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Wastewater treatment plants

Part 10: Safety principles

bsi.

National foreword

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Contents

European foreword

This document (EN 12255-10:2023) has been prepared by Technical Committee CEN/TC 165 "Waste water engineering", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2023, and conflicting national standards shall be withdrawn at the latest by September 2023.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12255-10:2000.

This is the tenth part prepared by Working Group CEN/TC 165/WG 40 relating to the general requirements and processes for treatment plants for a total number of inhabitants and population equivalents (PT) over 50.

The EN 12255 series, Wastewater treatment plants, consists of the following parts:

— *Part 1: General construction principles*

— *Part 2: Storm management systems*

— *Part 3: Preliminary treatment*

— *Part 4: Primary treatment*

— *Part 5: Lagooning processes*

— *Part 6: Activated sludge process*

— *Part 7: Biological fixed-film reactors*

— *Part 8: Sludge treatment and storage*

— *Part 9: Odour control and ventilation*

— *Part 10: Safety principles*

— *Part 11: General data required*

— *Part 12: Control and automation*

— *Part 13: Chemical treatment — Treatment of wastewater by precipitation/flocculation*

— *Part 14: Disinfection*

— *Part 15: Measurement of the oxygen transfer in clean water in aeration tanks of activated sludge plants*

— *Part 16: Physical (mechanical) filtration*

NOTE Part 2 is under preparation.

Any feedback and questions on this document should be directed to the users' national standards body. A complete listing of these bodies can be found on the CEN website.

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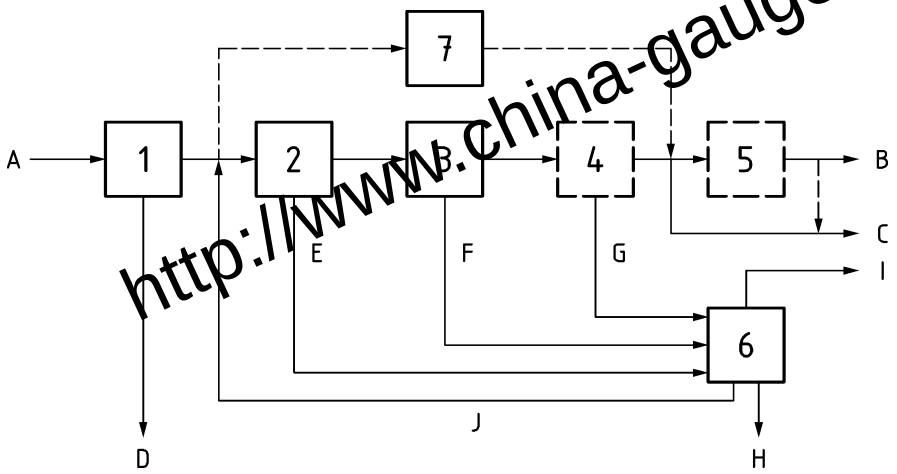
Introduction

Differences in wastewater treatment throughout Europe have led to a variety of systems being developed. This document gives fundamental information about the systems; this document has not attempted to specify all available systems. A generic arrangement of wastewater treatment plants is illustrated below in Figure 1:



Key

1 preliminary treatment
2 primary treatment
3 secondary treatment
4 tertiary treatment
5 additional treatment (e.g. disinfection or removal of micropollutants)
6 sludge treatment
7 lagoons (as an alternative)
A raw wastewater
B effluent for re-use (e.g. irrigation)
C discharged effluent
D screenings and grit
E primary sludge
F secondary sludge
G tertiary sludge
H stabilized sludge
I digester gas
J returned water from dewatering

Figure 1 — Schematic diagram of wastewater treatment plants

The primary application is for wastewater treatment plants designed for the treatment of domestic and municipal wastewater.

NOTE For requirements on pumping installations at wastewater treatment plants see EN 752, *Drain and sewer systems outside buildings* and the EN 16932 series, *Drain and sewer systems outside buildings — Pumping systems*:

— *Part 1: General requirements;*

— *Part 2: Positive pressure systems;*

— *Part 3: Vacuum systems.*

1 Scope

This document defines minimum safety requirements to be observed in the planning, construction or reconstruction of wastewater treatment plants.

The purpose of this document is to ensure the protection of people.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 476, *General requirements for components used in drains and sewers*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— IEC Electropedia: available at https://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
confined space
space in which the ventilation is restricted to the extent that special safety precautions need to be taken

[SOURCE: EN 16323:2014, term number 2.1.3.4]

3.2
manway
tightly lockable access opening in containers, tanks, vessels, boilers, bunkers etc. through which a person can enter to perform inspection or repair work

4 Symbols and abbreviations

ATEX Explosive Atmospheres (ATEX) Directives (2014/34/EU and 1999/92/EC)

LEL lower explosive limit

5 Requirements

5.1 General

Compliance with safety regulations is an integral part of the design and construction of the facilities. National or local regulations can exceed the requirements laid down in this document. In those jurisdictions that are bound by European Commission Directives, many aspects of safety have been enshrined in law so are not repeated in this document. For places not covered by such laws these Directives can be a useful guide for good practice. Accordingly, a list of the key Directives is given in Annex B in addition to a list of standards that contain detailed requirements (e.g. for machinery installations).

The primary consideration should be the avoidance of accidents and harmful incidents where foreseeable. Consideration of mitigation measures should be an additional layer of protection not an alternative.

5.2 Confined spaces

Toxic, explosive or oxygen deficient atmospheres can easily arise in confined spaces either enclosed or sunken where gasses can collect. They can also lead to high temperatures arising (e.g. inside protective clothing) which can make them unsuitable environments to carry out work. Typically, confined spaces in wastewater treatment plants include:

— conduits;

— shafts, inspection manholes, seepage water shafts;

— basins (covered or sunken);

— drop structures;

— valve structures;

— inlet and outlet structures;

— sunken or enclosed screening plants;

— pumping stations (dry or wet wells);

— sludge silos and covered thickeners;

— aerobic or anaerobic digestion tanks;

— gasholders (gasometers);

— completely covered plants.

The need to enter such spaces in order to carry out maintenance or inspections shall be minimized by design. Examples of how to achieve this include:

— ensuring equipment can be removed from the confined space in order for it to be maintained in an area that is a safe environment;

— installation of sensors rather than inspection points.

To prevent unauthorised access (e.g. by people who might not understand the associated risks), entry points to such confined spaces shall be adequately secured.

However, it is likely that all spaces will ultimately require access even if those occasions are rare. Therefore, suitably secured access should be provided and provision made for any temporary or permanent equipment that might be needed to undertake the work safely and for the potential need to rescue personnel.

Fixed or portable gas monitoring equipment shall be employed; portable gas monitoring shall be operable from safe places (see 5.4).

5.3 Hazardous substances

Hazards from substances in wastewater treatment plants can arise from solid substances, liquids, vapours, gases and bio-aerosols, microorganisms and dust particles in a dangerous quantity, or concentration and through the presence of oxygen-displacing media.

Hazards can also arise from substances being introduced from an external source or can be produced *in situ* by biological processes (e.g. fermentation, putrefaction) or by chemical reactions (e.g. when different wastewaters are mixed).

Hazards can arise from the following sources:

— gases or vapours which can cause fires or explosions;

— oxygen deficiency which can result in suffocation;

— toxic, corrosive, irritant, flammable or hot substances, which can cause harm to health by contact, absorption through the skin or by ingestion, inhalation, or penetration through puncture wounds;

— increase of flow or level of water, e.g. following heavy rain or flooding;

— microorganisms and their metabolic products which can result in infections;

— radioactive substances.

Where possible, designs should seek to avoid creating the circumstances leading to the formation of the hazard. Where this is not possible designs should seek to keep the hazard separated from people.

5.4 Warning systems for the safety of persons

Fixed provision shall be made to enable monitoring the atmosphere in frequently entered confined spaces and other areas where hazardous atmospheres are foreseeable to ensure that health risks for persons can be avoided. Where personnel will only need to enter areas under exceptional circumstances it may be assumed that portable monitoring systems will be used.

Fixed monitoring equipment may also be used to actuate emergency systems (e.g. switching on ventilation). The activation of these means shall be indicated by appropriate signals.

The monitoring equipment shall be tested to ensure reliability and shall be explosion protected.

There shall be an adequate means of communication between authorized personnel on the wastewater treatment site, e.g. telephone or radio.

5.5 Open water

Open tanks, lagoons and channels present risks of drowning.

Prevention of unauthorized or accidental access by personnel and animals should be the primary method of avoiding dangerous incidents (e.g. people rescuing pets, livestock or other animals that have strayed or fallen into the water). This is typically achieved by fencing or raising of tank sides to be above ground level.

Signage warning of deep or fast flowing water is also required.

The installation of a floating device or float-and-retrieval ring near lagoons or other expanses of water, should be considered where it is impractical to provide complete security by other means.

5.6 Vehicular and pedestrian traffic routes

5.6.1 Access considerations

Vehicular and pedestrian traffic routes shall be laid out to provide safe access to and egress from operational work places and maintenance positions. They shall be free of obstacles over which persons might trip, well-lit and shall be constructed in such a way that they can be kept safe to walk along when wet or icy.

This requirement is adequately satisfied, if e.g.:

— work places can be reached as directly and conveniently as possible;

— paths are even and not obstructed by parts of the plant and there are no obstacles on the paths such as pipeline crossings and they are not obstructed by the operation of valves;

— obstacles such as open channels or conveyor belts are bridged over;

— floors are easy to clean;

— floor coverings, gratings, roads and paths have non-slip surfaces, and collection of water on the surfaces is prevented;

— paths are constructed of materials which are resistant against wear and tear;

— slabs and pavings are laid even and with narrow joints;

— non-slip surfaces allow safe walking in every direction under adverse conditions;

— doors of emergency exits open to the outside.

5.6.2 Operational considerations

Traffic routes and thoroughfares shall be laid out in such a way as to prevent risks from vehicles during operation.

This requirement is adequately satisfied, if e.g.:

— traffic routes are kept free from installations so that they can be used at any time;

— traffic routes for vehicles where passing doors, gates, passageways, thoroughfares, or stair-exits shall have a minimum 1,0 m clearance between the exit and the traffic way. Blind exits shall be protected, e.g. by use of diversion barriers or mirrors;

— traffic routes are present in adequate numbers and their layout and dimensions are such that they can be used safely by pedestrians or vehicles according to their function, e.g. adequate turning areas for vehicles;

— traffic routes for motorized or rail-mounted means of transport are wide enough to maintain a minimum safety distance of 0,5 m on both sides of traffic routes between the outer edge of the means of transport and the boundary of the traffic route;

— lighting equipment on traffic routes is located and designed such that the lighting itself cannot cause any accident hazard; and the intensity of general lighting is at least 5 lux;

— speed limits have been considered.

5.6.3 Passageways

Passageways shall be a minimum of 2,0 m high and 0,6 m wide. If they are used for transporting loads they should be a minimum of 1,2 m wide.

5.6.4 Steps and ramps

Steps or ramps shall be provided for height differences of more than 0,2 m. Ramps shall not be steeper than 1 : 10 and shall be constructed without steps. Where steps and ramps are not possible, see 5.7.

5.7 Fixed ladders, manhole steps and staircases

If steps or ramps are not possible for structural reasons, fixed ladders, step irons, staircases or other access facilities shall be provided.

Fixed ladders, manhole steps and staircases shall be of non-slip design and shall offer adequate foot room.

Where water, oil or grease may be present, additional means of slip prevention such as profiling or coatings shall be used.

Fixed ladders shall have a minimum distance to the wall of 150 mm.

Where there is the danger of falling more than 3 m in height there shall be installed permanent equipment to prevent falling (e.g. safety rails for sledge and safety belt and where appropriate, fixing points for fall arresters).

Safety cages are not allowed around ladders in potentially confined spaces, where they may hinder the rescue of injured persons.

Suitable access aids shall be provided above access points for climbing on and off safely.

This requirement is adequately satisfied if e.g.:

— sleeves are built into the manhole cover frames into which projecting positively fixed gripping bars can be inserted which extend a minimum of 1,1 m above the cover frame;

— existing railings provide a handhold;

— a man-riding winch can be used.

Rest platforms shall be provided in maximum interval of 6 m on all steps or fixed ladders with a length of more than 10 m above ground or 6 m. into confined spaces in such a way that the rescue of injured persons and the transport of tools and materials will not be hindered.

The clearance on the user's side of fixed ladders shall be not less than 0,65 m for vertical ladders and not less than 1,1 m for sloping ladders.

5.8 Manholes and manways

Manhole shafts shall have a minimum width of DN/ID 1 000 (according to EN 476).

The clear width of manhole covers in vehicular traffic areas shall be not less than DN/ID 600. In non-traffic areas manhole covers should have a minimum clear width of DN/ID 800 (according to EN 124-1). Manways shall have a minimum diameter of 500 mm and should have a diameter between 600 mm and 1000 mm (where possible).

NOTE In the vast majority of Member States the safe clear opening is considered to be at least 600 mm for man entry. In some other Member States larger openings are required.

5.9 Falling preventions and covers

Work places and traffic routes adjacent to a vertical drop or other dangerous areas shall have permanent guardrails to prevent persons falling or entering these dangerous areas. For additional information on the maximum allowable vertical drop height not prevented by those guardrails etc., see national regulations.

When there is no special risk of falling into open channels or basins, tensioned chains, ropes or nets may be used.

Suitable protection against falling is provided e.g. by 1,1 m high permanently fixed railings or enclosing walls.

The protective barriers shall be constructed so as to prevent persons falling through.

In the case of protective barriers with vertical intermediate bars, the clear distance between the bars shall not exceed 0,18 m. For protective barriers with one or more knee-height rails, the distance between toe board and rail, between rail and hand-rail or between two intermediate rails shall not exceed 0,5 m.

In the absence of toe boards, the distance between ground and knee-height rail shall not exceed 0,3 m.

Toe boards shall be a minimum of 0,1 m high and shall be installed above all working-places and traffic routes, independent of the structure of protective barriers.

The protective barriers shall be constructed and fixed so they can withstand a horizontal force of 1 000 N/m at their upper edge. Alternatively, a design load of 500 N/m is sufficient for protective barriers on platforms or stairways and walkways with vertical traffic loads of maximum 5 000 N/m, or of 300 N/m for barriers in areas or on routes which are only used for control and maintenance purposes (e.g. tank roofs, inspection apertures on furnaces) and on vehicles and for slot-in railings.

The values quoted are design load values for the static calculation of the protective barrier.

Suitable trees, bushes and hedges can provide means of fall prevention on slopes with an incline up to 1 : 1.

If removable safety barriers are required, they shall be of the hinged, slidable or slot-in type. Removable safety barriers may be necessary, for example, at access points to ladders and stairways or at installation access apertures.

Covers shall be protected against unintentional displacement and shall withstand the operational and climatic stresses.

This requirement is adequately satisfied if e.g.:

— covers can be opened from safe standing positions;

— hinged covers can be secured in the open position;

— heavy covers are additionally equipped with counterbalances, hydraulically or mechanically actuated lifting devices or pneumatic springs.

5.10 Emergency exits

Tanks shall be equipped with permanently installed emergency exits in every self-contained basin section. One permanently installed emergency exit shall be reached within a range of 15 m to swim.

Ladders, manhole steps and staircases, reaching down a minimum of 1,0 m below the lowest operational water level, may be used as emergency exits.

Open tanks with sloped walls with inclines up to 1 : 2 may be equipped with other means (e.g. durable netting) for assisting climbing out.

5.11 Work places, work platforms and maintenance platforms

Work places, work platforms and maintenance platforms shall be arranged, set up and designed free of obstacles and so that it is possible to work safely on them, even if wet or icy. This applies in particular with regard to the material, their spaciousness, strength and stability, surface non-slip qualities, illumination and ventilation and with regard to avoiding harmful environmental effects and hazards caused by third parties.

The requirement for non-slipperiness also includes the requirement that gratings and standing positions shall where possible be located safe from flooding.

5.12 Lifting equipment

Suitable and sufficient lifting equipment shall be available for the handling of heavy loads.

This requirement is adequately satisfied if e.g.:

— a lifting device is installed;

— a support for a mobile hoist is built in;

— provision is made for a tripod and portable lifting hoist to be used with safety devices to prevent the legs shifting or splaying out;

— an adequate standing area is available, designed in size and in load-bearing capacity for a vehicle with pivoted and telescopic jib (crane boom);

— safe use is possible of multi-purpose lifting appliances, e.g. equivalently equipped lorry-mounted lifting devices, forklift trucks, small hydraulic excavators, etc.;

— lifting devices shall be certificated.

5.13 Electrical installations

Electrical equipment, its design and installation shall comply with the relevant European standards. A list of the principal standards on this topic and their relevant content description is given in Annex A. National and local regulations may also apply.

5.14 Ventilation

Spaces in wastewater treatment plants, in which dangerous substances, explosive atmosphere or aerosols can accumulate in concentrations that could be harmful to the health or in which an oxygen deficiency can arise, shall have effective ventilation.

It shall be possible to measure the efficiency of the ventilation by testing the air quality from a safe position.

Natural ventilation can be effective, if e.g. the design of the opening provides sufficient ventilation without dead zones and the ventilation openings cannot be shut.

Ventilation openings which are located only at the top or bottom of a door and windows shall not be deemed an effective means of ventilation.

Forced ventilation shall be provided if natural ventilation is not sufficient in a workspace or where explosive or corrosive atmospheric conditions could arise.

5.15 Areas at risk from explosions

Danger of explosions in wastewater-systems can arise e.g. by illegal introduction of inflammable substances or by anaerobic degradation processes, e.g. methane from sludge digestion.

Confined spaces in wastewater treatment plants shall be constructed and equipped in such a way as to prevent the formation of an explosive atmosphere. If it is not possible to prevent the formation of an explosive atmosphere, the ignition of explosive atmospheres shall be prevented by additional protective means, e.g. ventilation or permanent installation of gas warning devices to initiate emergency procedures.

Permanent gas warning devices (see 5.4) should have pre-set concentrations, e.g.:

— at 20 % lower explosive limit (LEL) preliminary alarm (e.g. switching on the technical ventilation, opening of doors);

— at 50 % LEL initiation of emergency functions (e.g. switching off ignition sources).

Explosive Atmospheres (ATEX) Directives (2014/34/EU and 1999/92/EC) of the European Parliament and of the Council are useful for assessing whether dangerous explosive atmospheres can occur and for the selection and implementation of protective measures to prevent hazards due to explosive atmospheres.

Areas of wastewater treatment plants with explosion hazards shall be clearly marked and access to them shall be prevented except for authorized workers.

Structural measures can limit the areas at risk from explosion. Structural measures include e.g. adequately gas-tight walls made of non-combustible material and gas-tight ducts and conduits. Brick walls, plastered on both sides, or reinforced concrete walls, are sufficiently gas-tight in this sense.

Rooms above ground level, where an explosive atmosphere may arise under exceptional circumstances, shall be isolated from adjoining rooms by automatically shutting gas-tight doors.

Explosion prevention measures which prevent the emergence of explosive atmosphere shall generally be considered in the early design stage.

Traffic routes for motor vehicles shall be located outside areas where explosion hazards may exist.

5.16 Hygienic facilities

The extent to which hygienic facilities are necessary will depend upon the size and location of the treatment plant.

These should include:

— washing protective clothing including shoes and boots;

— personal washing (hand-basins and showers);

— eating of meals and preparation of beverages;

— storage of personal effects;

— first aid materials.

Some facilities may be provided on a vehicle and others on a suitable location.

5.17 General warning signs

Signs indicating warnings should be clearly visible at all entrances of areas with increased risk, e.g.:

— electrical hazards;

— high noise level;

— automatically operated moving equipment;

— presence of dangerous gases and possible explosion hazard;

— oxygen deficiency;

— biological hazards;

— hazardous chemicals.

Signs indicating an obligation or requirement shall be placed at the entrance of the appropriate areas, e.g.:

— no smoking;

— use of safety glasses;

— use of safety gloves;

— use of hard hats;

— use of ear protection;

— use of escape or full breathing apparatus;

— qualification requirements;

— permit to work requirements.

Signs referring to safety and fire preventing equipment shall have information directing to the equipment location, e.g.:

— emergency exits;

— fire extinguishers;

— rescue equipment;

— first aid boxes.

6 Special requirements

6.1 Systems for separating solids from wastewater

Screening equipment and installations for dewatering the screenings as well as grit chambers and grease traps shall be designed so as to minimize contact by persons with the solids and to ensure safe removal of the solids.

In aerated grit chambers with spiral flow and water depths exceeding 1,5 m, a suitable holding fixture for self-rescue shall be provided on the downward flow side over the whole length of the chamber.

Safety barriers shall be installed at the water level around rotating equipment. In aerated grit chambers with horizontal flow, emergency exits shall be installed downstream. These emergency exits shall not be located near the inflow and shall be within reach of the holding fixture.

These emergency exits shall not be located in the vicinity of the grit hoppers and shall be within reach of the holding fixture.

Suitable holding fixtures for self-rescue can be for example, stay bars or tightly stretched steel cables.

Sunken loading bays for vehicle containers shall be equipped on the approach side with a raised edge to prevent the vehicle wheels falling in when reversing.

A suitable raised edge would be a barrier a minimum of 0,25 m high painted in yellow/black contrasting colours.

6.2 Wastewater pumping stations

In order to avoid hazards from dangerous substances, wet wells shall only have access from outside of the buildings and are not allowed to be connected with other rooms.

Permanent provision for man entry to wet wells is not required if there is no need for man entry either for cleaning or maintenance purposes.

Access is not required if e.g. the deposition of solids is prevented by mechanical equipment or if cleaning and maintenance work can be carried out effectively from safe standing places.

Pumps (even when installed in wet wells) and electrical equipment shall be so designed, that ignition energy cannot be released if they are used in locations where explosion hazards may occur.

This requirement is adequately satisfied, if e.g. explosion-protected submersible motor-pumps are used, or if the pump motors are completely submerged during the whole pumping cycle.

Pumps shall be designed and installed so that they can be maintained easily and safely. Each pump shall be capable of being hydraulically isolated while other pumps of the station are still operating.

In the case of Archimedean screw pumps in addition it shall be taken into account that:

— the screw can be cleaned safely;

— the standing places over the inlet are situated clear of the highest water level.

See the EN 16932 series, from 2018, *Drain and sewer systems outside buildings — Pumping systems*:

— *Part 1: General requirements*;

— *Part 2: Positive pressure systems*;

— *Part 3: Vacuum systems*

for further information on wastewater pumping stations.

6.3 Aeration tanks

Aeration and mixing devices shall be so designed that maintenance work can be carried out safely.

This requirement is adequately satisfied if e.g.:

— in basins equipped with compressed air aeration the aeration equipment can be lifted or swivelled out of the liquid; or

— basins can be emptied for maintenance purposes.

Aeration and mixing equipment shall be fitted with emergency shut-offs. These emergency shut-offs shall be located next to the aeration or circulating devices and be within easy reach.

Depending on the arrangement of surface aerators or mechanical mixing devices (flow generators), one or more emergency shut-offs may be required.

In aeration tanks with spiral flow and water depths exceeding 1,35 m, a suitable holding fixture for self-rescue shall be provided on the downward flow side over the whole length of the tank.

Safety ropes or bars shall be installed at the water level around horizontal rotors. In aeration tanks emergency exits shall be installed.

6.4 Digestion tanks, low-pressure gasholders

Sludge stabilization reactors and gas holders shall be provided with frost-proof over-pressure and under-pressure relief devices. Such devices can be water-logged syphons which close automatically when the over- or under-pressure has been relieved. Their liquid level shall be indicated, e.g. by a float. A signal shall be sent to a central control system, in case that the device operates.

Overflows of anaerobic sludge digesters and post-thickeners shall not release digester gas. They shall be enclosed and connected to the digester gas system.

The pressure safety devices shall be designed to reset automatically or to give an alarm to a monitoring in case of low pressure.

There shall be a minimum of two personnel entry points, one above ground level and the other on the top. At least one of the entry points to the digestion tanks shall have a minimum clear width of 0,8 m.

6.5 Digester gas pipes

Pipes and fittings carrying digester gas shall be designed to safely withstand the mechanical, chemical and thermal stresses to be expected in operation.

The requirement for mechanical and chemical durability is adequately satisfied, e.g. by suitable materials such as stainless steel.

Mechanical stresses due to subsidence, temperature differences and vibrations are to be absorbed by suitable structural design of the pipelines, e.g. pipe loops or installation of extension compensating members.

Pipes carrying digester gas shall be equipped with shut-off devices at the digester tank and before the gasholder.

Low points in gas systems shall be provided with condensate removal devices. Such devices can be water filled syphons. Where such are installed in enclosed spaces, the water level shall be monitored and a valve shall be automatically closed and an alarm rendered if the water level should drop below a safe level.

Flame arrestors shall be installed upstream of gas flares and gas consumers. The gas system shall be monitored by pressure sensors which shut off the system if the gas pressure should drop below the atmospheric pressure.

EN ISO 16852:2016 gives performance requirements, test methods and limits for use of flame arresters. The effectiveness of the equipment can be confirmed against national regulations.

Pipes carrying digester gas, which lead into enclosed rooms, shall be equipped with shut-off devices situated in safe places outside these rooms.

Facility shall be provided for the safe discharge of condensate occurring in digester gas systems.

This requirement is adequately satisfied by e.g.:

— automatic condensate discharge systems;

— locks with double shut-off fittings.

Digester gas pipes should be clearly identified.

6.6 Desulphurizing plants

Desulphurizing plants shall comply with the gas safety equipment as set out in 5.15.

In addition, arrangements shall be made to ensure that:

— air cannot enter the digester gas pipe and digester gas cannot enter the air pipe;

— the air supply is interrupted before a dangerous explosive atmosphere can develop;

— the temperature of the gas in the desulphurizing tank does not exceed 60 °C.

6.7 Gas engine rooms and gas engines

Gas engine rooms shall be provided with sufficient natural or forced ventilation (see also 5.14 and 5.15).

Gas engine rooms and air intake pipes of gas engines shall be so constructed that no gas can enter during operation or in the event of faults.

This requirement is adequately satisfied if e.g.:

— when the gas engine stops no gas can escape into the engine room. This can be achieved by installing an automatic gas shut-off valve (with redundant control);

— crankcase ventilating pipes are led into the open air or the exhaust gases are reinjected into the closed system;

— ventilation openings to gas engine rooms are not located near crankcase ventilating pipes or the entrance of air suction or exhaust pipes of gas engines;

— air suction pipes of gas engines are led in from outside.

The ignition system of gas engines shall remain inactive until engine and exhaust system have been adequately flushed with air.

6.8 Gas flares

Gas flares shall be constructed and positioned in such a way that persons are not at risk caused by gases, flames or hot components. Gas flares shall be equipped with automatic ignition devices, flame arrestors and flame monitoring equipment.

6.9 Sludge dewatering

Sludge dewatering plants, in which gases and vapours can accumulate in noxious concentrations, shall be equipped with effective ventilation devices to exhaust gases and vapours from the source.

During sludge dewatering, hazardous gases such as ammonia, hydrogen sulphide or methane may be produced depending on the process or conditioning method.

Hazardous gases may continue to be produced by dewatered sludge. Thus, rooms in which dewatered sludge is stored shall be well ventilated (see 5.14).

Mechanically operated sludge dewatering plants should be fitted with automatic cleaning equipment.

6.10 Installations for storage and handling of chemicals and hazardous substances

Systems for the delivering, filling, storage, mixing and addition of chemicals and hazardous substances shall be designed so that there is no risk to persons or the environment from liquids, gases, vapours and dust.

This requirement is adequately satisfied if e.g.:

— the surface of the area where the chemical is delivered and transferred to facilities is sealed and the system is designed so that accidental spills can be recovered without danger;

— tanks containing chemicals are made of adequately resistant material, connections for filling and discharging are tight-sealing and the filling level and nature of the contents can be checked from the outside, overfilling can be reliably prevented, leaking liquids can be collected safely (collecting bunds, double-walled tanks or containments) and the correct safety code is marked on the outer walls of tanks or access doors to storage rooms;

— lime silos and their filling and extraction equipment are of dust-tight construction and are marked clearly;

— lime-milk mixing systems are tightly sealed and inspection holes cannot be opened during the mixing process;

— a self-closing and locking security cabinet is available for the storage of small quantities of combustible, fire-assisting or toxic or corrosive hazardous substances at the work place (laboratories, workshops);

— separate lockable storage rooms with safety equipment (e.g. fire and explosion protection, ventilation and means for collecting leakages) and adequate safety marking are available for the storage of larger quantities of hazardous substances (e.g. lime, corrosive substances) as used in operating wastewater treatment plants;

— provisions are made to prevent environmental impact in case of leakage. A second emergency containment shall be provided (e.g. double underground pipes, double tank walls, tanks in bunds which have a minimum capacity of 110 % of the single largest tank) and sensors shall be installed which provide an alarm when the first containment is leaking.

Refer to EN 12255-1 for further information.

Annex A
(informative)

Relevant standards containing safety requirements

Table A.1 — Power and electrical safety standards

Standard	Description
EN 60204-1	Safety of machinery — Electrical equipment of machines
IEC 61508 (all parts)	Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
EN IEC 61439-1, EN IEC 61439-2, EN IEC 61439-7, EN 61439 parts 3 to 6	Low-voltage switchgear and controlgear assemblies
EN 50172	Code of practice for emergency lighting
IEC 60158-3	Specification for low voltage control gear
EN 60422	Mineral insulating oils in electrical equipment
EN 60079-30-2	Electric surface heating
EN 62305-4	Code of practice for protection of structures against lightning
EN 50110-1 and EN 50110-2	Operation of electrical installations
IEC 60479 parts 1 to 4	Guide to effects of current on human beings and livestock
EN 60529	Specification for degrees of protection provided by enclosures (IP code)
EN 60947 parts 1 to 8	Specification for low voltage switch gear and control gear

Table A.2 — Electrical appliance standards containing safety requirements

Standard	Description
EN 60309-1, EN 60309-2 and EN 60309-4	Plugs, socket-outlets and couplers for industrial purposes
EN 60320-1 and EN 60320-2	Appliance couplers for household and similar general purposes
EN 60335 (all parts)	Specification for safety of household and similar electrical appliances

Table A.3 — Electromagnetic compatibility standards

Standard	Description
EN IEC 61000-6-3 and EN IEC 61000-6-4	Electromagnetic compatibility — Generic emission standard
EN IEC 61000-6-1 and EN IEC 61000-6-2	Electromagnetic compatibility — Generic immunity standard
EN ISO 61000-4-2	Electromagnetic compatibility for industrial-process measurement and control equipment — Electrostatic discharge requirements

Table A.4 — Flammable atmospheres standards relevant to safety

Standard	Description
EEMUA 181	Guide to risk based assessments of *in situ* large Ex e and Ex n machines
EEMUA 186	A Practitioners handbook — Electrical installation and maintenance in potentially explosive atmospheres
EN 1127-1 and EN 1127-2	Explosive atmospheres — Explosion prevention and protection
CLC/TR 50404	Code of practice for avoidance of hazards due to static electricity
CLC/TR 50427	Assessment of inadvertent ignition of flammable atmospheres by radio-frequency radiation — Guide
EN ISO 10497	Testing of valves — Specification for fire type-testing requirements
EN 60079-6	Explosive atmospheres — Equipment protected by oil immersion “o”
EN 60079-2	Explosive atmospheres — Equipment protected by pressurized enclosures “p”
EN 60079-5	Explosive atmospheres — Equipment protected by powder filling “q”
EN 60079-1	Explosive atmospheres — Equipment protected by flameproof enclosures ‘d’
EN 60079-7	Explosive atmospheres — Equipment protected by increased safety ‘e’
EN 60079-11	Explosive atmospheres — Equipment protected by intrinsic safety ‘i’
EN 60079-29-2	Explosive atmospheres — Gas detection — Selection, installation, use and maintenance of detectors for flammable gases or oxygen
Energy Institute Model Code Of Safe Practice, Part 1 (IP1)	Electrical Safety Code
Energy Institute Model Code Of Safe Practice, Part 15 (IP15)	Area classification code for installations handling flammable fluids
Energy Institute Model Code Of Safe Practice, Part 21 (IP21)	Guidelines for the control of hazards arising from static electricity

Table A.5 — Machinery standards with relevant safety requirements

Standard	Description
EN ISO 12100	Safety of machinery — General principles for design — Risk assessment and risk reduction
EN ISO 13850	Safety of machinery — Emergency stop — Principles for design
EN ISO 14120	Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards
EN ISO 13849-1 and EN ISO 13849-2	Safety of machinery — Safety related parts of control systems — General principles for design
EN ISO 4413	Hydraulic fluid power — General rules and safety requirements for systems and their components
EN ISO 4414	Pneumatic fluid power — General rules and safety requirements for systems and their components
EN ISO 14118	Safety of machinery — Prevention of unexpected start-up
EN ISO 13857	Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs
EN ISO 13854	Safety of machinery — Minimum gaps to avoid crushing of parts of the human body
EN ISO 14119	Safety of machinery — Interlocking devices associated with guards — Principles for design and selection
EN 60204 (all parts)	Safety of machinery — Electrical equipment of machines
EN 61069 parts 1 to 8	Industrial-process measurement and control — Evaluation of system properties for the purpose of system assessment
EN 61310-1, EN 61310-2 and EN 61310-3	Safety of machinery — Indication, marking and actuation
EN ISO 61496-3	Safety of machinery — Electro-sensitive protective equipment

Annex B
(informative)

Relevant EC Directives that contain safety requirements

This document contains the main requirements for safety principles for the planning and construction of wastewater treatment plants. Further details and instructions can be found in national documents until comprehensive European standards are available.

Based on the articles 100(a) and 118(a) of the integrated European act, the EU decrees directives concerning the safety of work, which are to be observed in connection with these safety principles and which should be implemented in national legislation.

The Safety and Health Framework Directive (1989/391/EEC) together with its daughter directives and other relevant safety and health directives can apply including:

— Physical Agents (Noise) Directive (2003/10/EC);

— Machinery Directive (2006/42/EC);

— Use of Work Equipment Directive (2009/104/EC);

— Personal Protective Equipment Regulation (EU) 2016/425;

— Manual Handling Directive (1990/269/EEC);

— Display Screens Directive (1990/270/EEC);

— Asbestos at Work Directive (2009/148/EC);

— Temporary or Mobile Construction Sites Directive (1992/57/EEC);

— Working Time Directive (2003/88/EC);

— Explosive Atmospheres (ATEX) Directives (2014/34/EU and 1999/92/EC);

— Temporary Work at Height Directive (2001/45/EEC);

— Physical Agents (Vibration) Directive (2002/44/EC);

— Chemical Agents Directives (1998/24/EC);

— Carcinogens or Mutagens at Work (2004/37/EC);

— Low Voltage Directive (2006/95/EC);

— products for building Construction Products Regulation (305/2011);

— Workplace Directive (89/654/EEC);

— Directive on the protection of workers from risks related to exposure to biological agents at work (90/679/ EEC);

— minimum requirements for the provision of safety and/or health signs at work (92/58/EEC).

All Council Directives are published in the Official Journal of the European Union.

Compliance with safety regulations should be an integral part of the design and construction and operation of the facilities.

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EN 363, *Personal fall protection equipment - Personal fall protection systems*

EN 620, *Continuous handling equipment and systems - Safety requirements for fixed belt conveyors for bulk materials*

EN 894-3, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators*

EN ISO 14120, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120)*

EN 981, *Safety of machinery - System of auditory and visual danger and information signals*

EN 1837, *Safety of machinery - Integral lighting of machines*

EN 1993-1-1, *Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*

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EN IEC 60079-0, *Explosive atmospheres - Part 0: Equipment - General requirements*

EN 60204-1, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

EN IEC 60204-11, *Safety of machinery - Electrical equipment of machines - Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

EN 61439-6, *Low-voltage switchgear and controlgear assemblies - Part 6: Busbar trunking systems (busways)*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*

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EN 60947-1, *Low-voltage switchgear and controlgear - Part 1: General rules*

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EN ISO 7096, *Earth-moving machinery - Laboratory evaluation of operator seat vibration (ISO 7096)*

EN ISO 11202, *Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified positions applying approximate environmental corrections (ISO 11202)*

EN ISO 11688-1, *Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1)*

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