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Ships and marine technology — Drainage systems on ships and marine structures —

Part 1: Sanitary drainage-system design

Navires et technologie maritime — Installations de drainage sur navires et structures maritimes —

Partie 1: Conception des systèmes d'écoulement sanitaires

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 15749-1 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

ISO 15749 consists of the following parts, under the general title *Ships and marine technology — Drainage systems on ships and marine structures*:

— *Part 1: Sanitary drainage-system design*

— *Part 2: Sanitary drainage, drain piping for gravity systems*

— *Part 3: Sanitary drainage, drain piping for vacuum systems*

— *Part 4: Sanitary drainage, sewage disposal pipes*

— *Part 5: Drainage of decks, cargo spaces and swimming pools*

Ships and marine technology — Drainage systems on ships and marine structures —

Part 1: Sanitary drainage-system design

1 Scope

This part of ISO 15749 is valid, in conjunction with ISO 15749-2 to ISO 15749-4, for planning and designing drainage systems which evacuate wastewater from accommodation and commissary areas (sanitary drainage) on ships and marine structures.

Drainage of weather decks, cargo holds and swimming pools is covered by ISO 15749-5.

This series of standards takes into consideration the basic regulations and minimum requirements concerning hygienic requirements and the protection of the marine environment.

This part of ISO 15749 does not apply to pipe systems carrying oily, chemically contaminated wastewater capable of forming flammable gas/oxygen mixtures.

2 Normative references

The following referenced documents are indispensable for the application 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.

IMO Publication MARPOL, *Protocol of 1978 relating to the international convention for the prevention of pollution from ships 1973, Annex IV/Regulations for the prevention of pollution by sewage from ships* [1)]

IMO Publication MEPC.2 (VI), *Recommendation on international effluent standards and guidelines for performance tests for sewage treatment plants, January 1977* [1)]

IMO Publication MSC/Circ. 648, *Annex Guidelines for the operation, inspection and maintenance of ship sewage systems* [1)]

IMO Resolution A.753 (18), *Guidelines for the application of plastic pipes on ships*

ISO/R 538, *Conventional signs to be used in the schemes for the installations of pipeline systems in ships*

ISO 727-1, *Fittings made from unplasticized poly(vinyl chloride) (PVC-U), chlorinated poly(vinyl chloride) (PVC-C) or acrylonitrile/butadiene/styrene (ABS) with plain sockets for pipes under pressure — Part 1: Metric series*

ISO 1461, *Hot dip galvanized coatings on fabricated iron and steel articles — Specifications and test methods*

1) Published by International Maritime Organization, London.
Available from IMO Secretariat, Publications Section, 101-104 Picadilly, London W1V, United Kingdom.

ISO 1964, *Shipbuilding — Indication of details on the general arrangement plans on ships*

ISO 4067-1, *Technical drawings — Installations — Part 1: Graphical symbols for plumbing, heating, ventilation and ducting*

ISO 4067-2, *Building and civil engineering drawings — Installations — Part 2: Simplified representation of sanitary appliances*

ISO 10628, *Flow diagrams for process plants — General rules*

ISO 14617-3, *Graphical symbols for diagrams — Part 3: Connections and related devices*

ISO 15749-2, *Ships and marine technology — Drainage systems on ships and marine structures — Part 2: Sanitary drainage, drain piping for gravity systems*

ISO 15749-3, *Ships and marine technology — Drainage systems on ships and marine structures — Part 3: Sanitary drainage,drain piping for vacuum systems*

ISO 15749-4, *Ships and marine technology — Drainage systems on ships and marine structures — Part 4: Sanitary drainage, sewage disposal pipes*

ISO 15749-5, *Ships and marine technology — Drainage systems on ships and marine structures — Part 5: Drainage of decks, cargo spaces and swimming pools*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
wastewater
off-running water which has undergone change due to use, as for instance sewage (contaminated water), water from precipitation, seawater and condensation water that has reached the drain lines.

NOTE 1 With this type of wastewater, a distinction is made between grey water and sewage.

NOTE 2 For the classification of wastewater in accordance with origin, see Table 1 in Clause 4.

3.2
grey water
wastewater to be disposed of, excluding sewage

3.3
sewage
wastewater from water closets, urinals and bidets, including additives; medical areas (pharmacy, hospital, etc.) and from washing basins in those areas, bath tubs and water discharges; spaces housing living animals and other types of wastewater, if mixed with contaminated water already mentioned.

NOTE The definition of 'sewage' is in accordance with the definition of Annex IV of MARPOL 73/78.

3.4
pipes in sanitary drainage systems

3.4.1
drain line
general term for all pipes carrying wastewater (gravity or vacuum system) of the sanitary drainage system leading from the drain to the collector tank or sewage treatment plant

3.4.1.1
connecting line
⟨gravity system⟩ a short pipe directly linking the drain of the drained unit and the odour seal

3.4.1.2
connecting line
⟨vacuum system⟩ a short pipe directly linking the drain of the drained unit and the vacuum control valve

3.4.1.3
branch line

3.4.1.3.1
single branch
⟨gravity system⟩ part of the drain line which connects the odour seal and a line continuing, for instance, to a collecting branch

3.4.1.3.2
single branch
⟨vacuum system⟩ part of the drain line which connects either a sewage unit with an integrated vacuum mechanism or a vacuum control valve to a line continuing, for instance, to a collecting branch

3.4.1.3.3
collecting branch
line collecting the wastewater of several single branches and carrying them to a line continuing, for instance, to a gravity delivery line or a manifold

3.4.1.3.4
riser branch
a single or collective branch leading vertically upwards

NOTE Only in vacuum plants.

3.4.1.4
gravity delivery line
a vertical line with warpage, if necessary, passing through one or more decks, feeding the wastewater to a manifold

NOTE Only in gravity systems.

3.4.1.5
manifold
a line into which the wastewater from gravity and branch lines is fed

3.4.1.6
main sewer
a line into which wastewater from manifolds is fed and carried to a sewage treatment plant or a collector tank

NOTE For vacuum systems, the main sewer may also be configured as a valve manifold.

3.4.1.7
valve manifold
a short length of pipe closed at both ends with connections for drain lines (e.g. manifolds), including connections for lines to the vacuum generation plant and with pressure gauges and pressure control switches connected, as well as a connection for flushing

NOTE Only in vacuum systems.

3.4.2
vent line
designed to vent the sanitary drainage system without carrying any wastewater

3.4.3
sewage disposal pipe
a pressure pipe in the sanitary drainage system carrying wastewater to disposal points after it has passed through a sewage treatment plant or collector tank

3.5
drain
an opening via which wastewater is caught, collected and discharged into the drainage system

EXAMPLES Floor drain, in the washbasin, in the bathtub and shower basin, in the water closet and urinal.

NOTE In shipbuilding the terms “open inlet” or “opening” are used.

3.6
sewage treatment plant
serves to purify and disinfect the sewage fed into it

3.7
collector tank
a tank for temporary storage of untreated wastewater

3.8
intermediate tank
a tank in which wastewater from drain lines is collected and subsequently fed via a pressure line to a collector tank or sewage treatment plant

3.9
mixing and equalization tank
a tank in front of the wastewater for treatment plant, in which wastewater from drain lines is mixed and equalized to ensure feeding of the wastewater treatment plant without a hydraulic or pollution shock

3.10
holding tank
a tank in which treated wastewater from treatment plants is stored for a limited period of time, while the ship is in areas where drainage is not allowed

3.11
sludge storage tank
tank in which sludge from a sewage treatment plant is stored for subsequent removal to shore or aboard

3.12
vacuum generation plant
a plant for generation of the vacuum required to convey wastewater from the drains through the drain lines

3.13
disposal point
a point where the sewage disposal pipes terminate and the wastewater is passed out of the ship, as for instance an overboard wastewater discharge outlet in the shell or outlets for disposal to an external disposal unit

3.14
closing device
a pipe fitting which prevents water from entering into the ship from outboard

3.15
availability of the plant
quotient of working period and working period plus breakdown period

3.16
breakdown period
time during which the plant cannot be used due to repair or maintenance

4 Planning

4.1 General

Drainage systems shall be designed and built in accordance with the stipulations contained in this part of ISO 15749.

To get a high availability of the plant, the amount of sanitary facilities drained over one line should be limited. The maximum number of branches for each line as given in ISO 15749-3 shall not be exceeded.

4.2 Classification

Classification of wastewater according to origin is given in Table 1.

Table 1 — Classification of wastewater

Origin		Type of wastewater
Sanitary drainage		
Toilet installations	Bidets, water closets, urinals	sewage
	Water drains [a]	sewage or grey water
Hospital areas	All drainage units (including washing and bathing facilities, and water-drain discharges)	sewage
Washrooms and bathrooms	Bathtubs, showers, handbasin, washstands, water drains [a]	grey water or sewage
Galleys, pantries	Sinks, washing-up sinks, water drains, domestic appliances	grey water
Other spaces	Air conditioning centrals (if condensation water drains on deck), laundries, passageways, provisions refrigerating spaces, swimming pool, whirlpool	grey water

[a] Wastewater from water drains immediately adjacent to water closets or urinals is classified as sewage (see 3.3).

4.3 Amount of wastewater

When designing the plants, the minimum amount of wastewater in accordance with Table 2 has to be considered.

Table 2 — Minimum amount of wastewater

Ship type	Minimum amount of wastewater per person and day in litres			
	Plant without vacuum		Plant with vacuum	
	Sewage	Black and grey water	Sewage	Black and grey water
Passenger ships	70	230	25	185
Sea-ships excepting passenger-ships	70	180	25	135
Ships used near the coast can remain under these values on consultation with the responsible authorities.				
NOTE The values are recommended. Deviations due to national rules or to classification-society recommendations are to be considered				

4.4 Properties of wastewater

Drainage systems shall serve exclusively to discharge wastewater as given in 3.1.

If necessary, measures shall be taken to prevent the discharge of other substances as given in 3.1 via the drainage systems. Grinders for other kinds of waste shall not be connected to the wastewater lines.

5 Hygienic and environmental requirements

5.1 Reduction of noise and odour

5.1.1 Noise

The plant shall be designed and built in such way that it produces as little noise as possible and that the transmission of noises does not occur. If necessary, this shall be ensured by measures of acoustic insulation so that permissible sound level limits in rooms are not exceeded.

5.1.2 Odour

The plant shall be designed and built in such a way that there will be no annoyance caused by odour. Necessary ventilation shall be installed in such a way that there will be no annoyance caused by odour.

5.2 Hygienic considerations

5.2.1 Separate line routing

For hygienic reasons, sewage and grey water shall be conveyed separately. Each type of wastewater requires its own system of drain lines.

5.2.2 Discharge into collector tanks

Where wastewater is discharged into collector tanks, the drain lines for sewage and grey water may merge into a common discharge line (main sewer) immediately before reaching the tank.

In sanitary drainage systems with a common collector tank for grey water and sewage, a hydraulic seal should be provided for the grey water pipe near the tank. In this case, to ensure reliable operation of sanitary equipment, it is recommended to install a vent pipe.

5.2.3 Discharge into sewage treatment plants

Discharge of wastewater into treatment plants shall meet the requirements laid down by the manufacturer.

It is recommended to place a mixing and equalization tank in front of the wastewater treatment plant to ensure feeding of the wastewater treatment plant without shock.

6 Structure of a drainage system

6.1 Description

The wastewater is transported from the drains via drain lines.

These lines convey the wastewater to a collector tank or sewage treatment plant.

Bypass lines connected to these drain lines carry the wastewater directly to outlets in the shell in accordance with ISO 15749-4.

From the collector tank and/or sewage treatment plant, the wastewater is conveyed to a disposal point via sewage disposal pipes.

NOTE In exceptional cases, after the wastewater has been purified in the sewage treatment plant it is discharged into holding tanks and stored there before being disposed of overboard or to an external (e.g. shore-based) disposal facility, or discharged via the ballast water system.

6.2 Main system components

A drainage system may consist of the following components:

— drain lines;

— vent lines, (for drain lines, collector tanks, sewage treatment plants);

— intermediate tank (only if necessary);

— vacuum generation unit (for drain lines in a vacuum system);

— collector tank;

— mixing and equalization tank;

— sludge storage tank;

— pumps for wastewater and sludge overboard disposal or to external disposal facilities (e.g. on shore) or a sewage treatment plant;

— sewage disposal lines and a holding tank, if applicable.

6.3 Corrosion resistance

Pipes, mouldings, fittings and other system components shall be resistant to aggressive wastewater and its corrosive substances.

7 Drain lines

7.1 Requirements

7.1.1 Material

Depending on the locations of installation and taking the regulations of the classification societies into consideration, pipes, fittings, etc. are manufactured from

— steel (also as steel tubing with bell joints),

— ductile iron and malleable iron,

— stainless steel (also as a pipe with bell joints),

— copper/nickel alloy (also as a pipe with bell joints), or

— unplasticized polyvinyl chloride (PVC-U) may be employed.

Plastic pipes shall be approved in accordance with IMO-Resolution A.753 (18), except that low flame spread and smoke emission properties can be at the discretion of the classification society.

7.1.2 Temperature resistance

Pipes, mouldings and fittings for drain lines shall sustain the operating temperatures listed in Table 3.

Table 3 — Operating temperatures

Type of line in accordance with 7.1.1	Operating temperature, continuous operation °C
steel tubing	up to 100
steel tubing with bell joints	up to 60
stainless steel pipe with bell joints	up to 100
CuNi10Fe1,6Mn pipe with bell joints	
CuNi10Fe1,6Mn pipe	
PVC-U pipe	up to 60

7.1.3 Flow

The inside surface of pipes, mouldings and fittings shall be smooth, and there shall be no protrusions and recesses at the connecting points which may impede the conveyance of wastewater and favour deposition of matter or clogging.

7.1.4 Surface protection

When using steel pipes it is recommended to use pipes with surface protection, e.g. galvanized or surface coated pipes. Galvanized pipes shall be hot-dip galvanized in accordance with ISO 1461.

Steel pipes without surface protection shall be coated externally with a suitable corrosion-protection compound after installation.

7.2 Line routing

7.2.1 General

Drain lines shall not be installed in warm areas.

The lines shall be installed in such a way that they are easily accessible for necessary servicing and maintenance, e.g. in passageway areas. Maintenance should be possible without dismounting of parts of the plant. The number and position of cleaning openings shall be chosen such that the lines can be cleaned with available cleaning coils. Wastewater pipes shall be arranged within the compartments which they serve. The number of pipe penetrations through watertight bulkheads, decks and other watertight constructions shall be reduced to a minimum.

7.2.2 Hospital area

7.2.2.1 Drain lines from the hospital area shall be routed via disinfectors, which are to be activated in case of contamination. They shall be connected in such a manner that they are the lowest lines to the main sewer.

7.2.2.2 Drain line routing through a medical operation room, sterilization room and isolation ward is not permitted.

7.2.2.3 Drain line routing shall be avoided through medical premises. If this is unavoidable, the drain line shall be routed behind the lining and enclosed in a case without joints. This requirement does not cover the medical rooms indicated in 7.2.2.2.

NOTE The medical premises include: dispensary, hospital, isolation ward, sanitary cabin, medical operation room, sterilization room, chemist's shop, dental surgery, physiotherapy room, gynaecological and Roentgen room, laboratory, etc.

7.2.3 Accommodation and public rooms

7.2.3.1 Routing of drain lines through accommodation and public rooms shall be avoided. In technically reasonable cases, and if agreed with the customer, it is permissible to route drain lines protected with sound insulation through these rooms.

7.2.3.2 Where pipes are routed behind ceiling or wall panelling, doors or removable sheets shall be installed for inspection of pipe joints and valves.

7.2.4 Provision rooms

7.2.4.1 Drain lines from galley and meat preparation rooms shall be routed via grease separators.

These lines are to be combined as a common line and routed separately from all other drain lines up to the grease separator.

NOTE Grease separators are mounted when overboard disposal is directly carried out of these rooms and when the sewage treatment plant does not ensure necessary water purifying.

7.2.4.2 Drain lines from refrigerating rooms for provisions shall be routed directly to a collector tank or to a sewage treatment plant.

NOTE Condensation water from refrigerating rooms for provisions may be discharged into the bilge by means of a separate drain line and disposed of via the draining system.

7.2.4.3 Wastewater pipelines shall not be routed through foodstuff-processing rooms, provision store rooms, production/technological rooms for fish-processing and fish holds.

7.2.5 Cargo refrigerated rooms

If possible, drain lines should not be routed through refrigerated rooms.

As a general rule, sanitary spaces should not be located above such spaces.

7.2.6 Holds

Drain lines routed through holds shall be fitted in such a way as to protect them from mechanical damage.

7.2.7 Tanks

Drain lines shall not be routed through tanks for drinking water, fresh water, feed water, fuel, or lubricating oil.

If this cannot be avoided for design reasons, permission shall be obtained from the classification societies.

7.2.8 Rooms with electrical equipment

Wastewater lines shall not be routed through radio, gyrocompass and accumulator rooms. In technically reasonable cases, as agreed with the customer, it is permissible to route wastewater piping through these rooms only with welded pipes.

7.2.9 Penetrations

Pipe penetrations through watertight bulkheads, decks and other airtight and watertight constructions, as well as an installation of fittings on these constructions shall be carried out with joints which provide complete construction impermeability and reliable connections of piping.

Through-bolts and studs in watertight constructions are not admitted.

Penetrations of fire-rated bulkheads or decks are subject to classification society requirements.

7.2.10 Pipes in spaces containing food products

7.2.10.1 General

In general, grey water and sewage pipes are not allowed in those areas. If they cannot be avoided, additional specifications are necessary, e.g. laying in pipes for protection. In addition, the specifications in 7.2.10.2 to 7.2.10.5 have to be taken into account.

7.2.10.2 Pipe joints

Pipe joints shall be inseparable. They shall be in accordance with a), b) and c) below:

a) for steel pipes: bonded direct-welded pipe joints;

b) for spigot and socket pipes: bonded spigot and socket joints;

c) for PVC-U pipes: bonded socket joints.

7.2.10.3 Drain connections (floor drains)

Attachment of connecting lines to drains by means of pipe threads (male threads) shall be configured as follows:

a) for steel pipes: by means of screw joints with non-ageing sealant, or by means of welded joints;

b) for spigot and socket pipes: by means of connecting sockets with female threads;

For drains with direct socket joints, the connection shall be configured in accordance with 7.2.10.2 b).

c) for PVC-U pipes: by means of screw joints with an additional non-ageing sealant.

7.2.10.4 Horizontal pipes

Horizontal pipes of all types installed overhead shall be laid in pipe tunnels. Effective discharge of the tunnels to a place outside the respective spaces shall be ensured.

Inside pipe tunnels which are difficult to access, spigot and socket joints shall be avoided.

7.2.10.5 Vertical pipes

Vertical pipes of spigot and socket joints or PVC-U pipes shall be laid in such way that they are protected against mechanical damage.

7.2.11 Pipes in accommodation spaces

Connections in overhead horizontal pipes in living areas and mess facilities shall be configured in accordance with 7.2.10.2 and 7.2.10.3.

7.2.12 Pipe supports

Pipe supports shall be configured as fixed or detached supports.

When determining which supports are to be fixed or detached, attention shall be paid to the fact that changes in pipe direction in order to absorb longitudinal expansion shall be fully exploited.

Longitudinal expansion of drain lines caused by elastic deformation of the ship's hull are to be compensated for by means of adequate measures (e.g. sufficiently sized elbows).

For the support of PVC-U pipes, the following shall be applied:

— vertically laid pipes which pass through decks shall be supported at half the height of the decks;

— riser mains with direction changes shall be supported after each direction change.

The values listed in Table 4 are intended as a guide. The exact spacing of brackets shall be specified so that the brackets can be welded onto load bearings, e.g. to frames or girders.

Table 4 — Spacing of brackets for pipes

Nominal diameter, DN	32	40	50	65	80	100	125	150
Spacing max., m	2				3			

7.2.13 Supplementary regulations

7.2.13.1 General

The following applies to passenger ships and all other ships for which a buoyancy certificate is required.

7.2.13.2 The sanitary facilities and the respective drain lines above the bulkhead deck shall be arranged in such a manner that, in the event of damaged pipes, and with the ship listing temporarily, intact departments cannot be flooded.

7.2.13.3 Drain lines with open inlets below the bulkhead deck shall be routed to an intermediate tank. Such a tank would be a valuable installation for each watertight compartment.

There shall be a distance of at least 460 mm between the bottom of the intermediate tank and the base line.

Drain lines in vacuum systems shall be designed as riser branches and shall be routed above the bulkhead deck.

7.2.13.4 Drain lines which are routed from different watertight compartments to an intermediate tank, collector tank or sewage treatment plant shall be fitted with shutoff fittings at the watertight bulkhead to isolate the compartments.

It shall be possible to shut off these fittings from an accessible point above the bulkhead deck; they shall be fitted with an indicator for the “closed” position.

7.2.13.5 Drain lines with open inlets below the bulkhead deck, which are routed as closed lines through other watertight compartments, shall be installed outside the damage area in these compartments.

This requirement is considered to be fulfilled if the distance between these lines and the shell is greater than a perpendicular running at a distance of $0{,}2B$ [2] parallel to the shell at the subdivision load line.

Pipes laid in the double bottom shall be at least 460 mm from the base line.

7.3 Design

7.3.1 Applicable pipe joints and mouldings

7.3.1.1 Steel pipes

— plain-face flanges;

— flanges;

— malleable iron fittings;

— welded socket joints;

— flexible couplings;

— appropriate flexible coupling, e.g. rubber sleeves, between installation unit and pipeline;

— gasketed mechanical coupling;

— other joining methods which have demonstrated acceptable performance.

7.3.1.2 Spigot and socket pipes

Pipe joints and mouldings and appropriate flexible joints, e.g. rubber sleeve, between the installation unit and pipeline are applicable.

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2) *B* designates the ship's widest beam at the subdivision loadline.

7.3.1.3 CuNi-pipes

— flanges;

— mouldings;

— appropriate flexible joint, e.g. rubber sleeve, between installation unit and pipeline;

— gasketed mechanical couplings;

— other joining methods which have demonstrated acceptable performance.

7.3.1.4 PVC-U-pipes

Mouldings in accordance with ISO 727-1, as well as an appropriate flexible joint, e.g. rubber sleeve between installation unit and pipeline, are applicable.

7.3.2 Additional details

For additional design details concerning laying, selection of pipes, pipe unions, depending on the wastewater volume to be expected, the requirements given in

— ISO 15749-2 for drain lines in gravity systems,

— ISO 15749-3 for drain lines in vacuum systems,

— ISO 15749-4 for sanitary drainage, and

— ISO 15749-5 for drainage of decks, cargo spaces and swimming pools

shall be applied.

8 Collector tank

8.1 Requirements

8.1.1 The inside surface of the tank shall have a coating to protect it against the corrosive effects of wastewater.

8.1.2 The inside surfaces of the walls shall be smooth, and the use of stiffeners on these surfaces should be avoided. When such stiffeners are considered necessary, they shall run in a vertical direction.

8.1.3 The bottom of the tank should have an inclination towards the drain.

8.2 Equipment

The minimum equipment required for collector tanks is as follows:

— an overcharge alarm,

— a connection for flushing and/or steaming,

— a clean-out opening,

— connections for drain lines, sewage disposal lines, and vent lines which feed into the tank,

— if requirement grab rods are to be provided in collector tanks of large dimensions for going down into the tank,

— accelerator/mixing device,

— aeration.

8.3 Determination of volume

Taking into consideration the minimum amount of wastewater in accordance with 4.2, determine the volume

— for gravity systems in accordance with ISO 15749-2, or

— for vacuum systems in accordance with ISO 15749-3.

8.4 Venting

For details see Clause 10.

8.5 Draining

Sewage disposal lines shall be configured in accordance with ISO 15749-4.

9 Sewage treatment plant

9.1 Requirements

Sewage treatment plants shall meet the requirements laid down in IMO Publication MEPC.2 (VI).

The numeric values laid down therein for the permissible degree of contamination of the wastewater to be discharged overboard shall not be exceeded.

Sewage treatment plants shall be approved by way of certification reports issued by the classification societies.

NOTE The requirements can be met by plants using the following sewage treatment methods:

— biological treatment;

— mechanical-chemical treatment;

— electrochemical treatment;

— membrane-biological treatment;

— combinations of those methods.

9.2 Equipment

Sewage treatment plants shall be fitted with an alarm to indicate malfunctions.

9.3 Venting

For details see Clause 10.

9.4 Draining

Sewage disposal lines shall be configured in accordance with ISO 15749-4.

10 Ventilation of sewage treatment plants

10.1 General

For details see ISO 15749-2 and ISO 15749-3.

10.2 Vent lines

10.2.1 Nominal diameter

Vent lines of sewage treatment plants and collector tanks have a minimum nominal diameter of DN 50.

10.2.2 Vent outlets

Vent outlets leading outside shall not be located within the intake vicinity of the air conditioning and venting system. They shall be sited so that they do not cause odour nuisance.

10.2.3 Types of pipes and dimensions

For vent lines, the same types of pipes may be used as for drain lines.

10.2.4 Installation

Vent lines shall be sufficiently inclined as to be self-draining. If not possible, dewatering devices should be installed at the deepest point of the vent lines.

11 Sewage disposal pipes

For the configuration of sewage disposal pipes, for the location of closures in these lines, and for the location of discharge points, see ISO 15749-4.

12 Testing

12.1 Acceptance test

The acceptance test constitutes testing of the operational and functional reliability of the drainage system and the correct routing of the pipes with respect to the drawings and the requirements laid down in ISO 15749-1 to ISO 15749-4.

Any special regulations and requirements established by the cognizant supervising authority and manufacturers shall be observed.

12.2 Testing of drain lines

For testing of drain lines of the vacuum system, see ISO 15749-3.

12.3 Testing of sewage disposal pipes

The sewage disposal pipes shall be subjected to a pressure test at 1,5 times the operating overpressure.

13 Operation of pipework

13.1 Maintenance

When the system is handed over, the operator shall receive maintenance instructions for the sanitary drainage system and its components.

These instructions shall be compiled by the installation company or the system manufacturer.

The instructions for use shall contain detailed safety information. All possible hazards due to failure of plant components or due to operating errors shall be described.

For the preparation of the instructions for use, the requirements of IMO Publication MSC/Circ. 648, Annex, shall be taken into account. This includes, for example, the requirements that odour seals dried up by non-use have to be refilled.

13.2 Spare parts

For those parts liable to particular wear, the manufacturer of the system shall provide a list of spare parts recommended to be carried on board.

14 Graphical symbols and simplified representations

Representation of drainage systems and components on pipework drawings and flow charts shall be executed by way of graphic symbols and simplified representations.

The symbols for piping, pipe connections, fittings and devices employed in Annex A have been taken, for the most part, from the applicable standards for graphic symbols and simplified representations.