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Čistilne naprave za odpadno vodo - 12. del: Krmiljenje in avtomatizacija

Wastewater treatment plants - Part 12: Control and automation

Kläranlagen - Teil 12: Steuerung und Automatisierung

Stations d'épuration - Partie 12: Régulation et automatisation

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13.060.30 Odpadna voda Sewage water

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Wastewater treatment plants - Part 12: Control and automation

Stations d'épuration - Partie 12: Régulation et automatisation

Kläranlagen - Teil 12: Steuerung und Automatisierung

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

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European foreword

This document (prEN 12255-12:2022) 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 12255-12:2003-09.

This is the twelfth 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.

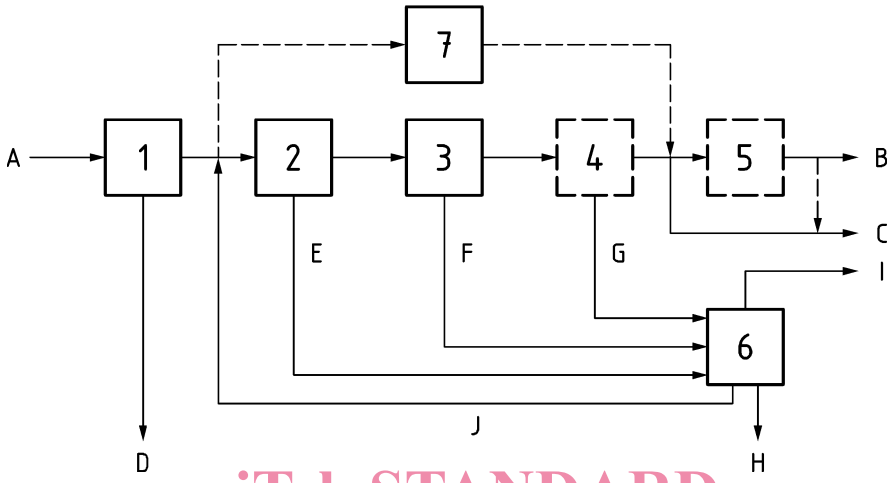
The EN 12255 series with the generic title “Wastewater treatment plants” consists of the following parts:

- *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*

NOTE Part 2 is under preparation.

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

Figure 1 — Schematic diagram of wastewater treatment plants

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

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 specifies general requirements for instrumentation and specific requirements for process control and automation systems on wastewater treatment plants for more than 50 PT.

NOTE Because of the rapid rate of development of sensor and control equipment, this document is intended as an overview and uses examples and general requirements, not detailed equipment specifications. Detailed information additional to that contained in this document can be obtained by referring to the bibliography

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 62305-3:2011, *Protection against lightning - Part 3: Physical damage to structures and life hazard*

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 terminological 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
instrumentation
electronic or mechanical devices that are used to either sense or monitor process parameters

Note 1 to entry: These can be split into sensors and monitors.

3.1.1
sensor
electrical or mechanical device that communicates the qualitative state of a process variable

Note 1 to entry: Examples of this include a contact probe or switch that outputs a 0 or 1 as an off/on state and devices which transmit an electrical signal (usually a voltage) that is scalable to a process variable.

3.1.2
monitor
electrical or mechanical device that communicates the quantitative state of a process variable

3.1.3
measurement system
combination of a sensor and a monitor that together communicates the quantitative state of a process variable

3.2
process control and automation
combination of a control device (such as a PLC, controller or relay) that takes inputs from the instrumentation system to automatically change the state of the system to a defined set of control parameters

Note 1 to entry: This can be a one-way system or if the control is a circular control this would be called closed-loop control.

3.2.1
process variable (PV)
quantity, quality, or condition of a process media or process object which value may be subject to change and can usually be measured

[SOURCE: ISO 15519-2, term 3.1.8]

3.2.2
set point (SP)
setting within the control system that is the target setting for the control system to change the process variable

3.2.3
controller
device for regulation or management of a system or component

[SOURCE: ISO 16484-5:2017, term 3.2.21]

3.2.4
telemetry system
communications system that receives data from instrumentation and control systems and transmits the readings to a remote data visualisation and storage system (e.g. a SCADA system)

3.2.5
SCADA system (Supervisory control and data acquisition system)
combination of hardware and software used to send commands and acquire data for the purpose of monitoring and control

Note 1 to entry: This is normally physically located on site.

4 Symbols and abbreviations

ASM	activated sludge models
ATEX	atmospheres explosible and regulation concerning potentially explosive atmospheres
HART	highway addressable remote transducer (protocol)
NIS	network and information security (check if used outside the directive title) – it isn't
PE	population equivalent
PLC	programmable logic controller
PV	process variable
RAS	return activated sludge
SAS	surplus activated sludge (also known as WAS or waste activated sludge)
SCADA	supervisory control and data acquisition
SP	set point
UV	ultraviolet light (UV treatment system)
WWTP	wastewater treatment plant

5 Instrumentation and control requirements

5.1 General Requirements

The control system shall be considered at an early planning stage when designing for the overall process. The costs, including the investment and operating expenses for the control system with respect to various treatment alternatives should be estimated. Account shall be taken of the fact, that a sophisticated control system requires skilled and trained personnel for maintenance. The decision, of whether a sophisticated control system or simple controls are required, is dependent on the plant size and process complexity. The relevant authority or national or local regulations may have requirements covering the nature of the control system.

Guidance for the selection of instrumentation, control and automation systems is given in Annex A.

5.2 Instruments

All instruments shall:

a) comply with electrical guidelines as outlined in IEC 60364 [2] (national or local regulations or the relevant authority may specify more detailed requirements);

b) limit risks due to cyber-security as outlined in Network and Information Security (NIS) Directive [1] (national or local regulations or the relevant authority may specify more detailed requirements);

c) ensure all risks due to health and safety, especially around instrumentation operation and maintenance, are minimized;

d) have appropriate certifications for use in hazardous areas (see ATEX Directive 2014/34/EU [3] for additional information) where the instrumentation and control systems are within a zoned area;

e) be suitably protected from energy surges and lightning strikes in line with EN 62305-3:2011.

5.3 Instrumentation systems

5.3.1 Instrumentation systems

All instrumentation systems shall:

- ensure the results of any monitoring are representative of the media being monitored taking into account differences in homogeneity;
- be currently capable of communicating with telemetry systems of the operator of the wastewater treatment system.

All instrumentation systems should be installed:

- so that any sampling of the media being monitored does not adversely affect the media as to affect the sample result;
- in such a way as to minimize the degree of fouling;
- in a way to be accessible so an appropriate maintenance regime can be undertaken;
- so that they do not affect the results of any other instruments that are installed in the media measured;

- to protect the instrument from the media that is being measured so as to minimize damage to the instruments;
- to protect the instrument from any damage to the display from climatic conditions including sun damage to the display;
- to take into account the ease of replacement;
- so that they can be safely replaced.

Where enclosures are used then they should have adequate ventilation to prevent overheating.

Where enclosures are used in outdoor conditions where the temperature is likely to fall below 5 °C then a condensation heater should be installed when required.

5.3.2 Instrumentation

Instrumentation shall be:

- appropriate to the application taking into account the nature of the media that is being measured and its propensity to affect measurement through the fouling of the instrument and the subsequent maintenance needs to keep the instrument recording accurately;
- suitably protected to ensure climatic conditions cannot adversely affect the results;
- installed so that if an instrument enters a fault state this shall be detectable through the telemetry system.

5.3.3 Cabling, cable bracketry and cable conduits

Electrical conduit shall be suitably equipped to allow for pulling additional cables through in the future (e.g. draw ropes in place and access points and space to utilize them).

Any electrical cable ladder installed should be suitably equipped to allow for attaching additional cables in the future.

The extent of extra capacity required should be agreed between the parties at an early stage in the design.

Cable conduits and fixings should be of types and be installed to limit damage from foreseeable external sources of degradation e.g. UV, animal interference.

All instrument and signalling connections shall be labelled to allow for ease of detection.

All underground electrical jointing should be installed so that it can be detected.

5.3.4 Operation and Maintenance of Instrumentation

An operational and maintenance strategy shall be put in place to ensure that instrumentation is maintained and calibrated as appropriate to its operation.

5.4 Process Control and Automation

5.4.1 General requirements

Process control and automation systems are designed to be used to document and manage the wastewater treatment system allowing for appropriate maintenance activities to be conducted.

The design shall take into account the required management information system with which it should integrate. In certain cases it can be advantageous to incorporate the control of the wastewater system upstream. This includes consideration of the asset data and the maintenance needs.

The control and automation concept shall be specially designed for each wastewater treatment plant depending on the treatment processes, manning levels and skills. It should also allow compliance with the requirements for reliability and the operation in special situations, e.g. in case of failure of some components.

The general requirements for control and automation are:

- all electrical components shall comply with electrical guidelines as outlined in IEC 60364 (national or local regulations or requirements of the relevant authority may also apply);
- all mechanical components shall be accessible for operational and maintenance purposes;
- all control-based systems shall comply with cyber security as per the Network and Information Security (NIS) Directive (National or local regulations or requirements of the relevant authority may also apply);
- compliance with ATEX Directive 2014/34/EU for operation in hazardous areas, where applicable;
- to take into account any software operating system redundancy issues.

5.4.2 Specification and installation requirements for process control and automation systems

The control and automation system shall be designed to take a process variable from a wide range of instrumentation inputs. Typically, this is via a 4-20mA analogue loop but may be via a number of different communication protocols or signal types. Checks should be made in designing the instrumentation, process control and automation system as to the communication compatibility between the instrumentation, the control systems and the overall SCADA system.

Any automated process control system shall be designed to use the data/signals from the instruments to adjust the treatment process using automated controls to achieve the desired result.

The periodicity of the measurement should be appropriate to the automation and control systems. This is to allow the process control system to make changes to the mechanical automation system in an appropriate timescale. The response times of instrument, process control and automation systems shall be appropriate to their normal operating range and duty. The mechanical/electrical automation system component should be sourced and installed correctly to achieve the desired process outcome taking into account the torque and response time of the element that is being controlled (e.g. an instrument controlling a penstock should not take the penstock control past it safe movement limit)

All electrical and mechanical elements of the automation system shall be, where possible, accessible to allow maintenance and correct operation of the control and automation system and shall facilitate the checking of the control loop signal.

An appropriate operation and maintenance strategy shall be put in place to ensure that the process automation system operates correctly when needed. The minimum requirement is for this to be in line with the manufacturer's recommendations.

No instrumentation or process control system should limit the ability to use technologies from other manufacturers. Unless otherwise agreed between the parties at an early stage in the design a non-proprietary protocol should be used (e.g. Modbus).

6 Design and Implementation

6.1 Initial design

As part of the initial design of the instrumentation, control and automation systems the following should be produced:

1) a complete list of instrumentation including: