

Thai Industrial Standard
Three-Phase Induction Motor: Minimum Efficiency

1. Scope

- 1.1 This standard covers only the minimum efficiency required of a three-phase squirrel-cage induction motor, with a rated output of 0.73 kW to 185 kW and a rated voltage not exceeding 1,000 V, hereinafter called “motor”.
- 1.2 This standard does not cover the minimum efficiency required of the following motors:
- (1) Submersible motors designed exclusively to be operated with the motor submerged, but excluding motors to be operated generally in air which are resistant to submergence
 - (2) Drive-incorporated motors that are non-detachable, such as motors built on the common axis of an air-conditioning compressor
 - (3) Multi-speed motors
 - (4) Motors used exclusively for short-term cycles of operation (such as motors used for hoists, revolving doors and cranes), with Type 2 rating in compliance with TIS 866.

2. Definition

The definitions of terminology in this standard shall be in accordance with TIS 866, and the following:

- 2.1 Efficiency
Output/input ratio in similar units, with efficiency generally expressed as a percentage
- 2.2 Multi-speed motor
Motor capable of operating continuously at 2 cycles or more, with switchgear setting coil reconnections or coil and power supply connections. This definition does not include motors running at different speeds under a voltage-changing or frequency-changing controller.

3. Requirements

3.1 Minimum efficiency

Motor efficiency is measured according to IEC 60034-2 at either the full load or 75% of the full load. The efficiency shall not be less than the minimum value indicated in Table 1, based on the tolerances in Table 2.

Table 1 Minimum efficiency
(Clause 3.1)

Rated output kW	Minimum efficiency %			
	2-pole	4-pole	6-pole	8-pole
0.73	74.0	74.4	72.4	68.4
0.75	74.0	74.4	72.4	68.4
1.1	76.2	76.2	75.2	71.5
1.5	78.5	78.5	77.3	74.6
2.2	81.0	81.0	79.6	77.6
3	82.6	82.6	81.4	79.7
4	84.2	84.2	83.0	81.5
5.5	85.7	85.7	84.6	83.3
7.5	87.0	87.0	86.0	85.0
11.0	88.4	88.4	87.6	86.8
15.0	89.4	89.4	88.8	88.2
18.5	90.0	90.0	89.6	89.0
22.0	90.5	90.5	90.1	89.7
30.0	91.4	91.4	91.1	90.8
37.0	92.0	92.0	91.7	91.5
45.0	92.5	92.5	92.3	92.0
55.0	93.0	93.0	92.8	92.6
75.0	93.6	93.6	93.5	93.4
90.0	93.9	93.9	93.9	93.7
110.0	94.4	94.4	94.3	94.1
132.0	94.8	94.7	94.7	94.4
150.0	95.0	95.0	94.9	94.7
<185.0	95.0	95.0	94.9	94.7

Note: For rated output ranging between the values in the table, the minimum efficiency is obtained by linear interpolation.

4. Marking and Labelling

This Clause shall comply with Clause 10 of TIS 866, and the following:

There shall be a number, letter or mark indicating motor efficiency on the rating label or in the technical documents, or shown in other certificates, with the coefficient not exceeding the value obtained from the testing.

Note: The tolerances indicated in Table 2 are not applicable.

5. Tolerances

Table 2 is applicable.

Table 2 – Tolerances
(Clauses 3 and 4)

Item	Volume	Tolerance
1	Efficiency \square - Motors with rated output not exceeding 150 kW - Motors with rated output over 150 kW	- 15% of $(1-\eta)$ - 10% of $(1-\eta)$
2	Total loss (applicable to motors with rated output over 150 kW)	+ 10% of the total loss

6. Testing

- 6.1 Testing on marking and labelling
Compliance is checked by inspection.
- 6.2 Testing of motor efficiency
The test is carried out according to IEC 60034-2 (1972), Amendment 1 (1995) and Amendment 2 (1996).
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