SLOVENSKI STANDARD
SIST EN 16764:2016

01-marec-2016

Stroji za izdelavo sladoleda - Lastnosti in vrednotenje porabe energije

Soft ice cream machines - Performance and evaluation of energy consumption

Automaten für Eiskrem und gefrorenen Nachspeisen - Bestimmung von Leistungsmerkmalen und Energieverbrauch

Machines à glace à l'italienne - Performance et évaluation de la consommation d'énergie

Ta slovenski standard je istoveten z: **EN 16764:2016**

ICS:

67.260	Tovarne in oprema za živilsko industrijo	Plants and equipment for the food industry

SIST EN 16764:2016 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16764

January 2016

ICS 67.260

English Version

Soft ice cream machines - Performance and evaluation of energy consumption

Machines à glace à l'italienne - Performance et évaluation de la consommation d'énergie

Automaten für Eiskrem - Bestimmung von Leistungsmerkmalen und Energieverbrauch

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16764:2016 E

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European foreword

This document (EN 16764:2016) has been prepared by Technical Committee CEN/TC 44 “Commercial and Professional Refrigerating Appliances and Systems, Performance and Energy Consumption”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2016, and conflicting national standards shall be withdrawn at the latest by July 2016.

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1 Scope

This European Standard specifies requirements and test conditions of soft ice cream machines for processing ice cream and similar frozen desserts.

It defines machines performance characteristics and energy consumption, measured under specified conditions and test methods, using a reference test mix.

This European Standard applies to the following types of soft ice cream machines: commercial ice cream, soft serve and shake freezers, which freeze and dispense frozen product (e.g. dairy, yogurt), included are conventional operation and pasteurization phase. The equipment may include separate refrigeration systems for the frozen product and fresh mix and may be either air-cooled or water-cooled.

The soft ice cream machines are evaluated for the following performance:

— maximum energy input rate, or maximum current draw,

— production capacity,

— overrun,

— initial freeze-down energy consumption and duration,

— production energy consumption,

— idle energy consumption,

— stand-by energy consumption,

— pasteurization energy consumption (if applicable).

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
compression type machines
machines where the cooling is performed by means of a refrigerant liquid at low pressure in a heat exchanger (evaporator), the steam thus formed becomes a liquid by a mechanical compression higher pressure and cooling in another heat exchanger (condenser)

3.2
condenser
heat exchanger in which after compression, the vaporized refrigerant is liquefied, giving off heat to external cooling system

3.3
evaporator
heat exchanger in which, after the reduction of pressure, the refrigerant is vaporized by absorbing heat from the medium which is cooled

3.4
pasteurization phase energy consumption
phase during which test mix is heated for a time fixed to different type of pasteurization and then immediately cooled to conservation temperature, to avoid the bacteria's development

3.5
soft ice cream
frozen soft and creamy dessert usually made with ready mixes that can be liquid or dry to be rehydrated

3.6
overrun
percentage increase in volume due to the addition of air to frozen product; the calculation of the overrun is the ratio between the liquid mix and the frozen mix

3.7
initial freeze down energy consumption
time and energy consumption required for a soft ice cream machine to be ready to serve when loaded with unfrozen product

3.8
idle energy consumption
rate of energy consumed by the soft ice cream machine while maintaining the product in a ready-to-serve state without dispensing product

3.9
stand-by energy consumption or night conservation
rate of energy consumed by the soft ice cream machine while maintaining the product without dispensing

3.10
freeze-down energy consumption
amount of energy consumed by the soft ice cream machine while cooling the product to a servable temperature

3.11
freeze-down time
time required for the soft ice cream machine for cooling the product to a servable temperature

3.12
reference test mix
product specifically prepared for testing

3.13
production capacity
number of reference portions drawn-off per hour

3.14
reference portion
mass of drawn-off soft ice cream equal to 150 g

3.15
hopper
reserve tank for the liquid reference test mix, which is feeding the freezing cylinder of the machine

3.16
soft ice cream machine
multifunction machine to pasteurize, conserve and freeze liquid mix

Note 1 to entry: On demand the soft ice cream is immediately distributed.

3.17
product temperature (extrusion temperature)
temperature of the mix in the hopper and temperature of frozen product immediately after extrusion

4 Performance characteristics

4.1 General

In order to carry out the performance characteristics of a soft ice cream machine, start by loading with a non operating empty soft ice cream machine at the test room temperature (24 °C ± 3 °C). The reference test mix shall be refrigerated prior to any testing. Fill the hopper with refrigerated reference test mix (5 °C ± 1 °C) to the manufacturer's recommended level. Switch on the soft ice cream machine. Fill the cylinder(s) and start the initial freeze down phase.

4.2 Initial freeze down

Record energy consumption, elapsed time and water consumption (if applicable) of the initial freeze down. When the machine is ready, according to the instructions of the manufacturer, dispense four portions of 75 g of soft ice cream and measure the temperature at the centre of the mass of the fourth portion.

The soft ice cream characteristics shall be the following:

— temperature < –5 °C;
— overrun with gravity machines > 20 %;
— overrun with pressurization pump machines > 40 %.

4.3 Production capacity

Production capacity of the soft ice cream machine declared by the manufacturer shall be verified (see 5.4.2.2) by the number of reference portions and the mass of soft ice cream obtained per hour.

The soft ice cream characteristics shall be the following:

— temperature < –5 °C;
— overrun with gravity machines > 20 %;
— overrun with pressurization pump machines > 40 %.

4.4 Production energy consumption

Production energy consumption of the soft ice cream machine shall be measured (see 5.4.2.3) by drawing-off 150 g reference portions respecting time intervals of 60 s. Soft ice cream draw-off shall be done for 30 min.

The soft ice cream characteristics shall be the following:

— temperature < –5 °C;
— overrun with gravity machines > 20 %;
— overrun with pressurization pump machines > 40 %.

4.5 Idle energy consumption

Idle energy consumption of the soft ice cream machine shall be measured (see 5.4.3) checking that hopper mix temperature and energy consumption of the soft serve machine maintains product temperature for a minimum of 2 h.

4.6 Stand-by energy consumption

Stand-by energy consumption of the soft ice cream machine shall be measured (see 5.4.4) checking that hopper mix temperature and energy consumption of the soft serve machine maintains product temperature for a minimum of 4 h.

4.7 Pasteurization phase energy consumption

The machine shall be operated as long as necessary so that the reference mix reaches the heating temperature > 65 °C for 30 min and then proceed to the cooling phase to the storage temperature −5 °C. Record the elapsed pasteurization times, the pasteurization temperature and the energy consumption. Record the water consumption, if applicable.

4.8 Product temperature (extrusion temperature)

The product temperature of the frozen reference test mix (Clause 6) depends on the adjusting and setting of the freezing equipment and is directly related to the characteristics of the final product.

The extrusion temperature of the frozen reference test mix (Clause 6) affects the energy consumption of the soft ice cream machine.

4.9 Overrun

Generally during the freezing of the reference test mix (Clause 6) air enters in the freezing chamber and is blended into the frozen product.

The overrun of the frozen product (Clause 6) depends on the adjusting and setting of the freezing equipment and is directly related to the characteristics of the final product. The overrun obtained with the operation of the beater and the operation of the pressurization pumps (if foreseen) affects the energy consumption of the soft ice cream machine.

5 Energy consumption test

5.1 Test room

5.1.1 General design, walls, floor and radiant heat

The test room shall be a parallelepiped space in which two of the opposite side walls, referred to as the discharge technical side wall and the return technical side wall, are designed to create an even, horizontal air flow within the test room. By convention, the distance separating these two technical side walls is referred to as the “length” of the test room.

The minimum useful dimensions (length, width, height) of the test room shall be dependent on the overall dimensions (length, depth, height) of the machine to be tested.

The ceiling and the two non-technical side walls of the room shall be thermally insulated and shall be equipped with an inner metal skin.

A minimum insulation level equivalent to 60 mm of rigid polyurethane foam $\lambda = 0{,}03$ W/(m K) should be used for the building of a new test room.

The floor shall be made of concrete or of thermally equivalent material and/or shall be sufficiently insulated to ensure that external climatic conditions do not affect the floor temperature.