Minimum Energy Performance Standards (MEPS) for Motors

Industry Briefing

1 June 2017
Outline

1. Background
2. MEPS level and Scope
3. Key Compliance Requirements
4. Q&A
Motor Usage in Singapore

In Singapore, motors are commonly used in motor driven systems (40%), process specific systems (32%), cooling & refrigeration systems (18%) and compressed air systems (6%). Motors account for about 80%\(^2\) of total electricity consumption in the industrial sector.

1 Based on 2015 energy use data submitted by companies regulated under the Energy Conservation Act (ECA)

2 It is assumed that 50% of the electricity consumption for process specific system is for driving motors.
Energy cost constitutes over 95% of the total life-cycle cost of motors.

**IE3 11kW motor**
- 4,000 hours per year
- 15 years

**Electrical energy cost**
96.7%

**Product purchase price**
2.3%

**Repair & maintenance cost**
1.0%

Source: EuP Lot 11 2008
# Energy Efficiency Levels of Motors

## Efficiency Levels for 4-Pole, 50 Hz Induction Motors

<table>
<thead>
<tr>
<th>Power Rating</th>
<th>Standard Efficiency IE1</th>
<th>High Efficiency IE2</th>
<th>Premium Efficiency IE3</th>
<th>Super Premium Efficiency IE4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75 kW</td>
<td>72.1%</td>
<td>79.6%</td>
<td>82.5%</td>
<td>85.7%</td>
</tr>
<tr>
<td>5.5 kW</td>
<td>84.7%</td>
<td>87.7%</td>
<td>89.6%</td>
<td>91.9%</td>
</tr>
<tr>
<td>7.5 kW</td>
<td>86.0%</td>
<td>88.7%</td>
<td>90.4%</td>
<td>92.6%</td>
</tr>
<tr>
<td>11 kW</td>
<td>87.6%</td>
<td>89.8%</td>
<td>91.4%</td>
<td>93.3%</td>
</tr>
<tr>
<td>45 kW</td>
<td>91.7%</td>
<td>93.1%</td>
<td>94.2%</td>
<td>95.4%</td>
</tr>
<tr>
<td>75 kW</td>
<td>92.7%</td>
<td>94.0%</td>
<td>95.0%</td>
<td>96.0%</td>
</tr>
<tr>
<td>200 – 375 kW</td>
<td>94.0%</td>
<td>95.1%</td>
<td>96.0%</td>
<td>96.7%</td>
</tr>
</tbody>
</table>

Source: International Electrotechnical Commission (IEC) 60034-30-1, Efficiency Classes of single speed, three phase, induction motors (IE-code)

- IE2 motors are about 1%-3% more efficient than IE1 motors
- IE3 motors are about 2%-5% more efficient than IE1 motors
Rationale and Benefits of Introducing MEPS for Motors

- Transform the market towards more efficient motors
- Reduce total life-cycle cost for end-users
- Reduce energy use and greenhouse gas emissions
Singapore’s GHG Emissions & Mitigation Plan

- In Sep 2016, Singapore ratified the Paris Agreement and formalised its pledge to reduce its emissions intensity by 36% below 2005 levels by 2030 and stabilise its emissions with the aim of peaking around 2030

- Further EE improvements will be required to achieve our 2030 commitments

**Power Generation**
- Adopt more efficient technologies
- Facilitate greater deployment of solar PV

**Industrial**
- Improve energy management
- Incentivise adoption of EE technologies

**Buildings**
- Raise EE standards
- Improve EE of building tenants and data centres

**Households**
- Raise EE of household appliances
- Promote energy-saving behaviour

**Transport**
- Increase use of public transport
- Encourage cycling and walking
MEPS Level and Scope
Overview of MEPS for Motors in Other Countries

**European Union**
- IE2 since 2011 (0.75 kW – 375 kW)
- IE3 or IE2 with VSD* since 2015 (7.5 kW – 375 kW)
- IE3 or IE2 with VSD since 1 Jan 2017 (0.75 kW – 375 kW)

**China**
- IE2 since 2011 (0.75 kW – 375 kW)
- IE3 since 2016 (7.5 kW – 375 kW)
- IE3 from 1 Sep 2017 (0.75 kW – 375 kW)

**South Korea**
- IE2 since 2011 (0.75 kW – 200 kW)
- IE3 since 2015 (37 kW – 200 kW)
- IE3 since 2016 (15 kW – 200 kW)
- IE3 since 1 Jan 2017 (0.75 kW – 200 kW)

**USA**
- EPAct (IE2 equivalent) since 1997 (0.75 kW – 375 kW)
- NEMA Premium (IE3 equivalent) since 2010 (0.75 kW – 150 kW)
- NEMA Premium (IE3 equivalent) since 2016 (0.75 kW – 375 kW)

**Australia**
- IE2 since 2006 (0.75 kW – 185 kW)

* Variable speed drive
# MEPS Level and Scope in Singapore

<table>
<thead>
<tr>
<th>MEPS Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency class IE3*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scope</th>
</tr>
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<tbody>
<tr>
<td>Single speed 3-phase induction motors:</td>
</tr>
<tr>
<td>a) 50 Hz</td>
</tr>
<tr>
<td>b) 2, 4 and 6-pole</td>
</tr>
<tr>
<td>c) Rated output power from 0.75 kW to 375 kW</td>
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<td>d) Rated voltage up to 1,000V</td>
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<td>e) Rated on the basis of continuous duty operation</td>
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* International Electrotechnical Commission (IEC) 60034-30-1, Efficiency Classes of single speed, three phase, induction motors
Exclusions

<table>
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<th>Exclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Motors specifically designed to operate</td>
</tr>
<tr>
<td>• where ambient air temperatures exceed 60°C</td>
</tr>
<tr>
<td>• in maximum operating temperature above 400°C</td>
</tr>
<tr>
<td>• where ambient air temperatures are less than -30°C for any motor or less than 0°C for a motor with water cooling</td>
</tr>
<tr>
<td>• where the water coolant temperature at the inlet to a product is less than 0°C or exceeding 32°C</td>
</tr>
<tr>
<td>• in potentially explosive environment</td>
</tr>
<tr>
<td>b) Motors that operate wholly immersed in a liquid</td>
</tr>
<tr>
<td>c) Multi-speed motors, brake motors and torque motors</td>
</tr>
<tr>
<td>d) Motors that are completely integrated into a product where the motors’ energy performance cannot be tested independently from the product (e.g. chiller compressor)</td>
</tr>
<tr>
<td>e) Motors supplied exclusively to a 3rd party who will incorporate the motors into equipment that will be exported to other countries</td>
</tr>
</tbody>
</table>
Example of Motors that are Integrated vs Motors that Can Be Uncoupled

**Excluded**

Motor completely integrated into a product and cannot be tested independently. The motor shares common components such as shaft and housing.

- Screw compressor in a chiller
- Common shaft
- Common housing

**Included**

Motor that can be uncoupled and tested independently. The driven equipment and the motor each has its own shaft, that are coupled together to operate as a system.

- Pump-set
- Pump
- Coupling
- AHU
- Motor
Example of Motors that are Integrated vs Motors that Can Be Uncoupled

<table>
<thead>
<tr>
<th>Excluded</th>
<th>Included</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Integrated gear-motor" /></td>
<td><img src="image2.png" alt="Motor that can be uncoupled from the gear" /></td>
</tr>
</tbody>
</table>

- **Excluded**
  - Integrated gear-motor

- **Included**
  - Motor that can be uncoupled from the gear
## Test Standards & Accepted Test Laboratories

Motors are to be tested:

### i. In accordance to one of the internationally-recognised standards:

- **IEC 60034-2-1** - Rotating electrical machines: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles); or
- **IEEE 112** - Standard Test Procedure for Polyphase Induction Motors and Generators

### ii. By one of the following laboratories:

- Manufacturer’s in-house testing lab
- Testing lab accredited by local accreditation bodies, which have signed a Mutual Recognition Arrangement with Singapore Accreditation Council (SAC), to carry out the tests in accordance to the prescribed test standards
- Testing lab accredited by SAC

*IEC 60034 and IEEE 112 are equivalent testing standards.*
Timeline

Jun 2017  
Briefing on requirements of MEPS for Motors

Sep/Oct 2017  
Announcement on implementation of MEPS for Motors

2Q 2018  
Briefing on registration / Start of registration

Oct 2018  
Implementation of MEPS for motors
3 Key Compliance Requirements
Key Compliance Requirements

Who are affected?
Anyone who supply 3-phase induction motors or equipment/system with 3-phase induction motors (e.g. pumps, fans and AHUs) in Singapore, including manufacturers, importers and distributors

What must be done?

- Register company with the National Environment Agency
- Register the motor models or family of models
- During registration, submit test report and relevant motor model information
- Display information on the motor nameplate
- Maintain a technical file
  - Certificate of registration
  - Test report
  - Records of modification
  - Other documents as required (e.g. product catalogue)

• More than 1-year transition period to clear stocks supplied before 1 Oct 2018
Registration of Suppliers

Online registration of suppliers with NEA

i. Application to be made online at the Energy Labelling Scheme (ELS) portal from 2Q 2018 – https://e-services.nea.gov.sg/els/els.aspx

ii. Information required include CorpPass, company UEN, names and NRIC of company’s representatives, etc.

iii. Applicant will be notified of the status and outcome of the application via email
Registration of Motor Models

Online registration of regulated motor models by registered suppliers at ELS portal

i. Information required:
   - Details of motor model or family of models
   - Test report
   - Other supporting documents

ii. Applicant will be notified of the status of their application(s) via email
   - Certificate of registration (COR) can be downloaded from the ELS portal once application is successful

iii. Registration fees per model (TBC)

<table>
<thead>
<tr>
<th></th>
<th>TBC</th>
</tr>
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<tr>
<td>First-time Registration</td>
<td>TBC</td>
</tr>
<tr>
<td>Renewal (every 3 years)</td>
<td>TBC</td>
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Test Report

i. Cover page to be printed on testing laboratory/company’s letterhead

ii. Report to be signed and stamped

iii. Report to contain results of tests carried out in accordance with the applicable test standard

iv. Data that are to be recorded and included in the report are specified in test standard

v. Minimally, information prescribed in test report templates must be provided
Other Supporting Documents

i. Colour photos of registered motor, including the motor nameplate

ii. Certificate and scope of accreditation of testing laboratory providing the test report, if applicable
Information to be Displayed on Motor Nameplate

Motor suppliers are required to display the following information in addition to the standard information provided on the motor:

- Efficiency level
- Year of manufacture
- Nominal efficiency* at 100%, 75% and 50% rated load

*Where the size of the name plate makes it impossible to display all the information, only the nominal efficiency at 100% load shall be displayed
Verification Testing (VT)

i. Suppliers of selected models for VT will be officially informed

ii. VT will be carried out at third-party accredited test labs and tested in accordance with applicable test standards

iii. Suppliers must provide sample models for the VT

iv. Sample models will be returned to the suppliers after the VT

v. Results of VT will be published
### Summary

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<th>1 Oct 2018</th>
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| Exclusions     | a) Special-purpose motors |
|                | b) Motors that operate wholly immersed in a liquid |
|                | c) Multi-speed motors, brake motors and torque motors |
|                | d) Motors that are completely integrated into a product |
|                | e) Motors that will be exported to other countries |

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| Requirements   | a) Suppliers to register themselves and the motor models with NEA |
|                | b) Suppliers are to display (1) IE class, (2) Year of manufacture and (3) Nominal efficiency at 100%, 75% and 50% rated load on the nameplate |
|                | c) Suppliers to maintain a technical file |
Grants for Higher Efficiency Motors

i. Industrial companies can apply for the **Energy Efficiency Fund (E2F)** when purchasing more efficient motors:

   • Before implementation of MEPS for motors in Oct 2018 – IE3 or better
   • After implementation of MEPS for motors in Oct 2018 – IE4 or better

ii. E2F co-funds up to 30% of the investment cost for the purchase of more efficient motors

For further enquiries and feedback, please send them to NEA_EEPC@nea.gov.sg by 16 Jun 2017
Our Environment

Safeguard • Nurture • Cherish