

Installation and Maintenance Manual



1LG0 low-voltage motor

Answers for industry.

SIEMENS



Chapter

1.0 INTRODUCTION	4
1.1 Application Scope	4
1.2 Construction Type	4
2.0 HANDLING AND STORAGE	5
3.0 COMMISSIONING	6
3.1 Installation	6
3.2 Terminal Box	6
3.3 Balancing and Transmission Coupling	6
3.4 Electrical Connection	7
3.5 Insulation Resistance Inspection	9
3.6 Drive Application	10
4.0 MAINTANCE	11
4.1 Bearing Lifetime	11
4.2 Grease Type	12
4.3 Grease Lifetime and Regreasing Intervals	12
4.4 Regreasing Procedure	13
4.5 Bearing Replacement	14
4.6 Drain Plug	15
5.0 START UP	16
6.0 SPARE PARTS	17



The data and recommendations specified in all of the instructions supplied ("Information on safety and commissioning"), must always be observed in order to avoid hazardous situations and the risk of personal injury or equipment damage.

Furthermore, the pertinent national, local and plant-specific regulations and requirements should be kept in mind and observed!

Special designs may vary in technical details. If in doubt, please contact the manufacturer, referencing the type designation and serial number (see rating plate), or have the installation, service and maintenance work executed by one of the SIEMENS Service Centers.

1.0 INTRODUCTION

1.1 Application scope

Prescribed use of 1LGO 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. For B5 mountings where the DE shaft is pointing downwards a canopy is necessary to prevent foreign objects from entering the fan cowling and restricting air flow. When the DE shaft is pointing upwards, additional care must be taken to prevent the ingress of water and liquids into the motor housing along the DE shaft.

Please refer to the following environmental application conditions.

- Installation Altitude $\leq 1000\text{m ASL}$
- Ambient temperature $+40^{\circ}\text{C}$
- Operating temperature range $-20^{\circ}\text{C} \sim +40^{\circ}\text{C}$
- Relative Humidity

$-20^{\circ}\text{C} \leq T \leq 20^{\circ}\text{C}$	100%
$20^{\circ}\text{C} < T \leq 30^{\circ}\text{C}$	95%
$30^{\circ}\text{C} < T \leq 40^{\circ}\text{C}$	55%

Note: If the ambient conditions and site altitude is different from the above mentioned, please review the derating table in the 1LGO Catalogue.

1.2 Motor construction and types

1LGO 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 blower is used, the correct direction of air flow must be taken into consideration for proper cooling.

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. In addition the motor shaft should be 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 prior to and removed after motor installation. 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 must 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 angular and radial alignment of a balanced transmission element (coupling, pulleys, fans, gear box, etc.) is essential.

As standard, the 1LG0 rotors are dynamically balanced using a half feather key as indicated on the ratings name plate (H=Half Key).

It is necessary to replace the V-ring on DE with an oil seal when coupling a gearbox to motors from FS80 to FS132.

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

3.4 Electrical connection



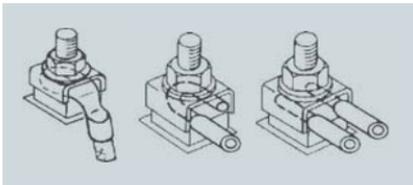
All work must be carried out by skilled worker.
Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable.
Mains must be secured against accidental switch on.

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.

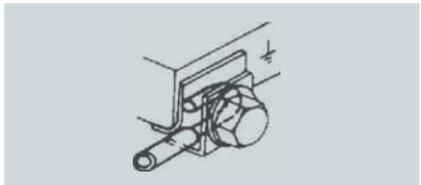
Mains Power Connection

Windings of standard three-phase single speed motors can be connected either in star or delta or star-delta connection. Voltage and frequency deviations of $\pm 5\%$ Vac and $\pm 2\%$ 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.



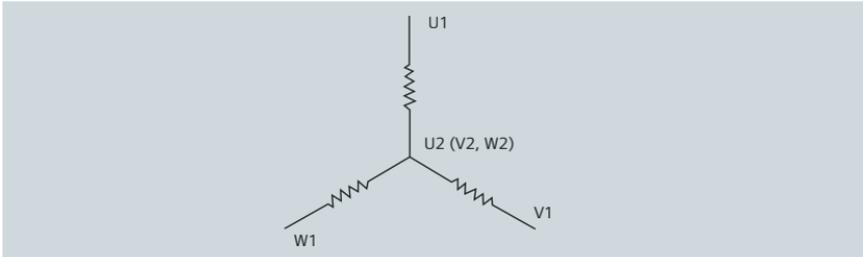
Table 1

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: $\pm 10\%$)

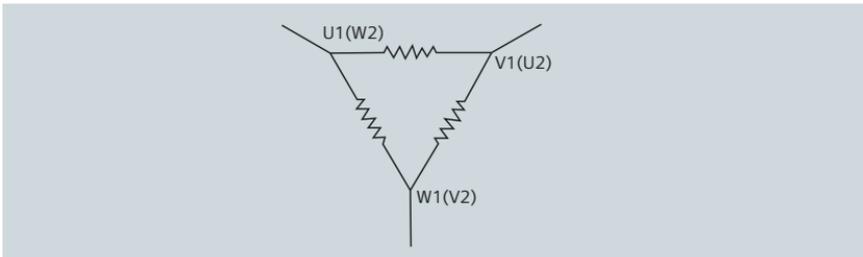
Star connection

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.



Star-delta connection

Star-delta starting allows a peak current reduction. It can be used only when the reduced starting torque obtained is higher than the resistant torque. Actually, it should be noted that the torque of an induction squirrel-cage motor is directly proportional to the square of the voltage. Motors whose rated voltage with delta connection corresponds to the mains voltage can be started with the star-delta method.

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.

Protection

1LGO motors have two types of electrical protection available as an option:

- PTC - used for temperature alarming or tripping function
- PT100 - used for alarming or tripping function

Note: Both the PTC and PT100 require connection to an external control unit.

Warning!

When PT100s are used for bearing temperature monitoring, the alarming and tripping values are independent of those of the winding class.

Aux terminal Connection

If the motors are configured with the options A11, A12, A60, A61, A72 or K45, the auxiliary terminal connection is shown in Table 2.

Table 2

A11		A12			A60			A61						A72		K45													
PTC		PTC		PTC		U		V		W		U		V		W		Thermometers for rolling-contact bearings		Heater									
C1	C2	C1	C2	C3	C4	T1	T2	T3	T4	T5	T6	T1	T2	T7	T8	T3	T4	T9	T10	T5	T6	T11	T12	T13	T14	T15	T16	P1	P2

Motors which are exposed to a wide temperature fluctuation during standstill are susceptible to condensation formation, hence it is strongly recommended that a space heater be added.

Warning!

The space heater must never be energised 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 10MΩ.

The critical insulation resistance (Recruit) is calculated by multiplying the rated voltage,

e.g. 0.69kV_{ac}, with the constant factor (0.5MΩ/kV):

$$\text{Recruit} = 0.69\text{kV} * 0.5\text{M}\Omega / \text{kV} = 0.345\text{M}\Omega$$

Measurement

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

Corrective measures

If the minimum insulation resistance is measured at less than 10MΩ

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 drive used (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 give to the mechanical components and transmission coupling.

Please refer to IEC 60034-1 for further details.

4.0 MAINTAINANCE

Safety precautions!



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
- Earthing and short-circuit
- 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.

Note: If the motor is equipped with an anti condensation drain plug(s), service is required at regular intervals. This interval is determined by operating environments such as temperature and humidity levels as well as mounting and operation cycles. See section 4.6 for drain plug location.

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.

Note: Extended storage periods, excessive vibrations and high humidity levels will reduce the useful life of the DE & NDE bearing and bearing grease. For sealed or regreasable bearing, it is recommended that permanently lubricated bearings should be replaced after 24 months of storage. 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 (K40 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

Motors from FS80 to FS160 are greased for life due to the fact sealed bearings is used.

Motors from FS180 to FS355 when operated as per the rated data on the nameplate and equipped with a regreasing nipple (K40 option) the recommended regreasing intervals is as per Table 3.

Table 3

Number of Poles	Frame Size	Operation Duration	Sealed	Regreasable
2	FS80-FS280	20,000hrs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4,6	FS80-FS280	40,000hrs	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	FS315	3,000hrs		<input checked="" type="checkbox"/>
4,6	FS315	5,000hrs		<input checked="" type="checkbox"/>
2	FS355	2,000hrs		<input checked="" type="checkbox"/>
4,6	FS355	4,000hrs		<input checked="" type="checkbox"/>

- Regreasing of 2, 4, 6 poles motors from FS180 ~ FS280** is only possible when the K40 option is selected.

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 Regreasing procedure

Warning! All local safety regulations must be considered when regreasing 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 regreasing cycles.

Note: The regreasing nipple (Zinc coated) should be cleaned of old grease and dust prior to attaching the regreasing device.

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

If it is not possible to regrease the motor during operation, then it recommended that a partial amount of the grease is injected and then the motor energised 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 regreased as necessary.

Note: Bearing grease will appear dark in colour 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	80 ~112	132 ~ 160	180 ~ 250	280 ~ 355
Bearing inner dia (mm)	20 ~ 30	35 ~ 50	55 ~ 80	85 ~120
Wear clearance (mm)	0.1	0.15	0.2	0.3

Note: 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.

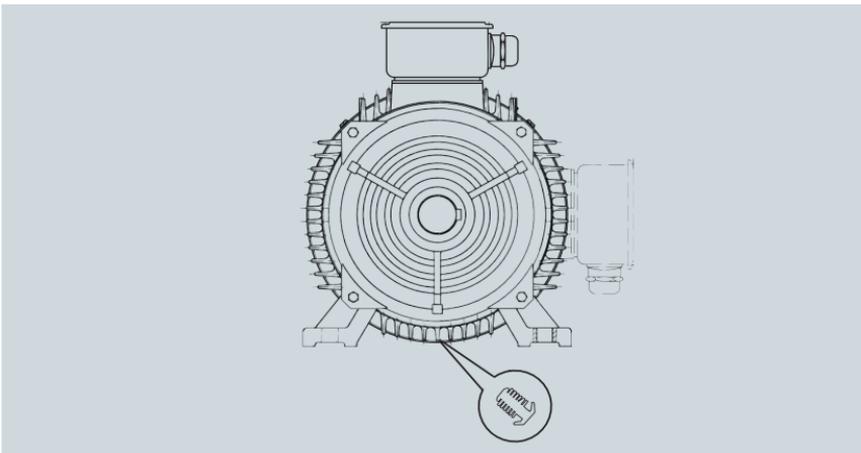
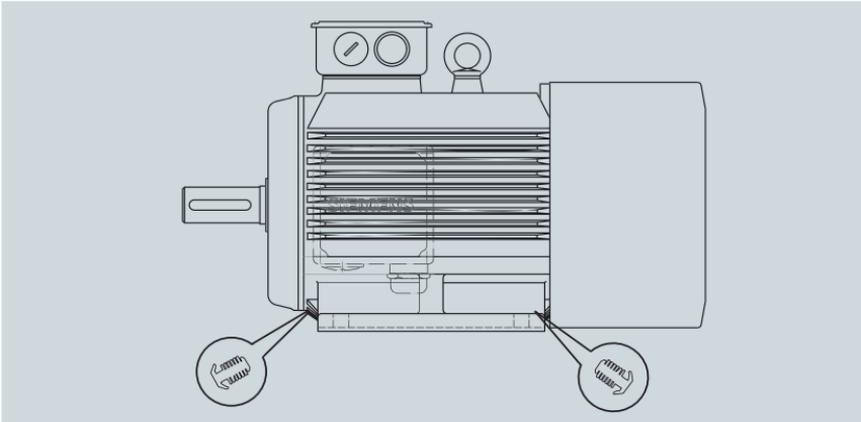


Size	M4	M5	M6	M8	M10	M12	M16	M20
Torque (Nm)	2	3.5	6	16	28	46	110	225

Note: Tightening Torque (Nm, Tolerance: $\pm 10\%$)

4.6 Condensation drain plug

On B3 construction types, the drain holes are located on the frame of the motor. Motors with drain holes are delivered from the factory with pre-installed plastic plugs.



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.

6.0 SPARE PARTS

- 1) IMB3 DE End Shield
- 2) IMB5 DE End Flange
- 3) Fan Cowling for all frame sizes
- 4) Bi-directional cooling fan for all frame sizes
- 5) Complete terminal box with out terminal board

Spare part inquiry

When enquiring about spares, it is necessary to provide the following information such as construction type, mounting arrangement, motor serial number and MLFB No. (when available)

Note: Minimum ordering quantities and values may apply. **(Please inquire)**

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