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Islamic Republic of Iran

سازمان استاندارد و تحقیقات صنعتی ایران

Institute of Standards and Industrial Research of Iran



استاندارد ملی ایران

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چاپ اول

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معیارها و مشخصات فنی مصرف انرژی و برچسب  
انرژی موتورهای الکتریکی القایی سه فاز

**Specification for energy consumption and  
Energy labeling of multi phase electrical motors**

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شماره پروانه ۵۳۴۶

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## Criteria & Technical Specifications of Energy Consumption

&

### Energy Label

#### Three-Phase Electric Induction Motors

#### 1 Purpose & Scope of Application

##### 1.1 Purpose

Purpose of formulation of this standard is to determine Criteria & Technical Specifications of Energy consumption in Three Phase Electric Induction Motors. Also, in this standard energy consumption label for these Motors is determined and measurement methods are being presented. This standard does not comprise specifications and performance requirements and safety of electric motors.

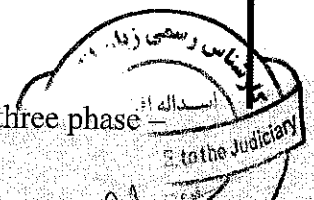
##### 1.2 Scope of Application

This standard is not applicable to three- phase electric induction motors. This standard is certified for three- phase electric induction motors utilized in various industries, residential and commercial purposes and public use with maximum rated output power 70 kW.

In this standard three-phase electric induction motors are classified in four groups according to number of poles as coming below:

- A: Three phase- two pole electric induction motors.
- B: Three phase- four pole electric induction motors
- C: Three phase- six pole electric induction motors
- D: Three phase- eight pole electric induction motors

Note: In this standard in some cases abbreviation of "motor" stands for "three phase electric motors".



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## 2 Compulsory References

Following compulsory documents contain some regulations that are being referred in this standard, so that regulations are considered as part of this standard.

References bearing date of publication or revised versions, amendments and consequent revisions made to these documents shall not be considered for this purpose. There fore beneficiary users of this standard are advised to inspect possibility of using latest revised version and amendments of such compulsory references.

Regarding references lacking date of publication or revised version, latest publication or revised version shall be noticed by the users. Application of following references for this standard is compulsory:

National Standard 3772: Rotating Electric Motors-section One: Nominal values and performance of other National Standards of 3772 group, if any case is applicable.

## 3. Terms and Definitions

In this standard in addition to definitions for national standard 3772, words and terms with the following definitions are reliable:

### 3.1 Rated quantities of the motor

Rated quantities of the motor include rated voltage and current, rated speed(s), rated power output and other characteristics, (as per national standard 3772) therefore in accordance with this standard, manufacturer specify speed conditions of the motor performance and specifications of the motor will be printed on a plate and affixed to the motor.

### 3.2 Nominal load

It is maximum load specified for motor that makes motor operate as per nominal specification.



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### 3.3 Energy Efficiency

Rated output is ratio of useful rated power output per total power input that is usually described in percentage.

### 3.4 Power factor

Power factor of an alternating current motor is ratio of rated power output (kW) per rated apparent output (kVA) that is usually described in percentage.

3.5 Rated speed of a motor is the speed of a motor that operates under its own voltage, frequency and rated power.

## 4. Classification of Motors

In this standard , in order to determine criteria of Energy Consumption, three phase induction motors shall be classified in 4 categories respecting rated power output and Number of the poles (refer to paragraph 2.1).

Energy label for each category shall be defined separately.

In table 1 classification of motors is specified on basis of rated power output and number of poles.



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Table 1- Classification of Three-Phase Induction Motors considering Rated Output Power & Number of Pole

Rated Output Power (kW)			
2 Pole	4 Pole	6 Pole	8 Pole
%37	%09	%37	%75
%55	%18	%55	1/1
%75	%25	%75	1/5
1/1	%55	1/1	2/2
1/5	%75	1/5	3
1/8	1/1	2/2	4
2/2	1/5	3	5/5
3	2/2	4	7/5
4	3	5/5	11
5/5	4	7/5	15
7/5	5/5	11	18/5
11	7/5	15	22
15	11	18/5	30
18/5	15	22	37
22	18/5	30	45
30	22	37	55
37	30	45	75
45	37	55	-
55	45	75	-
75	55	-	-
-	75	-	-



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## 5. Criteria & Technical Specifications of Energy Consumption & Energy Label

### 5.1 Energy Efficiency

In this standard input-output method is used to determine efficiency. In this method motor is under nominal voltage and is loaded by dynamometer considering rated output power (specified by manufacture) and is tuned properly so that equivalent of output power enforces the motor. In this state input power will be measured by measuring instruments. Output efficiency is ratio of output power (notified by manufacturer and is inserted on a plate indicating electro motor) input power (measured by dynamometer). Energy efficiency is described in percentage and without dimension.

$$\eta = \frac{\text{Input power}}{\text{Output power}}$$

Classification of three-phase induction motors is based on energy efficiency and for any of four classified three-phase induction motors (refer to table 1) following method is determined.

Classification of three phase-two pole induction motors

Classification of three phase-four pole induction motors

Classification of three phase-six pole induction motors

Classification of three phase-eight pole induction motors

Note: Accuracy of measurement instruments shall be as per National Standard 3772.

#### 5.1.1 Classification of energy efficiency in three phase- two pole induction motors

Classification of energy efficiency in three phase- two pole induction motors is calculated on basis of energy efficiency ( $\eta$ ) specified as per table 2. Energy efficiency rating scale provides an index of products efficiency from A (the most efficient) to E (the least efficient).



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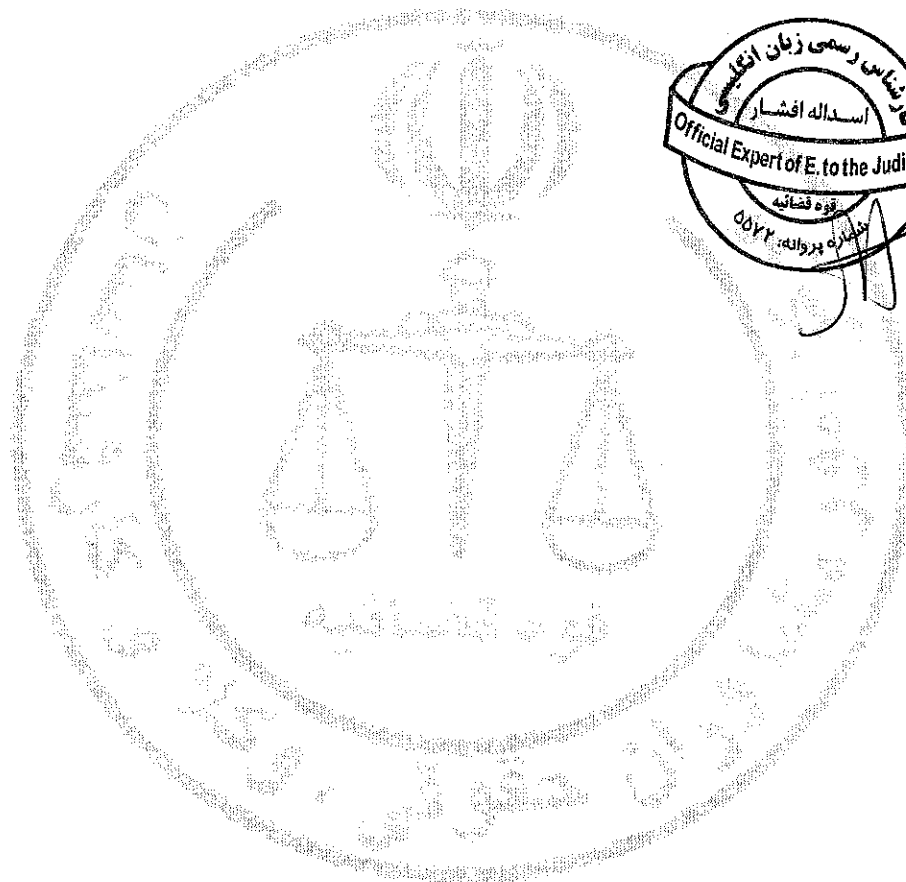
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Note: E & D groups shall be omitted from energy consumption label upon implementation of this compulsory standard by beginning of the third year.

Table 2 indicates energy efficiency in three phase- two pole induction motors.

Energy groups and energy label are shown in figure 1.





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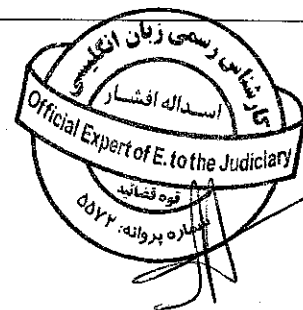
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Table 2- Classification of Three phase- Two pole Induction Motors based on Rated Efficiency

Rated Power(kW)	Energy Group on basis of Energy Efficiency				
	A	B	C	D	E
%37	$\geq 73$	$70 \leq \eta < 73$	$67 \leq \eta < 70$	$64 \leq \eta < 67$	$61 \leq \eta < 64$
%55	$\geq 78$	$75 \leq \eta < 78$	$72 \leq \eta < 75$	$69 \leq \eta < 72$	$66 \leq \eta < 69$
%75	$\geq 83$	$80 \leq \eta < 83$	$72 \leq \eta < 80$	$74 \leq \eta < 77$	$71 \leq \eta < 74$
1/1	$\geq 83$	$80 \leq \eta < 83$	$72 \leq \eta < 80$	$74 \leq \eta < 77$	$71 \leq \eta < 74$
1/5	$\geq 85$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$	$73 \leq \eta < 76$
1/8	$\geq 86$	$83 \leq \eta < 86$	$80 \leq \eta < 83$	$77 \leq \eta < 80$	$74 \leq \eta < 77$
2/2	$\geq 88$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$
3	$\geq 88$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$
4	$\geq 90$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$
5/5	$\geq 90$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$
7/5	$\geq 91$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$
11	$\geq 92$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$
15	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
18/5	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
22	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
30	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
37	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
45	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
55	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
75	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$

A More Efficiency  
B  
C  
D  
E Less Efficiency



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### 5.1.2 Classification of energy efficiency in three phase- four pole induction motors

Classification of energy efficiency in three phase- four pole induction motors is calculated on basis of energy efficiency ( $\eta$ ) specified as per table 3. Energy efficiency rating scale provides an index of products efficiency from A (the most efficient) to E (the least efficient).

Note: E & D groups shall be omitted from energy consumption label upon implementation of this compulsory standard by beginning of the third year.

Table 3 indicates energy efficiency in three phase- four pole induction motors



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Table 3- Classification of Three phase- Four Pole Induction Motors based on Rated Efficiency

Rated Power(kW)	Energy Group on basis of Energy Efficiency				
	A	B	C	D	E
%09	≥ 65	62≤η<65	59≤η<62	56≤η<59	53≤η<56
%18	≥ 68	65≤η<68	62≤η<65	59≤η<62	56≤η<59
%25	≥73	70≤η<73	67≤η<70	64≤η<67	61≤η<64
%55	≥80	77≤η<80	74≤η<77	71≤η<74	68≤η<71
%75	≥85	82≤η<85	79≤η<82	76≤η<79	73≤η<76
1/1	≥81	78≤η<81	75≤η<78	72≤η<75	69≤η<72
1/5	≥87	84≤η<87	81≤η<84	78≤η<81	75≤η<78
2/2	≥88	85≤η<88	82≤η<85	79≤η<82	76≤η<79
3	≥89	86≤η<89	83≤η<86	80≤η<83	77≤η<80
4	≥90	87≤η<90	84≤η<87	81≤η<84	78≤η<81
5/5	≥91	88≤η<91	85≤η<88	82≤η<85	79≤η<82
7/5	≥91	88≤η<91	85≤η<88	82≤η<85	79≤η<82
11	≥92	89≤η<93	86≤η<89	83≤η<86	80≤η<83
15	≥93	90≤η<93	87≤η<90	84≤η<87	81≤η<84
18/5	≥93	90≤η<93	87≤η<90	84≤η<87	81≤η<84
22	≥94	91≤η<94	88≤η<91	85≤η<88	82≤η<85
30	≥94	91≤η<94	88≤η<91	85≤η<88	82≤η<85
37	≥94	91≤η<94	88≤η<91	85≤η<88	82≤η<85
45	≥95	92≤η<95	89≤η<92	86≤η<89	83≤η<86
55	≥95	92≤η<95	89≤η<92	86≤η<89	83≤η<86
75	≥95	92≤η<95	89≤η<92	86≤η<89	83≤η<86

A More Efficiency  
B  
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D  
E Less Efficiency



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### 5.1.3 Classification of energy efficiency in three phase- six pole induction motors

Classification of energy efficiency in three phase- six pole induction motors is calculated on basis of energy efficiency ( $\eta$ ) specified as per table 4. Energy efficiency rating scale provides an index of products efficiency from A (the most efficient) to E (the least efficient).

Note: E & D groups shall be omitted from energy consumption label upon implementation of this compulsory standard by beginning of the third year.

Table 4 indicates energy efficiency in three phase- six pole induction motors



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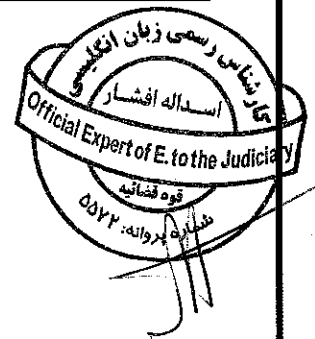
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Table 4- Classification of Three phase- Six Pole Induction Motors based on Rated Efficiency

Rated Power(kW)	Energy Group on basis of Energy Efficiency				
	A	B	C	D	E
%37	$\geq 77$	$74 \leq \eta < 77$	$71 \leq \eta < 74$	$68 \leq \eta < 71$	$65 \leq \eta < 68$
%55	$\geq 80$	$77 \leq \eta < 80$	$74 \leq \eta < 77$	$71 \leq \eta < 74$	$68 \leq \eta < 71$
%75	$\geq 86$	$83 \leq \eta < 86$	$80 \leq \eta < 83$	$77 \leq \eta < 80$	$74 \leq \eta < 77$
1/1	$\geq 87$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$	$75 \leq \eta < 78$
1/5	$\geq 88$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$
2/2	$\geq 89$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$	$77 \leq \eta < 80$
3	$\geq 90$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$
4	$\geq 90$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$
5/5	$\geq 91$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$
7/5	$\geq 92$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$
11	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
15	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
18/5	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
22	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
30	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
37	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
45	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
55	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
75	$\geq 96$	$93 \leq \eta < 96$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$

A More Efficiency  
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 E Less Efficiency



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#### 5.1.4 Classification of energy efficiency in three phase- eight pole induction motors

Classification of energy efficiency in three phase- eight pole induction motors is calculated on basis of energy efficiency ( $\eta$ ) specified as per table 5. Energy efficiency rating scale provides an index of products efficiency from A (the most efficient) to E (the least efficient).

Note: E & D groups shall be omitted from energy consumption label upon implementation of this compulsory standard by beginning of the third year.

Table 5 indicates energy efficiency in three phase- eight pole induction motors



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Table 5- Classification of Three phase- Eight Pole Induction Motors based on Rated Efficiency

Rated Power(kW)	Energy Group on basis of Energy Efficiency				
	A	B	C	D	E
%75	$\geq 77$	$74 \leq \eta < 77$	$71 \leq \eta < 74$	$68 \leq \eta < 71$	$65 \leq \eta < 68$
1/1	$\geq 80$	$77 \leq \eta < 80$	$74 \leq \eta < 77$	$71 \leq \eta < 74$	$68 \leq \eta < 71$
1/5	$\geq 81$	$78 \leq \eta < 81$	$75 \leq \eta < 78$	$72 \leq \eta < 75$	$79 \leq \eta < 72$
2/2	$\geq 84$	$81 \leq \eta < 84$	$78 \leq \eta < 81$	$75 \leq \eta < 78$	$72 \leq \eta < 75$
3	$\geq 85$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$	$73 \leq \eta < 76$
4	$\geq 87$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$	$75 \leq \eta < 78$
5/5	$\geq 88$	$85 \leq \eta < 88$	$82 \leq \eta < 85$	$79 \leq \eta < 82$	$76 \leq \eta < 79$
7/5	$\geq 89$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$	$77 \leq \eta < 80$
11	$\geq 90$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$	$78 \leq \eta < 81$
15	$\geq 92$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$
18/5	$\geq 92$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$	$80 \leq \eta < 83$
22	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
30	$\geq 93$	$90 \leq \eta < 93$	$87 \leq \eta < 90$	$84 \leq \eta < 87$	$81 \leq \eta < 84$
37	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
45	$\geq 94$	$91 \leq \eta < 94$	$88 \leq \eta < 91$	$85 \leq \eta < 88$	$82 \leq \eta < 85$
55	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$
75	$\geq 95$	$92 \leq \eta < 95$	$89 \leq \eta < 92$	$86 \leq \eta < 89$	$83 \leq \eta < 86$

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5.2 Numeral amount of energy efficiency shall be inserted in energy label.

5.3 Insulation layer of motor shall be mentioned in energy label.

**Note: If insulation layer is specified in specifications plate and motor marking, it is not required to be mentioned on energy label.**

## 6 Energy label

Energy label contains information about criteria and technical specifications of energy consumption in each product. Also, in energy label in three phase-electric induction motors energy efficiency is compared with accepted criteria in this standard.(refer to figure1).

Information on the label must be clear and eligible. Regarding three phase-electric induction motors, energy label must be placed on the motor or attached to it. Label must be easily sighted.

### Information inserted in the label

Following information must be inserted in energy label designed for three phase-electric induction motors.

- 1- Name or trademark of the manufacturer.
- 2- Model or specifications of the brand
- 3- Rated output power or kW
- 4- Rated power factor
- 5- Numeral index of energy efficiency
- 6- Insulation layer (if required)





Date..... : تاريخ

No ..... : شماره

Atch..... : پیوست



اسدالله افشار

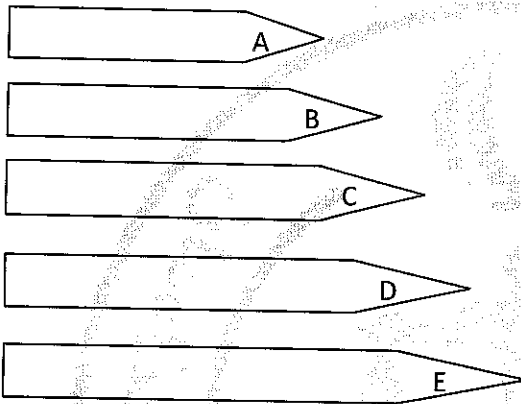
کارشناس رسمی زبان انگلیسی قوه قضائیه  
شماره پروانه ۵۳۴۶

A. AFSHAR

Official Expert of English Language to The Judiciary of I.R.Iran  
License No.5346

## Energy Label on Three- Phase Induction Motors

More Efficiency



Less Efficiency

Rated output power (KW):

Power factor:

Rated speed (R.P.M):

Efficiency in rated load:

Insulated layer:

Manufacturer's name:

As per Iran National Standard No.....

True Translation Certified.

Tehran

Dec.24, 2009

