

Installation guide and maintenance



FLSD

*3-phase induction motors
for atmospheres containing
explosive gases and dust*

Part number: 3781 en - 2017.10 / d

LEROY-SOMER™

IMPORTANT

These symbols   appear in this document whenever it is important to take special precautions during installation, operation, maintenance or servicing of the motors.

It is essential that electric motors are installed by experienced, qualified and authorised personnel.

In accordance with the main requirements of EEC Directives, the safety of people, animals and property should be ensured when fitting the motors into machines.

Particular attention must be given to equipotential ground or earthing connections.

The noise level of the machines, measured under standard conditions, conforms to the requirements of the standard and does not exceed the maximum value of 85 dB(A) pressure at 1 metre.



The following preliminary precautions must be taken before working on any stationary device:

- **Mains voltage disconnected and no residual voltage present**
- **Careful examination of the causes of the stoppage (jammed transmission - loss of phase - cut-out due to thermal protection - lack of lubrication, etc)**



Electric motors are industrial products. They must therefore be installed by qualified, experienced and authorised personnel. The safety of people, animals and property must be ensured when fitting the motors into machines (please refer to current standards).

Those persons required to work on electrical installations and equipment in zones where there is a risk of explosion must be specially trained and authorised for this type of equipment.

They must be familiar with not only the electrical risks, but also with those that are due to the chemical properties and physical characteristics of the products used in the installation (gas, vapour, dust), as well as the environment in which the equipment operates. These elements determine the risk of fire and explosion.

In particular, they must be informed and aware of the reasons for the specific safety instructions in order to comply with them. For example:

- Do not open when powered up
- Do not open when powered up in atmospheres that may contain explosive gas or dust
- Do not repair while powered up
- Do not move when on load
- After power-down, wait for 30 minutes before opening
- Replace the seals tightly to ensure watertightness



Before commissioning, ensure compatibility of the information on the motor nameplate with the actual explosive atmosphere and the operating zone.

NOTE:

LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

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 All brands and models have been registered and patents applied for.

Dear Customer,

You have just acquired a LEROY-SOMER **safety motor**.







This motor benefits from the experience of one of the largest manufacturers in the world, using state-of-the-art technology in automation, specially selected materials and rigorous quality control. As a result, the regulatory authorities have awarded our motor factories the ISO 9001 - Edition 2008 international certificate.

We thank you for making this choice, and would ask you to read the contents of this manual.

By observing a few essential rules, you will ensure problem-free operation for many years.

LEROY-SOMER MOTORS

EC DECLARATION OF CONFORMITY

	EC DECLARATION OF CONFORMITY AND INCORPORATION FLSD motor
<p>We, MOTEURS LEROY SOMER,</p> <p>declare, under our sole responsibility, that the following products :</p>	
<p>FLSD series type Ex d (or Ex d e) flameproof enclosure induction motors</p>	
<p>bearing the following markings on their nameplates :</p>	
<p>CE 0080  I M2 Ex d I Mb or CE 0080  II 2G Ex d(or d e) IIB T4 (or T3 or T5 or T6) Gb (zone 1) or CE 0080  II 2G Ex d(or d e) IIC T4 (or T3 or T5 or T6) Gb (zone 1) or CE 0080  II 2GD Ex d(or d e) IIB T4 (or T3 or T5 or T6) Gb Ex tb IIC T125°C or T100 °C or T 85°C Db (zone 21) or CE 0080  II 2GD Ex d(or d e) IIC T4 (or T3 or T5 or T6) Gb Ex tb IIC T125°C or T100 °C or T 85°C Db (zone 21) T3 motors can be marked T1 or T2 for commercial reasons.</p>	
<p>comply with :</p>	
<ul style="list-style-type: none"> ▪ European and international standards : 	<p>IEC 60079-0 :2007 ; EN60079-0:2009 IEC 60079-1:2007 ; EN60079-1:2007 IEC 60079-7:2006 ; EN60079-7:2007 (moteurs Ex d e) IEC 60079-31:2008 ; EN60079-31:2009 (moteurs Ex tb) IEC-EN60034 ; IEC-EN60072 ; IEC-EN60529</p>
<ul style="list-style-type: none"> • The Low Voltage Directive : • The ATEX European Directive : 	<p>2006/95/EC 94/9/EC (decree 96 1010 from 19/10/1996)</p>
<ul style="list-style-type: none"> • The type awarded an EC type-examination certificate By the notified body : INERIS (0080) – BP 2 – Parc technologique ALATA 60550 – VERNEUIL EN HALATTE 	<p>INERIS 10ATEX0025X (80 ≤ frame ≤ 132) IECEX INE100012X (80 ≤ frame ≤ 132) INERIS 11ATEX0048X (frame ≥ 160)</p>
<p>The design and manufacturing requirements are covered by the PRODUCT QUALITY ASSURANCE notifications</p>	<p>Under the responsibility of the notified body : INERIS</p>
<p>This conformity permits the use of these ranges of products in machines subject to the application of the Machinery Directive 2006/42/EC, provided that they are integrated or incorporated and/or assembled in accordance with, amongst others, the regulations of standard EN 60204 "Electrical Equipment for Machinery" and the Electromagnetic Compatibility Directive 2004/108/EC.</p>	
<p>The products defined above may not be put into service until the machines in which they are incorporated have been declared as complying with the applicable Directive.</p>	
<p>Installation of these motors must comply with the regulations, decrees, laws, orders, directives, application circulars, standards, rules or any other document relating to the installation site. LEROY-SOMER accepts no liability in the event of failure to comply with these rules and regulations.</p>	
<p>Note: When the motors are supplied via appropriate separate electronic inverters and/or controlled by electronic control or monitoring devices, they must be installed by a professional who will be responsible for ensuring that the electromagnetic compatibility regulations of the country in which the product is installed are observed.</p>	
<p>Signature of quality director :</p>	<p>Signature of technical director :</p>
<p>P. THERY</p>	<p>C.PLASSE</p>
	<p>QIT134_k dated 15/11/2011</p>

This document, included with the "Specific recommendations: Installation and maintenance" manual (ref. 3606), is supplied with the relevant products.

CONTENTS

INDEX

1 - RECEIPT 5
 1.1 - Identification and marking 5

2 - STORAGE 6

3 - COMMISSIONING 6

4 - INSTALLATION 7
 4.1 - Position of the lifting rings 7
 4.2 - Location - ventilation 7
 4.3 - Coupling 8
 4.4 - Fixing on slide rails 8

5 - ELECTRICAL PARAMETERS - LIMIT VALUES 9
 5.1 - Limiting problems caused by motor starting 9
 5.2 - Supply voltage 9
 5.3 - Starting times 9
 5.4 - Supply by frequency inverter 9

6 - USE 10

7 - SPECIAL OPERATING CONDITIONS 11
 7.1 - Use at variable speed 12

8 - MECHANICAL ADJUSTMENTS 13

9 - MAINS CONNECTION 15
 9.1 - Terminal box 15
 9.2 - Wiring diagram 16
 9.3 - Direction of rotation 16
 9.4 - Earth terminal 16
 9.5 - Connecting the cables 17

10 - MAINTENANCE 18
 10.1 - General information 18
 10.2 - Safety regulations 18
 10.3 - Routine maintenance 19
 10.4 - Terminal box rotation 20
 10.5 - Troubleshooting guide 21
 10.6 - Preventive maintenance 21

11 - EXPLODED VIEWS, PARTS LIST 22
 11.1 - FLSD 80 to 132 22
 11.2 - FLSD 160 to 225 23
 11.3 - FLSD 250 and 280 24-25
 11.4 - FLSD 315 to 355 26-27

Adjustment 13
 Alarms - early warning 10

Balancing 8
 Belts 14
 Built-in thermal protection 10

Cable glands 15
 Cables: cross-section 17 - 18
 Capacitors 18
 Connection diagrams 16
 Connection 17
 Coupling sleeves 13
 Coupling 8 - 13

Digistart 11
 Direction of rotation 16
 Draining condensation water 19

Earth terminal 16
 Earth 11 - 16
 EC Declaration of Conformity 3
 End shields 19
 European directives 3

Frequency inverter 12

Greasing - Grease nipples 6 - 19 - 20

Handling 7

Identification 5
 Inertia flywheel 13
 "Installation and Maintenance" manual 3
 Insulation 6

Lifting ring 7
 Location 7

Mains connection 15 to 18
 Marking 5
 Mounting 6

Nameplate 5

Power supply 9 - 17
 Power 9
 Protection 10
 Pulleys 14

Receipt 5
 Routine maintenance 19

Slide rails 8
 Space heaters 10
 Spare parts 18
 Starting 9
 Storage 6

Terminal box 16 - 20
 Terminal box: Tightening the screws 16 to 18
 Tolerances 13
 Troubleshooting 21

Variable speed 12
 Ventilation 7

1 - RECEIPT

On receipt of your motor, check that it has not suffered any damage in transit.

If there are obvious signs of knocks, contact the carrier (you may be able to claim on their insurance) and after a visual check, turn the motor by hand to detect any malfunction.

1.1 - Identification and marking

As soon as you receive the motor, check that the nameplate on the machine conforms to your order.

LERROY™		3 ~ FLSD132 M T		CE	
SOMER		N° 0123456J11 001		0080	
F - 16015 ANGOULEME		2011 IP65 IK08			
40 °C Ins. cl. F S1		1000m 93kg			
INERIS 10ATEX0025X		IECExINE10.0012X			
II 2 GD Ex d IIC T4 Gb		Ex tb IIIC T125°C Db			
DE:		g. /		h. (A) (H)	
NDE:					
V	Hz	min⁻¹	kW	cos φ	A
Δ 230	50	1460	7,50	0,83	25,40
λ 400	50	1460	7,50	0,83	14,70
λ 460	60	1765	7,50	0,81	12,85
CTP150°C					

IEC 60034-1
HSBA_1008

LERROY™		MOT. 3 ~ FLSD 250 M 4 B35		CE	
SOMER		N° 61064200ZG01		0080	
2011		565 kg			
DE: 6316 C3		33 g	1323 h	IP 55	1000 m
NDE: 6314 C3		26 g	1323 h	IK 08	
40 °C Ins. cl. F S1		% d/h		SF	
IE2		93,5 %			
V	Hz	min⁻¹	kW	A	cos φ
Δ 400	50	1480	55	99	0,85
II 2 G Ex d IIB T4 Gb					
INERIS 11ATEX0048X					

IEC 60034-1 - MADE IN FRANCE

Definition of symbols used on nameplates:

CE Legal mark of conformity of product to the requirements of European Directives.

Zone	ATEX marking	Gas protection type marking	Dust protection type marking (optional)	Ingress protection
/	(Ex) I M2	Ex d I Mb		IP55
1 & 2	(Ex) II 2 G	Ex d IIB T4 Gb (1) Ex d IIC T4 Gb (1) Ex d IIB T5 Gb (1) Ex d IIC T5 Gb (1) Ex d IIB T6 Gb (1) Ex d IIC T6 Gb (1)		IP55
1 & 21 2 & 22	(Ex) II 2 GD	Ex d IIB T4 Gb (1) Ex d IIC T4 Gb (1) Ex d IIB T5 Gb (1) Ex d IIC T5 Gb (1) Ex d IIB T6 Gb (1) Ex d IIC T6 Gb (1)	Ex tb IIIC T125°C Db Ex tb IIIC T125°C Db Ex tb IIIC T100°C Db Ex tb IIIC T100°C Db Ex tb IIIC T85°C Db Ex tb IIIC T85°C Db	IP65

(1): or Ex de

ATEX specific marking **(Ex)**

- (Ex)** : Marking for protection against risks of explosion
- II 2G or 2GD** : ATEX marking
- Ex d or de** : "Gas" protection type
- II B or II C** : "Gas" equipment group
- T4** : "Gas" temperature class
- Gb** : "Gas" EPL
- Ex tb** : "Dust" protection type (optional)
- IIIC** : "Dust" equipment group (optional)
- T125°C** : Maximum surface temperature (optional)
- Db** : "Dust" EPL
- 0080** : INERIS Notified Body
- INERIS 10ATEX0025X** : EC type-examination certificate number

Motor

- MOT 3 ~** : Three-phase A.C. motor
- FLSD** : FLSD range
- 132** : Frame size
- M** : Housing symbol

Motor no.

- 0123456** : Motor batch number
- J** : Month of production
- 11** : Year of production
- 001** : Batch number

- kg** : Weight
- IP65** : Ingress protection
- IK08** : Shock resistance index
- I cl.F** : Insulation class F
- 40°C** : Maximum ambient operating temperature
- S1** : Duty
- V** : Supply voltage
- Hz** : Supply frequency
- min⁻¹** : Speed of rotation
- kW** : Rated power
- cos φ** : Power factor
- A** : Rated current
- Δ** : Connection symbol

Bearings

- DE** : Drive end
Drive end bearing
- NDE** : Non drive end bearing
- g** : Amount of grease at each regreasing (in g)
- h** : Regreasing interval (in hours)
- (A)** : Vibration level
- (h)** : Balancing mode

2 - STORAGE

Prior to commissioning, machines should be stored:

- Away from humidity: At relative humidity levels above 90%, the machine insulation can drop very rapidly, to just above zero at around 100%. The state of the anti-rust protection on unpainted parts should be monitored.

For very long storage periods the motor can be placed in a sealed covering (for example heat-shrunk plastic) containing sachets of desiccant:

- Away from frequent significant variations in temperature, to avoid the risk of condensation. During storage the drain plugs must be removed to allow condensation water to escape.

- If the area is subject to vibration, try to reduce the effect of this vibration by placing the motor on a damping support (rubber plate or similar) and turn the rotor a fraction of a turn once a fortnight to prevent the bearing rings from becoming marked. Remove and replace the rotor locking device if applicable.

- Do not remove the rotor locking device (where there are roller bearings).

Even if the motor has been stored in the correct conditions, certain checks must be carried out before it is started up:

Greasing

- Motors fitted with permanently greased bearings: maximum storage period = 3 years; after this time, replace the bearings with an identical type.

- Motors fitted with grease nipples:

Storage period		
Grade 2 grease	Grade 3 grease	
< 6 months	< 1 year	No regreasing before commissioning.
6 months to 1 year	1 to 2 years	Before commissioning, regrease the motor in accordance with the instructions appearing on the nameplate (quantity and quality of grease).
1 to 5 years	2 to 5 years	Dismantling, cleaning the bearings. Completely replace the grease in accordance with the instructions appearing on the nameplate (quantity and quality of grease). Replace the seals on the shafts and for IP 66 motors on the spigots before commissioning.
> 5 years	> 5 years	Change the bearings. Completely replace the grease in accordance with the instructions appearing on the nameplate (quantity and quality of grease). Replace the seals on the shafts (lubricate them using the same grease as that on the bearings) and for IP 66 motors on the spigots before commissioning.



Caution: Do not perform a high voltage test on the auxiliaries.

Should the machine need to be repainted, the coating must not be more than 2 mm thick and 0.2 mm thick for equipment in group IIC. If not, it must be antistatic.

3 - COMMISSIONING

Before starting the motor, it is advisable to check the insulation between the phases and earth, and between phases.

This check is essential if the motor has been stored for longer than 6 months or if it has been kept in a damp atmosphere.

This measurement must be carried out using a megohmmeter at 500 V DC (do not use a magnetoelectric system).

It is better to carry out an initial test at 30 or 50 volts and if the insulation is greater than 1 megohm, carry out a second test at 500 volts for 60 seconds. The insulation value must be at least 10 megohms in cold state.

If this value cannot be achieved, or if the motor may have been splashed with water or salt spray, or kept for a long period in a very humid place or if it is covered with condensation, it is advisable to dry the stator for 24 hours in a drying oven at a temperature of between 110°C and 120°C.

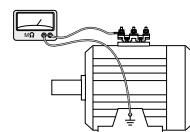
If it is not possible to place the motor in a drying oven:

- Switch on the motor, with the rotor locked, at 3-phase A.C. voltage reduced to approximately 10% of the rated voltage, for 12 hours (use an induction regulator or a reduction transformer with adjustable outlets).

- Or supply the 3 phases in series with a D.C. current, with the voltage at 1 to 2% of the rated voltage (use a D.C. generator with independent excitation or batteries for motors of less than 22 kW).

- NB: The A.C. current must be monitored using a clamp ammeter, and the D.C. current using a shunt ammeter. This current must not exceed 60% of the rated current.

It is advisable to place a thermometer on the motor housing: If the temperature exceeds 70°C, reduce the indicated voltage or current by 5% of the original value for every 10°C difference. While it is drying, all the motor orifices must be open (terminal box, drain holes). Before commissioning, all these covers must be replaced so that the motor conforms to degree of protection IP 55 or 65. Clean or replace the plugs or breathers and orifices before reassembling them.



Caution: If the high voltage test, carried out at the factory before despatch, needs to be repeated, it should be performed at half the standard voltage, ie: 1/2 (2 U + 1000 V). Check that the capacitive effect resulting from the high voltage test is eliminated before connecting the terminals to earth.

Prior to commissioning for all motors:

- Remove all dust from the machine

- Rotate the motor with no load (no mechanical load) for 2 to 5 minutes, checking that there is no abnormal noise. If there is any abnormal noise, see section 10.

4 - INSTALLATION

4.1 - Position of the lifting rings

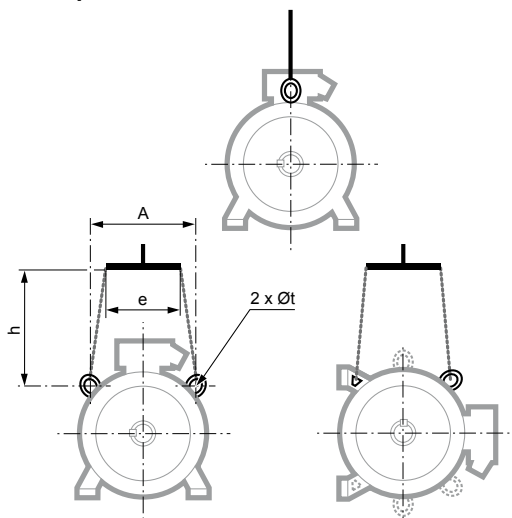
Position of lifting rings for lifting the motor only (not connected to the machine)

Labour regulations stipulate that all loads over 25 kg must be fitted with lifting devices to facilitate handling.

The positions of the lifting rings and the minimum dimensions of the loading bars are given below in order to help with preparation for handling the motors. If these precautions are not followed, there is a risk of warping or crushing some equipment such as the terminal box, protective cover or drip cover.

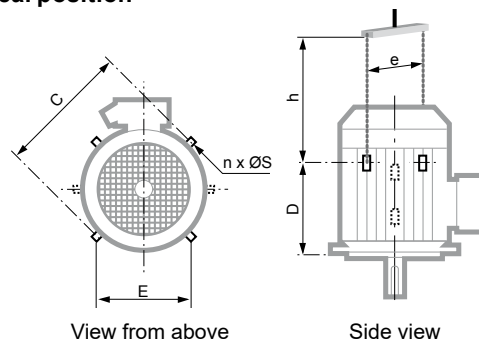
Motors intended for use in the vertical position may be delivered in the horizontal position on a pallet. When the motor is pivoted, the shaft must under no circumstances be allowed to touch the ground, as the bearings may be irreparably damaged. Moreover, additional special precautions must be taken, as the integral motor lifting rings are not designed for pivoting the motor.

• Horizontal position



Type	Horizontal position			Øt
	A	e min.	h min.	
100	120	200	150	9
112	120	200	150	9
132	160	200	150	9
160	200	160	110	14
180 MR	200	160	110	14
180 L	200	260	150	14
200	270	260	165	14
225 ST/MT	270	260	150	14
225 M	360	265	200	30
250	360	380	200	30
280	360	380	500	30
315 ST	310	380	500	17
315 M/L	360	380	500	23
355	310	380	500	23

• Vertical position



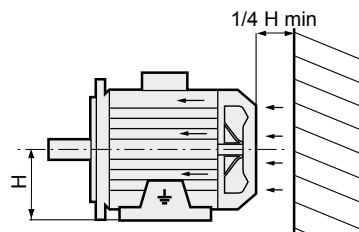
Type	Vertical position						
	C	E	D	n	ØS	e min.*	h min.
160	320	200	230	2	14	320	350
180 MR	320	200	230	2	14	320	270
180 L	390	265	290	2	14	390	320
200	410	300	295	2	14	410	450
225 ST/MT	410	300	295	2	14	410	450
225 M	480	360	405	4	30	540	350
250	480	360	405	4	30	540	350
280 S	480	360	485	4	30	590	550
280 M	480	360	585	4	30	590	550
315 ST	590	-	590	2	17	630	550
315 M/L	695	-	765	2	24	695	550
355	755	-	835	2	24	755	550

* If the motor is fitted with a drip cover, allow an additional 50 to 100 mm to avoid damaging it when the load is swung.

4.2 - Location - ventilation

Our motors are cooled in accordance with method IC 411 (standard IEC 60034-6), ie. "machine cooled by the surface, using the ambient fluid (air) flowing along the machine".

The fan at the non-drive end cools the motor. Air is sucked in through the grille of a fan cover (which provides protection against the risk of direct contact with the fan in accordance with standard IEC 60034-5) and blown along the housing fins to ensure thermal equilibrium of the motor whatever the direction of rotation.



The motor must be installed in an adequately ventilated area, with clearance for the air intake and outlet of at least one-quarter of the frame size.

Obstruction, even accidental (clogging), of the fan cover grille and the housing fins has an adverse effect on motor operation and safety.

In the case of vertical operation with the shaft extension facing down, it is advisable to fit the motor with a drip cover to prevent the entry of any foreign bodies.

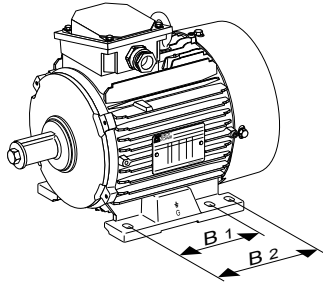
It is necessary to check that the hot air is not being recycled. If it is, pipes must be provided for the intake of cold air and discharge of hot air, in order to prevent abnormal temperature rise of the motor.

In this case, if the air is not circulated by an auxiliary fan, the dimensions of the pipes must be such that the pressure losses are negligible compared to those of the motor.

Positioning

The motor must be mounted in the position specified on the order, on a base which is rigid enough to prevent distortion and vibration.

Where the motor feet have six fixing holes, it is preferable to use those which correspond to the standard dimensions for the motor power rating (refer to the technical catalogue for induction motors) or, should this not be the case, to those shown at B2.



Provide easy access to the terminal box, the condensation drain plugs and, if appropriate, to the grease nipples. Use lifting equipment which is compatible with the weight of the motor (indicated on the nameplate).

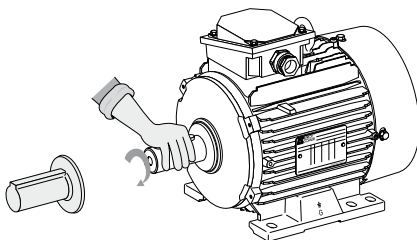
When the motor is fitted with lifting rings, they are for lifting the motor on its own and must not be used to lift the whole machine after the motor has been fitted to it.
Note 1: When installing a suspended motor, it is essential to provide protection in case the fixing breaks.
Note 2: Never stand on the motor.

4.3 - Coupling

Preparation

Turn the shaft by hand before coupling to detect any possible fault due to handling.

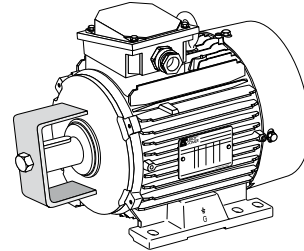
Remove any protection from the shaft extension. Drain off any condensation water which may have formed inside the motor (see section 3).



Rotor locking device

For made-to-order motors with roller bearings, remove the rotor locking device.

In exceptional circumstances when the motor has to be moved after the coupling device has been fitted, the rotor must be re-immobilised.



Balancing

Rotating machines are balanced according to standard IEC 60034-14:

- Half-key when the shaft extension is marked H

By special request, the balancing can be set:

- No key when the shaft extension is marked N

- Full key when the shaft end is marked F

Any coupling element (pulley, coupling sleeve, slip-ring, etc) must therefore be balanced accordingly.

Motor with 2 shaft extensions:

Operating a motor with a 2nd shaft extension (that is not used) is not permitted.

5 - ELECTRICAL PARAMETERS - LIMIT VALUES

5.1 - Limiting problems caused by motor starting

In order to protect the installation, any significant temperature rise in the cabling conduits must be prevented, while ensuring that the protection devices do not interrupt starting. Problems affecting the operation of other devices connected to the same source are due to the voltage drop caused by the current inrush on starting.

Even though mains supplies increasingly allow D.O.L. starting, the current inrush must be reduced for certain installations. Jolt-free operation and soft starting ensure greater ease of use and an increased lifespan for the machines being driven. The two essential parameters for starting cage induction motors are:

- Starting torque
- Starting current

The starting torque and the resistive torque determine the starting time.

Depending on the load being driven, it may be necessary to adapt the torque and the current to the machine starting time and to the possibilities of the mains power supply.

The five essential modes are:

- D.O.L. starting
- Star/delta starting
- Soft starting with autotransformer
- Soft starting with resistors
- Electronic starting

The “electronic” starting modes control the voltage at the motor terminals during the entire starting phase and enable very soft, jolt-free starting.

Starting systems must be placed outside the potentially explosive zone or be of an approved type for the zone.

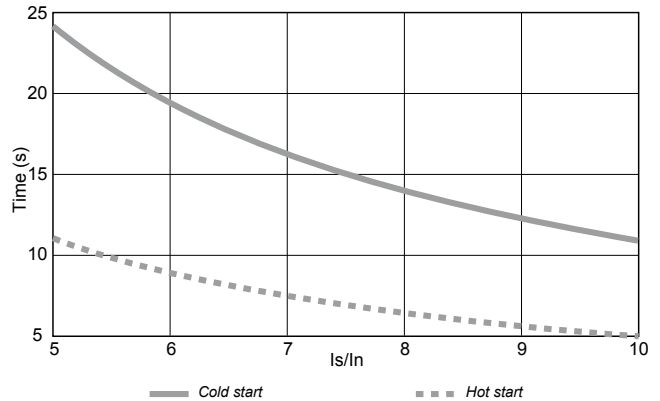
5.2 - Supply voltage

The rated voltage is indicated on the nameplate.

5.3 - Permissible starting times and locked rotor times

The starting times must remain within the limits stated below on condition that the number of starts per hour is 6 or less.

Three successive cold starts and two consecutive hot starts are allowed.




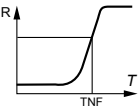
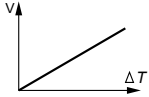
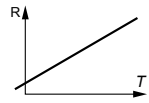
Permissible motor starting time as a function of the ratio I_s/I_N .

5.4 - Supply by frequency inverter

(See section 7.1).

6 - USE

Thermal protection (see section 9) and space heaters.

Type	Operating principle	Operating curve	Breaking capacity (A)	Protection provided	Mounting Number of devices*
Thermistor with positive temperature coefficient PTC	Variable non-linear resistor with indirect heating 		0	General surveillance for transient overloads	Mounted with associated relay in control circuit 3 in series
Thermocouples T ($T < 150^{\circ}\text{C}$) Copper Constantan K ($T < 1000^{\circ}\text{C}$) Copper-nickel	Peltier effect		0	Continuous surveillance of hot spots at regular intervals	Mounted in control panels with associated reading equipment (or recorder) 1 per hot spot
Platinum resistance thermometer PT 100	Variable linear resistor with indirect heating		0	High accuracy continuous surveillance of key hot spots	Mounted in control panels with associated reading equipment (or recorder) 1 per hot spot

- NRT: nominal running temperature

- The NRTs are chosen according to the position of the sensor in the motor and the temperature rise class.

* The number of devices relates to the winding protection.

Alarm and early warning

All protective equipment can be backed up by another type of protection (with different NRTs): the first device will then act as an early warning (light or sound signals given without shutting down the power circuits), and the second device will be the alarm (shutting down the power circuits).

Protection against condensation: space heaters

Identification: 1 label

A glass fibre flexible resistor is fixed on 1 or 2 coil end turns. This resistor heats the machines when stopped and thus prevents condensation inside the machines. The space heaters must be switched off when the machine is in use.
Power supply: 230 V single-phase unless otherwise specified by the customer.

Thermal magnetic protection


The motors must be protected by a thermal magnetic device located between the isolating switch and the motor. These protection devices provide total protection of the motor against non-transient overloads.


This device can be accompanied by fused circuit-breakers. The thermal protection must be set at the level of current shown on the motor nameplate for the voltage and frequency of the mains supply to which the machine is connected.


Built-in indirect thermal protection

The motors can be equipped with optional heat sensors. These sensors can be used to monitor temperature changes at "hot spots":

- Overload detection
- Cooling check
- Monitoring strategic points for maintenance of the installation
- **Ensuring the temperature of the hot spots is monitored**

 **When thermal sensors fitted on the motor are used, whether in variable speed applications or when powered directly from the mains, these must be connected to a device (in addition to and functionally independent of any system which could be required for operational reasons in normal conditions) which switches off the motor.**

 **Under no circumstances can these sensors be used to for direct control of the motor operating cycles.**

 **Control and breaking devices must be installed in cabinets placed outside the danger zone or must be of an approved type.**

Temperature sensor operating thresholds:

- Maximum surface temperature: 125°C (GD)
 - winding sensor: 150°C ± 5°C
 - DE shield sensor: 120°C ± 5°C
- Maximum surface temperature: 130°C (class T4)
 - winding sensor: 150°C ± 5°C
 - DE shield sensor: 120°C ± 5°C
- Maximum surface temperature: 95°C (class T5)
 - winding sensor: 110°C
 - DE shield sensor: 90°C
- Maximum surface temperature: 80°C (class T6)
 - winding sensor: 100°C
 - DE shield sensor: 80°C

7 - SPECIAL OPERATING CONDITIONS

- Thermal protection (see sections 6 & 8)

- Space heaters (see section 6)

- Temperatures: Storage and ambient

NB: T_a = ambient temperature

If the motor has been stored at a temperature lower than -10°C , heat it (see section 3) and turn the shaft manually before starting up the machine.

If the motor is to be used at a temperature lower than -20°C , space heaters are recommended.

Our standard motors are designed to operate at an ambient temperature of between -20°C and 40°C .

If $T_a < -25^{\circ}\text{C}$, the shaft seals must be made of silicon and the fan must be metal.

- Surface temperature

As standard, the maximum surface temperature of our T4 motors is 135°C at an ambient temperature $\leq 40^{\circ}\text{C}$ (G).

If the motors are also to be used in atmospheres which may contain explosive dust, the maximum surface temperature will be 125°C (GD marking).

- Installation zones

The motors are designed for use in zone 1 and 2.

In atmospheres which may contain explosive gas, the degree of protection is IP 55.

- Connection

Particular attention must be paid to the information on the nameplate in order to choose the correct type of connection for the supply voltage.

- Earthing

It is compulsory to earth the motor, and earthing must be performed in accordance with current regulations (protection of workers).

An external terminal on the housing ensures effective equipotential ground connection. This terminal must be protected against self-release.

- Seals

If the drain plugs or breathers are removed, they must be replaced in order to ensure that the motor conforms to IP 55 or IP 65 protection. Replace the seals that have been removed with new seals of the same type. Clean the holes and plugs before reassembly.

Each time the motor is dismantled, and during maintenance visits, replace the seals on the shafts, the shield spigots and the terminal box cover with new seals of the same type after cleaning all parts. The seals on the shafts must be fitted using the same type of grease as on the bearings.

- Workforce safety

Protect all rotating devices before power-up.

If a motor is started up without a coupling device having been fitted, carefully immobilise the key in its location.

All measures must be taken to ensure protection against the risks involving rotating parts (coupling sleeve, pulley, belt, etc).

Beware of backdriving when the motor is switched off. The appropriate precautions must be taken:

- For example, for pumps a non-return valve must be installed.

- LEROY-SOMER "Digistart" electronic starter

This is a multi-function electronic system with a micro-controller, which is used with all 3-phase cage induction motors.

It provides soft starting of the motor with:

- Reduction of the starting current
- Gradual, jolt-free acceleration, achieved by controlling the current absorbed by the motor.

After starting, the DIGISTART performs additional motor control functions in its other operating phases: steady state and deceleration.

- 18 to 1600 A models

- Power supply: 220 to 700 V - 50/60 Hz

DIGISTART is economical to install, as a fused switch is the only additional device needed.

The "Digistart" electronic starter used with the motor must be installed outside danger zones.

- Contactors - Isolators

In all cases, contactors, isolators, etc, must be installed and connected in an enclosure outside the dangerous zones or be of an approved type for the zone.

- Shock resistance

The motor can withstand a weak mechanical shock (IK 08 according to EN 50102). The user must provide additional protection if there is a risk of significant mechanical shock.

7.1 - Use at variable speed

When a drive is used, any special instructions detailed in the specific drive manuals must be observed. In particular, the following minimum steps must be taken:

- Check that the drive switching frequency is 3 kHz minimum.
- Check that the motor has a second nameplate indicating the maximum motor characteristics when used at variable speed.
- The reference voltage, usually 400 V 50 Hz, is indicated on the motor nameplate. The drive should deliver a constant voltage/frequency ratio.
- Program the maximum current value in the drive as well as the min. and max. frequency values indicated on the second motor nameplate.
- Connect all the temperature sensors on the motor (winding and if necessary the bearings) to safety devices independent of those used for operation in normal conditions.

Drives and sensor connection devices must be placed outside danger zones (outside zones 0, 1, 2, 20, 21 and 22).

7.1.1 - Special conditions for safe operation

- The motor must be fitted with thermal sensors in the winding (all frame sizes), and on the DE bearing (frame size 160 and above) in the following cases:
 - Motor supplied by a frequency inverter
 - Non-self-cooled motor in a sufficient air-flow (IC418)
 - Motor adapted so as to no longer be self-cooled (IC410)
 - Motor fitted with a backstop
- The thermal sensors fitted on the motor must be connected to a device placed outside the zone, which switches off the motor when the operating thresholds are reached, to ensure that the maximum surface temperature is never reached. This device must be in addition to and functionally independent of any system which could be required for operational reasons in normal conditions.
- When the motor is fitted with auxiliary or forced ventilation (IC416), a device must prevent the main motor from operating when there is no ventilation.

- Space heaters should only be supplied with power when the motor is switched off and cold; their use is recommended at ambient temperatures below – 20°C.
- The supply voltage and frequency must conform to those indicated on the motor nameplate.
- The frequency range specified on the motor nameplate must be strictly observed.
- When several motors are supplied by the same drive, for safety reasons individual protection must be provided on each motor starter (thermal relay for example).
- When a frequency inverter is used, any special instructions detailed in their specific manual must be complied with.
- The cable glands and components must be compatible with the protection method used for the connection. On variants with an integral cable(s), the motor must either be connected outside the potentially explosive atmosphere, or the connection must be protected by a recognised protection method that is suitable for the type of use.
- When the motor is fitted with one or more auxiliary junction boxes (protected by increased safety for Ex d, Ex d e or Ex n motors), it may only tolerate a low risk of mechanical danger, and the user will need to provide additional protection if there is a high level of risk. (In other words, when an auxiliary terminal box is attached to the main terminal box).
- The tensile strength of the fixing screws on the various parts of the Ex d flameproof casing must be at least class 8.8.

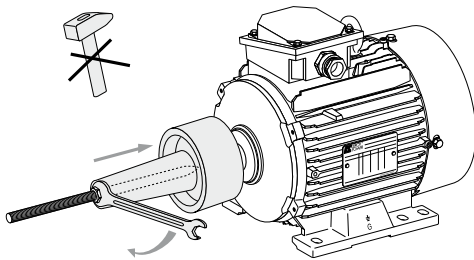
8 - MECHANICAL ADJUSTMENTS

Tolerances and adjustments

The standard tolerances are applicable to the mechanical characteristics given in our catalogues. They comply fully with the requirements of IEC standard 60072-1.

- Users must adhere strictly to the instructions provided by the transmission device supplier.
- Avoid impacts which could damage the bearings.

Use a spanner and the tapped hole of the shaft extension with a special lubricant (e.g. molykote grease) to make it easier to fit the coupling.



The hub of the transmission device must be:

- Fully in contact with the shoulder of the shaft or, if this is missing, hard up against the metal stop ring to form a labyrinth seal and thus lock the bearing in place (do not crush the seal).
- Longer than the shaft end (2 to 3 mm) so that it can be tightened using a screw and washer. If it is not, a spacer ring must be inserted without cutting the key (if this ring is large, it must be balanced)

The 2nd shaft extension may also be smaller than the main shaft extension, and under no circumstances can it deliver torques greater than half the rated torque.

Inertia flywheels must not be mounted directly onto the shaft extension, but installed between end shields and connected by a coupling device.

Direct connection onto the machine

When mounted directly on the motor shaft extension of the moving device (pump or fan turbine), check that this device is perfectly balanced and that the radial force and the axial thrust are within the limits indicated in the catalogue.

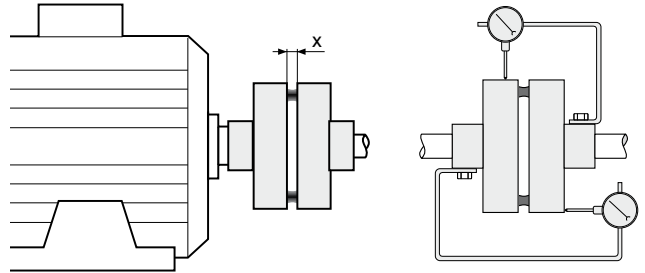
Direct connection using a coupling sleeve

Selection of the coupling sleeve should take account of the rated torque to be transmitted and the safety factor dependent on the starting conditions for the electric motor.

The machines must be carefully aligned, so that any lack of concentricity and parallelism in the two parts of the coupling sleeve is compatible with the recommendations of the coupling sleeve manufacturer.

Both coupling halves should be provisionally assembled to assist moving them in relation to one another.

Adjust the parallel plane of both shafts using a gauge. Measure the distance between the two coupling surfaces at one point on the circumference. Rotate them 90°, 180° and 270° in relation to this initial position, and measure each time. The difference between the two extreme values of dimension "x" must not exceed 0.05 mm for standard couplings.



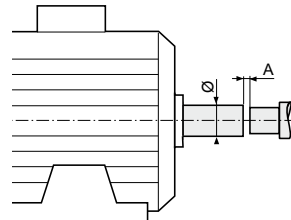
To perfect this adjustment and at the same time check the concentricity of the two shafts, fit 2 gauges as shown in the diagram and slowly turn both shafts.

The differences registered by either shaft will indicate the need for an axial or radial adjustment if the difference exceeds 0.05 mm.

Direct connection using a rigid coupling sleeve

The two shafts must be aligned so as to adhere to the tolerances of the coupling sleeve manufacturer.

Maintain the minimum distance between the shaft extensions to allow for expansion of the motor shaft and the load shaft.



Ø (mm)	A (mm) min.
9 to 55	1
60	1.5
65	1.5
75	2
80	2

Transmission via belt pulleys

With a belt/pulley assembly, check that the motor can cope with radial loads.

The user chooses the diameter of the pulleys.

Cast iron pulleys with a diameter over 315 are not recommended for rotation speeds of 3000 min⁻¹.

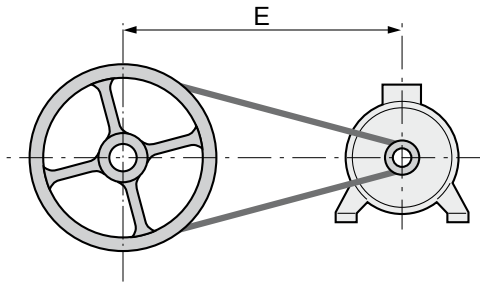
Flat belts cannot be used for rotation speeds of 3000 min⁻¹ or more.

Positioning the belts

The belts must be antistatic and flame-resistant.

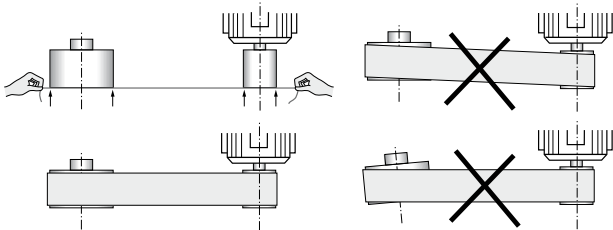
So that the belts can be correctly positioned, allow for possible adjustment of approximately 3% with respect to the calculated distance E.

Force must never be used when fitting the belts.
For notched belts, position the notches in the pulley grooves.



Pulley alignment

Check that the motor shaft is completely parallel with that of the receiving pulley.



Protect all rotating devices before power-up.

Adjusting the tension of the belts

The tension of the belts must be adjusted very carefully in accordance with the recommendations of the belt supplier and the calculations made when the product was specified.

Reminder:

- Tension too high = unnecessary force on the end shields which could lead to an abnormal temperature, premature wear of the bearing unit (end shield-bearings), and eventually break the shaft.
- Tension too low = vibration (wearing of the bearing unit).

Fixed distance between centres:

- Place a belt tensioning pulley on the slack side of the belts:
- Smooth pulley on the outside of the belt
 - Grooved pulley on the inside of the belts when using V-belts

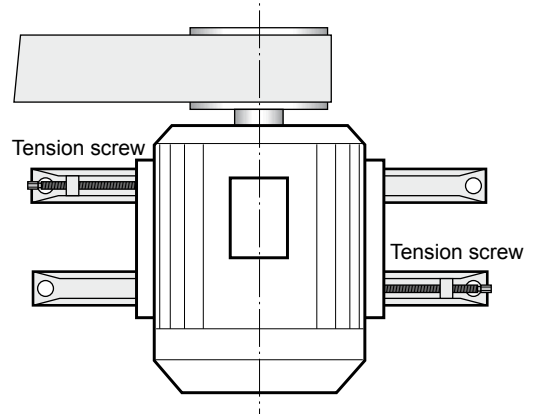
Adjustable distance between centres:

The motor is usually mounted on slide rails, which enables optimum adjustment of the pulley alignment and the belt tension. Place the slide rails on a completely horizontal baseplate.

Lengthways, the position of the slide rails is determined by the length of the belt, and crossways by the pulley of the machine being driven.

Mount the slide rails firmly with the tension screws in the direction shown in the diagram (slide rail screw on the belt side between the motor and the machine being driven).

Fix the slide rails to the baseplate and adjust the belt tension as before.



9 - MAINS CONNECTION

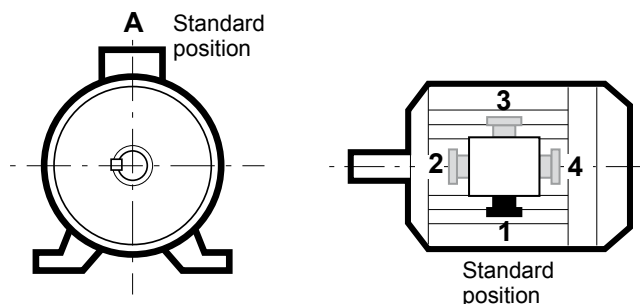
9.1 - Terminal box

This is placed as standard on the top of the motor near the drive end. It has IP 55 (G) or IP 65 (GD) protection and is fitted with a cable gland according to the table below.

Caution: The position of the terminal box cannot be easily modified, even with flanged motors, as the condensation drain holes (if present) must be at the bottom.

Terminal box positions

Cable gland positions



Cable gland

The standard position of the cable gland (1) is on the right, seen from the motor drive end.

If the non-standard position of the cable gland has not been correctly specified on the order, or is no longer suitable, the symmetrical construction of the terminal box enables it to be turned in any of the 4 directions except for position (2) on flange-mounted motors (B5).

A cable gland must never open upwards.

Check that the incoming bend radius of the cables prevents water entering via the cable gland.

The installer is responsible for the IP sealing of the cable path (see the motor nameplate and the instructions for assembling the cable gland).

All accessories must be of a type approved or certified by the group, the application (gas and/or dust) and the temperature class corresponding at minimum to those for the device location.

⚠ NB: FLSD motors are fitted with plugs as standard.

Cable size

Adapt the cable gland and its reducer or amplifier, if fitted, to the diameter of the cable being used, in accordance with the manual specific to the cable gland.

To maintain the original stated IP protection of the motor, it is essential to make a watertight seal between the rubber ring and the cable, by tightening the cable gland correctly (it should not be possible to unscrew it without a tool).

Any unused holes must be sealed with plugs certified Ex. When fitting cable glands or blocking holes, a seal of perbunan, or silicon or polyurethane mastic, must be inserted between the cable glands, the plugs, the reducers or (and) the amplifiers and the support or the terminal box.

For connections using screwed conduit entries, a minimum of 5 cylindrical threads must be engaged for motors with Ex d boxes (and a minimum screw depth of 8 mm).

The thread seal can be reinforced with grease.

AVERTISSEMENT



WARNING

NE PAS OUVRIR SOUS TENSION
NE PAS OUVRIR SI UNE ATMOSPHERE
EXPLOSIVE PEUT ETRE PRESENTE

DO NOT OPEN WHEN ENERGIZED
DO NOT OPEN WHEN AN EXPLOSIVE
ATMOSPHERE MAY BE PRESENT

ref. HS51A 31
PS1070EA060



The motors are factory-fitted with guidance labels which must be left in place.



Under no circumstances should the power supply cable be used for handling the motor.

9.2 - Wiring diagram for terminal block or isolators

All motors are supplied with a wiring diagram in the terminal box. If required, this diagram should be obtained from the supplier, specifying the motor type and number (shown on the motor nameplate).

The connector links required for coupling can be found inside the terminal box.

Single speed motors have a block with 6 terminals, whose marking complies with IEC 60034-8 (or NFC 51-118).

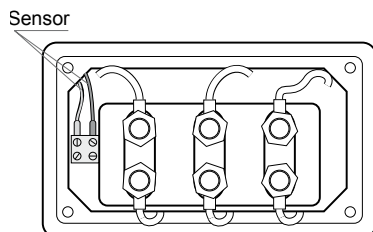
9.3 - Direction of rotation

When the motor is powered by U1, V1, W1 or 1U, 1V, 1W from a direct mains supply L1, L2, L3, it turns clockwise when seen from the main shaft extension.

If 2 phases of the power supply are changed over, the motor will rotate anti-clockwise (the motor should be checked to ensure that it has been designed to rotate in both directions).

If the motor is fitted with accessories (thermal protection or space heater), these must be connected on mini-terminals.

Motor fitted with a terminal block



9.4 - Earth terminal

It is compulsory to earth the motor, and earthing must be performed in accordance with current regulations (protection of workers).

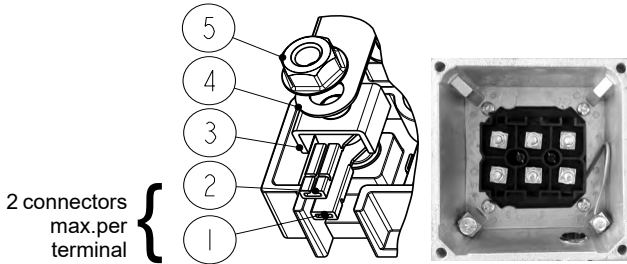
One earth terminal is located inside the terminal box, and another outside on the housing. They are marked: \perp
They must be protected against self-release by a jumper, lock washer, screw or locknut, or anti-vibration adhesive.
The sizing of the cables must comply with the specifications of standard 60079-0.

9.5 - Connecting the power supply cables to the terminal block

The cables must be fitted with connectors suitable for the cable cross-section and the terminal diameter (see diagram below). They must be crimped in accordance with the connector supplier's instructions.

Ex e M5 and M6 terminal block (FLSD 80-132)

LSE terminal blocks, mounted on the housing and held in place by 2 locked screws, make it possible to use standard round connectors.



Each terminal consists of the following items, positioned in order:

- 1 : motor cable connector, shank locked
- 2 : power supply cable connector, shank locked
- 3 : terminal washer
- 4 : Y or Δ connector link
- 5 : "Serpress" brake nut.

Tightening torque (N.m) for the nuts on LSE terminal blocks

Terminal	M4	M5	M6
Steel	2	3.2	5
Brass	1	2	3


- LS terminal block (FSLD 160-355)



Tightening torque (N.m) for the nuts on LS terminal blocks.

Terminal	M5	M6	M8	M10	M12	M14	M16
Steel	3.2	5	10	20	35	50	65
Brass	2	3	7	15	-	-	-

The fixing screws used for connecting the cables are supplied with the terminal block. Any modification of this equipment will lead to the loss of approval of the connection system. When closing the box, ensure that the seal is correctly positioned.

 As a general rule, check that no nut, washer or other foreign body has fallen into the terminal box and/or come into contact with the winding.

- Earth terminal:

This is situated inside the terminal box; in some cases, the earth terminal may be situated on one of the feet or on one of the cooling fins (round motors). It is indicated by the symbol:

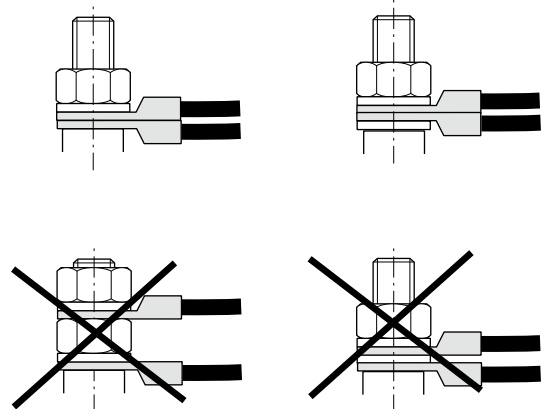


It is compulsory to earth the motor, and earthing must be performed in accordance with current regulations (protection of workers).

* If required, ask the supplier for this diagram, specifying the motor type and number (shown on the motor nameplate).

- Connecting the power supply cables to the terminal block:

The cables must be fitted with connectors suitable for the cable cross-section and the terminal diameter. They must be crimped in accordance with the connector supplier's instructions. Connection must be carried out with connector resting on connector (see diagrams below):



10 - MAINTENANCE

10.1 - General information

10.1.1 - Frequent monitoring

This monitoring, generally carried out by operators, is intended to:

- Monitor, as a preventive measure, the state of the equipment (cables, cable gland, etc) taking account of the environmental conditions (temperature, humidity, etc)
- Detect as early as possible any potentially dangerous problems, such as damage to the cable ducts by abrasion.
- Ensure that staff are fully trained on the risks and means of prevention.

If there is an accumulation of dust between the fins and/or on the fan cover grille, leading to a rise in the surface temperature, the motor should be cleaned frequently.

10.1.2 - Repairs

Repair and/or rewinding of an electric motor for use in explosive zones must be carried out by qualified staff using identical equipment in accordance with the specifications of standard 60079-19. Disregarding this may affect the safety of the equipment (for example, protection index not conforming to IP 55 or IP 65) or the surface temperature (for example, rewinding the motor). Service Centres (SCs) are trained and approved by "Saqr - ATEX" to ensure maintenance and repair of these motors is undertaken in complete safety.

WARNING:

Modification is strictly prohibited without the manufacturer's approval in writing.

Service Centres (SCs) are trained and approved by "Saqr - ATEX" to ensure maintenance and repair of these motors is undertaken in complete safety.

10.1.3 - Spare parts

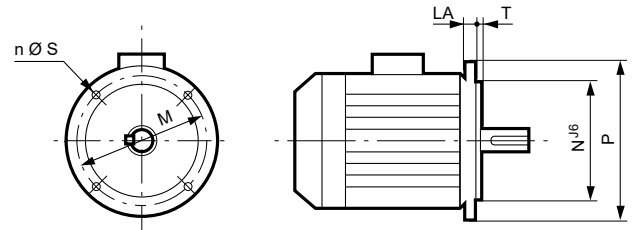
When ordering spare parts, you must indicate the complete motor type, its serial number and the information given on the nameplate (see section 1).

Part numbers can be found on the exploded views and their descriptions in the parts list (section 11).

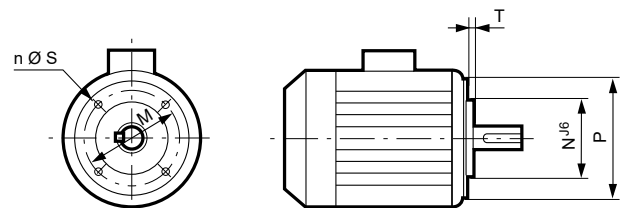
Routine maintenance kits can be obtained from our After Sales Service.

In the case of flange mounted motors, indicate the type of flange and its dimensions (see below).

Flange mounted motor



Face mounted motor



To ensure that our motors operate correctly and safely, it is essential to use original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

10.2 - Safety regulations

Before any work is carried out on the motor or in the cabinet, ensure that there is no potentially explosive atmosphere and that all the equipment components are switched off. Also make sure that the motor is cool enough to avoid any risk of burns.

Before any work is carried out on the motor or in the cabinet, check that the power factor compensation capacitors are isolated and/or discharged (read the voltage at the terminals).

Before any work is carried out in the terminal box or in the cabinet, check that the space heaters are switched off.

Depending on the type of thermal protection, the motor may remain powered up. Ensure that the mains supply is disconnected before any work is carried out in the terminal box or in the cabinet.

10.3 - Routine maintenance

Inspection after commissioning

After approximately 50 hours' operation, check the tightness of the fixing screws on the motor and the coupling device. In the case of chain or belt transmission, check that the tension is correctly adjusted.

Cleaning

To ensure the motor operates correctly, remove any dust or foreign bodies which may clog the air intake and the housing fins. Precaution: Check that the motor is completely sealed (terminal box, drain holes, etc) before carrying out any cleaning operation. Dry cleaning (vacuuming) is always preferable to wet cleaning. Under no circumstances should cleaning the motor lead to any build-up of static.

Cleaning must always be carried out at a pressure of less than 10 bars, from the centre of the motor outwards to avoid dust and particles getting under the seals.

Draining condensation water (if optional drain plugs fitted)

Variations in temperature cause condensation to form inside the motor. This must be removed before it affects the operation of the motor.

Condensation drain holes, located at the bottom of the motors (taking account of their operating position) are sealed with flameproof plugs.

Replace the drain hole covers in order to maintain the flameproof properties of the motor. Clean the holes and plugs before reassembly.

10.3.1 - Greasing

10.3.1.1 - Grease life

The lifetime of a lubricating grease depends on:

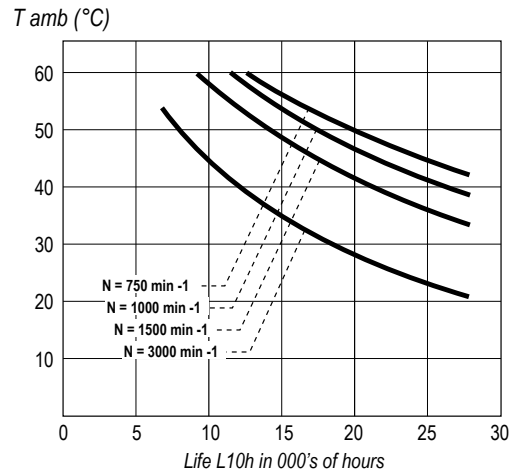
- the characteristics of the grease (type of soap and base oil, etc)
- service stress (type and size of bearing, speed of rotation, operating temperature, etc)
- contamination

10.3.1.2 - Permanently greased bearings

For motors of $80 \leq$ frame size < 132 , the type and size of the bearings make for long grease life and therefore lubrication for the lifetime of the machine. The grease life L_{10h} according to speed of rotation and ambient temperature is shown on the chart opposite.

Type	Frame size	Number of poles	N.D.E.	
			N.D.E.	D.E.
FLSD	80	2; 4; 6; 8	6203 ZZ C3	6204 ZZ C3
	90	2; 4; 6; 8	6204 ZZ C3	6205 ZZ C3
	100	2; 4; 6; 8	6205 ZZ C3	6206 ZZ C3
	112	2; 4; 6; 8	6205 ZZ C3	6206 ZZ C3
	132	2; 4; 6; 8	6207 ZZ C3	6308 ZZ C3

Grease life L_{10h} in 000's of hours, for frames sizes < 132



10.3.1.3 - Bearings with grease nipples

The chart below shows the regreasing intervals, depending on the type of motor, for standard bearing assemblies of frame size ≥ 160 fitted with grease nipples, operating at an ambient temperature of 40°C on a horizontal shaft machine.

NB: The quality and quantity of grease and the regreasing interval are shown on the machine nameplate. Caution, too much grease in a bearing is just as harmful as insufficient lubrication.

10.3.1.4 - Special assembly

For special assemblies (motors fitted with DE roller bearings or other types), machines of frame size ≥ 160 have bearings with grease nipples.

Instructions for bearing maintenance are given on the nameplates on these machines.

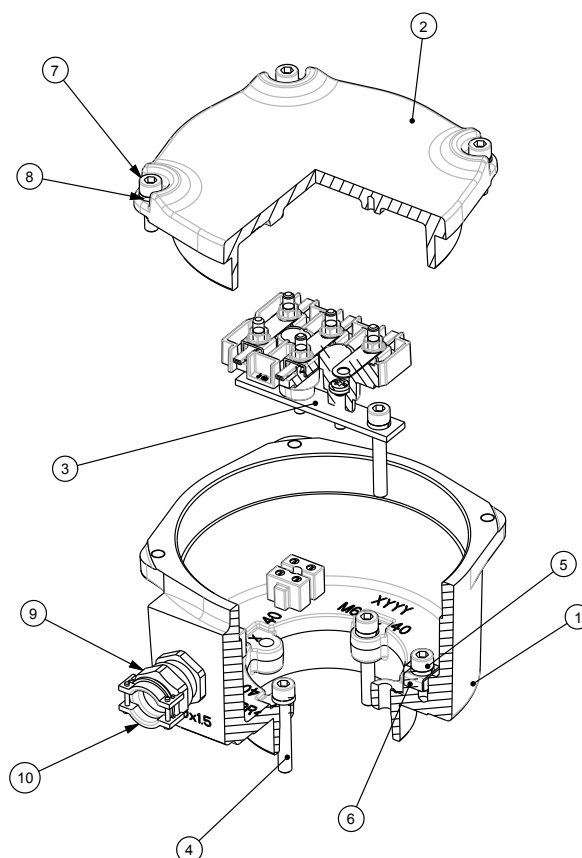
The chart below is valid for FLSD motors placed in horizontal position and lubricated with MOBIL POLYREX EM 103 grease, which is used as standard.

Type	Frame size	Number of poles	Type of bearing for bearings with grease nipples		Quantity of grease g	Regreasing intervals in hours							
			N.D.E.	D.E.		3000 rpm		1500 rpm		1000 rpm		750 rpm	
						25°C	40°C	25°C	40°C	25°C	40°C	25°C	40°C
Ex d(e)	160 - 180	2; 4; 6; 8	6310 C3	6310 C3	15	9200	4600	22000	11000	19500	9750	19500	9750
	200	2; 4; 6; 8	6312 C3	6312 C3	19	7200	3600	19400	9700	18000	9000	18000	9000
	225	2; 4; 6; 8	6312 C3	6313 C3	22	6400	3200	18000	9000	16500	8250	16500	8250
	250	2; 4; 6; 8	6314 C3	6314 C3	25	5600	2800	16600	8300	16000	8000	16000	8000
	280	2	6317 C3	6317 C3	36	3400	1700	-	-	-	-	-	-
	280	4; 6; 8	6318 C3	6318 C3	39	-	-	12400	6200	16000	8000	16000	8000
	315	2	6317 C4	6317 C4	36	3400	1700	-	-	-	-	-	-
	315	4; 6; 8	6320 C3	6320 C3	49	-	-	10800	5400	16000	8000	16000	8000
	355	2	6317 C4	6317 C4	36	3400	1700	-	-	-	-	-	-
	355	4; 6; 8	6322 C3	6322 C3	58	-	-	9000	4500	16000	8000	16000	8000

10.4 - Terminal box rotation

It is possible to pivot the terminal box by 90° or 180°.

- Remove the lid (2) by unscrewing all four fixing screws (7).
- Detach the terminal plate from its support (3) by unscrewing both fixing screws without undoing the connection cables coming from the winding.
- Move the terminal block aside so as to gain access to all the screws located underneath.
- Undo the screw holding the terminal block support plate (3).
- Undo the 3 screws (5) of the housing terminal box.
- Turn the terminal box (90° or 180°) to the required position, taking care not to damage the wires. It is equally important not to damage the flameproof seals.
- Lock the terminal box in its new position by replacing the fixing screws (4) and tightening them to the torque defined in the appendix.
- Replace the terminal block support plate (3) in its original position in relation to the housing. Ensure that the part opposite the plate is fully inserted in the anti-rotation knock-out, then tighten the fixing screw to the recommended torque.
- Place the terminal block opposite the fixing holes, replace the screws and tighten them to the defined torque.
- Replace the lid (2) taking care not to damage the flameproof seals and tighten them to the defined torque.



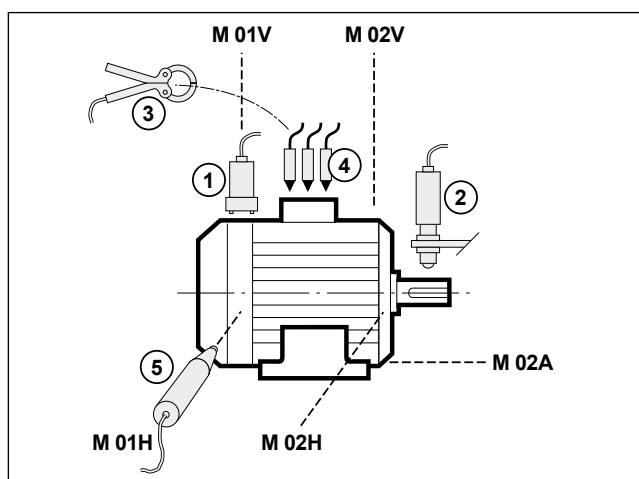
No.	Description	Tightening torque
10	Anchoring module	
9	Ex cable gland	
7-8	Class 8-8 screws and washers	10 Nm
6	Terminal washer	
5	Class 8-8 screws	10 Nm
4	Class 8-8 screws and washers	10 Nm
3	Terminal block support	
2	Lid	
1	Terminal box	

10.5 - Troubleshooting guide (in addition to standard IEC 79-17)

Incident	Possible cause	Remedy
Abnormal noise	Originating in motor or machine being driven?	Uncouple the motor from the equipment being driven and test the motor on its own
Noisy motor	<p>Mechanical cause: if the noise persists after switching off the electrical power supply</p> <ul style="list-style-type: none"> - Vibration - Damaged bearings - Mechanical friction: ventilation, coupling <p>Electrical cause: if the noise stops after switching off the electrical power supply</p> <ul style="list-style-type: none"> - Normal voltage and 3 phases balanced - Abnormal voltage - Phase imbalance (current) 	<ul style="list-style-type: none"> - Check that the key conforms to the type of balancing (see section 10.3) - Change the bearings - Check - Check the power supply at the motor terminals - Check the connection of the terminal block and the tightening of the connectors - Check the power supply line - Check the winding resistance and the balancing of the mains supply (voltage)
Motor heats abnormally	<ul style="list-style-type: none"> - Faulty ventilation - Faulty supply voltage - Terminal connection fault - Overload - Partial short-circuit - Phase imbalance 	<ul style="list-style-type: none"> - Check the environment - Clean the fan cover and the cooling fins - Check that the fan is correctly mounted on the shaft - Check - Check - Check the current consumption in relation to that indicated on the motor nameplate - Check the electrical continuity of the windings and/or the installation - Check the winding resistance
Motor does not start	<p>At no load</p> <ul style="list-style-type: none"> - Mechanical seizing - Broken power supply line <p>On load</p> <ul style="list-style-type: none"> - Phase imbalance 	<p>When switched off:</p> <ul style="list-style-type: none"> - Check by hand that the shaft rotates freely - Check the fuses, electrical protection, starting device, electrical continuity <p>When switched on:</p> <ul style="list-style-type: none"> - Check the direction of rotation (phase order) - Check the resistance and continuity of the windings - Check the electrical protection

10.6 - Preventive maintenance

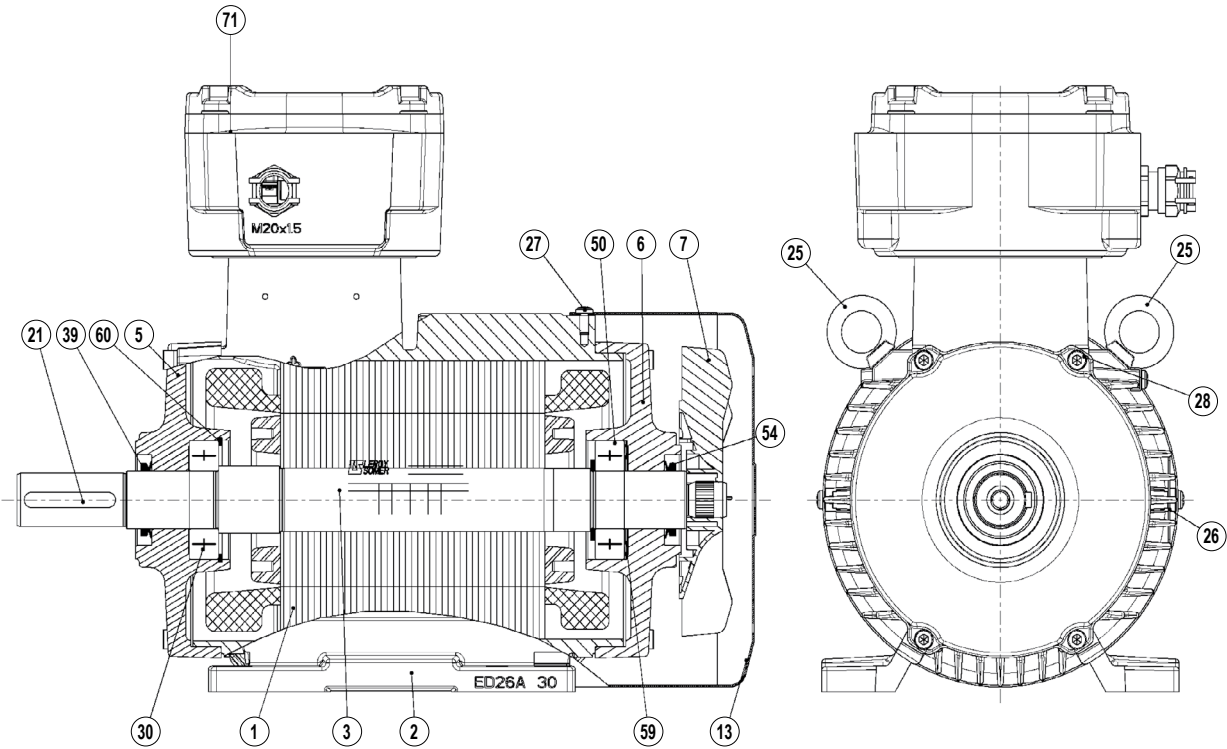
The diagram and table below give the recommended equipment to use and the ideal positions to take measurements of all parameters which can affect the operation of the machine, such as eccentricity, vibration, state of the bearings, structural problems, electrical problems, etc.



Detector	Measurement	Measurement points								
		M 01V	M 01H	M 02V	M 02H	M 02A	Shaft	E01	E02	E03
① Accelerometer	For measuring vibrations	●	●	●	●	●				
② Photo-electric cell	For measuring speed and phase (balancing)						●			
③ Clamp ammeter	For measuring current (D.C. and 3-phase A.C.)							●	●	●
④ Voltage probe	For measuring voltages							●	●	●
⑤ Infra-red probe	For measuring temperature	●		●						

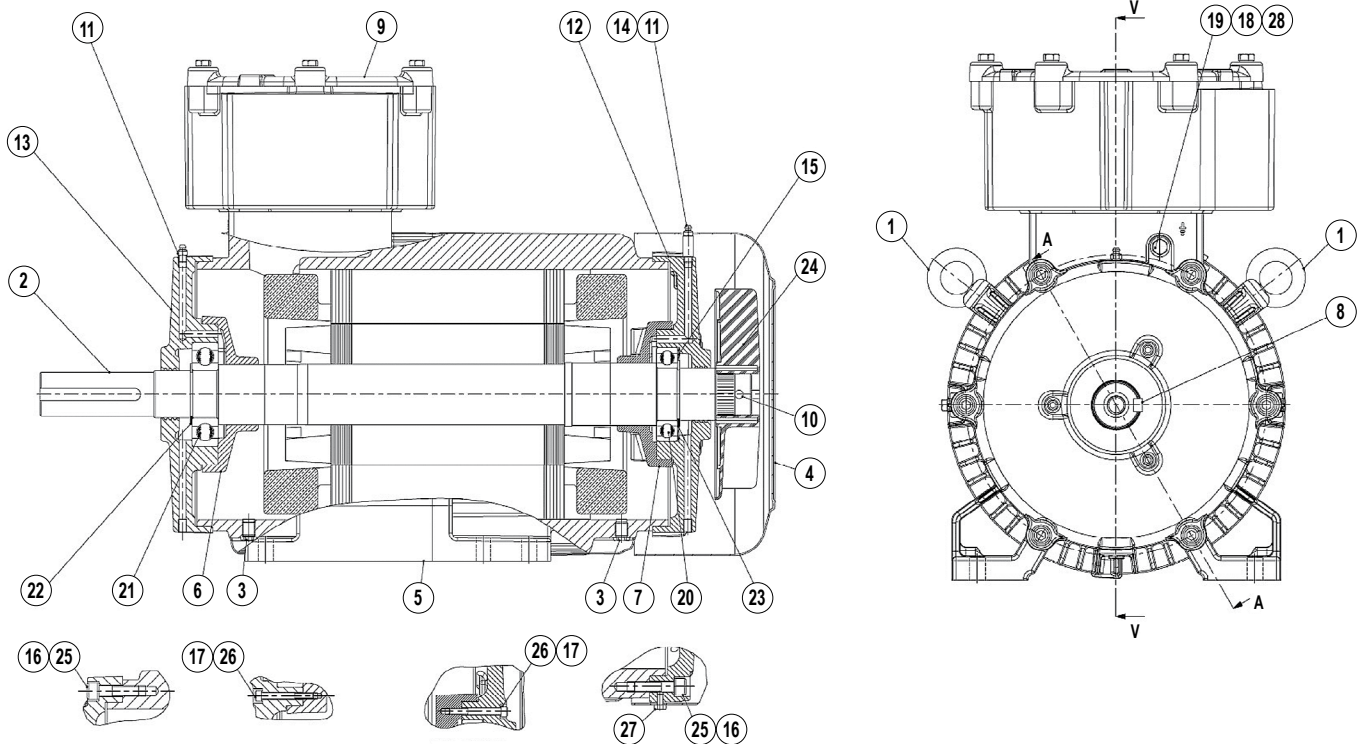
11 - EXPLODED VIEWS, PARTS LISTS

11.1 - FLSD 80 to 132



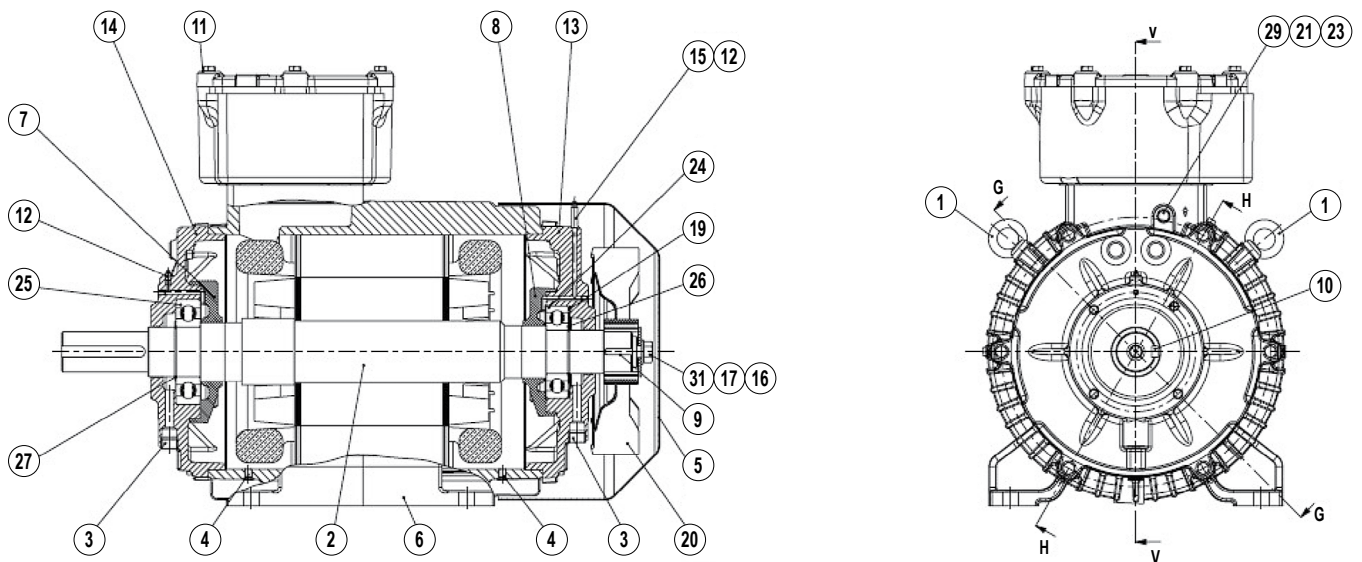
Number	Name	Number	Name	Number	Name
1	Wound stator	21	Shaft end key	50	Non-drive end bearing
2	Frame	25	Lifting ring	54	NDE seal
3	Rotor	26	Nut	59	Preloading (wavy) washer
5	DE shield	27	Cover fixing screw	60	Circlip
6	NDE shield	28	Screw	71	Terminal box
7	Fan	30	DE bearing		
13	Fan cover	39	Drive end seal		

11.2 - FLSD 160 to 225



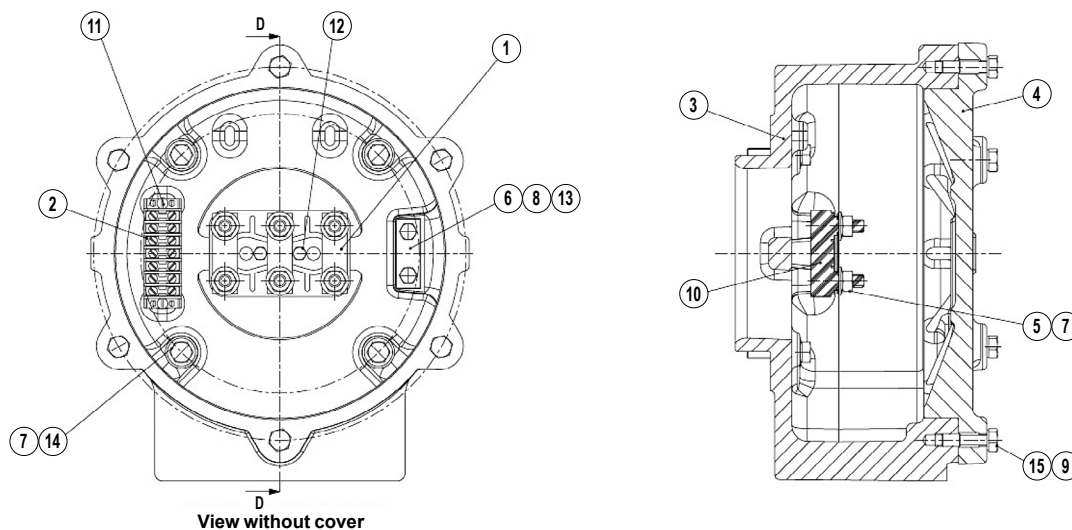
Number	Name	Number	Name	Number	Name
1	Lifting ring	11	"Hydraulic" grease nipple	21	Bearing
2	Shaft	12	NDE shield	22	Shaft circlip
3	Blanking plug	13	DE shield	23	Shaft circlip
4	Fan cover	14	Extension for grease nipple	24	Fan
5	B3 housing	15	Preloading (wavy) washer	25	Screw
6	Bearing retainer	16	Lock washer	26	Screw
7	Bearing retainer	17	Lock washer	27	Screw
8	Key	18	Lock washer	28	Screw
9	Terminal box assembly	19	Washer		
10	Spring pin	20	Bearing		

11.3 - FLSD 250 and 280



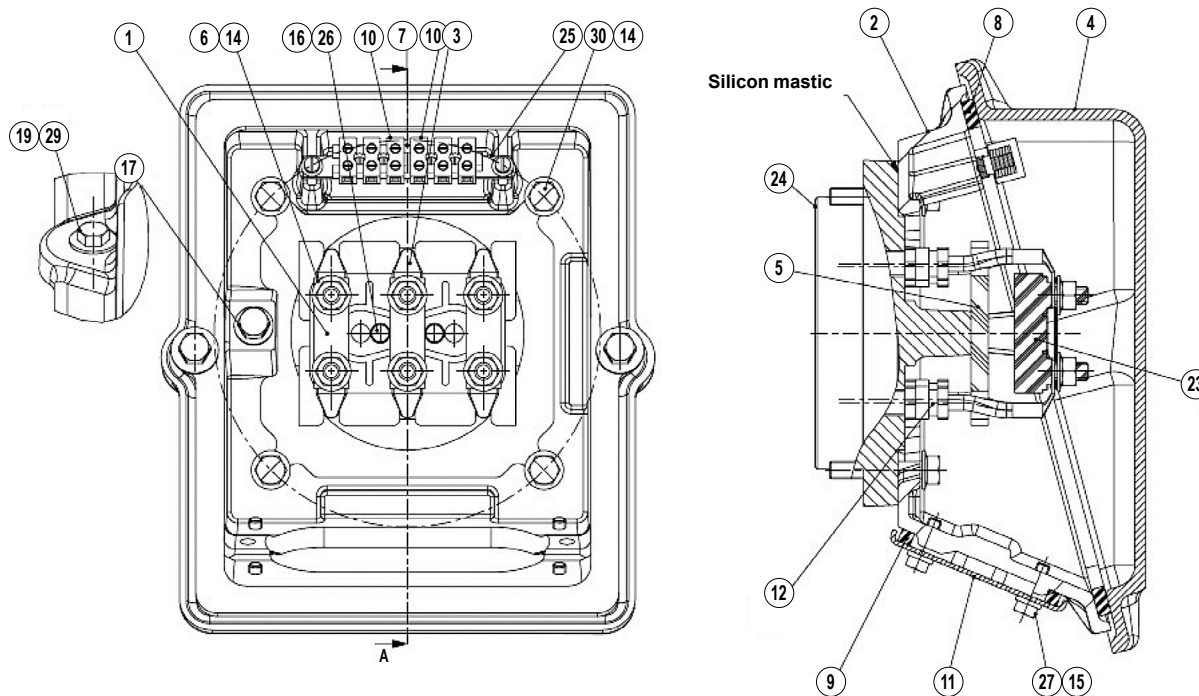
Number	Name	Number	Name	Number	Name
1	Lifting ring	12	"Hydraulic" grease nipple	23	Washer
2	Shaft	13	IP55 NDE shield	24	Bearing
3	Hexagonal-shaped plug	14	IP55 DE shield	25	Bearing
4	Blanking plug	15	Extension for grease nipple	26	Shaft circlip
5	Fan cover	16	Contact washer	27	Shaft circlip
6	Housing	17	Contact washer	28	Plastic fan
7	Bearing retainer	18	Shaft end washer	29	Screw
8	Bearing retainer	19	Preloading (wavy) washer	30	Screw
9	Key	20	Sealed washer	31	Screw
10	Key	21	Lock washer		
11	Terminal box assembly	22	Washer		

Ex d terminal box



Number	Name	Number	Name	Number	Name
1	Connector bar	6	Grounding plate	11	Screw
2	Auxiliary terminal block	7	Contact washer	12	Screw
3	Terminal box	8	Lock washer	13	Screw
4	Terminal box lid	9	Lock washer	14	Screw
5	Nut	10	Terminal baseplate	15	Captive screw

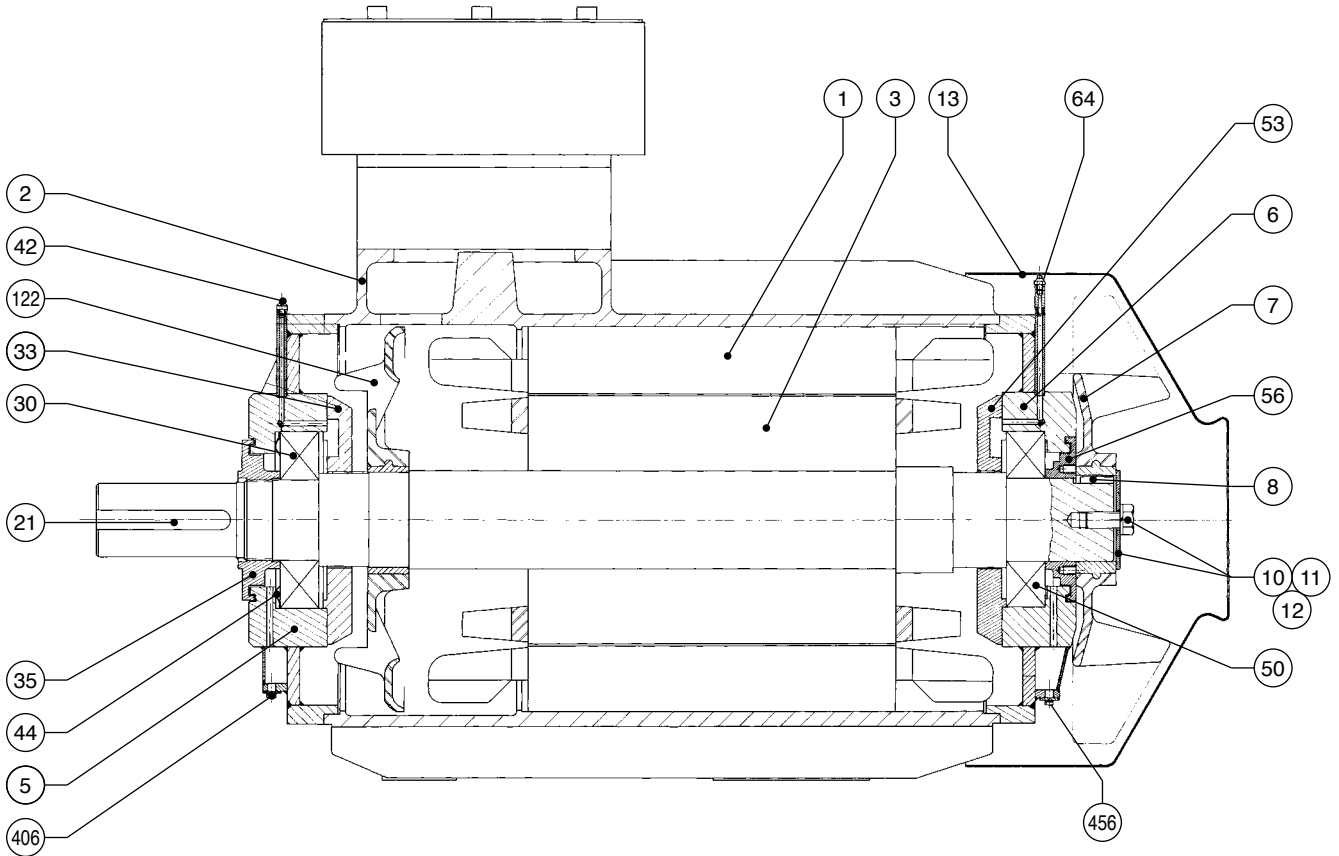
Ex e terminal box



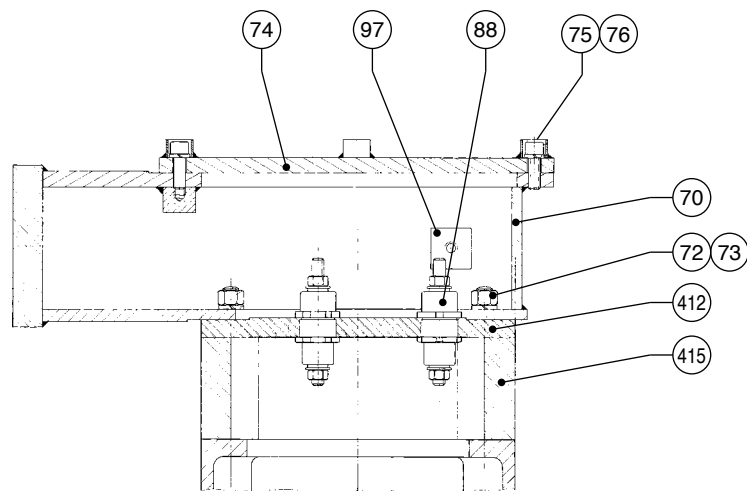
Number	Name	Number	Name	Number	Name
1	Connector bar	8	Terminal box lid seal	15	Sealed washer
2	Terminal box	9	Cable gland plate seal	16	Lock washer
3	Angled connector	10	BARTEC 3P mini-terminal	17	Lock washer
4	Terminal box cover	11	Cable gland support plate	18	Lock washer
5	Screen	12	Cable glands	19	Washer
6	Nut	13	Contact washer	20	Washer
7	BARTEC assembly	14	Contact washer		

11.4 - FLSD 315 to 355

Ex d



Ex d terminal box



Number	Name	Number	Name	Number	Name
1	Wound stator	30	DE bearing	74	"d" terminal box cover
2	Housing	33	DE internal cover	75	"d" cover fixing screw
3	Rotor	35	Moving part of DE grease valve	76	Cover washer
5	DE shield	42	DE grease nipple	88	Terminal post
6	NDE shield	44	DE preloading (wavy) washer	97	Earth terminal
7	Fan	50	NDE bearing	122	Stirrer
8	Fan key	53	NDE internal cover	406	Grease valve cover plate
10	Turbine or fan screw	56	Moving part of NDE grease valve	412	"d" terminal box support
11	Washer	64	NDE grease nipple	415	Terminal box height spacer
12	Lock washer	70	"d" terminal box casing	456	Grease valve cover plate
13	Fan cover	72	Terminal box screw		
21	Key	73	Terminal box washers		

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