BS ISO 30500:2018

BSI Standards Publication

Non-sewered sanitation systems — Prefabricated integrated treatment units — General safety and performance requirements for design and testing

Documents
Document Sharing Hub

Full document details: BS ISO 30500:2018

National foreword

This British Standard is the UK implementation of ISO 30500:2018.

The UK participation in its preparation was entrusted to Technical Committee B/505/41/1, Wastewater treatment systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2018
Published by BSI Standards Limited 2018

ISBN 978 0 539 02620 7

ICS 13.020.20; 91.140.70

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 November 2018.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS ISO 30500:2018

INTERNATIONAL STANDARD

ISO 30500

First edition
2018-10-02

Non-sewered sanitation systems — Prefabricated integrated treatment units — General safety and performance requirements for design and testing

Systèmes d'assainissement autonomes — Unités de traitement intégrées préfabriquées — Exigences générales de performance et de sécurité pour la conception et les essais

Reference number
ISO 30500:2018(E)

Documents
Document Sharing Hub

© ISO 2018

Full document details: BS ISO 30500:2018

COPYRIGHT PROTECTED DOCUMENT

© ISO 2018, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub

Full document details: BS ISO 30500:2018

Contents

Page

Foreword ... **vi**
Introduction ... **vii**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms, definitions and abbreviated terms ... **2**
3.1 Terms and definitions ... 2
3.1.1 System structure ... 2
3.1.2 System inputs and outputs ... 3
3.1.3 System safety and integrity ... 4
3.1.4 System use and impact ... 5
3.2 Abbreviated terms ... 6
4 General requirements ... **7**
4.1 User requirements ... 7
4.2 Metric system ... 7
4.3 Design capacity ... 7
4.3.1 Treatable input ... 7
4.3.2 Treatment capacity ... 7
4.3.3 Menstrual hygiene products ... 7
4.3.4 Overload protection ... 7
4.3.5 Operability following non-usage ... 7
4.3.6 Operability following short-term shut down ... 8
4.3.7 Operability following long-term shut down ... 8
4.3.8 Continuous use ... 8
4.3.9 Safe state ... 8
4.4 Performance requirements ... 8
4.4.1 General ... 8
4.4.2 Solid output and effluent requirements ... 8
4.4.3 Odour emissions requirements ... 8
4.4.4 Noise requirements ... 9
4.4.5 Air emissions requirements ... 9
4.5 Expected design lifetime ... 9
4.6 Aspirational and ergonomic design ... 9
4.7 Secure design ... 9
4.8 Operating conditions ... 9
4.8.1 Ambient temperature range ... 9
4.8.2 Ambient air humidity ... 9
4.8.3 Atmospheric pressure ... 10
4.9 Requirements for sanitation system components ... 10
4.9.1 General ... 10
4.9.2 Hygienic design ... 10
4.9.3 Tightness ... 10
4.9.4 Cleanability of surfaces ... 10
4.9.5 Chemical and biological additives ... 11
4.10 Material requirements ... 11
4.10.1 Durability of materials ... 11
4.10.2 Fire resistance of materials ... 11
4.11 Connections and joining elements ... 11
4.12 General safety design requirements ... 11
4.12.1 Safety of edges, angles, and surfaces ... 11
4.12.2 Fire and explosion protection ... 12
4.12.3 Structural integrity ... 12
4.12.4 Prevention of contact with unsafe effluent and reuse ... 12
4.12.5 Underground systems ... 12

AVA Documents
Document Sharing Hub

© ISO 2018 – All rights reserved

Full document details: BS ISO 30500:2018

4.12.6 External impacts ... 13
4.13 Information and marking ... 13
4.13.1 Information and warnings ... 13
4.13.2 Marking and labelling ... 13
4.14 Maintenance ... 14
4.14.1 Reasonable configuration, adjustment, and maintenance activities ... 14
4.14.2 Location and access of configuration, adjustment, and maintenance points ... 14
4.14.3 Discharge and cleaning ... 14
4.14.4 Tools and devices ... 15
4.14.5 User manual ... 15
4.14.6 Handling and transport of the sanitation system ... 15

5 Technical requirements ... 15
5.1 Safety assessment ... 15
5.2 Operational requirements ... 15
5.2.1 General ... 15
5.2.2 Intentional starting of sanitation system operation ... 16
5.2.3 Intentional stopping of sanitation system operation ... 16
5.2.4 Emergency stop ... 16
5.3 Reliability and safety requirements for energy supply ... 16
5.3.1 Security of energy supply ... 16
5.3.2 Safety requirements for electrical energy supply ... 16
5.3.3 Safety requirements for non-electrical primary energy supply ... 17
5.4 Mechanical requirements ... 17
5.4.1 Pressurized or vacuum equipment ... 17
5.4.2 Pipes, hoses and tanks ... 17
5.4.3 Moving and rotating parts ... 17
5.4.4 Backflow prevention ... 17
5.5 Requirements for radiation ... 17
5.5.1 High temperatures of parts and surfaces ... 17
5.5.2 Low temperatures of parts and surfaces ... 18
5.5.3 Other radiation emissions ... 18
5.6 Electrical and electronic equipment ... 18
5.6.1 Safety and reliability of electrical and electronic equipment ... 18
5.6.2 Control system ... 18
5.6.3 Safety-related function of the control system ... 19
5.7 Reliability of conveyance devices ... 19
5.8 Transitions from the backend ... 19

6 Additional requirements for the frontend ... 19
6.1 General ... 19
6.2 Use and operation ... 19
6.2.1 General usability requirements ... 19
6.2.2 Requirements for ease of cleaning ... 20
6.2.3 Requirements for ease of operation ... 20
6.2.4 Cultural requirements ... 20
6.3 Visibility of faeces ... 21
6.4 Evacuation performance ... 21
6.5 Integrity against external impacts ... 21
6.6 Slipping, tripping or falling ... 21
6.7 Water seal ... 21

7 Performance testing ... 22
7.1 General testing requirements ... 22
7.2 Controlled laboratory testing ... 22
7.2.1 General ... 22
7.2.2 Assembly, installation, operation, and maintenance ... 22
7.2.3 Documentation of input ... 23
7.2.4 Generated output ... 23
7.2.5 Test observations ... 23

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

7.2.6 Laboratory conditions ... 23
7.2.7 Testing sequence and duration ... 23
7.2.8 Loading pattern ... 26
7.2.9 Performance requirements during laboratory testing ... 26
7.3 Field verification of performance ... 30
7.3.1 General ... 30
7.3.2 Class 1 sanitation systems ... 31
7.3.3 Class 2 and Class 3 sanitation systems ... 31

8 Sustainability ... 32
8.1 General ... 32
8.2 Recovery of nutrients ... 32
8.3 Water consumption and reuse of effluent ... 32
8.3.1 Calculations ... 32
8.3.2 Water consumption ... 32
8.3.3 Reuse of effluent ... 32
8.4 Energy consumption and energy recovery ... 32
8.4.1 Calculations ... 32
8.4.2 Energy consumption ... 33
8.4.3 Direct and indirect energy recovery ... 33
8.5 Life cycle assessment ... 33
8.6 Recurring operational requirements ... 33

Annex A (normative) **Test methods and additional testing requirements ... 35**

Annex B (normative) **Risk assessment and list of significant hazards ... 68**

Annex C (normative) **User manuals ... 74**

Annex D (informative) **Sustainability measures ... 77**

Annex E (informative) **Design considerations ... 79**

Annex F (informative) **Health and environment parameters — Notes and references ... 83**

Bibliography ... 85

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Project Committee ISO/PC 305, *Sustainable non-sewered sanitation systems*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

Introduction

It is estimated that 2,3 billion people do not have access to basic sanitation systems. The devastating consequences of the lack of sanitation facilities include an estimated 1,8 billion people globally using a source of drinking water that is faecally contaminated and 361 000 children under 5 years of age dying per year, primarily from dysentery-like diarrhoeal diseases.

In March 2013, the United Nations (UN) issued a global call to action to eliminate the practice of open defecation by 2025. The UN and regional sanitation leaders have concluded that areas where open defecation is common have the highest levels of child death and disease, as a result of ingesting human faecal matter that has entered the food or water supply. A lack of safe, private sanitation is also associated with the highest overall levels of malnutrition, poverty, and disparity between rich and poor, and makes women and girls more vulnerable to violence.

On 1st January 2016, the 17 UN Sustainable Development Goals (SDG) were launched, including SDG 6: ensure access to water and sanitation for all. The SDGs are a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of the new UN sustainable development agenda.

Targets 6.2 and 6.3 of SDG 6 state:

— by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations;

— by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

In this context, the purpose of this document is to support the development of stand-alone sanitation systems designed to address basic sanitation needs and promote economic, social, and environmental sustainability through strategies that include minimizing resource consumption (e.g. water, energy) and converting human excreta to safe output.

This document is intended to promote the implementation of sanitation systems where increased sustainability is desired, or where traditional sanitary sewer systems are unavailable or impractical and thus, to ensure human health and safety as well as protecting of the environment.

However, this document does not attempt to exhaustively address sustainability concerns with respect to non-sewered sanitation systems (NSSS). There are many aspects to sustainability that are not covered in this document.

The concept of a NSSS is indicated in Figure 1, showing the integration of the frontend(s) and backend(s) along with the input and output. Inputs entering the NSSS primarily comprise of human faeces and urine, menstrual blood, bile, flushing water, anal cleansing water, toilet paper, other bodily fluids/solids. Outputs substances exiting the NSSS include the products of the backend treatment process such as solid output and effluent, as well as noise, air, and odour emissions.

By design, such sanitation systems operate without connection to any sewer or drainage network. The NSSS can be either manufactured as one package or manufactured as a set of prefabricated elements designed to be assembled without further fabrication or modification that influences the system function. The prefabricated components of NSSS are intended to require minimal work to be integrated and quickly provide fully functioning sanitation systems.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

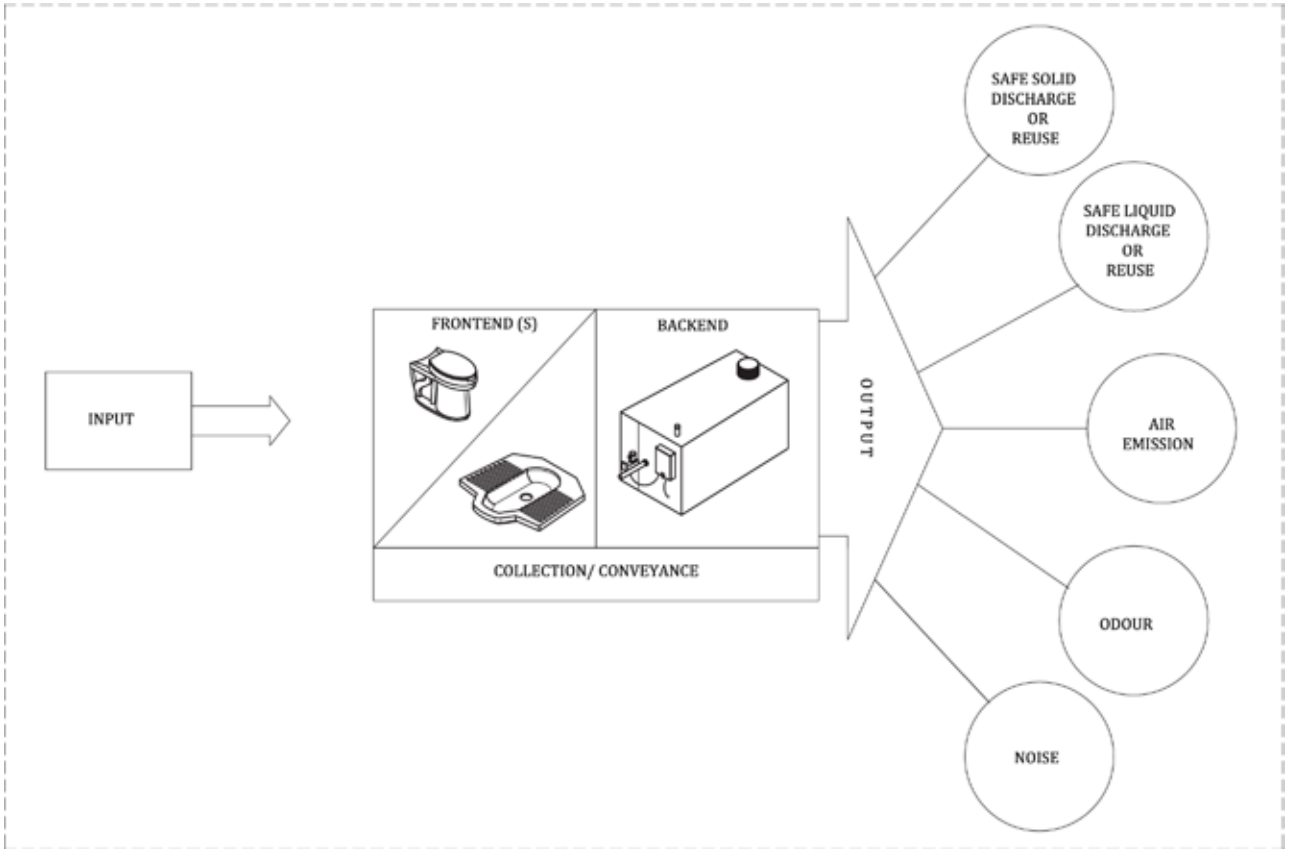

Figure 1 — Concept of a non-sewered sanitation system

In NSSS, the frontend includes user interfaces such as a urinal, squatting pan, or sitting pan, which may apply evacuation mechanisms ranging from conventional flush, pour flush, and dry toilets to novel evacuation mechanisms such as those employing mechanical forces requiring little to no water. Conventional and novel evacuation mechanisms may be combined with urine diversion applications (e.g. urine diversion flush toilet, urine diversion dry toilet). Backend treatment technologies and processes of NSSS range from biological or chemical to physical unit processes (e.g. anaerobic and aerobic digestion, combustion, electrochemical disinfection, membranes). Some systems use only one of these technologies or processes while others apply various unit processes in combination through several treatment units.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

INTERNATIONAL STANDARD ISO 30500:2018

Non-sewered sanitation systems — Prefabricated integrated treatment units — General safety and performance requirements for design and testing

1 Scope

This document specifies general safety and performance requirements for design and testing as well as sustainability considerations for non-sewered sanitation systems (NSSS). A NSSS, for the purposes of this document, is a prefabricated integrated treatment unit, comprising frontend (toilet facility) and backend (treatment facility) components that

a) collects, conveys, and fully treats the specific input within the system, to allow for safe reuse or disposal of the generated solid, liquid, and gaseous output, and

b) is not connected to a networked sewer or networked drainage systems.

This document is applicable to sanitation systems that are either manufactured as one package, or manufactured as a set of prefabricated elements designed to be assembled in one location without further fabrication or modification that influences the system function. The plane or surface (e.g. flooring, concrete pad) upon which a fully assembled NSSS is situated is beyond the scope of this document. This document is not applicable to sanitation systems constructed *in situ*.

This document also covers NSSS backend components that are designed to be integrated with one or more specified frontends.

Although this document is primarily applicable to the development of sanitation systems that are not connected to water and electricity networks, it can also be applied to systems that can utilize water mains and/or electricity.

This document defines the basic treatable input as primarily human excreta and gives options for extending the range of input substances. Requirements for the quality of the outputs from the sanitation system are given for solid and liquid discharges as well as odour, air, and noise emissions.

It contains criteria for the safety, functionality, usability, reliability, and maintainability of the system, as well as its compatibility with environmental protection goals.

This document does not encompass the following aspects:

— guidelines for selection, installation, operation and maintenance, and management of sanitation systems;

— transportation of treated output outside of the sanitation system (e.g. manual transport, transportation by truck or trunk pipes) for further processing, reuse, or disposal;

— treatment processes taking place at another location separate from that of the frontend and backend components;

— reuse and disposal of sanitation system output.

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.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

ISO 20816-1, *Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines*

ISO/IEC 17065:2012, *Conformity assessment — Requirements for bodies certifying products, processes and services*

IEC 60942:2017, *Electroacoustics — Sound calibrators*

IEC 61260-1:2014, *Electroacoustics — Octave-band and fractional-octave-band filters — Part 1: Specifications*

IEC 61672-1:2013, *Electroacoustics — Sound level meters — Part 1: Specifications*

EN 997:2012, *WC pans and WC suites with integral trap*

EN 13725:2003, *Air quality — Determination of odour concentration by dynamic olfactometry*

3 Terms, definitions and abbreviated terms

3.1 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:

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

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

3.1.1 System structure

3.1.1.1
non-sewered sanitation system
NSSS
system that is not connected to a networked sewer, and collects, conveys, and fully treats the specific *input* (3.1.2.1) to allow for safe reuse or disposal of the generated solid *output* (3.1.2.2) and/or *effluent* (3.1.2.7)

Note 1 to entry: For the purposes of this document, a NSSS that fully treats the specific input is a NSSS that meets the performance testing requirements specified in Clause 7.

3.1.1.2
evacuation mechanism
mechanism that delivers energy/movement to convey the *input* (3.1.2.1) from the *frontend* (3.1.1.3) to the *backend* (3.1.1.4) of the *non-sewered sanitation system* (3.1.1.1), such as conventional flushing mechanisms, pour flush, dry, and novel mechanisms

3.1.1.3
frontend
any user interface such as urinal, squatting or seat pan of a *non-sewered sanitation system* (3.1.1.1) employed for human defecation and urination, including the *evacuation mechanism* (3.1.1.2) and all system components that are clearly visible to the user

3.1.1.4
backend
combined set of system components encompassing the physical assets used to treat the *input* (3.1.2.1) entering the system via the *frontend* (3.1.1.3) in order to allow for the safe reuse or disposal of the generated *output* (3.1.2.2)

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

3.1.1.5
superstructure
additional structure added to or integrated with the *non-sewered sanitation system* (3.1.1.1) in order to provide shelter or privacy to users

3.1.2 System inputs and outputs

3.1.2.1
input
substances entering the *non-sewered sanitation system* (3.1.1.1) primarily comprising human *faeces* (3.1.2.4) and *urine* (3.1.2.3), menstrual blood, bile, flushing water, anal cleansing water, toilet paper, other bodily fluids/solids and, in some systems, additional input as defined by the manufacturer

EXAMPLE Examples of additional input may include water from hand washing, menstrual hygiene products, organic household waste.

3.1.2.2
output
substances exiting the *non-sewered sanitation system* (3.1.1.1), which include the products of the backend treatment process [solid output and *effluent* (3.1.2.7)] as well as noise, air, and odour emissions

Note 1 to entry: The output can be reusable product, a direct output to the environment, or a residual waste.

3.1.2.3
urine
liquid product of the human excretory system produced by the kidneys and expelled through the urethra via urination (i.e. micturition)

3.1.2.4
faeces
excreta products of the human digestive system, including microorganisms

3.1.2.5
excreta
waste products of human metabolism, in solid or liquid form, generally *urine* (3.1.2.3) and/or *faeces* (3.1.2.4)

[SOURCE: ISO 24521:2016, 3.3]

3.1.2.6
diarrhoea
loose, watery *faeces* (3.1.2.4), often resulting from viral, parasitic protozoan, bacterial, or helminth infection

3.1.2.7
effluent
treated liquid discharged from the *backend* (3.1.1.4)

3.1.2.8
chemical and biological additives
substances added to the *non-sewered sanitation system* (3.1.1.1) either to support the treatment process or to clean the system, including, but not limited to, chemical substances and/or biological agents

EXAMPLE Deodorants, bactericides, bacteriostats, microbiocides, chemical reactants, surfactants, or enzymatic agents.

3.1.2.9
energy supply
energy from electrical grid, photovoltaic, or other sources (e.g. mechanical storages, pressurized air reservoirs or windmills) that powers the *non-sewered sanitation system* (3.1.1.1)

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

3.1.2.10
electrical energy
energy derived from an electric current, which can be supplied by a variety of means such as connection to upstream electric power grid, batteries, or photovoltaic systems

3.1.3 System safety and integrity

3.1.3.1
hazard
source or situation with a potential for harm in terms of human injury or ill health (both short and long term), damage to property, environment, soil and vegetation, or a combination of these

[SOURCE: ISO 30000:2009, 3.4, modified — "soil and vegetation" has been added.]

3.1.3.2
risk
combination of the probability of occurrence of harm and the severity of that harm

[SOURCE: ISO 12100:2010, 3.12]

3.1.3.3
risk analysis
systematic use of available information to identify *hazards* (3.1.3.1) and to estimate the *risk* (3.1.3.2)

[SOURCE: ISO/IEC Guide 51:2014, 3.10]

3.1.3.4
risk evaluation
judgment, on the basis of *risk analysis* (3.1.3.3), of whether the risk reduction objectives have been achieved

[SOURCE: ISO 12100:2010, 3.16]

3.1.3.5
risk assessment
overall process comprising a *risk analysis* (3.1.3.3) and a *risk evaluation* (3.1.3.4)

[SOURCE: ISO 12100:2010, 3.17]

3.1.3.6
guard
physical barrier, designed as part of a *non-sewered sanitation system* (3.1.1.1) to provide protection

[SOURCE: ISO 12100:2010, 3.27, modified — The word "machine" has been replaced by "non-sewered sanitation system".]

3.1.3.7
safe state
operating mode of a *non-sewered sanitation system* (3.1.1.1) with an acceptable level of *risk* (3.1.3.2) for users and professional service personnel

Note 1 to entry: The safe state mode protects the user or service personnel by preventing potentially hazardous conditions (e.g. in the event of a malfunction or following intentional stoppage).

[SOURCE: ISO 25119-1:2010, 3.43, modified — The word "system" has been replaced by "non-sewered sanitation system", "for users and professional service personnel "and the note have been added.]

3.1.3.8
exposed material
material used within the *non-sewered sanitation system* (3.1.1.1) that comes into contact with human *urine* (3.1.2.3) or *faeces* (3.1.2.4), or intermediate products and residual waste in the course of operation of the system

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

3.1.3.9
water tightness
ability of the closed *non-sewered sanitation system* (3.1.1.1) to resist water penetration and prevent leakage

[SOURCE: ISO 15821:2007, 3.6, modified — The term "test specimen" has been replaced by "non-sewered sanitation system", "and prevent leakage" has been added.]

3.1.3.10
technical tightness
inherent characteristics of a *non-sewered sanitation system* (3.1.1.1) that prevents hazardous fluids, gases, or suspended particulate matter from passing from the external environment through to the processing/treatment internal environment, or from the processing/treatment internal environment to the external environment, or both

Note 1 to entry: The sanitation system or components thereof are considered technically tight if the leakage rate does not exceed 0,001 Pa·l/s.

Note 2 to entry: Subsystems, components, or boundaries that require technical tightness are to be identified in the safety assessment (see 5.1).

3.1.3.11
strength safety factor
ratio between the load or pressure limit at the material yield strength and the limit load (or pressure)

Note 1 to entry: The strength safety factor prevents structures from experiencing fractures, deformation, and fatigue.

3.1.3.12
proven
demonstrated through testing and validation, systematic analysis of operational experience, or other suitable qualification methods to be safe, effective, and reliable for the intended use

3.1.4 System use and impact

3.1.4.1
intended use
use of a *non-sewered sanitation system* (3.1.1.1) in accordance with the information for use provided in the instructions and the design limits of the manufacturer

3.1.4.2
reasonably foreseeable misuse
use of a *non-sewered sanitation system* (3.1.1.1) in a way not intended by the supplier, but which may result from readily predictable human behaviour

Note 1 to entry: Behaviours of interest include incorrect operation of the system such as overuse, inappropriate activation of mechanical and electrical controls, improper maintenance and depositing inappropriate materials into the frontend.

[SOURCE: ISO/IEC Guide 51:2014, modified — The term "product or system" has been replaced by "non-sewered sanitation system", Notes have been deleted and a new Note 1 to entry has been added.]

3.1.4.3
sustainability
state of the global system, including environmental, social, and economic aspects, in which the needs of the present are met without compromising the ability of future generations to meet their own needs

[SOURCE: ISO Guide 82:2014, 3.1]

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

3.2 Abbreviated terms

BL	Batch liquid
BS	Batch solid
CAPEX	Capital expenditure
CFU	Colony-forming units
COD	Chemical oxygen demand
EMC	Electromagnetic compatibility
EPA	US Environmental Protection Agency
GHG	Greenhouse gas
HACCP	Hazard analysis and critical control point
HAZOP	Hazard and operability study
IP	Ingress protection
LRV	Log reduction values
MOP	Maximum operating pressure
NIOSH	National Institute of Occupational Safety and Health
NPV	Net present value
OPEX	Operating expense
OSHA	Occupational Safety and Health Administration
PFU	Plaque-forming units
PL	Periodic liquid
PS	Periodic solid
PSLC	Product safety life cycle
SSF	Strength safety factors
TSS	Total suspended solids
UN	United Nations
UNICEF	United Nations Children's Emergency Fund
VOC	Volatile organic compound
WHO	World Health Organization

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4 General requirements

4.1 User requirements

The NSSS shall be designed in such a way as to ensure that the users can use the system safely and in the manner intended by the manufacturer. The design and implementation of the system shall ensure that users with little or no literacy or those who do not have technical expertise are able to safely and effectively use the system frontend and perform routine user maintenance as intended by the manufacturer.

NOTE Additional requirements for specific users, such as persons with disabilities and small children, are provided, for example, in Reference [26], Reference [33] and Reference [40].

4.2 Metric system

Design and construction of NSSS shall be specified in International System of Units of measurement.

4.3 Design capacity

4.3.1 Treatable input

NSSS shall be capable of treating, at a minimum, human faeces and urine, menstrual blood, bile, flushing water, anal cleansing water, toilet paper, and other bodily fluids/solids. Manufacturers may identify additional categories of input as acceptable for treatment, such as water from hand washing, menstrual hygiene products, and/or organic household waste.

4.3.2 Treatment capacity

The design capacity with regard to human faeces and urine shall be indicated as expected uses per day (faecal uses/day and urine uses/day). The average amount of faeces (kg/use) and urine (l/use) per use shall be determined as the basis for capacity calculations and shall be clearly indicated. Additionally, the expected daily capacity for further input (such as water, menstrual hygiene products and organic waste) shall be indicated by the manufacturer (in units such as kg/day or l/day).

EXAMPLE Reference [75] measured the average faecal production rate as 250 g/person/day to 350 g/person/day for low income countries, 250 g/person/day for urban low-income settings and 350 g/person/day for rural low-income settings, and found general urine production rates for adults to be 1,0 l/person/day to 1,3 l/person/day.

4.3.3 Menstrual hygiene products

If the system is intended to accept menstrual hygiene products separately from other system inputs, then the provisions and instructions for the safe operation and maintenance of the disposal mechanism or device shall be provided. Cultural norms, existing practices and aspirations regarding the disposal of menstrual hygiene products shall be considered (see D.4 and E.4).

4.3.4 Overload protection

A reasonable safety factor shall be incorporated into the design and indicated by the manufacturer in order to prevent overload. In order to indicate when the system is nearing maximum capacity (design capacity plus safety factor) the system shall be equipped with a visual and/or audible mechanism indicating to the user that the system is overloaded and therefore not usable. Should overload occur, the system shall enter into a safe state that prevents any hazards due to overload (see A.3.8.6).

4.3.5 Operability following non-usage

The system shall remain operable after a period of system non-usage of 60 h without causing malfunctions or requiring additional efforts to resume operation that exceed normal operating procedures.

© ISO 2018 – All rights reserved

AVA Documents Document Sharing Hub
Full document details: BS ISO 30500:2018

Non-usage is when there is no intentional shut down of the system by the user. In addition, the system is not used nor has any human interaction for a period of 60 h.

4.3.6 Operability following short-term shut down

Following restart after a short-term shut down (i.e. 60 h or less) specified by the manufacturer, the system shall be able to immediately accept input and return to normal operating state.

4.3.7 Operability following long-term shut down

The sanitation system manufacturer shall provide precise instructions for preparing the system for long-term shut down (i.e. more than 60 h). The instructions shall describe the procedures for achieving safe and stable system shut down conditions.

The manufacturer shall clearly indicate the duration of time necessary to complete the long-term shut down process. The long-term shut down process should not require more than 10 h for completion. Required user interaction during shut down should be minimized.

Following restart after long-term shut down, the sanitation system shall be able to immediately accept input and be capable to return to normal operating state within the time specified by the manufacturer.

4.3.8 Continuous use

The sanitation system shall allow continuous use without unreasonable waiting times between uses. The manufacturer shall specify the minimum wait time between uses in the user manual or as part of the equipment label or data plate.

4.3.9 Safe state

Means of indication (visual or audible) or instruction to determine if the system is in a safe state (see 3.1.3.7) shall be provided by the manufacturer.

4.4 Performance requirements

4.4.1 General

The sanitation system shall be such that when operated, maintained and used, the requirements in 4.4.2 to 4.4.5 are met under all operating conditions (see 4.8).

4.4.2 Solid output and effluent requirements

Solid output and effluent shall be fully treated within the sanitation system allowing for safe reuse or disposal. Solid output and effluent shall meet the requirements specified in 7.2.9.3 and 7.2.9.4 at all times including the start-up period when tested in accordance with A.3.4.

4.4.3 Odour emissions requirements

In order to minimize odour emissions from the sanitation system, the requirements in 7.2.9.5 shall be met when tested in accordance with A.3.5.

NOTE Potential origins of odour emissions from the sanitation system include faecal odours (faeces and urine, and aging of faeces and urine), and process odours such as those emerging during drying, pyrolysis, combustion, and discharge of output.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4.4.4 Noise requirements

Noise emissions from the NSSS shall not pose risks to the health and psychological wellbeing of the user. When tested in accordance with A.3.7, the sanitation system shall meet the requirements specified in 7.2.9.6.

4.4.5 Air emissions requirements

Potential air emissions from NSSS may be classified as pollutants or explosive gases. The monitoring of explosive gases during operation is addressed in 4.12.2. Air pollutants from the NSSS released indoors and outdoors shall not exceed a level that poses risks to the health of the user. When tested in accordance with A.3.6, the sanitation system shall meet the requirements specified in 7.2.9.7.

The design of the NSSS (frontend and backend) shall be such that emissions of bioaerosols and endotoxins are minimized. For NSSS with a backend that discharges directly in the indoor environment, and where bioaerosol and/or endotoxins can reasonably be expected, testing for pathogenic bioaerosols and for endotoxins is recommended.

At the time of publication of this document, no performance requirements are specified for bioaerosols or endotoxins. This may change in the future e.g. as occupational health standards are established for these hazards.

4.5 Expected design lifetime

NSSS shall be designed for a serviceable life of a minimum of 10 years, at the loading rates or frequency stipulated by the manufacturer, assuming use and maintenance according to the manufacturer's specifications. Maintenance requirements are specified in 4.14 and user manual requirements are specified in Annex C.

4.6 Aspirational and ergonomic design

NSSS should be designed not only for functionality but also for comfort. NSSS should also be designed for aesthetic satisfaction and sensory appeal. Designers should strive to evoke cleanliness in the appearance and user experience of the frontend (see E.2).

4.7 Secure design

In order to prevent theft or tampering, critical accessible components of the NSSS shall be assembled or affixed in such a way as to deter removal or dismantling by unauthorized parties.

NOTE Design requiring the use of tools for removal or dismantling of any components can help to deter theft.

4.8 Operating conditions

4.8.1 Ambient temperature range

NSSS shall operate safely and reliably in environments with ambient temperatures at a minimum range from 5 °C to 50 °C, which shall be understood as the requisite primary range for all systems complying with this document. Technologies designed for use in environments with ambient temperatures outside this range shall additionally demonstrate their capability to operate safely and reliably in these expanded ambient temperature ranges.

4.8.2 Ambient air humidity

NSSS shall operate safely and reliably in ambient air humidity conditions at a minimum range from 20 % to 100 %. Technologies designed for use in environments with ambient air humidity below 20 % shall additionally demonstrate their capability to operate safely and reliably in these expanded ambient air humidity ranges.

AVA Documents
Document Sharing Hub

© ISO 2018 – All rights reserved

Full document details: BS ISO 30500:2018

4.8.3 Atmospheric pressure

NSSS shall operate safely and reliably under atmospheric pressure conditions at a minimum range from sea level (101 kPa) to 2 500 m altitude (76 kPa). Technologies designed for use in environments with atmospheric pressure outside this range shall additionally demonstrate their capability to operate safely and reliably in these expanded atmospheric pressure ranges.

4.9 Requirements for sanitation system components

4.9.1 General

Critical materials, equipment, components, connections, and joining elements of the NSSS that are indispensable to the proper operation of the system shall be selected based on their suitability for sanitation applications.

Documentation of the performance adequacy shall be provided for any essential materials, equipment, components, connections, or joining elements that are not explicitly designed, commonly used or approved for use in sanitation systems. Performance adequacy can be demonstrated through risk assessments or other commonly accepted methods (e.g. failure mode and effects analysis, material testing, material safety data sheets).

When testing is conducted as part of the product certification process, the laboratory performing material testing shall meet the requirements in A.1.

4.9.2 Hygienic design

NSSS shall be designed in such a way as to mitigate any risk of infection due to potential pathogens from human urine or faeces or the intermediate and residual products of the sanitation system.

NSSS shall minimize the entry of insects and vermin to the subsystems.

4.9.3 Tightness

All installations that contain, transport, or store liquids shall achieve water tightness, at a minimum. In cases where the results of a safety assessment (see 5.1) indicate hazards that require mitigation through a higher degree of system tightness (e.g. potentially dangerous gases), technical tightness shall be achieved.

NOTE Resistance to the effects of flooding, such as inundation and the lateral force of floodwater, is an additional consideration for NSSS in flood-prone areas.

Related testing procedures are provided in A.3.1.

4.9.4 Cleanability of surfaces

Visibly exposed materials and related joining elements, reservoirs and piping shall be smooth and easily cleanable. Thus, surfaces shall be:

a) clear of pits and occlusions and have neither ridges nor crevices where organic materials could accumulate;

b) designed in such a way as to minimize projections, edges, and recesses.

Visibly exposed materials shall be designed in such a way as to ensure that faeces and residual substances can be removed by domestic household cleaning methods and without requiring the use of specialized chemical cleaning agents. Overall cleanability should have a minimum value equivalent to that of a No. 3 100 to 120 grit finish on stainless steel.

NOTE No. 3 100 to 120 grit steel is stainless steel featuring short, relatively coarse, parallel polishing lines, which extend uniformly along the length of the coil, achieved with 100 to 120 grit abrasives.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4.9.5 Chemical and biological additives

NSSS should minimize the use of chemical and/or biological additives. Systems that do require such additives shall not necessitate their use in a manner or to a degree that exceeds acceptable health or environmental risks. The manufacturer of the sanitation system shall provide documentation concerning risks and instructions on proper use, handling and storage of any additives necessary for system function (e.g. safety data sheets from the manufacturer of the relevant additives) (see Annex C).

4.10 Material requirements

4.10.1 Durability of materials

Materials used for NSSS shall be structurally stable, durable, and, where relevant, water tight, and shall be resistant to the effects of local conditions for the intended use (see 3.1.4.1) and reasonably foreseeable misuse (see 3.1.4.2).

Durability shall be achieved either through the use of materials inherently resistant to corrosion or through the application of a suitable coating. Where possible, anti-corrosion protection shall be integrated into the system manufacturing process.

If two or more different materials are connected within the sanitation system, detrimental galvanic corrosion shall be prevented. If components that bear mechanical loads are made of plastic material, detrimental effects of the environment (e.g. UV radiation, temperature) on such components shall be prevented (see E.3.3.3).

4.10.2 Fire resistance of materials

NSSS shall be resistant to fire. Materials shall not ignite, progressively glow, smoulder, or show evidence of being functionally impaired when exposed to a source of ignition. Materials should conform to ISO 10295 (all parts) or equivalent.

4.11 Connections and joining elements

Connections (e.g. welds, joints) within NSSS shall be durable and capable of withstanding stresses and wear during shipping, assembly, installation, operation, and maintenance. Connections shall resist corrosion. Joining elements applied (e.g. nuts, bolts, washers, screws) that are in contact with sanitation environments such as those involving wastewater or sludge shall be corrosion resistant (e.g. stainless steel of class A2 or A4; for more information see ISO 3506-1, ISO 3506-2 and ISO 3506-3).

Applied connection methods shall conform to proven state-of-the-art approaches. Connections identified as essential to safe operation or process reliability via the safety assessment (see 5.1) shall not require regular maintenance activity. Location, type, and specification of such connections shall be clearly indicated by the manufacturer in schematic diagrams provided with the system.

Reasonably foreseeable errors in applying connections and joining elements that could be a source of risk shall be prevented, primarily by the selection and combination of these elements, as well as their design and realization. The direction of movement or conveyance of moving parts and transition components of the sanitation system shall be clearly indicated by the manufacturer in schematic diagrams. Where a faulty connection (e.g. electric wiring or pipework) could pose a risk, incorrect connections shall be made impossible by design (e.g. by means of mechanical coding).

4.12 General safety design requirements

4.12.1 Safety of edges, angles, and surfaces

Surfaces and parts of NSSS with which users or service personnel can come into contact shall be free from rough or sharp edges or unnecessarily sharp points.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4.12.2 Fire and explosion protection

NSSS shall be designed in such a way as to avoid any risk of fire or overheating caused by operation or malfunctions of the NSSS itself, or by gases, liquids, dust, vapours, or other substances generated or used in the process of the system's operation.

NSSS shall be designed in such a way as to avoid any risk of explosion caused by explosive atmospheres or substances generated by the backend treatment technologies and processes including gases, liquids, dust, vapours, or other substances produced. Hazardous accumulations of potentially explosive gases, liquids, dust, vapours or other substances shall be monitored reliably, and appropriate mitigation measures shall be taken by the manufacturer, accounting for, at a minimum, the lower explosive limit and the evaluation of the potential sources of ignition. This protection can be realized either through appropriate design of the sanitation system that makes safety inherent, or through incorporation of safety-related installations and equipment that control any risk of explosion.

In systems in which combustion/incineration processes are applied, relevant fire and explosion hazards shall be controlled through safety-related functions with proven reliability (see 5.6.3).

NOTE Potential sources of hazards include slagging, blockage of the exhaust, and inferior quality of the fuel material.

4.12.3 Structural integrity

Materials, equipment, components, connections and joining elements within the sanitation system shall be capable of withstanding both static and dynamic stresses of expected operation.

Where a risk of rupture or disintegration remains despite countermeasures, the parts concerned shall be mounted, positioned, and/or guarded in such a way as to contain any hazards. Installations and pipes, whether rigid or flexible, that carry fluids and/or gases shall be capable of withstanding the defined internal and external stresses, and shall be firmly attached and/or protected to ensure that no risk is posed by a rupture.

Strength safety factors (SSF) shall be proven to achieve the following levels (see ISO 14622 for further information):

— for hazards that can cause injuries and fatalities, SSF ≥ 3;

— for hazards that halt backend operations, SSF ≥ 2;

— for hazards that cause inconvenience, SSF ≥ 1,5.

4.12.4 Prevention of contact with unsafe effluent and reuse

Sanitation systems that do not meet effluent requirements for flushing or handwashing (see 7.2.9.4) shall prevent this type of internal (or within the system) reuse in the design of the system through reasonably practicable means.

Sanitation systems that are designed for intentional effluent reuse (rather than safe discharge to the environment) shall meet the necessary requirements for the type of reuse (e.g. irrigation, flushing, handwashing) (see 7.2.9.4).

4.12.5 Underground systems

Components of NSSS that are designed to be positioned below ground level (e.g. for protection against extreme low temperatures)

— shall be capable of withstanding exposure to geotechnical impacts such as earth and hydrostatic pressures throughout the course of operation without loss of structural integrity; and

— should allow for easy monitoring to prevent leakages and groundwater and/or soil pollution.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4.12.6 External impacts

NSSS and their components and fittings shall be stable enough to prevent tilting, overturning, falling, or uncontrolled movements. If the shape or structure of the system does not offer both sufficient tilting stability and sufficient stability under mechanical load, then appropriate means of anchorage shall be incorporated in the manufactured product and their use shall be specified in the user manual (see 4.14.5). The system shall reliably resist reasonably expected external mechanical impacts incurred during transport, installation, normal operation, and maintenance.

4.13 Information and marking

4.13.1 Information and warnings

Information and warnings on NSSS shall be provided through clear and unambiguous symbols or pictograms to ensure the user's comprehension (see E.3.2). In addition, information and warnings on NSSS shall also take into account user requirements (see 4.1).

A data plate or label visible to the user in the vicinity of the frontend and near to the failure signal shall include, at a minimum:

a) expected number of users and uses per day (users/day and uses/day) (see 4.3.2) and manufacturer defined wait time between uses (see 4.3.8);

b) expected daily capacity for additional input such as water, menstrual hygiene products, and organic waste (kg/day or l/day); (see 4.3.2);

c) common items that shall not be added to the system;

d) instructions for obtaining service and contact information;

e) minimum and maximum operating temperature.

When a backend is supplied without a frontend, a data plate or label, consisting of the information listed in a) through to e), shall be provided by the manufacturer such that it can be placed securely in the vicinity of the frontend by the site owner or operator.

If the effluent of the system does not meet drinking water requirements (see 7.2.9.4), a data plate or label shall be placed in a location visible to the user in the vicinity of the backend, warning the user that the effluent is not drinkable.

Additionally, if the system is designed to produce treated output suitable for reuse, the manufacturer shall:

— specify the intended purpose/application of solid output, effluent and/or off-gas;

— provide information on the quality of the reusable output (e.g. nutrient content).

This information shall be in the form of a data plate or label placed in a location visible to the user in the vicinity of the backend.

Plates and labels shall be permanent and clearly legible.

Written information and warnings shall be composed at the reading level of the users and shall incorporate all information specified in Annex C. Information shall be provided in the official language(s) of the country of use. Warnings shall clearly indicate the extent of the safety risk.

4.13.2 Marking and labelling

NSSS shall have permanent and legible data plates. The information shall be provided in the official language(s) of the country of use.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

Data plates shall include, at a minimum:

a) manufacturer's name and address;

b) model number;

c) serial number;

d) date of manufacture;

e) total unit mass when operational;

f) parameters of primary electric circuits, including voltage and amperage.

4.14 Maintenance

4.14.1 Reasonable configuration, adjustment, and maintenance activities

NSSS shall be designed in such a way that frequency and complexity of configuration, adjustment, and maintenance activities to be performed by the user and the professional service personnel are reasonable with respect to the expectations, technology, and level of professional training present in the setting of users.

See D.3 to determine the suitability of a sanitation system for a given location and users regarding frequency and complexity of configuration, adjustment, and maintenance activities.

4.14.2 Location and access of configuration, adjustment, and maintenance points

To prevent contamination and minimize the risk of infection, configuration, adjustment, and maintenance points should be located separate from any hazardous areas. Removal of system blockages, when necessary, should be processed from the outside of the sanitation system and should not necessitate any disassembly.

NSSS shall be designed in such a way as to ensure that components requiring service can be accessed and if sanitation system access is required, re-configuration can be performed safely. Configuration, adjustment, and maintenance should not unnecessarily involve contact with input materials, intermediate process products, or residual products.

4.14.3 Discharge and cleaning

Cleaning and regular maintenance activities conducted by the user shall not require discharge of partially treated materials. Discharge of partially treated materials may be necessary for maintenance activities conducted through service personnel. If maintenance activities require discharging partially treated materials, either solid, liquid, or gas, these partially treated materials need not meet the requirements for outputs to the environment specified in this document. The service personnel shall be responsible for appropriate disposal of the partially treated material. Discharge of partially treated material for maintenance shall not be a substitute for treatment by the system.

It is understood that the volume of in-process or partially treated material remaining after shut down for a service interval will vary due to the prior loading conditions, treatment approach (batch, continuous, other) and timing of shut down procedure. It is intended to ensure that systems deliver full on-site treatment (as far as practicable) and as such the partially treated materials needing to be disposed of should be minimized.

The manufacturer should provide clear instructions to service personnel to deposit discharged partially treated material in a way that minimizes risk for health, safety and environment.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

4.14.4 Tools and devices

If specialized tools are required for emptying and maintaining the NSSS, then these specialized tools shall be described in the user manual (see 4.14.5) and supplied with the system.

4.14.5 User manual

A user manual with clear and definitive instructions to users and service personnel for configuration, adjustment, and maintenance of the NSSS shall be provided. At a minimum, the user manual shall clearly define all necessary procedures, activities, and schedules for configuration, adjustment, and maintenance that are essential to keeping the system safe and operational. Detailed requirements for user manuals are specified in Annex C.

4.14.6 Handling and transport of the sanitation system

NSSS, including primarily mobile systems, shall be capable of safely withstanding handling and transport to another location and, if required, withstanding storage safely and without incurring damage. The manufacturer shall clearly indicate which ambient conditions the sanitation system can withstand during handling and properly secured transport if the values differ from those specified in 4.8.1.

When transported, systems shall not produce sudden movements or unintended discharge of tanks, pipes, or any instability-related hazards. If required, appropriate attachments for lifting gears or fixation points shall be provided to ensure the safe transport of the system.

5 Technical requirements

5.1 Safety assessment

The manufacturer of a NSSS shall carry out either an iterative risk assessment or an equally effective assessment capable of demonstrating proven safety of sanitation systems. The safety assessment shall:

a) determine the particular health and safety requirements that apply to the product;

b) determine risk-mitigating measures to be taken;

c) demonstrate the safety of the product by documenting the results of the safety assessment.

This assessment should be carried out during the design process; however, the assessment may be carried out after the design process. The assessment shall cover the relevant life cycle of the sanitation system, giving consideration to its expected use and reasonably foreseeable misuse.

Additional requirements for risk assessments are specified in Annex B.

A product safety life cycle (PSLC) should be implemented as part of a risk management process that considers all relevant progressions within the general product development process (e.g. research and development, procurement and production, quality assurance, quality management). If a PSLC is conducted, the requirements specified in B.3 apply.

5.2 Operational requirements

5.2.1 General

The sanitation system shall meet basic functionality requirements such as starting of sanitation system operation, stopping of sanitation operation, and activating an emergency stop.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

5.2.2 Intentional starting of sanitation system operation

Starting and restarting of the system through voluntary actuation, including restarting after a stoppage, shall either be enabled through a single dedicated control device or, in systems in which the backend treatment processes prevent the use of a single dedicated device, shall be enabled through a logical sequence of control actions that is clearly indicated by the manufacturer.

If the starting of the sanitation system operation requires mechanical force to be applied by users, this force shall be no greater than 25 N.

5.2.3 Intentional stopping of sanitation system operation

The NSSS shall be equipped with a control device or clearly indicated sequence of control actions that brings relevant processes and operations safely to a complete stop and safe state. If a safe state cannot be immediately achieved upon activation of the control device/sequence and requires a transition period following initiation of the stop control(s), the duration of this transition period shall be clearly indicated by the manufacturer. The safety of the system during this transition period shall be ensured by a safety-related function (see 5.6.3). The stop control shall retain priority over the start and operational controls.

5.2.4 Emergency stop

If relevant and applicable, the NSSS shall be equipped with one or more emergency stop devices that safely halt all mechanical and electrical processes as well as operations and cut off energy supply. Manufacturers of NSSS should refer to ISO 13850 for additional guidance concerning emergency stop functions.

5.3 Reliability and safety requirements for energy supply

5.3.1 Security of energy supply

Failure of the primary energy supply (e.g. through deficiency, absence, or failures in energy return) shall not trigger hazardous system conditions. This hazard prevention may be realized through automatic system transition to a safe state or through the provision of an appropriate backup source of energy. The minimum capacity of the redundant source of energy should be sufficient to allow the safe preparation of the system for a long-term shut down (see 4.3.7). The amount of energy supplied by the redundant source shall be indicated to the user.

5.3.2 Safety requirements for electrical energy supply

5.3.2.1 Separation and isolation

The energy supply shall be separable and isolatable from the sanitation system through state-of-the-art safety devices such as circuit power switches, fuses, or other proven interlock devices. Isolators shall be made clearly noticeable by marking and arrangement and shall be capable of being locked if reconnection could endanger humans (e.g. during configuration, adjustment, and maintenance).

If the NSSS is plugged into an electrical outlet, removal of the plug may be sufficient to satisfy these requirements for separation and isolation of the energy source, provided that the operator can verify from any of the points to which he or she has access that the plug remains removed.

5.3.2.2 Energy discharge

The NSSS shall be equipped with a means of discharging any energy remaining or stored in the system following isolation from the energy supply (see 5.3.2.1) in order to achieve a safe state and prevent hazards.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

Subsystems of the sanitation system that supply or store energy need not be discharged if these subsystems can be separated from the system (e.g. through separation switches) in such a way as to ensure that the safe state of the system is not affected and hazards do not emerge from the subsystem.

5.3.3 Safety requirements for non-electrical primary energy supply

NSSS deriving energy from sources other than electrical energy shall be designed, realized, and equipped in such a way as to ensure that hazards associated with the energy supply are prevented. If applicable, the requirements given in 5.3.2 shall be met for systems deriving their primary energy supply from non-electrical sources.

5.4 Mechanical requirements

5.4.1 Pressurized or vacuum equipment

Pressurized equipment with a nominal operation gauge pressure higher than 50 kPa or vacuum equipment with a nominal operation gauge pressure lower than 50 kPa vacuum shall be designed so as to withstand the mechanical loading pressure to which the equipment is subjected, including appropriate structural strength safety factors.

Overpressures shall be controlled by appropriate and proven safety relief valves.

5.4.2 Pipes, hoses and tanks

Pipes and hoses shall be positioned and restrained to minimize deterioration resulting from contact with other elements of the system (e.g. hot surfaces, sharp edges). Pipes, hoses, and fittings shall be safely accessible for visual inspection.

Tanks and other storage vessels shall be capable of withstanding the stresses of prolonged containment of the relevant substances without breakage or other structural damage or deformation.

Storage vessels shall be provided with means of determining their fluid levels (e.g. fluid level indicators). Excessive pressure in storage vessels exceeding MOP shall be automatically compensated via a suitable device (e.g. vent, safety valve).

5.4.3 Moving and rotating parts

Risks associated with moving and rotating parts of the sanitation system shall be minimized either through design that prevents human contact with such parts or through the application of appropriate guards or protective devices.

NSSS shall be designed so as to prevent accidental blockage of moving parts.

5.4.4 Backflow prevention

If the sanitation system is connected to the water supply system, then backflow shall be prevented. The test method should be in accordance with ASME A112.1.2 or an equivalent national or international standard.

5.5 Requirements for radiation

5.5.1 High temperatures of parts and surfaces

Accessible parts or surfaces of the sanitation system that exceed the temperature of 60 °C shall be equipped with protection measures or fixed guards sufficient to prevent burn injuries.

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

5.5.2 Low temperatures of parts and surfaces

Accessible parts or surfaces of the sanitation system that fall below the temperature of −20 °C shall be equipped with protection measures or fixed guards sufficient to prevent injuries due to low temperatures.

5.5.3 Other radiation emissions

Undesirable radiation emissions from the sanitation system shall be suitable to meet safe levels.

5.6 Electrical and electronic equipment

5.6.1 Safety and reliability of electrical and electronic equipment

Electrical equipment such as pumps, drives, fans, or control systems shall be durable, require minimal maintenance, be adequately protected from any aggressive environment, and be capable of being easily serviced. These safety requirements shall be achieved by appropriate safety devices such as circuit breakers and fuses. Requirements of applicable equipment standards (such as applicable parts of IEC 60335) should be met.

Safety requirements shall include at a minimum:

a) adequate insulation and protection against hazards of direct and indirect live parts, and appropriate protection measures against short circuits and arcs;

b) electrical protection appropriate to the operating conditions, at a minimum complying with IP44 where required (further information on electric protection classes can be found in IEC 61140);

c) compliance with the requirements of electromagnetic compatibility (EMC), i.e. sanitation system operation shall not be disturbed by any external source of a relevant electromagnetic field, nor shall the electromagnetic field of the sanitation system disturb the operation of external electrical equipment (further information on EMC and suitable thresholds can be found in IEC 61000-6-1 and IEC 61000-6-3).

5.6.2 Control system

The NSSS should incorporate a control system that serves to acquire and process data and information regarding the safe, reliable, and efficient operation of the system. Information on relevant safety requirements can be found in ISO 13849-1.

Necessary control actions and required measurements shall be specified at an early design stage and shall reflect operation and installation conditions and the results of the assessment described in 5.1.

If a control system is incorporated, it shall ensure that:

a) devices of conveyance and treatment processing shall not start unexpectedly if by doing so they would pose a hazard to the user or professional service personnel; further, their start-up shall be indicated on the control display;

b) automatic or manual stopping of the controlled moving parts of sanitation system shall be unimpeded;

c) protective devices identified as necessary from the safety assessment (see 5.1) shall remain fully effective or issue a stop command;

d) the signalling system shall indicate status and include failure modes to inform the user of system availability or operational failure (e.g. electrical, mechanical, or hydraulic failure) of the system; the manufacturer shall indicate the type of failure corresponding to each alarm.

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

If a control system exists, it shall be capable of detecting, at a minimum:

— failure of electrical and mechanical components critical to the treatment processes, and shall deliver a visible and audible failure signal to the user;

— the overall availability for use, and shall deliver a visible and audible signal to notify the user of system unavailability.

Further control points should be defined based on HACCP, HAZOP or a comparable proven method. Control systems shall be designed in such a way as to ensure functional robustness with respect to external impacts, component failure (hardware and software), and human-machine interface. Failure shall reliably bring the system into safe state mode.

5.6.3 Safety-related function of the control system

If the safety assessment (see 5.1) reveals the need for additional safety-related functions within the control system, then these control functions should be developed, designed, verified, and validated in consideration of the principles contained in ISO 13849-1 and ISO 13849-2.

The safety-related functions shall be designed in such a way as to meet the safety integrity requirements and effectively mitigate the risks identified in the safety assessment (see 5.1).

NOTE Safety integrity requirements relate to architecture, diagnostic capacity, and reliability of the safety-related function.

5.7 Reliability of conveyance devices

The mechanical and hydraulic design of conveyance devices (e.g. internal pipework, connections and screws) shall prevent back flows, blockage, and surcharging during normal operation. Conveyance devices shall be designed so that transport capacity and performance meet the requirements of 4.3.2.

5.8 Transitions from the backend

Process transitions produced by the backend shall not provoke sensations of discomfort for the user nor result in hazards to the system's integrity.

NOTE Typical transition phenomena include vibration, shock, cold, or heat.

When tested in accordance with ISO 20816-1, the vibration level in the XYZ-axis at any possible area of the frontend user interface of NSSS shall not exceed 0,5 m/s^2.

6 Additional requirements for the frontend

6.1 General

Requirements specific to the frontend apply to NSSS in which frontend components are included as part of the manufactured product.

6.2 Use and operation

6.2.1 General usability requirements

The design of the frontend shall meet ergonomic requirements of the users. Anthropometric data of the users should be used for the design of all areas and parts accessed by the users, in accordance with ISO 7250 (all parts).

© ISO 2018 – All rights reserved

Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018

The sanitation system shall be easy to use. The frontend shall meet the usability needs of the users. Designers shall ensure that:

a) the users regard the system controls as intuitive;

b) the actions required to control operations follow a logical sequence;

c) complexity is minimized with respect to control panel signals.

The system shall achieve the following usability conditions:

— self-descriptiveness and intuitive design (look-and-feel);

— controllability;

— conformity with user expectations;

— user or maintenance error tolerance.

The manual control elements (e.g. hand levers, pedals, switches) and indicators shall be chosen, designed, realized, and arranged, so that:

— they are easy to access and locate according to user expectations;

— neutral positions of the manual control elements are automatically reset after triggering;

— the movement of the manual control elements to activate the flush functions correspond to the intended effect or to common practice, whenever possible;

— the activation forces are comfortable for the users.

6.2.2 Requirements for ease of cleaning

The frontend and connected installations that are accessible to the user (e.g. pipes and chutes) shall be designed in such a way as to ensure that the degree of cleaning necessary after use is no greater than that of conventional flushing toilets.

Frontend surfaces shall have curves with a radius sufficient to allow thorough cleaning with common cleaning methods and without requiring the use of specialized chemical cleaning agents. If specialized cleaning tools are required, they shall be addressed in the user manual (see 4.14.5) and supplied with the system.

6.2.3 Requirements for ease of operation

The design and realization of the NSSS shall minimize demands on the user with respect to the performance of periodically recurring operational activities (e.g. usage of rake, adding of bacteria) needed to keep the sanitation system safe and operational. These operational activities shall meet usability requirements defined in 6.2.1. If relevant, clear instructions for performing operational activities shall be addressed in the user manual, (see 4.14.5 and Annex C).

6.2.4 Cultural requirements

The design of the frontend shall anticipate and reflect cultural preferences and common practices. The design of the frontend should aim to accommodate preferences and practices prevalent in the cultural setting for which the sanitation system is designed, including:

a) mode of operation (water use, dry);

b) seating/squatting position;

c) personal cleansing material (washers/wipers).

© ISO 2018 – All rights reserved
Documents
Document Sharing Hub
Full document details: BS ISO 30500:2018