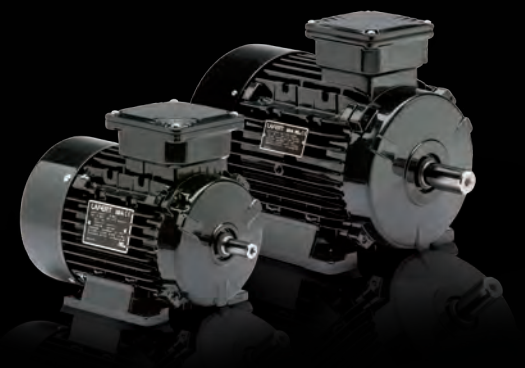
LAFERTMOTORS

HP SERIES

HIGH PERFORMANCE MOTORS
INTEGRAL DRIVE (HPI RANGE)
STAND ALONE MOTOR (HPS/HPF RANGE)



CATALOGUE 2020

IE4 c UL us

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One is different from the other.
Simply unique.

LAFERTGROUP

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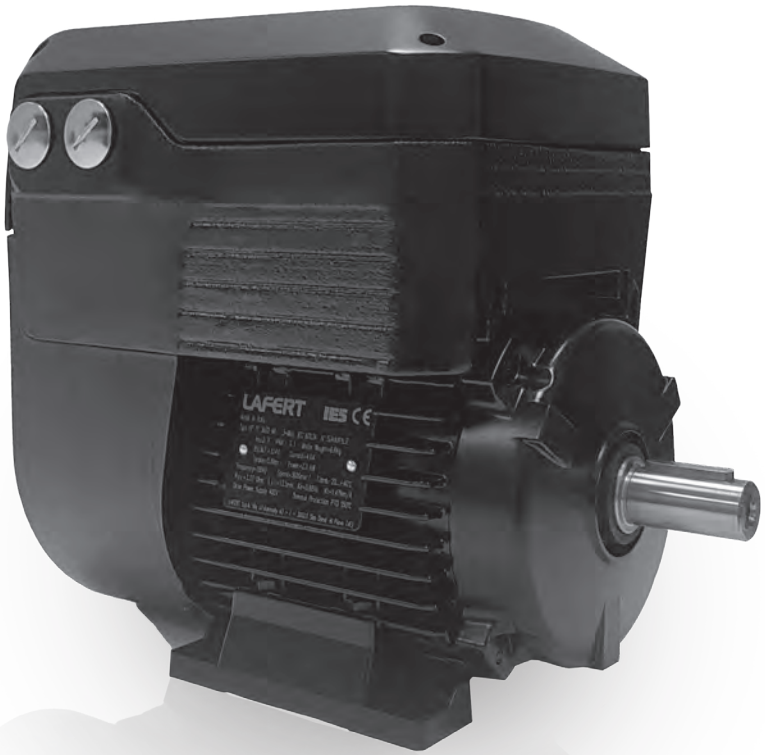
GENERAL INFORMATION



MISSION

The Lafert Group, a leading European Motor Company, is committed to continuous growth by being the global leading manufacturer of **customised engineered Electric Motors and Drives** with specific focus on Industry Automation, Energy Saving, and Renewables.

The Lafert Group will strive to be the ideal partner in the Electric Motors and Drives industry through focus on meeting specific customer demands. Mutually beneficial partnerships are developed by continuous process improvements utilising state-of-the-art products and techniques by a skilled, motivated and professional workforce.

ONE IS DIFFERENT FROM THE OTHER. SIMPLY UNIQUE.

Lafert design and build customised electric motors with unique characteristics, because the needs of our customers are unique. The control of the whole manufacturing process allows for any aspect of the motor to be modified. This gives the ability to engineer customized motors that fit the final application/work environment for maximum efficiency and reliability.

Lafert leverages almost 60 years of experience in partnering with Global Companies from its 12 locations spread across Europe, North America, Asia and Australia.

ASYNCHRONOUS MOTORS, Three-phase Motors Premium Efficiency - IE3 and High Efficiency - IE2 customized to specific applications and OEM requirements

BRAKE MOTORS, Asynchronous Motors, DC and AC brake, for heavy duty applications

HP RANGE, Permanent Magnet Synchronous Motors and Drives, Super Premium Efficiency – IE4/IE5, IPM and SMPM technology, designed for HVAC applications

SERVO MOTORS & DRIVES, Brushless Servomotors and Drives for Industrial Automation

LIFT RANGE, Synchronous Gearless Machines for M.R.L. Elevators

HP RANGE

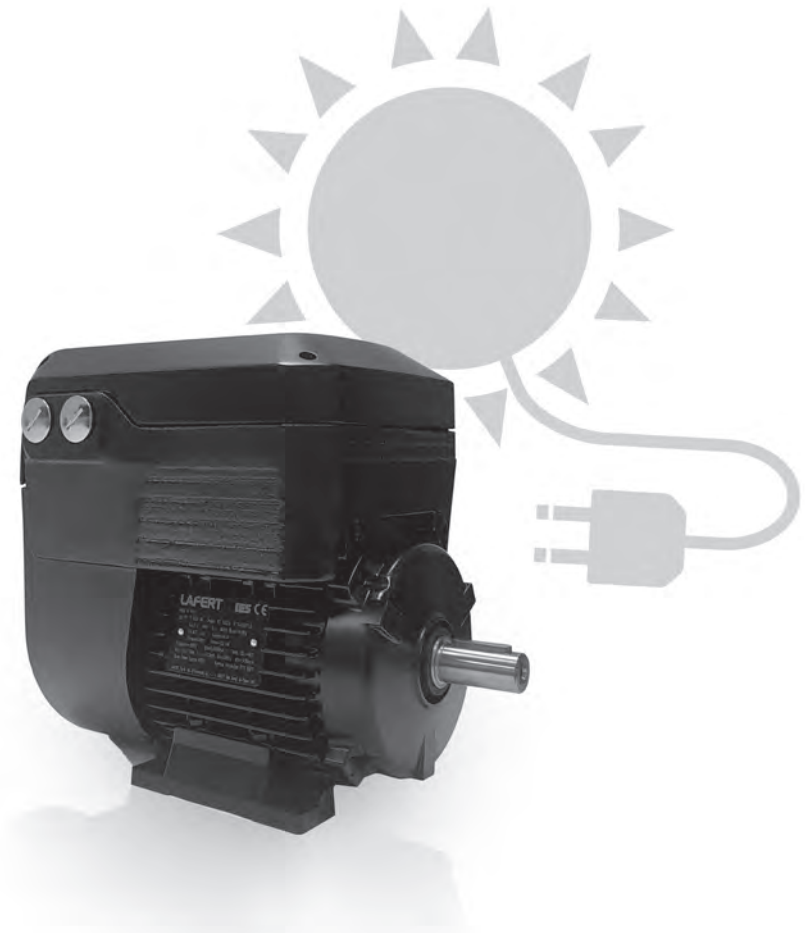
THE IE4 AVAILABLE SOLUTION

High Performance (HP) is a generation of **PM (Permanent Magnet) Synchronous Motors, achieving IE4 and IE5 Super Premium Efficiency** level, that offer improved electrical efficiency at stable and reduced production costs without applying rare earth magnets.

This uniquely engineered product combines the electrical design of Brushless Servomotors with the mechanical design of AC Induction Motors. The result is a compact motor primarily targeted toward HVAC applications in fans, compressors, and blowers, where there is emphasis on reducing the operating cost or weight and size of the motors.

The complete range 0.37 kW to 37 kW are supplied as s**tand-alone motors** (HPS/HPF) to be controlled by a separate drive or as **motor/drive integrated units** (HPI), specifically designed for their energy saving potential.

IE4 IE5 c UL us



SERVO MOTORS & DRIVES

PRECISION IS STANDARD, ONLY THE MOTOR IS CUSTOMIZED!

Lafert know-how in manufacturing permanent magnet motors is combined with the company's on-going drive for excellence and its ability to offer **non-standard solutions**, all of which is invested in this product range. On-going research and development, often in conjunction with customers, continues to bestow superior performance in terms of speed, accuracy and control **to satisfy application needs**.

The range of brushless Servo Motors is one of the most complete available on the market, with nominal torques 0.18 Nm to 390 Nm. Direct Drive Motors cover torques 10 Nm to 500 Nm. The full range is available with **ATEX Certification – Zone 2-22**, for use in potentially explosive atmospheres.

Lafert's Servo Drive range includes standard products and custom solutions that ensure high performance and cost reductions for diverse applications across the fields of **Industrial Automation and battery-powered applications** such as the automated handling of material and/or people.

A separate catalogue is available.

LIFT RANGE

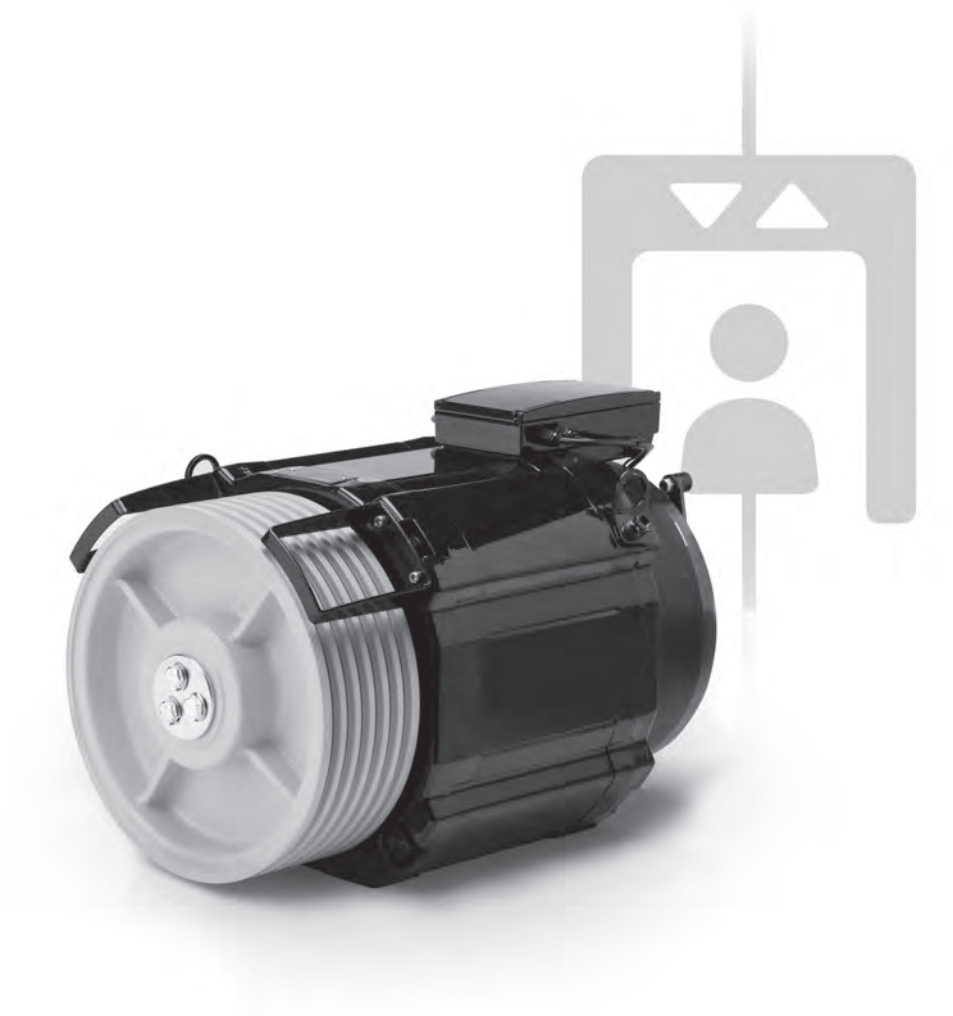
HIGHER & FASTER

Lafert's LIFT range has established the company internationally as one of leading manufacturer.The motor's innovative design, with its protected encoder and no external cabling, offers compactness and low weight, ideal for **home lift systems or new concept M.R.L..**

Its novel **inner rotor and fractional slot gearless technology** are of products of Lafert's in-house design and manufacturing expertise. It provides the highest levels of performance and energy efficiency plus enhanced response to satisfy today's needs and trends in the elevator market i.e. higher speed to greater heights.

Motors with torque up to 850 Nm for systems with a capacity load up to 1,600 kg, machines with TÜV SÜD Certifications, in compliance with the Specifications UNI EN 81-1:1998+A3:2009 and Lifts Directive 2014/33/EC.

A separate catalogue is available.



ASYNCHRONOUS MOTORS

HIGH EFFICIENCY, ENERGY SAVING

AC motors have a significant impact on the total energy operation cost for industrial, institutional and commercial buildings. Today, the major factor influencing the motor industry is energy efficiency driven by both increasingly demanding legislation and industry's greater awareness of green issue responsibilities.

Premium Efficiency and High Efficiency Three-phase Motors meeting the requirements of IE3 and IE2 efficiency levels in accordance with IEC 60034-30-1:2014 and test method IEC 60034-2-1;2014.

Premium Efficiency IE3 motors provide compliance with the requirements of EU MEPS for all motors 0.75 to 375kW in force since January 1, 2017 and NEMA EPAct/EISA in force since December 2010 in the USA and January 2011 in Canada.

High Efficiency IE2 motors comply with the EU's IE2 efficiency requirements, that are allowed in the EU market exclusively for motors 0.75 to 375kW put into operation with a variable speed drive (VSD) from January 2017.

A separate catalogue is available.

IE2 IE3 ENERGY c UL us

BRAKE MOTORS

EXTENSIVE CONFIGURATION OPTIONS MATCH MOTORS TO APPLICATIONS

The harsher the working environment the greater the demand on engineering standards, and non-standard then becomes the norm. Custom-design and engineering fulfil this need to give the reliability and performance demanded.

The Lafert Brake Motor series is engineered according to the client's specification. Total control over all aspects of production permits **multiple design options** including flanges, shafts, brakes plus optimum resistance to external agents and offshore environments for paints, seals, and magnet surfaces.

The result is a range of AC motors with DC and AC brake, produced entirely in-house which incorporates Lafert's own technical solutions for achieving robustness and performance, combined with the option for application-specific customization.

A separate catalogue is available.

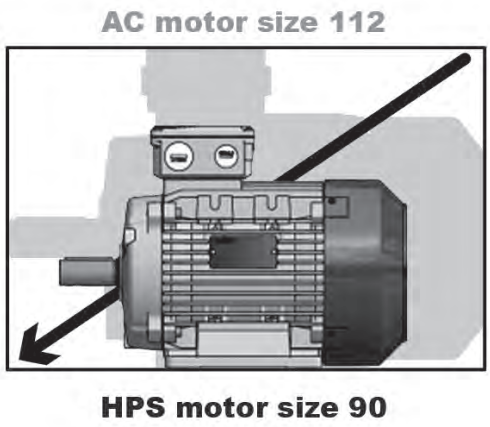
IE1 IE2 c UL us

LEVERAGING LEADING-EDGE TECHNOLOGIES

High Performance Motors (HPS/HPI) are an innovative range of **PM (Permanent Magnet) Synchronous Motors**, achieving **IE4 Super Premium Efficiency** level that offer improved efficiency and reduced operating costs.

Lafert's in house servo and AC induction motor design and manufacturing capabilities have facilitated the development of this uniquely engineered range of Permanent Magnet IE4 Synchronous Motors.

In order to develop the HP Motor, Lafert used a combination of product designs inspired by the brushless servo motor's electrical design and the AC induction motor's mechanical design.
With higher efficiencies than standard AC induction motors they also enhance the power/weight ratio, thereby allowing for significant **size and weight reductions of up to 50%.**



The Lafert PM rotor technology of the HP motor has no losses. Also, stator currents are lower, consequently generating lower losses due to lower current demand (Joule effect). The resulting benefit is a lower rated temperature rise for both the windings and bearings. These limited temperature rises can, in the right design, eliminate the need for a cooling fan and its related losses. Ultimately, the sum of these minimised heat contributions provide higher running speeds and extended bearing life.

Lafert place great emphasis on materials research. This has resulted in reduced dependency on rare earth magnets, allowing the use of more readily available permanent magnets, which ensures price and supply stability into the future. Following this development work Lafert have introduced a **second generation of PM Synchronous Motors**, named HPF, achieving **IE4 Super Premium Efficiency** level, with more stable and reduced production costs **without applying rare earth magnets.**

VALUE ADDED FEATURES & BENEFITS

The primary benefit offered by Lafert's HP synchronous motor is the reduction in the life cycle cost of the motor. The combination of servo brushless and induction motor technology used for the development of this product gives it a high efficiency low noise design. Because of the higher efficiency, the product dissipates lower heat, which improves its operating life.

This motor is primarily targeted toward **HVAC applications** in pumps, fans, compressors, and blowers, where there is an emphasis on reducing the operating cost or weight, and size of the motors. Lafert also offers flexibility in terms of design, customising the active and mechanical parts of the motor to suit specific customer requirements.

Lafert also has the ability to produce this motor in high volume on a regular scheduled delivery basis with modifications as per specific customer requirements. The HP PM synchronous motor is available in a range of power outputs, ranging **from 0.37 kW to 37kW**, with full flexibility in motor speed up to 6000 RPM; it can be controlled by most standard drives.

A **High Performance Integrated (HPI) version** of the product is also available, which includes an integrated drive control system.

INCREASED CUSTOMER ROI

The high operating efficiency offered by Lafert's PM synchronous motor leads to lower electricity consumption costs. The uniquely efficient design also improves the life of this motor, thereby reducing potential down time and refitting costs.

The product meets the IE4 efficiency class at all operating speeds, making it one of the most efficient electric motors available in the European market. This is ahead of the mandatory efficiency requirements set by the European Union, currently for IE2 and IE3 motors.

LAFERT PM MOTORS' AWARDS

Based on **Frost & Sullivan's** Best Practices independent research, Lafert have been granted the **2013 European New Product Innovation Leadership Award** in Electric Motors for Heating Ventilation Air Conditioning (HVAC) Applications.

The High Performance Motor from Lafert has been awarded as the winner in the **Green Building Category of the 2014 AHR Expo Innovation Awards Competition.**

The Lafert HPI range was included in the **ADI Index Design 2012**, the publication of the *Industrial Design Association* that awards an annual prize to the best Italian design in manufacturing.

RANGE OF PRODUCTS

A range of solutions to meet specific demand:

- **Integral construction** (HPI range) or **stand-alone drive** (HPS range)
- Sensorless control or with speed transducer
- **IPM** (Interior Permanent Magnets) or **SMPM** (Surface Mounted Permanent Magnets) **design**, depending on the performance demand

BRIEF DESCRIPTION

The following features of our HP Motors may vary depending on series and type:

- Admissible environmental temperature: from -15 °C up to +40 °C, with altitudes 1000 m above sea level
- Mounting: IM B3, B5, B14, B34, B35
- Flange concentricity degree "N"; balancing: vibration "A/B"; dynamic balancing with half key
- Shaft designed according to the standard version with key (also available without key)
- Available speeds: 1500, 1800, 3000, 3600, 4500 rpm (others on request)
- Drive operating voltage: 230 or 400 Vac
- Insulation class: "F"; temperature rise to class B (TEFC execution)
- IP55 degree of protection for the whole range
- On-Off PTO switch for thermal protection (NTC and PTC are available)
- Optional feedback on request: resolver, encoder, tacho and Hall sensors (several combinations may be added to this list)
- Reduced dimensions
- Permanent magnets technology

DEFINITIONS

- **HPS:** High Performance Stand alone motors to be controlled by a separate drive (SENSORLESS)

- **HPI:** High Performance Integral drive motors (SENSORLESS)

- **Rated torque (Mn):** Torque available on the shaft continuously (service S1) with rated speed and with a winding current equivalent to the rated current, holding the motor in rated working condition.

- **Peak torque (Mpk):** Torque available on the shaft discontinuously, with a winding current equivalent to the peak current.

- **Rated current (In):** Current supplied to the motor continuously at a rated speed, required to develop rated torque.

- **Peak current (Ipk):** Current supplied to the motor discontinuously within a wide range of speed, required to develop peak torque without exceed the thermal class of motor.

- **Voltage constant (Ke):** Ratio between voltage induced by the rotor rotation (RMS value for sinusoidal motor, peak value for trapezoidal motor) at a certain number of revolutions and angular speed ($\omega=2 \times \pi \times n/60$ where n is the speed expressed in rpm) measured in rad/sec.

- **Torque constant (Kt):** Ratio between torque on the shaft and the current RMS value for sinusoidal motors, peak value for trapezoidal motors (equivalent to the voltage constant of a trapezoidal motor and to that of a sinusoidal motor multiplied by $\sqrt{3}$).

- **Back electromotive force (B.E.M.F):** Voltage induced by the rotor rotation (RMS value for sinusoidal motor, peak value for trapezoidal motor) at a certain number of revolutions.

QUALITY SYSTEM CERTIFICATE

The strictness of our quality control assures the flawless operation and reliability of our products. Our quality is confirmed by the **Certificate ISO 9001:2015** awarded by KIWA-CERMET, a certification body authorized by ACCREDIA.

SAFETY STANDARDS

Our motors comply with the requirements of the International Standard **IEC 60034** for rotating electrical machines as well as with the following European Directives: **Low Voltage Directive** (LV) 2014/35/EC, **Electromagnetic Compatibility Directive** (EMC) 2014/30/EC.

All products comply with the requirements of the **Directive Machines** (MD) 2006/42/EC. In accordance with this Directive, induction motors are components and intended solely for integration into other machines. Commissioning is forbidden until conformity of the end-product with this Directive is proved.

CE The CE marking was applied for the first time in 1995.

When operating the motor, the observance of the Regulation EN 60204-1 and safety instructions indicated in our Operating Instructions must be complied with.

Motors complied with many other international standards are available on request:

c UL us Motors approved by UL Underwriters Laboratories Inc.

EFFICIENCY STANDARDS

The HPS motors comply with:

IEC TS 60034-30-2: Rotating electrical machines - Part 30-2: Efficiency classes of variable speed AC motors (IE-code)

The HPI motors comply with:

IEC 61800-9-1: Adjustable speed electrical power drive systems - Part 9-1: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - General requirements for setting energy efficiency standards for power driven equipment using the extended product approach (EPA) and semi analytic model (SAM)

IEC 61800-9-2: Adjustable speed electrical power drive systems - Part 9-2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications - Energy efficiency indicators for power drive systems and motor starters

EFFICIENCY VALUES ACCORDING TO IEC 60034-30-2:2016

Efficiencies are harmonized to the **International Standard IEC 60034-30-2:2016** that extends the efficiency levels to Super Premium Efficiency IE4 and IE5.

	IE4 REFERENCE LIMIT				IE5 REFERENCE LIMIT			
Output kW	Rated speed within 600 to 900 /min	Rated speed within 901 to 1200 /min	Rated speed within 1201 to 1800 /min	Rated speed within 1801 to 6000 /min	Rated speed within 600 to 900 /min	Rated speed within 901 to 1200 /min	Rated speed within 1201 to 1800 /min	Rated speed within 1801 to 6000 /min
0.12	62.3	64.9	69.8	66.5	67.4	69.8	74.3	71.4
0.18	67.2	70.1	74.7	70.8	71.9	74.6	78.7	75.2
0.2	68.4	71.4	75.8	71.9	73	75.7	79.6	76.2
0.25	70.8	74.1	77.9	74.3	75.2	78.1	81.5	78.3
0.37	74.3	78	81.1	78.1	78.4	81.6	84.3	81.7
0.4	74.9	78.7	81.7	78.9	78.9	82.2	84.8	82.3
0.55	77	80.9	83.9	81.5	80.6	84.2	86.7	84.6
0.75	78.4	82.7	85.7	83.5	82	85.7	88.2	86.3
1.1	80.8	84.5	87.2	85.2	84	87.2	89.5	87.8
1.5	82.6	85.9	88.2	86.5	85.5	88.4	90.4	88.9
2.2	84.5	87.4	89.5	88	87.2	89.7	91.4	90.2
3	85.9	88.6	90.4	89.1	88.4	90.6	92.1	91.1
4	87.1	89.5	91.1	90	89.4	91.4	92.8	91.8
5.5	88.3	90.5	91.9	90.9	90.4	92.2	93.4	92.6
7.5	89.3	91.3	92.6	91.7	91.3	92.9	94	93.3
11	90.4	92.3	93.3	92.6	92.2	93.7	94.6	94
15	91.2	92.9	93.9	93.3	92.9	94.3	95.1	94.5
18.5	91.7	93.4	94.2	93.7	93.3	94.6	95.3	94.9
22	92.1	93.7	94.5	94	93.6	94.9	95.5	95.1
30	92.7	94.2	94.9	94.5	94.1	95.3	95.9	95.5
37	93.1	94.5	95.2	94.8	94.4	95.6	96.1	95.8
45	93.4	94.8	95.4	95	94.7	95.8	96.3	96
55	93.7	95.1	95.7	95.3	94.9	96	96.5	96.2
75	94.2	95.4	96	95.6	95.3	96.3	96.7	96.5
90	94.4	95.6	96.1	95.8	95.5	96.5	96.9	96.6
110	94.7	95.8	96.3	96	95.7	96.6	97	96.8
132	94.9	96	96.4	96.2	95.9	96.8	97.1	96.9

For the nominal efficiency calculation refer to the IEC 60034-30-2:2016.

The HPS/HPI motors comply with the relevant standards and regulations, especially:

ELECTRICAL	Rating and performance	IEC 60034-1
	Efficiency classes of variable speed AC Motors (IE-CODE)	IEC 60034-30-2
	Terminal markings and direction of rotation of rotating electrical machines	IEC 60034-8
	Selection of Energy-efficient motors including variable speed applications-application guide	IEC/ST 60034-31
	Insulating materials	IEC 60085
MECHANICAL	Dimensions and output ratings	IEC 60072
	Mounting dimensions and relationship frame sizes-output ratings, IM B3, IM B5, IM B14	IEC 60072
	Cylindrical shaft ends for electric motors	IEC 60072
	Degrees of protection	IEC 60034-5
	Methods of cooling	IEC 60034-6
	Mounting arrangements	IEC 60034-7
	Mechanical vibration	IEC 60034-14
	Mounting flanges	DIN 42948
	Tolerances of mounting and shaft extensions	DIN 42955
	Classification of environmental conditions	IEC 60721-2-1
	Mechanical vibration; balancing	ISO 8821

COMPLIANCE WITH EMC DIRECTIVE 89/336/EEC

In the great majority of cases, the HPI Drive is used by professionals of the trade as a complex component forming part of a larger appliance, system or installation. It must be noted that the responsibility for the final EMC properties of the appliance, system or installation rests with the installer.

EMC GENERAL STANDARDS

The product standards are stated in **EN 61800-3** (IEC 61800-3): adjustable speed electrical power drive systems-Part 3. EMC product standard including specific test methods.

The HPI Motors comply with:
EN 61800-3, unrestricted distribution[1)]
EN 61800-3, restricted distribution
Residential, commercial and light industrial environment: EN 61000-6-3[2)], EN 61000-6-1
Industrial environment: EN 61000-6-2, EN 61000-6-4

1) Emission levels stated by EN 61800-3 unrestricted distribution are only fulfilled by HPI Motors with class B-1 filter.

2) Emission levels stated by EN 61000-6-3 are only fulfilled by HPI Motors with class B-1 optional filter.

EMC IMMUNITY

If there are problems with low frequency interference (ground loops), screened cable used for bus, standard bus, control cables and signal interface can be left open at one end.

BASIC STANDARDS

EMISSIONS

EN 55011: Limits and methods of measuring radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment

EN 55022: Limits and methods of measuring radio disturbance characteristics of information technology equipment

EN 61000-3-2: Limits for harmonic current emissions (equipment input current ≤16 A)

EN 61000-3-12: Limits for harmonic current emissions (equipment input current >16 A)

EN 61000-6-4: Electromagnetic compatibility (EMC)-Part 6-4, Generic standards-Emission standard for industrial environments

EN 61000-6-3[1)]**:** Residential, commercial and light industrial environment

1) Emission levels stated by EN 61000-6-3 are only fulfilled by HPI Motors with class B-1 optional filter.

IMMUNITY

EN 61000-2-4 (IEC 61000-2-4): Compatibility levels Simulation of voltage and frequency fluctuations, harmonics and commutation notches on the power line

EN 61000-4-2 (IEC 61000-4-2): Electrostatic discharge (ESD) Simulation of electrostatic discharge

EN 61000-4-4 (IEC 61000-4-4): Fast transients, burst 5/50 nS Simulation of transients caused by switching of contactors, relays or similar devices

EN 61000-4-5 (IEC 61000-4-5): Surges 1.2/50 µS. Simulation of transients caused by e.g. lightning that strikes near an installation

EN 61000-4-3 (IEC 61000-4-3): Radio-frequency electromagnetic field. Amplitude modulated. Simulation of interference caused by radio transmission equipment

EN 61000-4-6 (IEC 61000-4-6): RF common mode. Simulation of the effect from radio-transmitting equipment connected to connection cables

ENV 50204: Radio-frequency electromagnetic field. Pulse modulated. Simulation of interference caused by GSM mobile phones. General aspects of EMC emissions for high frequency shielding, screened cables used for CanBus or RS485, standard bus, control cables and signal interface must in general be connected to the enclosure at both ends

EN 61000-6-2: Electromagnetic compatibility (EMC)-Part 6-2: Generic standards-Immunity for industrial environments

EN 61000-6-1: Residential, commercial and light industrial environment

VIBRATION AND SHOCK

HPS/HPI Motors have been tested according to a procedure based on the following standards:

IEC 60068-2-6: Vibration (sinusoidal) - 1970
IEC 60068-2-34: Random vibration broad-band- general requirements
IEC 60068-2-35: Random vibration broad-band- high reproducibility
IEC 60068-2-36: Random vibration broad-band- medium reproducibility

HPS/HPI Motors comply with requirements that correspond to conditions in the standards mentioned above.

AIR HUMIDITY

HPS/HPI Motors have been designed to meet the IEC 60068-2-3 standard, EN 50178 item 9.4.2.2/DIN 40040, class E, at 40°C.
Cyclic damp heat according to IEC 60068-2-30, 40°C.

AGGRESSIVE ENVIRONMENTS

In common with all electronic equipment, a HPI drive contains a large number of mechanical and electronic components, all of which are vulnerable to environmental effects to some extent.
Therefore the HPI drive should not be installed in environments with airborne liquids, particles or gases capable of affecting and damaging the electronic components.

Failure to take the necessary protective measures increases the risk of stoppages, thus reducing the life of the drive. Damp and moisture can be carried through the air and condense in the drive. In addition to this, damp and moisture may cause corrosion of components and metal parts.
Steam, oil and salt water may cause corrosion of components and metal parts.
In environments with high temperatures and humidity, corrosive gases such as sulphur, nitrogen and chlorine compounds will cause chemical processes on the drive converter components.
Such chemical reactions will rapidly affect and damage the electronic components.

Mounting HPI drive in aggressive environments will increase the risk of stoppages and furthermore considerably reduce the life of electronic converter.

Before the installation, the ambient air should be checked for damp and moisture, particles and gases. This may be done by observing existing installations in this environment. Typical indicators of harmful airborne damp and moisture are water or oil on metal parts, or corrosion of metal parts.
Excessive dust particle levels are often found on installation cabinets and existing electrical installations.
One indicator of aggressive airborne gases is blackening of copper rails and cable ends on existing installations.

ELECTRICAL TOLERANCES

For industrial motors to **EN 60034-1**, certain tolerances must be allowed on guaranteed values, taking into consideration the necessary tolerances for the manufacture of such motors and the materials used. The standard includes the following remarks:

1- It is not intended that guarantees necessarily have to be given for all or any of the items involved. Quotations including guaranteed values subject to tolerances should say so, and the tolerances should be in accordance with the table.
2- Attention is drawn to the different interpretation of the term guarantee. In some countries a distinction is made between guaranteed values and typical or declared values.
3- Where a tolerance is stated in only one direction, the value is not limited in the other direction.

Values for	Tolerance
Efficiency (η) (by indirect determination)	- 0.15 (1 - η) at $P_N \leq 150$ kW - 0.1 (1 - η) at $P_N > 150$ kW
Power factor ($\cos \varphi$)	$\frac{1 - \cos \varphi}{6}$, minimum 0.02, maximum 0.07
Rated current with rated torque and revolutions (measurement in S1 duty cycle at rated speed with $\vartheta_{amb} \leq 40$ °C and altitude ≤1000 m above sea level)	In +/- 5%
Back electromotive force: Bemf	Bemf +/- 5%
Peak torque (M_K)	- 10 % of the guaranteed value (after allowing for this tolerance, M_K/M_N not less than 1.6)
Moment of inertia (J)	± 10 % of the guaranteed value

MECHANICAL TOLERANCES

Motors have to be installed according to their mounting arrangements defined by **IEC 60034-7**, Code I (in brackets Code II). The mechanical components may be designed in order to work as for the motor mounting code.
According to **IEC 60072-1**, the following tolerances on mechanical dimensions of electric motors are permitted:

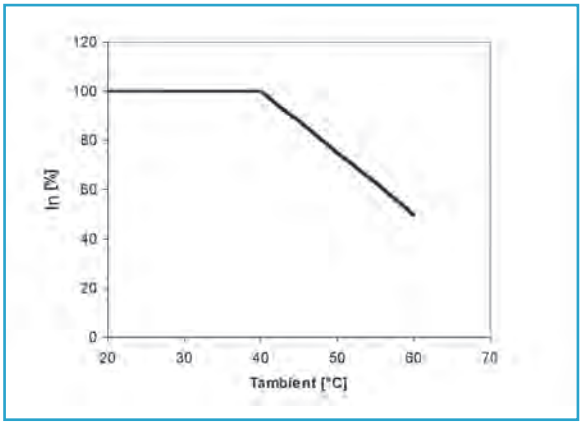
Parameter	Code	Tolerance	
Shaft height	H	- up to 132	-0.5 mm
Diameter of shaft end[1)]	D	- from 11 to 28 mm - from 38 to 48 mm	j6 k6
Hub key width	F		h9
Flange spigot	N	- up to 132 - over size 132	j6 h6

1) Centring holes in shaft extension to DIN 332 part 2

THERMAL PROTECTION AND DERATING

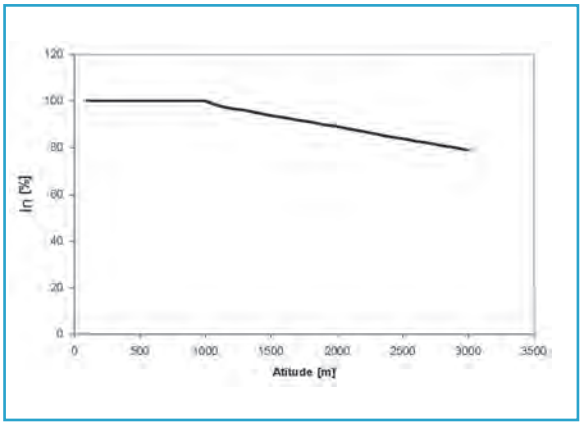
The HPS/HPI Motors are thermally protected in case limits are exceeded (140°C), another protection is provided throught the drive.

DERATING FOR AMBIENT TEMPERATURE



The ambient temperature (TAMAX) is the maximum temperature allowed. If HPS/HPI Motor is operated at temperatures above 40 °C, a derating of the continuous output current is necessary.

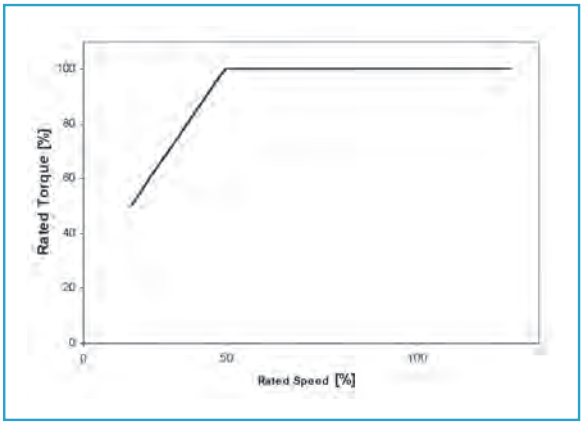
DERATING FOR AIR PRESSURE



Below 1000 m altitude no derating is necessary. Above 1000 m the ambient temperature (TA) or max. rated output current (IN) must be derated in accordance with the following diagram.

See the below diagram for derating of output current versus altitude at TA = max. 40°C

DERATING FOR RUNNING AT LOW SPEED



When a centrifugal pump or a fan is controlled by a HPS/HPI Motor, it is not necessary to reduce the output at low speed because the load characteristic of the centrifugal pumps/fans, automatically ensures the necessary reduction.

HPS/HPI motors running constant load torque applications continuously at low speed must be derated (see diagram as example) or an independent fan must be used.

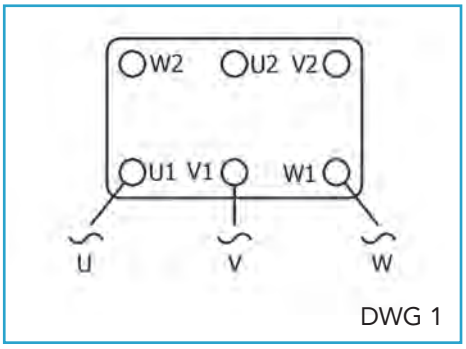
HPS ELECTRICAL CONNECTION

The stand-alone HPS motor can NOT be installed directly on the mains. HPS motor needs always to be controlled by a drive.
The 3 phases from the drive needs to be connected to U1, V1, W1 (Please see DWG 1).

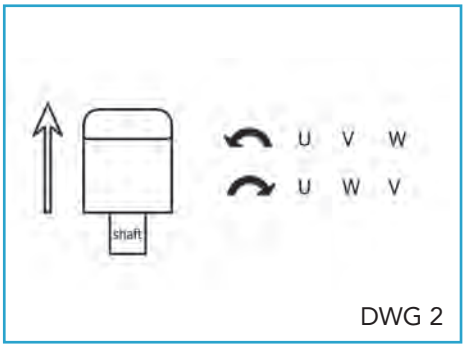
HPS motors covered in this catalogue are all related to 400V data, and are designed for one supply voltage. It is not possible to make star/delta connections in the terminal box like on an AC motor. HPS motor is in general 3*400V but can also be delivered for 3*230V.

Rotation direction: there are two ways to change the rotating direction of the HPS motor. First of all by changing the sequences of 2 phases from the drive or by having the drive to change the rotating direction via the software (Please see DWG 2).

Warning: please be aware that when turning the shaft and without any connection to the drive, the HPS motor will work as a generator and deliver a voltage level (BEMF Voltage) according to the rotating speed.



DWG 1



DWG 2

GALVANIC ISOLATION (PELV)

Galvanic (ensured) isolation is obtained by fulfilling requirements concerning higher isolation and by providing the relevant clearpage/clearance distances. These requirements are described in the EN 50178 standard.

In HPI Series all control terminals are supplied from or in connection with extra low voltage (PELV).

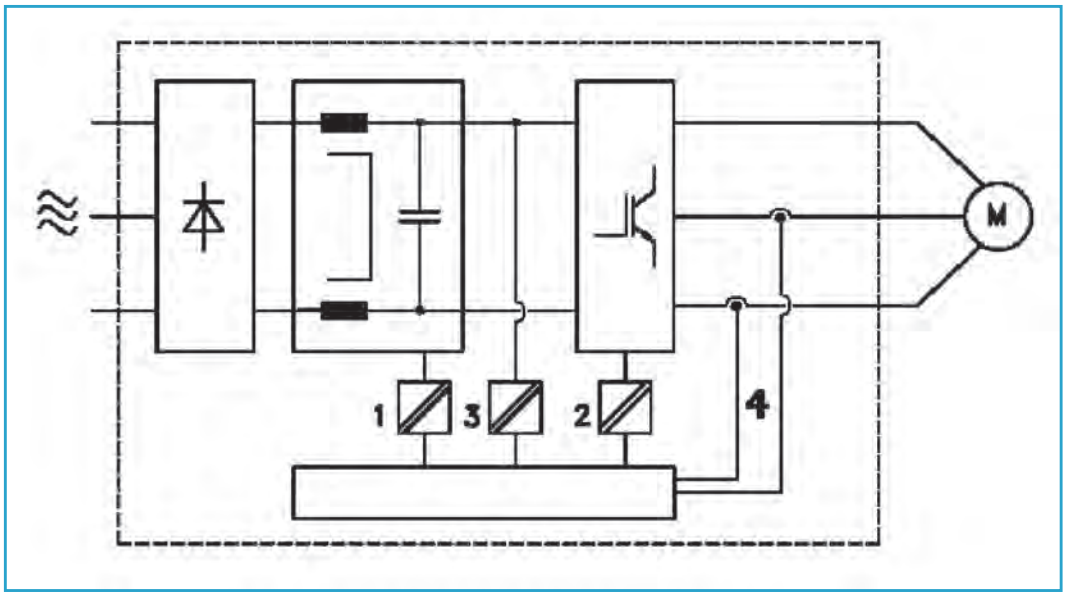
The components that make up the electrical isolation, as described below, also comply with the requirements concerning higher isolation and the relevant test as described in EN 50178. The galvanic isolation can be shown in three locations (see drawing below), namely:

1. Power supply (SMPS) including signal isolation of VDCbus, indicating the intermediate voltage.

2. Gate drive that runs the IGBTs (opto couplers)

3. DCbus Voltage transducer (opto couplers)

4. Current transducers (Hall Effect-Based Current Sensor).



EARTH LEAKAGE CURRENT

Earth leakage current is primarily caused by the capacitance between motor phases and the motor frame. The RFI filter contributes additional leakage current, as the filter circuit is connected to earth through capacitors (Cy).

The size of the leakage current to the ground depends on the following factors, in order of priority:
1 - Switching PWM frequency
2 - Motor grounded on site or not

The leakage current is of importance to safety during handling/operation of the drive if (by mistake) the drive has not been earthed.

OVER VOLTAGE PROTECTION

The voltage in the intermediate circuit is increased when the motor acts as a generator. This occurs in two cases:

1 - The load generates energy.
2 - During deceleration ("ramp-down") if the moment of inertia is high, the load is low and the ramp-down time is too short for the energy to be dissipated as a loss in the HPI frequency converter, the motor and the installation.

The drive turns off to protect the IGBT transistors and the intermediate circuit capacitors when a certain voltage level is reached on DCbus.

MAINS SUPPLY INTERFERENCE/HARMONICS

A HPI integral drive takes up a non-sinusoidal current from mains. A non-sinusoidal current can be transformed by means of a Fourier analysis and split up into sine wave currents with different frequencies, i.e. different harmonic currents IN with 50 Hz as the basic frequency.

Some of the harmonic currents might disturb communication equipment connected to the same transformer or cause resonance in connection with power-factor correction batteries.
To ensure low, harmonic currents, for the residential and commercial environments, an optional harmonic filter is necessary.

DEGREES OF PROTECTION

Degrees of mechanical protection for machines are designated in accordance with **IEC 60034-5** by the letters **IP** and two characteristic numerals.

First numeral: Protection against contact and ingress of foreign bodies

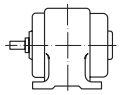
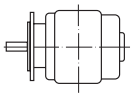
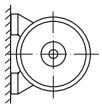
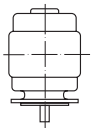
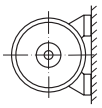
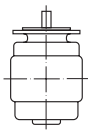
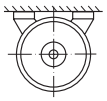
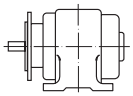
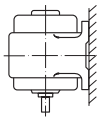
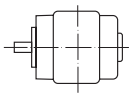
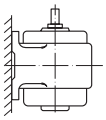
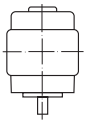
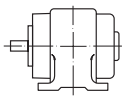
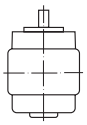
IP	Description
0	No special protection
1	Protection against solid foreign bodies larger than 50 mm (Example: inadvertent contact with the hand)
2	Protection against solid foreign bodies larger than 12 mm (Example: inadvertent contact with the fingers)
3	Protection against solid foreign bodies larger than 2.5 mm (Example: Wires, tools)
4	Protection against solid foreign bodies larger than 1 mm (Example: Wires, bands)
5	Protection against dust (harmful deposits of dust)
6	Complete protection against dust

Second numeral: Protection against ingress of water

IP	Description
0	No special protection
1	Protection against vertically falling water drops (condensation)
2	Protection against dropping water when inclined by up to 15°
3	Protection against waterspray at up to 60° from vertical
4	Protection against water splashed from any direction
5	Protection against water projected by a nozzle from any direction
6	Protection against heavy seas or water projected in powerful jets

MOUNTING ARRANGEMENTS

Mounting arrangements for rotating electrical machines are designated according to **IEC 60034-7**, *Code I* (in brackets Code II).

Foot mounting		Flange mounting	
IM B3 (IM 1001)		**IM B5 (IM 3001)** Flange type A to DIN 42 948 at drive end	
IM B6 (IM 1051)		**IM V1 (IM 3011)** Flange type A to DIN 42 948 at drive end	
IM B7 (IM 1061)		**IM V3 (IM 3031)** Flange type A to DIN 42 948 at drive end	
IM B8 (IM 1071)		**IM B35 (IM 2001)** Flange type A to DIN 42 948 at drive end	
IM V5 (IM 1011)		**IM B14 (IM 3601)** Flange type C to DIN 42 948 at drive end	
IM V6 (IM 1031)		**IM V18 (IM 3611)** Flange type C to DIN 42 948 at drive end	
IM B34 (IM 2101) Flange type C to DIN 42 948 at drive end		**IM V19 (IM 3631)** Flange type C to DIN 42 948 at drive end	

It is essential to state the desired mounting arrangement when ordering, as the constructive design depends partly on the mounting arrangement.

BEARING LUBRICATION AND MAINTENANCE

All motors have bearings type 2ZC3 with grease suitable for high and low temperature and permanent lubrication.

Frame size	Speed rpm	DE	NDE
56	Up to 4500	6202 2Z C3	6201 2Z C3
71	Up to 4500	6205 2Z C3	6303 2Z C3
90	Up to 4500	6206 2Z C3	6304 2Z C3
112	Up to 3600	6208 2Z C3	6306 2Z C3
132	Up to 3600	6309 2Z C3	6208 2Z C3
160	Up to 3600	6310 2Z C3	6310 2Z C3

PERMISSIBLE AXIAL FORCES

Maximum permissible axial forces without additional radial forces*

Frame size	Horizontal shaft					Vertical shaft force upwards					Vertical shaft force downwards				
	4500 min $^{-1}$ kN	3600 min $^{-1}$ kN	3000 min $^{-1}$ kN	1800 min $^{-1}$ kN	1500 min $^{-1}$ kN	4500 min $^{-1}$ kN	3600 min $^{-1}$ kN	3000 min $^{-1}$ kN	1800 min $^{-1}$ kN	1500 min $^{-1}$ kN	4500 min $^{-1}$ kN	3600 min $^{-1}$ kN	3000 min $^{-1}$ kN	1800 min $^{-1}$ kN	1500 min $^{-1}$ kN
56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	0.25	0.26	0.27	0.30	0.31	0.24	0.25	0.26	0.29	0.29	0.24	0.24	0.25	0.28	0.29
90 S-L	0.63	0.65	0.66	0.68	0.70	0.60	0.62	0.63	0.65	0.67	0.59	0.61	0.62	0.64	0.66
112 M	-	0.88	0.98	0.99	1.10	-	0.79	0.88	0.89	0.99	-	0.29	0.30	0.31	0.35
112 XL	-	0.87	0.97	0.98	1.09	-	0.78	0.87	0.88	0.98	-	0.72	0.75	0.76	0.78
132 M	-	0.87	0.97	0.98	1.09	-	0.71	0.80	0.80	0.89	-	0.84	0.94	0.95	1.05
132 XL	-	0.86	0.96	0.97	1.08	-	0.71	0.79	0.80	0.89	-	0.83	0.93	0.94	1.05
132 XXL	-	0.84	0.95	0.96	1.05	-	0.69	0.78	0.79	0.86	-	0.81	0.92	0.93	1.02

Values for 50 Hz. For service on 60 Hz, reduce values by 10%
* Consult according to direction of force

PERMISSIBLE RADIAL FORCES

Without additional axial force (Ball bearings)

Nominal life= 20.000 h (Lh10)

FR= permissible radial force in kn in load point corresponding to half shaft extension

Frame size	4500 min^{-1} kN	3600 min^{-1} kN	3000 min^{-1} kN	1800 min^{-1} kN	1500 min^{-1} kN
71	0.57	0.58	0.60	0.64	0.66
90 S-L	0.84	0.85	0.87	0.88	0.90
112 M	-	1.35	1.37	1.39	1.43
112 XL	-	1.37	1.40	1.42	1.45
132 M	-	2.50	2.55	2.59	2.60
132 XL	-	2.56	2.59	2.60	2.65
132 XXL	-	2.60	2.63	2.65	2.70

COOLING

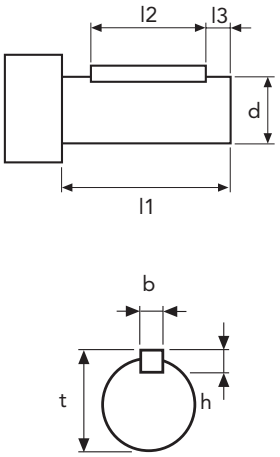
TEFC execution as standard.
Surface cooling, independent of the direction of rotation.

VIBRATION

The amplitude of vibration in electric motors is governed by EN 60034-14 ***Mechanical vibration of rotating electrical machines with shaft heights 56 and larger - methods of measurement and limits.***
Standard motors are designed to vibration grade A (normal). Vibration grade B is available at extra cost.

Rotors are at present dynamically balanced with **half** key fitted as per DIN ISO 8821. Other balancing only on request.
The motors are identified as follows:

"H" or "blank" means balanced with ***half key***
"F" means balanced with ***full key***
"N" means ***no key***



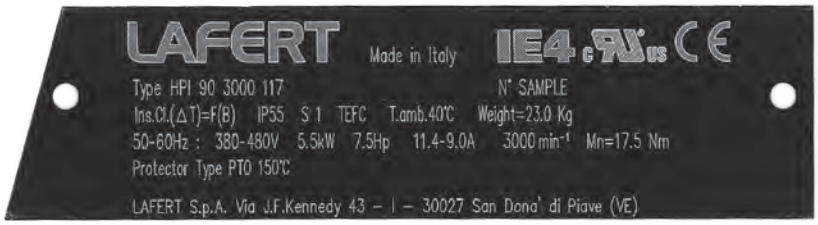
POSITION AND DIMENSIONS OF KEY

Frame size	d x l1	b x h	l2	l3	t
56	14 x 30	5 x 5	20	6	16
71	19 x 40	6 x 6	30	6	21.5
90	24 x 50	8 x 7	40	6	27
112	28 x 60	8 x 7	50	6	31
132	38 x 80	10 x 8	70	6	41
160	42x110	12 x 8	100	6	45

Dimensions in mm.
For larger shafts in special design the dimensions l2 and l3 are maintained.

NAMEPLATE EXAMPLE - HPS RANGE

NAMEPLATE EXAMPLE - HPI RANGE



HPI
INTEGRAL DRIVE

DRIVE SPECIFICATIONS

MAIN SUPPLY

Supply Frequency	48 - 62Hz
Supply Voltage	3 x 380/480V ± 10% - three-phase (L1 L2 L3)
	1 x 200/240V ± 10% - single-phase (L N)
Max. Imbalance of supply voltage	± 2% of rated supply
Switching on supply voltage	Once every 2 minutes

OUTPUT RATINGS

Output Current	100% Drive Rated Power continuously
Overload Capacity	150% for 60 secs

CONTROL SPECIFICATION

Control Method	Sensorless AC Vector Control
Max PWM Frequency	16kHz
Frequency range	up to 400 Hz
Resolution on output frequency	0.1%
Current/speed sampling time	83µs

DIGITAL INPUTS

Programmable digital inputs	4
Voltage level	0-24V_{dc} (user selectable npn or pnp)

PULSE INPUT

Programmable pulse input	1
Voltage level	0:24V_{dc}
Max frequency	10kHz

ANALOG INPUT

Programmable analog voltage input	1
Voltage Level	0:10V_{dc}
Input Resistance Rin	10KΩ
Resolution	12bit
Programmable analog current inputs	1
Current Range	0:20mA
Input Resistance Rin	500Ω
Resolution	12bit

DRIVE SPECIFICATIONS

RELAY OUTPUT

Programmable relay output	1 (n.o. n.c. com)
Max terminal load	250Vac 2A 500VA

BUS COMMUNICATION

RS485 or Canbus	For cascade mode
RS485	Serial comunication
Canbus	Can-Open

EXTERNALS

Enclosure	IP55
Vibration test	EC 60068-2-6
Max relatively humidity	95% (IEC 60068-2-3)
Operating ambient temperature	0:40°C
Storage ambient temperature	- 25°C:60°C
Min. ambient temperature at full operation	0°C
Altitude	0 - 3000m, derate 1% per 100m above 1000m

COMPLIANCE WITH STANDARDS

EN 61800-3:2004	Adjustable speed electrical power drive systems. EMC requirements
IEC 61800-5-1	Adjustable speed electrical drive systems - part 5-1: safety requirements - electrical, thermal and energy
EN 60204-1	Safety of machinery - electrical EMC equipment of machines - part 1: general rules

PROGRAMMING

Keypad	Yes
PC	Yes

HPI - INTEGRAL DRIVE
1500 MIN $^{-1}$

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Rated speed	Rated power	Rated torque	Peak torque	Motor Rated current	Motor Peak current	Efficiency HPI	Rated input current 380 Vac	Rated input current 480 Vac	Torque constant	Weight HPI
	n 1/min	P_n kW	M_n Nm	M_{pk} Nm	I_n Arms	I_{pk} Arms	η %	I_{in} Arms	I_{in} Arms	K_t Nm/A	Kg
1500 min^{-1}											
HPI71 1500 12*	1500	0.55	3.5	5.3	1.2	1.8	81.1%	1.3	1.0	3	7.3
HPI71 1500 16*	1500	0.75	4.8	7.2	1.6	2.4	81.8%	1.7	1.4	3	7.9
HPI71 1500 23*	1500	1.1	7.0	10.5	2.3	3.5	83.3%	2.5	2.0	3	8.7
HPI71 1500 32*	1500	1.5	9.6	14.4	3.2	4.8	84.1%	3.4	2.7	3	9.5
HPI90 1500 32	1500	1.5	9.6	14.4	3.2	4.8	87.6%	3.4	2.7	3	13.5
HPI90 1500 47	1500	2.2	14.0	21.0	4.7	7.0	88.3%	4.9	3.9	3	15.5
HPI90 1500 64	1500	3	19.1	28.7	6.4	9.6	88.6%	6.6	5.2	3	17.5
HPI90 1500 85	1500	4	25.5	38.3	8.5	12.7	89.0%	8.8	7.0	3	20.5
HPI112 1500 85	1500	4	25.5	38.3	8.5	12.7	89.0%	8.7	6.9	3	28.5
HPI112 1500 117	1500	5.5	35.0	52.5	11.7	17.5	89.1%	11.9	9.4	3	31.5
HPI112 1500 159	1500	7.5	47.8	71.7	15.9	23.9	89.5%	16.2	12.8	3	35.5
HPI132 1500 233	1500	11	70.0	105.0	23.3	35.0	91.1%	23.3	18.5	3	57.5
HPI132 1500 318	1500	15	95.5	143.7	31.8	47.8	91.3%	31.8	25.2	3	64.5
HPI132 1500 393	1500	18.5	117.8	176.7	39.3	58.9	91.5%	39.2	31.1	3	71.5

* HPI71 series is available also as single-phase design @ 230 V.
For values @ 230 V, please contact us.

HPI - INTEGRAL DRIVE
1800 MIN $^{-1}$

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Rated speed	Rated power	Rated torque	Peak torque	Motor Rated current	Motor Peak current	Efficiency HPI	Rated input current 380 Vac	Rated input current 480 Vac	Torque constant	Weight HPI
	n 1/min	P_n kW	M_n Nm	M_{pk} Nm	I_n Arms	I_{pk} Arms	η %	I_{in} Arms	I_{in} Arms	K_t Nm/A	Kg
1800 min^{-1}											
HPI71 1800 12*	1800	0.55	2.9	4.4	1.2	1.7	83.3%	1.3	1.0	2.5	7.3
HPI71 1800 16*	1800	0.75	4.0	6.0	1.6	2.4	84.9%	1.7	1.4	2.5	7.9
HPI71 1800 23*	1800	1.1	5.8	8.8	2.3	3.5	85.3%	2.5	2.0	2.5	8.7
HPI71 1800 32*	1800	1.5	8.0	11.9	3.2	4.8	85.8%	3.4	2.7	2.5	9.5
HPI90 1800 32	1800	1.5	8.0	11.9	3.2	4.8	87.5%	3.4	2.7	2.5	13.5
HPI90 1800 46	1800	2.2	11.7	17.5	4.6	7.0	87.9%	4.9	3.9	2.5	15.5
HPI90 1800 63	1800	3	15.9	23.9	6.3	9.5	88.3%	6.6	5.2	2.5	17.5
HPI90 1800 84	1800	4	21.2	31.8	8.4	12.7	88.6%	8.8	7.0	2.5	20.5
HPI112 1800 84	1800	4	21.2	31.8	8.4	12.7	89.0%	8.7	6.9	2.5	28.5
HPI112 1800 116	1800	5.5	29.2	43.8	11.6	17.4	89.0%	11.9	9.4	2.5	31.5
HPI112 1800 158	1800	7.5	39.8	59.7	15.8	23.8	89.6%	16.2	12.8	2.5	35.5
HPI112 1800 232	1800	11	58.4	87.5	23.2	34.9	90.0%	23.6	18.7	2.5	38.5
HPI132 1800 232	1800	11	58.4	87.5	23.2	34.9	91.2%	23.3	18.5	2.5	57.5
HPI132 1800 317	1800	15	79.6	119.4	31.7	47.5	91.5%	31.8	25.2	2.5	64.5
HPI132 1800 391	1800	18.5	98.1	147.2	39.1	58.6	91.6%	39.2	31.1	2.5	71.5

* HPI71 series is available also as single-phase design @ 230 V.
For values @ 230 V, please contact us.

HPI - INTEGRAL DRIVE
3000 MIN $^{-1}$

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Rated speed	Rated power	Rated torque	Peak torque	Motor Rated current	Motor Peak current	Efficiency HPI	Rated input current 380 Vac	Rated input current 480 Vac	Torque constant	Weight HPI
	n 1/min	P_n kW	M_n Nm	M_{pk} Nm	I_n Arms	I_{pk} Arms	η %	I_{in} Arms	I_{in} Arms	K_t Nm/A	Kg
3000 min^{-1}											
HPI71 3000 16*	3000	0.75	2.4	3.6	1.6	2.4	85.5%	1.7	1.3	1.5	7.3
HPI71 3000 23*	3000	1.1	3.5	5.3	2.3	3.5	86.9%	2.4	1.9	1.5	7.9
HPI71 3000 32*	3000	1.5	4.8	7.2	3.2	4.8	87.4%	3.3	2.6	1.5	8.5
HPI71 3000 47*	3000	2.2	7.0	10.5	4.7	7.0	87.7%	4.8	3.8	1.5	9.1
HPI90 3000 47	3000	2.2	7.0	10.5	4.7	7.0	86.9%	4.8	3.8	1.5	13.5
HPI90 3000 64	3000	3	9.6	14.4	6.4	9.6	88.4%	6.4	5.1	1.5	15.5
HPI90 3000 85	3000	4	12.7	19.1	8.5	12.7	88.9%	8.5	6.8	1.5	17.5
HPI90 3000 117	3000	5.5	17.5	26.3	11.7	17.5	89.4%	11.7	9.3	1.5	19.5
HPI112 3000 117	3000	5.5	17.5	26.3	11.7	17.5	88.4%	11.9	9.4	1.5	28.5
HPI112 3000 159	3000	7.5	23.9	35.9	15.9	23.9	90.0%	15.9	12.5	1.5	31.5
HPI112 3000 233	3000	11	35.0	52.5	23.3	35.0	90.3%	23.2	18.4	1.5	35.5
HPI112 3000 318	3000	15	47.8	71.7	31.8	47.8	90.5%	31.5	25.0	1.5	38.5
HPI132 3000 318	3000	15	47.8	71.7	31.8	47.8	90.2%	32.1	25.4	1.5	57.5
HPI132 3000 393	3000	18.5	58.9	88.4	39.3	58.9	90.8%	38.8	30.7	1.5	64.5
HPI132 3000 467	3000	22	70.0	105.0	46.7	70.0	91.1%	46.1	36.5	1.5	71.5

* HPI71 series is available also as single-phase design @ 230 V.
For values @ 230 V, please contact us.

HPI - INTEGRAL DRIVE
3600 MIN $^{-1}$

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Rated speed	Rated power	Rated torque	Peak torque	Motor Rated current	Motor Peak current	Efficiency HPI	Rated input current 380 Vac	Rated input current 480 Vac	Torque constant	Weight HPI
	n 1/min	P_n kW	M_n Nm	M_{pk} Nm	I_n Arms	I_{pk} Arms	η %	I_{in} Arms	I_{in} Arms	K_t Nm/A	 Kg
3600 min^{-1}											
HPI71 3600 16*	3600	0.75	2.0	3.0	1.6	2.4	86.4%	1.7	1.3	1.26	7.3
HPI71 3600 23*	3600	1.1	2.9	4.4	2.3	3.5	87.2%	2.4	1.9	1.26	7.9
HPI71 3600 32*	3600	1.5	4.0	6.0	3.2	4.8	97.9%	3.3	2.6	1.26	8.5
HPI71 3600 46*	3600	2.2	5.8	8.8	4.6	7.0	88.1%	4.8	3.8	1.26	9.1
HPI90 3600 46	3600	2.2	5.8	8.8	4.6	7.0	88.1%	4.8	3.8	1.26	13.5
HPI90 3600 63	3600	3	8.0	11.9	6.3	9.5	88.7%	6.4	5.1	1.26	15.5
HPI90 3600 84	3600	4	10.6	15.9	8.4	12.7	89.2%	8.5	6.8	1.26	17.5
HPI90 3600 116	3600	5.5	14.6	21.9	11.6	17.4	89.7%	11.7	9.3	1.26	19.5
HPI112 3600 116	3600	5.5	14.6	21.9	11.6	17.4	89.5%	11.9	9.4	1.26	28.5
HPI112 3600 158	3600	7.5	19.9	29.8	15.8	23.8	90.1%	15.9	12.5	1.26	31.5
HPI112 3600 232	3600	11	29.2	43.8	23.2	34.9	90.5%	23.2	18.4	1.26	35.5
HPI112 3600 317	3600	15	39.8	59.7	31.7	47.5	90.7%	31.5	25.0	1.26	38.5
HPI132 3600 317	3600	15	39.8	59.7	31.7	47.5	90.5%	32.1	25.4	1.26	57.5
HPI132 3600 391	3600	18.5	49.1	73.6	39.1	58.6	90.9%	38.8	30.7	1.26	64.5
HPI132 3600 465	3600	22	58.4	87.5	46.5	69.7	91.1%	46.1	36.5	1.26	71.5

* HPI71 series is available also as single-phase design @ 230 V.
For values @ 230 V, please contact us.

HPI - INTEGRAL DRIVE
4500 MIN $^{-1}$

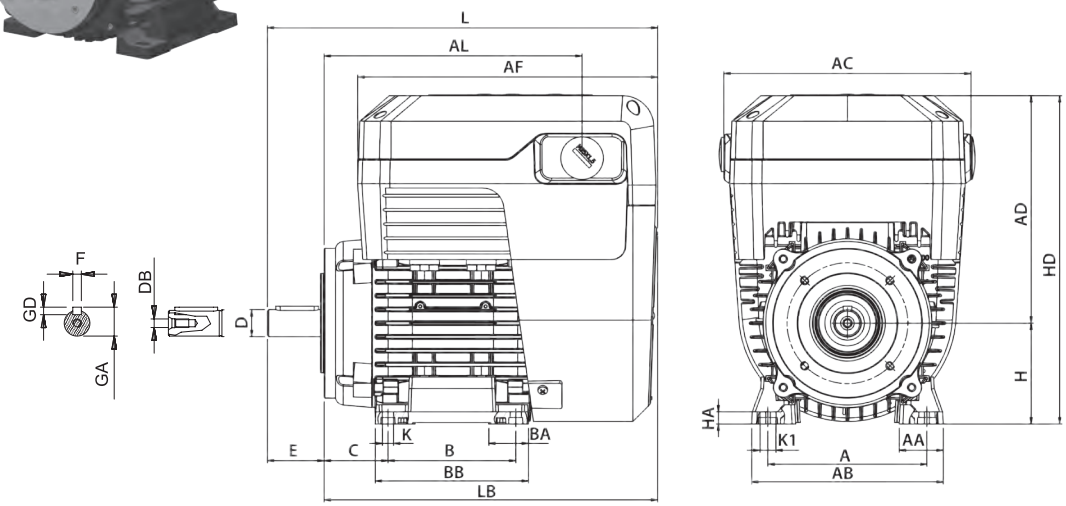
VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Rated speed	Rated power	Rated torque	Peak torque	Motor Rated current	Motor Peak current	Efficiency HPI	Rated input current 380 Vac	Rated input current 480 Vac	Torque constant	Weight HPI
	n 1/min	P_n kW	M_n Nm	M_{pk} Nm	I_n Arms	I_{pk} Arms	η %	I_{in} Arms	I_{in} Arms	K_t Nm/A	Kg
4500 min^{-1}											
HPI71 4500 23*	4500	1.1	2.3	7.0	2.3	3.5	86.4%	2.4	1.9	1	7.3
HPI71 4500 32*	4500	1.5	3.2	3.5	3.2	4.8	87.3%	3.3	2.6	1	7.9
HPI71 4500 47*	4500	2.2	4.7	6.8	4.7	7.0	88.1%	4.8	3.8	1	8.7
HPI71 4500 64*	4500	3	6.4	7.1	6.4	9.6	88.2%	6.5	5.1	1	9.5
HPI90 4500 64	4500	3	6.4	9.6	6.4	9.6	88.2%	6.4	5.1	1	13.5
HPI90 4500 85	4500	4	8.5	9.6	8.5	12.7	88.7%	8.5	6.8	1	15.5
HPI90 4500 117	4500	5.5	11.7	12.7	11.7	17.5	89.4%	11.7	9.3	1	17.5
HPI90 4500 159	4500	7.5	15.9	17.5	15.9	23.9	89.8%	15.9	12.6	1	20.5

* HPI71 series is available also as single-phase design @ 230 V.
For values @ 230 V, please contact us.

HPI FRAME SIZE 71 - 90 - 112 - 132 IM B3
ALUMINIUM ALLOY FRAME



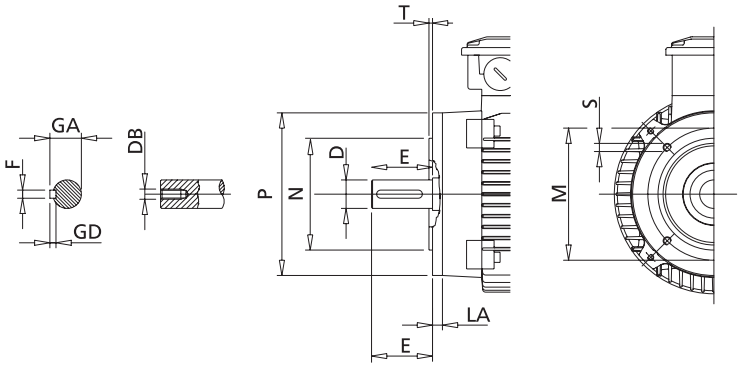
	IEC	H	A	B	C	K[1)]	AB	BB	AD[2)]	HD[2)]	AC	HA
71[4)]		71	112	90	45	8	135	108	160	231	174	8.5
90S		90	140	100	56	10	170	150	183	273	196	11
90L		90	140	125	56	10	170	150	183	273	196	11
112		112	190	140	70	12.5	220	176	228	340	246	15
132[4)]		132	216	178	89	12	256	218	243	375	280	17

	IEC	K[1]	L	LB	AL	AF	BA	AA	D	E	F	GD	GA	DB[3)]
71[4)]		11	275	235	182	211	28	31	19	40	6	6	22	M6
90S		15	369	319	254	280	28/53	37	24	50	8	7	27	M8
90L		15	369	319	254	280	28/53	37	24	50	8	7	27	M8
112		19	457	397	332	350	46	48	28	60	8	7	31	M10
132[4)]		20	545	465	380	415	45	59	38	80	10	8	41	M12

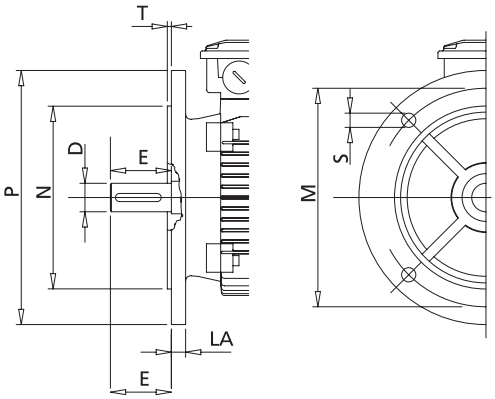
1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2
4) Not binding dimensions. Please contact us for more information.

HPI FRAME SIZE 71 - 90 - 112 - 132 IM B14, IM B5
ALUMINIUM ALLOY FRAM

IM B14

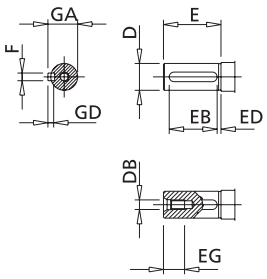


IM B5



	SMALL FLANGE B14						LARGE FLANGE B14						FLANGE B5					
IEC	P	N	LA	M	T	S[1]	P	N	LA	M	T	S[1]	M	N	P	T	LA	S[1]
71[2]	105	70	11	85	2.5	M6	140	95	8	115	3	M8	130	110	160	3.5	10	M8
90S-L	140	95	10	115	3	M8	160	110	9	130	3.5	M8	165	130	200	3.5	12	M10
112	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
132[2]	200	130	30	165	3.5	M10	250	180	12	215	4	M12	265	230	300	4	14	M12

1) Clearence hole for screw
2) Not binding dimensions. Please contact us for more information.



IEC	D	E	F h9	GD	GA	DB[1]	EG	EB	ED
71[2]	19 j6	40	6	6	22	M6	16	30	4
90S-L	24 j6	50	8	7	27	M8	19	40	4
112	28 j6	60	8	7	31	M10	22	50	4
132[2]	38 k6	80	10	8	41	M12	28	70	4

1) Centring holes in shaft extension to DIN 332 part 2
2) Not binding dimensions. Please contact us for more information.

HPS - STAND ALONE MOTOR

HPS - STAND ALONE MOTOR
1500 MIN $^{-1}$

EFFICIENCY LEVEL ACCORDING TO IEC 60034-30-2:2016

IE4

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Size	Rated speed	Rated power	Rated torque	Peak torque	Voltage constant	Torque constant	BEMF at rated speed	Rated current	Efficiency HPS	Weight
		n 1/min	P_n kW	M_n Nm	M_{pk} Nm	K_e Vs	K_t Nm/A	E_n Vrs	I_n Arms	η %	Kg
1500 min^{-1}											
HPS 56 1500 4	**56**	1500	0.18	1.2	3.4	1.73	3	272	0.4	72.0%	2.8
HPS 56 1500 5	**56**	1500	0.25	1.6	4.8	1.73	3	272	0.5	75.4%	3.0
HPS 56 1500 8	**56**	1500	0.37	2.4	7.1	1.73	3	272	0.8	78.9%	3.2
HPS71 1500 12	**71**	1500	0.55	3.5	10.5	1.73	3	272	1.2	86.0%	4.8
HPS71 1500 16	**71**	1500	0.75	4.8	14.4	1.73	3	272	1.6	87.0%	5.4
HPS71 1500 23	**71**	1500	1.1	7.0	21.0	1.73	3	272	2.3	87.8%	6.2
HPS71 1500 32	**71**	1500	1.5	9.6	28.8	1.73	3	272	3.2	88.5%	7.0
HPS90 1500 32	**S-L**	1500	1.5	9.6	28.7	1.73	3	272	3.2	91.0%	10
HPS90 1500 47	**S-L**	1500	2.2	14.0	42.0	1.73	3	272	4.7	91.5%	12
HPS90 1500 64	**S-L**	1500	3	19.1	57.3	1.73	3	272	6.4	92.0%	14
HPS90 1500 85	**S-L**	1500	4	25.5	76.4	1.73	3	272	8.5	92.3%	17
HPS112 1500 85	**M**	1500	4	25.5	76.4	1.73	3	272	8.5	92.4%	23
HPS112 1500 117	**M**	1500	5.5	35.0	105.1	1.73	3	272	11.7	92.5%	26
HPS112 1500 159	**M**	1500	7.5	47.8	143.3	1.73	3	272	15.9	93.1%	30
HPS112 1500 195	**M**	1500	9.2	58.6	175.8	1.73	3	272	19.5	93.0%	33
HPS132 1500 233	**XL**	1500	11	70.0	210.1	1.73	3	272	23.3	94.0%	51
HPS132 1500 318	**XXL**	1500	15	95.5	286.5	1.73	3	272	31.8	94.4%	58
HPS132 1500 393	**XXL**	1500	18.5	117.8	353.4	1.73	3	272	39.3	94.8%	65
HPS160 1500 233	**M**	1500	11	70	175	1.73	3	272	23.3	93.3%	70
HPS160 1500 318	**M**	1500	15	95	239	1.73	3	272	31.8	93.9%	75
HPS160 1500 393	**M**	1500	18.5	118	294	1.73	3	272	39.3	94.2%	85
HPS160 1500 467	**L**	1500	22	140	350	1.73	3	272	46.7	94.5%	95
HPS160 1500 637	**L**	1500	30	191	477	1.73	3	272	63.7	94.9%	115

HPS - STAND ALONE MOTOR
1800 MIN $^{-1}$

EFFICIENCY LEVEL ACCORDING TO IEC 60034-30-2:2016

IE4

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Size	Rated speed	Rated power	Rated torque	Peak torque	Voltage constant	Torque constant	BEMF at rated speed	Rated current	Efficiency HPS	Weight
		n 1/min	P_n kW	M_n Nm	M_{pk} Nm	K_e Vs	K_t Nm/A	E_n Vrs	I_n Arms	η %	Kg
1800 min^{-1}											
HPS 56 1800 4	**56**	1800	0.18	1.0	2.9	1.45	2.5	272	0.4	72.0%	2.8
HPS 56 1800 5	**56**	1800	0.25	1.3	4.0	1.45	2.5	272	0.5	75.4%	3.0
HPS 56 1800 8	**56**	1800	0.37	2.0	5.9	1.45	2.5	272	0.8	78.9%	3.2
HPS71 1800 12	**71**	1800	0.55	2.9	8.8	1.45	2.5	272	1.2	87.7%	4.8
HPS71 1800 16	**71**	1800	0.75	4.0	11.9	1.45	2.5	272	1.6	88.4%	5.4
HPS71 1800 23	**71**	1800	1.1	5.8	17.5	1.45	2.5	272	2.3	88.9%	6.2
HPS71 1800 32	**71**	1800	1.5	8.0	23.9	1.45	2.5	272	3.2	89.4%	7.0
HPS90 1800 32	**S-L**	1800	1.5	8.0	23.9	1.45	2.5	272	3.2	91.2%	10
HPS90 1800 46	**S-L**	1800	2.2	11.7	35.0	1.45	2.5	272	4.6	91.6%	12
HPS90 1800 64	**S-L**	1800	3	15.9	47.7	1.45	2.5	272	6.3	92.1%	14
HPS90 1800 84	**S-L**	1800	4	21.2	63.7	1.45	2.5	272	8.4	92.4%	17
HPS112 1800 84	**M**	1800	4	21.2	63.7	1.45	2.5	272	8.4	92.5%	23
HPS112 1800 116	**M**	1800	5.5	29.2	87.5	1.45	2.5	272	11.6	92.6%	26
HPS112 1800 158	**M**	1800	7.5	39.8	119.4	1.45	2.5	272	15.8	93.3%	30
HPS112 1800 232	**XL**	1800	11	58.4	175.1	1.45	2.5	272	23.2	94.0%	33
HPS132 1800 232	**M**	1800	11	58.4	175.1	1.45	2.5	272	23.2	94.2%	51
HPS132 1800 317	**XXL**	1800	15	79.6	238.7	1.45	2.5	272	31.7	94.6%	58
HPS132 1800 391	**XXL**	1800	18.5	98.1	294.4	1.45	2.5	272	39.1	94.9%	65
HPS160 1800 232	**M**	1800	11	58	146	1.45	2.5	272	23.2	93.3%	70
HPS160 1800 317	**M**	1800	15	80	199	1.45	2.5	272	31.7	93.9%	75
HPS160 1800 391	**M**	1800	18.5	98	245	1.45	2.5	272	39.1	94.2%	75
HPS160 1800 465	**L**	1800	22	117	292	1.45	2.5	272	46.5	94.5%	85
HPS160 1800 634	**L**	1800	30	159	398	1.45	2.5	272	63.4	94.9%	100

HPS - STAND ALONE MOTOR
3000 MIN $^{-1}$

EFFICIENCY LEVEL ACCORDING TO IEC 60034-30-2:2016

IE4

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Size	Rated speed	Rated power	Rated torque	Peak torque	Voltage constant	Torque constant	BEMF at rated speed	Rated current	Efficiency HPS	Weight
		n 1/min	P_n kW	M_n Nm	M_{pk} Nm	K_e Vs	K_t Nm/A	E_n Vrs	I_n Arms	η %	Kg
3000 min^{-1}											
HPS56 3000 5	**56**	3000	0.25	0.8	2.4	0.87	1.5	272	0.5	71.5%	2.6
HPS56 3000 8	**56**	3000	0.37	1.2	3.5	0.87	1.5	272	0.8	75.6%	2.6
HPS56 3000 12	**56**	3000	0.55	1.8	5.3	0.87	1.5	272	1.2	79.3%	2.8
HPS56 3000 16	**56**	3000	0.75	2.4	7.2	0.87	1.5	272	1.6	81.5%	3.0
HPS71 3000 16	**71**	3000	0.75	2.4	7.2	0.87	1.5	272	1.6	89.7%	4.8
HPS71 3000 23	**71**	3000	1.1	3.5	10.5	0.87	1.5	272	2.3	90.5%	5.4
HPS71 3000 32	**71**	3000	1.5	4.8	14.3	0.87	1.5	272	3.2	91.2%	6.0
HPS71 3000 47	**71**	3000	2.2	7.0	21.0	0.87	1.5	272	4.7	91.4%	6.6
HPS90 3000 47	**S-L**	3000	2.2	7.0	21.0	0.87	1.5	272	4.7	91.5%	10
HPS90 3000 64	**S-L**	3000	3	9.6	28.7	0.87	1.5	272	6.4	92.1%	12
HPS90 3000 85	**S-L**	3000	4	12.7	38.2	0.87	1.5	272	8.5	92.6%	14
HPS90 3000 117	**S-L**	3000	5.5	17.5	52.5	0.87	1.5	272	11.7	93.1%	16
HPS112 3000 117	**M**	3000	5.5	17.5	52.5	0.87	1.5	272	11.7	92.9%	23
HPS112 3000 159	**M**	3000	7.5	23.9	71.6	0.87	1.5	272	15.9	93.7%	26
HPS112 3000 233	**M**	3000	11	35.0	105.1	0.87	1.5	272	23.3	94.1%	30
HPS112 3000 318	**M**	3000	15	47.8	143.3	0.87	1.5	272	31.8	94.2%	33
HPS132 3000 318	**M**	3000	15	47.8	143.3	0.87	1.5	272	31.8	93.8%	51
HPS132 3000 393	**XL**	3000	18.5	58.9	176.7	0.87	1.5	272	39.3	94.6%	58
HPS132 3000 467	**XXL**	3000	22	70.0	210.1	0.87	1.5	272	46.7	94.9%	65
HPS132 3000 636	**XXL**	3000	30	95.4	286.0	0.87	1.5	272	63.6	95.0%	72
HPS160 3000 634	**L**	3000	30	95.4	239	0.87	1.51	272	63.4	93.7%	90
HPS160 3000 782	**L**	3000	37	118.0	294	0.87	1.51	272	78.2	94.1%	95

HPS - STAND ALONE MOTOR
3600 MIN $^{-1}$

EFFICIENCY LEVEL ACCORDING TO IEC 60034-30-2:2016

IE4

VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

Type	Size	Rated speed	Rated power	Rated torque	Peak torque	Voltage constant	Torque constant	BEMF at rated speed	Rated current	Efficiency HPS	Weight
		n 1/min	P_n kW	M_n Nm	M_{pk} Nm	K_e Vs	K_t Nm/A	E_n Vrs	I_n Arms	η %	Kg
3600 min^{-1}											
HPS 56 3600 5	**56**	3600	0.25	0.7	2.0	0.73	1.26	272	0.5	71.5%	2.6
HPS 56 3600 8	**56**	3600	0.37	1.0	2.9	0.73	1.26	272	0.8	75.6%	2.6
HPS 56 3600 12	**56**	3600	0.55	1.5	4.4	0.73	1.26	272	1.2	79.3%	2.8
HPS 56 3600 16	**56**	3600	0.75	2.0	6.0	0.73	1.26	272	1.6	81.5%	3.0
HPS71 3600 16	**71**	3600	0.75	2.0	6.0	0.73	1.26	272	1.6	90.0%	4.8
HPS71 3600 23	**71**	3600	1.1	2.9	8.8	0.73	1.26	272	2.3	90.9%	5.4
HPS71 3600 32	**71**	3600	1.5	4.0	11.9	0.73	1.26	272	3.2	91.6%	6.0
HPS71 3600 46	**71**	3600	2.2	5.8	17.5	0.73	1.26	272	4.6	91.8%	6.6
HPS90 3600 46	**S-L**	3600	2.2	5.8	17.5	0.73	1.26	272	4.6	91.7%	10
HPS90 3600 63	**S-L**	3600	3	8.0	23.9	0.73	1.26	272	6.3	92.4%	12
HPS90 3600 84	**S-L**	3600	4	10.6	31.8	0.73	1.26	272	8.4	92.8%	14
HPS90 3600 116	**S-L**	3600	5.5	14.6	43.8	0.73	1.26	272	11.6	93.3%	16
HPS112 3600 116	**M**	3600	5.5	14.6	43.8	0.73	1.26	272	11.6	93.2%	23
HPS112 3600 158	**M**	3600	7.5	19.9	59.7	0.73	1.26	272	15.8	93.9%	26
HPS112 3600 232	**M**	3600	11	29.2	87.5	0.73	1.26	272	23.2	94.3%	30
HPS112 3600 317	**M**	3600	15	39.8	119.4	0.73	1.26	272	31.7	94.5%	33
HPS132 3600 317	**M**	3600	15	39.8	119.4	0.73	1.26	272	31.7	94.2%	51
HPS132 3600 391	**XL**	3600	18.5	49.1	147.2	0.73	1.26	272	39.1	94.6%	58
HPS132 3600 465	**XXL**	3600	22	58.4	175.1	0.73	1.26	272	46.5	95.0%	65
HPS132 3600 634	**XXL**	3600	30	79.6	238.7	0.73	1.26	272	63.4	95.1%	72
HPS160 3600 629	L	3600	30	79.6	199	0.73	1.26	272	62.9	93.7%	85
HPS160 3600 776	L	3600	37	98.0	245	0.73	1.26	272	77.6	94.1%	90

HPS - STAND ALONE MOTOR
4500 MIN $^{-1}$

EFFICIENCY LEVEL ACCORDING TO IEC 60034-30-2:2016

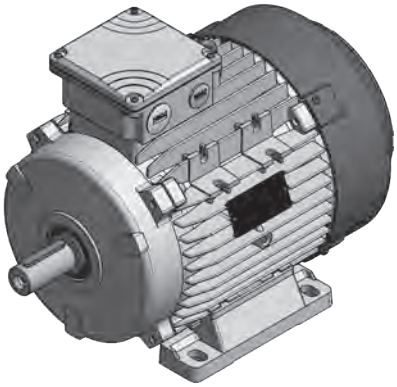
IE4

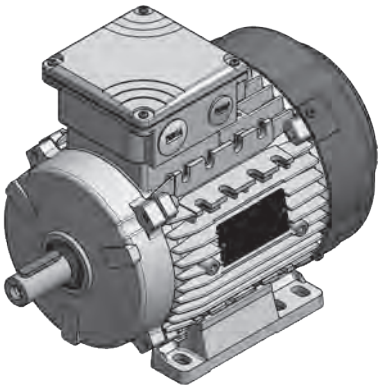
VALUES @ 400 V

TEMPERATURE RISE TO CLASS B

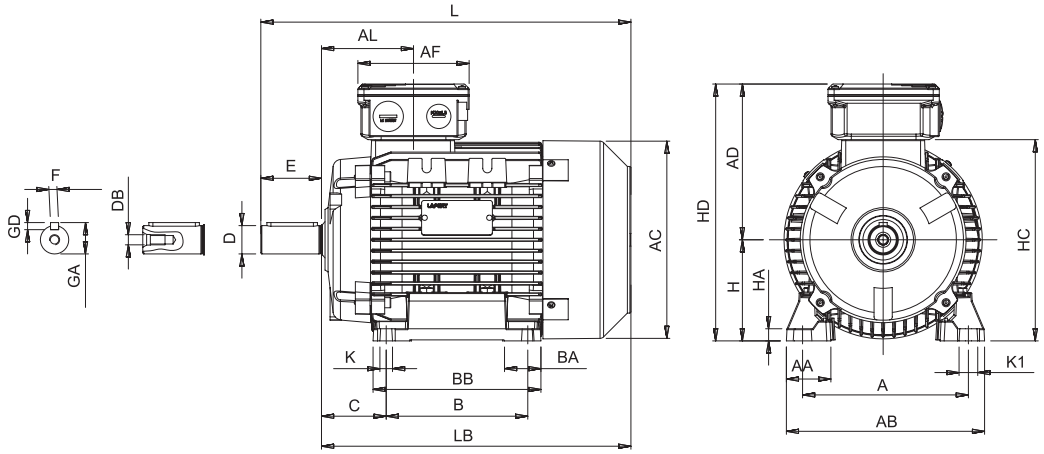
Type	Size	Rated speed	Rated power	Rated torque	Peak torque	Voltage constant	Torque constant	BEMF at rated speed	Rated current	Efficiency HPS	Weight
		n 1/min	P_n kW	M_n Nm	M_{pk} Nm	K_e Vs	K_t Nm/A	E_n Vrs	I_n Arms	η %	Kg
4500 min^{-1}											
HPS 56 4500 8	**56**	4500	0.37	0.8	2.4	0.58	1.00	272	0.8	75.6%	2.6
HPS 56 4500 12	**56**	4500	0.55	1.2	3.5	0.58	1.00	272	1.2	79.3%	2.6
HPS 56 4500 16	**56**	4500	0.75	1.6	4.8	0.58	1.00	272	1.6	81.5%	2.8
HPS 56 4500 23	**56**	4500	1.1	2.3	7.0	0.58	1.00	272	2.3	83.3%	3.0
HPS71 4500 23	**71**	4500	1.1	2.3	7.0	0.58	1	272	2.3	90.0%	4.8
HPS71 4500 32	**71**	4500	1.5	3.2	9.6	0.58	1	272	3.2	91.0%	5.4
HPS71 4500 47	**71**	4500	2.2	4.7	14.0	0.58	1	272	4.7	91.8%	6.2
HPS71 4500 64	**71**	4500	3	6.4	19.1	0.58	1	272	6.4	91.9%	7.0
HPS90 4500 64	**S-L**	4500	3	6.4	19.1	0.58	1	272	6.4	91.8%	10
HPS90 4500 85	**S-L**	4500	4	8.5	25.5	0.58	1	272	8.5	92.4%	12
HPS90 4500 117	**S-L**	4500	5.5	11.7	35.0	0.58	1	272	11.7	93.0%	14
HPS90 4500 159	**S-L**	4500	7.5	15.9	47.8	0.58	1	272	15.9	93.5%	17

HPS FRAME SIZE 56 - 71 - 90 - 112 IM B3
ALUMINIUM ALLOY FRAME





ONLY FOR SIZE 90L

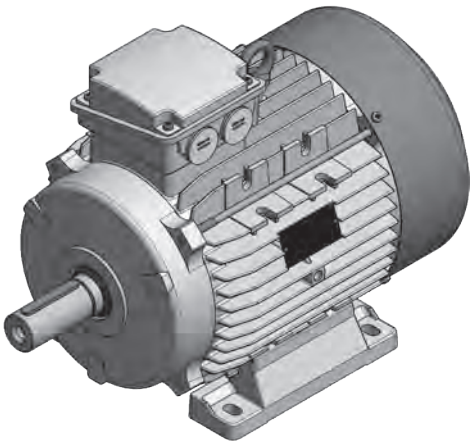


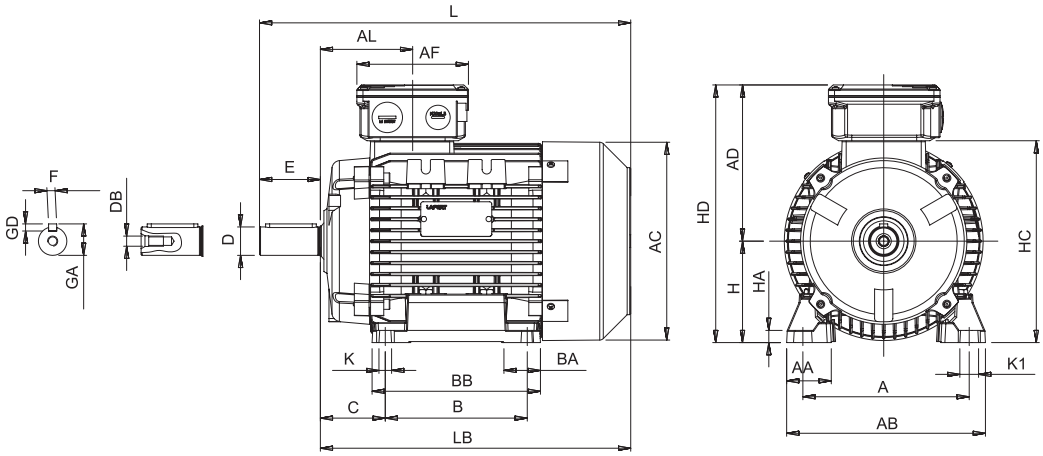
IEC	H	A	B	C	K[1)]	AB	BB	AD[2)]	HD[2)]	AC	HC	HA
56	56	90	71	36	6	107	86	92	148	110	109	8
71	71	112	90	45	8	135	108	114	185	142	142	9
90S	90	140	100	56	10	170	150	148	238	177	181	11
90L	90	140	125	56	10	170	150	148	238	177	181	11
112M	112	190	140	70	12.5	220	176	171	283	225	226	15
112XL	112	190	140	70	12.5	220	176	171	283	225	226	15

IEC	K1	L	LB	AL	AF	BA	AA	D	E	F	GD	GA	DB [3)]
56	9	188	168	61	93	27	27	14	30	5	5	16	M5
71	17	245	215	75	93	22	30	19	40	6	6	22	M6
90S	15	317	267	85	110	28/53	37	24	50	8	7	27	M8
90L	15	317	267	85	110	28/53	37	24	50	8	7	27	M8
112M	19	388	328	92	110	46	48	28	60	8	7	31	M10
112XL	19	410	350	92	110	46	48	28	60	8	7	31	M10

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2

HPS FRAME SIZE 132 IM B3
ALUMINIUM ALLOY FRAME



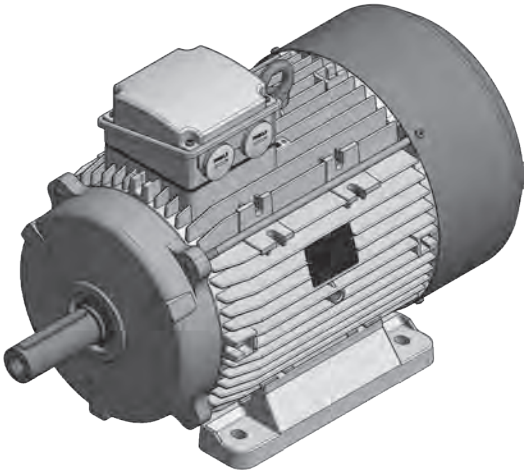


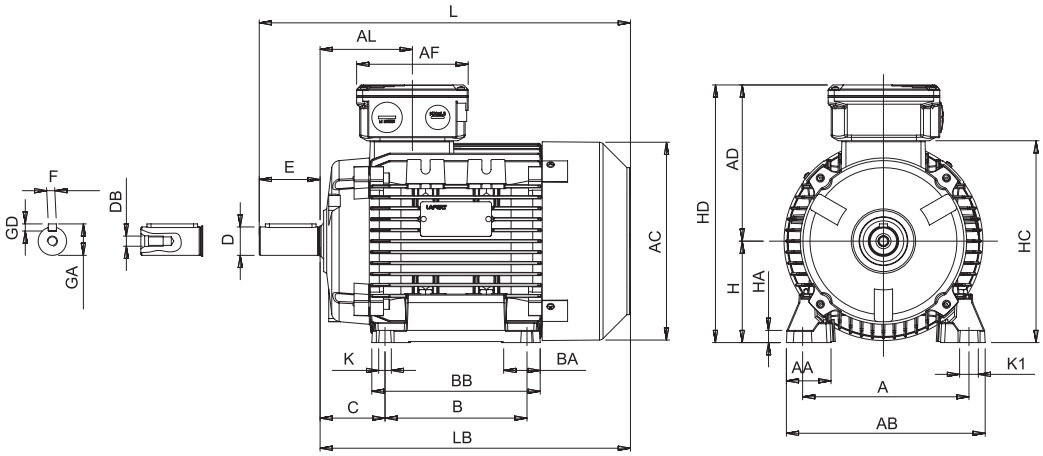
IEC	H	A	B	C	K[1)]	AB	BB	AD[2)]	HD[2)]	AC	HC	HA
132M	132	216	178	89	12	256	218	195	327	248	261	17
132XL	132	216	178	89	12	256	218	195	327	248	261	17
132XXL	132	216	178	89	12	256	218	195	327	248	261	17

IEC	K1	L	LB	AL	AF	BA	AA	D	E	F	GD	GA	DB [3)]
132M	20	485	405	122	133	45	59	38	80	10	8	41	M12
132XL	20	505	425	122	133	45	59	38	80	10	8	41	M12
132XXL	20	556	476	122	133	45	59	38	80	10	8	41	M12

1) Clearance hole for screw
2) Maximum dimension
3) Centering holes in shaft extensions to DIN 332 part 2

HPS FRAME SIZE 160 IM B3
ALUMINIUM ALLOY FRAME





IEC	H	A	B	C	K[1)]	AB	BB	AD[2)]	HD[2)]	AC	HC	HA
160M	160	254	210	108	14	320	270	238	398	317	316	23
160L	160	254	254	108	14	320	310	238	398	317	316	23

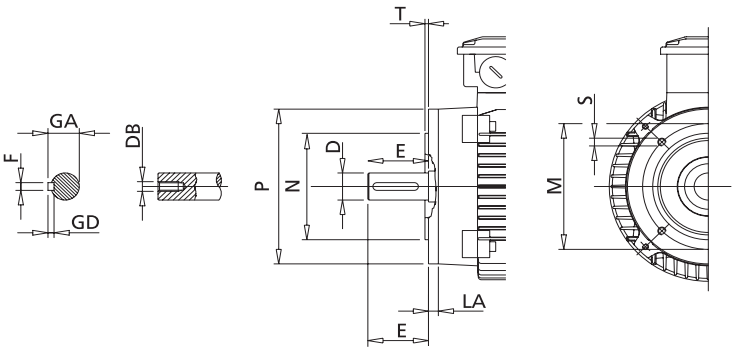
IEC	K1	L	LB	AL	AF	BA	AA	D	E	F	GD	GA	DB [3)]
160M	18	608	498	146	150	65	76	42*	110	12*	8*	45*	M16
160L	18	652	542	168	150	65	76	48	110	14	9	51.5	M16

1) Clearance hole for screw
2) Maximum distance
3) Centering holes in shaft extensions to DIN 332 part 2

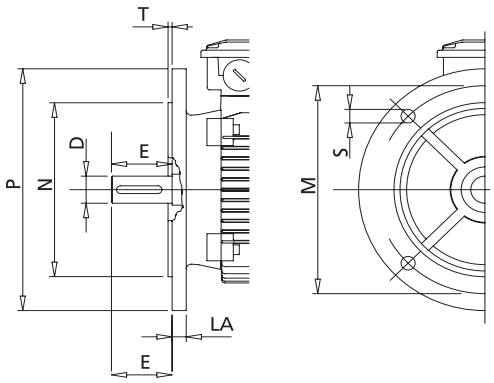
* For type HPS 160M 18.5kW, please refer to HPS 160L

HPS FRAME SIZE 56 - 71 - 90 - 112 - 132 - 160 IM B14, IM B5
ALUMINIUM ALLOY FRAME

IM B14

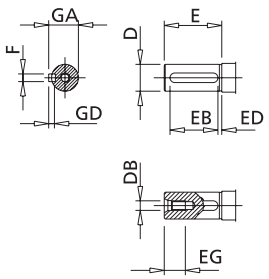


IM B5



	SMALL FLANGE B14						LARGE FLANGE B14						FLANGE B5					
IEC	P	N	LA	M	T	S[1)]	P	N	LA	M	T	S[1)]	M	N	P	T	LA	S[1)]
56	80	50	8	65	2.5	M5	105	70	8	85	2.5	M6	100	80	120	2.5	7	M6
71	105	70	11	85	2.5	M6	140	95	8	115	3	M8	130	110	160	3.5	10	M8
90S-L	140	95	10	115	3	M8	160	110	9	130	3.5	M8	165	130	200	3.5	12	M10
112M-XL	160	110	10	130	3.5	M8	200	130	12	165	3.5	M10	215	180	250	4	14	M12
132M-XL-XXL	200	130	23	165	3.5	M10	250	180	12	215	4	M12	265	230	300	4	14	M12
160M-L	250	180	20	216	4	M12	300	230	12	265	5	M16	300	250	350	5	15	M16

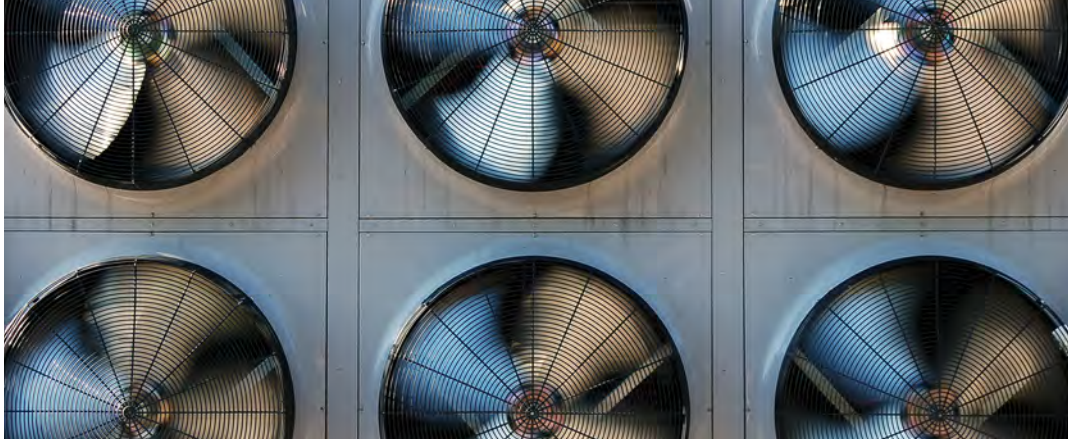
1) Clearence hole for screw



IEC	D	E	F h9	GD	GA	DB	EG	EB	ED
56	14	30	5	5	16	M5	12.5	20	4
71	19 j6	40	6	6	22	M6	16	30	4
90S-L	24 j6	50	8	7	27	M8	19	40	4
112M-XL	28 j6	60	8	7	31	M10	22	50	4
132M-XL-XXL	38 k6	80	10	8	41	M12	28	70	4
160M	42 k6*	110	12*	8*	45*	M16	36	100	4
160L	48k6*	110	14	9	51.5	M16	36	100	4

1) Centring holes in shaft extension to DIN 332 part 2

AC MOTORS - IE3, IE2



BRAKE MOTORS

HIGH PERFORMANCE MOTORS - IE4/IE5

SERVO MOTORS & DRIVES

LIFT MOTORS

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