

TECHNICAL CATALOGUE



ELECTRIC MOTORS

STANDARD **IEC**

1. GENERAL FEATURES

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| 6.1 | SALES CONDITIONS | 104 |
|------------|-------------------------------|------------|

Three-phase and single-phase asynchronous electric motors, totally enclosed, with external fan ventilation, cage rotor in die-cast aluminium alloy or aluminium, insulation class F, protection degree IP55, standardised height to centre and dimensions from 56 to 160S, standardised powers from 0.09 to 11 kW.

| Standard production | Series |
|---|--------|
| Three-phase, single polarity, standard efficiency | TS |
| Three-phase, single polarity, high efficiency | TH |
| Three-phase, single polarity, premium efficiency | TP |
| Three-phase, double polarity | D |
| Single-phase | S |
| Single-phase, high starting torque, electronic cutout | HSE |
| Three-phase, single polarity, self-braking motor, standard efficiency | TBS |
| Three-phase, single polarity, self-braking motor, high efficiency | TBH |
| Three-phase, single polarity, self-braking motor, high efficiency | TBP |
| Three-phase, double polarity, self-braking motor | DB |

1.2.1 Conformity with standards

The standard electric motors conform with the following Italian, European and international standards for rotating electrical machines:

| TITLE | CEI / EN | IEC |
|--|-------------------|----------------|
| General prescriptions for rotating electrical machines | CEI EN 60034-1 | IEC 60034-1 |
| Normalised methods for the determination, by testing, of the loss and efficiency of rotating electrical machines (excluding traction vehicle motors) | CEI EN 60034-2-1 | IEC 60034-2-1 |
| Classification of the protection ratings of rotating electrical machines | CEI EN 60034-5 | IEC 60034-5 |
| Cooling systems for electrical machines | CEI EN 60034-6 | IEC 60034-6 |
| Mounting position and installation type codes | CEI EN 60034-7 | IEC 60034-7 |
| Marking terminals and direction of rotation for rotating electrical machines | CEI 2-8 | IEC 60034-8 |
| Noise limits | CEI EN 60034-9 | IEC 60034-9 |
| Vibration levels for electrical machines | CEI EN 60034-14 | IEC 60034-14 |
| Efficiency classes for alternate current motors powered by mains (IE Code) | CEI EN 60034-30-1 | IEC 60034-30-1 |
| Dimensions and nominal powers of rotating electrical machines | EN 50347 | IEC 60072 |
| Nominal voltage for low voltage public power grids | CEI 8-6 | IEC 60038 |

1.2.2 Conformity with Community Directives - CE Marking

The standard electric motors are in conformity with the following Directives:

- Low Voltage Directive 2006/95/CE;
- Directive EMC 2004/108/CE regarding intrinsic characteristics in relation to emissions and levels of immunity;
- Directive 2002/95/CEE RoHS relating to the prohibition or limitation of use of noxious substances in electrical and electronic equipment;

The manufacturer of the machine is exclusively responsible for the conformity with the Machinery Directive and EMC Directive of a complete installation. Electric motors may not be commissioned until the machines to which they are coupled have themselves been declared conforming with the Machinery Directive (Certificate of Incorporation - Directive 2006/42/CE Annex II 1B).

1.2.3 Conformity with UL/CSA standards

On request, TS, TH, TP, TBS, TBH, TBP and D series electric motors can be manufactured in conformity with the following standards:

- UL1004 "Electric motors"
- CSA C22.2 No.100-04 "Motors and Generators" for the USA and CANADA markets respectively.

1.2.4 Conformity with EAC standards (former GOST)

On request, TS, TH, TBS, TBH, D, DB, S, HSE series electric motors can be manufactured in conformity with the following standards:

- EAC

for Russian, Belarussian and Kazakh market.

1.2.5 Conformity with European Directive 94/9/CEE (ATEX)

On request, TS, TH, TP, D and S series electric motors can be manufactured in conformity with the following standards:

- IEC-CEI-EN 60079-0 - Explosive Atmospheres - Equipment - General Requirements;
- IEC-CEI-EN 60079-1 - Explosive Atmospheres - Equipment Protection by Flameproof Enclosures "d";
- IEC-CEI-EN 60079-15 - Explosive Atmospheres - Equipment Protection by Type of Protection 'n';
- IEC-CEI-EN 60079-31 - Explosive Atmospheres - Equipment Dust Ignition Protection by Enclosure "t";

and hence meet the requirements of European Directive 94/9/EEC (ATEX).

In particular, MOTOVARIO electric motors may be constructed for Group II, category 3, atmosphere G with temperature class T3 (200°C) and protection mode "n" or atmosphere D with temperature class T135°C, and hence bear the double marking:

- **II 3G Ex nAc IIB T3 / II 3D Ex tc IIIB T135°C IP5X** (in case of non-conductive dust).
- **II 3G Ex nAc IIB T3 / II 3D Ex tc IIIC T135°C IP6X** (in case of conductive dust).

For further information, consult the respective documentation.

1.2.6 Conformity with CCC standards

On request, TS, TH, TBS, TBH series electric motors can be manufactured in conformity with the following standards:

- CCC

for the Chinese market, limited to the following sizes:

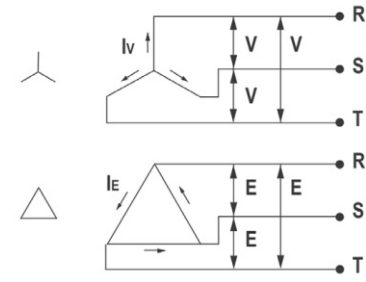
- 2-pole from size 63A2 0.18 kW to size 90L2 2.2 kW
- 4-pole from size 63A4 0.12 kW to size 90S4 1.1 kW
- 6-pole from size 63A6 0.09 kW to size 90S6 (TS) or 90L6 (TH, TP) 0.75 kW

1.3.1 Physical measurements and conversion factors

| Physical measurement | Unit of measurement | | Conversion from | |
|--------------------------|----------------------------------|------------------------------|--|---|
| | SI units | Imperial units | SI units to Imperial units | Imperial units to SI units |
| length | m = metre | ft = foot | 1 ft = 0.3048 m | 1 m = 3.2808 ft |
| | | in = inch | 1 in = 25.4 mm | 1 mm = 0.03937 in |
| speed | m/s | ft/s | 1 ft/s = 0.3048 m/s | 1 m/s = 3.2808 ft/s |
| | | in/s | 1 in/s = 25.4 mm/s | 1 mm/s = 0.03937 in/s |
| weight | kg = kilogram | lb = pound | 1 lb = 0.4536 kg | 1 kg = 2.205 lb |
| density | kg/m ³ | lb/ft ³ | 1 lb/ft ³ = 16.0185 kg/m ³ | 1 kg/m ³ = 0.0624 lb/ft ³ |
| | | lb/in ³ | 1 lb/in ³ = 27.6799 g/cm ³ | 1 g/cm ³ = 0.0361 lb/in ³ |
| moment of inertia | kg·m ² | lb·ft ² | 1 lb·ft ² = 0.4214 kg·m ² | 1 kg·m ² = 23.3 lb·ft ² |
| | | lb·in ² | 1 lb·in ² = 2.264 kg·cm ² | 1 kg·cm ² = 0.417 lb·in ² |
| force | N = newton | lbf = pound-force | 1 lbf = 4.44822 N | 1 N = 0.2248 lbf |
| | kgf* = kilogram-force | | 1 lbf = 0.4536 kgf | 1 kgf = 2.2045 lbf (1 N = 0.102 kgf 1 kgf = 9.8 N) |
| mechanical moment | [Nm] | lbf·ft | 1 lbf·ft = 0.138 kgf·m | 1 kgf·m = 7.23 lbf·ft |
| | kgf·m* | | 1 lbf·ft = 1.36 N·m | 1 N·m = 0.738 lbf·ft |
| energy | J = Joule (=Nm) | lbf·ft | 1 lbf·ft = 1.36 J | 1 J = 0.738 lbf·ft |
| | kWh = kilowatt hour | | 1 lbf·ft = 3.7·10 ⁻⁷ kWh | 1 kWh = 2.6·10 ⁶ lbf·ft |
| pressure | Pa = Pascal (=N/m ²) | psi (=lbf/ in ²) | 1 psi = 6.895·10 ³ Pa (N/m ²) | 1 Pa = 1.45·10 ⁻⁴ psi |
| | atm* = atmosphere | | 1 psi = 0.068 atm | 1 atm = 14.7 psi |
| | bar* | | 1 psi = 0.0689 bar | (1Pa=9.87·10 ⁻⁶ atm=10 ⁻⁵ bar) |
| power | W = Watt | hp = horse power | 1 hp = 745.7 W | 1 W = 0.00134 hp |
| | | lbf·ft/s | 1 lbf·ft/s = 1.356 W | 1 W = 0.738 ft·lbf/s |

(*) unit of measurement not included in SI system

1.3.2 Formulas

| MEASUREMENT | SYMBOLS AND UNITS OF MEASUREMENT | DESCRIPTION | RELATIONSHIPS |
|----------------------------------|---|--|--|
| phase voltage and current | E [V] I_E [A] | voltage and current measured between phase and neutral | |
| voltage and current concatenated | V [V] I_V [A] | voltage and current measured between phase and phase (threephase systems) | <p>three-phase system</p>  <p>$V = \sqrt{3}E \quad I_V = I_E/\sqrt{3}$</p> |
| speed of rotation | n [min^{-1}] ω [rad/s] | motor shaft speed | $n = (60/2p) \times \omega = 9,55 \times \omega$ |
| force weight force | F [N] P [N] | product of mass x acceleration product of mass x gravitational acceleration | $F = m_{[\text{kg}]} \times a_{[\text{m/s}^2]}$ $P = m_{[\text{kg}]} \times 9,8_{[\text{m/s}^2]}$ |
| moment | M [Nm] | product of force x distance r of point of application from axis | $M = F_{[\text{N}]} \times r_{[\text{m}]}$ |
| linear power | P [W] | product of force x linear speed | $P = F_{[\text{N}]} \times V_{[\text{m/s}]}$ |
| angular power | P [W] | product of torque x rotational speed | $P = M_{[\text{Nm}]} \times \omega_{[\text{rad/s}]}$ |
| energy | W [J] | power delivery over time | $W = P_{[\text{W}]} \times t_{[\text{s}]}$ |

1.3.3 Nominal characteristics

Nominal characteristics: total of numerical electrical and mechanical values (power voltage, frequency, current, speed, power delivery,...) together with their duration and sequence in time, attributed to the machine and indicated on the nameplate, in conformity with the specified conditions. In particular, the following values in relation to the operation of the motor; the same symbols are used in the performance tables.

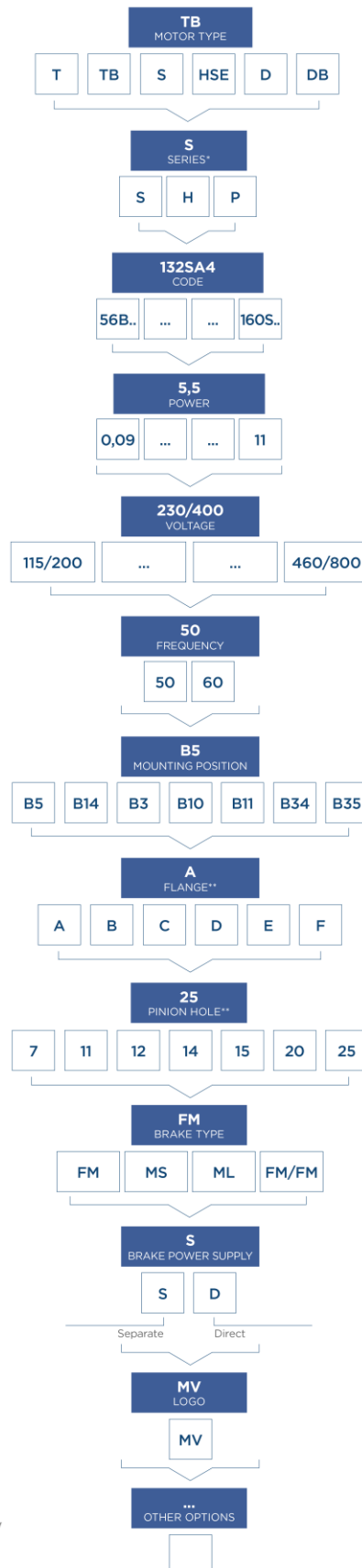
| MEASUREMENT | SYMBOLS AND UNITS OF MEASUREMENT | DESCRIPTION | | | | | | | | | | | | | | | |
|--------------------------|--|---|-------|-------------|-------------|---|------|------|---|------|------|---|------|------|---|-----|-----|
| nominal voltage | V_n [V] | concatenated voltage at the machine's terminals at nominal power | | | | | | | | | | | | | | | |
| nominal current | I_n [A] | current absorbed by the motor at nominal power | | | | | | | | | | | | | | | |
| starting current | I_s [A] | line current absorbed by the motor at nominal starting voltage and frequency | | | | | | | | | | | | | | | |
| nominal torque | M_n [Nm] | torque delivered by motor shaft at nominal conditions | | | | | | | | | | | | | | | |
| starting torque | M_s [Nm] | torque delivered by the motor shaft at starting | | | | | | | | | | | | | | | |
| sag torque | M_i [Nm] | minimum asynchronous torque under normal running conditions developed by the motor at speeds from zero to maximum torque speed; this definition does not apply to asynchronous motors whose torque decreases continuously as speed increases | | | | | | | | | | | | | | | |
| maximum torque | M_{max} [Nm] | <p>maximum torque under normal running conditions developed by the motor without a sudden drop in speed; this definition does not apply to asynchronous motors whose torque decreases continuously as speed increases</p> | | | | | | | | | | | | | | | |
| synchronous speed | ω_s [rad/s] n_s [min ⁻¹] | <p>synchronous motor shaft speed under no load; the following relations apply: $n_s = 120 \times f_n / p$ [rpm] $\omega_s = 4p \times f_n / p$ [rad/s] $\omega_s = n_s / 9,55$ [rad/s] where: f_n = nominal power supply frequency [Hz] p = number of motor poles it follows that:</p> <table border="1"> <thead> <tr> <th>poles</th> <th>rpm at 50Hz</th> <th>rpm at 60Hz</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>3000</td> <td>3600</td> </tr> <tr> <td>4</td> <td>1500</td> <td>1800</td> </tr> <tr> <td>6</td> <td>1000</td> <td>1200</td> </tr> <tr> <td>8</td> <td>750</td> <td>900</td> </tr> </tbody> </table> | poles | rpm at 50Hz | rpm at 60Hz | 2 | 3000 | 3600 | 4 | 1500 | 1800 | 6 | 1000 | 1200 | 8 | 750 | 900 |
| poles | rpm at 50Hz | rpm at 60Hz | | | | | | | | | | | | | | | |
| 2 | 3000 | 3600 | | | | | | | | | | | | | | | |
| 4 | 1500 | 1800 | | | | | | | | | | | | | | | |
| 6 | 1000 | 1200 | | | | | | | | | | | | | | | |
| 8 | 750 | 900 | | | | | | | | | | | | | | | |
| nominal speed | n_n [rpm] ω_n [rad/s] | motor shaft speed in nominal conditions at nominal power | | | | | | | | | | | | | | | |

| | | |
|--|--|--|
| <p>creep nominal creep</p> | <p>s s_n</p> | <p>ratio between the deviation of the shaft speed relative to the synchronous speed and the synchronous speed itself; normally declared as a percentage: $s = (\omega_s - \omega) / \omega_s \times 100$ $s_n = (\omega_s - \omega_n) / \omega_s \times 100$</p> |
| <p>mechanical power delivery</p> | <p>P [W]</p> | <p>numerical value of mechanical power delivered to the shaft; the relation between power, torque and speed is: $P [W] = T [Nm] \times \omega [rad/s]$</p> |
| <p>nominal power delivery</p> | <p>P_n [W]</p> | <p>numerical value of the mechanical power delivered to the shaft at nominal conditions $P_n [W] = T_n [Nm] \times \omega_n [rad/s]$</p> |
| <p>power factor nominal power factor</p> | <p>cosφ cosφ_n</p> | <p>cosine of the phase angle between the voltage and current, a function of the load characteristics</p> |
| <p>active absorbed electrical power</p> | <p>P_a [W]</p> | <p>numerical value of the active electrical power absorbed from the mains; the following relations apply: three-phase system $P_a [W] = \sqrt{3} V_{[V]} I_{[A]} \cos\phi$ single-phase system $P_a [W] = V_{[V]} I_{[A]} \cos\phi$</p> |
| <p>reactive electrical power absorbed</p> | <p>Q_a [VAr]</p> | <p>numerical value of the reactive electrical power absorbed from the mains; the following relations apply: three-phase system $Q_a [W] = \sqrt{3} V_{[V]} I_{[A]} \sin\phi$ single-phase system $Q_a [W] = V_{[V]} I_{[A]} \sin\phi$</p> |
| <p>reactive power furnished by an array of capacitors</p> | <p>Q_c [VAr]</p> | <p>numerical value of the reactive electrical power furnished by an array of capacitors of capacity C [μF], for three-phase systems: $Q_c = \sqrt{3} V^2 [V] C_{[\mu F]} 2\pi f_n [Hz]$</p> |
| <p>efficiency</p> | <p>η</p> | <p>ratio between mechanical power delivery and electrical power absorption $\eta = P / P_a$ $\eta\% = P / P_a \times 100$ once we know the efficiency, the power delivered to the shaft can be calculated as follows: asynchronous three-phase motor $P [W] = \sqrt{3} V_{[V]} I_{[A]} \eta \cos\phi$ asynchronous single-phase motor $P [W] = E_{[V]} I_{[A]} \eta \cos\phi$</p> |
| <p>moment of inertia</p> | <p>J [kg×m²]</p> | <p>Product of rotating mass m [kg] and the square of the equivalent radius of rotation r [m]: $J = m r^2$ In practice one uses PD², the product of the weight [kgp] and the square of the equivalent diameter of rotation D [m]; it follows that: $PD^2_{[kgp \times m^2]} = 4J_{[kg \times m^2]}$ Note that the weight in the practical system corresponds (numerically) to the mass in the SI system</p> |
| <p>acceleration time braking time</p> | <p>t_a [s] t_f [s]</p> | <p>In evaluating the acceleration and braking times we must sum the motor's moment of inertia J_m to that of the load J_{ext}, to obtain the total moment of inertia: $J_t = J_m + J_{ext}$ and analogously: $PD^2_t = PD^2_m + PD^2_{txt}$ Furthermore, to the torque delivered by the motor M_m, which may be accelerating or braking, we must subtract or add the resisting torque M_r, to obtain, as a first approximation: during acceleration, the accelerating torque: $M_a = M_m - M_r$ during braking, the braking torque: $M_f = M_m + M_r$ As a first approximation we can use for M_m the value of the starting torque as given in the catalogue; a more precise calculation, given the load curve, can be obtained by integrating from 0 to the nominal speed. The acceleration time, for a speed variation of Δω (or Δn), is: in the SI system $t_a = [J_t / M_a] \times \Delta\omega [kg \times m^2]$ in the practical system $t_a = [2.67 PD^2_t / M_a] \times \Delta n \times 10^{-3} [kgp \times m^2]$ The same formulas apply to the braking time, with M_a replaced by M_f and bearing in mind that M_a and Δn are negative. If the external loads are connected by gear reducers or speed multipliers, the respective moments of inertia must be referred to the motor axis by multiplying them by the square of the ratio between the load speed n_c and the motor speed n_m: $J_{ext} (n_c / n_m)^2$ and analogously for PD². To refer the inertia to a load of mass M drive in a linear motion by the motor to the motor's shaft, we must know the ratio between the linear speed v and the corresponding speed n (or ω) of the motor; the corresponding moment of inertia will be: in the SI system $J_{ext} = M_{[kg]} (v_{[m/s]} / \omega_{[rad/s]})^2$ in the practical system $PD^2 = 365 P_{[kgp]} (v_{[m/s]} / n_{[rpm]})^2$ where P is the weight of the moving part.</p> |

1.3.4 Tolerances

| | TOLERANCES |
|--|---------------------------------------|
| Efficiency (ratio between measured power delivery and absorption) | -15% di (1-h) |
| Power factor | -1/6 di (1-cosj) 0.02 min 0.07 max |
| Creep at full load and at operating temperature - Power delivery \geq 1kW - Power delivery < 1kW | \pm 20% \pm 30% |
| Current with rotor locked with any specific starting device | 20% |
| Torque with rotor locked | -15% +25% |
| Sag torque | -15% |
| Maximum torque | -10% |
| Moment of inertia | \pm 10% |
| Sound pressure level | +3dBA |
| Height of axis | -0.5mm. |
| Flange centring diameter | J6 |
| Outer diameter of shaft on delivery end D - Up to 28mm - Over 28mm | j6 k6 |
| Key dimensions F x GD | h9 |
| Keyway width F | N9 |

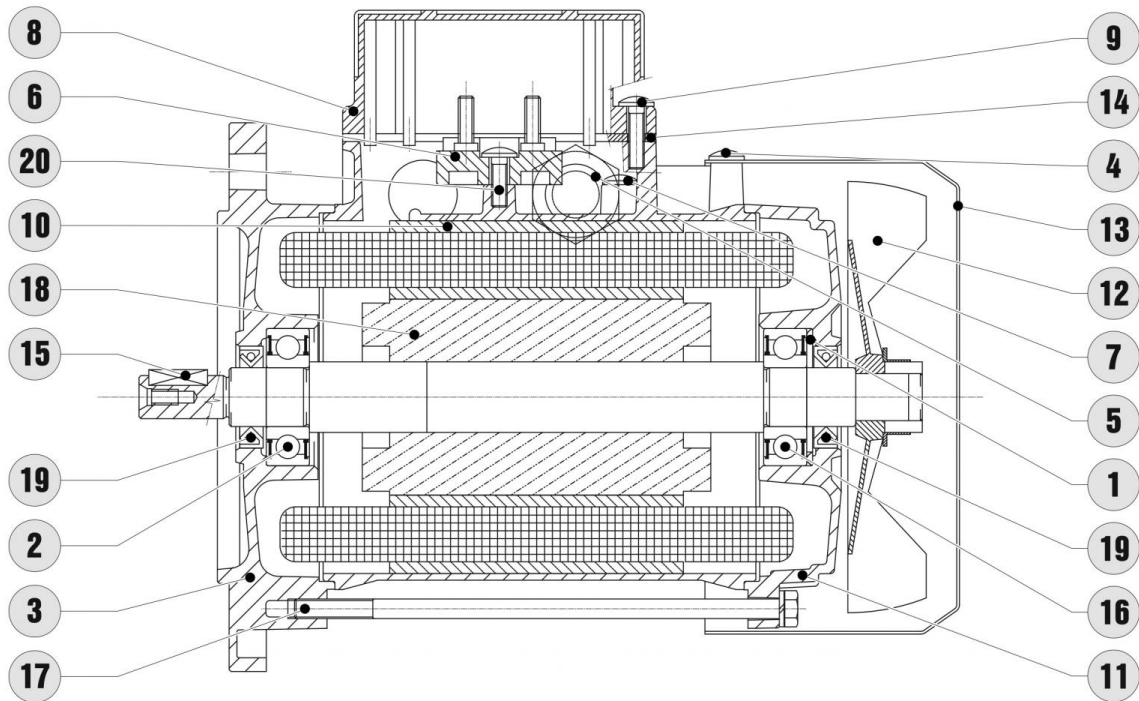
1.4.1 Designation



*T/TB series motors only
 **Mounting positions B10/B11 only


1.4 DESIGN FEATURES

1.4.2 Design features



1. Preloaded spring
2. Bearing on driving side
3. Flange/Shield driving side
4. Fan cover fastening screws
5. Cable gland
6. Terminal box
7. Ground screw
8. Terminal board cover
9. Terminal box fastening screws
10. Casing complete with winding
11. Shield opposite to driving side
12. Fan
13. Fan cover
14. Terminal box cover gasket F
15. Key
16. Bearing opposite to driving side
17. Stud
18. Rotor with shaft
19. Oil seal
20. Fastening screw for terminal box

Casing

- in die-cast aluminium alloy, chosen for its high tensile strength and corrosion resistance from size 56 to size 160S;
- finned; not painted from size 56 to size 160S (painting optional);
- fitted with lifting rings starting from size 100;
- fitted for mounting feet opposite the terminal block from size 56 to size 63; fitted for mounting feet opposite the terminal block and in the two side positions from size 71 to size 160S;
- fitted with clamp for grounding inside the terminal block; option of external GND connection on the motor casing. The terminal is marked with the symbol .

Shaft

In C40 steel or similar; dimensions, standardised output shaft and key, according to IEC60072-1; end of shaft with threaded hole on driving side. Optional double-ended shaft from size 63 to size 160S.

Rotor

The rotor is the squirrel-cage type in die-cast aluminium or aluminium alloy. The aluminium alloy (silumin) is used on single-phase motors to increase their starting torque. The angle, number of slots and geometrical shape of the rotors have been designed in relation to the number of stator slots and the polarity of the motor to ensure the most regular operation even in variable speed applications, decreasing the phenomenon of torque pulses, detrimental to the motor's correct operation and a cause of running noise. Rotor balancing, from frame size 90, is performed dynamically with the half-key method in accordance with ISO 2373 standard rating G6.3 for normal vibration. On request it is possible to have increased balancing (rating G2.3).

Stator and Winding

- Laminations with controlled magnetic properties. All TS motors are constructed with low loss magnetic laminations. All TH and TP motors are constructed with very low loss isolated magnetic laminations.
- Appropriate number of slots and geometrical shape in relation to the motor's polarity so as to enable the most regular operation;
- Winding made with glazing copper G2 degree in H class, capable of providing considerable mechanical strength and ensuring an adequate thermal reserve such as to slow down the ageing of the motor;
- Class F insulation system;
- 100% testing of all electrical parameters at line end.

Flange / Shield

Die-cast aluminium alloy, excluding B5 flange for size 160S (cast iron); cast iron rear shield on versions with FM or MS brake and backstop device.

Terminal block cover

In die-cast aluminium alloy with Motovario logo. All terminal box covers have a pre-defined thinner section to be easily broken, which is suitable for the fitting of a cable gland (M20 on size 63-71-80, M25 on size 90-100-112, M32 on size 132-160S) and allowing the insertion of power cable on fan or flange sides.

Fan

Centrifugal fan with radial blades to enable cooling in both directions of rotation, keyed externally onto the non-drive-end shaft. Made of loaded thermoplastic, suitable for normal motor operating temperatures. Optionally in aluminium for very high/low ambient temperatures, or for EU ATEX versions.

Fan cover

Made of galvanised stamped plate, suitably shaped to avoid phenomena of resonance and to improve the flow of air over the motor casing. The air feed grill has holes of a size, in relation to the distance from the accessible rotating parts, in conformity with the safety requirements of the UNI EN 294 standard.

Cable glands and plugs

Cable glands and plugs are in compliance with metric standardization.

| STANDARD MOTOR (TS, TH, TP, D, S, HSE) | | | | | | |
|--|--|----------------------|----------------|--|--------------------------|-------------------------------|
| Size | Fitted for cable gland | Cable gland included | Plugs included | Cable entry point Ø min - max [mm] | Power terminal clamps | Tightening torque max [Nm] |
| 56 | 2 x M16 x 1,5 (2 for side) | 1 x M16 x 1,5 | - | 5 - 10 | M4 | 2 |
| 63 | 4 x M16 x 1,5 (2 for side) | 1 x M16 x 1,5 (1) | - | 5 - 10 | M4 | 2 |
| 71 - 80 | 2 x M16 x 1,5 2 x M20 x 1,5 (1 + 1 for side) | 1 x M20 x 1,5 (1) | - | 6 - 12 | M4 | 2 |
| 90 | 2 x M25 x 1,5 (1 for side) | 1 x M25 x 1,5 | 1 x M25 x 1,5 | 9 - 17 | M5 | 3 |
| 100 | 2 x M25 x 1,5 (1 for side) | 1 x M25 x 1,5 | 1 x M25 x 1,5 | 9 - 17 | M5 | 3 |
| 112 | 2 x M25 x 1,5 (1 for side) | 1 x M25 x 1,5 | 1 x M25 x 1,5 | 9 - 17 | M5 | 3 |
| 132 - 160S | 2 x M32 x 1,5 (1 for side) | 1 x M32 x 1,5 | 1 x M32 x 1,5 | 11 - 21 | M6 | 4 |

| BRAKE MOTOR (TBS, TBH, TBP, DB) | | | | | | |
|---------------------------------|--------------------------------|---------------------------------------|---|--|--------------------------|-------------------------------|
| Size | Cable routing | Cable glands | Plugs | Cable entry point Ø min - max [mm] | Power terminal clamps | Tightening torque max [Nm] |
| 63 | 4 x M16 x 1,5 (2 for side) | 2 x M16 x 1,5 (2) | 2 o 3 x M20 x1,5 (2) | 5 - 10 | M4 | 2 |
| 71 - 80 | 4 x M20 x 1,5 (2 for side) | 1 x M20 x 1,5 1 x M16 x 1,5 (2) | 2 o 3 x M20 x1,5 (2) | 6 - 12 | M4 | 2 |
| 90 | 2 x M25 x 1,5 2 x M20 x 1,5 | 1 x M25 x 1,5 1 x M20 x 1,5 (3) | 1 x M25 x 1,5 1 o 2 x M20 x 1,5 (3) | 9 - 17 | M5 | 3 |
| 100 | 2 x M25 x 1,5 2 x M20 x 1,5 | 1 x M25 x 1,5 1 x M20 x 1,5 (3) | 1 x M25 x 1,5 1 o 2 x M20 x 1,5 (3) | 9 - 17 | M5 | 3 |
| 112 | 2 x M25 x 1,5 2 x M20 x 1,5 | 1 x M25 x 1,5 1 x M20 x 1,5 (3) | 1 x M25 x 1,5 1 o 2 x M20 x 1,5 (3) | 9 - 17 | M5 | 3 |
| 132 - 160S | 2x M32 x 1,5 | 1 x M32 x 1,5 1 x M20 x 1,5 (4) | none or 1 x M32 x 1,5 | 11 - 21 | M6 | 4 |

Notes:

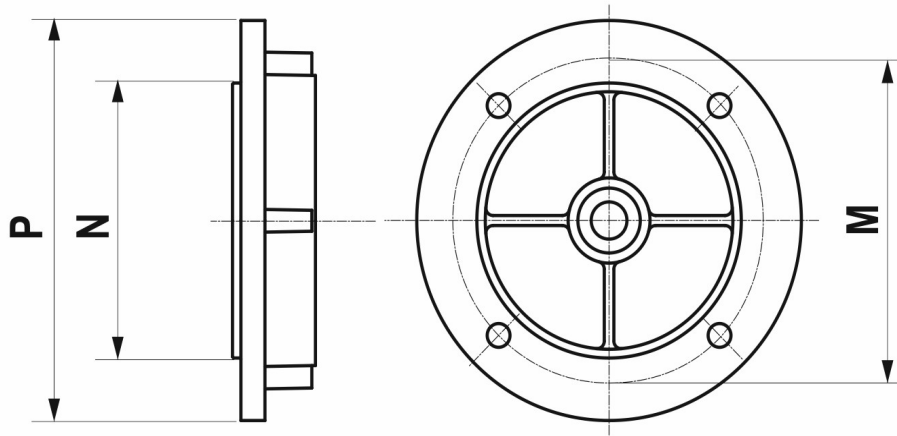
- (1) For motor sizes 63-71-80 in the standard version, cable glands are not installed but are included with the motor. The cable glands may be mounted in the desired positions by breaking on of the caps on the terminal block box.
- (2) a) Direct power: 3 plugs installed, 1 M16 cable gland included, the other cable gland is already installed;
b) Separate power: 2 plugs installed, both cable glands installed.
- (3) a) Direct power: 3 plugs installed, 1 M20 cable gland included, the other cable gland is already installed
b) Separate power: 2 plugs installed, both cable glands installed.
- (4) a) Direct power: 1 plug installed, 1 M20 cable gland included, the other cable gland is already installed;
b) Separate power: plugs not included, both cable glands installed.

For all motor sizes cable glands and nameplates may also be located opposite the standard side (respectively right and left viewed from the coupling side).

For all motor sizes mounting position B3 is mounted on feet with terminal block on the opposite side. As an option and excluding size 63, feet can be mounted also on the side with respect to the terminal block.

On request for motor sizes it is possible to have the cable gland fan side; in this case call our Technical Service for technical feasibility and dimensions.

1.4.3 Flange B5



| | | P [mm] | M [mm] | N [mm] | F [mm] | Mat. |
|---------|---|--------|--------|--------|--------|-------------|
| 56 | A | 120 | 100 | 80 | 7 | EN AC 46100 |
| 63 | A | 140 | 115 | 95 | 9,5 | EN AC 46100 |
| 71 | B | 140 | 115 | 95 | 9,5 | EN AC 46100 |
| | A | 160 | 130 | 110 | 9,5 | EN AC 46100 |
| 80/90 | B | 160 | 130 | 110 | 9,5 | EN AC 46100 |
| | A | 200 | 165 | 130 | 11,5 | EN AC 46100 |
| 100/112 | B | 200 | 165 | 130 | 11,5 | EN AC 46100 |
| | A | 250 | 215 | 180 | 11,5 | EN AC 46100 |
| 132 | B | 250 | 215 | 180 | 11,5 | EN AC 46100 |
| | A | 300 | 265 | 230 | 14,5 | EN AC 46100 |
| 160S | A | 350 | 300 | 250 | 18,5 | EN GJL 200 |

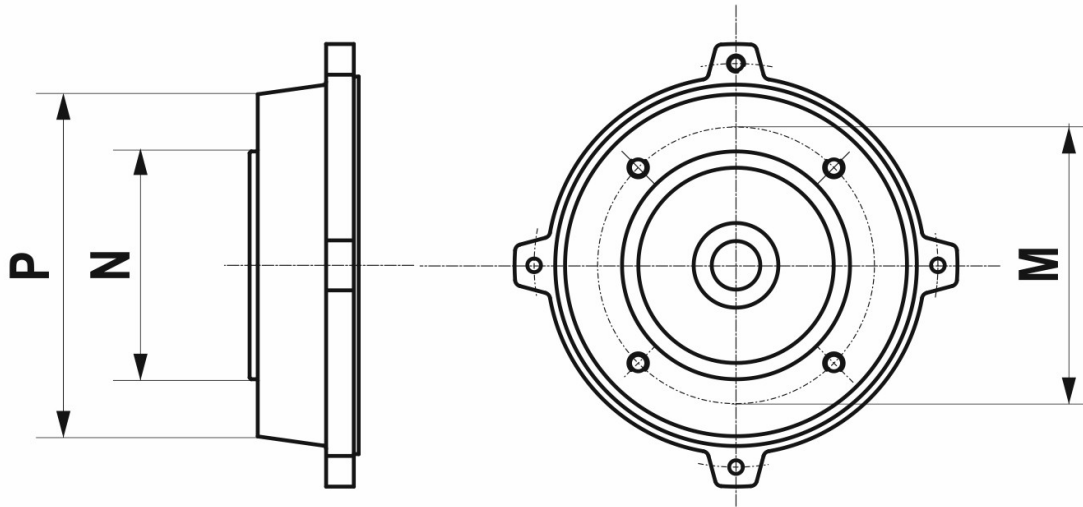
F - Through holes

A - Standard

B - Reduced

Note: contact our technical service for solutions with reduced or oversize flanges

1.4.4 Flange B14



| | | P [mm] | M [mm] | N [mm] | F [mm] | Mat. |
|-----------|---|--------|--------|--------|--------|-------------|
| 56 | A | 80 | 65 | 50 | M5 | EN AC 46100 |
| 63 | B | 80 | 65 | 50 | M5 | EN AC 46100 |
| | A | 90 | 75 | 60 | M5 | EN AC 46100 |
| 71 | B | 90 | 75 | 60 | M5 | EN AC 46100 |
| | A | 105 | 85 | 70 | M6 | EN AC 46100 |
| 80 | B | 105 | 85 | 70 | M6 | EN AC 46100 |
| | A | 120 | 100 | 80 | M6 | EN AC 46100 |
| 90 | B | 120 | 100 | 80 | M6 | EN AC 46100 |
| | A | 140 | 115 | 95 | M8 | EN AC 46100 |
| 100 / 112 | B | 140 | 115 | 95 | M8 | EN AC 46100 |
| | A | 160 | 130 | 110 | M8 | EN AC 46100 |
| 132 | A | 200 | 165 | 130 | M10 | EN AC 46100 |

F - Threaded holes

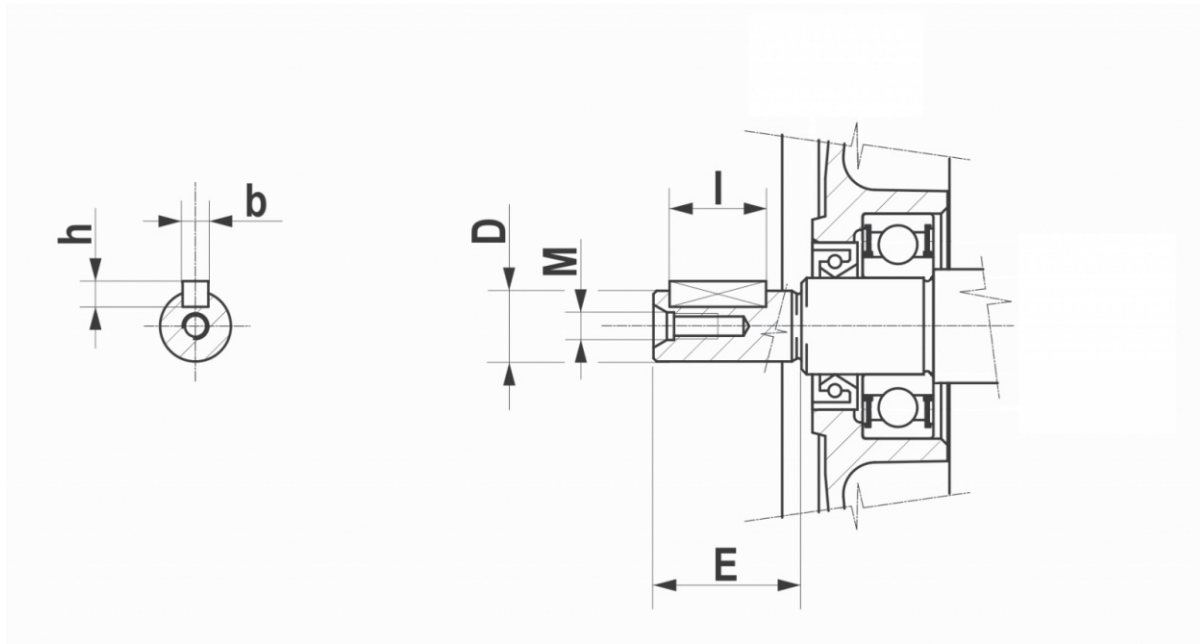
A - Standard

B - Reduced

Note: contact our technical service for solutions with reduced or oversize flanges

1.4.5 Motor shaft

Motor shaft end - drive side



| | | D x E [mm] | M | b x h x l [mm] |
|---------|---|------------|-----|----------------|
| 56 | A | 9 x 20 | M4 | 3 x 3 x 12 |
| 63 | B | 9 x 20 | M4 | 3 x 3 x 12 |
| | A | 11 x 23 | M4 | 4 x 4 x 15 |
| 71 | B | 11 x 23 | M4 | 4 x 4 x 15 |
| | A | 14 x 30 | M5 | 5 x 5 x 20 |
| 80 | B | 14 x 30 | M5 | 5 x 5 x 20 |
| | A | 19 x 40 | M6 | 6 x 6 x 30 |
| 90 | B | 19 x 40 | M6 | 6 x 6 x 30 |
| | A | 24 x 50 | M8 | 8 x 7 x 35 |
| 100-112 | B | 24 x 50 | M8 | 8 x 7 x 35 |
| | A | 28 x 60 | M10 | 8 x 7 x 45 |
| 132 | B | 28 x 60 | M10 | 8 x 7 x 45 |
| | A | 38 x 80 | M12 | 10 x 8 x 60 |
| 160S | B | 38 x 80 | M12 | 10 x 8 x 60 |
| | A | 42 x 110 | M16 | 12 x 8 x 90 |

A - Standard

B - Reduced

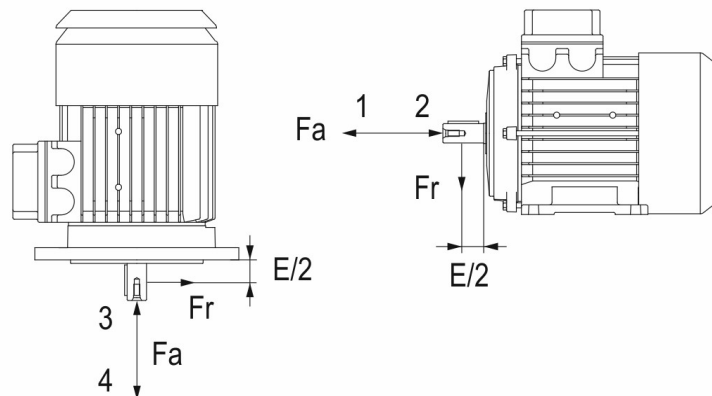
Note: contact our technical service for solutions with reduced or oversize flanges

1.4.6 Bearings

Radial, single race ball bearings are used, with normal play, lubricated for life, drive side shielding 2Z, non-drive side shielding 2Z or 2RS in the standard or brake versions respectively. The rear bearings are pre-loaded with a compensation ring that acts on the external ring of bearings to decrease operating noise and to enable axial movement by thermal action.

| Motor size | Drive side bearing (DE) | Non-drive side bearing (NDE) | Static load coefficient C_0 [N] |
|------------|-------------------------|------------------------------|-----------------------------------|
| 56 | 6201 2Z | 6201 2Z/2RS | n.d. |
| 63 | 6202 2Z | 6202 2Z/2RS | 3750 |
| 71 | 6202 2Z | 6202 2Z/2RS | 3750 |
| 80 | 6204 2Z | 6204 2Z/2RS | 6550 |
| 90S/L | 6205 2Z | 6205 2Z/2RS | 7800 |
| 100 | 6206 2Z | 6206 2Z/2RS | 11200 |
| 112 | 6306 2Z | 6306 2Z/2RS | 16000 |
| 132S/M | 6308 2Z | 6308 2Z/2RS | 24000 |
| 160S | 6309 2Z | 6308 2Z/2RS | 28000 |

1.4.7 Overhung load



Maximum overhung load F_r [N] at 50Hz with $F_a/F_r < 0.2$

| | 2 (p) | 4 (p) | 6 (p) | 8 (p) |
|------|-------|-------|-------|-------|
| 63 | 80 | 360 | 410 | 450 |
| 71 | 270 | 350 | 400 | 440 |
| 80 | 440 | 560 | 650 | 720 |
| 90S | 480 | 610 | 700 | 770 |
| 90L | 490 | 620 | 710 | 790 |
| 100 | 680 | 870 | 1000 | 1100 |
| 112 | 990 | 1260 | 1450 | 1600 |
| 132S | 1350 | 1720 | 1980 | 2190 |
| 132M | 1430 | 1830 | 2100 | 2320 |
| 160S | 1500 | 2650 | 3000 | 3100 |

(p) Pole

The following table was obtained by taking into account a radial load F_R applied on shaft output end centre line and a negligible axial load F_A ($F_A/F_R < 0,2$), with bearing reliability rate of 98% and lifetime of 20000 operating hours.

In the case of belt/pulley coupling, the motor shaft is subject to an overhung load F_R which can be evaluated as follows:

$$F_R = \frac{19100 \cdot P_n \cdot K}{n \cdot D_p} \pm P_P \text{ [N]}$$

where:

P_n = Nominal motor power [kW];

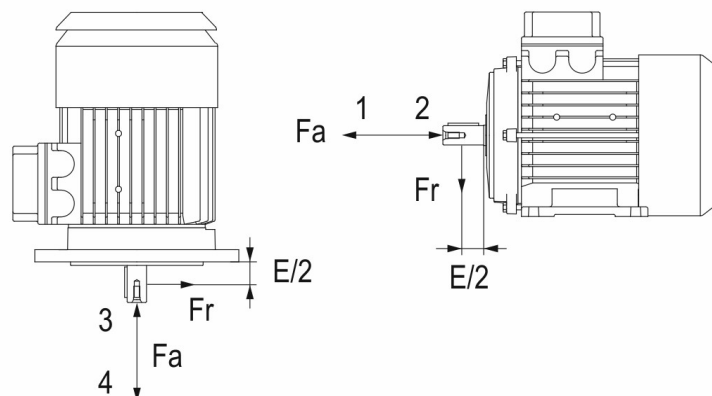
P_P = pulley weight; the sign in the equation accounts for whether the weight is acting with or against the belt tension [N];

n = speed [rpm];

D_p = primitive diameter of pulley [m];

K = coefficient, generally between 2 and 3, depending on type of belt/pulley transmission (refer to transmission documentation).

1.4.8 Axial load



Maximum axial load F_a [N] at 50Hz with no overhung load F_r

| | 2 (p) | | | | 4 (p) | | | | 6 (p) | | | | 8 (p) | | | |
|-------------|-------|-----|-----|------|-------|------|------|------|-------|------|------|------|-------|------|------|------|
| | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| 63 | 225 | 105 | 115 | 215 | 280 | 160 | 170 | 270 | 325 | 205 | 215 | 315 | 355 | 235 | 245 | 345 |
| 71 | 225 | 105 | 120 | 210 | 280 | 160 | 175 | 265 | 325 | 205 | 220 | 310 | 355 | 235 | 250 | 340 |
| 80 | 365 | 225 | 245 | 345 | 460 | 320 | 340 | 440 | 525 | 385 | 405 | 505 | 580 | 440 | 460 | 560 |
| 90S | 390 | 210 | 235 | 365 | 495 | 315 | 340 | 470 | 565 | 385 | 410 | 540 | 620 | 440 | 465 | 595 |
| 90L | 390 | 210 | 240 | 360 | 495 | 315 | 345 | 465 | 565 | 385 | 415 | 535 | 620 | 440 | 470 | 590 |
| 100 | 550 | 360 | 400 | 500 | 690 | 500 | 545 | 645 | 790 | 600 | 645 | 745 | 870 | 680 | 725 | 825 |
| 112 | 795 | 575 | 625 | 745 | 1000 | 780 | 830 | 950 | 1150 | 930 | 980 | 1100 | 1260 | 1040 | 1090 | 1210 |
| 132S | 1145 | 765 | 845 | 1065 | 1445 | 1065 | 1145 | 1365 | 1650 | 1270 | 1350 | 1570 | 1820 | 1440 | 1520 | 1740 |
| 132M | 1145 | 765 | 865 | 1045 | 1445 | 1065 | 1165 | 1345 | 1650 | 1270 | 1370 | 1550 | 1820 | 1440 | 1540 | 1720 |
| 160S | 1145 | 765 | 865 | 1045 | 1445 | 1065 | 1165 | 1345 | 1650 | 1270 | 1370 | 1550 | 1820 | 1440 | 1540 | 1720 |

(p) Pole

IMPORTANT: In case of vertical installation with the shaft end uppermost, values 3 and 4 must be inverted.

No axial loads above $0,25C_0$ are allowed. The following table was obtained with no axial load, based on the type of installation and of the force application direction; the calculation made includes any possible unfavourable effect of the rotor weight and of the preload spring force.

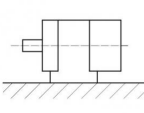
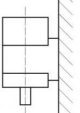
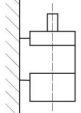
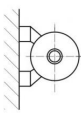
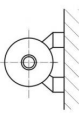
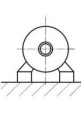
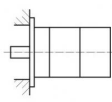
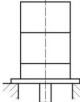
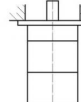
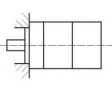
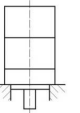
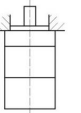
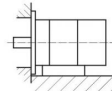
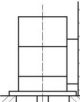
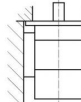
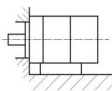
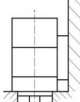
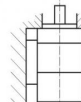
For 60Hz operation, a reduction of approximately 7% of the values specified in the table must be considered.

Mounting position: specific construction in relation to the mounting equipment, type of bearings and shaft end.

Installation type: positioning of the motor in relation to the axis line (horizontal or vertical) and mounting equipment.

The table lists the most common installation methods in relation to the mounting position.

With reference to standard IEC 34-7, the electric motor's nameplate must be marked with the mounting position (IMB3, IMB5, IMB14, IMB34, IMB35) independently of the installation type.

| | |
|-------|--|
| IMB3 |       |
| IMB5 |    |
| IMB14 |    |
| IMB35 |    |
| IMB34 |    |

Mounting position:

- IMB3 with feet
- IMB5 with drive side flange, through holes
- IMB14 with drive side flange, threaded holes
- IMB35 with feet and drive side flange, through holes
- IMB34 with feet and drive side flange, threaded holes

Besides being available in the above-indicated standardised mounting positions, motors are available also in compact versions; this applies to both aluminium CHA and CBA gear reducers (B10 mounting position) and to cast iron CH, CB and CS gear reducers (B11 mounting position). These mounting positions require special flanges integral with the gear reducer and cable output shaft where pinion is fitted before the reduction stage. The resulting gearmotor has reduced axial size. For further details, including dimensional drawings, refer to the specific catalogues of the gear reducers.

Definition and applicability (IEC 60034-5):

The protection rating gives the protection provided by the enclosure in relation to:

- protection of persons against approaching or contact with live components;
- protection against ingress of solid foreign matter;
- protection against damage by water.

It does not account for protection against mechanical damage or special conditions, including humidity (for example, as caused by condensation), corrosive vapours, mould, insects or explosive atmospheres.

The code indicating the protection rating is composed of the letters IP followed by two characteristic digits which indicate conformity with the conditions indicated in the table.

The Motovario electric motors in standard operation have an IP55 degree of protection; optionals include executions with IP56, IP65 and IP66 degrees of protection.

The Motovario self-braking electric motors have an IP54 degree of protection; optionals include executions with IP55, IP56, IP65 and IP66 degrees of protection.

Motors with superior degree of protection of IP66 cannot be supplied.

Protection degree of the motors is guaranteed and certified by tests carried out in qualified testing room.

| The first digit indicates the degree of protection against ingress of solid matter and approach to or contact with live components | |
|--|---|
| 0 | no protection |
| 1 | protection against ingress of solid bodies of diameter greater than 50mm. (e.g. involuntary contact with the hands) |
| 2 | protection against ingress of solid bodies of diameter greater than 12mm. (e.g. finger) |
| 3 | protection against ingress of solid bodies of diameter greater than 2.5mm |
| 4 | protection against ingress of solid bodies of diameter greater than 1mm |
| 5 | protection against ingress of dust; penetration by dust is not completely eliminated, but it may not enter in amounts sufficient to compromise the operation of the motor |
| 6 | total protection against ingress of dust |

| The second digit indicates the degree of protection against ingress of water | |
|--|--|
| 0 | no protection |
| 1 | drops of water falling vertically may not cause damage (e.g. condensation) |
| 2 | drops of water falling vertically may not cause damage when the machine is inclined at any angle up to 15° from its normal position |
| 3 | water falling at an angle to the vertical of up to 60° may not cause damage |
| 4 | water sprayed onto the machine from any direction may not cause damage |
| 5 | water sprayed onto the machine with a nozzle from any direction may not cause damage |
| 6 | waves or jets of water may not penetrate into the machine in amounts sufficient to cause damage |
| 7 | water may not penetrate into the machine in amounts sufficient to cause damage when it is submerged in given conditions of pressure and duration |
| 8 | the motor may remain submerged permanently in water in the conditions indicated by the manufacturer |

1.7.1 Insulation classes

The thermal insulation system is classified by a single letter (IEC60085).

Depending on the thermal class, the winding overtemperature, which is the difference between their temperature and ambient temperature, has the maximum limit given in the table; the resistance variation method is used to measure the overtemperature.

To obtain the maximum absolute temperature admitted for the insulation system, a maximum ambient temperature of 40°C is used.

Standard electric motors are made with a winding insulation system in conformity with thermal classification F, in accordance with publication IEC60034-1; the thermal reserve, for standardised powers, is such that the over-temperatures of the windings do not exceed the limits set for class B; this ensures less strain on the insulation from a thermal point of view, therefore a longer service life for the motor.

Given the ambient installation conditions, constructions to class H are optionally available, for which the respective overtemperature is permitted.

1.7.2 Thermal class

| MOT. | Thermal class | | | |
|---------------------|------------------------|-----------|------------|------------|
| | | B | F | H |
| $P_n < 600W$ | $\frac{\Delta T}{T_M}$ | 85 130 | 110 155 | 130 180 |
| $P_n \geq 600W$ | $\frac{\Delta T}{T_M}$ | 80 130 | 105 155 | 125 180 |
| IC410 / IEC 60034-7 | $\frac{\Delta T}{T_M}$ | 85 130 | 110 155 | 130 180 |

P_n = Nominal power

IC410 / IEC 60034-7 = Motors without ventilation (IC410 for IEC34-7)

ΔT = Winding overtemperature in [K] measured with the resistance variation method

T_M = Maximum operating temperature of windings in [°C] at ambient temperature of 40°C

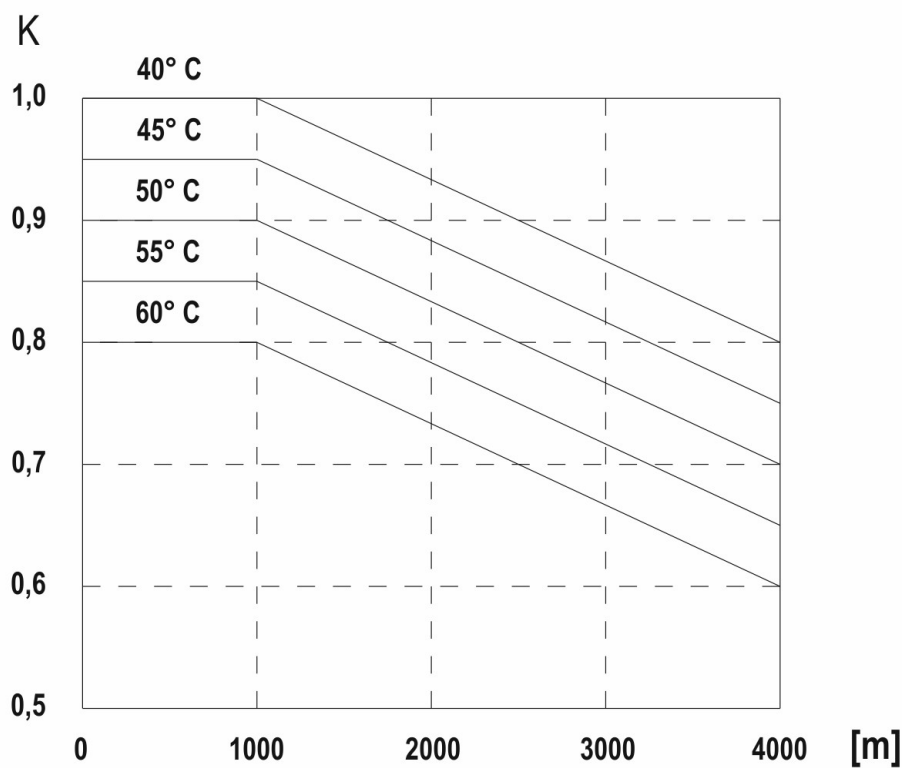
2.1.1 STD ambient conditions - Derating for non-standard conditions

Standard electric motors are designed for the following operating conditions on-site:

- **Altitude:** no greater than 1000 m above sea level.
- **Ambient temperature:** minimum -15°C, maximum +40°C.

If the motors are destined to operate at places at a height of between 1000 and 4000m a.s.l., or if the ambient temperature is between +40 and +60°C, it is necessary to **apply** a corrective coefficient (see graph) to the motor power to allow the motor to maintain its thermal reserve (maximum temperature reached by the windings in normal operating conditions). **Alternatively, to select the right motor size it is recommended to account for such ambient conditions by dividing the application's power requirement by the same corrective coefficient.**

In some cases, power corrective coefficient cannot be applied, this mainly applies to high-efficiency motors (TH and TP); however it must be borne in mind that this reduces the motor's thermal reserve. In any case, the maximum winding temperature must be within the range given for the thermal class in question. For further details, contact our Technical Service.



2.1.2 Options for particularly humid environments

The paint and the standard impregnation method adopted for insulation of the motor windings is also suitable in cases where there is a high humidity environment (tropical climates). In such case no additional treatment is required.

In the case of particular ambient conditions that may lead to the formation of condensation inside the motor, the following options are available:

1. Condensation drain holes. Holes for draining out condensation, normally closed with plastic plugs to provide the protection rating declared on the nameplate; periodically open the plugs to drain out the moisture and then close them again.
2. Condensation heater. Condensation heaters are electrical heating elements installed directly on the heads of the motor windings and, due to the particular nature of the impregnation process, connected to the latter. This prevents condensation forming even in extreme climatic conditions. The power cables are routed into the motor's terminal block enclosure and hooked up to a mammoth type terminal block. The heaters should not be powered while the motor is running.

Condensation heater technical data:

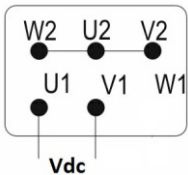
- insulation class: 180°C
- temperature range: -50 to +180°C
- dielectric rigidity: 2kV
- heating power:
 1. 12.5W (30W for UL/CSA homologated construction) for motor sizes 63 to 112
 2. 25W (50W for UL/CSA homologated construction) for motor sizes 132 and 160S
- operating voltage: 110V or 230V

Custom voltages and powers are available on request.

Condensation drain holes and condensation heaters can also be ordered as individual options.

With reference to the condensation heaters, with a DC power source, the same effect can be obtained by powering two phases of the motor with the motor off; the power voltage must be such as to provide the same heating effect as the condensation heater itself, as follows:

$$V_{dc} = \sqrt{(P \cdot R)}$$



where:

P = heating power [W]

R = resistance between two phases measured across terminals U1 - V1

Options 1) and 2) are not available in conjunction with servo-ventilation and on the self-braking motors with ML brake; on self-braking motors with brake, FM and MS are only available with IP55 degree of protection.

2.1.3 Low temperature construction (-40°C / -15°C)

In case of applications with ambient temperature included between -40°C and -15°C, the electric motor is equipped with special components:

- Bearings with special lubrication (LHT) and higher backlash (C3) suitable for low running temperatures;
- Silicone oil seal;
- Aluminium fan;
- Metal cable glands and plugs.

In these conditions, if condensation formation is a risk, we recommend employing, or at least order the condensation drain holes and/or heaters. The low temperature construction is not available in combination with forced ventilation or for brake motors with ML or MS brake; brake motors with FM brakes have this option only with IP55 protection rating.

2.1.4 High temperature construction (+60°C / +90°C)

In case of applications with ambient temperature included between +60°C and +90°C, the electric motor is equipped with special components:

- Class H winding insulation
- Bearings with special lubrication (LHT) and higher backlash (C3) suitable for high running temperatures;
- Viton/FKM seal rings;
- Aluminium fan;
- Metal cable glands and plugs.

Furthermore, when selecting the product it is advisable to adopt power derating for +60°C ambient temperature (see "Standard ambient conditions - Derating for non-standard ambient temperature/ altitude"). The high temperature construction is not available in combination with forced ventilation or on brake motors.

2.2.1 Standard high efficiency (TS), high (TH) and premium (TP) motors

Motovario, three-phase, single polarity motors are available in three different versions (IE1-IE2-IE3) in compliance with standard 60034-30-1 (see table). The efficiency value is calculated according to the method set forth in standard IEC 60034-2-1.

1. IE1: Standard efficiency TS series.
2. IE2: High efficiency TH series
3. IE3: Premium efficiency TP series. (*)

Table of Motovario commercial availability

| NOMINAL POWER [kW] | POLES | EFFICIENCY LEVEL | | |
|--------------------------|-----------|------------------|--------|--------|
| | | IE1 | IE2 | IE3 |
| $0,09 \leq P_n < 0,75$ | 2 - 4 - 6 | TS-TBS | - | - |
| $0,75 \leq P_n \leq 11$ | 2 - 4 | TBS | - | - |
| $0,75 \leq P_n \leq 5,5$ | 6 | TBS | TH-TBH | TP-TBP |
| $0,75 \leq P_n \leq 9,2$ | 2 - 4 | - | TH-TBH | - |
| $0,75 \leq P_n \leq 7,5$ | 2 - 4 | - | - | TP-TBP |
| $7,5 \leq P_n \leq 22$ | 6 | TBS (*) | - | TP |
| $11 \leq P_n \leq 90$ | 4 | - | - | TP |
| $15 \leq P_n \leq 37$ | 2 | TBS (*) | - | TP |
| $15 \leq P_n \leq 55$ | 4 | TBS (*) | - | - |

(*) TP series motors have the same external dimensions as their counterparts in the TH series, with the following exceptions:

- a) TP80B4 0.75 kW, TP90S4 1.1 kW, TP90L4 1.5 kW, TP112M4 4 kW, TP90S6 0.75 kW, TP112M6 2,2 kW with increased length compared to their counterparts in the TH and TS series (see dimensional tables);
- b) 3 kW 4 poles, manufactured in size 112 IE3 instead of 100 IE2;
- c) 5.5 kW 4 poles, manufactured in size 132M IE3 instead of 132S IE1;
- d) 1.1 kW 6 poles, manufactured in size 100 IE3 instead of 90L IE1.

For further details, refer to the dimensional pages.

Motor TP100LA4 2,2 kW and all TP 6 poles motors are available at 60Hz only upon request. As a consequence, these motors are in IE3 efficiency level at 50 Hz and IE2 at 60 Hz in case of bifrequency electrical design (standard 230/400-265/460V 50-60Hz and optional 200/346-220/380V 50-60Hz, 290/500-330/575V 50-60Hz and 400/690-460/800V 50-60Hz, see chapter on input voltage and frequency).

2.2.2 EC Regulation No. 640/2009

The EC Regulation 640/2009 (EU MEPS – Minimum Energy Performance Standard) implements Directive 2005/32/EC with regard to ecodesign requirements, to improve energy saving. It applies on the European Union territory to the three-phase asynchronous electric motors having the following features:

- 2, 4 or 6 poles;
- Nominal power greater than or equal to 0.75 kW;
- Maximum nominal voltage 1000 V;
- Suited for continuous duty;
- Suited for operation in standard environments (ambient temperature -15°C to +60°C, altitude below 4000m asl);

These motors can be placed on the Community market for the first time according to the 3 following deadlines:

1. June 16th 2011: all motors must have a minimum IE2 efficiency level (TH series).
2. January 1st 2015: all motors must have a minimum IE3 efficiency level (TP series) if their nominal power is higher or equal to 7.5 kW. The IE2 efficiency level is allowed if the motor is powered by an inverter. In this case, the IE2 motor (Motovario TH series) bears a sticker with indication (*).
3. January 1st 2017: all motors must have a minimum IE3 efficiency level (TP series). The IE2 efficiency level is allowed if the motor is powered by an inverter. In this case, the IE2 motor (Motovario TH series) must bear a sticker with indication (*).

(*) **IE2** | EU REGULATION 640/2009
USE WITH VARIABLE
SPEED DRIVE ONLY!

This regulation explicitly excludes the following types of motors that, as a consequence, do not need to comply with any special efficiency requirement:

- self-braking motors;
- motors conforming with European Directive 94/9/EC (ATEX);
- motors for intermittent (S3) or limited duration (S2) duty.

The energy performance, and hence efficiency, of Motovario compact motors (incorporated with the gear reducer) can be tested independent of the gear reducer; in compliance with Regulation No. 640/2009, they are thus not an exception to motors with coupling according to the IEC standard.

We remind you that in other parts of the world (i.e. USA, Australia, South Korea, etc.) other energy regulations, with other provisions, apply. It is a good practice to collect detailed information about these regulations before placing an electric motor on these markets.

2.3.1 Standard construction motor voltage and frequency

In the standard construction (Euro Voltage) the power voltages and frequencies permitted for motors are as follows:

1. For single polarity three-phase motors 230/400V 50Hz with 10% voltage tolerance;
2. For double polarity three-phase motors 400V 50Hz with 10% voltage tolerance;
3. For single-phase motors 230V 50Hz with 5% voltage tolerance.

Within the permitted voltage tolerance range the nominal motor ratings may differ slightly by an amount which generally depends on the motor size; no generally valid rules are available. As a first approximation, the data given in the table applies, where the values represent corrective coefficients for the catalogue and nameplate data.

| | $V_n -10\%$ | $V_n -5\%$ | V_n | $V_n +5\%$ | $V_n +10\%$ |
|--------------|-------------|------------|-------|------------|-------------|
| n | 0,97 | 0,99 | 1 | 1,01 | 1,02 |
| M_n | 1,03 | 1,01 | 1 | 0,99 | 0,98 |
| I_n | 1,05 | 1,03 | 1 | 1,03 | 1,05 |
| $\cos\phi_n$ | 1,08 | 1,05 | 1 | 0,95 | 0,9 |
| M_s/M_n | 0,81 | 0,9 | 1 | 1,1 | 1,21 |

Normally, single polarity three-phase motors in the standard (Euro Voltage) construction have nameplate ratings of 230/400V 50Hz and 265/460V 60Hz. The nominal power for 60 Hz voltages is greater by 15-20% in TS series motors; and is equal to the nominal power at 50 Hz in TH and TP series motors. A tolerance of 10% is guaranteed for all four voltage/frequency values.

2.3.2 Standard electrical construction motors with ST2 option

A single polarity three-phase motor in the standard (Euro Voltage) construction may also be used with 60Hz grid power. In particular, if powered at 460V 60Hz it can deliver 15% to 20% more than the nominal power at 50 Hz (over-rated power) while maintaining the other catalogue ratings (to an approximation). In further detail, with 60 Hz power the nominal operational ratings vary in relation to the power voltage compared to their values at 50 Hz (catalogue ratings) by approximately the factors given in the following table.

| V 50 Hz | V 60Hz | M_n | P_n | n_n | M_s | M_s/M_n |
|-------------------------------|-------------------------------|-------|-----------|-------|-------|-----------|
| 220/380 230/400 240/415 | 255/440 265/460 280/480 | 1,00 | 1,15-1,20 | 1,20 | 1,00 | 1,00 |
| | 220/380 230/400 240/415 | 0,83 | 1,00 | 1,20 | 0,70 | 0,83 |

Consequently, single polarity three-phase standard efficiency motors (TS series) for voltages 220/380V, 230/400V or 240/415V, frequency 60Hz and standard nominal power (second row in table above) are constructed with standard (Euro Voltage) winding; note however that some ratings will decrease (in particular, starting torque). If the performance is considered insufficient for the application, the said motors can be ordered with over-rated power which, since they are constructed with a custom winding, will guarantee the catalogue ratings (see next paragraph). For single polarity three-phase motors the voltages 220/380V \pm 5% 50Hz and 240/415V \pm 5% 50Hz are included in the interval 230/400V \pm 10% 50Hz and are thus constructed with standard windings. These voltage/frequency ratings are declared on the nameplate if the motors are explicitly requested with such power supply specifications in the order. On request, motors can be supplied for which even these voltages have a declared tolerance of \pm 10%.

Single-phase standard (Euro Voltage) motors cannot generally be used on 60Hz power, but require a custom electrical design (modified winding and capacitor).

2.3.3 Motors with non-standard power voltages (SP1 - optional)

As an option, single polarity three-phase motors can be provided for the optional voltages/frequencies indicated in the following table; in this case the winding is always non-standard. "S" indicates the nominal power at 50Hz, i.e. the catalogue rating (technical data table), while "M" indicates the overrated nominal power (15-20%) at 60Hz. TH and TP motors are not available at 60 Hz with over-rated power.

| [Hz] | [V] | TS | TH/TP |
|---------|------------------------|------------------|-------|
| 50-60 | 200/346-220/380 | S-M | S |
| | 290/500-330/575 | S-M | S |
| | 400/690-460/800 | S-M | S |
| 50 | 115/200 | S | S |
| | 133/230 | S | S |
| | 208/360 | S | S |
| | 255/440 | S | S |
| | 380/660 | S | S |
| | 415/720 | S | S |
| 60 | 120/208 | S, M | S |
| | 200/346 | S, M | S |
| | 208/360 | S, M | S |
| | 230/400 | M ⁽¹⁾ | S |
| | 240/415 | M ⁽¹⁾ | S |
| | 330/575 ⁽²⁾ | S | S |
| | 346/600 | S, M | S |
| | 380/660 | S, M | S |
| | 400/690 | S, M | S |
| 415/720 | S, M | S | |

Notes:

The voltage pair 220/380 60Hz can be selected with over-rated power by selecting 4 voltages 200/346-220/380V, 50-60 Hz; the standard power selection is available with standard winding and option ST2 for the TS series, or optional winding for the TH and TP series.

TP series 6-pole motors are available at 60 Hz only upon request. When the voltage values are present on nameplate, usually at 60 Hz, these motors (TP with 6 poles) have a IE2 efficiency class.

- Standard power at 50 Hz with standard winding and option ST2.
- By selecting 4 voltages 290/500-330/575V 50-60Hz the over-rated power is available for TS series, and standard power for TH series and TP series.

The following table gives the detailed values of "S" and "M" for all nominal voltages listed in the catalogue.

| | [kW] | | | | | | | | | | |
|-----|------|------|------|------|------|------|------|------|------|------|------|
| (S) | 0,09 | 0,12 | 0,15 | 0,18 | 0,22 | 0,25 | 0,3 | 0,37 | 0,55 | 0,75 | 0,92 |
| (M) | 0,11 | 0,14 | 0,17 | 0,21 | 0,26 | 0,29 | 0,36 | 0,45 | 0,65 | 0,9 | 1 |

| | [kW] | | | | | | | | | | |
|-----|------|-----|------|-----|-----|-----|-----|-----|-----|------|----|
| (S) | 1,1 | 1,5 | 1,85 | 2,2 | 3 | 4 | 4,8 | 5,5 | 7,5 | 9,2 | 11 |
| (M) | 1,3 | 1,8 | 2,1 | 2,6 | 3,6 | 4,7 | 5,7 | 6,5 | 9 | 10,5 | 13 |

High efficiency motors (TH series) and premium efficiency motors (TP series) for voltages 220/380V, 230/400V or 240/415V at 60 Hz are always made with a custom winding and are not available with over-rated power. Single-phase motors (S and HSE series) are available as an option with the following supply voltages: 230V 60Hz, 115V 60Hz, 230V 50Hz with balanced winding (see page 102). More voltages are available upon request. Normally, all single polarity three-

phase motors are fitted with a 6 terminal winding hooked up to a 6 clamp terminal block and are suited for D/Y connection. For the USA market, single polarity three-phase motors with UL/CSA homologation can be ordered for the voltage 230/460V 60Hz with 9 terminal winding hooked up to a 9 clamp terminal block for YY/Y connection. On request, motors suited for different power voltages than those indicated above are available. UL/CSA homologated motors do not declare voltages above 600V on their nameplates.

2.3.4 Inverter power supply

Standard asynchronous three-phase motors can be used in variable speed applications if powered by inverters, in observance of the general prescriptions for rotating electrical machines given in IEC 60034-1. This is possible thanks to the generous electromagnetic specification and effective insulation system, with an ample thermal and dielectric margin, such as to enable good response even in case of overloads and limited frequency applications. All three-phase motors are also equipped with phase separators to ensure resistance of the insulation to the voltage peaks generated by inverter power supply. Applications with an extremely high or low speed may require the use of forced ventilation, on the one hand to improve cooling as it is insufficient, on the other hand to eliminate the noise caused by self-ventilation and to decrease the load caused by the flow rate of the air produced by the fan, that becomes quite considerable at high speeds. Of course, the operating limits of the servo-fan are strictly connected with the conditions of load (duration and quantity); for S1 duty, please refer to the indications given in the operation diagram below. Applications at speeds above 3600rpm must be discussed with our technical service. Note that Motovario also produces the DRIVON vectorial inverter drive. For further information, consult the respective catalogue. In use, asynchronous electric motors with inverter power supply have two operating ranges:

Constant torque (magnetic flux) range: constant V/f ratio.

(400/50 for motor with 230/400V 50Hz star winding connection or 400/690V 50Hz Δ winding connection and three-phase inverter, 230/50 for 230/400V 50Hz Δ winding connection and single- or three-phase inverter). This range allows the motor to run at nominal torque down to a lower limit (approximately 30 Hz for self-ventilated motors in S1 continuous duty and 2 Hz for S3 intermittent or S2 limited duration duty, or with forced ventilation motor in S1 continuous duty), below which the torque is derated as shown in the graph; the low frequency torque curve is nonetheless dependent on the inverter settings (e.g. voltage boost function); in the case of a vectorial inverter (e.g. the DRIVON), the motor's nominal torque can be guaranteed down a few Hz, and even in S1 duty if the motor is of the forced ventilation type. Under these conditions, the best performance can be achieved through the integrated autotuning function, allowing inverter automatic setting by adapting it to the parameters of the equivalent circuit of the electric motor, thus optimizing its performance. In the case of a 230/400V 50Hz winding motor powered by a three-phase inverter, the motor can also be connected in Δ ; in these conditions the magnetic flux in the motor remains almost constant up to 87Hz, and the constant torque range can thus be extended up to that frequency, obviously if the inverter can deliver the current required by the Δ winding motor. Operation at constant V/f but at torques greater than nominal, even overloading the motor, are admitted, so far as they are compatible with the inverter's current limit and the duty time.

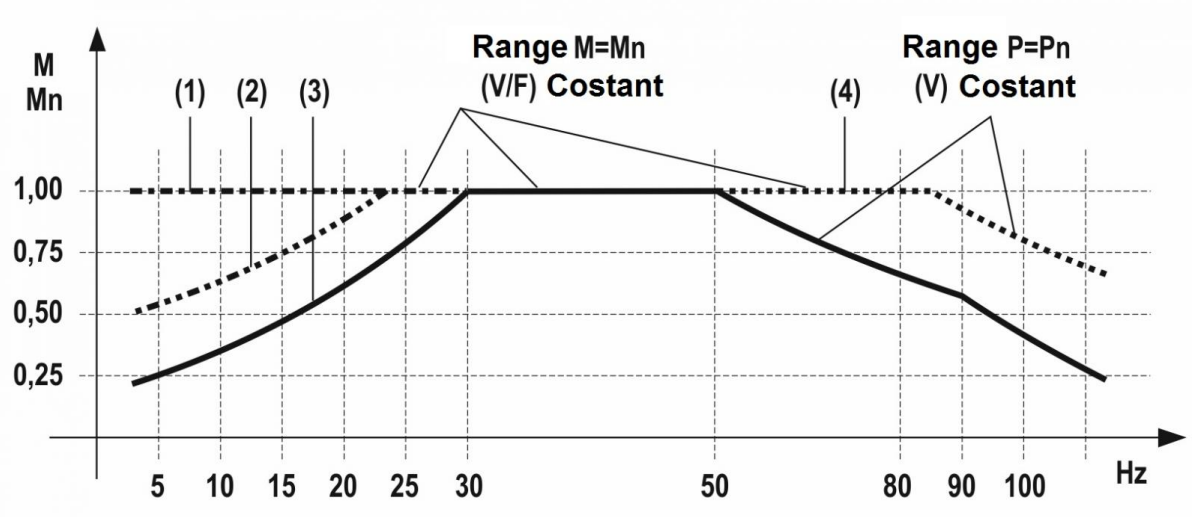
N.B.: On request, motors can be supplied with special windings to adapt the constant torque speed range to the client's actual application.

Constant voltage operating range (value set by power mains).

In this range, where the voltage reaches the maximum possible value (mains voltage), an increase in the speed and hence frequency decreases the V/f ratio and hence the magnetic flux (defluxing operation); there is also a drop off in torque with constant power delivery up to around 80-90Hz; beyond this limit (the "limit frequency") torque and power both fall off as the frequency rises. For motor operation with constant torque up to 87Hz, the line of the power remains constant for values above 100Hz. The limit frequency f_L can be determined as follows:

$$f_L = f_n M_{max}/M_n$$

where f_n and M_n are the nominal frequency (e.g. 50Hz) and nominal torque respectively, and M_{max} is the maximum torque. The value of M_{max}/M_n is given on the performance data page.



- (1) Torque limit with vectorial inverter (e.g. DRIVON) in S1 duty and forced ventilation motor (IC416), or S2 or S3 duty with self-ventilated motor (IC411).
- (2) Torque limit with scalar V/f inverter in S1 duty and forced ventilation motor (IC416), or S2 or S3 duty with self-ventilated motor (IC411).
- (3) Torque limit with vectorial inverter (e.g. DRIVON) in S1 duty and self-ventilated motor (IC411).
- (4) Extension of torque limit with three-phase inverter (e.g. DRIVON and delta winding connection).

2.4 SOUND PRESSURE LEVEL

The table gives the normal mean sound pressure level L_{pA} [dB(A)] for three-phase motors running under no load, power frequency 50Hz, with measurement per ISO R 1680; tolerance +3dB(A). At 60Hz the values are increased by around 2dB(A). The values are measured in a semi-anechoic chamber at 1 m from the housing of the motor located in a free field and on a reflecting plane. The measurements were made with standard motors in closed constructions with external surface ventilation (method IC411 per IEC 60034-6).

| | L_{pA} [dB(A)] | | | |
|------------|------------------|-------|-------|-------|
| | 2 (*) | 4 (*) | 6 (*) | 8 (*) |
| 63 | 56 | 46 | 47 | 44 |
| 71 | 61 | 48 | 47 | 45 |
| 80 | 64 | 54 | 52 | 50 |
| 90 | 65 | 55 | 53 | 51 |
| 100 | 69 | 57 | 56 | 53 |
| 112 | 70 | 58 | 56 | 53 |
| 132 | 76 | 60 | 58 | 56 |

(*) Poles

“Duty” is defined as being the load condition the machine is subject to, including (if applicable) the periods of starting, electrical braking, operating with no load, and rest, as well as their duration and sequence in time. Duty can be described as one of the following standard types, in line with IEC 60034-1, or by another type identified by the user with a graph to show the sequence over time of the variable duty parameters; if the sequence is not defined, a nominal sequence must be selected which is no less severe than the actual sequence, conforming to one of the predefined duty types; if the duty is not specified, S1 is deemed applicable. The values given in the catalogue tables refer to electric motors, totally enclosed, with fan-cooled external surface ventilation, for which in nominal operating conditions, taking account of the insulation class, the S1 duty is applied. The type of duty is given on the motor name plate. In case of non-continuous duty three-phase standard construction motors (duty S1) may be overloaded as indicated in the table.

| Duty | | Power over-rating factor |
|-------|--------|-------------------------------|
| S2 | 60min. | 1,1 |
| | 30min. | 1,2 |
| | 10min. | 1,4 |
| S3 | 60% | 1,1 |
| | 40% | 1,15 |
| | 25% | 1,25 |
| | 15% | 1,35 |
| Other | - | Contact our technical service |

S1 continuous duty

Operation at constant load of sufficient duration to achieve thermal equilibrium; for it to be applicable the user must precisely specify the load and nominal operating conditions in which the machine is to run for an unlimited period.

S2 limited duration duty

Constant load operation for a limited period of time, less than that required to achieve thermal equilibrium, followed by a period of standby sufficient to cool the machine down to the coolant fluid temperature, with a tolerance of 2°C. This duty is abbreviated as S2 followed by an indication of the running time; the user must precisely specify the load, running time and nominal operating conditions in which the machine, started at ambient temperature, may operate for a limited period. If the load is not specified, nominal load is assumed.

Sample designation: S2 30 min.

S3 periodic intermittent duty

Sequence of identical cycles, each including a period of operation at constant load and a period of standby; in this duty the cycle is such that the starting current does not significantly affect the overtemperature. The duty is designated S3 followed by the intermittency ratio; the cycle duration used to calculate the intermittency ratio is 10 minutes. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle.

Sample designation: S3 25%.

S4 periodic intermittent duty with starting

Sequence of identical cycles, each including a non-negligible starting phase, period of operation at constant load and period of standby. The duty is designated S4 followed by the intermittency ratio, the motor moment of inertia J_T and load moment of inertia J_L , referred to the motor shaft. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle.

Sample designation: S4 25% $J_T=0.15\text{kgm}^2$ $J_L=0.7\text{kgm}^2$

S5 periodic intermittent duty with electric braking

Sequence of identical cycles, each including a starting phase, period of operation at constant load, period of rapid electric braking and period of standby. The duty is designated S5 followed by the intermittency ratio, the motor moment of inertia J_T and load moment of inertia J_L , referred to the motor shaft. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle.

Sample designation: S5 25% $J_T=0.15\text{kgm}^2$ $J_L=0.7\text{kgm}^2$

S6 periodic uninterrupted duty with intermittent load

Sequence of identical cycles, each including a period of operation at constant load and period of operation under no load; there is no period of standby. The duty is designated S6 followed by the intermittency ratio; the cycle duration used to calculate the intermittency ratio is 10 minutes. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle.

Sample designation: S6 40%

S7 periodic uninterrupted duty with electric braking

Sequence of identical cycles, each including a starting phase, period of operation at constant load and period of electric braking; there is no period of standby. The duty is designated S7 followed by the motor moment of inertia J_T and load moment of inertia J_L , referred to the motor shaft. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle.

Sample designation: S7 $J_T=0.15\text{kgm}^2$ $J_L=0.7\text{kgm}^2$

S8 periodic uninterrupted duty with correlated variations of load and speed

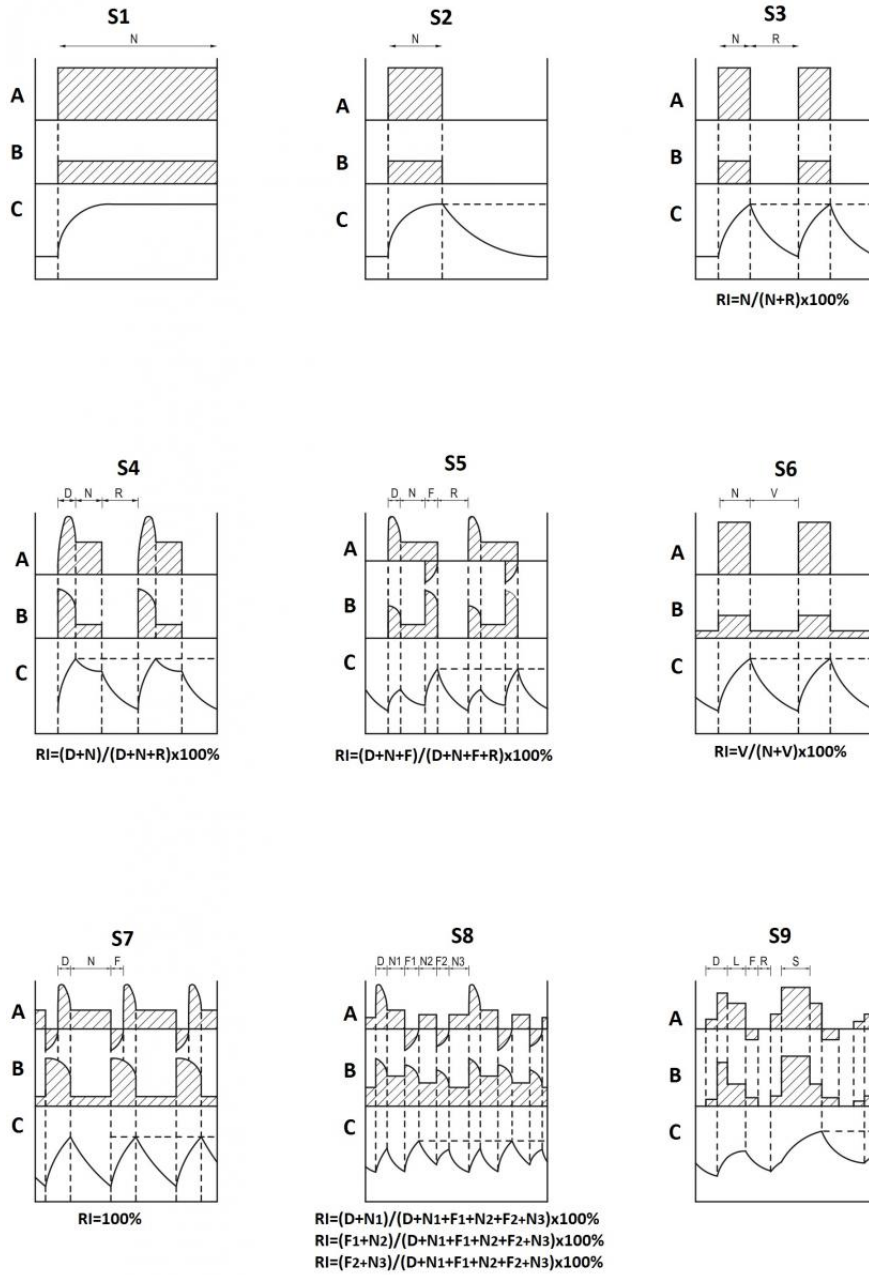
Sequence of identical cycles, each including a period of operation at constant load at a preset constant speed, followed by one or more periods of operation at other constant loads at other speeds (done by changing the number of poles, for instance); no standby period exists. The duty is abbreviated as S8 followed by the motor moment of inertia J_T and load moment of inertia J_L , referred to the engine shaft, the loads, speeds and intermittency ratios for each period of operation at a given speed. The user must precisely specify the load and nominal operating conditions in which the machine is to run for a periodic cycle. Sample designation:

S8 $J_T=0.15\text{kgm}^2$ $J_L=0.7\text{kgm}^2$ (1.5KW-740rpm-30%) (2KW-1460rpm-30%) (1.1KW-980rpm-40%).

S9 duty with non-periodic variations of load and speed

Duty in which the load and speed generally vary in a non-periodic manner within the allowable range; this duty includes frequent overloads which may largely exceed the full load values; for this type of duty one must consider suitable full load values as a reference for the overloads. The duty is designated S9; the user must give precise details of the loads, speed and other conditions, including overloads, in which the machine is to operate non-periodically.

2.5 DUTY



| | |
|----------------|--|
| A | Load |
| B | Electrical losses |
| C | Temperature |
| D | Starting or acceleration time |
| N | Constant load running time |
| F | Electric braking time |
| R | Standby time |
| RI | Intermittency ratio |
| V | No load running time |
| Θ_{max} | Maximum temperature reached during cycle |

2.6.1 Bimetal thermal cutouts

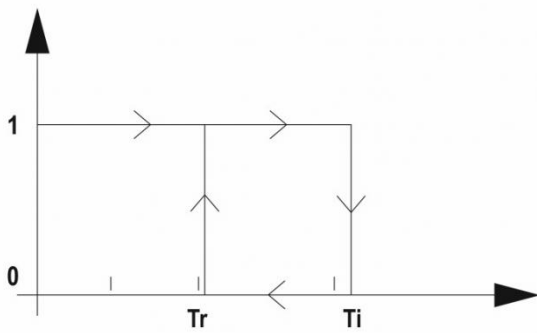
A bimetal thermal cutout is simply an NC bimetal contact which, at its trip temperature, switches from closed to open. It is normally used as a sensor to control a contactor which shuts off power. In this way the cutout guarantees quick circuit breaking without the maximum allowed winding temperature being exceeded, in relation to the motor insulation class per IEC60034-1. Thermal cutouts are normally positioned in close contact with the conductors inside the winding heads, before they are formed and impregnated. Normally in the three-phase motors three thermoprotectors in series are used (one for each phase). In single-phase motors there is only one thermoprotector. Thermoprotector terminals are available free within the terminal box; upon request their wiring is possible to a set of pins of the motor terminal block. Upon request it is possible to provide thermoprotectors that are normally open (NO), with the principle of operation inverse to that described.

Technical characteristics of standard bimetal thermal cutouts:

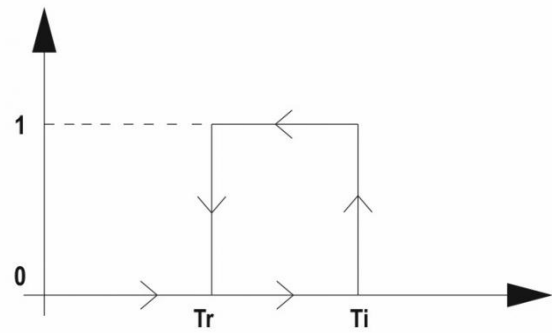
- Type NC;
- Trip temperature 130°C for class F insulation motors, 140°C for class F insulation motors homologated to the UL/CSA standards, 150°C for class H motors. Trip temperature tolerance $\pm 5^\circ\text{C}$;
- Insulation dielectrical rigidity 2KV;
- Conformity with standard IEC60034-11.

Different trip temperatures are available on request, from 70 to 180°C.

Operation with NC contact



Operation with NO contact

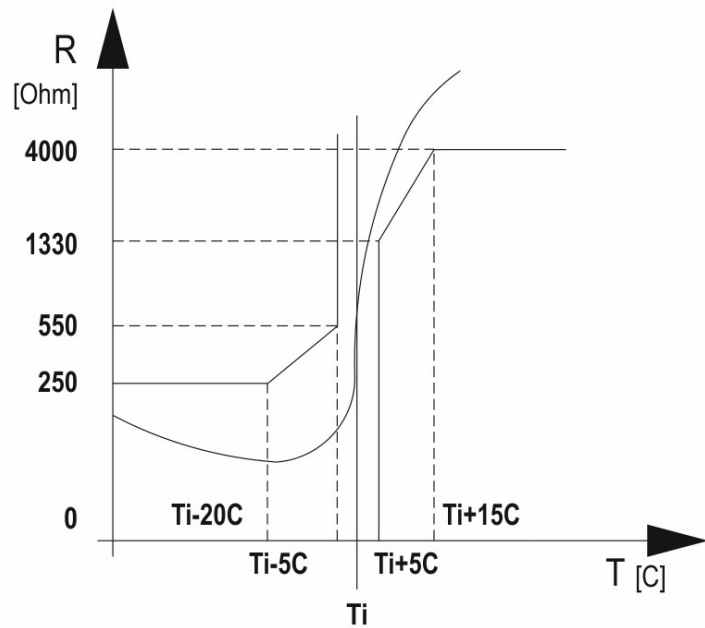


| | |
|--------------------------------|-------------------|
| T_I | Trip temperature |
| $T_r = T_I - 30^\circ\text{C}$ | Rearm temperature |

2.6.2 Thermistors (PTC)

Thermistors are temperature sensors with high temperature sensitivity. Thermistors with positive temperature coefficient (PTC) are generally used, whose resistance rises drastically in the vicinity of the trip temperature. Their use is similar to that of bimetallic thermal fuses, the resistance value can thus be used by a release device (not supplied by Motovario) protecting the motor. Thermistor terminals are free inside the terminal block box; their wiring to special pins of motor terminal board is available upon request.

TEMPERATURE - RESISTANCE DIAGRAM



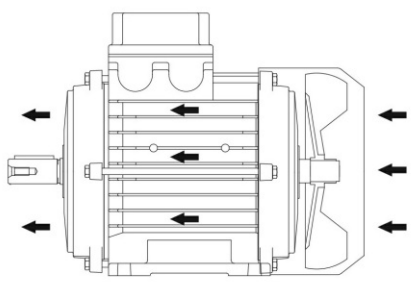
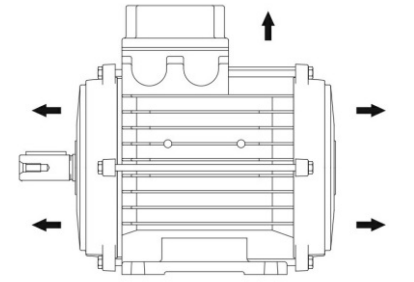
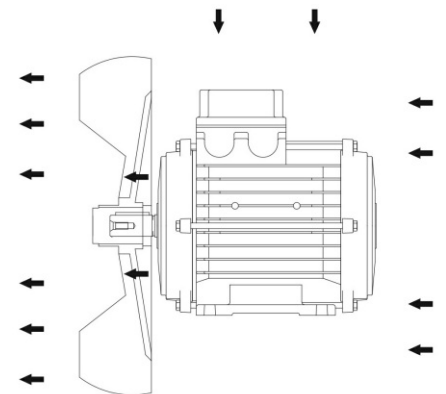
Technical characteristics of standard thermistors:

- Trip temperature 130°C for class F motors, also valid for UL/CSA homologation; 150°C for class H motors;
- Insulation dielectrical rigidity 2.5KV.

Different trip temperatures are available on request, from 60 to 180°C.

2.7.1 Cooling systems

Standard construction electric motors are closed and self-ventilated with a fan mounted to the motor shaft which operates in both directions of rotation. This cooling system, per IEC 60034-6, is designated IC411. Standard construction electric motors are constructed so that with IC411 cooling, duty is S1; this duty is guaranteed if the fan cover intake grille is not blocked by dirt deposited during operation or due to the installation itself (for example, inside the frame of a machine); such situations of poor ventilation must be carefully analysed to avoid compromising the motor's performance. If the cooling system is IC418 (e.g. motor driving a fan and cooled by the resulting current of air), standard motors can be used in non-ventilated construction and S1 duty; naturally the speed and flow of air must be at least equivalent to that of the IC411 system. In case of total lack of external surface ventilation (IC410) standard motors may be used only for limited duration or very periodic duty. In such conditions the standard duty is S2 10 min or S3 10%. On request, motors can be provided without ventilation for S1 duty; the power, for a given motor size, is reduced to around 1/3 of the power available in S1 duty for IC411 motors. Contact our technical service for further information.

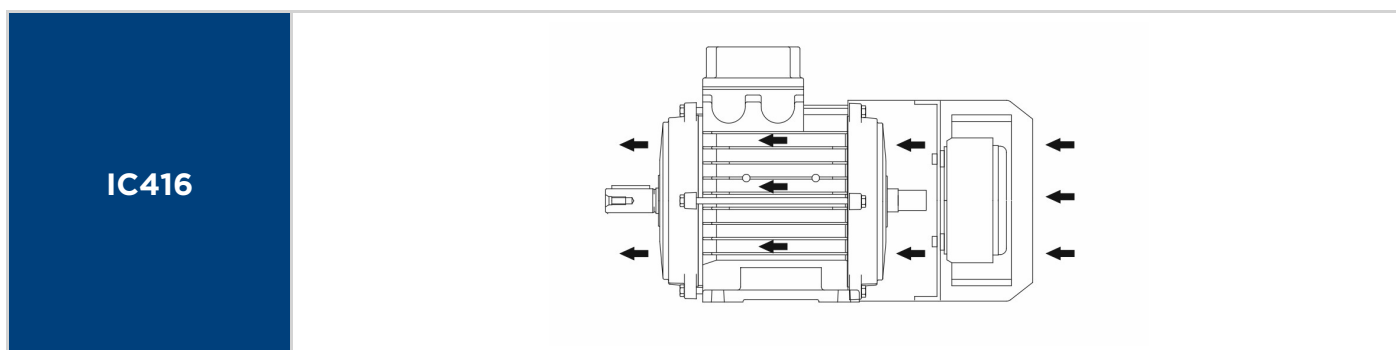
| | |
|---------------------|--|
| <p>IC411</p> |  |
| <p>IC410</p> |  |
| <p>IC418</p> |  |

2.7.2 Forced ventilation

In the case of applications of the variable speed motor, it may be necessary to resort to forced ventilation (cooling method IC416), obtained by means of an axial flow servo-fan whose air flow rate is independent of the speed of rotation of the drive shaft. The supply, independent from the electric motor, is given by means of a connector applied directly on fan cover (single phase version 230V 50-60Hz, sizes 63-90), or by means of a separate terminal box cover applied on fan cover (single-phase 230V 50-60Hz sizes 100-132/160S and three-phase 380/420-380/480V 50-60Hz sizes 100-132/160S). On request, we can analyse different solutions, or for special power voltages. Use of the servo-fan is recommended for motor speeds much lower than the nominal speed, when the air flow rate of the standard fan would be insufficient for correct cooling, and for much higher speeds than the nominal speed, when the losses due to ventilation of the standard fan would no longer be negligible compared to the nominal load and also the noise of ventilation would be annoying. Forced ventilation could be necessary in case of frequent starting torques, as this condition entails a high heating and a low heat dissipation by the fan fitted on motor shaft. The speed limit which determines the need for forced ventilation depends on the load conditions to which the electric motor is subjected, in relation to the speed and duty type. Forced ventilation has been designed as a kit; therefore it is possible to modify a standard selfventilated electric motor (IC411) into a motor with forced ventilation (IC416) by following these simple instructions:

- disassemble the standard fan cover, unscrewing the fastening screws from the motor casing;
- remove the fastening bush of the plastic fan and remove the fan with the help of a tool;
- assemble the forced ventilation kit by tightening to the motor casing with the fastening screws of the fan cover just disassembled.

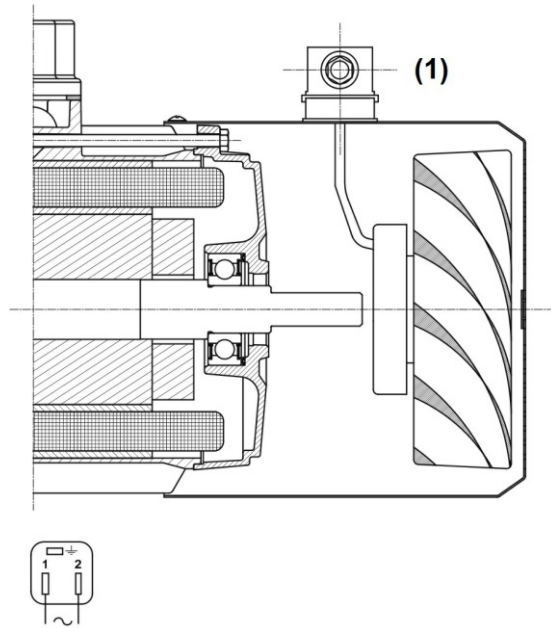
On request it is possible to supply forced ventilated motors with forced ventilation supply directly from the terminal box of the motor; in this case the forced ventilated unit cannot be supplied as a kit, but it should be ordered together with the complete motor. The application of the forced ventilation kit determines a length variation of the motor (see dimensional tables). Forced ventilation is not available for protection ratings higher than IP55 or in combination with high or low temperature.



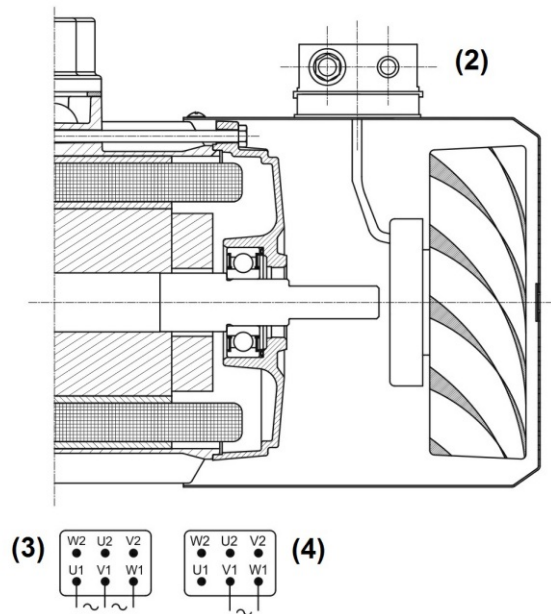
| | [V] / [Hz] | [W] | [A] |
|-----------------|-----------------------------|-------|-----------|
| 63 | 230V/50-60Hz | 14-16 | 0,09-0,11 |
| 71 | 230V/50-60Hz | 14-16 | 0,09-0,11 |
| 80 | 230V/50-60Hz | 33-36 | 0,20-0,24 |
| 90 | 230V/50-60Hz | 33-36 | 0,20-0,24 |
| 100 | 230V/50-60Hz | 33-36 | 0,20-0,24 |
| 112 | 230V/50-60Hz | 76-90 | 0,35-0,40 |
| 132-160S | 230V/50-60Hz | 76-90 | 0,35-0,40 |
| 100 | 380-420V/50Hz 380-480V/60Hz | 55-60 | 0,21-0,20 |
| 112 | 380-420V/50Hz 380-480V/60Hz | 55-60 | 0,21-0,20 |
| 132-160S | 380-420V/50Hz 380-480V/60Hz | 55-60 | 0,21-0,20 |

2.7 COOLING SYSTEMS

Single-phase power
sizes 63-71-80-90



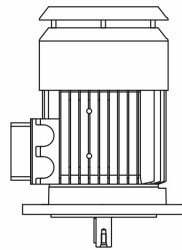
Single- and three-phase power
sizes 100-112-132



1. Connector mPm B202000N2 DIN 43650-A/ISO 4400
2. Cable gland M16x1.5 – Cable entry diameter 5-10 mm
3. Three-phase power 400V
4. Single-phase power 230V

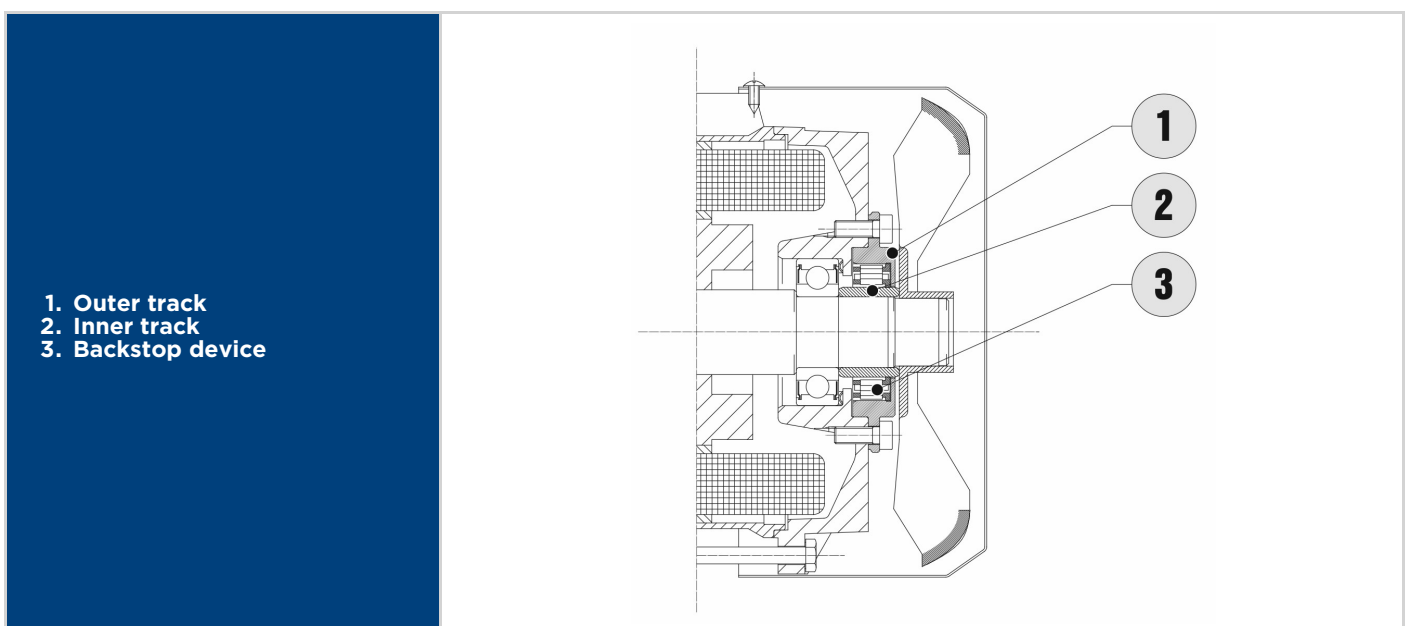
2.8.1 Version with roof

In the case of positioning the motor vertically in outdoor applications, with the end of the shaft on the driving side facing downwards, it is recommended to use a fan guard with a roof to shelter it from the rain. This version is generally recommended in all cases where entry of water or solid bodies is such as to jeopardise the correct operation of the motor, due to infiltration of water, partial blockage of the air grille, or an obstruction preventing the fan and the shaft from turning correctly. The roof not only protects against rain, but may be supplied for use in the textile industry; in this case the fan cover has the same roof as the rain cover, but without grille, to prevent blocking by textile processing fragments. The cover does not significantly alter the winding overtemperature. The application of the cover determines a height variation of the motor (see dimensional specifications). The presence of the roof is incompatible with the double extension shaft and/or with the recessed rear hexagon.



2.8.2 Backstop device

In applications where reverse motor rotation must be prevented, caused by the dragging action of the load, it is possible to have a backstop device applied directly on the motor on the fan side. This device is composed of eccentric cams with single spring guided by an inner and outer cage, themselves incorporated into two cylindrical tracks. When the inner track rotates with the motor shaft, the cams lift off the track due to the centrifugal force, thus allowing the shaft to rotate freely in the direction of rotation of the motor; when the shaft is rotated in the opposite direction, the cams lock down and prevent the shaft rotating. In consideration of the high speed of rotation, it is not recommended to use this device on 2 pole motors. For correct assembly of the backstop device, the direction of rotation of the motor must be specified in the order; a sticker on the fan cover shows the allowed direction of rotation. The backstop device, sized so as to be able to withstand the maximum torque transmitted by the motor and to work at the nominal speed of rotation of the motor without excessive wear, is lubricated for life with specific grease. The device's construction is such as not to increase the axial length of standard motors. The backstop device is not available for sizes 63 and 71.

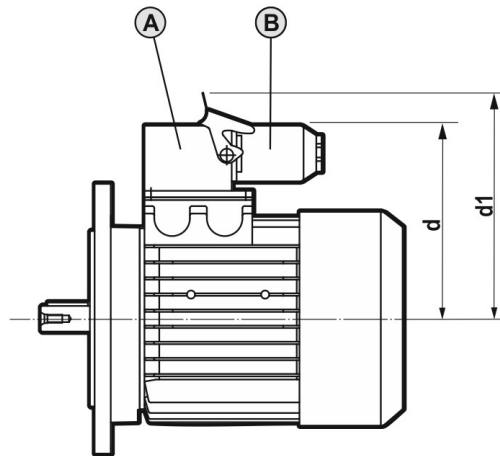


2.8.3 Rapid connection power supply

It is possible to supply motors with incorporated connector, for quick and safe power cable hookup. The connector has a modular structure, therefore it is possible to adapt the voltage values and the current capacities according to the motor type where the connector is applied. The motor is connected with fixed part (A) incorporated into the terminal block box and connections cabled directly to the connector and a piggyback part (B) supplied hooked on to the fixed part. As far as the application is concerned following solutions are suggested:

- 10 pole connector for three-phase motor in standard version (TS, TH, TP and D versions) or brake versions (series TBS, TBH, TBP and DB) with or without thermal cutout, excluding AC brake and separate supply. For the three-phase motors it is possible to prearrange the detachable part with double connection in order to do the star-delta connection;
- 10 pole connector for single-phase motor in standard version (S series) or self-braking version (SB series, upon request) with or without thermal protector;
- 5 pole connector for single-phase motor (series S) with or without thermal cutout. With thermal cutout version it is necessary to know the direction of rotation beforehand.

Rapid connection power supply is available for motors up to nominal power 4 kW and sizes 112 inclusive. Brake motors (TBS, TBH, TBP and DB series) with Hartling connection are only available with a protection level IP54. Higher protection levels can be confirmed on request.



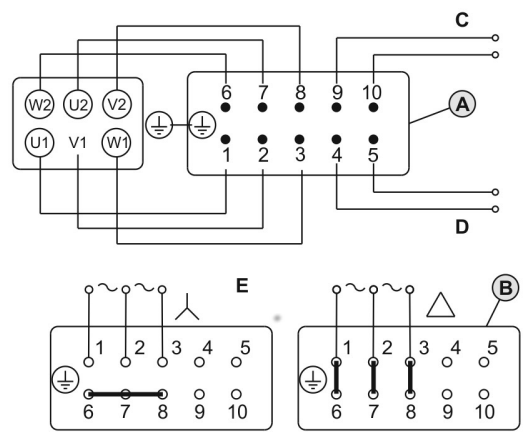
| | 5 (*) | | 10 (**) | |
|-----|--------|---------|---------|---------|
| | d [mm] | d1 [mm] | d [mm] | d1 [mm] |
| 63 | 96 | 120 | 122 | 160 |
| 71 | 108 | 132 | 134 | 172 |
| 80 | 119 | 143 | 145 | 183 |
| 90 | 127 | 151 | 157 | 195 |
| 100 | 136 | 160 | 166 | 204 |
| 112 | - | - | 181 | 219 |
| 132 | - | - | 222 | 260 |
| 160 | - | - | 222 | 260 |
| 180 | - | - | 237 | 275 |
| 200 | - | - | 237 | 275 |

(*) 5 pole connector

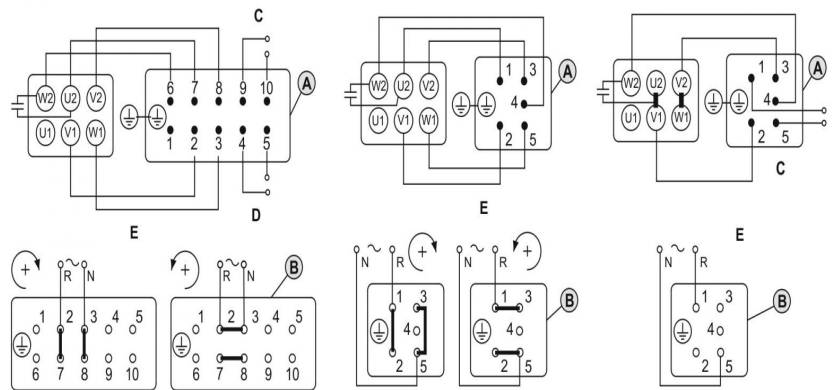
(**) 10 pole connector

2.8 OTHER OPTIONAL CONSTRUCTIONS

Series TS-TH-TP-D-TBS-TBH-TBP-DB (except for separate power AC brake)



Series S (SB On request)



C - Temperature sensor
 D - Separate power DC brake
 E - Motor power supply

2.8.4 Incremental encoder

Incremental encoders are used when the motor speed must be known with precision, for example when used as a feedback signal for an inverter or indirect angular position signal or speed signal for a component of the machine to which the motor is coupled. Motovario supplies two distinct incremental encoder solutions.

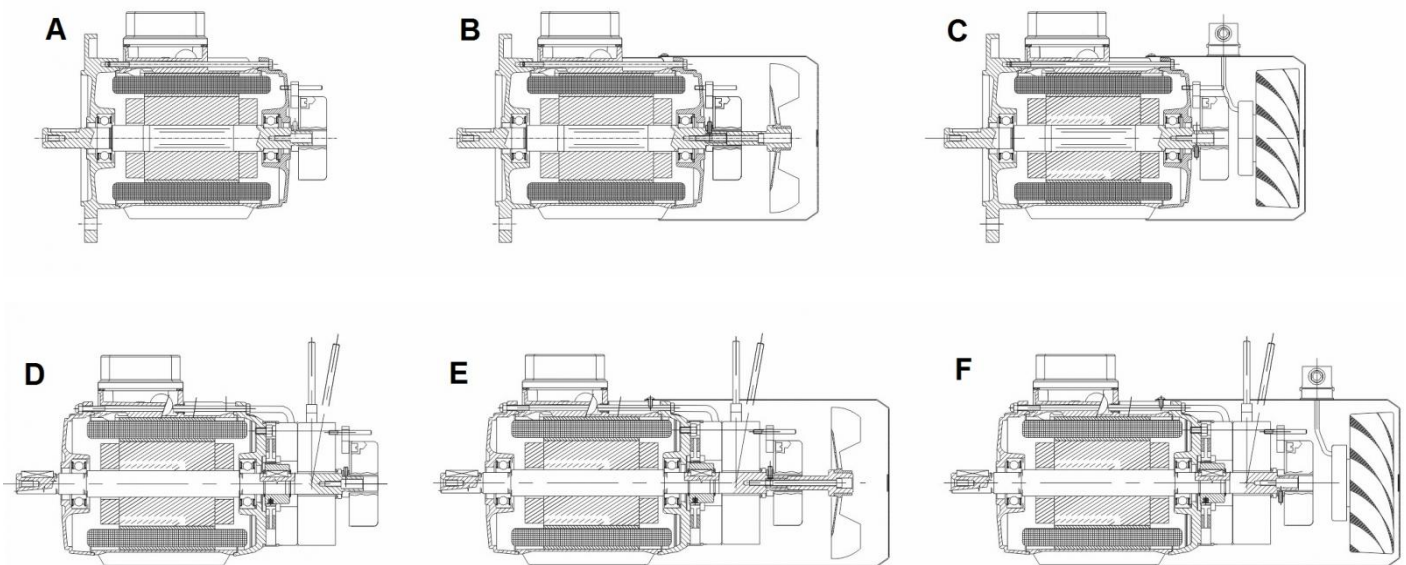
1. Standard incremental encoder

The encoder, available in the version with hollow through shaft, is mounted by locking the rotor directly onto the motor shaft, while its fixed part (stator) is held in place by locking pawl secured to the motor shield or directly to the brake; the pawl is then fitted into a slot in the encoder's reaction arm which has a certain axial elasticity to compensate for play and dampen vibrations. It can be supplied in the following versions:

- Three-phase motor (TS, TH and D series) and three-phase brake motor (TBS, TBH and DB series) with FM and MS brakes;
- Non-ventilated (IC410), self-ventilated (IC411), forced ventilation (IC416).

We give below the various constructions with standard incremental encoder without connector in the case of motor:

- Fig.A - three-phase (TS, TH, TP and D) without ventilation (IC410);
- Fig.B - three-phase (TS, TH, TP and D) self-ventilated (IC411);
- Fig.C - three-phase (TS, TH, TP and D) forced ventilation (IC416);
- Fig.D - three-phase brake (TBS, TBH, TBP and DB - MS and FM brake) without ventilation (IC410);
- Fig.E - three-phase brake (TBS, TBH, TBP and DB - MS and FM brake) self-ventilated (IC410);
- Fig.F - three-phase brake (TBS, TBH, TBP and DB - MS and FM brake) forced ventilation (IC410).



Mounting the standard incremental encoder changes the overall external dimensions of the motor (see dimensional tables).

Technical characteristics:

- standard resolution: 1024 pulse/cycle;
- Push-Pull (HTL) with 10-32 V power or Line Driver (TTL) with 5 V power;
- version without connector (free cable 0.5 m);
- version (optional) with male connector M23 12 pin cabled at the end of the wire 0.5 m; female connector supplied
- protection rating equal to that of the motor up to IP65;
- maximum speed: 9000 rpm;
- operating temperature: -30°C / +100°C;
- maximum current absorption under load: 30 mA;
- maximum current absorption under no load: 40 mA;
- maximum operating frequency: 300kHz.

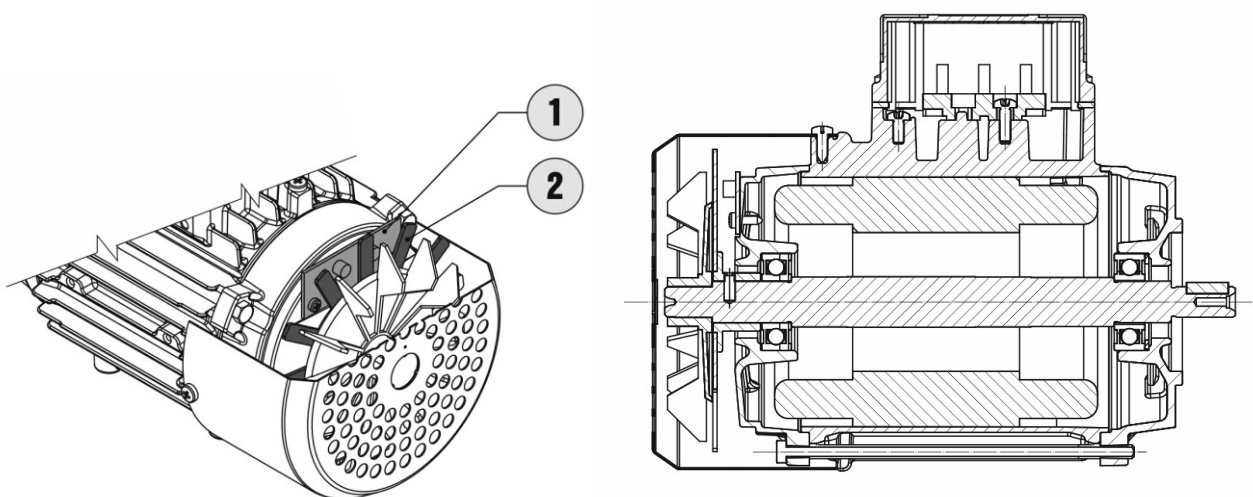
On request, incremental encoders can be provided with any logic (HTL or TTL) and pulse/cycle resolution (1 to 65536) desired.

2. Low resolution incremental encoder

Motovario low resolution incremental encoders are available on three-phase motors in the sizes 63-71-80-90, in brake and brakeless versions. On request, they can also be mounted to three-phase motors in the sizes 100-112-132/160S. They are composed of an encoder board to read the speed and a magnetic stainless steel phonic wheel. The board uses two Hall effect sensors to read the fins of the phonic wheel mounted to the motor shaft (see diagram). The 2 output signals are dephased by 90° to determine the direction of rotation. The logic is of the NPN type. Mounting a low resolution incremental encoder does not affect the overall external dimensions of the motor.

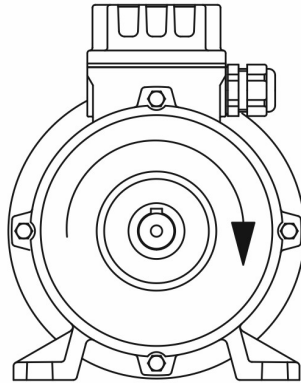
Technical characteristics:

- standard resolution: 13 pulses/cycle for size 63, 15 pulses/cycle for sizes 71-80-90;
- NPN version with 10-30 V power; PNP and Push-Pull versions available on request;
- version without connector (free cable 1.2 m);
- protection rating equal to that of the motor up to IP65;
- operating temperature: -40°C / +90°C;
- maximum current absorption under load: 25 mA;
- maximum operating frequency: 12.6 kHz.



1. Encoder board
2. Phonic wheel

2.9.1 Direction of rotation - Hookup



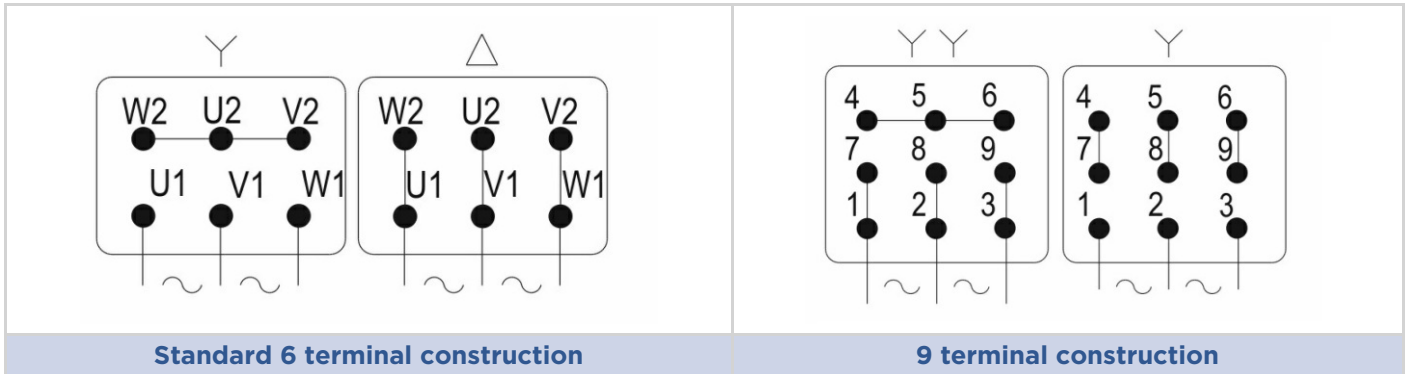
The connections on the terminal board and the direction of rotation are made in conformity with the requirements of the standard IEC60034-8. The direction of rotation, by definition, is the direction when viewing the motor from the coupling side (see figure). All standard motors are suitable for operation in both directions of rotation; clockwise is the default direction. The tables with the connections on the terminal board are inside the terminal board cover. If the motor needs to operate anticlockwise, ie. the opposite direction to the standard supply, it is necessary to proceed as follows:

- In the case of three-phase motors, by swapping over two supply phases;
- In the case of single-phase motors, by changing the connections on the terminal board as shown on the wiring diagrams.

In both cases it is prohibited to alter the internal connections of the motor to its terminals on the terminal board, they must remain unchanged. If the motor needs to be fitted for just one direction of rotation (e.g. with backstop device), this direction is shown with an arrow on the fan cover or in another clearly visible position.

2.9.2 TS-TH and TP series

The technical data given in the tables in the catalogue refer to standard three-phase asynchronous motors insulated in class F and in continuous duty S1, supplied at the nominal voltage of 400V and nominal frequency 50Hz. The connection types are marked inside the terminal block cover. The conventional direction of rotation (clockwise) is obtained by powering the unit with the direct three phases L1 L2 L3 connected to the terminals U1-V1- W1 respectively (standard 6 terminal construction) or terminals 1-2-3 (9 terminal construction for North American market).

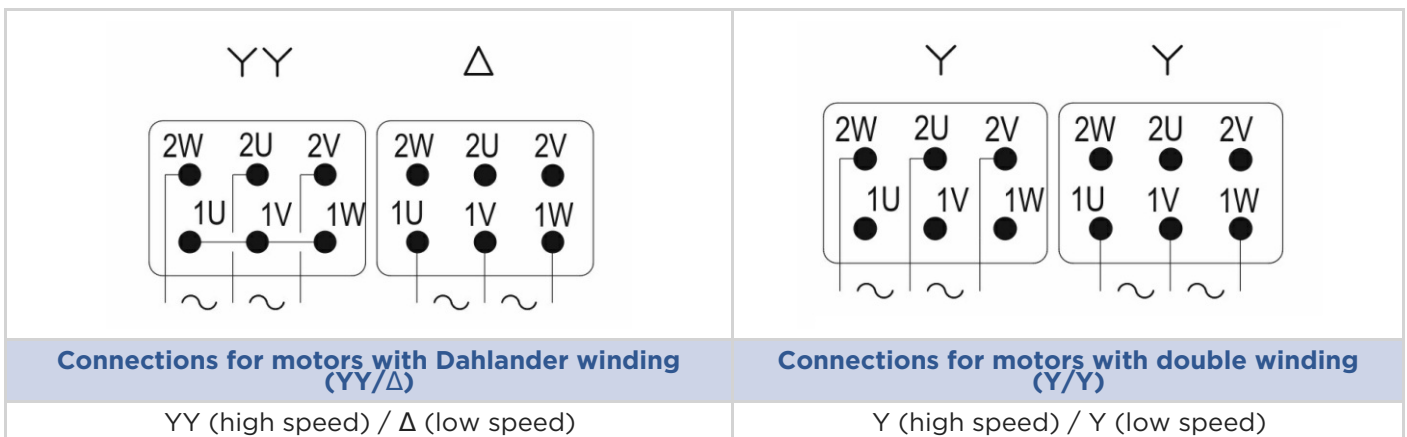


2.9.3 D series

The double polarity motors in the series D are used in applications requiring two fixed speeds, obtained by swapping over the poles of the motor. They comprise:

1. Motors with polarity ratio of 2 (2/4 pole, 4/8 pole) with single winding and pole number switching via modification of the internal connections; the standard version is with Dahlander YY-D connection and power with single voltage 400V/50Hz;
2. Motors with polarity ratio other than 2 (2/8 poles) for which there are two distinct windings and the possibility of supply with one voltage with a Y or D connection. Motors in standard execution are set only with the Y-Y connection and single voltage 400V/50Hz.

The conventional clockwise direction of rotation for D series motors is obtained by supplying the terminals U-V-W respectively with the direct triple voltage of the supply network L1-L2-L3.



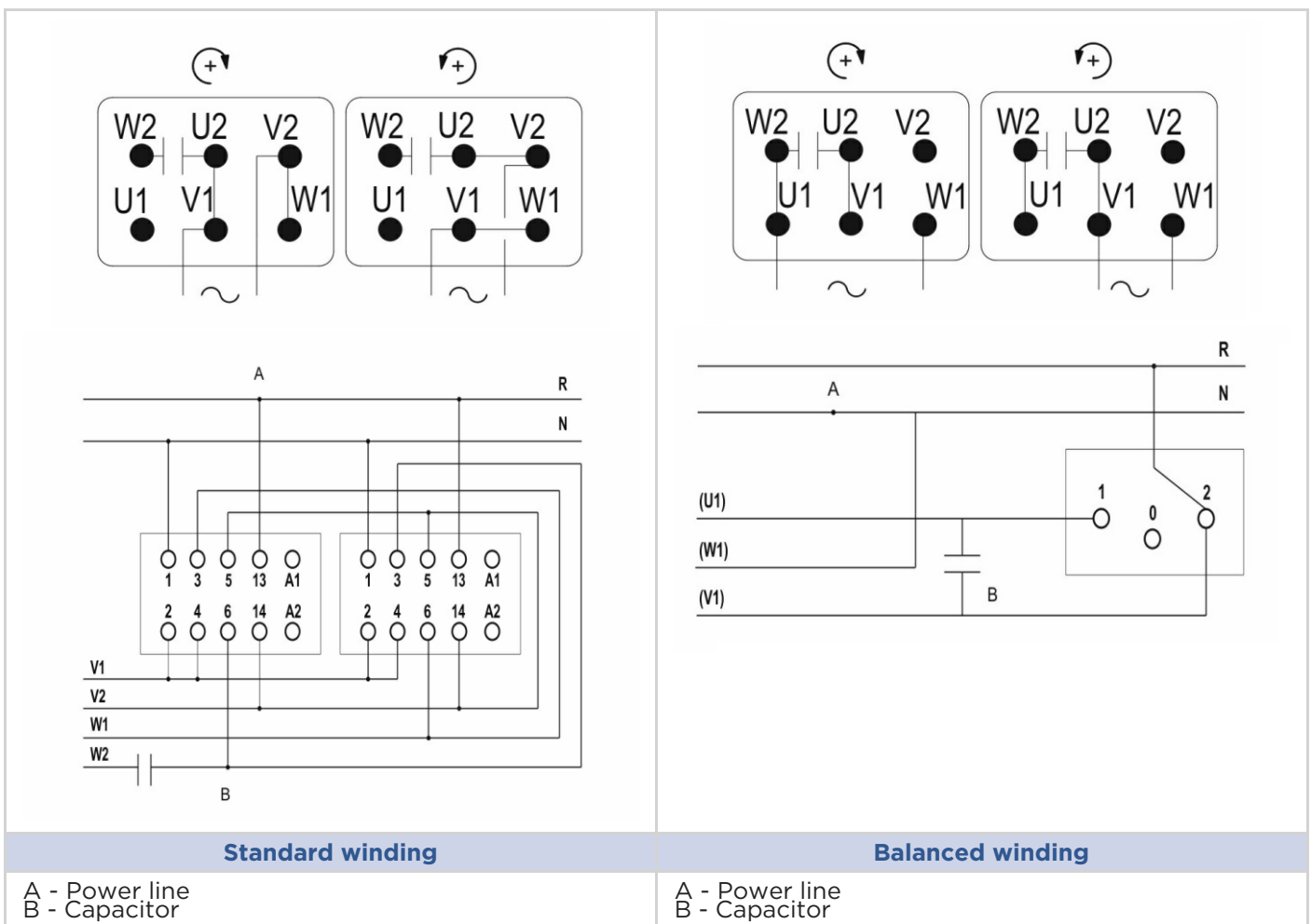
In applications of double polarity motors it is necessary to pay special attention to the phases of switching over from one polarity to the other. We recommend low speed starting with switching to high speed after completion of the starting phase. When passing over from the low polarity (high speed) to the high polarity (low speed) it is necessary to consider the braking torque that is applied during switchover; because when the synchronous speed is exceeded, the torque becomes negative; therefore when passing over the high and low speed, the load torque is sharply compounded with the braking torque, which applies its action until the motor stabilizes at the new point of operation at low speed; the stress created during switchover must not be neglected when sizing the transmission.

2.9.4 S series

The technical data given in the tables in the catalogue refer to standard single-phase asynchronous motors with running capacitor permanently activated, insulated in class F and in continuous duty S1, supplied at the nominal voltage of 230V and nominal frequency 50Hz. The allowed voltage tolerance is $\pm 5\%$. Standard motors cannot generally be used at 60Hz; as an option, motors with an supply voltage of 230V 60Hz or 115V 60Hz can be supplied; other supply voltage values are available upon request.

Single-phase motors (S series) have two separate windings: one running winding distributed on 2/3 of the stator slots and an auxiliary winding distributed on 1/3 of the slots. The type of winding makes it possible to reverse the direction of rotation by modifying two connections on the terminal board, or externally with two contactors.

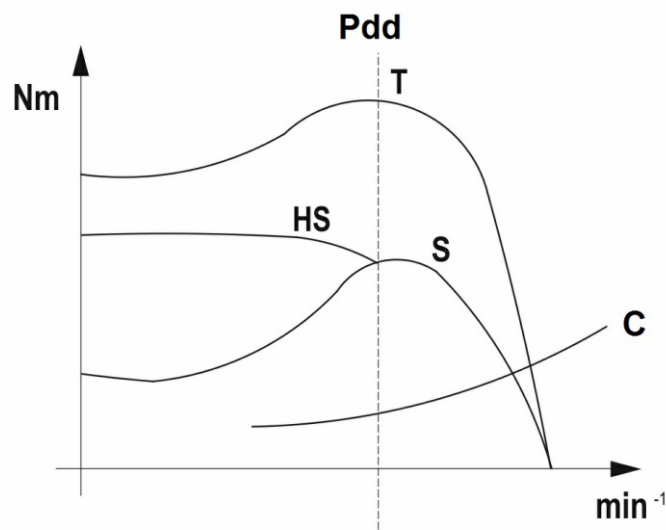
As an alternative, as an option, in case of 230V 50Hz supply voltage, single-phase motors with balanced winding - with one run and one auxiliary winding - can be supplied, composed of two identical windings each distributed over 1/2 of the stator slots. In this case the motor's performance in terms of torque is generally lower. This winding is only used for low-powered motors (size 63/71/80) and it has the great advantage of being able to swap over the direction of rotation from the outside without using the two contactors, by simply using a switch (with positions 0-1-2).



2.9.5 HSE series

HSE SERIES (high starting torque single phase with electronic cutout)

Standard single-phase asynchronous series motors (S series), due to their design and in contrast with three-phase motors, generally have starting torques lower than the nominal torque. In applications where the required starting torque is high, it is possible to use series motors which, along with a permanently activated running capacitor, are equipped with an auxiliary capacitor that is only activated in the motor start-up phase and is disconnected once full rate has been reached. The auxiliary capacitor makes it possible to obtain starting torques comparable to a three-phase motor of the same power (see graph).



Pdd - Cutout detachment point C - Load

Characteristics

To disconnect the auxiliary capacitor there is a triac device (electronic cutout) sensitive to the capacitor starting voltage which, unlike current relay and timer solutions, can be used in many types of motors (compressors, centrifugal pumps, etc.) also with inertia during switching off and reversing the direction of rotation. The cutout allows for safe starting under load since, as it is sensitive to the voltage at the starting capacitor terminals, which is itself proportional to the motor speed, the starting capacitor is only disengaged when a certain voltage is reached, corresponding to around 70% of nominal speed and thus only when the motor is effectively started (as happens with centrifugal cutouts). It also has a much shorter re-insertion time than other electronic solutions, since the motor can be restarted after a stop in 1 second; Note also the flexibility and simplicity of the construction (in practice a high starting torque HSE motor can be obtained simply by adding the cutout and starting capacitor to a normal S series motor). The HSE version is thus very competitive in comparison to centrifugal cutout solutions since it requires no special parts (motor shield, shaft, fan cover, etc.); it also maintains - except for the presence of the capacitors - the same overall dimensions as a standard motor (n advantage in cases in which an increased shaft length due to the application of a centrifugal cutout would not be tolerable). The device is designed for use also on balanced winding motors. The construction without centrifugal cutout mounted at the back of the motor, means brake motor versions are also available (HSB series, on request).

Protection equipment

The cutout is an internal protection device which trips when starting takes longer than 3 seconds (after which it is evident that either the application is not correctly sized or the motor is blocked by some external factor). Furthermore, there is a voltage discharge resistance to safeguard the correct operation of the capacitors (after the motor stops the capacitors are still charged, so any subsequent starting can generate hazardous overvoltages if the charge is not discharged).

Caution

For a correct use of HSE series single-phase motors, the following points must be considered:

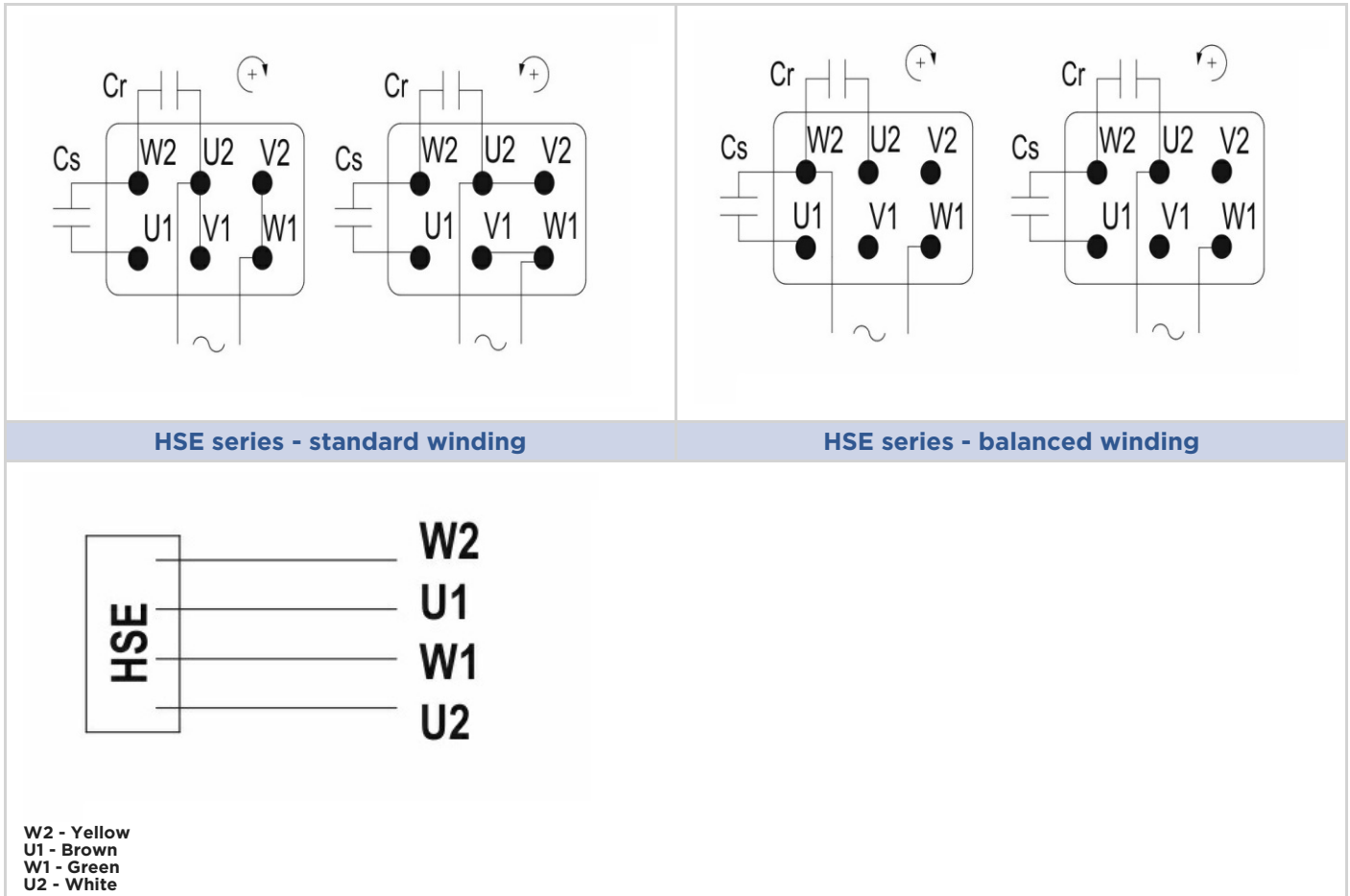
- The device's insertion time is around 1 second; this means that the device does not work if there are multiple starts in a period of less than one second;
- once the motor has started, the device disengages and can be restored only by shutting down and restarting the

2.9 SERIES AND HOOKUP

motor; under heavy, lengthy overloads which drastically reduce motor speed, the device does not act and the motor will tend to come to a stop; it is thus best that the motor is always coordinated with protection equipment in the electrical cabinet (thermal cutouts) to prevent the motor stalling or jamming. Upon request, to overcome this limit of the standard electronic cutout, a special electronic cutout can be requested: in case of temporary overload with strong speed reduction, it allows starting capacitor activation also when motor is already started.

Warning for all the single phase motors (S and HSE series)

Unlike the three phase motors, all the single phase motors have higher losses at no-load than full load: therefore you should not work at no-load for a long time to avoid overheating.



2.10.1 Brake motors

Standard motors (TS, TH, TP, D) can be constructed as brake motors (TBS, TBH, TBP, DB) when the driven machine must be stopped quickly and safely. This is done without modifying the motor's electrical or mechanical assemblies, except for the non-drive side where the brake is applied. The brake is electromagnetic in various versions for the range of possible applications.

Brake: FM

Power supply: DC

Action: Negative (1)

Applications: Ideal for applications which require smooth, silent and gradual operation (both in starting and braking thanks to the slower response of DC brakes), accompanied by rapid release and braking.

Typical applications: gearmotors, transfer machines, electric trucks.

Brake: MS

Power supply: AC

Action: Negative (1)

Applications: Ideal for applications requiring rapid and precise braking and high braking loads.

Typical applications: automation with a high number of actions, lifting and handling equipment, packaging and packing machines.

Brake: ML

Power supply: DC

Action: Negative (1)

Applications: Ideal for applications requiring smooth gradual braking and high loads per braking cycle (thanks to the steel or cast iron disk mounted to the motor shaft, which can dissipate high braking energies); also designed for reduced size and low cost.

Typical applications: cutting machines (e.g. wood working), safety stops (parking brakes).

(1) negative action: the brake acts without power supply.

If not otherwise specified, Motovario supplies brake motors with FM type DC brakes.

2.10.2 FM brake

Operation

The FM brake is a DC electromagnetic brake and acts with no power supply through the pressure of the springs. When the brake magnet (1) is powered, the moving coil (2) is attracted against the brake body and overcomes the spring force (7) thus leaving the shaft to which the brake disk (3) is mounted axially free on the toothed hub (4), to rotate freely. Once power is shut off, the springs press the moving coil and hence the disk mounted to the hub, against the motor shield (14) to brake the motor. Brake motors with FM brakes in the standard version have a standard protection rating of IP54.

Characteristics:

- power supply 230V±10% 50/60Hz or 400V±10% 50/60Hz; other voltages available as options. The brake's power voltage must always be specified if the brake is ordered with separate power supply (see below, "Hookup for DC brakes").
- service S1, insulation class F;
- silent friction surfaces, with no asbestos, with double braking surface;
- steel disk brake, sliding on splined drive hub; vibration damping O-ring;
- fixed braking moment selected in relation to nominal motor torque (value given in motor technical data table). Optionally, disks can be supplied with other braking moments; see column Mb in the table "Brake characteristic values". On request, brakes can be supplied with adjustable braking moment.

Options

- manual release lever with automatic return, hand lever can be removed; it is useful for manual operations in case of power outage or during installation; the lever is parallel to the terminal box cover; on request we can evaluate the possibility to supply the lever a different position; in case of gearmotors, the different positions available for the lever are always referred to the terminal block box position. As an option we can supply a release lever which can be locked in the released position, by screwing it in until it engages with a lug in the brake body.
- Anti-seizing stainless steel washer. This is a stainless steel washer mounted between the motor shield and brake disk to prevent the ferode from seizing to the shield, for example, during long periods of disuse.
- Brake motor with protection rating IP55. Including: a) protective boot to prevent foreign matter entering the brake (e.g.: textile flock); b) stainless steel washer between motor shield and brake disk; c) stainless steel hub and disk;
- Self-braking motor with IP65 degree of protection, in which, in addition to components for IP55 degree of protection are added: a) plastic caps to close the holes for the passage of the tie-beams of the release lever; b) brake fixing screws sealed with O-ring
- Self-braking motor with IP56 degree of protection, in which, in addition to components for IP55 degree of protection are added: a) hardware and brake fixing nuts in stainless steel; b) stainless steel springs.
- Self-braking motor with IP66 degree of protection which combines the characteristics for IP65 and for IP56.
- Motor with double FM brake. For applications in which, for instance, a redundant brake is required (e.g.: theatres) motors can be supplied with two FM brakes, each with its own rectifier. The motors are normally supplied with both brakes with separate power supply and, given the application, without ventilation, hence in duty S2 10 min or S3 10%.
- Silent brake. To ensure a lower noise level inside special environments. This is achieved by adding a O-ring between moving coil and electromagnet. This option is also available with dual brake and is therefore recommended for theatre applications.
- Hexagonal recess on non-drive side shaft end for manual rotation with straight hex key (6 mm key for ≤ size 90, 8 mm for sizes 100-112, 10 mm for size 132/160S);
- Microswitch to signal brake locking/releasing and brake ferode wear;
- Flywheel for gradual starting and braking. Brake motors with FM brake can be equipped with a steel hub, placed between the brake and fan, acting as a flywheel to increase the moment of inertia of the system. This is done to obtain
- starting and braking that are less sharp and more progressive to make the action smoother. Gradual starting and stopping is accomplished thanks to the increased moment of inertia, which extends the time of action for a given accelerating and braking torque. The overall length dimensions of the motor for application of the flywheel are
- unchanged with respect to the standard brake version.

Power supply

The brake is powered with direct current through a rectifier bridge, by rectifying the single-phase AC input:

- for three-phase TBS, TBH and TBP motors, the standard input voltage is 230V AC, rectified with a half-wave rectifier to obtain an output of 103V DC; the brake's power supply may be direct (drawn from the motor's power supply) or separate, from an external source (separate power option);
- for 2 pole three-phase DB motors, the standard input voltage is 400V AC, rectified with a half-wave rectifier to obtain an output of 178V DC; in this case the brake power supply is always separate.

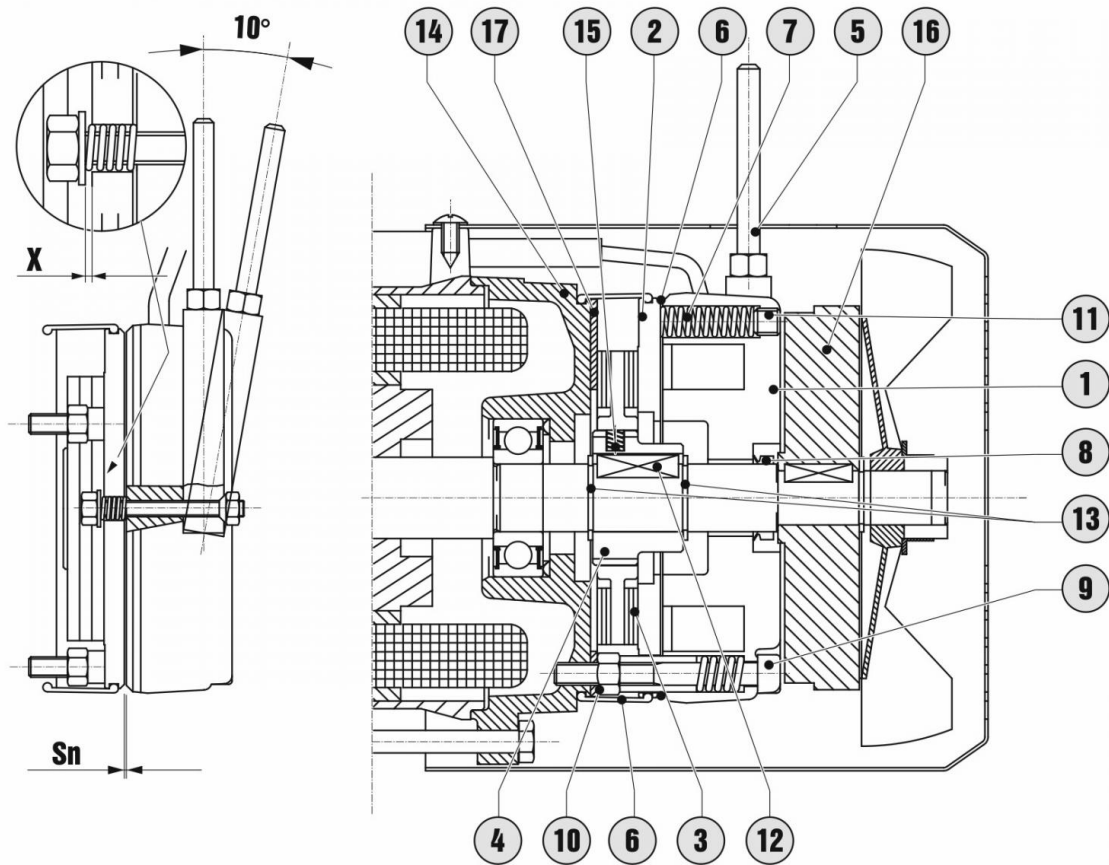
Optionally, brakes are available for the following power voltages: 115V AC, 133V AC, 200V AC, 208V AC, 230V AC, 255V AC, 265V AC, 280V AC, 290V AC, 330V AC, 346V AC, 380V AC, 400V AC, 415V AC, 12V DC, 24V DC, 103V DC, 178V DC (if a voltage is requested directly in DC, it is understood that the brake motor will be supplied without rectifier). Possible rectifiers are listed below:

- a. half-wave rectifier with NBR filter (standard from size 63 to size 100); in special cases, to adapt the requested AC

voltage to the brake winding's DC voltage, a full-wave DBR rectifier is supplied instead of an NBR rectifier (e.g. 115V AC-103V DC). DBR rectifiers have comparable braking and release response times to NBR rectifiers.

- b. half-wave quick detachment rectifier SBR (standard for sizes 112 and 132/160S; optional for sizes 63-100), thanks to which the brake, when release starts, is powered with full-wave rather than half-wave voltage; this results in shorter release times than standard (see "Brake characteristic values" and "Hookup for FM and ML brakes"); it is thus ideal for applications with frequent multiple braking cycles (e.g. lifting).
- c. half-wave rapid braking rectifier RSD (optional for size 63 to size 100), which reduces the brake de-excitation period, thus giving braking times comparable to those obtainable by opening the DC side (see "Brake characteristic values" and "Hookup for FM and ML brakes"). This rectifier does not have a rapid braking contact (see "Hookup for FM and ML brakes") and is only available for brake voltages 230V AC - 103V DC and 400V AC - 178V DC.
- d. half-wave rectifier for quick detachment and braking RRSD (as an option on all sizes), combines type b) and c) functionality. This rectifier does not have a rapid braking contact (see "Hookup for FM and ML brakes") and is only available for brake voltages 230V AC - 103V DC and 400V AC - 178V DC.

All rectifiers except for RRSD are also available in versions homologated to the UL/CSA standards. All rectifiers are compliant with the Low Voltage Directive 2006/95/CE; in relation to the EMC Directive 2004/108/CEE, the rectifier/coil assembly is conforming due to the use of a filter on the rectifier (NBR); for DC brakes with rapid half-wave rectifier (SBR, RSD and RRSD) the filter is implemented by connecting a capacitor (440V AC 0.22 μ F class X2 per EN132400) in parallel with the AC power supply (default configuration for this type of rectifier).



1. Brake magnet
2. Moving coil
3. Brake disk
4. Drive hub
5. Release lever (optional)
6. Boot (in combination with IP 55)
7. Thrust springs
8. V-ring (in combination with IP 55)
9. Mounting bolt
10. Locknuts
11. Braking torque adjuster screw (on request)
12. Key
13. Circlip
14. Cast iron shield
15. Vibration damping O-ring
16. Flywheel (optional)
17. Anti-seizing stainless steel washer (optional)

Brake characteristic values

| | T | S _n | S _{max} | X | J _B | W | W ₁ | t ₁ | t ₁₁ | t ₂ | t ₂₂ | m _B | P _a | M _B | m _F | J _F |
|------------------|------|----------------|------------------|-----|----------------|------|----------------|----------------|-----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| 63 | ..2 | 0,2 | 0,5 | 0,6 | 0,6 | 260 | 15,6 | 30 | 20 | 100 | 10 | 1,5 | 16 | 1,8-3,5 | 0,7 | 6,1 |
| 71 | ..3 | 0,2 | 0,5 | 0,8 | 1,1 | 370 | 22,4 | 60 | 25 | 120 | 10 | 2,2 | 20 | 2,5-5-7,5-10 | 1,1 | 13 |
| 80 | ..4 | 0,3 | 0,6 | 1 | 1,6 | 500 | 30 | 100 | 40 | 150 | 10 | 3,1 | 30 | 5-10-15-20 | 1,7 | 28 |
| 90S-L | ..5 | 0,3 | 0,6 | 1 | 3,5 | 750 | 45 | 120 | 50 | 220 | 15 | 4,9 | 40 | 13-26-40-55 | 2,3 | 54 |
| 100 | ..5 | 0,3 | 0,6 | 1 | 3,5 | 750 | 45 | 120 | 50 | 220 | 15 | 4,9 | 40 | 13-26-40-55 | 3,1 | 98 |
| 112 | ..6S | 0,35 | 0,7 | 1,2 | 8,8 | 1000 | 70 | - | 80 | 300 | 30 | 8,3 | 50 | 20-40-60 | 4,5 | 145 |
| 132S | ..6 | 0,35 | 0,7 | 1,2 | 10,3 | 1100 | 77 | - | 80 | 200 | 20 | 9,5 | 65 | 37-50-75-100 | 4,8 | 200 |
| 132M-160S | ..7 | 0,4 | 0,8 | 1,2 | 22,5 | 1650 | 132 | - | 100 | 200 | 20 | 12,3 | 65 | 50-100-150 | 6,9 | 350 |

T = Type

S_n = nominal airgap [mm]

S_{max} = maximum airgap [mm]

X = release lever play [mm]

J_B = brake disk moment of inertia [kgcm²]

W = maximum energy which can be dissipated by brake [MJ]

W₁ = energy which can be dissipated between two successive adjustments of airgap from S_n to S_{max} [MJ]

t₁(*) = brake release time with normal detachment rectifier (NBR, RSD) [ms]

t₁₁(*) = brake release time with rapid detachment rectifier (SBR, RRSD) [ms]

t₂(*) = brake response time - AC side opening [ms]

t₂₂(*) = brake response time - DC side opening [ms]

m_B = weight [kg]

P_a = power absorption [W]

M_B = brake moments available [Nm]

m_F = flywheel weight [kg]

J_F = flywheel moment of inertia [kgcm²]

(*) NOTE: the effective values may deviate slightly in relation to the ambient temperature and humidity, the brake temperature and wear of the friction surfaces; t₁, t₁₁, t₂ and t₂₂ refer to a brake calibrated with medium airgap, nominal voltage and separate power; as regards the braking moment, one must allow for running in to allow the ferode to adapt to the braking surface of the motor shield, for a period which depends on the actual braking loads; once running in is completed, in nominal operating conditions one can expect a deviation from the declared value of ±15%.

2.10.3 ML brake

Operation

The ML brake is a DC electromagnetic brake and acts with no power supply through the pressure of the springs. When the brake magnet (1) is powered, the moving coil (2) is attracted and overcomes the spring force (4) thus leaving the shaft, to which the brake disk + fan (9) are locked, to rotate freely. When power is shut off, the springs push the moving coil against the disk, thus braking the shaft. Brake motors with ML brakes in the standard version have a standard protection rating of IP54. High protection ratings are not available.

Characteristics:

- power voltage 230V±10% 50/60Hz or 400V±10% 50/60Hz;
- duty S1, insulation class F;
- silent, asbestos free friction surface;
- steel or cast iron braking flywheel;
- axial dimensions less than FM brake;
- airgap adjustable with one nut or collar;
- braking moment set for motor size (see value M_B in "Brake characteristic values");
- O-ring gasket protects airgap from dust and other external agents.

Options

- Manual release lever with automatic return, hand lever can be removed; it is useful for manual operations in case of power outage or during installation; the lever is parallel to the terminal box cover; on request we can evaluate the possibility to supply the lever a different position; in case of gearmotors, the different positions available for the lever are always referred to the terminal block box position.
- Microswitch to signal brake locking/releasing and brake ferode wear.

Braking moment

For each motor size, independently of the torque delivery, the braking moment is given by the value M_B in the table; the braking moment is NOT adjustable.

Power supply

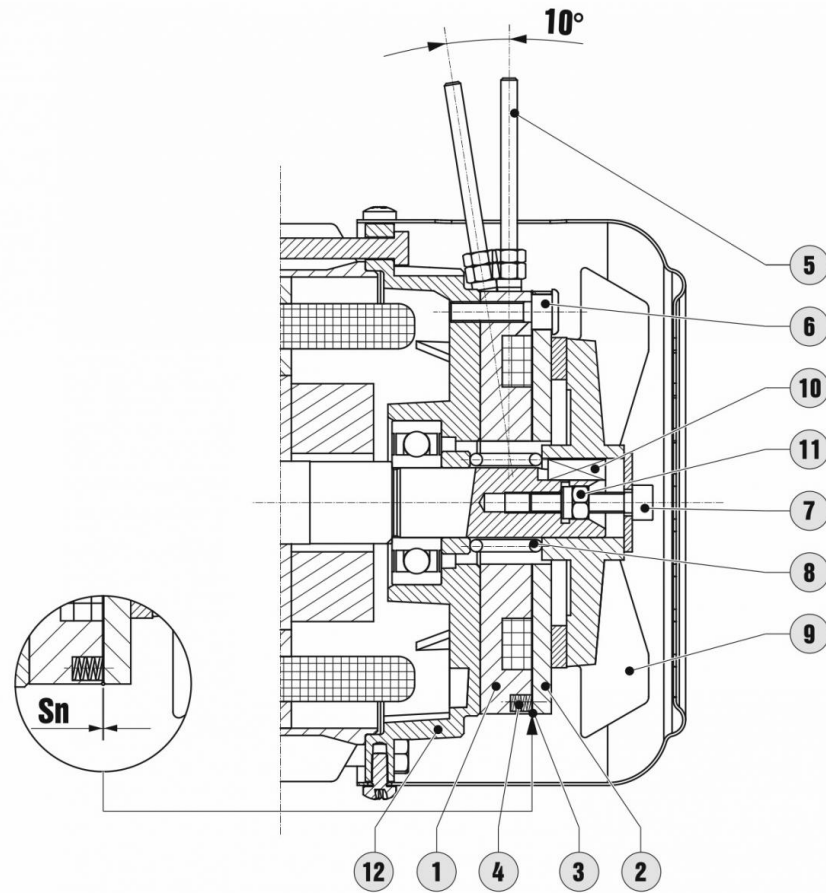
The brake is powered with direct current through a rectifier bridge, by rectifying the single-phase AC input:

- for three-phase TBS, TBH and TBP motors, the standard input voltage is 230V AC, rectified with a half-wave rectifier to obtain an output of 103V DC; the brake's power supply may be direct (drawn from the motor's power supply) or separate, from an external source (separate power option);
- for 2 pole three-phase DB motors, the standard input voltage is 400V AC, rectified with a halfwave rectifier to obtain an output of 178V DC; in this case the brake power supply is always separate.

Optionally, brakes can be supplied for the following voltages; 115V AC, 133V AC, 200V AC, 208V AC, 230V AC, 255V AC, 290V AC, 330V AC, 346V AC, 380V AC, 400V AC, 415V AC, 12V DC, 24V DC, 103V DC, 178V DC. If a voltage is requested directly in DC, then the brake motor will be supplied without rectifier. Possible rectifiers are listed below:

- half-wave rectifier with NBR filter (standard from size 63 to size 100); in special cases, to adapt the requested AC voltage to the brake winding's DC voltage, a full-wave DBR rectifier is supplied instead of an NBR rectifier (e.g. 115V AC-103V DC). DBR rectifiers have comparable braking and release response times to NBR rectifiers.
- half-wave quick detachment rectifier SBR (standard for sizes 112 and 132/160S; optional for sizes 63-100), thanks to which the brake, when release starts, is powered with full-wave rather than half-wave voltage; this results in shorter release times than standard (see "Brake characteristic values"); it is thus ideal for applications with frequent multiple braking cycles (e.g. lifting).
- half-wave rapid braking rectifier RSD (optional for size 63 to size 100), which reduces the brake de-excitation period, thus giving braking times comparable to those obtainable by opening the DC side (see "Brake characteristic values"). This rectifier is only available for brake voltages 230V AC - 103V DC and 400V AC - 178V DC.
- half-wave rectifier for quick detachment and braking RRSD (optionally available for all sizes), combines type b) and c) functionality. This rectifier is only available for brake voltages 230V AC - 103V DC and 400V AC - 178V DC.

All rectifiers except for RRSD are also available in versions homologated to the UL/CSA standards All rectifiers are compliant with the Low Voltage Directive 2006/95/CE; in relation to the EMC Directive 2004/108/CEE, the rectifier/coil assembly is conforming due to the use of a filter on the rectifier (NBR); for DC brakes with rapid half-wave rectifier (SBR, RSD and RRSD) the filter is implemented by connecting a capacitor (440V AC 0.22mF class X2 per EN132400) in parallel with the AC power supply (default configuration for this type of rectifier).



1. Brake magnet
2. Moving coil
3. O-ring
4. Thrust springs
5. Release lever (optional)
6. Mounting bolt
7. Airgap adjuster screw
8. Return spring
9. Steel/cast iron disk + fan
10. Key
11. Self-locking nut
12. Motor shield

Brake characteristic values

| | T | S _n | S _{max} | J _B | W | W ₁ | t ₁ | t ₂ | t ₂₂ | m _B | P _a | M _B |
|----------------|----|----------------|------------------|----------------|------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|
| 63 | 3 | 0,2 | 0,5 | 3 | 250 | 30 | 30 | 80 | 8 | 1,1 | 18 | 3 |
| 71 | 4 | 0,2 | 0,6 | 5 | 250 | 40 | 40 | 100 | 10 | 1,3 | 18 | 4 |
| 80 | 7 | 0,2 | 0,6 | 10 | 375 | 60 | 60 | 150 | 15 | 2,1 | 25 | 7 |
| 90S-L | 7 | 0,2 | 0,6 | 11 | 375 | 60 | 60 | 150 | 15 | 2,1 | 25 | 7 |
| 100 | 13 | 0,25 | 0,65 | 30 | 500 | 80 | 100 | 250 | 15 | 3,6 | 35 | 13 |
| 112 | 13 | 0,25 | 0,65 | 34 | 500 | 80 | 100 | 250 | 25 | 4 | 35 | 13 |
| 132S-M 160S | 30 | 0,3 | 0,7 | 50 | 1650 | 132 | 150 | 400 | 40 | 7,4 | 60 | 30 |

T = Type

S_n = nominal airgap [mm]

S_{max} = maximum airgap [mm]

J_B = brake disk moment of inertia [kgcm²]

W = maximum energy which can be dissipated by brake [MJ]

W₁ = energy which can be dissipated between two successive adjustments of airgap from S_n to S_{max} [MJ]

t₁(*) = brake release time [ms]

t₂(*) = brake response time - AC side opening [ms]

t₂₂(*) = brake response time - DC side opening [ms]

m_B = weight [kg]

P_a = power absorption [W]

M_B = brake moments available [Nm]

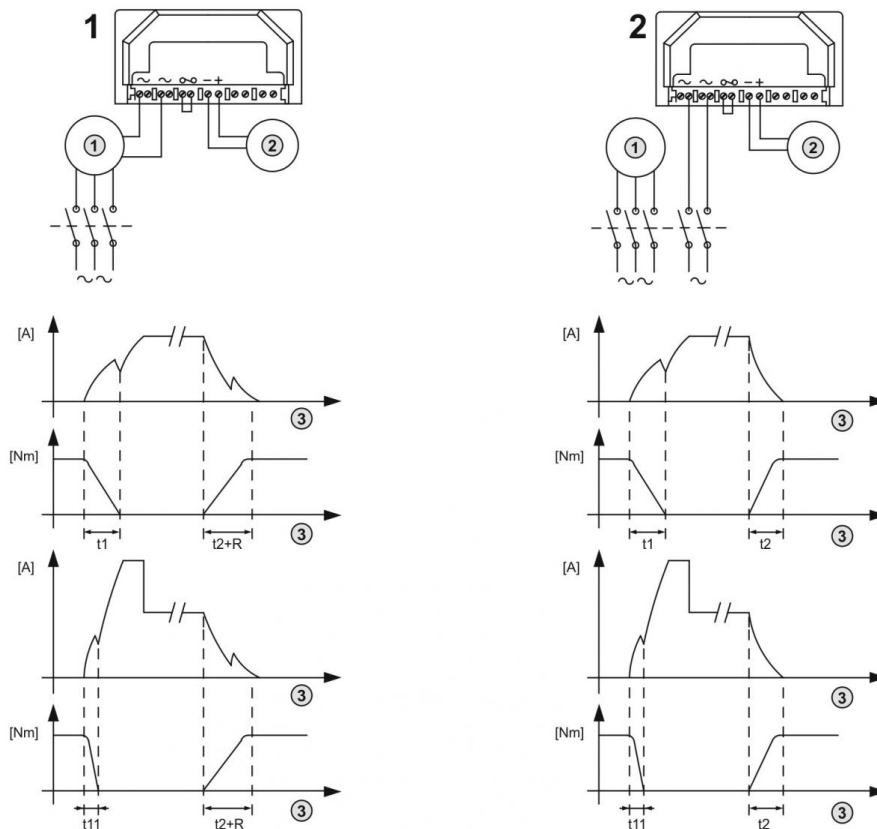
(*) NOTE: the effective values may deviate slightly in relation to the ambient temperature and humidity, the brake temperature and wear of the friction surfaces; t₁, t₂ and t₂₂ refer to a brake calibrated with medium airgap, nominal voltage and separate power; as regards the braking moment, one must allow for running in to allow the ferode to adapt to the braking surface of the motor shield, for a period which depends on the actual braking loads; once running in is completed, in nominal operating conditions one can expect a deviation from the declared value of ±10%.

2.10.4 Hookup for FM and ML brakes

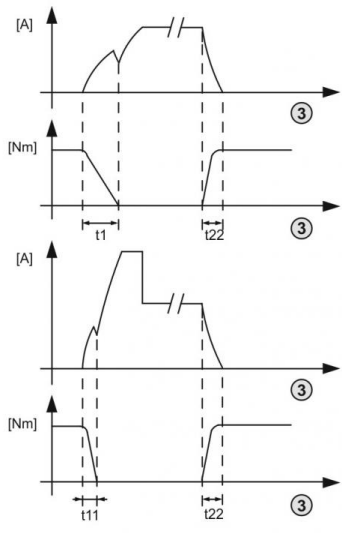
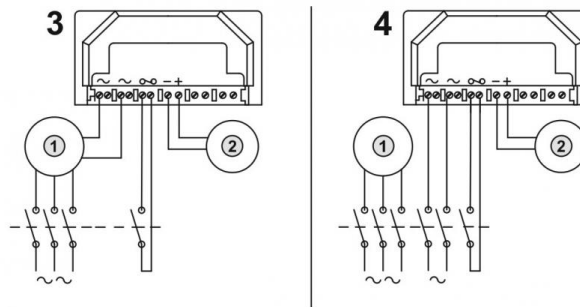
If the brake power is derived directly from the motor or is independent, one speaks of direct and separate brake power respectively. In detail, with reference to the figures given below:

1. Direct brake power: supply cables on the AC side of the rectifier are connected to the motor's power terminal board; when you power up the motor, the brake coil is automatically energised and the brake is released; when power to the motor is shut off, the brake automatically brakes the motor. During this phase, the brake response time t_2 has to be added to the delay R generated by the inertia of the load and by the energy accumulated by the motor. R changes in every motor and – as it depends on the load – cannot be previously calculated.
2. Separate brake power, brake opens only from the AC side: the brake is powered, via the rectifier, off terminals separate from those of the motor. In this case stop time t_2 does not depend on the characteristics of both the motor and load.
3. Direct brake power, DC side opens: connection possible on the basis of type 1, if one can cable the rectifier's rapid braking contact (DC side opening) as shown in figure 3. Despite the direct power supply (see point 1), the braking response time is independent of the characteristics of the motor and load, and is significantly shorter than that of case 2 ($t_{22} < t_2$). This connection is thus an alternative to the use of rapid braking rectifiers (RSD and RRSD).
4. Separate brake power, AC and DC sides open: connection possible on the basis of type 2, if one can cable the rectifier's rapid braking contact (DC side opening) as shown in figure 4. Response time equal to that of type 3, hence this connection is an alternative to the use of rapid braking rectifiers (RSD and RRSD). The advantage over the previous case is that, during braking, the energy accumulated by the motor does not discharge into the rectifier, thus safeguarding its service life.

Motovario supplies brakes connected as type 1 or 2 when ordered as “direct” or “separate” power supply respectively. Type 3 and 4 connections must be implemented by the client. If SBR rapid release rectifiers are used, the brake release time reduces from t_1 to t_{11} (see graph below). In case of independent power supply of the brake through direct current, therefore without any rectifier (ex. 24Vdc), the supply cables of the brake are set inside the terminal box and connected in a fly terminal board mammuth type. In this case, not considering the external power supply, for the time of operations you can refer to case 4.



2.10 BRAKE MOTORS



2.10.5 MS brake

Operation

MS brake is an a. c. electromagnetic brake and acts with no power supply through the pressure of the springs. When the brake magnet (1) is powered, the moving coil (2) is attracted against the brake body and overcomes the spring force (7) thus leaving the shaft to which the brake disk (3) is mounted axially free on the toothed hub (4), to rotate freely. Once power is shut off, the springs press the moving coil and hence the disk mounted to the hub, against the motor shield (14) to brake the motor.

Characteristics

- standard power supply voltage 230/400V±10% 50Hz 265/460V±10% 60Hz; other voltages available as options;
- duty S1, insulation class F;
- silent friction surfaces, with no asbestos, with double braking surface;
- steel brake disk sliding on the splined driving hub;
- fixed braking moment selected in relation to nominal motor torque (value given in motor technical data table). Optionally, disks can be supplied with other braking moments; see column M_D in the table "Brake characteristic values". On request, brakes can be supplied with adjustable braking moment.

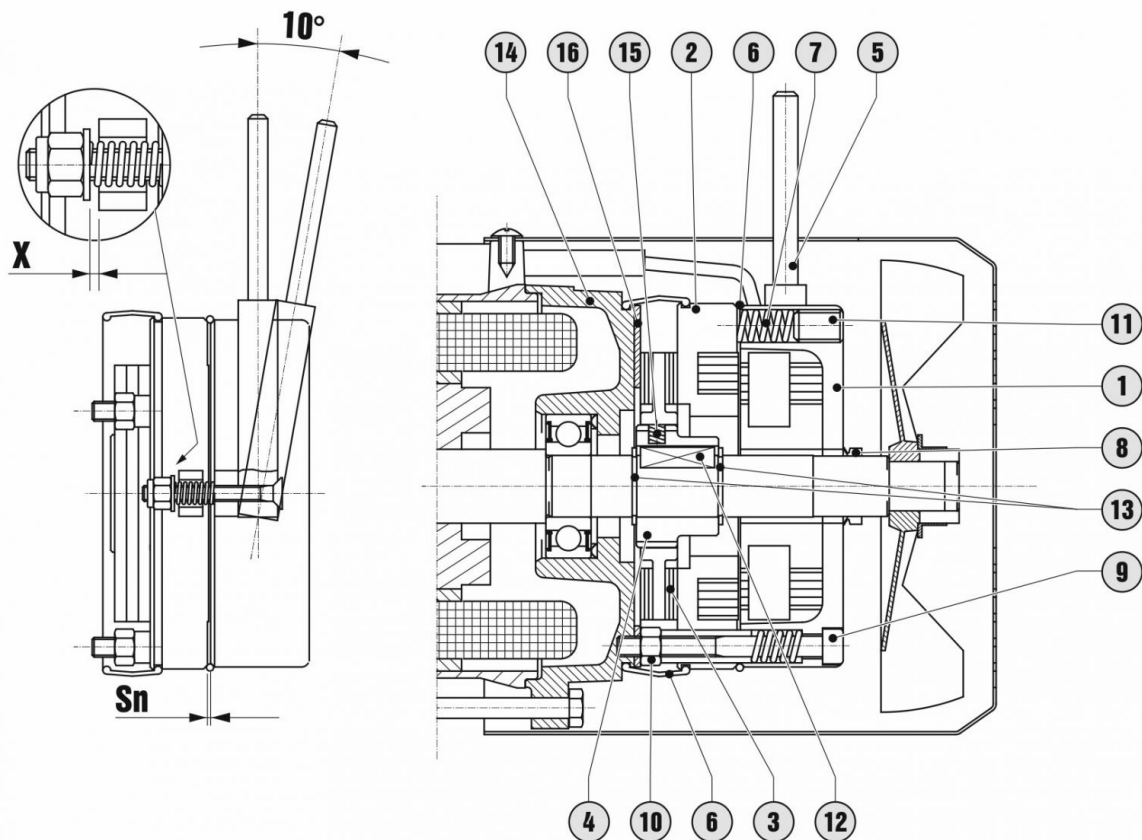
Options

- Manual release lever with automatic return, hand lever can be removed; it is useful for manual operations in case of power outage or during installation; the lever is parallel to the terminal box cover; on request we can evaluate other lever positions; in case of gearmotors, the different positions available for the lever are always referred to the terminal block box position.
- Anti-seizing stainless steel washer. This is a stainless steel washer mounted between the motor shield and brake disk to prevent the ferode from seizing to the cast iron shield, for example, during long periods of disuse.
- Brake motor with protection rating IP55 for applications in special conditions (e.g. installation outdoors) including: a) boot + O-ring to prevent foreign matter entering the brake (e.g.: textile flock); b) stainless steel washer between motor shield and brake disk; c) stainless steel hub and disk; d) V-ring on the motor shaft.
- Hexagonal recess on non-drive side shaft end for manual rotation with straight hex key (6 mm key for ≤ size 90, 8 mm for sizes 100-112, 10 mm for size 132/160S).

Power supply

The brake is powered AC 230/400V±10% 50Hz.

Optionally, brakes can be supplied for the following voltages: 115/200V 50Hz, 120/208V 60Hz, 133/230V 50Hz, 208/360V 50Hz, 208/360V 60Hz, 255/440V 50Hz, 200/346-220/380V 50-60Hz, 290/500-330/575V 50-60Hz, 400/690-460/800V 50-60Hz. In three-phase TBS, TBH and TBP motors, the brake is usually powered directly from the motor's power supply (direct power). Separate brake power is available as an option; in this case, a second terminal block is mounted in the terminal box to which are cabled the brake cables and an additional cable gland is provided to route the brake power cord into the terminal box; brake power is always separate for 2 pole three-phase DB motors.



1. Brake magnet
2. Moving coil
3. Brake disk
4. Drive hub
5. Release lever (optional)
6. Boot + O-ring (optional)
7. Thrust springs
8. V-ring (optional - in combination with protective boot + O-ring)
9. Mounting bolt
10. Locknuts
11. Braking torque adjuster screw (on request)
12. Key
13. Circlip
14. Cast iron shield
15. Vibration damping O-ring
16. Anti-seizing stainless steel washer (optional)

Brake characteristic values

| | T | S _n | S _{max} | X | J _B | W | W ₁ | t ₁ | t ₂ | m _B | P _a | M _B |
|--------------------|------|----------------|------------------|-----|----------------|------|----------------|----------------|----------------|----------------|----------------|----------------|
| 63 | ..2 | 0,2 | 0,5 | 0,6 | 0,6 | 260 | 15,6 | 4 | 20 | 1,3 | 60 | 1,8-3,5 |
| 71 | ..3 | 0,2 | 0,5 | 0,8 | 1,1 | 370 | 22,4 | 4 | 40 | 1,9 | 80 | 2,5-5-7,5-10 |
| 80 | ..4 | 0,3 | 0,6 | 1 | 1,6 | 500 | 30 | 6 | 60 | 3 | 110 | 5-10-15-20 |
| 90S-90L-100 | ..5 | 0,3 | 0,6 | 1 | 3,5 | 750 | 45 | 8 | 90 | 5,6 | 250 | 13-26-40 |
| 112 | ..6S | 0,35 | 0,7 | 1,2 | 8,8 | 1000 | 70 | 16 | 120 | 9,7 | 470 | 40-60 |
| 132S | ..6 | 0,35 | 0,7 | 1,2 | 10,3 | 1100 | 77 | 16 | 140 | 10,3 | 550 | 50-75-100 |
| 132L-M/160S | ..7 | 0,4 | 0,8 | 1,2 | 22,5 | 1650 | 132 | 16 | 180 | 14,7 | 600 | 50-100-150 |

T = Type

S_n = nominal airgap [mm]

S_{max} = maximum airgap [mm]

X = release lever play [mm]

J_B = brake disk moment of inertia [kgcm²]

W = maximum energy which can be dissipated by brake [MJ]

W₁ = energy which can be dissipated between two successive adjustments of airgap from S_n to S_{max} [MJ]

t₁(*) = brake release time [ms]

t₂(*) = brake response time [ms]

m_B = weight [kg]

P_a = power absorption [VA]

M_B = brake moments available [Nm]

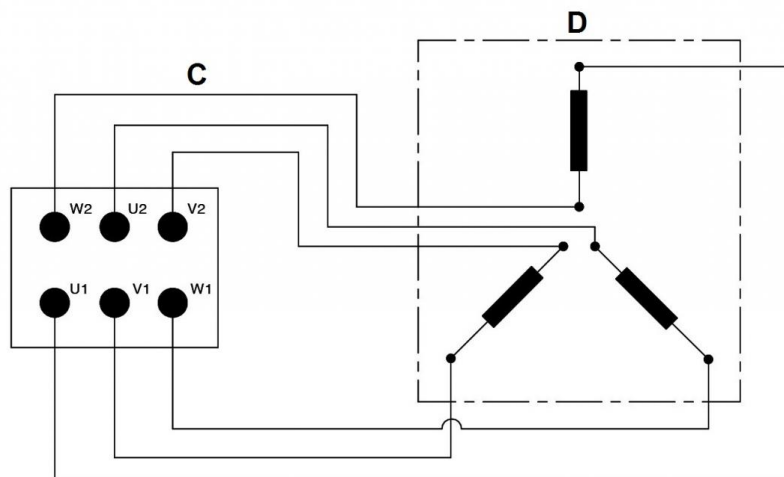
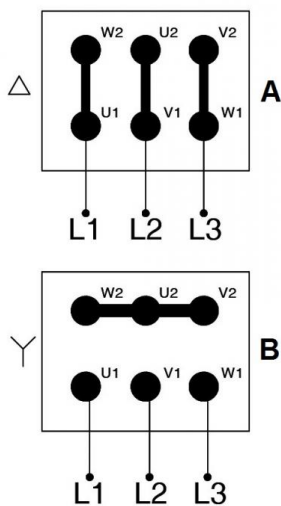
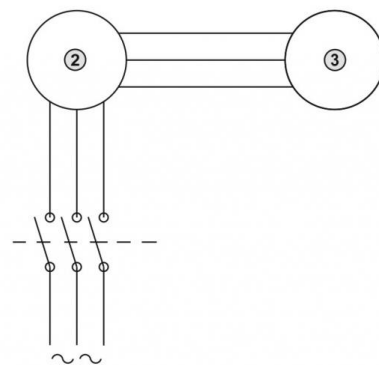
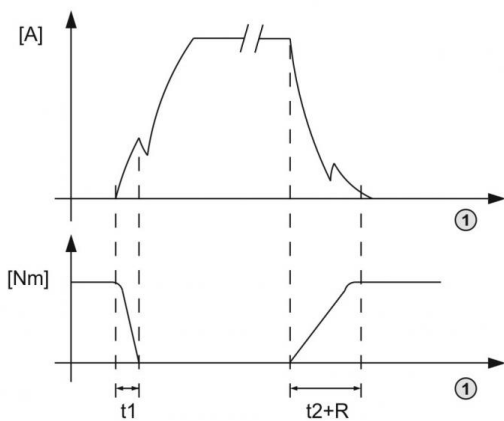
(*) NOTE: the effective values may deviate slightly in relation to the ambient temperature and humidity, the brake temperature and wear of the friction surfaces; t₁ and t₂ refer to a brake calibrated with medium airgap, nominal voltage and separate power; as regards the braking moment, one must allow for running in to allow the ferode to adapt to the braking surface of the motor shield, for a period which depends on the actual braking loads; once running in is completed, in nominal operating conditions one can expect a deviation from the declared value of ±10%.

2.10.6 Hookup for MS brakes

1. Direct brake power: the brake is powered directly off the motor's terminal block; when the motor is powered up, the brake coil is automatically energised and the brake is released; when power to the motor is shut off, the brake coil is automatically de-energised and the brake brakes the motor. During this phase, the braking response time t_2 has to be added to delay R, generated by the inertia of the load and by the energy accumulated by the motor. R changes in every motor and - as it depends on the load - cannot be previously calculated.

- 1. Time
- 2. Motor
- 3. Brake

- A. Delta connection
- B. Star connection
- C. Motor terminal board
- D. Brake

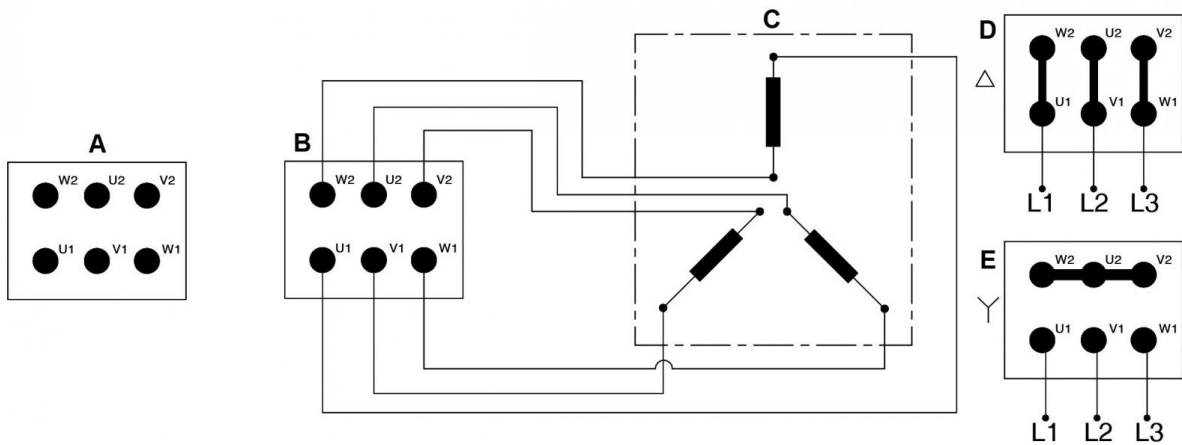
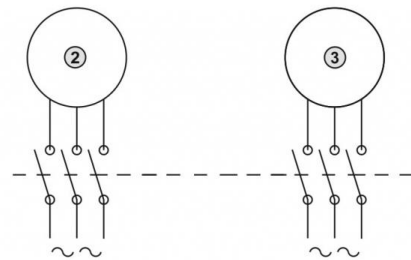
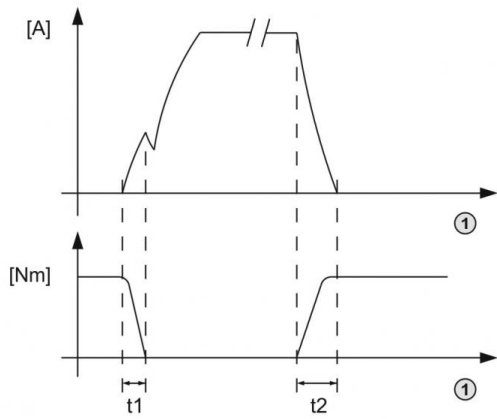


2.10 BRAKE MOTORS

2. Separate brake power: the brake is powered off a terminal block separate from the motor's block; in this case t_1 and t_2 depend only on the characteristics of the brake.

- 1. Time
- 2. Motor
- 3. Brake

- A. Motor terminal board
- B. Auxiliary terminal board
- C. Brake
- D. Delta connection
- E. Star connection



2.10.7 Notes and calculations

Calculating the braking moment

The rating of the brake depends largely on the moment of inertia it is to brake, the number of braking cycles per hour, the severity of the duty and the required stopping times; in particular, the following must be borne in mind:

- braking moment;
- wear of friction surfaces in relation to service intervals;
- thermal load (work which can be dissipated by the brake in relation to the load's moment of inertia and the number of cycles per hour);
- special ambient conditions for which guards or corrosion proofing are required.

The calculation of the braking moment M_B for a given application depends on the following design parameters:

J_{tot} = total inertia of rotating parts reduced to motor shaft [kgm²]

n_0 = motor shaft speed [rpm]

t_F = braking time [s]

M_L = moment of load acting on system (e.g. load to be lifted, resisting moment, etc.)

The braking moment is calculated as follows:

$$M_B = K [(2\pi * n_0 / 60) * J_{tot} \pm M_L] / t_F$$

where:

- K = safety coefficient (≥ 2)
- M_L takes the following sign:
 - "-" when lifting a weight or torque opposing the motor's direction of rotation;
 - "+" when lowering a weight or torque in the motor's direction of rotation.

Verification of heat which can be dissipated

In each cycle, the energy of the moving masses is transformed into heat by friction. The work done during braking is:

$$W_B = J_{tot} * [(2\pi * n_0 / 60)^2 / 2] * [M_B / M_B \pm M_L] \quad [J]$$

When we know the work done during a braking cycle W_B , the application's number of cycles per hour Z must be less than the maximum number of cycles per hour permitted for the type of brake selected as shown in the graph ($W_{Bmax}-Z$).

Instead, when we know the number of cycles per hour Z, the corresponding maximum work to be done W_{Bmax} must be greater than that of the actual application (calculation).

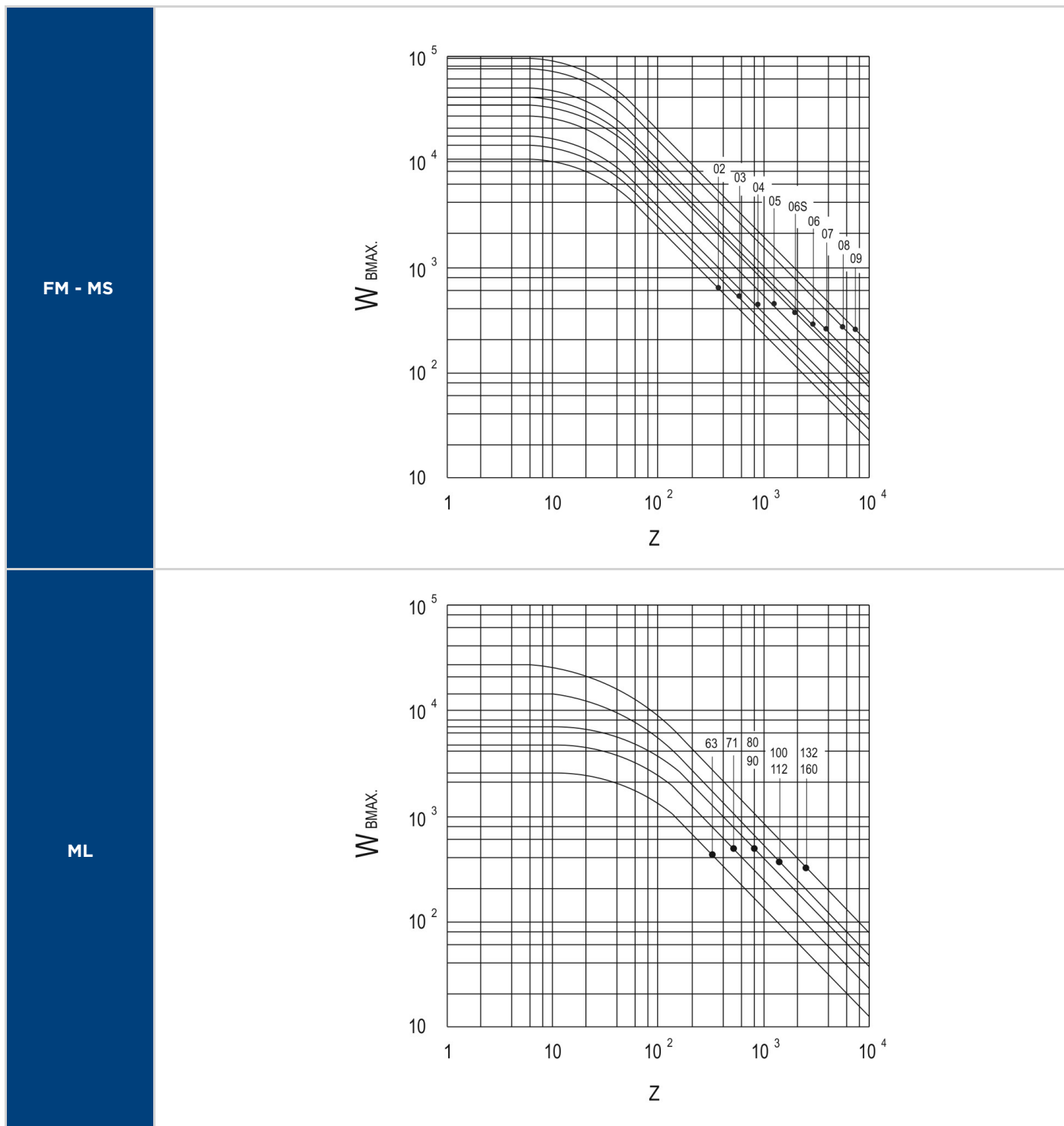
2.10 BRAKE MOTORS

Braking work which can be dissipated between two adjustments

Given the moments of inertia of the moving masses reduced to the shaft to be braked, and once the work per cycle W_B has been calculated, the number of cycles per interval between two successive adjustments is:

$$N = W_1 / W_B$$

W_1 is given in the table for the type of brake in question.



Starting frequency

For a given application, the maximum starting frequency Z in relation to the load and the inertias can be determined as:

$$Z = K_J * K_M * Z_0 \quad [h^{-1}]$$

where:

K_J = coefficient given in the table in relation to J/J_T

K_M = coefficient given in the table in relation to M_L/M_S

J_T = moment of inertia of the motor

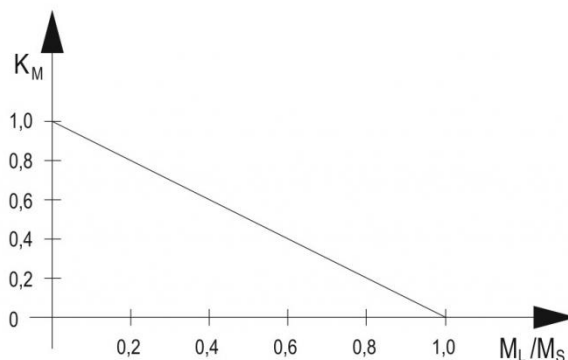
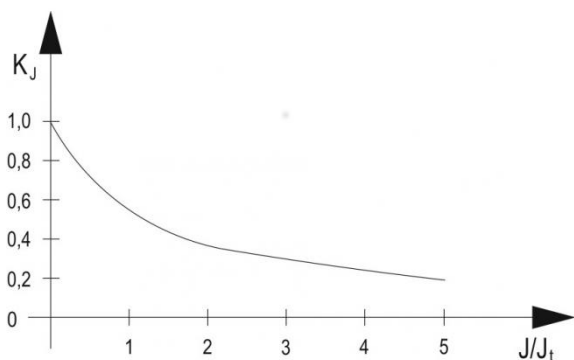
J = moment of inertia of the load excluding that of the motor itself

M_S = motor starting torque

M_L = resisting moment

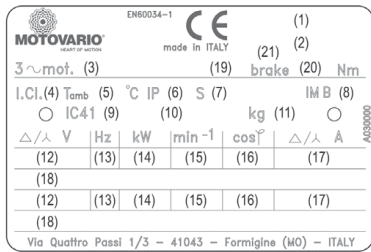
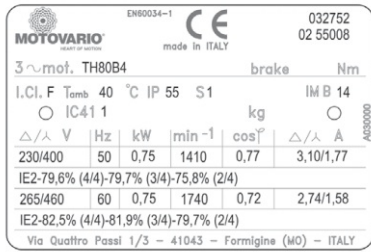
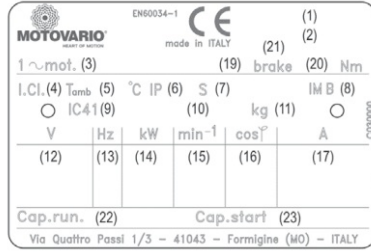
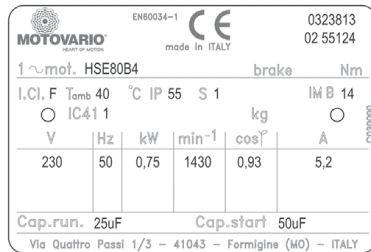
Z_0 = starting frequency under load and inertia except for that of the motor itself (value given in the performance data tables for each type of motor).

The resulting starting frequency Z must be less than the maximum number of cycles/hour permitted for the brake; if this condition is not met, the brake is unable to dissipate the heat generated by braking, so one must either reduce the starting frequency or oversize the brake (see brake ratings paragraph). If the value of Z is close to Z_0 , it is advisable to keep the motor windings temperature under control with, for instance, a bimetal cutout.



2.11 ELECTRIC MOTOR IDENTIFICATION

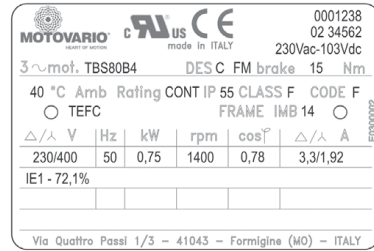
Electric motor can feature a metal silk-screen printed and/or punched nameplate or an adhesive label glued on metal support.

| | |
|---|--|
| <p>THREE-PHASE MOTOR NAMEPLATE LAYOUT</p> |  <p>EN60034-1 CE (1) MOTOVARIO made in ITALY (21) (2) 3~mot. (3) (19) brake (20) Nm I.Cl.(4) Tamb (5) °C IP (6) S (7) IM B (8) ○ IC41 (9) (10) kg (11) ○ Δ/Δ V Hz kW min⁻¹ cosφ Δ/Δ A (12) (13) (14) (15) (16) (17) (18) (12) (13) (14) (15) (16) (17) (18) Via Quattro Passi 1/3 - 41043 - Formigine (MO) - ITALY</p> |
| <p>THREE-PHASE MOTOR - FILLED-OUT EXAMPLE</p> |  <p>EN60034-1 CE 032752 MOTOVARIO made in ITALY 02 55008 3~mot. TH80B4 brake Nm I.Cl. F Tamb 40 °C IP 55 S1 IM B 14 ○ IC41 1 kg ○ Δ/Δ V Hz kW min⁻¹ cosφ Δ/Δ A 230/400 50 0,75 1410 0,77 3,10/1,77 IE2-79,6% (4/4)-79,7% (3/4)-75,8% (2/4) 265/460 60 0,75 1740 0,72 2,74/1,58 IE2-82,5% (4/4)-81,9% (3/4)-79,7% (2/4) Via Quattro Passi 1/3 - 41043 - Formigine (MO) - ITALY</p> |
| <p>SINGLE-PHASE MOTOR NAMEPLATE LAYOUT</p> |  <p>EN60034-1 CE (1) MOTOVARIO made in ITALY (21) (2) 1~mot. (3) (19) brake (20) Nm I.Cl.(4) Tamb (5) °C IP (6) S (7) IM B (8) ○ IC41 (9) (10) kg (11) ○ V Hz kW min⁻¹ cosφ A (12) (13) (14) (15) (16) (17) Cap.run. (22) Cap.start (23) Via Quattro Passi 1/3 - 41043 - Formigine (MO) - ITALY</p> |
| <p>SINGLE-PHASE MOTOR - FILLED-OUT EXAMPLE</p> |  <p>EN60034-1 CE 0323813 MOTOVARIO made in ITALY 02 55124 1~mot. HSE80B4 brake Nm I.Cl. F Tamb 40 °C IP 55 S 1 IM B 14 ○ IC41 1 kg ○ V Hz kW min⁻¹ cosφ A 230 50 0,75 1430 0,93 5,2 Cap.run. 25uF Cap.start 50uF Via Quattro Passi 1/3 - 41043 - Formigine (MO) - ITALY</p> |

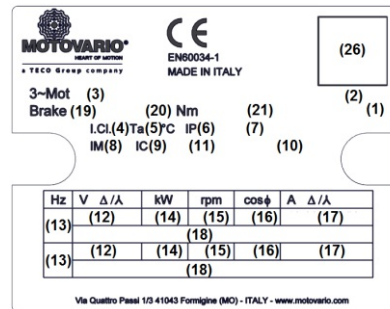
UL/CSA MOTOR NAMEPLATE



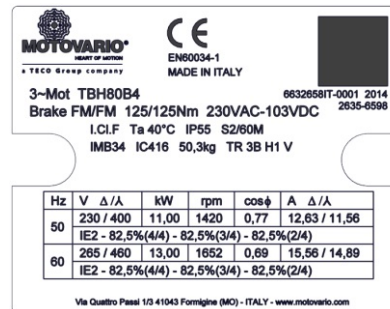
UL/CSA MOTOR - FILLED-OUT



THREE-PHASE MOTOR LABEL



THREE-PHASE MOTOR - FILLED-OUT EXAMPLE



SINGLE-PHASE MOTOR LABEL

MOTOVARIO
TECO Group company

CE
EN60034-1
MADE IN ITALY

(26)

1-Mot (3)
Brake Nm (2) (1)

I.Cl.(4)Ta(5)[°]C IP(6) (7)
IM(8) IC(9) (11)

| Hz | V | kW | rpm | cosφ | A |
|------|------|------|------|------|------|
| (13) | (12) | (14) | (15) | (16) | (17) |

Cap. run. (22)μF Cap. start. (23)μF

Via Quattro Passi 1/3 41043 Formigine (MO) - ITALY - www.motovario.com

SINGLE-PHASE MOTOR - FILLED-OUT EXAMPLE

MOTOVARIO
TECO Group company

CE
EN60034-1
MADE IN ITALY

1-Mot TBH80B4
Brake FM/FM 125/125Nm 230VAC-103VDC
I.Cl.F Ta 40[°]C IP55 S2/60M
IMB34 IC416 50,3kg TR 3B H1 V

6832658IT-0001 2014
2535-6596

| Hz | V | kW | rpm | cosφ | A |
|--|-----|-------|------|------|-------|
| 50 | 230 | 11,00 | 1420 | 0,77 | 12,63 |
| IE2 - 82,5%(4/4) - 82,5%(3/4) - 82,5%(2/4) | | | | | |

Cap. run. 100μF Cap. start. 100μF

Via Quattro Passi 1/3 41043 Formigine (MO) - ITALY - www.motovario.com

UL/CSA MOTOR LABEL

MOTOVARIO
TECO Group company

CE cRU^{us}
EN60034-1
MADE IN ITALY

(26)

3-Mot (3)
Brake (19) (20)Nm (21) (2) (1)

(5)[°]C Amb Rating(7) IP(6)
CLASS(4) CODE(24) DES(25)
(9) FRAME IM(8) (10)

| Hz | V | Δ/A | kW | rpm | cosφ | A | Δ/A |
|------|------|------|------|------|------|------|------|
| (13) | (12) | (14) | (15) | (16) | (17) | (18) | (17) |

Via Quattro Passi 1/3 41043 Formigine (MO) - ITALY - www.motovario.com

UL/CSA MOTOR - FILLED-OUT

MOTOVARIO
TECO Group company

CE cRU^{us}
EN60034-1
MADE IN ITALY

3-Mot TBH80B4
Brake FM/FM 125/125Nm 230VAC-103VDC
40[°]C Amb Rating S1 IP55
CLASS F CODE G DES C
TEFC FRAME IMB35

6832658IT-0001 2014
2535-6596

| Hz | V | Δ/A | kW | rpm | cosφ | A | Δ/A |
|--|-----------|-----|-------|------|------|---------------|-----|
| 50 | 230 / 400 | | 11,00 | 1420 | 0,77 | 12,63 / 11,56 | |
| IE2 - 82,5%(4/4) - 82,5%(3/4) - 82,5%(2/4) | | | | | | | |
| 60 | 265 / 460 | | 13,00 | 1652 | 0,69 | 15,58 / 14,89 | |
| IE2 - 82,5%(4/4) - 82,5%(3/4) - 82,5%(2/4) | | | | | | | |

Via Quattro Passi 1/3 41043 Formigine (MO) - ITALY - www.motovario.com

1. Serial number
2. Year of manufacture - order number
3. Motor type code (series/size/n. poles)
4. Insulation class
5. Maximum ambient operating temperature
6. Protection rating
7. Duty
8. Mounting position
9. Cooling system (*)
10. Additional options (see below)
 11. Motor weight (only for > 30 kg)
 12. Motor voltage (depending on connection)
 13. Power frequency [Hz]
 14. Nominal power delivery [kW]
 15. Nominal speed [rpm]
 16. Nominal power factor
 17. Nominal current (depending on connection) [A]
 18. Code IE1, IE2 or IE3 (depending on type of motor and whether applicable) followed by efficiency value at 4/4, 3/4 and 2/4 of nominal power.

Brake motors only

19. Brake type
20. Nominal braking moment [Nm]
21. Brake power supply

Single-phase version only

22. Running capacitor [μ F]
23. Starting capacitor [μ F]

UL/CSA version only

24. Current identification with rotor blocked (ANSI/NFPA 70-1996)
25. "NEMA Electrical Design Classification"
26. QR code

ADDITIONAL OPTIONS (10)

- H1 condensation heaters for voltage 110V
- H2 condensation heaters for voltage 230V
- LT low temperature construction
- HT high temperature construction
- 3B n. 3 bimetal cutouts
- 3P n. 3 thermistors (PTC)
- A backstop device (counterclockwise rotation permitted)
- B backstop device (clockwise rotation permitted)
- E encoder
- V flywheel
- HC rapid connection

(*) For motors in UL/CSA versions, the cooling system is indicated with the following codes:
 TEFC = (T)otally (E)nclosed (F)an (C)ooled - corresponds to IC411 (self-ventilation)
 TENV = (T)otally (E)nclosed (N)ot (V)entilated - corresponds to IC410 (non-ventilated)
 TEBC = (T)otally (E)nclosed (B)lower (C)ooled - corresponds to IC416 (forced ventilation)

3.1 TS-TBS

2 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | τ T | τ TB | | | | | | | | τ T | τ TB | | | | |
| 0,12 | 56B2 | 2650 | 0,38 | 0,43 | - | - | 57,9 | 54,1 | - | 0,77 | 3,2 | 3,5 | 2,7 | 1,2 | - | 3,3 | - | - | - |
| 0,18 | 63A2 | 2800 | 0,59 | 0,61 | - | - | 61,1 | 59,6 | - | 0,72 | 2,9 | 4,0 | 3,2 | 2,0 | 2,6 | 3,7 | 5,2 | 4,7 | 1,8 |
| 0,25 | 63B2 | 2800 | 0,73 | 0,85 | - | - | 65,6 | 66,1 | - | 0,75 | 2,9 | 4,1 | 3,2 | 2,2 | 2,8 | 4,1 | 5,6 | 4,7 | 1,8 |
| 0,37 | 63C2 | 2790 | 1,00 | 1,27 | - | - | 69,6 | 68,6 | - | 0,77 | 2,9 | 4,4 | 3,2 | 2,5 | 3,1 | 4,5 | 6,0 | 4,0 | 3,5 |
| 0,37 | 71A2 | 2820 | 1,14 | 1,25 | - | - | 65,8 | 66,2 | - | 0,71 | 3,1 | 4,3 | 3,1 | 4,0 | 4,7 | 5,4 | 7,6 | 4,0 | 5,0 |
| 0,55 | 71B2 | 2810 | 1,56 | 1,87 | - | - | 70,8 | 71,2 | - | 0,72 | 3,1 | 4,3 | 3,0 | 4,4 | 5,5 | 6,0 | 8,2 | 4,0 | 5,0 |
| 0,75 | 71C2 | 2800 | 1,95 | 2,56 | IE1 | 72,1 | 72,1 | 71,4 | - | 0,77 | 3,0 | 4,5 | 2,9 | 5,1 | 6,2 | 7,0 | 9,2 | 3,0 | 7,5 |
| 0,75 | 80A2 | 2810 | 2,03 | 2,55 | IE1 | 72,1 | 72,1 | 71,6 | - | 0,74 | 2,8 | 5,0 | 3,0 | 9,0 | 10,6 | 8,1 | 11,6 | 3,0 | 10,0 |
| 1,10 | 80B2 | 2830 | 2,79 | 3,71 | IE1 | 75,0 | 75,0 | 75,0 | - | 0,76 | 2,8 | 5,0 | 3,0 | 10,4 | 12,0 | 9,2 | 12,7 | 3,0 | 15,0 |
| 1,50 | 80C2 | 2810 | 3,49 | 5,10 | IE1 | 77,2 | 77,5 | 77,7 | - | 0,80 | 2,7 | 5,0 | 2,7 | 12,1 | 15,6 | 10,7 | 14,2 | 2,5 | 15,0 |
| 1,50 | 90S2 | 2840 | 3,30 | 5,04 | IE1 | 77,2 | 79,9 | 80,4 | - | 0,82 | 3,3 | 6,1 | 3,5 | 14,0 | 15,6 | 12,7 | 16,2 | 2,5 | 15,0 |
| 2,20 | 90L2 | 2860 | 4,83 | 7,35 | IE1 | 79,7 | 80,1 | 80,5 | - | 0,82 | 3,5 | 6,8 | 3,8 | 19,0 | 22,5 | 15,0 | 20,6 | 2,5 | 26,0 |
| 3,00 | 100LA2 | 2870 | 6,73 | 9,98 | IE1 | 81,5 | 81,5 | 81,6 | - | 0,79 | 3,0 | 6,4 | 3,4 | 32,0 | 35,5 | 19,4 | 25,0 | 1,8 | 40,0 |
| 4,00 | 100LB2 | 2870 | 8,37 | 13,31 | IE1 | 83,1 | 83,1 | 83,4 | - | 0,83 | 3,2 | 6,8 | 3,6 | 42,0 | 45,5 | 22,8 | 28,4 | 1,5 | 40,0 |
| 4,00 | 112MA2 | 2900 | 8,79 | 13,17 | IE1 | 83,1 | 83,1 | 83,5 | - | 0,79 | 3,0 | 6,3 | 3,4 | 62,7 | 71,5 | 26,6 | 36,3 | 1,5 | 40,0 |
| 5,50 | 112MB2 | 2910 | 11,40 | 18,05 | IE1 | 84,7 | 84,9 | 85,0 | - | 0,82 | 3,3 | 6,7 | 3,5 | 72,4 | 81,2 | 30,8 | 40,5 | 1,4 | 60,0 |
| 5,50 | 132SA2 | 2910 | 11,16 | 18,05 | IE1 | 84,7 | 84,7 | 84,9 | - | 0,84 | 3,0 | 6,3 | 3,2 | 106,0 | 116,0 | 36,0 | 46,3 | 1,2 | 75,0 |
| 7,50 | 132SB2 | 2910 | 14,47 | 24,61 | IE1 | 86,0 | 86,0 | 86,1 | - | 0,87 | 2,6 | 6,6 | 3,2 | 142,0 | 152,0 | 41,9 | 52,2 | 1,1 | 75,0 |
| 9,20 | 132MA2 | 2910 | 17,37 | 30,19 | IE1 | 86,9 | 86,9 | 87,1 | - | 0,88 | 3,0 | 7,0 | 3,3 | 180,0 | 203,0 | 49,2 | 63,9 | 1,0 | 100,0 |
| 11,00 | 132MB2 | 2910 | 20,32 | 36,10 | IE1 | 87,6 | 87,8 | 87,8 | - | 0,89 | 2,9 | 7,0 | 3,2 | 213,0 | 236,0 | 55,1 | 69,8 | 0,8 | 150,0 |
| 11,00 | 160SA2 | 2910 | 20,32 | 36,10 | IE1 | 87,6 | 87,8 | 87,8 | - | 0,89 | 2,9 | 7,0 | 3,2 | 213,0 | 236,0 | 56,9 | 71,6 | 0,8 | 150,0 |

3.1 TS-TBS

2 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ ×Kgm ² | | Kg | | Z ₀ [10 ³ ×1/h] | M _B [Nm] | |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|-------|-------|------|--|------------------------|-------|
| | | | | | | | | | | | | | T T | T TB | T T | T TB | | | |
| 0,12 | 56B2 | 3320 | 0,34 | 0,34 | - | - | 59,6 | 57,2 | - | 0,74 | 3,0 | 3,3 | 3,2 | 1,2 | - | 3,3 | - | - | - |
| 0,18 | 63A2 | 3440 | 0,53 | 0,50 | - | - | 62,3 | 60,4 | - | 0,68 | 3,6 | 4,3 | 3,7 | 2,0 | 2,6 | 3,7 | 5,2 | 4,7 | 1,8 |
| 0,25 | 63B2 | 3430 | 0,66 | 0,70 | - | - | 64,7 | 63,8 | - | 0,73 | 3,5 | 4,3 | 3,6 | 2,2 | 2,8 | 4,1 | 5,6 | 4,7 | 1,8 |
| 0,37 | 63C2 | 3430 | 0,87 | 1,03 | - | - | 68,4 | 67,2 | - | 0,78 | 3,5 | 4,4 | 3,6 | 2,5 | 3,1 | 4,5 | 6,0 | 4,0 | 3,5 |
| 0,37 | 71A2 | 3460 | 1,05 | 1,02 | - | - | 65,3 | 64,1 | - | 0,68 | 3,8 | 4,5 | 3,7 | 4,0 | 4,7 | 5,4 | 7,6 | 4,0 | 5,0 |
| 0,55 | 71B2 | 3440 | 1,48 | 1,53 | - | - | 66,6 | 65,0 | - | 0,70 | 3,7 | 4,4 | 3,6 | 4,4 | 5,5 | 6,0 | 8,2 | 4,0 | 5,0 |
| 0,75 | 71C2 | 3420 | 1,68 | 2,09 | - | - | 74,8 | 72,5 | - | 0,75 | 3,5 | 4,6 | 3,4 | 5,1 | 6,2 | 7,0 | 9,2 | 3,0 | 7,5 |
| 0,75 | 80A2 | 3450 | 1,73 | 2,08 | - | - | 74,5 | 72,1 | - | 0,73 | 3,5 | 5,2 | 3,7 | 9,0 | 10,6 | 8,1 | 11,6 | 3,0 | 10,0 |
| 1,10 | 80B2 | 3450 | 2,39 | 3,04 | - | - | 77,1 | 75,4 | - | 0,75 | 3,6 | 5,1 | 3,7 | 10,4 | 12,0 | 9,2 | 12,7 | 3,0 | 15,0 |
| 1,50 | 80C2 | 3440 | 3,10 | 4,16 | - | - | 77,9 | 77,2 | - | 0,78 | 3,4 | 5,1 | 3,5 | 12,1 | 15,6 | 10,7 | 14,2 | 2,5 | 15,0 |
| 1,50 | 90S2 | 3460 | 3,02 | 4,14 | - | - | 77,9 | 78,2 | - | 0,80 | 3,7 | 5,8 | 3,9 | 14,0 | 15,6 | 12,7 | 16,2 | 2,5 | 15,0 |
| 2,20 | 90L2 | 3470 | 4,33 | 6,05 | - | - | 79,8 | 80,1 | - | 0,80 | 4,0 | 6,1 | 4,3 | 19,0 | 22,5 | 15,0 | 20,6 | 2,5 | 26,0 |
| 3,00 | 100LA2 | 3490 | 5,87 | 8,21 | - | - | 82,3 | 81,9 | - | 0,78 | 3,7 | 6,1 | 3,9 | 32,0 | 35,5 | 19,4 | 25,0 | 1,8 | 40,0 |
| 4,00 | 100LB2 | 3490 | 7,25 | 10,95 | - | - | 83,4 | 83,0 | - | 0,83 | 3,8 | 6,5 | 4,2 | 42,0 | 45,5 | 22,8 | 28,4 | 1,5 | 40,0 |
| 4,00 | 112MA2 | 3520 | 7,71 | 10,85 | - | - | 83,5 | 83,3 | - | 0,78 | 3,5 | 6,6 | 3,9 | 62,7 | 71,5 | 26,6 | 36,3 | 1,5 | 40,0 |
| 5,50 | 112MB2 | 3530 | 10,04 | 14,88 | - | - | 84,9 | 84,7 | - | 0,81 | 3,8 | 6,8 | 4,0 | 72,4 | 81,2 | 30,8 | 40,5 | 1,4 | 60,0 |
| 5,50 | 132SA2 | 3520 | 9,80 | 14,92 | - | - | 84,9 | 85,0 | - | 0,83 | 3,6 | 6,2 | 3,7 | 106,0 | 116,0 | 36,0 | 46,3 | 1,2 | 75,0 |
| 7,50 | 132SB2 | 3520 | 12,63 | 20,35 | - | - | 86,7 | 86,5 | - | 0,86 | 3,2 | 6,6 | 3,7 | 142,0 | 152,0 | 41,9 | 52,2 | 1,1 | 75,0 |
| 9,20 | 132MA2 | 3520 | 15,12 | 24,96 | - | - | 87,8 | 88,1 | - | 0,87 | 3,4 | 6,8 | 3,9 | 180,0 | 203,0 | 49,2 | 63,9 | 1,0 | 100,0 |
| 11,00 | 132MB2 | 3520 | 17,75 | 29,84 | - | - | 88,4 | 88,2 | - | 0,88 | 3,4 | 6,9 | 3,9 | 213,0 | 236,0 | 55,1 | 69,8 | 0,8 | 150,0 |
| 11,00 | 160SA2 | 3520 | 17,75 | 29,84 | - | - | 88,4 | 88,2 | - | 0,88 | 3,4 | 6,9 | 3,9 | 213,0 | 236,0 | 56,9 | 71,6 | 0,8 | 150,0 |

3.1 TS-TBS

4 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] | |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|-------|------|---|------------------------|-------|
| | | | | | | | | | | | | | T T | T TB | T T | T TB | | | |
| 0,09 | 56B4 | 1250 | 0,42 | 0,68 | - | - | 45,4 | 43,4 | - | 0,66 | 2,0 | 2,2 | 2,1 | 1,5 | - | 3,1 | - | - | - |
| 0,12 | 63A4 | 1340 | 0,48 | 0,86 | - | - | 54,6 | 52,9 | - | 0,66 | 2,4 | 2,8 | 2,3 | 2,4 | 3,0 | 3,6 | 5,1 | 12,5 | 1,8 |
| 0,18 | 63B4 | 1330 | 0,67 | 1,29 | - | - | 57,2 | 54,9 | - | 0,68 | 2,3 | 2,8 | 2,2 | 2,8 | 3,4 | 4,1 | 5,6 | 12,5 | 3,5 |
| 0,22 | 63C4 | 1330 | 0,87 | 1,58 | - | - | 57,3 | 58,1 | - | 0,64 | 2,2 | 2,6 | 2,2 | 2,8 | 3,4 | 4,2 | 5,7 | 10,0 | 3,5 |
| 0,25 | 63D4 | 1320 | 0,83 | 1,81 | - | - | 62,4 | 62,9 | - | 0,69 | 2,3 | 2,9 | 2,2 | 3,6 | 4,2 | 4,9 | 6,4 | 10,0 | 3,5 |
| 0,25 | 71A4 | 1390 | 0,79 | 1,72 | - | - | 62,3 | 61,9 | - | 0,73 | 2,3 | 3,7 | 2,3 | 7,8 | 8,9 | 5,4 | 7,6 | 10,0 | 5,0 |
| 0,37 | 71B4 | 1380 | 1,09 | 2,56 | - | - | 66,1 | 65,3 | - | 0,74 | 2,3 | 3,7 | 2,3 | 8,8 | 9,9 | 6,0 | 8,2 | 10,0 | 7,5 |
| 0,55 | 71C4 | 1370 | 1,50 | 3,83 | - | - | 68,7 | 68,6 | - | 0,77 | 2,3 | 3,8 | 2,2 | 11,0 | 12,1 | 7,2 | 9,4 | 8,0 | 7,5 |
| 0,55 | 80A4 | 1400 | 1,48 | 3,75 | - | - | 69,8 | 69,3 | - | 0,77 | 2,3 | 4,3 | 2,5 | 20,8 | 22,4 | 8,4 | 11,9 | 8,0 | 10,0 |
| 0,75 | 80B4 | 1400 | 1,92 | 5,12 | IE1 | 72,1 | 72,1 | 71,3 | - | 0,78 | 2,4 | 4,6 | 2,6 | 25,4 | 27,0 | 9,9 | 13,4 | 7,1 | 15,0 |
| 0,92 | 80C4 | 1400 | 2,34 | 6,28 | IE1 | 73,7 | 73,7 | 72,9 | - | 0,77 | 2,4 | 4,4 | 2,5 | 25,4 | 27,0 | 10,0 | 13,5 | 5,0 | 15,0 |
| 1,10 | 80D4 | 1410 | 2,64 | 7,45 | IE1 | 75,0 | 75,1 | 75,5 | - | 0,80 | 2,7 | 4,8 | 2,8 | 29,9 | 31,5 | 11,4 | 14,9 | 5,0 | 15,0 |
| 1,10 | 90S4 | 1400 | 2,82 | 7,50 | IE1 | 75,0 | 75,0 | 75,4 | - | 0,75 | 2,9 | 4,8 | 3,0 | 25,0 | 26,6 | 11,9 | 15,4 | 5,0 | 15,0 |
| 1,50 | 90LA4 | 1400 | 3,60 | 10,23 | IE1 | 77,2 | 77,2 | 77,4 | - | 0,78 | 2,9 | 5,0 | 3,0 | 32,0 | 35,5 | 14,3 | 19,9 | 4,0 | 26,0 |
| 1,85 | 90LB4 | 1400 | 4,36 | 12,62 | IE1 | 78,6 | 78,6 | 79,0 | - | 0,78 | 2,9 | 5,0 | 3,0 | 38,4 | 41,9 | 16,0 | 21,6 | 4,0 | 40,0 |
| 2,20 | 100LA4 | 1420 | 5,10 | 14,80 | IE1 | 79,7 | 79,8 | 80,0 | - | 0,78 | 2,5 | 5,1 | 2,7 | 53,0 | 56,5 | 18,7 | 24,3 | 3,2 | 40,0 |
| 3,00 | 100LB4 | 1420 | 6,78 | 20,18 | IE1 | 81,5 | 81,9 | 82,4 | - | 0,78 | 2,5 | 5,2 | 2,7 | 72,0 | 75,5 | 22,6 | 28,2 | 3,2 | 55,0 |
| 4,00 | 112MA4 | 1440 | 8,79 | 26,53 | IE1 | 83,1 | 83,1 | 83,4 | - | 0,79 | 2,8 | 6,0 | 3,0 | 119,0 | 128,0 | 29,0 | 38,7 | 2,5 | 60,0 |
| 4,80 | 112MB4 | 1430 | 10,31 | 32,05 | IE1 | 84,0 | 84,0 | 84,2 | - | 0,80 | 2,5 | 5,8 | 2,7 | 132,0 | 141,0 | 31,9 | 41,6 | 1,8 | 60,0 |
| 5,50 | 132S4 | 1450 | 11,72 | 36,22 | IE1 | 84,7 | 84,7 | 85,0 | - | 0,80 | 2,4 | 5,5 | 2,5 | 240,0 | 250,0 | 41,7 | 52,0 | 1,8 | 100,0 |
| 7,50 | 132MA4 | 1450 | 15,72 | 49,39 | IE1 | 86,0 | 86,1 | 86,3 | - | 0,80 | 2,6 | 5,7 | 2,6 | 330,0 | 353,0 | 52,0 | 66,7 | 1,2 | 150,0 |
| 9,20 | 132MB4 | 1450 | 18,87 | 60,59 | IE1 | 86,9 | 86,9 | 87,0 | - | 0,81 | 2,8 | 5,8 | 2,7 | 391,6 | 414,6 | 58,2 | 72,9 | 1,1 | 150,0 |
| 11,00 | 132MC4 | 1440 | 21,84 | 72,95 | IE1 | 87,6 | 87,6 | 87,8 | - | 0,83 | 2,7 | 5,6 | 2,8 | 417,4 | 440,4 | 62,6 | 77,3 | 0,9 | 150,0 |
| 11,00 | 160S4 | 1440 | 21,84 | 72,95 | IE1 | 87,6 | 87,6 | 87,8 | - | 0,83 | 2,7 | 5,6 | 2,8 | 417,4 | 440,4 | 65,4 | 80,1 | 0,9 | 150,0 |

3.1 TS-TBS

4 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ ×Kgm ² | | Kg | | Z ₀ [10 ³ ×1/h] | M _B [Nm] | |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|-------|-------|------|--|------------------------|-------|
| | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | | |
| 0,09 | 56B4 | 1620 | 0,38 | 0,53 | - | - | 48,4 | 45,2 | - | 0,60 | 2,5 | 2,6 | 2,5 | 1,5 | - | 3,1 | - | - | - |
| 0,12 | 63A4 | 1670 | 0,44 | 0,69 | - | - | 52,1 | 50,6 | - | 0,65 | 3,1 | 2,8 | 3,0 | 2,4 | 3,0 | 3,6 | 5,1 | 12,5 | 1,8 |
| 0,18 | 63B4 | 1670 | 0,60 | 1,03 | - | - | 55,9 | 53,2 | - | 0,67 | 3,0 | 2,8 | 2,9 | 2,8 | 3,4 | 4,1 | 5,6 | 12,5 | 3,5 |
| 0,22 | 63C4 | 1670 | 0,77 | 1,26 | - | - | 57,9 | 58,1 | - | 0,62 | 3,0 | 2,8 | 2,9 | 2,8 | 3,4 | 4,2 | 5,7 | 10,0 | 3,5 |
| 0,25 | 63D4 | 1660 | 0,73 | 1,44 | - | - | 63,1 | 63,5 | - | 0,68 | 3,0 | 2,9 | 3,0 | 3,6 | 4,2 | 4,9 | 6,4 | 10,0 | 3,5 |
| 0,25 | 71A4 | 1720 | 0,70 | 1,39 | - | - | 63,0 | 63,3 | - | 0,71 | 2,9 | 3,8 | 2,9 | 7,8 | 8,9 | 5,4 | 7,6 | 10,0 | 5,0 |
| 0,37 | 71B4 | 1710 | 0,93 | 2,07 | - | - | 68,2 | 67,5 | - | 0,73 | 2,9 | 3,8 | 2,8 | 8,8 | 9,9 | 6,0 | 8,2 | 10,0 | 7,5 |
| 0,55 | 71C4 | 1700 | 1,35 | 3,09 | - | - | 69,2 | 69,0 | - | 0,74 | 2,9 | 3,8 | 2,8 | 11,0 | 12,1 | 7,2 | 9,4 | 8,0 | 7,5 |
| 0,55 | 80A4 | 1730 | 1,31 | 3,04 | - | - | 69,5 | 68,9 | - | 0,76 | 2,8 | 4,5 | 3,1 | 20,8 | 22,4 | 8,4 | 11,9 | 8,0 | 10,0 |
| 0,75 | 80B4 | 1730 | 1,66 | 4,14 | - | - | 73,5 | 71,6 | - | 0,77 | 2,9 | 4,8 | 3,2 | 25,4 | 27,0 | 9,9 | 13,4 | 7,1 | 15,0 |
| 0,92 | 80C4 | 1720 | 2,08 | 5,11 | - | - | 74,1 | 72,9 | - | 0,75 | 3,0 | 4,7 | 3,0 | 25,4 | 27,0 | 10,0 | 13,5 | 5,0 | 15,0 |
| 1,10 | 80D4 | 1730 | 2,33 | 6,07 | - | - | 75,9 | 73,4 | - | 0,78 | 3,2 | 5,1 | 3,2 | 29,9 | 31,5 | 11,4 | 14,9 | 5,0 | 15,0 |
| 1,10 | 90S4 | 1720 | 2,43 | 6,11 | - | - | 75,8 | 73,4 | - | 0,75 | 3,4 | 5,1 | 3,6 | 25,0 | 26,6 | 11,9 | 15,4 | 5,0 | 15,0 |
| 1,50 | 90LA4 | 1720 | 3,14 | 8,33 | - | - | 77,9 | 78,1 | - | 0,77 | 3,4 | 5,1 | 3,7 | 32,0 | 35,5 | 14,3 | 19,9 | 4,0 | 26,0 |
| 1,85 | 90LB4 | 1720 | 3,82 | 10,27 | - | - | 78,9 | 79,1 | - | 0,77 | 3,5 | 5,2 | 3,8 | 38,4 | 41,9 | 16,0 | 21,6 | 4,0 | 40,0 |
| 2,20 | 100LA4 | 1740 | 4,42 | 12,07 | - | - | 81,1 | 80,9 | - | 0,77 | 2,7 | 5,0 | 3,0 | 53,0 | 56,5 | 18,7 | 24,3 | 3,2 | 40,0 |
| 3,00 | 100LB4 | 1740 | 5,92 | 16,46 | - | - | 82,6 | 82,4 | - | 0,77 | 2,8 | 5,1 | 3,1 | 72,0 | 75,5 | 22,6 | 28,2 | 3,2 | 55,0 |
| 4,00 | 112MA4 | 1750 | 7,56 | 21,83 | - | - | 85,1 | 84,3 | - | 0,78 | 3,4 | 6,4 | 3,5 | 119,0 | 128,0 | 29,0 | 38,7 | 2,5 | 60,0 |
| 4,80 | 112MB4 | 1740 | 8,88 | 26,34 | - | - | 85,9 | 85,2 | - | 0,79 | 3,1 | 6,1 | 3,2 | 132,0 | 141,0 | 31,9 | 41,6 | 1,8 | 60,0 |
| 5,50 | 132S4 | 1750 | 10,15 | 30,01 | - | - | 86,1 | 85,6 | - | 0,79 | 2,9 | 5,8 | 3,0 | 240,0 | 250,0 | 41,7 | 52,0 | 1,8 | 100,0 |
| 7,50 | 132MA4 | 1750 | 13,65 | 40,93 | - | - | 87,3 | 86,9 | - | 0,79 | 3,1 | 5,9 | 3,2 | 330,0 | 353,0 | 52,0 | 66,7 | 1,2 | 150,0 |
| 9,20 | 132MB4 | 1750 | 16,63 | 50,20 | - | - | 87,9 | 87,3 | - | 0,79 | 3,1 | 6,0 | 3,2 | 391,6 | 414,6 | 58,2 | 72,9 | 1,1 | 150,0 |
| 11,00 | 132MC4 | 1740 | 19,28 | 60,37 | - | - | 88,4 | 87,6 | - | 0,81 | 2,9 | 5,8 | 3,0 | 417,4 | 440,4 | 62,6 | 77,3 | 0,9 | 150,0 |
| 11,00 | 160S4 | 1740 | 19,28 | 60,37 | - | - | 88,4 | 87,6 | - | 0,81 | 2,9 | 5,8 | 3,0 | 417,4 | 440,4 | 65,4 | 80,1 | 0,9 | 150,0 |

3.1 TS-TBS

6 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ ×Kgm ² | | Kg | | Z ₀ [10 ³ ×1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|-------|------|------|--|------------------------|
| | | | | | τ T | τ TB | | | | | | | | τ T | τ TB | | | | |
| 0,09 | 63A6 | 860 | 0,49 | 1,00 | - | - | 42,1 | 39,3 | - | 0,63 | 2,1 | 2,0 | 2,1 | 3,6 | 4,2 | 5,0 | 6,5 | 12,5 | 3,5 |
| 0,12 | 63B6 | 860 | 0,68 | 1,33 | - | - | 43,1 | 40,0 | - | 0,59 | 2,2 | 2,0 | 2,2 | 3,6 | 4,2 | 5,1 | 6,6 | 12,5 | 3,5 |
| 0,15 | 63C6 | 810 | 0,80 | 1,77 | - | - | 42,1 | 39,2 | - | 0,64 | 2,0 | 2,0 | 2,0 | 3,6 | 4,2 | 5,1 | 6,6 | 11,8 | 3,5 |
| 0,18 | 71A6 | 900 | 0,62 | 1,91 | - | - | 59,3 | 59,9 | - | 0,71 | 2,0 | 2,7 | 2,0 | 9,3 | 10,4 | 5,2 | 7,4 | 11,2 | 5,0 |
| 0,25 | 71B6 | 900 | 0,80 | 2,65 | - | - | 63,4 | 63,8 | - | 0,71 | 2,2 | 3,2 | 2,2 | 12,0 | 13,1 | 6,0 | 8,2 | 11,2 | 7,5 |
| 0,37 | 71C6 | 880 | 1,12 | 4,00 | - | - | 64,2 | 64,4 | - | 0,74 | 2,0 | 3,1 | 2,0 | 14,8 | 15,9 | 6,8 | 9,0 | 10,0 | 7,5 |
| 0,37 | 80A6 | 940 | 1,18 | 3,80 | - | - | 66,3 | 64,0 | - | 0,68 | 2,6 | 4,1 | 2,6 | 25,4 | 27,0 | 9,6 | 13,0 | 9,5 | 10,0 |
| 0,55 | 80B6 | 930 | 1,75 | 5,60 | - | - | 66,8 | 64,2 | - | 0,68 | 2,7 | 4,1 | 2,8 | 29,9 | 31,5 | 11,1 | 14,6 | 9,0 | 15,0 |
| 0,75 | 80C6 | 920 | 2,21 | 7,80 | - | - | 70,0 | 67,2 | - | 0,70 | 2,7 | 4,0 | 2,7 | 29,9 | 31,5 | 11,3 | 14,8 | 7,1 | 15,0 |
| 0,75 | 90S6 | 920 | 2,31 | 7,80 | - | - | 70,0 | 67,5 | - | 0,67 | 2,7 | 3,6 | 2,7 | 28,1 | 29,7 | 12,9 | 16,4 | 7,1 | 13,0 |
| 1,10 | 90L6 | 930 | 3,30 | 11,30 | - | - | 72,9 | 71,1 | - | 0,66 | 2,9 | 4,1 | 2,9 | 38,4 | 41,9 | 15,9 | 21,5 | 5,3 | 26,0 |
| 1,50 | 100LA6 | 930 | 4,00 | 15,40 | - | - | 74,9 | 75,2 | - | 0,73 | 2,2 | 3,8 | 2,2 | 72,0 | 75,5 | 20,0 | 25,6 | 3,6 | 40,0 |
| 1,85 | 100LB6 | 930 | 4,90 | 19,00 | - | - | 75,1 | 75,5 | - | 0,73 | 2,2 | 3,6 | 2,2 | 88,0 | 91,5 | 24,0 | 29,6 | 3,2 | 40,0 |
| 2,20 | 112MA6 | 930 | 5,70 | 23,00 | - | - | 75,9 | 76,3 | - | 0,74 | 2,2 | 4,3 | 2,4 | 148,0 | 176,8 | 24,0 | 33,7 | 2,5 | 60,0 |
| 3,00 | 112MB6 | 930 | 7,20 | 31,00 | - | - | 77,3 | 77,8 | - | 0,78 | 2,1 | 4,9 | 2,4 | 188,0 | 216,8 | 30,5 | 40,2 | 2,5 | 60,0 |
| 3,00 | 132SA6 | 960 | 7,30 | 30,00 | - | - | 78,9 | 79,1 | - | 0,75 | 2,2 | 5,1 | 2,4 | 320,0 | 330,3 | 40,0 | 50,3 | 2,3 | 75,0 |
| 4,00 | 132MA6 | 960 | 9,60 | 40,00 | - | - | 79,4 | 78,8 | - | 0,76 | 2,1 | 5,6 | 2,5 | 380,0 | 402,5 | 46,4 | 61,1 | 1,5 | 100,0 |
| 5,50 | 132MB6 | 960 | 12,60 | 55,00 | - | - | 80,7 | 81,0 | - | 0,78 | 2,2 | 5,1 | 2,3 | 460,0 | 482,5 | 52,5 | 67,2 | 1,3 | 150,0 |

3.1 TS-TBS

6 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ ×Kgm ² | | Kg | | Z ₀ [10 ³ ×1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------------------------|------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|------------------------------------|-------|------|------|--|------------------------|
| | | | | | τ T | τ TB | | | | | | | | τ T | τ TB | | | | |
| 0,09 | 63A6 | 1070 | 0,44 | 0,80 | - | - | 43,3 | 39,8 | - | 0,59 | 2,6 | 2,4 | 2,6 | 3,6 | 4,2 | 5,0 | 6,5 | 12,5 | 3,5 |
| 0,12 | 63B6 | 1080 | 0,62 | 1,06 | - | - | 44,3 | 40,7 | - | 0,55 | 2,8 | 2,4 | 2,8 | 3,6 | 4,2 | 5,1 | 6,6 | 12,5 | 3,5 |
| 0,15 | 63C6 | 1070 | 0,75 | 1,34 | - | - | 46,3 | 46,0 | - | 0,54 | 2,6 | 2,2 | 2,6 | 3,6 | 4,2 | 5,1 | 6,6 | 11,8 | 3,5 |
| 0,18 | 71A6 | 1130 | 0,57 | 1,52 | - | - | 63,4 | 63,8 | - | 0,63 | 2,4 | 3,2 | 2,4 | 9,3 | 10,4 | 5,2 | 7,4 | 11,2 | 5,0 |
| 0,25 | 71B6 | 1130 | 0,74 | 2,11 | - | - | 64,8 | 65,0 | - | 0,65 | 2,5 | 3,9 | 2,5 | 12,0 | 13,1 | 6,0 | 8,2 | 11,2 | 7,5 |
| 0,37 | 71C6 | 1100 | 0,99 | 3,20 | - | - | 65,2 | 64,9 | - | 0,72 | 2,2 | 3,7 | 2,2 | 14,8 | 15,9 | 6,8 | 9,0 | 10,0 | 7,5 |
| 0,37 | 80A6 | 1150 | 1,10 | 3,10 | - | - | 68,2 | 63,1 | - | 0,62 | 3,1 | 4,8 | 3,1 | 25,4 | 27,0 | 9,6 | 13,0 | 9,5 | 10,0 |
| 0,55 | 80B6 | 1150 | 1,59 | 4,60 | - | - | 68,8 | 64,1 | - | 0,63 | 3,1 | 4,8 | 3,2 | 29,9 | 31,5 | 11,1 | 14,6 | 9,0 | 15,0 |
| 0,75 | 80C6 | 1130 | 2,07 | 6,30 | - | - | 69,9 | 69,5 | - | 0,65 | 3,2 | 4,7 | 3,2 | 29,9 | 31,5 | 11,3 | 14,8 | 7,1 | 15,0 |
| 0,75 | 90S6 | 1130 | 2,24 | 6,30 | - | - | 68,8 | 68,4 | - | 0,61 | 3,2 | 4,3 | 3,3 | 28,1 | 29,7 | 12,9 | 16,4 | 7,1 | 13,0 |
| 1,10 | 90L6 | 1140 | 3,00 | 9,20 | - | - | 71,0 | 70,4 | - | 0,64 | 3,4 | 4,6 | 3,4 | 38,4 | 41,9 | 15,9 | 21,5 | 5,3 | 26,0 |
| 1,50 | 100LA6 | 1150 | 3,50 | 12,50 | - | - | 77,0 | 77,9 | - | 0,69 | 2,4 | 3,9 | 2,5 | 72,0 | 75,5 | 20,0 | 25,6 | 3,6 | 40,0 |
| 1,85 | 100LB6 | 1140 | 4,40 | 15,50 | - | - | 75,2 | 75,6 | - | 0,70 | 2,5 | 4,0 | 2,6 | 88,0 | 91,5 | 24,0 | 29,6 | 3,2 | 40,0 |
| 2,20 | 112MA6 | 1160 | 5,00 | 18,10 | - | - | 78,3 | 78,6 | - | 0,70 | 2,6 | 4,5 | 2,7 | 148,0 | 176,8 | 24,0 | 33,7 | 2,5 | 60,0 |
| 3,00 | 112MB6 | 1160 | 6,30 | 24,70 | - | - | 79,2 | 79,5 | - | 0,75 | 2,3 | 4,9 | 2,4 | 188,0 | 216,8 | 30,5 | 40,2 | 2,5 | 60,0 |
| 3,00 | 132SA6 | 1170 | 6,50 | 24,50 | - | - | 81,3 | 81,5 | - | 0,71 | 2,7 | 6,0 | 2,9 | 320,0 | 330,3 | 40,0 | 50,3 | 2,3 | 75,0 |
| 4,00 | 132MA6 | 1170 | 8,40 | 32,60 | - | - | 81,5 | 81,2 | - | 0,73 | 2,3 | 6,4 | 2,5 | 380,0 | 402,5 | 46,4 | 61,1 | 1,5 | 100,0 |
| 5,50 | 132MB6 | 1160 | 11,00 | 45,30 | - | - | 82,5 | 81,2 | - | 0,76 | 2,6 | 6,3 | 2,7 | 460,0 | 482,5 | 52,5 | 67,2 | 1,3 | 150,0 |

3.2 TH-TBH

2 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80A2 | 2840 | 1,64 | 2,52 | IE2 | 77,4 | 78,8 | 79,3 | 77,1 | 0,84 | 3,4 | 6,4 | 3,3 | 13,5 | 15,1 | 10,0 | 13,5 | 3,0 | 10,0 |
| 1,10 | 80B2 | 2840 | 2,35 | 3,70 | IE2 | 79,6 | 80,6 | 80,7 | 80,7 | 0,84 | 3,7 | 6,5 | 3,4 | 14,4 | 16,0 | 11,3 | 14,9 | 3,0 | 15,0 |
| 1,50 | 90S2 | 2870 | 3,16 | 4,99 | IE2 | 81,3 | 81,5 | 81,2 | 81,2 | 0,84 | 3,8 | 7,4 | 3,8 | 16,8 | 18,4 | 14,2 | 17,7 | 2,5 | 13,0 |
| 2,20 | 90L2 | 2880 | 4,65 | 7,29 | IE2 | 83,2 | 83,3 | 83,1 | 83,1 | 0,82 | 4,0 | 7,6 | 3,9 | 22,8 | 26,3 | 17,1 | 22,7 | 2,5 | 26,0 |
| 3,00 | 100L2 | 2900 | 6,09 | 9,88 | IE2 | 84,6 | 84,6 | 83,5 | 80,5 | 0,84 | 4,0 | 8,2 | 4,1 | 43,2 | 46,7 | 23,6 | 29,2 | 1,5 | 40,0 |
| 4,00 | 112M2 | 2930 | 8,11 | 13,04 | IE2 | 85,8 | 85,8 | 85,2 | 85,2 | 0,83 | 3,5 | 8,6 | 3,9 | 79,1 | 87,9 | 31,2 | 40,9 | 1,5 | 40,0 |
| 5,50 | 132SA2 | 2940 | 10,85 | 17,86 | IE2 | 87,0 | 87,1 | 86,4 | 83,7 | 0,84 | 3,0 | 8,0 | 3,7 | 141,0 | 151,0 | 43,0 | 53,3 | 1,2 | 75,0 |
| 7,50 | 132SB2 | 2930 | 14,29 | 24,44 | IE2 | 88,1 | 88,1 | 87,6 | 85,4 | 0,86 | 3,4 | 8,1 | 3,8 | 178,0 | 188,0 | 49,0 | 59,3 | 1,1 | 75,0 |
| 9,20 | 132M2 | 2930 | 16,97 | 29,99 | IE2 | 88,8 | 88,9 | 88,9 | 88,9 | 0,88 | 3,7 | 8,2 | 3,9 | 216,0 | 239,0 | 56,3 | 71,0 | 1,0 | 100,0 |

2 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80A2 | 3470 | 1,44 | 2,06 | IE2 | 75,5 | 79,8 | 78,1 | 75,4 | 0,82 | 3,7 | 6,9 | 3,7 | 13,5 | 15,1 | 10,0 | 13,5 | 3,0 | 10,0 |
| 1,10 | 80B2 | 3460 | 2,03 | 3,04 | IE2 | 82,5 | 82,9 | 81,5 | 78,2 | 0,82 | 4,1 | 7,3 | 4,0 | 14,4 | 16,0 | 11,3 | 14,9 | 3,0 | 15,0 |
| 1,50 | 90S2 | 3490 | 2,70 | 4,10 | IE2 | 84,0 | 84,0 | 83,0 | 80,7 | 0,83 | 4,2 | 8,5 | 4,1 | 16,8 | 18,4 | 14,2 | 17,7 | 2,5 | 13,0 |
| 2,20 | 90L2 | 3490 | 3,94 | 6,02 | IE2 | 85,5 | 85,5 | 84,1 | 81,9 | 0,82 | 4,4 | 8,8 | 4,4 | 22,8 | 26,3 | 17,1 | 22,7 | 2,5 | 26,0 |
| 3,00 | 100L2 | 3520 | 5,18 | 8,14 | IE2 | 87,5 | 87,5 | 85,9 | 83,1 | 0,83 | 4,5 | 9,5 | 4,7 | 43,2 | 46,7 | 23,6 | 29,2 | 1,5 | 40,0 |
| 4,00 | 112M2 | 3540 | 6,90 | 10,79 | IE2 | 87,5 | 87,7 | 86,1 | 83,9 | 0,83 | 4,1 | 9,5 | 4,5 | 79,1 | 87,9 | 31,2 | 40,9 | 1,5 | 40,0 |
| 5,50 | 132SA2 | 3540 | 9,29 | 14,84 | IE2 | 88,5 | 88,5 | 87,2 | 84,3 | 0,84 | 4,0 | 9,1 | 4,7 | 141,0 | 151,0 | 43,0 | 53,3 | 1,2 | 75,0 |
| 7,50 | 132SB2 | 3530 | 12,37 | 20,29 | IE2 | 89,5 | 89,5 | 88,9 | 85,8 | 0,85 | 4,2 | 9,2 | 4,7 | 178,0 | 188,0 | 49,0 | 59,3 | 1,1 | 75,0 |
| 9,20 | 132M2 | 3530 | 14,78 | 24,89 | IE2 | 89,5 | 89,8 | 89,0 | 86,1 | 0,87 | 4,3 | 9,2 | 4,8 | 216,0 | 239,0 | 56,3 | 71,0 | 1,0 | 100,0 |

3.2 TH-TBH

4 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80B4 | 1430 | 1,79 | 5,01 | IE2 | 79,6 | 79,6 | 79,7 | 75,8 | 0,76 | 3,0 | 5,8 | 3,2 | 31,8 | 33,4 | 11,6 | 15,1 | 7,1 | 15,0 |
| 1,10 | 90S4 | 1430 | 2,53 | 7,35 | IE2 | 81,4 | 81,5 | 81,7 | 77,9 | 0,77 | 3,2 | 5,7 | 3,2 | 32,5 | 36,0 | 14,2 | 17,7 | 5,0 | 13,0 |
| 1,50 | 90L4 | 1420 | 3,49 | 10,09 | IE2 | 82,8 | 82,8 | 82,4 | 79,3 | 0,75 | 3,5 | 5,9 | 3,5 | 38,4 | 41,9 | 16,3 | 21,9 | 4,0 | 26,0 |
| 2,20 | 100LA4 | 1430 | 5,02 | 14,69 | IE2 | 84,3 | 84,3 | 84,7 | 83,3 | 0,75 | 3,0 | 5,7 | 3,2 | 76,3 | 80,5 | 21,0 | 28,0 | 3,2 | 40,0 |
| 3,00 | 100LB4 | 1430 | 6,75 | 20,03 | IE2 | 85,5 | 85,5 | 85,8 | 84,2 | 0,75 | 3,1 | 5,7 | 3,2 | 88,9 | 92,7 | 24,0 | 31,0 | 3,2 | 40,0 |
| 4,00 | 112M4 | 1450 | 8,51 | 26,34 | IE2 | 86,6 | 87,0 | 87,2 | 85,7 | 0,78 | 3,2 | 6,8 | 3,4 | 137,0 | 146,0 | 32,1 | 41,8 | 2,5 | 60,0 |
| 5,50 | 132S4 | 1460 | 11,14 | 35,97 | IE2 | 87,7 | 88,0 | 88,4 | 87,3 | 0,81 | 2,6 | 6,5 | 3,1 | 288,0 | 298,0 | 47,0 | 57,3 | 1,8 | 100,0 |
| 7,50 | 132MA4 | 1460 | 15,24 | 49,06 | IE2 | 88,7 | 88,8 | 89,2 | 88,0 | 0,80 | 2,7 | 6,7 | 3,2 | 388,0 | 411,0 | 58,8 | 73,2 | 1,2 | 150,0 |
| 9,20 | 132MB4 | 1460 | 19,04 | 60,18 | IE2 | 89,3 | 89,4 | 89,6 | 88,2 | 0,78 | 2,7 | 6,1 | 3,0 | 413,0 | 436,0 | 63,0 | 77,0 | 1,1 | 150,0 |

4 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80B4 | 1750 | 1,56 | 4,09 | IE2 | 82,5 | 82,5 | 81,9 | 79,7 | 0,73 | 3,4 | 6,9 | 3,7 | 31,8 | 33,4 | 11,6 | 15,1 | 7,1 | 15,0 |
| 1,10 | 90S4 | 1750 | 2,25 | 6,00 | IE2 | 84,0 | 84,0 | 83,5 | 80,0 | 0,73 | 3,8 | 6,6 | 3,8 | 32,5 | 36,0 | 14,2 | 17,7 | 5,0 | 13,0 |
| 1,50 | 90L4 | 1740 | 3,11 | 8,23 | IE2 | 84,0 | 84,0 | 83,6 | 80,9 | 0,72 | 4,1 | 6,9 | 4,0 | 38,4 | 41,9 | 16,3 | 21,9 | 4,0 | 26,0 |
| 2,20 | 100LA4 | 1740 | 4,44 | 12,07 | IE2 | 87,5 | 87,5 | 87,1 | 85,1 | 0,71 | 3,6 | 6,6 | 3,7 | 76,3 | 80,5 | 21,0 | 28,0 | 3,2 | 40,0 |
| 3,00 | 100LB4 | 1740 | 6,05 | 16,46 | IE2 | 87,5 | 87,7 | 87,3 | 85,4 | 0,71 | 3,7 | 6,6 | 3,7 | 88,9 | 92,7 | 24,0 | 31,0 | 3,2 | 40,0 |
| 4,00 | 112M4 | 1760 | 7,58 | 21,70 | IE2 | 87,5 | 88,3 | 87,8 | 86,6 | 0,75 | 3,6 | 7,5 | 3,9 | 137,0 | 146,0 | 32,1 | 41,8 | 2,5 | 60,0 |
| 5,50 | 132S4 | 1760 | 9,75 | 29,84 | IE2 | 89,5 | 89,6 | 88,9 | 87,8 | 0,79 | 3,1 | 7,6 | 3,5 | 288,0 | 298,0 | 47,0 | 57,3 | 1,8 | 100,0 |
| 7,50 | 132MA4 | 1760 | 13,39 | 40,69 | IE2 | 89,5 | 90,1 | 89,1 | 88,0 | 0,78 | 3,1 | 7,7 | 3,6 | 388,0 | 411,0 | 58,8 | 73,2 | 1,2 | 150,0 |
| 9,20 | 132MB4 | 1760 | 16,84 | 49,92 | IE2 | 89,5 | 90,2 | 89,8 | 88,3 | 0,76 | 3,2 | 7,6 | 3,6 | 413,0 | 436,0 | 63,0 | 77,0 | 1,1 | 150,0 |

3.2 TH-TBH

6 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | T T | T TB | T T | T TB | | |
| 0,75 | 90S6 | 940 | 2,10 | 7,62 | IE2 | 75,9 | 75,9 | 75,3 | 72,1 | 0,68 | 2,2 | 3,9 | 2,4 | 45,0 | 46,6 | 13,6 | 17,0 | 7,1 | 13,0 |
| 1,10 | 90L6 | 940 | 3,03 | 11,18 | IE2 | 78,1 | 78,1 | 77,6 | 73,7 | 0,67 | 2,4 | 4,0 | 2,5 | 70,5 | 74,0 | 20,4 | 26,0 | 5,3 | 26,0 |
| 1,50 | 100L6 | 940 | 3,77 | 15,24 | IE2 | 79,8 | 79,8 | 79,6 | 76,2 | 0,72 | 3,0 | 5,0 | 2,9 | 91,6 | 95,1 | 24,8 | 30,4 | 3,6 | 40,0 |
| 2,20 | 112M6 | 960 | 5,18 | 21,88 | IE2 | 81,8 | 81,8 | 81,6 | 80,0 | 0,75 | 2,2 | 5,7 | 2,7 | 202,0 | 231,0 | 30,9 | 40,6 | 2,8 | 40,0 |
| 3,00 | 132S6 | 970 | 6,66 | 29,53 | IE2 | 83,3 | 85,5 | 85,9 | 84,9 | 0,76 | 2,5 | 6,2 | 2,5 | 384,0 | 394,0 | 47,4 | 57,7 | 2,3 | 75,0 |
| 4,00 | 132MA6 | 970 | 8,87 | 39,38 | IE2 | 84,6 | 86,8 | 87,0 | 86,3 | 0,75 | 2,5 | 6,2 | 2,6 | 456,0 | 479,0 | 53,5 | 68,2 | 1,5 | 75,0 |
| 5,50 | 132MB6 | 970 | 12,20 | 54,15 | IE2 | 86,0 | 87,9 | 88,6 | 87,5 | 0,74 | 2,5 | 6,1 | 2,6 | 562,0 | 585,0 | 61,7 | 76,4 | 1,3 | 100,0 |

6 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE2 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | T T | T TB | T T | T TB | | |
| 0,75 | 90S6 | 1150 | 1,84 | 6,23 | IE2 | 80,0 | 80,0 | 77,4 | 74,1 | 0,64 | 2,4 | 4,4 | 2,6 | 45,0 | 46,6 | 13,6 | 17,0 | 7,1 | 13,0 |
| 1,10 | 90L6 | 1150 | 2,56 | 9,13 | IE2 | 85,5 | 85,5 | 80,6 | 73,0 | 0,63 | 2,7 | 4,7 | 2,9 | 70,5 | 74,0 | 20,4 | 26,0 | 5,3 | 26,0 |
| 1,50 | 100L6 | 1150 | 3,15 | 12,46 | IE2 | 86,5 | 86,5 | 81,2 | 75,3 | 0,69 | 3,5 | 6,3 | 3,4 | 91,6 | 95,1 | 24,8 | 30,4 | 3,6 | 40,0 |
| 2,20 | 112M6 | 1170 | 4,44 | 17,96 | IE2 | 87,5 | 87,5 | 83,1 | 77,2 | 0,71 | 2,5 | 6,5 | 3,1 | 202,0 | 231,0 | 30,9 | 40,6 | 2,8 | 40,0 |
| 3,00 | 132S6 | 1170 | 5,86 | 24,49 | IE2 | 87,5 | 88,0 | 87,3 | 83,8 | 0,73 | 2,8 | 6,8 | 2,9 | 384,0 | 394,0 | 47,4 | 57,7 | 2,3 | 75,0 |
| 4,00 | 132MA6 | 1170 | 7,84 | 32,65 | IE2 | 87,5 | 88,9 | 88,7 | 86,2 | 0,72 | 2,8 | 6,9 | 3,0 | 456,0 | 479,0 | 53,5 | 68,2 | 1,5 | 75,0 |
| 5,50 | 132MB6 | 1170 | 10,86 | 44,89 | IE2 | 89,5 | 89,5 | 89,1 | 86,9 | 0,71 | 2,9 | 6,8 | 3,1 | 562,0 | 585,0 | 61,7 | 76,4 | 1,3 | 100,0 |

3.3 TP-TBP

2 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] | |
|------------------------|-------|-------------------------|-----------------------|------------------------|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|-------|------|---|------------------------|-------|
| | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | | |
| 0,75 | 80A2 | 2860 | 1,58 | 2,50 | IE3 | 80,7 | 81,8 | 82,3 | 80,9 | 0,84 | 3,2 | 6,1 | 3,3 | 13,5 | 15,1 | 10,0 | 13,5 | 3,0 | 10,0 |
| 1,10 | 80B2 | 2860 | 2,31 | 3,67 | IE3 | 82,7 | 84,0 | 85,0 | 84,3 | 0,82 | 3,4 | 7,0 | 3,2 | 14,4 | 16,0 | 11,3 | 14,9 | 3,0 | 15,0 |
| 1,50 | 90S2 | 2860 | 3,27 | 5,01 | IE3 | 84,2 | 84,8 | 84,2 | 82,0 | 0,78 | 4,7 | 6,5 | 4,0 | 16,8 | 18,4 | 15,3 | 18,8 | 2,5 | 13,0 |
| 2,20 | 90L2 | 2880 | 4,78 | 7,29 | IE3 | 85,9 | 86,2 | 85,9 | 83,6 | 0,77 | 4,7 | 7,2 | 4,3 | 22,8 | 26,3 | 18,3 | 23,9 | 2,5 | 26,0 |
| 3,00 | 100L2 | 2900 | 6,06 | 9,88 | IE3 | 87,1 | 87,2 | 86,7 | 83,9 | 0,82 | 4,3 | 8,9 | 4,6 | 43,2 | 46,7 | 23,9 | 29,5 | 1,5 | 40,0 |
| 4,00 | 112M2 | 2930 | 8,23 | 13,04 | IE3 | 88,1 | 88,8 | 88,7 | 86,8 | 0,79 | 4,0 | 9,2 | 4,6 | 79,1 | 87,9 | 32,9 | 42,7 | 1,5 | 40,0 |
| 5,50 | 132S2 | 2950 | 10,60 | 17,80 | IE3 | 89,2 | 90,2 | 90,0 | 88,0 | 0,83 | 4,3 | 9,5 | 4,8 | 178,0 | 188,0 | 49,0 | 59,3 | 1,2 | 75,0 |
| 7,50 | 132M2 | 2950 | 14,16 | 24,28 | IE3 | 90,1 | 91,0 | 90,9 | 89,1 | 0,84 | 3,7 | 8,2 | 3,9 | 216,0 | 239,0 | 56,3 | 71,0 | 1,0 | 100,0 |

2 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] | |
|------------------------|-------|-------------------------|-----------------------|------------------------|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|-------|------|---|------------------------|------|
| | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | | |
| 0,75 | 80A2 | 3490 | 1,41 | 2,05 | IE3 | 77,0 | 81,6 | 81,7 | 78,9 | 0,82 | 3,8 | 7,8 | 3,7 | 13,5 | 15,1 | 10,0 | 13,5 | 3,0 | 10,0 |
| 1,10 | 80B2 | 3490 | 2,04 | 3,01 | IE3 | 84,0 | 84,7 | 84,6 | 83,3 | 0,80 | 4,3 | 8,4 | 4,0 | 14,4 | 16,0 | 11,3 | 14,9 | 3,0 | 15,0 |
| 1,50 | 90S2 | 3490 | 2,90 | 4,10 | IE3 | 85,5 | 85,5 | 84,8 | 81,9 | 0,76 | 5,8 | 8,4 | 4,8 | 16,8 | 18,4 | 15,3 | 18,8 | 2,5 | 13,0 |
| 2,20 | 90L2 | 3510 | 4,15 | 5,99 | IE3 | 86,5 | 86,5 | 85,4 | 82,6 | 0,77 | 6,2 | 9,3 | 5,1 | 22,8 | 26,3 | 18,3 | 23,9 | 2,5 | 26,0 |
| 3,00 | 100L2 | 3520 | 5,32 | 8,14 | IE3 | 88,5 | 88,5 | 87,2 | 84,8 | 0,80 | 4,9 | 10,3 | 5,8 | 43,2 | 46,7 | 23,9 | 29,5 | 1,5 | 40,0 |
| 4,00 | 112M2 | 3550 | 7,16 | 10,76 | IE3 | 88,5 | 88,8 | 88,1 | 85,3 | 0,79 | 5,3 | 10,8 | 6,0 | 79,1 | 87,9 | 32,9 | 42,7 | 1,5 | 40,0 |
| 5,50 | 132S2 | 3550 | 9,40 | 14,80 | IE3 | 89,5 | 89,6 | 88,5 | 85,4 | 0,82 | 5,5 | 11,1 | 5,9 | 178,0 | 188,0 | 49,0 | 59,3 | 1,2 | 75,0 |
| 7,50 | 132M2 | 3530 | 12,37 | 20,29 | IE3 | 90,2 | 90,6 | 88,6 | 86,2 | 0,84 | 4,3 | 11,5 | 5,6 | 216,0 | 239,0 | 56,3 | 71,0 | 1,1 | 75,0 |

3.3 TP-TBP

4 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE3 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80B4 | 1440 | 1,67 | 4,97 | IE3 | 82,5 | 82,9 | 82,5 | 80,0 | 0,78 | 3,2 | 6,1 | 3,5 | 38,1 | 39,7 | 13,2 | 16,7 | 7,1 | 15,0 |
| 1,10 | 90S4 | 1430 | 2,41 | 7,35 | IE3 | 84,1 | 84,5 | 84,6 | 82,6 | 0,78 | 3,2 | 6,2 | 3,4 | 42,3 | 45,8 | 17,7 | 21,2 | 5,0 | 13,0 |
| 1,50 | 90L4 | 1430 | 3,20 | 10,02 | IE3 | 85,3 | 85,6 | 85,6 | 83,0 | 0,79 | 3,3 | 6,5 | 3,4 | 48,0 | 51,5 | 19,7 | 25,3 | 4,0 | 26,0 |
| 2,20 | 100LA4 | 1440 | 4,57 | 14,59 | IE3 | 86,7 | 86,9 | 86,9 | 85,2 | 0,80 | 3,3 | 7,5 | 3,7 | 88,9 | 92,7 | 24,0 | 31,0 | 3,2 | 40,0 |
| 2,20 | 112MR4 | 1460 | 4,64 | 14,39 | IE3 | 86,7 | 88,9 | 88,4 | 86,2 | 0,77 | 4,0 | 9,0 | 4,3 | 137,0 | 146,0 | 32,1 | 41,8 | 2,5 | 40,0 |
| 3,00 | 112MS4 | 1450 | 6,16 | 19,76 | IE3 | 87,7 | 87,8 | 88,0 | 86,7 | 0,80 | 3,5 | 7,9 | 3,5 | 137,0 | 146,0 | 33,0 | 43,0 | 2,5 | 40,0 |
| 4,00 | 112M4 | 1450 | 8,35 | 26,34 | IE3 | 88,6 | 88,7 | 88,7 | 87,2 | 0,78 | 3,4 | 7,7 | 3,7 | 155,0 | 164,0 | 35,0 | 45,0 | 2,5 | 60,0 |
| 5,50 | 132MS4 | 1470 | 11,08 | 35,73 | IE3 | 89,6 | 89,6 | 89,6 | 87,9 | 0,80 | 3,8 | 8,2 | 3,9 | 388,0 | 411,0 | 61,0 | 75,0 | 1,8 | 100,0 |
| 7,50 | 132M4 | 1460 | 15,16 | 49,06 | IE3 | 90,4 | 90,4 | 90,6 | 89,5 | 0,79 | 3,5 | 6,9 | 3,3 | 413,0 | 436,0 | 64,0 | 78,0 | 1,1 | 150,0 |

4 Pole

460V 60Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | IE3 | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | τ T | τ TB | τ T | τ TB | | |
| 0,75 | 80B4 | 1750 | 1,49 | 4,09 | IE3 | 83,5 | 85,5 | 82,8 | 79,8 | 0,74 | 3,8 | 7,2 | 4,0 | 38,1 | 39,7 | 13,2 | 16,7 | 7,1 | 15,0 |
| 1,10 | 90S4 | 1750 | 2,13 | 6,00 | IE3 | 86,5 | 86,5 | 85,6 | 82,8 | 0,75 | 3,8 | 7,6 | 3,8 | 42,3 | 45,8 | 17,7 | 21,2 | 5,0 | 13,0 |
| 1,50 | 90L4 | 1750 | 2,82 | 8,19 | IE3 | 86,5 | 86,6 | 85,7 | 82,7 | 0,77 | 3,8 | 7,8 | 4,2 | 48,0 | 51,5 | 19,7 | 25,3 | 4,0 | 26,0 |
| 2,20 | 112MR4 | 1770 | 4,11 | 11,87 | IE3 | 89,5 | 89,5 | 88,6 | 85,9 | 0,75 | 5,0 | 10,9 | 5,6 | 137,0 | 146,0 | 32,1 | 41,8 | 2,5 | 40,0 |
| 3,00 | 112MS4 | 1760 | 5,39 | 16,28 | IE3 | 89,5 | 89,5 | 88,8 | 86,8 | 0,78 | 4,1 | 9,5 | 4,7 | 137,0 | 146,0 | 33,0 | 43,0 | 2,5 | 40,0 |
| 4,00 | 112M4 | 1760 | 7,48 | 21,70 | IE3 | 89,5 | 89,5 | 89,0 | 87,0 | 0,75 | 3,8 | 9,1 | 4,5 | 155,0 | 164,0 | 35,0 | 45,0 | 2,5 | 60,0 |
| 5,50 | 132MS4 | 1770 | 9,65 | 29,67 | IE3 | 91,7 | 91,7 | 90,2 | 88,3 | 0,78 | 4,2 | 9,7 | 4,6 | 388,0 | 411,0 | 61,0 | 75,0 | 1,8 | 100,0 |
| 7,50 | 132M4 | 1760 | 13,33 | 40,69 | IE3 | 91,7 | 91,7 | 91,0 | 89,4 | 0,77 | 3,9 | 7,9 | 3,9 | 413,0 | 436,0 | 64,0 | 78,0 | 1,1 | 150,0 |

3.3 TP-TBP

6 Pole

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | | η _n % (4/4) limit | η _n % (4/4) | η _n % (3/4) | η _n % (2/4) | cosφ _n | M _s M _n | I _s I _n | M _{max} M _n | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|--------|-------------------------|-----------------------|------------------------|-----|------------------------------------|---------------------------|---------------------------|---------------------------|-------------------|----------------------------------|----------------------------------|------------------------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | | | | | T T | T TB | T T | T TB | | |
| 0,75 | 90S6 | 940 | 1,85 | 7,62 | IE3 | 78,9 | 78,9 | 79,0 | 74,9 | 0,74 | 2,5 | 5,0 | 2,7 | 65,0 | 66,6 | 15,4 | 18,8 | 7,1 | 26,0 |
| 1,10 | 100LR6 | 950 | 2,73 | 11,06 | IE3 | 81,0 | 82,0 | 82,2 | 80,8 | 0,71 | 2,6 | 5,1 | 2,8 | 88,0 | 91,5 | 22,7 | 27,9 | 4,0 | 26,0 |
| 1,50 | 100L6 | 940 | 3,69 | 15,24 | IE3 | 82,5 | 82,6 | 83,2 | 81,0 | 0,71 | 2,7 | 4,9 | 2,9 | 91,6 | 95,1 | 24,8 | 30,4 | 3,6 | 40,0 |
| 2,20 | 112M6 | 960 | 5,09 | 21,88 | IE3 | 84,3 | 84,3 | 84,5 | 81,8 | 0,74 | 2,3 | 6,1 | 2,9 | 229,0 | 258,0 | 34,0 | 44,0 | 2,8 | 40,0 |
| 3,00 | 132S6 | 970 | 6,70 | 29,53 | IE3 | 85,6 | 86,2 | 87,2 | 86,5 | 0,75 | 2,5 | 6,1 | 2,7 | 384,0 | 394,0 | 46,0 | 57,0 | 2,3 | 75,0 |
| 4,00 | 132MA6 | 970 | 8,95 | 39,38 | IE3 | 86,8 | 87,2 | 88,0 | 88,2 | 0,74 | 2,5 | 6,6 | 2,9 | 456,0 | 479,0 | 53,5 | 68,2 | 1,5 | 75,0 |
| 5,50 | 132MB6 | 970 | 12,15 | 54,15 | IE3 | 88,0 | 88,3 | 88,6 | 87,7 | 0,74 | 2,7 | 6,4 | 2,9 | 562,0 | 585,0 | 61,7 | 76,4 | 1,3 | 100,0 |

4 Pole

230V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n 230V [A] | M _n [Nm] | η _n % | cosφ _n | C _r [μF] | $\frac{M_s}{M_n}$ | $\frac{I_s}{I_n}$ | $\frac{M_{max}}{M_n}$ | J _T [10 ⁻⁴ ×Kg·m ²] | W _T [Kg] |
|------------------------|--------|-------------------------|----------------------------|------------------------|------------------|-------------------|------------------------|-------------------|-------------------|-----------------------|--|------------------------|
| 0,12 | 63A4 | 1420 | 1,30 | 0,81 | 48,0 | 0,88 | 6,3 | 0,8 | 2,7 | 2,4 | 2,8 | 4,2 |
| 0,18 | 63B4 | 1400 | 1,60 | 1,23 | 57,0 | 0,90 | 8,0 | 0,8 | 2,8 | 1,9 | 3,5 | 4,8 |
| 0,25 | 71A4 | 1340 | 2,10 | 1,78 | 59,0 | 0,94 | 10,0 | 0,7 | 2,7 | 1,7 | 8,6 | 5,9 |
| 0,37 | 71B4 | 1360 | 2,80 | 2,60 | 61,0 | 0,95 | 14,0 | 0,7 | 2,9 | 1,6 | 10,8 | 6,7 |
| 0,55 | 80A4 | 1400 | 3,80 | 3,75 | 64,0 | 0,98 | 20,0 | 0,7 | 3,7 | 1,9 | 25,0 | 10,1 |
| 0,75 | 80B4 | 1400 | 5,10 | 5,12 | 65,0 | 0,98 | 25,0 | 0,6 | 3,6 | 1,9 | 31,0 | 11,5 |
| 1,10 | 90S4 | 1370 | 7,70 | 7,67 | 69,0 | 0,91 | 30,0 | 0,5 | 3,2 | 1,7 | 30,0 | 13,5 |
| 1,50 | 90L4 | 1350 | 9,30 | 10,61 | 72,0 | 0,96 | 40,0 | 0,5 | 3,0 | 1,6 | 38,0 | 16,5 |
| 2,20 | 100LA4 | 1400 | 13,20 | 15,01 | 72,0 | 0,95 | 60,0 | 0,5 | 3,0 | 1,5 | 72,0 | 22,8 |

4 Pole

230V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % | cosφ _n | C _r / C _s [μF] | $\frac{M_s}{M_n}$ | $\frac{I_s}{I_n}$ | $\frac{M_{max}}{M_n}$ | J _T [10 ⁻⁴ × Kg m ²] | W _T [Kg] |
|------------------------|--------|-------------------------|-----------------------|------------------------|------------------|-------------------|---|-------------------|-------------------|-----------------------|---|------------------------|
| 0,12 | 63A4 | 1420 | 1,30 | 0,81 | 48,0 | 0,88 | 6,3 / 12,5 | 2,4 | 3,3 | 2,4 | 2,8 | 4,2 |
| 0,18 | 63B4 | 1400 | 1,60 | 1,23 | 57,0 | 0,90 | 8 / 16 | 2,3 | 3,2 | 1,9 | 3,5 | 4,8 |
| 0,25 | 71A4 | 1340 | 2,10 | 1,78 | 59,0 | 0,94 | 10 / 20 | 2,5 | 3,0 | 1,7 | 8,6 | 5,9 |
| 0,37 | 71B4 | 1360 | 2,80 | 2,60 | 61,0 | 0,95 | 14 / 25 | 2,3 | 3,2 | 1,6 | 10,8 | 6,7 |
| 0,55 | 80A4 | 1400 | 3,80 | 3,75 | 64,0 | 0,98 | 20 / 40 | 2,4 | 4,2 | 1,9 | 25,0 | 10,1 |
| 0,75 | 80B4 | 1400 | 5,10 | 5,12 | 65,0 | 0,98 | 25 / 50 | 2,3 | 4,0 | 1,9 | 31,0 | 11,5 |
| 1,10 | 90S4 | 1370 | 7,70 | 7,67 | 69,0 | 0,91 | 30 / 80 | 2,3 | 3,4 | 1,7 | 30,0 | 13,5 |
| 1,50 | 90L4 | 1350 | 9,30 | 10,61 | 72,0 | 0,96 | 40 / 120 | 2,3 | 3,9 | 1,6 | 38,0 | 16,5 |
| 2,20 | 100LA4 | 1400 | 13,20 | 15,01 | 72,0 | 0,95 | 60 / 140 | 2,1 | 3,4 | 1,5 | 72,0 | 22,8 |

3.6 D-DB

2/4 Pole - Dahlander YY/Δ

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % | cosφ _n | $\frac{M_s}{M_n}$ | $\frac{I_s}{I_n}$ | $\frac{M_{max}}{M_n}$ | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|----------|-------------------------|-----------------------|------------------------|------------------|-------------------|-------------------|-------------------|-----------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | T D | T DB | T D | T DB | | |
| 0,18 / 0,12 | 63A2/4 | 2800 / 1370 | 0,55 / 0,55 | 0,62 / 0,83 | 60 / 50 | 0,77 / 0,65 | 1,5 / 1,4 | 3,4 / 2,5 | 1,7 / 1,7 | 2,8 | 3,4 | 4,2 | 5,7 | 4,0 / 6,3 | 1,0 |
| 0,20 / 0,15 | 63B2/4 | 2790 / 1370 | 0,64 / 0,66 | 0,70 / 1,05 | 62 / 51 | 0,80 / 0,64 | 3,0 / 2,7 | 4,0 / 2,6 | 3,1 / 2,8 | 2,8 | 3,4 | 4,2 | 5,7 | 3,4 / 5,8 | 3,0 |
| 0,25 / 0,18 | 63C2/4 | 2820 / 1380 | 0,70 / 0,70 | 0,85 / 1,25 | 63 / 54 | 0,82 / 0,70 | 2,4 / 2,3 | 3,5 / 2,6 | 2,5 / 2,4 | 3,5 | 4,1 | 4,8 | 6,5 | 2,8 / 5,3 | 3,0 |
| 0,25 / 0,18 | 71A2/4 | 2850 / 1420 | 0,70 / 0,60 | 0,84 / 1,23 | 64 / 62 | 0,80 / 0,70 | 2,0 / 1,9 | 4,2 / 3,6 | 2,1 / 2,0 | 7,2 | 8,3 | 5,3 | 7,5 | 2,8 / 5,3 | 5,0 |
| 0,37 / 0,25 | 71B2/4 | 2810 / 1420 | 0,98 / 0,78 | 1,25 / 1,70 | 66 / 64 | 0,86 / 0,75 | 2,2 / 2,1 | 4,7 / 4,0 | 2,3 / 2,2 | 8,6 | 9,7 | 5,9 | 8,1 | 2,8 / 5,3 | 5,0 |
| 0,55 / 0,37 | 71C2/4 | 2790 / 1390 | 1,3 / 1,1 | 1,88 / 2,55 | 69 / 67 | 0,88 / 0,78 | 2,0 / 1,9 | 4,5 / 3,7 | 2,1 / 2,0 | 10,8 | 11,9 | 6,7 | 8,9 | 2,3 / 4,2 | 5,0 |
| 0,60 / 0,45 | 80A2/4 | 2800 / 1410 | 1,75 / 1,25 | 2,1 / 3,1 | 58 / 64 | 0,87 / 0,82 | 1,7 / 1,7 | 3,6 / 4,1 | 1,8 / 2,0 | 19,0 | 20,6 | 8,7 | 12,2 | 2,3 / 4,2 | 5,0 |
| 0,80 / 0,60 | 80B2/4 | 2830 / 1410 | 1,95 / 1,5 | 2,7 / 4,0 | 68 / 70 | 0,89 / 0,84 | 1,8 / 1,8 | 4,6 / 4,6 | 1,9 / 1,9 | 25,0 | 26,6 | 10,1 | 13,6 | 2,0 / 3,5 | 10,0 |
| 1,10 / 0,75 | 80C2/4 | 2850 / 1420 | 2,7 / 1,9 | 3,7 / 5,1 | 68 / 70 | 0,90 / 0,86 | 1,7 / 1,9 | 4,3 / 5,0 | 1,9 / 2,0 | 31,0 | 32,6 | 11,3 | 14,8 | 1,6 / 2,8 | 10,0 |
| 1,4 / 1,1 | 90S2/4 | 2800 / 1390 | 3,7 / 2,9 | 4,8 / 7,6 | 69 / 72 | 0,79 / 0,78 | 2,5 / 2,3 | 4,4 / 4,8 | 2,6 / 2,4 | 29,0 | 30,6 | 13,5 | 17,0 | 1,2 / 2,0 | 13,0 |
| 1,7 / 1,3 | 90LA2/4 | 2830 / 1390 | 3,8 / 3,0 | 5,7 / 8,9 | 73 / 71 | 0,89 / 0,86 | 2,3 / 2,1 | 4,8 / 4,3 | 2,4 / 2,1 | 32,0 | 35,5 | 14,5 | 20,1 | 1,1 / 1,9 | 26,0 |
| 2,2 / 1,5 | 90LB2/4 | 2850 / 1420 | 5,0 / 3,5 | 7,4 / 10,3 | 72 / 74 | 0,84 / 0,80 | 2,3 / 2,6 | 4,8 / 5,3 | 2,4 / 2,6 | 39,0 | 42,5 | 16,5 | 22,1 | 1,0 / 1,7 | 26,0 |
| 2,3 / 1,8 | 100LA2/4 | 2870 / 1420 | 5,5 / 4,2 | 7,6 / 12,2 | 73 / 74 | 0,84 / 0,80 | 2,4 / 2,4 | 6,3 / 4,6 | 2,5 / 2,7 | 53,0 | 56,5 | 19,1 | 24,7 | 1,0 / 1,7 | 26,0 |
| 3,0 / 2,2 | 100LB2/4 | 2870 / 1420 | 6,9 / 5,2 | 10,0 / 14,7 | 74 / 75 | 0,85 / 0,80 | 2,1 / 2,2 | 5,4 / 5,1 | 2,6 / 2,4 | 64,0 | 67,5 | 21,2 | 26,8 | 0,8 / 1,3 | 40,0 |
| 3,3 / 2,6 | 100LC2/4 | 2860 / 1420 | 7,5 / 6,0 | 10,8 / 17,3 | 74 / 75 | 0,86 / 0,81 | 2,1 / 2,0 | 5,4 / 4,5 | 2,6 / 2,4 | 72,0 | 75,5 | 22,8 | 28,4 | 0,7 / 1,2 | 40,0 |
| 4,0 / 3,0 | 112MA2/4 | 2800 / 1420 | 9,0 / 6,6 | 13,7 / 20,2 | 74 / 78 | 0,85 / 0,84 | 2,5 / 2,5 | 5,2 / 5,8 | 2,6 / 2,6 | 90,0 | 98,8 | 25,0 | 34,7 | 0,7 / 1,2 | 60,0 |
| 4,8 / 3,6 | 112MB2/4 | 2870 / 1420 | 10,0 / 7,7 | 16,0 / 24,2 | 79 / 81 | 0,87 / 0,84 | 2,1 / 2,1 | 6,1 / 5,0 | 2,8 / 2,4 | 110,0 | 118,8 | 29,4 | 39,1 | 0,6 / 1,1 | 60,0 |
| 6,0 / 4,5 | 132SA2/4 | 2880 / 1440 | 12,5 / 10,0 | 20,0 / 29,9 | 80 / 82 | 0,88 / 0,81 | 2,0 / 2,0 | 6,2 / 4,7 | 2,4 / 2,4 | 240,0 | 250,3 | 42,3 | 52,6 | 0,5 / 0,8 | 75,0 |
| 7,5 / 5,8 | 132SB2/4 | 2890 / 1440 | 16,7 / 12,8 | 24,6 / 38,3 | 77 / 80 | 0,86 / 0,82 | 2,5 / 2,5 | 5,8 / 4,7 | 2,6 / 2,6 | 307,0 | 317,3 | 50,2 | 60,5 | 0,4 / 0,7 | 100,0 |
| 9,2 / 7,0 | 132MA2/4 | 2900 / 1440 | 18,8 / 14,8 | 29,9 / 45,9 | 81 / 83 | 0,86 / 0,82 | 2,5 / 2,6 | 7,6 / 5,2 | 2,6 / 2,7 | 350,0 | 373,0 | 54,8 | 69,5 | 0,4 / 0,7 | 100,0 |
| 11,0 / 8,5 | 132MB2/4 | 2920 / 1460 | 24,0 / 17,0 | 35,7 / 55,8 | 82 / 86 | 0,81 / 0,83 | 2,2 / 2,2 | 7,9 / 5,8 | 2,3 / 2,3 | 389,0 | 412,0 | 59,4 | 74,1 | 0,4 / 0,7 | 150,0 |

2/8 Pole - Separate windings Y/Y

400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % | cosφ _n | $\frac{M_s}{M_n}$ | $\frac{I_s}{I_n}$ | $\frac{M_{max}}{M_n}$ | 10 ⁻⁴ × Kg m ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|----------|-------------------------|-----------------------|------------------------|------------------|-------------------|-------------------|-------------------|-----------------------|--------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | T D | T DB | T D | T DB | | |
| 0,18 / 0,045 | 71A2/8 | 2890 / 710 | 0,58 / 0,42 | 0,61 / 0,61 | 57 / 28 | 0,82 / 0,60 | 2,0 / 2,6 | 4,5 / 2,0 | 2,1 / 2,7 | 7,2 | 8,3 | 5,3 | 7,5 | 7,5 / 19 | 2,5 |
| 0,25 / 0,06 | 71B2/8 | 2890 / 700 | 0,75 / 0,50 | 0,85 / 0,84 | 65 / 35 | 0,80 / 0,53 | 2,0 / 2,4 | 4,8 / 2,0 | 2,1 / 2,5 | 8,6 | 9,7 | 5,9 | 8,1 | 7,1 / 17 | 2,5 |
| 0,37 / 0,09 | 71C2/8 | 2880 / 680 | 1,05 / 0,70 | 1,23 / 1,27 | 64 / 32 | 0,82 / 0,53 | 2,1 / 2,5 | 4,9 / 2,1 | 2,2 / 2,6 | 10,8 | 11,9 | 6,7 | 8,9 | 6,0 / 14 | 5,0 |
| 0,55 / 0,12 | 80B2/8 | 2900 / 720 | 1,60 / 0,78 | 1,83 / 1,63 | 64 / 37 | 0,81 / 0,63 | 2,1 / 2,0 | 5,0 / 2,4 | 2,2 / 2,2 | 25,0 | 26,6 | 10,1 | 13,6 | 2,7 / 11,2 | 5,0 |
| 0,75 / 0,18 | 80C2/8 | 2900 / 710 | 1,95 / 0,92 | 2,5 / 2,4 | 68 / 44 | 0,86 / 0,63 | 1,8 / 1,6 | 5,3 / 2,5 | 2,0 / 1,9 | 31,1 | 32,7 | 11,7 | 15,2 | 2,4 / 10 | 10,0 |
| 0,90 / 0,20 | 90S2/8 | 2840 / 680 | 2,30 / 0,95 | 3,0 / 2,8 | 68 / 44 | 0,86 / 0,68 | 1,6 / 1,3 | 4,4 / 2,1 | 2,1 / 1,6 | 25,0 | 26,6 | 12,0 | 15,5 | 1,9 / 9,0 | 10,0 |
| 1,1 / 0,25 | 90L2/8 | 2890 / 690 | 2,70 / 1,25 | 3,6 / 3,5 | 72 / 45 | 0,83 / 0,64 | 2,6 / 1,8 | 5,8 / 2,2 | 2,7 / 2,0 | 32,0 | 35,5 | 14,5 | 20,1 | 1,7 / 7,5 | 13,0 |
| 1,5 / 0,37 | 100LA2/8 | 2890 / 710 | 3,9 / 1,8 | 4,9 / 4,8 | 70 / 48 | 0,85 / 0,58 | 2,1 / 1,6 | 5,4 / 2,5 | 2,5 / 1,9 | 53,0 | 56,5 | 19,1 | 24,7 | 1,6 / 5,6 | 26,0 |
| 2,2 / 0,55 | 100LB2/8 | 2900 / 710 | 5,1 / 2,7 | 7,3 / 7,5 | 75 / 52 | 0,87 / 0,59 | 2,3 / 1,7 | 6,5 / 2,5 | 2,5 / 1,9 | 72,0 | 75,5 | 22,8 | 28,4 | 1,4 / 4,5 | 26,0 |
| 3,0 / 0,75 | 112M2/8 | 2920 / 710 | 6,5 / 3,4 | 10,0 / 10,1 | 78 / 59 | 0,87 / 0,52 | 2,4 / 1,8 | 7,0 / 2,6 | 2,2 / 2,7 | 120,0 | 128,8 | 30,5 | 40,2 | 1,3 / 4,0 | 40,0 |
| 4,0 / 1,1 | 132S2/8 | 2920 / 710 | 8,9 / 4,5 | 13,0 / 14,8 | 75 / 62 | 0,86 / 0,57 | 2,6 / 2,1 | 5,2 / 2,9 | 2,7 / 2,2 | 240,0 | 250,3 | 42,3 | 52,6 | 1,1 / 3,1 | 50,0 |
| 5,5 / 1,5 | 132M2/8 | 2940 / 720 | 11,5 / 5,7 | 18,0 / 20,1 | 83 / 69 | 0,87 / 0,56 | 2,8 / 2,3 | 5,6 / 2,7 | 2,9 / 2,5 | 330,0 | 352,5 | 52,5 | 67,2 | 0,8 / 2,5 | 50,0 |

4/8 Pole - Dahlander YY/Δ

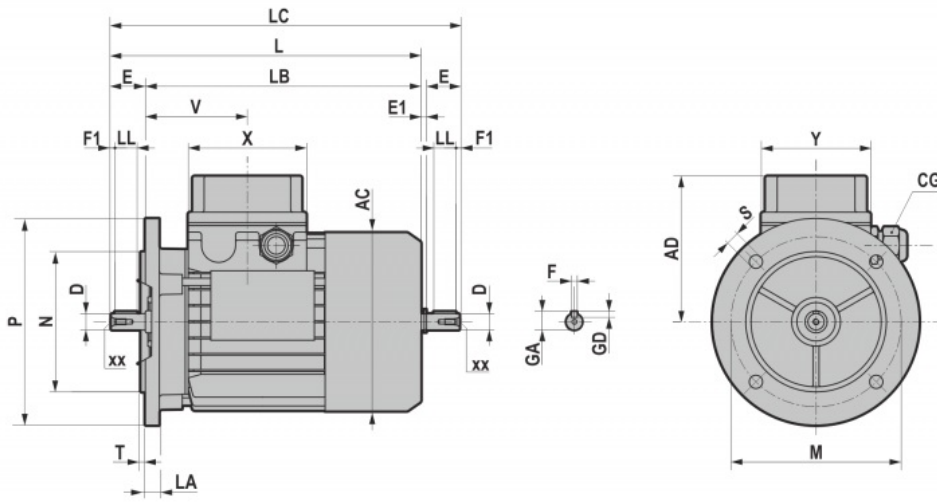
400V 50Hz

| P _n [kW] | Size | n _n [rpm] | I _n [A] | M _n [Nm] | η _n % | cosφ _n | $\frac{M_s}{M_n}$ | $\frac{I_s}{I_n}$ | $\frac{M_{max}}{M_n}$ | 10 ⁻⁴ × Kgm ² | | Kg | | Z ₀ [10 ³ × 1/h] | M _B [Nm] |
|------------------------|----------|-------------------------|-----------------------|------------------------|------------------|-------------------|-------------------|-------------------|-----------------------|-------------------------------------|-------|------|------|---|------------------------|
| | | | | | | | | | | T D | T DB | T D | T DB | | |
| 0,18 / 0,11 | 71B4/8 | 1380 / 690 | 0,53 / 0,72 | 1,27 / 1,55 | 59 / 35 | 0,84 / 0,60 | 1,7 / 2,1 | 3,4 / 2,2 | 2,2 / 2,5 | 12,0 | 13,1 | 6,0 | 8,2 | 4,2 / 7,5 | 3,5 |
| 0,25 / 0,15 | 71C4/8 | 1370 / 670 | 0,72 / 0,89 | 1,76 / 2,10 | 60 / 38 | 0,78 / 0,57 | 1,7 / 1,9 | 3,4 / 2,1 | 2,1 / 2,4 | 14,8 | 15,9 | 6,8 | 9,0 | 4,0 / 6,7 | 5,0 |
| 0,30 / 0,18 | 80A4/8 | 1390 / 700 | 0,76 / 0,85 | 2,1 / 2,5 | 66 / 50 | 0,88 / 0,64 | 1,6 / 1,7 | 3,9 / 2,2 | 1,9 / 2,1 | 22,0 | 23,6 | 9,3 | 12,7 | 4,0 / 6,7 | 5,0 |
| 0,40 / 0,25 | 80B4/8 | 1390 / 690 | 1,05 / 1,15 | 2,8 / 3,5 | 68 / 50 | 0,85 / 0,61 | 1,6 / 1,5 | 3,6 / 1,9 | 1,8 / 1,8 | 28,0 | 29,6 | 10,9 | 14,4 | 3,8 / 6,5 | 10,0 |
| 0,55 / 0,30 | 80C4/8 | 1390 / 700 | 1,3 / 1,3 | 3,8 / 4,1 | 69 / 54 | 0,89 / 0,65 | 1,6 / 2,1 | 4,1 / 3,1 | 2,4 / 3,0 | 31,0 | 32,6 | 11,7 | 15,2 | 3,2 / 5,6 | 10,0 |
| 0,75 / 0,40 | 90S4/8 | 1400 / 700 | 1,70 / 1,75 | 5,1 / 5,5 | 75 / 58 | 0,86 / 0,56 | 1,5 / 2,1 | 4,6 / 2,9 | 2,5 / 2,5 | 45,0 | 46,5 | 13,1 | 16,6 | 3,1 / 5,3 | 13,0 |
| 1,0 / 0,55 | 90L4/8 | 1390 / 700 | 2,4 / 2,4 | 7,5 / 7,5 | 75 / 58 | 0,88 / 0,58 | 1,5 / 2,3 | 3,8 / 3,2 | 2,1 / 2,8 | 60,0 | 63,5 | 16,0 | 21,6 | 2,8 / 4,8 | 13,0 |
| 1,25 / 0,7 | 100LA4/8 | 1420 / 710 | 2,7 / 3,0 | 8,5 / 9,5 | 75 / 58 | 0,88 / 0,56 | 1,9 / 2,4 | 5,5 / 3,2 | 2,2 / 2,6 | 72,0 | 75,5 | 20,0 | 25,6 | 1,9 / 3,3 | 26,0 |
| 1,6 / 0,9 | 100LB4/8 | 1420 / 710 | 3,5 / 3,8 | 10,8 / 12,1 | 77 / 60 | 0,88 / 0,56 | 2,0 / 2,6 | 5,5 / 3,3 | 2,4 / 2,8 | 91,0 | 94,5 | 24,0 | 29,6 | 1,8 / 3,0 | 26,0 |
| 2,3 / 1,2 | 112MA4/8 | 1410 / 710 | 5,0 / 4,5 | 15,6 / 15,9 | 74 / 67 | 0,88 / 0,57 | 1,3 / 1,7 | 4,4 / 3,8 | 2,1 / 2,5 | 115,0 | 122,2 | 23,9 | 33,6 | 1,7 / 2,8 | 40,0 |
| 3,0 / 1,5 | 112MB4/8 | 1420 / 720 | 6,2 / 5,5 | 20,5 / 20,2 | 78 / 70 | 0,89 / 0,55 | 1,7 / 2,2 | 5,5 / 4,1 | 2,1 / 2,5 | 140,0 | 148,8 | 28,9 | 38,6 | 1,7 / 2,8 | 40,0 |
| 3,8 / 2,1 | 132SA4/8 | 1430 / 720 | 8,2 / 7,6 | 25,3 / 27,8 | 77 / 71 | 0,86 / 0,57 | 1,5 / 2,1 | 5,0 / 4,2 | 1,9 / 2,2 | 330,0 | 340,3 | 42,0 | 52,3 | 1,4 / 2,3 | 75,0 |
| 4,5 / 2,4 | 132SB4/8 | 1440 / 720 | 9,6 / 9,0 | 30,1 / 31,7 | 80 / 71 | 0,86 / 0,52 | 1,6 / 2,4 | 5,4 / 4,1 | 1,9 / 2,4 | 380,0 | 390,3 | 46,4 | 56,7 | 1,2 / 2,1 | 75,0 |
| 5,2 / 3,0 | 132MA4/8 | 1430 / 720 | 10,3 / 10,9 | 34,2 / 39,6 | 82 / 73 | 0,86 / 0,54 | 1,7 / 2,4 | 6,3 / 4,1 | 2,3 / 2,4 | 430,0 | 453,0 | 52,5 | 67,2 | 1,0 / 1,7 | 100,0 |
| 6,0 / 3,7 | 132MB4/8 | 1440 / 720 | 12,6 / 12,5 | 39,7 / 48,8 | 80 / 70 | 0,88 / 0,60 | 1,7 / 2,2 | 6,0 / 4,1 | 2,2 / 2,2 | 510,0 | 533,0 | 59,4 | 74,1 | 0,95 / 1,6 | 100,0 |

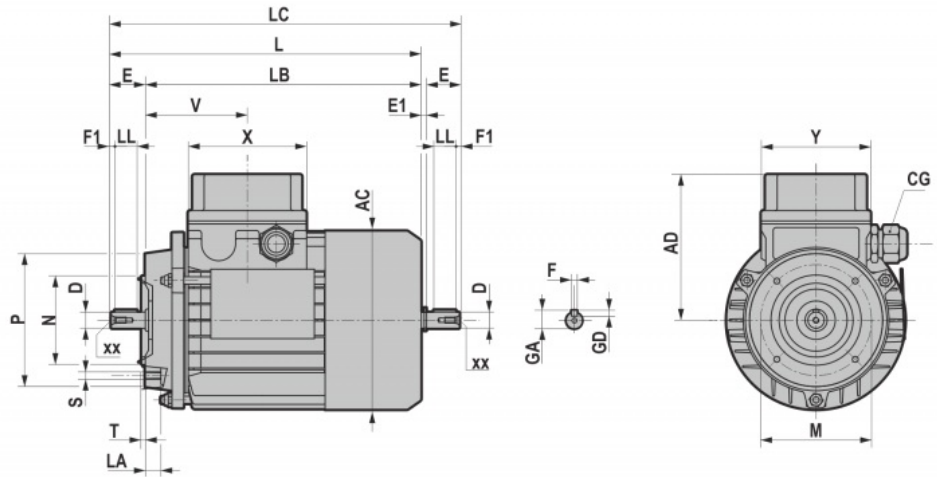
4.1 DIMENSIONS

4.1.1 General dimensions

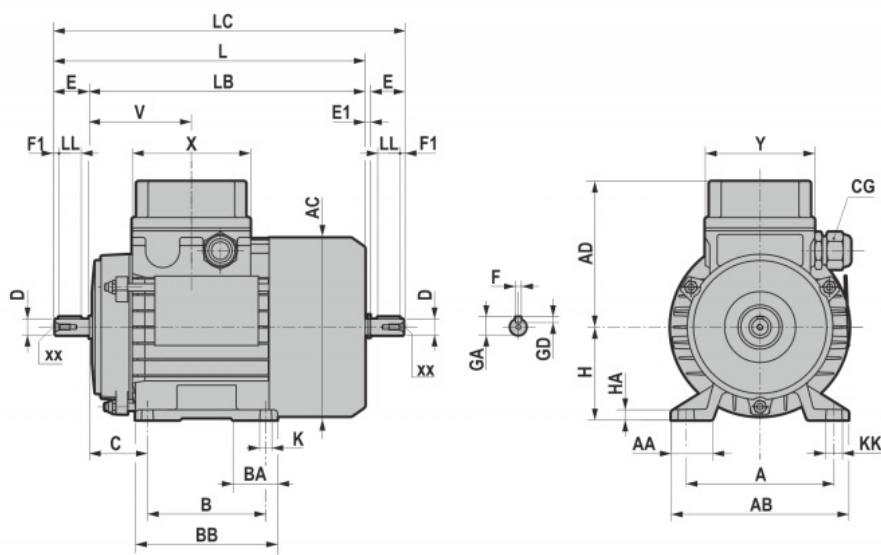
B5



B14



B3



4.1 DIMENSIONS

| | AC | AD | L | LB | X | Y | V | LC |
|------|-------|-------|-------------------|-------------------|-----|-----|-------|-------------------|
| 56 | 106 | 95 | 197 | 177 | 93 | 93 | 55 | - |
| 63 | 121 | 104 | 211 | 188 | 80 | 74 | 70 | 235,5 |
| 71 | 139 | 112 | 238,5 | 208,5 | 80 | 74 | 74,5 | 271 |
| 80 | 158 | 121,5 | 272,5 *(295,5) | 232,5 *(255,5) | 80 | 74 | 78 | 314 *(337) |
| 90S | 173 | 146 | 298 *(331) | 248 *(281) | 98 | 98 | 87 | 349,5 *(380,5) |
| 90L | 173 | 146 | 323 *(356) | 273 *(306) | 98 | 98 | 87 | 374,5 *(407,5) |
| 100 | 191 | 154,5 | 368 | 308 | 98 | 98 | 97,5 | 431,5 |
| 112 | 210,5 | 169,5 | 383,5 *(407,5) | 322,5 *(347,5) | 98 | 98 | 100 | 447 *(472) |
| 132S | 248,5 | 195 | 453 | 372 | 118 | 118 | 115,5 | 536,5 |
| 132M | 248,5 | 195 | 490 | 410 | 118 | 118 | 115,5 | 574,5 |
| 160S | 248,5 | 195 | 520 | 410 | 118 | 118 | 115,5 | - |

*TP80B4, TP90S4, TP90L4, TP90S6, TP112M4, TP112M6

| | Shaft end | | | | | | Key | | | Cable gland | | |
|------|-----------|-----|-----|---------|-----|------|-----|----|----|-------------|--------------|--------------|
| | D | E | E1 | xx | F1 | GA | F | GD | LL | xxx | Ø hollow min | Ø hollow max |
| 56 | 9 | 20 | - | M4x12 | 3,5 | 10 | 3 | 3 | 14 | M16x1,5 | 5 | 10 |
| 63 | 11 j6 | 23 | 1,5 | M4x10 | 2,5 | 12,5 | 4 | 4 | 15 | M16x1,5 | 5 | 10 |
| 71 | 14 j6 | 30 | 2,5 | M5x12,5 | 3 | 16 | 5 | 5 | 20 | M20x1,5 | 6 | 12 |
| 80 | 19 j6 | 40 | 1,5 | M6x16 | 5 | 21,5 | 6 | 6 | 30 | M20x1,5 | 6 | 12 |
| 90S | 24 j6 | 50 | 1,5 | M8x19 | 5 | 27 | 8 | 7 | 35 | M25x1,5 | 13 | 18 |
| 90L | 24 j6 | 50 | 1,5 | M8x19 | 5 | 27 | 8 | 7 | 35 | M25x1,5 | 13 | 18 |
| 100 | 28 j6 | 60 | 3,5 | M10x22 | 7,5 | 31 | 8 | 7 | 45 | M25x1,5 | 13 | 18 |
| 112 | 28 j6 | 60 | 3,5 | M10x22 | 7,5 | 31 | 8 | 7 | 45 | M25x1,5 | 13 | 18 |
| 132S | 38 k6 | 80 | 4 | M12x28 | 10 | 41 | 10 | 8 | 60 | M32x1,5 | 18 | 25 |
| 132M | 38 k6 | 80 | 4 | M12x28 | 10 | 41 | 10 | 8 | 60 | M32x1,5 | 18 | 25 |
| 160S | 42 k6 | 110 | - | M16x36 | 10 | 45 | 12 | 8 | 90 | M32x1,5 | 18 | 25 |

| B5 | M | N | P | LA | S | T |
|-----|-----|-----|-----|------|------|-----|
| 56 | 100 | 80 | 120 | 9 | 7 | 3 |
| 63 | 115 | 95 | 140 | 10 | 9 | 3 |
| 71 | 130 | 110 | 160 | 10 | 9,5 | 3,5 |
| 80 | 165 | 130 | 200 | 12 | 11 | 3,5 |
| 90 | 165 | 130 | 200 | 12 | 11 | 3,5 |
| 100 | 215 | 180 | 250 | 15 | 14 | 4 |
| 112 | 215 | 180 | 250 | 14,5 | 14 | 4 |
| 132 | 265 | 230 | 300 | 20 | 14 | 3,5 |
| 160 | 300 | 250 | 350 | 13 | 18,5 | 3,5 |

| B14 | M | N | P | LA | S | T |
|-----|-----|-----|-----|------|-----|-----|
| 56 | 65 | 50 | 80 | 9 | M5 | 3 |
| 63 | 75 | 60 | 90 | 10 | M5 | 2,5 |
| 71 | 85 | 70 | 105 | 10,5 | M6 | 2,5 |
| 80 | 100 | 80 | 120 | 10,5 | M6 | 3 |
| 90 | 115 | 95 | 140 | 11,5 | M8 | 3 |
| 100 | 130 | 110 | 160 | 15 | M8 | 3,5 |
| 112 | 130 | 110 | 160 | 11,5 | M8 | 3,5 |
| 132 | 165 | 130 | 200 | 20,5 | M10 | 3,5 |

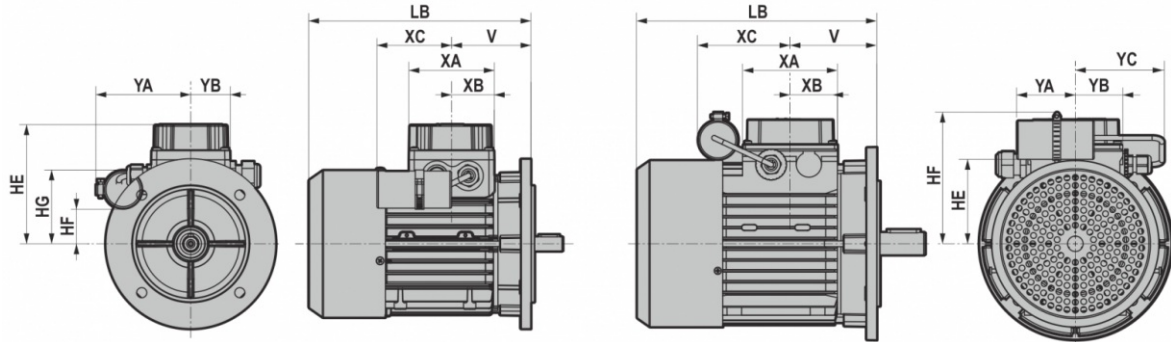
| B3 | A | AA | AB | KK | B | BB | BA | K | C | H | HA |
|------|-----|------|-----|------|-----|-----|----|------|----|-----|----|
| 63 | 100 | 44 | 120 | 12 | 80 | 108 | 25 | 7,5 | 40 | 63 | 9 |
| 71 | 112 | 44 | 132 | 12 | 90 | 108 | 25 | 7,5 | 44 | 71 | 9 |
| 80 | 125 | 56,5 | 156 | 19,5 | 100 | 122 | 26 | 9,5 | 49 | 80 | 11 |
| 90S | 140 | 56 | 172 | 12 | 100 | 136 | 33 | 8,5 | 54 | 90 | 11 |
| 90L | 140 | 57 | 172 | 12 | 125 | 155 | 33 | 8,5 | 54 | 90 | 13 |
| 100 | 160 | 64 | 192 | 20 | 140 | 170 | 37 | 8,5 | 62 | 100 | 14 |
| 112 | 190 | 76 | 221 | 21 | 140 | 175 | 40 | 8,5 | 69 | 112 | 14 |
| 132S | 216 | 84 | 260 | 22 | 140 | 175 | 40 | 10,5 | 87 | 132 | 16 |
| 132M | 216 | 85 | 260 | 22 | 180 | 210 | 40 | 10,5 | 87 | 132 | 16 |

4.1 DIMENSIONS

4.1.2 S series

63 - 71 - 80

90 - 100

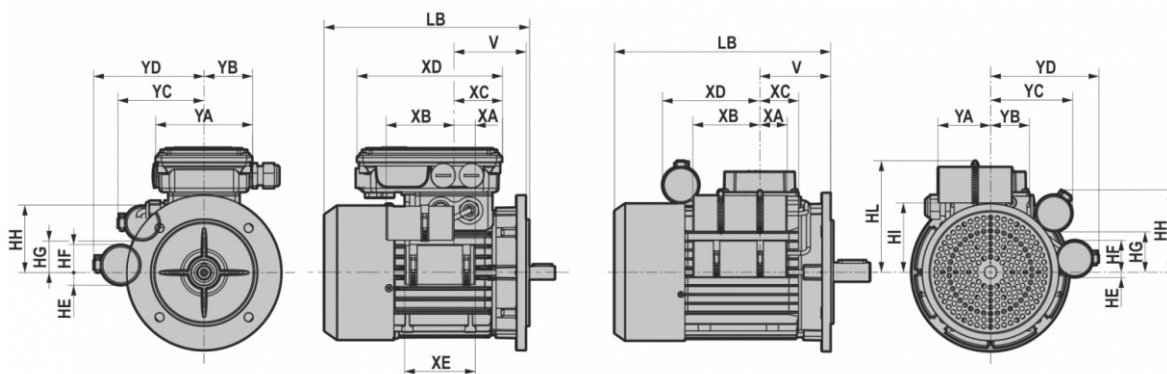


| | V | YA | YB | YC | HE | HF | HG | XA | XB | XC |
|---------------|------|----|----|----|-----|-----|----|----|----|-----|
| 63A4 | 69 | 86 | 37 | - | 104 | 29 | 62 | 80 | 40 | 60 |
| 63B4 | 69 | 89 | 37 | - | 104 | 28 | 62 | 80 | 40 | 60 |
| 71A4 | 75 | 89 | 37 | - | 112 | 32 | 70 | 80 | 40 | 60 |
| 71B4 | 75 | 89 | 37 | - | 112 | 32 | 70 | 80 | 40 | 60 |
| 80A4 | 78 | 94 | 37 | - | 122 | 39 | 81 | 80 | 40 | 70 |
| 80B4 | 78 | 94 | 37 | - | 122 | 39 | 81 | 80 | 40 | 73 |
| 90S4 | 89,5 | 60 | 49 | 90 | 146 | 136 | - | 98 | 49 | 96 |
| 90L4 | 89,5 | 67 | 49 | 90 | 146 | 141 | - | 98 | 49 | 123 |
| 100LA4 | 89,5 | 80 | 49 | 90 | 155 | 150 | - | 98 | 49 | 138 |

4.1 DIMENSIONS

4.1.3 HSE series

63 - 71 - 80 **90 - 100**

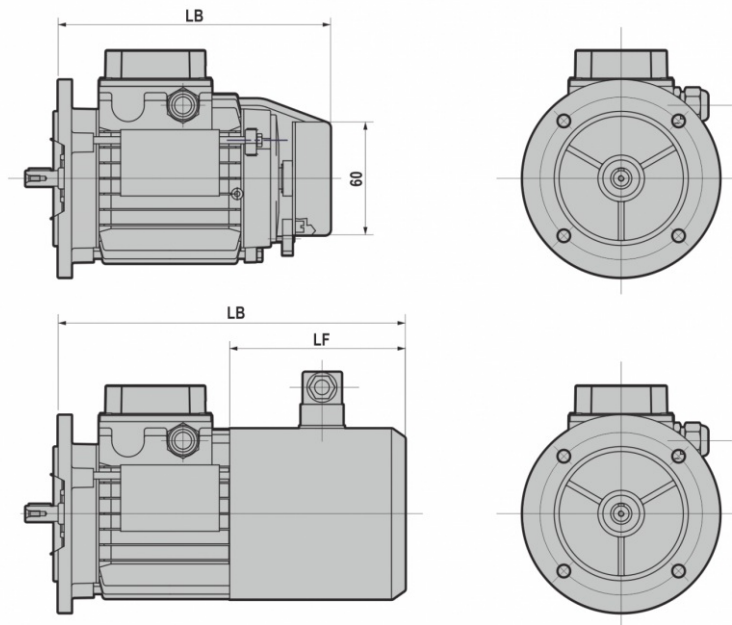


| | V | YA | YB | YC | HE | HF | HG | XA | XB | XC |
|---------------|------|----|----|----|-----|-----|----|----|----|-----|
| 63A4 | 69 | 86 | 37 | - | 104 | 29 | 62 | 80 | 40 | 60 |
| 63B4 | 69 | 89 | 37 | - | 104 | 28 | 62 | 80 | 40 | 60 |
| 71A4 | 75 | 89 | 37 | - | 112 | 32 | 70 | 80 | 40 | 60 |
| 71B4 | 75 | 89 | 37 | - | 112 | 32 | 70 | 80 | 40 | 60 |
| 80A4 | 78 | 94 | 37 | - | 122 | 39 | 81 | 80 | 40 | 70 |
| 80B4 | 78 | 94 | 37 | - | 122 | 39 | 81 | 80 | 40 | 73 |
| 90S4 | 89,5 | 60 | 49 | 90 | 146 | 136 | - | 98 | 49 | 96 |
| 90L4 | 89,5 | 67 | 49 | 90 | 146 | 141 | - | 98 | 49 | 123 |
| 100LA4 | 89,5 | 80 | 49 | 90 | 155 | 150 | - | 98 | 49 | 138 |

| | V | YA | YB | YC | YD | HE | HF | HG | HH | HI | HL | XA | XB | XC | XD | XE |
|---------------|------|-----|----|-----|-----|----|----|----|-----|------|-----|----|----|----|-----|-----|
| 63A4 | 69 | 110 | 54 | 86 | 98 | 16 | 21 | 29 | 63 | - | - | 25 | 60 | 50 | 153 | 70 |
| 63B4 | 69 | 110 | 54 | 89 | 98 | 16 | 21 | 27 | 66 | - | - | 25 | 60 | 50 | 153 | 70 |
| 71A4 | 74,5 | 110 | 54 | 89 | 114 | 13 | 29 | 32 | 69 | - | - | 22 | 70 | 50 | 153 | 73 |
| 71B4 | 74,5 | 110 | 54 | 89 | 114 | 13 | 29 | 32 | 69 | - | - | 22 | 70 | 50 | 153 | 73 |
| 80A4 | 78 | 110 | 54 | 94 | 128 | 18 | 29 | 39 | 81 | - | - | 30 | 70 | 50 | 153 | 95 |
| 80B4 | 78 | 110 | 54 | 94 | 128 | 18 | 29 | 39 | 81 | - | - | 45 | 72 | 50 | 153 | 120 |
| 90S4 | 89,5 | 60 | 49 | - | 148 | 12 | 45 | - | - | 86,5 | 136 | 51 | 69 | 49 | 96 | - |
| 90L4 | 89,5 | 67 | 49 | 104 | 137 | 7 | 40 | 51 | 104 | 86,5 | 141 | 35 | 85 | 49 | 123 | - |
| 100LA4 | 97,5 | 80 | 49 | 103 | 157 | 10 | 47 | 58 | 113 | 96 | 150 | 31 | 89 | 49 | 138 | - |

4.1 DIMENSIONS

4.1.4 Incremental standard encoder



| | | LB | LF |
|-----|-------|---------------|---------------|
| 63 | IC410 | 210 | / |
| | IC411 | 247 | 124,5 |
| | IC416 | 280 | 158 |
| 71 | IC410 | 226 | / |
| | IC411 | 254 | 118 |
| | IC416 | 296 | 160 |
| 80 | IC410 | 245 *(268) | / |
| | IC411 | 305 *(328) | 152 *(175) |
| | IC416 | 338 *(361) | 185 *(208) |
| 90S | IC410 | 255 *(288) | / |
| | IC411 | 325 *(358) | 166 *(199) |
| | IC416 | 341 *(374) | 182 *(215) |
| 90L | IC410 | 280 *(313) | / |
| | IC411 | 350 *(383) | 166 *(199) |
| | IC416 | 366 *(399) | 182 *(215) |

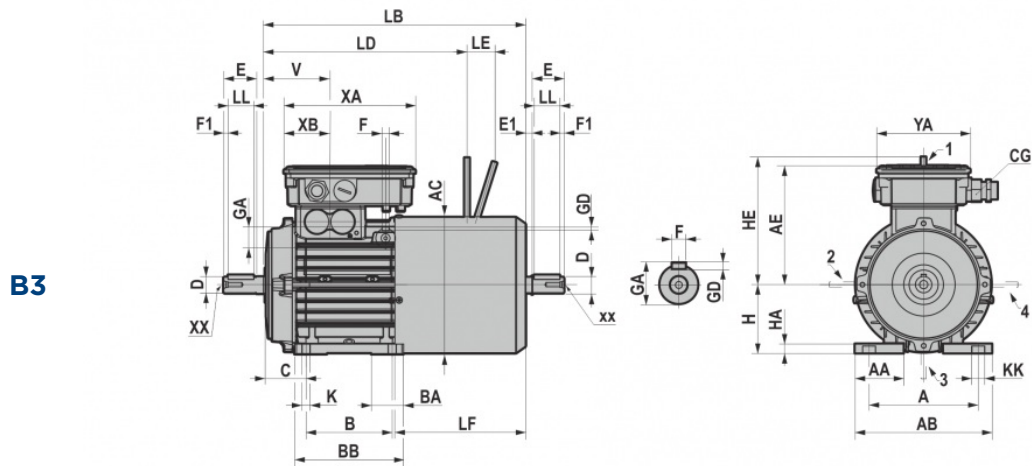
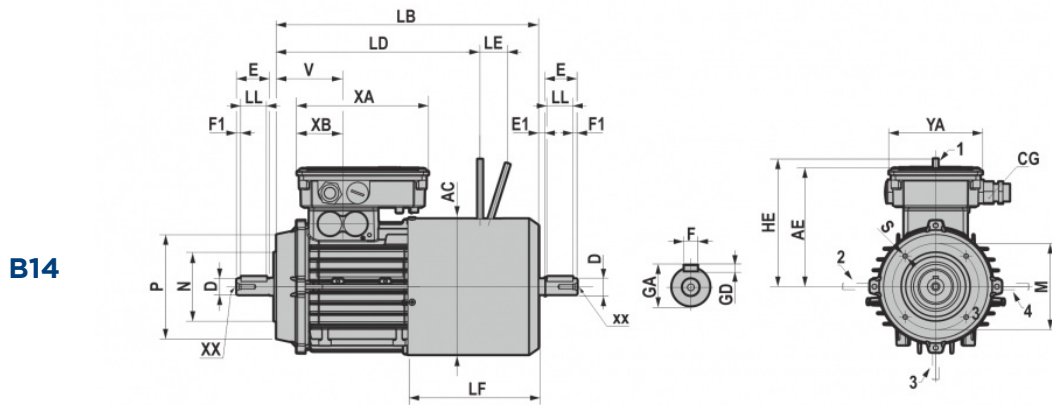
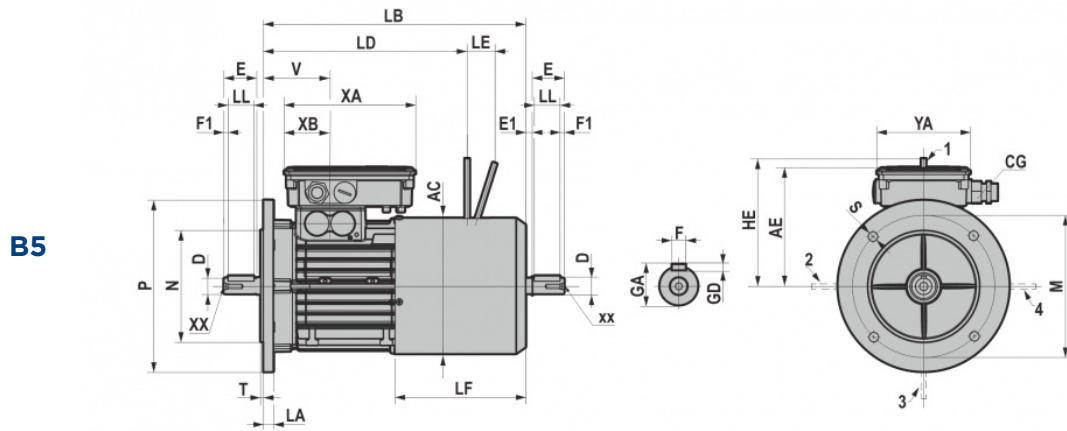
| | | LB | LF |
|------|-------|---------------|---------------|
| 100 | IC410 | 308 | / |
| | IC411 | 389,5 | 183 |
| | IC416 | 437 | 230 |
| 112 | IC410 | 321 *(346) | / |
| | IC411 | 420 *(445) | 201 *(226) |
| | IC416 | 450 *(475) | 230 *(255) |
| 132S | IC410 | 360 | / |
| | IC411 | 463 | 212 |
| | IC416 | 490 | 240 |
| 132M | IC410 | 398 | / |
| | IC411 | 501 | 212 |
| | IC416 | 528 | 240 |
| 160S | IC410 | 398 | / |
| | IC411 | 501 | 212 |
| | IC416 | 528 | 240 |

* TP80B4, TP90S4, TP90L4, TP90S6, TP112M4, TP112M6

IC410 = NON-VENTILATED
 IC411 = SELF-VENTILATED
 IC416 = FORCED VENTILATED

4.1 DIMENSIONS

4.1.5 Brake motors



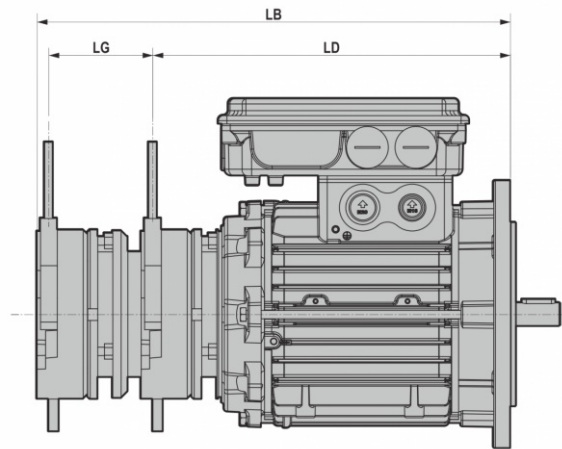
4.1 DIMENSIONS

| | Brake Power supply | Cable gland | | | XA | XB | YA |
|------------|-----------------------|-------------|--------------|--------------|-----|------|-----|
| | | Pg | Ø hollow min | Ø hollow max | | | |
| 63 | AC / DC | M16x1.5 | 5 | 10 | 153 | 54 | 109 |
| 71 | | | | | | | |
| 80 | | | | | | | |
| 90 | AC / DC | M20x1.5 | 6 | 12 | 206 | 66,5 | 132 |
| 100 | | | | | | | |
| 112 | | | | | | | |
| 132 | AC / DC | M20x1.5 | 6 | 12 | 145 | 75 | 145 |
| 160 | | | | | | | |

| | | LD | LE | HE | LB | LF | AE | V |
|-------------|-----------|-----------------|------|-------|-----------------|---------------|-----|-------|
| 63 | MS | 192 | 21 | 116 | 249 | 124,5 | 120 | 69 |
| | FM | 192 | 17,5 | 96 | 249 | 124,5 | 120 | 69 |
| | ML | - | - | - | 203 | 72 | 120 | 69 |
| 71 | MS | 211,5 | 23 | 124 | 276 | 137 | 129 | 74,5 |
| | FM | 214 | 19 | 101,5 | 276 | 137 | 129 | 74,5 |
| | ML | 182 | 18 | 103 | 225 | 80 | 129 | 74,5 |
| 80 | MS | 238 *(259) | 23 | 134 | 304 *(326) | 152 *(174) | 137 | 78 |
| | FM | 237 *(258) | 22,5 | 129 | 304 *(326) | 152 *(174) | 137 | 78 |
| | ML | 203 | 22 | 128 | 248 | 84 | 137 | 78 |
| 90S | MS | 252,5 *(297) | 27,5 | 160 | 324,5 *(372) | 166 *(213) | 157 | 89,5 |
| | FM | 255 *(300) | 28 | 159,5 | 324,5 *(372) | 166 *(213) | 157 | 89,5 |
| | ML | 212,5 | 22 | 128 | 261 | 90 | 157 | 89,5 |
| 90L | MS | 279 *(324) | 28 | 160 | 349,5 *(396) | 166 *(212) | 157 | 89,5 |
| | FM | 279 *(324) | 27,5 | 159,5 | 349,5 *(396) | 166 *(212) | 157 | 89,5 |
| | ML | 237,5 | 22 | 128 | 285 | 90 | 157 | 89,5 |
| 100 | MS | 307 | 28 | 160 | 389,5 | 183 | 178 | 97,5 |
| | FM | 307 | 27,5 | 159,5 | 389,5 | 183 | 178 | 97,5 |
| | ML | 267 | 26 | 148 | 325 | 105 | 178 | 97,5 |
| 112 | MS | 330 *(358) | 34,5 | 198 | 419 *(446) | 201 *(227) | 183 | 100 |
| | FM | 326 *(353) | 35 | 199 | 419 *(446) | 201 *(227) | 183 | 100 |
| | ML | 281 | 26 | 148 | 325 | 95 | 183 | 100 |
| 132S | MS | 364 | 34,5 | 200 | 461,5 | 212 | 237 | 115,5 |
| | FM | 359 | 35,5 | 204 | 461,5 | 212 | 237 | 115,5 |
| | ML | 317,5 | 30 | 172 | 395 | 133 | 237 | 115,5 |
| 132M | MS | 404,5 | 37,5 | 217 | 513,5 | 212 | 237 | 115,5 |
| | FM | 403,5 | 39 | 226 | 513,5 | 212 | 237 | 115,5 |
| | ML | 355,5 | 30 | 172 | 434 | 133 | 237 | 115,5 |
| 160S | MS | 404,5 | 37,5 | 217 | 513,5 | 212 | 230 | 115,5 |
| | FM | 403,5 | 39 | 226 | 513,5 | 212 | 230 | 115,5 |
| | ML | 355,5 | 30 | 172 | 434 | 133 | 230 | 115,5 |

* TBP80B4, TBP90S4, TBP90L4, TBP90S6, TBP112M4, TBP112M6 (for versions TBP ML brake is not expected).

4.1.6 Double brake

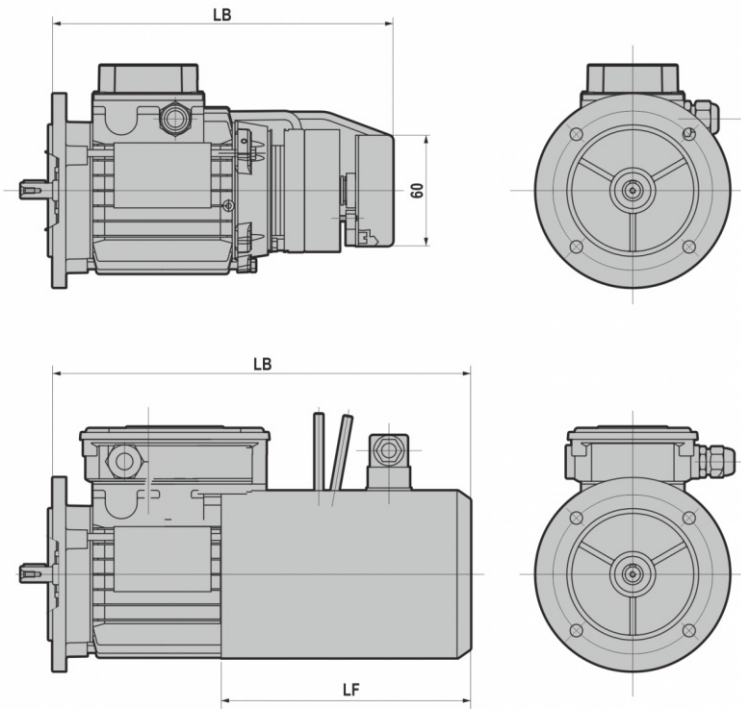


| | LB | LD | LG |
|-------------|---------------|---------------|----|
| 63 | 256 | 192 | 58 |
| 71 | 283 | 214 | 63 |
| 80 | 319 *(342) | 237 *(260) | 73 |
| 090S | 343 *(376) | 255 *(288) | 81 |
| 090L | 369 *(402) | 279 *(312) | 81 |
| 100 | 396 | 307 | 81 |
| 112 | 427 *(452) | 326 *(351) | 89 |
| 132S | 463 | 359 | 89 |
| 132M | 516 | 403.5 | 96 |
| 160S | 516 | 403.5 | 96 |

*TBP80B4, TBP90S4, TBP90L4, TBP90S6, TBP112M4, TBP112M6

For other dimensions, refer to the dimensional charts for the brake motors.

4.1.7 Brake motors with incremental encoder



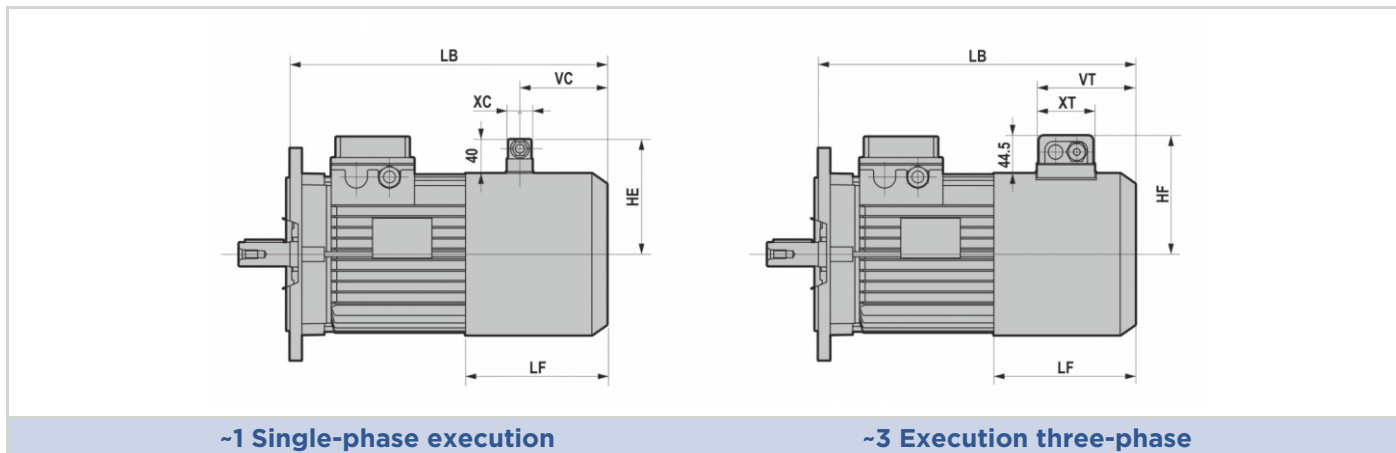
| | LF | LB (IC411 - IC416) | LB (IC410) |
|-------------|---------------|-----------------------|---------------|
| 63 | 198 | 320 | 254 |
| 71 | 199 | 336 | 283 |
| 80 | 235 *(258) | 388 *(411) | 311 *(334) |
| 90S | 242 *(275) | 401 *(434) | 334 *(367) |
| 90L | 242 *(275) | 426 *(459) | 359 *(392) |
| 100 | 293 | 505,5 | 380 |
| 112 | 288 *(313) | 507 *(532) | 410 *(435) |
| 132S | 294 | 545 | 448 |
| 132L | 294 | 583 | 486 |
| 160 | 292 | 583 | 486 |

*TBP80B4, TBP90S4, TBP90L4, TBP90S6, TBP112M4, TBP112M6

Note: Version with incremental encoder available only with MS and FM brakes.

4.1 DIMENSIONS

4.1.8 Forced ventilation



-1 Single-phase execution

-3 Execution three-phase

1 = standard (T-D-S series) 2 = brake motor (TB-DB-SB series)

| | | LB | LF |
|------|---|-------------------|---------------|
| 63 | 1 | 239 | 117 |
| | 2 | 311,5 | 190 |
| 71 | 1 | 254,5 | 118 |
| | 2 | 331 | 195 |
| 80 | 1 | 295,5 *(318,5) | 143 *(166) |
| | 2 | 382 *(405) | 230 *(253) |
| 90S | 1 | 308 *(341) | 149 *(182) |
| | 2 | 398,5 *(431,5) | 240 *(273) |
| 90L | 1 | 333 *(366) | 149 *(182) |
| | 2 | 423,5 *(456,5) | 240 *(273) |
| 100 | 1 | 407 | 200 |
| | 2 | 500 | 293 |
| 112 | 1 | 419 *(444) | 201 *(226) |
| | 2 | 532 *(557) | 313 *(338) |
| 132S | 1 | 461 | 212 |
| | 2 | 568,5 | 319 |
| 132M | 1 | 499 | 212 |
| | 2 | 620,5 | 319 |
| 160S | 1 | 499 | 212 |
| | 2 | 620,5 | 319 |

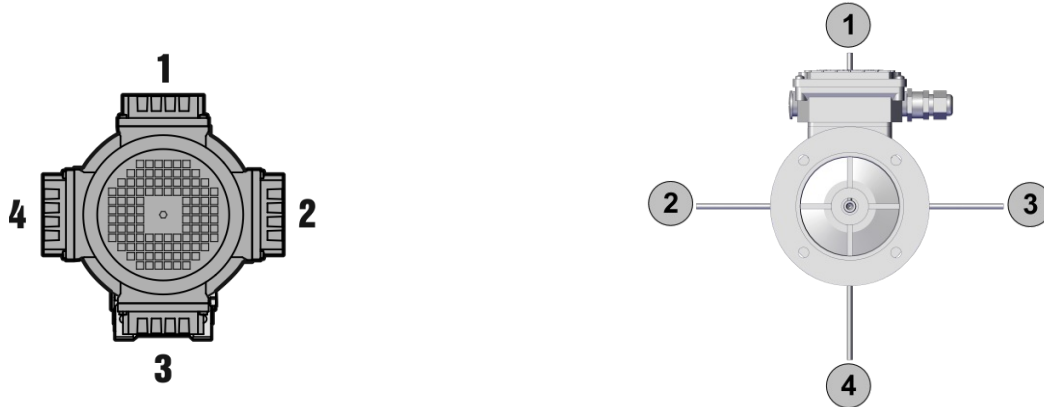
| | | HE | VC | XC | HF | VT | XT |
|----|-----|-------|-----|----|-----|-----|----|
| -1 | 63 | 100,5 | 59 | 30 | - | - | - |
| | 71 | 109,5 | 64 | 30 | - | - | - |
| | 80 | 119 | 78 | 30 | - | - | - |
| | 90 | 126,5 | 87 | 30 | - | - | - |
| | 100 | 135,5 | 103 | 30 | - | - | - |
| | 112 | 145 | 95 | 30 | - | - | - |
| | 132 | 169 | 109 | 68 | - | - | - |
| | 160 | 169 | 109 | 68 | - | - | - |
| -3 | 100 | - | - | - | 140 | 158 | 75 |
| | 112 | - | - | - | 150 | 158 | 75 |
| | 132 | - | - | - | 159 | 158 | 75 |
| | 160 | - | - | - | 159 | 158 | 75 |

*TP/TBP80B4, TP/TBP90S4, TP/TBP90L4, TP/TBP90S6, TP/TBP112M4, TP/TBP112M6

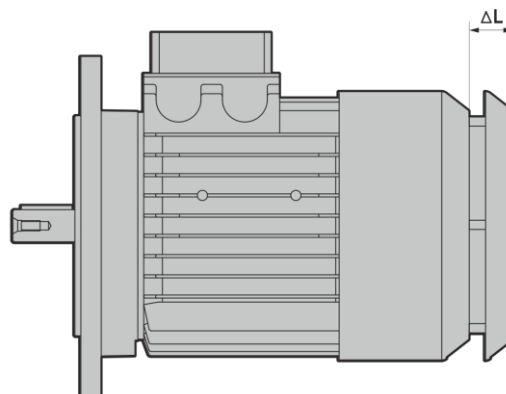
4.1 DIMENSIONS

4.1.9 Position of terminal box-Release lever-Forced ventilation connector

Unless otherwise specified when ordering, the moto is supplied with terminal box/release lever/forced ventilation connector in position 1.



4.1.10 Version with rain cover



| | ▲L (T) | ▲L (P) |
|-----|-----------|-----------|
| 63 | 11 | 20 |
| 71 | 15 | 20 |
| 80 | 11 | 22 |
| 90 | 14 | 23 |
| 100 | 19 | 25 |
| 112 | 19 | 30 |
| 132 | 19 | 35 |
| 160 | 19 | 35 |

(T) = Textile roof

(P) = Rain guard roof

- B35 (B3+B5)
- B34 (B3+B14)
- Reduced B5 flange
- Reduced shaft end
- Second shaft end
- Rear hexagon
- Protection rating IP65, IP56, IP66
- Insulation class H
- Condensation drain holes
- Condensation heater (110V - 230V)
- Low temperature construction
- High temperature construction
- Bimetal cutout - NC contact (130°C for class F / 140°C for class F UL/CSA / 150°C for class H)
- PTC thermistors (130°C for class F / 150°C for class H)
- Single-phase motor with balanced winding
- Single-phase motor, high starting torque with electronic cutout (HSE series motors)
- Rain cover roof
- Textile roof
- Backstop device (sizes 80/90/100/112/132/160S)
- Rapid connection (HARTING)
- Motor without ventilation (IC410)
- Single-phase forced ventilation kit (up to size 132/160S inclusive)
- Three-phase forced ventilation kit (from size 100 inclusive)
- Incremental encoder without connector
- Incremental encoder with connector
- Low resolution incremental encoder (without connector)
- Single-phase forced ventilation kit (up to size 132/160S inclusive) for encoder version
- Three-phase forced ventilation kit (from size 100 inclusive) for encoder version
- Motor paint job
- Optional power voltages (see respective section)
- 9 terminal construction for 1 pole three-phase motors (230V/460V 60Hz)
- Motor construction to UL/CSA (TS, TH, TP, TBS, TBH, TBP and D series only)
- Motor constructions to ATEX II 3GD (TS, TH, TP, D and S series only)
- Motor constructions to CCC (TS, TH series only)

With FM brake:

- Separate power
- Special brake coil voltage (*)
- Manual release lever
- Hexagonal machining on non-drive shaft end
- Brake motor to IP55
- Brake motor to IP56
- Brake motor to IP65
- Brake motor to IP66
- Motor with double brake
- Anti-seizing stainless steel washer
- Microswitch
- Silent brake
- Inertial flywheel (gradual braking/starting)
- Double-ended shaft
- Half-wave fast detachment rectifier SBR (from sizes 63 to 100)
- Single-phase forced ventilation kit (up to size 132/160S inclusive)
- Three-phase forced ventilation kit (from size 100 inclusive)
- Incremental encoder without connector
- Incremental encoder with connector
- Low resolution incremental encoder (without connector, sizes 63-71-80-90)
- Single-phase forced ventilation kit (up to size 132/160S inclusive) for encoder version
- Three-phase forced ventilation kit (from size 100 inclusive) for encoder version
- Motor paint job

With ML brake:

- Separate power
- Special brake voltage (*)
- Manual release lever
- Motor paint job

With MS brake:

- Separate power
- Special brake coil voltage (*)
- Manual release lever
- Hexagonal machining on non-drive shaft end
- Brake motor to IP55- IP65
- Anti-seizing stainless steel washer
- Double-ended shaft
- Single-phase forced ventilation kit (up to size 132/160S inclusive)
- Three-phase forced ventilation kit (from size 100 inclusive)
- Incremental encoder without connector
- Incremental encoder with connector
- Low resolution incremental encoder (without connector, sizes 63-71-80-90)
- Single-phase forced ventilation kit (up to size 132/160S inclusive) for encoder version
- Three-phase forced ventilation kit (from size 100 inclusive) for encoder version
- Motor paint job

(*) Standard brake coil voltages

- FM - ML brakes: 103V DC for TBS and TBH / 178V DC for DB
- MS brake: 230/400V/50Hz

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<http://www.motovario.com/eng/corporate/sales-conditions>

