INTERNATIONAL STANDARD

ISO 7547

Second edition
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Ships and marine technology — Air-conditioning and ventilation of accommodation spaces — Design conditions and basis of calculations

Navires et technologie maritime — Conditionnement d'air et ventilation des emménagements — Conditions de conception et bases de calcul

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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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7547 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

This second edition cancels and replaces the first edition (ISO 7547:1985), which has been technically revised.

Annexes A and B of this International Standard are for information only.

Ships and marine technology — Air-conditioning and ventilation of accommodation spaces — Design conditions and basis of calculations

1 Scope

This International Standard specifies design conditions and methods of calculation for air-conditioning and ventilation of accommodation spaces and the radio cabin on board seagoing merchant ships for all conditions except those encountered in extremely cold or hot climates (i.e. with lower or higher conditions than those stated in 4.2 and 4.3).

Annex A provides guidance and details of good practice in the design of ventilation and air-conditioning systems in ships.

Annex B gives the thermal conductivities of commonly used construction materials.

Users of this International Standard should note that, while observing the requirements of this International Standard, they should at the same time ensure compliance with statutory requirements, rules and regulations as may be applicable to the individual ship concerned.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 31-4:1992, *Quantities and units — Part 4: Heat*

ISO 3258:1976, *Air distribution and air diffusion — Vocabulary*

3 Terms and definitions

For the purposes of this International Standard, the definitions given in ISO 31-4, ISO 3258 and the following apply.

3.1
accommodation
space used as public rooms, cabins, offices, hospitals, cinemas, games and hobby rooms, hairdressing saloons and pantries without cooking appliances

3.2
air-conditioning
form of air treatment whereby temperature, humidity, ventilation and air cleanliness are all controlled within limits prescribed for the enclosure to be air-conditioned

3.3
ventilation
provision of air to an enclosed space, sufficient for the needs of the occupants or the process

3.4
relative humidity
ratio, in humid air, expressed as a percentage, of the water vapour actual pressure to the saturated vapour pressure at the same dry bulb temperature

3.5
dry bulb temperature
temperature indicated by a dry temperature-sensing element shielded from the effects of radiation

EXAMPLE The bulb of a mercury-in-glass thermometer is an example of a dry temperature-sensing element.

4 Design conditions

4.1 General

The system shall be designed for the indoor air conditions specified in 4.2 and 4.3 in all accommodation spaces defined in 3.1 at the stated outdoor air conditions and the outdoor supply airflow, ventilation and air balance given in 6.2.1, 6.2.2 and 6.5 respectively.

NOTE All temperatures stated are dry bulb temperatures.

4.2 Summer temperatures and humidities

Summer temperatures and humidities are as follows:

a) Outdoor air: + 35 °C and 70 % humidity;

b) Indoor air: + 27 °C and 50 % humidity.

NOTE In practice, the indoor air conditions obtained, especially humidity, can be different from those stated.

4.3 Winter temperatures

Winter temperatures are as follows:

a) Outdoor air: – 20 °C;

b) Indoor air: + 22 °C.

NOTE This International Standard does not specify requirements for humidification in winter.

4.4 Outdoor air

The minimum quantity of outdoor air shall be not less than 40 % of the total air supplied to the spaces concerned.

4.5 Occupancy

The number of persons to be allowed for in the various accommodation spaces shall be as follows, unless otherwise stated by the purchaser.

a) Cabins:

— the maximum number of persons for which the cabin was designed;

b) Public rooms such as saloons, mess- or dining-rooms and recreation rooms:

— the number of persons who can be seated or, in the case where the purchaser does not specify:

i) one person per 2 m^2 floor area for saloons;

ii) one person per 1,5 m^2 floor area for mess- or dining-rooms;

iii) one person per 5 m^2 floor area for recreation-rooms;

c) Captain's and chief engineer's day-room:

— four persons;

d) Other private day-rooms:

— three persons;

e) Hospital:

— the number of beds plus two;

f) Gymnasium, games-room:

— four persons;

g) First-aid-room:

— two persons;

h) Offices:

— two persons.

5 Calculation of heat gains and losses

5.1 Applicability

For the calculation of summer conditions, 5.2 to 5.5 inclusive shall apply.

For the calculation of winter conditions, 5.2 only shall apply.

5.2 Heat transmission

5.2.1 Method of calculation

The following formula shall be used for calculating the transmission losses or gains, in watts, for each separate surface:

$$\Phi = \Delta T\left(k_{\mathrm{v}} A_{\mathrm{v}}\right)+\left(k_{\mathrm{g}} A_{\mathrm{g}}\right)$$

where

ΔT is the difference in air temperature, in kelvins, (for the difference of air temperature between air-conditioned and non-air-conditioned internal spaces, see 5.2.2);

k_v is the total heat transfer coefficient, in watts per square metre kelvin, for the surface A_v (see 5.2.3);

A_v is the surface, in square metres, excluding side scuttles and rectangular windows (glazing + 200 mm) (see Figures 1 and 2);

k_g is the total heat transfer coefficient, in watts per square metre kelvin, for the surface A_g (see 5.2.3);

A_g is the area, in square metres, of side scuttles and rectangular windows (glazing + 200 mm) (see Figures 1 and 2).

Dimensions in millimetres

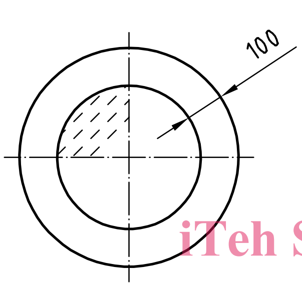

Figure 1 — Side scuttles

Dimensions in millimetres

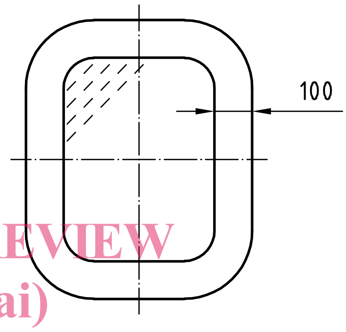

Figure 2 — Rectangular windows

5.2.2 Temperature differences between adjoining internal spaces

For differences of air temperature, ΔT, in kelvins, between conditioned and non-air-conditioned internal spaces, see Table 1.

Table 1 — Temperature differences between adjoining internal spaces

Deck or bulkhead	ΔT, K	
	Summer	**Winter**
Deck against tank provided with heating	43	17
Deck with bulkhead against boiler-room	28	
Deck and bulkhead against engine-room and against non-air-conditioned gallery	18	
Deck and bulkhead against non-heated tanks, cargo spaces and equivalent	13	42
Deck and bulkhead against laundry	11	17
Deck and bulkhead against public sanitary space	6	0
Deck and bulkhead against private sanitary space		
a) with any part against exposed external surface	2	0
b) not exposed	1	0
c) with any part against engine/boiler-room	6	0
Bulkhead against alleyway	2	5
NOTE It is understood that means of heating are provided in exposed sanitary spaces.		

5.2.3 Total heat transfer coefficients

The values for the total heat transfer coefficients, k, in watts per square metre kelvin, given in Table 2 assume that adequate thermal insulation is provided on all surfaces exposed to outdoor conditions or adjoining hot or cold spaces, or hot equipment or pipework.

The values given in Table 2 shall be used where appropriate, unless otherwise advised by the purchaser. For other cases, a method calculation of coefficient is given in 5.2.4.

5.2.4 Calculation of heat transfer coefficient

The heat transfer coefficient shall be calculated as follows:

$$\frac{1}{k} = \sum \frac{1}{\alpha} + \frac{\sum \frac{d}{\lambda} + M_\mathrm{L} + M_\mathrm{b}}{\mu}$$

where

k is the total heat transfer coefficient, in watts per square metre kelvin [W/(m^2·K)];

α is the coefficient of heat transfer for surface air, in watts per square metre kelvin [W/(m^2·K)], as follows:

α = 80 W/(m^2·K) for outer surface exposed to wind (20 m/s),

α = 8 W/(m^2·K) for inside surface not exposed to wind (0,5 m/s);

d is the thickness of material, in metres;

λ is the thermal conductivity, in watts per metre kelvin [W/(m·K)];

M_L is the thermal insulance for an air gap, in square metres kelvin per watt [m^2·K/W)];

M_b is the thermal insulance between different layers of material, in square metres kelvin per watt [m^2·K/W)];

μ is a correction factor for steel structure as follows:

μ = 1,2 for insulation in accordance with Figure 3,

μ = 1,45 for insulation in accordance with Figure 4.

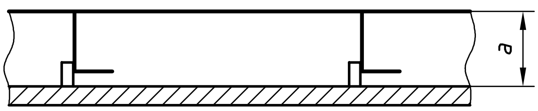

Figure 3 — Plane insulation of uniform thickness

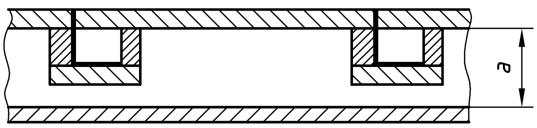

Figure 4 — Corrugated insulation of uniform thickness