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Automatic milking installations — Requirements and testing

Installations de traite automatique — Exigences et essais

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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 organizations, 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20966 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

Automatic milking installations — Requirements and testing

WARNING — Some of the tests specified in this International Standard involve procedures which could lead to a hazardous situation. The attention of any person performing tests in accordance with this International Standard is drawn to the need to be appropriately trained in the type of work to be carried out. It is left to the responsibility of the user to check all national regulatory conditions and health and safety requirements applicable for the relevant country.

1 Scope

This International Standard specifies requirements for the construction of automatic milking installations (AMI), including specific safety and hygiene aspects and minimum performance requirements and testing, in addition to those described in ISO 5707 and ISO 6690.

It does not contain requirements for the design of the building in which the milking installation is installed.

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 3600, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*

ISO 3918, *Milking machine installations — Vocabulary*

ISO 4413, *Hydraulic fluid power — General rules relating to systems*

ISO 4414, *Pneumatic fluid power — General rules relating to systems*

ISO 5707, *Milking machine installations — Construction and performance*

ISO/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

ISO/TR 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design*

ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

ISO 13852:1996, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

ISO 14159, *Safety of machinery — Hygiene requirements for the design of machinery*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 1: General requirements*

IEC 60245-1, *Rubber insulated cables — Rated voltages up to and including 450/750 V — Part 1: General requirements*

IEC 60529:2001, *Degrees of protection provided by enclosures (IP code)*

IEC 60825-1:2001, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide*

IEC 60947-4-1, *Low-voltage switchgear and control gear — Part 4-1: Contactors and motor starters — Electromechanical contactors and motor starters*

IEC 60947-5-1, *Low-voltage switchgear and control gear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

IEC 61800-1, *Adjustable speed electrical power drive systems — Part 1: General requirements — Rating specifications for low-voltage adjustable speed d. c. power drive systems*

EN 1088, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 13732, *Food processing machinery — Bulk milk coolers on farms — Requirements for construction, performance, suitability for use, safety and hygiene*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3918 and the following apply.

3.1
control system
assembly of hardware and software components to start, operate and stop the AMI

4 Safety and hygiene requirements

The safety requirements given in Annex A apply.

The hygiene requirements given in ISO 14159 apply.

5 Functional requirements

5.1 General

The milking machine shall fulfil the requirements specified in ISO 5707.

It shall be possible to operate the AMI both for milking and testing purposes.

5.2 Preparation before milking

5.2.1 Cleaning of teats

There shall be provision to clean the teats and the parts of the udder in contact with the liners without injuring the animal.

The result of the cleaning operation is checked by inspection of the teat and udder areas after operation.

NOTE Annex B presents an example of a method of evaluating the inspection of cleaning of teats and udders, although the ultimate result of cleaning is the milk quality in the bulk milk tank.

5.2.2 Foremilking

There shall be provisions for separation of the foremilk from the milk intended for human consumption.

Information shall be provided about the procedures regarding separation of foremilk, and how to inspect the performance.

The performance of the foremilk separation shall be verified during operation.

5.3 Milking

5.3.1 Accidental teatcup detachment

The system shall have provisions to detect accidental teatcup detachment so that the AMI can initiate corrective action to attempt to achieve a successful milking.

5.3.2 Milk yield measurement

The milk yield for each milking shall be measured. The accuracy of milk yield measuring systems shall be stated in the user’s manual.

5.3.3 Detection of abnormal milk

Where an automatic milking unit has provisions to detect abnormal milk from an individual animal and prevent its milk from being mixed with milk intended for human consumption, the abnormal milk detection method together with recommended limit values shall be described in the user’s manual.

NOTE Annex C presents an example of a method of evaluating detection systems for milk deemed as abnormal due to blood or changes in homogeneity with possible limits of blood levels.

5.3.4 Teatcup removal

There shall be provisions to limit the total machine-on time. Methods, procedures and limits shall be stated in the user’s manual.

5.4 Post-milking teat applications

It is recommended that there be means to apply disinfectant and/or skin conditioner to the teats after milking.

5.5 Milk transport

5.5.1 Diversion of milk

The AMI shall have provisions to divert milk identified as abnormal, undesirable or withheld milk before it reaches the storage tank.

NOTE The decision to divert undesirable and withheld milk is always taken before milking. The decision to divert abnormal milk can be taken at any time during foremilking, milking or after milking of the animal. Diverted milk can be transported to a holding tank or a safe means of disposal.

5.5.2 Delivery lines

Milk shall be prevented from entering the bulk milk tank during cleaning of the bulk milk tank.

Milk shall be prevented from entering the bulk milk tank during milk collection if required by local, regional or national regulations.

5.6 Milk cooling and storage

5.6.1 General

A bulk milk tank shall have provision to inform the automatic milking machine (AMM) if milk can be received or not.

Cleaning solution shall be prevented from entering the bulk milk tank whilst milk is present in the tank.

5.6.2 Refrigerated bulk milk tank

A refrigerated bulk milk tank shall comply, where appropriate, with EN 13732.

NOTE 1 EN 13732 was developed for batch milking excluding continuous milking such as with an AMM.

The cooling system shall have sufficient capacity to cool milk received in an empty bulk milk tank from high-producing animals milked simultaneously in the available milking units.

The cooling system shall be designed so that the milk does not freeze, even at low milk flow from a single animal into an empty tank.

NOTE 2 Milk temperatures and cooling times are usually stated by local, regional or national requirements.

5.6.3 Tank for temporary storage

If milk is intended to be stored in a temporary tank (buffer tank) longer than 1 h, such as during milk collection and cleaning of the bulk milk tank, the cooling time specified by local, regional or national requirements applies (see 5.6.2, Note 2).

6 Cleaning

There shall be provisions to initiate automatic cleaning, rinsing or sanitizing of milk contact surfaces for:

a) teatcups, between milking of each animal, including surfaces that can come in contact with the animal teat;

b) all surfaces that have come into contact with milk detected as abnormal, undesirable or withheld milk, before milking an animal for milk intended for human consumption;

c) surfaces that have been in contact with unrefrigerated milk after a specified time without milking;

d) system cleaning after a specified interval.

NOTE Cleaning intervals are specified by international, national or local regulations.

7 Instructions for use

In addition to the instructions for milking machines, at least the following shall be emphasized in the user's manual:

a) procedures to be followed in the event of alarms raised;

b) use of system check functions;

c) entering animal details, events and action points into the AMI management and monitoring system;

d) use of the AMI management system, and any sensors, to produce alarms and action lists required by the user as a basis for management of the animals.

8 Management

8.1 Alarms and notifications

When the safety of a human or animal is at risk, an alarm shall be transmitted immediately to the human supervisor. When the system detects an error but the safety of humans and animals is not at risk, a notification shall be directed to the human supervisor at an appropriate time.

8.2 Retrieval of information

The user shall have provision to access at least the following time-stamped information for a specified number of days:

a) data for each milking, including animal identity, duration, yield, whether milking was successful or not on all teats, unintended detachment, re-attachment of teatcups during milking, reason for diversion of milk;

b) data for each non-milking visit to the milking machine, including animal identity;

c) data for each system cleaning, including duration and action done, such as rinsing or sanitation;

d) data and reason for each alarm;

e) identification of each bottle or vial used during automatic milk sampling.

NOTE 1 If any of the above information is intended for export to other parties, a suitable format for data transfer can be that specified in ISO 11787[2], ISO 11788-1[3] and ISO 11788-2[4].

NOTE 2 Other information of interest can be:

— milk quality parameters such as conductivity, somatic cell count, fat content, protein content, urea content;

— system cleaning parameters such as detergent type and dosage, temperature of the cleaning fluid;

— milk cooling parameters such as a log of milk tank temperatures.

9 Monitoring

9.1 Animals

The system shall maintain a current record of the following:

a) time since last milking for each animal;

NOTE For practical reasons the time can be measured from when the animal leaves the milking place.

b) animals due for milking;

c) animals that are overdue for milking (a preset time has elapsed since permission to be milked was granted);

d) animals with unsuccessful milking;

e) animal identity where the system has detected abnormal milk;

f) animal identity and time of each milking where the milk has been diverted.

9.2 Disinfection

Means shall be provided to monitor the cleaning solution temperature and to ensure that intended cleaning and disinfecting has been carried out.

9.3 Stored milk

Means shall be provided to monitor the temperature of the milk in the bulk milk tank and to ensure that intended cleaning and disinfecting of milk storage vessels has been carried out.

Annex A
(normative)

Safety requirements with respect to humans and animals

A.1 Scope

This annex defines safety requirements for AMI falling within the scope of this International Standard. It also stipulates requirements on the electrical equipment of the installations.

A.2 Safety requirements and measurements

A.2.1 General

A.2.1.1 All known, relevant and significant hazards related to the intended use of AMI have been addressed. When, through machine evolution or technological development, new and previously unknown hazards are discovered, the general principles of risk reduction as outlined in Clause 5 of ISO 12100-1:2003 shall be applied to the hazard(s).

A.2.1.2 Unless otherwise specified in this International Standard, the safety distances shall comply with the requirements given in Tables 1, 3, 4 and 6 of ISO 13852:1996.

A.2.2 Controls

A.2.2.1 Safety and reliability of control systems

The control systems shall be designed and constructed to comply with the following standards.

a) Electrical components shall comply with:

   1) IEC 60947-5-1 (section 3) for control switches with positive opening operation used as mechanically actuated position detectors for interlocking guards and for relays used in auxiliary circuits;

   2) IEC 60947-4-1 for electromechanical actuators and motor starters used in main circuits;

   3) IEC 60245-1 for rubber insulated cables;

   4) IEC 60227-1 for polyvinyl chloride cables, if this cable is additionally protected against mechanical damage by positioning (e.g. inside frames).

b) Mechanical components shall comply with 3.5 of ISO 12100-2:2003.

c) Mechanically actuated position detectors for guards actuated in the positive mode shall comply with EN 1088.

d) Pneumatic and hydraulic components and systems shall comply with ISO 4414 and ISO 4413 respectively.

e) Electrical principles used shall comply with IEC 60204-1.

f) Adjustable speed electrical power drive systems shall comply with IEC 61800-1.