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 laws.

Commission Regulation 640/2009 (amended by regulation 4/2014), in force in Europe till the 30th of June 2021, determines motors minimum efficiency levels and it applies to squirrel cage induction motors with single speed (2, 4, and 6 poles), three-phase 50 Hz or 60 Hz, 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 this European Regulation.

The new European regulation (regulation EU 2019/1781), on the other hand, it establishes new requirements for brake motors rated for operation on a 50 Hz, 60 Hz or 50/60 Hz sinusoidal voltage, rated voltage above 50 V and up to and including 1000 V and continuous duty (S1, S3 ≥ 80%, S6 ≥ 80%) operation, starting from the 1st of July 2021.

Starting from the 1st of July 2021:
- three phase brake motors with rated power 0,75 kW ≤ P_N ≤ 1000 kW with 2, 4, 6, 8 pole, must be IE3.
- three phase brake motors with rated power 0,12 kW ≤ P_N < 0,75 kW with 2, 4, 6, 8 pole, must be IE2.

Starting from the 1st of July 2023:
- single phase brake motors with rated power P_N ≥ 0,12 kW with 2, 4, 6, 8 pole, must be IE2.

The new regulation doesn't apply to some types of motors among which 2 speed motors and TENV motors.

The following table shows the technical data of BAX and BMX series motors (three phase brake motors) with efficiency class IE2 (rated power P_N < 0,75 kW) and IE3 (rated power P_N ≥ 0,75 kW) that comply with the new efficiency regulation. The provided data refers to 50 Hz motor operation.

Motor Efficiency regulations are different for each country in the world 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.

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:

Annual economic savings = H_{year} x kW x %FL x Costkwh x ($1/eff_a - 1/eff_b$)

H_{year} = annual motor running (hours)
kW = motor rated power (kW)
% FL = fraction of full load power at which motors effectively run
Costkwh = electricity cost
eff_a = motor 'a' efficiency (%) at the effective load condition / 100
eff_b = motor 'b' efficiency (%) at the effective load condition / 100

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

Series	Motor type	P_N (kW)	r.p.m	In (A) 400 V 50 Hz	Cn (Nm)	Ca / Cn	Ia / In	IE	100%		75%		50%	
									Efficiency	cos φ	Efficiency	cos φ	Efficiency	cos φ
2 pole														
BMX	56 B2	0.12	2750	0.41	0.42	3.0	3.3	IE2	59.0	0.72	59.0	0.62	56.4	0.49
BMX	63 A2	0.18	2800	0.63	0.61	3.0	3.6	IE2	60.4	0.69	59.3	0.60	56.6	0.54
BMX	63 B2	0.25	2780	0.73	0.86	3.5	5.0	IE2	64.8	0.76	63.7	0.67	60.8	0.62
BAX-BMX	71 A2	0.37	2810	1.00	1.26	2.6	4.5	IE2	69.5	0.76	68.4	0.67	65.3	0.63
BAX-BMX	71 B2	0.55	2810	1.40	1.86	2.6	4.5	IE2	74.1	0.76	73.0	0.67	69.7	0.61
BAX-BMX	80 A2	0.75	2849	1.74	2.52	3.6	5.7	IE3	80.7	0.77	80.2	0.68	76.6	0.54
BAX-BMX	80 B2	1.1	2865	2.50	3.66	3.3	5.4	IE3	82.7	0.77	83.0	0.73	80.9	0.58
BAX-BMX	90 SA2	1.5	2900	3.30	4.93	3.8	8.2	IE3	85.3	0.82	85.1	0.75	82.8	0.63
BAX-BMX	90 LA2	2.2	2887	4.95	7.28	4.4	8.4	IE3	85.9	0.75	85.7	0.66	84.0	0.53
BAX-BMX	100 LB2	3.0	2905	6.60	9.86	4.4	8.8	IE3	87.1	0.76	86.3	0.68	84.2	0.54
BAX-BMX	112 MC2	4.0	2935	7.70	13.0	4.6	10.5	IE3	89.0	0.84	89.1	0.79	88.5	0.69
BAX-BMX	132 SA2	5.5	2935	10.10	17.9	4.3	9.5	IE3	89.2	0.88	89.6	0.85	87.4	0.73
BAX-BMX	132 SB2	7.5	2930	13.40	24.4	4.0	9.0	IE3	90.1	0.89	91.0	0.85	90.0	0.77
BAX-BMX	160 MA2	11.0	2945	20.30	35.7	4.5	10.2	IE3	91.7	0.85	91.9	0.80	90.0	0.78
BAX-BMX	160 MB2	15.0	2950	27.50	48.6	4.6	10.3	IE3	91.9	0.85	92.0	0.80	90.7	0.69
BAX-BMX	160 LA2	18.5	2955	33.80	59.8	4.6	10.3	IE3	92.4	0.86	92.6	0.81	91.6	0.71
BAX-BMX	180 LA2	22.0	2958	36.80	71.1	4.2	10.8	IE3	92.7	0.93	92.0	0.92	91.0	0.88
BAX-BMX	200 LA2	30.0	2955	51.65	97.0	4.7	9.8	IE3	93.4	0.90	93.5	0.87	92.3	0.81
BAX-BMX	200 LB2	37.0	2955	62.70	119.6	4.7	9.8	IE3	93.9	0.91	94.0	0.85	92.1	0.80
4 pole														
BMX	63 A4	0.12	1300	0.36	0.82	2.2	2.8	IE2	59.1	0.73	59.8	0.61	54.1	0.46
BMX	63 B4	0.18	1340	0.58	1.28	2.2	2.8	IE2	64.7	0.70	62.5	0.60	51.4	0.46
BMX	63 C4	0.22	1350	0.70	1.55	2.6	3.6	IE2	67.1	0.69	67.0	0.62	66.4	0.47
BAX-BMX	71 A4	0.25	1400	0.76	1.70	2.0	3.6	IE2	68.5	0.69	66.3	0.59	61.4	0.47
BAX-BMX	71 B4	0.37	1375	1.00	2.62	2.2	3.9	IE2	72.7	0.74	73.0	0.65	70.3	0.50
BAX-BMX	71 C4	0.55	1360	1.43	3.86	2.4	4.2	IE2	77.1	0.72	78.2	0.63	75.1	0.50
BAX-BMX	80 A4	0.55	1410	1.41	3.70	2.4	4.3	IE2	77.1	0.72	76.4	0.62	73.5	0.50
BAX-BMX	80 B4	0.75	1415	2.0	5.06	3.1	5.6	IE3	82.5	0.67	82.8	0.60	81.2	0.47
BAX-BMX	90 SA4	1.1	1428	2.6	7.37	3.4	5.7	IE3	84.1	0.73	84.3	0.64	82.6	0.50
BAX-BMX	90 LA4	1.5	1430	3.5	10.0	3.5	6.2	IE3	85.3	0.74	85.2	0.64	83.6	0.50
BAX-BMX	100 LA4	2.2	1440	4.8	14.5	2.9	7.0	IE3	86.7	0.76	87.0	0.67	85.4	0.54
BAX-BMX	112 MB4	3	1455	6.4	19.7	4.0	8.6	IE3	87.7	0.77	88.7	0.69	87.2	0.55
BAX-BMX	112 MC4	4	1445	8.4	26.4	3.7	7.1	IE3	88.6	0.77	88.8	0.69	87.6	0.55
BAX-BMX	132 SB4	5.5	1457	11.0	36.0	3.5	7.6	IE3	89.6	0.80	91.1	0.74	89.3	0.62
BAX-BMX	132 MA4	7.5	1457	14.9	49.2	3.3	7.9	IE3	90.4	0.82	90.7	0.75	90.2	0.63
BAX-BMX	160 MB4	11.0	1460	22.3	71.5	3.8	9.1	IE3	91.4	0.78	91.6	0.71	91.0	0.59
BAX-BMX	160 LA4	15.0	1470	30.2	97.4	3.5	9.1	IE3	92.1	0.78	92.3	0.71	91.8	0.59
BAX-BMX	180 LA4	18.5	1475	37.1	119.8	3.5	9.1	IE3	92.6	0.78	92.6	0.72	91.7	0.59
BAX-BMX	180 LB4	22.0	1472	41.7	142.4	4.3	8.6	IE3	93.0	0.82	93.0	0.73	92.0	0.68
BAX-BMX	200 LB4	30.0	1475	53.2	194.2	2.9	8.4	IE3	93.6	0.87	93.4	0.84	93.4	0.75
BAHX-BMX	225 S4	37.0	1480	66.2	238.7	2.7	8.5	IE3	93.9	0.86	94.4	0.77	91.9	0.72
BAHX-BMX	225 M4	45.0	1480	79.3	290.4	2.8	8.8	IE3	94.2	0.87	94.7	0.78	92.2	0.73
BAHX-BMX	250 M4	55.0	1480	96.6	354.9	3.2	9.8	IE3	94.6	0.87	95.1	0.78	92.6	0.73
BAHX-BMX	280 S4	75.0	1488	136.4	481.3	2.2	7.6	IE3	95.4	0.83	95.5	0.79	95.0	0.69
BAHX-BMX	280 M4	90.0	1488	160.7	577.6	2.2	7.6	IE3	95.2	0.84	95.5	0.75	93.2	0.70
BAHX-BMX	315 S4	110.0	1489	193.5	705.5	2.6	9.2	IE3	95.4	0.86	95.9	0.77	93.4	0.72
BAHX-BMX	315 M4	132.0	1489	231.7	846.6	2.7	9.2	IE3	95.6	0.86	96.1	0.77	93.6	0.72
6 pole														
BMX	63 D6	0.12	865	0.62	1.3	2.7	1.9	IE2	50.6	0.55	50.4	0.50	48.5	0.42
BAX-BMX	71 A6	0.18	900	0.61	2.1	2.0	2.6	IE2	56.6	0.69	56.7	0.61	52.8	0.47
BAX-BMX	71 B6	0.25	875	0.80	2.8	1.6	2.8	IE2	61.6	0.70	62.1	0.61	57.4	0.45
BAX-BMX	80 A6	0.37	940	1.3	3.8	2.7	3.5	IE2	67.6	0.57	67.5	0.48	60.8	0.40
BAX-BMX	80 B6	0.55	920	1.7	4.2	2.8	3.5	IE2	73.1	0.63	72.8	0.61	69.2	0.55
BAX-BMX	90 SA6	0.75	935	2.1	7.7	2.5	5.5	IE3	79.0	0.66	79.4	0.57	77.2	0.52
BAX-BMX	90 LA6	1.1	935	3.3	11.2	3.1	4.6	IE3	81.0	0.61	81.4	0.51	79.2	0.38
BAX-BMX	100 LA6	1.5	955	4.0	15.2	3.0	5.3	IE3	82.5	0.66	82.1	0.56	79.1	0.43
BAX-BMX	112 MC6	2.2	960	5.0	21.9	2.4	6.4	IE3	84.3	0.75	84.4	0.66	82.5	0.61
BAX-BMX	132 SB6	3.0	965	6.8	29.7	3.1	8.1	IE3	85.6	0.75	85.8	0.66	83.8	0.61
BAX-BMX	132 MA6	4.0	965	9.2	39.6	3.1	6.7	IE3	87.1	0.72	88.2	0.63	87.1	0.50
BAX-BMX	132 MB6	5.5	965	12.5	54.4	3.0	6.6	IE3	88.0	0.72	88.2	0.63	86.6	0.50
BAX-BMX	160 MB6	7.5	965	15.8	74.2	3.0	7.2	IE3	89.1	0.76	89.3	0.68	88.2	0.55
BAX-BMX	160 LB6	11	965	22.9	108.9	2.7	9.1	IE3	90.3	0.77	90.5	0.68	88.5	0.63
BAX-BMX	180 LB6	15	978	31.3	147.7	3.1	9.1	IE3	91.2	0.76	91.2	0.67	90.0	0.54
BAX-BMX	200 LA6	18.5	980	37.4	180.3	3.7	8.6	IE3	91.7	0.80	91.8	0.71	89.9	0.58
BAX-BMX	200 LB6	22	975	43.1	215.5	3.1	7.3	IE3	92.2	0.80	92.3	0.71	90.4	0.58
BAHX-BMX	225 M6	30	985	57.9	291.4	3.7	7.7	IE3	92.9	0.80	93.2	0.76	92.9	0.66
BAHX-BMX	250 M6	37	980	68.2	360.5	3.2	7.9	IE3	93.3	0.84	93.4	0.75	91.5	0.62
BAHX-BMX	280 S6	45	987	88.8	436.3	2.8	6.0	IE3	93.7	0.78	93.8	0.76	91.9	0.63
BAHX-BMX	280 M6	55	987	108.1	533.2	2.8	6.6	IE3	94.1	0.78	94.2	0.76	92.3	0.63
BAHX-BMX	315 S6	75	988	141.3	724.9	2.6	7.0	IE3	94.6	0.81	94.7	0.72	92.8	0.59
BAHX-BMX	315 M6	90	988	169.0	869.9	2.6	7.0	IE3	94.9	0.81	95.0	0.72	93.1	0.59