TECHNICAL REPORT

SHKOLLA 9-VJECARE "EMIN DURAKU"

Project Name:

Reconstruction of 9-Year School "Emin Duraku",

Tirana Municipality

Programme Title: *EU4Schools*
Financed by: *European Union EU*
Design Team: *HT Construction (High Tech Construction) Ltd*

TIRANA, 2021

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Date: 2022.03.09 12:52:36 +02'00'

HVAC TECHNICAL REPORT

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1. Selection of mechanical systems

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 envisaging 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 have been taken into account during the design as an essential reference for the qualification of mechanical implant solutions:

- Adherence to technical norms
- Comfort of service,
- Functional reliability,
- Inspection,
- Hygiene and safety,
- Personalized efficient use,
- Low operating costs,
- Sustainable investment,
- Low maintenance costs,
- Standardization of system components,
- Ecological and environmental friendly,

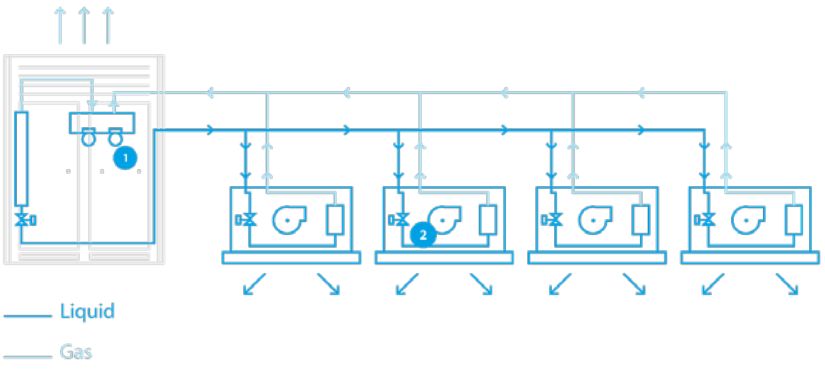
The selected air conditioning system is designed in accordance with the respective European norms and Albanian standards.

2. Introduction

Heating, ventilation, and air conditioning (HVAC) system is designed to achieve the environmental requirements for the comfort of building occupants.
HVAC systems can be classified according to necessary processes and distribution process. The required processes include the heating process, the cooling process, and ventilation process. Other processes can be added such as humidification and dehumidification process also air quality monitoring. These processes can be achieved by using suitable HVAC equipment such as heating systems, air-conditioning systems, ventilation fans, air monitoring devices and dehumidifiers. The HVAC systems need the distribution system to deliver the required amount of air with the desired environmental condition. The distribution system mainly varies according to the refrigerant type and the delivering method such as air handling equipment, fan coils, air ducts, and pipes.

3. Selecting an energy and cost-efficient system

HVAC system selected for Emin Duraku School is the Variable Refrigerant Volume (VRV) system also referred to as VRF, variable refrigerant flow.
VRV is a technology that alternates the refrigerant volume in a system to match a building's precise requirements. Only a minimum amount of energy is required for a system to maintain set temperatures and ensure that it automatically shuts off when no occupants are detected in a room. This unique mechanism achieves more sustainability in the long run, as end users save on energy costs while reducing their system's carbon emissions.



With up to 64 indoor units connected to 1 outdoor unit, the VRV system operates similar to a Multi-Split system. Each individual indoor unit determines the capacity it needs based on the current indoor temperature and requested temperature from the remote control (set point).

The total demand among all indoor units will determine how the outdoor unit adjusts the refrigerant volume and temperature accordingly. By only supplying the cooling or heating that is needed, the inverter compressor continues to save a large amount of energy during VRV operation.

4. Design Conditions

Thermo hygrometric comfort conditions (physiological wellbeing) that can be provided within the premises are subject to the use of the premises. The following data are used as references for the project.

Location	**Tirane**
Geographic Longitude	41.3275° N, 19.8187° E
For the heating period - Winter	
Internal temperature calculation	
✓ Classrooms	20 - 22°C
✓ Corridors + service areas	18°C
Internal relative humidity	45–55%
Air speed	0.13 - 0.15 m/sek
Internal circulation	min 2 Vol/ore
Outdoor design temperature	0 °C
External outdoor humidity	90 %
For the cooling period - Summer	
Internal temperature calculation	24–27°C
Internal relative humidity	50–60%
Air speed	0.16 - 0.23 m/sek
Internal circulation	min 2 Vol/ore
Temperature max. of the hot month	36 °C
External outdoor humidity	55 %

5. Noise level

The maximum permissible noise levels within the premises are determined by UNI 8199 and are 35 dB (A).

6. Air Quality

Air quality is especially related with the particular use of the building, its destination and activity, pollution, etc. In order to maintain indoor acceptable conditions, natural ventilation shall be scheduled by the maintenance team.

Another aspect of air quality is the allowed speed of the air flow that circulates in the ambient due to air supply grilles. The acceptable airflow parameters in school classrooms air are prescribed according to UNI 10339 and ASHRAE 62 / 89R.

It is strongly recommended to install air quality monitoring devices after HVAC commissioning handover.

7. Heat load

Heat loads have been reviewed all factors influencing such, orientation with the horizon, adjacent zones/areas, the thermo physical characteristics of the surrounding walls, windows, floors, ceilings, etc.

Heat loss is also influenced by the zone occupancy, lighting, natural ventilation, etc., which are anticipated in the terms, discussed in advance with the architect.

Thermal loads based on the nature of the factor and the influence on the thermal balance is counted as losses or as thermal additions, however, those influencing directly are:

- the number of persons present in the area;
- their physical activity;
- the level of lighting and installed electrical appliances;
- the level of solar radiation;
- air infiltration by door-window (natural ventilation).

The loads in the air conditioning systems depend on the fact that not all the premises are loaded or used in a constant manner.

Thus, this fact requires the concentration chart or the operating chart of the air conditioning plant, to relate to the typology of the system and its degree of automation, control and command.

All of these factors, as understood are not always present in the same value and with the same influence, therefore considered as a variable thermal load (loss). While in the architectural

construction, etc. building result, constant thermal loss (wall, window, door, floor, ceiling, etc.) is calculated.
These factors have a constant influence on thermal loads and as such are carefully selected so that the cost of plant construction does not exceed the goal of saving energy losses and on the other hand, does not over-dimension the air conditioning system.

From the point of view of thermal capacity of the equipment, we underline that the load capacity varies considerably during the day based on the variation of the occupation of the premises. In order to avoid super-dimensioning of equipment capacities, was preliminarily analyzed the occupancy profile of the area as well as the preliminary prediction of energy consumption.

8. Description of HVAC system

Emin Duraku school facilities will be served by the VRV System (VRF) system. The outdoor units of the VRF system will be of the single block type and will include at least one Scroll compressor of the Linear Inverter type with frequency change bands (30Hz - 115Hz), thus enabling the adjustment of the speed and the amount of fluid in compliance with heating / cooling requirements. They will be placed on the terrace of the building.
The indoor units for the offices are designed of the vertical type on the floor, while for the school premises they will be of the mural type. They will be connected to the outdoor units through two lines of copper pipes as well as distribution elements of the collector distribution type as well as "branching header" pre-prepared in the factory.
The operating conditions of each indoor unit will be selected individually by each user and will be supervised by a central control system.

8.1. Fluid circulation

The connection between indoor and outdoor units will be made with quality copper pipes, with pipe thickness suitable for use for fluid R410a or R32 according to the chosen equipment. They will be insalled in a straight line, with supports every 5m (maximum), inside the suspended ceiling. Pipeline crossings will be optimized to maximize longitudinal losses.

All welds will be made with nitrogen currents and special care must be taken eliminating the risk of dirt or moisture remaining inside the pipes.
All deviations will be made with ready elements of the type "multi kit or header", horizontally or vertically and always in accordance with the recommendations of the manufacturer's installation manual.
Each pipe will be thermally insulated separately, with thermal insulation material M0 or M1, with a minimum thickness of 9 mm for the liquid line and 13 mm for the gas line.

8.2. Electrical connections

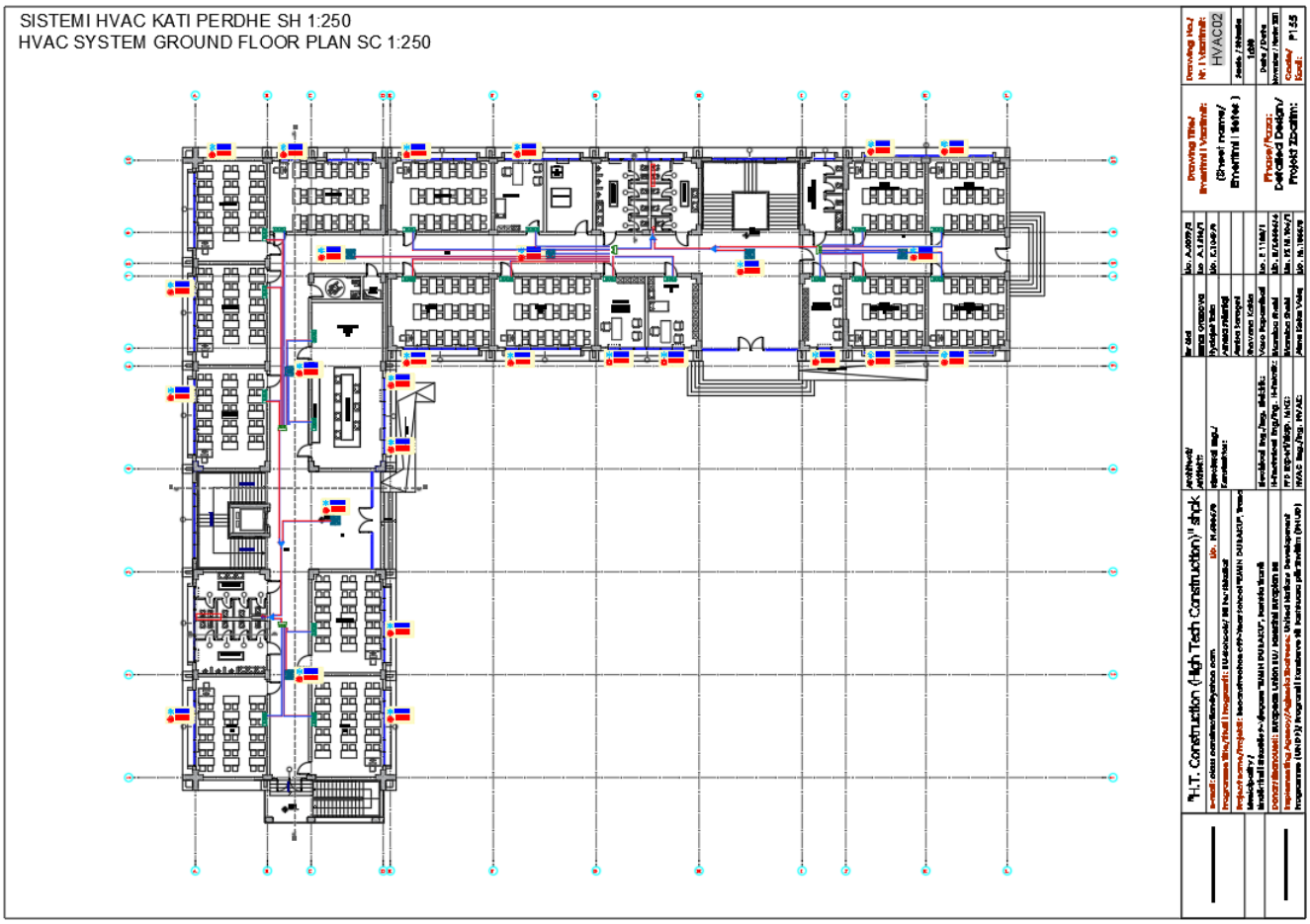
Each outdoor unit will be equipped with panel 400V / 3 / 50Hz + neutral + earthing with protection at the entrance of the line and circuit breaker type D.
Each indoor unit will be supplied by 220-240V / 1 / 50Hz panel + Neutral + grounding with line input protection and type C circuit breakers.
A bus connection will enable communication between outdoor units and all indoor units. The bus will include 2 conductors with a minimum cross section of 0.75mm2, un polarized and scrambled.
When several indoor units are installed in the same environment, they will be connected together with an H-LINK bus, limiting the risk of connection errors. The communication network must be able to connect together all internal and external units.

8.3. Management System

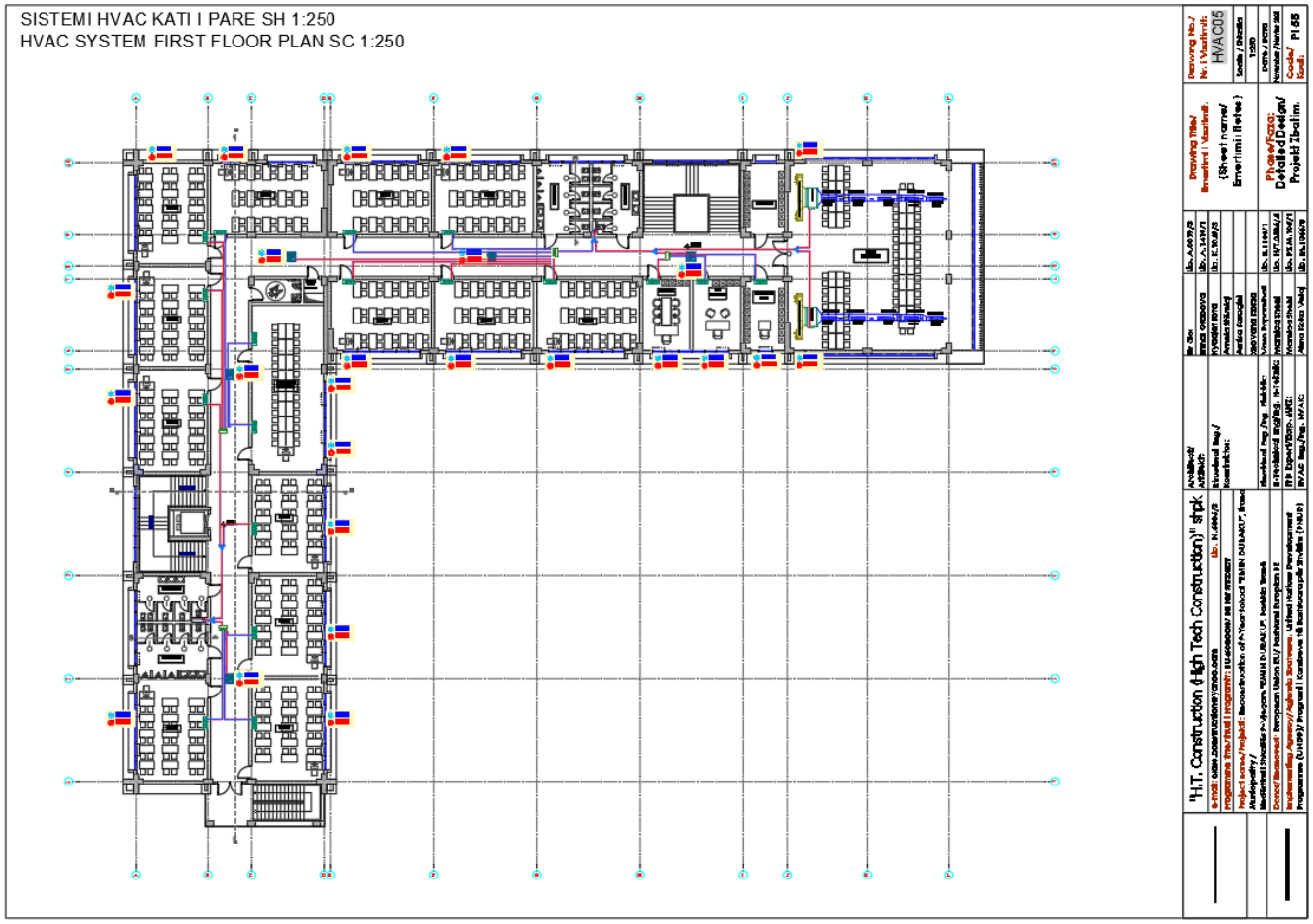
Indoor units will be controlled by REMOTE CONTROL remote controllers.
Each controller must command and control individually and simultaneously all indoor units through a "liquid crystal" display and will enable the user to select and view the following parameters:
turning the device on and off;
required temperature (in the range 17 ° C / 30 ° C);
room temperature;
fan speed (Hi / Me / Lo).
The remote controller must be able to select the mode of operation (5 modes including automatic heating / cooling), command of the weekly control, protection against freezing, etc.

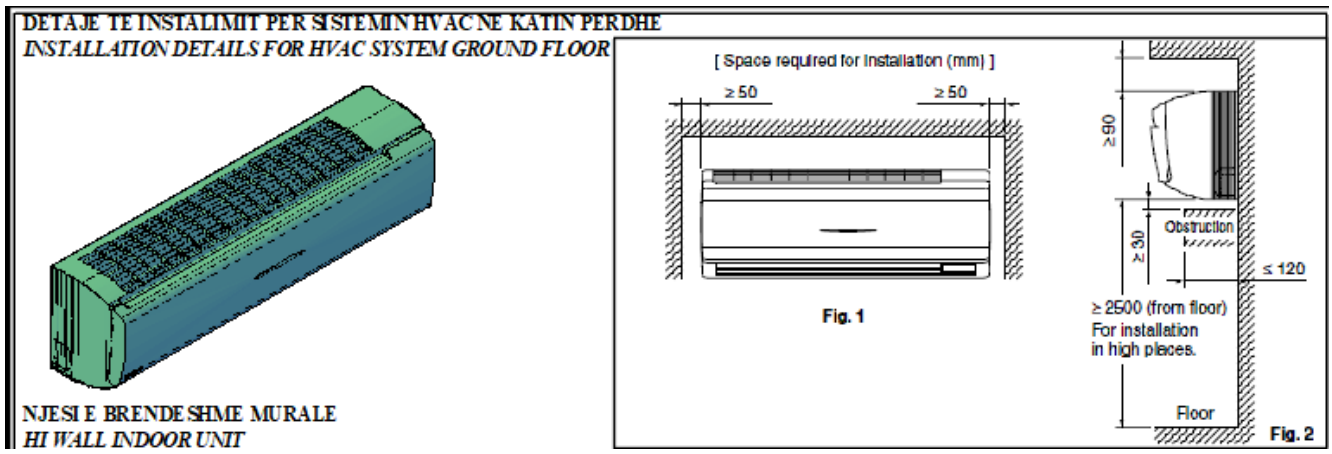
Through a simple programming, the remote control should enable, among other things, the possibility of observing the operating parameters (required temperature, mode of operation, fan speed and all other functions and parameters necessary for maintenance (error codes, auto diagnostics, etc.)

8.4. HVAC system ground floor

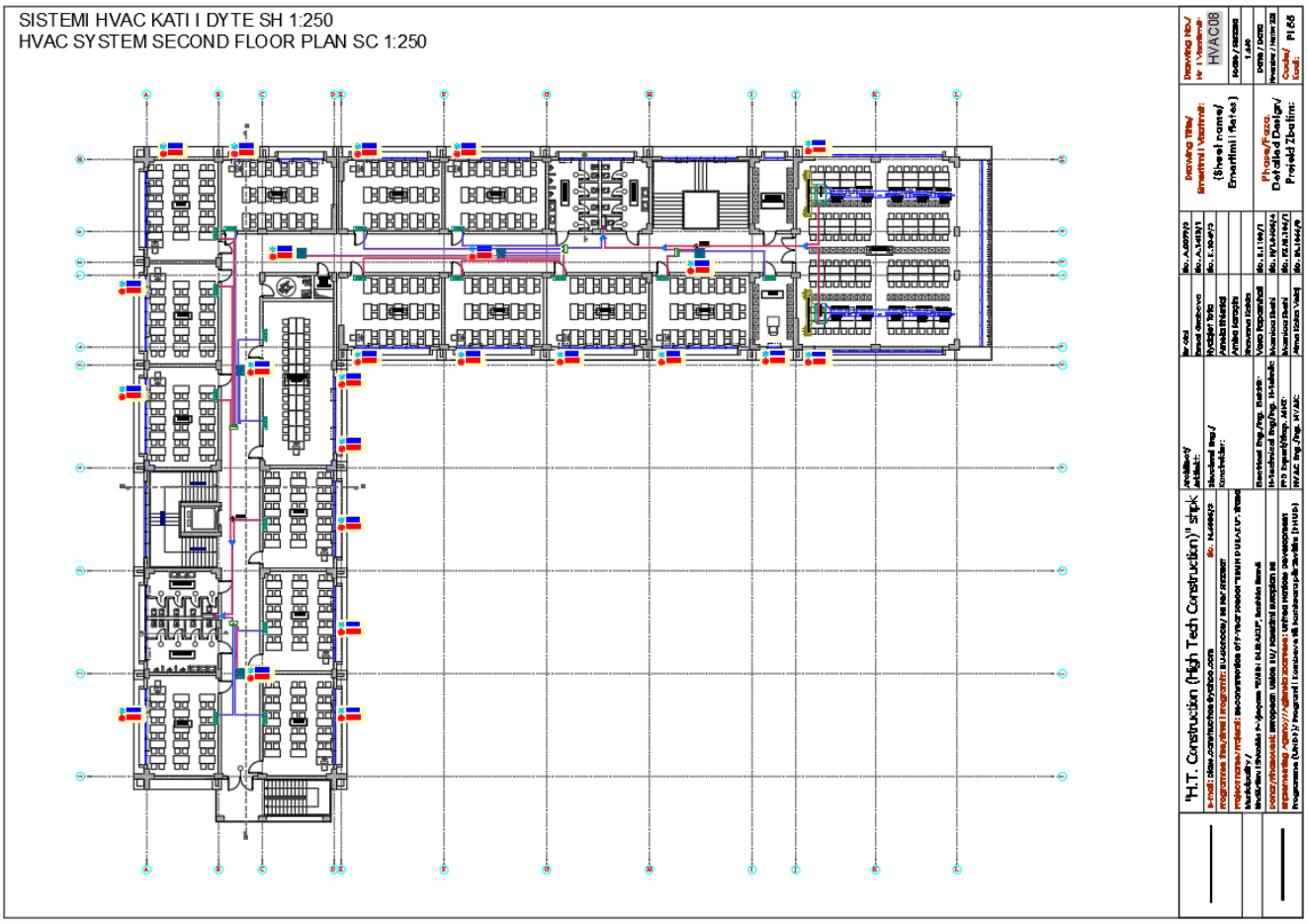


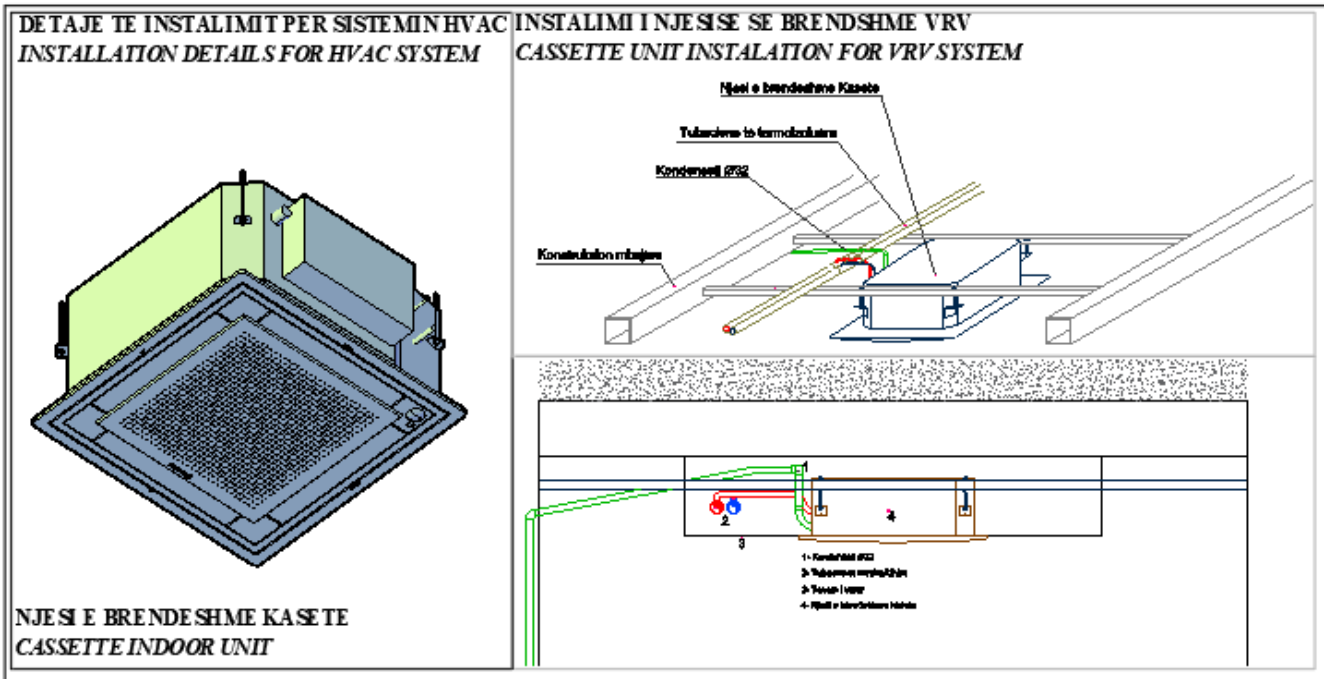
8.5. HVAC system first floor



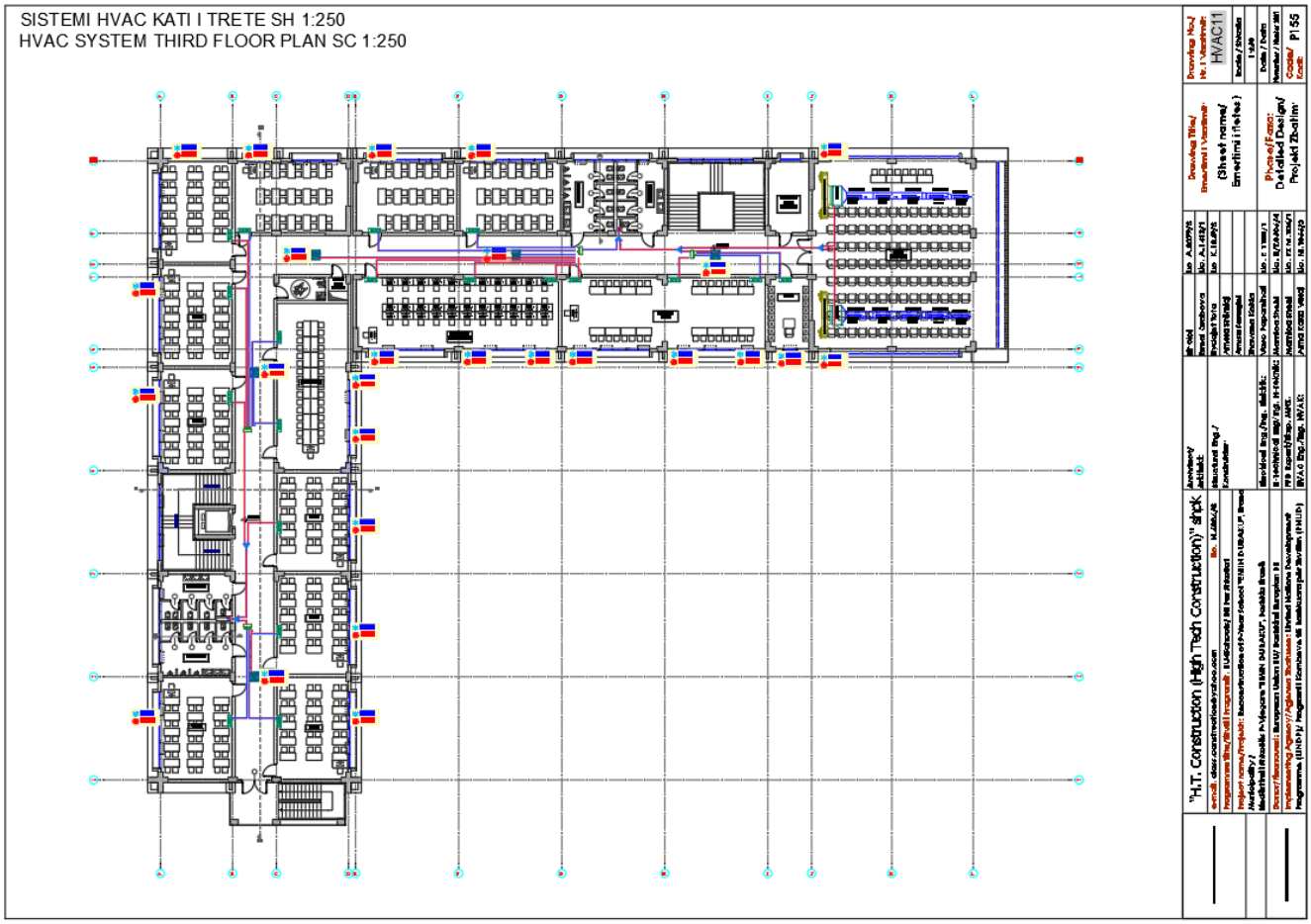


8.6. HVAC System Second floor

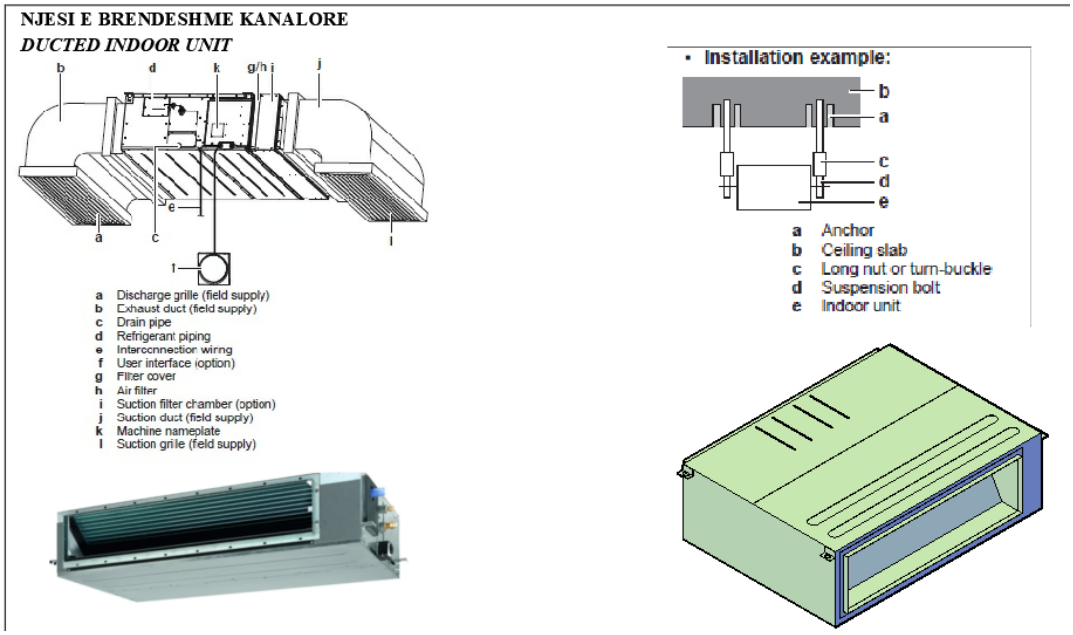




8.7. HVAC System Third floor

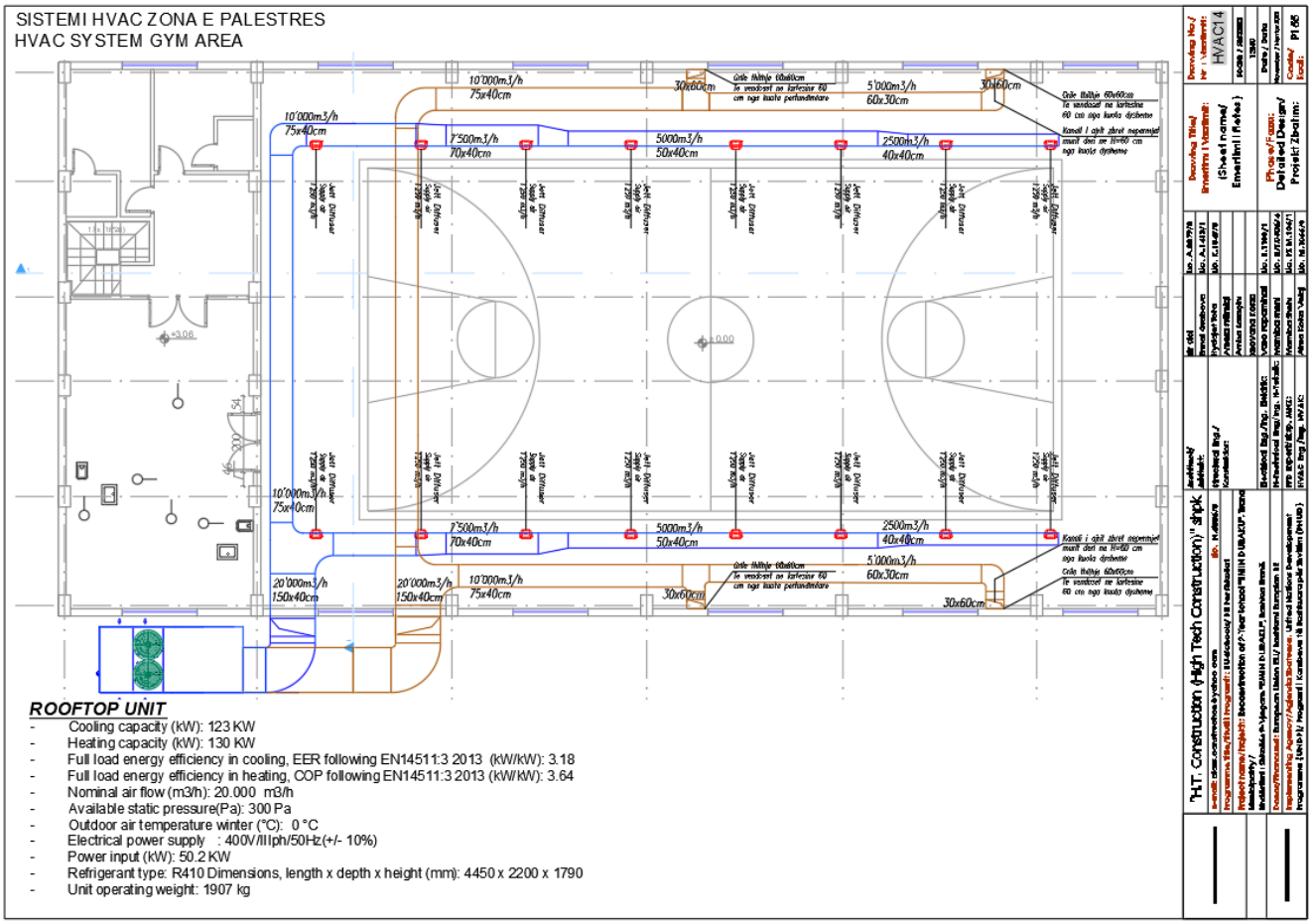


8.8. HVAC system installation details



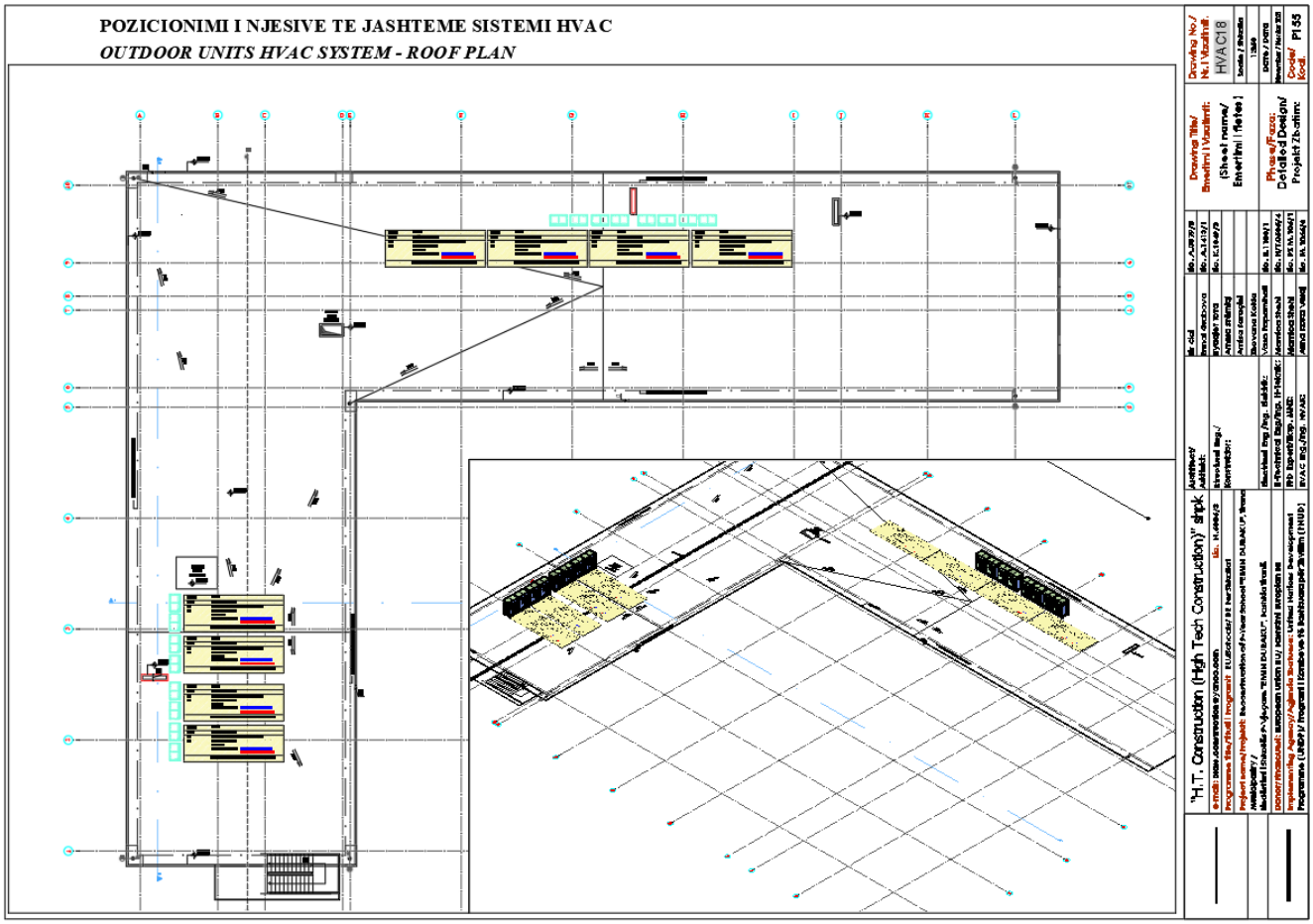
8.9. HVAC system for gym area

Gym area will be treated separately relying on one rooftop unit installed next to the gym building. The pipeline network and diffusers will distribute the air conditioning to the entire environment.



8.9.1 Rooftop Unit for Gym Area

8.10. Plan of the outdoor units on the roof



9. Njesia e jashteme

All outdoor units of the VRV system shall be placed on the roof following the design plans.

10. Cooling/Heating Terminals

Indoor units in hallways shall be cassette type inverter VRF indoor units.

These units ensure comfort parameters for kids because of good orientation of the air flow.

For school classrooms hi wall type air terminal is selected.

11. Typical installation of VRV system