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Kläranlagen - Teil 13: Chemische Behandlung - Abwasserbehandlung durch Fällung/Flockung

Stations d'épuration - Partie 13: Traitement chimique - Traitement des eaux usées par précipitation/floculation

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EUROPEAN STANDARD

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Wastewater treatment plants - Part 13: Chemical treatment - Treatment of wastewater by precipitation/flocculation

Stations d'épuration - Partie 13: Traitement chimique -
Traitement des eaux usées par
précipitation/floculation

Kläranlagen - Teil 13: Chemische Behandlung -
Abwasserbehandlung durch Fällung/Flockung

This European Standard was approved by CEN on 24 April 2023.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents	Page
European foreword	3
Introduction	5
1 Scope	6
2 Normative references	6
3 Terms and definitions	6
4 Symbols and abbreviations	8
4.1 Symbols	8
4.2 Abbreviations	8
5 Requirements	9
5.1 General	9
5.2 Regulation	9
5.3 Phosphorus removal strategies	9
5.4 Design considerations	10
5.5 Chemical background and process options	11
5.6 Storage preparation and dosing of chemicals	15
5.7 Dosing equipment	15
5.8 Silos, tanks and pipes	16
5.9 Mixing	17
5.10 Control systems for dosing of chemical	17
5.11 Flocculation reactors	19
5.12 Sedimentation tanks	20
5.13 Flotation	20
5.14 Physical filtration	20
5.15 Sludge	20
Annex A (informative) Precipitation chemicals	22
Bibliography	24

European foreword

This document (EN 12255-13:2023) 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of an identical text or by endorsement, at the latest by January 2024, and conflicting national standards shall be withdrawn at the latest by January 2024.

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 12255-13:2002.

This is the thirteenth 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 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*

EN 12255-13:2023 (E)

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.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

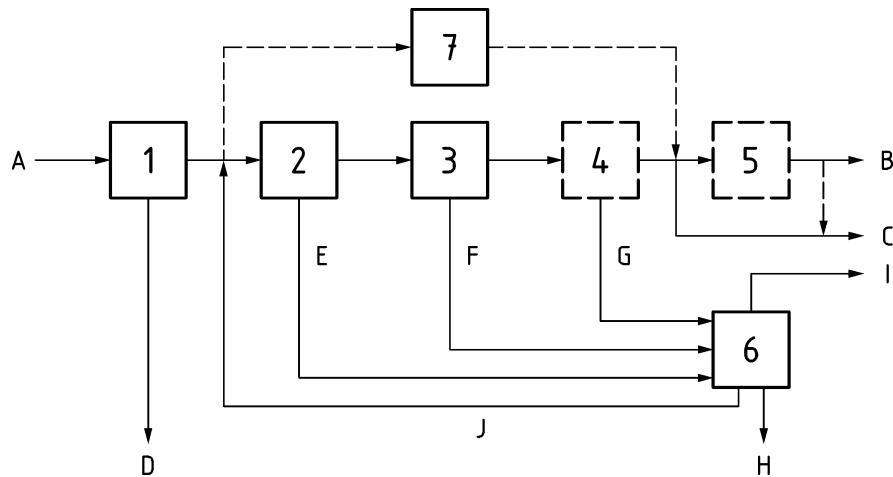
iTeh STANDARD PREVIEW
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Introduction

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 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 EN 16932, *Drain and sewer systems outside buildings — Pumping systems*:

- *Part 1: General requirements;*
- *Part 2: Positive pressure systems;*
- *Part 3: Vacuum systems.*

EN 12255-13:2023 (E)**1 Scope**

This document specifies the requirements for chemical treatment of wastewater by precipitation/flocculation for removal of phosphorus and suspended solids.

The application of polymers is not described in this document.

This document has not attempted to specify all available practices.

NOTE Chemical treatment can be performed in combination with primary and more commonly with secondary treatment, but it can also be performed as separate tertiary treatment, usually in combination with filtration (see EN 12255-16). Chemical treatment can provide a potential contribution to the **circular economy** through the recovery of materials, such as phosphorus, from wastewater or sludge.

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 12255-1, *Wastewater treatment plants - Part 1: General construction principles*

EN 12255-11, *Wastewater treatment plants - Part 11: General data required*

EN 16932-1, *Drain and sewer systems outside buildings - Pumping systems - Part 1: General requirements*

EN 16932-2, *Drain and sewer systems outside buildings - Pumping systems - Part 2: Positive pressure systems*

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**chemical treatment**

process involving the addition of chemicals to achieve a specific result

Note 1 to entry: For wastewater, typical chemical treatments comprise: coagulation/precipitation with metal salts (including lime) or organic polymers in order to remove inorganic and organic phosphorus compounds or suspended solids and colloids.

[SOURCE: ISO 6107:2021, definition 3.108 modified – Note 1 to entry added]

3.2**chemical precipitation**

conversion of components dissolved in water into an undissolved form by chemical reaction with a precipitant

[SOURCE: EN 16323:2014, 2.3.5.8]

3.3

precipitant

chemical used to bring about precipitation

[SOURCE: EN 16323:2014, 2.3.5.45]

3.4

coagulation

destabilisation of undissolved and colloiddally dispersed matter to allow aggregation, usually by addition of coagulants

[SOURCE: EN 16323:2014, 2.3.5.9]

3.5

coagulant

chemical added to destabilise suspensions or emulsions

[SOURCE: EN 16323:2014, 2.3.1.21]

Note 1 to entry: A coagulant is normally based on an aluminium or iron salt (inorganic coagulant) but could also be a polymer (organic). In water treatment, the coagulant always has a positive charge

3.6

flocculation

formation of separable flocs by aggregation of small particles

[SOURCE: EN 16323:2014, 2.3.5.19]

Note 1 to entry: Micro-flocculation can be achieved by destabilization and coagulation/aggregation, macro-flocculation can be achieved by addition of bridge building polymers.

3.7

destabilisation

compensation of negative charges on the surfaces of particles by addition of positively charged bivalent or trivalent metal ions to achieve particle aggregation

Note 1 to entry: Destabilization is performed by reduction of the zeta-potential.

3.8

tertiary treatment

additional treatment processes which result in further purification than that obtained by primary and secondary treatment

[SOURCE: EN 16323:2014, 2.3.5.51]

3.9

aerobic

dissolved oxygen is present

[SOURCE: EN 16323:2014, 2.3.1.1]

Note 1 to entry: The terms oxic and aerobic are synonyms.

EN 12255-13:2023 (E)**3.10****anaerobic**

absence of dissolved oxygen, nitrate, nitrite and sulphate

[SOURCE: EN 16323:2014, 2.3.1.2]

Note 1 to entry: It can be important that other oxidising chemicals are also absent.

3.11**anoxic**

absence of dissolved oxygen but presence of nitrite or nitrate

[SOURCE: EN 16323:2014, 2.3.1.3]

4 Symbols and abbreviations**4.1 Symbols**

C_{Dos}	concentration of the dosed iron or aluminium salt (kg/m ³)
$C_{\text{P,in}}$	arriving P-concentration (mg/l)
$C_{\text{P,out}}$	remaining P-concentration (mg/l)
$L_{\text{P,rem}}$	removed phosphorus load (kg/h)
Q	wastewater flow (l/s)
Q_{Dos}	dose rate (m ³ /h)
ω	specific molar weight of the chemical (g/mol)
ρ	density of the chemical (kg/m ³)
β	ratio between the dosed precipitant (e.g. iron) to the stoichiometrically required precipitant for the phosphorus to be removed

4.2 Abbreviations

ADP	adenosine-di-phosphate
ASP	activated sludge plants
ATP	adenosine-tri-phosphate
DS	dry solids
EBPR	enhanced biological phosphorus removal
FPD	flow proportional dosing
FST	final settlement tanks
P	phosphorus
TSR	tertiary solids removal

5 Requirements

5.1 General

Chemical treatment of wastewater can be divided into two processes:

- a reaction phase, that consists of precipitation of dissolved phosphates, destabilization of colloids and the formation of flocs; and
- a separation phase, in which the flocs are separated from the water.

The reactors and floc separators (sedimentation tanks, flotation or filtration units etc.) for the chemical treatment can be integrated with the other parts of the wastewater treatment plant (pre-precipitation as part of primary treatment, simultaneous precipitation as part of secondary treatment, see 5.5.2.1 and 5.5.2.2) or be a separate part of the treatment plant (post precipitation, direct precipitation, i.e. tertiary treatment, see 5.5.2.3, or direct precipitation).

The water level in the chemical reactors and tanks may be controlled by fixed or adjustable weirs. It is particularly important where there are multiple parallel reactors.

The design of the process shall take into account variations in flow and load as stipulated in EN 12255-1 and EN 12255-11.

5.2 Regulation

National or local regulations or the relevant authority can set requirements for phosphorus removal, recovery and re-use. This might also include a limit for the metal (iron or aluminium) used in the precipitation/flocculation of phosphorus in its various forms.

Limits would typically be on the remaining concentration of cations and anions (e.g. chloride, sulfate or aluminium) in the final effluent or its pH range. The mechanism and risk of over-dosing should be considered in the design phase.

5.3 Phosphorus removal strategies

5.3.1 General

Phosphorus can be removed by primary treatment followed by biological or chemical treatment and may require tertiary (solids and phosphate removal) to meet tighter consents.

The Total Phosphorus permit limits imposed on sites can typically range from 2 mg/l down to 0,1 mg/l. The recommend strategy for achieving these permits varies depending on a number of factors:

- the total Phosphorus permit;
- the site's biological treatment stage;
- the site's final effluent solids removal performance;
- the precipitant chemical chosen to achieve Phosphorus removal;
- the means by which the precipitant is added and mixed;
- the characteristics of the influent (e.g. organic load, pH, industrial discharges etc)

Table 1 outlines an approach for sites with new total phosphorus permits which have not previously had final effluent total phosphorus permits and do not have existing tertiary solids removal (TSR) e.g. through effluent filtration: