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

Part 2: Sanitary drainage, drain piping for gravity systems

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

Partie 2: Drainage sanitaire, tuyaux de drainage pour système par gravité

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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 15749-2 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 2: Sanitary drainage, drain piping for gravity systems

1 Scope

This part of ISO 15749 applies to the design of sanitary drain lines in gravity systems (gravity drainage) on ships and marine structures.

For planning and basic requirements, see ISO 15749-1.

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 Resolution A.753 (18), *Guidelines for the application of plastic pipes on ships* [1)]

ISO 65, *Carbon steel tubes suitable for screwing in accordance with ISO 7-1*

ISO 4200, *Plain end steel tubes, welded and seamless — General tables of dimensions and masses per unit length*

ISO 7268, *Pipe components — Definition of nominal pressure*

ISO 9329-1, *Seamless steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steels with specific room temperature properties*

ISO 9330-1, *Welded steel tubes for pressure purposes — Technical delivery conditions — Part 1: Unalloyed steel tubes with specified room temperature properties*

ISO 15749-1, *Ships and marine technology — Drainage systems on ships and marine structures — Part 1: Sanitary drainage-system design*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15749-1 apply.

4 Gravity systems

4.1 Description

4.1.1 Drain lines in gravity systems convey wastewater by gravity to a collector tank or sewage treatment plant.

4.1.2 Wastewater lines downstream of the sewage treatment plant are not part of the gravity system. For their configuration, ISO 15749-4 applies.

4.1.3 Figure 1 gives an example of a drainage system with drain lines in a gravity system.

4.2 Operating pressure

Pipes in sanitary systems (drain and vent lines) shall be designed such that the operating pressure [2] (internal pressure) cannot exceed 0,5 bar.

5 Pipes

5.1 General

Depending on the location, the following pipes may be used for gravity drain lines and vent lines:

— steel pipes in accordance with 5.2;

— steel pipes and CuNiFe pipes with spigot and socket joints [3] in accordance with 5.3;

— CuNiFe pipes in accordance with 5.4;

— PVC-U pipes in accordance with 5.5; plastic pipes shall be approved in accordance with IMO Resolution A.753 (18).

For nominal bores see Table 1.

Table 1 — Nominal bores for drain lines

Nominal bore, NB	32	40	50	65	70	80	100	125	150
Steel and CuNiFe pipes	X	X	X	X	—	X	X	X	X
Spigot and socket pipes	—	X	X	—	X	X	X	X	X
PVC-U pipes	X	X	X	X	—	X	X	X	X

X: NB possible for this type of pipe;
—: NB not possible for this type of pipe.

2) For definitions see ISO 7268.

3) Hereinafter referred to as spigot and socket pipes.

5.2 Steel pipes

The following types of pipes are applicable:

— seamless steel pipes in accordance with ISO 4200 and ISO 9329-1, of S 235 JR;

— welded steel pipes in accordance with ISO 4200 and ISO 9330-1, of S 235 JR;

— threaded steel pipes in accordance with ISO 65, of S 185.

For dimensions see Table 2.

Table 2 — Dimensions of steel pipes

Nominal bore, NB			32	40	50	65	80	100	125	150
Outside diameter of pipe d		mm	42,4	48,3	60,3	76,1	88,9	114,3	139,7	168,3
Wall thickness s_{min}	A	mm	4,5							
	B	mm	6,3			7,1		8		8,8
	N	mm	2,3			2,6	2,9	3,2	3,6	4
NOTE Other minimum wall thicknesses according to the requirements of a classification society may be considered.										

For selection of wall thickness series depending on the location, see Table 3.

Table 3 — Wall-thickness series depending on the location

Location	**Wall thickness series**
Tanks with same medium	A
Tanks with different medium [a]	B
Pipes below freeboard deck or bulkhead deck leading to an overboard wastewater outlet with closing devices	A
Above freeboard deck	N
Cargo space	B
[a] Permitted only upon agreement of the classification society.	

5.3 Spigot and socket pipes

Spigot and socket pipes with dimensions in accordance with Table 4 are applicable. Also, CuNi10Fe1,6Mn pipes with these dimensions are applicable.

Employment only in those areas where steel pipes of wall-thickness series N in accordance with Table 3 are permitted.

Table 4 — Dimensions of spigot and socket pipes

Nominal bore, NB		40	50	70	80	100	125	150
Outside diameter d	mm	42	53	73	89	102 (103)	133	159
Wall thickness s_{min}	mm	1,5		1,6 (1,5)		2 (1,5)	2,5 (2)	2,5
Values in brackets are for stainless spigot and socket pipes.								

5.4 CuNiFe pipes

Pipes of CuNi10Fe1,6Mn with dimensions in accordance with Table 5 are applicable. For selection of the wall-thickness series depending on the location, see Table 3.

Table 5 — Dimensions of CuNiFe pipes

Nominal bore, NB		32	40	50	65	80	100	125	150
Outside diameter d	mm	38	44,5	57	76	89	108	133	159
Wall thickness s_{min}	A	2,5			3	3,5	3,5	4	4
	B	—			4	5		6	6
	N	2					2,5		
NOTE Other minimum wall thicknesses in accordance with the requirements of the relevant classification society may be considered.									

5.5 PVC-U pipes

Pipes with dimensions in accordance with Table 6 are applicable.

Pipes made from PVC-U may only be used in areas where steel pipes of wall thickness series N according to Table 3 are permitted.

Table 6 — Dimensions of PVC-U pipes

Nominal bore, NB		32	40	50	65	80	100	125	150
Nominal bore d	mm	40	50	63	75	90	110	140	160
Wall thickness s_{min}	mm	3	3,7	4,7	3,6	4,3	5,3	6,7	7,7

6 Laying of drain lines

6.1 Line routing

Line routing, including vent lines, shall be in accordance with ISO 15749-1.

6.2 Drains

All sanitary water drainage items and floor drains shall be fitted with an odour seal.

6.3 Gradient of pipeline

6.3.1 All drain lines shall be self-draining and shall therefore be run with an adequate gradient. The gradient should be evenly distributed as far as practicable.

Branch lines connecting drainage items to gravity delivery lines and manifolds shall be kept as short as possible.

If, in exceptional cases, drain lines cannot be run with a gradient, suitable means shall be considered to ensure that the wastewater can run off properly despite the ship's listing or trim.

6.3.2 The pipe gradient in relation to the base line shall be in accordance with the values listed in Table 7 taking the location in the ship into consideration.

Table 7 — Pipe gradient

Pipes	Gradient
Branch line (except water closet)	1:100 to 1:66,7
Water closet branch line, manifold, main sewer	1:66,7 to 1:50

6.3.3 Wastewater from the mid-ship area shall be led at least one deck height downwards either to both sides of the ship or to the ship's centre area.

6.4 Cleaning openings

Cleaning openings shall be fitted in drain line sections which cannot be cleaned otherwise.

In any case, drain lines of galleys and water closets shall have cleaning openings.

7 Determination of nominal bores

7.1 General

The nominal bores of drain lines are determined with respect to the wastewater flow rate. Calculations of nominal bores shall be based on the data listed in Table 9 for single branches.

7.2 Single branches

7.2.1 The wastewater flow rates and nominal bores for single branches of sanitary drainage items, galley equipment, washing machines, drains, and other single branches are laid down in Table 8.

NOTE For drainage items not mentioned in Table 8, the wastewater flow rate can be determined by the size of the connection, the volume of sewage, and the time required for draining.

Table 8 — Flow rate and nominal bore for connecting lines and single branches of drainage items with odour seals

No.	Drainage item		Flow rate *l/s* ≈	Nominal bore, NB
1	Water closet		2,5	100
2	Urinal		0,5	32 to 50
3	Bidet		0,5	32 or 40
4	Bathtub		1,0	50
5	Washbasin		0,5	32 or 40
6	Sink		1,0	40 or 50
7	Basins, general		0,9 to 1,2	50
8	Service equipment	Dishwasher, small galley equipment with drain	0,3 to 1,2	[a]
9		Potato peeler		65, 70 or 80 [b]
10		Washing machine	1,5	50, 65 or 70 [b]
11	Drain (also called “floor drain”)		1 to 2	40, 50, 65, 70 or 100 [b]

[a] For nominal bores for connections, the manufacturer's information shall be followed.

[b] NB 70 only for spigot and socket pipes and for naval ships.