

Summary of ISO 12759

Fans – Efficiency classification of fans

This presentation is only a summary of the full standard. Please see the actual standard for further details.

- The purpose of ISO 12759 is to provide a world wide performance characteristic for fans.
- It can be the basis for legislators, regulatory bodies, but also industry to set minimum efficiency targets.
- The formulas have been incorporated in the EU directive 327-2011; “Ecodesign for fans drive by motors between 125 W and 500 kW.”
- The standard is not directly applicable for
 - Smoke fans
 - Fans for automotive, trains, aeroplanes, ships
 - Explosion proof fans
 - Box fans, air curtain fans and roof fans
 - Jet fans

Two sets of rating schemes

- FEG (Fan efficiency grade) for bare shaft fans (mainly used in the USA).
- FMEG (Fan motor efficiency grades) for fans with motors (main method in Europe).

The efficiency is defined as the optimal peak efficiency at maximum speed.

Tolerances given in ISO 13348 apply.

Different FMEG values are used for different fan types

	Axial, Forward Curved & Radial Centrifugal fans, Mixed flow fans	Backward Bladed Centrifugal fans	Crossflow fans
<10 kW	$\eta_{opt} = 2.74 \cdot \ln(P_e) - 6.33 + N_G$	$\eta_{opt} = 4.56 \cdot \ln(P_e) - 10.5 + N_G$	$\eta_{opt} = 1.14 \cdot \ln(P_e) - 2.6 + N_G$
≥ 10 kW	$\eta_{opt} = 0.78 \cdot \ln(P_e) - 1.88 + N_G$	$\eta_{opt} = 1.1 \cdot \ln(P_e) - 2.6 + N_G$	$\eta_{opt} = N_G$

→ See the following pages for a graphic representation of the various FMEG's and optimal minimum efficiencies.

η_{opt} = Minimum peak efficiency at maximum speed

P_e = Electrical power input in kilowatt.

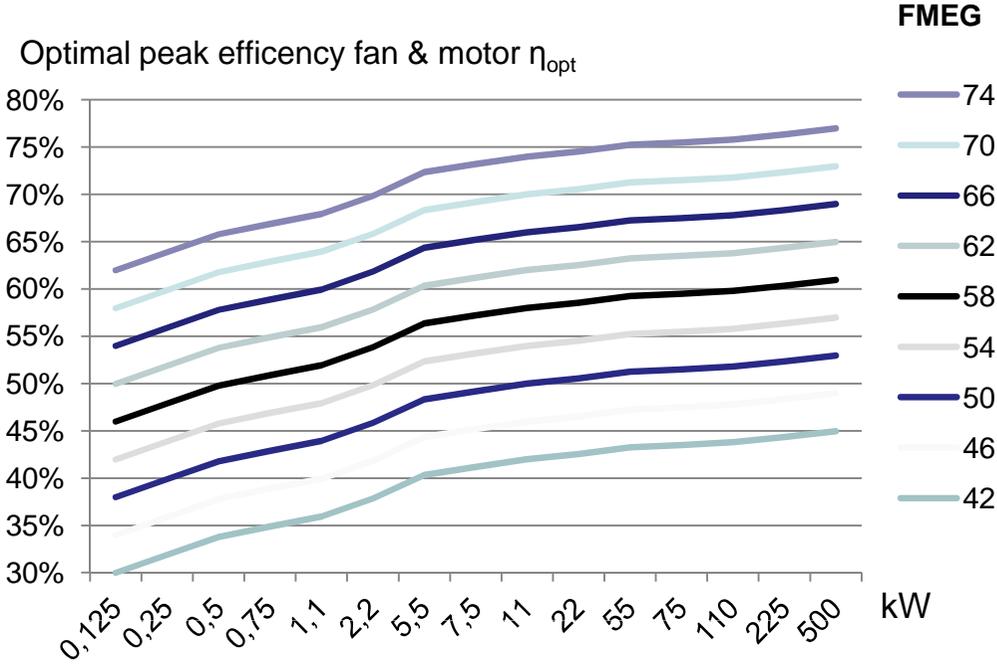
N_G = Grade number (integer) of the FMEG e.g. $N_G = 40$ for FMEG 40.

Optimal peak & efficiency grades

Optimal peak efficiencies for axial, forward curved centrifugal and mixed flow fans

Efficiency grades for axial, forward curved centrifugal and mixed flow fans

FMEG\ Pe	0,125 kW	0,25 kW	0,5 kW	0,75 kW	1,1 kW	2,2 kW	5,5 kW	7,5 kW	11 kW	22 kW	55 kW	75 kW	110 kW	225 kW	500 kW
42	30%	32%	34%	35%	36%	38%	40%	41%	42%	43%	43%	43%	44%	44%	45%
46	34%	36%	38%	39%	40%	42%	44%	45%	46%	47%	47%	47%	48%	48%	49%
50	38%	40%	42%	43%	44%	46%	48%	49%	50%	51%	51%	51%	52%	52%	53%
54	42%	44%	46%	47%	48%	50%	52%	53%	54%	55%	55%	55%	56%	56%	57%
58	46%	48%	50%	51%	52%	54%	56%	57%	58%	59%	59%	59%	60%	60%	61%
62	50%	52%	54%	55%	56%	58%	60%	61%	62%	63%	63%	63%	64%	64%	65%
66	54%	56%	58%	59%	60%	62%	64%	65%	66%	67%	67%	67%	68%	68%	69%
70	58%	60%	62%	63%	64%	66%	68%	69%	70%	71%	71%	71%	72%	72%	73%
74	62%	64%	66%	67%	68%	70%	72%	73%	74%	75%	75%	75%	76%	76%	77%



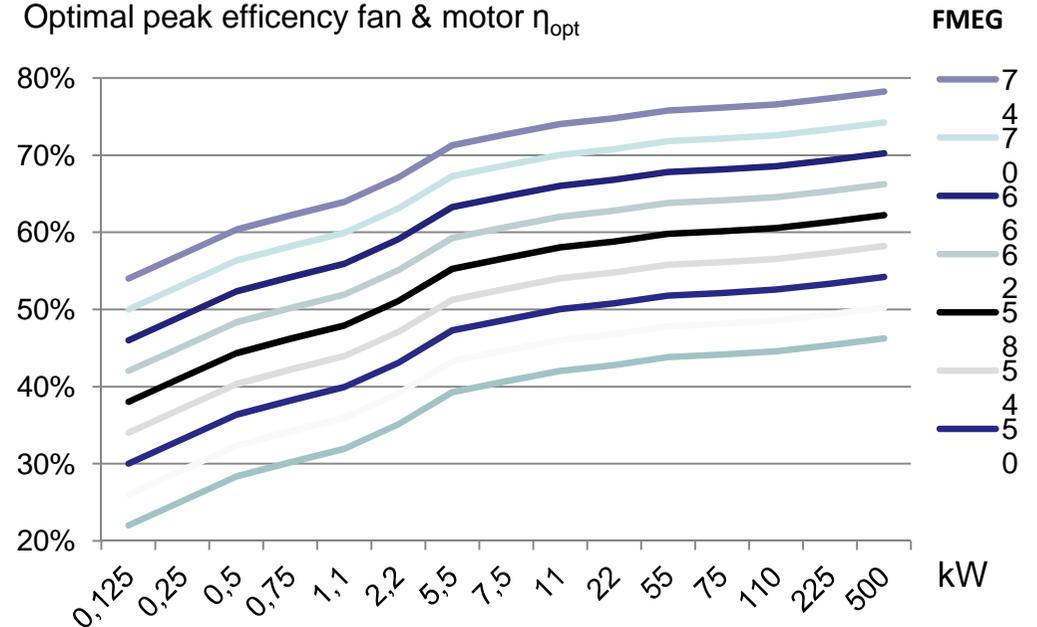
Optimal peak & efficiency grades

Optimal peak efficiencies for backward curved centrifugal fans

FMEG \ Pm	0,125 kW	0,25 kW	0,5 kW	0,75 kW	1,1 kW	2,2 kW	5,5 kW	7,5 kW	11 kW	22 kW	55 kW	75 kW	110 kW	225 kW	500 kW
42	22%	25%	28%	30%	32%	35%	39%	41%	42%	43%	44%	44%	45%	45%	46%
46	26%	29%	32%	34%	36%	39%	43%	45%	46%	47%	48%	48%	49%	49%	50%
50	30%	33%	36%	38%	40%	43%	47%	49%	50%	51%	52%	52%	53%	53%	54%
54	34%	37%	40%	42%	44%	47%	51%	53%	54%	55%	56%	56%	57%	57%	58%
58	38%	41%	44%	46%	48%	51%	55%	57%	58%	59%	60%	60%	61%	61%	62%
62	42%	45%	48%	50%	52%	55%	59%	61%	62%	63%	64%	64%	65%	65%	66%
66	46%	49%	52%	54%	56%	59%	63%	65%	66%	67%	68%	68%	69%	69%	70%
70	50%	53%	56%	58%	60%	63%	67%	69%	70%	71%	72%	72%	73%	73%	74%
74	54%	57%	60%	62%	64%	67%	71%	73%	74%	75%	76%	76%	77%	77%	78%

Efficiency grades backward curved centrifugal fans

Optimal peak efficiency fan & motor η_{opt}

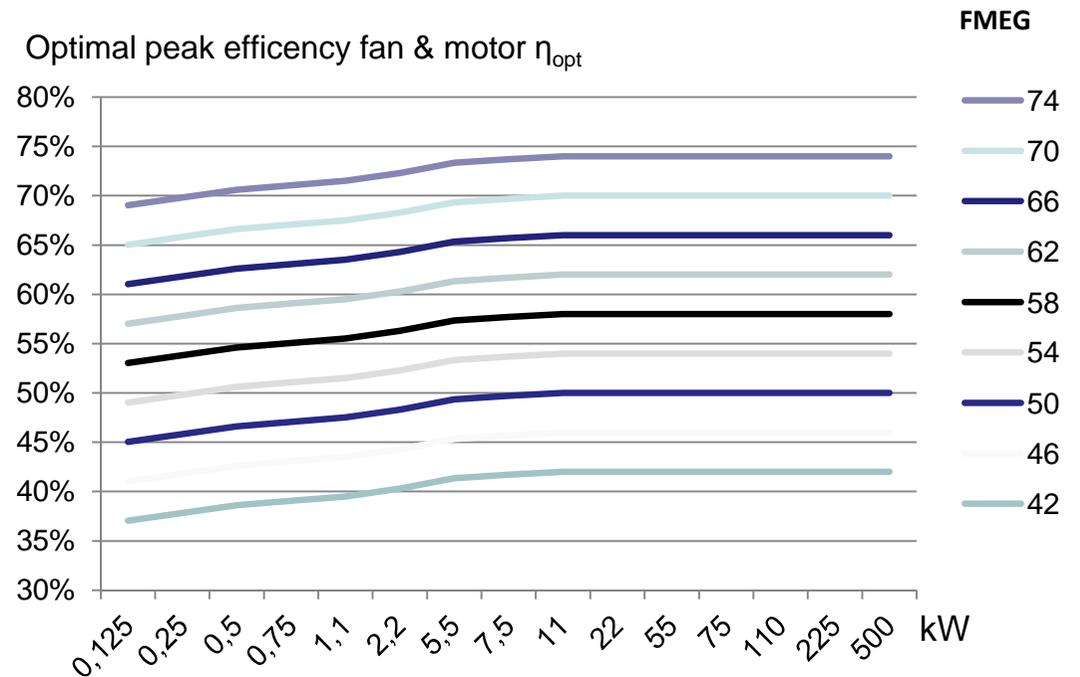


Optimal peak & efficiency grades

Optimal peak efficiencies for cross flow fans

FMEG \ Pm	0,125 kW	0,25 kW	0,5 kW	0,75 kW	1,1 kW	2,2 kW	5,5 kW	7,5 kW	11 kW	22 kW	55 kW	75 kW	110 kW	225 kW	500 kW
42	37%	38%	39%	39%	40%	40%	41%	42%	42%	42%	42%	42%	42%	42%	42%
46	41%	42%	43%	43%	44%	44%	45%	46%	46%	46%	46%	46%	46%	46%	46%
50	45%	46%	47%	47%	48%	48%	49%	50%	50%	50%	50%	50%	50%	50%	50%
54	49%	50%	51%	51%	52%	52%	53%	54%	54%	54%	54%	54%	54%	54%	54%
58	53%	54%	55%	55%	56%	56%	57%	58%	58%	58%	58%	58%	58%	58%	58%
62	57%	58%	59%	59%	60%	60%	61%	62%	62%	62%	62%	62%	62%	62%	62%
66	61%	62%	63%	63%	64%	64%	65%	66%	66%	66%	66%	66%	66%	66%	66%
70	65%	66%	67%	67%	68%	68%	69%	70%	70%	70%	70%	70%	70%	70%	70%
74	69%	70%	71%	71%	72%	72%	73%	74%	74%	74%	74%	74%	74%	74%	74%

Efficiency grades cross flow fans



IEC 60034-30 defines the minimum efficiency levels of the motors

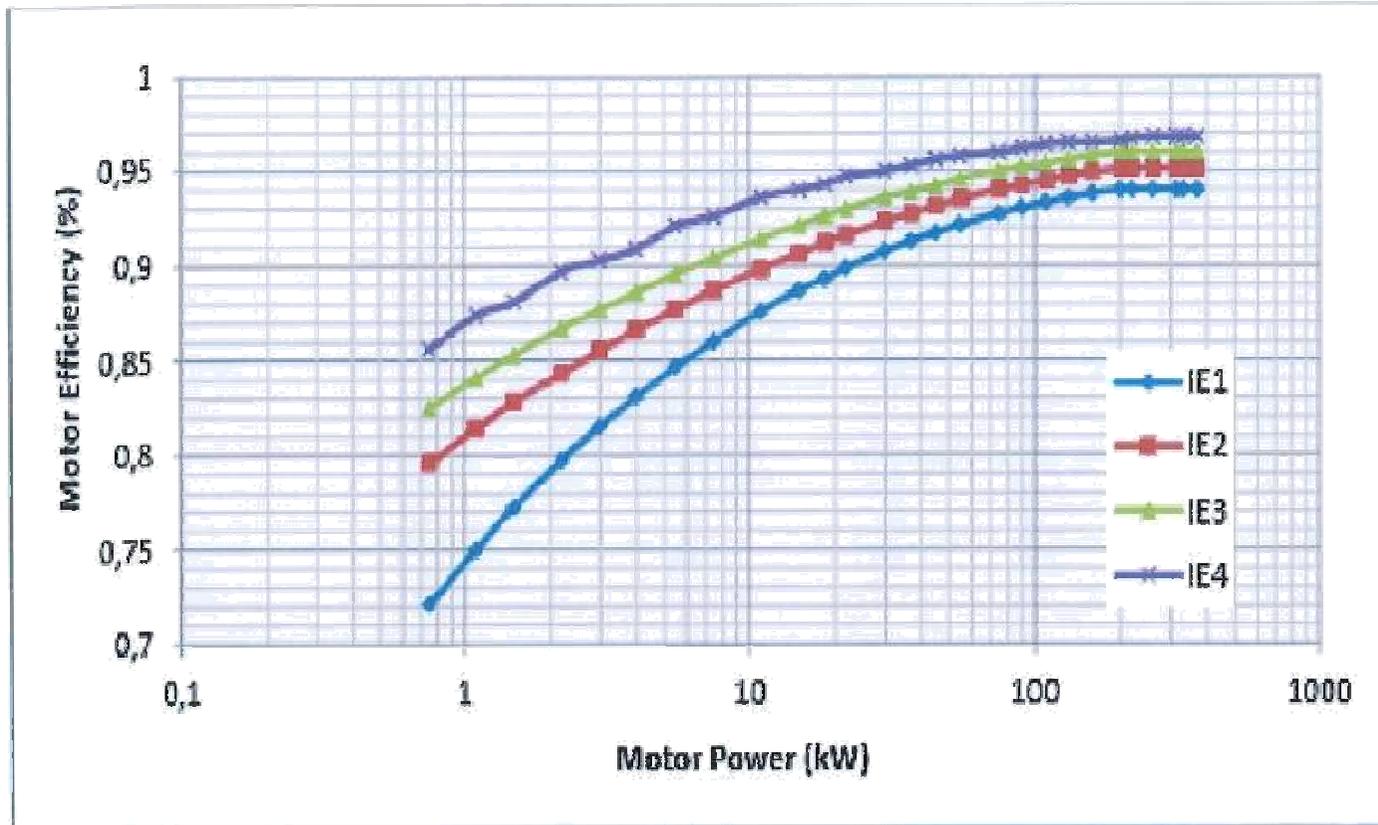


Figure 1-2. IE1, IE2 and IE3 efficiency levels in the IEC 60034-30 standard for 4 poled motors [6] and the new IE4 proposed in the IEC 60034-31 standard [12].

Variable speed

For variable speed drives a compensation factor may be used.

Electrical input power	Compensation factor
< 5kW	$-0,03 \times \ln * P_e + 1,088$
$\geq 5kW$	1,04

This is done in recognition that variable speed drives give a positive contribution to improve overall energy efficiency.

Summary

- ISO 12759 provides a method to define minimum efficiencies standards for complete fan units.
- In combination with the IEC 60034-30 which sets minimum efficiencies for motor, the resulting minimum efficiencies for the fan itself can be calculated.
- The detailed standard provides additional guideline for how to include for various drive types.
- The standard is the basis for the EU directive 327-2011. “Ecodesign for fans“.