

**DRAFT IN WIDE  
CIRCULATION**

**DOCUMENT DESPATCH ADVICE**

| Reference    | Date       |
|--------------|------------|
| ET 15/ T- 41 | 22-09-2010 |

**TECHNICAL COMMITTEE ETD 15**

---

ADDRESSED TO:

1. All Members of Rotating Machinery  
Sectional Committee, ET 15;
2. All Members of Electrotechnical Division Council; and
3. All other Interested.

Dear Sir(s),

Please find enclosed a copy of the following draft Indian Standard:

| Sl No. | Doc No.       | Title  |
|--------|---------------|--|
| 1      | ETD 15 (6291) | Energy Efficient Three Phase Squirrel Cage Induction Motors<br>( <i>Second Revision</i> of IS 12615) |

Kindly examine the draft standard and forward your views stating any difficulties which you are likely to experience in your business or profession, if this is finally adopted as Indian Standard.

Comments, if any, may please be made in the format given overleaf and mailed to the undersigned.

Last date for comments: **25-11-2010.**

Thanking you,

Yours faithfully

(R. K. Trehan)  
Sc 'F' & Head (Electrotechnical)

Encl: As above



## FOREWARD

Rotating Machinery Sectional Committee, ET 15

(Formal clause will be added later)

Electric Motors are the most important type of electric load in the industries. The motor driven systems account for almost 70 percent of the energy consumed by the industry. There is a large potential for cost effective savings in the use of energy efficient motor systems by about 20 percent to 30 percent. Electric motor systems include a number of energy using products, such as motors, drives, pumps or fans, compressors and other machines. Energy efficient motors form a major component to in contributing to the energy saving by way of the increased efficiency of the product itself. Therefore, attempts are being made globally to develop and implement standards specifying efficiencies of the industrial motors. Further, with the different testing methods adopted by different standards, the one to one comparison becomes difficult for the buyer or the end user. Hence there have been efforts globally to harmonize these standards with the international standards so as to have a common yardstick for comparison of performance available to the end users. IEC has published IEC 60034-30, for efficiency classes of 3 phase squirrel cage induction motors referring to related standard IEC 60034-2-1 on the methods of testing. Hence an immediate need is felt to harmonize the existing Indian Standard IS 12615 with IEC to the extent possible. During the process the other performance figures considered in the existing Indian standard (which are not mentioned in the IEC) are also being modified suitably.

Acknowledging the need for energy saving in view of the energy scarcity, climate change mitigations and the potential that exists with energy efficient motors, number of countries have issued directives to withdraw lower efficiency classes and adopt higher efficiency class motors as per IEC 60034-30 thus defining Minimum Efficiency Performance Standards (MEPS) in their countries. Such regulations will impose barriers to all the imports of motors which are with lower efficiency classes than the MEPS in to their countries. Keeping in view the threats to the exports from India and also complimenting the role of various Govt. initiatives like National Mission for Energy Efficiency, it is intended that the efficiency levels of the motors covered in this standard may be upgraded in a phased manner and the performance values given in the tables 1, 2 and 3 will be revised as per the proposed schedule below: (Refer Clause 17 for the efficiency classification)

1. To publish this revised edition of standard by June 2011
2. To recommended withdrawal of IE1 efficiency class for the motors under scope of the standard (from the the performance values given in the tables 1,2 and 3 with effect from Jan 2012
3. Similarly the committee recommends withdrawal of IE2 efficiency classes given in table 1,2 and 3 w.e.f from Jan 2014 for motor/s that are not supplied through variable frequency drive.; the motors would meet IE2 efficiency level if equipped with a variable frequency drive

Further, in line with the IEC standards, efficiency class IE4 is under consideration and envisaged to be incorporated in future by reducing the losses further than the IE3 levels. The technologies other than cage induction motors will be required to meet IE4 levels and the scope of the standard will be amended accordingly.

**BUREAU OF INDIAN STANDARDS**  
**DRAFT FOR COMMENTS ONLY**

(Not to be reproduced without the permission of BIS or used as *Indian Standard*)

Draft *Indian Standard*

**ENERGY EFFICIENT THREE PHASE SQUIRREL CAGE INDUCTION MOTORS**  
***Second Revision***

Last date for receipt of comments is **25-11-2010**

---

**1 SCOPE**

**1.1** This standard covers the requirements and performance of energy efficient, 3 phase squirrel cage induction motors in 2, 4, 6 poles for frame sizes from 80 up to 315L having output ratings as specified in IS 1231 for continuous duty (S1) operation, at rated voltage and frequency of 415 volts, 50Hz. The ratings and related frame sizes are given in the table 1, 2 and 3 with relevant performance figures. For higher ratings (above 160kW in 2 pole and 4 pole and above 132 kW in 6 pole), frame sizes will be as per manufacturers' catalogue.

**1.2** The performance of motors designed for operation on voltage other than rated voltage mentioned in 1.1 but up to 690 V, shall be in accordance with the relevant performance Tables 1 to 3 except the full load current values. The full load current will vary in the inverse proportion to the voltage in comparison to the values specified in the above-referred tables.

**1.3** To conform to this standard and eligible to be considered as energy efficient, the motors shall meet the norms specified in Tables 1 to 3 when read with clause 4 related to site conditions as applicable. All performance values are subjected to tolerances specified in IS 325/IEC 60034-1

**1.4 Exclusions:** Motors made solely for converter duty application in accordance with IEC 60034-25, motors completely integrated into the machine (e.g pumps, compressors, special machines etc) that cannot be tested separately from the machine and the motors rated for duty cycles S4 and above are excluded for the scope of this standard

**2. REFERENCES**

**2.1** The standards listed in Annex A are necessary adjuncts to this standard.

**3. TERMINOLOGY**

**3.1** For the purpose of this standard, definitions given in IS 1885 (Part 35) shall apply.

**4. SITE CONDITIONS**

The following shall constitute the normal site conditions.

## **4.1 Altitude and Temperature**

Motors shall be designed for the following site conditions unless otherwise agreed to between the manufacturer and the purchaser.

### **4.1.1 Altitude**

Altitude not exceeding 1000m Refer IS/IEC 60034-1

### **4.1.2 Temperature**

The cooling air temperature not exceeding 40°C. Refer IS/IEC60034-1

## **4.2 Electrical operating conditions**

**4.2.1** Clause 7 of IS/IEC 60034-1 shall apply

### **4.2.2 Form and Symmetry of Voltages and Currents**

The motors shall be so designed as to be able to operate on virtually sinusoidal and balanced voltage conditions as defined in **7.2.1** of IS/IEC60034-1.

## **4.3 Voltage and Frequency Variation**

**4.3.1** Motors shall be capable of delivering rated output with:

- a) The terminal voltage differing from its rated value by not more than  $\pm 10$  percent, or
- b) The frequency differing from its rated value by not more than  $\pm 5$  percent, or Combined variation – the sum of absolute percent variations of (a) and (b) not exceeding 10 percent.

In the case of continuous operation at extreme voltage limits as per the tolerance band of above variations, the temperature – rise limits specified in Table 1 of IS 12802 shall not exceed by more than 20°C for motors covered under this standard. In such case, motor may be required with higher class of insulation. Motors operated under the extreme conditions of voltage and / or frequency as per the tolerance bands above their performance in accordance with this standard may get reduced.

## **4.4 Location, moisture, Fumes etc.**

**4.4.1** It shall be assumed that the location and moisture or fumes shall not seriously interfere with the operation of the motor.

## **5 TYPE OF ENCLOSURES**

**5.1** The motors covered under this standard shall have IP 44 or superior degree of protection provided by the enclosures specified in IS/IEC 60034-5.

## **6 METHODS OF COOLING**

**6.1** The method of cooling shall be IC 411 in accordance with IS 6362(Part0/Sec0):1995 / IEC 60034-6:1991.

## **7 STANDARD VOLTAGE AND FREQUENCY**

### **7.1 Standard Voltage**

The preferred rated voltage shall be 415 V (*see* also **1.2**).

### **7.2 Standard Frequency**

The standard frequency shall be 50 Hz.

## **8 DUTY AND RATING**

**8.1** The motors shall be rated for duty type S1 (continuous duty) as specified in 4.2.1 of IS/IEC 60034-1 or S3 (intermittent periodic duty) with a rated cyclic duration factor of 80% or higher. This standard will not be applicable to the motors with duty cycles S2, S4 and above.

## **9 DIMENSIONS, FRAME NUMBER AND OUTPUT RELATIONSHIP**

**9.1** The fixing dimensions and shaft extensions of motors shall conform to the values specified in IS 1231 and IS 2223 (or IEC 60072-1) as relevant.

**9.2** The relationship between output in KW and frame number shall be according to IS 1231/ IEC 60072-1) as relevant.

## **10 EARTHING**

**10.1** The earthing on the motor shall be provided in accordance with IS 3043 / IEC 60204-1

## **11 OVERLOAD**

### **11.1 Momentary Excess Torque**

The motor shall be capable of withstanding 1.6 times the rated torque for 15 s without stalling or abrupt change in speed (under gradual increase of torque), the voltage and frequency being maintained at their rated values.

### **11.2 Pull up torque**

Unless otherwise specified, the minimum pull-up-torque of motors, at rated voltage and frequency shall be minimum 0.5 times the rated full load torque.

### **11.3 Sustained Overloads**

Motor rated in accordance with this standard are not expected to be capable of carrying sustained overloads.

### **12 TEMPERATURE RISE**

**12.1** The determination of the temperature rise of motors delivering rated output under rated conditions of voltage, frequency shall be in accordance with **IS/IEC 60034-1**

**12.1.1** The limits of temperature rise shall be 80°C (by resistance method) over an ambient of 40°C for motor with Class B or Class F insulation, however, Class F insulation is preferred

### **13 LIMITS OF VIBRATION**

**13.1** The motors manufactured shall conform to “Vibration Grade A” according to IS 12075:1887 / IEC 60034-14)

### **14 PERFORMANCE VALUES**

**14.1** Operating at rated voltage and rated frequency, the performance of the motor at rated conditions shall be as specified in Tables 1 to 3. All the performance values are subject to tolerance as specified in IS/IEC 60034-1

**14.2** The value of full load current shall be taken as the average of the currents measured in the three phases.

**14.3** For motors having rated voltage other than 415V, the performance of the motor shall be as per the values in the relevant tables, except that the value of the maximum full load current would be changed in the inverse proportion of the voltage.

**14.4** With reference to the locked rotor current refer Tables 1 to 3

Energy efficient cage-induction motors are typically built with more active material to achieve higher efficiency and hence the starting performance of these motors differs somewhat from motors with a lower efficiency. The locked-rotor current increases approximately by 10 to 15 percent for increase in each level of efficiency for the same output power and the values are as given in the tables 1 to 3

### **15 NOISE LEVEL**

**15.1** The noise level of motors shall be in accordance with IS 12065 / IEC 60034-9

### **16 TERMINAL MARKING**

**16.1** The terminal markings shall be in accordance with IS/IEC 60034-8

### **17. EFFICIENCY**

**17.1** For compliance with the requirements of this standard, the values of efficiency listed under appropriate efficiency class will be as per the enclosed tables 1,2 and 3. The values given in tables 1,2 and 3 are subject to tolerance as specified in IS/IEC 60034-1,

The efficiency classes shall be described as per following:

| <b>Efficiency Class</b>   | <b>Description</b> | <b>Definition</b>  |
|---|--------------------|--|
| IE1   | Standard           | Motors with rated full load efficiency => the corresponding limits listed in table 1,2,3 |
| IE2   | High               |  |
| IE3   | Premium            |  |
| IE4   | Super Premium      | Under Consideration **   |
| ** Efficiency class IE4 is under consideration and envisaged to be incorporated in future by reducing the losses further than IE3 levels. |                    |  |

**17.2** The losses and efficiency of these motors shall be calculated according to IEC60034-2-1.

**17.3** To ensure a representative test result for windage and friction losses and in accordance with the common practice, the test should be done in a stabilized bearing condition and in the case of motors with seals, tests shall be conducted without installing the seals.

## **18 TEST AND TEST CERTIFICATES**

### **18.1 Tests and Their Classification**

**18.1.1** Tests and their classification shall be in accordance with IS/IEC 60034-1. The tests specified below shall normally be carried out at the manufacturer's works. If normal test arrangements are inapplicable, as for example, in the case of certain large or special motors, the test to be made and the manner of application shall be a matter of agreement between the manufacturers and the purchasers. For details of test method, reference may be made to IS/IEC 60034-1. For those tests that are not covered under IS/IEC 60034-1, reference may be made to IS: 4029: 1967.

#### **18.1.2 Classification of Test**

##### **18.1.2.1 Type Tests**

The following shall constitute type tests:

- a) Dimensions
- b) Measurement of resistance of windings of stator
- c) No load test at rated voltage to determine input current power and speed
- e) Reduced voltage running up test at no load (for squirrel cage motors up to 37 kW only)
- f) Locked rotor readings of voltage, current, power input and torque at a suitable reduce voltage
- g) Full load test to determine efficiency power factor and slip
- h) Temperature rise test
- j) Momentary overload test
- k) Insulation resistance test
- m) High voltage test

- \*n) Test for vibration severity of motor
  - \*p) Test for noise levels of motor
  - \*q) Test for degree of protection by enclosure
  - \*r) Temperature rise test at limiting values of voltage and frequency variation;
  - \*s) Over speed test and
  - \*t) Test on insulation system
- \*These are optional tests subject to mutual agreement between manufacturer and purchaser

#### **18.1.2.2 Routine Tests:**

The following shall constitute the routine tests:

- a) Insulation resistance test
- b) Measurement of resistance of windings of stator
- c) No load test
- d) Locked rotor readings of voltage, current and power input at a suitable reduced voltage
- e) Reduced voltage running up test
- f) High voltage test

#### **18.2 Test Certificates**

**18.2.1** Unless otherwise specified, the purchaser shall accept manufacturer's certificate as evidence of compliance of the motor with the requirements of this standard together with a type test certificate on a motor identical in essential details with the one purchased, together with routine tests on each individual motor.

**18.2.2** Certificate of routine tests shall show that the motor purchased has been run and has been found to be electrically and mechanically sound.

#### **19 LABELING**

**19.1** In addition to the data specified in IS/IEC 60034-1, the appropriate efficiency class (for example, IE2) as additional information on the name plate after the efficiency value and Reference to this standard, shall be marked in the name plate.

**Table 1 - Values of Performance Characteristics of 2 Pole Energy Efficient Induction Motors**  
(Clauses Foreword, 1.1, 4.3 & 17.1)

| Sl No. | Rated Output | Frame Size | Full Load Speed (Min) | Full Load Current (Max.) | Breakaway Torque in terms of full load torque (Min) | Breakaway Current in terms of full load current (equal or below) |         |         | Nominal efficiency (percent) |         |         |
|--------|--------------|------------|-----------------------|--------------------------|---|--|---------|---------|------------------------------|---------|---------|
|        |              |            |                       |                          |   | For IE1  | For IE2 | For IE3 | IE1                          | IE2     | IE3     |
|        |              |            |                       |                          | RPM   | Amps   | Percent | Percent | Percent                      | Percent | Percent |
| 1.     | 0.37         | 71         | 2790                  | 1.2                      | 170   | 600  | 650     | 700     | 66.1                         | 72.2    | 75.5    |
| 2.     | 0.55         | 71         | 2760                  | 1.6                      | 170   | 600  | 650     | 700     | 69.1                         | 74.8    | 78.1    |
| 3.     | 0.75         | 80         | 2780                  | 2.0                      | 170   | 600  | 650     | 700     | 72.1                         | 77.4    | 80.7    |
| 4.     | 1.1          | 80         | 2790                  | 2.8                      | 170   | 600  | 650     | 700     | 75.0                         | 79.6    | 82.7    |
| 5.     | 1.5          | 90S        | 2800                  | 3.7                      | 170   | 600  | 650     | 700     | 77.2                         | 81.3    | 84.2    |
| 6.     | 2.2          | 90L        | 2810                  | 5.0                      | 170   | 650  | 700     | 770     | 79.7                         | 83.2    | 85.9    |
| 7.     | 3.7          | 100L       | 2820                  | 8.0                      | 160   | 650  | 700     | 770     | 82.7                         | 85.5    | 87.8    |
| 8.     | 5.5          | 132S       | 2830                  | 11.0                     | 160   | 650  | 700     | 770     | 84.7                         | 87.0    | 89.2    |
| 9.     | 7.5          | 132S       | 2840                  | 15.0                     | 160   | 650  | 700     | 770     | 86.0                         | 88.1    | 90.1    |
| 10.    | 9.3          | 160M       | 2840                  | 18.5                     | 160   | 650  | 700     | 770     | 86.9                         | 88.8    | 90.7    |
| 11.    | 11.0         | 160M       | 2860                  | 21.5                     | 160   | 650  | 700     | 770     | 87.6                         | 89.4    | 91.2    |
| 12.    | 15.0         | 160M       | 2870                  | 29.0                     | 160   | 650  | 700     | 770     | 88.7                         | 90.3    | 91.9    |
| 13.    | 18.5         | 160L       | 2880                  | 35.0                     | 160   | 650  | 700     | 770     | 89.3                         | 90.9    | 92.4    |
| 14.    | 22.0         | 180M       | 2890                  | 41.5                     | 160   | 650  | 700     | 770     | 89.9                         | 91.3    | 92.7    |
| 15.    | 30.0         | 200L       | 2900                  | 54.0                     | 160   | 650  | 700     | 770     | 90.7                         | 92.0    | 93.3    |
| 16.    | 37.0         | 200L       | 2900                  | 67.0                     | 160   | 650  | 700     | 770     | 91.2                         | 92.5    | 93.7    |
| 17.    | 45.0         | 225M       | 2955                  | 80.0                     | 160   | 650  | 700     | 770     | 91.7                         | 92.9    | 94.0    |
| 18.    | 55.0         | 250M       | 2960                  | 95.0                     | 160   | 650  | 700     | 770     | 92.1                         | 93.2    | 94.3    |

|     |       |  |      |       |     |     |     |     |      |      |   |
|-----|-------|--|------|-------|-----|-----|-----|-----|------|------|---|
| 19. | 75.0  | 280S                                     | 2970 | 130.0 | 160 | 650 | 700 | 770 | 92.7 | 93.8 | 9 |
| 20. | 90.0  | 280M                                     | 2970 | 150.0 | 160 | 650 | 700 | 770 | 93.0 | 94.1 | 9 |
| 21. | 110.0 | 315S                                     | 2980 | 185.0 | 160 | 650 | 700 | 770 | 93.3 | 94.3 | 9 |
| 22. | 125.0 | 315M                                     | 2980 | 209.0 | 160 | 650 | 700 | 770 | 93.4 | 95.5 | 9 |
| 23. | 132.0 | 315M <sup>1)</sup>                       | 2980 | 220.0 | 160 | 650 | 700 | 770 | 93.5 | 94.6 | 9 |
| 24. | 160.0 | 315L <sup>1)</sup>                       | 2980 | 265.0 | 160 | 650 | 700 | 770 | 93.8 | 94.8 | 9 |
| 25. | 200.0 | As per<br>manufact-<br>urer<br>catalogue | 2980 | 340.0 | 160 | 650 | 700 | 770 | 94.0 | 95.0 | 9 |
| 26. | 250.0 |  | 2980 | 425.0 | 160 | 650 | 700 | 770 | 94.0 | 95.0 | 9 |
| 27. | 315.0 |  | 2980 | 536.0 | 160 | 650 | 700 | 770 | 94.0 | 95.0 | 9 |
| 28. | 355.0 |  | 2980 | 604.0 | 160 | 650 | 700 | 770 | 94.0 | 95.0 | 9 |

**Table 2 - Values of Performance characteristics of 4 pole Energy Efficient Induction motors**

| Sr No | Rated Output | Frame Size | Full Load Speed (Min.) | Full Load Current (Max.) | Breakaway Torque in terms of full load torque (Min) | Breakaway Current in terms of full load current (equal or below) |         |         | Nominal efficiency (%) |         |         |
|-------|--------------|------------|------------------------|--------------------------|---|--|---------|---------|------------------------|---------|---------|
|       |              |            |                        |                          |   | For IE1  | For IE2 | For IE3 | IE1                    | IE2     | IE3     |
|       | KW           |            | RPM                    | Amps                     | Percent   | Percent  | Percent | Percent | Percent                | Percent | Percent |
| 1     | 0.37         | 71         | 1330                   | 1.4                      | 170.0   | 550  | 600     | 650     | 65.1                   | 70.1    | 73.0    |
| 2     | 0.55         | 80         | 1340                   | 1.7                      | 170.0   | 550  | 600     | 650     | 69.1                   | 75.1    | 78.0    |
| 1     | 0.75         | 80         | 1360                   | 2.2                      | 170.0   | 550  | 600     | 650     | 72.1                   | 79.6    | 82.5    |
| 2     | 1.1          | 90S        | 1370                   | 2.9                      | 170.0   | 550  | 600     | 650     | 75.0                   | 81.4    | 84.1    |
| 3     | 1.5          | 90L        | 1380                   | 3.8                      | 170.0   | 550  | 600     | 650     | 77.2                   | 82.8    | 85.3    |
| 4     | 2.2          | 100L       | 1390                   | 5.1                      | 170.0   | 650  | 700     | 750     | 79.7                   | 84.3    | 86.7    |
| 5     | 3.7          | 112M       | 1410                   | 8.1                      | 160.0   | 650  | 700     | 750     | 82.7                   | 86.3    | 88.4    |
| 6     | 5.5          | 132S       | 1420                   | 11.4                     | 160.0   | 650  | 700     | 750     | 84.7                   | 87.7    | 89.6    |
| 7     | 7.5          | 132M       | 1430                   | 15.4                     | 160.0   | 650  | 700     | 750     | 86.0                   | 88.7    | 90.4    |
| 8     | 9.3          | 160M       | 1430                   | 18.5                     | 160.0   | 650  | 700     | 750     | 86.9                   | 89.3    | 91      |
| 9     | 11.0         | 160M       | 1440                   | 22.0                     | 160.0   | 650  | 700     | 750     | 87.6                   | 89.8    | 91.4    |
| 10    | 15.0         | 160M       | 1440                   | 30.0                     | 160.0   | 650  | 700     | 750     | 88.7                   | 90.6    | 92.1    |
| 11    | 18.5         | 180M       | 1440                   | 36.0                     | 160.0   | 650  | 700     | 750     | 89.3                   | 91.2    | 92.6    |
| 12    | 22.0         | 180L       | 1440                   | 43.0                     | 160.0   | 650  | 700     | 750     | 89.9                   | 91.6    | 93.0    |
| 13    | 30.0         | 200L       | 1450                   | 56.0                     | 160.0   | 650  | 700     | 750     | 90.7                   | 92.3    | 93.6    |
| 14    | 37.0         | 225S       | 1450                   | 69.0                     | 160.0   | 650  | 700     | 750     | 91.2                   | 92.7    | 93.9    |
| 15    | 45.0         | 225M       | 1460                   | 84.0                     | 160.0   | 650  | 700     | 750     | 91.7                   | 93.1    | 94.2    |
| 16    | 55.0         | 250M       | 1460                   | 99.0                     | 160.0   | 650  | 700     | 750     | 92.1                   | 93.5    | 94.6    |

|    |       |  |      |       |       |     |     |     |      |      |      |
|----|-------|--|------|-------|-------|-----|-----|-----|------|------|------|
| 17 | 75.0  | 280S                                     | 1470 | 134.0 | 160.0 | 650 | 700 | 770 | 92.7 | 94.0 | 95.0 |
| 18 | 90.0  | 280M                                     | 1470 | 164.0 | 160.0 | 650 | 700 | 770 | 93.0 | 94.2 | 95.2 |
| 19 | 110.0 | 315S                                     | 1480 | 204.0 | 160.0 | 650 | 700 | 770 | 93.3 | 94.5 | 95.4 |
| 20 | 125.0 | 315M                                     | 1480 | 234.0 | 160.0 | 650 | 700 | 770 | 93.4 | 94.6 | 95.5 |
| 21 | 132.0 | 315M <sup>1)</sup>                       | 1480 | 247.0 | 160.0 | 650 | 700 | 770 | 93.5 | 94.7 | 95.6 |
| 22 | 160.0 | 315L <sup>1)</sup>                       | 1480 | 288.0 | 160.0 | 650 | 700 | 770 | 93.8 | 94.9 | 95.8 |
| 23 | 200.0 | As per<br>manufact-<br>urer<br>catalogue | 1480 | 348.0 | 160.0 | 650 | 700 | 770 | 94.0 | 95.1 | 96.0 |
| 24 | 250.0 |  | 1480 | 435.0 | 160.0 | 650 | 700 | 770 | 94.0 | 95.1 | 96.0 |
| 25 | 315.0 |  | 1480 | 548.0 | 160.0 | 650 | 700 | 770 | 94.0 | 95.1 | 96.0 |
| 26 | 355.0 |  | 1480 | 618.0 | 160.0 | 650 | 700 | 770 | 94.0 | 95.1 | 96.0 |
| 27 | 375.0 |  | 1480 | 653.0 | 160.0 | 650 | 700 | 770 | 94.0 | 95.1 | 96.0 |

Note- Output to frame size relation is maintained in accordance with IS:1231 for all motors except those marked as <sup>1)</sup>, wherein the frame size indicated is "preferred size"

**Table 3 - Values of Performance characteristics of 6 pole Energy Efficient Induction motors**

| Sr No | Rated Output | Frame Size | Full Load Speed (Min.) | Full Load Current (Max.) | Breakaway Torque in terms of full load torque (Min) | Breakaway Current in terms of full load current (equal or below) |                |                | Nominal efficiency (%) |                |                |
|-------|--------------|------------|------------------------|--------------------------|---|--|----------------|----------------|------------------------|----------------|----------------|
|       |              |            |                        |                          |   | For IE1  | For IE2        | For IE3        | IE1                    | IE2            | IE3            |
|       | <b>KW</b>    |            | <b>RPM</b>             | <b>Amps</b>              | <b>Percent</b>                                      | <b>Percent</b>   | <b>Percent</b> | <b>Percent</b> | <b>Percent</b>         | <b>Percent</b> | <b>Percent</b> |
| 1     | 0.37         | 80         | 870                    | 1.4                      | 160   | 550  | 600            | 650            | 63.0                   | 69.0           | 71.9           |
| 2     | 0.55         | 80         | 870                    | 1.9                      | 160   | 550  | 600            | 650            | 67.0                   | 72.9           | 75.9           |
| 1     | 0.75         | 90S        | 890                    | 2.3                      | 160   | 550  | 600            | 650            | 70.0                   | 75.9           | 78.9           |
| 2     | 1.1          | 90L        | 900                    | 3.2                      | 160   | 550  | 600            | 650            | 72.9                   | 78.1           | 81.0           |
| 3     | 1.5          | 100L       | 900                    | 4.0                      | 160   | 550  | 600            | 650            | 75.2                   | 79.8           | 82.5           |
| 4     | 2.2          | 112M       | 910                    | 5.5                      | 150   | 650  | 700            | 750            | 77.7                   | 81.8           | 84.3           |
| 5     | 3.7          | 132S       | 920                    | 8.8                      | 150   | 650  | 700            | 750            | 80.9                   | 84.3           | 86.5           |
| 6     | 5.5          | 132M       | 920                    | 12.7                     | 150   | 650  | 700            | 750            | 83.1                   | 86.0           | 88.0           |

|    |       |                                   |     |       |     |     |     |     |      |      |      |
|----|-------|-----------------------------------|-----|-------|-----|-----|-----|-----|------|------|------|
| 7  | 7.5   | 160M                              | 930 | 16.7  | 150 | 650 | 700 | 750 | 84.7 | 87.2 | 89.1 |
| 8  | 9.3   | 160L                              | 930 | 20.5  | 140 | 650 | 700 | 750 | 85.6 | 88.0 | 89.7 |
| 9  | 11.0  | 160L                              | 935 | 23.0  | 140 | 650 | 700 | 750 | 86.4 | 88.7 | 90.3 |
| 10 | 15.0  | 180L                              | 940 | 30.5  | 140 | 650 | 700 | 750 | 87.7 | 89.7 | 91.2 |
| 11 | 18.5  | 200L                              | 940 | 37.5  | 140 | 650 | 700 | 750 | 88.6 | 90.4 | 91.7 |
| 12 | 22.0  | 200L                              | 945 | 44.0  | 140 | 650 | 700 | 750 | 89.2 | 90.9 | 92.2 |
| 13 | 30.0  | 225M                              | 945 | 59.0  | 140 | 650 | 700 | 750 | 90.2 | 91.7 | 92.9 |
| 14 | 37.0  | 250M                              | 950 | 72.0  | 140 | 650 | 700 | 750 | 90.8 | 92.2 | 93.3 |
| 15 | 45.0  | 280S                              | 960 | 87.0  | 140 | 650 | 700 | 750 | 91.4 | 92.7 | 93.7 |
| 16 | 55.0  | 280M                              | 960 | 107.0 | 140 | 650 | 700 | 750 | 91.9 | 93.1 | 94.1 |
| 17 | 75.0  | 315S                              | 970 | 145.0 | 140 | 650 | 700 | 770 | 92.6 | 93.7 | 94.6 |
| 18 | 90.0  | 315M                              | 970 | 175.0 | 140 | 650 | 700 | 770 | 92.9 | 94.0 | 94.9 |
| 19 | 110.0 | 315M <sup>1)</sup>                | 970 | 214.0 | 140 | 650 | 700 | 770 | 93.3 | 94.3 | 95.1 |
| 20 | 125.0 | 315M <sup>1)</sup>                | 970 | 245.0 | 140 | 650 | 700 | 770 | 93.4 | 94.4 | 95.2 |
| 21 | 132.0 | 315L <sup>1)</sup>                | 980 | 257.0 | 140 | 650 | 700 | 770 | 93.5 | 94.6 | 95.4 |
| 22 | 160.0 | as per<br>motor mfr<br>catalogue. | 980 | 315.0 | 140 | 650 | 700 | 770 | 93.8 | 94.8 | 95.6 |
| 23 | 200.0 |                                   | 980 | 370.0 | 140 | 650 | 700 | 770 | 94.0 | 95.0 | 95.8 |
| 24 | 250.0 |                                   | 980 | 463.0 | 140 | 650 | 700 | 770 | 94.0 | 95.0 | 95.8 |
| 25 | 315.0 |                                   | 980 | 583.0 | 140 | 650 | 700 | 770 | 94.0 | 95.0 | 95.8 |
| 26 | 355.0 |                                   | 980 | 657.0 | 140 | 650 | 700 | 770 | 94.0 | 95.0 | 95.8 |
| 27 | 375.0 |                                   | 980 | 694.0 | 140 | 650 | 700 | 770 | 94.0 | 95.0 | 95.8 |

Note- Output to frame size relation is maintained in accordance with IS:1231 for all motors except those marked as <sup>1)</sup>, wherein the frame size indicated is "preferred size"

**Annexure A**  
**(Clause 2.1)**  
**List of reference Standards**

| IS No.           | Title   |
|------------------|---|
| 325              | Three phase induction motors  |
| 900              | Code of practice for installation and maintenance of induction motors   |
| 1231             | Dimensions of three phase foot mounted induction motors   |
| 1885             | Electro technical vocabulary: Part 35 Rotating Machines   |
| 2223             | Dimensions of flange mounted ac induction machines  |
| 2254             | Dimensions of vertical shaft motors for pumps   |
| 3043             | Code of Practice for Earthing   |
| 4029             | Guide for testing three phase induction motors  |
| 4691             | Degrees of protection provided by enclosure for rotating electric machinery   |
| 4728             | Terminal marking and direction of rotation for rotating electric machinery  |
| IS/IEC 60034-2-1 | Methods of determination of efficiency of rotating electric machines  |
| 6362             | Designation of methods of cooling of rotating electric machines   |
| 12065            | Permissible Noise Levels for rotating Electrical machines   |
| 12075            | Mechanical vibration of rotating electrical machines with shaft heights 56mm and higher- measurement, evaluation and limits of vibration severity |
| 12802            | Temperature Rise measurement of rotating electric machines  |

-----