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N-compact Three-Phase Asynchronous Motors

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N-compact Three-Phase Asynchronous Motors

◊ Overview

N-compact Range	Cooling Method	Degree of Protection	Power Range 50 Hz	Power Range 60 Hz	Type of Construction	Operation
1LA8	IC411	IP55	250 - 1,000 kW	288 - 1,150 kW	IM B3, IM B35, IM V1	Line-supply and converter-fed
1LA8 Standardline	IC411	IP55	250 - 500 kW	-	IM B3	Line-supply and converter-fed
1PQ8	IC416	IP55	250 - 1,000 kW	288 - 1,150 kW	IM B3, IM B35, IM V1	Converter-fed
1PQ8 High-Speed	IC416	IP55	200 - 1,050 kW*		IM B3	Converter-fed
1LL8	IC01	IP23	315 - 1,250 kW	360 - 1,430 kW	IM B3, IM B35, IM V1	Line-supply and converter-fed
1LH8	IC71W	IP55	800 - 1,150 kW	-	IM B3, IM V1	Line-supply and converter-fed

*) for rotational speeds of up to 5,000 rpm

1LA8, 1LA8 Standardline

1PQ8

1PQ8 High-Speed

1LL8

1LH8

Cooling Method

IC411: Enclosed, air-cooled, self-ventilated
IC416: Enclosed, air-cooled, separately-ventilated
IC01: Open, air-cooled, self-ventilated
IC71W: Enclosed, water-cooled

Degree of Protection

IP55: Protection against dust and water jets
IP23: Protection against infiltration of solid, foreign matter with a diameter of more than 12.5 mm and spraying water with a gradient of up to 60° from vertical

Type of Construction

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

N-compact Three-Phase Asynchronous Motors

◊ Short Description

The low-voltage motors in the N-compact range are fin- or water-cooled, non-standard, asynchronous motors with squirrel cage rotors.

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 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.

N-compact 1LA8

Their technically-sophisticated cooling system, which features an additional inner cooling circuit, allows the motors in the N-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 N-compact range are designed for both line-supply and frequency converter-fed operation. When combined with frequency converters in the SINAMICS product range, 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:

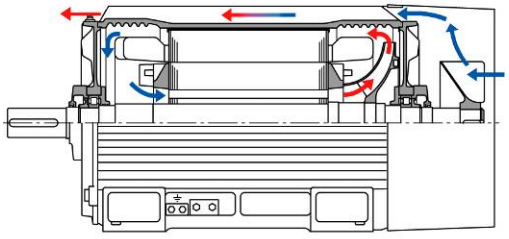
- Our web page at http://www.siemens.com/n-compact
- Our catalogues D81.1 (1LA8, 1PQ8 and 1LL8) and D86.1 (1LA8 Standardline)
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase Asynchronous Motors

◊ Product Ranges

N-compact Range 1LA8

Type 1LA8 motors are totally enclosed, self-ventilated, fin-cooled machines (cooling method IC411) with degree of protection IP55 as standard. They cover the power range from 250 kW to 1,000 kW (at 50 Hz) and are designed for both line-supply and converter-fed operation. The available types of construction are IM B3, IM B35 and IM V1.



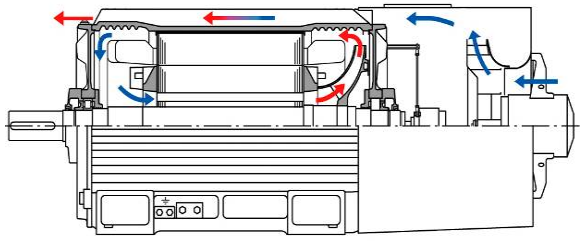
Cross-section of a 1LA8 motor

N-compact Range 1LA8 Standardline

4-pole motors of type 1LA8 (cooling method IC411, degree of protection IP55) in the power range from 250 kW to 500 kW (at 50 Hz) can also be obtained as Standardline models. The option spectrum associated with this motor range has been limited to allow the optimisation of order handling and the production process so that delivery times may be significantly reduced. These motors are designed for both line-supply and converter-fed operation. The only available type of construction is IM B3.

N-compact Range 1PQ8

Type 1PQ8 motors are totally enclosed, separately-ventilated, fin-cooled (cooling method IC416) machines with degree of protection IP55 as standard. They cover the power range from 250 kW to 1,000 kW (at 50 Hz) and are specifically 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.



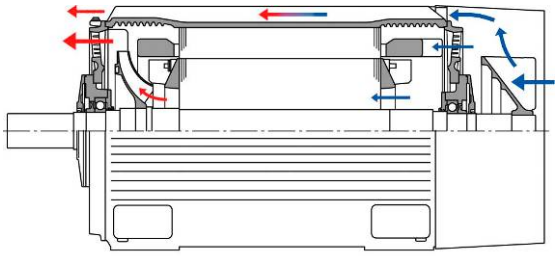
Cross-section of a 1PQ8 motor

N-compact Range 1PQ8 High-Speed

2-pole, variable-speed 1PQ8 motors (cooling method IC416, degree of protection IP55) in the power range from 300 kW to 1,050 kW can also be obtained as High-Speed models with rotational speeds of up to 5,000 rpm. In this context, the entire speed range can be exploited as no critical speed range exists due to sub-critical operation. In order to take advantage of the high rotational speeds, the machines must be used with a frequency converter for which purpose the SINAMICS low-voltage converters are highly suitable. The only available type of construction is IM B3.

N-compact Range 1LL8

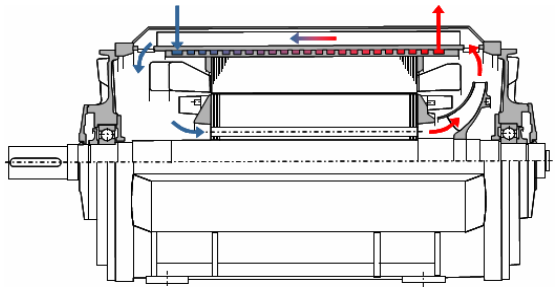
Type 1LL8 motors are open, self-ventilated, fin-cooled machines (cooling method IC01) with degree of protection IP23 as standard. By opening the inner cooling circuit, the active motor area is provided with an external supply of cool air. This affords an additional increase in power density by comparison with the totally enclosed motors. Correspondingly, it is possible to cover a power range of 315 kW to 1,250 kW (at 50 Hz). These machines are, however, only intended to be installed indoors. They are designed for both line-supply and converter-fed operation. The available types of construction are IM B3, IM B35 and IM V1.



Cross-section of a 1LL8 motor

N-compact 1LH8

Type 1LH8 motors are water-jacket cooled machines (cooling method IC71W) with degree of protection IP55 as standard. They cover the power range from 800 kW to 1,150 kW (at 50 Hz) and are designed for both line-supply and converter-fed operation. Due to water cooling, the motors can be operated at ambient temperatures of up to 55°C and water inlet temperatures of up to 35°C without a power derating. Furthermore, they demonstrate an even greater power density at even lower noise levels than the other motors in the N-compact range. The available types of construction are IM B3 and IM V1.



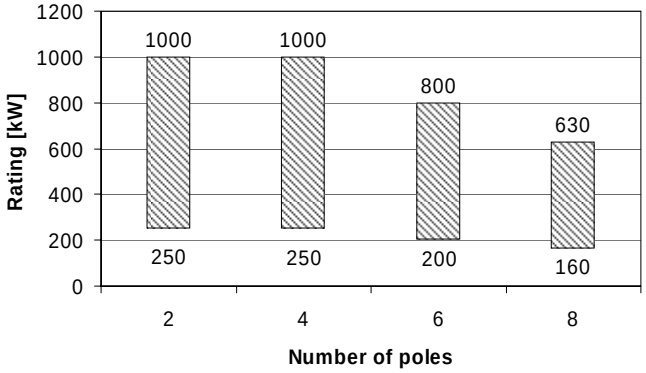
Cross-section of a 1LH8 motor

N-compact Three-Phase 1LA8 Asynchronous Motors

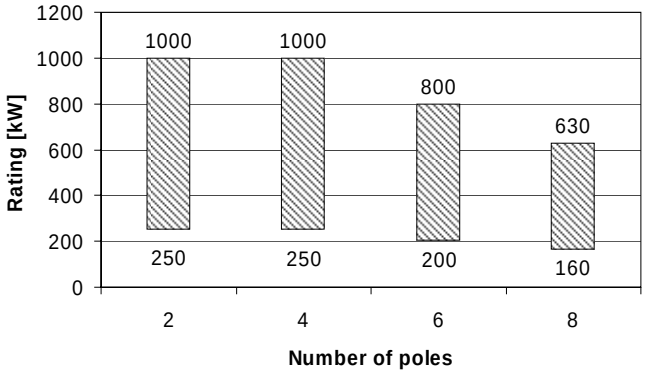
◊ Power Range

Type 1LA8 motors are the self-ventilated, totally enclosed, fin-cooled machines in the N-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.

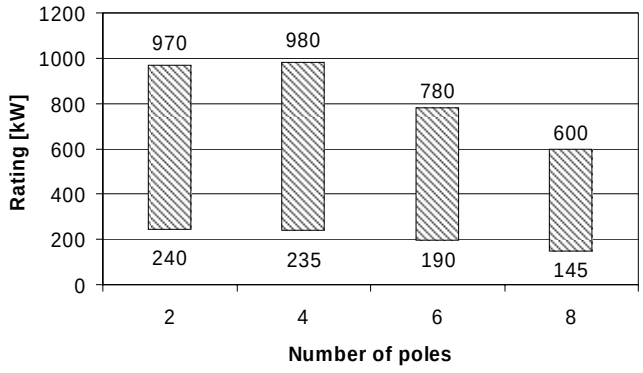
Power range of the 1LA8 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LA8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Standard isolation up to 500 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LA8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 690 VΔ



N-compact Three-Phase 1LA8 Asynchronous Motors

◊ Technical Details

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 1LA8 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 attachment is provided by integrally-cast, box-shaped feet.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearing 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 final coating is also available.

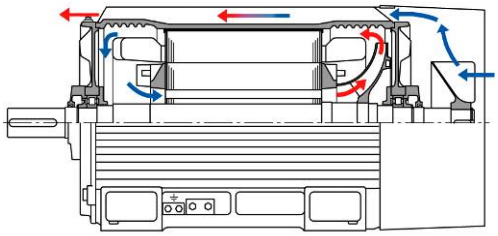
Degree of Protection / Type of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 as standard. Options M72 and M73, as well as options M35 and M39, also allow them to be adapted for use in zone 2 (type of protection „Ex nA") and zone 22 (type of protection „Ex tD").

Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes 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 either in die-cast aluminium or, in two-pole machines with a shaft height of 450, 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

1LA8 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 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 1LA8 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 rolling-contact bearings:

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 Shaft height 315	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Vertical Shaft heights 355 to 450	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing as locating bearing

*) For converter-fed operation, an isolated bearing will be built onto the non-drive end as standard

In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantees a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

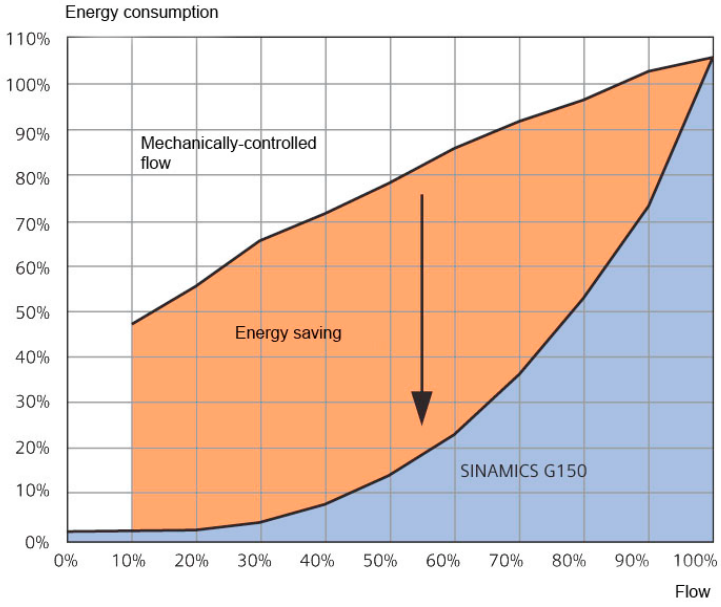
With terminal boxes, various models and modifications can be chosen. If no particular terminal box is specified, the three terminal boxes listed in the table below will be used depending on the size of the motor.

Size	Terminal Box
315	GT 640
355	1XB1 621
400, 450	1XB1 631

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 top and on both sides of the machines and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. The latter is supported by a staggered arrangement of the motor terminals in the terminal box.

Converter-Fed Operation

In combination with the frequency converters in the SINAMICS product range, 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:

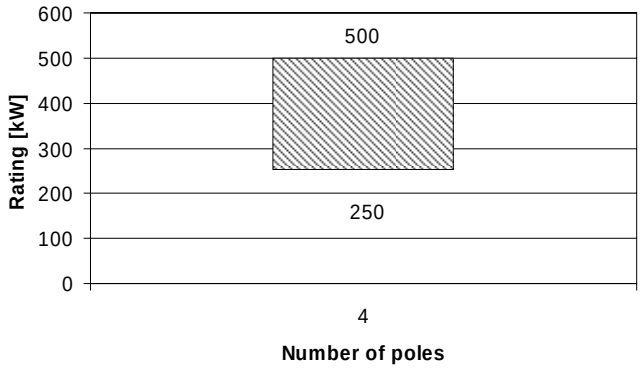
- Our webpage at http://www.siemens.com/n-compact
- Our catalogue D81.1, particularly pages 3/10 to 3/21
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase 1LA8 Standardline Asynchronous Motors

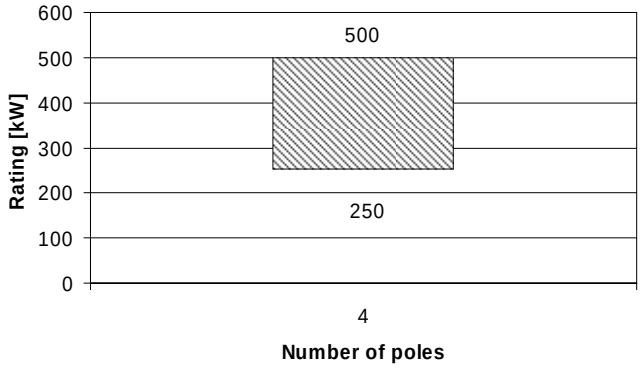
◊ Power Range

1LA8 Standardline motors are the self-ventilated, totally enclosed, fin-cooled machines with a selected option range, which form part of the N-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 a high level of reliability and availability despite small dimensions. The available power ranges are shown in the graphs below.

Power range of the 1LA8 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 and 355
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LA8 Standardline (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Standard isolation up to 500 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft heights 315 and 355
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



N-compact Three-Phase 1LA8 Standardline Asynchronous Motors

◊ Technical Details

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

Cast-Iron Casings
Machines of type 1LA8 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 attachment is provided by integrally-cast, box-shaped feet.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearing 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 final coating is also available.

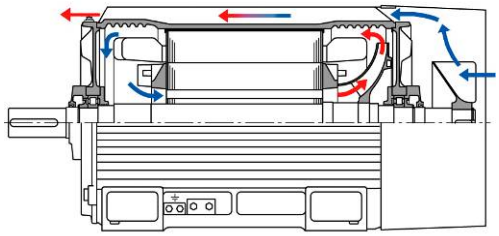
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 as standard.

Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes 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 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

1LA8 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 1LA8 Standardline 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

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

*) For converter-fed operation, an isolated bearing will be built onto the non-drive end

In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantees a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

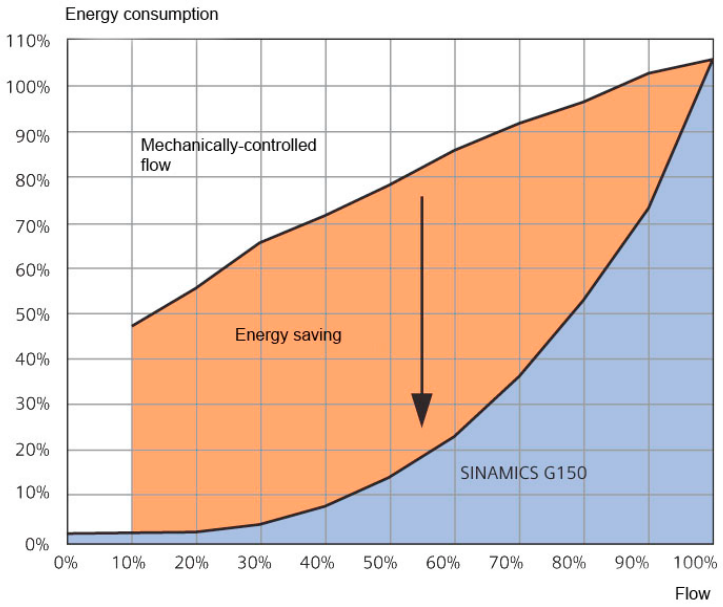
With terminal boxes, various models and modifications can be chosen. If no particular terminal box is specified, the two terminal boxes listed in the table below will be used depending on the size of the motor.

Size	Terminal Box
315	GT 640
355	1XB1 621

The terminal boxes given in the table above are perfectly suited to the corresponding motors and can be mounted on both sides of the machines. They are also generously dimensioned to allow easy and safe connection to the line terminals. The latter is supported by a staggered arrangement of the motor terminals in the terminal box.

Converter-Fed Operation

In combination with the frequency converters in the SINAMICS product range, 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:

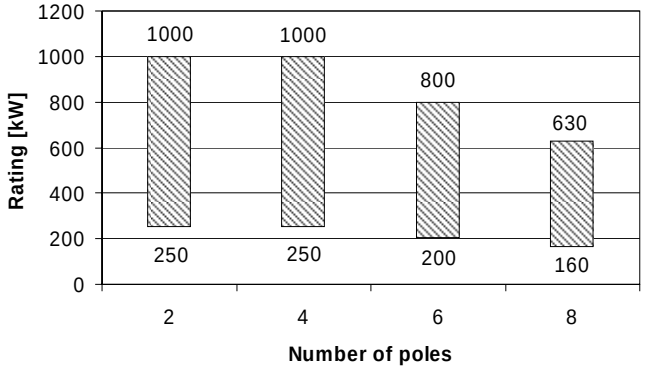
- Our webpage at http://www.automation.siemens.com/ld/ac-motor-low/html_76/n-compact/n-compact-standard-1.html
- Our catalogue D86.1, particularly pages 2/1 to 3/3
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase 1PQ8 Asynchronous Motors

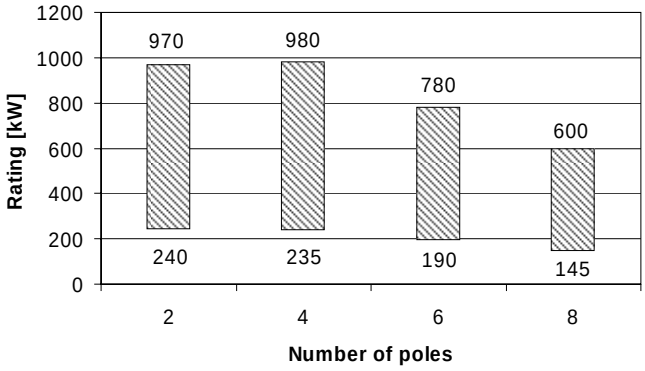
◊ Power Range

Type 1PQ8 motors are the separately-ventilated, totally enclosed, fin-cooled machines in the N-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 options allow these motors to be adapted for use with a variety of different applications. The available power ratings are given in the graphs below.

Power range of the 1PQ8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Standard isolation up to 500 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height of 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1PQ8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height of 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 V



N-compact Three-Phase 1PQ8 Asynchronous Motors

◊ Technische Details

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 1PQ8 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 attachment is provided by integrally-cast, box-shaped feet.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearing 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 final coating is also available.

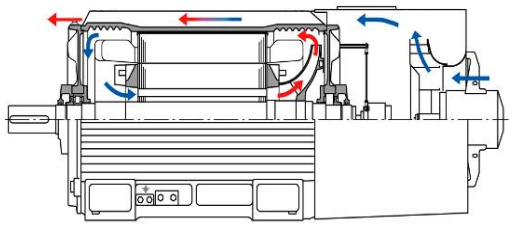
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 as standard.

Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes 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 either in die-cast aluminium or, in two-pole machines with a shaft height of 450, 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

1PQ8 machines have a technically-sophisticated cooling concept of type IC416 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 1PQ8 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 rolling-contact bearings:

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 Shaft height 315	Deep-groove ball bearing as locating bearing	Deep-groove ball bearing with axial compression springs as floating bearing
Vertical Shaft heights 355 to 450	Angular-contact ball bearing and deep-groove ball bearing as locating bearings	Deep-groove ball bearing with axial compression springs as floating bearing

*) For converter-fed operation, an isolated bearing will be built onto the non-drive end

In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantees a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

With terminal boxes, various models and modifications can be chosen. If no particular terminal box is specified, the three terminal boxes listed in the table below will be used depending on the size of the motor.

Size	Terminal Box
315	GT 640
355	1XB1 621
400, 450	1XB1 631

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 top and on both sides of the machines and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. The latter is supported by a staggered arrangement of the motor terminals in the terminal box.

Converter-Fed Operation

1PQ8 motors are designed for converter-fed operation whereby, especially in combination with the frequency converters in the SINAMICS product range, system solutions adaptable to a variety of requirements can be realised.

◊ Further Information

Further information can be obtained from the following sources:

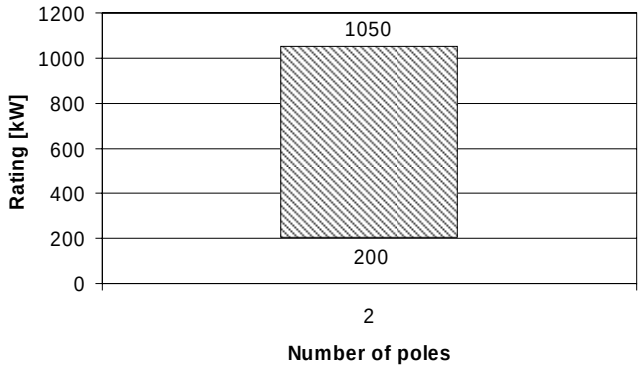
- Our webpage at http://www.siemens.com/n-compact
- Our catalogue D81.1, particularly pages 3/22 to 3/29
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase 1PQ8 High-Speed Asynchronous Motors

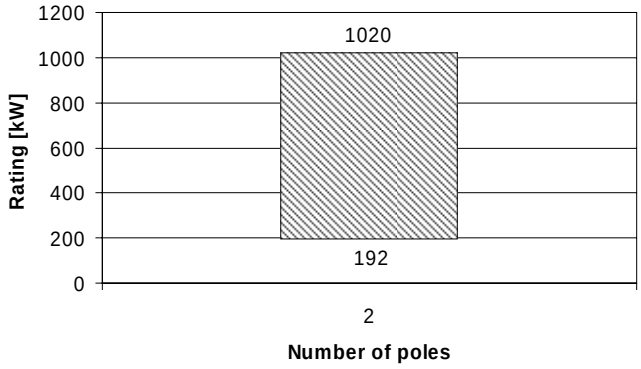
◊ Power Range

1PQ8 high-speed motors are the separately-ventilated, totally enclosed, fin-cooled machines with a high rotational speed in the N-compact range. They are characterised by this high rotational speed and 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 ratings and rotational speeds are given in the graphs below.

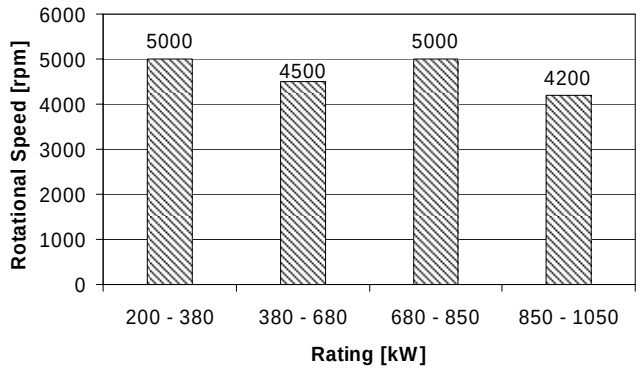
Power range of 1PQ8 High-Speed motors (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Standard isolation up to 500 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of 1PQ8 High-Speed motors (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 V



Rotational speed range of 1PQ8 High-Speed motors (dependent on the power)



N-compact Three-Phase 1PQ8 High-Speed Asynchronous Motors

◊ Technical Details

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

Cast-Iron Casings
Machines of type 1PQ8 High-Speed 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 attachment is provided by integrally-cast, box-shaped feet.

Cast-Iron Bearing Brackets
In addition to their purposes of supporting the bearing 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.

Shock Mounts
In order to achieve soft mounting and to decouple the motors from the foundations, shock mounts are attached to the feet of the casings. This allows both the vibrations and noise transferred from the motor to the foundation, as well as those transferred from the foundation to the motor, to be reduced to an absolute minimum. This facilitates the construction of the foundation and leads to motor operation with few vibrations and low levels of noise emission.

Shock mount

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 as standard.

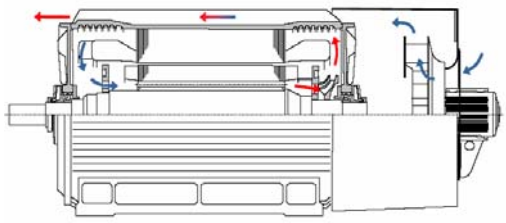
Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes is used for isolation purposes. This system corresponds to thermal class 155 (F) and ensures the machines a long operational life and a high level of reliability. This 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 the squirrel-cage windings are fitted later either at shaft heights 315 and 355 in die-cast aluminium or, at shaft heights 400 and 450, 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

1PQ8 High-Speed machines have a technically-sophisticated cooling concept of type IC416 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 1PQ8 High-Speed 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 be 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

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

*) For converter-fed operation, an isolated bearing will be built onto the non-drive end

In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantees a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

With terminal boxes, various models and modifications can be chosen. If no particular terminal box is specified, the two terminal boxes listed in the table below will be used depending on the size of the motor.

Size	Terminal Box
315	1XB1 621
355, 400, 450	1XB1 631

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 top and on both sides of the machines and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. The latter is supported by a staggered arrangement of the motor terminals in the terminal box.

Converter-Fed Operation

1PQ8 High-Speed motors are designed for converter-fed operation whereby, especially in combination with the frequency converters in the SINAMICS product range, system solutions adaptable to a variety of requirements can be realised.

◊ Further Information

Further information can be obtained from the following sources:

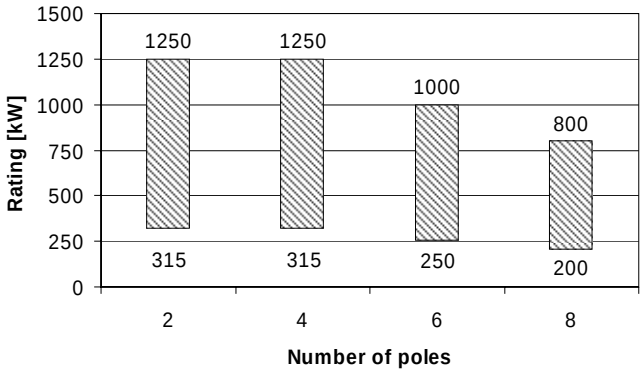
- Our webpage at http://www.automation.siemens.com/ld/ac-motor-low/html_76/n-compact/n-compact-hs-1.html
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase 1LL8 Asynchronous Motors

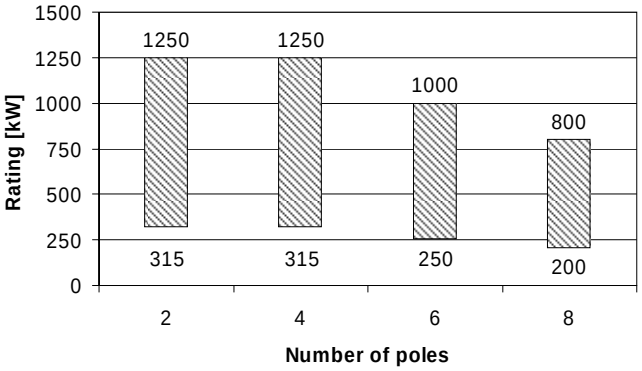
◊ Power Range

Type 1LL8 motors are the self-ventilated, open, fin-cooled machines in the N-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. The available power ranges are given in the graphs below.

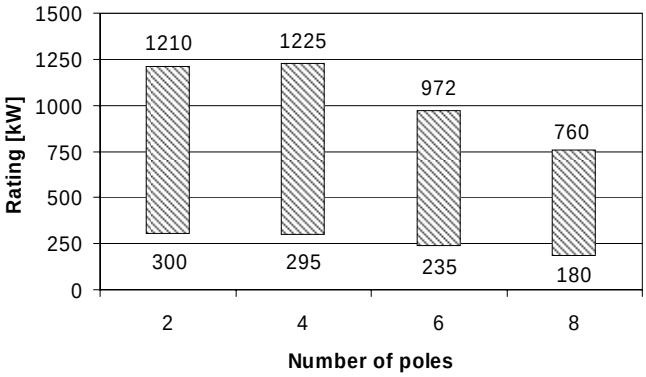
Power range of the 1LL8 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LL8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Standard isolation up to 500 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LL8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 315 to 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



N-compact Three-Phase 1LL8 Asynchronous Motors

◊ Technical Details

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 1LL8 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 attachment is provided by integrally-cast, box-shaped feet.

Cast-Iron Bearing Brackets
In addition to supporting the bearing and acting as a continuation of the casing, 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 final coating is also available.

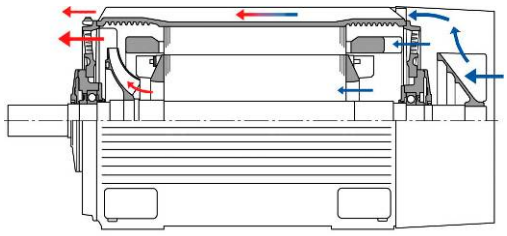
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP23 as standard.

Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes 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 either in die-cast aluminium or, in two-pole machines with a shaft height of 450, 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

1LL8 machines have a technically-sophisticated cooling concept of type IC01 according to IEC / EN 60034-6. As the diagram on the right shows, a fan is located on the non-drive end, which draws in air from outside, carries it axially over the outer cooling fins of the casing as well as directly into the active motor area. 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 1LL8 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 rolling-contact bearings:

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 bearings	Deep-groove ball bearing as locating bearing

*) For converter-fed operation, an isolated bearing will be built onto the non-drive end as standard

In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantees a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

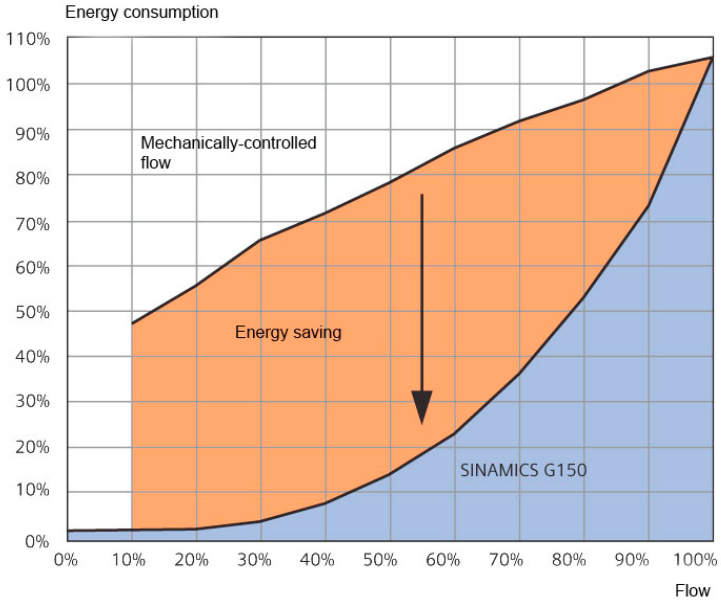
With terminal boxes, various models and modifications can be chosen. If no particular terminal box is specified, the two terminal boxes listed in the table below will be used depending on the size of the motor.

Size	Terminal Box
315	1XB1 621
355, 400, 450	1XB1 631

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 top and on both sides of the machines and rotated through 4 x 90°. They are also generously dimensioned to allow easy and safe connection to the line terminals. The latter is supported by a staggered arrangement of the motor terminals in the terminal box.

Converter-Fed Operation

In combination with the frequency converters in the SINAMICS product range, 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:

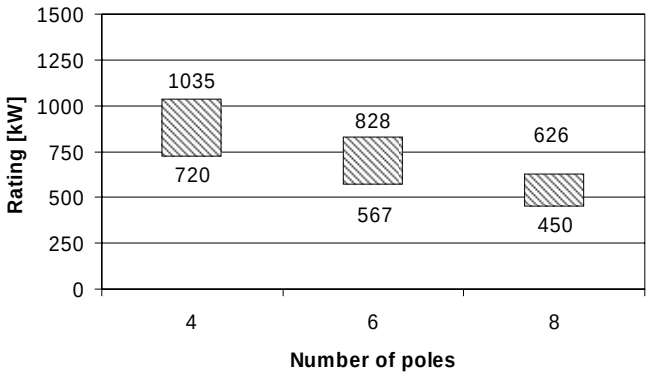
- Our webpage at http://www.siemens.com/n-compact
- Our catalogue D81.1, particularly pages 3/30 to 3/39
- Our worldwide contact persons at https://www.siemens.com/automation/partner

N-compact Three-Phase 1LH8 Asynchronous Motors

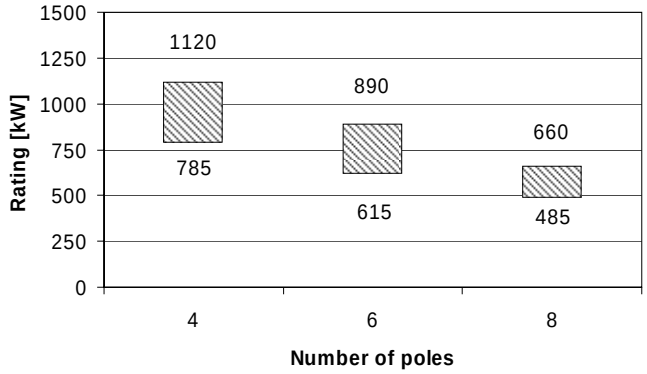
◊ Power Range

Type 1LH8 motors are the water-cooled machines in the N-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 35°C without a power derating. The outstanding efficiency and compact and robust design of these machines guarantee high levels of reliability and availability despite small dimensions. The available power ranges are given in the graphs below.

Power range of the 1LH8 (dependent on the number of poles) for:
- Line-supply operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 130 (B)
- Shaft height 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



Power range of the 1LH8 (dependent on the number of poles) for:
- Converter-fed operation at 50 Hz
- Special isolation up to 690 V
- Thermal class 155 (F), utilisation according to thermal class 155 (F)
- Shaft height 450
- 400 VΔ / 690 VY, 500 VΔ, 690 VΔ



N-compact Three-Phase 1LH8 Asynchronous Motors

◊ Technical Details

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

Steel Casings
The casings of type 1LH8 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.

Cast-Iron Bearing Brackets
In addition to supporting the bearing and acting as a continuation of the casing, 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 final coating is also available.

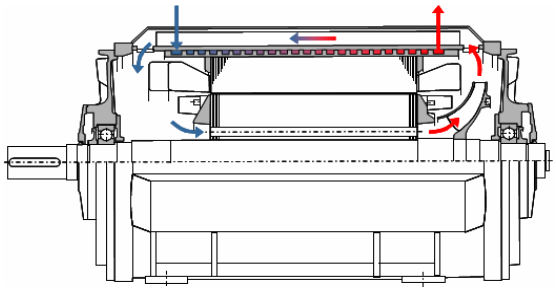
Degree of Protection
These motors are manufactured according to IEC / EN 60034-5 with degree of protection IP55 as standard.

Isolation System
The DURIGNIT system with impregnation according to the VPI (Vacuum Pressure Impregnation) or UV (Ultraviolet) processes 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 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

1LH8 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 35°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 heat 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 1LH8 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 locating bearing	Deep-groove ball bearing with axial compression springs as floating 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 converter-fed operation, an isolated bearing is built onto the non-drive end

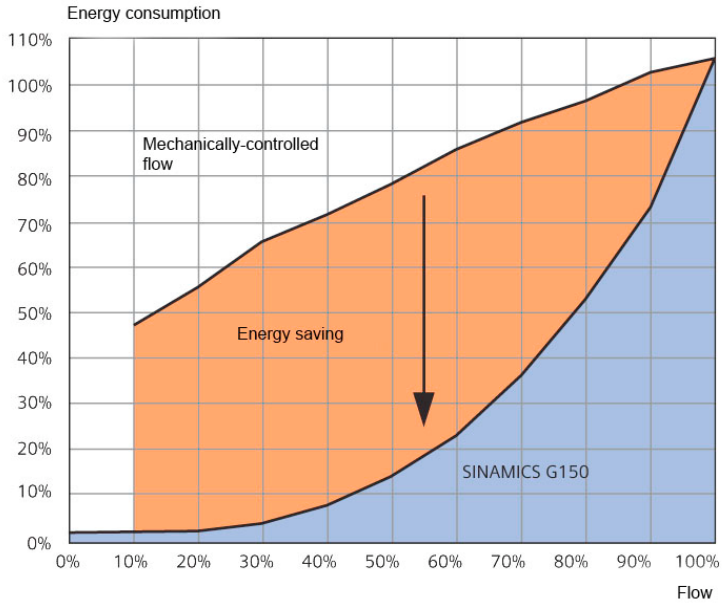
In order to guarantee a secure bearing system, relubricating devices with grease slingers and relubrication nipples are installed on both motor sides and the bearing itself is protected against dirt contamination by a V-ring. This bearing concept boasts long relubrication intervals, which consequently reduce grease usage and guarantee a very good level of durability. There is also the option to install labyrinth seals to improve the protection of the bearings against the infiltration of dust and water or shock pulse measurements for the monitoring of bearing functionality. Furthermore, various auxiliary devices such as temperature sensors for the monitoring of bearings, for example, can be added.

Wiring Method

For connection to the three-phase supply system, only terminal box 1XB9 629 is used, which, when looking at the motor from the drive end, is always mounted on the left-hand side. This terminal box is perfectly suited to the motor and offers a high level of protection against dust and water jets, which, in turn, allows a secure connection in rugged environments. It is also generously dimensioned to guarantee easy and safe connection to the line terminals.

Converter-Fed Operation

In combination with the frequency converters in the SINAMICS product range, 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/n-compact
- Our worldwide contact persons at https://www.siemens.com/automation/partner

