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H-compact Three-Phase Asynchronous Motors

◊ Table of Content

H-compact Three-Phase Asynchronous Motors

◊ Overview of the Standard Designs of the H-compact Range

H-compact Range	Operation	Voltages	Power Range 50 Hz	Power Range 60 Hz	Cooling Method	Degree of Prot.	Type of Prot.	Type of Construction
1LA4	Line & Converter	690 V - 11 kV	200 - 3,000 kW	240 - 3,300 kW	IC411	IP55	-	IM B3, IM B35, IM V1
1LA4 Standardline	Line	2,0 - 6,6 kV	200 - 800 kW	-	IC411	IP55	-	IM B3
1MS4	Line (Converter on request)	2,0 - 11 kV	200 - 3,000 kW	240 - 3,300 kW	IC411	IP55	Ex nA	IM B3, IM B35, IM V1
1MG4		2,0 - 11 kV	200 - 3,000 kW	240 - 3,300 kW	IC411	IP55	Ex pe	IM B3, IM B35, IM V1
1MA4		3,0 - 6,6 kV	170 - 630 kW	-	IC411	IP55	Ex e	IM B3, IM B35, IM V1
1PQ4	Line & Converter	690 V - 6,6 kV	1,150 - 1,700 kW	-	IC416	IP55	-	IM B3, IM B35, IM V1
1LH4	Line & Converter	690 V - 6,6 kV	1,380 - 1,750 kW	1,550 - 2,000 kW	IC71W	IP55	-	IM B3, IM B35, IM V1

1LA4, 1LA4 Standardline, 1MS4, 1MA4

1MG4

1PQ4 (Low-voltage version)

1LH4 (Low-voltage version)

Cooling Method

IC411: Enclosed, air-cooled, self-ventilated
IC416: Enclosed, air-cooled, separately-ventilated
IC71W: Enclosed, water-cooled

Degree of Protection

IP55: Protection against dust and water jets

Type of Protection

Ex nA: Non-sparking motor, zone 2
Ex pe: Pressurised enclosure of the motor, increased safety of the terminal box, zone 1
Ex e: Increased safety of the motor, zone 1

Type of Construction

IM B3: Horizontal, with feet, without flange
IM B35: Horizontal, with feet, with flange
IM V1: Vertical, without feet, with flange

H-compact Three-Phase Induction Motors

◊ Short Description of the H-compact Range

The high-voltage motors in the H-compact range are fin- or water-cooled, non-standard, asynchronous motors with squirrel cage rotors, which, for converter-fed operation, are also manufactured as low-voltage versions.

H-compact 1LA4

Their robust design, which includes several high-quality features, such as enclosures and bearing brackets made of cast-iron or steel, superior corrosion protection, a MICALASTIC or DURIGNIT isolation system and die-cast aluminium or copper cage rotors, makes these motors not only particularly durable but also very reliable.

Designed to provide maximum reliability, the bearings also guarantee good vibration characteristics and low maintenance costs.

Their technically-sophisticated cooling system, which features an additional inner cooling circuit, allows the motors in the H-compact range to distinguish themselves through their ability to provide a large, available power rating whilst themselves being of small dimension. This compactness facilitates equipment integration and also allows the entire unit to be reduced in both size and weight.

A further key argument in favour of this range of motors is its excellent efficiency rating. The machines are optimised both structurally and in terms of their efficiency and thus benefit from considerable energy savings.

Motors in the H-compact range are designed for both line-supply and frequency converter-fed operation. When combined with frequency converters in the SINAMICS product range or Perfect Harmony converters, they create perfectly coordinated drive systems for applications with speed-variable operation.

A wide range of technical extras allows machines to be tailored to the applications for which they are required, in order that they may be used in various industrial sectors. The chemical, paper, water / waste water, steel and shipbuilding industries are just some examples.

◊ Further Information

Further information can be obtained from the following sources:

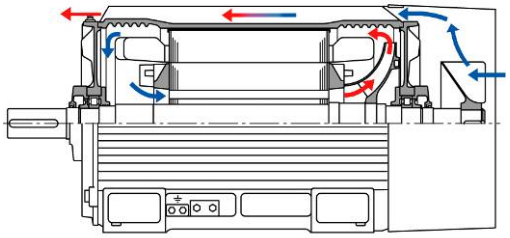
- Our webpage at http://www.siemens.com/h-compact
- Our catalogue D86.1 (1LA4 Standardline)
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase Asynchronous Motors

◊ Short Description of the Standard Designs of the H-compact Range

H-compact Range 1LA4

Type 1LA4 motors are totally enclosed, self-ventilated, fin-cooled machines (cooling method IC411) with degree of protection IP55, which, for converter-fed operation, also exist in low-voltage versions. They cover the power range from 200 kW to 3,000 kW (at 50 Hz) and are designed for line-supply and converter-fed operation. The available types of construction are IM B3, IM B35 and IM V1.



Cross-section of a 1LA4, 1LA4 Standardline, 1MS4, 1MG4 and 1MA4 motor

H-compact Range 1LA4 Standardline

2-, 4- and 6-pole motors of type 1LA4 (cooling method IC411, degree of protection IP55) in the power range from 200 kW to 800 kW (at 50 Hz) can also be obtained as Standardline models. The option spectrum associated with this motor range has been limited in order to allow the optimisation of order handling and the production process so that delivery times may be significantly reduced. These motors are designed for line-supply operation and thus only exist in high-voltage versions. The only available type of construction is IM B3.

H-compact Range 1MS4

Type 1MS4 motors are totally enclosed, self-ventilated, fin-cooled machines (cooling method IC411) with degree of protection IP55 and cover the power range from 200 kW to 3,000 kW (at 50 Hz). Electrically, they correspond to type 1LA4 motors, but, in contrast, have type of protection "Ex nA" and are, in principle, designed for line-supply operation. The available types of construction are IM B3, IM B35 and IM V1.

H-compact Range 1MG4

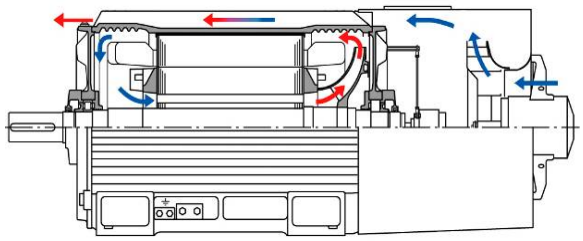
Type 1MG4 motors are totally enclosed, self-ventilated, fin-cooled machines (cooling method IC411) with degree of protection IP55 and cover the power range from 200 kW to 3,000 kW (at 50 Hz). Electrically, they correspond to type 1LA4 motors, but, in contrast, have type of protection "Ex pe" and are, in principle, designed for line-supply operation. The available types of construction are IM B3, IM B35 and IM V1.

H-compact Range 1MA4

Type 1MA4 motors are totally enclosed, self-ventilated, fin-cooled machines (cooling method IC411) with degree of protection IP55 and cover the power range from 170 kW to 630 kW (at 50 Hz). They have type of protection "Ex e" and are, in principle, designed for line-supply operation. The available types of construction are IM B3, IM B35 and IM V1.

H-compact Range 1PQ4

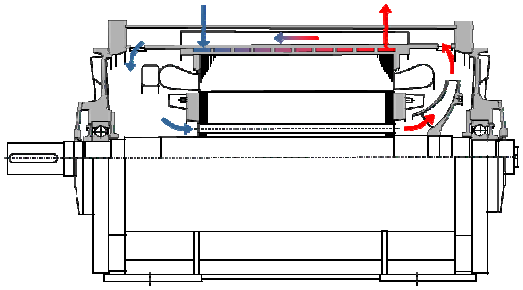
Type 1PQ4 motors are totally enclosed, separately-ventilated, fin-cooled machines (cooling method IC416) with degree of protection IP55, which, for converter-fed operation, also exist in low-voltage versions. They cover the power range from 250 kW to 1,000 kW (at 50 Hz) and are designed for variable-speed applications with constant torque. As a result of the external fan unit mounted on the motor, a consistently elevated cooling air flow is supplied, which allows operation with high torques at low speeds. The available types of construction are IM B3, IM B35 and IM V1.



Cross-section of a 1PQ4 motor

H-compact Range 1LH4

Type 1LH4 motors are water-jacket cooled machines (cooling method IC71W) with degree of protection IP55, which, for converter-fed operation, also exist in low-voltage versions. They cover the power range from 1,380 kW to 1,750 kW (at 50 Hz) and are designed for both line-supply and converter-fed operation. Due to water cooling, they can be operated at ambient temperatures of up to 55°C and at water inlet temperatures of up to 38°C without a power derating. Furthermore, they demonstrate an even greater power density at even lower noise levels than the other motors in the H-compact range. The available types of construction are IM B3, IM B35 and IM V1.



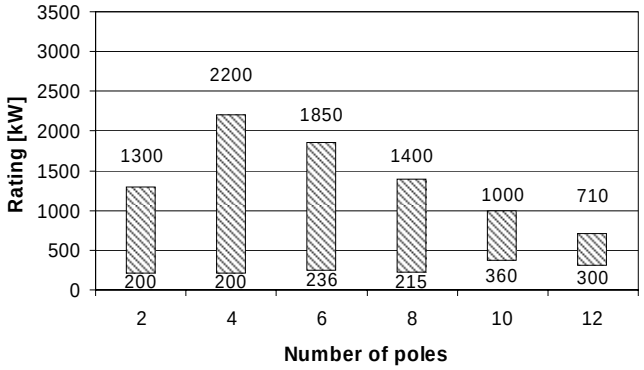
Cross-Section of a 1LH4 motor

H-compact Three-Phase 1LA4 Asynchronous Motor

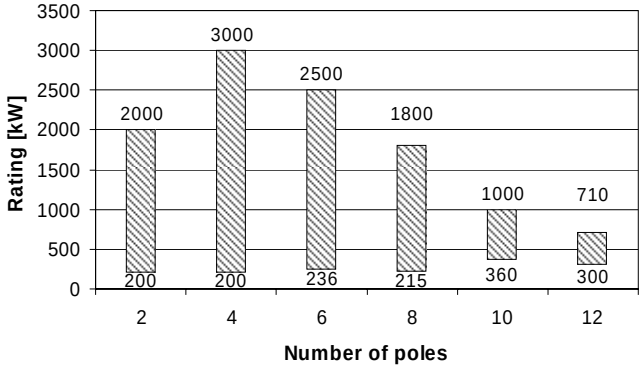
◊ Power Range of the Standard Designs

Type 1LA4 motors are the self-ventilated, totally enclosed, fin-cooled machines in the H-compact range. They are characterised by their compact and robust design, which guarantees excellent reliability and a high operating availability despite small dimensions. Their outstanding level of efficiency and wide range of accessories allow these motors to be adapted for use with a variety of different applications across all industrial sectors. The available power ranges are given in the graphs below.

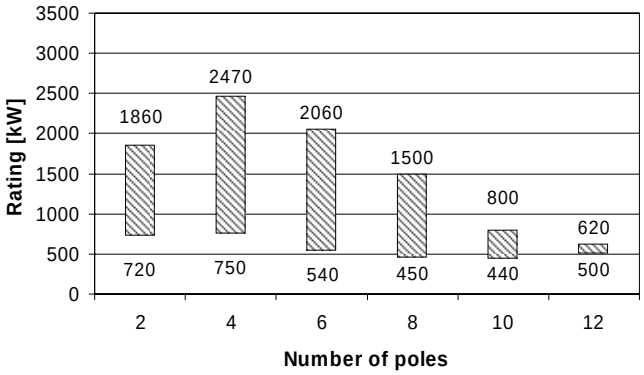
Power range of the 1LA4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 560
- 2.0 kV to 3.3 kV



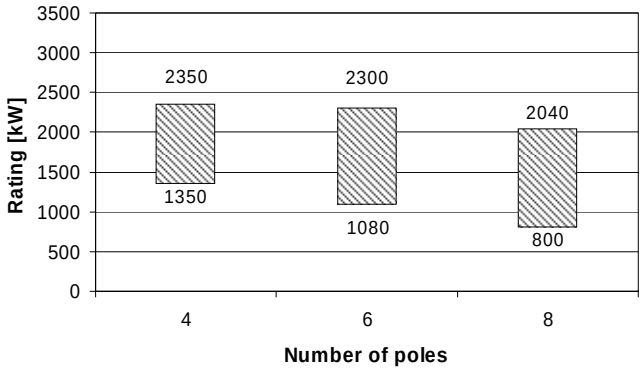
Power range of the 1LA4 (depending on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 630
- 3.3 kV to 6.6 kV



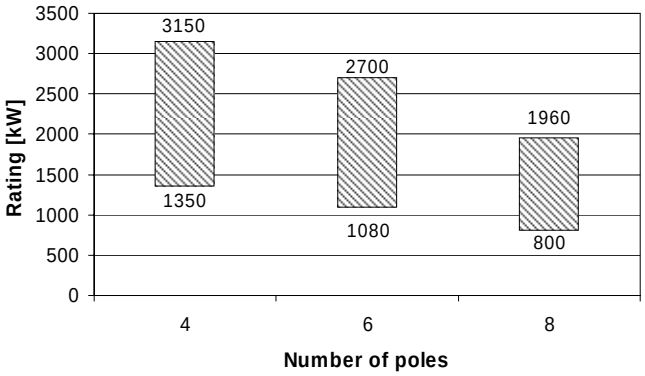
Power range of the 1LA4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 450 to 630
- 9 kV to 11 kV



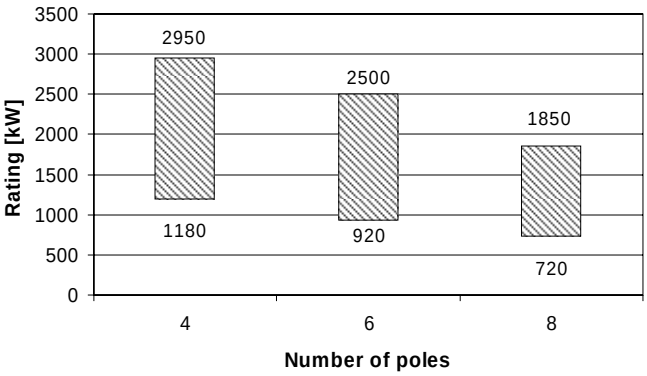
Power range of the 1LA4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 2.3 kV



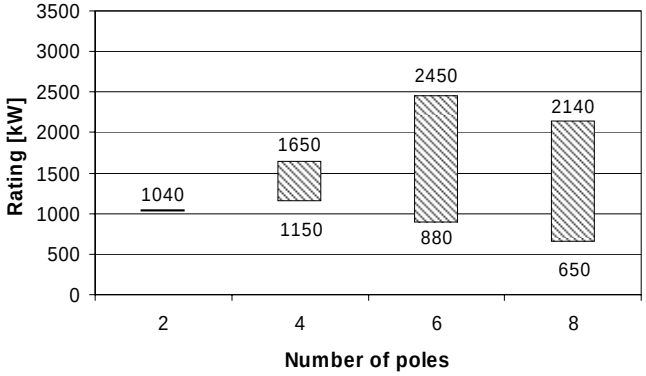
Power range of the 1LA4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 3.3 kV; 4.16 kV



Power range of the 1LA4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 6 kV; 6.6 kV



Power range of the 1LA4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 450 to 630
- 690 V



H-compact Three-Phase 1LA4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7.

Cast-Iron Casings
Machines of type 1LA4 have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55.

Isolation System
The MICALASTIC or, for low-voltage, 4-, 6- and 8-pole motors with a shaft height of 450, the DURIGNIT system according to the VPI (Vacuum Pressure Impregnation) process are used for isolation purposes. Both systems correspond to thermal class 155 (F) and ensure a long motor lifetime as well as excellent reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and high mechanical stability for intermittent operation and vibration stress.

Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and the squirrel-cage windings are fitted later either in die-cast aluminium or as copper rods, as shown in the following tables:

Line-Supply Operation

Size	Number of Poles					
	2	4	6	8	10	12
315	Al	Al	Al	-	-	-
355	Al	Al	Al	Al	-	-
400	Al	Al	Al	Al	-	-
450	Cu	Al	Al	Al	Al	Cu
500	Cu	Al	Cu	Cu	Cu	Cu
560	Cu	Cu	Cu	Cu	Cu	Cu
630	Cu	Cu	Cu	Cu	Cu	Cu

Converter-Fed Operation

High-Voltage Motor

Size	Number of Poles			
	2	4	6	8
450	Cu	Cu	Cu	Cu
500	-	Cu	Cu	Cu
560	-	Cu	Cu	Cu

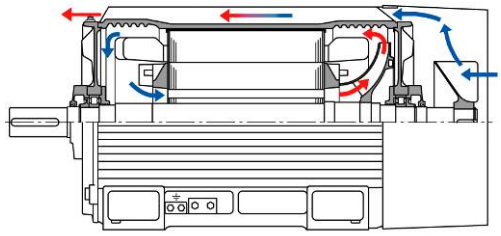
Low-Voltage Motor

Size	Number of Poles			
	2	4	6	8
450	Cu	Al	Al	Al
500	-	Cu	Cu	Cu
560	-	Cu	Cu	Cu

For coupling with the load machine, the shafts have a cylindrical shaft extension with a feather key on the drive end and are dynamically balanced with a half-key.

Cooling

1LA4 machines have a technically-sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, a fan is located on the non-drive end, which draws in air from outside and carries it axially over the external cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-section of a 1LA4 motor

The fan wheels for the internal and external cooling air flow are attached to the motor shaft and, thanks to their aerodynamically-optimised form, contribute to greatly-reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

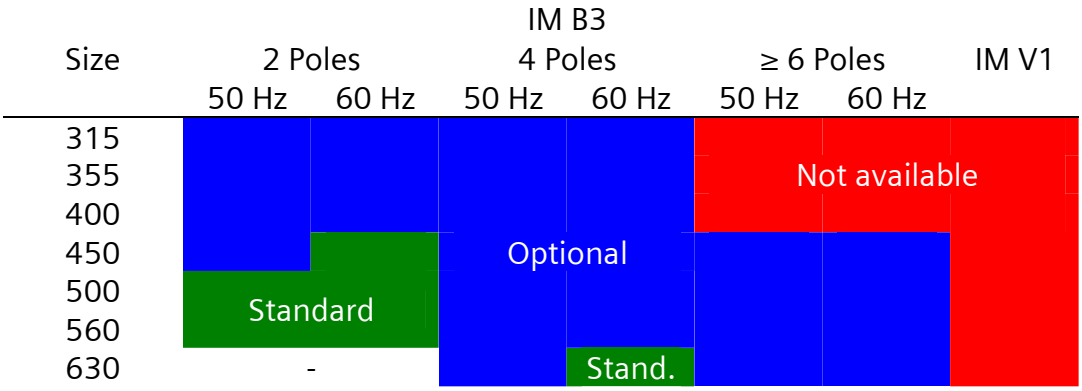
According to the connection, type, and in keeping with the operational conditions given in the order, the motors are equipped with different types of bearing:

Line-Supply Operation

Type	Drive End	Non-Drive End*
Horizontal with coupling output Shaft heights 315 to 450	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Horizontal with coupling output Shaft heights 500 to 630	Deep-groove ball bearing and cylindrical roller bearing as locating bearing	Cylindrical roller bearing as floating bearing
Horizontal with increased cantilever forces (e. g. belt output) Shaft heights 315 to 355	Cylindrical roller bearing as floating bearing	Deep-groove ball bearing as locating bearing
Vertical Shaft heights 315 to 560	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing
Vertical Shaft height 630	Deep-groove ball bearing as floating bearing	Paired angular-contact ball bearings as locating bearing

*) If shaft voltages that may lead to bearing currents are reached, an isolated bearing will be built onto the non-drive end.

2-pole, horizontal motors at 50 Hz with a shaft height of 500 and above, 2-pole motors at 60 Hz with a shaft height of 450 and above and 4-pole motors at 60 Hz with a shaft height of 630 are equipped with sleeve bearings only. The availability of sleeve bearings for all other motor types is shown in the table below.



Converter-Fed Operation

Type	Drive End	Non-Drive End*
Horizontal Shaft heights 315 to 560	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing

Horizontal Shaft height 630	Deep-groove ball bearing and cylindrical roller bearing as locating bearing	Cylindrical roller bearing as floating bearing
Vertical Shaft heights 315 to 560	Angular-contact ball bearing and deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Vertical Shaft height 630	Deep-groove ball bearing as locating bearing	Angular-contact ball bearing as floating bearing

*) For drive converter operation at a low-voltage level, an insulated bearing is used on the non-drive end; for drive converter operation at a medium-voltage level, insulated bearings are used on both ends and the shaft is grounded at the non-drive end.

2-pole, horizontal motors with a shaft height of 450 and a rated speed of over 3,000 rpm are equipped with sleeve bearings only. The availability of sleeve bearings for all other motor types is shown in the table below.

Size	IM B3		IM V1
	2 Poles	4 to 8 Poles	
450	Standard for $n > 3{,}000\ min^{-1}$, otherwise optional	Optional	Not available
500	Available on request		
560			
630	-		

In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. If technically possible, the sleeve bearings come with a natural cooling system, otherwise with forced oil cooling. For both bearing types, it is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

High-Voltage Motors

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals
1XB8 911	up to 11 kV	up to 315 A	3 main terminals
1XB9 513 (plug connection)	up to 11 kV	up to 360 A	3 main terminals

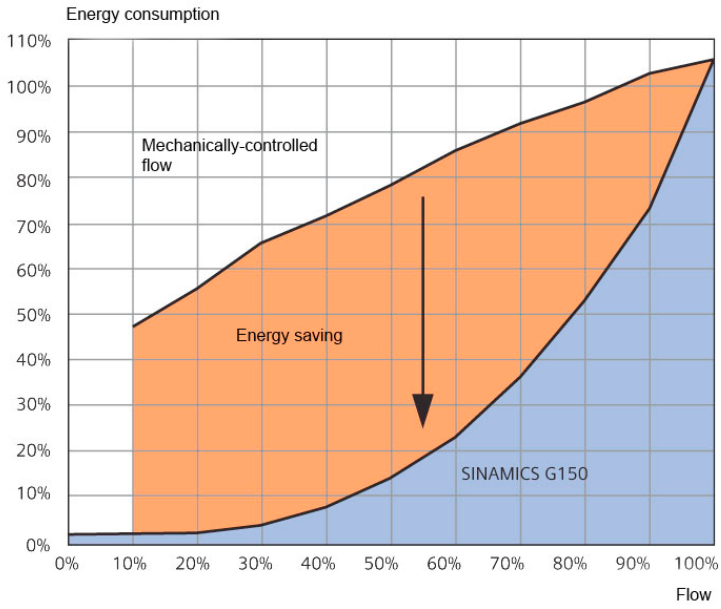
Low-Voltage Motors

Terminal	Rated Voltage	Rated Current	Connection
1XB1 631	690 V	up to 1,230 A	12 main terminals

The terminal boxes given in the tables above are perfectly suited to the corresponding motors and offer a lot of flexibility because they can be mounted on both sides of the machine and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. With models 1XB8 751 and 1XB1 631, the latter is due to the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

Converter-Fed Operation

In combination with either the frequency converters in the SINAMICS product range or a Perfect Harmony converter, system solutions, adaptable to a variety of requirements, can be realised. As the graph on the right shows, the flexible adaptation of the drive power to the system requirements allows energy savings of up to 60% when using fluid flow engines, for example. This results from the fact that pumps and fans especially often function in partial-load operation which, in drives with a fixed rotational speed, can only be achieved using a throttle valve or other similar device. Consequently, a large part of the drive power remains unused.



Comparison of energy consumption with mechanically-controlled and converter-controlled flow

In many cases, the use of frequency converters also allows processes to be realised more accurately. For example, smooth starting and stopping preserves the mechanics of the system and is very easily achievable with the implementation of continuous speed control. This accurate control reduces operational costs and contributes to a shorter amortisation period.

◊ Further Information

Further information can be obtained from the following sources:

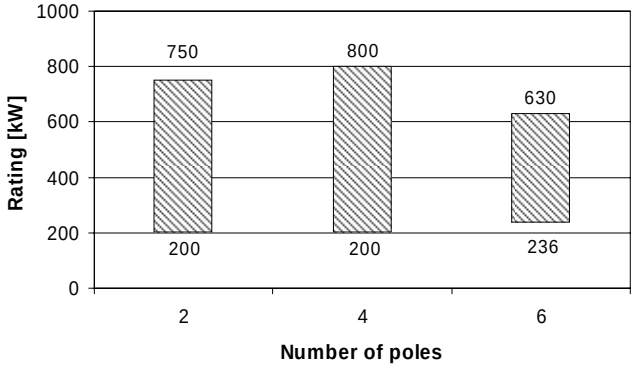
- Our webpage at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1LA4 Standardline Asynchronous Motor

◊ Power Range of the Standard Designs

Type 1LA4 Standardline motors are the self-ventilated, totally enclosed, fin-cooled machines with a selected option range, which form part of the H-compact range. Thanks to this selected option range, these motors offer considerably shorter delivery times, resulting from the optimisation of the simplified ordering procedure and the standardisation of the production process. An outstanding level of efficiency and a compact and robust design guarantee high reliability and availability despite small dimensions. The available power ratings are given in the graph below.

Power range of the 1LA4 Standardline (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 400
- 2.0 kV to 6.6 kV



H-compact Three-Phase 1LA4 Standardline Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
The only available construction type is IM B3 in accordance with IEC / EN 60034-7.

Cast-Iron Casings
Machines of type 1LA4 Standardline have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

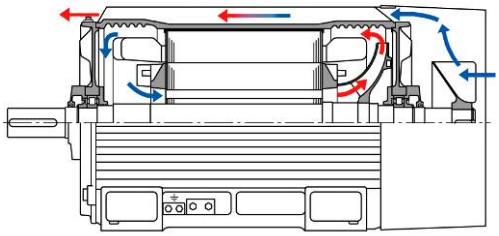
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55.

Isolation System
The MICALASTIC system with impregnation according to the VPI (Vacuum Pressure Impregnation) is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and high mechanical stability for intermittent operation and vibration stress.

Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. The core assembly is fitted directly onto the shafts and the squirrel-cage windings are fitted later in die-cast aluminium. For coupling with the production machine, the shafts have a cylindrical shaft extension on the drive end and are dynamically balanced with a half-key.

Cooling

1LA4 Standardline machines have a technically sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, an external fan is located on the non-drive end, which draws in air from outside and carries it axially over the outer cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-section of a 1LA4 Standardline motor

The fan wheels for the internal and external cooling are flow are attached to the motor shaft and, thanks to their optimised and aerodynamic form, contribute to greatly reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

These motors are equipped with the following type of rolling-contact bearing:

Type	Drive End	Non-Drive End*
Horizontal	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing

*) If shaft voltages that may lead to bearing currents are reached, an isolated bearing will be built onto the non-drive end.

In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. It is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

For connection to the three-phase supply system, only the following terminal box is used:

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals

The terminal box given in the table above is perfectly suited to the corresponding motors and offers a lot of flexibility because it can be mounted on both sides of the machine and rotated through 4 x 90°. It is also generously dimensioned to allow easy and safe connection to the line terminals. Furthermore, an auxiliary terminal box is available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

◊ Further Information

Further information can be obtained from the following sources:

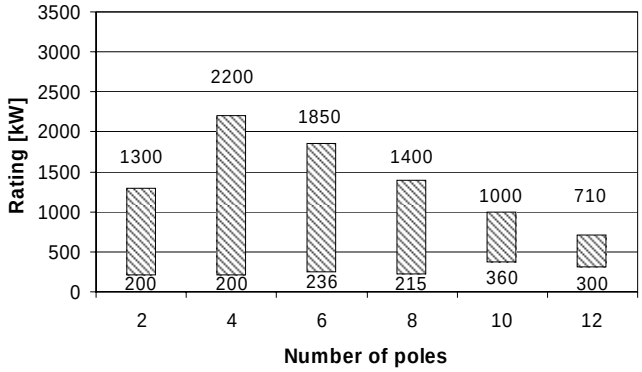
- Our webpage at http://www.automation.siemens.com/ld/ac-motor-high/html_00/asyn-kaefig/h-compact/h-compact-standard-1.html
- Our catalogue D86.1, particularly pages 4/1 to 4/10
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1MS4 Asynchronous Motor

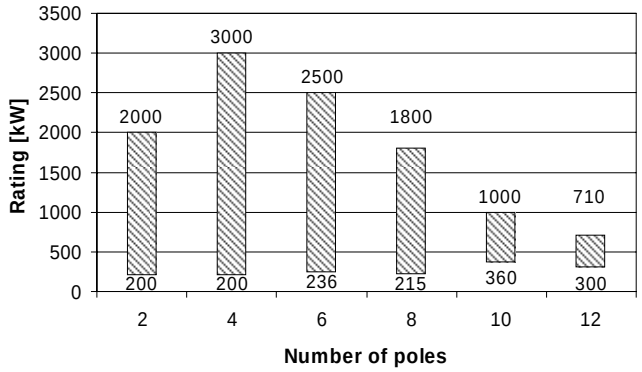
◊ Power Range of the Standard Designs

Type 1MS4 motors are the self-ventilated, totally enclosed, fin-cooled machines in the H-compact range, which are equipped with type of protection "Ex nA". They are characterised by their compact and robust design, which guarantees high reliability and availability despite small dimensions. Their outstanding level of efficiency and wide range of accessories allow these motors to be adapted for use with a variety of different applications across all industrial sectors. The available power ranges are shown in the graphs below.

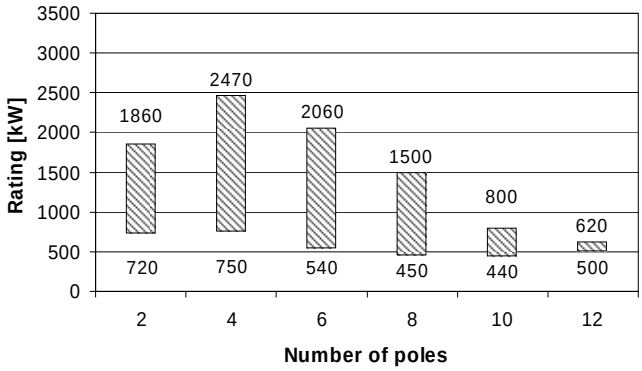
Power range of the 1MS4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 560
- 2.0 kV to 3.3 kV



Power range of the 1MS4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 630
- 3.3 kV to 6.6 kV



Power range of the 1MS4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 450 to 630
- 9 kV to 11 kV



H-compact Three-Phase 1MS4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7

Cast-Iron Casings
Machines of type 1MS4 have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

Degree of Protection / Type of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 and according to IEC / EN 60079-15 with type of protection „Ex nA". The latter allows them to be used in zone 2 hazardous areas.

Isolation System
The MICALASTIC system with impregnation according to the VPI (Vacuum Pressure Impregnation) is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and strong mechanical stability for intermittent operation and vibration stress.

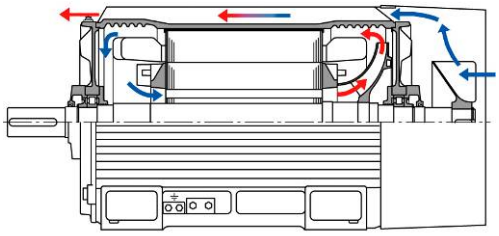
Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and the squirrel-cage windings are fitted later either in die-cast aluminium or as copper rods, as shown in the following table:

Size	Number of Poles					
	2	4	6	8	10	12
315	Al	Al	Al	-	-	-
355	Al	Al	Al	Al	-	-
400	Al	Al	Al	Al	-	-
450	Cu	Al	Al	Al	Al	Cu
500	Cu	Al	Cu	Cu	Cu	Cu
560	Cu	Cu	Cu	Cu	Cu	Cu
630	Cu	Cu	Cu	Cu	Cu	Cu

For coupling with the load machine, the shafts have a cylindrical shaft extension with a feather key on the drive end and are dynamically balanced with a half-key.

Cooling

1MS4 machines have a technically-sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, a fan is located on the non-drive end, which draws in air from outside and carries it axially over the external cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-section of a 1MS4 motor

The fan wheels for the internal and external cooling air flow are attached to the motor shaft and, thanks to their aerodynamically-optimised form, contribute to greatly-reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

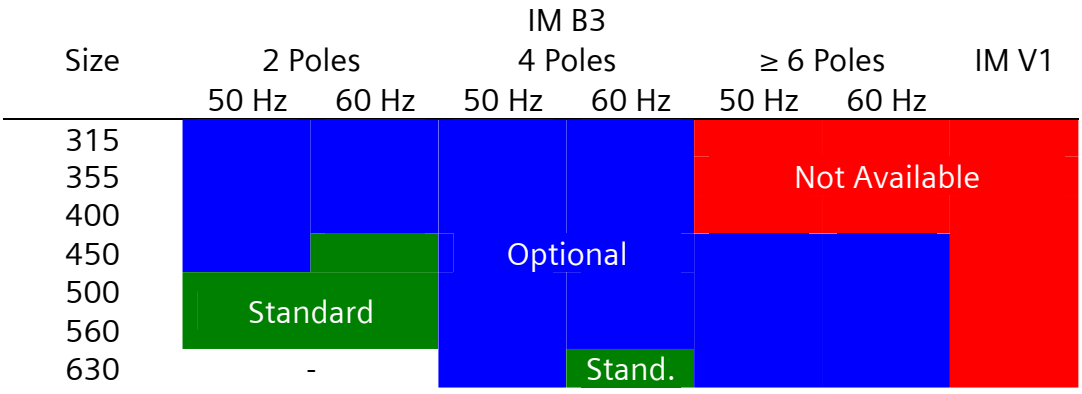
According to type and in keeping with the operational conditions given in the order, the motors are equipped with different types of bearing:

Type	Drive End	Non-Drive End*
Horizontal with coupling output Shaft heights 315 to 450	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Horizontal with coupling output Shaft heights 500 to 630	Deep-groove ball bearing and cylindrical roller bearing as locating bearing	Cylindrical roller bearing as floating bearing
Horizontal with increased cantilever forces (e. g. belt output) Shaft heights 315 to 355	Cylindrical roller bearing as floating bearing	Deep-groove ball bearing as locating bearing
Vertical Shaft heights 315 to 560	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing

Vertical Shaft height 630	Deep-groove ball bearing as floating bearing	Paired angular-contact ball bearings as locating bearing

*) If shaft voltages that may lead to bearing currents are reached, an isolated bearing will be built onto the non-drive end.

2-pole horizontal motors at 50 Hz with a shaft height of 500 and above, 2-pole motors at 60 Hz with a shaft height of 450 and above and 4-pole motors at 60 Hz with a shaft height of 630 are equipped with sleeve bearings only. The availability of sleeve bearings for all other motor types is shown in the table below.



In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. If technically possible, the sleeve bearings come with a natural cooling system, otherwise with forced oil cooling. For both bearing types, it is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals
1XB8 911	up to 11 kV	up to 315 A	3 main terminals
1XB9 513 (plug connection)	up to 11 kV	up to 360 A	3 main terminals

The terminal boxes given in the table above are perfectly suited to the corresponding motors and offer a lot of flexibility because they can be mounted on both sides of the machine and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. With model 1XB8 751, the latter is due to the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral

point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

◊ Further Information

Further information can be obtained from the following sources:

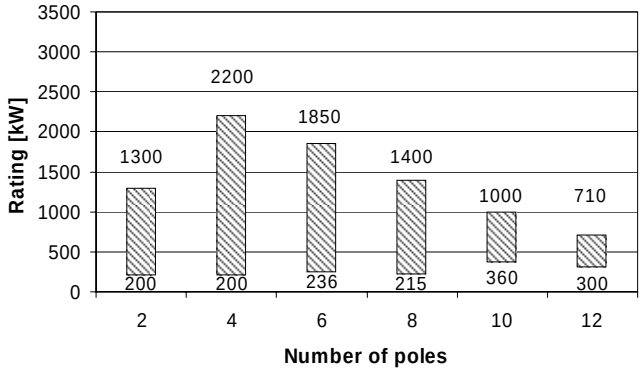
- Our webpage at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1MG4 Asynchronous Motor

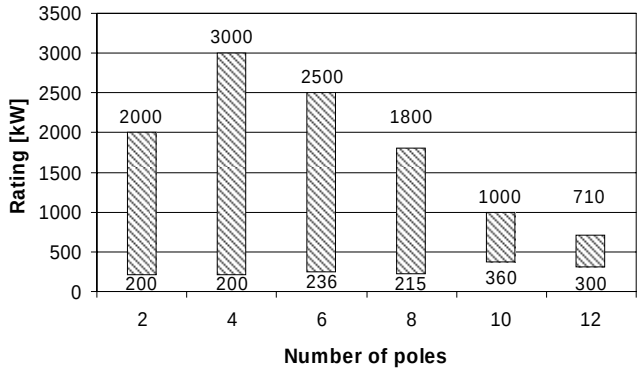
◊ Power Range of the Standard Designs

Type 1MG4 motors are the self-ventilated, totally enclosed, fin-cooled machines in the H-compact range, which are equipped with type of protection "Ex pe". They are characterised by their compact and robust design, which guarantees high reliability and availability despite small dimensions. Their outstanding level of efficiency and wide range of accessories allow these motors to be adapted for use with a variety of different applications across all industrial sectors. The available power ranges are shown in the graphs below.

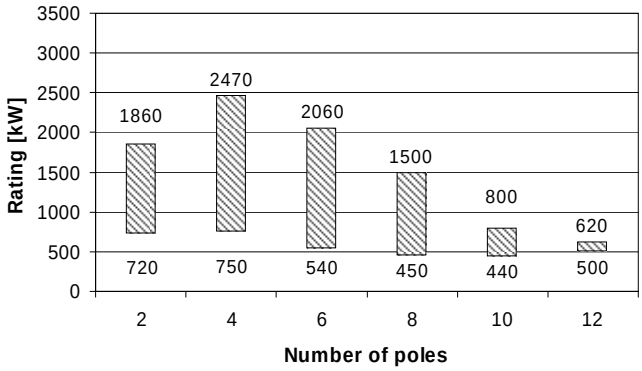
Power range of the 1MG4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 560
- 2.0 kV to 3.3 kV



Power range of the 1MG4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 630
- 3.3 kV to 6.6 kV



Power range of the 1MG4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 450 to 630
- 9 kV to 11 kV



H-compact Three-Phase 1MG4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7

Cast-Iron Casings
Machines of type 1MG4 have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

Degree of Protection / Type of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 and according to IEC / EN 60079-15 with type of protection „Ex pe". The latter allows them to be used in zone 1 hazardous areas.

Isolation System
The MICALASTIC system with impregnation according to the VPI (Vacuum Pressure Impregnation) is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and strong mechanical stability for intermittent operation and vibration stress.

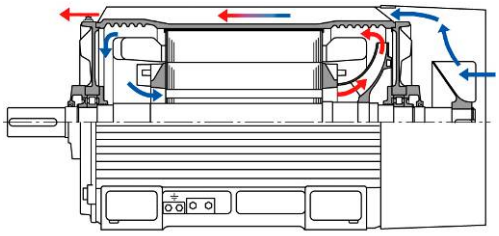
Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and the squirrel-cage windings are fitted later either in die-cast aluminium or as copper rods, as shown in the following table:

Size	Number of Poles					
	2	4	6	8	10	12
315	Al	Al	Al	-	-	-
355	Al	Al	Al	Al	-	-
400	Al	Al	Al	Al	-	-
450	Cu	Al	Al	Al	Al	Cu
500	Cu	Al	Cu	Cu	Cu	Cu
560	Cu	Cu	Cu	Cu	Cu	Cu
630	Cu	Cu	Cu	Cu	Cu	Cu

For coupling with the load machine, the shafts have a cylindrical shaft extension with a feather key on the drive end and are dynamically balanced with a half-key.

Cooling

1MG4 machines have a technically-sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, a fan is located on the non-drive end, which draws in air from outside and carries it axially over the external cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-section of a 1MG4 motor

The fan wheels for the internal and external cooling air flow are attached to the motor shaft and, thanks to their aerodynamically-optimised form, contribute to greatly-reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

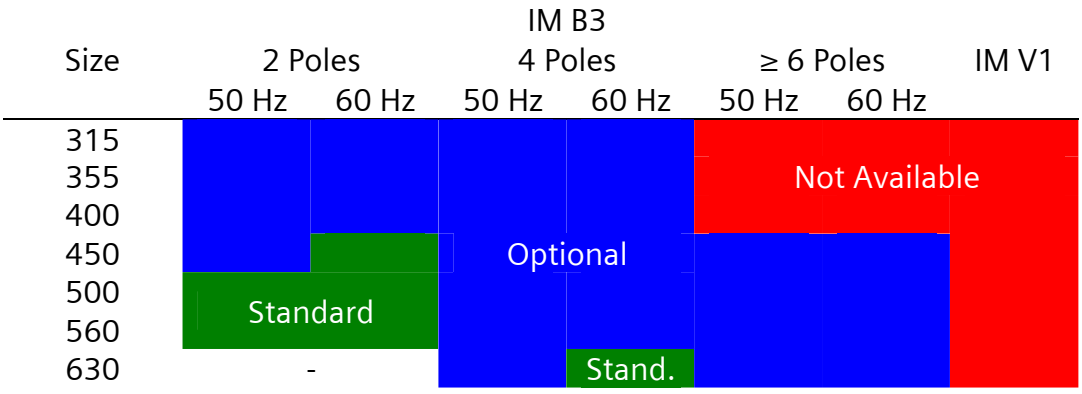
According to type and in keeping with the operational conditions given in the order, the motors are equipped with different types of bearing:

Type	Drive End	Non-Drive End*
Horizontal with coupling output Shaft heights 315 to 450	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Horizontal with coupling output Shaft heights 500 to 630	Deep-groove ball bearing and cylindrical roller bearing as locating bearing	Cylindrical roller bearing as floating bearing
Horizontal with increased cantilever forces (e. g. belt output) Shaft heights 315 to 355	Cylindrical roller bearing as floating bearing	Deep-groove ball bearing as locating bearing
Vertical Shaft heights 315 to 560	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing

Vertical Shaft height 630	Deep-groove ball bearing as floating bearing	Paired angular-contact ball bearings as locating bearing

*) If shaft voltages that may lead to bearing currents are reached, an isolated bearing will be built onto the non-drive end.

2-pole horizontal motors at 50 Hz with a shaft height of 500 and above, 2-pole motors at 60 Hz with a shaft height of 450 and above and 4-pole motors at 60 Hz with a shaft height of 630 are equipped with sleeve bearings only. The availability of sleeve bearings for all other motor types is shown in the table below.



In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. If technically possible, the sleeve bearings come with a natural cooling system, otherwise with forced oil cooling. For both bearing types, it is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals
1XB8 911	up to 11 kV	up to 315 A	3 main terminals
1XB9 513 (plug connection)	up to 11 kV	up to 360 A	3 main terminals

The terminal boxes given in the table above are perfectly suited to the corresponding motors and offer a lot of flexibility because they can be mounted on both sides of the machine and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. With model 1XB8 751, the latter is due to the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral

point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

◊ Further Information

Further information can be obtained from the following sources:

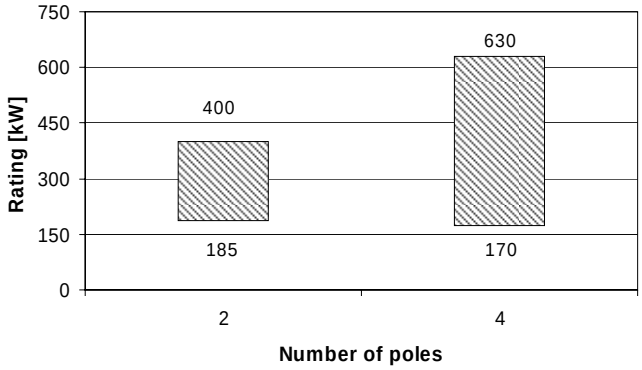
- Our webpage at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1MA4 Asynchronous Motor

◊ Power Range of the Standard Designs

Type 1MA4 motors are the self-ventilated, totally enclosed, fin-cooled machines in the H-compact range, which are equipped with type of protection "Ex e". They are characterised by their compact and robust design, which guarantees high reliability and availability despite small dimensions. Their outstanding level of efficiency and wide range of accessories allow these motors to be adapted for use with a variety of different applications across all industrial sectors. The available power ranges are given in the graph below.

Power range of the 1MA4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft heights 315 to 400
- 3.0 kV to 6.6 kV



H-compact Three-Phase 1MA4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7.

Cast-Iron Casings
Machines of type 1MA4 have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

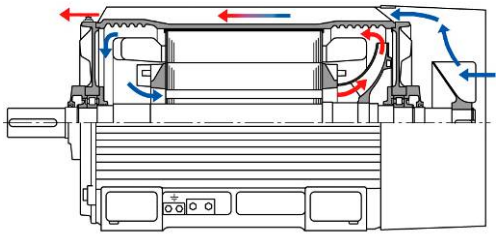
Degree of Protection / Type of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 and according to IEC / EN 60079-15 with type of protection „Ex e". The latter allows them to be used in zone 1 hazardous areas.

Isolation System
The MICALASTIC system with impregnation according to the VPI (Vacuum Pressure Impregnation) is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and strong mechanical stability for intermittent operation and vibration stress.

Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and the squirrel-cage windings are fitted later in die-cast aluminium. For coupling with the load machine, the shafts have a cylindrical shaft extension on the drive end and are dynamically balanced with a half-key.

Cooling

1MA4 machines have a technically-sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, a fan is located on the non-drive end, which draws in air from outside and carries it axially over the external cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-Section of a 1MA4 motor

The fan wheels for the internal and external cooling air flow are attached to the motor shaft and, thanks to their aerodynamically-optimised form, contribute to greatly-reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

According to type and in keeping with the operational conditions given in the order, the motors are equipped with different types of bearing:

Type	Drive End	Non-Drive End*
Horizontal with coupling output	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Horizontal with increased cantilever forces (e.g. belt output)	Cylindrical roller bearing as floating bearing	Deep-groove ball bearing as locating bearing
Vertical	Angular-contact ball bearing and deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing

*) If shaft voltages that may lead to bearing currents are reached, an isolated bearing will be built onto the non-drive end.

Sleeve bearings are optional and available as follows:

Size	IM B3 2 Poles 50 Hz	IM B3 2 Poles 60 Hz	IM B3 4 Poles 50 Hz	IM B3 4 Poles 60 Hz	IM B3 ≥ 6 Poles 50 Hz	IM B3 ≥ 6 Poles 60 Hz	IM V1
315 355 400	Optional				Not Available		

In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected

relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. The sleeve bearings always come with a natural cooling system. For both bearing types, it is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals

The terminal boxes given in the table above are perfectly suited to the corresponding motors and offer a lot of flexibility because they can be mounted on both sides of the machine and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. With model 1XB8 751, the latter is due to the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

◊ Further Information

Further information can be obtained from the following sources:

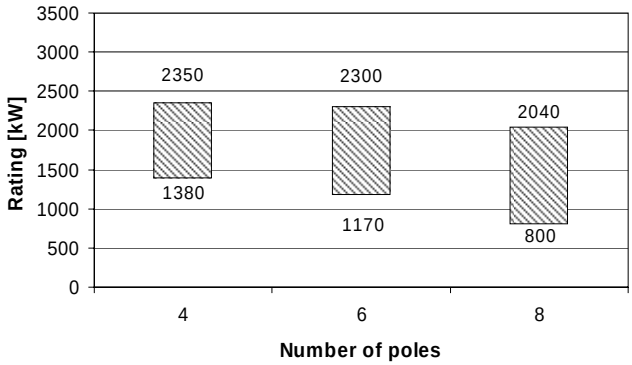
- Our website at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1PQ4 Asynchronous Motor

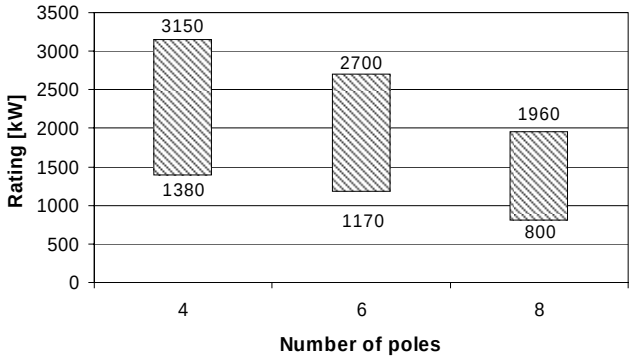
◊ Power Range of the Standard Designs

Type 1PQ4 motors are the separately-ventilated, totally enclosed, fin-cooled machines in the H-compact product range. They are characterised by their compact and robust design, which guarantees high reliability and availability despite small dimensions. Their outstanding level of efficiency and wide range of accessories allow these motors to be adapted for use with a variety of different applications. The available power ranges are shown in the graphs below.

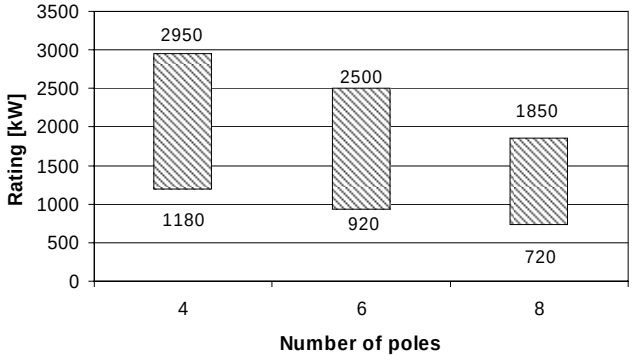
Power range of the 1PQ4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 2.3 kV



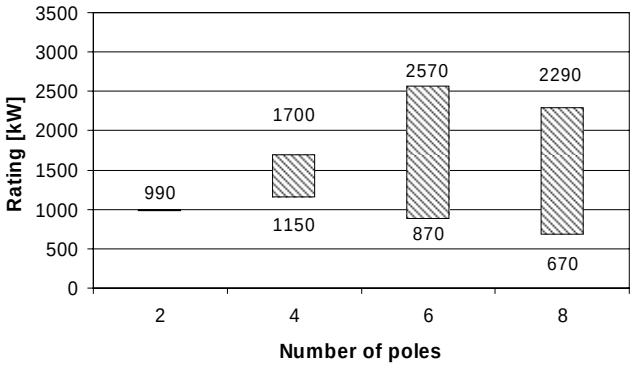
Power range of the 1PQ4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 3.3 kV; 4.16 kV



Power range of the 1PQ4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 500 to 630
- 6 kV; 6.6 kV



Power range of the 1PQ4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 450 to 630
- 690 V



H-compact Three-Phase 1PQ4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Type of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7.

Cast-Iron Casings
Machines of type 1PQ4 have cast-iron casings, which are characterised by several different features. Designed for use in the most difficult conditions, this type of casing makes these motors particularly resistant to shocks and vibrations; internal fins support heat removal and give a very high level of vibro-rigidity and external fins provide a large surface area for cooling. Furthermore, a stable base is provided by integrally-cast, box-shaped feet with wide bases.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearings and closing the casings, the cast-iron bearing brackets are also a continuation of the internal and external fins, thus ensuring very good stability and optimal heat dissipation in the bearing area.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions, such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55.

Isolation System
The MICALASTIC or, for low-voltage, 4-, 6- and 8-pole motors with a shaft height of 450, the DURIGNIT system according to the VPI (Vacuum Pressure Impregnation) process are used for isolation purposes. Both systems correspond to thermal class 155 (F) and ensure a long motor lifetime as well as excellent reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and high mechanical stability for intermittent operation and vibration stress.

Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and the squirrel-cage windings are fitted later either in die-cast aluminium or as copper rods, as shown in the following tables:

High-Voltage Motors

Size	Number of Poles			
	2	4	6	8
450	Cu	Cu	Cu	Cu
500	-	Cu	Cu	Cu
560	-	Cu	Cu	Cu
630	-	-	Cu	Cu

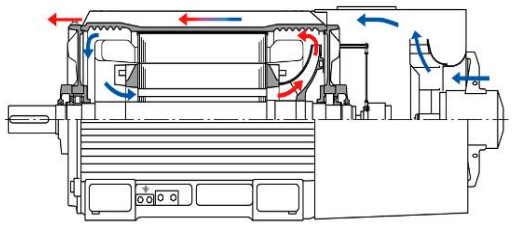
Low-Voltage Motors

Size	Number of Poles			
	2	4	6	8
450	Cu	Al	Al	Al
500	-	Cu	Cu	Cu
560	-	Cu	Cu	Cu
630	-	-	Cu	Cu

For coupling with the load machine, the shafts usually have a cylindrical shaft extension with a feather key on the drive end and are dynamically balanced with a half-key.

Cooling

1PQ4 machines have a technically-sophisticated cooling concept of type IC411 according to IEC / EN 60034-6 with an additional, internal cooling circuit. As the diagram on the right shows, an external fan is located on the non-drive end, which draws in air from outside and carries it axially over the external cooling fins of the casing. A thermal exchange with the internal cooling circuit then occurs, which ensures an even temperature distribution in the motor and bearing areas.



Cross-Section of a 1PQ4 motor

The fan wheel for the internal cooling circuit is attached to the motor shaft and generally functions independently of the direction of rotation. As the external cooling air flow is produced by a separately-driven fan, which ensures a constant cooling capacity in all operating conditions, the machine can always be used at any setting within the speed control range and in both rotational directions. Thanks to their aerodynamically-optimised form, both fan wheels contribute to greatly reduced noise emissions. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

According to type and in keeping with the operational conditions given in the order, the motors are equipped with different types of bearing:

Type	Antriebsseite	Nicht-Antriebsseite*
Horizontal Shaft heights 315 to 560	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Horizontal Shaft height 630	Deep-groove ball bearing and cylindrical roller bearing as locating bearing	Cylindrical roller bearing as floating bearing
Vertical Shaft heights 315 to 560	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing

Vertical Shaft height 630	Deep-groove ball bearing as floating bearing	Angular-contact ball bearing as locating bearing

*) For drive converter operation at a low-voltage level, an insulated bearing is used on the non-drive end; for drive converter operation at a medium-voltage level, insulated bearings are used on both ends and the shaft is grounded at the non-drive end.

2-pole, horizontal motors with a shaft height of 450 and a rated speed of over 3,000 rpm are equipped with sleeve bearings only. The availability of sleeve bearings for all other motor types is shown in the table below.

Size	IM B3 2 Poles	IM B3 4 to 8 Poles	IM V1
450	Standard for $n > 3{,}000\ min^{-1}$, otherwise optional	Optional	Not available
500	Available on request		
560	Available on request		
630	-		

In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearings are protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage, and guarantees a very good level of durability. If technically possible, the sleeve bearings come with a natural cooling system, otherwise with forced oil cooling. For both bearing types, it is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

High-Voltage Motors

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals

Low-Voltage Motors

Terminal	Rated Voltage	Rated Current	Connection
1XB1 631	690 V	up to 1,230 A	12 main terminals

The terminal boxes given in the tables above are perfectly suited to the corresponding motors and offer a lot of flexibility because they can be mounted on both sides of the machine and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe

the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

Converter-Fed Operation
1PQ4 motors are designed for converter-fed operation whereby, especially in combination with the frequency converters in the SINAMICS product range or a Perfect Harmony converter, system solutions adaptable to a variety of requirements can be realised.

◊ Further Information

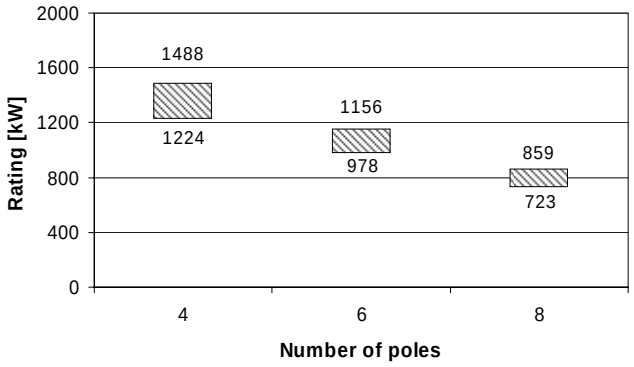
Further information can be obtained from the following sources:
- Our webpage at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

H-compact Three-Phase 1LH4 Asynchronous Motor

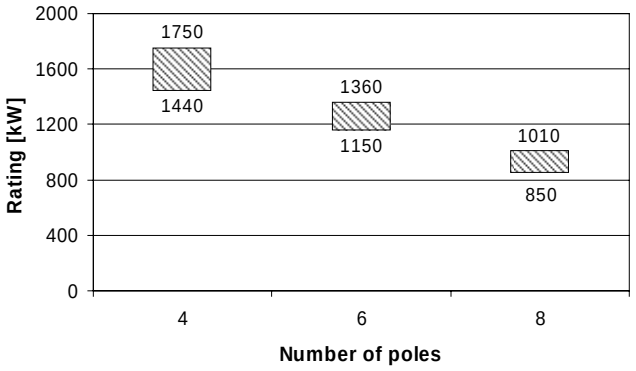
◊ Power Range of the Standard Designs

Type 1LH4 motors are the water-cooled machines in the H-compact range. Thanks to their water cooling system, they can be operated in rugged environments with an ambient temperature of up to 55°C and a water inlet temperature of 38°C without a power derating. Outstanding efficiency and a compact and robust design guarantee high reliability and availability despite small dimensions. The available power ranges are given in the graphs below.

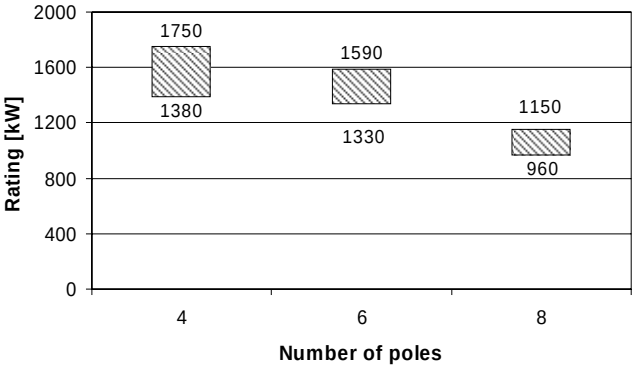
Power range of the 1LH4 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft height of 500
- 2.0 kV to 6.6kV



Power range of the 1LH4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height of 500
- 2.3 kV; 3,3 kV; 4.16 kV



Power range of the 1LH4 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height of 500
- 690V



H-compact Three-Phase 1LH4 Asynchronous Motor

◊ Technical Details of the Standard Designs

Types of Construction
Types of construction IM B3, IM B35 and IM V1 are available in accordance with IEC / EN 60034-7.

Steel Casings
The casings of type 1LH4 machines are made from steel as its rigidity and its suitability for welding make it the best choice of material for creating this sophisticated casing form, which includes a cooling spiral for the water cooling and numerous attachments. Designed for use in the most difficult conditions, this casing type also makes these motors particularly resistant to shocks and vibrations and the base attachment is made especially stable by welded, box-shaped feet with wide bases.

Steel Bearing Brackets
The casings are finished with steel bearing brackets which have both internal and external fins to ensure optimal heat dissipation and to maintain the stability of the whole motor.

Coating / Corrosion Protection
The entire machine is provided with a coating, which makes it resistant to aggressive ambient conditions such as high humidity, high temperatures or atmospheres containing dust or salt. A multi-layered special coating is also available.

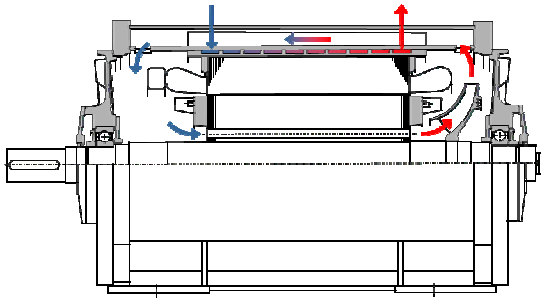
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55.

Isolation System
The MICALASTIC system with impregnation according to the VPI (Vacuum Pressure Impregnation) is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This is, however, mainly achieved by a high dielectrical strength for both line-supply and converter-fed operation and high mechanical stability for intermittent operation and vibration stress.

Rotor
The rotors of the machines consist of a shaft, a core assembly and a squirrel-cage winding. Core assemblies are fitted directly onto the shafts and squirrel-cage windings are fitted later as copper rods. For coupling with the load machine, the shafts have a cylindrical shaft extension on the drive end and are dynamically balanced with a half-key.

Cooling

1LH4 machines have a technically-sophisticated cooling concept of type IC71W according to IEC / EN 60034-6 with an additional, internal cooling circuit. This cooling concept allows motors to be operated in ambient temperatures of up to 55°C and with a water inlet temperature of 38°C without a power derating. As the diagram on the right shows, the cool water enters the cooling spiral on the drive end and is discharged on the non-drive end. Using this spiral, an intense thermal exchange with the internal cooling circuit occurs, which ensures an even temperature distribution in the motor and bearing areas and also permits high utilisation and power density.



Cross-Section of a 1LH4 motor

The fan wheel for the internal cooling air flow is attached to the motor shaft and, thanks to its aerodynamically-optimised form and in the absence of an external fan, it contributes to greatly reduced noise emissions. Furthermore, as a result of their water cooling systems, these machines can also be used in rugged environments and, due to the several ship certifications on offer, are especially suitable for use on ships. Temperature sensors are built into the stator winding so that windings may be monitored.

Bearing System

According to type, the motors are equipped with different types of rolling-contact bearings:

Type	Drive End	Non-Drive End*
Horizontal	Deep-groove ball bearing as floating bearing	Paired angular-contact ball bearings as locating bearing
Vertical	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing

*) For drive converter operation at a low-voltage level, an insulated bearing is used on the non-drive end; for drive converter operation at a medium-voltage level, insulated bearings are used on both ends and the shaft is grounded at the non-drive end.

In order to guarantee a secure bearing system, a relubricating device with grease slinger and relubrication nipple as well as a mechanism for shock pulse measurements for the monitoring of bearing functionality are installed on both motor sides. The bearing itself is protected against dirt contamination by a V-ring or a labyrinth seal. This bearing concept boasts long relubrication intervals, which consequently reduces grease usage and guarantees a very good level of durability. It is also possible to install various auxiliary devices, such as temperature sensors for the monitoring of bearings.

Wiring Method

With terminal boxes, various models and modifications can be selected. If no particular terminal box is specified, the terminal boxes listed below will be used depending on the type and the rated data of the motor.

High-Voltage Motors

Terminal Box	Rated Voltage	Rated Current	Connection
1XA8 711	up to 6.6 kV	up to 315 A	3 main terminals
1XB8 751	up to 6.6 kV	up to 630 A	6 main terminals

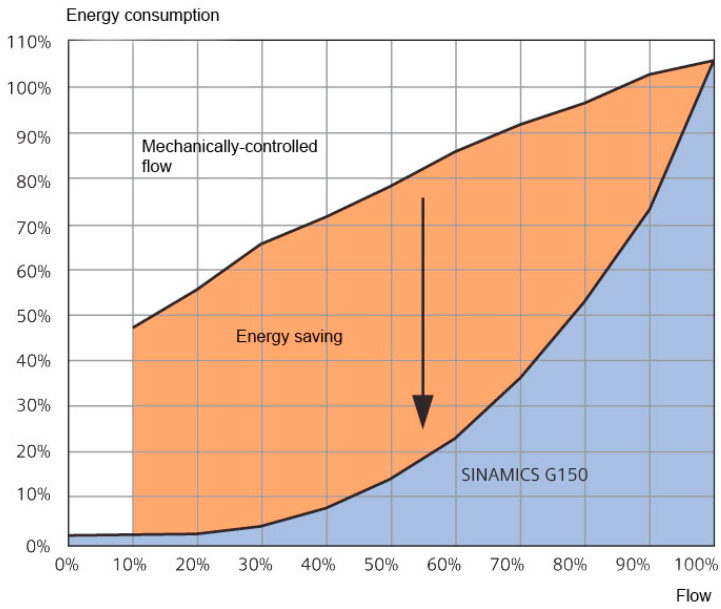
Low-Voltage Motors

Terminal	Rated Voltage	Rated Current	Connection
1XB1 631	690 V	up to 1,230 A	12 main terminals

The terminal boxes given in the tables above are perfectly suited to the corresponding motors and can, when only one terminal is mounted per drive side, be rotated in the direction of the non-drive end. They are also generously dimensioned to allow easy and safe connection to the line terminals. With models 1XB8 751 and 1XB1 631, the latter is due to the increased number of terminals supported by a staggered arrangement of the main terminals in the terminal box. Furthermore, the high-voltage terminal boxes can be used for the creation of a neutral point with accessible cable ends and a variety of auxiliary terminal boxes are available for additional purposes such as the connection of monitoring devices, anti-condensation heaters or the installation of transmitters.

Converter-Fed Operation

In combination with either the frequency converters in the SINAMICS product range or a Perfect Harmony converter, system solutions, adaptable to a variety of requirements, can be realised. As the graph on the right shows, the flexible adaptation of the drive power to the system requirements allows energy savings of up to 60% when using fluid flow engines, for example. This results from the fact that pumps and fans especially often function in partial-load operation which, in drives with a fixed rotational speed, can only be achieved using a throttle valve or other similar device. Consequently, a large part of the drive power remains unused.



Comparison of energy consumption with mechanically-controlled and converter-controlled flow

In many cases, the use of frequency converters also allows processes to be realised more accurately. For example, smooth starting and stopping preserves the mechanics of the system and is very easily achievable with the implementation of continuous speed control. This accurate control reduces operational costs and contributes to a shorter amortisation period.

◊ Further Information

Further information can be obtained from the following sources:

- Our webpage at http://www.siemens.com/h-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

