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Wastewater treatment plants

Part 4: Primary treatment

bsi.

National foreword

This British Standard is the UK implementation of EN 12255-4:2023. It supersedes BS EN 12255-4:2002, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/505/40, Wastewater Treatment Plants > 50 PT.

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European foreword

This document (EN 12255-4:2023) 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of an identical text or by endorsement, at the latest by September 2023, and conflicting national standards shall be withdrawn at the latest by September 2023.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 12255-4:2002.

It is the fourth part prepared by the 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*

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NOTE 1 Part 2 is under preparation.

NOTE 2 For requirements on pumping installations at wastewater treatment plants, see EN 752, *Drain and sewer systems outside buildings — Sewer system management* and EN 16932 (all parts), *Drain and sewer systems outside buildings — Pumping systems*.

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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:

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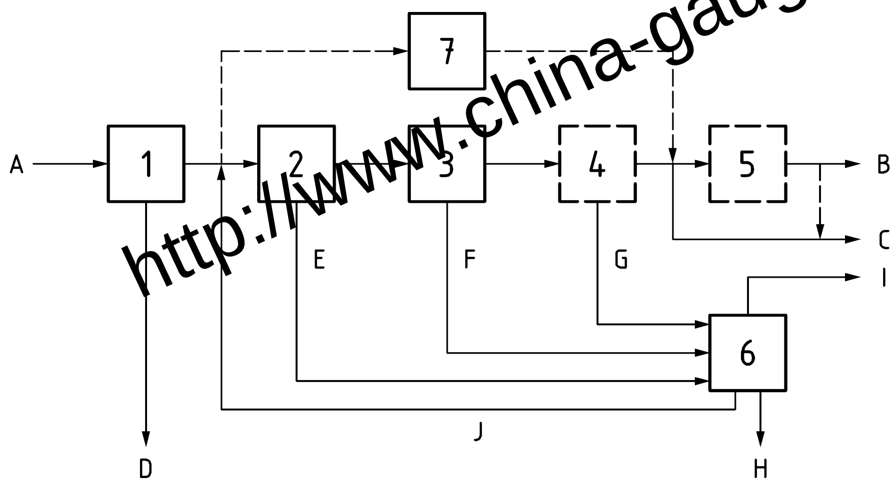

Key

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

Detailed information additional to that contained in this document can be obtained by referring to the bibliography.

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

1 Scope

This document specifies the design requirements for plant and equipment to remove solids, other than screenings and grit, from raw wastewater, at wastewater treatment plants for over 50 PT.

It includes primary treatment with sedimentation, fine screens and micro-screens.

NOTE 1 The removal of screenings and grit is covered in EN 12255-3.

NOTE 2 Dissolved air flotation (DAF) is not covered in detail in this document because it is not commonly used for primary treatment in municipal wastewater treatment plants. It can be used for primary treatment of industrial wastewater, but then the design is specific to the application.

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

EN 16323:2014, *Glossary of wastewater engineering terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16323:2014 and the following apply.

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

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

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

3.1
dissolved air flotation
DAF
separation of solids from wastewater whereby air is dissolved in recirculated wastewater under pressure, generates micro-bubbles when the pressure is released within a tank, which attach to particles and floats them to the wastewater surface as scum

3.2
lamella separator
device comprising regularly spaced, inclined plates or tubes designed to increase the effective settling area

[SOURCE: EN 16323:2014, term number 2.3.2.6]

3.3
micro-screen
screen with a typical mesh size between 0,1 mm and 1,0 mm

3.4
fine screen
screen with a slot or perforation diameter between 1 mm and < 8 mm

[SOURCE: EN 12255-3]

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4 Symbols and abbreviations

BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
FOG	Fat, Oil and Grease
rbdCOD	readily biodegradable COD
P_{tot}	Total Phosphorus
TKN	Total Kjeldahl Nitrogen
TS	Total Solids
TSS	Total Suspended Solids

5 Requirements

5.1 General

Primary treatment has the objective of removing solids and the associated organic load from raw wastewater (solid-liquid separation). Retained solids are removed continuously or on a regular basis in the form of primary sludge. The kind of solids removed depends on the process employed: primary clarifiers and lamella separators remove solids depending on their size and density by sedimentation (settable solids) or by flotation (fat, oil and grease), but they do not effectively remove solids with a density close to that of the wastewater. Screens remove solids from wastewater based on their particle size and rigidity, independent of their density.

The type and size of units employed will depend on the overall system, on the inflow and solids load and their variabilities, on the available space and ground conditions.

Primary treatment can include the following units:

a) Primary clarifier (settling tank or lamella separator):

- upward flow;
- horizontal flow;
- clarifier/sludge storage tank combination;
- lamella separator;
- imhoff tank.

Figure A.1 to A.6 in Appendix A show sketches of typical gravity clarifiers and lamella separators.

b) Micro-screen:

- rotating cylindrical screens with flow from the inside out;
- continuous belt screen which is horizontal or slightly sopped upwards;
- other micro-screens which might be developed.

Figure A.7 in Appendix A shows sketches of typical micro-screens, i.e. of a belt and drum screen.

c) Dissolved air flotation:

- system with or without addition of coagulants or flocculants;
- system with or without lamella separators.

Figure A.8 in Appendix A shows a sketch of a typical dissolved air flotation unit.

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Primary treatment is not required where secondary wastewater treatment and simultaneous aerobic sludge stabilization is achieved. However, upstream preliminary treatment with fine screens for the removal of solids and grit removal is always required if there is no primary treatment with sedimentation.

Primary treatment can be enhanced through coagulant and flocculant (polymer) addition.

5.2 Planning

5.2.1 Required Data and Information

Performance requirements shall be determined considering the following factors:

- the nature and quantity of flow, including its variation (in particular storm events);
- chemical Oxygen Demand (COD) and Suspended Solids (TSS) loads and their variations;
- ratio of dissolved (or particulate) COD to total COD;
- ratio of readily biodegradable COD (rbdCOD) to total COD; knowledge of this ratio is required where biological Nitrogen removal is performed during subsequent biological treatment; the ratio of Biochemical Oxygen Demand (BOD) to COD may be used as a substitute;
- total Kjeldahl Nitrogen (TKN) load; this parameter is also required where biological Nitrogen removal is performed during subsequent biological treatment;
- slot or perforation width of the headworks screens; lamella separators and micro-screens require fine screens (see Part 3) with a maximum slot width of 4 mm or a perforation diameter of maximum 6 mm;
- the quantity and quality of primary sludge generated, including its peak during storm events, which depends on the quality and operation of the sewer system;
- type of sludge stabilization and requirements concerning the primary sludge solids concentration (gravity or mechanical sludge thickening is usually needed);
- the quantity and quality of the effluent and its variation; where nitrogen removal is required, the COD/TKN-ratio of the effluent should not be below 6:1 so that enough rbdCOD for denitrification

remains in the effluent. More specifically, the ratio of rbdCOD to TKN in the effluent should not be lower than 1:1,2;

- redundancy requirements;
- health and safety requirements;
- concentrations of Sulfide and Chloride in the influent (they can cause concrete and metal corrosion).

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Figure 2 shows the composition of COD and TSS in raw wastewater. Typical average specific loads are shown, but they can vary depending on local conditions. It should be noted that 85-Percentiles of the specific loads are about 20 % higher.

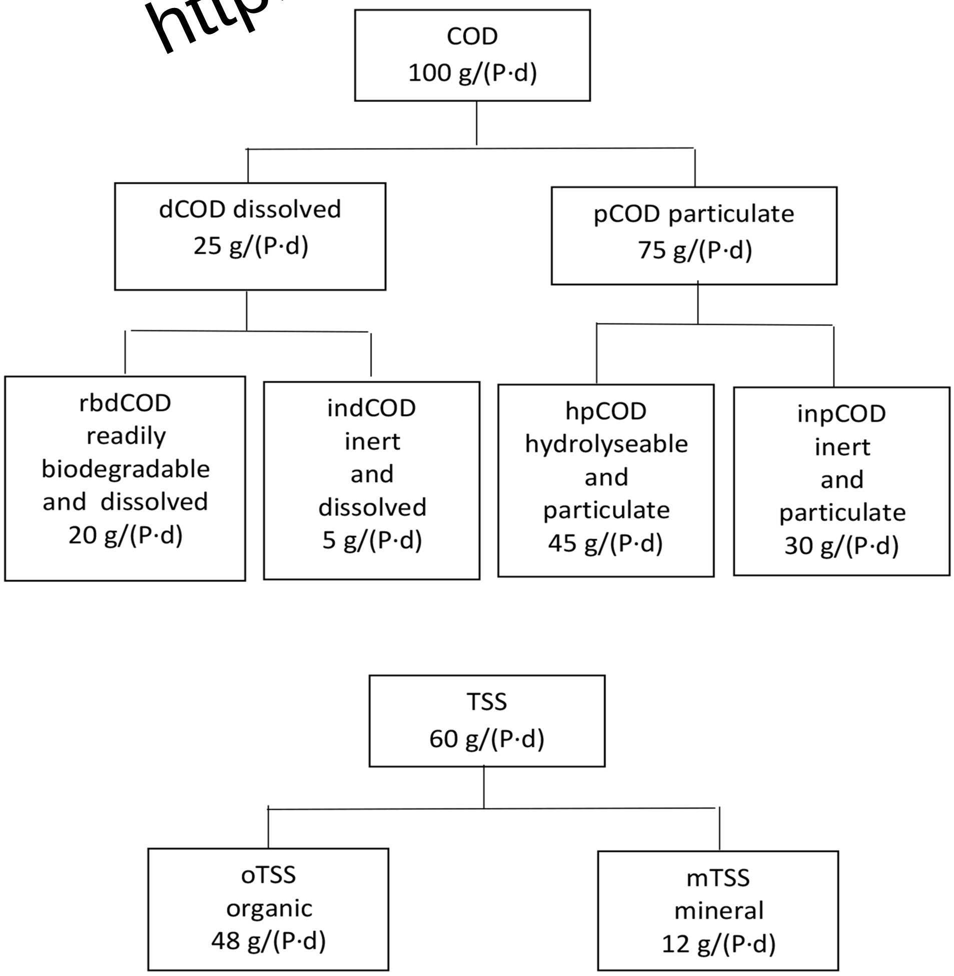

Figure 2 — Typical composition of COD and TSS

5.2.2 Advantages and Disadvantages of Primary Treatment Systems

Lamella separators have the following pros and cons in comparison with conventional clarifiers:

Pros:

— their footprint is about half that of primary clarifiers;

— savings of construction costs;

— better flow distribution.

Cons:

— additional costs of mechanical equipment and its maintenance;

— need for regular cleaning;

— inconsistent performance due to more frequent blockages from fat and rags which can be mitigated by good preliminary treatment (see Part 3).

Lamella separators are typically taken into consideration where:

— existing primary clarifiers need upgrading; or

— where the available footprint for conventional primary clarifiers is insufficient.

Micro-screens have the following pros and cons in comparison with conventional clarifiers:

Pros:

— they require only about 10 % of the footprint of primary clarifiers;

— savings of construction and investment costs;

— smaller variation of removal ratios depending on flow [1];

— removal ratios can be adjusted by changing the mesh;

— removal of fibres and thus protection of subsequent treatment stages from cording;

— removal of micro-plastic;

— can be used to thicken primary sludge (saving pre-thickening storage and separate thickeners).

Cons:

— micro-screens typically generate a head loss of up to 0,4 m and thus can need inflow pumping (this can be comparable to a flow splitter chamber and traditional clarifiers); however, pumping offers the benefit of flow control;

— power consumption is higher;

— need for redundancy: Failure of one unit shall not result in total loss of primary treatment capacity;

— increased reliance on mechanical equipment which requires maintenance.

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Micro-screens are typically taken into consideration where:

— an existing primary clarifier needs upgrading; instead a portion of the inflow can be mechanically treated by micro-screening;

— there is a lack of available space for a conventional clarifier;

— a wastewater plant with aerobic sludge stabilization is changed into a plant with anaerobic sludge stabilization and it is difficult to add a primary clarifier (lack of space or requirement for pumping);

— sea or river outflows need mechanical treatment (with or without prior coagulation or flocculation).

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5.2.3 Performance

In a primary clarifier the removal rate depends on the mean retention period, as shown in Table 1.

Table 1 — Removal Efficiencies of primary clarifiers (DWA-A 131 modified)

	Removal effectivity η in %				
Retention period in primary clarifier calculated with the average dry weather flow	**0,75 h – 1 h**	**1 h – 1,5 h**	**1,5 h – 2 h**	**2 h – 2,5 h**	**> 2,5 h**
COD	30 %	32,5 %	35 %	37,5 %	40 %
Particulate COD	45 %	50 %	55 %	57,5 %	60 %
TSS	50 %	55 %	60 %	62,5 %	65 %
TKN	10 %				
P_{tot}	10 %				

Where nitrogen is to be removed during subsequent biological treatment, the mean retention period during dry weather conditions in a clarifier should be between 0,5 h and 1,5 h. Where this is not the case, a dry weather retention period between 1,5 h and 2,5 h may be used.

Primary clarifiers for wastewater treatment plants serving a total population of up to 1 000 PT should have a retention period, based on the design flow, of minimum 2 h. In such cases the primary clarifier can also serve as primary sludge storage tank. Its volume shall be calculated accordingly. The primary sludge should be removed in such intervals that it does not become septic. The primary sludge can be transferred to a larger plant where it can be stabilized (e.g.in an anaerobic digester).

Micro-screens with a mesh size of 0,3 mm and without prior flocculation can remove about 70 % of the TSS and 50 % of the COD [1]. After prior flocculation up to 90 % of the TSS can be removed.

Micro-screens can also be used for mechanical treatment at sea and river outfalls. In such cases prior flocculation should be provided.

Where no subsequent nitrogen removal is required, the TSS- and COD-removal rate should be as high as reasonably possible and therefore mesh sizes between 0,1 mm and 0,25 mm should be used. This raises the ratio of primary to secondary sludge, increasing the gas production of anaerobic digesters, reduces the volatile solids ratio of stabilized sludge, and improves its dewaterability.

However, where subsequent biological nitrogen removal is required, the denitrification capacity depends on the availability of rbdCOD and the COD/TKN-ratio should not drop below 6:1. In such cases the mesh size of very fine screens should be in a range between 0,2 mm and 0,5 mm, so that about 25 % of the COD and about 60 % of the TSS are removed.

Where only a single clarifier or micro-screen is provided, the primary clarifier and micro- screen shall be provided with a bypass permitting control of the removal ratio and allowing maintenance work.

Waste activated sludge or excess sludge from biofilm plants can be returned to primary treatment. At plants serving a total population of 10 000 or more, separate sludge thickening (by gravity or mechanically) shall be considered.

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5.3 Design

5.3.1 General

Solids removal rates shall be in accordance to the needs of any downstream process.

Flow distribution to parallel units shall be as equal as reasonable possible. This should be by symmetric proportional length distribution weirs in a chamber. Pipelines or channels, or provision of nozzles which are controlled by flow meters used to distribute flows are less accurate and rely on mechanical equipment that requires maintenance.

A bypass of the mechanical treatment stage (a microscreen) shall be provided. The bypass can be used to control the removal ratios but this will allow coarse solids to cause blockages in downstream process units and increased energy consumption.

The general construction principles of Part 1 of this standard series (EN 12255-1) apply. Part 1 includes information on scrapers and wheel tracks.

5.3.2 Specifications

Specification documents shall include the following information:

1) maximum, minimum and average flow;

2) maximum, minimum and average solids load;

3) information on industrial influents in respect to quantity and quality;

4) information on site conditions, including space and geological conditions;

5) information on hydraulic restrictions;

6) redundancy requirements;

7) material specifications.

5.3.3 Required Capacity

The system's capacity shall be designed for the maximum flow and load. The TSS- and COD removal ratios and their remaining loads shall be determined or estimated for design (maximum), average and minimum loads and flows.

5.3.4 Systems for primary treatment

5.3.4.1 Primary Clarifiers

The mean retention period during dry weather flow should be between 0,5 h and 2,5 h, depending on subsequent nitrogen removal requirement (see 5.2.3) In general, with appropriate sludge removal practices, the longer the retention period, the better is the removal ratio (see Table 1). In order to prevent too much removal, the retention period upstream of activated sludge systems with nitrogen removal should remain between 0,75 h and 1,5 h under normal circumstances.

The flow over overflow weirs at maximum flow shall not exceed 150 $m^3/(m \cdot h)$.

Clarifiers with a surface of up to 30 m^2 can be designed for upward flow. Such Dortmund tanks have a side wall and a conical or pyramidal shape with a minimum 60 ° slope and no scraper. Their use is limited by their depth. Settled sludge is removed from the bottom tip of the cone or pyramid through a rising pipe. The inflowing wastewater is radially distributed via a stilling device at a level about 2/3rd of the tank's depth. It flows radially upward to a circumferential overflow weir.

Larger clarifiers are designed for essentially horizontal flow and provided with sludge hoppers and bottom scrapers. They are circular or rectangular tanks.

Such clarifiers shall be provided with one or several sludge hoppers, dependent on their size and geometry. Sludge hoppers can be circular or square. The slope of the hopper walls should not be less than 60 °, unless they are provided with a scraper.

Table 2 shows design dimensions for horizontal and vertical flow clarifiers. At small plants (≤1 000 PT) the primary clarifier can also serve as storage tank for primary and secondary sludge if the settled sludge is removed every few months and treated at a larger plant. The volume of the sludge storage tank shall be sufficient to store primary sludge of 3 % Dry Solids content for at least 4 weeks.

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Table 2 — Typical design data for primary clarifiers for design flow

Design Parameter for New Builds	Horizontal flow	Vertical flow	Clarifier + sludge storage combination
Max. surface area	1 250 m^2 (circular) and 400 m^2 (rectangular)	Up to 80 m^2	Up to 30 m^2
Tank dimensions	20 m to 40 m diameter or 2 m to 10 m width and 20 m to 40 m length	10 m	e.g. 6 m × 6 m
Minimum Side Wall Depth	2 m	0,75 m	2,5 m
Minimum Diffuser Drum Diameter	10 % but preferably about 20 % of tank diameter	20 % of tank diameter	N/A
Diffuser Drum Submergence	Min. 1,0 m	Approx. 2/3rd of depth	N/A
Minimum Diffuser Drum Freeboard	0,3 m	0,3 m	
Inflow velocity (Horizonal velocity component of the inflow into the tank)	0,3 m/s to 0,4 m/s during dry weather conditions	same	same
Floor Slope	min. 3° (circular) and min 0,5° (rectangular)	min. 60°	N/A
Minimum Central Hopper Slope	60°	integral	N/A
Central Hopper Volume/sludge storage volume	Sufficient to retain up to 4 h sludge at 3 % TS and average production rates	Sufficient to retain up to 4 h sludge at 3 % TS and average production rates	Sufficient to retain min. 1 week sludge at 3 % TS
Retention period (tR) at dry weather conditions depending on the requirement for nitrogen removal	0,5 h to 2,5 h	0,5 h to 2,5 h	Min 1,5 h above sludge storage volume
Maximum Upflow Rate (qA)	0,8 m/h to 1,5 m/h	0,8 m/h to 1,5 m/h	0,8 m/h to 1,5 m/h
Weir overflow rate	30 $m^3/(h·m)$ to 60 $m^3/(h·m)$ during dry weather conditions and max. 150 $m^3/(h·m)$ at peak flow	30 $m^3/(h·m)$ to 60 $m^3/(h·m)$ during dry weather conditions and max. 50 $m^3/(h·m)$ at peak flow	N/A

Where several sludge hoppers are provided, the primary sludge should be sequentially removed from individual hoppers over short time intervals to mitigate water funnelling through the hopper. TS-probes can be provided. Flow meters or sludge level detectors can be provided to detect blockage.

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Sludge is removed from the hoppers through pipes. They may be directly connected to sludge pumps (usually redundant pumps are required) or connected to a primary sludge tank wherefrom the sludge is forwarded via pumps. Where there are several sludge hoppers, each pipe shall be provided with a shut off device (usually automated). Where the sludge hoppers are connected to a primary sludge tank, the head shall be 1,5 m to 2,0 m to guarantee sufficient flow.

Wastewater shall enter the tank through a stilling device, reducing the kinetic energy of the inflow and evenly distributing it. The inflow velocity shall be reduced to below 0,5 m/s. A vertically installed very coarse perforated screen can be provided for this purpose if it can easily be cleaned.

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The introduced and stilled wastewater flows longitudinally or radially upwards to an overflow weir.

The freeboard shall be minimum 0,3 m.

The length to width ratio of rectangular clarifiers with horizontal flow shall be minimum 3:1. Their ratio of length to the average water depth should not exceed 20:1.

A scum board and scum scraper should be provided, driving scum over a ramp to a scum hopper or channel. The scum scraper is usually integral with the bottom scraper.

Overflow weirs should have a serrated shape to equalize the overflow. Their height should be adjustable.

Scum boards shall have a distance of minimum 300 mm from overflow weirs. The lower edge of scum boards shall be minimum 200 mm below the water surface.

It shall be considered how equipment for inflow distribution, baffles and overflow weirs, as well as channels can be cleaned. Mechanical cleaning equipment can be provided, e.g. brushes attached to a scraper.

Structural tolerances of clarifiers with scrapers are listed in EN 12255-1.

It shall be considered whether scrapers should run on rails or on wall tracks. Structural requirements on wheel tracks are included in EN 12255-1.

Bottom scrapers in circular clarifiers are usually shield scrapers. In rectangular tanks bar and chain scrapers can be used as an alternative.

Requirements on scraper design are included in EN 12255-1.

Imhoff tanks are horizontal clarifiers with an unheated anaerobic sludge digestion zone underneath wherefrom digester gas is collected. Imhoff tanks are no longer built in Europe, but could be useful in warm climates.

Examples of primary clarifiers are shown in Annex A.

5.3.4.2 Lamella Separators

The raw wastewater flow enters the space between the lamella either at their bottom ends or laterally. Settling solids collect at the upper face of the lamellae while floating material collects at their lower faces. The angle of the lamellae shall be minimum 60° to ensure that settled solids can slide down on the upper faces and that scum can slide up on the lower faces.

The surface flow rate is about double that of conventional clarifiers (see 5.3.3).

The distance between lamella surfaces or the internal diameter of tubes shall not be below 50 mm to prevent clogging.

One or several sludge hoppers shall be provided below the lower end of the lamellae and one or several scum hoppers shall be provided near the upper end of the lamella. Scrapers for sludge and scum can be needed. Bar and chain scrapers are typically used.

Even distribution of the raw wastewater to the spaces between the lamella is essential. A vertical very coarse perforated screen can be provided for this purpose, provided it can easily be cleaned.

5.3.4.3 Micro-screens

There are various kinds of micro screens which can be used for primary treatment. The dry solids concentration of removed primary sludge can vary in a wide range between 2 kg/m³ and 60 kg/m³, depending on local conditions. An optional screw press can be used for dewatering of the removed sludge to between 20 % and 40 % dry solids.

Micro-screens shall be provided with sensors determining their head loss and controlling their cleaning cycles.

The capacity of micro-screens is reduced by fat, oil and grease (FOG). For this reason, high pressure spray washing should be provided.

Regular chemical cleaning is usually not necessary.

For a mesh size between 0,2 mm and 0,3 mm the surface specific design flow rate should be within a range of 25 to 50 $m^3/(m^2 \cdot h)$ which is equivalent to between 25 and 50 m/h.

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5.3.4.4 Rotary drum screens

The screen should generally be made of a stainless steel mesh. The wastewater flows from the inside out. The drum is partially immersed in the effluent.

When the head loss through the screen and thus the water level inside the drum rises above a certain level, the drum rotates lifting the retained solids out of the wastewater.

The retained solids are flushed with spray water at the high point of the screen, so that the solids drop into a channel conveying them into a positive displacement forwarding pump.

Regular flushing is done with low-pressure plant effluent for around 50 % of the filtration time. The pressure is around 0,6 MPa. The flushing water consumption is within a range of 2 % to 4 % of the wastewater flow.

High-pressure water flushing with a travelling nozzle, a pressure of ca. 12 MPa and a water flow of about 0,25 l/s should be done once or twice per day for 5 min to 10 min.

5.3.4.5 Belt screens

The screen removes solids with a continuous-loop fine-mesh belt, made of a flexible and durable material (e.g. woven nylon filaments). The wastewater flows from top to bottom through the moving mesh. As the belt is usually slightly inclined, it acts like a conveyor and lifts retained solids out of the incoming wastewater. A cleaning system removes the solids from the belt and they drop into a hopper or channel. On the returning belt a laterally moving high-pressure water spray can be provided to periodically remove oil and grease that can block the belt. Chemical cleaning of the belt could be required from time to time because oil and grease can be trapped between filaments of the belt.

5.3.4.6 Information from micro-screen suppliers

Suppliers of micro-screens shall provide the following data:

1) dimensions of the tank or channel wherein the screen can be installed;

2) weight of the complete screen;

3) minimum and maximum water level upstream the screen;

4) minimum and maximum head loss of the entire unit;

5) net screening area at minimum and maximum head;

6) mesh size and material of the screen;

7) area specific design flow rate;

8) spray water and air pressure (where provided) as well as average and peak spray water and air consumptions;

9) power consumption of all pumps and drives during average and peak load (including the power consumption of spray water generation);

10) regular maintenance intervals and requirements (manpower needed and spare parts replaced).

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5.3.5 Materials

Materials used for the mechanical equipment (e.g. screens and scrapers, but also pipes, scum boards and overflow weirs) shall be resistant to attack by the constituents of municipal wastewater and sludge, aerosols, sewage gases and atmospheric influences as appropriate and consistent with the relevant requirements. The client shall inform the equipment supplier of any special factors, such as the presence of septic sewage. If different materials are connected, detrimental galvanic corrosion shall be prevented. If load-bearing components are made of plastic material, detrimental effects of the environment (e.g. UV-radiation, temperature) shall be considered.

Local conditions can require the use of particularly durable materials. Durability can be achieved by the use of materials inherently resistant to corrosion (e.g. stainless steel of appropriate grade) or by the application of a suitable coating.

General requirements for materials are given in EN 12255-1.

5.3.6 Control and Automation

General information is provided in EN 12255-1 and EN 12255-12.

Screens and scrapers shall be fully automated. Remote alarm shall be transmitted in case of their failure.

5.3.7 Operation and Maintenance

General requirements for maintenance are included in EN 12255-1.

All parts requiring maintenance shall be easily accessible and exchangeable.

It shall be possible to empty all tanks. Clarifiers could be emptied through their sludge hoppers using a pump (e.g. their sludge pump). Otherwise they shall be provided with a pump sump at their lowest point wherein a submersible pump can be inserted.

It shall be possible to take representative samples from the in- and outflow of every unit.

It shall be possible to clean all mechanical equipment (e.g. screens, scrapers, lamellae, channels).

It should be possible to flush sludge pipes in reverse flow.

5.3.8 Health and Safety

See the EU machine regulation 206/42/EC for additional information.

Health and safety requirements in EN 12255-1 and EN 12255-10 apply.

Annex A
(informative)

Illustrations of typical clarifiers

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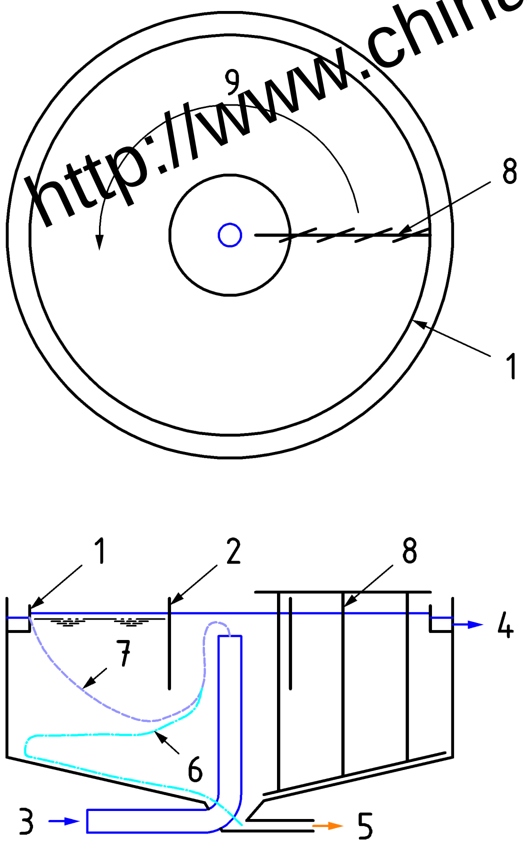
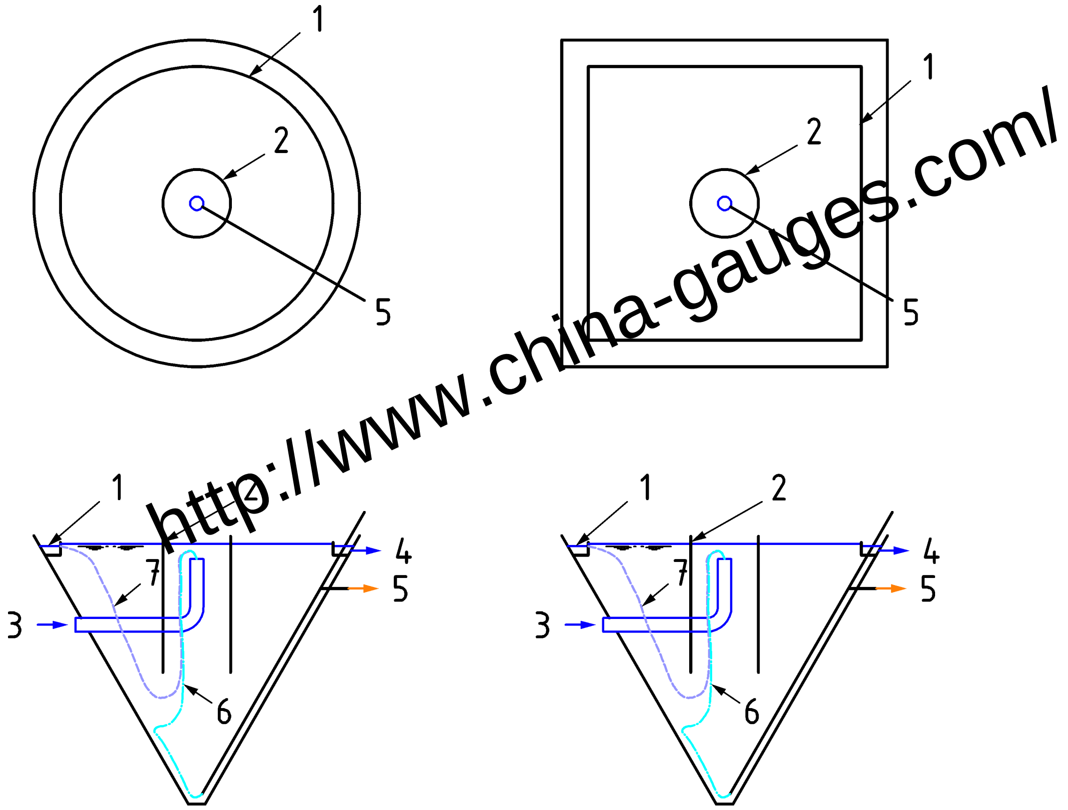
Typical general arrangements of different clarifier types are illustrated in Figure A.1 to A.8.



Key

1 effluent weir
2 baffle
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 scraper with blade
9 scraper rotational direction

Figure A.1 — Circular clarifier with scraper



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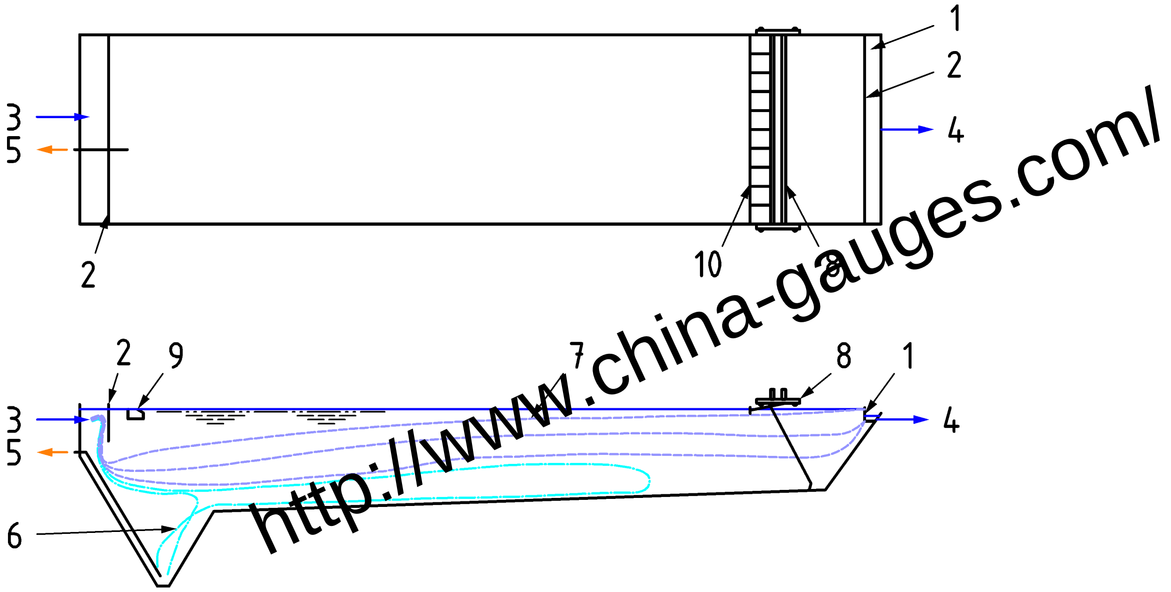
Key

1 effluent weir
2 baffle
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)

Figure A.2 — Circular or square clarifier without scraper (Dortmund tank)



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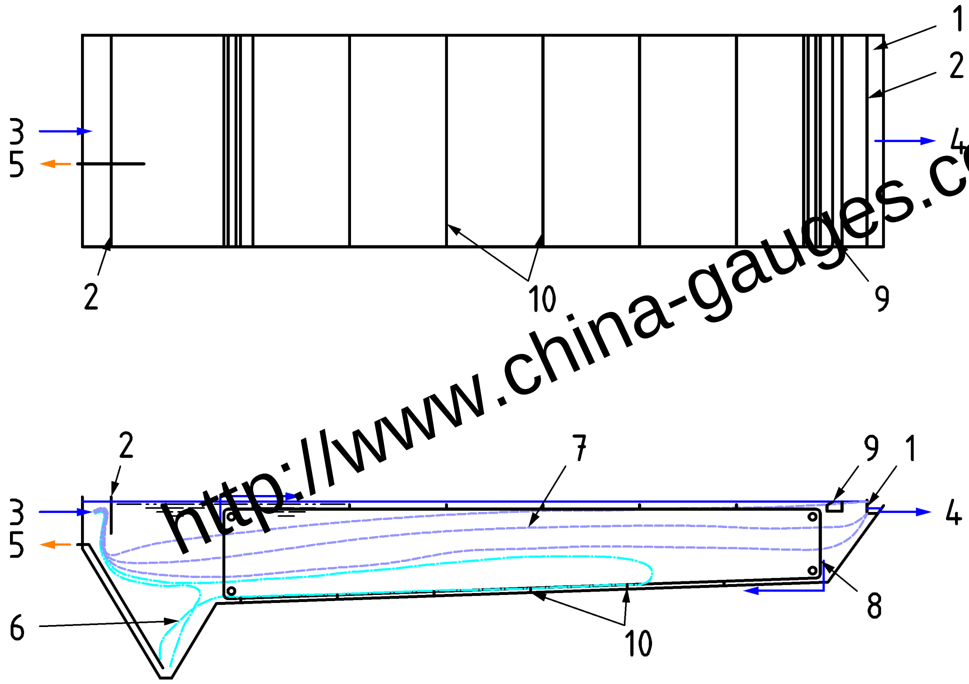
Key

1 effluent weir
2 baffle
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 scraper bridge
9 scum trough

Figure A.3 — Rectangular clarifier with bottom and scum scraper



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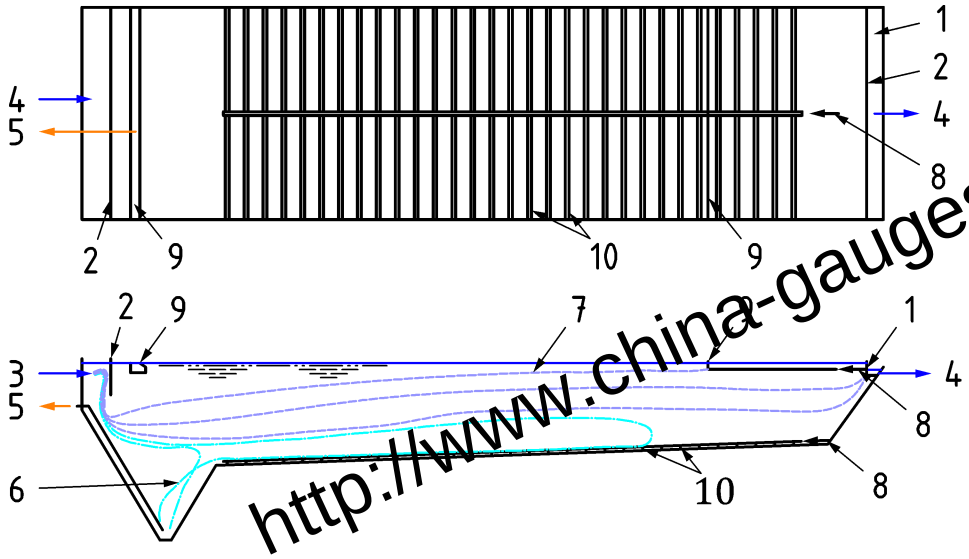
Key

1 effluent weir
2 baffle
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 chain
9 scum trough
10 sludge and scum scraper blades

Figure A.4 — Rectangular clarifier with chain scraper



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Key

1 effluent weir

2 baffle

3 influent

4 effluent

5 primary sludge withdrawal

6 sludge flow route (general)

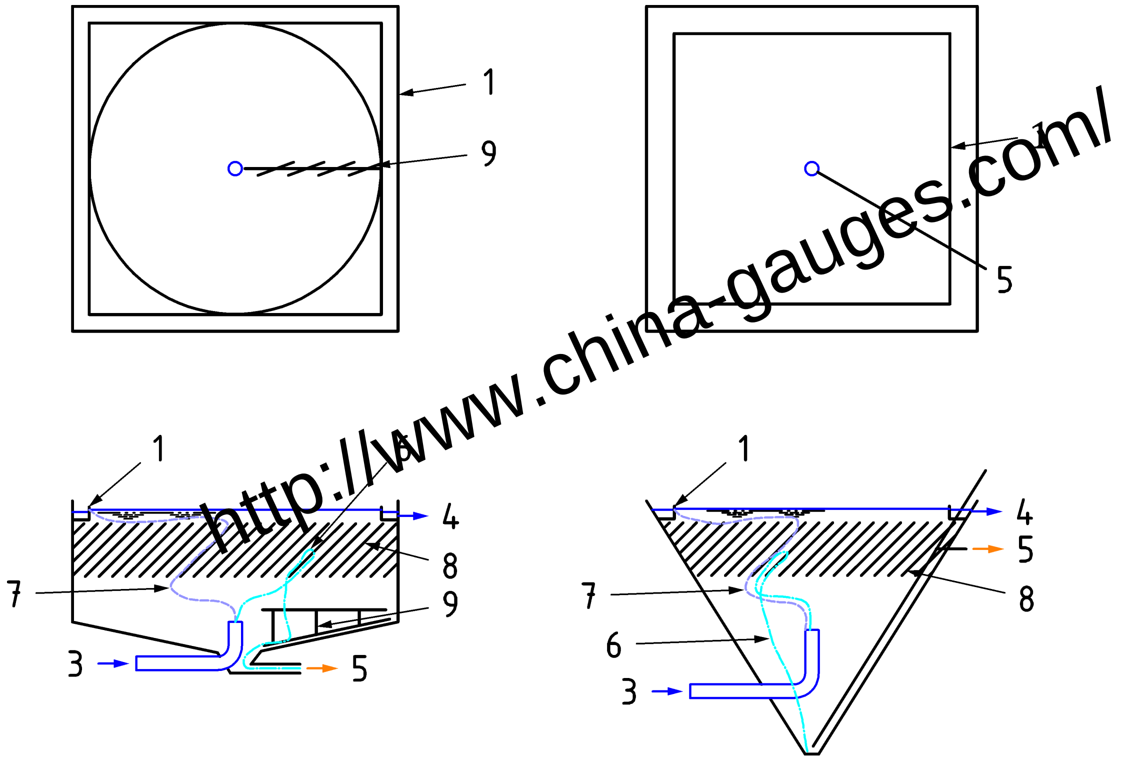
7 wastewater flow route (general)

8 hydraulic ram

9 scum trough

10 wedge shaped scraper blades

Figure A.5 — Rectangular clarifier with ram scraper



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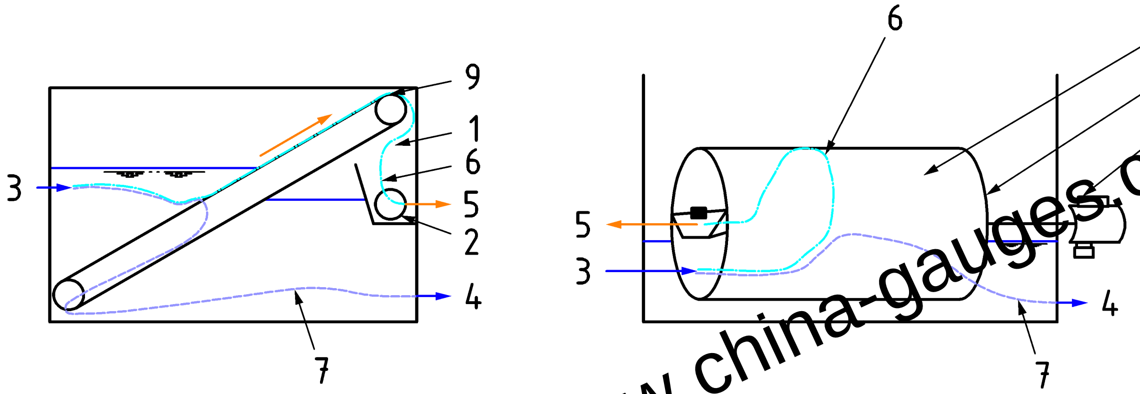
Key

1 effluent weir
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 lamella plates
9 scraper

Figure A.6 — Clarifier with lamella separators



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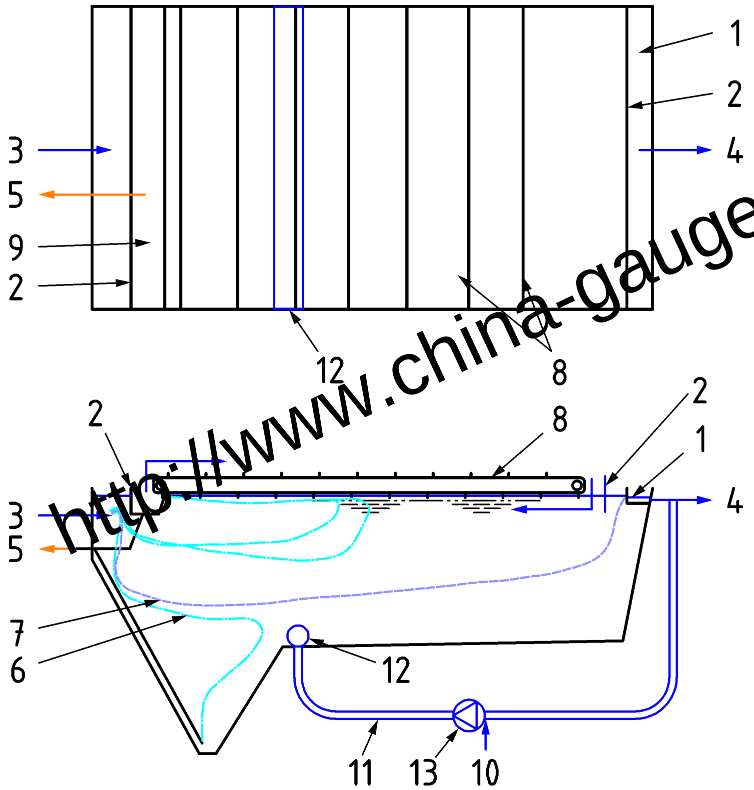
Key

1 cleaning mechanism
2 drive
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 drum
9 belt

Figure A.7 — Belt or drum clarifier



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Key

1 effluent weir
2 baffle
3 influent
4 effluent
5 primary sludge withdrawal
6 sludge flow route (general)
7 wastewater flow route (general)
8 scum scraper
9 scum trough
10 air injection
11 milky water route
12 milky water distributer
13 pump

Figure A.8 — Dissolved air flotation clarifier

Annex B
(normative)

Dimensions and tolerances for the structures of clarifiers

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NOTE Annex B describes the required tolerances for civil structures of clarifiers.

B.1 Circular clarifiers with scrapers

— internal tank diameter: ± 0,03 m;

— contour of the bottom floor: ± 0,03 m;

— internal and external diameter of wall track: ± 0,03 m.

B.2 Rectangular clarifiers with scrapers

— distance of the side walls from the longitudinal axis: ± 0,02 m;

— distance of side walls from each other: ± 0,02 m;

— distance of wall tracks from each other: ± 0,02 m;

— lateral contour of the bottom floor: ± 0,01 m;

— longitudinal contour of the bottom floor over length sections of 4 m: ± 0,02 m;

— vertical distance from the track to the bottom floor: ± 0,03 m (only where scrapers with fixed shields are employed).

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