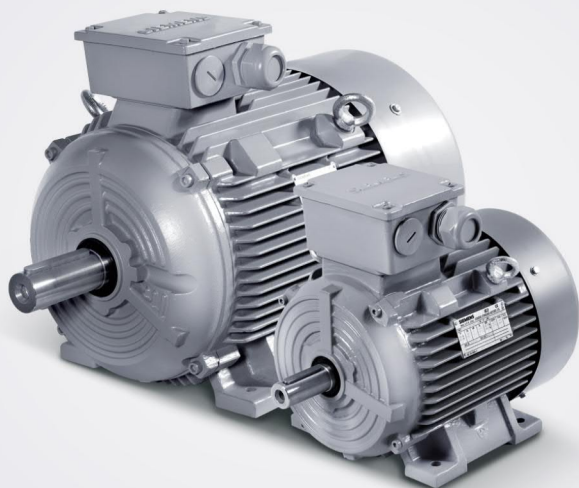


Installation and Maintenance Manual



1LE0 Export Low-voltage Motors

2020.09

Answers for industry.

SIEMENS



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1.0 INTRODUCTION

1.1 Application scope

Prescribed use of 1LE0 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 Altitudes≤1000m ASL
- Ambient temperature+40 °C
- Operating temperature range-20 °C ~ +40 °C
- Relative Humidity

Ambient temperature	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 with Siemens.

1LE0 series motors comply with IEC 60034-30 《Efficiency classes of single-speed, three-phase, cage-induction motors (IE-CODE)》. IE code of the motors and the value of energy efficiency are shown on rating plate.

1.2 Motor construction and types

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

1LE0 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: 1) The frame size of aluminum housing motor is FS80 ~ 160.

2) Other special construction and installation types, please consult Siemens.

2.0 HANDLING AND STORAGE

When lifting the motors, always use all 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 cowl. 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 checked if storage has 1 year and 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 anti-corrosive agent to prevent rusting. However these surfaces should be retreated during storage as deemed necessary. It is recommended to rotate motor's shaft regularly to ensure grease distribution, and to prevent static impression on bearing rings.

3.0 INSTALLATION AND 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

A fine foundation and exact installation is regarded as a basic requirement for coming long-time reliable working. Inappropriate foundation or installation may cause abnormal motor vibration and noise.

3.1.1 Foundation requirement

The foundation of installation can be a metal base or a platform of concrete structure, whatever structure the foundation has, the foundation must have enough strength and rigidity in order to support motors.

The design of foundation can refer to DIN 4024.

The supporting surface of the foundation must be flat, flatness of the supporting surfaces for conventional motors:

Frame size(FS)	Flatness (mm)
≤132	0.10
160	0.15
≥180	0.20

3.1.2 Installation requirement


Because of the manufacture tolerance and cumulate errors existing in mechanical parts, clearance may exist between the motor feet plane and the foundation support surface.

When install motors, the clearance size must be measured carefully by feeler gauge. For clearance which >0.05mm, shim with proper thickness should be inserted. The size of shim is according to the actual value of clearance.



Insert a shim with proper thickness

- 3.1.3 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.
- 3.1.4 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.
- 3.1.5 Ensure cooling

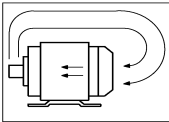
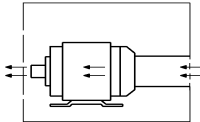
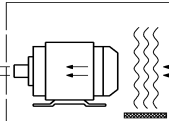
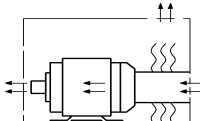
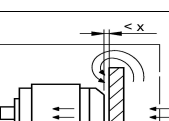
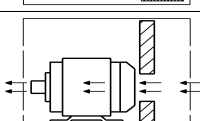
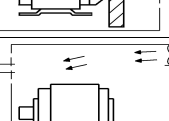
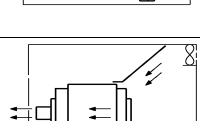
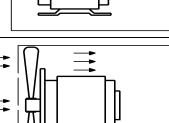
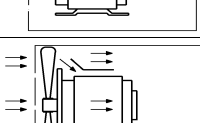


Warning

Death, severe injury or material damage can occur if you do not carefully observe the following points.

- Do not obstruct ventilation.
- Prevent the air expelled by neighboring equipment from being immediately sucked in again.
- For machines with a vertical type construction with air entry from above, prevent the ingress of foreign bodies and water in the air entry openings.
- If the shaft extension is facing upwards, liquid must be prevented from entering by moving along the shaft.

For motors equipped with separately driven fan, please make design to ensure the motor cannot be started when the fan is not running.

Wrong	Correct
	
	
	
	
	

The minimum distance between motor fan cover and adjacent object "X" is shown below:

Frame size	X mm
80 ... 100	20
112	25
132	30
160	40
180 ... 200	90
225 ... 250	100
280 ... 315	110
355	140

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 1LE0 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 fixed or removed from the motor shaft prior to starting if no transmission is coupled.

3.4 Electrical connection



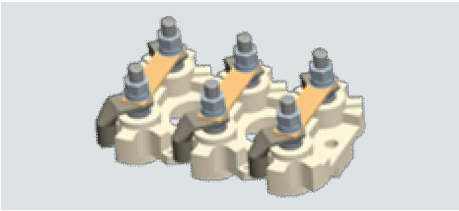
All work must be carried out by skilled worker. Before starting any work, be sure to isolate the machine from the main and auxiliary power supply as applicable. Mains must be secured against accidental switch on.

There are six power terminals and one earthing terminal located in the terminal box .
For 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 $\pm 5\%$ VAC and $\pm 2\%$ Hz respectively of the rated voltage and frequency values are acceptable for proper operation.

Examples



External Earthing



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



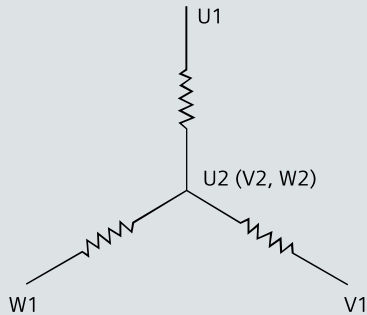
Table 1

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

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

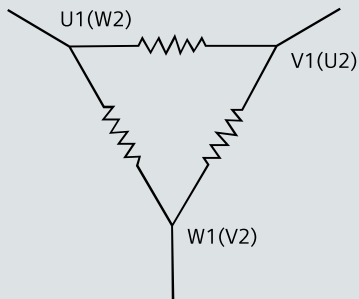
Star connection

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.



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)

1LE0 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
- PT1000 - used for motor temperature detection with temperature sensor

Notice!

The PTC, PT100 and PT1000 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's.

Auxiliary terminal Connection

If the motors are configured with winding protection PTC, PT100, PT1000 and space heating, the auxiliary terminal connection is shown in Table 2.

Table 2

PTC		2PTC		PT100				2PT100								PT1000		Option code Q5A		Q02	
2TP1	2TP2	2PT1	2PT2	1PT1	1PT2	1R1	1R2	2R1	2R2	3R1	3R2	U		V		W		Temperature sensor	2 PT100 resistance thermometer for bearing		Heater
												U1	U2	V1	V2	W1	W2		DE	NDE	

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 M Ω .

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

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

Measurement

The minimum insulation resistance between the windings and ground measurement is taken at 500 V DC and at a winding temperature of 25 °C \pm 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 Temperature Inspection

Temperature is an important reference index of motor running, the important parts for motor real-time temperature, the operation state, effective prevention of master motor fault, to ensure reliable operation is very important.

The motor temperature is influenced by cooling medium and environmental temperature.

Measurement of motor winding temperature rise, usually embedded temperature measuring device (such as PT100), temperature measuring element through the lead wire connection control system, the motor temperature, or using the high precision of resistance method is founded. For measuring surface temperature of motor, should use special instruments such as infrared thermometer to measure, measure position generally in the middle position of the motor or eyebolt position.



Warning

when Motor is running, the surface temperature will gradually rise,
Please do not directly touch by hand, in order to avoid scald.

3.7 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.

For VSD application, in order to prevent bearing damaged by current through shaft, it is recommended to use insulation bearing (option code L27).

4.0 MAINTENANCE



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.

- Notice!**
- 1) Every 10K above 40°C will reduce grease lifetime by half.
 - 2) Extended storage periods, excessive vibrations and high humidity levels will reduce the useful life of the DE & NDE bearing and bearing grease.
 - 3) For sealed or regreasable bearing, it is recommended that permanently lubricated bearings should be replaced after 24 months of storage.
 - 4) 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.



Note
Different brands and types of grease must not be mixed.

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. For the waste grease should be properly handled to prevent environmental pollution.

Notice! In order to avoid too much grease in bearing, old grease plug must be removed before adding grease. After adding, please let the motor run a while, check to verify no more grease is coming out, then put back the plug.

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.

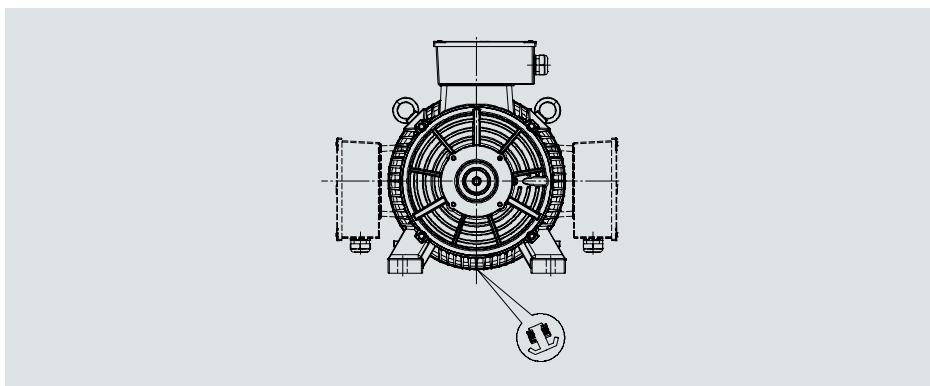
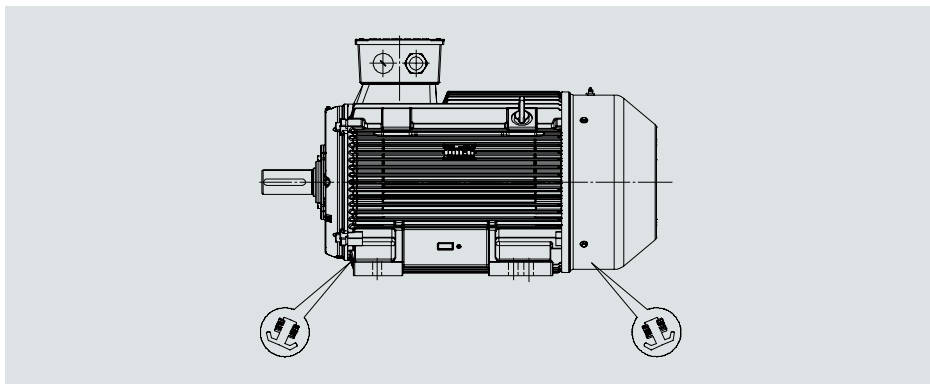


Size	M4	M5	M6	M8	M10	M12	M16	M20
Torque (Nm)	2	3.5	6	16	28	46	110	225

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

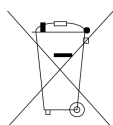
After power is applied to the motor, be sure to check motor for correct direction of rotation, air flow, current draw and any signs of excessive vibrations and noise levels.

6.0 DISPOSAL

Protecting the environment and preserving its resources are corporate goals of the highest priority for us. Our worldwide environmental management system to ISO 14001 ensures compliance with legislation and sets high standards in this regard. Environmentally friendly design, technical safety and health protection are always firm goals even at the product development stage.

Recommendations for the environmentally friendly disposal of the machine and its components are given in the following section. Be sure to comply with local disposal regulations.

Country - specific legislation



The machine uses materials that can be recovered or recycled. Correctly separating materials helps to simply recycle important materials.

- When disposing of the machine or of waste that is created during the individual phases of its life cycle, please observe the statutory requirements applicable in the country of use.
- Please contact your local authorities for more information about disposal.

6.1 RoHS - restricting the use of certain hazardous substances

In compliance with RoHS ("Restriction of certain Hazardous Substances") we replace substances that are damaging to the environment by those that are not based on state-of-the-art technology. In doing so, safety in operation and handling will take priority at all times.

6.2 Information according to Article 33 of the REACH regulation

This product contains one or several subproducts in which the following substance – belonging to the "list of candidates" – exists in a concentration exceeding 0.1 percent by weight.

- CAS No. 7439-92-1, lead

Based on the currently available information, we assume that this substance does not represent any risk when correctly used, including its disposal.

6.3 Preparing for disassembly

Disassembly of the machine must be carried out and/or supervised by qualified personnel with appropriate expert knowledge.

1. Contact a certified waste disposal organization in your vicinity. Clarify what is expected in terms of the quality of dismantling the machine and provision of the components.
2. Follow the five safety rules .
3. Disconnect all electrical connections and remove all cables.
4. Remove all liquids such as oil and cooling liquids. Collect the liquids separately and dispose of them in a professional manner.
5. Detach the machine fixings.
6. Transport the machine to a suitable location for disassembly.

6.4 Dismantling the machine

Dismantle the machine using the general procedures commonly used in mechanical engineering.



Warning

Machine parts can fall

The machine is made up of heavy parts. These parts are liable to fall during dismantling. This can result in death, serious injury or material damage.

- Before you release any machine parts, secure them so that they cannot fall.
-

6.5 Disposal of components

Components

The machines consist mainly of steel and various proportions of copper and aluminum. Metals are generally considered to be unlimitedly recyclable.

Sort the components for recycling according to whether they are:

- Iron and steel
- Aluminum
- Non-ferrous metal, e.g. windings

The winding insulation is incinerated during copper recycling.

- Insulating materials
- Cables and wires
- Electronic waste

Process materials and chemicals

Sort the process materials and chemicals for recycling according to whether they are for example:

- Oil
- Grease
- Cleaning substances and solvents
- Paint residues
- Anti-corrosion agent
- Coolant additives such as inhibitors, antifreeze or biocides

Dispose of the separated components according to local regulations or via a specialist disposal company. The same applies for cloths and cleaning substances which have been used while working on the machine.

Packaging material

- If necessary, contact a suitable specialist disposal company.
- Wooden packaging for sea transport consists of impregnated wood. Observe the local regulations.
- The foil used for water-proof packaging is an aluminum composite foil. It can be recycled thermally. Dirty foil must be disposed of via waste incineration.

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