
Guide for reference installation and reference service-conditions for low- voltage general purpose cage induction motors with duty type S1

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Leitfaden für installations und Betriebsbezugsbedingungen für Niederspannungskäfiglaufer-induktionsmotoren für allgemeine Zwecke und Betriebsart S1

Guide relatif aux conditions de référence pour l'installation et l'utilisation au service type S1 des moteurs a basse tension à induction à cage d'usage général

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A GUIDE FOR REFERENCE INSTALLATION AND REFERENCE
SERVICE-CONDITIONS FOR LOW VOLTAGE GENERAL
PURPOSE CAGE INDUCTION MOTORS WITH DUTY TYPE S1

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G 002 - 001

(prepared by CENELEC / TC 2)

A GUIDE FOR REFERENCE INSTALLATION AND REFERENCE SERVICE-
CONDITIONS FOR LOW VOLTAGE GENERAL PURPOSE CAGE INDUCTION
MOTORS WITH DUTY TYPE S1

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1 SCOPE

This guide is applicable to low voltage general purpose motors and particularly to cage induction motors with ball or roller bearings, continuous running with duty type S1 * and output up to 315 kW.

2 OBJECT

The object is to describe the reference conditions, on which the manufacturer bases the design of insulation, bearings and lubrication and which must be considered by the user in order to use the motor in applications for which it was made to get adequate life time of the insulation system, of the bearings and of the bearing lubricant. Also some influences on the life of the insulation system, the life time of the bearings and the life time of the bearing lubricant at other than reference conditions are described.

3 DEFINITIONS

3.0

General

For the definitions of general terms in this guide, reference should be made to the International Electrotechnical Vocabulary, see IEC Publication 50 (411). For the purpose of this guide some definitions are repeated and some new ones are added.

3.1

General purpose motor (411-03-35)

Any motor designed, listed and offered in standard ratings with operating characteristics and mechanical construction suitable for use under usual service-conditions ** without restrictions to a particular application or type of application.

3.2

Cage induction motor (411-03-15)

An induction motor in which a primary winding on one member, usually the stator, is connected to the power source, and a secondary cage-winding on the other member usually the rotor, carries induced current.

* See HD 53-1 S2, clause 4.1

** In this guide the "usual service-conditions" are called the "reference service-conditions".

3.3 Reference conditions

The reference conditions include

- rating according to HD 53-1 S2
- reference installation-conditions (see clause 4) : These are the reference fixing, the reference position of the shaft, the reference mechanical coupling, the reference connection to the electricity supply and the reference provisions for cooling and protection.
- reference service-conditions (see clause 5) : These are the reference environmental and functional stresses and the requirements on servicing, inspection and examination when the motor is used in applications for which it was made.

3.4 Environmental stresses

Stresses on the motor which originate from its environmental influences only and which act on the motor when running and when at rest.

3.5 Functional stresses

Stresses on the motor which originate from its function only and which act on the motor when running.

3.6 Application for which it was made

The application for which it was made, in the sense of this guide is the application, for which the motor is suited according to the instructions of the manufacturer. To the application for which it was made belongs also the proper installation and to apply the prescribed conditions of service and maintenance.

3.7 Servicing

This consists of attentions that can be carried out without interrupting the operation of the motor.

3.8 Inspection

This consists of attentions which require the motor to be switched off, however can be carried out without dismantling the motor.

3.9 Examination

This consists of attentions which require the motor to be dismantled.

3.10 Servicing, inspection, examination intervals

Servicing, inspection and examination intervals are respectively the time intervals between two successive servicing or inspections or examinations. The interval can comprise times in operation and/or times at rest.

3.11 Life times

The observed span of time for the single, non repairable component from the beginning of the stresses until the failure. There are 3 life times defined in a motor :

- the life time of the insulation system,
- the life time of the bearings.

Note : The nominal life time of one bearing is the one that 90 % of a sample number of similar bearings will achieve, before the first signs of deterioration *.

Generally for direct coupled drives the nominal life time of the bearings is ca. 40 000 h. This value serves for the information of the user, it does not establish a commercial guarantee.

- the life time of the bearing lubricant,

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Note : The nominal life of the bearing lubricant is the time of the serviceableness of the one charge of lubricant under definite stresses. For definite conditions this life time can be taken from manufacturers instructions.

4 - REFERENCE INSTALLATION-CONDITIONS

The reference installation-conditions must be considered at the installation of the motor in order to reach a adequate life time of the insulation system, of the bearings and of the bearing lubricant.

4.1 Transport and storage

At transport and storage there shall not be considerable stresses of the insulation, the bearings and the bearing lubricant. Adequate packing and means for avoiding the perils of transportation e. g. rotor locking arrangement shall be provided. Transport and storage shall be made according to the instructions of the manufacturer.

* See ISO 281

4.2 Fixing of the motor and position of the shaft

All fixing components shall be properly adjusted, so that the motor is not subjected to additional stresses, e. g. twisting of the housing structure on account of incorrect shimming.

The reference position of the shaft is horizontal.

Note : In a vertical position of the motor a shorter life time of the bearings can be expected, but there is generally no change in the life time of the bearing lubricant.

4.3 Coupling and drive

The reference mechanical coupling is a direct coupling of the motor to the driven machine with use of a semiflexible or a flexible coupling device. The machines are aligned according to the instructions of the manufacturer of the coupling device.

Note : For belt drive the life time of the bearings will be reduced. There is no change in the life time of the bearing lubricant. The reduction of life time of the bearing for belt drive can be compensated by using a roller bearing. However in that case the life time of the bearing lubricant will be reduced. Such replacing is not provided within the concept of general purpose motors.

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Fixing/coupling and the environment shall not induce vibrations of the motor under full load higher than the limits in vibration severity for free suspension, uncoupled and unloaded *.

4.4 Connection to electricity supply and electrical and mechanical safety

The motor shall be connected to the electricity supply according to the relevant regulations.

If the motor is marked with an arrow indicating one direction of rotating this instruction shall be respected because in the opposite direction cooling is restricted and the life time of the insulation system and of the lubricant is seriously reduced.

Connection to the electricity supply and to earth shall be established properly, durably und safely. Adequate means shall be provided to protect the motor against inadmissible temperature rise by overload or when stalled.

4.5 Provisions for cooling and protection

The location of the motor shall be such as to avoid obstruction of the cooling air, for the inlet as well as for the outlet. If necessary provisions shall be made to prevent exhausted air from immediately reentering the cooling system.

* See IEC Publication 34-14

Note : Ostructing the cooling air will add to the temperature rise and reduces the life time of the insulation system and of the bearings because of the shorter life time of the bearing lubricant.

Conditional on the structure of the housing of the motor the degree of protection shall be adjusted to the environmental influences. Generally the motor shall have a degree of protection by enclosure of IP 22 minimum.

Motors for outdoor location have usually IP 44 protection minimum, and additional means (e.g. shelter) may be necessary.

5 - REFERENCE SERVICE-CONDITIONS

The reference service-conditions must be considered at the service of the motor in order to reach a adequate life time of the insulation system, of the bearings and of the bearing lubricant.

The real service-conditions, which deviate from the reference service-conditions, increase or reduce the life time of the insulation system, of the bearings and of the bearing lubricant.

5.1 Environmental stresses

5.1.1 Altitude

The reference altitude is from 0 to 1 000 m height above sea level.

Note : For altitude greater than 1 000 m, see HD 53-1 §2, clauses 11.1 and 16.3.

5.1.2 Temperature of the cooling air

The reference temperature of the cooling air/ambient is from - 15°C to 40°C.

Note : Motors with water-cooled heat-exchangers are not considered to be general purpose motors within the sense of this guide.

The inlet temperature of the cooling air and the ambient temperature are considered to be equal.

Note : At lower temperatures than - 15°C properties of steel and other materials might need special attentions.

Below 40°C until 10°C the life time of the insulation system is doubled for about each 10 K lower temperature of the cooling air.

For bearing temperatures between 70°C et 105°C the life time of the bearing lubricant is doubling by about 15 K lower temperature. The life time of the lubricant is not considerably influenced by the temperature of the cooling air/ambient during times at rest.

5.1.3 Humidity and climate

5.1.3.1 Indoor location

The reference relative humidity is : Normally between 20 % and 75 %, average 55 %, in the temperature range from - 5°C to + 40°C.

5.1.3.2 Outdoor location

The reference relative humidity is : Normally between 36 % et 98 % (extreme daily mean value), in the temperature range from - 10°C to + 35°C ; the absolute humidity above 25°C being not more than 23 g/m³ which corresponds to a relative humidity of 95 % at 27°C (Statistical open-air climate Dry Warm, see IEC Publication 721-2-1).

Abrupt changes in temperature generating condensation are covered, as far as occurring in this climate.

Note : For humidities greater than above and climates hotter and more humid than above the life time of the insulation system and of the bearing lubricant generally will be less than for the reference conditions.

5.1.4 Chemical, biological, radiational pollution

In reference conditions the cooling air/ambient may contain industrial arial contaminations as being found in industrial surroundings.

Note : More severe stresses due to dust, fungus, insects, solar or nuclear radiation or chemical pollution greater than above are not part of the reference service-conditions. If there are such stresses or other pollutions their result has to be object of a special study. Their influences on the insulation and on the bearing lubricant and the corrosion on various parts of the motor may diminish the life time of the insulation system and other parts of the motor, the life time of the bearings and the life time of the bearing lubricant.

5.2 Functional stresses

5.2.1 Load

The reference load condition is operating continuously with duty type S1 with values of output near up to or of rated output.

5.2.2 Supply voltage

The reference conditions of the supply voltage are :

- the voltage to be virtually sinusoidal (see HD 53-1 S2, clause 12.2.1 a).