



D10.5.2

Technical Harmonization and Regulation

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Author(s)	Bartosz Starosielec (MOSTOSTAL)

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Contributors to this document

In the following list the members of FC-DISTRICT consortium who have contributed to the preparation of the deliverable are reported.

- Anna Paraboschi (DAPP) – Chapter 3.



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Summary

This document is report within Task 10.5: Harmonization with codes. In this task two deliverables were prepared. Both documents have the same title, but were delivered in different project stages.

First part was a report, prepared at month 23, containing definition of construction requirements for “source room”, where SOFC is placed, energy storage room and sedimentation tank room¹.

Subject of this deliverable, prepared at month 36, is verification of compliance and the possibility to incorporate appliances for new or retrofitting buildings, in the aspects of existing rules and standards. There are also guidelines for the new technical regulation associated with the use of new systems and technologies.

Aim of this Document

This document is intended to provide guidance for EU authorities in matter of creating and/or updating regulations concerning built-in SOFC “source room”, energy storage room and sedimentation tank room. It mostly includes information on safety issues as well as convenience in maintenance and services.

As for today obligatory regulations applicable to fuel cells, energy storage and sedimentation tank system in UE are:

- Machinery Directive (98/37/EC, 2006/423/EC),
- Low Voltage Directive (LVD) (2006/95/EC, 73/23/EC),
- Electromagnetic Compatibility Directive (EMC) (2004/108/EC),
- Cogeneration Directive (2004/8/EC),
- Pressure Equipment Directive (PED) (97/23/EC),
- ATEX Directive (94/9/EC),
- Gas Appliance Directive (GAD) (90/396/EEC, 93/68/EEC).

Some information about how to prepare appropriate space for SOFC “source room”, energy storage room and sedimentation tank room are included in directives and standards listed above. There is no document which gathers all the necessary information in one place what makes designing process complicated. This document gathers the most important information in one place, coming both from experience of performing demonstration in Poland, and from existing regulations.

¹ FC-DISTRICT Deliverable 10.5.1: Technical Harmonization and Regulation, 2012

1. SOFC source room

Prior concern of designing SOFC “source room” is safety. Main hazards associated with systems located in such spaces are:

- possibility of release of combustible/toxic/high temperature gases and liquids,
- contact of person with mechanical elements, electrical parts, hot surfaces,
- potentially explosive mixtures in normal or abnormal operating conditions.

In a situation when combustible gas or liquid is released probability of explosion occurs. Depending on fuel composition used in SOFC, different concentration of gas/fumes and air forms an explosive mixture. Equally dangerous situation might occur when toxic substances extract from the process. Both such incidents expose people to harm and even death. Also high temperature factor released from the device may lead to unpleasant consequences. Properly executed device designing process and high quality elements should guarantee safety.

Responsibility at assembly process is critical to avoid harm from moving parts of mechanical elements, electric shock from uninsulated circuits, unearthed elements or burns from not secured hot surfaces while operating devices.



Figure 1 Early concept of FC-DISTRICT SOFC unit

Within designing process of any equipment it is necessary to analyse all possible scenarios during years of exploitation in normal and abnormal conditions. Many substances may precipitate and

react with each other making it difficult to capture it at the beginning. In some cases it might lead to breakdowns or even deadly accidents.

Except safety the second concern is convenience of maintenance and services of the devices. It is important to realize that accessibility, solid and reliable service of equipment is essential to long and inexpensive operation, without breakdowns and accidents.

Additional standards concerning stationary fuel cell power systems published by International Electrotechnical Commission (IEC), which are optional in use, are listed below:

- IEC 62282-2 ed2.0 (2012-03) Fuel cell technologies - Part 2: Fuel cell modules
- IEC 62282-3-100 ed1.0 (2012-02) Fuel cell technologies - Part 3-100: Stationary fuel cell power systems – Safety,
- IEC 62282-3-200 ed1.0 (2011-10) Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods
- IEC 62282-3-300 ed1.0 (2012-06) Fuel cell technologies - Part 3-300: Stationary fuel cell power systems – Installation,
- IEC 62282-6-100 ed1.1 Consol. with am1 (2012-10) Fuel cell technologies - Part 6-100: Micro fuel cell power systems – Safety.

1.1 System location and accessibility

The SOFC system can be placed in technical room together with other devices and storage systems. Locating SOFC units in a permanent people presence room is forbidden, however kitchen and bathroom should not be treated as such. It is recommended to allocate the source in a dedicated room, closet, wardrobe or in the aforementioned kitchen or bathroom. Good practice is to install most of the plumbing components at sight, in order to easily detect leakages, damages and material breaches.

The “source room” should be located as close as possible to the centre of the heated zone, to minimize pressure losses to the farthest heat receiver, minimize heat losses and minimize quantity of piping. It is very convenient to place the “source room” next to an outside wall from one side. It enables locating openable windows which gives natural lighting and possibility of emergency ventilation.

Operating SOFC units might generate noise, which can be disruptive in the long run. To provide acoustic comfort it is recommended to finish “source room” in a technology which protects against noise transmission to other spaces. Avoiding common walls for permanent people presence room and “source room” is a good practise, which should be implemented if possible.

Due to risk of freezing of the heating medium in the system, a positive temperature in the "source room" should be ensured. It is forbidden to allocate SOFC in a place with a high risk of temperature drop below zero Celsius.

Technical rooms need to be accessible for people for maintenance and services. The complete access path from outside (street level) to the inside of the room needs to be wide enough to enable replacement of the biggest component, with an expected lifetime that is shorter than the building's lifetime. It is necessary to allow access for service to all devices by leaving space around equipment according to manufacturer's manuals.

1.2 Lighting

The room has to be lightened in order to permit regular maintenance and inspections any time it is necessary. It is recommended to use as much natural lighting (windows and other glass surfaces) as it is possible with assistance of artificial lighting.

Lamps should have International Protection Rating (IP) of at least 24 according to EN 60529:1991 standard to minimize chance of electrocution and electrical breakdown.

1.3 Ventilation

The SOFC “source room” must be ventilated to avoid accumulation of such gases as: hydrogen, natural gas, carbon monoxide, dioxide, as well as overheating that could cause difficulties in proper system functioning and lead to health or environmental hazards. It is recommended to use natural ventilation with supporting fan for use in warm period. Minimum net area of the duct should not be less than 200 cm².

Fan should be installed on the top of the suction section and it must not obstruct the air flow while turned off. Recommended solution is switching fan on/off based on temperature in the “source room” and when gases concentration exceeds the alarm limit.

Air exhaust should be located in the highest point of the ceiling, air supply near the floor, to optimize circulation. It is acceptable to use door grille with net area of at least 200 cm² in the bottom part as an air supply.

1.4 Air supply and flue gas ducts

SOFC is powered with natural gas and oxidization process is hermetically closed. Most convenient solution is to provide device with supply air in the outer layer of flue gas duct in a concentric chimney. It simplifies installation process and provides higher safety level in case when inner duct is not hundred percent tight. Chimney should not be smaller than Ø80/125 mm.

High level of heat recovery guarantees low temperature of flue gas what leads to intense condensation processes in the inner duct. Condensate can be acidic and it should be hooked up into sewage system through odour trap. SOFC device has a built-in condensate drainage, what enables to install chimney with slope in the heat source direction. In some cases condensate neutralization might be needed.

It is very important not to exceed maximum horizontal length and amount of bends, to avoid problems with air intake in the device. Maximum recommended horizontal length of the duct is 3 meters and the number of bends should not exceed 3 pieces.

1.5 Plumbing

SOFC unit has to be connected to natural gas installation, water heating installation, safety valve drainage and condensate drainage.

Natural gas is oxidized inside the SOFC unit, in which heat and electrical power is produced. Gas installation has to be adopted for safety and optimal usage with SOFC fuel cells. The most important parameter is the gas pressure which should not get below 3.5 kPa on the inlet. Also fuel humidity and impurity should not be too high considering device life span. Always a good solution

is to equip gas supply pipe with dirt separator just before the shut off valve. It is permitted to connect the device to the installation using flexible hose dedicated to gas installations.

Internal gas installations should be made of steel or copper. It is forbidden to make the installation of plastic. It is not recommended to use threaded or clamped connections, but welded or brazed with hard solder only.

FC-DISTRICT SOFC unit has a built-in filter, electronic pump, return valve and safety valve. In such case connection to water heating circuit can be made with use of shut off valves only. As with gas connection it is permitted to install the device using flexible hoses.

SOFC unit has a safety valve and condensate drainages which should be connected to the sewage system. Unless the outflow to sewage is installed in the floor, there might be need to place the device on a platform or use condensate pump. Due to the small amount of condensate there should be no need for neutralization of the acidic medium. Connection to the sewage should be via odour trap.

1.6 Floor, walls and ceiling

Floor or wall near the device should be made of non-combustible materials. If the floor or wall is made of combustible materials, the minimum distance of 0.5 m from the edge of the SOFC should be permanently covered with a non-combustible material.

If the SOFC “source” room is located on the lowest level it must be protected against the penetration of ground water and other causes of flooding. Recommended solution is to set the device on the platform, install floor drainage or both.

1.7 Electricity and wiring

SOFC unit, in both – energy consumption and production mode, use the same wiring. Depending on the size of device, loom can be of 3 or 5-wires. There are no any specific requirements for wiring, except for meeting the European standards. Wire size should be determined each time for the maximum current value that can occur regardless of the operation mode – consumption or production.

1.8 Safety requirements

The main condition for the correct operation of the device is ensuring a minimum flow rate of the heating medium through the heat exchanger in the unit. Providing the required minimum heat exchange between the device and heating medium protects equipment from overheating.

The main safety condition that has to be ensured is protection of the installation against excessive pressure. Pressure systems are required to be secured with expansion vessel located in the district management building and locally using safety valves with each SOFC unit.

Additional solution, which in some cases may be advisable, is the use of gas sensors cooperating with electromagnetic shutoff valves and audio-visual alarm modules. This solution increases the level of safety of the installation, however, entails substantial additional costs.

Other factors providing safe operation of the installation include: usage of gas shut off valves before each unit, as well as each building, mesh filters usage before each unit, on both water and

gas installation, correctly performed flushing of the system with use of special ingredients and ultimately usage of softened water with the addition of corrosion inhibitors in the heating circuit.

1.9 Installation maintenance

Once a year, some actions have to be performed, to ensure the maintenance of the installations in an efficient condition. Such basic activities include:

- Verification of the safety system operation;
- Verification of joints in the gas installation;
- Verification of patency of the chimney;
- Verification of the chimney draft;
- Purging mesh filters on both, water and gas installations.

Appropriate instructions on use and operation of installation, with the necessary schemas should be placed in a visible spot in the SOFC “source room”.

Table 1. Main parameters and checklist.

Parameter	Checked	
1.1 System location and accessibility		
- SOFC in technical room, kitchen, bathroom, closet, wardrobe*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- No common walls with permanent people presence rooms	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Openable window	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against noise transmission	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against negative temperatures*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Plumbing at sight	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Accessibility for maintenance and service*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.2 Lighting		
- Natural lighting	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Artificial lighting with IP24*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.3 Ventilation		
- 100 cm ² net area of air exhaust, max 10 cm under the ceiling*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 200 cm ² net area of air supply, max 10 cm above the floor*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Not obstructing natural ventilation supporting fan	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.4 Air supply and flue gas ducts		
- Concentric chimney with slope in the SOFC direction, min Ø80/125 mm, horizontal length max 3 m, max number of bends 3 pieces*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.5 Plumbing		
- Natural gas installation made of steel or copper, min pressure 3,5 kPa, dirt separator and shut off valve*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Heating circuit connection with shut off valves*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Condensate connection to the sewage via odour trap*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.6 Floor, walls and ceiling		
- Non combustible floor and walls, min 0,5 m from the edge of the SOFC*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Platform, min 10 cm high or floor drainage or both*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.7 Electricity and wiring		
- 3-wires electricity installation*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 5-wires electricity installation	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Electrical connections protected with appropriate fuses*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.8 Safety requirements		
- Gas sensors cooperating with electromagnetic shut-off valve on the gas installation	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>

2. Energy storage room

Each district heating built according to FC-DISTRICT project guidelines should have an energy storage room with a set of devices which enable the whole heating network to work properly. The most significant devices necessary for the installation operation are listed below:

- Energy storage tank;
- Set of pumps;
- Pressure stabilization system;
- Installation water refilling system with treatment unit.



Figure 2 Set of pumps connected in parallel

Dangers associated with operation of listed equipment are listed below:

- The likelihood of burns, as a result of burst of the plant element due to hot factor overpressure;
- Possibility of burns, as a result of contact with a hot surfaces;
- Possibility of injury resulted of contact with mechanical devices;
- Risk of electric shock due to inadequate maintenance of equipment.

To ensure the safety operation of pressure systems there are three major issues which have to be solved. First factor is a proper design. If all the calculations are carried out in accordance with the requirements, the risk of failure is significantly reduced. The second important element is the proper implementation of the designed system. Operation by trained personnel, a clear indication of system components, providing clear diagrams and installation protection against tampering by unauthorized persons are yet another challenge to meet. Unless all these issues are solved there is no assurance that the system will operate safely and without failure.

2.1 System location and accessibility

Energy storage tank should be placed in technical room together with main loop pumps and main circuit armature, close to the district manager control room. It is recommended to allocate the energy storage room at the lowest possible level. There is a possibility of combining function of the room with other technical space, as long as the local authorities permit such solution. Good

practice is to install most of the plumbing components at sight, in order to easily detect leakages, damages and material breaches.



Figure 3 Pressure stabilization device controlled with pressured air system

It is best if the energy storage room is located near the centre of the heated district to minimize pressure losses to the farthest building, minimize heat losses and minimize quantity and size of piping. It is very convenient to place the energy storage room next to an outside wall from one side. It enables locating openable windows which gives natural lighting and possibility of emergency ventilation.

Operating main circle pumps might generate noise, which can be disruptive in the long run. To provide acoustic comfort it is recommended to finish energy storage room in a technology which protects against noise transmission to other spaces. Avoiding common walls for permanent people presence room and energy storage room is a must.



Figure 4 Part of a water treatment system - water demineralization device

Due to risk of freezing of the heating medium in the system, a positive temperature in the energy storage room should be ensured. It is forbidden to allocate main circuit equipment in a place with a high risk of temperature drop below zero Celsius.

Technical rooms need to be accessible for people for maintenance and services. The complete access path from outside (street level) to the inside of the room needs to be wide enough to enable replacement of the biggest component, with an expected lifetime that is shorter than the building's lifetime. It is necessary to allow access for service to all devices by leaving space around equipment according to manufacturer's manuals.

2.2 Lighting

The room has to be lightened in order to permit regular maintenance and inspections any time it is necessary. Lamps should have International Protection Rating (IP) of at least 24 according to EN 60529:1991 standard to minimize chance of electrocution and electrical breakdown.

2.3 Ventilation

Energy storage room should be definitely ventilated. It is recommended to use natural ventilation system. Usage of mechanical exhaust ventilation is also an acceptable solution. The amount of air exchanged within one hour should be of about 0.5 of the room capacity.

Air exhaust should be located in the highest point of the ceiling, air supply near the floor, to optimize circulation. It is acceptable to use door grille with net area of at least 200 cm² in the bottom part as an air supply.

2.4 Plumbing

Among the basic equipment of energy storage room is energy storage tank, district main circuit pumps, pressure stabilization system, installation water refilling system and some additional armature. All of these devices are a part of district heating system. Furthermore pressure stabilizing system has to be incorporated into the sewage system and installation water refilling system has to be connected to the service water system. In the figure 5 example of energy storage room plumbing system is presented.

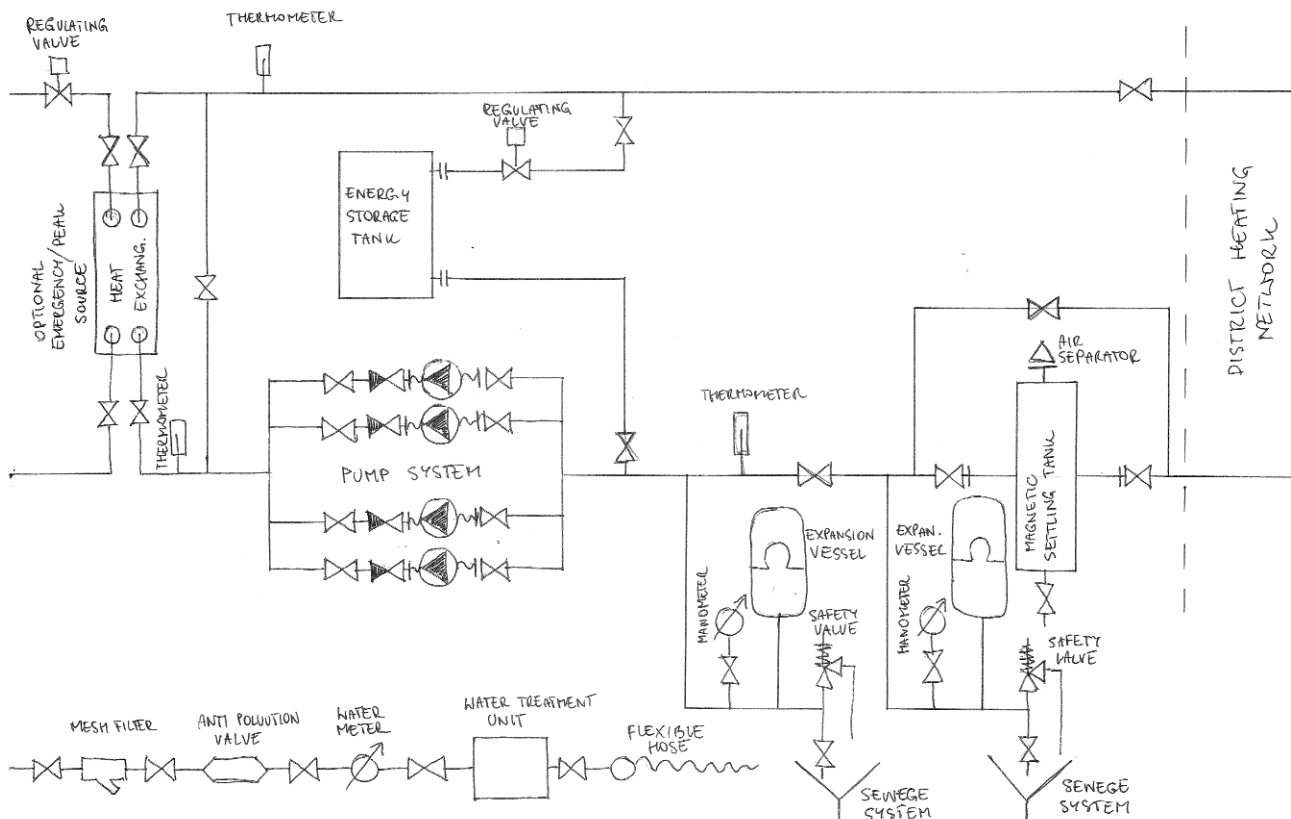


Figure 5 Scheme of the energy storage room plumbing, equipment and armature

Energy storage tank is intended for use in heat demand peaks, which occur during the heating season. Sizing the tank should include calculation of the district heat balance and analysis of statistical data of intensity and duration of the frost in the particular area for the minimum of 20 years. Calculations should also take into account heat losses from the tank.

The scheme presented above contains the optional heating exchanger for covering heat demand in emergency situations. Usage of multiple pump system is needed in large district networks, but in some situations two-pumps is enough. The second pump is required if the main one fails and optionally in the peak heat demand. It should also be useful in the installation flushing process. Parallel pump connection should always be done using collectors. In the example, there are two expansion vessels. First from the left should be able to take over the excess of the capacity in the energy storage room part of the system and the second one the excess of the capacity in the whole district system, including internal parts of installations in the supplied buildings. In large systems the second expansion vessel might need to be replaced with a pressure stabilization system controlled with compressed air to minimize the tank size. The energy storage room heating installation should be also secured by the safety valves. An indispensable element of the system is the magnetic settling tank, which should be equipped with an air separator and water drain. To ensure the ability to work without a break in the heat supply it is recommended to use bypasses of the heat exchanger and the settler. The layout in figure 5 allows smooth operation and efficient service due to optimized ball valve implementation.

Energy storage room should be provided with water supply. Supply pipe should be armed with mesh filter, anti-pollution valve, water meter and water treatment unit. Water treatment system should be adapted to local conditions, to fulfil requirements posed by the used equipment. In large district heating networks automatic water filling system is needed.

Besides floor drainage it is necessary to provide inlets to the sewer system. The inlets should be equipped with odour traps. Outlets from both safety valves should be incorporated to the sewerage as well as installation drains.

2.5 Floor, walls and ceiling

If the energy storage room is located on the lowest level it must be protected against the penetration of ground water and other causes of flooding. Regardless of the location, the room should be equipped with a floor drain and cooling well of capacity of the largest appliance within, but not more than 1 m³.

Due to its importance, the energy storage room should be isolated as a separate fire zone. Because of it, all the construction partitions including walls and ceiling must be made of non-combustible technology with a minimum fire resistance and gas tightness of 120 minutes (EIS120).

2.6 Electricity and wiring

Electrical power that should be connected to the room depends on the type and size of equipment used. After all, it is recommended to supply the room with three-phase power in case of system expansion. There are no any specific requirements for wiring, except for meeting the European standards. Wire size should be determined each time for the maximum current value that can occur during energy storage room operation.

2.7 Safety requirements

The main safety condition that has to be ensured is protection of the installation against excessive pressure. Pressure systems are required to be secured with expansion vessel located in the district management building, in the energy storage room. The installation should also be secured using safety valves with expansion vessels and locally with each heat source in the supplied buildings.

Other factors providing safe operation of the installation include: usage of mesh filters, air separation, correctly performed flushing of the system with use of special ingredients and ultimately usage of treated water with the addition of corrosion inhibitors in the heating circuit.

2.8 Installation maintenance

Once a year, some actions have to be performed, to ensure the maintenance of the installations in an efficient condition. Such basic activities include:

- Verification of the safety system operation;
- Electrical equipment operation review;
- Performing electrical measurements;
- Testing quality of treated water;
- Verification of patency of the chimney;
- Purging magnetic settling tank.

Appropriate instructions on use and operation of installation, with the necessary schemas should be placed in a visible spot in the energy storage room.

Table 2. Main parameters and checklist.

Parameter	Checked	
1.1 System location and accessibility		
- Technical room*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Near centre of the heated district	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- No common walls with permanent people presence rooms*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Openable window	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against noise transmission	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against negative temperatures*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Plumbing at sight*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Accessibility for maintenance and service*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.2 Lighting		
- Natural lighting	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Artificial lighting with IP24*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.3 Ventilation		
- Air exchanged within one hour is about 0.5 of the room capacity*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 100 cm ² net area of air exhaust, max 10 cm under the ceiling*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 200 cm ² net area of air supply, max 10 cm above the floor*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Not obstructing natural ventilation supporting fan	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.4 Plumbing		
- District main circuit pump system*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Pressure stabilization system*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Installation water refilling system*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Sewage system connection*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Service water system connection*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Magnetic settling tank*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.5 Floor, walls and ceiling		
- Protection against room flooding*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Floor drainage and cooling well of capacity of the largest appliance within, not more than 1 m ³ *	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Floor, all walls and ceiling are fire protection partition with fire resistance of 120 min. (EIS120)*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.6 Electricity and wiring		
- 5-wires electricity installation*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Electrical connections protected with appropriate fuses*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.7 Safety requirements		
- Expansion vessels*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Safety valves*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Air separation*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>

3. Sedimentation tank room

In the following the sedimentation tank room features are discussed. In particular:

- Tank positioning inside the tank room;
- Tank room requirements and desiderata;

are discussed.

3.1 Tank Positioning

First of all the room where the tank is located should be close to the garbage area, and far from an intensive exposure to the sun light.

Secondly the tank should be positioned preferably close to the vertical outlet of the main draining pipe (dedicated pipe) connecting the kitchen sinks. The main draining pipe should be recommended at the barycentre as far as the kitchens concerns. In effect the draining pipe in each single kitchen's sink should be up to 10-12 meters far from the main draining pipe.

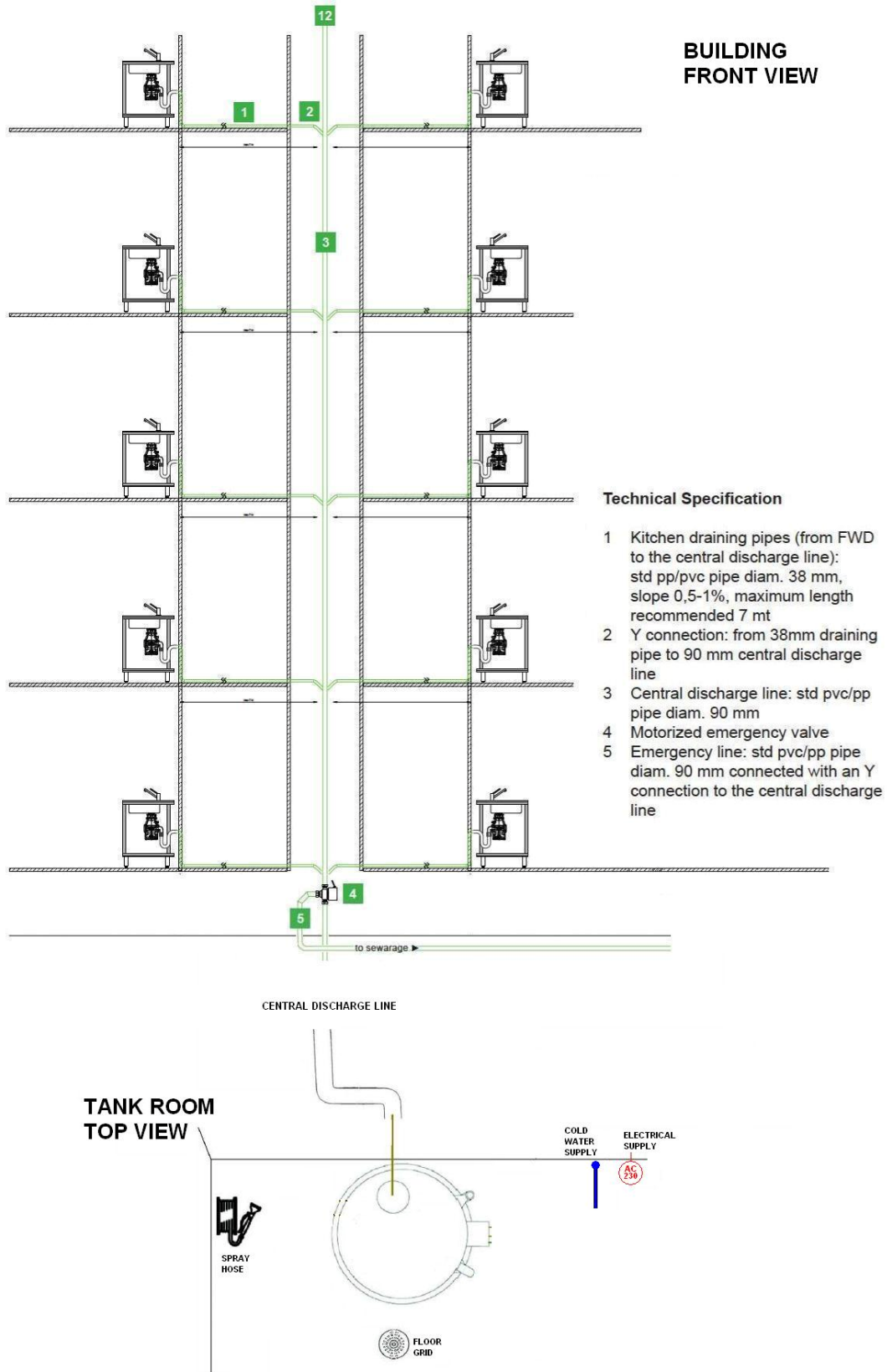


Figure 6 Tank positioning

3.2 Tank room requirements and desiderata

3.2.1 Dimensions

The room surface required is between 9 -12 m² with the lower side 3 m.

3.2.2 Accessibility

The tank room should be located in an area looking onto a building passageway (max. 15 m recommended) to facilitate the emptying operation of the toilet truck.

In case the room is located in a area below the street level, the room should no lower than 4 m underground to let the toilet truck operation possible.

The tank room has to be considered a “restricted area” accessible to the dedicated personnel (doorkeeper, maintenance and cleaning company).

3.2.3 Lighting

Lighting must be guaranteed and adequate (preferably from the ceiling) even through an emergency lamp in case of power cut.

3.2.4 Ventilation

According the present experience gas emissions and/or unpleasant odours from the tank are absent. In any case they should be limited installing a duct connected to the main ventilation duct of the building. Nevertheless forced ventilation should be more appropriate if the limited experience of the innovative system is taken into consideration.

3.2.5 Plumbing

A plumbing system is necessary and it has to provide:

- A cold water supply to feed a spray-hose to clean the room when needed;
- A cold water supply (3/4 “ pipe) to feed the washing ring;
- Under the floor a 90 mm draining line to connect to the sewerage:
 1. a floor grid where the waste water produced during the room cleaning activity is collected ;
 2. the tank overflow;
 3. the waste water deriving from the tank maintenance operation (scheduled complete washing cycles);
 4. the tank filtered water.

3.2.6 Floor, walls and ceiling

A tiled floor has to be provided to let the cleaning maintenance ease. In the proper slanting position a floor grid is provided. The walls should be made out of tiles or of any easily cleaning treatment up to an high of 180 cm (to clean the room from potential waste water splashing).

The ceiling should be 100 cm. higher than the total high of the tank to make the filter changes simple and easy. With the present tank the ceiling high is 3 m.

3.2.7 Energy Supply

The electrical supply require an interlocked plug a.c. 230 V – 16 A for a total power installed < 3 kW.

3.2.8 Tank communication - Connectivity

An access point (AP) is required to allow the connection between the tank and the central control system. The AP can be: Ethernet, Wi-Fi or Mobile phone system.

Table 3. Main parameters and checklist.

Parameter	Checked	
1.1 System location and accessibility		
- Technical room, close to garbage area, not exposed for sunlight, ground or underground level, floor not deeper than 4 m underground, minimum 3 m high*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Access to the sedimentation tank with a vacuum truck equipment*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Sedimentation tank considered "restricted area"*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Openable window	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against noise transmission	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Protection against negative temperatures*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Plumbing at sight*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Accessibility for maintenance and service*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.2 Lighting		
- Natural lighting	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Artificial lighting with IP24*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.3 Ventilation		
- Air exchanged within one hour is about 0.5 of the room capacity*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 100 cm ² net area of air exhaust, max 10 cm under the ceiling*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 200 cm ² net area of air supply, max 10 cm above the floor*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Not obstructing natural ventilation supporting fan	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.4 Plumbing		
- Spray hose connected to the service water installation*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Service water system connection*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Sewage system connection*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.5 Floor, walls and ceiling		
- Protection against room flooding*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Floor drainage*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Walls covered with tiles for a minimum of 180 cm high*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Floor, all walls and ceiling are fire protection partition with fire resistance of 120 min. (EIS120)*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
1.6 Electricity and wiring		
- 3-wires electricity installation*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- 5-wires electricity installation	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>
- Electrical connections protected with appropriate fuses*	YES <input checked="" type="checkbox"/>	NO <input checked="" type="checkbox"/>

Acknowledgments

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References

- [1] Machinery Directive 98/37/EC, 2006/423/EC
- [2] Low Voltage Directive LVD 2006/95/EC, 73/23/EC
- [3] Electromagnetic Compatibility Directive EMC 2004/108/EC
- [4] Cogeneration Directive 2004/8/EC
- [5] Pressure Equipment Directive PED 97/23/EC
- [6] ATEX Directive 94/9/EC
- [7] Gas Appliance Directive GAD 90/396/EEC, 93/68/EEC
- [8] FC-DISTRICT Deliverable 4.2: Tank functional requirements, 2011
- [9] FC-DISTRICT Deliverable 4.3: Tank design, characterization and technical guide, 2012
- [10] FC-DISTRICT Deliverable 10.5.1: Technical harmonization and regulation, 2012