Indian Standard for Energy Efficient Motors
(For Line operated Three Phase A.C. Motors)

Electric motors are a basic need of industry and are known as the “work horses” of industry as it is estimated that motors use about 70% of the total electrical load in industry. Electric motors are used in driving a broad range of industrial applications, such as pumps, compressors, fans or blowers, conveyors and other machines.

The poor efficiency of the substandard motors lead to more energy consumption and energy cost. Therefore improvement in efficiency of the motor must be a part of any comprehensive energy conservation effort.

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 60034-30-1: 2014, thus defining minimum efficiency performance standards (MEPS) in their countries. Such regulations are expected to impose technical barriers to all the imports of motors which are with lower efficiency classes than the MEPS in to their countries.

Upgrading the Indian Standard inline with International standards also addresses the threat of trade barriers for exports and at the same time arrest the potential influx of inefficient motors in the country.

IS 12615 was first published in 1989 with further revisions were implemented in 2004, 2011 & 2018 to harmonize with the global standards & international best practices to include all the efficiency classes present. Year 2018 was a historical year for LT Motor Industry as with the Quality Control Order (QCO) released by Dept. of Industrial Policy & Promotion (DIPP), efficiency class IE2 became Minimum Energy Performance Standard (MEPS) in India.

**IS 12615 – Past & Present**

**1989**
- 1st version of IS: 12615:1989
- Covers 4 pole motors up to 37kW

**2004**
- 1st revision of IS: 12615-2004
- Extends the range of motors (covers 2P and 4P motors from 0.37kW-160kW, 6P motors from 0.37-132kW 8P motors from 0.37-110kW)
- Efficiency Levels – Eff1 & Eff2 (CEMEP)
- Test method – 60034-2

**2011**
- 2nd revision of IS: 12615-2011
- Extends the range of motors (covers 2P, 4P and 6P motors from 0.37kW – 375kW)
- Efficiency levels – IE1, IE2 & IE3 (IEC60034-30:2008)
- Additional parameters like breakaway torque, current & full load current are included.

**2018**
- 3rd Revision of IS 12615:2018
- Extends range up to 1000kW & also includes 8P motors
- Testing Method: As per IS 15999 (Part 2)/IEC 60034-1
- Efficiency Classes: IE2, IE3, IE4 in line with IEC 60034-30-1: 2014
- Motors with customized dimensions different from IS 1231 are also covered by this standard.

**LIKELY FUTURE:** Minimum Energy Performance Standard as IE3
The Motor Efficiency Classes are as under:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3-phase induction motors (Low Voltage &lt; 1,000 V)</td>
<td>IEC 60034-30-1, 2014</td>
<td>IEC 60034-2-1, 2014</td>
<td>Mandatory MEPS III</td>
<td></td>
</tr>
<tr>
<td>Global classes IE-Code</td>
<td>Incl. stray load losses</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Super Premium Efficiency**
- **IE4**
  - Canada: (0.75 - 150 kW)
  - Mexico: (0.75 - 375 kW)
  - US: (0.75 - 375 kW)
  - US: (0.18 - 2.2 kW)
  - Republic of Korea***: (37 - 375 kW)
  - EU 28*: (0.75 - 375 kW)
  - Switzerland*: (0.75 - 375 kW)
  - Turkey*: (7.5 - 375 kW)
  - Japan Toprunner: (0.75 - 375 kW)
  - Israel: (7.5 - 375 kW)
  - Taiwan: (0.75 - 200 kW)
  - Saudi Arabia: (0.75 - 375 kW)
  - Australia: (< 185 kW)
  - Brazil: (< 185 kW)
  - Canada: (150 - 375 kW)
  - China**: (0.75 - 375 kW)
  - EU 28*: (IE2 + VFD)
  - Republic of Korea***: (0.75 - 30 kW)
  - New Zealand: (< 185 kW)
  - Israel: (0.75 - 5.5 kW)
  - Turkey: (0.75 - 5.5 kW)
  - Japan Toprunner: (0.75 - 375 kW)
  - Republic of Korea***: (0.75 - 30 kW)
  - New Zealand: (< 185 kW)
  - Israel: (0.75 - 5.5 kW)
  - Turkey: (0.75 - 5.5 kW)
  - Iran (Islamic Republic of)
  - India *** ***): (0.37 - 375 kW)
  - Costa Rica
  - Chile: (< 7.5 kW)
  - Vietnam

**Premium Efficiency**
- **IE3**

**High Efficiency**
- **IE2**

**Standard Efficiency**
- **IE1**

**Below Standard**
- **IE0**

Note: Motor must at least meet IE2 to be classified as Energy Efficient.

Diagram: Motor Efficiency Classes - 4 pole motors
Highlights of IS 12615: 2018

This standard covers the following range of single speed line operated a.c. motors, which:

- Have a rated power from 0.12 kW to 1 000 kW;
- Have 2, 4, 6 or 8 poles
- Have a rated voltage Un up to 1000 V with a rated frequency of 50 Hz
- Frame size from 56 up to and including 315 M having Frame to output co-relation as specified in Table 3 of IS 1231
- Frame size 315 L with dimensions as per IS 1231 and having output rating as declared by motor manufacturer
- Frame size 355 and above, with dimensions and output ratings as declared by motor manufacturer but conforming to IS 8223
- Are capable of continuous operation at their rated power with a winding temperature rise within the specified insulation temperature class
- Are marked with any ambient temperature within the range of – 20°C to + 60°C
- Are marked with an altitude up to 4000 m above sea level
- This standard covers motors with or without service factor
- Most motors covered by this standard are primarily rated for duty type S1 (continuous duty). Motors rated for duty cycles S2 and above with an equivalent S1 duty are also covered. These motors must also be marked with the equivalent S1 duty output and its corresponding IE class. Declaration of S1 duty output value may be as per mutual agreement between motor manufacturer and customer
- Motors with output power rating higher than as specified in Table 3 of IS 1231 for a given frame, must meet the efficiency class corresponding to that power rating

The values of efficiency for motors to classify as IE2, IE3 or IE4 in accordance with the new IS 12615 are as under:

<table>
<thead>
<tr>
<th>Rating (kW)</th>
<th>Frame Size</th>
<th>2 POLE Efficiency (%)</th>
<th>Frame Size</th>
<th>4 POLE Efficiency (%)</th>
<th>Frame Size</th>
<th>6 POLE Efficiency (%)</th>
<th>Frame Size</th>
<th>8 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.12</td>
<td>56</td>
<td>53.6</td>
<td>60.8</td>
<td>66.5</td>
<td>56</td>
<td>59.1</td>
<td>64.8</td>
<td>69.8</td>
</tr>
<tr>
<td>0.18</td>
<td>63</td>
<td>60.4</td>
<td>65.9</td>
<td>70.8</td>
<td>63</td>
<td>64.7</td>
<td>69.9</td>
<td>74.7</td>
</tr>
<tr>
<td>0.25</td>
<td>63</td>
<td>64.8</td>
<td>69.7</td>
<td>74.3</td>
<td>71</td>
<td>68.5</td>
<td>73.5</td>
<td>77.9</td>
</tr>
<tr>
<td>0.37</td>
<td>71</td>
<td>69.5</td>
<td>73.8</td>
<td>78.1</td>
<td>71</td>
<td>72.7</td>
<td>77.3</td>
<td>81.1</td>
</tr>
<tr>
<td>0.55</td>
<td>71</td>
<td>74.1</td>
<td>77.8</td>
<td>81.5</td>
<td>80</td>
<td>77.1</td>
<td>80.8</td>
<td>83.9</td>
</tr>
<tr>
<td>0.75</td>
<td>80</td>
<td>77.4</td>
<td>80.7</td>
<td>83.5</td>
<td>80</td>
<td>79.6</td>
<td>82.5</td>
<td>85.7</td>
</tr>
<tr>
<td>1.1</td>
<td>80</td>
<td>79.6</td>
<td>82.7</td>
<td>85.2</td>
<td>90S</td>
<td>81.4</td>
<td>84.1</td>
<td>87.2</td>
</tr>
<tr>
<td>1.5</td>
<td>90S</td>
<td>81.3</td>
<td>84.2</td>
<td>86.5</td>
<td>90L</td>
<td>82.8</td>
<td>85.3</td>
<td>88.2</td>
</tr>
<tr>
<td>2.2</td>
<td>90L</td>
<td>83.2</td>
<td>85.9</td>
<td>88</td>
<td>90L</td>
<td>84.3</td>
<td>86.7</td>
<td>89.5</td>
</tr>
<tr>
<td>3.7</td>
<td>100L</td>
<td>85.5</td>
<td>87.8</td>
<td>89.7</td>
<td>112M</td>
<td>86.3</td>
<td>88.4</td>
<td>90.9</td>
</tr>
<tr>
<td>5.5</td>
<td>132S</td>
<td>87</td>
<td>89.2</td>
<td>90.9</td>
<td>132S</td>
<td>87.7</td>
<td>89.6</td>
<td>91.9</td>
</tr>
<tr>
<td>7.5</td>
<td>132S</td>
<td>88.1</td>
<td>90.1</td>
<td>91.7</td>
<td>132M</td>
<td>88.7</td>
<td>90.4</td>
<td>92.6</td>
</tr>
<tr>
<td>11</td>
<td>160M</td>
<td>89.4</td>
<td>91.2</td>
<td>92.6</td>
<td>160M</td>
<td>89.8</td>
<td>91.4</td>
<td>93.3</td>
</tr>
<tr>
<td>15</td>
<td>160L</td>
<td>90.3</td>
<td>91.9</td>
<td>93.3</td>
<td>160L</td>
<td>90.6</td>
<td>92.1</td>
<td>93.9</td>
</tr>
<tr>
<td>18.5</td>
<td>160L</td>
<td>90.9</td>
<td>92.4</td>
<td>93.7</td>
<td>180M</td>
<td>91.2</td>
<td>92.6</td>
<td>94.2</td>
</tr>
<tr>
<td>22</td>
<td>180M</td>
<td>91.3</td>
<td>92.7</td>
<td>94</td>
<td>180L</td>
<td>91.6</td>
<td>93</td>
<td>94.5</td>
</tr>
<tr>
<td>30</td>
<td>200L</td>
<td>92</td>
<td>93.3</td>
<td>94.5</td>
<td>200L</td>
<td>92.3</td>
<td>93.6</td>
<td>94.9</td>
</tr>
<tr>
<td>37</td>
<td>200L</td>
<td>92.5</td>
<td>93.7</td>
<td>94.8</td>
<td>225S</td>
<td>92.7</td>
<td>93.9</td>
<td>95.2</td>
</tr>
<tr>
<td>45</td>
<td>225M</td>
<td>92.9</td>
<td>94</td>
<td>95</td>
<td>225M</td>
<td>93.1</td>
<td>94.2</td>
<td>95.4</td>
</tr>
<tr>
<td>55</td>
<td>250M</td>
<td>93.2</td>
<td>94.3</td>
<td>95.3</td>
<td>250M</td>
<td>93.5</td>
<td>94.6</td>
<td>95.7</td>
</tr>
<tr>
<td>75</td>
<td>280S</td>
<td>93.8</td>
<td>94.7</td>
<td>95.6</td>
<td>280S</td>
<td>94</td>
<td>95</td>
<td>96</td>
</tr>
<tr>
<td>90</td>
<td>280M</td>
<td>94.1</td>
<td>95</td>
<td>95.8</td>
<td>280M</td>
<td>94.2</td>
<td>95.2</td>
<td>96.1</td>
</tr>
<tr>
<td>110</td>
<td>315S</td>
<td>94.3</td>
<td>95.2</td>
<td>96</td>
<td>315S</td>
<td>94.5</td>
<td>95.4</td>
<td>96.3</td>
</tr>
<tr>
<td>132</td>
<td>315M1</td>
<td>94.6</td>
<td>95.4</td>
<td>96.2</td>
<td>315M1</td>
<td>94.7</td>
<td>95.6</td>
<td>96.4</td>
</tr>
<tr>
<td>160</td>
<td>315L1</td>
<td>94.8</td>
<td>95.6</td>
<td>96.3</td>
<td>315L1</td>
<td>94.9</td>
<td>95.8</td>
<td>96.6</td>
</tr>
<tr>
<td>200 to 1000</td>
<td>Manufacture catalogue</td>
<td>95</td>
<td>95.8</td>
<td>96.5</td>
<td>Manufacture catalogue</td>
<td>95.1</td>
<td>96</td>
<td>96.7</td>
</tr>
</tbody>
</table>

As per manufacturer catalogue

<table>
<thead>
<tr>
<th>8 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>95</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>8 POLE Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>93</td>
</tr>
</tbody>
</table>
FAQs related to Standard

Q1. Does the standard cover different types of mounting arrangements?
A. The standard covers implicitly and explicitly all mounting arrangements naming a few as B3, B6, B7, B8, B35, B34, B5, B14, V5, V6, V15, V36, V1, V3, V18 and V19.

Q2. Does the standard cover Service Factors greater than 1.0?
A. The standard clearly covers motors with and without Service Factor. Refer Clause 1.1 (k). Also if service factor greater than 1.0 is declared, the motor is intended to be run for a short time (< 1 hour) (See Note 5 under clause 1.1). In this case the efficiency can match the rated power of the motor. However, if the motor is declared to operate at a service factor greater than 1.0 continuously (for greater than 1 hour), the efficiency has to match the service factor power (Rating X Service Factor).

Q3. Does the standard cover motors made exclusively for converter duty applications?
A. When the Motors and Drives are independent units, motors must have minimum IE2 efficiency when tested with sinusoidal supply (grid/DG set or equivalent). In other words, only IE2/IE3/IE4 motors can be used with VFD supply. (See note under clause 15.1.1)

Q4. Are motors with Integrated Converters covered by the standard?
A. Where the motor cannot be independently tested without the controller, those are exempt from marking with the IE code. See Clause 1.4 (f). But the Motors with integrated frequency converters (compact drives) can be separated and the motor can be independently tested. These motors are covered for efficiency classification. (See note under clause 1.4 (f))

Q5. Does the standard cover motors completely integrated with the load?
A. If the product cannot be tested independent of the load (like mono-bloc pumps), the standard does not cover the same. See Clause 1.4 (e).

Q6. Does the standard cover motors that have an ambient temperature other than 40oC (old IS12615: 2011)
A. The standard covers temperatures between -20oC to +60oC. Besides, upto 50oC ambient temperature, it has to maintain the frame to output correlation. (Clause 4.1.2)

Q7. Does the standard cover Geared Motors?
A. Yes, please refer Clause 1.3. It also covers non-standard flanges, mountings, etc. However if the motor is integrated with the Gear Box so as to not be able to test the motor independently, then it is not covered (Clause 1.4 (e)).

Q8. Does the standard cover Permanent Magnet AC Motors?
A. NO. If it is operated with a drive.
   YES. If it can be operated with a line-fed 3 phase AC Supply

Q9. Does the standard cover motors with IP21, IP22, IP23 protection?
A. NO. Refer Clause 1.4 (d).
Q10. Are ratings not listed in tables 1 to 4 covered by the standard?
A. YES. Intermediate ratings are covered by the standard. Interpolation data given in Tables 5 and 6 can be used to calculate the efficiency.

Q11. Can IS: 4029 and IS: 4889 be used to determine the IE2/IE3/IE4 efficiency?
A. NO. Only IS 15999 (Part 2/Sec1):2011 is applicable to determine the motor efficiency. This is identical with IEC 60034–2–1: 2007

Q12. In what ways is IS12615:2018 different from IEC 60034-30-1?
A. There are certain parameters defined in the standard which are not available in the IEC Standard. The parameters are as follows:
   — Locked rotor torque.
   — Locked rotor current.
   — Full load speed.
   — Full load current.
   — Frame size v/s output kW correlation.
   — Higher variation in voltage and frequency, (± 10% and ± 5% respectively)
   — Temperature rise limit under extreme conditions of voltage variation.
   — Schedule of tests

Q13. If operating with VFD, can IE1 motor be used?
A. NO. IE1 does not exist in the Indian Standard.

Q14. Are HT motors covered by the standard?
A. NO. Motors operated with more than 1000 volts are not covered in the standard.

Q15. Are duty cycles S2 and higher covered by the standard?
A. YES. For other than S1 duty, manufacture has to declare the equivalent S1 duty output and its corresponding IE class. Declaration of S1 equivalent rating will be as per mutual agreement between motor manufacturer and user.

Q16. Are motors manufactured in smaller frame covered by the standard?
A. YES. If the motor manufacturer agrees to supply, then motor has to meet the performance parameters of the rated power even in smaller frame. (see clause 1.1 (n)).

Q17. Are motors with special dimensions covered by the standard?
A. Yes. Motors with non-standard / special dimensions are covered by the standard. (Refer clause 1.3, 7, 16.2.1).

Q18. Whether IS 325 and IS 4722 still exists?
A. NO. Both standards are obsolete. Please refer IS 15999 (Part 1) in place of the obsolete standards.
FAQs related to Certification

Q1. What is the procedure of obtaining BIS license?
A. The Bureau grants a license based on successful assessment of the manufacturing infrastructure, production process, quality control and testing capabilities of a manufacturer through a visit to its manufacturing premises. Conformity of the product to the relevant standard(s) is also established through third party laboratory testing or testing in the manufacturing premises or a combination of both. There are two options available for obtaining BIS product certification license under Scheme – I. For more details visit BIS website.

Q2. Which laboratories test report are accepted?
A. Test reports of the following laboratories shall be accepted:
   i) Laboratories established, maintained or recognized by the Bureau for the product (including Group – 2 labs as specified under the Laboratory Recognition Scheme of the Bureau);
   ii) Government laboratories empanelled by the Bureau;
   iii) Any other laboratories as decided by the Executive committee of the Bureau

Q3. What is the fee structure?
A. The application fee, renewal application fee and annual license fee is Rs. 1,000 each and the visit charges are Rs. 7,000 per manday. The marking fee for each product is specified individually in the BIS (Conformity Assessment) Regulations, 2018. Rs. While marking fee is Rs. 1.75 per kW for all units with a minimum marking fee of Rs. 46000 for large scale units and Rs. 37000 for Micro, Small & Medium Enterprises units.

Q4. What is the timeline for grant of BIS license?
A. Average time taken for grant of license under option 2 is generally one month and under option 1 four months from the date of receipt of complete application and its recording. It may vary for reasons like delay in response to queries raised, if any; organizing inspection(s); sample deposition and fee dues, etc.

Q5. Can one application be submitted for different products/ISS being manufactured at the same factory location?
A. No, separate application for each product/ISS is to be submitted for each factory location.

Q6. Can one application be submitted for same products being manufactured at the different factory locations?
A. No, separate application for each product/ISS is to be submitted for each factory location.

Q7. What is the validity of BIS certification?
A. BIS certification under Scheme–I may be granted initially up to two years which is valid only for the varieties mentioned in the license. For extension of validity and varieties covered in license, application with requisite fee and documents under the existing license is required to be submitted. License may be renewed up to five years from the last date of the validity.
About International Copper Association India

The International Copper Association India (ICA India) is a member of Copper Alliance and the Indian arm of the International Copper Association Limited (ICA), the leading not for profit organization for the promotion of copper worldwide set up in 1959.

ICA India was formed in 1998 to actively associate with the growing number of copper users in India. With a mission to “Bring together the global copper industry to develop and defend markets for copper and to make a positive contribution to society’s sustainable development goals”

ICA India is a knowledge based organization that has the expertise and ability to implement market transformation projects. It provides a platform that represents a “non-commercial’ voice by a group of independent and credible experts. ICA India conducts programs in the interest of Electrical Safety, Energy Efficiency and Sustainability. Employing a mix of market development and regulation advocacy approach to encourage the use of copper.

Our current initiatives:

- Encourage safe house wiring practices in the Building Construction sector
- Increase awareness of Power Quality through Asia Power Quality Initiative Platform (APQI)
- Reduce distribution losses in the Power sector by promotion of low loss Distribution Transformers
- Propagate the use of Energy Efficient Motors for energy savings in Industries
- Promote 5 mm Microgroove Copper Tube heat exchangers technology to OEMs

ICA India drives its program through interactive workshops across India in collaboration with like-minded organizations, institutions and trade bodies. It also publishes technical handbooks, training manuals and brochures aimed at spreading awareness and in-depth knowledge on the benefits of copper and its use in technology.

For further information contact:
Abhishek Dhupar
302, Alpha, Hiranandani Business Park, Powai, Mumbai – 400 076, India
Phone: +91 (22) 6114 7300
Email: abhishek.dhupar@copperalliance.asia
Website: www.copperindia.org