

DREAMERS

Design REsearch, implementation And Monitoring of Emerging technologies for a new generation of Resilient Steel buildings

Executive project of mechanical and electrical building services

Deliverable D3.1 – D11

WP3 - Executive design of the electric and mechanical systems, structural design of the façade and of the non-structural components, definition of the technical specifications to achieve the targeted sustainability

Coordinator:

Vincenzo Piluso

Authors:

Nicola Galotto, Alessandro Vitale, Alfonso Pisano, Roberto Campagna, Michele Petrocelli, Fabrizio Fiorenza, Rocco Carfagna, Giuseppe Sorrentino, Aniello De Martino, Valentino Vitale, Salvatore Ferrandino, Vincenzo Agosti

University of Salerno, Fisciano (SA), Italy



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LIST OF CONTENTS

1. INTRODUCTION	3
2. WINTER/SUMMER AIR CONDITIONING SYSTEM	3
3. ELECTRICAL BUILDING SERVICES	9
4. FIRE FIGHTING WATER SYSTEMS	11
5. THE TECHNICAL GAS SYSTEMS	12
6. THE WATER SYSTEM AND SEWAGE SYSTEM	12
7. THE DATA NETWORK	15
8. LIST OF EXECUTIVE DESIGN DOCUMENTATION	17

LIST OF TABLES

Table 1: Climatic data	4
Table 2: Heating and cooling capacities.....	4

LIST OF FIGURES

Figure 1: Heating and cooling system – ground floor with technical compartment	6
Figure 2: Heating and cooling system – first floor	7
Figure 3: Heating and cooling system – second floor	8
Figure 4: Heating and cooling system – distribution between the floors	9
Figure 5: Photovoltaic park located on the roof of the building	10

1. INTRODUCTION

This deliverable is aimed to provide a summary of the design choices concerning the executive project of mechanical and electrical building services of the C3 Building within the framework of RFCS DREAMERS project. The services equipping the building are the fire fighting water systems, the electrical system, the photovoltaic system, the technical gas systems, the air conditioning system, the hydronic system, the water system and sewage system, the data network.

The concept and design of the mechanical and electrical services of the building has been carried out to accommodate the maximum displacements required by the structure under seismic loading conditions. To achieve this goal, flexible fittings have been used where needed. Moreover, the services have been designed, aiming at ensuring high standards in terms of environmental sustainability according to the instructions provided by Task 1.3. The Task has been accomplished by UNISA that, through its internal technical design office, has produced the executive project of the building services (mechanical, electrical, plumbing, etc.). The project complies with the quality standards set by Italian law (Decree Law 50/2016). Energy and sustainability issues have been solved, considering the use of up-to-date services relying on renewable resources, leading to the design of an NZEB building.

According to the Grant Agreement all the design documentation is due in Italian language, because it has to fulfil the Italian Code provisions and has to be delivered to the National local authorities to obtain the relevant authorizations. Therefore, in this report only a brief discussion is provided. However, the detailed design documentation is also listed at the end of this report and fully delivered (in Italian) on the project website (www.dreamersproject.eu).

2. WINTER/SUMMER AIR CONDITIONING SYSTEM

The winter/summer air conditioning system envisaged for the building varies according to the intended use of the rooms, a hydronic system with fan coils will be implemented for the offices, while an all-air conditioning system is foreseen for the laboratories. The generation of the carrier-fluid used will take place through a system of high efficiency heat pump generators which work sequentially according to the actual requirements of the building, modulating power and flow rate. The heat pumps are equipped with a desuperheater unit which, through active heat recovery, allows the production of a hot vector fluid in a percentage of approximately 20% of the nominal cooling capacity, even when the generators work cold for summer air conditioning.

The use of the reversible heat pump and the hydronic terminals makes it possible to air-condition the rooms in all seasons, guaranteeing at the same time a high environmental comfort and the reduction of energy consumption due to the use of a low temperature heat vector (40-45°C).

The system described consists of the following components:

- Automated vector-fluid softening system;
- Reversible cascade heat pumps with high efficiency, low noise and complete with desuperheater module;
- Insulated 1500-litre buffer tank in hydraulic separator configuration;
- Inverter circulation units on primary heat pump circuit;
- Primary distribution manifolds;
- Separate inverter circulators for the Air Conditioning and Ventilation circuits;
- Air Handling Unit with Hydronic coils;
- Cross-flow Heat Recovery for Primary Ventilation;
- Supply lines on the various floors of the building;
- Floor distribution circuit;
- Hydronic Terminals - 4-Way Cassette Fan Coils;
- Hydronic Terminals - Channel coils.

The climatic data for the design of the winter/summer air conditioning system are given in Table 1.

Table 1: Climatic data

Location	Fisciano (SA)	
Degree Days	1637	
Climatic Zone	C	
Design external temperature (winter)	0 °C	
Outside temperature dry bulb (summer)	30.6 °C	
WINTER REFERENCE PARAMETERS		
External reference temperature	0,0	°C
Average relative reference humidity	70,0	%
Final internal temperature	21,0	°C
Average final relative humidity	50,0	%
SUMMER REFERENCE PARAMETERS		
External reference temperature	30,6	°C
Average relative reference humidity	45,0	%
Final internal temperature	24,0	°C
Average final relative humidity	50,0	%

The calculations were carried out using the transmittance values of the building components. The calculations of the thermal and cooling requirements were processed using software approved by the Italian Thermotechnical Committee. The results of the necessary heating and cooling capacities are summarized in Table 2.

Table 2: Heating and cooling capacities

SECOND FLOOR OFFICES					
Winter Power Air Conditioning	13,50	[kW]	Winter Power	29,50	[kW]
Winter Power Ventilation	16,00	[kW]			
Summer Power Air Conditioning	20,00	[kW]	Summer Power	27,00	[kW]
Summer Power Ventilation	7,00	[kW]			
FIRST FLOOR LABORATORIES					
Winter Power Air Conditioning	13,50	[kW]	Winter Power	64,50	[kW]
Winter Power Ventilation	36,00	[kW]			
Power for temperature control (+3°C) C)temperatura (+3°C)	15,00	[kW]			
Summer Power Air Conditioning	20,00	[kW]	Summer power	85,00	[kW]
Summer Power Ventilation	50,00	[kW]			
Power for temperature control (-3°C) C)temperatura (+3°C)	15,00	[kW]			
			Winter Calculation Power	94,00	[kW]
			Summer Calculation Power	112,00	[kW]

The vector-fluid distribution network will be made with different pipes depending on the area of use:

- Transport pipes in external environments and thermal power plant: Seamless pipes in black steel compliant with UNI 10255 standard;

- Distribution manifolds: Seamless pipes in black steel compliant with UNI 10255 standard joined by electric arc welding;
- Distribution inside the locals: Multilayer polyethylene pipes with vapor barrier (internal PE-X, intermediate AL, external PE-HD) connected by means of fittings with a "press" system.

The distribution circuit will consist of supply backbones with branches near the points of use, the pressurization system will ensure that the pressure and flow rate required by the application are maintained.

The delivery and return circuits will lead to the manifolds located in the technical compartment, will develop along the main backbones and will end in special terminal distribution manifolds, from which the connection pipes with the Fan Coil units will depart.

All the pipes making up the Carrier Fluid distribution circuit must be installed complete with insulation made with closed-cell elastomeric insulation, also as regards the pipes and shut-off devices installed in external environments, the insulation will be protected with casings made of aluminium plate and fixed with mechanical connections in order to guarantee the water proofing of the coating.

The sizing of the pipes was carried out according to the maximum speed criterion.

Concerning the equipment, a reversible heat pump is adopted: an air cooled water chiller/heat pump with axial fans, running on gas R410A, scroll type compressors, bearing structure in steel sheet panels, plate heat exchangers, complete with electrical panel pre-assembled on board the machine, power supply 400 V-3-50 Hz.

The reversible heat pump, the carrier fluid storage and distribution system will be located in the technical compartment (Figure 1) specially created in the basement, a solution that guarantees complete management of the system even in adverse weather conditions.

The circulation group has the task of distributing the carrier fluid to all points of the secondary circuit, the design choice fell on a modular model capable of responding linearly to the demands of the system.

Regarding the Fan Coil Terminal Units of the Office Floor, based on the results obtained from the calculation of the thermal powers required for each individual room and maintained the initial hypotheses on the subdivision of the two systems serving them (Aeraulic, Hydronic), the sizing of the Fan Coil terminal units was carried out. The criterion used was to size the units on the basis of the demand in the summer period (which represents the most onerous condition).

The internal units provided are cassette fan coils with 4-way diffusion installed on the ceiling and equipped with a Brushless Inverter motor which allows precise adaptation to the real demands of the internal environment without temperature oscillations. The air flow rate can be varied continuously via a 1-10 V signal generated by regulation and control commands, which significantly improves acoustic comfort.

The hydronic terminal units will be equipped with a regulation system which, by acquiring the temperature and humidity values of the room from special sensors in the field, will be able to modulate the fluid flow rate and the speed of the internal motor according to the request.

The management of the flow takes place via the inverter circulators and the balancing of the circuit is guaranteed by the automatic regulation and balancing valves installed on board the individual terminals.

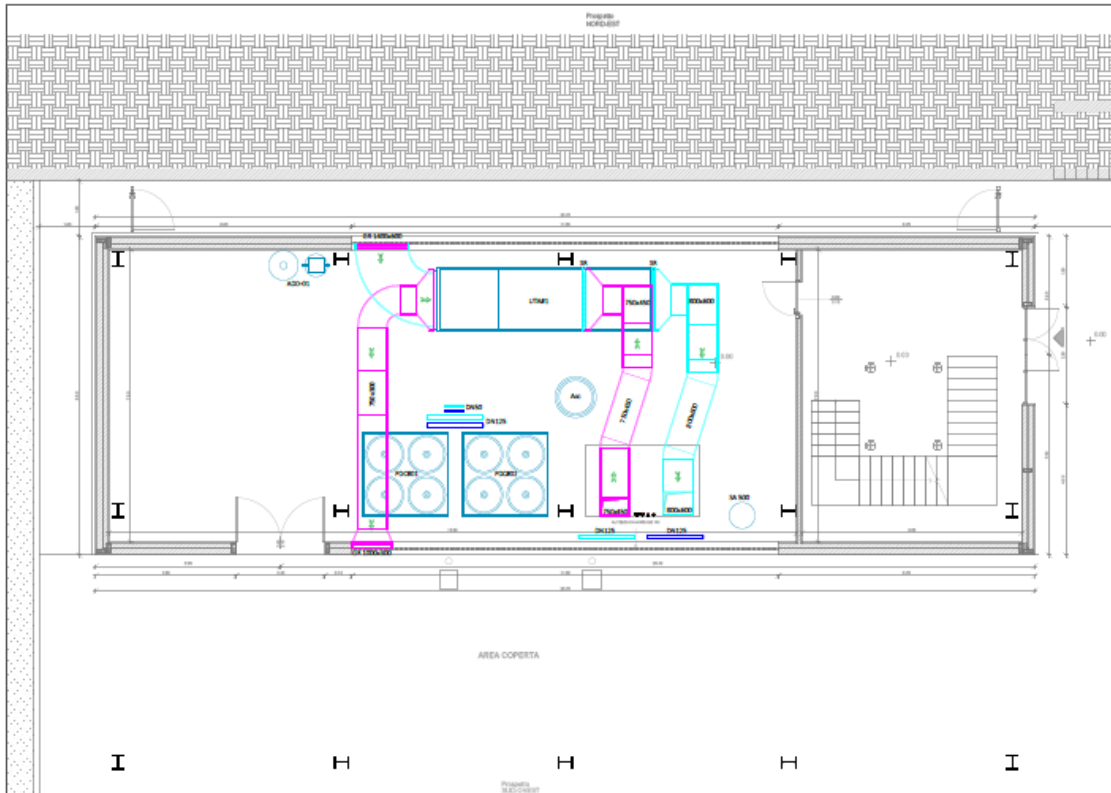


Figure 1: Heating and cooling system – ground floor with technical compartment

Concerning the Channel Hydronic Battery Terminal Units of the Laboratory Floor, hydronic coils powered by the vector fluid produced by the heat pump generators will be provided into each individual environment to allow the "fine" adjustment of the temperature of the air introduced. The heat flow will be adjustable via room thermostats and automatic two-way valves with three functions: regulation, pre-definition of maximum volumetric flow and automatic flow regulation.

Moreover, in order to prolong the life of the plant, it was decided to use treated water for the production of the carrier fluid, for this purpose the project involves the implementation of a duplex ion exchange softening system.

The air renewal systems inside the building will be implemented with an operating logic which involves introducing mechanically (through filtration) and thermally (by means of a hydronic battery) primary air into the environment in order to respond to the characteristics desired final temperatures.

The primary air system is sized in compliance with the UNI 10339 standard which, in relation to the size and intended use of the rooms, imposes numerical coefficients for calculating the necessary air volume. As far as the toilets are concerned, always responding to the dictates of the aforementioned legislation, an extraction of air equal to 8 volumes/hour will be envisaged.

The ventilation system proposed for the second floor where the offices are located involves the use of a cross-flow heat recovery unit, a single unit installed in the toilet rooms and sized in such a way as to make up for the required amount of air; the vector fluid (hot in winter and cold in summer) produced by the heat pump serving the system allows the thermal treatment of the air introduced through heat exchange coils installed in ducts.

The delivery and expulsion ducts of the air for distribution to the floor abut from the recuperator. The air speed in the primary supply and return ducts will always be below 6.0 m/s to limit noise.

In order to allow the correct diffusion of the air, the ducts will be equipped with aeraulic delivery and recovery elements equipped with adjustable calibration dampers to allow the correct balancing of the system, furthermore, near the connections on the heat recovery units, some manually operated regulation shutters. The distribution will take place in the locals in various ways; air inlet on the ceiling by means of aeraulic diffusers installed in the false ceiling module and equipped with a plenum for a uniform distribution of the air and an adjustment damper for the correct balancing of the flow rate. The return air, on the other hand, will be conveyed by means of grilles positioned in the lower part of the

rooms, which are also equipped with an adjustment damper. On the first floor where the laboratories are located (Figure 2), it was decided to implement an all-air ventilation system sized in compliance with UNI 10339 standard which, in relation to the size and intended use of the premises, imposes numerical coefficients for calculating the required volume of air. As far as the toilets are concerned, always responding to the dictates of the aforementioned legislation, an extraction of air equal to 8 volumes/hour will be envisaged. Also, in this case the introduced air will be treated mechanically and thermally by a treatment unit.

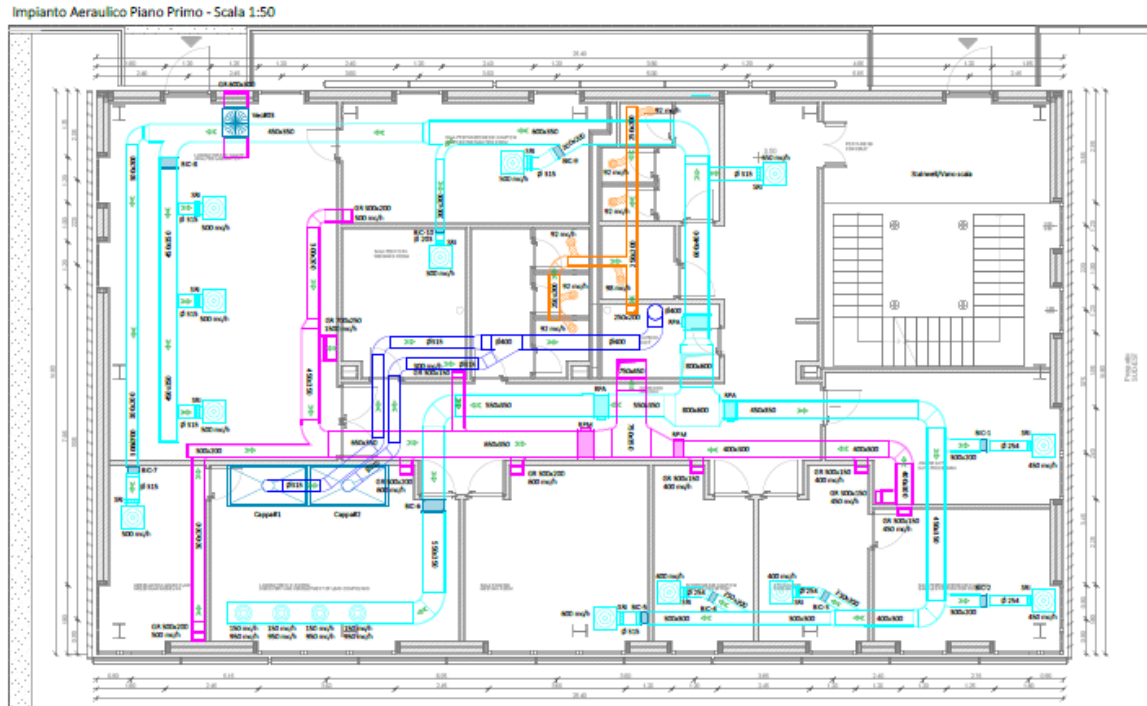


Figure 2: Heating and cooling system – first floor

To obtain a uniform distribution of the temperature and comply with the number of air changes required by law, the air handling unit will be sized for an overall flow rate of 6350 m³/h in normal working conditions, while it will process a maximum flow rate of 9,550 m³/h to compensate for the air extracted by the hoods of the “Sintesi laboratory” when the latter go into operation.

Figure 3 shows the heating and cooling system at the second floor.

The system is therefore configured with a variable flow delivery (managed by automatically operated duct flow regulators) and a fixed flow return. In addition to the heat treatment operated by the AHU coils, hydronic coils will be implemented in each room on the laboratory floor, controlled by the vector fluid and by a thermoregulation system that allow for the differentiation of the temperature for each room.

The ducts, necessary to connect all the equipment of the ventilation systems to each other, for making the external air intakes, the expulsions, the extractions, the plenums, the fittings, the special pieces, will be in hot-dip galvanized steel sheet (Sendzimir lock - forming quality) of variable thickness according to the dimensions adopted.

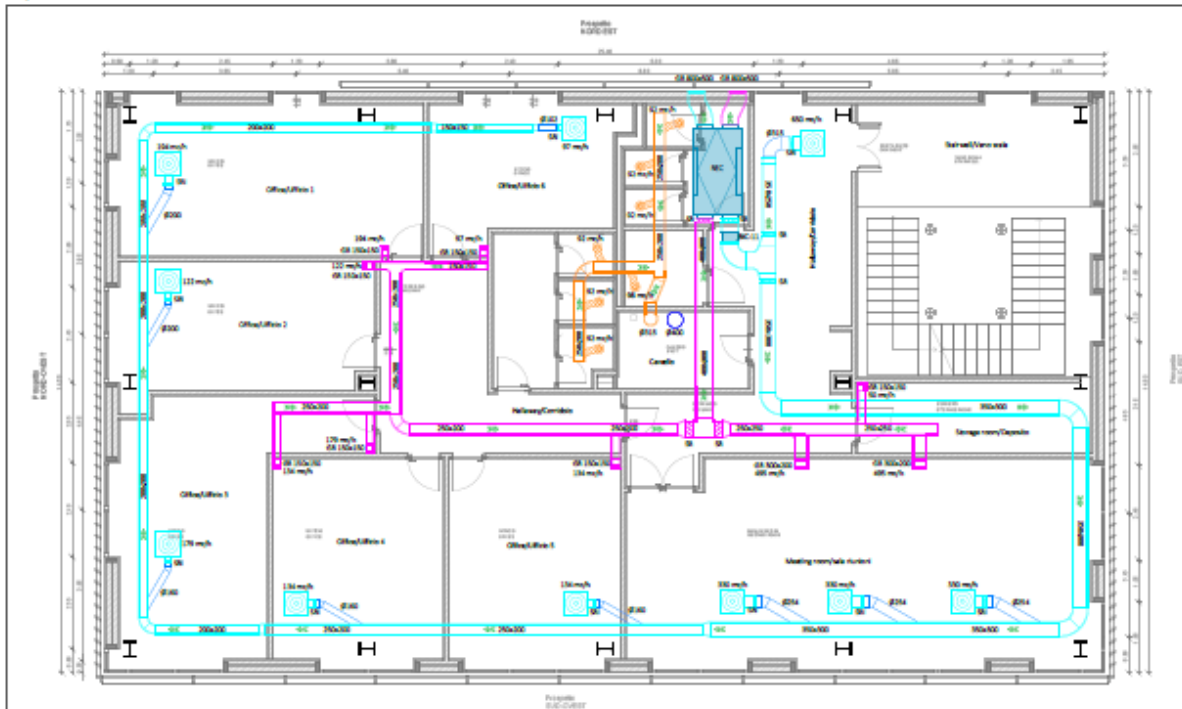


Figure 3: Heating and cooling system – second floor

Furthermore, all the channels will be extensively reinforced so as not to undergo appreciable deformation due to the effect of the air pressure and supported by special brackets conveniently secured to the building structure.

The ducts will be equipped with curves such as to reduce pressure drops to a minimum and, where necessary, these curves will be provided with internal deflectors. The 90° bends will be of the smooth type and formed by at least 5 sectors.

The radius of curvature of the axis of the channel will be equal to 1.5 times its diameter. Any junctions of channels built with different metals will be made with flexible joints in order to avoid the generation of galvanic currents.

Diffusion inside the rooms takes place through delivery vents including regulation dampers sized in such a way as to have a sound emission below 20.0 dB and placed at ceiling height to make the most of the “Coanda” effect.

The recovery diffusers, including regulation dampers, are distributed in the main corridors of the building and the passage of air between one room and another is ensured by transit grilles of suitable dimensions installed on the access doors.

The regulation and monitoring system at the service of the heating system involves the use of a compact PLC capable of managing and monitoring the entire heating system, providing real-time information about anomalies, and reading of the fluids produced thanks to the use of a network operator terminal, with Touch-screen technology, to be installed in a manned place. This solution, in addition to improving room comfort, supplying the fluids at a temperature in proportion to the outside temperature, allows for energy purposes a management economy of 10% and information to maintenance workers in real time.

Figure 4 shows the distribution between the floors constituting the heating and cooling system of the whole building.

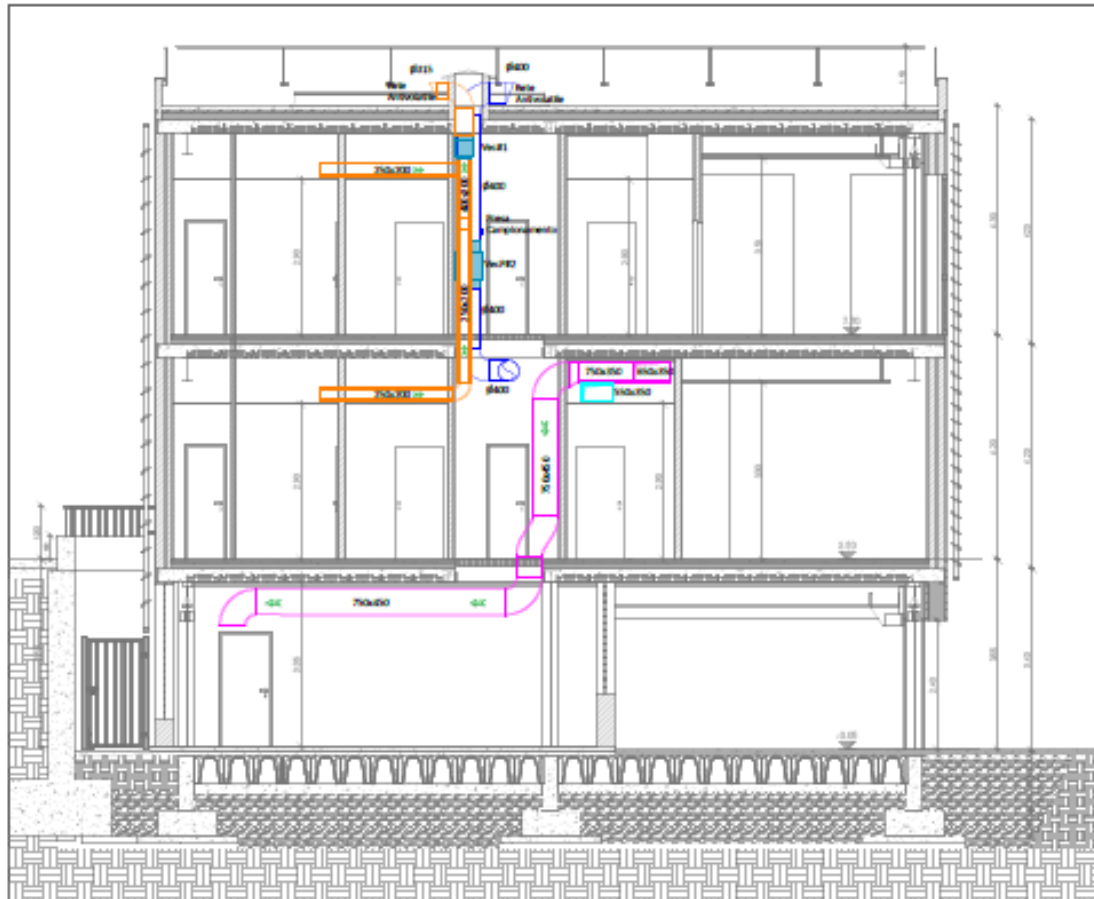


Figure 4: Heating and cooling system – distribution between the floors

3. ELECTRICAL BUILDING SERVICES

In this section of the technical report, the design criteria underlying the construction of the low voltage electrical distribution system, serving the new building are briefly illustrated.

The building will be structured on three levels above ground, with an ordinary internal staircase and an elevator system. It will be electrically connected to the general switchboard of the "Invariante 7E" electrical substation, through a section of new underground canalization and a section in the existing technological tunnel. On the ground level, in a dedicated room, there will be the general electrical panel, the centralized absolute electrical continuity group and the photovoltaic inverter. On the first level there will be a series of laboratories belonging to the Pharmacy department and a toilet block. On the second level there will be a series of offices and a toilet block. At the roof level, the installation of photovoltaic generators (Figure 5) connected to the inverter located on the ground level is envisaged. The building, in any case connected to the university electricity system, will benefit from the energy benefits of the photovoltaic park in operation.

Energy efficiency is no longer just an option. The Kyoto protocol has encouraged governments around the world to approve legislation that guarantees a more intelligent and conscious use of energy in buildings. In March 2007, the European Union undertook to achieve a 20% reduction in CO2 emissions by 2020. This plan of measures, known as the "3x20 by 2020", also provides for a 20% increase in the level of Energy Efficiency and the achievement of 20% of the energy produced from renewable energy sources. Real changes will be needed to achieve these goals; governments are stepping up efforts to enact laws, regulate and set standards for better energy efficiency. This new move towards stricter energy efficiency regulations began with the Kyoto Protocol. Laws such as the US Energy Policy Act set the standard for the energy future.

In Italy it was published, with the D.L. no. 192 of 08/19/2005, the European directive 2002/91/EC (EPBD) relating to energy efficiency in buildings and, more recently, the D.M. 26/06/2009 (national guidelines for the energy certification of buildings). On 18/06/2010 the new European directive 2010/31/EC on energy performance in buildings was published, within which the importance of active control systems such as automation, control and monitoring systems aimed at saving energy was recognized. This directive is applied in the community standard UNI EN 15232:2012, which clearly indicates the benefits obtainable by opting for a specific efficiency class.

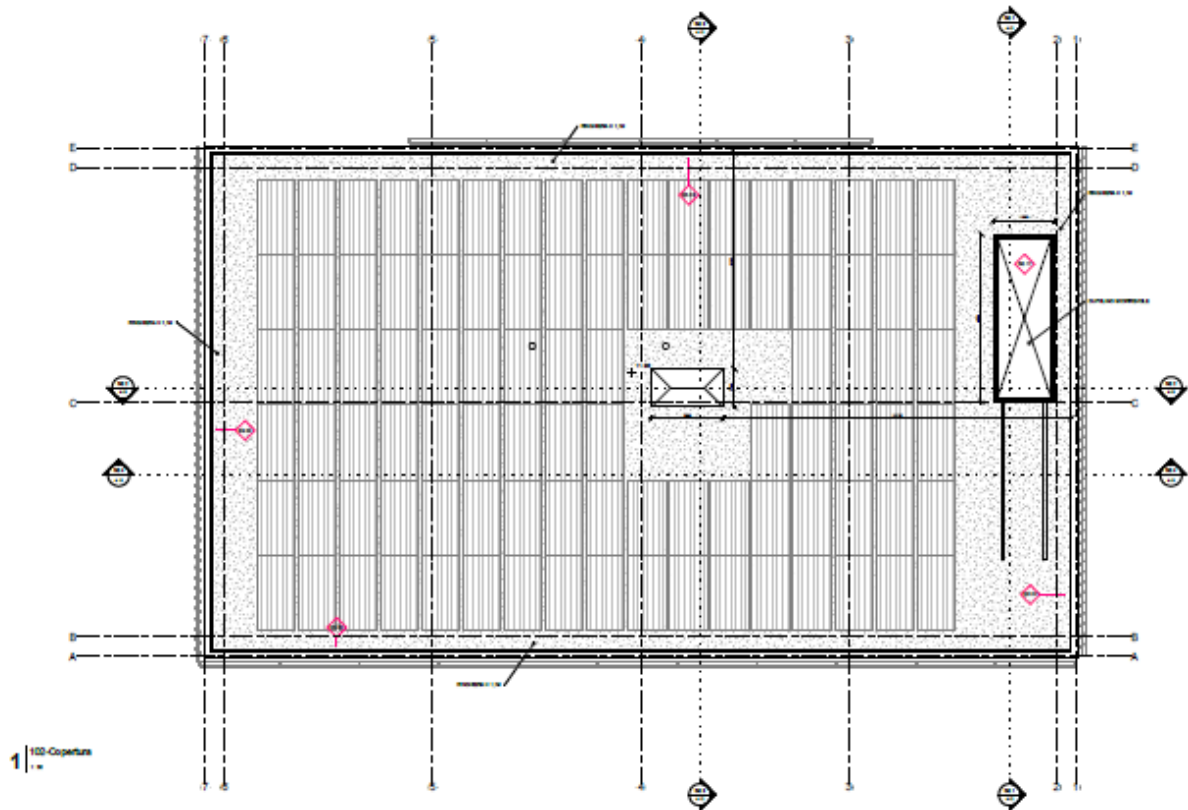


Figure 5: Photovoltaic park located on the roof of the building

The most recent UNI EN 15232-1:2017 standard, dated October 2017, indicates a method for defining the minimum requirements or any other specification concerning the control, automation and technical management functions of buildings that contribute to energy efficiency. In particular, it identifies, among other things, a structured list of the control, automation and technical management functions of buildings that contribute to their energy performance. The functions, called BAC - Building automation and control, are classified and structured with reference to building regulations, and a method for defining the minimum requirements or any other specification concerning the control, automation and technical management functions of the buildings that contribute to the energy efficiency of a building, which can be implemented in buildings of different complexity. In this sense, the building will be built to be classified as NZEB (Nearly Zero Energy Building). It will therefore be operated with energy consumption tending to zero, in relation to winter heating, summer cooling, domestic hot water production, lighting and ventilation for air exchange, in compliance with the European directive EPBD (31/2010 /THERE IS).

In this sense, the electrical system serving the building is equipped, among other things, with an advanced type of automation to pursue, as a primary objective, that of classifying the building itself as belonging to the energy efficiency class "A" according to the UNI-EN 15232 community standard.

As a discriminating element, therefore, it was envisaged to equip the various electrical panels with a real-time supervision, automation and control system, based on the by now consolidated KNX

communication protocol, capable of managing the information for automatic regulation with appropriate logics of utilities.

The construction of the electrical system is completed with the use of lighting fixtures with a LED photodiode unit light source designed for the functionality of the regulation of the luminous flux which will be entrusted to the consolidated DALI communication protocol, suitably prepared by the automation panels zone and flanked by presence sensors and lighting level.

4. FIRE FIGHTING WATER SYSTEMS

This Section summarizes the hypotheses and calculation of the fire prevention system in particular active protection systems using water-based firefighting systems (networks hydrants) serving the "C3 BUILDING" to be built on the Fisciano Campus of the University of Salerno.

This project involves the construction of a building intended for laboratory and offices for university research with related services, therefore, in the design of the system of the building, reference was made to the provisions of the Ministerial Decree of 26 August 1992 "Fire prevention regulations for school buildings" and amendments and clarifications, with the extension to universities established by the decree of 5 August 1998, n. 363 In particular, the requirements valid for type 1 schools (with number of people present at the same time up to 100), in an "isolated" building equipped of fire-fighting water systems interconnected to the Campus network.

The hydrant network object of the project will have to serve a building intended for teaching and research in the university environment which is spread over four levels above ground of the same surface and same general purpose. Based on the provisions of the Decree and the UNI standards mentioned above, they were expected:

- A connection pipe between the planned building and the fire prevention water network of the Campus, consisting of an interconnected system of storage tanks and systems fire pressure capable of providing the required flow rate and pressure. In particular the new system will connect with the existing network located in the technological tunnel downstream of the canteen. The pipe in question is made of steel and installed via flanged junction with the existing pipe in the tunnel.
- An internal distribution network consisting of a circuit of steel pipes leading from supply manifold are distributed to the various floors inside a plant shaft. Inside each floor the supply pipes to the hydrants are always made of steel and will be placed in the false ceiling.
- N.3 UNI 45 hydrants with 20 m hoses, distributed in the number of 01 on each floor;
- N. 01 above ground hydrant type 2 x UNI 70 with motor pump connection and N. 01 group

Fire Brigade motor pump connection UNI 70 with two ports for pressurizing the network from part of the Fire Brigade's tankers installed outside on the road axis correspondence of the building. The supply of this hydrant will take place with a pipe buried in Pead terminal of the main circuit serving the building.

The entire system can be sectioned due to the presence of:

- A valve at the connection of the collector to the existing pipes (technological tunnel a Mensa valley);
- Valves at the foot of the riser in the building, and valves on the branches of supplying above-ground hydrants.

The hydrants are connected to the risers with 1" 1/2 pipes and will be located, for each floor, along the central balcony in a position not far from the stairs, always and in any case, in an easily accessible and visible position, marked by special signs that allow this identification and at a mutual distance such as to reach all areas with the jet to protect. Each hydrant will be equipped with a tap and 20 MISA certified flexible hose meters, lance and containment box in stove-painted steel sheet with crash-safe door.

The distribution network will be independent from that of health services. The pipes, where necessary according to the UNI EN 12241:2009 standard, will be insulated against frost using cups of glass wool insulating material protected with final aluminum coating. This material offers the advantage over other insulators of improve the fire behavior of the net to which it gives a resistance RE in case of fire.

Appropriate fire collars will be used, complying with EN 1366-3, for sealing penetrations on walls or slabs of any type and pipes combustible, non-combustible, with or without insulation, consisting of a metal structure with internally inserted thermo-expanding material, complete with fixing plugs and declaration of conformity for Class REI 120 (Classification report EN 13501-2).

For technical details, please refer to the graphic tables.

5. THE TECHNICAL GAS SYSTEMS

This Section refers to the "technical gas systems" to be built on the first floor of the building. In particular, the supply of the following technical gases is envisaged: N₂ (nitrogen 5.0); N₂ UHP (ultrapure nitrogen 5.5/6.0); Ar (Argon 5.0); He (Helium 5.0) serving the Analysis Laboratory, the Preparation Room and the Synthesis Laboratory.

Given that the exact location of the gas leak will be defined by the researchers, the project has exclusively involved the arrangement of the pipes in the false ceiling, subsequently, when supplying the furnishings, we will proceed with a separate procedure for supply and assembly.

The pure gas distribution system must be built according to the following specifications:

- Supply of 2 outdoor concrete boxes for neutral and flammable gases;
- Supply of 4 pure gas plants with automatic exchange and manual reset with pressure transducers;
- Construction of distribution lines in AISI 316L ASTM A269 steel;
- Supply of 1 general shut-off valve panel;
- Supply of 12 ball valves for sectioning lines in the false ceiling;
- Supply of ramp unloaded signaling control units on site;
- Supply of an O₂ gas detection system consisting of 8 sensors;
- Supply of 3 O₂ sensor alarm repeaters;
- Supply of 6 3-way solenoid valves on site;
- Supply of 1 unloaded ramp alarm reporting control unit;
- Supply of 1 oxygen alarm and display control unit on site.

More information is given in the design drawings.

6. THE WATER SYSTEM AND SEWAGE SYSTEM

This Section concerns the design of water and sewerage systems relating to the executive project of the "C3 BUILDING" to be built on the Campus Fisciano of the University of Salerno, and analyzes the sizing and the verification of the water-sanitary network and the internal sewerage system.

The intervention area currently consists of a green area located between the buildings: Canteen to the North, Lot I Residences to the East and Canteen Parking to the West of the Campus overlooking the nearest connection points with all existing water networks (potable and non-drinkable), in the tunnel that goes towards the Bus Terminal where all the arrangements for derive the project lines.

During the project phase it was decided to power the toilet sinks and bidets (when present) with drinkable water and to supply the toilets with non-drinkable water derived from the "pozzi" circuit of the Campus. Furthermore, it was decided to provide hot water only toilets intended for disabled people.

The correct sizing of the pipes and other system components must ensure that in the most unfavorable operating circumstances (periods of maximum consumption) there are normal supply conditions also at the supply points located in disadvantaged positions.

As stated, the drinking water supply pipeline will be derived from tunnel that goes towards the Bus Terminal where the necessary connections had already been prepared.

The derivation from the main pipeline, running in parallel along the "Via della Tecnica" will reach the first level (ground floor) of the new building, in particular it will branch out in a line that will serve the irrigation system in case of emergency and in a line that it will reach under the bathroom shaft where the relevant riser column will detach vertical which will serve the two bathroom groups located on the respective floors (P1, P2). Along the route, a service connection will be left for the room of the aforementioned thermal power plant and a coupling, equipped with a specific hydraulic disconnecter, for the possible power supply of the rising non-drinking water in the event of the latter being out of service.

The underground pipeline will be entirely in PE 100 (High Density Polyethylene) at depth between 1÷1.5 m which will cross the building and reach the side border wall A.DI.S.U. to then act as a connection to the planned C4 building.

The vertical drinking water upright will be made of steel and will serve the lines at the various levels supply to the sinks [pieces: $8 = (2+2) \times 2$], and in each of the two bathrooms for disabled people: the toilet shower and sink.

Obviously also the hot water boiler in the bathroom room for disabled people will be supplied by drinking water lines.

The intervention under consideration involves using well water as well as for irrigation of gardens and flowerbeds also to supply toilet flushing. It was also expected to equip the heating plant and the irrigation system with service socket points.

The power supply to the aforementioned points will be derived from the new pipeline coming from tunnel that goes up towards the Bus Terminal and will be completely in PE100.

The section will be underground and the power supply will be derived along its route irrigation system control unit. Subsequently the power supply for the uprights of the bathroom groups and for the boiler room, and finally it will continue up to the wall of A.DI.S.U. side border to then act as a connection to the planned C4 building.

The vertical riser for non-drinking water will be in PE 100 and will serve at the various levels the supply lines to the toilets [pieces: $12 = (3+3) \times 2$], and in each of the two bathrooms for disabled people: toilet and will continue to the roof where a point will be set up with service tap.

The sewage systems designed take into account the fact that the Fisciano Campus has a separate drainage network for sewage and rainwater whose main collectors pass, in an underground position, a short distance from the intervention area.

In particular, near the building being planned there is: 1) A sewage collector along the embankment flanking Via della Tecnica a service of the university residences first lot of circular shape with diameter from 400mm; 2) A white water collector along Via della Tecnica with a circular shape and diameter from 500 mm.

Therefore the designed exhaust system was designed to convey the waste separately black flows (fecals and laboratory furniture waste) and flows of meteoric origin. In this design the following networks have been distinguished: a) Sewage drainage network inside the building; b) FECALS: This is the disposal network of the sanitary equipment present in the building ends at the wells connection to the

external sewer system. The connecting sections between the devices and the fecal, the fecal itself for its entire vertical development and the stretch that goes from the foot of the fecal to the first well outside the building, will be made with polypropylene pipes (PP) with socket coupling equipped with double seal SBR gaskets.

The project involved the construction of a fecal: which conveys everyone's waste the appliances present in the bathrooms on the various floors. In line to fecal (configuration of system with primary ventilation in accordance with the UNI 12056-2 standard) has been foreseen ventilation pipes that cross the building and then flow into the roof. The anchoring of all pipes to the vertical and horizontal structures will occur with use of appropriately positioned clamps, collars and tie rods.

The following general requirements must be guaranteed:

- All direction changes must be performed with open turns (<45°)
- The horizontal sections must have a slope >2%
- All joints must be leak-proof
- All section changes must occur immediately before the next entry
- The pitch of the fixing/support brackets for non-steel pipes must be:
 - <15 Ø in the sections where the route of the rainwater/fecal pipes is vertical (slope >200%);
 - <7 Ø in the sections where the route of the rainwater/fecal pipes is horizontal (slope <200%) (where Ø is the external diameter of the pipe to be supported).

In turn the supports will go anchored to the concrete walls using expansion bolts of appropriate dimensions and bars threaded.

In correspondence with the vertical/horizontal transition curves, provisions must be provided pipe support saddles.

Waste water drainage network inside the building – DOWNPIPES: This is the network disposal of rainwater falling on the building. The hypothesized system foresees that the water from the stairwell roof is conveyed through two downspouts in PP (Ø160) which will have a vertical trend except for a change of direction horizontal at the intrados of the first floor. Called downpipes they will pass inside the building partly inside the technical rooms. The pipes of the white water system between the intake points on the roof terrace and the first well outside the building will be made with HDPE pipes (High density polyethylene), whose joints will be made by welding electrofusion with electric sleeve. The system thus created must guarantee tightness at a minimum pressure of +5 Bar. Anchoring the pipes to the structures vertical and horizontal will take place with the use of appropriate clamps, collars and tie rods position yourself.

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- <15 Ø in the sections where the route of the rainwater/fecal pipes is vertical (slope >200%);
- <7 Ø in the sections where the route of the rainwater/fecal pipes is horizontal (slope <200%) (where Ø is the external diameter of the pipe to be supported). In turn the supports will

goanchored to the concrete walls using expansion bolts of appropriate dimensions and bars threaded.

In correspondence with the vertical/horizontal transition curves, provisions must be provided pipe support saddles. White and black water drainage network outside the building is the network that collects the rainwater from the waterproof areas outside the building and into which the downspouts are inserted of the building itself, reaching the respective exhaust manifold. All piping drains have been made of PVC.

The external disposal network has been designed ensuring an equal or greater slope at 2% for all sections.

7. THE DATA NETWORK

The physical infrastructure of the University data network is hierarchical and, as described in the CEI EN 50173 standard, made up of the following elements:

- Telecommunication Outlet (TO), which represent the sockets to which the user's equipment is connected (computers, telephones, printers, etc.).
- Floor Distributor (FD), which represents the aggregation point of the TOs created on the single floor of a building.
- Building Distributor (BD), is the aggregation point of a building's FDs.
- Campus Distributor (CD), is the aggregation point of the BDs of all the buildings involved in the network infrastructure.

These functional elements are connected to each other through:

- Campus Backbone, which includes all cabling components (cables, patch panels, patch cords, etc.) to connect the CD to the BDs connected to it.
- Building Backbone, which includes all cabling components (cables, patch panels, patch cords, etc.) to connect the BD to the FDs connected to it.
- Horizontal Backbone, which includes all cabling components (cables, patch panels, patch cords, etc.) to connect the FD to the floor TOs. The regulations establish that horizontal cabling meets the following requirements:
 - 90 meters maximum distance permitted between the distribution cabinet and the workplace;
 - 10 meters of maximum length for the patch cords, calculating the total between the cord on the cabinet side and the one on the user side;
 - the connection cable must be single-track and without intermediate interruptions;
 - it is good practice to maintain a length of no less than 15 metres;
 - must support the IEEE 802.3bt standard, concerning Next Generation Power over Ethernet (NG PoE) technology for powering equipment through the network interface (power delivered up to 100W).

The functional elements of the subsystems are interconnected to form a basic hierarchical topology.

This structure is valid regardless of the category or class in which the wiring is made.

Currently the University data network is made up of:

- approximately n. 30,000 (thirty thousand) single network points, organized in TOs with 2, 3 or 4 sockets;

- n. 200 (two hundred) FD;
- n. 12 (twelve) BD;
- n. 1 (one) CD.

The entire C3 building will be equipped with a single FD, which will have to be built in the technical room located on Level 0. The FD will be made up of n. 1 (one) rack cabinet.

The FD created must be connected by single-mode optical fiber with the BD of building C (formerly Stecca 3) of the Fisciano Campus, as indicated in the diagram in Figure 1 and in detail in the RD04 plan.

The optical fiber will be single-mode OS 2 9/125μ, capable of supporting transmissions with the Ethernet standard of 100 GBit/s. A reinforced cable with LSZH sheath and CPR B2ca category according to the European regulation UE305:2011, anti-rodent, composed of 12 fibres, will be laid and will run along the cable duct that will be built to access the already existing technological tunnel. Patch panels will be installed in the FD and BD where the optical fibers will be connected to LC type connectors.

In general, the copper construction of the Horizontal Backbone (HB) will start from the FD, to connect the TOs to the network. The copper wiring will be made with Class EA performance channels, i.e. Category 6a with unshielded cable, according to the specifications dictated by the CEI EN 50173 standard. Therefore, all service pipes must have a minimum diameter of 40 mm, be placed in it operates with curvature radii such as to allow the creation of systems compliant with current standards, and be prepared for higher category systems in the event of future implementations. Each Telecommunication Outlet (TO) will be served by two cables.

The copper cables will comply with the European regulation EU305:2011 category CPR Cca.

The data network will consist of n. 1 (one) switch cabinet, called Rack A, which will act as a Floor Distributor (FD) for the entire building. He will be allocated to Level 0 in the room dedicated to technological services.

Both data sockets will be installed to serve users and equipment, as well as data sockets dedicated to services, such as the wi-fi network, video surveillance, access control, etc.

The equipment and users will be able to connect to the wired network with a throughput of 1 Gb/s and, in a "looped VLAN" architecture, will use the native network configurations of the relevant Department.

The passive infrastructure will be set up for the wi-fi network compliant with the latest generation Wi-Fi 6 standard, which allows connection to the network with a throughput of 5 Gb/s and management of transmission channels that improve the user experience through techniques of support to the high density. As in all buildings on the University campuses, authorized users will be able to access the Eduroam network (education roaming), a service that allows users on the move at other institutions to access the wi-fi network easily and securely using the same credentials provided by your organization.

Born in Europe, Eduroam is a service widespread in eighty-nine countries and there are approximately eighty million accesses by Italian users per year. It is based on the most secure encryption and authentication standards currently available. It uses the IEEE 802.1x protocol which makes the transmission of your credentials over the wi-fi network safe.

Regarding the floor distributor:

- Level 0.00m Rack A

The 42-unit switch cabinet will be placed in the dedicated technical room and from here the structured cabling of the 0.00m, 3.50m and 7.70m levels of Building C3 will be developed.

In total, n. 67 (sixty-seven) TO, according to the following scheme:

- Level 0:

- n. 7 (seven) to be installed in the technical room through pipes laid in masonry tracks;
- n. 1 (one) to be installed in the false ceiling, to be used for any video surveillance cameras, wi-fi access points or other services;
- Level 3.30m
 - n. 24 (twenty-four) to be installed in the rooms through pipes laid in brickwork or on the floor;
 - n. 8 (eight) to be installed in the false ceiling, to be used for any video surveillance cameras, wi-fi access points or other services;
- Level 7.70m
 - n. 19 (nineteen) to be installed in the rooms through pipes laid in brickwork or on the floor;
 - n. 8 (eight) to be installed in the false ceiling, to be used for any video surveillance cameras, wi-fi access points or other services.

The details of the installations are indicated in the plans RD01, RD02 and RD03.

8. LIST OF EXECUTIVE DESIGN DOCUMENTATION

As already stated, according to the Grant Agreement all the design documentation is due in Italian language, because it has to fulfil the Italian Code provisions and has to be delivered to the National local authorities to obtain the relevant authorizations. The detailed design documentation is listed in the following Tables and fully delivered (in Italian) on the project website (www.dreamersproject.eu).

Relazioni Tecniche/Technical Reports

R08	Relazione Tecnica Impianti Elettrici e Speciali	Technical Report on Electrical and Special Systems
R09	Relazione Tecnica Rete Dati	Data Network Technical Report
R10	Relazione Tecnica Impianti Meccanici	Technical Report on Mechanical Systems
R11	Relazione Tecnica ex L. 10/91	Technical Report pursuant to Law 10/91
R12	Relazione e Disciplinare Impianti Gas Tecnici	Report and Disciplinary for Technical Gas Plants
R19	Relazione di calcolo Impianti Elettrici e Speciali	Calculation report for Electrical and Special Systems
R20	Relazione di calcolo Impianti Meccanici	Calculation report Mechanical Plants
R21	Relazione tecnica impianti idrici di carico, scarico, antincendio ed irrigazione	Technical report on water loading, unloading, fire prevention and irrigation systems

Elaborati grafici/Graphic documentation

IA 01	Rete antincendio Esterna	External fire protection network
IA 02	Rete antincendio interna ai vari piani	Internal fire prevention network on the various floors
IA 03	Impianti idrici antincendio - Schema distributivo	Fire-fighting water systems - Distribution scheme
IS 01	Planimetria - impianti fognari	Planimetry - sewage systems
IS 02	Planimetria - impianti idrici di adduzione	Planimetry - water supply systems
IS 03	Planimetria - impianto di irrigazione	Floor plan - irrigation system
IS 04	Piante e gruppo bagni - adduzione e	Plants and bathroom group - supply and

	scarico	drainage
IE 01	Schema altimetrico dell'impianto elettrico	Altimetric scheme of the electrical system
IE 02	Impianto elettrico - Schema unifilare quadri elettrici primari e secondari	Electrical system - Single-line scheme of primary and secondary electrical panels
IE 03	Impianto elettrico - Planimetria distribuzione primaria e secondaria e di automazione PT	Electrical system - Planimetry of primary and secondary distribution and PT automation
IE 04	Impianto elettrico - Planimetria distribuzione primaria e secondaria e di automazione P1	Electrical system - Planimetry of primary and secondary distribution and automation P1
IE 05	Impianto elettrico - Planimetria distribuzione primaria e secondaria e di automazione P2	Electrical system - Planimetry of primary and secondary distribution and P2 automation
IE 06	Impianto elettrico - Planimetria impianto fotovoltaico - piano copertura	Electrical system - Photovoltaic system plan - roofing plan
IE 07	Impianto di illuminazione e di emergenza e sicurezza - Planimetria componenti e canalizzazioni - PT	Lighting, emergency and safety system - Component and duct planimetry - PT
IE 08	Impianto di illuminazione e di emergenza e sicurezza - Planimetria componenti e canalizzazioni - P1	Lighting and emergency and safety system - Components and ducts plan - P1
IE 09	Impianto di illuminazione e di emergenza e sicurezza - Planimetria componenti e canalizzazioni - P2	Lighting and emergency and safety system - Components and ducts plan - P2
IE 10	Allaccio esterno - cabina 7E - Planimetria componenti e canalizzazioni	External connection - cabin 7E - Components and ducts plan
RI 01	Impianto di Rilevazione Incendi - Planimetria componenti e canalizzazioni PT	Fire Detection System - Ground floor components and ducts plan
RI 02	Impianto di Rilevazione Incendi - Planimetria componenti e canalizzazioni P1	Fire Detection System - Components and ducts plan P1
RI 03	Impianto di Rilevazione Incendi - Planimetria componenti e canalizzazioni P2	Fire Detection System - Components and ducts plan P2
RD 01	Planimetria Rete Dati Livello 0	Data Network Plan Level 0
RD 02	Planimetria Rete Dati Livello 3.50m	Data Network Plan at 3.50m level
RD 03	Planimetria Rete Dati Livello 7.70m	Data Network Plan Level 7.70m
RD 04	Planimetria Percorso Fibra Ottica	Fiber Optic Route Plan
IM 01	P&ID Impianto Climatizzazione	P&ID Air Conditioning System
IM 02	Schema funzionale impianto Aeraulico	Functional diagram of the aeraulic system
IM 03	Configurazioni Funzionamento UTA	AHU Operation Configurations
IM 04	Impianto Aeraulico Piano Primo	Aeraulic system on the first floor
IM 05	Impianto Aeraulico Piano Secondo	Second Floor Aeraulic System
IM 06	Impianto aeraulico mandata Piano Primo	Air supply system on the first floor
IM 07	Impianto aeraulico ripresa Piano Primo	Air conditioning system for recovery on the first floor
IM 08	Impianti speciali piano primo	Special systems on the first floor
IM 09	Impianto idronico piano primo	First floor hydronic system
IM 10	Impianto idronico piano secondo	Second floor hydronic system
IM 11	Layout impianti vano tecnico	Layout of technical compartment systems
IM 12	Tavola Staffaggio Canali Vano Tecnico	Technical Compartment Channel Bracket

		Table
IM 13	Tavola Staffaggio Canali Piano Primo	Channel Fixing Board First Floor
IM 14	Tavola Staffaggio Canali Piano Secondo	Second Floor Channel Fixing Table
IM 15	Abaco Elementi Aeraulici Piano Primo	Abacus of Aeraulic Elements First Floor
IM 16	Abaco Elementi Aeraulici Piano Secondo	Abacus of Aeraulic Elements Second Floor
IM 17	Tavola Staffaggio Tubazioni Clima Piano Primo	Clima Piping Fixing Board First Floor
IM 18	Tavola Staffaggio Tubazioni Clima Piano Secondo	Second Floor Clima Piping Fixing Table
IM 19	Dettagli Impianto Aeraulico	Aeraulic System Details
IM 20	Architettura Sistema Termoregolazione	Architecture of Thermoregulation System
IGT01	Impianti Gas Tecnici	Technical Gas Systems

Analisi dei costi/Cost analysis

AP03	Analisi Prezzi Impianti Elettrici e Impianti Speciali	Price Analysis of Electrical Systems and Special Systems
AP04	Analisi Prezzi Rete Dati	Data Network Price Analysis
AP05	Analisi Prezzi Impianti Meccanici	Mechanical Plant Price Analysis
AP06	Analisi Prezzi Impianti Gas Tecnici	Price Analysis of Technical Gas Systems
EP03	Elenco Prezzi Impianti Elettrici e Impianti Speciali	List of prices for electrical systems and special systems
EP04	Elenco Prezzi Rete Dati	Data Network Price List
EP05	Elenco Prezzi Impianti Meccanici	Mechanical Systems Price List
EP06	Elenco Prezzi Impianti Gas Tecnici	List of prices for technical gas systems
CM03	Computo Metrico Estimativo Impianti Elettrici e Impianti Speciali	Estimated Metric Computation for Electrical Systems and Special Systems
CM04	Computo Metrico Estimativo Rete Dati	Data Network Estimated Metric Computation
CM05	Computo Metrico Estimativo Impianti Meccanici	Estimated Metric Computation for Mechanical Systems
CM06	Computo Metrico Estimativo Impianti Gas Tecnici	Estimated Metrics for Technical Gas Systems