



Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2019

I, Angus Taylor, Minister for Energy and Emissions Reduction, make the following determination.

Dated 3/7/2019

Angus Taylor
Minister for Energy and Emissions Reduction

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Part 1—Preliminary

1 Name

This instrument is the *Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2019*.

2 Commencement, revocation and replacement

This Determination:

- (a) commences and comes into force on the day after it is registered; and
- (b) revokes the *Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2018*; and
- (c) replaces that Determination.

Note: The form of this section reflects the requirements of sections 34 and 35 of the *Greenhouse and Energy Minimum Standards Act 2012*, which deal with how a GEMS determination enters into force and how it replaces an earlier one. Subsection 35(2) of the *Greenhouse and Energy Minimum Standards Act 2012* provides that, when a GEMS determination is revoked and replaced, the revoked determination ceases to be in force immediately before the replacement determination comes into force.

3 Authority

This Determination is made under sections 23 and 35 of the *Greenhouse and Energy Minimum Standards Act 2012*.

4 Definitions—standards referred to in this Determination

Note 1: Subsection 6(2) has the effect that the applicable version of each standard referred to in this section is the version that existed at the date this Determination was made.

Note 2: Each of the standards listed in this section is available to purchase from Standards Australia Ltd.

In this Determination:

IEC 60034-1 means International Standard *IEC 60034-1 Ed. 13.0 (Bilingual 2017) Rotating electrical machines – Part 1: Rating and Performance*.

IEC 60034-2-1 Ed. 2.0 means International Standard *IEC 60034-2-1 Ed. 2.0 (Bilingual 2014) Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)*.

IEC 60034-30-1 Ed. 1.0 means International Standard *IEC 60034-30-1 Ed. 1.0 (Bilingual 2014) Rotating electrical machines – Part 30-1: Efficiency classes of line operated AC motors (IE code)*.

IEC 60050-411 means International Standard *IEC 60050-411 Ed. 2.0 (Bilingual 1996) International Electrotechnical Vocabulary – Chapter 411: Rotating machinery*.

Note: IEC 60050-411 includes all amendments up to and including *IEC 60050-411 Amd.1 Ed. 2.0 (Bilingual 2007): Amendment 1 – International Electrotechnical Vocabulary – Part 411: Rotating machinery*, made on 27 November 2007.

IEEE 112:2004 (USA) means IEEE Standard *IEEE 112:2004 Test Procedure for Polyphase Induction Motors and Generators*.

IEEE 112:2017 (USA) means IEEE Standard *IEEE 112:2017 Test Procedure for Polyphase Induction Motors and Generators*.

5 Definitions—other expressions used in this Determination

In this Determination:

Act means the *Greenhouse and Energy Minimum Standards Act 2012*.

cage induction motor means an induction motor with secondary cage (squirrel cage) winding(s) that consist of a number of conducting bars that have their extremities connected by conducting rings or plates at each end.

Note: This is the same meaning as in clauses 411-33-07 and 411-37-26 of IEC 60050-411.

IEC Standard means an international standard that is published by the International Electrotechnical Commission denoted by the letters “IEC” and identifying number and/or letters.

IEEE Standard means a standard that is published by the Institute of Electrical and Electronics Engineers denoted by the letters “IEEE” and identifying number and/or letters.

product class—see subsection 11(2).

rated quantity or value means a quantity or value assigned, generally by a manufacturer, for a specified operating condition of a machine.

Example: Rated output power, rated voltage, and rated current.

S2 – short-time duty means operation at constant load for a given time, less than that required to reach thermal equilibrium, followed by a time de-energised and at rest of sufficient duration to re-establish machine temperatures within 2 Kelvin of the coolant temperature.

Note: This is the same meaning as in subclause 4.2.2 of IEC 60034-1.

standard means an Australian Standard, an Australian/New Zealand Standard, an IEC Standard or any other equivalent document.

totally enclosed air over motor—see subsection 15(5).

Note: Several other words and expressions used in this Determination have the meaning given by section 5 of the Act. For example:

- category A product;
- covered by;
- family of models;
- GEMS;
- GEMS labelling requirements;
- GEMS level requirements;
- model;
- product classes.

6 Applicable definitions and applicable versions of standards and documents incorporated into standards

Applicable definitions of terms or phrases

- (1) If there is inconsistency in the definitions of words or expressions, words or expressions will be interpreted in the following order of priority to the extent of any inconsistency:
 - (a) the Act;
 - (b) this Determination;
 - (c) a standard referred to in this Determination, or another standard referred to in such a standard.

Applicable version of documents incorporated into standards

- (2) For the purposes of this Determination the applicable version of any:
 - (a) standard; or
 - (b) other document, that:
 - (i) is referred to in a standard under the heading “Referenced Documents”, or under an equivalent heading in a standard; and
 - (ii) must be applied to give effect to this Determination or a standard referred to in this Determination;

is the version of the standard or other document that existed at the date this Determination was made.

Note: For example, clause 3 of IEC 60034-2-1 Ed. 2.0 indicates that, for the purposes of that document, the terms and definitions given in IEC 60051-1 apply (in addition to those given in the document itself and in IEC 60034-1). The applicable version of IEC 60051-1 is the version that existed at the date this Determination was made.

7 Families of models

- (1) For section 28 of the Act, for the product class covered by this Determination, two or more models are in the same family of models if:
 - (a) they are members of a family that has been declared to the GEMS Regulator; and
 - (b) the requirements of this section are satisfied in relation to the models and the family.
- (2) For paragraph (1)(b), each model must:
 - (a) be of the same brand; and
 - (b) have the same frame size; and
 - (c) have the same characteristics for each of the following:
 - (i) number of poles;
 - (ii) the duty type, as specified in clause 4 of IEC 60034-1, assigned in accordance with clause 5 of IEC 60034-1;
 - (iii) rated output power (in kilowatts); and
 - (d) rely on a single test report that was prepared prior to the application for registration for the model being made under section 41 of the Act.

Note: For subparagraph (2)(c)(ii), the duty type is generally assigned by the manufacturer.

- (3) For paragraph (1)(b), for each model in the family, the product of the rated voltage and the rated current must be the same.
- (4) For paragraph (1)(b), a family must not contain more than 10 models.

8 Product category

For section 29 of the Act, the products covered by this Determination are category A products.

9 Registrations affected by this Determination

For section 36 of the Act, this Determination does not affect the registration of any models registered against the *Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2018*.

Note 1: If a model's registration is affected, the model's registration against the *Greenhouse and Energy Minimum Standards (Three Phase Cage Induction Motors) Determination 2012* ceases to be in force. See section 48 of the Act.

Note 2: If a model's registration is not affected, the model is taken to be registered against this Determination. See section 36 of the Act.

Part 2—Products covered by Determination

10 Purpose of Part

For subsections 23(1) and (2) of the Act, this Part specifies:

- (a) one or more classes of products that are covered by this Determination; and
- (b) one or more classes of products that are not covered by this Determination.

11 Classes of products that are covered by this Determination

- (1) This Determination covers three phase cage induction motors with:
 - (a) a rated output power greater than or equal to 0.73 kilowatts but less than 185 kilowatts; and
 - (b) a rated voltage of up to 1100 volts alternating current (V a.c.); and
 - (c) 2, 4, 6 or 8 poles.
- (2) This class of products forms a single *product class* for the purposes of the Act.

12 Classes of products that are not covered by this Determination

This Determination does not cover the following:

- (a) a submersible (sealed) motor specifically designed to operate wholly immersed in a liquid;
Note: This Determination covers motors of a kind referred to in section 11 that normally operate with a surrounding medium of air but that may withstand temporary inundation.
- (b) a motor that:
 - (i) shares common components, apart from connectors such as bolts, with the driven unit; and
 - (ii) cannot operate as a motor if separated from the driven unit, even if a temporary end shield or a drive-end bearing is fitted;
Example: A motor constructed on the same shaft as a compressor for an air-conditioning unit.
- (c) a motor that can run at two or more discrete speeds by using switchgear to reconfigure the connection of the motor's winding or windings to the supply;
Note 1: A motor of a kind referred to in paragraph (c) is known as a "multi-speed motor".
Note 2: Paragraph (c) does not cover such motors that run at different speeds by means of a variable voltage or variable frequency controller.
- (d) a motor that is to be used only for short-time duty cycle applications which have a duty type rating of S2 – short-time duty;
Example: Motors used for hoists, roller doors and cranes.
- (e) a motor:
 - (i) that has had its insulated winding or windings replaced; and
 - (ii) in respect of which the supplier has not made any claim that the motor meets a GEMS level requirement;
Note: A motor of a kind referred to in subparagraph (e)(i) is known as a "rewound motor".
- (f) a motor that is supplied exclusively to third parties who will incorporate the motors into equipment that will be exported to a country other than Australia or New Zealand;
- (g) a high slip motor designed primarily to provide torque, often at or near 100 per cent slip.
Note: A motor of a kind referred to in paragraph (g) is known as a "torque motor".

Part 3—GEMS level requirements

13 Purpose of Part

For paragraph 24(1)(a) of the Act, this Part specifies GEMS level requirements in accordance with section 25 of the Act for the product classes covered by this Determination.

14 GEMS level requirements

- (1) The efficiency of a motor covered by this Determination, at 75 per cent or 100 per cent of rated load, must not be less than:
 - (a) for a motor with a rated output power specified in Table 1 in Schedule 1—the minimum efficiency specified in the table for the type of motor; and
 - (b) for a motor with a rated output power in between the values specified in Table 1—the value determined in accordance with the method specified in clause 5.4.5 or 5.4.6, as appropriate, of IEC 60034-30-1 Ed. 1.0.

Note 1: Clause 5.4.5 of IEC 60034-30-1 Ed. 1.0 deals with Interpolation of nominal efficiency limits of intermediate rated powers for 50 Hz mains supply frequency.

Note 2: Clause 5.4.6 of IEC 60034-30-1 Ed. 1.0 deals with Interpolation of nominal efficiency limits of intermediate rated powers for 60 Hz mains supply frequency.

- (2) For subsection (1), the types of motor are:
 - (a) 50 Hz and 60 Hz; and
 - (b) 2-pole, 4-pole, 6-pole and 8-pole.

15 Conducting tests

General requirements

- (1) Subject to subsections (2) and (3), the motor's efficiency must be tested in accordance with the requirements mentioned in subclause 6.1.3 of IEC 60034-2-1 Ed. 2.0 (Method 2-1-1B – Summation of losses, additional load losses according to the method of residual loss).
- (2) The testing requirements specified in subsection (1) can be met by using the alternative test methods specified in Table 3 in Schedule 2 of this Determination.

Note: In the standards the alternative test method referred to in this subsection may be described as a “technically equivalent” method.

Special requirements—totally enclosed air over motors

- (3) For totally enclosed air over motors, the testing requirements specified in subsection (1) must be met while using an externally and independently generated air-stream, at laboratory ambient air temperature, directed over the motor's stator from the non-drive end, with air-flow parallel to the motor's shaft at the minimum declared air velocity specified by the manufacturer for normal operation of the product.
- (4) For tests conducted according to subsection (3):
 - (a) measurement of the externally-generated air flow velocity must be made using a hot-wire anemometer, or similar, type instrument; and
 - (b) efficiency measurements must be carried out using the same procedure as for products subject to the requirements of paragraph 15(1); and

(c) the power required to generate the air-stream must not be counted against the results for the motor under test.

(5) In this section:

totally enclosed air over motor means a frame surface cooled machine, the exterior of which is cooled by a ventilating means external to the motor, for example by a fan.

Part 4—GEMS labelling requirements

16 Purpose of Part

For paragraph 24(1)(b) of the Act, this Part specifies GEMS labelling requirements in accordance with section 26 of the Act for the product classes covered by this Determination.

17 GEMS labelling requirements

The specified labelling and communication requirements are the requirements mentioned in clause 10 of IEC 60034-1 (Rating plates).

Note: See also subsection 21(2).

18 Conducting tests

The specified requirements for conducting tests for the purposes of this Part are the same as the requirements specified in section 15.

19 Impact of replacement determination

A GEMS labelling requirement of this Determination (the *revoked requirement*) is taken to be complied with if:

- (a) this Determination is revoked in accordance with paragraph 35(1)(a) of the Act; and
- (b) another GEMS determination (the *replacement determination*) is made in accordance with paragraph 35(1)(b) of the Act; and
- (c) a transitional GEMS labelling requirement (the *replacement requirement*) of the replacement determination provides that, if the replacement requirement is complied with, the revoked requirement is taken to be complied with.

Part 5—Other requirements

20 Purpose of Part

For subsection 24(2) of the Act, this Part specifies other requirements in accordance with section 27 of the Act for product classes covered by this Determination.

21 High efficiency level

- (1) A motor covered by this Determination meets the high efficiency level if its efficiency at 75 per cent or 100 per cent of rated load is not less than:
 - (a) for a motor with a rated output power specified in Table 2 in Schedule 1—the minimum efficiency specified in the table for the type of motor; and
 - (b) for a motor with a rated output power in between the values specified in Table 2—the value determined in accordance with the method specified in clause 5.4.5 or 5.4.6, as appropriate, of IEC 60034-30-1 Ed. 1.0.

Note 1: Clause 5.4.5 of IEC 60034-30-1 Ed. 1.0 deals with Interpolation of nominal efficiency limits of intermediate rated powers for 50 Hz mains supply frequency.

Note 2: Clause 5.4.6 of IEC 60034-30-1 Ed. 1.0 deals with Interpolation of nominal efficiency limits of intermediate rated powers for 60 Hz mains supply frequency.

- (2) A motor may be designated as “high efficiency” only if it meets the high efficiency level.
- (3) For subsection (1), the types of motor are:
 - (a) 50 Hz and 60 Hz; and
 - (b) 2-pole, 4-pole, 6-pole and 8-pole.

22 Conducting tests

The specified requirements for conducting tests for the purposes of this Part are the same as the requirements specified in section 15.

Schedule 1—Minimum efficiency levels

Note: See sections 14 and 21 of this Determination.

1 Table 1—GEMS level requirements

For section 14 of this Determination, Table 1 is as follows:

Rated output power (kW)	50 Hz motors Minimum efficiency (%)				60 Hz motors Minimum efficiency (%)			
	2-pole	4-pole	6-pole	8-pole	2-pole	4-pole	6-pole	8-pole
0.73	77.4	79.6	75.9	66.2	75.5	78.0	73.0	66.0
0.75	77.4	79.6	75.9	66.2	75.5	78.0	73.0	66.0
1.1	79.6	81.4	78.1	70.8	82.5	84.0	85.5	75.5
1.5	81.3	82.8	79.8	74.1	84.0	84.0	86.5	82.5
2.2	83.2	84.3	81.8	77.6	85.5	87.5	87.5	84.0
3	84.6	85.5	83.3	80.0	87.5	87.5	87.5	85.5
4	85.8	86.6	84.6	81.9	87.5	87.5	87.5	85.5
5.5	87.0	87.7	86.0	83.8	88.5	89.5	89.5	85.5
7.5	88.1	88.7	87.2	85.3	89.5	89.5	89.5	88.5
11	89.4	89.8	88.7	86.9	90.2	91.0	90.2	88.5
15	90.3	90.6	89.7	88.0	90.2	91.0	90.2	89.5
18.5	90.9	91.2	90.4	88.6	91.0	92.4	91.7	89.5
22	91.3	91.6	90.9	89.1	91.0	92.4	91.7	91.0
30	92.0	92.3	91.7	89.8	91.7	93.0	93.0	91.0
37	92.5	92.7	92.2	90.3	92.4	93.0	93.0	91.7
45	92.9	93.1	92.7	90.7	93.0	93.6	93.6	91.7
55	93.2	93.5	93.1	91.0	93.0	94.1	93.6	93.0
75	93.8	94.0	93.7	91.6	93.6	94.5	94.1	93.0
90	94.1	94.2	94.0	91.9	94.5	94.5	94.1	93.6
110	94.3	94.5	94.3	92.3	94.5	95.0	95.0	93.6
132	94.6	94.7	94.6	92.6	95.0	95.0	95.0	93.6
160	94.8	94.9	94.8	93.0	95.0	95.0	95.0	93.6
185	95.0	95.1	94.9	93.3	95.4	95.0	95.0	93.6

Note 1: For a motor with a rated output power specified in Table 1, the minimum efficiency is the relevant amount specified in the table. See paragraph 14(1)(a) of this Determination. The last row of this table is not relevant in relation to paragraph 14(1)(a) of this Determination, as a motor covered by this Determination cannot have a rated output power of 185 kW. See paragraph 11(1)(a) of this Determination.

For a motor with a rated output power between values specified in Table 1, the minimum efficiency is the relevant amount worked out in accordance with paragraph 14(1)(b) of this Determination. The last row of this table is relevant in relation to paragraph 14(1)(b) of this Determination.

Note 2: The values in this table are equivalent to the efficiency requirements for IE2 (High Efficiency) levels in the IEC framework.

2 Table 2—High efficiency requirements

For section 21 of this Determination, Table 2 is as follows:

Rated output power (kW)	50 Hz motors				60 Hz motors			
	Minimum efficiency (%)				Minimum efficiency (%)			
	2-pole	4-pole	6-pole	8-pole	2-pole	4-pole	6-pole	8-pole
0.73	80.7	82.5	78.9	75.0	77.0	83.5	82.5	75.5
0.75	80.7	82.5	78.9	75.0	77.0	83.5	82.5	75.5
1.1	82.7	84.1	81.0	77.7	84.0	86.5	87.5	78.5
1.5	84.2	85.3	82.5	79.7	85.5	86.5	88.5	84.0
2.2	85.9	86.7	84.3	81.9	86.5	89.5	89.5	85.5
3	87.1	87.7	85.6	83.5	88.5	89.5	89.5	86.5
4	88.1	88.6	86.8	84.8	88.5	89.5	89.5	86.5
5.5	89.2	89.6	88.0	86.2	89.5	91.7	91.0	86.5
7.5	90.1	90.4	89.1	87.3	90.2	91.7	91.0	89.5
11	91.2	91.4	90.3	88.6	91.0	92.4	91.7	89.5
15	91.9	92.1	91.2	89.6	91.0	93.0	91.7	90.2
18.5	92.4	92.6	91.7	90.1	91.7	93.6	93.0	90.2
22	92.7	93.0	92.2	90.6	91.7	93.6	93.0	91.7
30	93.3	93.6	92.9	91.3	92.4	94.1	94.1	91.7
37	93.7	93.9	93.3	91.8	93.0	94.5	94.1	92.4
45	94.0	94.2	93.7	92.2	93.6	95.0	94.5	92.4
55	94.3	94.6	94.1	92.5	93.6	95.4	94.5	93.6
75	94.7	95.0	94.6	93.1	94.1	95.4	95.0	93.6
90	95.0	95.2	94.9	93.4	95.0	95.4	95.0	94.1
110	95.2	95.4	95.1	93.7	95.0	95.8	95.8	94.1
132	95.4	95.6	95.4	94.0	95.4	96.2	95.8	94.5
160	95.6	95.8	95.6	94.3	95.4	96.2	95.8	94.5
185	95.7	95.9	95.7	94.5	95.8	96.2	95.8	95.0

Note 1: For a motor with a rated output power specified in Table 2, the high efficiency level is the relevant amount specified in the table. See paragraph 21(1)(a) of this Determination. The last row of this table is not relevant in relation to paragraph 21(1)(a) of this Determination, as a motor covered by this Determination cannot have a rated output power of 185 kW. See paragraph 11(1)(a) of this Determination.

For a motor with a rated output power between values specified in Table 2, the high efficiency level is the relevant amount worked out in accordance with paragraph 21(1)(b) of this Determination. The last row of this table is relevant in relation to paragraph 21(1)(b) of this Determination.

Note 2: The values in this table are equivalent to the efficiency requirements for IE3 (Premium Efficiency) levels in the IEC framework.

Schedule 2—Alternative test methods

Note: See section 15 of this Determination.

1 Table 3—Alternative test methods

For section 15 of this Determination, Table 3 is as follows:

Ref	Alternative test methods	Standard
1	Method B (Test Procedure for Polyphase Induction Motors and Generators)	IEEE 112:2004 (USA)
2	Method B (Test Procedure for Polyphase Induction Motors and Generators)	IEEE 112:2017 (USA)