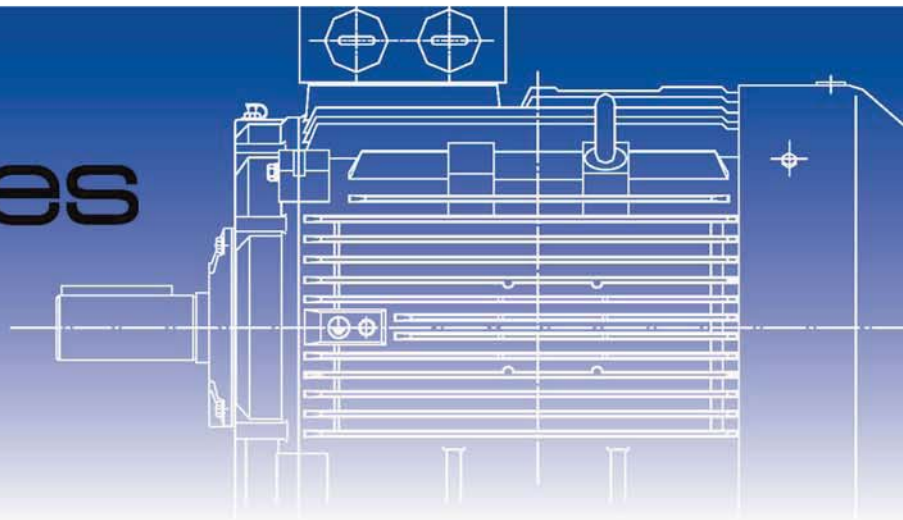


TP2 Series

IE2 High Efficiency



CAST IRON
Frame 71-355

NEW EFFICIENCY CLASSES FOR LOW-VOLTAGE THREE-PHASE MOTORS (IE-CODE)

Along with the international discussion on energy efficiency a worldwide harmonized energy efficiency classification system has been established for low-voltage three-phase asynchronous motors.

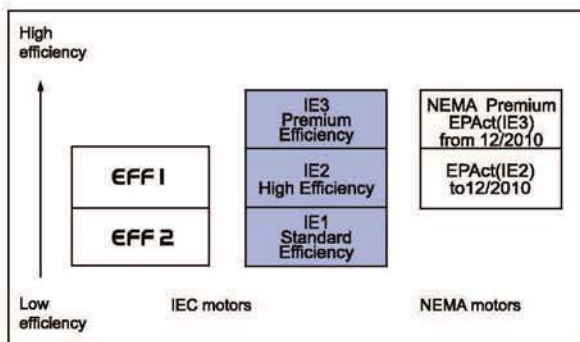
The efficiency factor defines the efficiency of motors when transforming electrical into mechanical energy. For many years low-voltage three-phase motors in the European Union have been sold in three efficiency classes EFF3, EFF2 and EFF1. Energy efficiency classification systems have been introduced and well-proven in many countries all over the world. They unfortunately differ from each other in terms of scope, wording and values. That was the reason for the International Electrotechnical Commission IEC to develop and publish an energy efficiency standard which replaces all the different national issues. In parallel IEC developed and issued a new standard for the determining the motor efficiencies. The new standard IEC 60034-30 defines and harmonizes worldwide the efficiency classes IE1, IE2 and IE3 for low-voltage three-phase motors.

New international efficiency classes of motors (IE = International Efficiency)

The new EN 60034-30:2009 defines worldwide the following efficiency classes of low-voltage three-phase asynchronous motors in the power range from 0.75 kW to 375 kW.

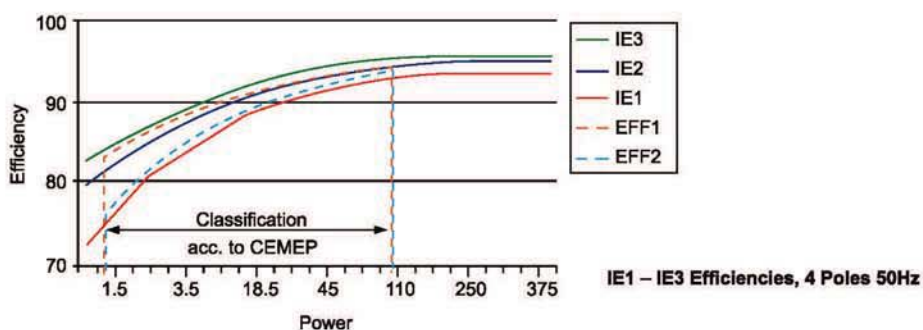
- IE1 = Standard Efficiency (comparable to EFF2)
- IE2 = High Efficiency (comparable to EFF1)
- IE3 = Premium Efficiency

The higher the efficiency class the higher is the complexity of motor production and the higher is the amount of material to be used (as for instance copper). The motor price will increase accordingly. In relation to the motor life time the purchase price is only a few percentage points and due the saved energy cost the pay-back period is short.



New method for determining the efficiency

The method for measuring the efficiency of low-voltage three-phase asynchronous motors was revised with the new EN 60034-2-1:2007 standard. The new standard significantly increases the accuracy under defined laboratory conditions. It will replace the previous standard EN 60034-2:1996. The new standard can be applied from now. The old standard will become void in November 2010. The efficiency levels according to EN 60034-30 are measured with the new method stipulated in EN 60034-2-1. In a direct comparison of both measuring methods at the same motor, it is expected that the efficiency levels determined according to the new method are up to a few percentage points below the efficiency levels using the old method. To achieve compatibility with the old EFF1 and EFF2 classes, the limit values of IE2 and IE1 classes were lowered slightly. For example, a today's 11 kW, 4-pole EFF1 motor with 91,0% efficiency is identical with a new IE2 motor with 89,8% efficiency. The motor has not physically changed but measured with two different methods. The EN 60034-30 defines requirements of efficiency classes, creating internationally consistent provisions. It has no legislative power and does not define mandatory efficiency levels to be used for the motors under this scope. This is left to the respective legislation in the individual countries or regions.



GENERAL SPECIFICATION

SPECIFICATION

Cast iron motors are suitable for almost all applications and are designed to operate in an ambient temperature of -20°C to +40°C and at an altitude not exceeding 1000m above sea level.

INSULATION AND TEMPERATURE RISE

Standard motors are designed complying with Class F insulation system, but temperature rise is checked according to Class B. That improves motor's useful life and reliability.

COOLING

The standard cooling method is Totally Enclosed Fan Cooled (TEFC) in accordance with code IC 411 of IEC 60034-6.

ENCLOSURE

The standard protection degree is IP55, which offer complete protection against contacting with live or moving parts inside the enclosure and against water splashing from any direction. More higher degree of protection is available.

TERMINAL BOX

Terminal boxes on all motors are of a generous size for easy of connection and maintenance.

VOLTAGE

Standard voltage are 415V 50Hz, 400V 50Hz and 380V 50Hz, but any single voltage in the range of 200-660V could be designed.

STARTING

Direct-on-line starting can be used on all frame sizes. Single speed, single voltage motors above 2.2kW are provided with 6 terminals that can be used for star-delta starting if required. All motors, when started direct-on-line, will meet the requirements of IEC 60034-12.

SHAFTS

All shaft diameters are machined to IEC 60072. For ease of fitting, removing or securing fittings, a tapped hole in the drive end shaft is provided as standard on all motor shafts.

BALANCING

All motors are dynamically balanced to IEC 60072. Reduced and special balances are available.

TOLERANCES ON MAIN PERFORMANCE PARAMETERS

IEC 60034-1, specifies allow tolerances for efficiency, power factor, speed, locked rotor torque, pullout torque, starting current and moment of inertia.

QUALITY TESTING

All motors are tested to strict engineering tolerances and are subject to mechanical and electrical tests at intermediate and final stages of manufacture. Individual motors are also tested to specific customer requirements.

QUALITY ASSURANCE

Stringent quality procedures are observed from first design to finished product in accordance with the ISO9001 documented quality systems. Our factory has assessed to meeting these requirements, a further assurance that only the highest possible standards of quality are accepted.

STANDARDS COMPLIANCE

BROOK CROMPTON motors are designed and built to suit all industrial requirements, including operation outside in the weather, in the tropics, or sub zero temperatures.

BROOK CROMPTON motors are built to comply with the requirements of the following international standards:

1. International Electrotechnical Commission-IEC60034 and IEC60072.
2. British Standards-BS 5000 and BS 4999.
3. Australian Standards-AS 1359.
4. The requirements for European "CE" marking, Low Voltage Directive 73/23(1973), modified by Directive 93/68(1993) & the EMC-Directive 89/336. These motors are designed for use with other machineries, and they should only be used if the complete machinery is in conformity with the Directive for Safety of Machinery(89/392/EEC).

Standards	IEC	CEN/CENELEC	BS
IEC60034			
General Requirements for Electrical machines	60034-1	EN60034-1	4999-1 4999-69
Methods of Determining Losses & Efficiency	60034-2	HD 53 2	4999-34
Degrees of Protection	60034-5	EN 60034-5	4999-20
Method of Cooling	60034-6	EN 60034-6	4999-21
Mounting arrangements	60034-7	EN 60034-7	4999-22
Terminal Markings and Direction of Rotation	60034-8	HD53 8 S4	4999-3
Noise limits	60034-9	EN60034-9	4999-51
Starting Performance	60034-12	EN60034-12	4999-112
Mechanical vibration	60034-14	EN60034-14	4999-50
Standard voltages	60038	HD 472 S1	
Dimensions & Output ratings	60072		
Mounting Dimensions & relationship frame sizes-output ratings.	60072	HD 231	4999-10 51-110
Shaft dimensions	60072	HD 231	4999-10
Classification of environmental conditions	600721-2-1		
IEC60085			
Insulation material	60085		
Efficiency of TP2 series	60034-30 IE2		

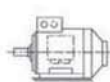
TECHNICAL INFORMATION

DEGREES OF PROTECTION (IEC 60034-5)

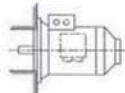
1st Digit	Protection Against Foreign Object	2nd Digit	Protection Against Moisture
0	Not Protected	0	Not Protected
1	Protected Against Objects > 50 mm	1	Protected Against Dripping Water
2	Protected Against Objects > 12 mm	2	Protected Against Dripping Water Titled 15° N
3	Protected Against Objects > 2.5 mm	3	Protected Against Spraying Water
4	Protected Against Objects > 1.0 mm	4	Protected Against Splashing Water
5	Dust Protected	5	Protected Against Water Jets
6	Dust Tight	6	Protected Against Heavy Seas
7	Not Applicable	7	Protected Against the Effect of Immersion
8	Not Applicable	8	Protected Against Submersion

MOUNTING ARRANGEMENTS (IEC60034-7)

Horizontal shaft:



**IM B3
IM 1001**
foot mounted



**IM B5
IM 3001**
flange at DE
no feet



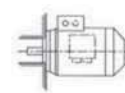
**IM B6
IM 1051**
foot wall mounted with
feet on left-hand side
when viewed from DE



**IM B7
IM 1061**
foot wall mounted with
feet on right-hand side
when viewed from DE

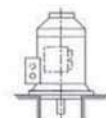


**IM B8
IM 1071**
ceiling mounted
with feet
above motor

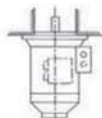


**IM B14
IM 3601**
face at DE
no feet

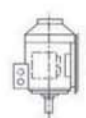
Vertical shaft:



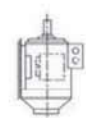
**IM V1
IM 3011**
flange at DE
shaft down
no feet



**IM V3
IM 3031**
flange at DE
shaft up
no feet



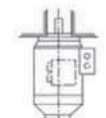
**IM V5
IM 1011**
vertical foot
wall mounted
shaft down



**IM V6
IM 1031**
vertical foot
wall mounted
shaft up



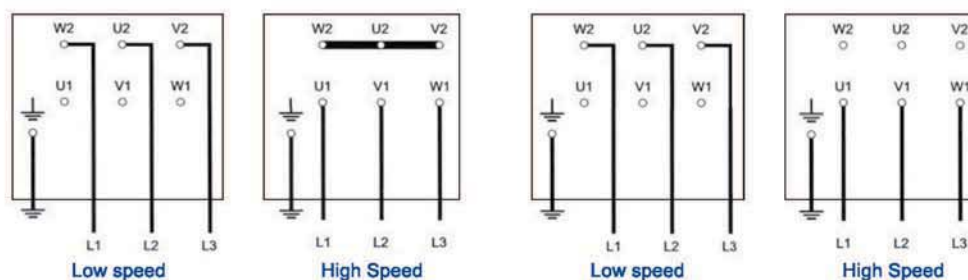
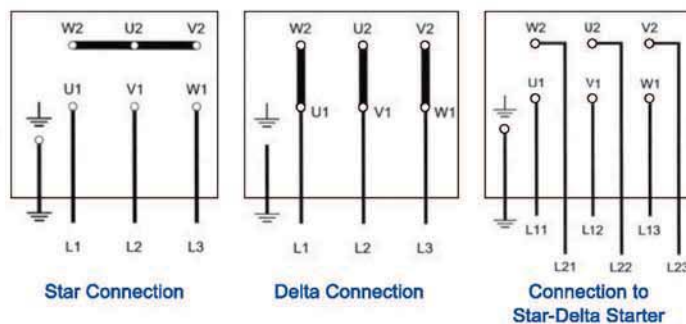
**IM V18
IM 3611**
face at DE
shaft down
no feet



**IM V19
IM 3631**
face at DE
shaft down
no feet

CONNECTION DIAGRAMS

Three Phase motors with cage rotor



Multi-speed motors in
Dahlander Connection
(Tapped winding)

Multi-speed motors
2 separate windings

INDICATIVE OPERATING COST SAVINGS

Below is a typical example of the cost saving of a Brook Crompton TP2 IE2 Motor when compared to standard efficiency motor:

For a factory with 50 units of 37kW 4p motor with running of 24 hours, 356 days, yearly.
Using a 37kW 4 Pole motor the cost savings can be calculated as follows:

$$S = kW \times \text{Power Cost} \times \text{Running time} \times ((100/\text{Std Eff}) - (100/\text{IE2 Eff}))$$

kW = rated motor output	= 37kW
Power cost = Energy cost per kW hr	= RM0.30
Running time = running time in hrs/year	= 8760 hrs - 365 Days
Std Eff = Standard Efficiency Motor	= 91.30%
IE2 Eff = Brook Crompton TP2 IE2 Motor	= 92.70%
S = annual saving in Rm	= RM1,608.44
Total Saving for 50 units motor per annum	= RM80, 422.00

Pay-Back Example

Initial cost Brook Crompton TP2 IE2 Motor	= RM 6000
Cost of Standard Efficiency Motor	= RM 4500
Purchase Price Different	= RM 1500
Additional Price Pay-Back Period	= 0.93 years
Purchase price Pay-Back period	= 3.73 years

Conclusion

Total Saving per annum for 50 units motor will be RM80,422.00

Users will should place high priority on the cost saving advantages to purchase Brook Crompton TP2 IE2 motor.

Users will quickly recovered by reduced running cost of Brook Crompton TP2 IE2 motors.

Will need less than ONE year for return of investment