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Milking machine installations — Construction and performance

Installations de traite mécanique — Construction et performances

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Contents

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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 organisations, 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.

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.

International Standard ISO 5707 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, in collaboration with the International Dairy Federation (IDF) and the International Committee for Recording the Productivity of Milk Animals (ICRPMA), now named the International Committee for Animal Recording (ICAR).

This second edition cancels and replaces the first edition (ISO 5707:1983), which has been amended based on new scientific knowledge, field experiences and technical development.

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

Introduction

This International Standard was developed in response to worldwide demand for minimum specifications for milking machine installations. The basic requirements for the construction and performance of milking machines for animals are determined by the physiology of the animal and the need for a standard of high hygiene and milk quality. In addition, the equipment has to be effective, easy and safe to use and test.

Since most milking machines depend on a public electricity supply that fails occasionally, alternate means for operating the machine in such emergencies should be installed.

It is important to design and install the equipment so that noise levels in the cowshed or parlour and in the vicinity are as low as practicable and comply with requirements in national legislation.

Milking equipment and connection to milk storage facilities on the farm should be designed and maintained to minimize turbulence, frothing, foaming or agitation, thereby reducing physical damage to the milk fat and the development of free fatty acids.

Further safety and hygiene requirements will be covered by legislation that will be the subject of other International Standards.

Milking machine installations — Construction and performance

1 Scope

This International Standard specifies the minimum performance requirements and certain dimensional requirements for satisfactory functioning of milking machines. It also specifies requirements for materials, construction and installation.

This International Standard is applicable to milking machines intended for milking cows and water buffaloes. The qualitative requirements apply also to installations for milking sheep and goats.

This International Standard is not expected to apply in every respect to installations with special design features that are (or may be) available, such as:

— single-pipe pipeline milking installations;

— milking installations with double vacuum systems;

— milk extraction without pulsation;

— pulsation pump plants;

— small mobile installations that have an individual vacuum pump for each unit;

— separate air and milk transport milking machines;

— milking installations with compressed air pulsation systems or other special pulsation characteristics.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subjected to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 228-1:1994, *Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation.*

ISO 3918:—[1], *Milking machine installations — Vocabulary.*

ISO 4288:—[2], *Geometrical Product Specification (GPS) — Surface texture: Profile method — Rules and procedures for the assessment of surface texture.*

ISO 6690:—[3], *Milking machine installations — Mechanical tests.*

ISO/TR 12100-1:1992, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology.*

ISO/TR 12100-2:1992, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications.*

IEC 335-2-70:1993, *Safety of household and similar appliances — Part 2: Particular requirements for milking machines.*

3 Definitions

For the purposes of this International Standard, the following definition and those given in ISO 3918 apply.

3.1 ancillary equipment: all equipment powered by the same vacuum source as for the extraction of milk, but not directly used for milk extraction from an animal.

4 General

4.1 Tests for compliance

The requirements in this International Standard for characteristics established by mechanical testing are based on the tests described in ISO 6690, which shall, therefore, be applied for verifying compliance with this International Standard.

NOTE — The performance of an installation incorporating special design features is often difficult to determine under dry testing conditions. Special performance characteristics that are not covered by the requirements in this International Standard should be described and specified by the manufacturer in the instruction handbook.

4.2 Access for measurements

The connection points identified below can be accessed by dismantling parts of the milking machine.

4.2.1 To enable measurement of effective reserve, regulation loss and regulator leakage, a connection point shall be provided:

— at or near the receiver, upstream of the sanitary trap in pipeline milking machines;

— at the sanitary trap, or near the sanitary trap on the milking vacuum line, in recorder milking machines;

— between the regulator sensing point and the first vacuum tap in bucket or direct-to-can milking machines.

This connection point corresponds to point A1 in ISO 3918:—, figures 1, 2 and 3.

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1) To be published. (Revision of ISO 3918:1977)

2) To be published. (Revision of ISO 4288:1985)

3) To be published. (Revision of ISO 6690:1983)

In bucket and transport-can milking machines the connection point A1 is also used to measure airline leakage.

The connection shall have the same internal diameter as the airline or 48 mm, whichever is smaller.

4.2.2 To enable an air flow meter to be connected to measure milk system leakage and airline leakage in pipeline and recorder milking machines, a T-piece shall be fitted in the airline between the sanitary trap and the vacuum pump, so that the axis of the branch is above the centreline of the pipeline. The branch of the T-piece shall have the same internal diameter as the airline or 48,5 mm, whichever is smaller.

See measurement point A2 in ISO 3918:—, figures 2 and 3.

4.2.3 Additional connection points shall be provided for measuring vacuum level:

— at point A1 (Vm) or upstream of this point;

— near the regulator sensing point (Vr); and

— near the vacuum pump inlet (Vp).

See measurement points Vm, Vr and Vp in ISO 3918:—, figures 1, 2 and 3.

NOTES

1 The connection point at, or upstream of, A1 is called Vm. In a pipeline milking machine Vm can be any point in the milking system in, or upstream of, the receiver. In a recorder milking machine Vm can be in the milking vacuum line or in the nearest convenient recorder jar. In a bucket milking machine Vm can be combined with the connection point Vr or the nearest convenient vacuum tap.

2 These connection points should be at least five pipe diameters from any elbows, air inlet points, or other fittings creating air turbulence.

4.2.4 To enable measurement of exhaust back pressure, a suitable connection point shall be provided on the exhaust line near the vacuum pump outlet.

This connection point corresponds to point Pe in ISO 3918:—, figures 1, 2 and 3.

4.2.5 Means shall be provided to isolate the vacuum pump from the installation to facilitate the measurement of vacuum pump capacity.

4.3 Safety

Installations shall comply with the relevant safety requirements given in ISO/TR 12100-1 and ISO/TR 12100-2. The electrical components shall comply with the relevant safety requirements given in IEC 335-2-70.

NOTE — The significant hazards which require action to reduce risk are: crushing, shearing and slipping, tripping and falling hazards; electrostatic phenomena and external influences on electrical equipment; noise; unhealthy postures, inadequate local lighting and hazards caused by failure of the energy supply or disorder of the control system.

4.4 Cleaning

It shall be possible to check the installed cleaning and disinfecting system in accordance with the supplier's specification for the system.

NOTES

1 The critical factors in a circulation cleaning system are:

— design and installation of the equipment;

— volume of solutions used in the cleaning and disinfecting process;

— minimum temperatures of the solutions used in the cleaning and disinfecting process;

— chemical strength of the cleaning and disinfecting solutions;

— flow rates and the distribution of the cleaning and disinfecting solutions throughout the plant.

2 A velocity range of 7 m/s to 10 m/s is preferred, for the cleaning of pipelines with water-slugs.

3 Any recommended cleaning and disinfecting procedure that has been followed, is expected to:

— leave milk contact surfaces visibly free from milk residues and other deposits;

— leave surfaces free from undesirable residues of cleaning and disinfecting chemicals; and

— reduce the count of viable bacteria to an acceptable level.

4.5 Material

All components that are subjected to a vacuum shall be designed and constructed to withstand a minimum vacuum of 90 kPa, without permanent distortion.

Materials that may involve danger if damaged, such as glass, shall be designed using a safety factor of 5 against external pressure (i.e. 5 x 90 kPa).

All materials in contact with milk or cleaning solutions, whether used for rigid components (for example, buckets, pipelines or recorder jars) or flexible components (for example, joint rings, teatcup liners), shall be constructed to withstand the maximum temperature used in the plant as specified in the instructions. In addition, such materials, when used in accordance with the manufacturer's recommendations, shall not impart a taint to the milk.

All milk contact surfaces shall be free from engraving or embossing. All metal milk contact surfaces, except for welded seams, shall have a surface roughness, R_a, less than or equal to 2,5 µm when tested in accordance with ISO 4288. Surface roughness, R_a, on welded seams shall not exceed 16 µm.

Copper or copper alloys shall not be used in any part of the installation that may come into contact with milk or cleaning and disinfecting fluids other than water.

NOTE — Materials that come into contact with cleaning and disinfecting fluids, at normal use concentrations, should be suitable for such contact. Materials that also come into contact with milk should be made from materials resistant to both milk fat and cleaning and disinfecting solutions.

4.6 Instructions for use and maintenance

The installer shall provide written instructions for:

— operating procedures;

— cleaning and disinfecting procedures for the installation, including consumption of water;

— the maximum temperature at which the installation can be cleaned and disinfected; and

— the chemicals recommended.

Instructions shall also be given for routine servicing, including the replacement of individual parts.

The instructions shall be written in, at least, one of the official languages of the user's country.

At least the following design details shall also be provided:

a) the nominal vacuum level;

b) the vacuum pump capacity and rotational frequency at 50 kPa;

c) the effective reserve, plus an indication of any allowance;

d) the maximum number of units or maximum milk flow rate per slope of the milkline;

e) the releaser milk pump's discharge rate at 50 kPa working vacuum and 20 kPa discharge pressure;

f) the air consumption of vacuum-driven ancillary equipment, where fitted, at the maximum milk flow rate;

g) the pulsation rate and the pulsator ratio.

If it is intended that the user shall make adjustments, the manufacturer shall provide instructions for such adjustments. If special tools are required, these shall be supplied with the installation.

5 Vacuum pumps

The vacuum pump shall be capable of meeting the operating requirements (milking and cleaning) of the milking installation, together with those of other equipment, whether operating continuously or intermittently during milking and which create a demand for air.

NOTE — In addition to meeting the operating requirements, the vacuum pump should have sufficient capacity so that the vacuum drop in or near the receiver does not exceed 2 kPa during the course of normal milking, including cup attachment and removal, liner slip or cluster falls.

For calculation of pump capacity, see examples in annex A. Capacity shall be measured in accordance with ISO 6690:—, subclause 5.3.

If more than one vacuum pump is installed, it shall be possible to isolate the pump(s) not in use.

5.1 Effective reserve

The installation shall have a minimum effective reserve determined in accordance with table 1 for installations equipped with automatic shut-off valves at the milking units.

For installations without automatic shut-off valves at the milking units the minimum effective reserve in table 1 shall be increased by 80 l/min for bucket milking machines and by 200 l/min for the other types of milking machines.

The effective reserve shall be measured in accordance with ISO 6690:—, subclause 5.2.

Annex A gives examples of minimum effective reserve calculated in accordance with table 1 together with the calculation of allowances.

Table 1 —: Minimum effective reserve with automatic shut-off valve at the milking unit

Number of units n	Minimum effective reserve [1], in l/min of free air	
	Milking pipeline and recorder	Bucket milking machines
$2 \leq n \leq 10$	$200 + 30n$	$80 + 25n$
> 10	$500 + 10\,(n - 10)$	$330 + 10\,(n - 10)$
1) Plus addition for ancillary equipment in accordance with clause 17.		

5.2 Influence of altitude

For installations at altitudes of less than or equal to 300 m, an atmospheric pressure of 100 kPa shall be assumed for calculating effective reserve in accordance with 5.1.

To fulfil the requirements at altitudes greater than 300 m, a vacuum pump with increased capacity shall be installed, as given by the calculation in A.5.

5.3 Exhaust

The exhaust shall not obstruct the passage of the exhaust air by sharp bends, T-pieces or unsuitably designed silencers.

An oil separator shall be fitted to the exhaust pipe of oil-lubricated vacuum pumps. Either the exhaust pipe shall have a continuous slope away from the vacuum pump or a moisture trap, with provision for drainage, shall be fitted.

NOTE — The exhaust pipe should not discharge into a closed room, where foodstuff is stored or processed, nor where persons or animals could be present.

5.4 Prevention of reverse flow through vacuum pump

Automatic means shall be provided to prevent reverse flow of air from the exhaust through the vacuum pump.

5.5 Location

The vacuum pump shall be located so that the vacuum drop in the airline fulfils the requirements in 8.3. The vacuum pump shall be installed so that its speed and the extraction capacity and vacuum level can be measured.

NOTE — The vacuum pump should be isolated from the milking parlour and milk room in a well-ventilated position.

5.6 Marking

The vacuum pump shall be indelibly marked with the following information:

a) the direction of rotation;

b) the range of speed and power consumption in kilowatts;

c) the corresponding range of extraction capacity at 50 kPa, expressed as free air at an atmospheric pressure of 100 kPa;

d) the type and identification, for example serial number or code;

e) the recommended lubricant, if used;

f) the name of the manufacturer or supplier.

The pump manufacturer shall also state the maximum permissible exhaust back pressure, measured in accordance with ISO 6690:—, subclause 5.4.

6 Vacuum regulation

6.1 Mounting

The regulator shall be mounted rigidly and in accordance with the manufacturer's specifications.

In pipeline and recorder milking machines the sensing point of the regulator shall be connected between the interceptor and the receiver or in the receiver.

NOTE — Only sensors designed so that they fulfil the hygiene requirements may be placed at the sanitary trap or the receiver or between them.

In bucket milking installations the sensing point of the regulator shall be connected between the interceptor and the first connection to the airline, or on the interceptor.

NOTES

1 The regulator should be installed in a place and manner to minimize noise for the operator(s) and to ensure that clean air enters the regulator.

2 The sensing point for the regulator should be as near the sanitary trap as practicable or, where there is no sanitary trap, the first milking unit.

6.2 Regulation sensitivity

The regulator(s) shall control the vacuum level such that, when tested in accordance with ISO 6690:—, subclause 5.5, the increase in vacuum level does not exceed 1 kPa.

6.3 Regulation loss

The total regulation loss when tested in accordance with ISO 6690:—, subclause 5.6, shall not exceed 35 l/min of free air or 10 % of the manual reserve, whichever is the greater.

6.4 Regulator leakage

The total air leakage through the regulator or regulators when tested in accordance with ISO 6690:—, subclause 5.7, shall not exceed 35 l/min of free air or 5 % of the manual reserve, whichever is the greater, at a vacuum level of 2 kPa below the working vacuum at the regulator sensing point.

6.5 Marking and specification

The regulator shall be marked indelibly with the following information:

a) name of manufacturer or supplier;

b) mark and type;

c) designed working vacuum range;

d) air flow capacity at 50 kPa working vacuum, expressed as free air at an atmospheric pressure of 100 kPa.

The regulator manufacturer shall also state the air flow capacity at the upper and lower end of the designed working vacuum range.