DESIGN REPORT

Eastern Partnership European School

MEP
DESIGN
CONSTRUCTION

Contents

1 General requirement 5
2 Design composition 5
2.1 General Design Conditions 6
2.1.1 Location data 6
2.2 Project stages: 6
2.3 Scope of MEP works 6
3 Common systems and General 7
4 Outdoor Utilities 8
4.1 General introduction 8
4.2 The basis for the design 8
4.3 Water supply 8
4.3.1 Basic design solutions 8
4.4 Sewerage system: 9
4.5 Rain drainage: 9
4.5.1 Basic design solutions 9
4.6 Irrigation system 10
4.6.1 Basic design solutions 10
5 Plumbing (Water supply and sewerage, drainage systems) 10
5.1 Standards and codes 10
5.2 The below sanitary plumbing systems designed in the building technical solutions: 11
5.3 Water tank Calculation and Pump Selection 12
5.3.1 Determination of water demand and waste water quantity in water supply and sewerage system 12
5.3.2 Determination of water demand for Dormitory building 1
5.3.3 Determination of Water Demand for Academic Building 1
5.4 Water treatment sytem 2
5.4.1 ORP CONTROLLED DOSING UNIT 2
5.4.2 VOLUMETRIC WATER SOFTENER UNIT 3
5.4.3 ULTRAVIOLET UNIT 3
5.5 Station Water Supply pipe line 3
5.6 Sanitary appliances 6
5.7 Hot water preparation 6
5.7.1 Hot Water Demand Calculation 6
5.7.2 Determination of hot Water for Dormitory 6
5.7.3 Determination of hot Water demand for Academic Building 7
5.8 Sewerage system 9

5.8.1 Domestic sewer 9
5.8.2 Technological wastewater 11
5.9 Rainwater sewer 14
6 HVAC (Heating/cooling and ventilation systems) 15
6.1 Standards and codes 15
6.1.1 Indoor air quality related standards 15
6.1.2 Technical standards on ventilation 15
6.1.3 Acoustical design criteria 16
6.1.4 General provisions of Air-conditioning and ventilation systems. 17
6.2 Ventilation systems. 17
6.2.1 In general 18
6.2.2 Ventilation rate 18
6.2.3 Occupancy 18
6.2.4 Air Handling Units. 18
6.3 Smoke and heat control systems 20
6.3.1 All building 20
6.4 Air Cooling Systems/Heating 20
6.4.1 Temperature and humidity conditions 20
6.4.2 Systems and Soliutions 21
6.4.3 Cooling/Heating System Outdoor Units 22
6.4.4 AHU connection to Outdoor DX units 22
7 Firefighting systems 23
7.1 Standards and codes 23
7.2 Water-based firefighting system 23
7.3 Sprinklers 24
7.3.1 Sprinkler Types basing on protection areas 24
7.3.2 Design criteria 25
7.3.3 Sprinklers head position 26
7.3.4 Additional Sprinkler soliution 26
7.3.5 Portable and Mobile Extinguishers 27
7.4 Pump room and firefighting station 28
7.5 Distribution pipelines of firefighting water supply system 28
7.6 Special requirements 29
7.7 Automatic fire extinguishing system 29
8 Electrical systems 29
8.1 Standards and codes 29
8.2 General information 29

8.3 Power supply 30
8.3.1 HV Switchgear 30
8.3.2 Transformer 30
8.4 Loads Calculation 31
8.5 Lightning protection, earthling and equipotencialization (bonding) systems 31
8.6 Lighting 32
8.7 Emergency lighting 32
8.8 Security systems: 33
8.9 Fire alarm system 34
8.10 Audio Voice Evacuation 35

1 General requirement

The following shall be adhered to in the development of design of the building engineering and in making relevant design solutions:

- Construction and territorial planning laws, technical regulations, norms and standards in force in the territory of Georgia;
- Contract on the accomplishment of design works;
- Due consideration should be given to the requirements for different engineering components set forth in the respective European Union norms and standards;
- Standards and requirements of the future school operator;
- Employer's requirements;
- The developer of detail design shall rely on the requirements, principles and criteria contained in the present design terms of reference. Nevertheless, other technical requirements are also acceptable provided they have no principal deviations from the original terms of reference.

2 Design composition

In general, the moment of commencement of the building design shall be considered the day when a code of the building design conditions is approved. Design tasks of the building design components are developed on the basis of the building design conditions. Design works by a designer are performed on the basis of the design task (design terms of reference) which forms an inseparable part of the Contract on the accomplishment of design works.

The present design task encompasses the main indoor engineering components of the building:

- Ventilation
- Fire ventilation systems (pressurization, smoke exhaust)
- Heating
- Air Conditioning
- Plumbing
- Rainwater system
- Outdoor networks (sewage, water, territory rainwater systems)
- Water Fire Systems
- Electrical Power Supply (incl. transformer station and interruptible power supply through UPS and generator)
- Lights system
- territory lights
- Earthing system

- Lightning protection system
- Fire Alarm system
- CCTV
- BMS

2.1 General Design Conditions

2.1.1 Location data

LOCATION	Tbilisi, Georgia
Latitude	41.68
Longitude	44.95
Elevation	448
Time zone (hours ahead of GMT)	+4

2.2 Project stages:

Detail Design.

2.3 Scope of MEP works

- Co-ordinated mechanical & plumbing drawings, Electrical, Extra Low Voltage and Life & Fire Safety systems.
- Heating, ventilation, air-conditioning floor plans;
- HVAC systems final functional schematics and riser diagrams with all pipe and duct sizes.;
- Plumbing and sanitary drainage floor plans;
- Fire protection floor plans;
- Plumbing, sanitary drainage, fire protection riser diagrams with all pipe sizes;
- Plan details and sections;
- Final design report including all calculations, equipment selections, system descriptions;
- Mechanical Equipment schedules;
- Co-ordinated Electrical drawings.
- Plan details and sections;
- Automatic control schematics;
- Power distribution system floor plans;
- Cable tray system floor plans & cable journals;
- Lighting system floor plans;

- Fire alarm & public address and emergency announcement floor plans;
- CCTV & security system floor plans
- Load and voltage drop calculations and cable list;
- Transformer, diesel/gas generator and UPS selections and calculations;
- Short circuit calculations;
- Earthling calculations;
- Final design report including all calculations, equipment selections, system descriptions;
- Electrical Equipment schedules;
- Building Management System schematic plans and diagrams, floor plans.
- Standard details (such as hangers and supports, insulation, wall penetrations etc.)
- Bills of Quantities (estimations to be submitted at each stage

Below are given the general constituents of detail design of the building engineering components:

- *An explanatory note;*
- *Calculations;*
- *Technical specifications;*
- *Bill of quantities of the main materials and equipment units;*
- *Drawings.*

3 Common systems and General

There is a legal obligation for the utility companies to connect the new development projects to the networks within the certain period of time.

- Tbilisi Energy – gas supplier. It is obligation of the company to bring the pipe to the limit of the site and install the meter. The pipe from the meter to the final user (say central heating boiler) shall be separately designed and installed. In most of the cases Tbilisi Energy performs such services at extra cost. Connection time – 60 days
- Telasi- Electricity supplier. Investor will have to make a decision either to buy from Telasi 10kV (or 6kV) power. The Investor must apply to Telasi for electricity connection 90 days prior the electricity must be connected. Telasi will do the design and connection works itself. Investor must pay one-time connection fee
- GWP – water and sewage. Investor must apply for the connection technical conditions. The conditions will be issued within 3 weeks.
- Municipality – Rainwater. Investor must apply for the connection technical conditions. The conditions will be issued within 3 weeks.

4 Outdoor Utilities

4.1 General introduction

This section of external water supply and sewerage networks is carried out to ensure the drinking and irrigation needs of the buildings object: Eastern Partnership European School.

Project location: Lisi lake Site, Tbilisi, Georgia.

4.2 The basis for the design

The section is based on the following source information:
- tasks for the implementation of project documentation for the complex of buildings of Eastern Partnership European School.
- report of geological structures of the building construction site.
technical requirements for connection to existing communications issued by city operating organizations in accordance with the current regulatory and technical documents:
СП 31.13330.2012 Водоснабжение. Наружные сети и сооружения. Актуализированная редакция СНиП 2.04.02-84*
СП 32.13330.2012 Канализация. Наружные сети и сооружения. Актуализированная редакция СНиП 2.04.03-85;

4.3 Water supply

Water supply of the school building complex is provided by the input pipe d159mm.
Connection point - planned main pipe outside the school.
The maximum flow rate for the complex is 17,82l/s (including irrigation),
The required pressure in point of connection to the municipality system is 4-5 atm.
Material of the pipe - PE SDR 17 with electrofusion fittings.
The water supply system is dead-end.
The project provides water supply of buildings, pressure and flow - in accordance with the requirements of the project of the internal systems.

4.3.1 Basic design solutions

The technical solutions adopted in the working drawings meet the requirements of environmental, sanitary-hygienic, fire-fighting and other applicable norms and rules and ensure the safe operation of the facility for human life and health, subject to the measures provided for by the project.
For on-site of water supply system, an underground open laying of pipes is provided.
Taking into account the freezing depth, and to avoid heating the water during the warm season - pressure pipelines are laid at a depth of 1 m.
To measure the amount of water consumed by the complex, a water meter unit has to be installed in the chamber №1.
Emptying the B1 system for repairs is carried out through wells on the lower sections of the route (see the project).
Cases for pipes are made of corrugated pipes of the Corsis brand must be used to protect against mechanical loads under roads.

The system also provides for connection to drinking fountains on the territory of the school, the connection is made through a plastic box in which there are valves for

turning off fountains in winter.

4.4 Sewerage system:

Information about projected sewer systems. The domestic sewage system is designed to divert domestic wastewater from the school's facilities that have domestic premises (bathrooms, showers, etc.) and a buffet.
Sewer pipes which are coming out of the building will be collected in an external sewerage system with iron-concrete manholes and corrugated pipes type SN8.
Sewer system of the school will be connected to the planned sewer collector which will be located outside of school complex.
Laying of pipelines is carried out in an open way.
To prevent damage and deflection of the pipe under the main road - a case is provided.
The connection to the external system of pipes from kitchens is made through oil separators installed underground outside the building.

4.5 Rain drainage:

The collection of surfaces rain water is provided by the organization of the relief and the implementation of drainage projected elements of the system of collection and drainage of surface effluents (rain collector, linear drainage (drainage tray).

4.5.1 Basic design solutions

The rain sewer system is designed for:
- collection and drainage of surface effluents.
The main indicators for surface (rain and melt) waters diverted from the site of the projected building:
- total second flow rate of rainwater is 240,5 l/s;
- the amount of water received at the sites are indicated on the project

The removal of surface effluents from the projected site is provided by a system of gravity collectors with a installation of rain receivers.
Surface (rain and thawed) water through trays, and further, through rain sewer system in gravity method are diverted to the existing pipeline.
Information about the material of pipelines and wells, methods of their protection:
Non-pressure sewerage system are designed with pipes SN8 with a double-layer profiled wall.
Linear drainage is made with the help of a system of concrete drainage trays in the complete deliver.
Laying of pipelines is carried out in an open way.
The installation of inspection wells according to the standard drawings of the album No. 902-09-22.84. 4is provided on the network of non-pressure sewerage at the angles of rotation and on straight sections (the distance between wells depending on the diameter of the pipeline).
Manholes are made of round reinforced concrete rings. Internal waterproofing of the bottom and walls of wells of the working part of manholes is provided.
Before laying plastic pipes, a base of sandy soil with a thickness of 20 cm is provided, in addition, a protective layer of sandy soil with a thickness of 30 cm is provided on the sides and on top of the pipelines.
The collection of rainwater from roads is carried out by the method of collection into rain-receiving devices along the road.

To reduce the depth of the pipe, it was decided to divide the main collectors into two parts - the 1st school territory (roofs, roads), the 2nd - sports fields.

4.6 Irrigation system

The project of the automatic irrigation system was developed on the basis of the information provided by the customer.
Source of water supply: water supply system from external water supply line on the territory of school. It is necessary to provide a bypass on inside the building, with the possibility of subsequent installation of a pumping station, if the required flow rate is not provided during operation, since there is enough pressure.

4.6.1 Basic design solutions

The system is organized with selective simultaneous zoning of irrigation sections, which significantly reduces the installation limit of water supply and volley water spill, and also allows you to locally organize a convenient time and frequency of irrigation. These activities are carried out with the help of electromechanical time valves installed in valve boxes for each irrigation area. There are 14 zones in total, according to the hydraulic calculation, In accordance to the project (p4.1-4.3). The maximum flow rate of simultaneously switched-on irrigation zones should not exceed 8 l/s

Sprinklers: In accordance with the geometry and size of lawns, the plan for finding trees, a scheme for placing sprinklers on the site is proposed, a choice of a scheme for placing sprinklers, their number and radius of action. produced in accordance with the following basic principles: the same amount of water at any point of irrigation. exclusion of damage to plants by a sprinkler jet.
All sprinklers installed on the site are divided and grouped into 14 zones. This division ensures optimal use of water source resources and allows you to set your own irrigation regime for each zone.
All amounts of water by zones and by sections are indicated in the drawings.

The depth of the main pipes is 1m, the depth of the branches is 0.5 m

5 Plumbing (Water supply and sewerage, drainage systems)

5.1 Standards and codes

- *EN 13443-1:2002+A1:2007 Water conditioning equipment inside buildings –Mechanical filters – part 1 Particle rating 80 um to 150*
- *EN 13443-2:2005 +A1:2007 Water conditioning equipment inside buildings –Mechanical filters – Part 2, Particle rating 1 um to less than 80 um*
- *EN 14095: 2003 Water Conditioning Equipment inside buildings –Electrolytic treatment systems with aluminum anodes*
- *EN 14652:2005+A1:2007 Water conditioning equipment inside buildings –Membrane separation devices*
- *EN 14743:2005+A1:2007Water conditioning equipment inside buildings –Softeners*
- *EN 14812:2005+A1:2007Water Conditioning Equipment inside buildings –Chemical dosing systems – pre-set dosing system*
- *EN14897:2006+A1:2007 Water conditioning equipment inside buildings –Devices using mercury low-pressure ultraviolet radiators*

- *EN 14898:2006+A1:2007 Water condition equipment inside buildings –Active media filters*
- *EN 15161: 2006 Water conditioning equipment inside buildings –Installation, operation, maintenance and repair*
- *EN15848:2004 Water Conditioning Equipment inside building –Adjustable chemical dosing systems*
- *EN 1401: Plastics piping systems for non-pressure underground drainage and sewerage - Unplasticized poly(vinyl chloride) (PVC-U)*
- *СНиП 2.04.02-84* Водоснабжение. Наружные сети и сооружения. (SNiP Vodoprovod. Naruzhnyje seti i sooruzhenija) (SNiP Water supply. External pipelines and constructions).*
- *СНиП 2.04.02-84. Канализациия. Наружные сети и сооружения (SNiP Kanalizacija. Naruzhnyje seti i sooruzhenija) (SNiP Sewer. External pipelines and constructions).*
- *СНиП 3.05.01-85.Внутренные санитарно-технические системы. (SNiP Vnutrennyje sanitaro-tehnicheskije sistemy). (SNiP Internal sanitary systems. Assembling, installing).*
- *EN 805: Water supply. Requirements for systems and components outside buildings*
- *EN 877: Cast iron pipes and fittings, their joints and accessories for the evacuation of water from buildings. Requirements, test methods and quality assurance*
- *EN 1092: Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, PN designated*
- *EN 10216: Seamless steel tubes for pressure purposes*
- *EN 10216-1: Part 1: Non-alloy steel tubes with specified room temperature properties*
- *EN 10216-2: Part 2: Non alloy and alloy steel tubes with specified elevated temperature properties*
- *EN 10217-3: Part 3: Alloy fine grain steel tubes*
- *EN 10216-4: Part 4: Non-alloy and alloy steel tubes with specified low temperature properties*
- *EN 10216-5: Part 5: Stainless steel tubes*
- *EN 10217: Welded steel tubes for pressure purposes*
- *EN 10217-1: Part 1: Non-alloy steel tubes with specified room temperature properties*
- *EN 10217-2: Part 2: Electric welded non-alloy and alloy steel tubes with specified elevated temperature properties*
- *EN 10217-4: Part 4: Electric welded non-alloy steel tubes with specified low temperature properties*
- *EN 12056-1: 2000 Gravity drainage systems inside buildings - Part 1: General and performance requirements.*
- *EN 12056-2: 2000 Gravity drainage systems inside buildings - Part 2: Sanitary pipework, layout and calculation*
- *EN 12056-3: 2000 Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation*
- *EN 752: 2008 Drain and sewer systems outside buildings.*
- *EN 1610: 1998 Construction and testing of drains and sewers.*
- *EN 1295-1: 1998 Structural design of buried pipelines under various conditions of loading - Part 1: General requirements. Where vacuum systems are used they should meet the requirements of EN 12109: 1999 Vacuum drainage systems inside buildings*
- *EN 1825-1:2004 Grease separators. Principles of design, performance and testing, marking and quality control*

5.2 The below sanitary plumbing systems designed in the building technical solutions:

- Cold water supply system;
- Hot water supply system;
- Domestic wastewater discharge system;
- Rainwater sewer system.

Water supply system and the related equipment and appliances shall be selected taking into account the requirements, Water consumption norms and Construction technical regulation, Water supply system and wastewater discharger. Building engineering systems.

Outdoor/municipal engineering networks. Furthermore, the Republic of Georgia Law on Construction and other relevant legislation, technical normative documents and guidance documents in force in the Republic of Georgia shall be followed.
Potable quality cold water supply shall be foreseen via the municipal water supply network according to Connection conditions issued by GWP Water Company. Calculations shall be relied on to determine water demand for the building and the required pressure. Moreover, pressure boosting facilities shall be foreseen in the event of pressure insufficiency (if deviated from what has been stated in the technical conditions).
Domestic water system inside the building will be needed to cover domestic needs of the school students and staff and food court areas, for dormitory as well for green areas watering, for individual ventilation units and for fire-fighting purposes.
A common (inlet) cold water meter shall be mounted in the building to register the consumed volume of cold water for domestic needs.
Individual water meters are planned for the following:

- Cold water for the preparation of hot water;
- Cold water for green areas watering.
- Cold water for dining and kitchen areas
- Cold water for dormitory unit

Water meters shall be equipped with M-bus communication interface.
The space of water metering unit shall be with a separate entrance from the outside or from the common use non-lockable spaces. The room of water metering unit shall be lit and the temperature to be maintained there shall not be lower than +5 ºC.
The supplied cold and hot water shall be in line with the requirements stated in the Georgian hygiene norms, Potable water safety and quality requirements. For the cases of water quality deviations from the prescribed norms, water treatment facilities shall be planned. A possibility to connect disinfection equipment for water supply system cleaning and decontamination activities shall be designed.
A separate cold and hot water metering with „M-bus “interface shall be foreseen in the premises:
For inlet of Main School Block
For inlet of Dormitory units
For irrigation system
A technological task containing a precise positioning of connection points for appliances and accurate water demand ranges shall be presented for the kitchen area. The water supplied to the kitchen spaces pass softening places and mane building (as per parameters stated by technologists).

Based on the technological task for watering of green areas developed by landscape designers and architects, a separate system of watering of green areas designed in the building. A separate
water metering equipped with M-bus interface shall be foreseen.

5.3 Water tank Calculation and Pump Selection

5.3.1 Determination of water demand and waste water quantity in water supply and sewerage system

The demands of cold and hot water are determined in accordance with СП 30.13330.2016 “Internal water supply and sewerage of buildings”. (Внутренний водопровод и канализация зданий)
In whole object will be such groups of water consumers:

- Academic block 460 pupils and lectors; the number of devices Ntot 73; total second water consumption for water fittings (device), taken in accordance the СП 30.13330.2016 , Appendix 3, that is 10 l /day, 3.1 l / h and 0.14 l / s; hourly water flow sanitary fixture 100 l / h;

-Dormitory, number of inhabitors 200; the number of devices Ntot 256; total second water consumption l / s, water fittings (device), taken in accordance with СП 30.13330.2016 , Appendix 3, that is 230 l /day, 19 l /h and 0,2 l /s; hourly water flow sanitary fixture 115 l /h;

-Kitchen/Dining, the total number of seats 120;

number of dishes U = 2.2 x 50 x 1.5 = 396; the number of devices Ntot 30; For one dish, the total second water consumption for water fittings (device), taken in accordance with СП 30.13330.2016 , Appendix 3, that is 12 l /day, 12 l /h and 0.3 l /s; hourly water flow sanitary device 300 l /h;

- hall for sporting, number of visitors 100; the number of devices Ntot 18; total second water consumption for water fittings (device), taken in accordance with СП 30.13330.2016 , Appendix 3, that is 100 l /day, 9 l /h and 0.2 l /s; hourly water flow sanitary fixture 80 l / h.

Total daily water consumption:

Academic block: 460x10 = 4.60 m^3 / day;

- Dormitory: 200x 230 = 46.00 m^3 / day;

Kitchen/Dining: 396x 12 = 4.75 m^3 / day;

hall for sporting: 100x 100 = 10.00 m^3/ day;

Total 65.35 m^3 / day.

instant probability for Academic block:

$$P_b = \frac{3x460}{0,14x73x3600} = 0,035;$$ PN = 2.56; α=1,67.

instant probability for Dormitory:

$$P_b = \frac{19x200}{0,2x256x3600} = 0,021;$$ PN = 5.28;

instant probability for Kitchen/Dining:

$$P_b = \frac{12x396}{0,3x30x3600} = 0,15;$$ PN = 4.50; α=2,386

instant probability for sport hall:

$$P_b = \frac{9x100}{0,2x18x3600} = 0,069;$$ PN = 1,25.

instant total probability:

$$P_b = \frac{2.56 + 5.28 + 4.50 + 1.25}{377} = 0,036,$$ PN = 13.6; α=5.159.

Average water consumption for device:

$$q_b = \frac{2,56x0,14 + 5,28x0,2 + 4,50x0,3 + 1,25x0,2}{2,56 + 5,28 + 4,50 + 1,25} = 0,222;$$

instant total water consumption:

q=5x0,222x5,159 **= 5,73 (l/s).**

DN100 pipe size inlet.

If inlet will be installed from PE pipes, recommended sizes below:

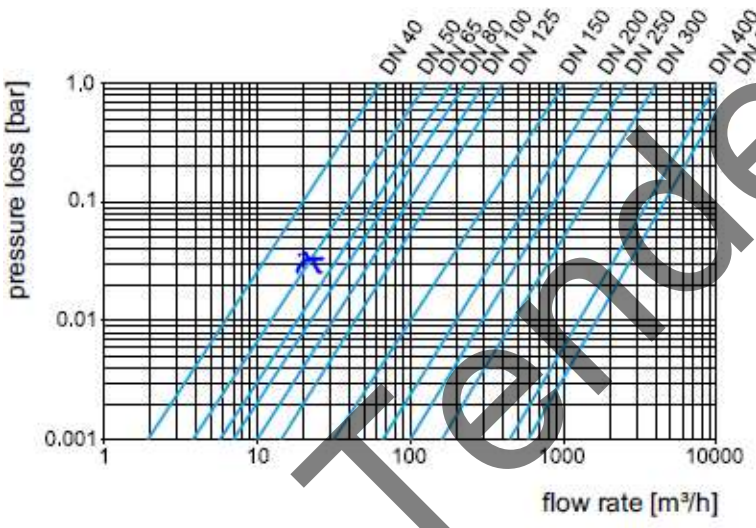
-PE100 SDR17, PN10, d125x7,4 mm, Di (inner diameter) 110,2 mm;

-PE100 SDR11, PN16, d125x11,4 mm, Di (inner diameter) 102,2 mm;

-PE100 SDR9, PN20, d125x14,0 mm, Di (inner diameter) 95,32 mm. Sizing of water meter on inlet:

q= 5,73 l/s = 20,63 m^3/h.

Pressure loses in wter meter must not exceed 0,25 bar. From diagram below water meter DN50 is eligible.



Head loss curves

Hourly probability secondary school:

$$P = \frac{3600x0,035x0,14}{100} = 0,176;\ PN = 12,87;$$

Hourly probability for hostel:

$$P = \frac{3600x0,021x0,2}{115} = 0,131;\ PN = 33,66;$$

Hourly probability for canteen:

$$P = \frac{3600x0,15x0,3}{300} = 0,54;\ PN = 16,20;$$

Hourly probability for sport hall:

$$P=\frac{3600x0,069x0,2}{80}=0,621;\ PN=11,12;$$

Average Hourly water consumption for device:

$$q_b=\frac{12,87x100+33,66x115+16,20x300+11,12x80}{12,87+33,66+16,20+11,12}=147,8;$$

Hourly total probability:

$$P=\frac{3600x0,036x0,222}{147,8}=0,195;\ PN=73,4;\ \alpha=19,81.$$

Hourly total maximum water consumption:

$Q_{h\ max}$=0,005x147,8x19,81= 14,63 (m^3/h).

Determination of household wastewater flow

The maximum second flow rate of risers should be calculated as the sum of the maximum second flow rate of water (according to 5.2.2) and the maximum second flow rate of

$$q^s = q^{tot} + q_0^{s,1}$$

wastewater from the device with maximum drainage according to the formula where q_0 is the maximum second flow rate of wastewater from the device with the maximum drainage from the toilet flush cistern, equal to 1.6 l / s.

5.3.2 Determination of water demand for Dormitory building

-Dormitory, number of inhabitors 200; the number of devices Ntot 256; total second water consumption l / s, water fittings (device), taken in accordance with SNiP 2.04.01-85, Appendix 3, that is 230 l /day, 50 l /h and 19 l /s; hourly water flow sanitary fixture 115 l / h; instant probability for hostel:

$$P_b=\frac{19x200}{0,2x256x3600}=0,021;\ PN=5.28;\ \alpha=2,65.$$

instant total water consumption for hostel building:

q=5x0,2x2,65 = 2,65 (l/s).

NOTE: This demand includes water amount for hot water preparation.

DN65 pipe size inlet.

If inlet will be installed from PE pipes, recommended sizes below:

-PE100 SDR17, PN10, d75x4,5 mm, Di (inner diameter) 66 mm;

-PE100 SDR11, PN16, d75x6,8 mm, Di (inner diameter) 61,4 mm;

-PE100 SDR 9, PN20, d75x8,4 mm, Di (inner diameter) 57,19 mm.

5.3.3 Determination of Water Demand for Academic Building

instant probability for Academic building:

$$P_b = \frac{3x460}{0,14x73x3600} = 0,035; \quad PN = 2.56;$$

instant probability for Kitchen/Dining:

$$P_b = \frac{12x396}{0,3x30x3600} = 0,15; \quad PN = 4.50;$$

instant probability for sport hall:

$$P_b = \frac{9x100}{0,2x18x3600} = 0,069; \quad PN = 1,25.$$

instant total probability:

Average water consumption for device:

$$q_b = \frac{2,56x0,14 + 4,50x0,3 + 1,25x0,2}{2,56 + 4,50 + 1,25} = 0,236;$$

instant total water consumption for Academic building:
q=5x0,236x 3,616= 4,3 (l/s).
NOTE: This demand includes water amount for hot water preparation.
DN65 pipe size inlet.

5.4 Water treatment sytem

All Water treatment equpment located in Academic block B01 Level technical room. The designed water treatment system includes foreseen components:

5.4.1 ORP CONTROLLED DOSING UNIT

Membrane dosing pump with digital adjustmentl(proportional or constant adjustabe flow) and storage tank. Pump is digital and complete with built-in electronic control panel, with bright display in 6 different languages to be selected(english, italian, german, french, spanish, turkish). A password to protecct the programmed data can also be entered. All programming and setting are made by mean of digital keyboard, provided with alarm relay remote alarm report and input connections for remote inhibition of pump working. The housing, IP65 protection, is made in fiberglass reinforced polypropilene with screw-closing colourless cover. Membranes and seats, made in PTFE, allow to dose all kind of chemicals for water treatment; for different chemicals apply. The pump can be mounted on a wall or on horyzontal surface, as well as on storage tanks, by a proper bearing supplied with pump. Pump will be supplied equipped with fittings and tubings of suction and forcing, injection fitting, screws to fix the pump on wall or on the storage tank. Adjustable constant flow pump, analogical adjustment of flow(1/100%) Adjustable proportional flow pumps controlled by a pulse sender water meter or by current input 0/4÷20mA; the pump can also work as constant flow or time controlled modes. All digital selection and settings are made by a push-button panel and digit display. Prearranged for level switch and flow sensors.

5.4.2 VOLUMETRIC WATER SOFTENER UNIT

The working of the unit is controlled by an electronic computerized programmer, low tension woring(12V), by a built-in transformer. The regeneration can be adjusted according to the volume, time and volume/time modes, always with the visualization of supplied volume of treated water.

The programmer is complete with bufer battery to save up the memory even in case of power failure. The time of the several phases of regeneration can also be adjusted, in order to fit the working of the unit to the special application and to avoid useless waste of water and salt for regeneration. The unit is supplied complete with external pulse sender water meter with dry dial and totalizer. During the regeneration cycle, a safety internal by-pass allows to supply (untreated) water. Constructions materials are non toxic and suitable for drinking water. Vessel made in fiberglass reinforced polyester resin, food grade ion exchange resins with high exchange capacity, brine tank made in shock-resistant moulded polyethilene c/w float valves, protection pipe, separation plate, automatic control valve 5-cycles working (backwash, brine suction and slow rinse, rinse, brine tank refill, service) made in no-toxic ABS. Auxiliary push-button regeneration start, out of any automatic schedule. The regeneration will be automatically completed and the system will turn back on service. A free voltage contact will be available, upon request, for remote report of running regeneration.

5.4.3 ULTRAVIOLET UNIT

Water will be provided in order to carry out disinfection with ultraviolet rays. A sensor on the device that measures radiation dose with the control board shall have three kinds of alarm function. Lamp failure, radiation dose and electricity cuts will alert the user with light an alarm system. At the top of the device, leaving the necessary clearance for ease of lamps to change.Inputs and outputs to connect to the plumbing to easily gear or bushed crafted.

SCHEDULE OF WATER TREATMENT				
EQUPMENT	**Ultraviolet unit**	**Sand Filter**	**Water Softner**	**Chlorine Dosing unit**
EQUPMENT TAG	UV-01	SF-01/02	WSU-01/02	C-01/02
LOCATION	Technical Room B01-20	Technical Room B01-20	Technical Room B01-20	Technical Room B01-20
SERVICE	Domestic Cold Water Academic	Domestic Cold Water	Domestic Cold Water	Domestic Cold Water
Water Flow Rate Q m3/h	10.7	14.63	14.63	1
Head (bar)	6	6	6	6
Quantity	1	2 Duty	2 Duty	2

5.5 Station Water Supply pipe line

All pipelines designed for their mounting in a concealed manner, with an exception of technical spaces. Cold water supply mains, risers and access branches to appliances shall be designed from PE-X or multilayer pipes.

Cold water pipelines shall be insulated against dew formation. Hot water pipelines shall be insulated with thermal insulation.

Closing valves with separate sections enabling cut-off for inspection, repair or backwashing purposes shall be installed in the supply pipeline. Water discharge valves for water draining in case or repairs or emergency situations shall be foreseen for the lowest points of the pipeline sections.

Fire sealing and smoke sealing shall be projected for the pipelines intersecting fire walls or floor decking.

Academic Block and Dormitory provided two Domestic water tanks with water treatment system and booster set in Basement Level in technical area.

Water tank selected based on calcunated in item 4.3.1 daily water consumption 65.35 m^3 / day. Hot dipped galvanized modular tanks DWT-01/02 each V= 28m3

Booster Set Selection

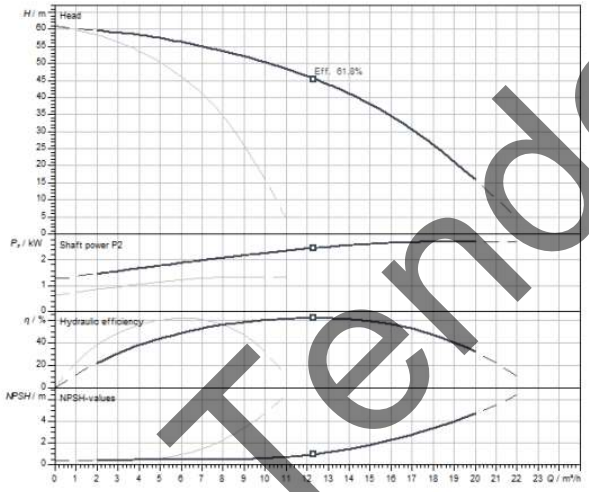
EQUPMENT	Booster Set	Booster Set
EQUPMENT TAG	BSP-01	BSP-02
LOCATION	Technical Room B01-20	Technical Room B01-20
SERVICE	Domestic Cold Water Academic	Domestic Cold Water Dormitory
TYPE	Booster Set	Booster Set
Water Flow Rate Q m3/h	10.7	2.5
Head (bar)	6	6
Quantity	1Duty+1Standby	1Duty+1Standby
Motor power (kW)	2x1.1	2x1.5

BSP-01 selection printout

Economy CO-2Helix V.../CE 607/CE

wilo

Pump curves



Economy CO-2Helix V.../CE 607/CE

wilo

Data sheet

Hydraulic data

Maximum inlet pressure p_{inl}	6 bar
Max. operating pressure p	16 bar
Pipe connection on the discharge side *DNd*	R 2
Pipe connection on the suction side *DNs*	R 2
Number of pumps	2
Number of stages	-
Number of standby pumps	1
Number of operating pumps	1
System output without standby pump Q	10 m³/h
Min. fluid temperature T_{min}	3 °C
Max. fluid temperature T_{max}	50 °C
Min. ambient temperature T_{min}	5 °C
Max. ambient temperature T_{max}	40 °C

Motor data

Mains connection	3~400 V, 50 Hz
Voltage tolerance	±10 %
Rated power P_2	1.5 kW
Rated current I_N	3 A
Rated speed n	2900 1/min
Insulation class	F
Protection class	IP55
Motor efficiency η_M *50%*	80.9 %
Motor efficiency η_M *75%*	83.8 %
Motor efficiency η_M *100%*	84.2 %

Materials

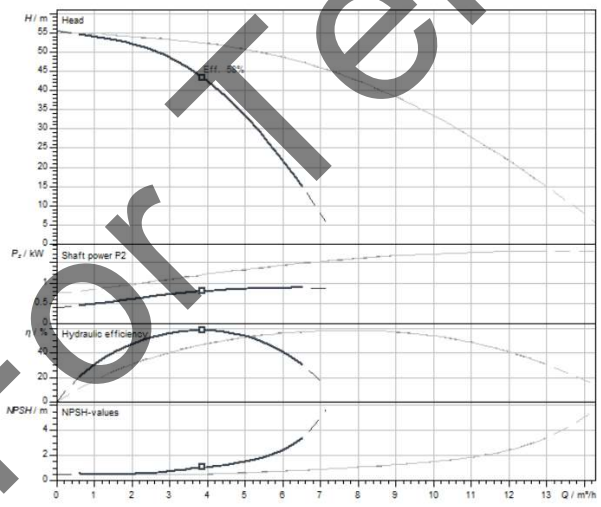
Pump housing	Stainless steel
Impeller	Stainless steel
Shaft	Stainless steel
Mechanical seal	Q1BE3GG
Gasket material	EPDM
Pipework material	Stainless steel

BSP-02 selection printout

Economy CO-2Helix V.../CE 407/CE

wilo

Pump curves



Economy CO-2Helix V.../CE 407/CE

wilo

Data sheet

Hydraulic data

Maximum inlet pressure p_{inl}	6 bar
Max. operating pressure p	16 bar
Pipe connection on the discharge side DN_d	R 1½
Pipe connection on the suction side DN_s	R 1½
Number of pumps	2
Number of stages	-
Number of standby pumps	1
Number of operating pumps	1
System output without standby pump Q	7 m³/h
Min. fluid temperature T_{min}	3 °C
Max. fluid temperature T_{max}	50 °C
Min. ambient temperature T_{min}	5 °C
Max. ambient temperature T_{max}	40 °C

Motor data

Mains connection	3~400 V, 50 Hz
Voltage tolerance	±10 %
Rated power P_2	1.1 kW
Rated current I_N	2.5 A
Rated speed n	2900 1/min
Insulation class	F
Protection class	IP55
Motor efficiency η_M 50%	78.7 %
Motor efficiency η_M 75%	82 %
Motor efficiency η_M 100%	82.7 %

Materials

Pump housing	Stainless steel
Impeller	Stainless steel
Shaft	Stainless steel
Mechanical seal	Q1BE3GG
Gasket material	EPDM
Pipework material	Stainless steel

5.6 Sanitary appliances

Sanitary appliances refer to Architectural part. Hydro-sanitary equipment should be first class. The type, type, color of the model as well as the specific preferences required in relation to the sanitary equipment are determined and chosen by the investor. After the placement of these devices, their functionality must be checked and verified by the supervisory body.
Sanitary fixtures shall be complete with all required trimming, including mixers, waste plugs, traps, supplies, stop valves, escutcheons, casings and all necessary hangers, plates, brackets, anchors and supports.
Vitreous china fixtures shall be of first quality with smooth glazed surfaces, free from warp, cracks, checks, discolorations or other imperfections. - Enamelled cast iron fixtures shall be of acid-resisting type. - In the selection of sanitary fixtures and their accessories , model numbers of certain manufacturers catalogues are given to describe the type, shape and quality of the items requested and do not in any way limit the supply to the model listed. Any item of different make judged by the Engineer to be similar in quality and manufacture will be approved.

5.7 Hot water preparation

5.7.1 Hot Water Demand Calculation

5.7.2 Determination of hot Water for Dormitory

Centralized - in heat points - hot water will be prepared for both buildings separately. Number of inhabitors 200; the number of devices Nhot 169; hot water consumption l / s, water fittings (device), taken in accordance with СП 30.13330.2016, Appendix 3, that is 140 l /day, 12 l /h and 0,14 l /s; hourly water flow sanitary fixture 80 l / h;
instant probability for Dormitory:

$$P_b = \frac{12x200}{0,14x169x3600} = 0,028;$$ PN = 4,76; α=2,442.

instant hot water consumption for Dormitory building:

q=5x0,14x2,442 **= 1,72 (l/s).**

DN50 pipe size inlet.

Polypropholen (PP Stabi Al) PN16 pipe d63x8,6 mm is recommended; Or galvanized iron pipe d60,0x 3,0 (DN50) isrecommended.

Hourly probability for hostel:

$$P = \frac{3600x0,028x0,14}{80} = 0,176;$$ PN = 29,81; α=9,41.

Hourly total maximum hot water consumption Dormitory:

Qh max=0,005x80 x9,41= **3,76 (m^3/h).**

5.7.3 Determination of hot Water demand for Academic Building

- Academic block, 460 pupils and lectors; the number of devices Nhot 28; hot water consumption for water fittings (device), taken in accordance the СП 30.13330.2016 Appendix 3, that is
3 l /day, 1 l / h and 0.1 l / s; hourly water flow sanitary fixture 60 l / h;

-Kitchen/Dinning, the total number of seats 120;

number of dishes U = 2.2 x 50 x 1.5 = 396; the number of devices Nhot 25; For one dish, the hot water consumption for water fittings (device), taken in accordance with СП 30.13330.2016, Appendix 3, that is 4 l /day, 4 l /h and 0.2 l /s; hourly water flow sanitary device 200 l /h;

- hall for sporting, number of visitors 100; the number of devices Nhot 16; hot water consumption for water fittings (device), taken in accordance with СП 30.13330.2016, Appendix 3, that is 60 l /day,
5 l /h and 0.14 l /s; hourly water flow sanitary fixture 50 l / h.

instant probability for Academic Block:

$$P_b = \frac{1x460}{0,1x28x3600} = 0,046;$$ PN = 1.28;

instant probability for Kitchen/Dining:

$$P_b = \frac{4x396}{0,2x25x3600} = 0,088;$$ PN = 2.20;

instant probability for sport hall:

$$P_b = \frac{5x100}{0,14x16x3600} = 0,062; \quad PN = 0.99.$$

instant total probability:

$$P_b = \frac{1.28 + 2.20 + 0.99}{69} = 0,065; \quad PN = 4.47; \ \alpha = 2.470.$$

Average water consumption for device:

$$q_b = \frac{1,28x0,1 + 2,20x0,2 + 0,99x0,14}{1,28 + 2,20 + 0,99} = 0,16;$$

Instant total water consumption:

q=5x0,16x 2,47**= 2,0 (l/s).**

DN50 pipe size inlet.

Hourly probability Academic Block:

$$P = \frac{3600x0,046x0,1}{60} = 0,276; \ PN = 7,73;$$

Hourly probability for Kitchen/Dining:

$$P = \frac{3600x0,088x0,2}{200} = 0,317; \ PN = 7,93;$$

Hourly probability for sport hall:

$$P = \frac{3600x0,062x0,14}{50} = 0,625; \ PN = 10,0;$$

Average Hourly water consumption for device:

$$q_b = \frac{7,73x60 + 7,93x200 + 10,0x50}{7,73 + 7,93 + 10,0} = 99,37;$$

Hourly total probability:

$$P = \frac{3600x0,065x0,16}{99,37} = 0,377; \ PN = 26,0; \ \alpha = 8,447.$$

Hourly hot maximum water consumption for school building:

$Q_{h\,max}$=0,005x99,37x8,447= **4,20 (m^3/h).**

Hot water preparation provided only for sanitary and kitchen equipment's. Hot water circulation provided for all building.

Academic Block Boiler room will be constructed as a separate unit outside of the building

For Dormitory Units, Heating and Hot Water preparation will be provided with Wall type boilers, allocated on the roof of each building.

5.8 Sewerage system

5.8.1 Domestic sewer

Domestic wastewater produced in the property will be discharged to the outdoor/municipal wastewater system according to the technical conditions issued by the local operator of wastewater system. Domestic wastewater outlets designed under foundation of building.

Calculation of Building Outlets:

Calculation based on discharge units' value (DU)

Appliance	DU (L/s)
Wash basin or bidet	0.3
Shower without plug	0.4
Shower with plug	1.3
Single urinal with cistern	0.4
Slab urinal (per person)	0.2
Bath	1.3
Kitchen sink	1.3
Dishwasher (household)	0.2
Washing machine (6kg)	0.6
Washing machine (12kg)	1.2
WC with 6 l cistern	1.2 – 1.7
WC with 7.5 l cistern	1.4 – 1.8
WC with 9 l cistern	1.6 – 2.0

The peak design flow calculated applying a frequency of K factor to the total um of discharge units, and by using the following equation:

$Qww=K\sqrt{\sum DU}$

Qww =Waste flow rate(l/s)

K=Frequency of use

∑DU=Sum of discharge units

Usage of appliances	K
Congest use, e.g. hotel, and/or showers open to the public	1
Frequent use, hotel restaurant, school, hospital	0.75

DU as per one shaft calculation:

SHAFT 1.7&1.8 outlet

Level L03

2 Shower without plug	x0.4	=0.8
2 Wash Basin	x0.3	=0.6
2WC with cistern 7.5	x1.8	=3.6
Total per L03		5 L/s

Level L02

2 Shower without plug	x0.4	=0.8
2 Wash Basin	x0.3	=0.6
2WC with cistern 7.5	x1.8	=3.6
Total per L02		5 L/s

Level L01

2 Shower without plug	x0.4	=0.8
2 Wash Basin	x0.3	=0.6
2WC with cistern 7.5	x1.8	=3.6
Total per L01		5 L/s

Level L00

4Washing machine	x0.6	=2.4
3 Wash Basin	x0.3	=0.9
1 Shower without plug	x0.4	=0.4
1WC with cistern 7.5	x1.8	=1.8
Total per L00		5.5 L/s

Total ∑DU=Sum of discharge units fot this Outlet K1.1 L00+L01+L02+L03= 5.5+5+5+5=20.5 L/s

K=0.75; so Qww=0.75√20.5=3.4 L/s ,i=2%; v=0.86m/s; Q=12.24 m^3/h.

As per schedule selected pipe DN160

The same principal is calculated all building outlets.

Gravity wastewater system designed in the building. Low-noise pipes designed in the shafts and in the areas where the noise level is limited or must be insulated. PVC socket pipes designed in the remaining locations. Ventilation risers with a canopy on the roof intended for the system ventilation. Access ports designed on risers for sewer cleaning (where possible the access ports designed in a concealed manner in the shafts, cabinets and the like) and mud-holes shall be planned in horizontal sections of drains.

The pipelines designed in a concealed manner in the shafts, spaces over the ceiling or at columns and with a minimum slope ensuring self-cleaning they connected to the designed domestic wastewater discharge outlets. Sewer not be designed in the space above the ceiling in the spaces where the food is prepared, stored or consumed.

Floor drains with stainless steel grill and hydraulic barrier (to stop bad odour spreading) projected in sanitary units for the handicapped and in common sanitary units and technical spaces.

All pipelines that intersect fire walls and floor decking shall be with fire couplings or other fire sealing members.

According to the task of ventilation system designers, connection of condensate extraction projected from the space air cooling units. Condensate connection lead to domestic sewer network and when necessary, to rainwater sewer network. For connection to wastewater pipeline a hydraulic barrier (siphon) projected.

5.8.2 Technological wastewater

Technological wastewater will be produced in the kitchen spaces of the food dining areas. Fat removed prior to wastewater discharge to the municipal sewer network and for the reason a grease separator/trap provided outside the building near mentioned spaces.

The calculation of the grease trap begins with the determination of wastewater flow. To do this, you can use the regulatory data given in Appendixes 2 and 3 to SNiP 2.04.01-85 * or, if the installation is carried out at an operating facility, make the necessary measurements. It is important to consider that if capacitive equipment is used in the process or for washing dishes (sinks or bathtubs in which water and detergent are changed in portions), the volume of “volley” discharge is taken for calculation.

The total number of seats at Dining 120;
number of dishes U = 2.2 x 120 x 1.5 = 396;

When calculating the parameter, the following formula is used:

$Qs = M*Vm*F/(3600*t)$

Here:
M – number of conventional meals per day; M=396
Vm – standard water consumption per dish (l); V=100

F – the peak flow correction factor; F=5
t – hours of daily work; t=10

Qs = M*Vm*F/(3600*t)=396 x 100 x 5 / 3600 x 10 =**5,5.**

The parameters Vm and F are taken from the table:

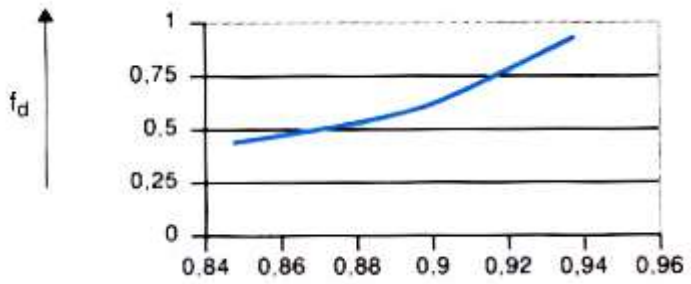
Type	Vm (л)	F
Factory canteen	5	20
24-hour catering facility (preparation of ready meals)	10	22
Hospital	20	13
Cafes and restaurants	50	8,5
Hotel	100	5

The number of conditional meals per day is calculated by the formula:
*M = t*2,2*n*m*,
here:
n – number of seats at canteen;
m – number of visitors per site per hour. For public canteens and cafes, the indicator is taken equal to 2, for factory and student canteens - 3, for restaurants - 1.5.

Based on the calculated nominal capacity, the required equipment model is selected. In this case, it should be borne in mind that if the calculation resulted in an intermediate value, then it is rounded up only.
For food industry enterprises producing semi-finished and finished products (sausages, cheeses, mayonnaise, etc.), the calculation of fat traps is performed using a different formula:

*Ns = Qs*Ft*Fd*Fr*,

here:
Ft – wastewater temperature coefficient, which is equal to 1 when t° ≤60°C and 1,3 when t° >60°C; Ft=1.0
Fd – density coefficient determined from the composition of fats according to the schedule:



The density of various types of fats is shown in the table:

Type of fat	Density (g/cm³) when t°=20°C
Animal fats	0,85 – 0,94
Vegetable oils	0,86 – 0,94
Fish oils	0,89 – 0,95
Butter	0,91
Castor oil	0,95 – 0,97

If the exact composition of fats is not known, then Fd should be taken equal to 1. If fats with a density above 0.94 are predominantly used at the enterprise, then Fd should be taken equal to 1,5.

Fd=1.0

Fr – detergent utilization rate:

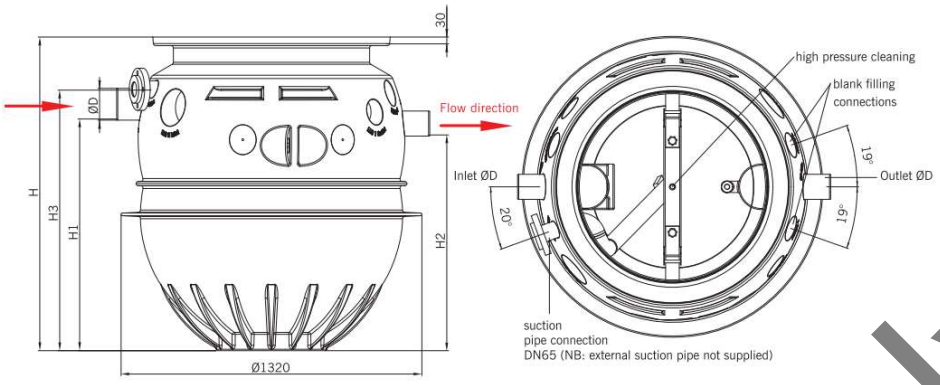
Fr=1.3

Capacity of grease separator:

Ns = Qs*Ft*Fd*Fr =5,5 x 1.0 x 1.0 x 1.3 = 7,2 l/s.

We select the nearest standard capacity:

Kitchen preparation areas split for two different side of building. We selected 2 grease separators for meal preparation areas Ns=4 L/s.



Nominal size	Spigot nominal size	Sludge storage volume (l)	Grease storage volume (l)	Total capacity (l)	ØD (mm)	H (mm)	H1 (mm)	H2 (mm)	H3 (mm)	Dry Weight (kg)	Product Ref
NS 2	DN 100	245	270	720	110	1377	1015	945	1147	119	3202.82.00
NS 2*	DN 100	460	270	930	110	1594	1235	1165	1364	134	3202.82.10
NS 4	DN 100	460	270	930	110	1594	1235	1165	1364	134	3204.82.00
NS 4*	DN 100	980	270	1465	110	2129	1745	1675	1899	145	3204.82.10
NS 5.5	DN 150	570	230	1465	160	2129	1745	1675	1899	148	3205.82.00

Technological wastewater network designed of high temperature resistance pipes.

Stainless steel drains planned for the kitchen spaces.

5.9 Rainwater sewer

Rainwater and snow melting water from the roof of the building be discharged to the outdoor rainwater sewer system based on the technical conditions issued by the local water supply system operator. Outdoor rain water risers and principle refer to architectural part.

6 HVAC (Heating/cooling and ventilation systems)

6.1 Standards and codes

6.1.1 Indoor air quality related standards

- *CR 1752:1998 Ventilation for buildings - Design criteria for the indoor environment.*
- *EN 15251: 2007 Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics.*
- *EN 13779:2007 Ventilation for non-residential buildings - Performance requirements for ventilation and room-conditioning systems.*
- *CEN/TR 14788:2006 Ventilation for buildings - Design and dimensioning of residential ventilation systems.*
- *EN 12097:2006 Ventilation for Buildings - Ductwork - Requirements for ductwork components to facilitate maintenance of ductwork systems.*
- *EN 13053:2006 Ventilation for buildings - Air handling units - Ratings and performance for components and sections.*
- *EN 15239:2007 Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of ventilation systems.*
- *EN 15240:2007 Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air conditioning systems.*
- *prEN 15780:2008. Ventilation for buildings - Ductwork - Cleanliness of ventilation systems.*
- *FprEN 779:2011. Particulate air filters for general ventilation - Determination of the filtration.*

6.1.2 Technical standards on ventilation

- *EN ISO 7730:2006 Ergonomics of the thermal environment - Analytical de-termination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria (ISO 7730:2005).*
- *EN 12237:2003 Ventilation for buildings - Ductwork - Strength and leakage of circular sheet metal ducts.*
- *EN 12599:2001 Ventilation for buildings - Test procedures and measuring methods for handing over installed ventilation and air conditioning systems.*
- *EN 13141-1:2004 Part 1: Externally and internally mounted air transfer de-vices.*
- *EN 13141-2:2010 Part 2: Exhaust and supply air terminal devices.*
- *EN 13141-5:2004 Part 5: Cowls and roof outlet terminal devices.*
- *EN 13182:2002 Ventilation for buildings - Instrumentation requirements for air velocity measurements in ventilated spaces.*
- *EN 15241:2007 Ventilation for buildings – Calculation methods for energy requirements due to ventilation systems in buildings.*
- *EN 15242:2007 Ventilation for buildings - Calculation methods for the de-termination of air flow rates in buildings including infiltration.*

- *EN 15243:2007 Ventilation for buildings - Calculation of room temperatures and of load and energy for buildings with room conditioning systems.*
- *EN 15727:2010 Ventilation for buildings – Ducts and ductwork components, leakage classification and testing.*
- *EN 15650:2010 Ventilation for buildings - Fire dampers.*
- *EN 15871:2009 Ventilation for buildings - Fire resisting duct sections.*

6.1.3 Acoustical design criteria

The various air conditioning and ventilation systems and equipment must be treated to achieve the background noise criteria levels listed below. The noise levels must be measured at a distance of one meter from discharge or inlet points.

Indoor

AREA	*Lp, dB(A)*
Dining areas	*40*
Administration area	*40*
Corridors	*40*
Public toilets, toilets for workplaces or similar	*45*
Changing rooms	*45*
Sport areas	*45*
Kitchen	*50*
Technical plant rooms	*N/A*

1 N/A – not applicable.

Outdoor

External noise levels from open plant areas and louvers *serving internal plant, i.e. chillers, air intake and exhaust* louvers must *be to the requirement*s of the Georgian Hygiene norm.

6.1.4 General provisions of Air-conditioning and ventilation systems.

- Ventilation systems of premises will be designed and installed in a manner securing their retained function and suitability for ventilation involving the least possible costs of adapting the heating and cooling systems in case the arrangement of internal partitions is altered.
- In case of fire, electricity receivers of supply and extraction ventilation systems will be tripped;
- Fire dampers will be mounted at the points of connection of air ducts from different floors/stores to a vertical collector and other fire zones passes;
- All ventilation units will be connected to the building management system (BMS);
- Air handling units will be equipped with filters which would ensure IDA2 air quality level at clean outdoor air (ODA 1 category according to EN13779:2007) and supply of design air flow (10-15 l/s/person);
- Supply and exhaust air ducts in the technical room will be covered with 30 mm thick thermal insulation;
- Intake ducts will be insulated with two layers of synthetic rubber insulation (32+13 mm);
- Unless otherwise is stated, exhaust air ducts passing the shafts will not be insulated;
- Air duct sections extending from the shaft to variable flow terminals will be covered with 30 mm thick rock wool mats.
- Silencers designed for minimization of noise generated by ventilation system fans;
- Silencers installed to suppress noise generated by variable flow terminals.
- Air supply and exhaust mains will be assembled of galvanized tin plate air ducts and fittings;
- Ventilation units controlled via the pre-set time programmer: ventilation units out of operation during non-working hours, on holidays and days off, unless otherwise is stated;
- Specific fan power (SFP) of ventilation units not exceed:
- Balanced mechanical ventilation system with heating, cooling and heat recovery – 2.2 kW/m³/s;
- Zonal supply system where fan is remote from zone – 1.4 kW/m³/s;
- Zonal extract system where fan is remote from zone – 0.5 kW/m³/s;
- Kitchen extract, fan remote from zone with grease filter – 1.0 kW/m³/s;
- The heat recovery efficiency of balanced mechanical ventilation systems incorporating heat recovery should not be worse than 75%.
- Variable air flow (DCV) systems shall be designed for ventilation of premises, unless otherwise is stated;
- The return air need not be ducted from each room as the space above the suspended ceiling can be used as return air plenum. An insulated "Z" duct shall be used to pick return air from rooms where the partitions extend up to the under side of the structural ceiling. The exhaust air shall be ducted from each space to be exhausted. Transfer of supply, return, and exhaust air, from one occupied area to another, is not permitted without ducted connections. Exception: Toilets and janitor closets.
- Fans and fan-coils of continuous operation shall be in a complete set with electronically commuted (EC) motors.

6.2 Ventilation systems.

6.2.1 In general

Ventilation systems serving premises with possible smells equipped with coil or plate heat recovery units as well without, depending on the size of the systems, actual running time or importance for energy saving.

Premises without smells ventilated with AHU's equipped with rotary heat recovery units or Plate Heat exchanger sections.

6.2.2 Ventilation rate

AREA	SUPPLY	EXTRACT
Classrooms	6.7 l/s·person	6.7 l/s·person
Office area	2.0 l/s/m2	2.0 l/s/m2
Lecture Halls (fixed seats)	4.0 l/s·person	4.0 l/s·person
Music/Theatre	5.9 l/s·person	5.9 l/s·person
Gymnasium (playing floors)	1.5 l/s/m2	1.5 l/s/m2
Lift lobbies, corridors	0.5 l/s/m2	0.5 l/s/m2
Public toilets (continuous operation)	-	30 l/s per unit
Locker Rooms		2.5 l/s/m2 -
Shower spaces (continuous operation)	-	24 l/s per shower head
Kitchen (1)	Min. 20 l/s/m2	Min. 25 l/s/m2
Technical plant rooms	0.5 h-1	0.5 h-1

1. Calculation based on kW rating of kitchen equipment multiplied by simultaneous coefficient (0.7).

2. This table applies to non-smoking areas (Smoking is prohibited by law in all public areas to protect non-smokers from the harmful effects of second-hand smoke).

6.2.3 Occupancy

AREA	OCCUPANT DENSITY per100 m2
Classrooms	35 person
Lecture	65 person
Lecture Halls (fixed seats)	150 person
Music/Theatre/	35 person
Cafeteria	100 person
Administrative/Office Areas	6.0 m²/person

1) If the occupancy category for a proposed space is not listed in EN standards, the requirements for the occupancy category shall be used from ASHRAE standard 62.1-2007.

6.2.4 Air Handling Units.

Most of the air handling units (AHU) will be located on the technical roof.
Separate AHU's are foreseen:

1) AHU for Offices & Music block
2) AHU for Dining
3) AHU Kitchen hot preparation
4) AHU for Auditorium (200psc)
5) AHU for Sport Hall
6) AHU for Black Boks
7) AHU for Kitchen cold preparation
8) AHU for Atrium/Circulation area

The Academic block Laboratories equipment's located on Academic Block Attic L03.
Dedicated ventilations systems must be designed to ventilate classes and adjacent premises.
Separate AHU's are foreseen:

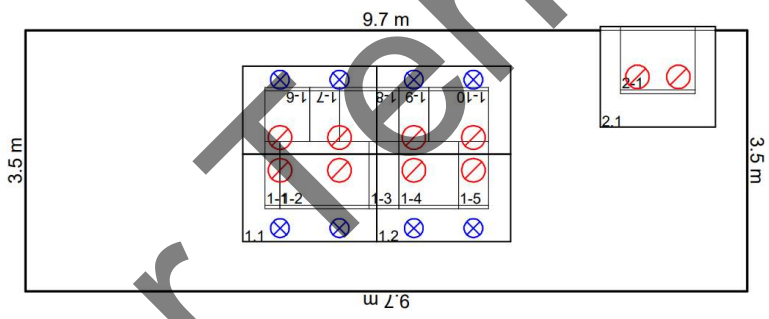
2 AHU for Academic block classroom/laboratories
Dormitory AHU units located on each Dormitory building in technical areas on the roof L03.
Separate AHU's are foreseen:
2 AHU for Dormitory living room
AHU for Dormitory Main L00 premises on the roof L03.
Note: For Exactly Equipment specification please refer to Equipment Schedule List.

The design of a kitchen ventilation system based on the flow rate in the thermal plume (since it is rare that all the equipment is simultaneously operating in the kitchen, the heat gain from cooking appliances will be multiplied by the reduction factor 0.7, called the simultaneous coefficient). The Kitchen exhaust air quantities calculated based on electrical equipment's. Approximately 50% of kitchen make-up air will be transferred from the adjacent dining area.
For simulation used Halton-Help selection program. Kitchen equipment elected buy Technological project.
Access for the kitchen extract ductwork every 5m will be provided.
Separate extraction system provided for kitchen hoods, public toilets, changing room and BOH, Chemical store, Technical rooms.
For extract air compensation from public toilet transfer air grill must be provided.

Halton HELP 1

Project: LISI SCHOOL
Location: TBILISI
Designed by: AB
Date: 6/11/2022

LAYOUT OF ROOM "Hot preparation"



APPLIANCES

Nmb	Description	L mm	W mm	H mm	Load kW	k-sim	Fuel
1-1	Table	200	900	850	-	0.00	None
1-2	Range (4 element with oven)	1200	900	850	24.0	0.70	Electric
1-3	Table	400	900	850	-	0.00	None
1-4	Fryer (deep fat)	800	900	850	24.0	0.70	Electric
1-5	Table	400	900	850	-	0.00	None
1-6	Grill	600	730	850	7.5	0.70	Electric
1-7	Table	400	730	850	-	0.00	None
1-8	Braising pan	800	730	850	14.0	0.70	Electric
1-9	Table	400	730	850	-	0.00	None
1-10	Broiler (large conveyor)	800	730	850	16.4	0.70	Electric

Size of the group: 3000 x 1630 mm

Halton HELP 4

Project: LISI SCHOOL
Location: TBILISI
Designed by: AB
Date: 6/11/2022

HOODS

Code	Model	L mm	W mm	H mm	qv-exh m3/s	dp-exh Pa	qv-cap m3/s	dp-cap Pa	qv-sup m3/s
1.1	KVF/2	1800	2350	555	0.881	41			0.777
1.2	KVF/2	1800	2350	555	1.049	58			0.864
Total:		3600	2350	555	1.930				1.641

If gas is used for cooking equipment a kitchen hood exhaust system will used to control grease-laden vapours and 2-hour fire rated ductwork is adopted.
If there is a requirement for gas and an independent ventilation system in the kitchen, they will be interlocked to shut off the gas in the event of fan failure.

6.3 Smoke and heat control systems

6.3.1 All building

Separate smoke exhaust systems designed for Academic Blocks Atrium. But generally, smoke exhaust be designed according to requirement of fire safety engineer as per Georgian Regulations.

6.4 Air Cooling Systems/Heating

6.4.1 Temperature and humidity conditions

6.4.1.1 Outside design conditions

The capacity calculations for the HVAC systems will be based on the outdoor cli-matic conditions listed in ASHARE design weather database V6. The designer will use the following values:

› Summer – 0.4 percent design dry bulb and wet bulb temperatures.
› Winter – 99.6 percent design dry bulb temperature.

PARAMETER	HEATING (99.6%)	COOLING, (0.4%)
Temperature	-6 ºC	37.2 ºC
Wet bulb temperature	-	22.4 ºC
Humidity ratio	-	10.9 g/kg
Enthalpy	-	65.4 kJ/kg

Explanation:
Values of ambient dry-bulb, dew-point, and wet-bulb temperature and wind speed corresponding to the various annual percentiles represent the value that is exceeded on average by the indicated percentage of the total number of hours in a year (8760). The 0.4 value is exceeded on average 35 h per year for the period of record. The design values occur more frequently than the corresponding nominal percentile in some years and less frequently in others. The 99.0 and 99.6% (cold-season) values are defined in the same way but are usually viewed as the values for which the corresponding weather element is less than the design condition for 88 and 35 h, respectively.

6.4.1.2 Inside design conditions

AREA	WINTER	SUMMER
Classrooms/Offices	22±1.^{0}C	23±1.0^{0}C/50%

Meeting rooms	22±1.0^{0}C	23±1.0^{0}C/50%
Lift lobbies, corridors	21±1.0C	24±1.0^{0}C/50%
Gymnasiums (Sport hall)	22±1.0^{0}C	24±1.0^{0}C/50%
For gym with wooden floor, 35 to 50% humidity recommended at all times		
Cafeteria	22±1.0^{0}C	26±1.0^{0}C
Kitchen	22±1.0^{0}C	29±1.0^{0}C
Staircase	12±1.0^{0}C	Not controlled
Toilets	21±1.0^{0}C	Not controlled
Locker/Shower Rooms	26±1.0^{0}C	Not controlled
Corridors	20±1.0^{0}C	Not controlled
Uninterruptable power supply room (UPS)	≥50C	≤260C
Technical rooms	≥120C	≤32°C
Domestic cold-water inlet	≥50C	Not controlled
Fire pump room	≥50C	≤49°C
Transformer rooms	≥50C	≤39°C
LV panel room Not controlled		≤25°C

1 The indoor design conditions are not operating limits. All room thermostats shall be ad-justable between 15C and 29C with an adjustable dead band.

2 The summer inside design relative humidity listed above need not be maintained by any humidity control. This value merely represents the design reference point; and, in actual practice, could vary with the prevailing internal heat loads and coil leaving conditions.

3 Single toilets do not require individual room temperature controls in cooling mode. For exterior single toilets, thermostatically controlled heating terminal devices should be provided to maintain space temperature in winter mode.

4 In the absence of any heat producing equipment, ventilation or cooling/heating are not required for small electrical and telephone closets. The storage closets, with areas less than 6 m2, also need not be ventilated or cooled/heated.

5 Mechanical cooling shall be evaluated for the electrical equipment and transformer rooms for locations with the outdoor summer design temperature in excess of 310C and, where the use of a ventilation system would create excessive air movement, in excess of 30 air changes per hour.

6.4.2 Systems and Soliutions

Different air-cooling units will be used for different premises:

Academic Block Classes –3sytem for one block, one floor-one 3 pipe VRF system.

Sport Area- Heating/Cooling ventilation system.

Administration and indoor located premises- 2 two pipe VRF system.

Dormitory two 3pipe system, one for each block

Server room – DX type air conditioning system.

AHU –DX type condensers.

a. For Academic block Classes, Administration provided Ceiling Cassette - 4Way type indoor units;
b. For Dormitory living room and small administration, make up room wall mounted type indoor units;
c. For Kitchen hot/cold premises area Ceiling Concealed Ducted Type.

A b c

Note: For Exactly Equipment specification please refer to Equipment Schedule List.

Room thermostat designed for each room. Freon Linkages detection must be provided

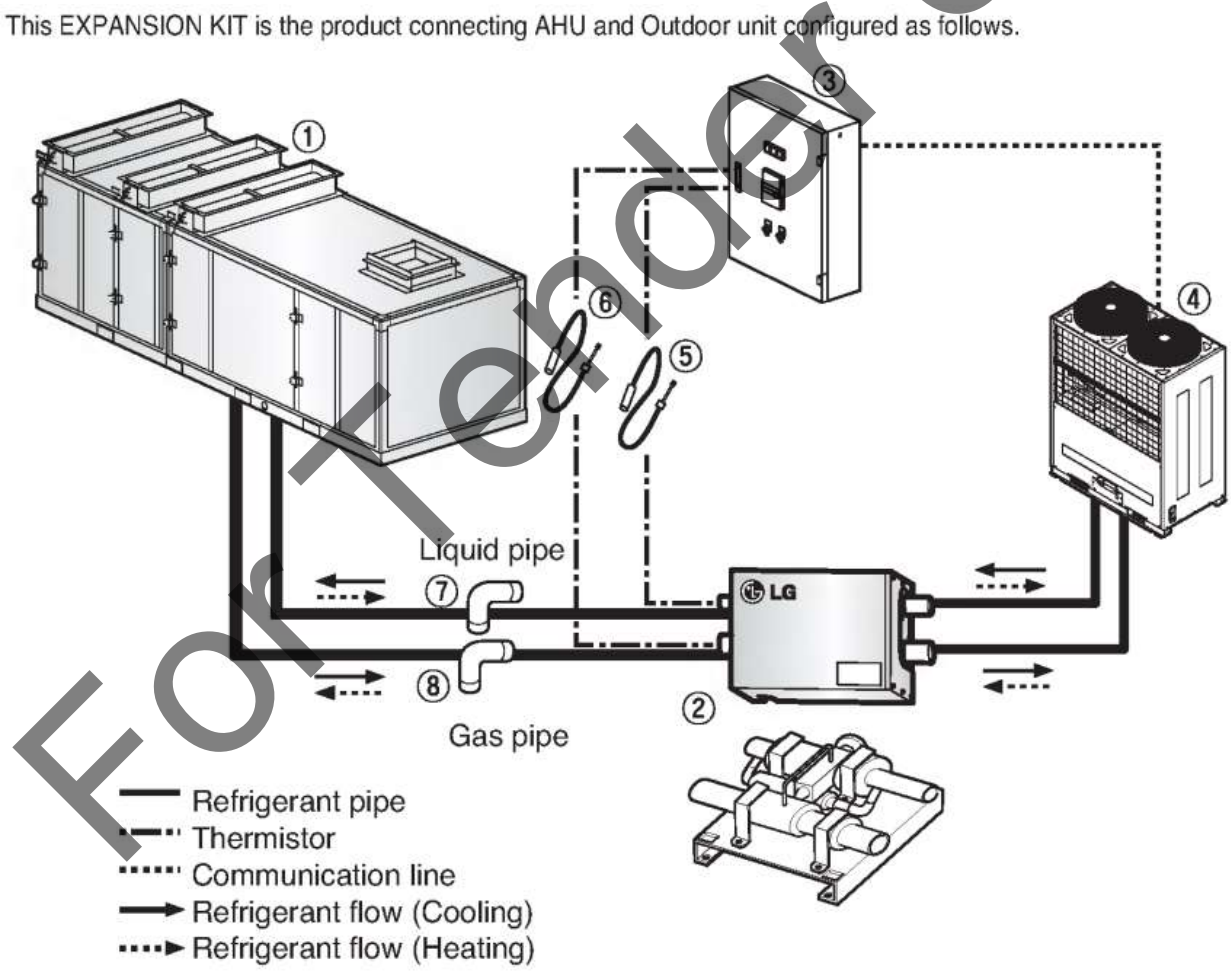
6.4.3 Cooling/Heating System Outdoor Units

VRF/VRV plant located to minimize pipe and conduit runs, but outside of conditioned area. Unobstructed flow of condenser air is essential to maintain VRF/VRV capacity and operating efficiency. Determining unit placement, careful consideration given to assure a sufficient flow of air across the condenser heat transfer surface. Two detrimental conditions are possible and must be avoided - warm air recirculation and coil starvation:

Units should be separated from each other by sufficient distance to prevent warm air recirculation or coil starvation.

When the unit is placed in an enclosure or small depression, the top of the fans should be no lower than the top of the enclosure or depression. If they are, consideration should be given to ducting the top of the unit. Ducting individual fans, however, is not recommended.

6.4.4 AHU connection to Outdoor DX units



7 Firefighting systems

7.1 Standards and codes

- *NFPA (National Fire Protection Association)*
- *EN (European Norms EN 12845)*
- *Georgian Regulations #41*

7.2 Water-based firefighting system

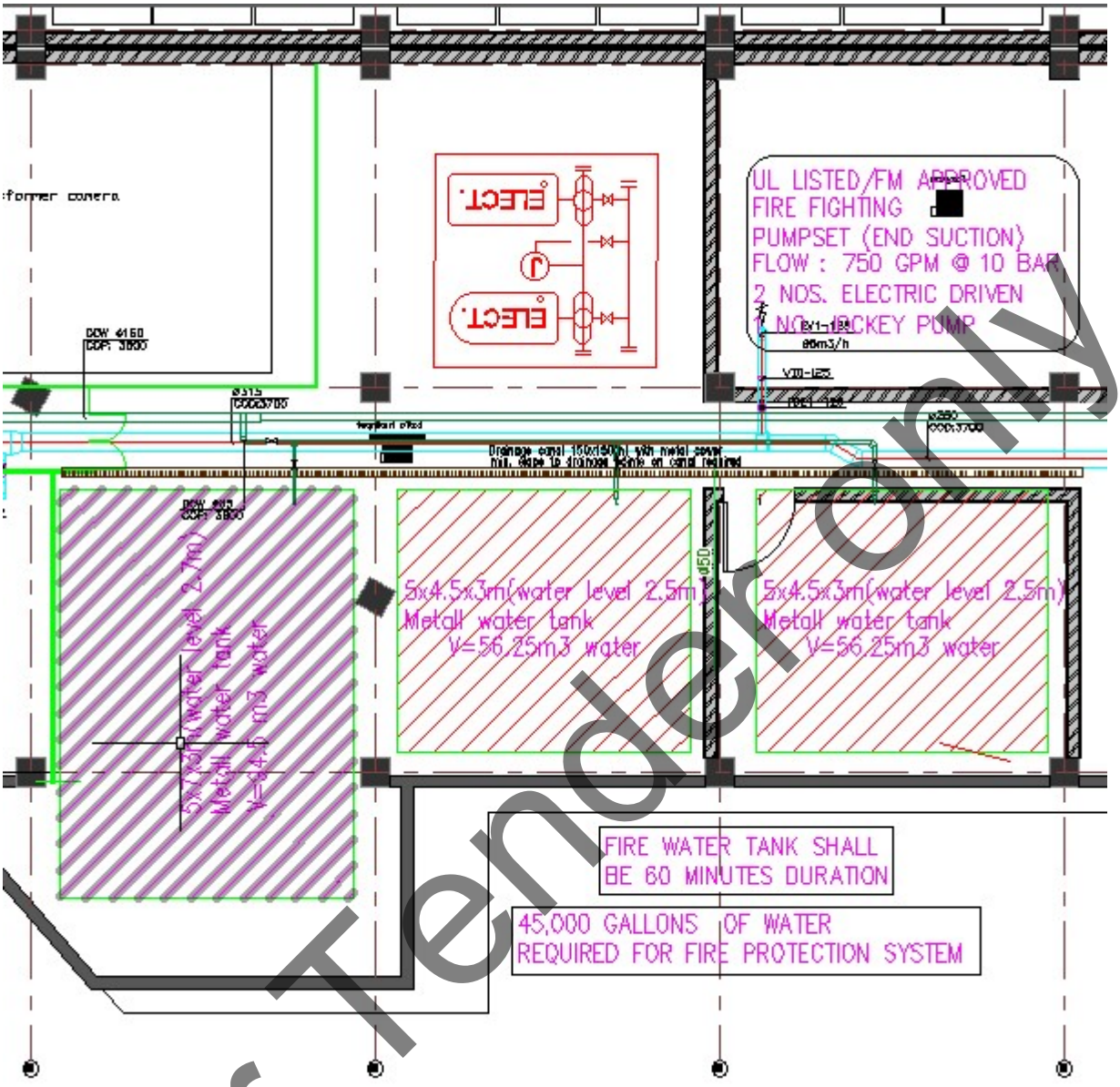
The design developed adhering to the laws and technical normative documents in force in the territory of Georgia. International and European Union normative documents as well as the relevant documents of institutions of other foreign countries shall be applicable as per procedure stipulated by the Government or the Government-authorized institution of Georgia.

Firefighting water supply system for the building above ground structure shall be designed according to the "Rules of design and installation of the building indoor extinguishing water supply systems" and relying on the submitted design task of Fire safety discipline.

Water supply for firefighting purposes shall take place from the municipal water supply network. If provided the availability of the required water demand and supply category is failed, water tank/reservoir designed.

An automatic reservoir refilling from the municipal water supply network designed. For the reservoir overfilling a separate pipeline connected to the nearest drainage. The reservoir designed in Academic Block B01 level the technical area, near to the pump station.

Fire water demands in the facility, fire pumps nominal ratings are assumed as 750 gpm @ 10 bar (2 electrical pumps, one jockey pump). Pipe diameters on the suction sides of piping DN 200 sizes on discharge sides minimum DN 150 in accordance with fire pumps nominal flow rates. Water tank designed for 60min duration. 45000gallons required water for fire protection system.



7.3 Sprinklers

7.3.1 Sprinkler Types basing on protection areas

Area	Hazard Class	Sprinkler Type[1]
Offices, Fitness	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Theater, MP Hall	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Auditorium, Cafe	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80

Classroom, Labs	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Dormitory Rooms	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Mechanical Room	Ord. Hazard G. 1	Quick Response, Standard Spray, Upright, 68°C, K80
Electrical Room[2]	Ord. Hazard G. 1	Quick Response, Standard Spray, Upright, 68°C, K80
Storage Room[3]	Ord. Hazard G. 2	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Commercial Kitchen[4,5]	Ord. Hazard G. 1	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Circulations[6]	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Public Restrooms7	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Staff Rooms8	Light Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 68°C, K80
Generator, F. Tank[9]	Special Hazard	Quick Response, Standard Spray, Pendent, Adj. Escutcheon, 92°C, K80

1) *If sidewall sprinkler heads are used in any portion of buildings, these shall have "Quick Response, Extended Coverage, 68°C, K80" specifications*
2) *Sprinklers on low ceiling and confined spaces such as electrical rooms on floors shall equip with protection guards*
3) *In order to restrict hazard class of storage rooms, storage height shall not exceed 3.7 m*
4) *Commercial kitchens involving fryers, grills, ranges and spaces open to this area shall be protected with 79-107 °C temperature rated sprinkler heads*
5) *"Dry Type" sprinkler heads shall be provided in "Cold rooms"*
6) *Corridors, halls, lobby, foyer*
7) *Sprinkler heads in Public Restroom, Lockers, Washroom, Laundry shall be furnished with "corrossion resistant" finished sprinkler heads*
8) *Security room, Offices*
9) *If generator and fuel tank room located indoor*
10) *Water supply*

Figure 1. Quick Response Sprinkler Heads

7.3.2 Design criteria

Design criteria for hazard classes in terms of sprinkler positions, operation area, design density and water supply duration are as follows:

Design Criteria for Hazard Classes

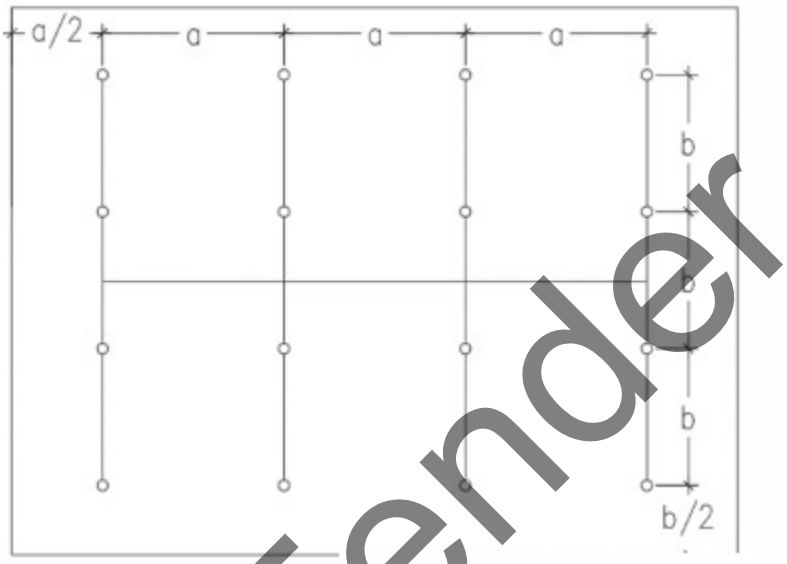
Hazard Class	Sprinkler Position	Maximum Coverage	Design Density[1]	Operation Area[2]	Water Supply Duration[4]
Light Hazard	4.6 m x 4.6 m	20.9 m^2	4.1 mm/min/m^2	139 m^2	30 min
Ordinary Hazard	Max[5] 4.6 m	12.1 m^2	6.1 mm/min/m^2	139 m^2	60 min

Special Hazard[3]	Max 3.7 m	9.3 m^2	6.5 mm/min/m^2	Room Size	60 min

1) *Areas at Ordinary Hazard Group 2 classification shall have 8,1 mm/min/m2 design densities*
2) *Sprinkler Operation Area can be reduced as per NFPA 13 - 11.2.3.2.3.1 and basing on space ceiling heights for spaces not have more than 6.1 m ceiling height and protected with "Wet Pipe" Automatic Sprinkler System*
3) *Automatic Foam-Water Sprinkler System to be designed for generator room and adjacent fuel tank room if located in the building*
4) *Water supply duration shall not be less than 90 minutes in storage areas*
5) *Sprinkler coverage shall not exceed 12.1 m2 and spaced such as 2.6 m x 4.6 m / 3 m x 4 m / 3.4 m x 3.4 m arrangements.*

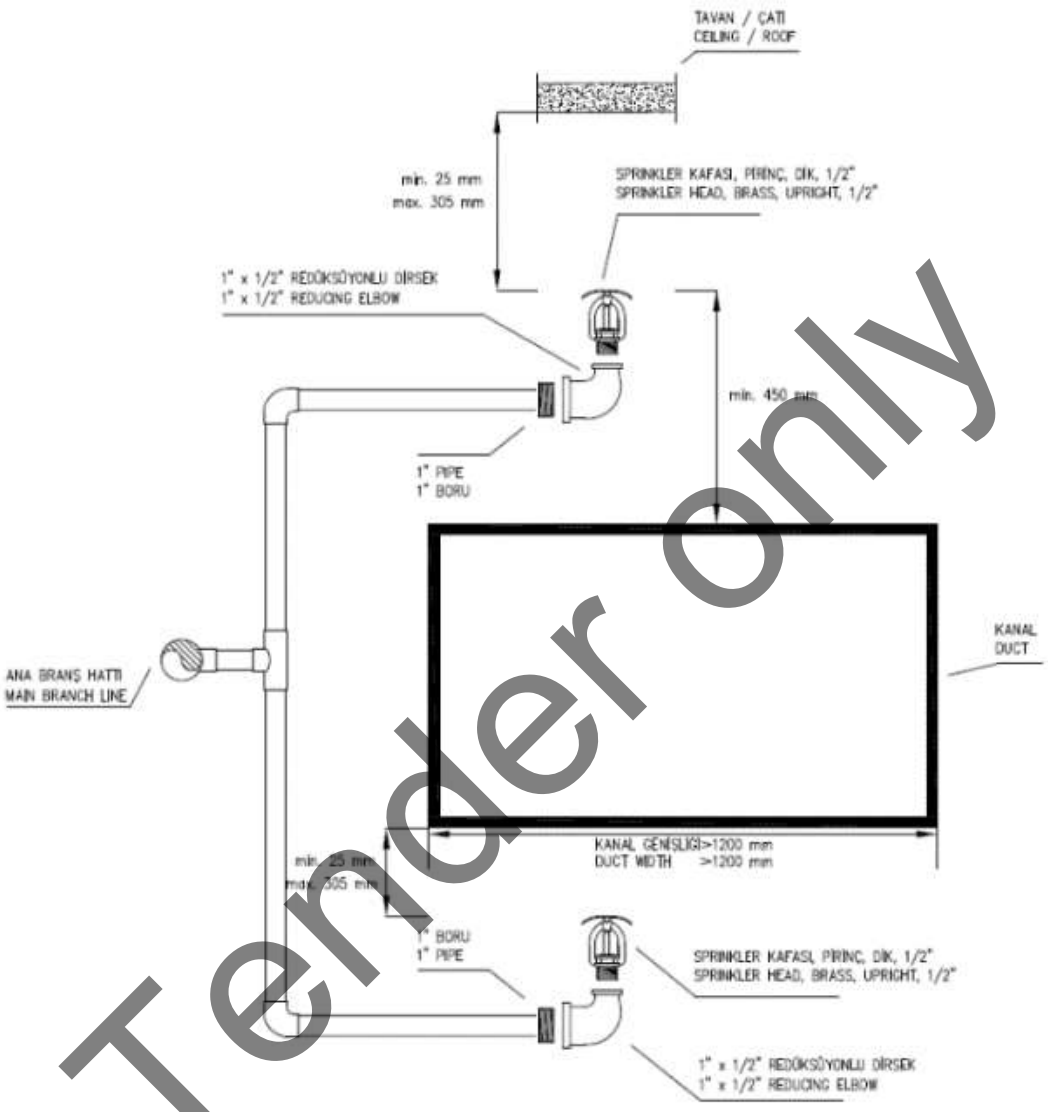
7.3.3 Sprinklers head position

Sprinkler head positions shall be arranged in accordance with below rules:
Light Hazard (a x b) ≤ 20.9 m2 , "a" and "b", max 4.6 m
Ordinary Hazard (a x b) ≤ 12.1 m2 , if "a" 4.6 m, "b"max 2.6 m
Special Hazard (a x b) ≤ 9.3 m2 , "a" and "b", max 3.7 m 1.8 m ≤ a or b ≤ 4.6 m



7.3.4 Additional Sprinkler soliution

Where concentrated mechanical and electrical installations such as pipe bundles, cable trays, ductwork are positioned at ceiling levels, additional sprinkler heads shall be provided under these installations to provide required sprinkler protection.
Additional Sprinkler under ductwork



7.3.5 Portable and Mobile Extinguishers

Extinguishers, which are used to block the contact between fire and oxygen that keep ignition with the cooling effect or to prevent the continuation of burning by directly disrupting the chemical interaction of the fire, are utilized against A, B, C, D and K class fires according to the room functions in the building.

Types of extinguishers and their disitributions in the building shall be as follows:

Area[1]	Fire Class	Ext. Type	Distribution[2,3,4]
Auditorium, MP Hall	A	6 kg ABC, portable	500 m2 /ext.
Cafe	A	6 kg ABC, portable	500 m2 /ext.
Mechanical Rooms	A, C	6 kg ABC, portable	250 m2 /ext.
Electrical Rooms[6]	B, C	5 kg CO2, portable	250 m2 /ext.
Storage	A, B	6 kg ABC, portable	250 m2 /ext.
Commercial Kitchen[7]	A, K	6 kg ABC, portable	250 m2 /ext.
Restrooms, Lockers	A	6 kg ABC, portable	500 m2 /ext.
Staff Rooms	A	6 kg ABC, portable	500 m2 /ext.

1) *1 Acceptable to use extinguishers positioned in corridors on floors, storage, restrooms and staff rooms, provided that above distribution rule is followed, otherwise, at least 1 extinguisher shall be available in the room/area*
2) *It shall be accessible within 23 m travel distance from any point on the floor*
3) *Extinguisher can be positioned exposed to the room or housed in a partition of fire hose cabinet*
4) *Portable extinguishers shall be hung on the wall, vertical distance from floor to top of extinguisher shall be not more than*
5) *1.5 m, distance from floor to bottom of extinguisher shall be minimum 0.1 m, and a sign shall be provided to the wall*
6) *25 kg %3 concentrated AFFF wheeled type extinguisher shall be provided near generator*
7) *6lt Wet chemical portable extinguisher shall be positioned near cooking and frying appliances in commercial kitchen*

Extinguishers distributed throughout the facility in accordance with NFPA 10 and in compliance with EN 54-3 and EN 1866-2 standards.

Portable Exitinguisher Installation heigh

7.4 Pump room and firefighting station

A separate space for firefighting pump room and firefighting station with signal control valves to be designed for Academic and Dormitory units. The location of the station shall be designed next to the reservoir. A direct exit from the pump room and firefighting station shall be resolved in an architectural design.

The pump room shall be equipped with the first category el. power supply. The main electrical and reserve diesel fire pumps shall be designed.

Parameters of fire pumps shall be selected based on hydraulic calculations of the system.

Adequate diameter drains shall be designed for firefighting station to enable removal of water drained through the emptying vent of firefighting direction signal valve.

7.5 Distribution pipelines of firefighting water supply system

Firefighting water supply system shall be designed in the building. The fire hose type for firefighting water supply system shall be selected according to the Fire safety discipline task.

Distribution pipelines of firefighting water supply system in the building shall be designed from black steel.

Fire Tanks and Fire pump room for Academic Block will be allocated on the basement level in technical area.

Fire tanks and fire pump room will be for Dormitory units will be allocated near the building underground together with Domestic water reservoir and Diesel – Generator set

7.6 Special requirements

Wet, water-filled fixed firefighting systems shall be designed in the building.

The system hydraulic calculations with selected parameters shall be appended as the project attachment.

7.7 Automatic fire extinguishing system

A common indication panel of pumps and firefighting automatics shall be designed for the purposes of indicating the condition of firefighting system. The panel should be mounted in the guard post.

All valves available inside the building and able to stop water supply to firefighting system when closed, shall be with an electronic position indication.

8 Electrical systems

8.1 Standards and codes

- *ГОСТ 13109-97: Electric Energy. Compatibility of technical means is electromagnetic. Standards for the quality of electrical energy in general-purpose power supply systems.*
- *ПУЭ-7: Electrical Installation Regulations, Edition 7*
- *IEC 60204-1: Electrical equipment of machines*
- *IEC 60364-5-52: Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems*
- *DIN EN 60228 VDE 0295:2005-09: Conductors of insulated cables*
- *IEC 60027-1: Letters symbols to be used in electrical technology - Part 1: General*
- *IEC 60038: Standard voltages*
- *ГОСТ 28249-93: Short Circuit in Electrical Installation*
- *IEC 60947: Low-voltage switchgear and controlgear*
- *IEC 60529: Degrees of protection provided by enclosures (IP Code)*
- *NFC 17-102: Lightning Protection Systems for Early streamer Emission technology*

8.2 General information

Low voltage input voltage: 0,4 kV/50 Hz
Rated power: **1477,57** kW
Rated current: 2525,75 A.
Expected maximum voltage drop in power receiver circuits: 7.78%
Average power factor of a low voltage system: 0,84. For reactive power compensation and stable maintenance of the power factor within 0.99, a complete 660 kVAr capacitor unit with 11 60 kVAr control steps is installed in the 0.4 kV MDB switchgear.

8.3 Power supply

8.3.1 HV Switchgear

The Electrical Power Plant will house the H.V switchgear, the transformers, generators and the L.V switchgear. The building will be served by one high voltage feeder in co-ordination with the local utility.

8.3.2 Transformer

Rating of transformer shall be sized to take full load of the component to serve a single component load in which transformer loading not to exceed 80% of the rating of the transformer.

- Building is to be feed by 1 LV normal line (~400V 50Hz) connected directly from LV switchgear in transformer station and by 1 LV backup (~400V 50Hz) fire rated line E90 is to be connected from diesel generator to the life safety and emergency equipment bus.
- Power supply connection control to be managed automatically by the automatic transfer system (ATS) built in the building main switchgear. In case normal LV standard line break down, diesel generator starts automatically and all the emergency consumers:
    - Smoke Extraction Fans;
    - Lifts;
    - Telephone Station;
    - Servers and server rooms cooling systems;
    - Lighting;
    - Voice evacuation system;
    - Fire alarm system;
    - Fire fighting system;
    - Enter control system;

  will be connected to the generator LV backup line. Interconnection time between LV lines feeding life safety & emergency equipment including diesel generator starting and connection is no more 10sec. (NFPA requirement).
- Accounting: commercial electric metering devices will be installed by the requirements of the city grid on the MV power supply line (~10kV) or on the LV outgoing lines (~400V).
- Main switchgear room for the building is to be located on dedicated room.
- Submeters to be installed in the main switchboard for Academic Block and Dormitory Block.
- Central UPS (uninterruptible power supply unit) to be installed for the following: IT racks, surveillance cameras, recorders and monitoring station, all the printers, for all computer systems. Each IT rack will be equipped by central UPS. Sockets in racks to be equipped with surge protection devices.
- All UPS connected consumers will be 100% backuped for 10 min. by the central UPS.
- The UPS must have an external bypass switch, an external audible alarm to indicate faults and fault signal.
- All UPS circuits must be protected by a rated circuit breaker and clearly labelled at both ends.
- Power sockets will be installed by Client description.
- Cables and wires will be XLPE (N2XH) type cabling no PVC allowed.
- Main and floor distribution boards must be equipped with surge arrester relevant category.

- All metal consumers to which human touch is possible must be protected by residual current protection devices.

8.4 Loads Calculation

Name	Phase	Quntytis psc.	Рн, kW	Рн. sum, kW	Cosф	Кс	Рр, kW	Ip, A
Staible Technologies Regime								
Руст = 1491,27 kW								
Prime Calculation								
Power points								
Power								
Academic Block MDB AMDB	ABC	1	906,02	906,02	0,81			
Hostel MDB HMDB	ABC	1	525,25	525,25	0,89			
Green House DB GRHDB	ABC	1	20	20	0,9			
PRKDB1	A	1	5	5	0,95			
Sculpture Garden DB SCDB	B	1	5	5	0,95			
PRKDB2	B	1	5	5	0,95			
Total		6		1466,27	0,84	1	1466,27	2509,87
Sport place								
SPDB	ABC	1	25	25	0,9			
Total		1		25	0,9	0,9	22,5	36,02
Total Pp.c				1491,27	0,84	1	1488,77	2545,63
Phase load differences								
Sa=587,89кВА, Ia=2556,04A	A				0,84		496,26	2556,04
Sb=593,81кВА, Ib=2581,79A	B				0,84		501,26	2581,79
Sc=581,97кВА, Ic=2530,29A	C				0,84		491,26	2530,29
ΔPh = 1,99%; ΔPh доп = 15%; ΔPh < ΔPh доп								
Determining criterion: Prime Calculation								
Total					0,84		1488,77	2545,63
The most powerful EP								
Academic Block MDB AMDB	ABC		906,02		0,81		906,02	1611,43
Sp = 1763,67 кВА; Smax эп = 1116,43 кВА; Sp >= Smax эп								
Defining criterion: Design load								
Result: Leading criterion "Direct settlement"								
Total for normal process mode					0,84		1488,77	2545,63

8.5 Lightning protection, earthling and equipotencialization (bonding) systems

- Earthling and lightning protection systems including surge protection is to be calculated accordingly BS/EN/IEC 623054.
- All the power distribution inside the buildings is to be TN-C-S type.
- Following installations shall be connected to the building equipotential bonding system:
  - Every metal pipe incoming from outside to the buildings.
  - Lift shafts
  - Telecommunication server room bonding bar
  - Main electrical distribution board PEN bus
  - Metal cable ladders
  - Metal ventilation duct pipes
  - Tap water metal pipes

  - Steel sprinkler pipes
  - Structural steel constructions
- Active lightning system covering all the Academic and Dormitory buildings is to be planned. (Earthing , lightning protection system grounding and other individual earthing systems such as MV, transformers, Generators etc. are going to be connected each other in the ground level)

8.6 Lighting

- The maintained luminance levels, UGR limits and uniformity for indoor/outdoor areas are to be in compliance with the standard EN 12464.
- Power Density and Lighting Efficiency:
- Comply with ASHRAE Standard 90.1-2007 (www.ashrae.com) or applicable Energy Codes. Since UL certified lighting fixtures are very expensive, they may not be necessary for fixtures in areas of low importance (carpark, storage etc.)
- All of the building lighting devices including landscape, façade lights are to be LED type with pulsation coefficient not more 5%.
- Lighting equipment for living spaces or spaces with a constant stay of people color temperature should not be higher 3500K.
- Staircases with façade windows will be lit all the night time.
- Driveway lighting must be pole-mounted, high energy efficient and long life.
- Lighting in class rooms, administration units to be controlled by local wall switches.
- Lighting in technical rooms is to be controlled by local wall switches.
- Light colour temperature will be listed the luminaire specifications
- Lighting equipment selected by the designer and must meet all of the above requirements.

8.7 Emergency lighting

- Is to be designed by NFPA.
- Emergency lighting is to be provide sub circuit protection in all areas by self contained fittings.
- The lights and circuits is to be included on the generator supplies under total building failure. Essential Load During Power Failure (No fire Condition)
- The means of egress, paths leading to a public way, and the public way is to be illuminated at all times the building or space is occupied.
- Mandatory lighting to be achieved a minimum illumination level of 1 ft-candle/10.8 lux at the floor for the following locations: stairs, landings, change of levels, change of direction, intersections, at emergency stairwell doors (corridor side), at emergency exit doors from areas of risk such as kitchens and public assembly spaces and at emergency exit doors from back of house spaces (plant rooms, plumbing/sprinkler rooms, switchgear/transformer rooms, etc.)
- Mandatory lighting to be achieved a minimum illumination level of 0.5 ft-candle/5.4 lux at the floor directly in front of all firefighting equipment/ appliances, fire panels and pull stations, throughout the entire property.
- Infill lighting between mandatory lighting along the means of egress, to be achieved an average minimum illumination level of 0.5 ft-candle/5.4 lux at the floor and, not less than 0.1

ft-candle/1.1 lux at any point, along the entire means of egress at floor level and at the public way.

- In the event of total power failure, emergency power to be supplied for the egress lighting for a minimum of 90 minutes.
- Exit signs are lit permanently in all the building. (supplied by emergency generator).
- Low energy LED lights foreseen for exit routes emergency illuminance and for Exit signs.
- Emergency lights should be designed relying on the submitted design task of Fire safety discipline according Georgian Regulations and NFPA Standards
- Emergency lighting is supplied with emergency batteries designed for 90 minutes of operation after the main power is turned off

8.8 Security systems:

- CCTV system:
  Separate systems to be designed for:
- Academic Block
- Dormitory Units

  - CCTV cameras to be foreseen outside covering:
    - all the building facades,
    - all entrances to the building.
  - CCTV cameras to be foreseen inside the building the minimum for areas:
    - Passenger elevator/lift lobbies -- all levels
    - Staff entry
    - Corridors
    - Main sport area
    - Additional locations may be required upon review by the Architecture and Construction Department.
  - CCTV cameras will not be placed in, or aimed at, classrooms, locker rooms, restrooms or other non-public areas.
  - IP-type cameras with PoE, no less that 4MP to be foreseen. All the cameras are to be with mounted-in IR lighting.
    In line with digital technology, the proposed CCTV System shall be IP-networkable with night vision analytic features type comprises of a mixed of fixed dome, fixed camera in outdoor housing and PTZ cameras to provide enhanced surveillance.

    All CCTV network switches will be connected to dual core switches via fibre optic panels such that the failure of any single core switch will not affect the entire CCTV system. The design scheme can be referred to the schematic for the CCTV System

  - Network recorder for no less than 45 days records by all the cameras to be foreseen. (Depend on operator requirements)
  - Network recorder will be mounted in the main IT room. Monitors and computer with record review and copy function to be foreseen in the security room.

- The CCTV system must be integrated into the intruder alarm system to give alarm indication and functions on the screen for door activations, silent alarm activations as described in the intruder alarm section in Brand's standard.

8.9 Fire alarm system

An automatic addressable fire alarm system shall provide fire detection and activation of fire alarm, in compliance with NFPA and local fire regulatory requirements.

A single main fire alarm panel (MAP) with Master Mimic Panel (MMP) shall be located within the fire control center (FCC) of the building, shared amongst all assets (Academic, Sport, Administration) as a single point of call for the fire brigade during fire. Seaprate Fire Alarm System should be provided for Dormitory Block

Sub alarm panels (SAP) with mimic panels located in firefighting lobbies of each level/zone of the building will connect to the MAP and monitor:

- Automatic sprinkler system ACVs or ZCV flow switches
- Smoke detectors and heat detectors
- Manual break-glass call points
- Fire suppression systems
- Smoke control systems
- Sprinkler, WR or HR pump status (incl. fault)

If fire is detected, the fire alarm system will:

- Ring fire alarm bells
- Activate emergency voice alarm communication (EVAC) to broadcast pre-recorded announcements
- Notify fire brigade via link system (if available)
- Deactivate access control of selected doors
- Activate relevant smoke control systems
- Turn-off non-fire-mode mechanical ventilation

- System design will comply with
  NFPA Fire
  NFPA 72 National Fire Alarm Code
  NFPA 101 Life Safety Code
  NFPA 5000 Building Construction and Safety Code
- Central panel to be foreseen in guardroom where the guard personnel is working 24h per day and 7 days per week.
  (main fire commander room)

- Fire alarm system foreseen with back-up battery set, able to feed the whole fire alarm system and assure all its functions up to 30 hours standby time and 30 minutes in alarm mode.
- All equipment including cabling must be supported and approved by one of the following testing laboratories:
  international test certificate is sufficient
- Vds (Verband der Sachvershicherer), Germany
- BS (British Standards)
- CEN (European Committee for Standardization)
- System operational matrix shall follow standards and design task of Fire safety discipline.
- Manual call points will be provided at each floor exit and at each exit to the exterior.
- Fire alarm repeater panel and manual call point will be provided at the front desk.
- Voice alarm speakers will be of metal construction without exposed terminals and should be supplied with a protective fire dome to EN54
- The voice alarm system will be zoned by floor except staircases, which should be zoned by individual stair.
- The PA voice alarm will be battery backed for 24 hours standby and 1 hour in operation within the racks(after approval by fire department of fire concept engineer)
- UPS back up: (wherever as necessary)
- • 1 for Main server / computer room
- • 1 for Office areas/Admin/reception etc.
- • 1 for each separated Building services systems i.e. serving FA system / CCTV / BMS / AV systems etc.
- 4 hours in the case where UPS is NOT backed up from an emergency generator. However if we have all the UPS served from the generator power supply as well as the mains supply, then a 1 hour battery life can be accepted
- Personal attack alarm switches will be positioned 1 per workstation on reception, all cash handling areas (including bar and restaurant), spa reception, finance office, fitness centre).

8.10 Audio Voice Evacuation

Emergency Voice Communication System comprises one way digital communication systems shall be provided for the development and the design concept is having common system serving to the Academic, Administration and Sport Blocks respectively. Dormitory Block will be equipped with own Emergency Voice Communication System.

The one-way communication system will also be used for public address paging.

EVC system shall be provided and the equipment to be provided for each component will be as follow:

- Main operator console, Network switches and its system work station should be in the FCC of the development
- Two paging consoles, one located in Security Room and the other at Customer Counter or Information Counter

- Event Recorder and Pre-recorded messages.
- Amplifiers and standby units.
- CD/MP3 player for background music
- UPS (minimum 2 hours)

The speakers connected to this system must be in every room of the building. The system should be divided into zones in proportion to the areas of use.

All zones should be united in one station, which is connected to the fire safety panel.

Separately provide an alert on the forest ranks. In areas where there is also the use of other music (sports hall, shopping malls, restaurants, all these systems must have access to connect to a voice notification system and automatically turn off when it is activated)

The warning system is an integral part of automatic fire protection in buildings.

The warning system (CO) is primarily designed to alert staff and customers about a fire and other emergencies, and also allows you to make service announcements in any of the warning zones.

The choice of a method of warning people about a fire was carried out by:

- On the approval of fire safety standards "Designing systems for warning people about a fire in buildings and structures" (

According to the requirements, the building must be equipped with a CO of the third type: automatic speech (recording and transmission of special texts) and light (“Exit” light indicators).

The notification should be carried out: by broadcasting voice information about the need for evacuation and other actions aimed at ensuring safety.

Evacuation management should be carried out:

- inclusion of emergency lighting;

- transfer of specially developed texts through JI aimed at preventing panic and other phenomena that complicate the evacuation process (crowds in the aisles, etc.);

During normal operation, background music shall be provided to designated public areas. Emergency paging facility will be provided only at the main microphone paging panel in the Fire Command Centre. The entire sound system shall be electrically supervised to indicate malfunctions including open circuits, short circuits and ground faults. Sound Pressure Level (SPL) at listening level shall be at least 10dB above ambient noise; and at least 95dB for M&E areas, and 85 dB for public and other areas.

Generally, ceiling and box speakers shall be spaced no more than 6m apart. Sound projectors shall be proposed for the carpark area and outdoor areas.