INTERNATIONAL STANDARD

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Shipbuilding — Ventilation and air-treatment of galleys and pantries with cooking appliances

Construction navale — Ventilation et traitement de l'air des cuisines et des offices avec appareils de cuisson à bord des navires

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Foreword

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ISO 9943 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 9943:1991), which has been technically revised.

Shipbuilding — Ventilation and air-treatment of galleys and pantries with cooking appliances

1 Scope

This International Standard specifies the design requirements and general considerations for the ventilation and air-treatment of galleys and pantries with cooking appliances onboard merchant seagoing ships, when such ventilation and air-treatment is specified by the shipowner.

It applies for normal conditions in all waters except those encountered in extremely cold or hot climates (i.e. with a lower or higher temperature than those stated in 4.3 and 4.4).

For the purposes of this International Standard, pantries with cooking appliances, referred to above, are those which contain appliances consuming more than the small amount of electrical power needed for coffee urns, hot-plates for keeping food warm, electric water boilers, etc.

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

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.

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

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

3 Terms and definitions

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

3.1
ventilation
provision of air to an enclosed space, sufficient for the needs of the occupants or process

3.2
air-treatment
use of devices to control such air properties as temperature, humidity and cleanliness

3.3
galley
enclosed space(s) containing appliances used for cooking food for the ship's crew

3.4
pantry with cooking appliances
pantry with devices that typically produce significantly more heat load than a single coffee urn, electric hot-plate, electric water boiler, etc.

4 Design requirements

4.1 General

A separate supply air system shall be provided for the galley; this supply air system shall take in outdoor air only.

A separate exhaust air system shall be provided for the galley, discharging the total airflow to the atmosphere.

The system shall be designed for the conditions given in 4.3 and 4.4 and the airflow required by Clause 5.

For pantries of comparatively low heat generation, the supply air system may be connected to an air-conditioning system serving other spaces. In such cases, approval by the appropriate authority of such arrangements is a precondition.

4.2 Ordering information

The purchaser shall provide the manufacturer with the following:

a) a plan showing the galley with its appliances;

b) rated power, heating method, amount of release of heat and humidity, and the details of the hood (if installed) with respect to each cooking appliance;

c) simultaneity factor for the appliances (see 5.1).

4.3 Summer conditions

The cooling power shall have the capability of cooling the supply airflow to 10 °C below an outdoor condition of 35 °C dry bulb and 70 % relative humidity.

4.4 Winter conditions

The heating power shall have the capability of heating the supply airflow to +20 °C when the outdoor air temperature is −20 °C dry bulb.

5 Airflow calculation

5.1 Supply airflow

The supply airflow to a galley shall be determined in accordance with the formula below.

The airflow, V_{qt} (expressed in m^3/s), to remove the sensible heat and latent heat emitted from appliances, shall be determined by the following formula (see also Annex C for example calculation):

$$V_{qt} = \frac{L \times \sum \phi_{qt}}{\rho \times \Delta_i}$$

where

L is the simultaneity factor [see a)];

ϕ_{qt} is the total heat emitted from the appliances, expressed in kW [see b)];

ρ is the density of the air, i.e. 1,2 kg/m^3 [see c)];

Δ_i is the difference between the average enthalpy of the room and the supply air, expressed in kJ/kg [see c)].

a) Simultaneity factor L means the ratio of operating and installed appliances. The factor shall not be lower than 0,5. Where specific data are not available, the following factor may be used for calculations.

$L = 1$ for pantries.

$L = 0,8$ for galleys with up to 250 cooked meals served per day.

$L = 0,7$ for galleys with more than 250 cooked meals served per day.

b) Where specific data on the emitted heat are not available, the values of Table B.1 may be used for calculation.

c) Supply air condition is changed as shown in Figure 1. Outside air (35 °C, 70 % RH) is cooled by 10 °C to 25 °C (see 4.3). Properties of supply air blown into the room change according to the incline angle of room sensible heat factor (RSHF) and reach room conditions.

RSHF = (Sensible heat kW / total heat kW) ratio (see Figure 1).

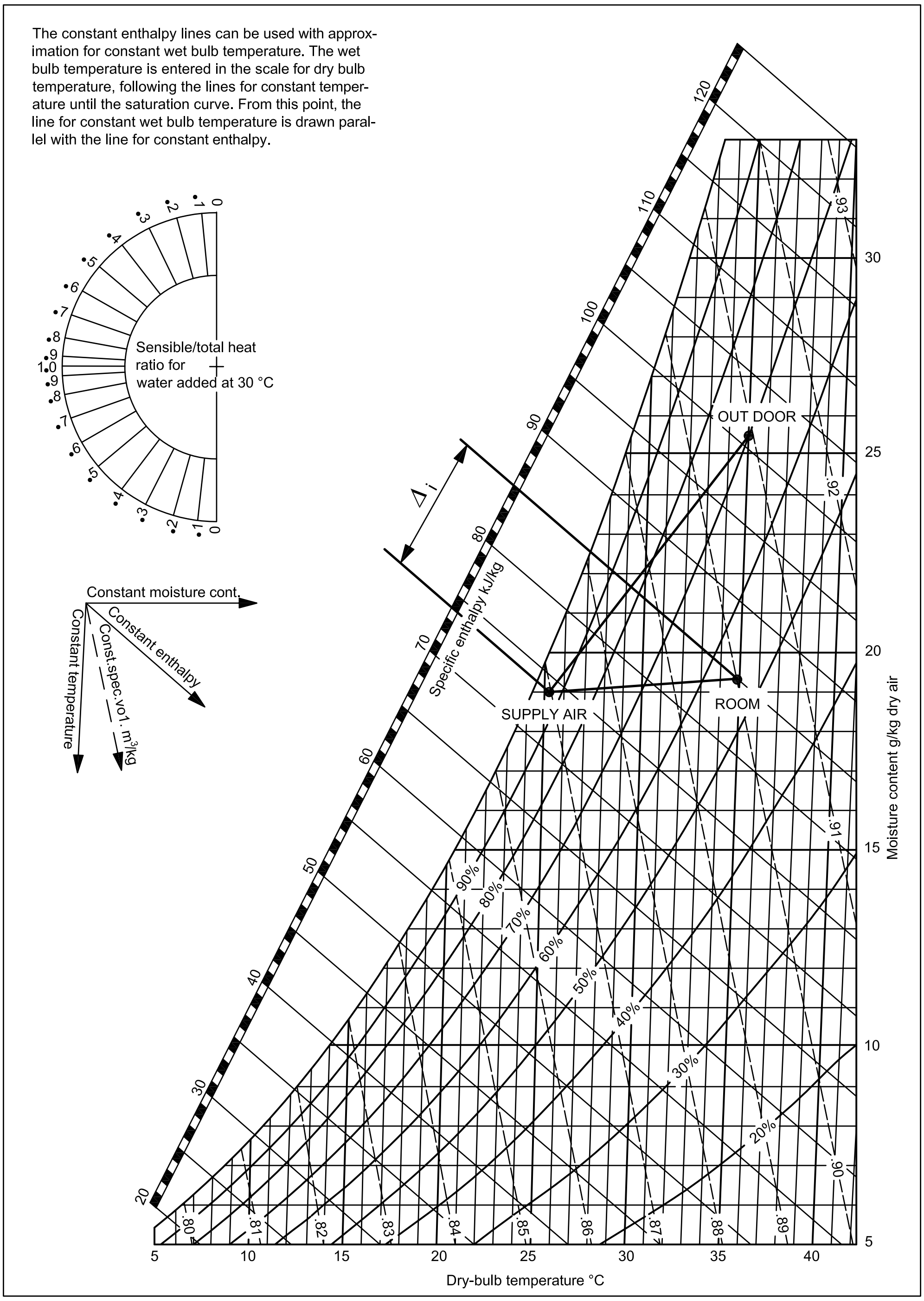


Figure 1 — Air flow conditions in psychrometric chart based on a barometric pressure of 1 013 mbar

5.2 Exhaust airflow

The quantity of the exhaust airflow shall be greater than that of the supply airflow. (See also A.2.3.)

Annex A
(informative)

Guidance and good practice

A.1 General

Special consideration should be paid to draughts. The planning of the galley and the arrangement of the exhaust and supply air terminal devices should be such that air movement in the areas occupied will, as far as possible, not have a velocity higher than 0,5 m/s.

Latent heat higher than 130 W/m^2 emitted in the space will generally result in a galley with a less satisfactory working environment.

A.2 Air distribution and equipment

A.2.1 Distribution of exhaust airflow

It is known that most of the heat and water vapour created by cooking appliances are emitted to the room. This heating effect can be reduced by providing appropriate exhaust air equipment (consisting of fans and ducts).

Appliances which heat and contaminate air (e.g. range, fryer) should be equipped with a hood-type exhaust air terminal device.

These hoods should be equipped with grease drip-trays and grease filters that are easy to clean and change; the hoods should be so designed that they will collect and evacuate the contaminated air before it has diffused.

Other exhaust air terminal devices should also be easy to clean.

A placard with cleaning instructions for all exhaust air terminal devices should be displayed in the vicinity of hoods and other exhaust air terminals.

A.2.2 Distribution of supply airflow

The supply airflow should be distributed with consideration of the cook's working areas. Air supply devices should be constructed so their operation does not inconvenience the cooks.

The supply airflow should be arranged so that exhaust air will not be affected and air mixing between supply and exhaust air terminals is avoided.

The system shall be designed to control room temperature during heating periods.

A.2.3 Pressure considerations

There should be lower air pressure in the galley than in adjoining accommodation spaces.

For this reason, it is necessary to install, in each supply and exhaust air duct, a damper which maintains proper air balance between the galley and adjoining spaces. In some cases, a natural supply air system should be fitted.

Designers should be aware that excess airflow reduces the capacity of filters and accelerates the accumulation of fouling inside ducts.

A.3 Fans and outdoor air filters

It should not be possible to run the supply air fans alone or at a higher capacity than exhaust air.

The motor for the exhaust air fan should be placed outside the air stream in order to prevent contact with grease deposits, thereby reducing fire risk.

The casing of an exhaust air fan should have inspection covers and be provided with drain outlets at the lowest part.

The air supplied from outside should be filtered by an appropriate filter, for example EUROVENT, class EU-3[1)].

The use of more efficient filters should be considered for ships with dusty cargoes.

A.4 Exhaust air ducting

Exhaust ducts should, wherever possible, be positioned outside accommodation areas. Where this is not possible, they should be fire-proofed to the appropriate fire protection standard and be under negative pressure.

Horizontal exhaust air ducts should have inspection covers, be as short as possible, and be provided with drain outlets at the lowest part.

If exhaust air ducting is led through cold zones of a ship, heat insulation should be provided to eliminate the possibility of condensation in the ducting.

An exhaust air duct should be required for dishwashing machines with direct type.

The levels and positions of the exhaust air discharge opening and of the air intake for the accommodation spaces and engine room should be such that mixing is not possible.

Pollution to the environment under the influence of different winds should be considered.

A.5 Sound pressure level

The A-weighted sound pressure level from the air distributing system measured 1 m from the air terminal device should not exceed 75 dB (A).

1) This information is given for the convenience of the users of this International Standard, and does not constitute an endorsement by ISO of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Annex B
(informative)

Sensible and latent heat emission of galley appliances to room

B.1 Calculation of thermal load from appliances during cooking

In order to accurately determine the value[2)] of heat emission, it is necessary to use the energy input rate shown on the actual appliance plate, together with appropriate use rate and radiation rate. When the data in the specifications is not obtainable, Table B.1 may be used. In this case, it is necessary to combine the heating effects of multiple appliances provided in the same room. [See also the simultaneity factor given in 5.1 a).]

B.2 Cooking appliances having exhaust air equipment (hood)

At locations with an efficient hood (combination of hood with appropriate shape, duct for exhaust air and exhaust air fan), only radiant heat is counted in the cooling load. Convection heat and sensible heat which are generated from cooking or burning are discharged and do not add to the thermal load in the galley.

The gain of the radiant heat (sensible heat) from cooking appliances stays in the range from 15 % to 45 % of the input energy; Table B.1 contributes a better understanding of this fact.

B.3 Cooking appliances having no exhaust air equipment (hood)

For all cooking appliances having no effective hood device, calculation may be performed with the heat load rate at 50 % irrespective of the kind of energy used. In this case, on average, 34 % of the heat load may be deemed as latent heat and the remaining 66 % as sensible heat. Sensible heat may also be calculated using the rated hourly input.

Hood devices that do not have a duct should be treated the same as devices without hoods for these calculations.

2) The values in Table B.1 are mean values for cooking periods; i.e. they are not the values at the time of cooking inception.

Table B.1 — Recommended rate of heat emission

Appliance	Size	Recommended rate of heat emission[a]			
		Having no hood			Having hood
		Sensible heat emission	Latent heat emission	Total heat emission	Sensible heat emission
		kW/kW	kW/kW	kW/kW	kW/kW
Dishwasher	100 dish/h	0,15	0,32	0,47	0,15
Deep fat fryer	—	0,093	0,715	0,808	—
Hot food distribution counter	—	0,562	—	0,562	—
Hot plate (single burner, high speed)	—	0,47	0,33	0,79	0,37
Hot water urn (small)	7,6 l	0,38	0,13	0,51	0,16
Kettle (cooking)	—	0,05	0,029	0,079	—
Microwave oven	20 l	1,00	—	1,00	0,00
Refrigerator (small)	0,17 to 0,71 m^3	0,40	—	0,40	0,00
Slicer	0,06 to 0,09 m^2	1,00	—	1,00	0,32
Soup cooker	7 to 11l	0,35	0,18	0,53	0,16
Toaster (small pop-up)	four slice	0,53	0,47	1,00	0,32
Steam cooker	30 to 60 l	0,08	0,05	0,13	0,04
Oven (roasting)	0,22 to 0,66m^3	—	—	—	0,04
Range (hot/fry top)	0,36 to 0,74 m^2	—	—	—	0,37

[a] Actual heat emission can be obtained by multiplying the value given by the energy input rate.

Annex C
(informative)

Galley ventilation example

C.1 Assumed appliances for the example

In this example, the ship is assumed to be using

- a dishwasher having a hood,
- a hot water urn (small) having no hood,
- a refrigerator (small) having no hood,
- a toaster (small, pop-up) having no hood, and
- a range (hot/fry top) having a hood.

The space is assumed to be a galley. The temperature in the room is 35 °C. The conditions outside are 35 °C dry bulb and 70 % relative humidity. It is also assumed that all adjacent spaces are at the same temperature as the galley.

NOTE Unless otherwise calculated, the simultaneity factor, L, should be assigned a value of 1.

C.2 Calculation of ϕ_{qt}, the total heat emitted from the appliances, in kW

	Sensible heat	Latent heat
Dishwasher having a hood	0,15 kW/kW	0,00 kW/kW
Hot water urn (small) having no hood	0,38 kW/kW	0,13 kW/kW
Refrigerator (small)	0,40 kW/kW	0,00 kW/kW
Toaster (small, pop-up)	0,53 kW/kW	0,47 kW/kW
Range (hot/fry top) having a hood	0,37 kW/kW	0,00 kW/kW

Assume the following energy input rate in kW for each item as follows (these should be acquired from the manufacturer of the device under consideration).

Dishwasher having a hood	5,0 kW
Hot water urn (small) having no hood	1,5 kW
Refrigerator (small) having no hood	0,6 kW
Toaster (small, pop-up)	1,2 kW
Range (hot/fry top) having a hood	15,0 kW

The total heat emitted, ϕ_{qt}, is calculated as:

Sensible heat	Latent heat
$0,15 \times 5,0 = 0,75$ kW	
$0,38 \times 1,5 = 0,57$ kW	$0.13 \times 1,5 = 0,20$ kW
$0,40 \times 0,6 = 0,24$ kW	
$0,53 \times 1,2 = 0,64$ kW	$0,47 \times 1,2 = 0,57$ kW
$\underline{0,37 \times 15,0 = 5,55 \text{ kW}}$	

Total: $7,75 \text{ kW} + 0,77 \text{ kW} = 8,52 \text{ kW}$

C.3 Calculation of airflow, V_{qt} (m³/sec)

$$V_{qt} = \frac{L \times \sum \phi_{qt}}{\rho \times \Delta_i}$$

where RSHF = 7,75 / 8,52 = 0,91 (see Figure C.1).

From Figure C.1, the enthalpy difference, Δ_i, is (84,8-73,9 kJ/kg) based on an RSHF of 0,91.

$$V_{qt} = \frac{1 \times 8,52 \text{ kW}}{1,2 \text{ kg/m}^3 \times (84,8 - 73,9)(\text{kJ/kg})} = (0,65 \text{ m}^3/\text{sec})$$

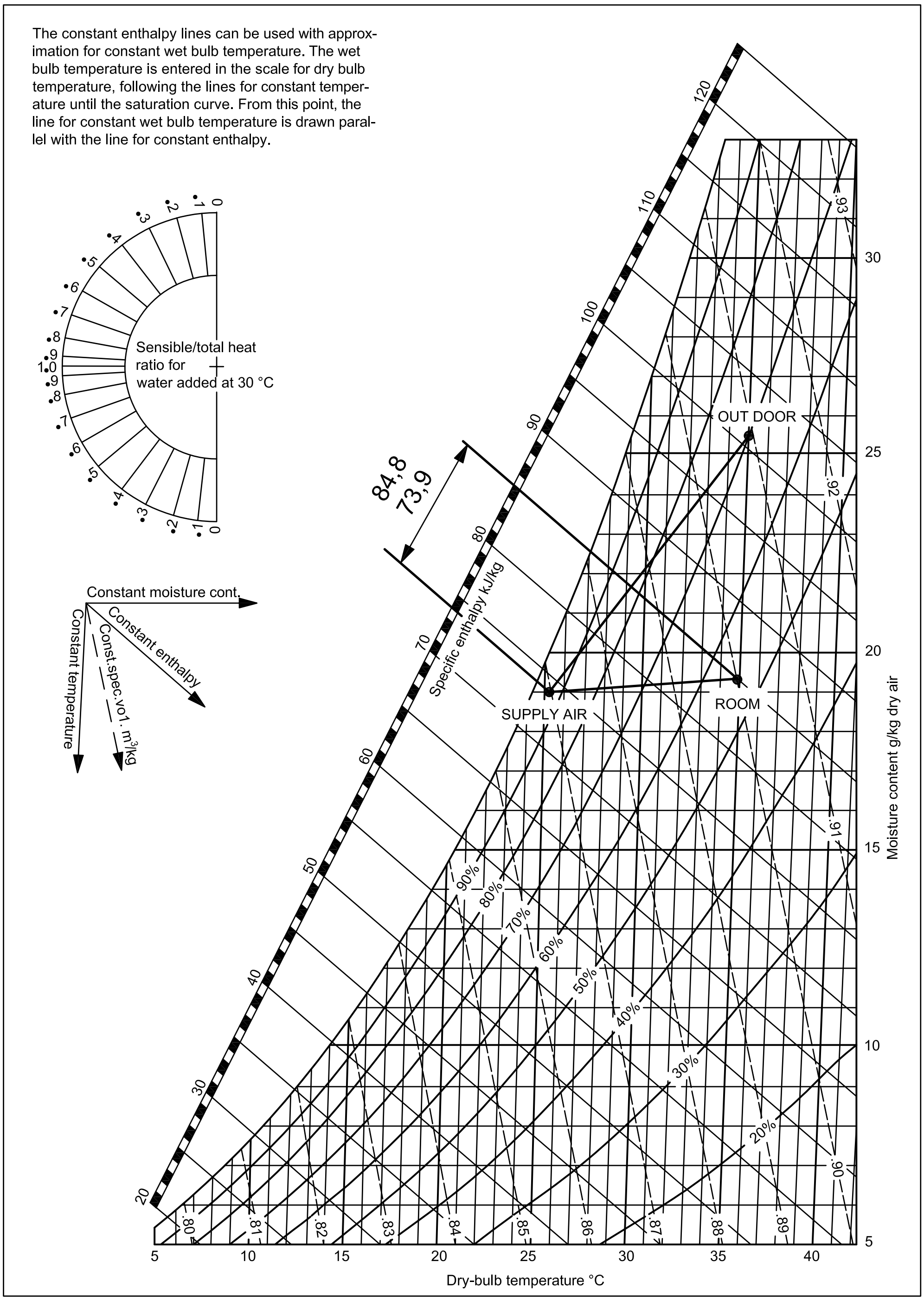
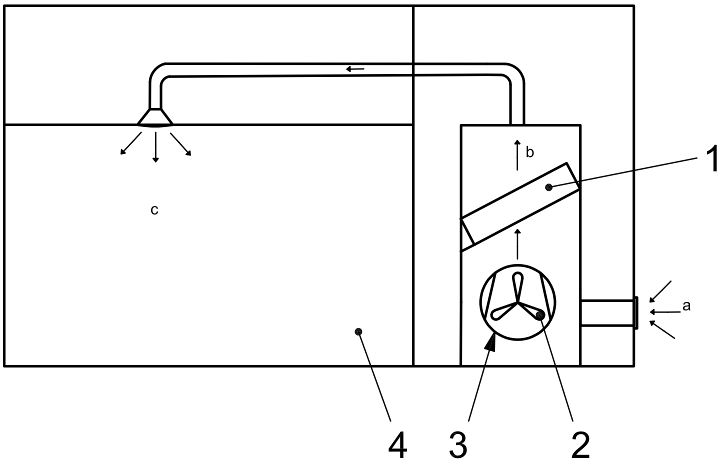


Figure C.1 — Enthalpy difference in psychometric chart based on a barometric pressure of 1 013 mbar

Annex D
(informative)

Galley ventilation/conditioning process



Key

1 air cooler

2 fan

3 air conditioning unit

4 galley

a Outside air at 35 °C, 70 % RH.

b Airstream at 25 °C.

c Room temperature 35 °C. RH is dependent on RSHF.

Figure D.1 — Example schematic of galley ventilation/conditioning process

ICS 47.020.90

Price based on 12 pages