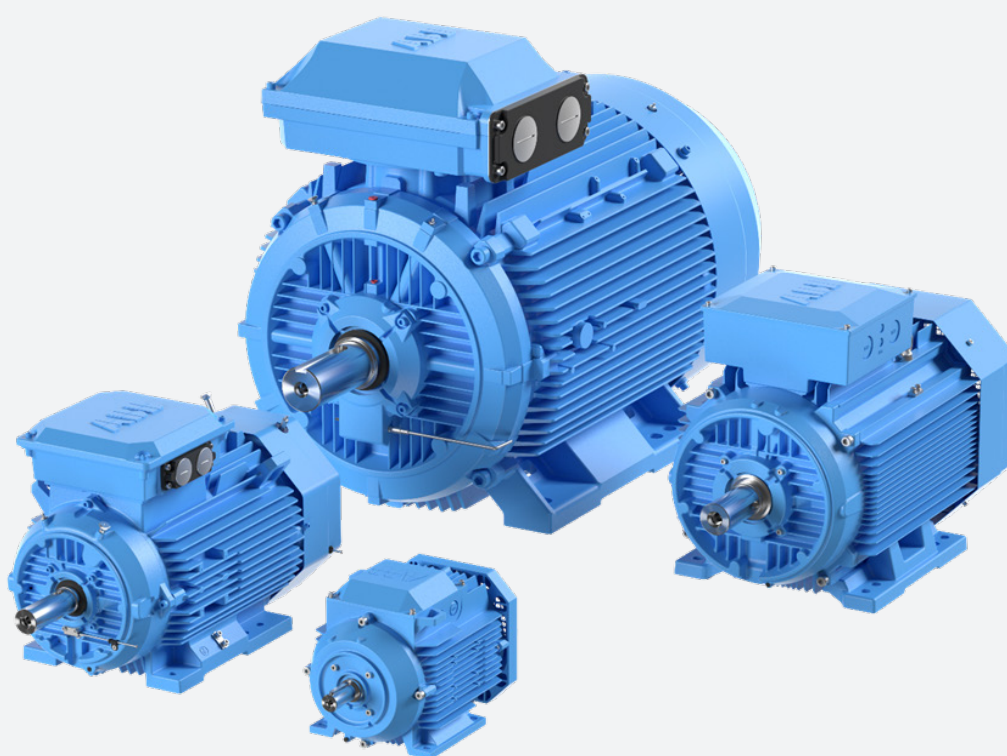


INSTRUCTION

End-of-life instructions for Low voltage motors





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1. Introduction

1.1. General

This instruction covers all different electric motors manufactured by ABB, both synchronous and induction motors. The purpose of this document is to describe general guidelines for the disposal of the motors for ABB customers and for professional recyclers. There are some specific instructions for how to dismantle and dispose permanent magnet motors, which will also be explained in this document.

Actions shown in this manual are only to be performed by professionals.

The actual appearance of the motor may vary from the illustrations in this manual, depending on the final design.

Abbreviations and nomenclature used in this manual:

WARNING: signal word used to indicate a potentially hazardous situation which, if not avoided, can result in death or serious injury.

Symbols used in this manual:



Safety Alert Symbol, warns of a potential personal injury hazard.



Prohibition, No access for people with active implanted cardiac devices (pace maker).

1.2. Intended application

ABB offers Low voltage motors to all industry segments and applications in global supply. Ranging from process performance motors, motors for explosive atmospheres and products which are more industry and application specific such as brake motors.

Due to the nature of their electrical and mechanical operating conditions, improper installation, or operation, as well as insufficient maintenance, could introduce hazards which could lead to severe bodily injuries or damages to property.

These instructions only consider those measures which must be observed when the motor is being operated in its operative range and in its intended application. The applicable national, local and plant regulations must also be taken into consideration.

1.3. Information on electromagnetic compatibility

The user must take precautions during installation and operation in order not to impair the electromagnetic compatibility. If it is necessary to replace any anti-interference components, filters or screened cables, the new parts must be identical to the originals.

1.4. Required qualifications for personnel handling motors

Installation, operation, maintenance, and repair work may only be carried out by professionals properly trained for this work. These persons must be well informed about the motor, that is, they must have completely read and fully understand the relevant chapters of the operating instruction.

1.5. Safety

Modification, alteration, or lack of maintenance procedures as described in the service manual may adversely affect the safety and efficiency of this device. The manufacturer is not responsible for malfunctions that comprise safety as a result of alteration, use of non-ABB replacements parts, neglect or misuse.

Should pre-owned ABB equipment be purchased and reconditioned, the equipment should not be used until testing and analysis demonstrate that the equipment meets the original or upgraded specifications.

The use of solvents as cleaning agents and the use of lubricants can involve health and/or safety hazards. The recommended precautions and procedures stated by the manufacturers should be followed.

Non-authorized modifications as well as the use of tools, components and auxiliary components not corresponding to the installation or maintenance instructions exclude any liability of the motor manufacturer.

The motor has rotating parts and parts which may be spinning even at rest, and possibly hot surface.

1.6. Guidance

The motor is not designed, sold, or intended to be used outside of the motor specifications or limitations.

If technical modifications are considered, they shall always be approved by ABB and be carried out by professionals.

2. Waste disposal and recycling

This clause or part of the instruction concerns the disposal and recycling of electric Motors. The motors are designed in such a way that it is easy to separate different components and types of material from each other, making it easier to recycle.

NOTE: The methods are described in a very general way.

2.1. Dismantling the motor



Warning – Heavy Components
Risk of personal injury when dismantling the motor. Only professionals should carry out dismantling.

The possible use of recycled materials is very much dependent on how degraded by alloys it is. To get as pure materials as possible at the recycling stage, the motor has to be dismantled. The objective of the dismantling is to, as far as possible, get pieces of only one material. If two materials cannot be dismantled from each other they have to be fragmented to be recycled. This means that the mixed material is cut into small pieces. Thereafter it is separated by magnetic methods. There are strong economic incentives for dismantling the motor before recycling the material, since the economic value of the material increases with its purity. When the motor has been dismantled into its different components, the different components must be separated and grouped together depending on material types.

2.1.1. Dismantling of Permanent magnet motors



Warning – risk of explosion
Risk of personal injury when dismantling the motor. Only professionals should carry out dismantling.



Prohibition, no access for people with active implanted cardiac devices (pace maker).

Permanent magnets (PM) motors contain a rotor that is permanently magnetized by internal magnets. It is generally very difficult to remove the rotor due to high magnetic forces between the rotor and stator. This goes especially for larger motors. In general, removing of rotor is possible using mechanical assistance, but it involves a high safety risk and is not recommended. The base magnetized rotor tends also to pull metallic objects with high force which is another safety issue. In case there is a need to dismantle a PM motor, the entire motors should first be heat treated in an oven with minimum 300 C temperature for several hours. This will demagnetize the magnets after which the dismantling process can continue the normal way. As most of the organic components (glue, resin etc.) will vaporize at the mentioned temperature, special care must be taken to ventilation. Unventilated vapor can form an explosive mixture together with air.

2.2. Exploded view of a Low Voltage Motor

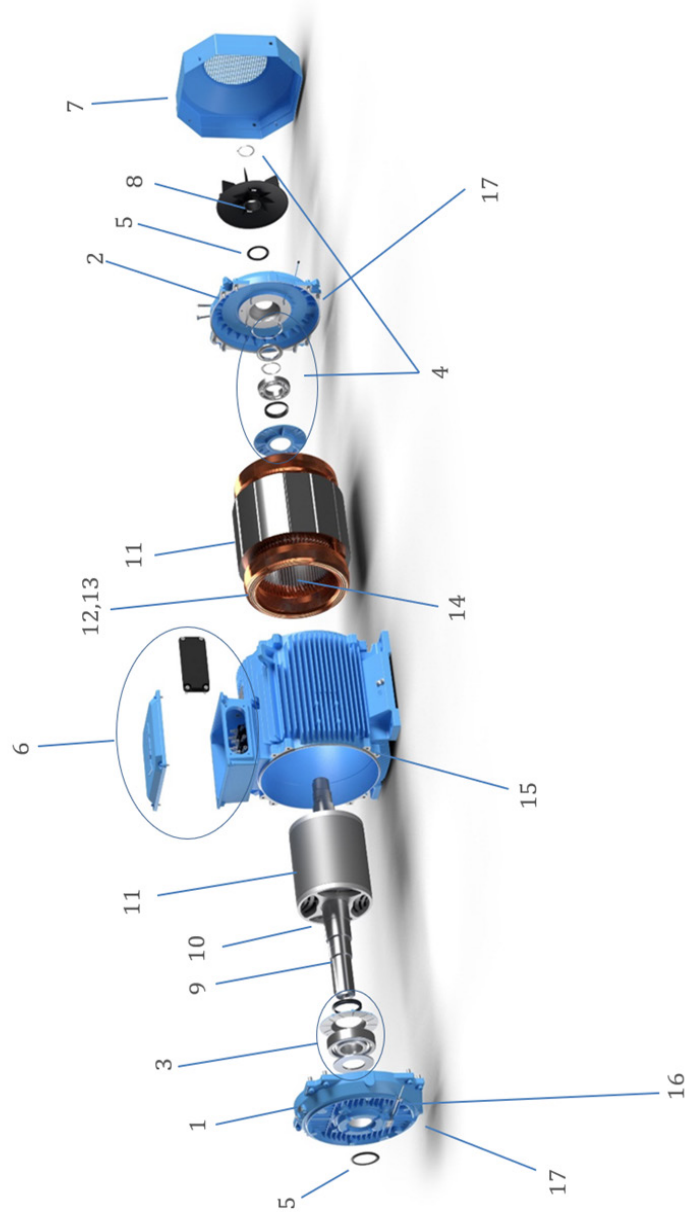


Figure 1. Figure 1. Exploded view of an LV motor. Numbers showing where the different components are positioned, more info can be seen in Table 1.

2.3. Component description

Position	Description	Material	Comment
1,2	End-shields	Cast iron, aluminum, steel	Recyclable
3,4	Bearings Bearing covers Labyrinth discs V-rings ³⁾ Wave springs Retaining rings	Steel, steel/rubber Cast iron, steel Cast iron, steel Rubber Steel Steel	Recyclable Recyclable Recyclable Landfill/energy recovery Recyclable Recyclable
5	Shaft seals	Cast iron Steel/rubber	Recyclable Landfill/energy recovery
6	Terminal box Terminal box cover Cover gasket Cable gland flange Terminal blocks, terminal fasteners Terminal fittings, plugs Intermediate flange (non-Ex) Intermediate flange/ cable bushing (Ex)	Cast iron, aluminum, steel Cast iron, aluminum, steel Rubber Cast iron, steel, stainless steel Plastic, brass, steel Brass, stainless steel, Plastic Steel/cast iron Steel, cast iron, resin	Recyclable Recyclable Landfill/energy recovery Recyclable Landfill/energy recovery Recyclable Recyclable Landfill/energy recovery Recyclable Recyclable, landfill
7	Fan cover	Steel, stainless steel, plastic	Recyclable Landfill/energy recovery
8	Fan	Plastic Aluminum, steel, stainless steel	Landfill/energy recovery Recyclable
9	Shaft, key	Steel, stainless steel	Recyclable
10	Rotor end plates	Steel, cast iron	Recyclable
11	Rotor core* *(see Table 2 for permanent magnet motors)	Electrical steel Aluminum (Not in SynRM or Permanent Magnet motors)	Recyclable Recyclable
12	Stator core	Electrical steel	Recyclable
13	Windings Cables	Copper, Copper & plastic/silicone rubber, resin	Recyclable, landfill Recyclable
14	Slot insulation	Polyimide film	Landfill/energy recovery
15	Stator housing	Cast iron/aluminum	Recyclable
16	Grease outlets	Stainless steel, steel, Rubber	Recyclable, Landfill/energy recovery
17	Drainage plugs	Plastic Stainless steel	Landfill/energy recovery Recyclable
18	Fasteners, vibration measurement & grease nipples	Steel, stainless steel	Recyclable

Table 1. Description of components of the motor, the position in the Figure 1 and their respective material composition. The last comment column displays how the material should be managed at the end of life.

2.3.1. Permanent magnet motors

Permanent magnet motors differ from the standard low voltage motor when it comes to the rotor. An exploded view of that is provided below, see Figure 2.

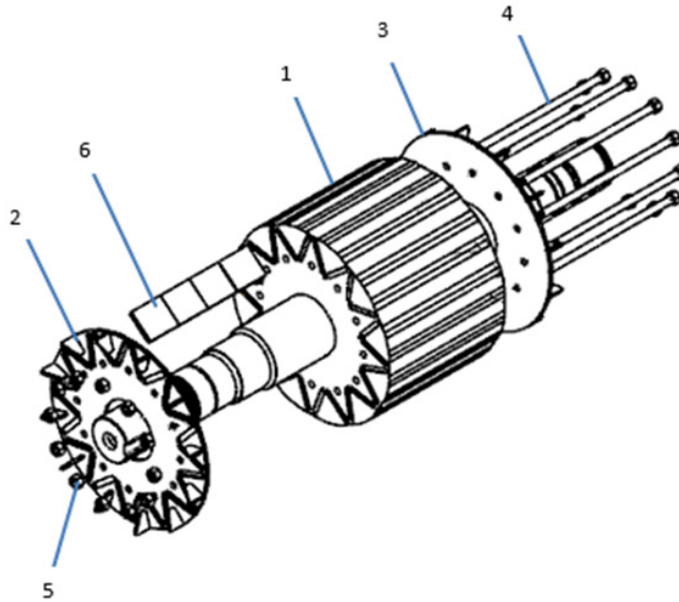


Figure 2. Exploded view of a permanent magnet rotor. Numbers showing where the different components are positioned. More detailed info in Table 2.

The arrows in the figure refers to different components, this can be seen in Table 2.

Position	Description	Material	Comment
1	Rotor lamination	Electrical steel	Recyclable
2	D-end endplate	Stainless steel	Recyclable
3	N-end endplate	Stainless steel	Recyclable
4	Stud bolts	Stainless steel	Recyclable
5	Stud bolt nuts	Stainless steel	Recyclable
6	Permanent magnets	Samarium cobalt or neodymium	Recyclable

Table 2. Description of components in the permanent magnet rotor, the position in Figure 2 and their respective material composition. The last comment column displays how the material should be managed at the end of life.

2.4. Material handling description

The components are separated into groups as follows:

Electrical steel

First, the stator must be separated from the housing. The motor should be heat treated in an oven or by using gas torches. If the housing is made of aluminium, it is most easily sawed. If the housing is made of cast iron, it is easier to process the stator out. The stator coil runs through the slots of the stator core. Due to an impregnation resin the coils are very rigid. To separate the coils from the steel core, first remove one end of the winding. This might be done using a pneumatic saw or by using other cutting tools. The rest of the winding can be slid out of the steel core with some force. It is not recommended that the complete stator is sent for fragmentation, as the value of the components in this case will be very low.

Copper

This might be the most important material to separate. Copper is a material of limited access in nature. It has a high value and needs a lot of energy to be produced. Copper is integrated in the actual components and need some effort to be separated. There exist some special tools for making this separation simpler but normally wedges, large hammers, gas burners and some force can do this.

The major copper material is in the stator coils which run through the slots of the stator core. Follow the instructions above under Electrical steel, to separate the coils from the steel core.

Permanent magnet material

Permanent magnet material can be recycled, and it has a substantial value. In case there is a need to recover the PM material from the motor, the motor should first be heat treated using an oven as described in chapter 2.1.1. After the heat treatment, the magnets (see (6) in Figure 2), are demagnetized and the glue holding them has lost its adhesion. Then, the magnets can be pushed out from the rotor slots. Unmagnetized magnets can be shipped to ABB who can take care of the recycling of the magnetic material.

Components made of normal steel are 100% recyclable and may have an important value as metallic scrap, if it is not mixed with other metals or landfill waste.

Steel

Components made of normal steel are 100% recyclable and may have an important value as metallic scrap if it is not mixed with other metals or landfill waste.

Aluminium

For environmental reasons, aluminium is very important to separate, as new aluminium needs a large amount of energy to be manufactured.

Cast iron and iron alloy

The components of cast iron or iron alloys are disassembled by undoing bolts, and then recycled.

Resin, Plastic and Rubber

The resin on the winding ends should be disposed according to the European Waste Catalog (EWC) codes 080112 or 080410. It should not be mixed with other general/land fill waste.

Rubber and plastic waste should either go to landfill or be used for energy recovery.

Polyimide film

This is not considered to be hazardous waste. It may go to landfill or to be used for energy recovery. The power plants need to be adapted for this kind of fuel and have proper types of filters, etc., to protect the environment from the gases and dust produced.

Hazardous waste

Warning – Grease handling

The grease from the bearings is to be considered as hazardous waste and must be taken care of according to appropriate country specific or local regulations.

Packaging

The product packaging is made of corrugated cardboard or wood, depending on the size of the motor. These materials can be recycled. Straps around the packaging is made of metal and can also be recycled.

To avoid pollution caused by unnecessary transportation, the factory does not take back used packages.



For more information and contact details:

www.abb.com/motors&generators