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COMMISSION REGULATION (EU) .../...

of **XXX**

**laying down ecodesign requirements for electric motors and variable speed drives
pursuant to Directive 2009/125/EC of the European Parliament and of the Council**

and repealing Commission Regulation (EC) No 640/2009

(Text with EEA relevance)

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THE EUROPEAN COMMISSION,

Having regard to Article 114 of the Treaty on the Functioning of the European Union,

Having regard to Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products¹, and in particular Article 15(1) thereof,

Whereas:

- (1) Pursuant to Directive 2009/125/EC, the Commission should set ecodesign requirements for energy-related products which account for significant volumes of sales and trade in the Union and which have a significant environmental impact and present significant potential for improvement through design in terms of their environmental impact, without entailing excessive costs.
- (2) The Ecodesign Working Plan 2016-2019 established by the Commission in application of Article 16(1) of Directive 2009/125/EC sets out the working priorities under the ecodesign and energy labelling framework for the period 2016-2019. The Working Plan identifies the energy-related product groups to be considered as priorities for the undertaking of preparatory studies and eventual adoption of implementing measures, as well as the review of the current regulations.
- (3) Measures from the Working Plan have an estimated potential to deliver a total in excess of 260 TWh of annual final energy savings in 2030, which is equivalent to reducing greenhouse gas emissions by approximately 100 million tonnes per year in 2030. Electric motors is one of the product groups listed in the Working Plan, with an estimated 10 TWh of annual final energy savings in 2030.
- (4) The Commission established ecodesign requirements for electric motors in Commission Regulation (EC) No 640/2009² and pursuant to that Regulation, the Commission shall review that Regulation in the light of technological progress on both motors and drives.

¹ OJ L 285, 31.10.2009, p. 10.

² Commission Regulation (EC) No 640/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for electric motors (OJ L 191, 23.7.2009, p. 26).

- (5) The Commission has reviewed Regulation (EC) No 640/2009 and analysed the technical, environmental and economic aspects of electric motors and drives as well as real-life user behaviour. The review was carried out in close cooperation with stakeholders and interested parties from the Union and third countries. Its results were made public and presented to the Consultation Forum established pursuant to Article 18 of Directive 2009/125/EC.
- (6) Electric motor driven systems use about half the electricity produced in the Union. It is estimated that electric motors converted 1 425 TWh of electricity into mechanical energy and heat in 2015, corresponding to 560 Mt of CO₂-equivalent emissions. This value is expected to rise to around 1 470 TWh by 2020 and to about 1 500 TWh by 2030.
- (7) The review also shows that variable speed drives are placed on the Union's market in large quantities, with their use-phase energy consumption being the most significant environmental aspect of all life cycle phases. In 2015, variable speed drives converted about 265 TWh of electricity from the grid into electricity with a frequency suited for the driven application; this corresponds to 105 Mt of CO₂ emissions. This value is expected to rise to around 380 TWh by 2020 and to about 570 TWh by 2030.
- (8) The review indicates that Regulation (EC) No 640/2009 would save 57 TWh annually by 2020 and 102 TWh annually by 2030. As the provisions of that Regulation are being maintained, these savings will also continue to materialise.
- (9) There is significant additional scope for improving these motor driven systems' energy efficiency cost-effectively. One cost-effective way to do so is by making motors more energy-efficient, including motors not covered by Regulation (EC) No 640/2009, and using energy-efficient variable speed drives. This implies that ecodesign requirements for electric motors should be adjusted and ecodesign requirements set for variable speed drives, to realise their full potential for cost-effective energy efficiency.
- (10) Ecodesign requirements should also include product information requirements that will help potential buyers make the most appropriate decision and make it easier for Member States to perform market surveillance.
- (11) Many motors are integrated in other products. To maximise cost-efficient energy saving, this Regulation should apply to such motors, provided that their efficiency can be tested separately.
- (12) The environmental aspect of products in the scope of this Regulation that have been identified as significant for the purposes of this Regulation is energy consumption in the use phase.
- (13) Electric motors are used in many different types of products, such as pumps, fans or machine tools, and under many different operating conditions. The energy use of motor-driven systems can be reduced if motors in variable speed and load applications are equipped with variable speed drives, but also if these drives have their own minimum energy efficiency requirements. In fixed speed (constant load) applications, a variable speed drive induces additional costs and energy losses. The use of a variable speed drive should not, therefore, be mandatory under this regulation.
- (14) Improvements in the electricity consumption of electric motors and variable speed drives should be achieved by applying existing, non-proprietary and cost-effective technologies that can reduce the total combined costs of purchasing and operating them.

- (15) Ecodesign requirements should harmonise energy efficiency requirements for electric motors and variable speed drives throughout the Union, thus contributing to the smooth operation of the internal market and helping to improve these products' environmental performance.
- (16) Manufacturers should have enough time to redesign or adapt their products where needed. The timing should be such as to minimise negative impact on the functionalities of electric motors or variable speed drives. It should also take account of cost implications for manufacturers, especially small and medium-sized enterprises, while ensuring that the objectives pursued by this rRgulation are achieved in good time.
- (17) The inclusion of motors not covered by Regulation (EC) No 640/2009, notably smaller and larger motors, in conjunction with updated minimum energy efficiency requirements that are in line with international standards and technological progress, and together with the inclusion of variable speed drives, should increase the market penetration of electric motors and variable speed drives with an improved life-cycle environmental impact. This should result in additional estimated net electricity savings of 10 TWh per year, and should reduce net greenhouse gas emissions by 3 Mt CO₂ equivalent annually by 2030, compared with the situation that would prevail if no additional measures were taken.
- (18) Although the environmental impacts of medium voltage motors are relevant, for the time being no classification exists for the energy efficiency of electric motors with a rated voltage above 1 000 V. Once such a classification is developed, the possibility of setting minimum requirements for medium voltage motors should be reassessed.
- (19) Although the environmental impacts of submersible motors are relevant, there is, at the present time, no test standard that defines energy efficiency classes for these motors. Once such a test standard and classification is developed, the possibility of setting minimum requirements for submersible motors should be reassessed.
- (20) The Commission communication on the circular economy³ and on the Communication on the Ecodesign working plan⁴ underline the importance of using the ecodesign framework to support the move towards a more resource efficient and circular economy. This regulation should therefore lay down appropriate requirements that will contribute to circular economy objectives, including the provision of information on disassembly, recycling or disposal at end-of-life.
- (21) In addition, to cut the costs of repairing products containing motors that were placed on the market before the entry into force of the Regulation, or to avoid to scrap them early if they cannot be repaired, motors supplied as spare parts should be exempted for a given period. This is meant to avoid the problem that arises if it is impossible to replace a non-compliant motor by a compliant one without disproportionate costs to the end-user.
- (22) In particular situations, for instance, where safety, functionality or disproportionate costs are at stake, certain motors or variable speed drives (VSDs) should be exempted from efficiency requirements. However, this Regulation should nonetheless cover such products as regards product information requirements, such as information concerning

³ COM/2015/0614 final of 02.12.2015.

⁴ COM(2016) 773 final of 30.11.2016.

disassembly, recycling or disposal at end-of-life, or other information useful for market surveillance purposes.

- (23) The relevant product parameters should be measured using reliable, accurate and reproducible methods. These methods should take into account the recognised state-of-the-art measurement methods including, where available, harmonised standards adopted by the European standardisation organisations, as listed in Annex I to Regulation (EU) No 1025/2012 of the European Parliament and of the Council⁵.
- (24) In accordance with Article 8(2) of Directive 2009/125/EC, this Regulation should specify the applicable conformity assessment procedures.
- (25) To facilitate compliance checks, manufacturers should provide the information in the technical documentation referred to in Annexes IV and V to Directive 2009/125/EC, insofar as that information relates to the requirements laid down in this Regulation.
- (26) To improve the effectiveness of this Regulation and to protect consumers, products that automatically alter their performance in test conditions to improve the declared parameters should be prohibited.
- (27) In addition to the legally binding requirements laid down in this Regulation, indicative benchmarks for best available technologies should be identified to make information on product's environmental performance over their life-cycle subject to this Regulation widely available and easily accessible in accordance with Directive 2009/125/EC, Annex I, part 3, point 2.
- (28) A review of this Regulation should assess the appropriateness and effectiveness of its provisions in achieving its goals. The timing of the review should be sufficient for all provisions to be implemented and show an effect on the market.
- (29) Regulation (EC) No 640/2009 should therefore be repealed.
- (30) The measures provided for in this Regulation are in accordance with the opinion of the Committee established by Article 19(1) of Directive 2009/125/EC,

HAS ADOPTED THIS REGULATION:

Article 1 **Subject matter**

This Regulation establishes ecodesign requirements for the placing on the market and/or the putting into service of electric motors and variable speed drives, including where they are integrated in other products.

Article 2 **Scope**

This Regulation applies to the following products:

⁵ Regulation (EU) No 1025/2012 of the European Parliament and of the Council of 25 October 2012 on European standardisation, amending Council Directives 89/686/EEC and 93/15/EEC and Directives 94/9/EC, 94/25/EC, 95/16/EC, 97/23/EC, 98/34/EC, 2004/22/EC, 2007/23/EC, 2009/23/EC and 2009/105/EC of the European Parliament and of the Council and repealing Council Decision 87/95/EEC and Decision No 1673/2006/EC of the European Parliament and of the (OJ L 316, 14.11.2012, p. 12).

- (a) induction electric motors without brushes, commutators, slip rings or electrical connections to the rotor, rated for operation on a 50 Hz, 60 Hz or 50/60 Hz sinusoidal voltage, that:
 - (i) have two, four, six or eight poles;
 - (ii) have a rated voltage U_N above 50 V and up to and including 1 000 V;
 - (iii) have a rated output P_N from 0,12 kW up to and including 1 000 kW;
 - (iv) are rated on the basis of continuous duty operation; and
 - (v) are suited for direct on-line operation.
- (b) variable speed drives with 3 phases input that are:
 - (i) rated for operating with one motor referred to in point (a), within the 0,75 kW - 1 000 kW motor rated output range;
 - (ii) have a rated voltage above 100 V and up to and including 1 000 V AC;
 - (iii) have only one AC voltage output.

Article 3 **Definitions**

For the purposes of this Regulation, the following definitions shall apply:

- (1) ‘electric motor’ or ‘motor’ means a device that converts electrical input power into mechanical output power in the form of a rotation with a rotational speed and torque that depends on factors including the frequency of the supply voltage and number of poles of the motor.
- (2) ‘variable speed drive’ (VSD) means an electronic power converter that continuously adapts the electrical power supplied to the motor to control the motor’s mechanical power output according to the torque-speed characteristic of the load driven by the motor, by adjusting the power supply to a variable frequency and voltage supplied to the motor.
- (3) ‘energy efficiency’ of a motor means the ratio of its mechanical output power to the electrical input power.
- (4) ‘pole’ means a north or a south pole produced by the rotating magnetic field of the motor, whose total number of poles determines its base speed.
- (5) ‘continuous duty operation’ means capable of continuous operation at rated power with a temperature rise within the specified insulation temperature class, specified as specific duty types S1, S3 ≥ 80 %, S6 or S9 according to IEC 60034-1:2017.
- (6) ‘phase’ means the type of configuration of the mains electrical supply.
- (7) ‘AC’ means alternating current.
- (8) ‘motor with mechanical commutators’ means a motor in which a mechanical device reverses the direction of the current.
- (9) ‘totally enclosed non-ventilated (TENV) motor’ means a motor designed and specified to operate without a fan, and which dissipates heat predominantly through natural ventilation or radiation on the totally enclosed motor surface.
- (10) ‘totally enclosed air over (TEAO) motor’ means a motor designed and specified to be cooled by the air stream coming from the driven equipment.

- (11) 'brake motor' means a motor equipped with an electromechanical brake unit operating directly on the motor shaft without couplings.
- (12) 'increased safety motor' means a motor intended for use in explosive atmospheres and certified 'Ex eb', as defined in standard IEC EN 60079-7:2015.
- (13) 'other explosion-protected motor' means a motor intended for use in explosive atmospheres and certified 'Ex ec', 'Ex tb' or 'Ex tc', as defined in standard IEC EN 60079-7:2015.
- (14) 'test load' of a VSD means the electrical device used for testing purposes that determines the output current and the output displacement factor $\cos \phi$.
- (15) 'equivalent model' means a model with the technical characteristics as set out in Annex I, and is placed on the market by the same supplier, but has a different model identifier.

Article 4

Ecodesign requirements

1. Motors and variable speed drives within the scope of this Regulation shall comply with the ecodesign requirements set out in Annex I from the dates indicated therein. Compliance shall be measured and calculated in accordance with Annex II.
2. The following motors shall be exempt from the efficiency requirements specified in section 1 of Annex I. Nonetheless, they shall comply with the product information requirements specified in points (3), (4), (12), and (13) of section 2 of Annex I:
 - (a) motors completely integrated into a product (for example into a gear, pump, fan or compressor) and whose energy performance cannot be tested independently from the product, even with the provision of a temporary end-shield and drive-end bearing; the motor must share common components (apart from connectors such as bolts) with the driven unit (for example, a shaft or housing) and shall not be designed in such a way that the motor can be separated in its entirety from the driven unit and operate independently. For a motor to be exempt from performance requirements, the process of separation must render it inoperative;
 - (b) motors with an integrated variable speed drive (compact drives) whose energy performance cannot be tested independently from the variable speed drive;
 - (c) motors with an integrated brake which forms an integral part of the inner motor construction and can neither be removed nor supplied by a separate power source during the testing of the motor efficiency;
 - (d) motors specified to operate exclusively:
 - (i) at altitudes exceeding 4 000 metres above sea-level;
 - (ii) where ambient air temperatures exceed 60 °C;
 - (iii) in maximum operating temperature above 400 °C;
 - (iv) where ambient air temperatures are less than -30 °C;
 - (v) where the water coolant temperature at the inlet to a product is below 0 °C or above 32 °C.
 - (e) Motors designed and specified to operate wholly immersed in a liquid;

- (f) motors specifically qualified for the safety of nuclear installations, as defined in Article 3 of Council Directive 2009/71/EURATOM⁶;
 - (g) motors in cordless or battery-operated equipment;
 - (h) motors in hand-held equipment whose weight is supported by hand during operation;
 - (i) motors in hand-guided mobile equipment moved while in operation;
 - (j) motors with mechanical commutators;
 - (k) Totally Enclosed Non-Ventilated (TENV) motors;
 - (l) Totally Enclosed Air Over (TEAO) motors;
 - (m) motors placed on the market not later than 1 July 2029 as substitutes for identical motors integrated in products and placed on the market no later than 1 July 2022;
 - (n) multi-speed motors, i.e. motors with multiple windings or with a switchable winding, providing a different number of poles and speeds;
 - (o) motors designed specifically for traction electric vehicles.
3. The following VSDs are exempt from the efficiency requirements specified in Annex I.3, but must meet the product information requirements specified in points (3), (4), (8) and (9) of section 4 of Annex I:
- (a) VSDs integrated into a product and whose energy performance cannot be tested independently from the product;
 - (b) VSDs qualified specifically for the safety of nuclear installations, as defined Article 3 of Directive 2009/71/EURATOM;
 - (c) VSDs placed on the market not later than 1 July 2029 as substitute for identical VSDs integrated in products and placed on the market no later than 1 July 2022.

Article 5

Conformity assessment

1. The conformity assessment procedure referred to in Article 8 of Directive 2009/125/EC shall be the internal design control system set out in Annex IV of that Directive or the management system set out in Annex V of that Directive.
2. For the purposes of the conformity assessment pursuant to that Directive, the technical documentation of motors shall contain the information set out in point 2 of Annex I to this Regulation.
3. For the purposes of the conformity assessment pursuant to that Directive, the technical documentation of VSDs shall contain the information set out in point 4 of Annex I to this Regulation.
4. Where the information included in the technical documentation referred to in that Directive has been obtained for a particular model by calculations on the basis of design, or extrapolation from another model, or both, the documentation shall include

⁶ Council Directive 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations (OJ L 172, 2.7.2009, p. 18).

details of such calculations or extrapolations, or both, and of tests carried out by manufacturers to verify the accuracy of such calculations and extrapolations.

Article 6

Verification procedure for market surveillance purposes

Member States shall apply the verification procedure laid down in Annex III when performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC.

Article 7

Circumvention

The manufacturer or importer shall not place on the market products designed in such a way that their performance is automatically altered under test conditions with the aim of reaching a more favourable level for any of the parameters specified in this Regulation or declared by the manufacturer in the technical documentation or included in any of the documentation provided with the product.

Where applicable, the power consumption of the product shall not increase after a software or firmware update when measured with the same test standard originally used for the declaration of conformity, except with explicit consent of the end-user prior to the update.

Article 8

Indicative benchmarks

The indicative benchmarks for the best-performing motors and variable speed drives available at the time of adopting this Regulation are set out in Annex IV.

Article 9

Review

The Commission shall review this Regulation in the light of technological progress and present the results of this review, including, if appropriate, a draft revision proposal, to the Consultation Forum no later than *[OP - please insert date – 5 years after its entry into force]*.

This review shall in particular address:

- (1) further resource efficiency, re-use and recycling opportunities;
- (2) the appropriateness of the level of verification tolerances;
- (3) the possibility of setting stricter requirements for motors and variable speed drives;
- (4) the possibility of setting minimum energy efficiency requirements for motors with a rated voltage above 1000 V, as well as for submersible motors;
- (5) the possibility of setting requirements for combinations of motors and VSDs placed on the market together, as well as integrated variable speed motors (compact drives);
- (6) the relevance of the exemptions set out in Articles 4(2) and 4(3).

Article 10

Repeal

Regulation (EC) No 640/2009 is repealed with effect from 15 January 2021.

Article 11
Entry into force and application

This Regulation shall enter into force on the twentieth day following that of its publication in the Official Journal of the European Union.

It shall apply from 15 January 2021.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels,

For the Commission
Jean-Claude JUNCKER
The President