International Standard 5708

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Refrigerated bulk milk tanks

Refroidisseurs de lait en vrac

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5708 was developed by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, and was circulated to the member bodies in March 1981.

It has been approved by the member bodies of the following countries :

Austria	Ireland	South Africa, Rep. of
Belgium	Italy	Spain
Denmark	Korea, Rep. of	Sweden
Egypt, Arab Rep. of	Netherlands	United Kingdom
Finland	New Zealand	USSR
India	Portugal	
Iran	Romania	

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Australia
Czechoslovakia
France
Germany, F. R.

Printed in Switzerland

Contents

Refrigerated bulk milk tanks

Section one : General

1 Scope

This International Standard specifies certain requirements for design, construction and performance of refrigerated bulk milk tanks and the related methods of test.

NOTE — Electrical safety regulations are not dealt with this International Standard.

2 Field of application

This International Standard applies to refrigerated bulk milk tanks with automatic control intended for fixed or mobile installation in farms or at milk collecting points. It only applies to tanks for two milkings (24 h) and four milkings (48 h).

3 References

ISO/R 468, *Surface roughness.*

ISO 683/13, *Heat-treated steels, alloy steels and freecutting steels — Part 13 : Wrought stainless steels.*

ISO/R 1662, *Refrigerating plants — Safety requirements.*

ISO 1992/2, *Commercial refrigerated cabinets — Methods of test — Part 2 : General test conditions.*

Code of principles concerning milk and milk products, International Standards and standard methods of sampling and analysis for milk products; Seventh edition 1973, Joint FAO/WHO Food Standards Programme, Codex Alimentarius Commission.

International Standard for drinking-water, Third edition 1971, World Health Organization, Geneva.

4 Definitions

For the purpose of this International Standard, the following definitions apply :

4.1 refrigerated bulk milk tank : Equipment for bulk refrigeration and bulk storage of refrigerated fresh raw milk.

4.2 automatic control : Arrangement by which the equipment functions, under normal operating conditions, without requiring action by the operator.

4.3 atmospheric tank : Tank of which the inner vessel is designed to operate at atmospheric pressure.

4.4 vacuum tank : Tank of which the inner vessel is designed to operate at a pressure below atmospheric pressure.

4.5 agitator : Device to mix the milk to promote heat transfer and to ensure uniform distribution of butterfat.

4.6 reference position : The position specified by the manufacturer for correct installation and operation of the tank.

4.7 maximum volume : Volume to which the inner vessel in its reference position and without agitation can be filled without overflowing.

4.8 rated volume : Volume of the maximum permissible filling of the tank stated by the manufacturer.

4.9 direct cooling system : Cooling system in which the evaporator of the refrigerating system is in direct thermal contact with the milk or the inner vessel.

4.10 indirect cooling system : Cooling system in which the heat is transferred from the milk to the refrigerant through a cooling medium.

4.11 ice bank tank : Tank with an indirect cooling system in which the cooling medium is water and ice is built on the evaporator.

4.12 milking : Quantity of milk which at one milking operation is added to the tank.

4.13 tank for two milkings : Tank intended to be emptied for milk collection each day and designed for cooling and storing its rated volume every 24 h.

4.14 tank for four milkings : Tank intended to be emptied for milk collection every two days and designed for cooling and storing its rated volume every 48 h.

4.15 normal operating conditions : State during which the tank is in use for the cooling and storage of milk in accordance with its design requirements and all accessories are functioning effectively.

4.16 ambient atmosphere : Atmosphere surrounding the tank and in front of the air-cooled condenser of the refrigerating plant.

4.17 ambient temperature : Mean temperature of the ambient atmosphere. [See 15.1.]

4.18 performance temperature (PT) : Ambient temperature to be used when measuring the milk cooling time.

4.19 safe operating temperature (SOT) : Higher limit of the range of ambient temperatures at which the equipment is required to function effectively.

4.20 initial temperature : Mean temperature of the milk to be cooled at the time of its entry into the tank.

4.21 storage temperature : Mean temperature to which the milk to be cooled is reduced for storage.

4.22 cooling time : Time required to cool a milking from the initial temperature to the storage temperature, including the period of entry into the tank.

4.23 cooling cycle : Period between two successive milk collections. For tanks for two milkings the cooling cycle is 24 h. For tanks for four milkings the cooling cycle is 48 h.

4.24 specific energy consumption : Energy consumption in watt hours per litre cooled milk, measured as the mean consumption of all components (excluding cleaning) during a cooling cycle under the test conditions appropriate to the performance class.

For the purpose of the methods of test, the following additional definitions also apply :

4.25 milk : Normal bovine mammary secretion obtained from one or more milkings without either addition thereto or extraction therefrom, untreated and not standardized, complying with *Code of principles concerning milk and milk products, international standards and standard methods of sampling and analysis for milk products*, of the Joint FAO/WHO Food Standards Programme.

4.26 water : Water, suitable for human consumption, meeting the requirements specified in *International standards for drinking-water* of the World Health Organization.

4.27 "milk" : Water used for test purpose in place of milk (the cooling time for water is nearly the same as that for milk).

4.28 "milking" : Volume of "milk" measured at a temperature of 4 °C which is fed into the tank in place of a milking.

4.29 filling : Volume of the milk (or "milk") in the tank measured at a temperature of 4 °C.

4.30 temperature of the milk (or "milk") : Mean temperature of the milk (or "milk") at a particular moment. [See 15.5.]

4.31 hot point of the milk (or "milk") : Maximum temperature of the milk (or "milk") at a given point during storage.

Section two : Requirements

5 Materials

The inner vessel and all attachments which are in, or may come into, contact with milk shall be manufactured from austenitic stainless steel or from a material approved by an appropriate official authority.

The grade of steel shall be of a quality at least equivalent to that of steel 11 in Part 13 of ISO 683, especially in regard to suitability for welding and resistance to corrosion. All joints shall be welded and ground and shall have a strength and corrosion resistance not less than that of the parent metal.

Stainless steel surfaces shall have a surface roughness $R_a \leqslant 1{,}0$ µm, where R_a is as defined in ISO/R 468.

Materials used for seals shall be fat-resistant, non-toxic, resistant to cleaning and disinfecting agents in normal conditions of dosage and temperature and shall not impart a taint to milk.

6 Construction

6.1 General

The tank and associated equipment shall be designed to provide sufficient mechanical strength to allow its transportation and handling and to give satisfactory and safe operation under normal conditions. It shall be so constructed as to prevent any contamination of the milk and any corrosion of the materials of construction and to enable cleaning, disinfection and inspection to be carried out without difficulty.

6.2 Inner vessel

The inner vessel shall be so designed that the rated volume is 90 to 95 % of the maximum volume (see clause 4).

All inside corners of the inner vessel which form an angle of less than 2,36 radians (135°) shall have radii not less than 25 mm (see figure 1). All other corners in the inner vessel shall have radii not less than 3 mm.

Every component which is permanently attached within the inner vessel shall be welded to it. The welds shall have radii not less than 6 mm and the angles shall be not less than 1,57 radians (90°). Any component not satisfying these requirements shall be capable of being removed.

If the tank is fitted with automatic or semi-automatic cleaning equipment, care shall be taken to ensure that all internal surfaces of the inner vessel will be cleaned effectively when the equipment is used in accordance with the manufacturer's instructions.

If the tank is equipped with a device for measuring the volume of milk by reference to linear measurements in accordance with the regulations of the relevant authorities, the inner vessel shall be so constructed and supported that it is rigid and free from deformation under normal conditions of transport and use.

6.3 Outer casing

The outer casing shall be rigid, shall prevent the ingress of water and shall be free draining.

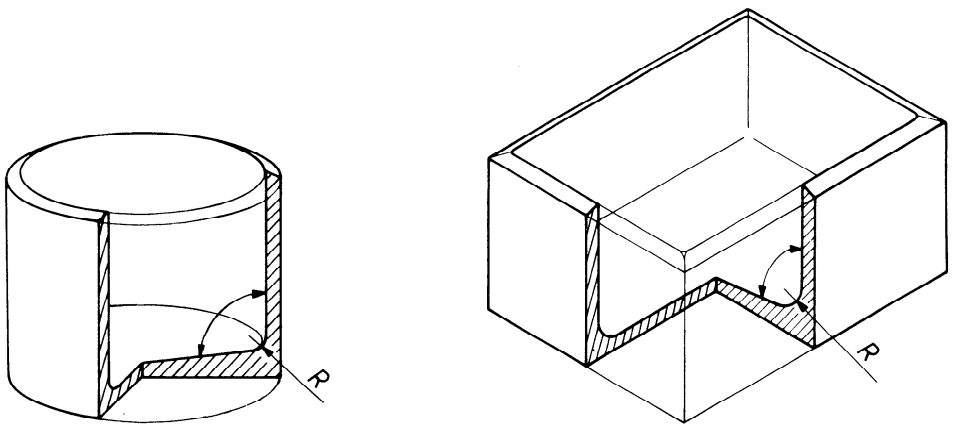

Figure 1 — Examples of inside corners less than 2,36 radians (135°) with radii R

6.4 Thermal insulation

The insulating medium shall be non-settling and shall not be liable to displacement during transportation or service.

Adequate provision shall be taken to ensure that the thermal insulation will comply permanently with the requirements of 11.4.

6.5 Supports

A tank which is not designed for mounting on a solid plinth shall be fitted with adjustable supports or feet to permit it to be placed in its reference position when installed on a floor with a gradient not greater than 1 in 50 in any direction so long as the fall of the floor between the supports is not greater than 50 mm.

If the tank is equipped with a device for measuring the volume of milk by reference to linear measurements in accordance with regulations of the relevant authorities, the supports or feet shall be so constructed that they can be sealed after the tank has been levelled.

The distance between the tank and the floor shall be such that the base of the tank (with the exception of the supports or feet and the outlet pipe) when installed on a horizontal floor shall be situated above two imaginary planes having a gradient of 1 in 10 to the horizontal, the line of intersection being horizontal and 100 mm above the floor (see figure 2). For the distance between the outlet and the floor, see 6.9.

If the tank is designed to be mounted on a solid plinth, the above requirements do not apply but precautions shall be taken to ensure that water cannot enter between the tank and the plinth.

These requirements do not apply to tanks intended for mobile installation.

6.6 Covers

A tank shall be provided with one or more close-fitting self-draining covers which overlap the opening(s) in the inner vessel and have downturned edges. Covers shall allow easy inspection and sampling of the milk.

The tank shall be so constructed that it can be filled without requiring removal of the above cover(s).

Any bridge or bracket required to be supported from the inner vessel shall be welded to it, shall be provided with upturned edges not less than 10 mm high and shall be sloped to drain clear of the inner vessel. Every component which is permanently attached to the bridge shall be welded to it.

All apertures in covers and/or bridges shall be provided with an upturned edge not less than 5 mm high for apertures up to 70 mm diameter or not less than 10 mm high for apertures over 70 mm diameter. For every aperture an overlapping cover or deflector shall be provided.

The covers for tanks designed to be cleaned manually shall be so constructed that they can be opened sufficiently to enable all parts to be cleaned easily by hand. Safe support shall be provided for hinged covers in the open position. Where appropriate, provision shall be made to ensure the safety of the operator during cleaning.

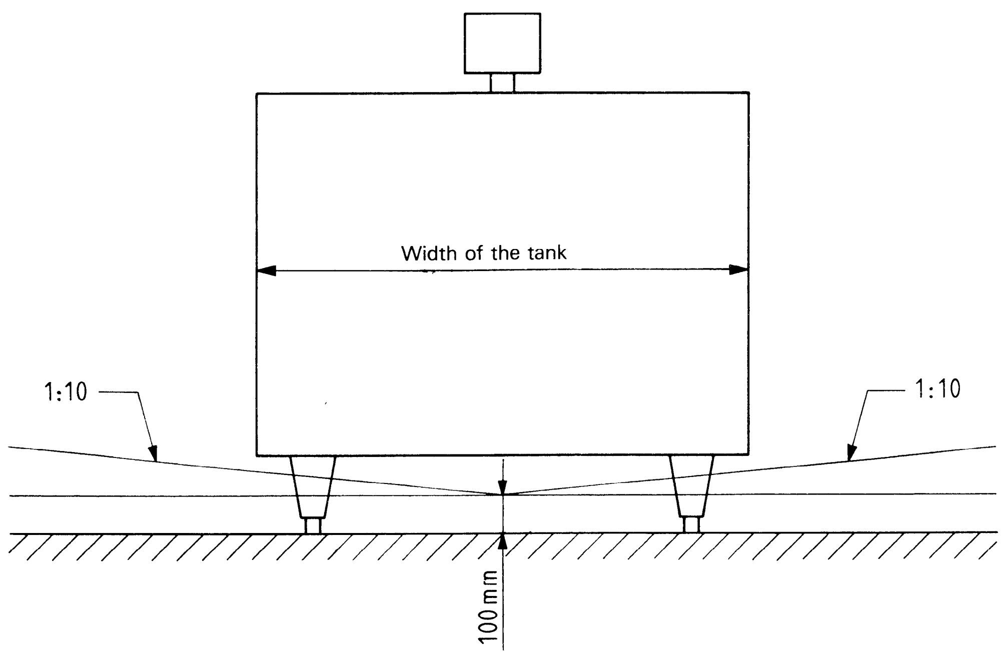

Figure 2 — Clearance between tank and floor

The covers for tanks designed to be cleaned by non-manual methods shall permit inspection of all parts which may come into contact with milk. These tanks shall have not less than one opening with dimensions at least equivalent to an ellipse 400 mm × 300 mm.

Small tanks where the greatest inside dimension of the inner vessel (including the diagonal) does not exceed 700 mm shall have not less than one opening with a diameter not less than 180 mm.

6.7 Agitator

The agitation device shall be so constructed that protection is provided against any contamination of the milk which could enter from outside.

The agitator shall be so guarded that operators cannot come in contact with moving parts. This protection may be provided as follows :

a) For agitators attached to the cover of refrigerated tanks and/or for immersion coolers with a circumferential force greater than 50 N and/or a circumferential speed greater than 1,8 m/s at the end of the blades, special equipment shall be provided to disconnect the agitator automatically when lifting the cover of the refrigerated tank. For equipment where the agitator is not disconnected automatically when the cover is raised, the cover shall be clearly and visibly marked to indicate that the agitator must be stopped before the cover is opened. This notice must be written in the language of the country in which the tank is installed.

b) No projecting parts shall be present on the agitator shaft with the exception of the agitator blades and accessories for the cleaning system. These parts shall be free from sharp edges.

The agitator shall be so designed that it can be cleaned effectively. If the tank is fitted with automatic or semi-automatic cleaning equipment care shall be taken to ensure that the agitator will be cleaned effectively when the equipment is used in accordance with the manufacturer's instructions.

The lowest point at which milk could enter a coupling on an agitator shall be at least 30 mm above the level of milk which corresponds to maximum volume.

Agitator shaft seals shall be of robust construction and shall be so designed that no condensed water vapour, oil or other substances liable to cause contamination can enter the inner vessel.

For performance requirements see 11.6.

6.8 Milk inlet

The tank shall be provided with not less than one inlet pipe or with not less than one inlet aperture or with both.

Where an inlet pipe is part of the tank it shall be so designed that the formation of froth is prevented as far as practicable.

Where an inlet aperture for pouring is provided it shall have a diameter of not less than 180 mm.

6.9 Outlet

The tank shall be provided with an outlet for wash water. The outlet orifice and the bottom of the inner vessel shall be designed so that all the wash water drains to the outlet.

When the outlet is designed to be used also as a milk outlet, the following requirements shall apply :

a) The highest point of the inside of the outer end of the outlet pipe (see figure 3), including outlet valve, shall be lower than the lowest part of the bottom of the inner vessel.

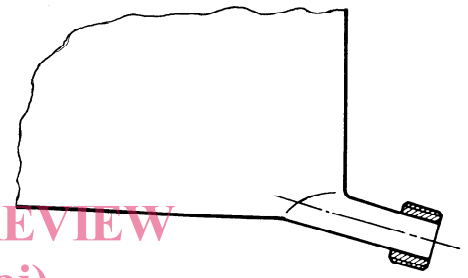

Figure 3 — Outlet position (broken lines horizontal)

b) The outlet pipe shall be constructed from stainless steel and shall have an inner diameter of 50 ± 3 mm. The outlet pipe shall have not more than one bend and one joint. The outlet valve or, if there is no valve, the outlet pipe, shall terminate with a male fitting which shall be provided with a cap. The total length of the outlet shall be as short as practicable.

c) The ground clearance under the outlet fitting shall not be less than 100 mm.

d) When a plug and rod device is used, it shall be so designed that the plug seals without the rod having to be clamped in position. The plug and rod device shall remain clear of the milk agitator in the open position and shall not interfere with the draining of the milk.

e) With the tank in its reference position and containing 40 l of milk, at least 39,8 l shall run out in 1 min by gravity.

f) In order to avoid excessive quantities of air being drawn in when a tank is designed for rapid transfer from the outlet it shall satisfy the dynamic drainage test in 16.9.2. This test will not be required if the tank complies with the following :

— with the tank in its reference position all parts shall drain to the outlet with a slope of not less than 1 in 20 for rectangular tanks or 1 in 15 across the diameter through the outlet for vertical cylindrical tanks;

— the tank shall have a circular or elliptical outlet well not less than 25 mm deep and of diameter not less than 100 mm nor more than 200 mm (see figure 4).

Dimensions in millimetres

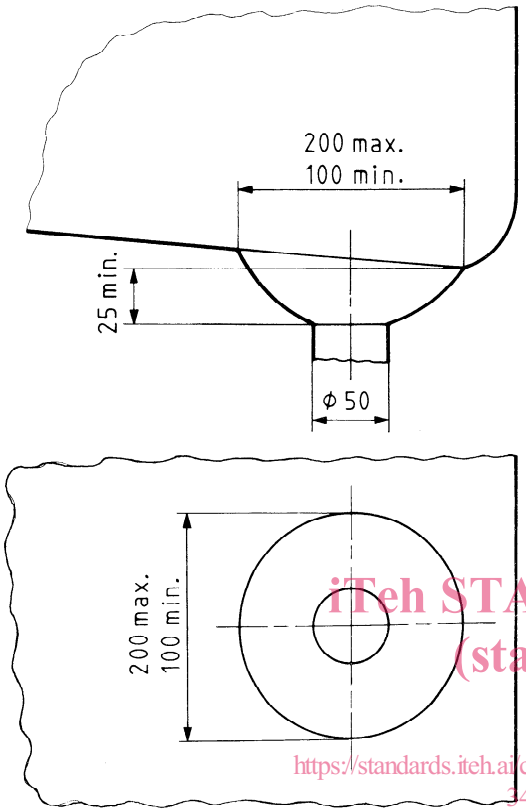

Figure 4 — Dimensional criteria for outlet well

6.10 Vacuum tank

A vacuum tank shall meet the performance requirements when subjected to an internal working vacuum up to 80 kPa (0,8 bar) i.e. an absolute pressure of approximately 20 kPa (0,2 bar).

The sealing of a vacuum tank shall be such that when the vacuum in the tank is 50 kPa (0,5 bar) and the agitator is either stationary or in operation the volume of air admitted is not greater than 5 l of free air per min.

6.11 Ice bank tank

An ice bank tank shall be designed so that in the event of a failure in the ice bank controller neither the inner vessel nor the outer casing shall suffer any damage.

The container for chilled water shall be of a size to ensure that the ice bank control and circulation system can operate satisfactorily and sufficient ice can be formed to cool 60 % of the rated volume of a tank for two milkings, or 30 % of the rated volume of a tank for four milkings, from 35 to 4 °C without further operation of the refrigerating system.

The equipment shall be designed to ensure that ice re-forms regularly over the whole evaporator surface.

Adequate provision shall be made to permit inspection of the ice bank.

The container for chilled water shall be designed so that the water can be changed without difficulty.

7 Controls

7.1 Milk temperature control

The equipment for the control of the milk temperature shall operate satisfactorily (see 11.4) with any volume of between 10 % and 100 % of the rated volume at milk temperatures from 0 to 35 °C.

It shall also be capable of withstanding, without loss in calibration, temperatures inside the inner vessel − 10 to + 70 °C and ambient temperatures from − 10 °C to the specified safe operating temperature (SOT).

Provision shall be made to ensure that cooling starts as soon as practicable after commencing to add the second and following milkings.

7.2 Control of ice bank

An ice bank tank shall be fitted with an independent control for the condensing unit which will automatically control the amount of ice and will operate satisfactorily in ambient temperatures from 10 °C to the specified safe operating temperature (SOT), so that for any volume of milk between 10 % and 100 % of the rated volume the ice bank will be adequate to ensure compliance with the requirements of 11.2 and 11.3.

This control shall ensure that excessive ice cannot form in the chilled water container so as to prevent effective functioning of the equipment.

7.3 Switchgear

Not less than one duty selection switch incorporating a marked OFF position shall be provided.

Except where the milk agitator is designed to operate continuously during cooling and storage or where automatic delay is provided (see below), the milk agitator and the condensing unit of a direct cooling system, or the cooling medium circulation of an indirect system, shall normally operate together and shall be controlled automatically by the milk temperature controller. An over-riding manual switch shall also be provided.

With indirect cooling systems, the operation of the condensing unit shall be controlled automatically by the ice bank controller or cooling medium thermostat. An over-riding manual switch shall also be provided.

Except where the tank is intended for direct pick-up without extra agitation before sampling, a time switch shall be provided to operate the milk agitator independently from other components for a period of not less than 2 min.

A milk temperature controller which automatically delays the start of the milk agitator during the first filling until the milk temperature is reduced to a predetermined value may be provided. It shall be designed so that when the agitator starts the control is re-set automatically to comply with the requirements of 11.4.

A periodic time switch may be fitted to operate the milk agitator for pre-set periods at pre-set intervals independently from other components.

Provision shall be made to operate the milk agitator during automatic cleaning.

8 Measuring equipment

8.1 Instrument for measuring milk temperature

Every tank shall be provided with an instrument to measure the temperature of the milk at any volume between 10 % and 100 % of the rated volume.

If detachable instruments are used they shall be suspended above the maximum level of the milk and shall be easily accessible.

Glass thermometers shall not be used unless they are fitted with a suitable protective casing to prevent milk coming into contact with the glass.

The instrument shall comply with the requirements of 6.1 and shall be suitably protected to ensure that neither dust nor liquid can enter it.

The instrument shall be capable of withstanding, without loss in calibration, temperatures inside the inner vessel from − 10 to + 70 °C and ambient temperatures from − 10 °C to the specified safe operating temperature (SOT).

The instrument shall not penetrate the inner vessel.

The instrument shall be fitted with a graduated scale which shall be easily legible and preferably fitted on the side from which the tank is emptied. The temperature scale shall be graduated in degrees Celsius with one division per degree Celsius up to 12 °C and shall be marked from at least 0 to 40 °C. In the range from 2 to 12 °C the scale length shall be not less than 20 mm. On instruments fitted with circular scales, the scale length is read along a circle described by the tip of the pointer or along a circle through the outer ends of the strokes of one division per degree Celsius whichever is the less. In the case of digital indication the height of the figures shall be not less than 6 mm.

In ambient temperatures from 5 °C to the specified performance temperature (PT), the error of the instrument shall not be greater than 1 °C between 2 and 12 °C, when the milk temperature is changing at a rate of not more than 10 °C/h.

8.2 Dipstick

If the tank is equipped with a dipstick for measuring the milk volume it shall comply with the requirements of clause 5 and 6.1.

The dipstick shall be graduated from 10 % or less to not less than 100 % of the rated volume. Each division on the dipstick shall represent a volume not greater than 0,5 % of the rated volume.

9 Refrigerating equipment

The refrigerating equipment shall be adequately protected against corrosion and shall comply with ISO/R 1662, taking into account possible differences in safety requirements of national legislation.

The condensing unit shall be selected so that the refrigerating system satisfies the requirements of 11.2 and it operates satisfactorily in ambient temperatures between 5 °C and the specified performance temperature (PT).

10 Electrical equipment

The electrical equipment shall be capable of ensuring continuous operation of the refrigerating equipment.

11 Performance

11.1 Performance classes

The performance of a tank shall be specified according to the following classification :

11.1.1 Number of milkings

The numeral "2" designating a tank for two milkings.

The numeral "4" designating a tank for four milkings.

11.1.2 Ambient temperature

Classification	Performance temperature (PT) °C	Safe operating temperature (SOT) °C
A	38	43
B	32	38
C	25	32

11.1.3 Milk cooling time

Classification	Cooling time in hours	
	All milkings 35 to 4 °C	Second milking 10 to 4 °C
I	2,5	0,8
II	3,0	1,5
III	3,5	1,75
IV	1)	1)

1) The performance and related conditions are to be given by the manufacturer, for example in the case of pre-cooling.