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Wastewater treatment plants - Part 10: Safety principles

Kläranlagen - Teil 10: Sicherheitstechnische Baugrundsätze

Stations d'épuration - Partie 10: Principes de sécurité

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Wastewater treatment plants - Part 10: Safety principles

Stations d'épuration - Partie 10: Principes de sécurité

Kläranlagen - Teil 10: Sicherheitstechnische Baugrundsätze

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European foreword

This document (prEN 12255-10:2021) has been prepared by Technical Committee CEN/TC 165 “Waste water engineering”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12255-10:2000.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

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 with the generic title “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 settlement*

— *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*

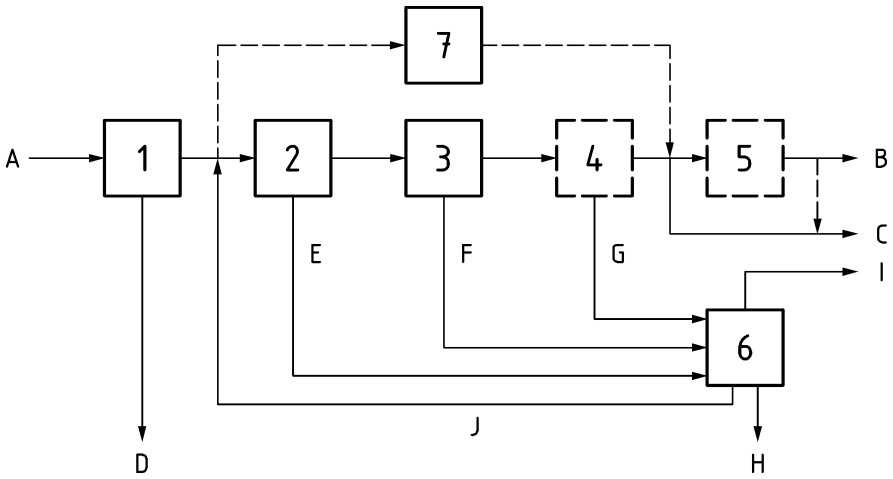
— *Part 14: Disinfection*

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

— *Part 16: Physical (mechanical) filtration*

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:



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 digested 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 EN 16932, *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

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological 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]

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 should be an integral part of the design and construction of the facilities. National or local regulations may exceed the requirements laid down in this standard. In this case the requirements of those regulations should be observed. 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 European standard. 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 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;

— 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 extracted from the confined space in order for it to be maintained;

— installation of sensors rather than inspection points.

To prevent unauthorised access by people who may 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 monitoring equipment shall be employed; portable monitoring shall be operable from places of safety (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 profilings 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 users 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

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.)

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 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 a minimum of 1,0 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