8kw – 4kw

Technical specifications of the collector:

1. External frame: anodized aluminium profile
2. Back side: galvanized sheeting - 0,6 mm
3. Back insulation: rock wool 40 mm
4. Side insulation: glass-wool of 20 mm
5. Absorber: A unique sheet of copper with selective titanium coating or with black paint / ulstrasonic weldings or type "omega" (ø).
6. Absorber's tubes: copper pipes Ø10 & Ø22 (risers and headers)
7. Cover: solar tempered glass
8. Water-tightness: epdm rubber/transparent silicone

Figure 10 : Solar energy

The total needs for supporting our sanitary hot water supply system is 2 solar panels as is show on the drawings, with the technical specification as below:

Model	Dimension of storage tank (mm)	Dimension of collectors (mm)	Capacity (lit)	Power of electric resistance (W)
200	570x1320	2050x1010x90	200	4000

1.7 PIPES

The sanitary water system pipes will serve to transmit cold water from the main network and warm water from electrical storage water heater (boiler) to the sanitary equipment's.

The sanitary water system pipes have fulfilled the requirements of standards/norms. Those are selected in the design process by the engineer as the client as required.
The sanitary water system pipes are divided as follows according to the material:

- Pipes HDPE - (high density Polyetilene)
- PPR pipe (Polypropylene pipe)

Figure 11 : Pipe for sanitary installations

- **Pipes HDPE - (high density Polyetilene)**

HDPE pipes (high density Polyetilene) HD5620EA is a tube high-density molecular allocation that spread every inch the length of the tube. These pipe density degrees have the following features:

- Flexibility for large quantities of fluid;
- Sites with great resistance;
- Flexible for quick use.

Specifications:

Characteristics	Unit	Value	Testing procedure
MFI (190°C/2.16 kg)	gr/10 min	20	ASTM D 1238 –7 condition E
Density	gr/cm³	0.956	ASTM D 2839 - 69
Hardness Tensions leakage	Mpa	22	ASTM D 638 - 72
Elongation and fracture tensions	%	900	ISO R527-Tipi 2 velocity D
Flexion tension	Mpa	1000	ASTM D 790 - 71
Hardness impact	KJ/m²	10	ASTM D 256 - 73B
Hardness	Shore D	66	ASTM D 2240 - 75

- **PPR pipe (Polypropylene pipe)**

  - Main lines inside the building from the tecnical area to the sink ore toilets will be PPR Pipes:

Characteristic of PPR Pipes

- Density of PPR: 0,9 g/cm³
- Welding temperature 146 °C
- Thermal Conductivity in 20 Degrees 0,23 W/mK
- Linear expansion coefficient 1,5 x 0,0001 K
- Elasticity in 20 degrees 670 N/mm²
- Resistance to leak in 20 grade 22 N/mm²
- Resistance in destruction in 20 grade 35 N/mm²

- Thermal Insulation of Pipe PPR

All PPR pipes installed in the building shall be thermal insulated.
The specification of the thermal insulation of PPR pipe are described below.

- Thickness 6mm
- Vapor conductivity μ>3500
- Thermal conductivity (40°C) 0.039 W/(mK)

Figure 12 : Thermal Insulation

Method of expansion tubes, quotes, and different layers for pipe support and coverage are given in the technical details of the project.

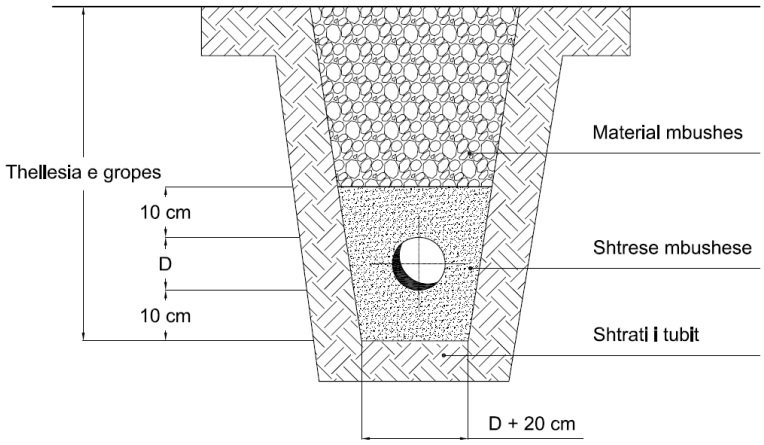


Figure 13 : Method of installation pipes

All works associated with the installation and placement of water pipes in the building should be made and according to the technical requirements of the supervisor and the project. A catalog with technical data, quality certificates, the origin of the material, the minimum guarantee of 3 years and certificate of testing done by the manufacturer, shall be provided for review supervisor for an approval before they can be placed on the object.

1.8 VALVES

The valves are special tools that shall be used regarding the flowing control in the water pipelines. With the help of the valves it can be changed the flowing quantity or the flowing can be completely interrupted. The valves can be of bronze, pig iron or stainless steel. They are spherical, of join type, filleting type or with flange.
The valves of joining type to the pipes are divided in: with flange and with fillets.

The valves used in a water supply line afford a pressure 1, 5 times more than the working pressure. They should face a minimal pressure of 10 bars.

The valves should provide a perfect resistance to the corrosion, resistance to chemical agents, lightweight, easily repairing and transport, duration over 25 years and resistance to the mechanical attacks.

In special cases, are designed also one-way valves? These are placed in the sucking pipe or in the distribution one. Their installation is foreseen also in the main building entrance.

All the works related to their installation and placing in site shall be according to the technical requirements of the design.

A valve sample, which shall be used supported by the quality, origin, testing, and warranty certificate, is to be given before placing in site.

1.9 SANITARY FIXTURE

1.9.1 Water Closet (WC) set and flash box+ plastic coated wooden seat

In the Toilet rooms, Water Closet (WC) sets are foreseen. The WC sets are porcelain sanitary toilets made of in Porcelain materials in accordance with international quality standards ISO 9001, as described in the Technical Drawings from designer. The Type of WC set is chosen Modern (French) type.

The WC sets, are selected too type, Modern (French) and (Turkey model). French type will be strongly fixed on the floor or to the wall by brass clamps and screw plugs and screws, without creating gaps in the wall tiling. WC set will be connected with water discharge pipes before the installation on the wall by brass clamps. The outlet of the WC set can be under the body of the set or on the backside of the WC set. The WC set with side outlet should be 19 cm high from floor level.

In the lowest part of the collector basin will be a hole with minimal diameter of D= 90 mm. The upper part of WC set can be oval or circular in accordance with the project requirements and WC set type. The height of WC set, modern type, is 38-40 cm. They will be installed in accordance with the project requirement. Horizontal Distance between WC Sets and other sanitation equipment (Washbasin, bidet, etc.) should be minimum 30 cm.

WC sets should provide a fast and big water flow. They should be resistant against mechanical shutting, corrosion and chemical agents. They should provide water insulation, good condition during the work and easy access for the repair.

The WC set should be connected with sewerage pipes (The connection will be realized with a siphon type tube). The connection pipes of WC sets should be PP pipes (of the same technical characteristic with other sewerage pipes). Their Diameters should match the outlet of the WC set (Usually their diameter is 110 mm).

The WC set will be connected with drinking water system. The connection will be realized to a flash box that can be installed directly on the WC set or on the wall (separately from the WC set). This depends on the type of WC set. The flash box will be installed in the height of 1,5 m high from floor level. The flash box made of porcelain materials will be in accordance the project and quality standards ISO with requirements. The sewerage pipe will be fixed on the wall every 50 cm.

Sample of the WC set together with quality certificate, certificate of origin, test certificate and warranty certificate will be submitted to the supervisor for the initial approval before WC installation at the site. The WC set technical data (including WC type, working pressure, name of the manufacturer, standards and year of production) should be given in the catalogue.

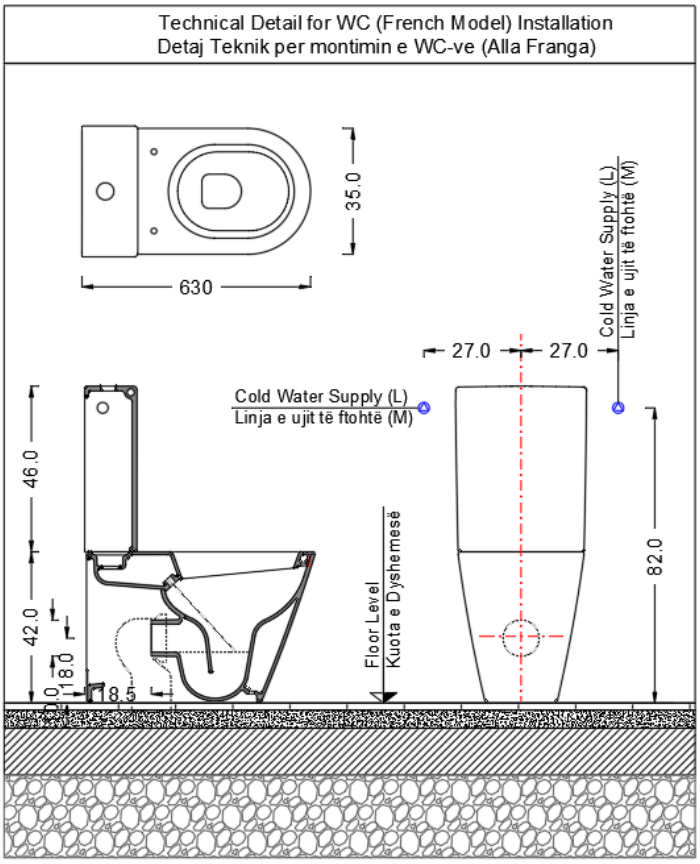


Figure 14 : Technical Detail for Toilets (French Model)

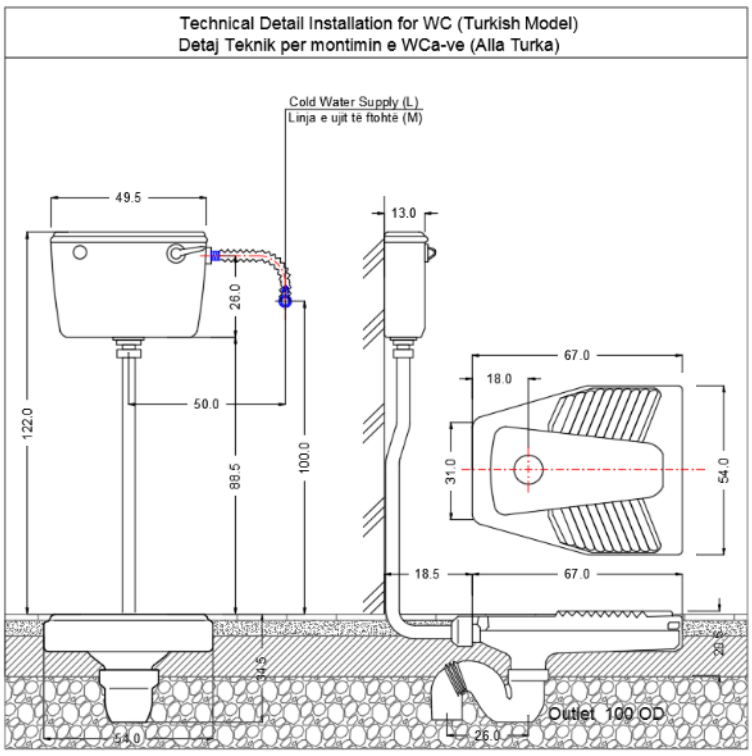


Figure 15 : Technical Detail for Toilets (Turkey model)

1.9.2 Suspended Wash Basin sets + monocontrol mixer tap

In the all toilet rooms and washing parts Wash Basin + monocontrol mixer tap sets are foreseen. The Wash Basin sets are sanitary equipment for washing hands, face, etc. Wash Basin set must be made of porcelain materials. Material type for Wash Basin set will be in accordance with the international quality standards ISO 9001, as described in the Technical Drawings from designer.

The Washbasin sets should provide a fast and big water flow. They should be resistant against mechanical shutting, corrosion and chemical agents. They should provide water insulation, sound insulation, and good condition during the work and easy access for the repair.
The Wash Basin and their support will be strongly fixed to the wall by brass clamps and screw plugs and screws, without any gaps of the wall tiling. Washbasin set will be connected with water discharge pipes before the installation to the wall by brass clamps.

In the lowest part of the collector basin will be a metallic hole with minimal diameter of D= 40 mm. The size of collector basin is 40/60 cm x 36/ 45 cm (depending the type and model). The collector basin can be oval in accordance with the project and type requirements. The height of the Washbasin set is 75 - 85 cm. They will be installed in accordance with the project requirements. Horizontal distance between the Wash Basin Set and other sanitation equipment (Water Closet, bidet) should be minimum 30 cm.
The Washbasin set should be connected with sewerage pipes (The connection will be realized with a siphon type tube). The above connection will be made by fittings, type Tee, with 45 degree or 60 degree. The connection pipes of Washbasin sets should be PP pipes (in same technical characteristic with other sewerage pipes). Their length should be 20 - 40 cm and their diameters should match the outlet of the Washbasin set.

The Washbasin set will be connected with drinking water system. The connection will be realized with two flexible pipes with the length of 30 - 50 cm and diameter 1/2". The pipes will realize connection of valves with pipes of hot and coldwater system.
The monocontrol mixer tap will be installed in the place of connection of valves with the washbasin set, because the water leakage should be stopped during the working time.
All the supervisor technical requirements to complete the work in a first class should be included. The connection of the Washbasin set with the sewerage pipes should be with special materials for PP pipes in accordance with the pipe manufacturer's recommendations.

Sample of the Wash basin set together with the quality certificate, certificate of origin, test certificate and warranty certificate will be submitted to the supervisor for the initial approval before the fixing at the site. The technical data of the Washbasin set (including the Washbasin type, working pressure, name of the manufacture, standards and year of production) should be given in the catalogue.

1.9.3 Single Lever Plus Wash-Basin Mixer

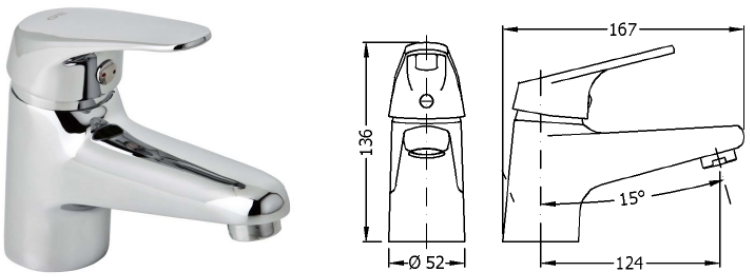


Figure 16 : Singer Lever Plus Wash-Basin Mixer

- Features
  - Body made in brass according to UNE-EN 1982.

- Handle made in Zamak.
- Chrome plated according to EN 248.
- Guided outlet noiseless Ø40 ceramic cartridge.
- Anti-lime M24x1 plastic aerator with chrome plated brass cover.
- Fitted with chain holder, 35 cm long flexible connectors (M10x1; G ⅜") and stainless steel horseshoe fixation set.
- Minimum flow rate: 12 l/min (3 bar).
- Maximum use temperature: 85 °C.
- Max. recommended temp.: 65 °C.
- Maximum use pressure: 10 bar.
- Minimum use pressure: 0,5 bar.
- Recommended pressure: 1 - 5 bar.

Water Flow

Presión / Pressure		Caudal / Water flow
Bar	psi	l/min
0,5	7,3	4,2
1,0	14,5	7,0
1,5	21,8	9,4
2,0	29,0	11,3
2,5	36,3	12,9
3,0	43,5	14,4
3,5	50,8	15,5
4,0	58,0	16,7
4,5	65,3	17,8
5,0	72,5	18,7
5,5	79,8	19,5

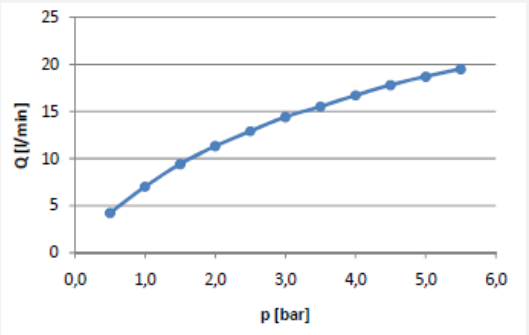


Figure 17 : Water flow for Mixer

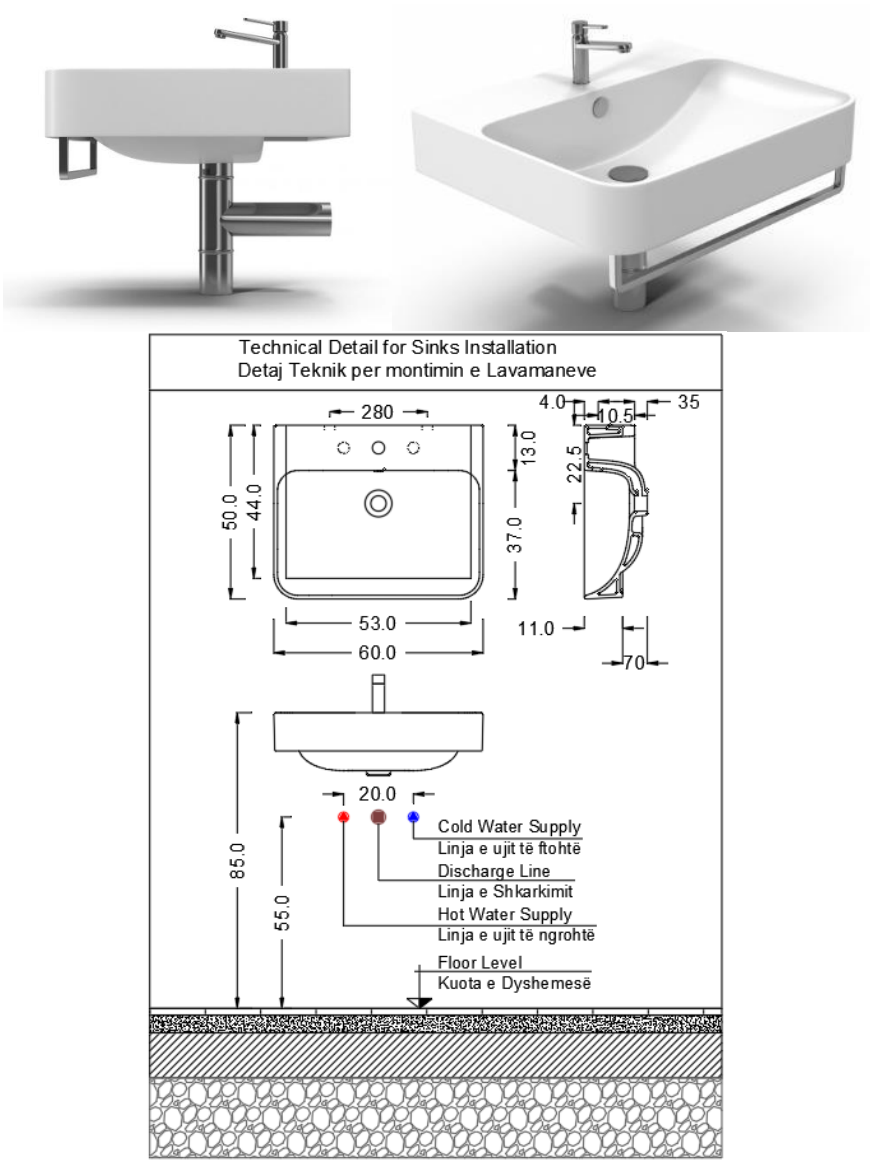


Figure 18 : Technical detail installation for Sink

3. SEWAGE WATER SYSTEM

3.1 DIMENSIONING

The dimensioning and projecting of all components and accessories of the discharge waste Water pipes distribution net shall perform taking in to consideration of the relevant element As bellow:

- Distribution sketch (inner derivation of sanitary apparatus + columns + collectors + pits)
- Determination of nominal discharge flow for each sanitary apparatus
- Determination of projecting discharge flow.
- Lay – out and dimensioning of the inner waste water pipe derivations
- Lay – out and dimensioning of discharging waste water columns pipe
- Lay – out and dimensioning of balancing pressure and ventilation pipe of waste water columns
- Lay – out and dimensioning of inner collectors

The sizes of pipes will be depending from calculation flow of wastewater, flow velocities and full scale of pipes. The flow velocity should be 1, 0-1, 2 m/sec and the full scale of pipes should be 0, 5- 0, 8.
The lengths of pipes should be 6-10 m. Diameters and thickness should be in accordance with data of technical of drawings. All data on outside diameters, pressure, name of manufacturer, year of production, etc., should be stamped on every pipe.

3.2 WASTE WATER DISCHARGE PIPE MATERIALS

For wastewater discharges within the premises will be used PP plastic pipes - (polypropylene thermos stabilizer at high temperatures) that meet all quality requirements according to EN 1451 standard (application for testing and quality pipes). They are designed in accordance with the standard EN 12056.
These pipes should ensure perfect resistance to corrosion, resistance to chemical agents, light weight, simple opportunities repair, transportation, simple and quick installation and durability over 30 years.

Figure 19 : Wastewater Discharges Pipe Inside the Building

Drainage pipes should be placed in the entire height of the building, in the form of columns, in those toilets where extinguishers are grouped and possibly closer to those nodes that collect more polluted waters and greater pollution.
Discharge pipes associated with sanitary facilities or set of devices on each floor through delivery pipes. Binding delivery pipes with exhaust stacks must be steep three branches under an angle 45 or 60 degrees. Delivery pipes can be laid side walls or under floors keeping in mind certain conditions, for installation of internal sewerage network. The length of these tubes should not be more than 10 m. Their diameter will be a function of exit sanitary equipment is located.
Each vertical column discharge equipped with checkpoints that must be placed in every two floors starting from the bottom of the column.
Discharge pipes to be used in outdoor environments, JANTA PP pipes dizzy, with the following technical specifications:

Technical specification:
Material: HDPE (High Density Polyethylene) black and yellow
Dimensions:
- D [mm]: 150-600 q
- L [m]: 3, 6

Max. Operating temperature [° C]: 95
Hardness class [kN / m^2]: SN 4, SN 8

Figure 20 : Wastewater Discharges Pipe corrugate Outside the Building

3.3 FITTINGS OF WATER DISCHARGE PIPES

The PP fittings will be used for connection of discharge pipes with sanitation equipment and other part of sewerage system. . It will be in accordance with international quality standards EN 1451 (Quality and Test Requirements for pipes).

The fittings (connection parts) should be excellent resistant against corrosion and chemical agents, low weight, ease of maintenance for repair and transport, fast installation, long working life.

The sizes of fittings will be depending from calculation flow of wastewater, kind of sanitation equipment, flow velocities and diameter of respectively pipes. The flow velocity should be 1, 0-1, 2 m/sec and the full scale of pipes should be 0, 5-0, and 8.

Diameters and thickness should be in accordance with data of technical drawings. All data on outside diameters, lengths, pressure, name of manufacture, referred standard, year of production, etc., should be stamped on every fitting.

The diameter of fittings should be equal with diameter of discharge pipes. The smallest diameter is not recommended. If the pipes will change their diameter, the fittings should be adapted with them.

Figure 21 : Fitting for water discharge pipes

3.4 VENTILATION AND BALANCING PRESSURE PIPES

The PP ventilation pipe is extension of upper part of discharge pipe. They will be installed until 70 - 100 cm over the upper part of roofing or terrace of building.

The ventilation pipe will provide the ventilation of internal and external sewerage network. This ventilation will provide the fast leaving of vapours from discharge columns and other vapours that are not good for health of peoples.

Also, the ventilation pipe will connect the sewerage columns with atmosphere. So, they will improve the works of sanitation equipment siphons.

The diameter of ventilation pipes will be DN 75 mm and on the ventilation pipe will be installed a cover that will be improved the ventilation of discharge columns.

The ellipsoidal equipment that is installed in ventilation pipes (depending requirement of project) can improve the ventilation of discharge columns. They will provide the fast leaving of vapour from discharge columns.

3.5 FLOOR DRAIN

The floor drain pipe should be used for discharge of water from floor. They will be in accordance with international quality standards EN 1451 (Quality and Test Requirements for pipes). The type is chosen PP Floor trap horizontal with stainless steel grid.
The floor drain set should provide the fast and large flow of the water. They should be resistant against mechanic shutting, corrosion and chemical agents. They should provide water insulation, simple possibility for the repair, transport and connection.
The floor drain will be installed in the lowest part of the water collector basin. Usually, they will be installed near of centre of the floor. They cannot be installed near of the connection of the walls with floor.
The floor drain set should be connected with discharge columns by PP pipe or (The connection will be realised with a siphon type tube). Fittings, single branch with 45 degree, 60 or 90 degree, bends, single sleep-on will make the above connection, all with seals type Tee, with 45 degree or 60 degree. The connection pipes should be PP pipes (in same technical characteristic with other water sewerage pipes). The lengths of them should is 20-30 cm. Their diameters should be in function of the outlet of the floor drain. If the diameter of floor drain is different from supply pipe, should be used the reductions fittings.

3.6 Sewage and Rain manholes

All the above types of wells can be such walls with concrete prefabricated elements, or concrete poured in place.

The material from which it is produced as both frames must be cast iron lid.
Wells must meet the following technical requirements:

- load retention, external;
- The pressure of the earth;
- Water pressure.

Manholes dimensions are calculated in function of the flow are defined by the designer in the respective drawings.

Figure 22 : Sewage and Rain manholes

Also, the dimensions of the collector that discharge wastewater and rain are calculated and dimensioned in function of flow and the material is selected corrugated PE we polished outer surface and at the inner dimensions ranging from 200 - 250mm.

3.7 Storm water drainage

An important during the design of a building is the drainage of rain water collected from roofs or terraces.
Rain waters will have a new drainage around the building and then drip channel general school and beyond existing in that area.
Roofs, balconies, terraces and other elements of construction, water should be removed by a system composed of slop to wells and further collected through pipes inside the building.

4. HEATING AND COOLING SYSTEM

4.1 Variable Refrigerant Flow (VRV) Systems

Variable refrigerant flow (VRV) is an air-condition system configuration where there is one outdoor condensing unit and multiple indoor units. The term variable refrigerant flow refers to the ability of the system to control the amount of refrigerant flowing to the multiple evaporators (indoor units), enabling the use of many evaporators of differing capacities and configurations connected to a single condensing unit. The arrangement provides an individualized comfort control, and simultaneous heating and cooling in different zones.

The control is achieved by continually varying the flow of refrigerant through a pulse modulating valve (PMV) whose opening is determined by the microprocessor receiving information from the thermistor sensors in each indoor unit. The indoor units are linked by a control wire to the outdoor unit which responds to the demand from the indoor units by varying its compressor speed to match the total cooling and/or heating requirements.
VRV systems promise a more energy-efficient strategy (estimates range from 11% to 17% less energy compared to conventional units) at a somewhat higher cost.
Refrigerant piping runs of more than 60 mm are possible, and outdoor units are available in sizes up to 70 kw.
A schematic VRV arrangement is indicated below:

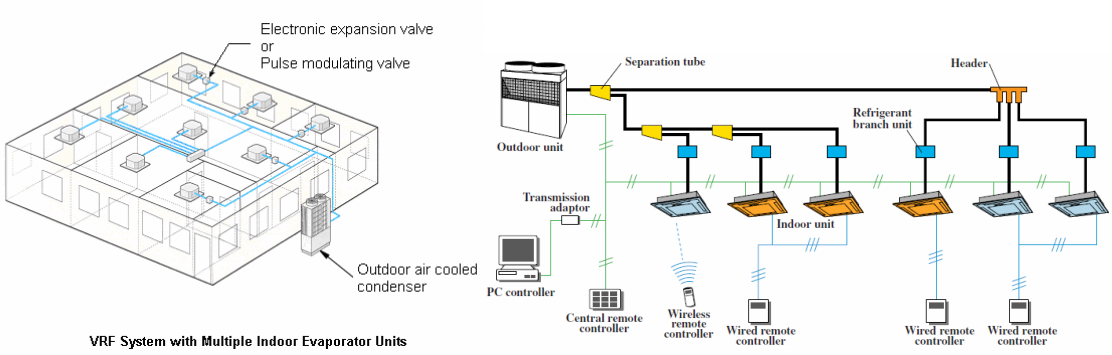


Figure 23 : VRV Installation Scheme

The modern VRV technology uses an inverter-driven scroll compressor and permits as many as 48 or more indoor units to operate from one outdoor unit (varies from manufacturer to manufacturer). The inverter scroll compressors are capable of changing the speed to follow the variations in the total cooling/heating load as determined by the suction gas pressure measured on the condensing unit. The capacity control range can be as low as 6% to 100%.

VRV systems are engineered systems and use complex refrigerant and oil control circuitry. The refrigerant pipe-work uses a number of separation tubes and/or headers (refer schematic figure above).

A separation tube has two branches whereas a header has more than two branches. Either of the separation tube or header, or both, can be used for branches. However, the separation tube is **NEVER** provided after the header because of balancing issues.

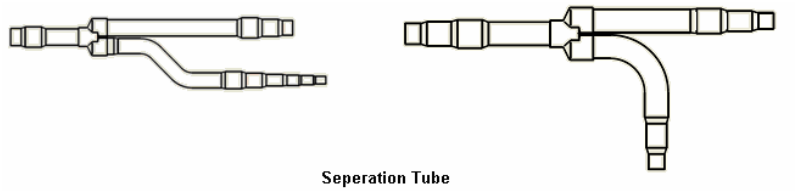


Figure 24 : Joint for separation pipes

4.2 Technical data of indoor units VRV

Cooling capacity	Nom.		kW	1.7 (1)	2.2 (1)	2.8 (1)	3.6 (1)	4.5 (1)	5.6 (1)
Heating capacity	Nom.		kW	1.9 (2)	2.5 (2)	3.2 (2)	4.0 (2)	5.0 (2)	6.3 (2)
Power input - 50Hz	Cooling	Nom.	kW	0.043			0.045	0.059	0.092
	Heating	Nom.	kW	0.036			0.038	0.053	0.086
Casing	Material			Galvanised steel plate					
Dimensions	Unit	Height	mm	260					
		Width	mm	575					
		Depth	mm	575					
	Packed unit	Height	mm	270					
		Width	mm	780					
		Depth	mm	616					
Weight	Unit		kg	15.5			16.5		18.5
	Packed unit		kg	18.5			19.5		21.5

Figure 25 : Technical Data for Indoor Unit VRV (Type 1)

Cooling capacity	Nom.		kW	2.2	2.8	3.6	4.5	5.6	7.1	9.0	11.2	14.0
Heating capacity	Nom.		kW	2.5	3.2	4.0	5.0	6.3	8.0	10.0	12.5	16.0
Power input - 50Hz	Cooling	Nom.	kW	0.038				0.053	0.061	0.092	0.115	0.186
	Heating	Nom.	kW	0.038				0.053	0.061	0.092	0.115	0.186
Power input - 60Hz	Cooling	Nom.	kW	0.038				0.053	0.061	0.092	0.115	0.186
	Heating	Nom.	kW	0.038				0.053	0.061	0.092	0.115	0.186
Casing	Material			Galvanised steel plate								
Dimensions	Unit	Height	mm	204						246		288
		Width	mm	840								
		Depth	mm	840								
	Packed unit	Height	mm	220						260		300
		Width	mm	880								
		Depth	mm	880								
Weight	Unit		kg	19			20	21		24		26
	Packed unit		kg	23			24	26		29		31

Figure 26 : Technical Data for Indoor Unit VRV (Type 2)

4.3 Technical data of outdoor unit VRV

Cooling capacity	Nom.		kW	61.5 (1)	67.4 (1)	73.5 (1)	78.5 (1)	83.5 (1)	90.0 (1)	95.0 (1)	101.0 (1)	106.0 (1)	112.0 (1)
Heating capacity	Nom.		kW	69.0 (2)	75.0 (2)	82.5 (2)	87.5 (2)	93.5 (2)	100.0 (2)	106.0 (2)	113.0 (2)	120.0 (2)	125.0 (2)
Power input - 50Hz	Cooling	Nom.	kW	16.3 (1)	18.2 (1)	20.0 (1)	22.0 (1)	23.7 (1)	26.0 (1)	27.7 (1)	31.5 (1)	31.0 (1)	
	Heating	Nom.	kW	16.5 (2)	18.3 (2)	20.3 (2)	21.9 (2)	23.5 (2)	25.6 (2)	27.2 (2)	29.8 (2)	29.9 (2)	30.9 (2)
EER				3.77 (1)	3.70 (1)	3.68 (1)	3.57 (1)	3.52 (1)	3.46 (1)	3.43 (1)	3.21 (1)	3.42 (1)	3.61 (1)
ESEER				5.58 (17) / 7.07 (18)	5.42 (17) / 6.81 (18)	5.39 (17) / 6.89 (18)	5.23 (17) / 6.69 (18)	5.17 (17) / 6.60 (18)	5.05 (17) / 6.50 (18)	5.01 (17) / 6.44 (18)	4.68 (17) / 6.02 (18)	5.03 (17) / 6.36 (18)	5.29 (17) / 6.74 (18)
COP				4.18 (2)	4.10 (2)	4.06 (2)	4.00 (2)	3.98 (2)	3.91 (2)	3.90 (2)	3.79 (2)	4.01 (2)	4.05 (2)
Maximum number of connectable indoor units				64 (3)									

Figure 27 : Technical Data for Outdoor Unit VRV

4.4 Air cooled heat pump inverter chiller

The heat pump is an extremely flexible and reliable device: an intelligent control module optimizes the operating time and power supply from Scroll compressors based on the heat load required by the system. The device is equipped with R410A refrigerant.

The chiller should be placed and installed in spacious places and with spare parts available, in order for a routine maintenance service not to take more than 5 hours and such an annual service a maximum of 2 days and a break time of 4 days.

The chiller must be selected for a lifespan of at least 12 years (45000 working hours) under the current service conditions of the building, while the chiller must be maintained by the respective manufacturer under a specified maintenance program.

Note!

Heat pumps must be equipped with certificates:

- EUROVENT
- Declarations of conformities according to the European directive 97/23/EC–Annex VII,
- Quality approval according to the European directive 97/23/EC
- UNI EN ISO 9001:2008 (ISO 9001:2008)

Figure 28 : Air cooled heat pump inverter chiller

Cooling capacity	Nom.		kW	16.6 (1)	20.7 (1)	24.7 (1)	30.9 (1)	41.5 (1)	49.7 (1)	62.3 (1)
	Max.		kW	19.8 (1)	24.7 (1)	29.5 (1)	36.9 (1)	49.5 (1)	59.3 (1)	74.3 (1)
Heating capacity	Nom.		kW	17.0 (2)	21.3 (2)	25.7 (2)	32.1 (2)	42.5 (2)	51.1 (2)	63.7 (2)
	Max.		kW	20.2 (2)	25.3 (2)	30.5 (2)	38.1 (2)	50.5 (2)	60.7 (2)	75.7 (2)
Capacity control	Method			Inverter controlled						
	Minimum capacity		%	25						
	Maximum capacity		%	120						
Power input	Cooling	Nom.	kW	5.80 (1)	7.59 (1)	9.74 (1)	13.5 (1)	15.4 (1)	19.7 (1)	27.4 (1)
	Heating	Nom.	kW	5.73 (2)	7.44 (2)	9.36 (2)	11.1 (2)	14.7 (2)	18.5 (2)	21.7 (2)
EER				2.86 (1)	2.73 (1)	2.54 (1)	2.29 (1)	2.69 (1)	2.52 (1)	2.27 (1)
ESEER				4.21	4.18	4.04	3.62	4.24	4.12	3.78
COP				2.97 (2)	2.86 (2)	2.75 (2)	2.89 (2)		2.76 (2)	2.94 (2)
Casing	Colour									
	Material			Polyester coated galvanised steel plate						
Dimensions	Unit	Height	mm	1,684						
		Width	mm	1,371			1,684	2,358		2,980
		Depth	mm	774				780		
	Packed unit	Height	mm	1,860						
		Width	mm	1,394			1,707	2,377		2,997
		Depth	mm	834				838		
Weight	Unit		kg	264	317		397	571		730
	Operation weight		kg	267	320		401	577		738
	Packed unit		kg	291	344		428	616		783

Figure 29 : Technical Data for Outdoor Unit Air cooled heat pump inverter chiller

4.5 Heat recovery ventilation

Heat recuperators work for ventilation and supply the fresh air inside the diferent building and at the same time realize the recovery of heat from the air that rises outside during ventilation and supply the air at a temperature suitable for the environment.
In this way this device makes possible the heating and cooling of the air that is supplied to the environment through the exchanger with a high efficiency without affecting the heating / cooling device during the operation.
These devices will be mounted on the interior ceilings of the building according to the project.

Figure 30 : Heat recovery

TECHNICAL DATA

Size			008	010	013	020	031	042
Power supply	V/ph/Hz		230V/~N/50	230V/~N/50	230V/~N/50	230V/~N/50	400V/3/50	400V/3/50
Type of ventilation units	*							
Heat recovery								
Type heat recovery system	*	type/n°						
Heating efficiency dry	*(1)	%	80	79,9	80	79,9	79,9	83,8
Total recovered heating capacity (EN308)	(2)	kW	4,2	5,4	7	10,7	16,6	22,8
Heating efficiency for renovation	(3)	%	90	90	90	90	90	90
Total recovered heating capacity	(3)	kW	7,2	9,1	11,8	18,1	28,1	38,5
Air flow rate supply/extract	*	m³/s	0,22	0,28	0,36	0,56	0,86	1,18
		m³/h	790	1000	1300	2000	3100	4250
Air flow rate min.		m³/h	200	200	400	1000	1000	1300
Air flow rate max.		m³/h	980	1260	1530	2350	3700	4600
Fans								
Driving	*							
Fans		type/n°	EC/2	EC/2	EC/2	EC/2	EC/2	EC/2
Supplied electrical power consumption		kW	0,16	0,24	0,33	0,6	0,79	1,3
Recovered electrical power consumption		kW	0,15	0,23	0,33	0,56	0,76	1,2
Total input electric power	*	kW	0,31	0,47	0,66	1,16	1,55	2,5
Total input electric power	(4)	kW	0,6	1,24	1,26	1,66	5,26	5,26
Corrente assorbita massima totale	(4)	A	4,6	7,5	7,5	9,3	11,1	11,1

Figure 31 : Aspirator for Gym

4.6 Aspirator for gym

Air aspirators are devices that will serve for ventilation of various environments. These devices are with centrifugal motor which are calculated depending on the environment in order to make it possible to remove polluted odors from different environments and throw them in the space around the building. These fittings will be mounted on the interior ceilings of the building, on the walls and on the terraces according to the project. Aspirators should be boxed and insulated from the factory in order to eliminate possible noise in the surrounding environment.

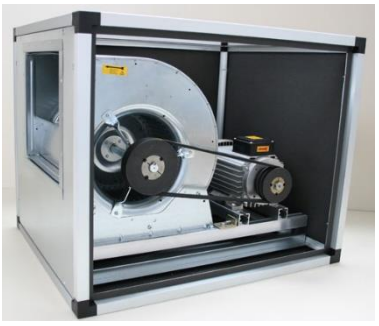


Figure 32 : Aspirator for Gym

m³/h	100 Pa			150 Pa			200 Pa			250 Pa			300 Pa			350 Pa			400 Pa			500 Pa		
	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)	kW	rpm	dB(A)
1.000	0,37	848	65	0,37	1.031	69	0,37	1.191	72	0,37	1.333	74	0,37	1.461	75	0,37	1.577	77	0,37	1.685	78			
2.000	0,37	1078	74	0,37	1.184	75	0,37	1.289	76	0,55	1.394	77	0,55	1.497	78	0,55	1.598	79	0,75	1.697	81	0,75	1886	82
2.000	0,37	704	67	0,37	823	68	0,37	935	70	0,37	1.042	71	0,37	1.146	73	0,55	1.248	74	0,55	1.347	76	0,75	1.536	78
3.000	0,37	825	74	0,55	924	75	0,55	1.014	75	0,55	1.098	76	0,75	1.177	76	0,75	1.254	77	0,75	1.329	78	1,1	1474	79
3.000	0,37	634	70	0,37	734	71	0,37	830	72	0,55	922	73	0,55	1.011	74	0,75	1.096	76	0,75	1.178	77	1,1	1.331	79
4.000	0,55	726	76	0,55	803	76	0,75	879	76	0,75	954	77	0,75	1.027	77	1,1	1.099	78	1,1	1.169	79	1,1	1305	80
4.000	0,37	557	70	0,55	653	71	0,55	739	72	0,75	818	74	0,75	893	75	1,1	964	76	1,1	1.032	77	1,1	1.159	79
6.000	0,75	648	77	1,1	726	78	1,1	801	78	1,5	870	79	1,5	935	79	1,5	995	80	1,5	1.053	81	2,2	1163	82

Figure 33 : Technical Data for Aspirator

4.7 Radiant Floor Heating System

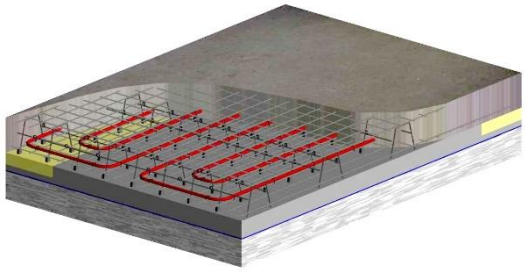


Figure 34 : Detail for underfloor heating installation

4.7.1 System description

The system for under floor heating applications consists of:
- PE-Xa pipe, fittings and accessories
- rails
- retaining pins
- manifolds
- flow temperature control
- zone control

Main supply and return pipes including valves and fittings, main circulation pump, heat source and all other components required to render the system fully operational are not included in this section.

4.7.2 Reference documentation

The documents referred to in this section are:
BS EN 1264 Floor heating - Systems and components
BS 7291 Thermoplastic pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings

4.7.3 General system design, installation and commissioning

Planning, installation and commissioning must comply with the following documents:
BS EN 1264 - Floor heating - Systems and components Piping, Connection and System Guidelines
- Technical information for Under Floor Heating/Cooling
- Technical Information

4.7.4 Project specific design parameters

Pipe	PE-Xa pipe
Pipe dimensions	17 x 2.0mm
System	Radiant Floor Heating System
Pipe laying pattern	Reverse Spiral (Refer to below drawing)
Pipe spacing	100mm
Max. length per circuit	90m (17 x 2.0mm)
Max. floor temperature	29 ºC
Flow control type	3-Way mixing valve in the technical plant

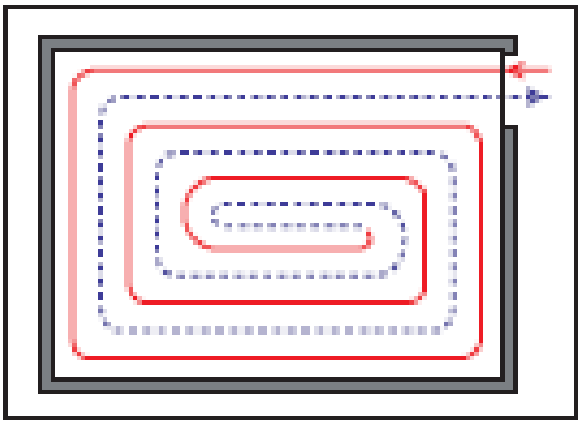


Figure 35 : Floor heating pipe assembly scheme

4.7.5 Materials

- *PE-Xa cross-linked polyethylene pipe*

Pipe materials shall be a PE-Xa inner layer and an outer EVOH oxygen barrier with red adhesive for clear distinction as radiant heating/cooling pipe. Oxygen-tight according to DIN 4726.
Suitable for use in heating and cooling applications in residential and commercial applications in accordance with BS EN 1264 and BS 7291.

- *Pipe performance specification*

Material	Flexible, high-pressure cross-linked polyethylene pipe PE-Xa (in accordance with DIN 16892/16893)
Pressure rating	PN12.5 (derived from AS/NZS 2492)
Design pressure	C Class 5/8bar (in accordance with ISO 15875)
Continuous operation	70 °C at 300 kPa (3 bar)
Maximum operating pressure	600 kPa (6 bar)
Maximum operating temperature	90 °C
short-term maximum temperature	100 °C
Operational life time (at 70°C / 300 kPa)	50 years
Sizes in mm	17 x 2.0mm

4.7.6 Fittings and sleeves

Connections shall be axial compression sleeve mechanism, featuring the following benefits:

- Permanently sealing compression sleeve jointing technique
- Self-sealing pipe material – connection without the use of an O-ring
- Increased hydraulic properties based on expansion technology
- Approved for flush-mounted installation
- Robust jointing technique highly suitable for construction sites
- Simple visual inspection
- Joint can be pressurised immediately after installation
- Requires no calibration or deburring

Fittings and sleeves shall be made of brass with silver surface finish.

4.7.7 System

Rails:

Rails made of impact-resistant and highly stable polypropylene, CFC, HFC and PVC free. With barbs and pins, or alternatively flat bars with molded connectors, to securely hold the pipe and to prevent the pipe from floating. Rails can be connected and provide a pipe spacing of 50mm and multiples thereof. Suitable for pipes 17mm.
Rail length 1000mm, width 50mm, height 27mm, pipe lift 5mm.

4.7.8 Retaining pins:

Fixing pins made of polypropylene to fasten the FIX rails to the insulation sheet. Length 50 mm, tip distance 20mm.

Edge insulation strips:

To prevent sound and heat bridges. Made of closed cell polyethylene foam, with profiled wall, a self-adhesive strip on back and foil flaps. The tear-proof foil flaps with self-adhesive film base prevents moisture and water from the screed reaching the EPS floor insulation. Height 180mm, thickness 10mm.

Technical Data	
Material wall	PE (Polyethylene)
Material foil flap	PE (Polyethylene)
Height	180mm
Gauge	10mm
Length foil flat	280mm

Expansion joint profile:

To provide a thermal break between adjoining heated screeds and/or controlled zones and to form permanently elastic joints between screed fields. Self-adhesive base to ensure secure retention on the insulation layer. Height 100mm, thickness 10mm, length 1200mm.

Technical Data	
Material wall	PE (Polyethylene)
Material foil flap	PVC-U
Height	100mm
Gauge	– 11mm
Length	1.2m

PE (Polyethylene) Membrane

The PE (Polyethylene) membrane must be tear resistant and meets the requirements set out for DIN 18560. Must prevents moisture and water from the screed reaching the EPS floor insulation and therefore reduces heat bridging.

4.7.9 Manifold

Manifolds shall be installed at a location and position as a design condition. The number of manifold outlets shall correspond to the number of circuits served by that manifold.

- Fittings
  All manifolds are supplied with:
  - Two 1" isolation ball valves - red for flow and blue for return
  - Two combination valves with manual air vent and fill/drain point.

  Both can be mounted either side of the headers.

- Fixings
  The manifolds should be fixed directly to a solid structure, or within a manifold cabinet. When attaching the pipe to the manifold a retaining pipe rail should be used along with fixing lugs to secure the pipe in place.

- Manifold cabinets

Manifold cabinets will be made from galvanized steel with welded seams for strength and durability. Integral brackets allow for easy mounting of brass manifold. Cabinets come with adjustable legs to mount the cabinet on the floor; legs can be removed to flush-mount the cabinet inside a wall cavity. Height and depth are adjustable. Cabinets include a steel door and have pipe knockouts on both sides for pipe connections to the manifold.

	Dimensions (mm)			Dimensions (in)			Package	Unit Weight	
Stations	W	H	D	W	H	D	Quantity	kg	lb
1 to 3	400	700	110-160	15.7	27.6	4.3-6.3	1	10.0	22.0
2 to 6	550	700	110-160	21.7	27.6	4.3-6.3	1	13.0	28.7
3 to 9	750	700	110-160	29.5	27.6	4.3-6.3	1	16.0	35.3
4 to 12	950	700	110-160	37.4	27.6	4.3-6.3	1	19.0	41.9
5 to 12	1150	700	110-160	45.3	27.6	4.3-6.3	1	22.0	48.5

4.7.10 Installation and commissioning

- *Installation*

Make sure installation area is fully cleared, flat even floor and surface free of irregularities.
Coordinate with builder at shop drawing stage to identify all construction joints and saw cuts with concrete floors. Install the manifold straight at the designated position.
Ensure the area for installation remains dry and weathertight by incorporating a dampproof membrane in the floor slab. Lay insulation to the total area of the installation, with edge insulation on all internal and external wall lines. If the floor construction is a two-part slab with the walls already in place, edge

insulation is required around the walls to prevent heat loss up the walls and to allow the screed for expansion.

Connect rails to form the desired length and lay parallel on the floor with a spacing of 1m. Secure rails with retaining pins with a spacing of 400mm. Connect one end of the pipe to the manifold and clip the pipe into the moulded connectors of the rail. Secure the pipe in areas of direction change with additional Tacker staples or retaining pins. Mark all heated and non-heated areas and floor joints on the floor area. Assemble the expansion joint profile.

- *Pipework Layout*

Pipework fixed onto the insulation board to designer's recommendations. Lay pipes in a continuous length from the manifold in the pre-designed configuration. Fittings can be embedded into concrete if agreed with designer. Fittings to be wrapped with PVC tape. Pipes start and finish at the manifold position. Pipes must run to the corresponding port on the manifold. Do not cross pipes over in the floor. Note the real pipe length of each circuit to adjust the hydraulic balancing of the manifold. Mark the name of each circuit on the corresponding manifold outlet.
All coils in floors shall be installed strictly in compliance with the requirements of the structural engineer and in accordance with the recommendations for concrete floor heating applications. Piping shall be installed completely free of twists, warps or buckles. Screed height should provide a minimum thickness of 45mm above the crown of the pipework. Depending on structural loads the screed thickness must eventually be increased.

- *Conduit Sleeving*

Sleeve all flow pipes with conduit sleeving where the pipe enters and returns from screed/ concrete for the first metre to requirements. Sleeve across construction joints in floor. When installing pipe in door frames or through walls install a section of corrugated sleeving in this area to allow free movement of the pipe.

- *Connection to main supply and return lines*

Provide total flow rates and head losses for each manifold to the contractor of the main supply and return lines to enable them to design pump sizes, pipe dimensions and all other components required to render the system fully operational. The connection of the UFH/C system to the main supply and return pipes is the duty of the mechanical contractor.

- *Filling and Pressure Testing*

Pressure test the system with water before the slab is laid to ensure all joints are watertight and no damage has occurred to the pipe during installation. In case of freezing conditions, add antifreeze to avoid freezing of the water in the pipes. Make sure antifreeze is suitable for PEX and brass materials. Allow for pressure testing of the underfloor heating pipe circuits to 600kPa. Lay the slab as soon as possible, in good contact to the pipes, without any air pockets, after laying the pipe circuits and completion of a pressure test. Leave pipe circuits under pressure until concrete is cured. Provide signed and witnessed pressure testing protocol.

- *Initial Warm-Up*

Allow the concrete to dry for 3 weeks. Balance the system via the valves on the manifold to achieve an even flow and heat up. Start the warm-up procedure according with the requirements. Provide signed and witnessed warm-up protocol.

- *Commissioning*

Ensure the complete central heating system, including main supply circulation pump is working. Based on the real pipe length noted during laying of the pipework, adjust each circuit slowly via the valves on the manifold to ensure an even flow and heat up is achieved (hydraulic balancing). Provide commissioning certificate.

Run the system for at least two weeks before the floor covering is finally laid. For floor coverings use adhesive suitable for temperatures up to 40ºC.

4.7.11 Documentation

- *Design Data*

Installer to provide pipe layout drawing to main contractor prior to installation.

- *As-Built documents – to main contractor*

Installer to provide as-built information to the main contractor on completion of the UFH/C installation, including:

a) Photographs recording actual layout
b) Drawings showing the as built layout
c) Protocols for Pressure Testing, Warm-up and Commissioning

- *As-Built documents – to owner*

Installer to provide as-built information to the owner within 10 working days of practical completion, including:

a) Photographs recording actual layout
b) Drawings showing the as built layout
c) Protocols for Pressure Testing, Warm-up and Commissioning