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**COMMISSION REGULATION (EU) No 547/2012**

**of 25 June 2012**

**implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water pumps**

**(Text with EEA relevance)**

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### Article 1

#### Subject matter and scope

1. This Regulation establishes ecodesign requirements for the placing on the market of rotodynamic water pumps for pumping clean water, including where integrated in other products.
2. This Regulation shall not apply to:
  - (a) water pumps designed specifically for pumping clean water at temperatures below  $-10\text{ °C}$  or above  $120\text{ °C}$ , except with regard to the information requirements of Annex II, points 2(11) to 2(13);
  - (b) water pumps designed only for fire-fighting applications;
  - (c) displacement water pumps;
  - (d) self-priming water pumps.

### Article 2

#### Definitions

In addition to the definitions set out in Directive 2009/125/EC, the following definitions apply:

- (1) ‘*water pump*’ is the hydraulic part of a device that moves clean water by physical or mechanical action and is of one of the following designs:
  - End suction own bearing (ESOB),
  - End suction close coupled (ESCC),
  - End suction close coupled inline (ESCCi),
  - Vertical multistage (MS-V),
  - Submersible multistage (MSS);
- (2) ‘*End suction water pump*’ means a glanded single stage end suction rotodynamic water pump designed for pressures up to 16 bar, with a specific speed  $n_s$  between 6 and 80 rpm, a minimum rated flow of  $6\text{ m}^3/\text{h}$  ( $1,667 \cdot 10^{-3}\text{ m}^3/\text{s}$ ), a maximum shaft power of 150 kW, a maximum head of 90 m at nominal speed of 1 450 rpm and a maximum head of 140 m at nominal speed of 2 900 rpm;
- (3) ‘*Rated flow*’ means the head and flow that the manufacturer will guarantee under normal operating conditions;
- (4) ‘*Glanded*’ means sealed shaft connection between the impeller in the pump body and the motor. The driving motor component remains dry;

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- (5) ‘*End suction own bearing water pump*’ (ESOB) is an end suction water pump with own bearings;
- (6) ‘*End suction close coupled water pump*’ (ESCC) is an end suction water pump of which the motor shaft is extended to become also the pump shaft;
- (7) ‘*End suction close coupled inline water pump*’ (ESCCi) means a water pump of which the water inlet of the pump is on the same axis as the water outlet of the pump;
- (8) ‘*Vertical multistage water pump*’ (MS-V) means a glanded multi stage ( $i > 1$ ) rotodynamic water pump in which the impellers are assembled on a vertical rotating shaft, which is designed for pressures up to 25 bar, with a nominal speed of 2 900 rpm and a maximum flow of 100 m<sup>3</sup>/h ( $27,78 \cdot 10^{-3}$  m<sup>3</sup>/s);
- (9) ‘*Submersible multistage water pump*’ (MSS) means a multi stage ( $i > 1$ ) rotodynamic water pump with a nominal outer diameter of 4" (10,16 cm) or 6" (15,24 cm) designed to be operated in a borehole at nominal speed of 2 900 rpm, at operating temperatures within a range of 0 °C and 90 °C;
- (10) ‘*rotodynamic water pump*’ means a water pump that moves clean water by means of hydrodynamic forces;
- (11) ‘*displacement water pump*’ means a water pump that moves clean water by enclosing a volume of clean water and forcing this volume to the outlet of the pump;
- (12) ‘*self-priming water pump*’ means a water pump that moves clean water and which can start and/or operate also when only partly filled with water;
- (13) ‘*clean water*’ means water with a maximum non-absorbent free solid content of 0,25 kg/m<sup>3</sup>, and with a maximum dissolved solid content of 50 kg/m<sup>3</sup>, provided that the total gas content of the water does not exceed the saturation volume. Any additives that are needed to avoid water freezing down to – 10 °C shall not be taken into account.

The definitions for the purpose of Annexes II to V are set out in Annex I.

### *Article 3*

#### **Ecodesign requirements**

The minimum efficiency requirements as well as information requirements for rotodynamic water pumps are set out in Annex II.

Ecodesign requirements shall apply in accordance with the following timetable:

- (1) from 1 January 2013, water pumps shall have a minimum efficiency as defined in Annex II, point 1(a);
- (2) from 1 January 2015, water pumps shall have a minimum efficiency as defined in Annex II, point 1(b);
- (3) from 1 January 2013, the information on water pumps shall comply with the requirements set out in Annex II, point 2.

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Compliance with ecodesign requirements shall be measured and calculated in accordance with requirements set out in Annex III.

No ecodesign requirement is necessary regarding any other ecodesign parameter referred to in Annex I, Part 1, of Directive 2009/125/EC.

*Article 4***Conformity assessment**

The conformity assessment procedure referred to in Article 8(2) of Directive 2009/125/EC shall be the internal design control set out in Annex IV to that Directive or the management system for assessing conformity set out in Annex V to that Directive.

*Article 5***Verification procedure for market surveillance purposes**

When performing the market surveillance checks referred to in Article 3(2) of Directive 2009/125/EC, for the ecodesign requirements set out in Annex II to this Regulation, the authorities of the Member States shall apply the verification procedure set out in Annex IV to this Regulation.

*Article 6***Indicative benchmarks**

The indicative benchmarks for the best-performing water pumps available on the market at the time of entry into force of this Regulation are set out in Annex V.

*Article 7***Revision**

The Commission shall review this Regulation in the light of technological progress and shall present the result of this review to the Consultation Forum no later than four years after its entry into force. The review shall aim at adopting an extended product approach.

The Commission shall review the tolerances used in the methodology for calculating the energy efficiency before 1 January 2014.

*Article 8***Entry into force**

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

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



## ANNEX I

**Definitions applicable for the purposes of Annexes II to V**

For the purpose of Annexes II to V, the following definitions apply:

- (1) ‘*Impeller*’ means the rotating component of a rotodynamic pump which transfers energy to the water;
- (2) ‘*Full impeller*’ means the impeller with the maximum diameter for which performance characteristics are given for a pump size in the catalogues of a water pump manufacturer;
- (3) ‘*Specific speed*’ ( $n_s$ ) means a dimensional value characterising the shape of the water pump impeller by head, flow and speed ( $n$ ):

$$n_s = n \cdot \frac{\sqrt{Q_{BEP}}}{(H_{BEP})^{\frac{3}{4}}} [\text{min}^{-1}]$$

Where

- ‘*Head*’ ( $H$ ) means the increase in the hydraulic energy of water in meters [m], produced by the water pump at the specified point of operation,
  - ‘*Rotational speed*’ ( $n$ ) means the number of revolutions per minute [rpm] of the shaft,
  - ‘*Flow*’ ( $Q$ ) means the volume flow rate [ $\text{m}^3/\text{s}$ ] of water through the water pump,
  - ‘*Stage*’ ( $i$ ) means the number of series impellers in the water pump,
  - ‘*Best efficiency point*’ (BEP) means the operating point of the water pump at which it is at the maximum hydraulic pump efficiency measured with clean cold water,
- (4) ‘*Hydraulic pump efficiency*’ ( $\eta$ ) is the ratio between the mechanical power transferred to the liquid during its passage through the water pump and the mechanical input power transmitted to the pump at its shaft;
  - (5) ‘*Clean cold water*’ means clean water to be used for pump testing, with a maximum kinematic viscosity of  $1,5 \times 10^{-6} \text{ m}^2/\text{s}$ , a maximum density of  $1\,050 \text{ kg}/\text{m}^3$  and a maximum temperature of  $40 \text{ }^\circ\text{C}$ ;
  - (6) ‘*Part load*’ (PL) means the operating point of the water pump at 75 % of the flow at BEP;
  - (7) ‘*Over load*’ (OL) means the operating point of the water pump at 110 % of the flow at BEP;
  - (8) ‘*Minimum Efficiency Index*’ (MEI) means the dimensionless scale unit for hydraulic pump efficiency at BEP, PL and OL;
  - (9) ‘*C*’ means a constant for each specific water pump type quantifying the differences in efficiency for different pump types.



## ANNEX II

### Ecodesign requirements for water pumps

#### 1. EFFICIENCY REQUIREMENTS

(a) From 1 January 2013, water pumps shall have a minimum efficiency:

- at the best efficiency point (BEP) of at least  $(\eta_{\text{BEP}})_{\text{min requ}}$ , when measured according to Annex III, and calculated with the C-value for  $\text{MEI} = 0,1$ , according to Annex III,
- a minimum efficiency at part load (PL) of at least  $(\eta_{\text{PL}})_{\text{min requ}}$  when measured according to Annex III, and calculated with the C-value for  $\text{MEI} = 0,1$ , according to Annex III,
- a minimum efficiency at over load (OL) of at least  $(\eta_{\text{OL}})_{\text{min requ}}$  when measured according to Annex III and calculated with the C-value for  $\text{MEI} = 0,1$ , according to Annex III.

(b) From 1 January 2015, water pumps shall have:

- a minimum efficiency at the best efficiency point (BEP) of at least  $(\eta_{\text{BEP}})_{\text{min requ}}$  when measured according to Annex III and calculated with the C-value for  $\text{MEI} = 0,4$ , according to Annex III,
- a minimum efficiency at part load (PL) of at least  $(\eta_{\text{PL}})_{\text{min requ}}$  when measured according to Annex III and calculated with the C-value for  $\text{MEI} = 0,4$ , according to Annex III,
- a minimum efficiency at over load (OL) of at least  $(\eta_{\text{OL}})_{\text{min requ}}$  when measured according to Annex III and calculated with the C-value for  $\text{MEI} = 0,4$ , according to Annex III.

#### 2. PRODUCT INFORMATION REQUIREMENTS

From 1 January 2013, the information on water pumps referred to in Article 1 set out in following points (1) to (15) shall be visibly displayed on:

- (a) the technical documentation of water pumps;
- (b) free access websites of manufacturers of water pumps.

The information shall be provided in the order as presented in points (1) to (15). The information referred to in points (1) and (3) to (6) shall be durably marked on or near the rating plate of the water pump.

- (1) Minimum efficiency index:  $\text{MEI} \geq [x,xx]$ ;
- (2) Standard text: ‘The benchmark for most efficient water pumps is  $\text{MEI} \geq 0,70$ ’, or, alternatively, the indication ‘Benchmark  $\text{MEI} \geq 0,70$ ’;
- (3) Year of manufacture;
- (4) Manufacturer’s name or trade mark, commercial registration number and place of manufacture;
- (5) Product’s type and size identifier;
- (6) Hydraulic pump efficiency (%) with trimmed impeller  $[xx,x]$ , or, alternatively, the indication  $[-.-]$ ;
- (7) Pump performance curves for the pump, including efficiency characteristics;
- (8) Standard text: ‘The efficiency of a pump with a trimmed impeller is usually lower than that of a pump with the full impeller diameter. The trimming of the impeller will adapt the pump to a fixed duty point,

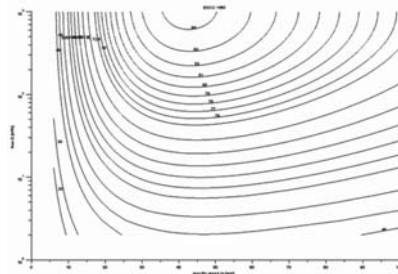
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leading to reduced energy consumption. The minimum efficiency index (MEI) is based on the full impeller diameter.’;

- (9) Standard text: ‘The operation of this water pump with variable duty points may be more efficient and economic when controlled, for example, by the use of a variable speed drive that matches the pump duty to the system’;
- (10) Information relevant for disassembly, recycling or disposal at end-of-life;
- (11) Standard text for water pumps designed only for pumping clean water at temperatures below  $-10\text{ }^{\circ}\text{C}$ : ‘Designed for use below  $-10\text{ }^{\circ}\text{C}$  only’;
- (12) Standard text for water pumps designed only for pumping clean water at temperatures above  $120\text{ }^{\circ}\text{C}$ : ‘Designed for use above  $120\text{ }^{\circ}\text{C}$  only’;
- (13) For pumps designed specifically for pumping clean water at temperatures below  $-10\text{ }^{\circ}\text{C}$  or above  $120\text{ }^{\circ}\text{C}$ , manufacturer must describe the relevant technical parameters and characteristics used;
- (14) Standard text: ‘information on benchmark efficiency is available at [www.xxxxxxxxxxxx.xxx]’;
- (15) Benchmark efficiency graph for  $\text{MEI} = 0,7$  for the pump based on the model shown in the Figure. Similar efficiency graph shall be provided for  $\text{MEI} = 0,4$ .

*Figure*

Example of a benchmark efficiency graph for ESOB 2900



Further information may be added and may be complemented by graphs, figures or symbols.



### ANNEX III

#### Measurements and calculations

For the purposes of compliance and verification of compliance with the requirements of this Regulation, measurements and calculations shall be made using harmonised standards the reference numbers of which have been published in the *Official Journal of European Union*, or using other reliable, accurate and reproducible methods, which take into account the generally recognised state of the art, and produce results deemed to be of low uncertainty. They shall fulfil all of the following technical parameters.

The hydraulic pump efficiency, as defined in Annex I, is measured at the head and flow corresponding to the best efficiency point (BEP), part load (PL) and over load (OL) for full impeller diameter with clean cold water.

The formula for calculating the required minimum efficiency at best efficiency point (BEP) is as follows:

$$(\eta_{\text{BEP}})_{\text{min,requ}} = 88,59 x + 13,46 y - 11,48 x^2 - 0,85 y^2 - 0,38 x y - C_{\text{Pump Type,rpm}}$$

Where,

$x = \ln(n_s)$ ;  $y = \ln(Q)$  and  $\ln$  = natural logarithm and  $Q$  = flow in [ $\text{m}^3/\text{h}$ ];  
 $n_s$  = specific speed in [ $\text{min}^{-1}$ ];  $C$  = value found in Table.

The value of  $C$  depends on the pump type and nominal speed, and also the MEI value.

Table

#### Minimum efficiency index (MEI) and its corresponding C-value depending on the pump type and speed

C-value for MEI $C_{\text{PumpType,rpm}}$	MEI = 0,10	MEI = 0,40
C (ESOB, 1 450)	132,58	128,07
C (ESOB, 2 900)	135,60	130,27
C (ESCC, 1 450)	132,74	128,46
C (ESCC, 2 900)	135,93	130,77
C (ESCCi, 1 450)	136,67	132,30
C (ESCCi, 2 900)	139,45	133,69
C (MS-V, 2 900)	138,19	133,95
C (MSS, 2 900)	134,31	128,79

The requirements for part load (PL) and over load (OL) conditions are set at slightly lower values than those for 100 % flow ( $\eta_{\text{BEP}}$ ).

$$(\eta_{\text{PL}})_{\text{min,requ}} = 0,947 \cdot (\eta_{\text{BEP}})_{\text{min,requ}}$$

$$(\eta_{\text{OL}})_{\text{min,requ}} = 0,985 \cdot (\eta_{\text{BEP}})_{\text{min,requ}}$$

All efficiencies are based on full (untrimmed) impeller. Vertical multistage water pumps are to be tested with a 3 stage ( $i = 3$ ) version. Submersible multistage water pumps are to be tested with a 9 stage ( $i = 9$ ) version. If this number of



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stages is not offered within the specific product range the next higher number of stages within the product range is to be chosen for testing.

**▼ M1***ANNEX IV***Product compliance verification by market surveillance authorities**

The verification tolerances defined in this Annex relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation or in interpreting these values with a view to achieving compliance or to communicate better performance by any means.

When verifying the compliance of a product model with the requirements laid down in Annex II to this Regulation pursuant to Article 3(2) of Directive 2009/125/EC, for the requirements referred to in this Annex, the authorities of the Member States shall apply the following procedure:

- (1) The Member State authorities shall verify one single unit of the model.
- (2) The model shall be considered to comply with the applicable requirements if:
  - (a) the values given in the technical documentation pursuant to point 2 of Annex IV to Directive 2009/125/EC (declared values), and, where applicable, the values used to calculate these values, are not more favourable for the manufacturer or importer than the results of the corresponding measurements carried out pursuant to paragraph (g) thereof; and
  - (b) the declared values meet any requirements laid down in this Regulation, and any required product information published by the manufacturer or importer does not contain values that are more favourable for the manufacturer or importer than the declared values; and
  - (c) when the Member State authorities test the unit of the model, the determined values (the values of the relevant parameters as measured in testing and the values calculated from these measurements) comply with the respective verification tolerances given in Table 2.
- (3) If the results referred to in point 2(a) or (b) are not achieved, the model shall be considered not to comply with this Regulation.
- (4) If the result referred to in point 2(c) is not achieved, the Member State authorities shall select three additional units of the same model for testing.
- (5) The model shall be considered to comply with the applicable requirements if, for these three units, the arithmetical mean of the determined values complies with the respective verification tolerances given in Table 2.
- (6) If the result referred to in point 5 is not achieved, the model shall be considered not to comply with this Regulation.
- (7) The Member State authorities shall provide all relevant information to the authorities of the other Member States and to the Commission without delay after a decision being taken on the non-compliance of the model according to points 3 and 6.

The Member State authorities shall use the measurement and calculation methods set out in Annex III.

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The Member State authorities shall only apply the verification tolerances that are set out in Table 2 and shall only use the procedure described in points 1 to 7 for the requirements referred to in this Annex. No other tolerances, such as those set out in harmonised standards or in any other measurement method, shall be applied.

*Table 2***Verification tolerances**

Parameters	Verification tolerances
Efficiency at BEP ( $\eta_{\text{BEP}}$ )	The determined value shall not be lower than the declared value by more than 5 %.
Efficiency at PL ( $\eta_{\text{PL}}$ )	The determined value shall not be lower than the declared value by more than 5 %.
Efficiency at OL ( $\eta_{\text{OL}}$ )	The determined value shall not be lower than the declared value by more than 5 %.

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*ANNEX V*

**Indicative benchmarks referred to in Article 6**

At the time of entry into force of this Regulation, the indicative benchmark for the best available technology on the market for water pumps is a minimum efficiency index (MEI)  $\geq 0,70$ .