

Specification for

Capacity and performance of refrigerated farm milk tanks

Co-operating organizations

The Dairying Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Association of Public Analysts
- Chemical Society
- Dairy and Ice Cream Equipment Association
- Dairy Engineers' Association*
- Department of Agriculture and Fisheries for Scotland
- Embassy of the Republic of South Africa
- Hannah Dairy Research Institute
- Milk Distributive Council*
- Milk Marketing Board*
- Milk Marketing Board for Northern Ireland*
- Ministry of Agriculture, Fisheries and Food*
- Ministry of Health
- Ministry of Technology — Laboratory of the Government Chemist
- National Association of Creamery Proprietors and Wholesale Dairymen
- National Farmers' Union
- National Institute for Research in Dairying*
- National Physical Laboratory (Ministry of Technology)
- Office of the High Commissioner for Australia
- Office of the High Commissioner for Canada
- Office of the High Commissioner for New Zealand
- Royal Association of British Dairy Farmers
- Royal Institute of Public Health & Hygiene
- Royal Society for the Promotion of Health
- Scottish Milk Marketing Board*
- Scottish Milk Trade Federation
- Society for Analytical Chemistry
- Society of Chemical Industry
- Society of Dairy Technology*
- University of Reading

The Government department and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Agricultural Engineers' Association
- Aluminium Federation
- Board of Trade
- British Iron and Steel Federation
- British Plastics Federation
- British Refrigeration Association
- Electricity Council, the Generating Board and the Area Board in England and Wales
- Institute of Refrigeration
- Institute of Weights & Measures Administration
- Milking Machine Manufacturers' Association
- Scottish Home & Health Department

This British Standard, having been approved by the Dairying Industry Standards Committee and endorsed by the Chairman of the Chemical Divisional Council, was published under the authority of the General Council on 8 February 1966

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Foreword

This standard makes reference to the following British Standard:

BS 696, *Gerber method for the determination of fat in milk and milk products*.

This British Standard, published under the authority of the Dairying Industry Standards Committee, covers the essential performance requirements of refrigerated farm milk tanks when cooling milk. These performance requirements are similar to those which must be met by tanks approved by the United Kingdom Milk Marketing Boards.

Details of tests to check performance are given and in the case of daily refrigeration capacity and rate of cooling alternative tests using milk or water are included. The choice of test liquid for the refrigeration capacity and rate of cooling tests will not affect the result obtained, within the limits of experimental error. A form of report is also given.

The standard does not include any requirements concerning materials, dimensions or methods of construction.

NOTE Where metric equivalents are stated, the figures in British units are to be regarded as the standard. The metric conversions are approximate and more accurate conversions should be based on the tables in BS 350, "*Conversion factors and tables*".

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 Scope

This British Standard specifies the capacity and performance requirements of two classes of refrigerated farm milk tank:

- a) Class ED for cooling and holding milk at temperatures at or below 40 °F (4.4 °C) for every day collection of milk.
- b) Class AD for cooling and holding at temperatures at or below 40 °F (4.4 °C) for alternate day collection of milk.

The following types of tanks are included:

Directly refrigerated, in which the refrigeration unit has a sufficient extraction rate to cool the milk at the specified rate.

Indirectly refrigerated, in which the refrigeration unit has insufficient extraction rate to cool the milk at the specified rate and therefore requires a thermal storage system commonly of the chilled water and ice-bank type.

2 Designation of capacity

Each farm milk tank shall be designated by its "rated capacity".

3 Method of testing performance

The performance of a refrigerated farm milk tank at its rated capacity shall be tested in accordance with Appendix A or Appendix B as agreed between the purchaser and supplier. (See Appendix C for a suitable test report.)

4 Thermal insulation

- a) With indirectly refrigerated systems the thermal insulation shall ensure that the average heat leakage rate during the eight hour thermal insulation test, expressed in Btu/h per gallon (kcal/h per litre) of rated tank capacity, shall not exceed 10 Btu/h (2.5 kcal/h) per gal (4.5 litres) at 50 gallon (227 litres) rated capacity with a linear variation to 6 Btu/h (1.5 kcal/h) per gal (4.5 litres) at 250 gallon (1 135 litres) rated capacity with a further linear variation to 4.75 Btu/h (1.2 kcal/h) per gal (4.5 litres) at 500 gallon (2 270 litres) rated capacity and above.
- b) With directly refrigerated systems the thermal insulation shall ensure that the average heat leakage rate shall not exceed 60 % of the values in Sub-clause 4 a).

5 Milk agitation

The means of milk agitation provided to give thorough mixing of the milk and to promote heat transfer shall be effective down to 10.0 % of the rated capacity of the tanks and shall not cause "buttering" or spillage. The agitation shall be such as to produce throughout the contents of the tank a butterfat distribution uniform to within a range of 0.1 % butterfat in a period not exceeding 2 minutes in milk previously cooled to 40 °F (4.4 °C) and left undisturbed for 6 hours.

6 Milk thermometer

- a) When tested independently of the tank the instrument shall not have an error exceeding 2 degF (1 degC) at 40 °F (4.4 °C) in ambient temperatures of 20 °F (– 6.7 °C) and 90 °F (32.2 °C) when the observed temperature is changing at a rate of 1 degF (0.5 degC) in one minute in either direction. When testing for this requirement depths of immersion of the sensitive element shall be those corresponding to 10.0 % and 100.0 % of the rated capacity.
- b) When installed in its operating position on the tank, with the same setting as that applicable in Subclause 6 a), in ambient temperatures of 20 °F (– 6.7 °C) and 90 °F (32.2 °C), the instrument shall not have an error exceeding 2 degF (1 degC) at 40 °F (4.4 °C) when the temperature is falling under the action of the cooling system with the tank filled to 10.0 % of rated capacity and upwards.
- c) The range of the thermometer shall extend from not more than 30 °F (– 1.1 °C) to not less than 100 °F (37.8 °C). The scale shall cover not more than 20 degF/in (4 degC/cm) of scale length in the range 40 °F (4.4 °C) to 50 °F (10.0 °C). The design of the thermometer shall be such that the indicated temperature can be read easily.

7 Ice-bank controller

- a) The ice-bank control system, if any, shall automatically regulate the size of the ice-bank in ambient temperatures of 20 °F (– 6.7 °C) to 90 °F (32.2 °C).
- b) The ice-bank shall not deform the inner vessel at any time.

8 Refrigeration duty

- a) *Class ED tanks*. Class ED tanks shall have refrigerating equipment of a capacity sufficient to perform the following daily duty:
 - i) Cool 100.0 % of rated tank capacity from 95 °F (35.0 °C) to 40 °F (4.4 °C) or below,

- ii) Remove all stray heat gains,
- iii) Remove heat input resulting from the addition to the cold empty tank of a quantity of wash water at a temperature of 75 °F (23.9 °C) equivalent to 7.5 % of the rated tank capacity,

all in an ambient temperature of 90 °F (32.2 °C) with condenser water (where used) at 75 °F (23.9 °C) inlet and 90 °F (32.2 °C) minimum outlet temperatures.

b) *Class AD tanks.* Class AD tanks shall have refrigerating equipment of a capacity sufficient to perform the following daily duty:

- i) Cool 50.0 % of the rated tank capacity from 95 °F (35.0 °C) to 40 °F (4.4 °C) or below,
- ii) Remove all stray heat gains,
- iii) Remove heat input resulting from the addition to the cold empty tank of a quantity of wash water at a temperature of 75 °F (23.9 °C) equivalent to 7.5 % of the rated tank capacity,

all in an ambient temperature of 90 °F (32.2 °C) with condenser water (where used) at 75 °C (23.9 °C) inlet and 90 °F (32.2 °C) minimum outlet temperatures.

9 Milk cooling performance

The milk cooling performance of tanks of Classes ED and AD shall comply with the following requirements:

a) *Class ED tanks.* The whole contents of the tank in an ambient temperature of 90 °F (32.2 °C) shall reach a temperature of 40 °F (4.4 °C) in not more than 30 minutes from completion of the following procedure:

- i) The tank shall contain 40 % of its rated capacity at 40 °F (4.4 °C) or at such lower temperature as is normally attained after overnight storage.
- ii) Test medium at a temperature of 95 °F (35.0 °C) equivalent to 60.0 % of the rated tank capacity shall be added at a uniform rate over a period of 2 hours.

b) *Class AD tanks.* The whole contents of the tank in an ambient temperature of 90 °F (32.2 °C) shall reach a temperature of 40 °F (4.4 °C) in not more than 30 minutes from completion of the following procedure:

- i) The tank shall contain 70.0 % of its rated capacity of milk at 40 °F (4.4 °C) or at such lower temperature as is normally attained after overnight storage.

- ii) Test medium at a temperature of 95 °F (35.0 °C) equivalent to 30.0 % of the rated tank capacity shall be added at a uniform rate over a period of 2 hours.

10 Control of milk temperature

a) The control of milk temperature shall be such that the main milk cooling operation and any subsequent cooling cycles are terminated within the temperature range 40 °F (4.4 °C) to 37 °F (2.8 °C). Any further fall in milk temperature due to static cooling shall be ignored. This requirement shall be met with any milk volume in excess of 10.0 % of the rated capacity of the tank in ambient temperatures of 20 °F (– 6.7 °C) and 90 °F (32.2 °C).

b) In respect of milk volumes in excess of 10.0 % of the rated capacity of the tank, in an ambient temperature of 90 °F (32.2 °C), the temperature of the milk during storage at any point in the tank shall not exceed 48 °F (8.9 °C) and the mean temperature shall not exceed 40 °F (4.4 °C).

11 Operation at low ambient temperatures

The tank and all its components and auxiliary services shall be capable of operation without damage in ambient temperatures down to 20 °F (– 6.7 °C).

12 Prevention of freezing

The refrigeration system shall not cause either milk or moisture to freeze on the inner walls of the milk vessel.

13 Marking

Tanks shall be visibly and indelibly marked with the following information:

- a) Class of tank (see Clause 1) and serial number.
- b) Rated capacity (see Clause 2).
- c) Manufacturer's name or identification.
- d) The number of this British Standard, i.e. BS 3976.

Items a) and b) shall be stamped or engraved on the upper part of the outside of the milk vessel above the outlet pipe.