

# SERVO MOTORS

BRUSHLESS SERVO MOTORS  
ATEX ZONE 2-22



OPERATING INSTRUCTIONS



3014/23 EN

Read these Operating Instructions before performing any transportation, installation, commissioning, maintenance or repair activities on the industrial motors and generators.

The instructions contained in this manual cannot provide all the detailed information on the possible construction variations, nor every possible case regarding assembly, operation and maintenance.

The symbols provided below will draw attention to the safety measures and supplementary instructions contained in these Operating Instructions.

SPECIAL SAFETY AND WARRANTY INSTRUCTIONS:



DANGER:



NOTE ON EXPLOSION PROTECTION



Strictly observe the safety measures and supplementary instructions contained in these Operating Instructions, for the protection of property and people.



Low-voltage electric machines contain dangerous rotating and conductive parts. They may have very hot surfaces. All of the transportation, installation, commissioning, maintenance and repair activities must be carried out by qualified personnel and under the supervision of experts in charge (in conformity with directives VDE 0105; IEC 364). Improper use of the aforementioned machines can cause serious damage to property and people.



To receive further information, contact the manufacturer or an authorised workshop immediately.



All motors and generators must be installed and used exclusively by qualified personnel.

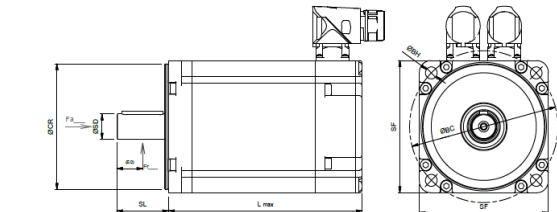
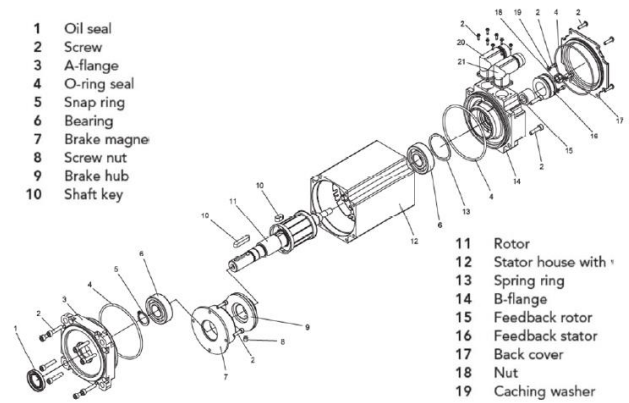
## GENERAL INFORMATION

### SCOPE

These instructions refer to synchronous brushless servomotor made of a three phases stator winding and a permanent magnet rotor protected by an IP65 metal housing according with standards EN 60034.

The functionality is linked to the electronic drive that supplies it controlling stator phase switching. The currents are distributed to windings through power static switches according to the position detected by means of an angular position transducer, such as resolver, encoder or Hall sensor. The feature is constant torque up to rated speed, transmitted by the end-shaft which protrude out of the metal housing.

Here below the motor design and the motor type in function of the mechanical dimensions.



Key		
SF = Flange square	BH = Screws diameter Ø	L = Motor length
CD = Coupling ring Ø	SD = Shaft diameter Ø	FA = Axial load
BC = Centering screws	SL = Shaft length	FB = Radial load

MOTOR TYPE	SF mm	CD Ø	BC mm	SD Ø	SL mm
B20	40	Ø30	46	8	20
B28	58	Ø40	63	9 - 11	20 - 23
B30	60	Ø50	70	14	30
B36	70	Ø60	75	11-14	23 - 30
B40	80	Ø70	90	16	40
B56	91.3	Ø80	100	14 - 19	30 - 40
B63	100 - 116	Ø95	115	19 - 24	40 - 50
B64	116	Ø110	130	24	50
B65	130	Ø110	145	22	55
B71	142	Ø130	165	24 - 32	50 - 58
B90	180	Ø114,3	200	35	60
B100	190	Ø180	215	32 - 38	58 - 60
B132	240	Ø230	265	38 - 42	80 - 110
B160	270	Ø250	300	55 - 60	110 - 140
B16	Ø275	Ø180	Ø215	55/68 Hollow	110

The motors comply with the requirement of industrial installations, in accordance of DIN harmonising standards VDE0530/EN60034. It is compulsory to follow any special instructions regarding their use. Brushless servo motors, with external ventilation, are designed to operate at a maximum altitude of ≤ 1000 m above sea level and at ambient temperature between - 20°C and + 40°C. The motor shall not be exposed to direct sun light.



Observe the information provided on the rating plate. The operating conditions must line up with the data reported on the rating plate.

Brushless servo motors are part of a machine, according to Directive Machines 2006/42/EC. It is forbidden to commission the machine if the final product does not fulfil this standard (EN 60204-1).

## TRANSPORT

Any damage discovered on delivery must be immediately reported to the delivery company. Do not commission the machine.

## LIFTING EYEBOLTS



Lift the motors exclusively by the relative lifting eyebolts provided for this purpose. Do not add loads to the motor.

The lifting eyebolts are designed to support only the weight of the motor. Should it be necessary, use appropriate jacks, slings and lifting beams?

## INSTALLATION AND COMMISSIONING

	NOTE ON EXPLOSION PROTECTION
	The installation shall comply with standard 60079-14 for setting electrical machinery

### MECHANICAL PARTS

#### TRANSMISSION ELEMENTS



Use elastic couplings only. Rigid couplings require a special bearing design.

The use of transmission elements that cause radial or axial shaft loads during operation (pulleys, gearwheels, etc.), requires checking compatibility with admissible motor loads. Relevant data is contained in the respective technical catalogue.

Rotors are dynamically balanced with half key, in conformity with standard DIN ISO 8821.

When the motor is balanced with a half key (H), the coupling has also to be balanced in the same way. Remove the overhanging visible part of the key.

Remove anti-corrosion paint using specific solvent and grease the shaft extension. Only use suitable tools to mount or pull off pulleys or couplings, as illustrated in figure 1 (warm up if necessary), and use a protective cover against any accidental contact. Avoid inadmissible tension of the belts (technical catalogue). It is necessary to use the intermediate disc to protect centring on the shaft end.

If necessary, completely balance the motor with the pinion according to standard ISO1940.

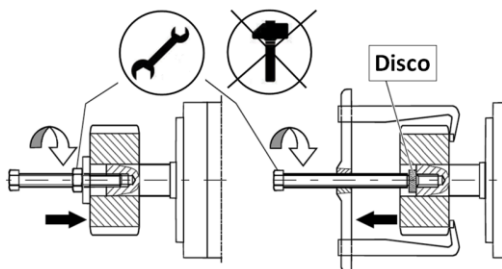


Fig. 1 removing the pinion

The bearings must strictly not be subject to pressure or impact.

#### COUPLINGS

Transmission of the machine's rotating motion can be carried out through direct coupling or through belts and gears.



Make sure the selected transmission gears are able to transmit the maximum torque delivered by the motor and support the pre-selected maximum operating speed. Sizing the pinion must be done with an ample safety margin in mind.

	NOTE ON EXPLOSION PROTECTION
	<ul style="list-style-type: none"><li>When the installation is finished, IP test shall be done. Closing the connector, use 1.8 Nm of tightening torque.</li><li>Optional. They are available on request thread holes in the motor housing, closed with taps. External devices (such as compressed air connectors) can be fixed on these holes. The external devices must have M5 screw according to ISO965-1, 6g tolerance, sealing suitable for IP65 and thermal rating <math>\geq 130</math> °C.</li><li>Cables connected to the motor to complete the power/signal connection must have a thermal rating <math>\geq 80</math> °C.</li></ul>

#### COUPLING WITH BELTS

Install the motor with the shaft perfectly parallel and aligned with the pulley, to avoid axial thrusting on the supports.

The belt tension must be suitable to avoid sideways shifting during full motor operation, while it must strictly not exceed the maximum applicable load, stated in the technical catalogue. Excessive belt tension can cause the bearings to wear quickly, and even break the shaft.

Consult the belt supplier's catalogue for peripheral belt speeds, transmitted powers, ratios between pulley diameters etc. Always use balanced pulleys.

	NOTE ON EXPLOSION PROTECTION
	If using belt pulleys/toothed belt pulleys use only belts that cannot cause electrostatic charge.

#### PRESS-FITTING TRANSMISSION GEARS

Couplings, pinions etc. must always be pressed on according to standard and using appropriate tools. It is strictly forbidden to use hammers, to avoid damaging bearings and any accessories. Prior to pressing on the transmission gear, use alcohol or specific solvent to remove any rust-proof paint from the motor shaft and key (it is important to avoid the solvent from leaking into the bearings).

Do not use emery cloth, scrapers or other to remove the paint. Grease the end of the shaft and key before fitting the drive gear on and performing assembly according to the manufacturer's instructions.

#### CLAMPING AND POSITIONING

Make sure the flange is attached correctly and that it adheres correctly to the entire surface that it is fitted onto. Also check for correct alignment in case of direct coupling.

Avoid resonance of the supporting base with rotation frequency. Turn the rotor manually to ensure there are no anomalous noises. (see "Vibrations during operation").

#### ALIGNMENT

If the motor is connected to the machine by a coupling, both axes must be axially and radially aligned. Make sure the comparators are securely fitted on. The measurements must be taken in four points, 90° from each-other, turning both coupled parts simultaneously.

#### AXIAL OSCILLATION (FIG. 2)

The permanent margin for error must not exceed 0.03 mm, in relation to a diameter of 200 mm.

#### RADIAL OSCILLATION (FIG. 3)

The remaining margin for error must not exceed 0.03 mm. The adjustment of the axial distance between the two coupled halves («E» dimension) must be carried out based on the manufacturer's requirement for coupled drive gears.



Once again, make sure the machine is aligned with the operating temperature.

## COMBINED MEASUREMENT OF AXIAL AND RADIAL ALIGNMENT (FIG. 4)

Figure 4 illustrates how to combine the two measurements in a relatively easy way. The comparators are placed a flat iron seats, screwed or locked in, eg. with captive screws.

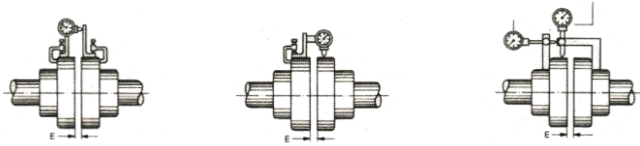


Fig. 2

Fig. 3

Fig. 4

Fig. 2 Axial alignment

Fig. 3 Radial alignment

Fig. 4 Radial and axial alignment

The tolerances provided by the coupling manufacturer's underlines what the coupling can support, therefore, do not use these to assess how accurate the alignment needs to be. When tolerance ranges are too broad, this leads to vibration, causing damage to the bearing and/or machine. It is therefore advisable to achieve the lowest possible offsets.

The machine must be aligned with the utmost caution. Remember to record all measurements, for future checks.

## VIBRATIONS DURING OPERATION

Vibration levels  $V_{eff} \leq 2.3$  mm/s is not problematic for coupled machines. If there are any anomalies in relation to normal operation, such as high temperatures, anomalous noises or vibrations, check the cause and, if necessary, contact the manufacturer.

Bolt size	Tightening torque [Nm]
M10	20
M12	40



Do not disable the safety devices, not even to perform tests. In case of doubt, switch the machine off.

## ELECTRICAL PARTS

### INSULATION RESISTANCE

(See "Check before commissioning")



The drive shall be a sinusoidal three phases Pulse With Modulation device with specified characteristics in the motor nameplate: bus voltage, switching frequency, impulse voltage amplitude according to IEC 60034-25 and IEC 60034-18-41.

NOTE ON EXPLOSION PROTECTION	
	Additional drive characteristics shall:
	<ul style="list-style-type: none"> <li>correctly manage the thermal protector</li> <li>limit the common mode current</li> <li>limit the current ripple due to PWM</li> <li>limit electrical noise and vibrations by a fine tuning of the parameters</li> </ul>

## CONNECTION DIAGRAMS: POWER AND SIGNAL

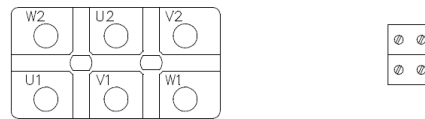
Below are the standard types of electrical power and signal connections.

## POWER CONNECTION BY CONNECTOR

Pin Size 1.5	Pin Size 1	Signal	Colour
U	1	Phase U	Black
V	3	Phase V	Blue
W	4	Phase W	Red
⊕	2⊕	Motor Case	Yellow-Green
1	A	N.c.	N.c.
2	B	N.c.	N.c.
+	C	+24V Brake (Option)	Red
-	D	0V Brake (Option)	Blue or Black

## POWER CONNECTION BY TERMINAL BLOCK

MORSETTIERA POTENZA - POWER TERMINAL BOARD "BIG SIZE" and BRAKE BOARD



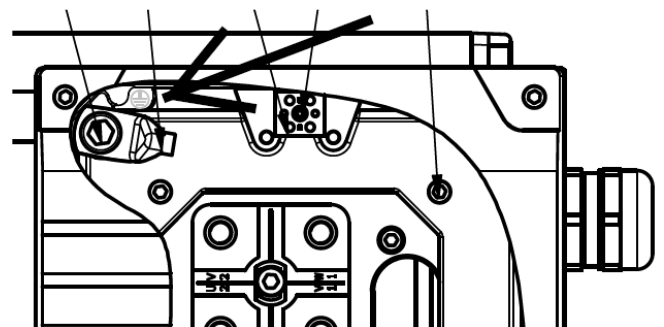
TERMINAL	SIGNAL	COLOUR	
U1	Fase U / Phase U	Nero / Black	+24V - Freno Arancione / Orange or +24V - Brake Rosso / Red
V1	Fase V / Phase V	Blu / Blue	
W1	Fase W / Phase W	Rosso / Red	0V - Freno 0V - Brake Blu / Blue or Nero / Black

Use lugs size in relation to the motor current. Ensure minimum 10 mm distance among lugs of different phases connected to the terminal box.

Tightening torque of the bolt which fix the lug:

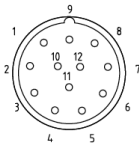
NOTE ON EXPLOSION PROTECTION			
	Use only cable gland originally provided with the motor. Specifications on acceptable cable diameter and tightening torque:		
	Cable gland size	Cable diameter range [mm]	Tightening torque [Nm]
	M40	19 - 28	17
M50	26 - 35	20	

Ground connection is available inside the terminal box, highlighted by "ground connection symbol" (image below as an ex.)



## RESOLVER CONNECTOR

Signal connector



Pin	Signal	Colour
1	S2	Yellow
2	S1	Red
3	S3	Black
4	N.c.	N.c.
5	N.c.	N.c.
6	S4	Blue
7	R1	Red-White
8	N.c.	N.c.
9	PTO	White
10	PTO	White
11	R2	Yellow-White
12	N.c.	N.c.

## INCREMENTAL ENCODER CONNECTOR

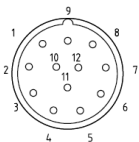
Signal connector



Pin	Signal	Colour
1	HALL V	White
2	HALL V-	White-Black
3	Z	Yellow
4	Z-	Yellow-Black
5	HALL U	Brown
6	HALL U-	Brown-Black
7	B	Blue
8	B-	Blue-Black
9	A	Green
10	A-	Green-Black
11	+5V	Red
12	HALL W	Grey
13	HALL W-	Grey-Black
14	PTO	White
15	PTO	White
16	0V	Black
17	N.c.	N.c.

## HYPERFACE ENCODER CONNECTOR

Signal connector



Pin	Signal	Colour
1	Us (7-12 V)	Red
2	GND	Blue
3	Ref Sin	Brown
4	Ref Cos	Black
5	Data+	Grey
6	Data-	Green
7	+ Sin	White
8	+ Cos	Pink
9	PTO	White
10	PTO	White
11	N.c.	N.c.
12	N.c.	N.c.



Thermal protection can have different pinout in the connector according to customer needs.



### NOTE ON EXPLOSION PROTECTION

- Connector shall have a maximum temperature of 130°C. Wiring shall have a maximum temperature of 80°C.
- The tolerance of the connectors thread is according to DIN 13, class 6g – 6H.
- Do not unplug connectors while they carry voltage or the motor is running.

## THERMAL PROTECTION



### NOTE ON EXPLOSION PROTECTION

- Motor protection is made through appropriate thermal protection. The drive has to handle the input sent by the thermal protection. The input can vary depending the type of those protection. Below a list of thermal protection used. Other thermal protection can be used according to customer needs.
- For full performances characteristic it's recommended a transducer suitable for 120 °C working temperature.

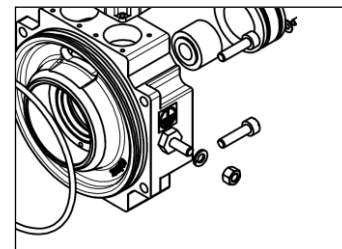
THERMAL PROTECTION	DRIVE HAS TO OPEN WHEN
PTO (Normally Closed)	the temperature is greater than 140°C
Normally Open	the temperature is greater than 140°C
KTY83-110 (PTC)	the resistance is greater than 2150 Ohm
KTY84-130 (PTC)	the resistance is greater than 1216 Ohm
KTY84-150 (PTC)	the resistance is greater than 1191 Ohm
SNM (PTC)	the resistance is greater than 1330 Ohm
KD 335 YGM (PTC)	the resistance is greater than 1330 Ohm
TF101/K (PT100)	the resistance is greater than 153,58 Ohm
B57227 -K333 A1 (NTC)	the ratio between the measured resistance value and the resistance@25°C is less than 0,17251 Ohm
AM-LPTC600 (PTC)	the resistance is greater than 1262 Ohm
AM-LPTC1000 (PTC)	the resistance is greater than 2124 Ohm

## EQUIPOTENTIAL BONDING



### NOTE ON EXPLOSION PROTECTION

- According to EN 60079-14 and 61241-0, it shall be a connection to an equipotential bonding system (see following figure).
- The ground must be fixed in the appropriate pin with size of 4 mm<sup>2</sup> and greater or equal to conductor size.

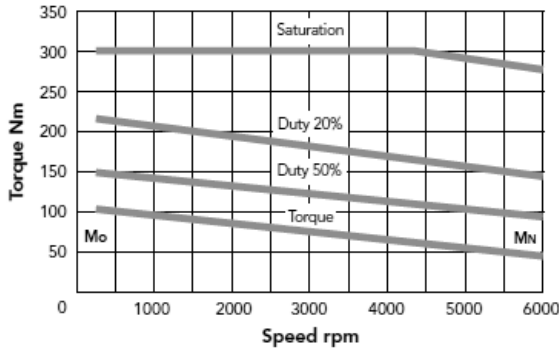


## MOTOR PERFORMANCES



### NOTE ON EXPLOSION PROTECTION

- Motor performances comply with IEC60034-1 once the motor is coupled to a metal flange not insulated and without additional external heating.
- For complex performances cycle, RMS value of the current shall be within the label data.
- The maximum speed shall be never exceed.
- For rotating speed close to 0 [rpm] the RMS current value shall be reduced of 20%
- At rated performances the end-shaft length will protrude of max 0,12% and the housing length will draw back of max 0,3%



With drive characteristics other than specified in the motor nameplate, the motor performances can vary.

### MARKING

Electric motor characteristics are defined in the motor nameplate (image ex.)

<b>LAFERT</b>			
M0= 4.00 Nm	I0= 2.5 A	Nn= 3000 /min	2P= 8
Mn= 3.50 Nm	In= 2.1 A	Vi= 296 V	Feedback: RES.2P
Brake: 24V/0,83A		Coolant: -	
Iso Cl.F THERM. PROTECT		IP65	Sn: 1234567
Type: B6304Q3H7B050000U		Date: 05/23	
Lafert S.p.A., Via E. Majorana 2 - I - 30020 Noventa di Piave (Ve), Italy			

M0:	Stall torque	Feedback:	Transducer type
I0:	Stall current	Coolant:	Coolant type
Mn:	Nominal torque	Brake:	Voltage/Current
In:	Nominal current	Iso CL:	Thermal class
2p:	Pole pairs	Type:	Motor model
IP:	IP protection level	Date:	Production date
nn:	Rated speed	Sn:	Serial number
Vi:	Open circuit voltage at nominal speed		

<b>MARKING</b>	
CE	Mark of conformity to the applicable European directives
	Mark of conformity indicating explosion protection
II	Equipment suitable for above ground areas
GAS	
3G	Equipment suitable for areas with presence of category 3G gasses or vapors
EX ec	Specified type of protection "increased safety"
IIC	Equipment appropriate for gasses and vapor in group IIC
T155°C	Motor temperature class, external and internal.
Gc	Equipment protection level
DUST	
3D	Equipment suitable for areas with presence of category 3D dust
EX tc	Specified type of protection "protection by enclosure"
IIID	Equipment appropriate for gasses and vapor in group IIID
T135°C	Maximum external motor temperature
Dc	Equipment protection level
XYZW xx ATEX yyyy	XYZW: Laboratory that issued the CE certificate. xx: year of the issued certificate. yyyy certificate number

## MAINTENANCE



Before carrying out any work on the motor, disconnect it and secure it against restarting.



**Attention: danger of accidents! Avoid any contact with moving parts!**

## CLEANING

The air passages must be cleaned on a regular basis, depending on the ambient conditions.

NOTE ON EXPLOSION PROTECTION	
	• Clean servomotors in explosion-proof areas regularly. Prevent dust deposits > 5mm.
	• Explosion protection can only be ensured if servomotors and brakes are serviced and maintained correctly.

## BEARING LUBRICATION

All of the motors have 2ZC3 or 2RSC3 bearings with grease suitable for high and low temperatures and permanent lubrication.

## REPAIR INSTRUCTIONS



Any repair work performed during the warranty period is subject to manufacturer approval.

## GENERAL WARNINGS

For motor repairs, it will be necessary to contact the supplier.

## INSTRUCTIONS FOR STORAGE

Prolonged electric motor storage (ex. spare motors) must be carried out the following precautions.

## STORAGE LOCATION

Make sure the motor is stored in a dry and dust-free environment with minimum vibrations ( $V_{eff} \leq 0.2$  mm/s) (damage to the bearings). Ambient temperature: between -10°C and +40°C, relative humidity < 90%.

## ROTOR LOCKING DEVICE

On motors with roller bearings, fix the rotor in place by means of the locking device, to protect the bearings against damage due to vibration.

Motors shipped on vibration dampers should also be stored in this condition.

Where pulleys, half couplings, etc. are already mounted on the shaft extension, fit the locking device or place the motor on vibration dampers, if possible.



Use dampers and locking device also for any future transport of the motor.

## CHECK BEFORE COMMISSIONING

### BEARINGS

Before commissioning a motor that has been stored for more than 4 years, check the bearings.

For motors without regressing device, grease has to be renewed or bearings have to be changed after 2 years at the latest.



Even minor corrosion can considerably shorten the service life of the bearings.

The rotor must be rotated every month by approx. 30 degrees, in order to avoid compression spots on the bearings due to static load.



To turn the rotor on brake motors, turn the power on to unblock its movement. When the rotor has been turned, switch the power back off.

#### INSULATION RESISTANCE



Before commissioning check the insulation resistance. With values  $\leq 1 \text{ kW per Volt}$  rated voltage, dry the winding.

Check the insulation resistance of each phase against earth by means of a hand-driven generator (max. 630 VDC) until the measured value is constant.

The insulation resistance of new windings is above  $10 \text{ M}\Omega$ . The resistance can be lowered considerably by moisture.

If, at room temperature, the resistance is below  $0.5 \text{ M}\Omega$ , the winding must be dried. In this case the winding temperature must not exceed  $80^\circ \text{C}$ .

For drying connect the space heater or another heating device, or apply an AC voltage of 5 or 6% (connect in delta) of the rated motor voltage to terminals U1 and V1. Repeat the measurement. The motor can be put into operation when the resistance is above  $0.5 \text{ M}\Omega$ .

Insulation resistance is temperature-dependent, i.e. if the temperature is increased/decreased by 10K, the resistance value is halved/doubled, respectively.

#### WARNING FOR THE CORRECT DISPOSAL OF THE MOTORS AT THE END OF THEIR LIFETIME



According to the art. 26 of the Italian law 2014, March 14th n. 49  
"Implementation of the DIRECTIVE 2012/19/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2012, on waste electrical and electronic equipment (WEEE)"

The above symbol, applied to the equipment or its packaging, means that at the end of its lifetime the motors need to be disposed separately from the other waste materials.

The users must dispose their unused motors on behalf of the national authorized collection centers which have been approved for the electrical and electronic waste.

The right collection for recycling, treatment and disposal will contribute to avoid any potential negative environmental & healthy effect and will help both the reuse and the recycling of the motor' components/materials.

TABLE OF DISPOSAL CODES FOR ELECTRIC MOTORS

CODE OF THE MOTOR (WASTE) DISPOSED IN ALL ITS PARTS	EWC (European Waste Code)	EWC DESCRIPTION
In the event of disposal of the full motor	16.02.14	Discarded equipment
<b>In the event of disposal of a disassembled motor:</b>		
<u>Aluminium parts:</u> flange, cover, terminal box and frame in aluminium	12.01.03	Non-ferrous metal filings and turnings
<u>Steel parts:</u> rotor with shaft (both die-cast and with magnets), stator pack with wire windings, cast iron flange and cover, terminal box, brake with magnet, friction disc, springs, etc.	12.01.01	Ferrous metal filings and turnings
<u>Plastic parts:</u> fan, fan cover, terminal box, brake cover, shaft protection	12.01.05	Plastics shavings and turnings
<u>Electrical components:</u> switches, capacitors, starters, terminal board, etc.	16.02.16	Components removed from discarded equipment



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