Identity Card of Every Asynchronous Motor

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Identity Card of Every Asynchronous Motor (on photo: ABB AC motor in top lift; by Melissa Blair, BaldorPowerWI via Flickr)

Motor parameters

A motor is characterized by different electrical and constructional parameters which identify its ***correct application field***.

The whole of all these parameters constitutes the rating of the machine and is reported on a nameplate positioned on the motor itself.

Hereunder is a short description of the main parameters included in the nameplate rating with simple information about the electrical parameters which are the most known ones and those more easily explained, whereas particular attention is paid to those which are less common and refer to working and environmental conditions.

The electrical and mechanical parameters which constitute the rating of a motor identify its rated performances and are:

1. The power in kW

The power in kW, which represents the rated mechanical power made available by the shaft; in many countries it is common to express the ***available mechanical power of the motor shaft*** also in ***horsepower***:

- ***1hp (UK and US horsepower)*** is equivalent to ***745.7W***
- ***1hp (metric horsepower)*** is equivalent to ***736W***

2. The supply voltage of the motor

The supply voltage of the motor, e.g. 230VΔ, 400VY.

With a three-phase distribution system at 400V (*phase-to-neutral voltage 230V, phase-to-phase voltage 400V*) ***the motor can be only star-connected***. In case of delta connection the motor windings would be subject to 400V, when they have been dimensioned for ***230V***.

As a consequence, the considered motor does not result suitable for connection to the network in the example with delta-connected windings.

To summarize:

A motor having double operating voltage could be used in the following configurations:

1. Windings with ***delta-connection*** only supplied at the lower voltage;
2. Windings with ***star-connection*** only supplied at the higher voltage);
3. Windings with ***Y/Δconnection*** (*with six conductors to the motor*) with Y configuration at motor starting and Δ configuration during motor running, possible when the lower value of the rated voltage of the motor coincides with the voltage of the supply;
4. The rated current linked to the power and to the voltage through the ***rated efficiency parameters "η"*** and the ***power factor "cos□"***;
5. The rotation speed in rpm linked to the frequency (*50Hz or 60Hz*) and to the number of poles.

The other information on the nameplate, with a meaning less clear or not easily recognizable, are referred to:

1. Duty type:

To be declared by the purchaser of the motor (*classifications given by the Std. IEC 60034-1 "Rotating electrical machines. Part 1: "Rating and performance"*) and necessary to define the rating that the motor must guarantee according to the application type.

Where a duty is not declared, the manufacturer shall assume that ***duty type S1 (continuous running duty) applies***. For a thorough analysis on duty types, please refer to Annex D;

2. Degree of protection (IP code classification):

It indicates the degree of protection provided by the enclosures of electrical rotating machines (*prescriptions and classification complying with the* ***Std. IEC 60034-5 Part 5: "Degrees of protection provided by the integral design of rotating electrical machines"***).

The first characteristic numeral indicates the degree of protection provided by the enclosure both to persons as

well as to the parts of the machine inside the enclosure. It gives information about protection against approach to or contacts with live parts and against contact with moving parts inside the enclosure and protection of the machine against ingress of solid foreign objects.

The second characteristic numeral ***indicates the degree of protection*** provided by the enclosure with respect to harmful effects due to ingress of water.

3. Thermal class:

It indicates the temperature limits for motor windings.

It is expressed through insulation classes identified by letters, to which the maximum permitted temperature for the windings is associated as represented in ***Table 1***.

Systems with ***insulation class F*** are often used; for them a temperature rise referred to ***thermal class B*** is allowed, which guarantees a margin of safety on the insulation life.

Table 1 – References for thermal class and relevant temperature

Thermal class	Temperature class
A	105
E	120
B	130
F	155
H	180

Other codes which allow to go further into details on motor typology, but which result to be quite complex to intepret and relevant to problems not closely connected to the purpose of this technical paper may be:

4. IC code:

It is a designation relevant to the methods of cooling and is formed by numerals and letters representing the circuit arrangement, the coolant and the methods of movement of the coolant itself.

For further details please refer to the Std. IEC 60034-6 “Rotating electrical machines. Part 6: Methods of cooling”.

5. IM code:

It is a designation relevant to the classifications of types of constructions (*arrangement of machine components with regard to fixings, bearing arrangement and shaft extensions*) and mounting arrangements (*orientation on site of the machine as the whole with regard to shaft alignment and position of fixings*) of rotating electrical machines.

For further details please refer to the Std. IEC 60034-7 “Rotating electrical machines. Part 7: Classification of types of constructions and mounting arrangements (IM Code)”.

Reference: *ABB technical application paper – Three-phase asynchronous motors Generalities and ABB proposals for the coordination of protective devices*

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