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Del 1: Allmänna konstruktionsprinciper

Wastewater treatment plants –
Part 1: General construction principles

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English version

Wastewater treatment plants - Part 1: General construction principles

Stations d'épuration - Partie 1: Principes généraux de construction

Kläranlagen - Teil 1: Allgemeine Baugrundsätze

This European Standard was approved by CEN on 9 November 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 165 "Wastewater 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of an identical text or by endorsement, at the latest by July 2002, and conflicting national standards shall be withdrawn at the latest by December 2002.

It is the first part prepared by the Working Groups CEN/TC 165/WG 42 and 43 relating to the general requirements and processes for treatment plants for a total number of inhabitants and population equivalents (PT) over 50. The parts of the series are as follows:

— Part 1: General construction principles

— Part 3: Preliminary treatment

— Part 4: Primary settlement

— Part 5: Lagooning processes

— Part 6: Activated sludge processes

— 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 [1)]

NOTE For requirements on pumping installations at wastewater treatment plants, provided initially as part 2 "Pumping installations for wastewater treatment plants", see EN 752-6 "Drain and sewer systems outside buildings — Part 6: Pumping installations".

The parts EN 12255-1, EN 12255-3 to EN 12255-8 and EN 12255-10 and EN 12255-11 were implemented together as a European package (Resolution 232/2001 taken by CEN/TC 165).

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1) in preparation

This European standard is limited to general construction principles. Separate standards for special construction principles for elements of wastewater treatment plants are covered in other parts.

Safety principles and general data required are covered in EN 12255-10 and EN 12255-11.

Annex A is informative, annex B is normative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this document: Austria, Belgium, the Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies general requirements for structures and equipment as they relate to wastewater treatment plants for a total population of more than 50 PT.

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

Requirements for structures which are not specific for wastewater treatment plants are not within the scope of this European Standard. Other ENs can apply.

Equipment which is not solely used in wastewater treatment plants is subject to the applicable product standards. However, specific requirements for such equipment when used in wastewater treatment plants are included in this part.

General principles of building construction, mechanical and electrical engineering are not subject of this standard.

This European Standard does not cover the design of treatment processes.

Differences in wastewater treatment throughout Europe have led to a variety of systems being developed. This standard gives fundamental information about the systems; this standard has not attempted to specify all available systems.

Detailed information additional to that contained in this standard may be obtained by referring to the Bibliography.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 752-6, *Drain and sewer systems outside buildings – Part 6: Pumping installations*.

EN 809, *Pumps and pump units for liquids – Common safety requirements*.

EN 1085, *Wastewater treatment – Vocabulary*.

EN 12255-9, *Wastewater treatment plants — Part 9: Odour control and ventilation*.

EN 12255-10, *Wastewater treatment plants – Part 10: Safety principles*.

prEN 12255-12, *Wastewater treatment plants — Part 12: Control and automation.*

EN 60034-1, *Rotating electrical machines – Part 1: Rating and performance (IEC 60034-1:1996, modified).*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529: 1989)*.

ISO 3506-1, *Mechanical properties of corrosion-resistant stainless-steel fasteners – Part 1: Bolts, screws and studs*.

ISO 3506-2, *Mechanical properties of corrosion-resistant stainless-steel fasteners – Part 2: Nuts*.

ISO 3506-3, *Mechanical properties of corrosion-resistant stainless-steel fasteners – Part 3: Set screws and similar fasteners not under tensile stress*.

ISO 4200, *Plain end steel tubes, welded and seamless – General tables of dimensions and masses per unit length*.

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1085 and the following apply.

3.1
structure
any construction and its components built for the accommodation of equipment

3.2
equipment
any component which is installed in, mounted on, attached to, or operated on structures, in the performance of their intended function

3.3
unit
any structure including any related equipment which is used as a process stage and which can be isolated from other parallel, upstream or downstream structures

NOTE Examples for a unit are a grit chamber, a clarifier, an aeration tank, a thickener, a digester.

3.4
assembly
mechanical equipment that can be removed and replaced as a whole

NOTE Examples for an assembly are a pump, a compressor, a gas engine, an aerator.

3.5
wastewater treatment plant
system for the purification of wastewater including structures and equipment

3.6
client
municipality, city or other organisation which intents to built a wastewater treatment plant or parts thereof, or its representative

3.7
Bidder
company or other organisation which offers to built a plant, or to built or supply parts thereof

3.8
contractor
company or organisation which received a contract to built a plant, or to built or supply parts thereof

3.9
tracks
those parts of a structure on which wheels run

3.10
design loading Y_N
effective average loading in continuous operation under full load

NOTE It is greater than or equal to the value of the operating loading which, for example, fluctuates as a function of the given load.

3.11
continuous load bearing capacity Y_C
load bearing capacity in continuous operation under full load

3.12
maximum loading Y_{max}
peak loading which is taken as the switch-off value to which, for example, overload circuit breakers are adjusted

3.13
maximum load bearing capacity Y_B
highest possible load bearing capacity limited to short-term load peaks, such as occur on switching on and off

NOTE In addition, alarm loadings Y_S, lying between the design loading Y_N and the switch-off loading Y_{max}, can be agreed as required, Y_N and Y_{max} being stated by the equipment supplier.

3.14
utilisation factor K_A
parameter for the effects on drive units etc., intrinsic to their operation

NOTE Usually K_A includes either directly or indirectly information on the loading, running time and temperature and is an overall value of the relationship between load bearing capacity and loading.

3.15
design service life [2)]
operating time until break-down of a machinery element under design loading, which is reached by a certain percentage of the elements tested

NOTE

— as an example, the percentage for rolling bearings is 90 %;

— the design service life is different from both the warranty time and an average service life of use, as used for cost efficiency calculations.

3.16
mode of operation
characteristic value related to the effects on motors and other electrical components intrinsic to their operation (e.g. frequency of starts, temperatures)

3.17
degree of protection
characteristic value related to the effects on motors and other electrical components intrinsic to their environmental conditions (e.g. effects of water or dust)

4 Requirements

4.1 General requirements

Wastewater treatment plants shall meet the following requirements:

a) national regulations shall be observed;

b) the discharge limits shall be met;

c) be capable of satisfactory treatment of the full range of flows and loads;

d) personal safety;

e) nuisance, odour, noise and toxicity, aerosols and foam shall be considered and shall meet the relevant requirements according to EN 12255-9 and EN 12255-10;

f) danger to operating personnel shall be minimized;

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2) Explanatory note see annex A

g) the required service life and long term structural integrity shall be achieved, including water and gas;

h) tightness;

i) provisions shall be made for case of operation and maintenance;

j) provision for future extensions or modifications of the plant shall be considered;

k) the reliability of operation shall be high and risk of danger and the impact of malfunctions shall be limited;

l) be cost effective in respect of total costs (capital and operating costs);

m) the energy consumption during construction and operation shall be considered;

n) the waste products shall be reduced in quantity and improved in quality as far as reasonably achievable to allow for reuse or safe disposal.

4.2 Design requirements

The following requirements shall be considered during the design stage of a wastewater treatment plant:

a) All assemblies that are subject to occasional failure (e.g. pumps and compressors) shall be installed with sufficient stand-by capacity so as to achieve full treatment capacity and efficiency with one assembly out of service. In the case where stand-by assemblies cannot be practically installed, provisions shall be made to replace rapidly by another one kept in stock.

b) Where practicable and necessary for maintenance work it shall be possible to bypass every unit or assembly, either by a parallel unit or assembly, channel or pipe.

c) Where necessary the inlet to the treatment plant shall include a facility which limits the flow. Such facilities may be balancing tanks and/or stormwater overflows as required by the authorities.

d) Where power supply is subject to prolonged interruption, wastewater treatment plants shall have emergency power generation or an equivalent facility to provide a sufficient power supply during power failure of the network, e.g. a terminal for easy connection with a readily available mobile power generator. Connected to the emergency power supply shall as a minimum include the measuring and control system, the pumps for waste water and return sludge and any aeration equipment (at a designed minimum capacity).

e) When the power supply is restored after an interruption, the treatment plant shall be designed so that normal operating status is resumed automatically.

f) Provision shall be made for taking representative samples upstream and downstream of each unit and of any flow whose characteristics are important for operation and supervision.

g) The design shall ensure that all information (quantities and qualities) that is important for effective operation of the plant is readily obtainable (e.g. flows, levels, pressures, temperatures, dissolved oxygen concentrations, pH-values, other concentrations).

h) The design shall enable cleaning, maintenance and repairs to be carried out easily and safely (e.g. access, flushing connections to pipes, isolation means).

i) Appropriate provision shall be made for the case of malfunction or emergency.

4.3 Structural requirements

4.3.1 General

Structures shall be

— stable to bear all loads during construction, operation and maintenance periods, e.g. water pressures, static and dynamic forces being induced by the equipment,

— resistant against chemical and biological attack from wastewater, sludge, air and gas components and against temperatures and temperature changes as appropriate,

— protected against flotation.

4.3.2 Dimensional tolerances

The permissible dimensional tolerances for structures which are required for the function of the equipment are specified in the relevant specific standards or annex B. Other dimensional tolerances shall be agreed with the supplier of the equipment.

4.3.3 Concrete tracks

Tracks shall be identified in the drawings.

Tracks shall be level and free of ridges.

Particular requirements in regard of the quality and placing of the concrete shall be met in order to reinforce the tracks against the effects of

— compression and shear forces,

— frost and de-icing salt.

The strength of concrete shall not be less than 35 N/mm². The thickness of the concrete covering of the reinforcement on the wall crest if exposed to de-icing salt shall be at least 1 cm more than normal.

The maximum pressure on the wheels shall be limited to:

— rubber wheels 2,5 MN/m^2;

— polyurethane wheels 5,0 MN/m^2.

In the latter case, protection of the track with steel plates or other suitable material may be necessary.

4.3.4 Fixings and connections between equipment and structures

The possibility of differential settlement between structures, and between structures and equipment (such as pipelines) shall be taken into account. Sufficient flexible joints and flexibility in the equipment itself or in its connections to the structures shall be provided.

Reinforcement in the structure shall not be used for securing equipment.

Where different metals are in contact, measures shall be incorporated to prevent corrosion by galvanic action.

Where metallic fixings might be in electrical contact with the reinforcement of the structure appropriate electrical insulation shall be provided, e.g. insulating, chemical anchor with threaded rod.

4.3.5 Access

Safe access in the form of paths, gangways, bridges, stages and the like shall be provided to allow supervision, operating, servicing, cleaning and maintenance. Openings shall be provided which allow easy replacement of equipment.

The location of operating and maintenance points shall allow for adverse weather conditions and other hazards (e.g. handling of gases, vapours, sludge, oil and grease) and possibility of collapse, squeeze and sheer points.