Installation and Maintenance Manual

1LE0

Answers for industry.

SIEMENS

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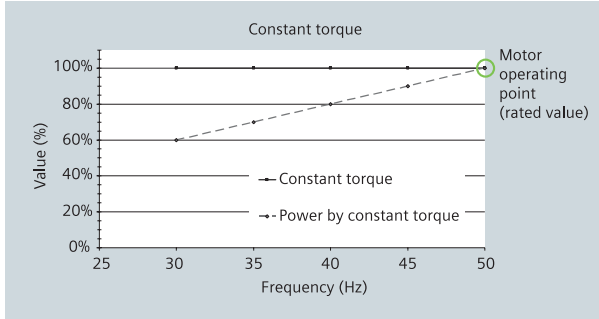
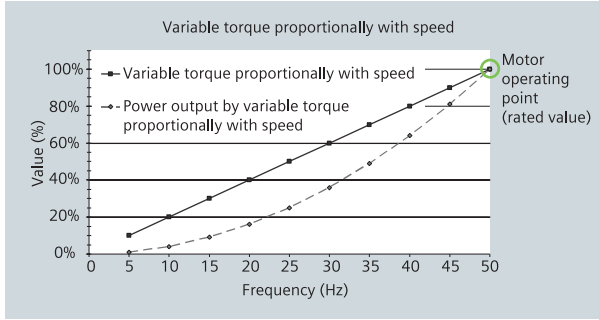
1.0 INTRODUCTION

The 1LE0002 motor series will be used as three phase asynchronous inverter duty motor with constant torque for frequency range 30 to 50Hz (or 60Hz by voltage option) and variable torque for frequency range 5 to 50Hz (or 60Hz by voltage option) with torque proportionally with (square of) speed.

Feature of constant torque:



Feature of variable torque proportionally with speed:



On the name plate the rated 50Hz values are shown. By option voltage are shown the rated values of operation figures from selected voltage.

By combination with option code G17 (separately driven fan) have a constant torque by frequency range 5 to 50Hz.

Connection of 1LE0002 motor series:
Output ≤ 3kW shall be connected as star (Y)
Output > 3kW shall be connected as delta (Δ)

1.1 Application scope

Prescribed use of 1LE0002 standard motors according to IEC 60034-5: The standard motors are provided with degree of protection IP55 and can be used in a dusty and damp environment. A suitable canopy cover is recommended if the motors are installed outdoors with exposure to direct sunlight, rain, snow and ice.

Please refer to the following environmental application conditions.

- Installation Altitude≤1000m ASL
- Ambient temperature+40 °C
- Operating temperature range-20 °C ~ +40 °C
- Relative Humidity

-20 °C≤T≤20 °C	100 %
20 °C<T≤30 °C	95 %
30 °C<T≤40 °C	55 %

If the ambient conditions and site altitude is different from the above mentioned, please consult Siemens.

1.2 Motor construction and types

Self-ventilation (standard): Type of cooling IC411 in accordance with IEC / EN 60034-6

1LE0002 motors are totally enclosed and self-ventilated (TEFC) by a bi-directional fan mounted on the NDE of the rotor shaft. Care must be taken to ensure adequate clearance for maximum air flow and cooling. If the optional external fan is used, the correct direction of air flow must be taken into consideration for proper cooling.

Forced ventilation (optional): Type of cooling IC416 in accordance with IEC / EN 60034-6
Cooling independent of the motor is achieved by means of a separately driven fan wheel (forced ventilation).

Forced ventilation is independent of the operating state of the machine.

Notice!

1) Ensure the air flow of the separately driven fan smooth, and consistent with external air flow;
2) The separately driven fan is powered by an independent module. And it must be ensured that the rotation direction of the separately driven fan is consistent with the mark shown on fan cowl;
3) The separately driven fan can not be powered through converter;
4) It must be ensured that the machine is not operated without starting the external fan, and stopped before external fan stop.

1.3 Types of construction/method of installation

The type of construction of the machine is stated on the rating plate.

Warning

During transport, machines may only be hoisted in a position corresponding to their basic type of construction.

Basic type of construction code	Graphics-Based Representation	Application Scope (Frame size)	Other methods of installation	Graphics-Based Representation	Application Scope (Frame size)
IM B3 (IM 1001)		80 mm ~ 355 mm	IM V5 (IM 1011)		80 mm ~ 315 mm
			IM V6 (IM 1031)		80 mm ~ 315 mm
			IM B6 (IM 1051)		80 mm ~ 315 mm
			IM B7 (IM 1061)		80 mm ~ 315 mm
			IM B8 (IM 1071)		80 mm ~ 315 mm
IM B5 (IM 3001)		80 mm ~ 315 mm	IM V1 (IM 3011)		80 mm ~ 355 mm
			IM V3 (IM 3031)		80 mm ~ 315 mm
IM B14 (IM 3601)		80 mm ~ 160 mm	IM V18 (IM 3611)		80 mm ~ 160 mm
			IM V19 (IM 3631)		80 mm ~ 160 mm
IM B35 (IM 2001)		80 mm ~ 355 mm	IM V15		80 mm ~ 315 mm

Note: About the special mounting construction type, please consult with Siemens.

2.0 HANDLING AND STORAGE

When lifting the motors, always use the lifting eyes provided. Prior to lifting the motor make sure that the lifting eyes are installed correctly and tightened. Never lift a motor using the rotor shaft and fan cowling. In addition care must be taken during lifting and lowering of the motor to avoid any shocks or vibrations which can result in bearing damages.

It is recommended that all motor be stored in a dry, dust free environment and free of excessive vibrations.

If the DE and NDE bearings are of the sealed types, it is recommended that they are replaced if storage has exceeded 2 years from date of motor manufacture. If the motors have the regreasable bearings, then the recommendation is to replace the grease after 2 years of storage.

The service life of the motor can be considerably reduced if the storage period extends beyond 2 years in environments with high moisture and dirt. If necessary, the insulation resistance of the winding could be measured determine the health of the motor prior to installation and start-up, (see Section 3.5. for reference values).

Machined surfaces (flange, DE rotor shaft) are treated at the factory with an anti corrosive agent to prevent rusting. However these surfaces should be retreated during storage as deemed necessary. It is recommended that the motor shaft is rotated by hand on a frequent basis to ensure even grease distribution.

3.0 COMMISSIONING

All work must be carried out by a skilled worker.Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable.Mains must be secured against accidental switch on.

3.1 Installation

Lifting eyes are screwed in place and must be tightened. If the motor is installed vertically with the DE shaft facing downwards, a protective canopy is recommended to cover the fan cowling. This canopy is necessary to prevent the ingress of water and foreign objects that may inhibit proper fan operation.

If the DE shaft is facing upwards, a protective canopy and / or suitable protective measures are recommended to be taken to prevent liquids from entering the motor windings via the shaft.

Care must be taken to install the motor on a solid foundation so as to avoid excessive vibration which can result in premature bearing failure.

3.2 Terminal box

Terminal box is either top or side mounted (LHS or RHS) on the motor and can be rotated 4 times by 90° thus allowing for multiple cable entry possibilities.

3.3 Balancing and coupling of transmission elements

To ensure a quiet and vibration free operation, proper axial and radial alignment of a balanced transmission element (coupling, pulleys, fans, gear box, etc.) is essential.

As standard, the 1LE0002 rotors are dynamically balanced using a half feather key as indicated on the ratings name plate (H=Half Key).

Notice!

1) The transmission and coupling elements are required to be half-key balanced to ensure a vibration free operation.
2) Coupling and motor temperature considerations must be taken into account during alignment of the transmission.
3) Key must be removed from the motor shaft prior to starting if no transmission is coupled.

3.4 Electrical connection

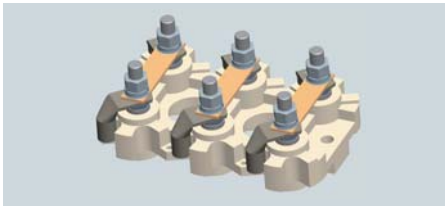
All work must be carried out by skilled worker. Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable. Mains must be secured against accidental switch on.

There are six power terminals and one earthing terminal located in the terminal box for FS80 to FS355. For FS315 and FS355, there is an additional earthing point located on the base of the frame. All motors are suitable for bi - directional rotation (CW or CCW). Phase change can be achieved by interchanging any two phases.

Mains Power Connection

Windings of standard three-phase single speed motors can be connected either in star or delta connection. Voltage and frequency deviations of ±5% VAC and ±2% Hz respectively of the rated voltage and frequency values are acceptable for proper operation.

Cable Connection Examples



FS315 & FS355 External Earthing

Please refer to Table 1 for tightening torque and direction for electrical terminal lugs.

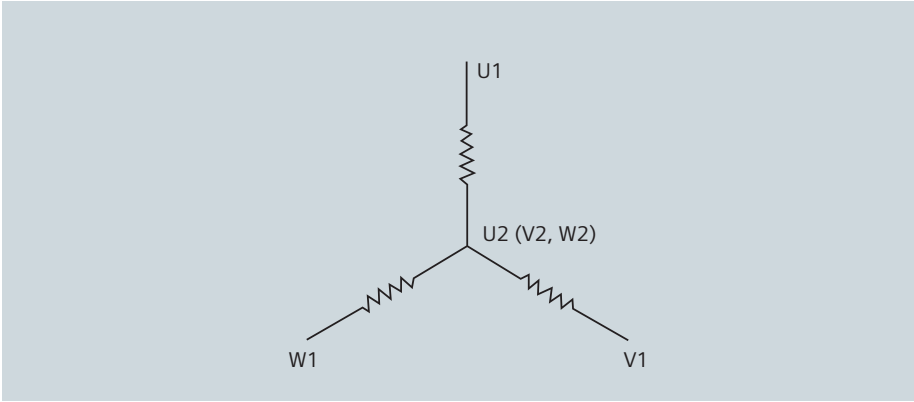
Table 1

Size	M4	M5	M6	M8	M10	M12	M16
Torque (Nm)	1.2	2.5	4.0	8.0	13	20	40

Note: Tightening Torque (Nm, Tolerance: ±10%)

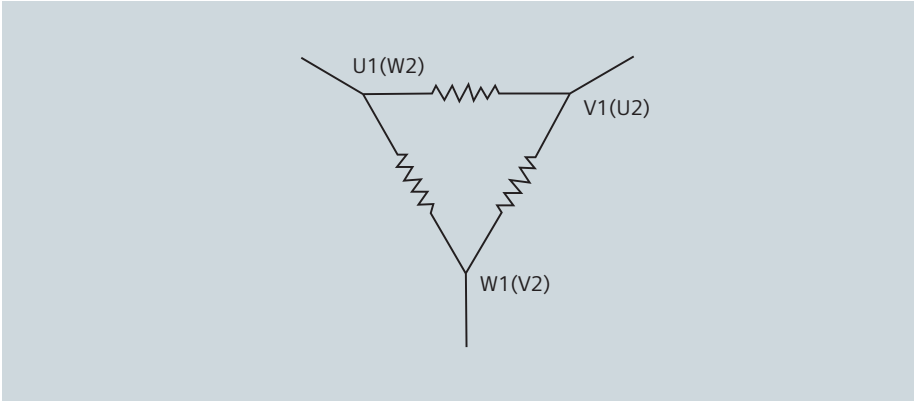
Star connection

A star connection is obtained by connecting W2, U2, V2 terminals to each other and the U1, V1, W1 terminals to the mains.



Delta connection

A delta connection is obtained by connecting the end of a phase to the beginning of the next phase.



Note: If the auxiliary or mains cable entries on the terminal box is sealed with gland plugs, a flat (standard) screw driver is required for removal.

Winding Protection (15th letter of motor code)

1LE0002 motors have three types of electrical protection available as an option:

- PTC - used for temperature alarming (145 °C) or tripping function (155 °C)
- PT100 - used for monitoring temperature of bearing or stator windings.
- KTY84-130 - used for motor temperature detection with temperature sensor

Notice!	The PTC, PT100 and KTY84-130 require connection to an external control unit. When PT100s are used for bearing temperature monitoring, the alarming and tripping values are independent of those of the winding class Option code:Q5A .

Auxillary terminal Connection

If the motors are configured with winding protection PTC, PT100, KTY84-130 and space heating, the auxiliary terminal connection is shown in Table 2.

Table 2

PTC		2PTC			PT100			2PT100								KTY84		Option code Q5A				Q02	
PTC 155 °C		PTC 155 °C		PTC 145 °C	U	V	W	U		V		W		Temperature sensor		2 PT100 resistance thermo-meter for bearing						Heater	
								U1	U2	V1	V2	W1	W2			DE		NDE					
2TP1	2TP2	1TP1	1TP2	2TP1	2TP2	1R1	1R2	2R1	2R2	3R1	3R2	1R1	1R2	2R1	2R2	3R1	3R2	4R1	4R2	5R1	5R2	6R1	6R2	+1R1	-1R2	10R1	10R2	11R1	11R2	2HE1	2HE2

Note: by usage of 2 PTC, terminal 2TP1 and 2TP2 are used for tripping, 1TP1 and 1TP2 are used for alarming.

Motors which are exposed to a wide temperature fluctuation during standstill are susceptible to condensation formation, hence it is strongly recommended to add a space heater (Option code: Q02).

Warning

The space heater must never be energized during motor operation.

3.5 Insulation resistance inspection

After extended periods of storage or standstill (6 months or longer), it is recommended to measure the insulation resistance between phases and phase to ground prior to applying power at start-up.

Warning

During and shortly after the resistance measurement, the motor terminals are hazardous with a residual voltage charge. Avoid touching the terminals.

Insulation resistance

The minimum insulation resistance between new, cleaned or repaired windings with reference to ground is 10 MΩ.

The critical insulation resistance (Recruit) is calculated by multiplying the rated voltage, e.g. 0.69 kV AC, with the constant factor (0.5MΩ / kV):

Recruit = 0.69 kV × 0.5 MΩ/kV = 0.345 MΩ

Measurement

The minimum insulation resistance between the windings and ground measurement is taken at 500 V DC and at a winding temperature of 25 °C ± 15 °C.

The measurement of the critical insulation resistance: it should be measured with 500 V DC with the winding at operating temperature.

Normal failure and corrective measures on insulation resistance

Cause: Might be due to high humidity.

Correction: Windings must be dried.

Cause: After extended periods of operation, the minimum insulation resistance may decrease. However as long as the measured value is not less than the Recruit values the motor will continue to operate.

Correction: If the measured value is less than the Recruit value then the motor must be replaced or repaired.

3.6 Drive Application

In applications when motor torque is variable (piston-type compressor, load for example), the inevitable result is a non-sinusoidal motor current, whose harmonics can lead to excessive system perturbation or excessive electromagnetic interference.

Electromagnetic compatibility

In application where the motor is driven by a drive, the degree of electrical interference depends on the type of used drive (type, number of IGBTs, interference suppression measures, and manufacturer), cabling, distance and application requirements.

The installation guidelines of the drive manufacturer with regards to electromagnetic compatibility must be considered at all times during the design and implementation phases.

If the motor is driven by a drive and the, operating speed exceeds synchronous speed then considerations must be given to the mechanical components and transmission coupling.

Please refer to IEC 60034-1 for further details.

Noise, Temperature and Vibration

When motor are used with converter fed operation, the noise and temperature rise will be a little worse than standard motor with rated speed.

Due to increased speeds above the rated speed, vibration of motor will increase. Therefore the mechanical smooth running is changed, and lifetime of grease and bearing will be reduced.

4.0 MAINTENAINCE

Before starting any service and maintenance work on the motor the motor must be properly isolated from the mains and auxiliary power.

The usual "5 safety rules" (as set forth in DIN VDE 0105) are:
- Isolate the equipment
- Take effective measures to prevent reconnection
- Verify equipment is dead
- Ensure Earthing correctly
- Cover or fence off adjacent live parts

These precautions listed above should remain in force until all maintenance work is finished and the motor has been fully assembled.

4.1 Bearing lifetime

The average bearing lifetime for motors with sealed or open bearing at the DE & NDE varies between 20.000 and 40.000 hours for horizontal mounted motors without additional axial loading. This 20.000 or 40.000 hours of operation applies to 2, 4, 6 pole motors when operated at an ambient 40°C based on rating plate data. For every 10K temperature rise above 40°C, the grease lifetime is reduced by one half.

Notice！ 1）Extended storage periods, excessive vibrations and high humidity levels will reduce the useful life of the DE & NDE bearing and bearing grease.
2）For sealed or regreasable bearing, it is recommended that permanently lubricated bearings should be replaced after 24 months of storage.
3）If the motor is equipped with regreasable DE & NDE bearing, the grease must be replaced as per the published time intervals in section 4.2.

Warning

Operating a motor above synchronous speeds for extended periods of time will reduce the bearing grease lifetime.

4.2 Grease type

Type of grease: UNIREX N3 (Esso); Conforms to DIN 51825-K3N.

Motors equipped with a regreasing device (L23 option) will have the grease information stamped on the rating plate or a sticker on the fan cowling.

4.3 Grease lifetime and regreasing intervals

During the bearing lifetime, the grease need not to be changed for the motor with frame size "80~90" .

When the motor with frame size "100~250" runs under rated voltage and frequency in normal environment, the grease need not to be changed during the bearing lifetime. When motor runs under very harsh environment, where grease life is significantly shortened, re-greasing device (option code: L23) is recommended to be selected for convenient grease change. Please refer to the re-greasing intervals in Table 3.

The standard motor with frame size "280~355" is equipped with re-greasing device. Please refer to re-greasing intervals in Table 3.

Table 3

Number of Poles	Frame Size	Bearing lifetime	Permanent lubrication	Re-lubrication	Re-lubrication Interval
2, 4, 6	80 – 90	20.000 hours by admissible permitted load or 40.000 hours without coupling output	Standard	-/-	-/-
2, 4, 6	100 – 160		Standard	Option（L23）	8.000 h
2,	180 – 250		Standard	Option（L23）	4.000 h
4, 6	180 – 250		Standard	Option（L23）	8.000 h
2,	280 – 315		-/-	Standard	3.000 h
4, 6	280 – 315		-/-	Standard	5.000 h
2,	355		-/-	Standard	2.000 h
4, 6	355		-/-	Standard	4.000 h

Exception! In applications where the motor is installed vertically or operating with heavy vibration, sudden load changes, frequent reversing operation, etc., the grease should be changed at considerably more frequent intervals than the operating hours stated above.

4.4 Re-greasing procedure

Warning

All local safety regulations must be considered when re-greasing the motor in operation or at a standstill.

Care must be taken not to over grease the bearings as this can result in increased bearing temperatures.
Dust and old grease must be prevented from entering the motor bearings during the re-greasing cycles.

Notice! The re-greasing nipple should be cleaned of old grease and dust prior to attaching the re-greasing device.

It is recommended that the DE and NDE bearings should be re-greased while the motor is in operating and at operating temperature.

If it is not possible to re-grease the motor during operation, then it recommended that a partial amount of the grease is injected and then the motor energized and rotated for a few revolutions to allow for grease dispersion. After coming to a complete stop the remaining grease should be added.

If a DE or NDE bearing have experienced overheating, it is recommended that the bearing should be inspected for heat damage and replaced or re-greased as necessary.

Notice! Bearing grease will appear dark in color if overheating was experienced.

4.5 Bearing replacement – assembly and disassembly

As bearings near the end of their useful lifespan, the vibration and noise levels of the motor will increase considerably.

If bearing inner diameter or wear clearance is out of specification as per table 4, the bearing must be replaced.

Table 4

Frame size (mm)	80~112	132~160	180~250	280~355
Bearing inner ø (mm)	20~30	35~50	55~80	85~120
Wear clearance (mm)	0.1	0.15	0.2	0.3

> Notice! Worn or damaged bearings must be replaced with an equivalent bearing matching the original specifications.

When replacing the bearing, dismantle the necessary parts and use a suitable bearing extraction tool to remove the damaged or worn bearing.

Before installing the new bearing, pre-heat the bearing as per the manufacture instruction prior to pressing it onto the rotor shaft. Shaft sealing rings (V Ring or Oil Seal) must be replaced with new ones after bearing replacement.

Warning

Any impacts or hits (such as with a hammer etc.) is strictly forbidden as this will damage the bearing and result in premature failure.

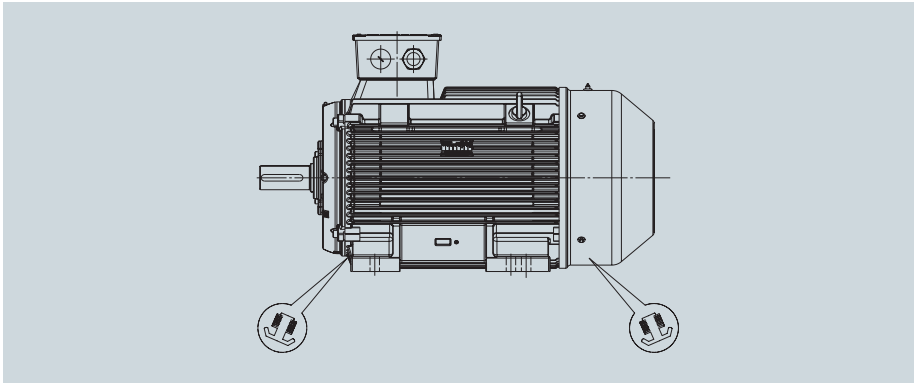
Please refer to tightening torques for the end flange bolts.

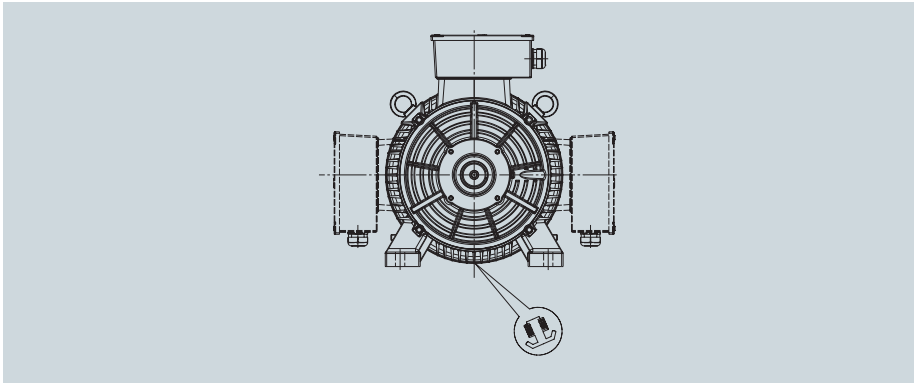
Size	M4	M5	M6	M8	M10	M12	M16	M20
Torque (Nm)	2	3.5	6	16	28	46	110	225

Note: Tightening Torque (Nm, Tolerance: ±10%)

4.6 Condensation drain plug

The condensation drain holes are located on the frame of motor or on the end-shields, depends on construction and mounting type (14th letter of motor code). And the motors with condensation drain holes are delivered from factory with pre-installed plastic plugs. Please refer to the location of condensation drain hole shown in the following pictures.





5.0 START UP

Preliminary Inspection

Before applying power to the motor for the first time, it is recommended to check:

1) All retaining bolts are tightened including transmission coupling and alignment

2) Motor cooling fan unobstructed

3) Adequate bearing lubrication (grease) if equipped with regreasing nipples

4) Mains supply voltage and connection method match those of the rating nameplate

for operation on DOL, Soft start, Drive

5) Proper connection of earthing (grounding) terminal

6) Terminal connection correctness for thermal sensor and space heater if equipped

After power is applied to the motor, be sure to check motor for correct direction of rotation, air flow, current draw and any signs of excessive vibrations and noise levels.

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