



## efficiency

“Efficiency” indicates how well an electric motor transforms electrical energy into mechanical energy. The higher the efficiency of a motor in specific operating conditions, the lower is its energy consumption. International standard IEC 60034-30-1 defines efficiency classes through the code “IE” followed by a number.

**IE1 (standard efficiency)**

**IE2 (high efficiency)**

**IE3 (premium efficiency)**

**IE4 (super premium efficiency)**

The Standard IEC 60034-30-1 defines motor efficiency classes, but it doesn't legally determine minimum efficiency requirements. As a matter of fact the standard does not specify if motors shall comply with a minimum efficiency class. Minimum efficiency standard are instead specified by individual countries directives and laws.

Commission Regulation 640/2009 (amended by regulation 4/2014), currently in force in Europe determines motors minimum efficiency levels and it applies to squirrel cage induction motors with single speed (2, 4, and 6 poles), three-phase 50Hz or 60Hz, power from 0.75 kW up to 375 kW, nominal voltage up to 1000 V and working on continuous duty (S1).

Some motor categories are excluded from this regulation.

**Brake motors are not included in the application field of the European Regulation.**

MGM brake motors (BAX and BMX series) are also available with IE3 efficiency level even if not required by the European regulation 640/2009 (amended by regulation 4/2014).

The table shows the efficiency level of motor at 100%, 75%, and 50% of the nominal load for different powers and number of poles. The provided data refers to 50Hz motor operation.

BAX and BMX series motors are recommended where continuous duty is required with a prolonged operation, in order to allow an effective energy saving. The increased purchasing price for IE3 efficiency class motors is quickly recovered due to the total savings in energy costs.

For a quick calculation of the annual economic savings using a motor with an efficiency ( $eff_a$ ) instead of a motor with an efficiency ( $eff_b$ ) with the same rated power you can consider the following formula:

$$\text{Annual economic savings} = H_{\text{year}} \times \text{kW} \times \%FL \times \text{Cost}_{\text{kwh}} \times (1/eff_a - 1/eff_b)$$

$H_{\text{year}}$  = annual motor running (hours)

$\text{kW}$  = motor rated power (kW)

$\% FL$  = fraction of full load power at which motors effectively run

$\text{Cost}_{\text{kwh}}$  = electricity cost

$eff_a$  = motor 'a' efficiency (%) at the effective load condition / 100

$eff_b$  = motor 'b' efficiency (%) at the effective load condition / 100

Higher motor efficiency doesn't necessarily turn out in a significant energy saving for intermittent duty applications, frequent starts and stop or short operation times. BAX and BMX series IE3 (premium) efficiency motors have a moment of inertia greater than the equivalent motors in the BA and BM series therefore it's not recommended to use them (BAX and BMX series) for applications with high start and stops frequency.

BAX and BMX motor series have the same brake components as the BA and BM series, therefore the braking performance are the same. BAX and BMX series motors maintain the same dimensions as BA and BM series motors.

Motor Efficiency regulations are different for each country with regards to minimum efficiency levels, exclusions and deadlines. As regulations are subject to changes please contact MGM technical department for the most updated information about efficiency regulations.

IE3 - 50 Hz

Series	Motor type	Power (kW)	r.p.m	In (A) 400 V 50 Hz	Cn (Nm)	Ca / Cn	Ia / In	100%		75%		50%	
								Efficiency	cos φ	Efficiency	cos φ	Efficiency	cos φ
2 pole													
BAX-BMX	80 A2	0.75	2849	1.74	2.52	3.6	5.7	80.7	0.77	80.2	0.68	76.6	0.54
BAX-BMX	80 B2	1.10	2865	2.50	3.66	3.3	5.4	82.7	0.77	83.0	0.73	80.9	0.58
BAX-BMX	90 SA2	1.50	2900	3.30	4.93	3.8	8.2	85.3	0.82	85.1	0.75	82.8	0.63
BAX-BMX	90 LA2	2.20	2887	4.95	7.28	4.4	8.4	85.9	0.75	85.7	0.66	84.0	0.53
BAX-BMX	100 LB2	3.00	2905	6.60	9.86	4.4	8.8	87.1	0.76	86.3	0.68	84.2	0.54
BAX-BMX	112 MC2	4.00	2935	7.70	13.00	4.6	10.5	89.0	0.84	89.1	0.79	88.5	0.69
BAX-BMX	132 SA2	5.50	2935	10.10	17.90	4.3	9.5	89.2	0.88	89.6	0.85	87.4	0.73
BAX-BMX	132 SB2	7.50	2930	13.40	24.40	4.0	9.0	90.1	0.89	91.0	0.85	90.0	0.77
BAX-BMX	160 MA2	11.00	2945	20.30	35.70	4.5	10.2	91.7	0.85	91.9	0.80	90.0	0.78
BAX-BMX	160 MB2	15.00	2950	27.50	48.60	4.6	10.3	91.9	0.85	92.0	0.80	90.7	0.69
BAX-BMX	160 LA2	18.50	2955	33.70	59.80	4.6	10.3	92.6	0.86	92.6	0.81	91.6	0.71
BAX-BMX	180 LA2	22.00	2955	38.10	71.10	4.6	11.0	92.7	0.90	92.7	0.87	91.7	0.81
BAX-BMX	200 LA2	30.00	2955	51.65	97.00	4.7	9.8	93.4	0.90	93.5	0.87	92.3	0.81
BAX-BMX	200 LB2	37.00	2955	62.70	119.60	4.7	9.8	93.9	0.91	94.0	0.85	92.1	0.80
4 pole													
BAX-BMX	80 B4	0.75	1415	2.00	5.06	3.1	5.6	82.5	0.67	82.8	0.60	81.2	0.47
BAX-BMX	90 SA4	1.10	1428	2.60	7.37	3.4	5.7	84.1	0.73	84.3	0.64	82.6	0.50
BAX-BMX	90 LA4	1.50	1430	3.50	10.00	3.5	6.2	85.3	0.78	85.8	0.69	83.8	0.55
BAX-BMX	100 LA4	2.20	1440	4.80	14.50	2.9	7.0	86.7	0.76	87.0	0.67	85.4	0.54
BAX-BMX	112 MB4	3.00	1455	6.40	19.70	4.0	8.6	87.7	0.77	88.7	0.69	87.2	0.55
BAX-BMX	112 MC4	4.00	1445	8.40	26.40	3.7	7.1	88.6	0.77	88.8	0.69	87.6	0.55
BAX-BMX	132 SB4	5.50	1457	11.00	36.00	3.5	7.6	89.6	0.80	90.1	0.74	89.3	0.62
BAX-BMX	132 MA4	7.50	1457	14.90	49.20	3.3	7.9	90.4	0.82	90.7	0.75	90.2	0.63
BAX-BMX	160 MB4	11.00	1460	22.30	71.50	3.8	9.1	91.4	0.78	91.6	0.71	91.0	0.59
BAX-BMX	160 LA4	15.00	1470	30.20	97.40	3.5	9.1	92.1	0.78	92.3	0.71	91.8	0.59
BAX-BMX	180 LA4	18.50	1475	37.10	119.80	3.5	9.1	92.6	0.78	92.6	0.72	91.6	0.59
BAX-BMX	180 LB4	22.00	1472	41.70	142.40	4.3	8.6	93.0	0.82	93.0	0.73	92.0	0.68
BAX-BMX	200 LB4	30.00	1475	53.20	194.20	2.9	8.4	93.6	0.87	93.4	0.84	93.4	0.75
BAHX-BMX	225 S4	37.00	1480	66.20	238.70	2.7	8.5	93.9	0.86	94.4	0.77	91.9	0.72
BAHX-BMX	225 M4	45.00	1480	79.30	290.40	2.8	8.8	94.2	0.87	94.7	0.78	92.2	0.73
BAHX-BMX	250 M4	55.00	1480	96.60	354.90	3.2	9.8	94.6	0.87	95.1	0.78	92.6	0.73
BAHX-BMX	280 S4	75.00	1488	136.40	481.30	2.4	8.0	95.4	0.83	95.5	0.79	95.0	0.69
BAHX-BMX	280 M4	90.00	1488	160.70	577.60	2.6	9.6	95.2	0.84	95.5	0.76	93.2	0.71
6 pole													
BAX-BMX	90 SA6	0.75	935	2.10	7.70	2.5	5.5	79.0	0.66	79.4	0.57	77.2	0.52
BAX-BMX	90 LA6	1.10	935	3.30	11.20	3.1	4.6	81.0	0.61	81.4	0.51	79.2	0.38
BAX-BMX	100 LA6	1.50	955	4.20	15.00	3.0	5.3	82.5	0.62	82.9	0.53	80.7	0.48
BAX-BMX	112 MC6	2.20	960	5.00	21.90	2.4	6.4	84.3	0.75	84.4	0.66	82.5	0.61
BAX-BMX	132 SB6	3.00	965	6.80	29.70	3.1	8.1	85.6	0.75	85.8	0.66	83.8	0.61
BAX-BMX	132 MA6	4.00	965	9.20	39.60	3.1	6.7	87.1	0.72	88.2	0.63	87.1	0.50
BAX-BMX	132 MB6	5.50	965	12.50	54.40	3.0	6.6	88.0	0.72	88.2	0.63	86.6	0.50
BAX-BMX	160 MB6	7.50	965	15.80	74.20	3.0	7.2	89.1	0.76	89.3	0.68	88.2	0.55
BAX-BMX	160 LB6	11.00	965	22.90	108.90	2.7	9.1	90.3	0.77	90.5	0.68	88.5	0.63
BAX-BMX	180 LB6	15.00	970	31.30	147.70	3.1	9.1	91.2	0.76	91.2	0.67	90.0	0.54
BAX-BMX	200 LA6	18.50	980	37.40	180.30	3.7	8.6	91.7	0.80	91.8	0.71	89.9	0.58
BAX-BMX	200 LB6	22.00	975	43.10	215.50	3.1	7.3	92.2	0.80	92.3	0.71	90.4	0.58
BAHX-BMX	225 M6	30.00	985	57.90	291.40	3.7	7.7	92.9	0.81	93.2	0.76	92.9	0.66
BAHX-BMX	250 M6	37.00	980	68.20	360.50	3.2	7.9	93.3	0.84	93.4	0.75	91.5	0.62
BAHX-BMX	280 S6	45.00	987	88.80	436.30	2.8	6.0	93.7	0.78	93.8	0.76	91.9	0.63
BAHX-BMX	280 M6	55.00	987	108.10	533.20	2.8	6.6	94.1	0.78	94.2	0.76	92.3	0.63