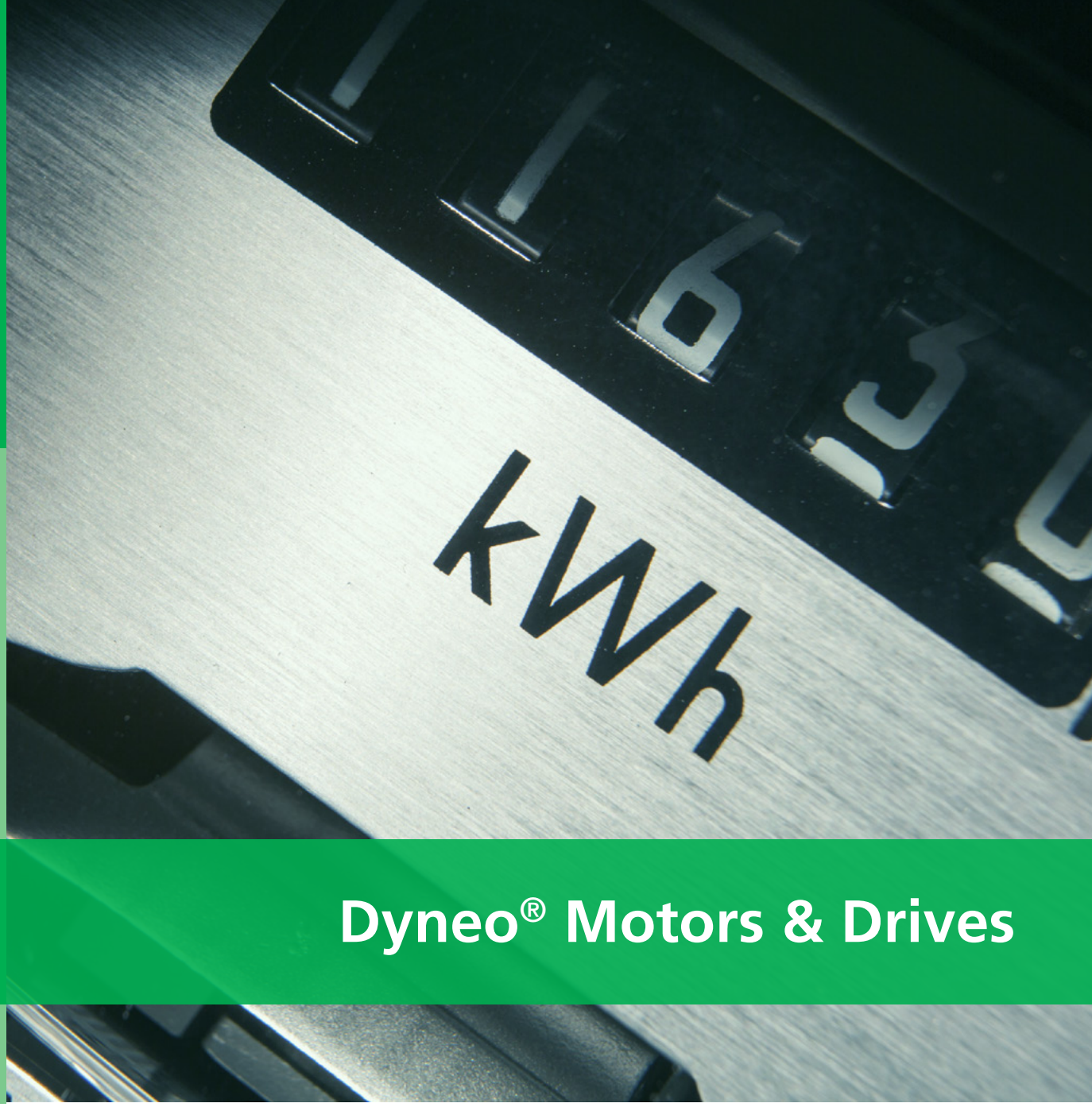


Dyneo® Motors & Drives

Unidrive M variable speed drives
LSRPM permanent magnet synchronous motors

13 to 320 HP (9.8 to 240 kW)
460 V

CONTROL TECHNIQUES™

Nidec
All for dreams

High-performance Solutions

Control Techniques presents the Dyneo® range, a high-performance solution consisting of permanent magnet synchronous motors and variable speed drives.

Combined with Unidrive M600 and M700 drives, LSRPM motors offer solutions suited to the industrial environment, producing optimum electrical and mechanical performance, that are ideal for saving energy and substantially cutting operating costs:

- Extended speed range
- High torque
- Super premium efficiency
- Unrivalled power density
- Motor control with or without encoder feedback

The Unidrive M - LSRPM combinations described in this catalog are suitable for most applications.

Add-ons or options for drives and motors can be included to satisfy particular demands.

Sensorless control

Fifteen years' experience of controlling permanent magnet motors and ongoing collaboration between our motors and drives development teams have allowed us to test different algorithms for total sensorless control of the majority of Process applications.

The aim is to offer the user the benefit of the excellent performance of permanent magnet motors with the simplicity of induction motors.

For information about the detailed operating conditions of this control mode, see the "Control modes" section.

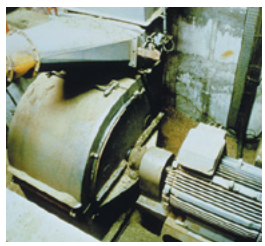
Single manufacturer warranty

A motor-drive system produced by a single manufacturer ensures optimum performance obtained by using components designed to work together, with a global warranty from a single company.

Further information about the products described in this catalog is available in the corresponding technical documentation.







Unidrive M AC/Servo Drives

Unidrive M Product Range 0.33 HP (0.25 kW) to 4,200 HP (2.8 MW)

Customized range of drives to meet the needs of industrial sectors

The Unidrive M range has been specifically designed for industrial applications and offers excellent levels of functionality, flexibility and performance.

The Unidrive M motor control algorithm has been optimized with Dyneo® motors in order to obtain maximum performance.

Unidrive M drives are designed for easy integration in industrial enclosures.

CODESYS

Ethernet Onboard

Sensorless
Permanent Magnet Motor Control

SIL3
Safety Integrity Level

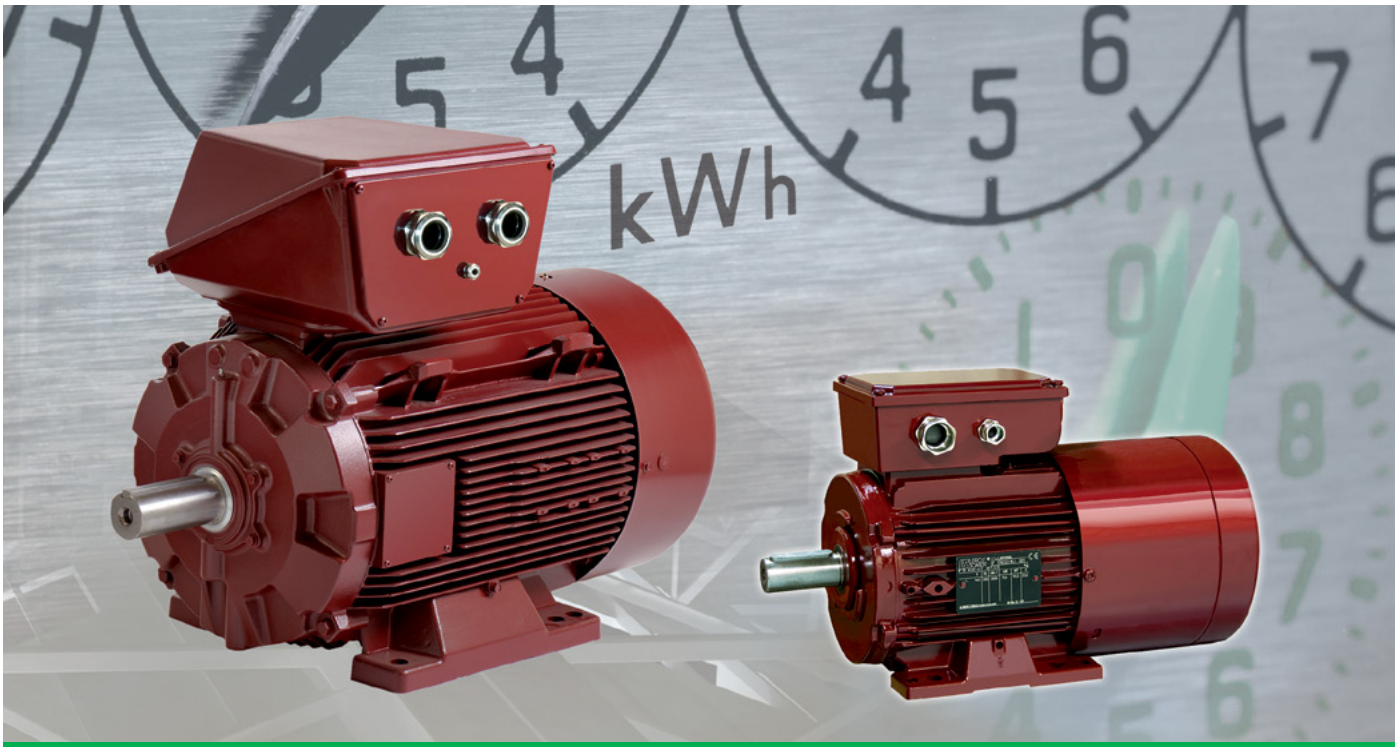
IEEE 1588
Precision Time Protocol

More information about Unidrive M

N1652

E171230

Dyneo® Permanent Magnet Motors



Dyneo® Product Range 1.0 HP (0.75 kW) to 670 HP (500 kW)

Innovation you can place your trust in

Alliance of magnet rotor technology and the induction motor's tried and tested mechanical arrangement

Exceptional savings

On the purchase price

- Simplification through elimination of transmission devices (pulleys, belts, etc.): extended speed range
- Longer service life
- Reduction in the weight and dimensions of the driven machine: up to 3 frame sizes smaller

On energy bills

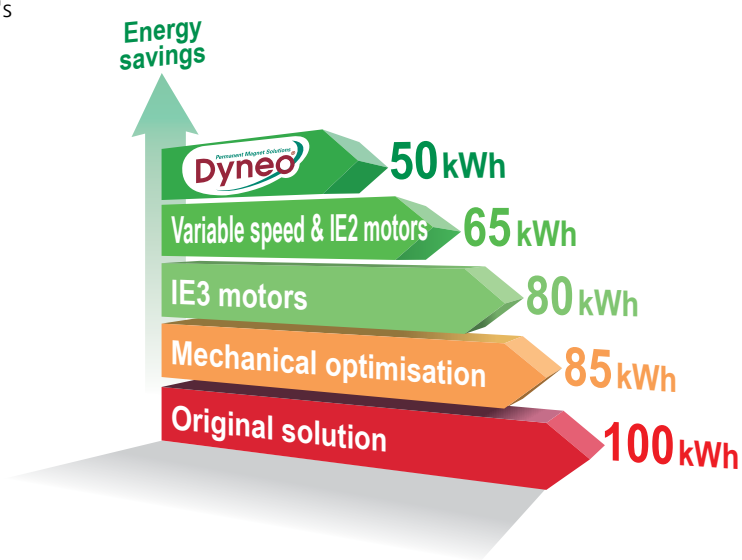
- High efficiency over the entire speed range

On maintenance

- Less stress on the machine

Performance

- Guaranteed torque over the entire speed range
- Optimized power with centrifugal torque operation



kWh: electricity consumption

Unidrive M, Fast and Easy Integration Flexibility

Programming and parameter-setting options

Unidrive M Connect

KI-Keypad

KI-Keypad RTC

Remote Keypad

Remote Keypad RTC

Human-Machine Interface

Smartcard

SD card with SD card adapter

KI-485-Adaptor

Speed feedback

SI-Encoder

SI-Universal Encoder

- Standard on Unidrive M700:
  - 2 universal encoder input channels
  - BISSC EnDat 2.2, HIPERFACE and SSI taken into account
  - 1 simulated encoder output

Control modes

LSRPM

LSRPM
with encoder

- Control of induction motors in open loop flux vector or V/Hz mode
- RFC (Rotor Flux Control) of induction motors in open loop mode (RFC-A)
- RFC (Rotor Flux Control) of induction motors in closed loop mode (RFC-A)

  (with SI-Encoder option for Unidrive M600)
- Control of permanent magnet motors in open loop mode (RFC-S)
- Control of permanent magnet motors in closed loop mode (RFC-S) (Unidrive M700)

Power converter
AFE (Active Front End)

Applications with PLC functionality and motion control

Ease of use of both the onboard PLC and the Advanced Motion Controller for Unidrive M700, within the IEC61131 programming environment

SI-Applications Plus

for programs developed on SYPTPro

Option for the Unidrive M700

MCi 200

Advanced machine control

Option for the Unidrive M700

MCi 210

Advanced machine control with additional Ethernet connectivity

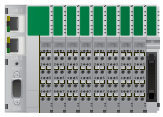
Option for the Unidrive M700

I/O

Standard on Unidrive M700 and M701
- 5 x analog I/O*
- 8 x digital I/O
- 1 x STO
  (2 X STO for M702)

*Unidrive M702 does not have analog I/O as standard

Remote I/O



SI-I/O

PLC/Centralized motion controller for Unidrive M700

Motion controller

PLC

Industrial PC

Safety

SI-Safety

Communications

- *Unidrive M600 and M701:*
  - *RS485 (Modbus RTU)*
- *Unidrive M700 and M702:*
  - *Ethernet (IEEE 1588 V2)*
  - *EtherNet/IP*
  - *Modbus TCP/IP*
  - *TCP/IP*
  - *UDP*

SI-Ethernet

SI-DeviceNet

SI-PROFINET-V2

SI-EtherCAT

SI-CANopen

SI-PROFIBUS

See the individual Unidrive M product brochures and technical documentation for model details including selection and options.

Unidrive M drives

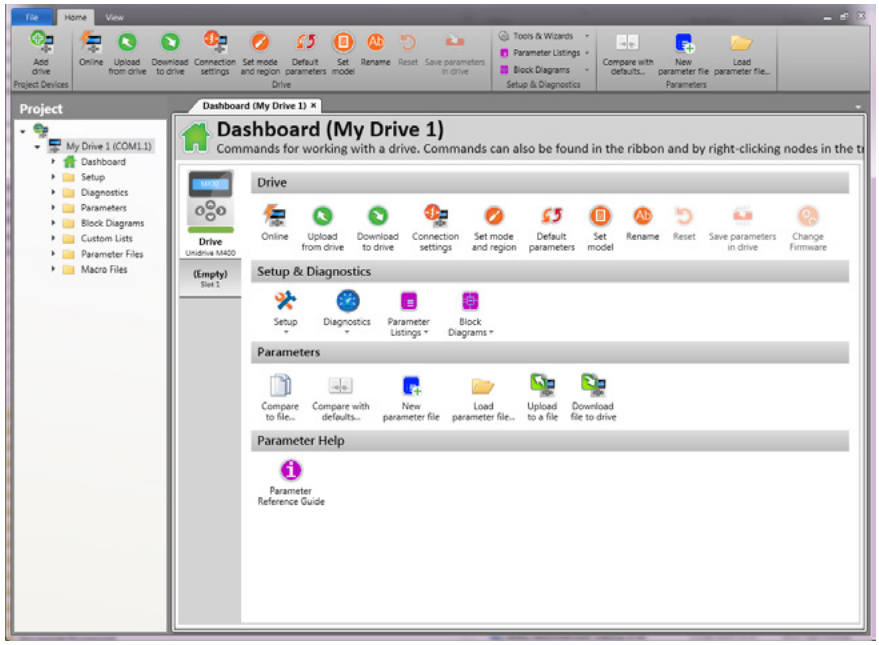
Unidrive M is a range of variable speed drives designed for controlling induction, servo and synchronous motors.

This feature gives the Unidrive M a vast field of applications, and it has a level of performance and functionality to cope with the most demanding systems.

The **Unidrive M600** model is dedicated to Sensorless control of LSRPM motors for applications matching the conditions described in the "Control modes" section.

The **Unidrive M700, M701** and **M702** models also feature Sensorless control and can be used to control LSRPM motors in closed loop mode with higher performance, and guarantees maximum machine productivity thanks to its advanced functions.

For quick and easy commissioning of a Unidrive M600 or M700/LSRPM motor-drive unit, use the Unidrive M Connect configuration software. Follow the instructions in the "Quick initial commissioning" section described in the commissioning manual for the relevant drive.



LSRPM motors

Motor Specifications

Description	Materials	Comments
Housing	LSRPM: Aluminum alloy	- With integral or screw-on feet, or without feet - 4 or 6 fixing holes for housings with feet - Lifting rings - Ground terminal with an optional jumper screw
Stator	Insulated low-carbon magnetic steel laminations Electroplated copper	- Low carbon content guarantees long-term lamination pack stability - Welded laminations - Optimized magnetic circuit - Insulation or coating system making it possible to withstand the sudden voltage variations caused by the high switching frequencies of IGBT transistor drives - Class F insulation - Thermal protection provided by PTC probes (1 per phase, 2-wire output)
Rotor	Insulated low-carbon magnetic steel laminations Aluminum alloy Nd-Fe-B magnets	- Magnet fixing system, patented by Leroy-Somer - Rotor balanced dynamically with a half-key (H)
Shaft	Steel	
End shields	Cast iron	
Bearings and lubrication		- Ball bearings, C3 play - Preloaded NDE bearings - Greased for life up to frame size 200, regreasable in larger sizes - Insulated NDE bearings on some motors - Aegis grounding ring on some motors
Labyrinth seal Lipseals	Plastic or steel Synthetic rubber	- Lipseal or deflector at drive end for all flange mounted motors - Lipseal, deflector or labyrinth seal for foot mounted motors
Fan	Composite material or aluminum alloy or steel	- Bi-directional
Fan cover	Pressed steel	- Fitted, on request, with a drip cover for operation in vertical position, shaft end facing down
Terminal box	Aluminum alloy	- Fitted with a terminal block with 3 or 6 steel terminals as standard (brass as an option) - Pre-drilled terminal box without cable glands or with undrilled mounting plate (optional cable gland) - Ground terminal in each terminal box
Brake motor		FCR: synchronous motor and failsafe brake, from 0.33 HP (0.25 kW) to 15 HP (11 kW) FCPL: synchronous motor and failsafe brake, from 20 HP (15 kW) to 175 HP (132 kW)

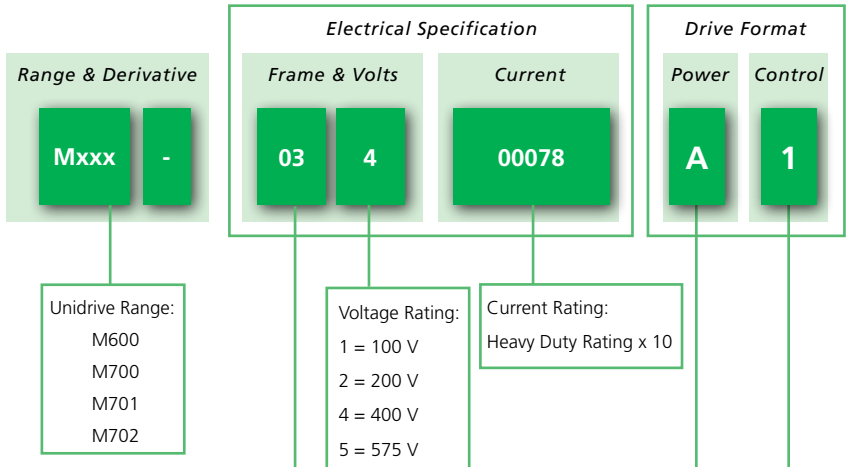
The motor rotor contains a powerful magnetic field. When the rotor is separated from the motor, its field can affect pacemakers or disturb digital devices such as watches, cell phones, etc.

Assembly or maintenance of the rotor must not be carried out by people with a pacemaker or any other implanted medical electronic device.

The assembled motor presents no risk.

Drives

DRIVE ORDER CODE

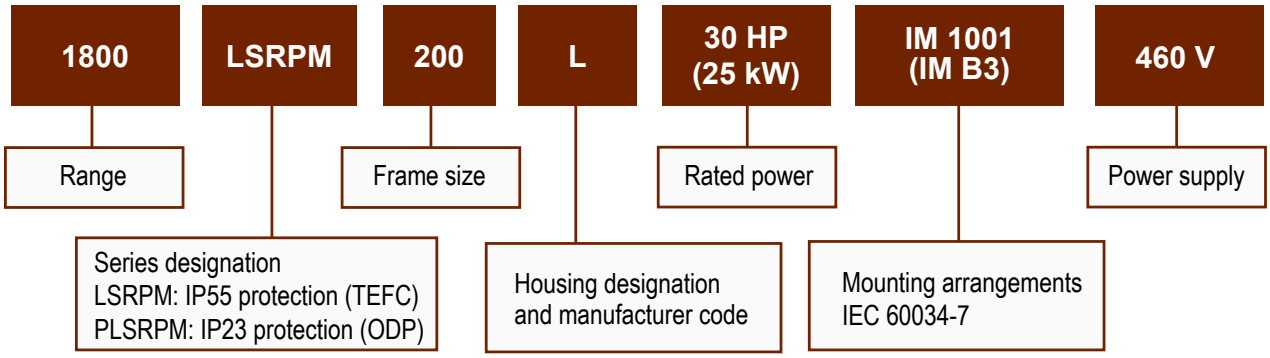


Power	Range ID
A	AC to AC internal line choke
E	AC to AC external line choke required, order separately
D	DC to AC inverter
T	AC to AC integrated twin rectifier and inverter. External line choke required
A	AC to DC 6 pulse rectifier
T	AC to DC 12 pulse rectifier

Control	
1	Standard control factory fit
U	Unassigned power module (requires separate controller)

Motors

MOTOR DESCRIPTION



Control modes

The LSRPM motor combined with the Unidrive M has different characteristics depending on the selected control mode. This should be determined based on:

- the starting torque

- the inertia of the driven machine

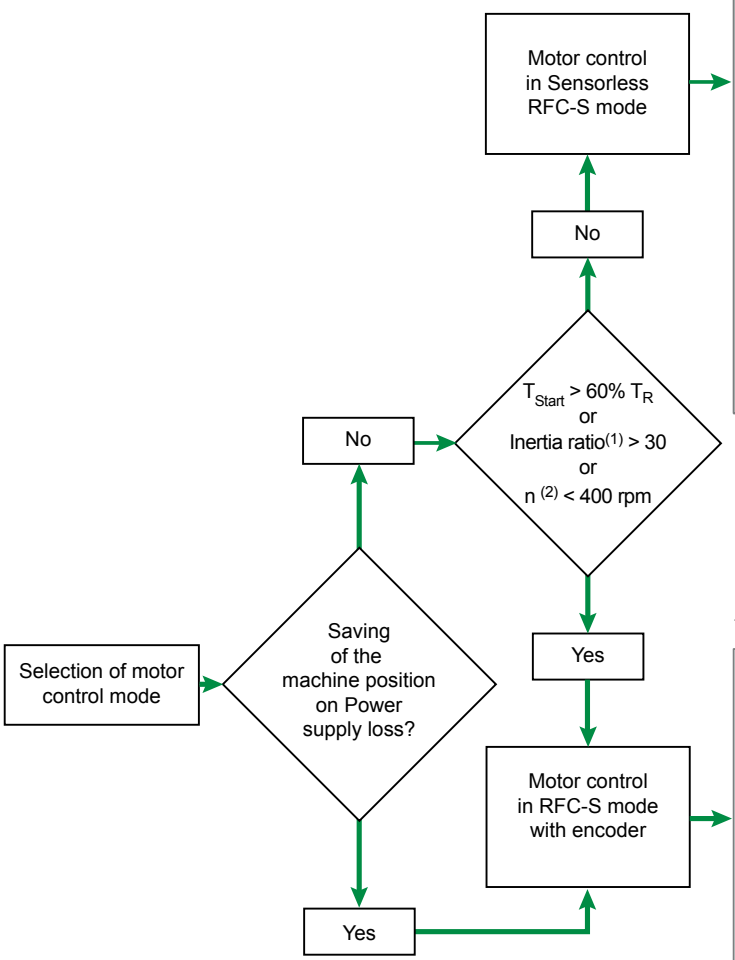
- the machine's rated speed (or regulation range)

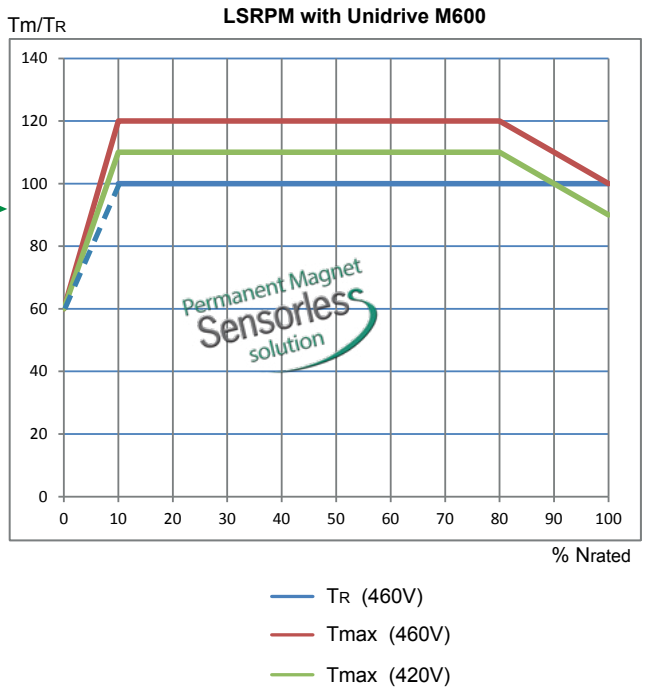
The diagram below can be used to determine the most suitable control mode for the application.

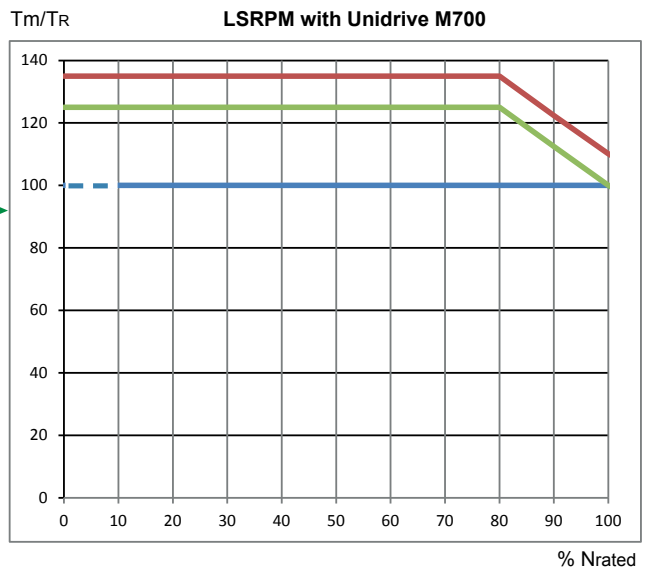
RFC-S Sensorless mode is particularly suitable for applications with low starting torque and an inertia ratio less than 30. The optimum drive model for this operating mode is the Unidrive M600.

In RFC-S mode with encoder feedback (closed loop), the Unidrive M700 offers ideally suited levels of functionality.

To select the encoder, see the "Selection of encoder" section in the "Installation and options" chapter.







(1) Ratio between the driven load inertia related to the motor speed and the motor inertia
(2) Minimum speed

Selection method

Example 1:
A centrifugal pump requires torque of 129 lb-ft at 1,800 rpm in continuous duty (regulation from 600 to 1,800 rpm). The maximum torque is < 115% of T_R, and the starting torque is negligible.

Step 1: Selection of the control mode

Depending on the criteria, RFC-S Sensorless control may be suitable. This can be checked using the table of compatibility between drives and motors.

Example 2:
A machine requires a torque of 129 lb-ft from 1,080 to 1,700 rpm in continuous duty. The maximum torque is 130% of T_n, and the starting torque is 70% of T_R.

Step 1: Selection of the control mode

Depending on the criteria, RFC-S control with encoder feedback may be suitable. This can be checked using the table of compatibility between drives and motors.

Step 2: Selection of the motor-drive unit

Select the motor-drive unit according to the rated and maximum torque required by the application (Selection section).

MOTOR			DRIVE	MOTOR & DRIVE COMBINATION										MOTOR	
Type	Rated power	Efficiency IEC 6003421	Unidrive	Available power	Rated torque	Starting torque	Maximum torque	Maximum torque / Rated torque	Maximum Torque @ rated speed	Full load current Drive (Motor)	Maximum current / Full load current	Switching frequency	Motor & drive efficiency	Moment of inertia	Weight
	Pr	η		Pn	Tr	Ts	Tmax	Tmax/Tr		FLC	Imax / FLC	Fs	η	J	IM B3
	(HP)	(%)	M700-	(HP)	(lb-ft)	(lb-ft)	(lb-ft) (1)		(lb-ft) (2)	(Amps) (3)		(kHz) (4)	(%)	(lb-ft²)	(lb)

1800 range - without encoder (Sensorless)

LSRPM 160 LR	36.6	94.0	06400420A	36.6	106.8	64.1	122.4	1.15	106.8	45	1.17	3.0	92.1	1.486	174.2
LSRPM 200 L	44.3	94.0	07400660A	44.3	129.1	77.5	151.0	1.17	129.1	72	1.21	3.0	92.1	3.085	297.6
LSRPM 200 L	53.6	94.8	07400660A	53.6	156.5	93.9	174.9	1.12	156.5	77	1.13	3.0	92.9	4.034	330.7

1800 range - with encoder

LSRPM 160 LR	36.6	94.0	06400470A	36.6	106.8	146.2	146.2	1.37	125.3	45	1.45	3.0	92.1	1.486	174.2
LSRPM 200 L	44.3	94.0	07400660A	44.3	129.1	155.9	155.9	1.21	140.4	69	1.26	3.0	92.1	3.085	297.6
LSRPM 200 L	44.3	94.0	07400770A	44.3	129.1	176.9	176.9	1.37	151.6	69	1.45	3.0	92.1	3.085	297.6

Example 1:
Selected motor-drive unit:1800 LSRPM 200 L 44 HP and Unidrive M600/074-00660A

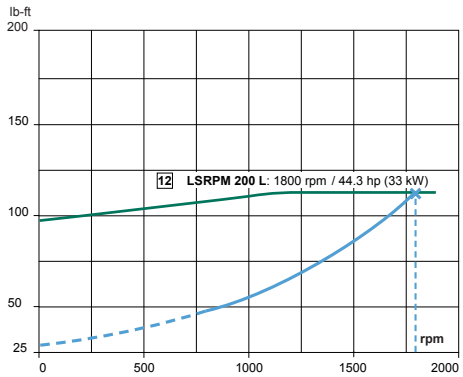
Example 2:
Selected motor-drive unit:
1800 LSRPM 200 L 44 HP and Unidrive M700/074-00770A

Step 3: Check the selection

Using the motor thermal curve, check that the motor is suitable for the torque range required by the application.

Example 1:

Torque from 107 to 333 lb-ft

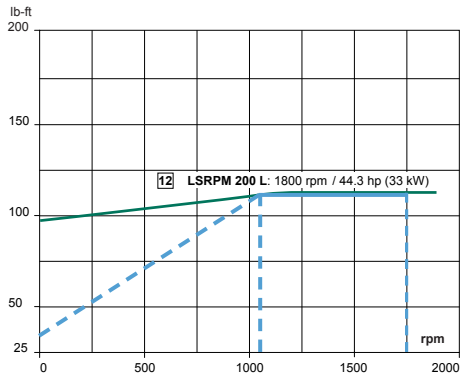


1800 range

Legend
MOTOR
LOAD

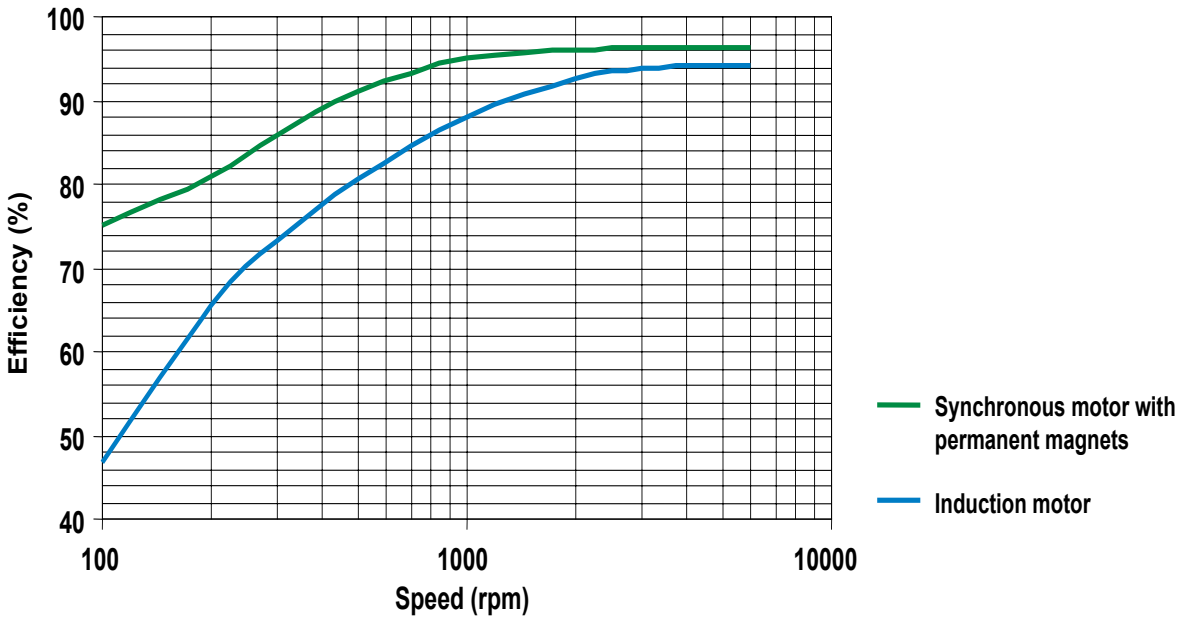
Example 2:

Torque from 107 to 333 lb-ft



Efficiency

The efficiency of Leroy-Somer permanent magnet synchronous motors is higher than those of induction motors and more consistent over the operating speed range (see graph below).



Efficiency of permanent magnet synchronous motors

Apart from a few exceptions, synchronous motors cannot operate correctly on a traditional sinusoidal AC supply. They are practically always supplied via a drive. This catalog provides the efficiencies of Motor & Drive combinations, controlled by Control Techniques drives.

Efficiency of induction motors supplied via drives

As a general rule, the efficiencies of induction motors listed in catalogs are values measured on a sinusoidal AC supply at rated speed.

The voltage and current waveforms created by the drive are not sinusoidal. Supplying power via a drive therefore results in additional losses in the motor. These are estimated at 20% of the total losses, according to specifications 60034-17. These losses have a direct impact on the "actual" efficiency of the motor.

In variable speed mode, this efficiency should therefore be corrected in accordance with the formula below.

$$\eta_2 = \eta_1/(1.2 - 0.2\ \eta_1)$$

η_2 = efficiency of induction motor controlled by a drive

η_1 = efficiency of induction motor supplied from the AC supply

Example of induction/synchronous efficiency: 270 HP application at 3600 rpm

η_1: Efficiency of the 270 HP, 2-pole induction motor on 60 Hz AC supply = 96%

η_2: Estimated efficiency of the same induction motor supplied via a drive at 60 Hz

η_2 = 0.96/(1.2 - 0.2 x 0.96) = 0.9524 i.e. 95.24%

Efficiency of the equivalent synchronous motor = 97.3%

Notes

1800 range - without encoder (Sensorless)

Class F - DT80K - S1 Self-Cooled - Altitude 1000 m max - Ambient temperature 40°C max

460 V drive input voltage

Drive limit
Motor limit

MOTOR			DRIVE	MOTOR & DRIVE COMBINATION										MOTOR	
Type	Rated power	Efficiency IEC 6003421	Unidrive	Available power	Rated torque	Starting torque	Maximum torque	Maximum torque / Rated torque	Maximum Torque @ rated speed	Full load current Drive (Motor)	Maximum current / Full load current	Switching frequency	Motor & drive efficiency	Moment of inertia	Weight
	Pr	η		Pn	Tr	Ts	Tmax	Tmax/Tr		FLC	Imax / FLC	Fs	η	J	IM B3
	(HP)	(%)	M600-	(HP)	(lb-ft)	(lb-ft)	(lb-ft) (1)		(lb-ft) (2)	(Amps) (3)		(kHz) (4)	(%)	(lb-ft²)	(lb)
LSRPM 132 M	13.1	92.0	04400150A	13.1	38.4	23.0	42.8	1.12	38.4	18	1.13	3.0	90.2	0.392	88.2
LSRPM 132 M	13.1	92.0	04400172A	13.1	38.4	23.0	46.0	1.20	38.4	18	1.25	3.0	90.2	0.392	88.2
LSRPM 132 M	16.5	92.5	04400172A	16.5	48.2	28.9	56.1	1.16	48.2	22	1.20	3.0	90.6	0.548	97.0
LSRPM 132 M	19.3	93.0	04400172A	18.5	54.1	32.5	59.4	1.10	54.1	24 (25)	1.10	3.0	91.1	0.738	108.0
LSRPM 132 M	19.3	93.0	05400270A	19.3	56.3	33.8	67.6	1.20	56.3	25	1.25	3.0	91.1	0.738	108.0
LSRPM 160 MP	25.1	93.5	05400270A	23.5	68.6	41.2	75.4	1.10	68.6	30 (32)	1.10	3.0	91.6	0.992	132.3
LSRPM 160 MP	25.1	93.5	05400300A	24.3	70.9	42.6	78.0	1.10	70.9	31 (32)	1.10	3.0	91.6	0.992	132.3
LSRPM 160 MP	25.1	93.5	06400350A	25.1	73.2	43.9	87.8	1.20	73.2	32	1.25	3.0	91.6	0.992	132.3
LSRPM 160 MP	30.8	94.0	06400350A	30.8	90.0	54.0	99.0	1.10	90.0	38	1.10	3.0	92.1	1.220	152.1
LSRPM 160 MP	30.8	94.0	06400420A	30.8	90.0	54.0	108.0	1.20	90.0	38	1.25	3.0	92.1	1.220	152.1
LSRPM 160 LR	36.6	94.0	06400420A	36.6	106.8	64.1	122.4	1.15	106.8	45	1.17	3.0	92.1	1.486	174.2
LSRPM 200 L	44.3	94.0	07400660A	44.3	129.1	77.5	151.0	1.17	129.1	72	1.21	3.0	92.1	3.085	297.6
LSRPM 200 L	53.6	94.8	07400660A	53.6	156.5	93.9	174.9	1.12	156.5	77	1.13	3.0	92.9	4.034	330.7
LSRPM 200 L	53.6	94.8	07400770A	53.6	156.5	93.9	187.7	1.20	156.5	77	1.25	3.0	92.9	4.034	330.7
LSRPM 200 L	73.8	95.7	07400770A	68.7	200.3	120.2	220.4	1.10	200.3	94 (101)	1.10	3.0	93.8	4.746	363.8
LSRPM 200 L	73.8	95.7	07401000A	73.8	215.2	129.1	253.5	1.18	215.2	101	1.22	3.0	93.8	4.746	363.8
LSRPM 225 ST1	93.9	96.1	08401340A	93.9	273.9	164.3	328.6	1.20	273.9	125	1.25	3.0	94.2	6.170	425.5
LSRPM 225 MR1	114.0	96.0	08401340A	112.5	328.3	197.0	361.2	1.10	328.3	155 (157)	1.10	3.0	94.1	7.594	491.6
LSRPM 225 MR1	114.0	96.0	08401570A	114.0	332.5	199.5	399.0	1.20	332.5	157	1.25	3.0	94.1	7.594	491.6
LSRPM 250 ME	134.1	96.1	08401570A	134.1	391.2	234.7	442.4	1.13	391.2	176	1.15	3.0	94.2	15.425	628.3
LSRPM 250 ME	134.1	96.1	09402000A	134.1	391.2	234.7	469.5	1.20	391.2	176	1.25	3.0	94.2	15.425	628.3
LSRPM 280 SC	167.6	96.3	09402000A	167.6	489.0	293.5	545.4	1.12	489.0	216	1.13	3.0	94.4	19.934	727.5
LSRPM 280 SC	167.6	96.3	09402240A	167.6	489.0	293.5	586.8	1.20	489.0	216	1.25	3.0	94.4	19.934	727.5
LSRPM 280 SD	201.2	96.4	09402240A	195.0	569.1	341.5	642.5	1.13	569.1	255 (263)	1.15	3.0	94.5	23.730	837.8
LSRPM 280 SD	201.2	96.4	10402700E	201.2	586.9	352.2	704.4	1.20	586.9	263	1.25	3.0	94.5	23.730	837.8
LSRPM 280 MK1	234.7	96.5	10402700E	234.7	684.7	410.8	786.4	1.15	684.7	299	1.18	3.0	94.6	42.715	1252.2
LSRPM 315 SP1	261.5	96.7	10402700E	251.3	733.1	439.9	806.5	1.10	733.1	320 (333)	1.10	3.0	94.8	53.156	1399.9
LSRPM 315 SP1	261.5	96.7	10403200E	261.5	762.9	457.8	884.1	1.16	762.9	333	1.19	3.0	94.8	53.156	1399.9
LSRPM 315 MR1	308.4	96.9	10403200E	289.3	843.8	506.3	928.1	1.10	843.8	361 (385)	1.10	3.0	95.0	64.072	1587.3
LSRPM 315 MR1	308.4	96.9	11403770E	308.4	899.9	539.9	1,078.9	1.20	899.9	385	1.25	3.0	95.0	64.072	1587.3

(1) See the Maximum torque curve in the Introduction, Control mode section.
(2) The maximum torque decreases from 80% of the rated speed to the value indicated at the rated speed.
(3) Motors & Drives rated current. If the motor rated current is higher, its value is indicated in brackets. The motor rated current must be entered in the drive.
(4) Minimum switching frequency. This value must be entered in the drive. Automatic changing of the switching frequency must be disabled.

1800 range - with encoder

Class F - DT80K - S1 Self-Cooled - Altitude 1000 m max - Ambient temperature 40°C max

460 V drive input voltage

Drive limit
Motor limit

MOTOR			DRIVE	MOTOR & DRIVE COMBINATION										MOTOR	
Type	Rated power	Efficiency IEC 6003421	Unidrive	Available power	Rated torque	Starting torque	Maximum torque	Maximum torque / Rated torque	Maximum Torque @ rated speed	Full load current Drive (Motor)	Maximum current / Full load current	Switching frequency	Motor & drive efficiency	Moment of inertia	Weight
	Pr	η		Pn	Tr	Ts	Tmax	Tmax/Tr		FLC	Imax / FLC	Fs	η	J	IM B3
	(HP)	(%)	M700-	(HP)	(lb-ft)	(lb-ft)	(lb-ft) (1)		(lb-ft) (2)	(Amps) (3)		(kHz) (4)	(%)	(lb-ft²)	(lb)
LSRPM 132 M	13.1	92.0	04400150A	13.1	38.4	44.5	44.5	1.16	40.7	17	1.19	3.0	90.2	0.392	88.2
LSRPM 132 M	13.1	92.0	04400172A	13.1	38.4	52.4	52.4	1.37	45.0	17	1.45	3.0	90.2	0.392	97.0
LSRPM 132 M	16.5	92.5	04400172A	16.5	48.2	58.0	58.0	1.21	52.3	21	1.26	3.0	90.6	0.548	97.0
LSRPM 132 M	16.5	92.5	05400270A	16.5	48.2	65.9	65.9	1.37	56.5	21	1.45	3.0	90.6	0.548	108.0
LSRPM 132 M	19.3	93.0	04400172A	19.3	56.3	62.0	62.0	1.10	58.0	24	1.10	3.0	91.1	0.738	108.0
LSRPM 132 M	19.3	93.0	05400270A	19.3	56.3	73.3	73.3	1.30	64.1	24	1.38	3.0	91.1	0.738	108.0
LSRPM 160 MP	25.1	93.5	05400270A	24.3	70.8	77.9	77.9	1.10	72.9	30 (31)	1.10	3.0	91.6	0.992	132.3
LSRPM 160 MP	25.1	93.5	05400300A	25.1	73.2	80.5	80.5	1.10	75.3	31	1.10	3.0	91.6	0.992	152.1
LSRPM 160 MP	25.1	93.5	06400350A	25.1	73.2	93.5	93.5	1.28	82.3	31	1.35	3.0	91.6	0.992	174.2
LSRPM 160 MP	30.8	94.0	06400350A	30.8	90.0	99.8	99.8	1.11	93.1	37.5	1.11	3.0	92.1	1.220	174.2
LSRPM 160 MP	30.8	94.0	06400420A	30.8	90.0	119.8	119.8	1.33	103.8	37.5	1.41	3.0	92.1	1.220	337.3
LSRPM 160 LR	36.6	94.0	06400420A	36.6	106.8	122.4	122.4	1.15	112.6	45	1.17	3.0	92.1	1.486	337.3
LSRPM 160 LR	36.6	94.0	06400470A	36.6	106.8	146.2	146.2	1.37	125.3	45	1.45	3.0	92.1	1.486	392.4
LSRPM 200 L	44.3	94.0	07400660A	44.3	129.1	155.9	155.9	1.21	140.4	69	1.26	3.0	92.1	3.085	429.9
LSRPM 200 L	44.3	94.0	07400770A	44.3	129.1	176.9	176.9	1.37	151.6	69	1.45	3.0	92.1	3.085	429.9
LSRPM 200 L	53.6	94.8	07400660A	53.6	156.5	177.8	177.8	1.14	164.2	75	1.16	3.0	92.9	4.034	551.2
LSRPM 200 L	53.6	94.8	07400770A	53.6	156.5	204.2	204.2	1.30	178.3	75	1.38	3.0	92.9	4.034	551.2
LSRPM 200 L	73.8	95.7	07400770A	71.5	208.6	229.4	229.4	1.10	214.7	94 (97)	1.10	3.0	93.8	4.746	590.8
LSRPM 200 L	73.8	95.7	07401000A	73.8	215.2	261.5	261.5	1.22	234.9	97	1.27	3.0	93.8	4.746	634.9
LSRPM 225 ST1	93.9	96.1	07401000A	88.4	257.8	283.6	283.6	1.10	265.4	112 (119)	1.10	3.0	94.2	6.170	634.9
LSRPM 225 ST1	93.9	96.1	08401340A	93.9	273.9	371.0	371.0	1.35	319.2	119	1.43	3.0	94.2	6.170	844.4
LSRPM 225 MR1	114.0	96.0	08401340A	114.0	332.5	374.8	374.8	1.13	347.2	149	1.14	3.0	94.1	7.594	491.630
LSRPM 225 MR1	114.0	96.0	08401570A	114.0	332.5	428.0	428.0	1.29	375.7	149	1.36	3.0	94.1	7.594	491.630
LSRPM 250 ME	134.1	96.1	08401340A	123.6	360.9	397.0	397.0	1.10	371.6	155 (168)	1.10	3.0	94.2	15.425	628.317
LSRPM 250 ME	134.1	96.1	08401570A	134.1	391.2	456.7	456.7	1.17	417.0	168	1.20	3.0	94.2	15.425	628.317
LSRPM 250 ME	134.1	96.1	09402000E	134.1	391.2	535.1	535.1	1.37	458.7	168	1.45	3.0	94.2	15.425	628.317
LSRPM 280 SC	167.6	96.3	08401570A	156.5	456.7	502.4	502.4	1.10	470.2	184 (197)	1.10	3.0	94.4	19.934	727.525
LSRPM 280 SC	167.6	96.3	09402000E	167.6	489.0	581.1	581.1	1.19	526.7	197	1.23	3.0	94.4	19.934	727.525
LSRPM 280 SC	167.6	96.3	09402240E	167.6	489.0	670.2	670.2	1.37	574.1	197	1.45	3.0	94.4	19.934	727.525
LSRPM 280 SD	201.2	96.4	09402240E	201.2	586.9	671.4	671.4	1.14	618.1	250	1.17	3.0	94.5	23.730	837.756
LSRPM 280 SD	201.2	96.4	10402700E	201.2	586.9	781.3	781.3	1.33	676.8	250	1.41	3.0	94.5	23.730	837.756
LSRPM 280 MK1	234.7	96.5	10402700E	234.7	684.7	807.7	807.7	1.18	734.3	288	1.22	3.0	94.6	42.715	1252.224
LSRPM 280 MK1	234.7	96.5	10403200E	234.7	684.7	893.6	893.6	1.31	780.1	288	1.38	3.0	94.6	42.715	1252.224
LSRPM 315 SP1	261.5	96.7	10402700E	261.5	762.9	845.5	845.5	1.11	788.8	316	1.11	3.0	94.8	53.156	1399.934
LSRPM 315 SP1	261.5	96.7	10403200E	261.5	762.9	919.4	919.4	1.21	828.6	316	1.26	3.0	94.8	53.156	1399.934
LSRPM 315 SP1	261.5	96.7	11403770E	261.5	762.9	1,045.8	1,045.8	1.37	895.7	316	1.45	3.0	94.8	53.156	1399.934
LSRPM 315 MR1	308.4	96.9	10403200E	300.9	878.0	965.8	965.8	1.10	903.7	361 (370)	1.10	3.0	95.0	64.072	1587.326
LSRPM 315 MR1	308.4	96.9	11403770E	308.4	899.9	1,114.1	1,114.1	1.24	993.2	370	1.30	3.0	95.0	64.072	1587.326

(1) See the Maximum torque curve in the Introduction, Control mode section.
(2) The maximum torque decreases from 80% of the rated speed to the value indicated at the rated speed.
(3) Motors & Drives rated current. If the motor rated current is higher, its value is indicated in brackets. The motor rated current must be entered in the drive.
(4) Minimum switching frequency. This value must be entered in the drive. Automatic changing of the switching frequency must be disabled.

3600 range - without encoder (Sensorless)

Class F - DT80K - S1 Self-Cooled - Altitude 1000 m max - Ambient temperature 40°C max

460 V drive input voltage

Drive limit
Motor limit

MOTOR			DRIVE	MOTOR & DRIVE COMBINATION										MOTOR	
Type	Rated power	Efficiency IEC 6003421	Unidrive	Available power	Rated torque	Starting torque	Maximum torque	Maximum torque / Rated torque	Maximum Torque @ rated speed	Full load current Drive (Motor)	Maximum current / Full load current	Switching frequency	Motor & drive efficiency	Moment of inertia	Weight
	Pr	η		Pn	Tr	Ts	Tmax	Tmax/Tr		FLC	Imax / FLC	Fs	η	J	IM B3
	(HP)	(%)	M600-	(HP)	(lb-ft)	(lb-ft)	(lb-ft) (1)		(lb-ft) (2)	(Amps) (3)		(kHz) (4)	(%)	(lb-ft²)	(lb)
LSRPM 132 M	23.6	94.5	06400350A	23.6	34.4	20.7	41.4	1.20	34.4	31	1.25	8.0	92.6	0.392	88.2
LSRPM 132 M	29.5	94.5	06400350A	29.5	43.1	25.8	47.3	1.10	43.1	38	1.10	8.0	92.6	0.548	97.0
LSRPM 132 M	29.5	94.5	06400420A	29.5	43.1	25.8	51.7	1.20	43.1	38	1.25	8.0	92.6	0.548	97.0
LSRPM 132 M	34.9	95.0	06400420A	32.5	47.4	28.5	58.3	1.23	47.4	41 (44)	1.29	8.0	93.1	0.738	108.0
LSRPM 132 M	34.9	95.0	06400470A	32.5	47.4	28.5	60.3	1.27	47.4	41 (44)	1.34	8.0	93.1	0.738	108.0
LSRPM 132 M	34.9	95.0	07400660A	34.9	50.9	30.5	61.1	1.20	50.9	44	1.25	8.0	93.1	0.738	108.0
LSRPM 160 MP	45.6	95.0	07400660A	45.6	66.5	39.9	79.8	1.20	66.5	56	1.25	8.0	93.1	0.992	132.3
LSRPM 160 MP	55.0	95.5	07400660A	55.0	80.2	48.2	96.3	1.20	80.2	67	1.25	8.0	93.6	1.220	152.1
LSRPM 160 LR	65.7	95.5	07400660A	64.9	94.7	56.8	104.1	1.10	94.7	79 (80)	1.10	8.0	93.6	1.486	174.2
LSRPM 160 LR	65.7	95.5	07400770A	65.7	95.9	57.5	115.1	1.20	95.9	80	1.25	8.0	93.6	1.486	174.2
LSRPM 200 L1	93.9	96.0	07401000A	86.9	126.8	76.0	139.5	1.10	126.8	112 (121)	1.10	4.0	94.1	4.034	337.3
LSRPM 200 L1	93.9	96.0	08401340A	93.9	137.0	82.2	164.3	1.20	137.0	121	1.25	4.0	94.1	4.034	337.3
LSRPM 200 L1	114.0	96.4	08401340A	114.0	166.3	99.8	195.7	1.18	166.3	140	1.22	4.0	94.5	5.221	392.4
LSRPM 200 LU2	154.2	96.8	08401570A	144.7	211.1	126.7	232.2	1.10	211.1	184 (196)	1.10	4.0	94.9	6.170	429.9
LSRPM 200 LU2	154.2	96.8	09402000E	154.2	224.9	135.0	268.3	1.19	224.9	196	1.24	4.0	94.9	6.170	429.9
LSRPM 225 SG	177.0	96.8	09402000E	177.0	258.2	154.9	284.7	1.10	258.2	220	1.11	4.0	94.9	12.814	551.2
LSRPM 225 SG	177.0	96.8	09402240E	177.0	258.2	154.9	309.8	1.20	258.2	220	1.25	4.0	94.9	12.814	551.2
LSRPM 250 SE1	221.3	96.9	10402700E	221.3	322.8	193.7	387.0	1.20	322.8	282	1.25	4.0	95.0	13.526	590.8
LSRPM 250 SE1	254.8	97.1	10402700E	254.8	371.7	223.0	419.5	1.13	371.7	307	1.15	4.0	95.2	15.425	634.9
LSRPM 250 SE1	254.8	97.1	10403200E	254.8	371.7	223.0	446.1	1.20	371.7	307	1.25	4.0	95.2	15.425	634.9
LSRPM 280 SD1	321.8	97.1	11403770E	321.8	469.5	281.7	563.4	1.20	469.5	380	1.25	4.0	95.2	23.730	844.4

(1) See the Maximum torque curve in the Introduction, Control mode section.
(2) The maximum torque decreases from 80% of the rated speed to the value indicated at the rated speed.
(3) Motors & Drives rated current. If the motor rated current is higher, its value is indicated in brackets. The motor rated current must be entered in the drive.
(4) Minimum switching frequency. This value must be entered in the drive. Automatic changing of the switching frequency must be disabled.

3600 range - with encoder

Class F - DT80K - S1 Self-Cooled - Altitude 1000 m max - Ambient temperature 40°C max

460 V drive input voltage

Drive limit
Motor limit

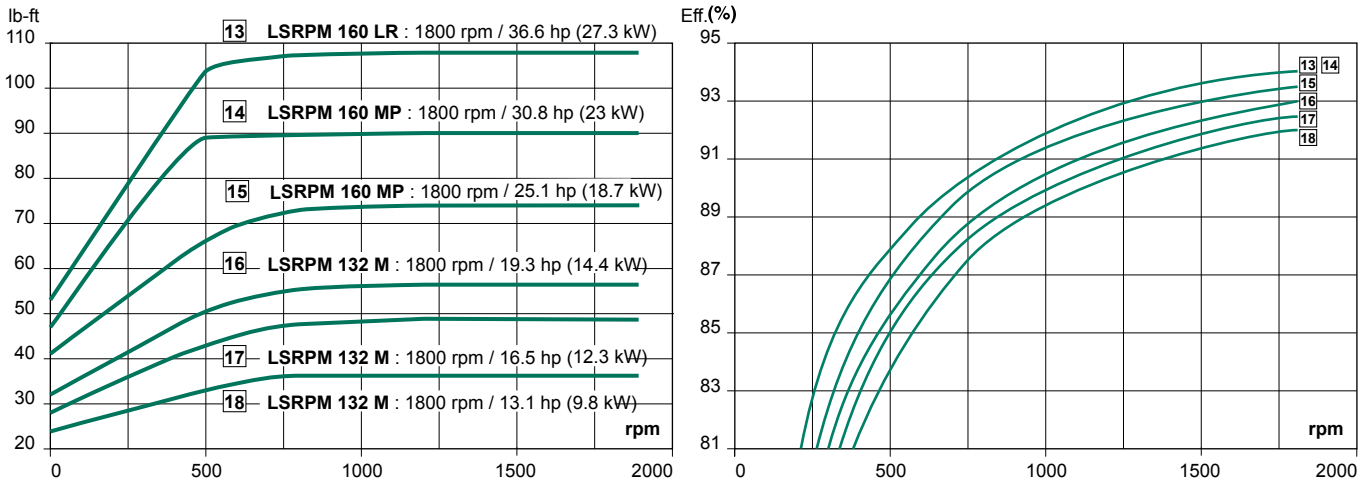
MOTOR			DRIVE	MOTOR & DRIVE COMBINATION										MOTOR	
Type	Rated power	Efficiency IEC 6003421	Unidrive	Available power	Rated torque	Starting torque	Maximum torque	Maximum torque / Rated torque	Maximum Torque @ rated speed	Full load current Drive (Motor)	Maximum current / Full load current	Switching frequency	Motor & drive efficiency	Moment of inertia	Weight
	Pr	η		Pn	Tr	Ts	Tmax	Tmax/Tr		FLC	Imax / FLC	Fs	η	J	IM B3
	(HP)	(%)	M700	(HP)	(lb-ft)	(lb-ft)	(lb-ft) (1)		(lb-ft) (2)	(Amps) (3)		(kHz) (4)	(%)	(lb-ft²)	(lb)
LSRPM 132 M	23.6	94.5	06400350A	23.6	34.4	45.4	45.4	1.32	39.5	30	1.39	8.0	92.6	0.392	88.2
LSRPM 132 M	29.5	94.5	06400350A	29.5	43.1	48.2	48.2	1.12	44.8	37	1.13	8.0	92.6	0.548	97.0
LSRPM 132 M	29.5	94.5	06400420A	29.5	43.1	58.1	58.1	1.35	50.1	37	1.43	8.0	92.6	0.548	97.0
LSRPM 132 M	34.9	95.0	06400420A	33.3	48.5	59.7	59.7	1.23	53.3	41 (43)	1.29	8.0	93.1	0.738	108.0
LSRPM 132 M	34.9	95.0	06400470A	33.3	48.5	70.0	70.0	1.44	58.8	41 (43)	1.52	8.0	93.1	0.738	108.0
LSRPM 132 M	34.9	95.0	07400660A	34.9	50.9	69.8	69.8	1.37	59.7	43	1.45	8.0	93.1	0.738	108.0
LSRPM 160 MP	45.6	95.0	07400660A	45.6	66.5	91.2	91.2	1.37	78.1	55	1.45	8.0	93.1	0.992	132.3
LSRPM 160 MP	55.0	95.5	07400660A	55.0	80.2	103.3	103.3	1.29	90.6	64	1.36	8.0	93.6	1.220	152.1
LSRPM 160 MP	55.0	95.5	07400770A	55.0	80.2	110.0	110.0	1.37	94.2	64	1.45	8.0	93.6	1.220	152.1
LSRPM 160 LR	65.7	95.5	07400660A	65.7	95.9	107.1	107.1	1.12	99.6	77	1.13	8.0	93.6	1.486	174.2
LSRPM 160 LR	65.7	95.5	07400770A	65.7	95.9	122.1	122.1	1.27	107.7	77	1.34	8.0	93.6	1.486	174.2
LSRPM 160 LR	65.7	95.5	07401000A	65.7	95.9	131.3	131.3	1.37	112.5	77	1.45	8.0	93.6	1.486	174.2
LSRPM 200 L1	93.9	96.0	07401000A	93.9	137.0	151.5	151.5	1.11	141.4	111	1.11	4.0	94.1	4.034	337.3
LSRPM 200 L1	93.9	96.0	08401340A	93.9	137.0	187.8	187.8	1.37	160.8	111	1.45	4.0	94.1	4.034	337.3
LSRPM 200 L1	114.0	96.4	08401340A	114.0	166.3	206.2	206.2	1.24	183.7	131	1.30	4.0	94.5	5.221	392.4
LSRPM 200 L1	114.0	96.4	08401570A	114.0	166.3	228.0	228.0	1.37	195.3	131	1.45	4.0	94.5	5.221	392.4
LSRPM 200 LU2	154.2	96.8	08401570A	153.4	223.8	246.1	246.1	1.10	230.3	184 (185)	1.10	4.0	94.9	6.170	429.9
LSRPM 200 LU2	154.2	96.8	09402000E	154.2	224.9	281.2	281.2	1.25	249.7	185	1.31	4.0	94.9	6.170	429.9
LSRPM 200 LU2	154.2	96.8	09402240E	154.2	224.9	308.3	308.3	1.37	264.0	185	1.45	4.0	94.9	6.170	429.9
LSRPM 225 SG	177.0	96.8	09402000E	177.0	258.2	296.0	296.0	1.15	272.3	207	1.17	4.0	94.9	12.814	551.2
LSRPM 225 SG	177.0	96.8	09402240E	177.0	258.2	345.1	345.1	1.34	298.5	207	1.41	4.0	94.9	12.814	551.2
LSRPM 250 SE1	221.3	96.9	10402700E	221.3	322.8	406.0	406.0	1.26	359.6	266	1.32	4.0	95.0	13.526	590.8
LSRPM 250 SE1	254.8	97.1	10402700E	254.8	371.7	443.2	443.2	1.19	401.1	284	1.24	4.0	95.2	15.425	634.9
LSRPM 250 SE1	254.8	97.1	10403200E	254.8	371.7	491.5	491.5	1.32	426.9	284	1.40	4.0	95.2	15.425	634.9
LSRPM 280 SD1	321.8	97.1	10402700E	296.8	433.0	476.3	476.3	1.10	445.7	320 (347)	1.10	4.0	95.2	23.730	844.4
LSRPM 280 SD1	321.8	97.1	10403200E	314.5	458.7	525.0	525.0	1.14	483.2	339 (347)	1.17	4.0	95.2	23.730	844.4
LSRPM 280 SD1	321.8	97.1	11403770E	321.8	469.5	615.4	615.4	1.31	536.3	347	1.39	4.0	95.2	23.730	844.4

(1) See the Maximum torque curve in the Introduction, Control mode section.
(2) The maximum torque decreases from 80% of the rated speed to the value indicated at the rated speed.
(3) Motors & Drives rated current. If the motor rated current is higher, its value is indicated in brackets. The motor rated current must be entered in the drive.
(4) Minimum switching frequency. This value must be entered in the drive. Automatic changing of the switching frequency must be disabled.

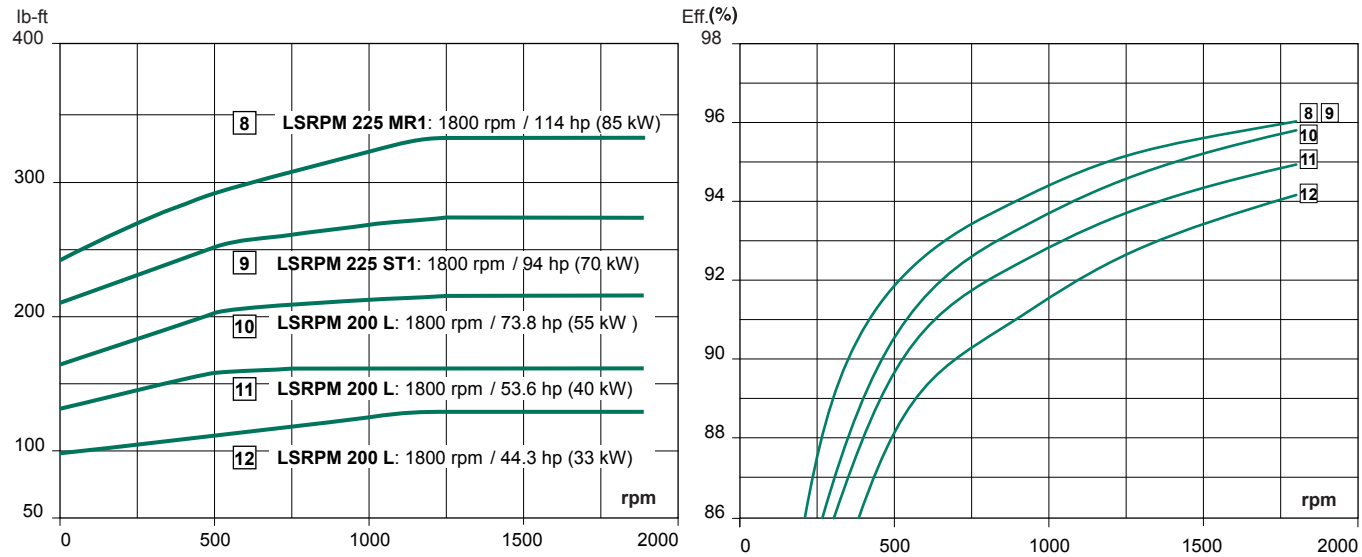
1800 range - 0 to 1,800 rpm performance

Thermal torque (S1 duty without forced ventilation) and efficiency curves

Torque from 0 to 107 lb-ft



Torque from 107 to 333 lb-ft

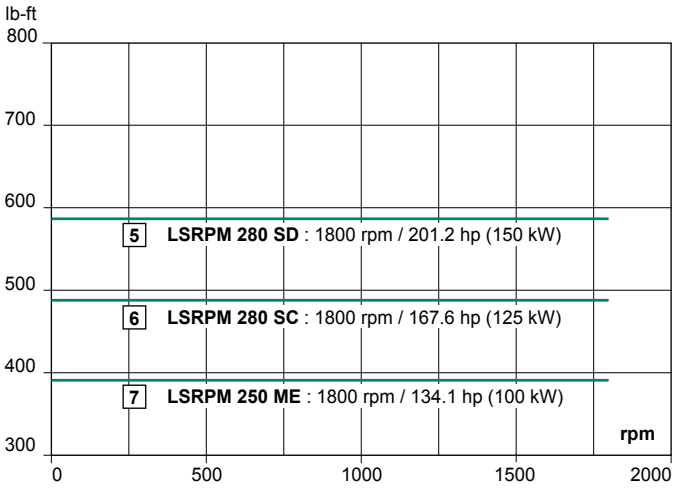


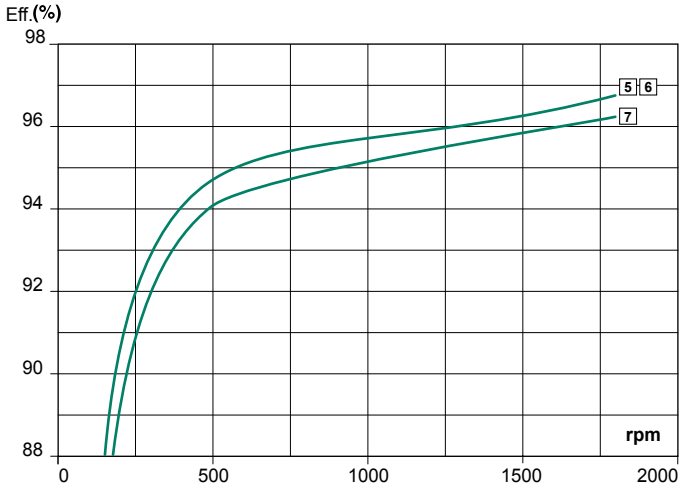
LSRPM motors with higher output power are also available.

1800 range - 0 to 1,800 rpm performance

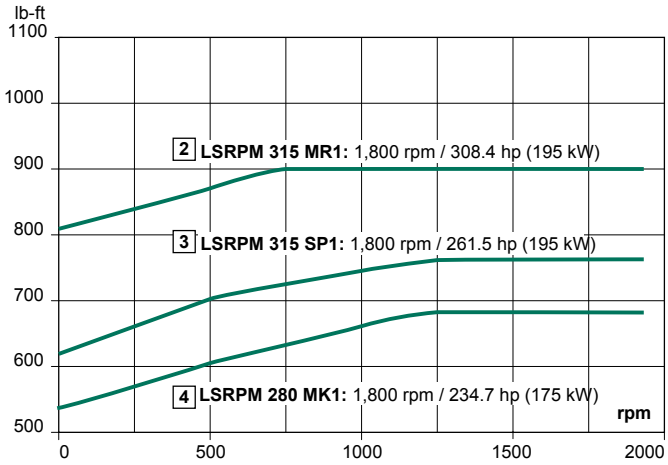
Thermal torque (S1 duty without forced ventilation) and efficiency curves

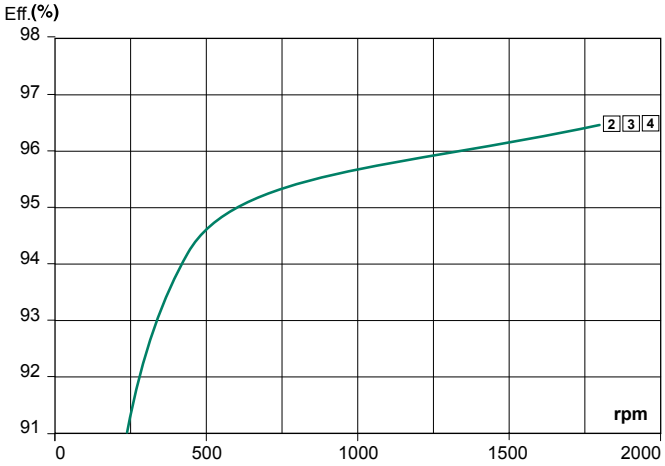
Torque from 333 to 585 lb-ft





Torque from 585 to 900 lb-ft



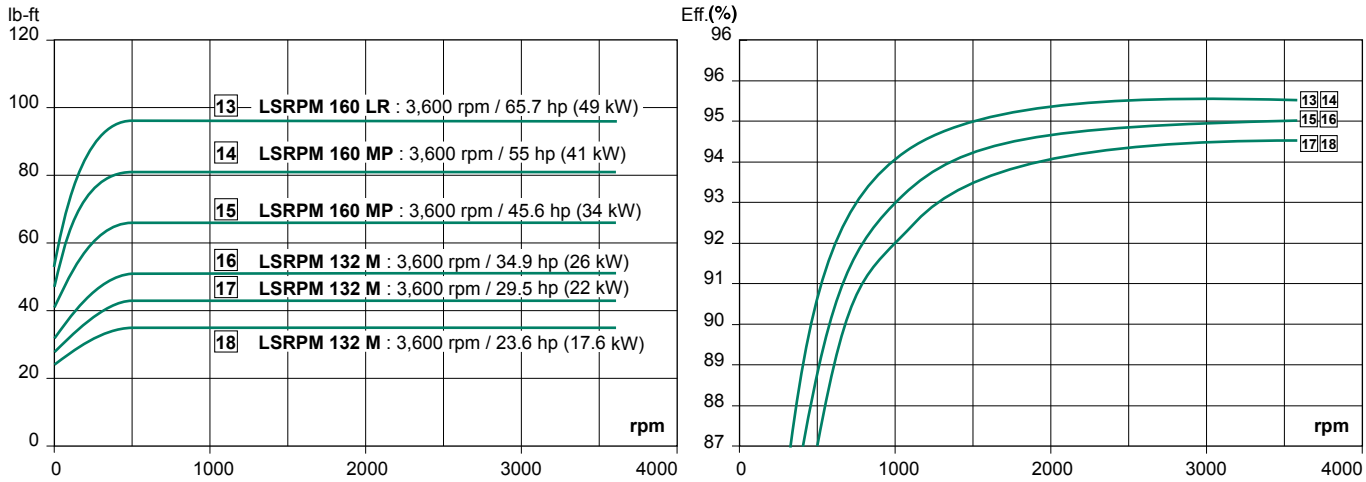


LSRPM motors with higher output power are also available.

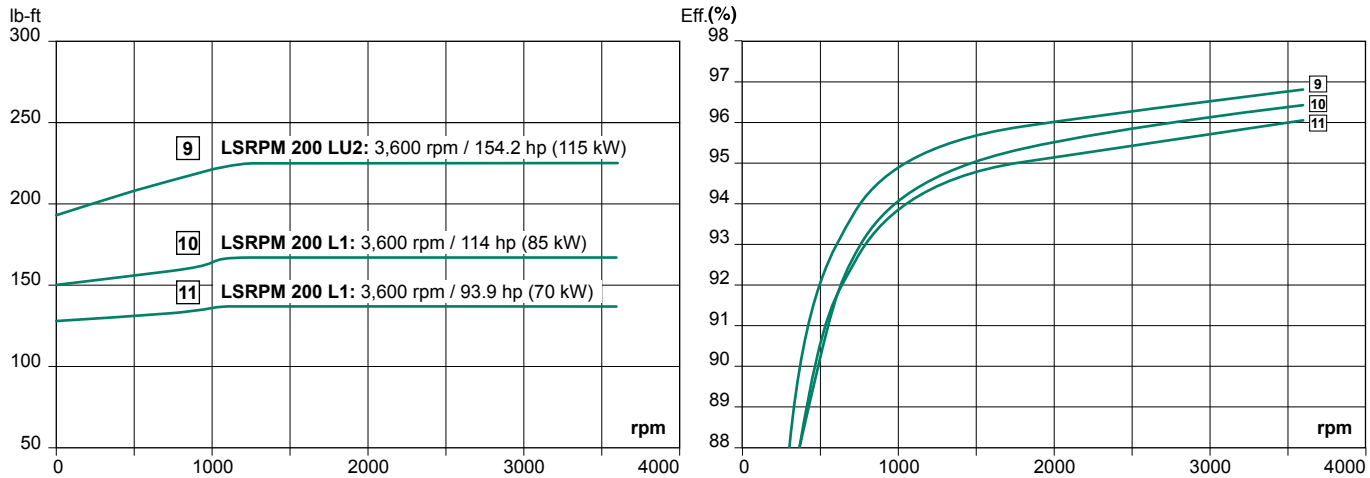
3600 range - 0 to 3,600 rpm performance

Thermal torque (S1 duty without forced ventilation) and efficiency curves

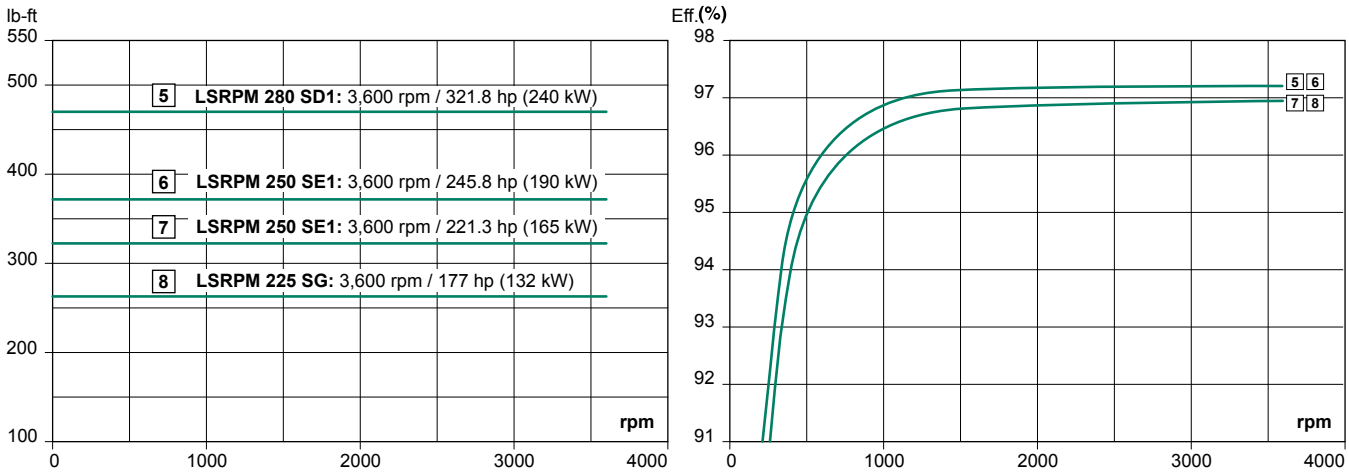
Torque from 0 to 96 lb-ft



Torque from 96 to 225 lb-ft

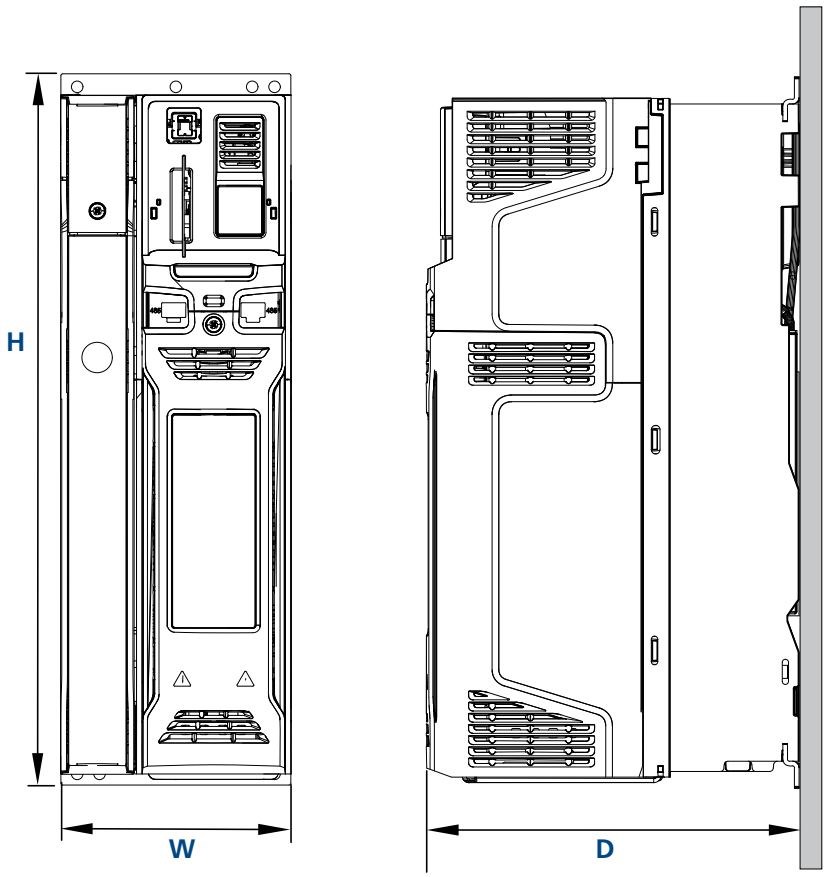


Torque from 225 to 470 lb-ft



LSRPM motors with higher output power are also available.

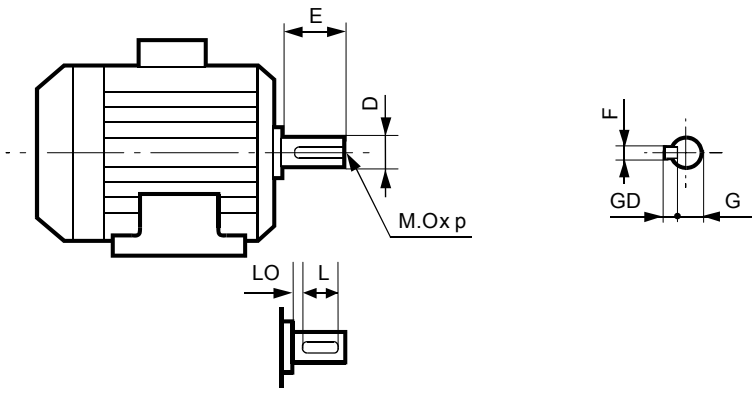
Unidrive M



Drive type	Dimensions and weights							
Unidrive M600 and M700	H		W		D		Weight	
	(in)	(mm)	(in)	(mm)	(in)	(mm)	(lbs)	(kg)
Size 03	15.0	382	3.3	83	7.9	200	9.9	4.5
Size 04	15.4	391	4.9	124	7.9	200	14.3	6.5
Size 05	15.4	391	5.6	143	7.6	202	16.3	7.4
Size 06	15.4	389	8.3	210	8.9	227	30.9	14
Size 07	21.9	557	10.6	270	11.0	280	61.7	28
Size 08	31.6	803	12.2	310	11.4	290	114.6	52
Size 9A	43.6	1108	12.2	310	11.4	290	146.6	66.5
Size 9E	42.1	1069	12.2	310	11.4	290	101.4	46
Size 10E	42.1	1069	12.2	310	11.4	290	101.4	46
Size 11E	48.9	1242	12.2	310	12.3	312	138.9	63

Motor shaft dimensions

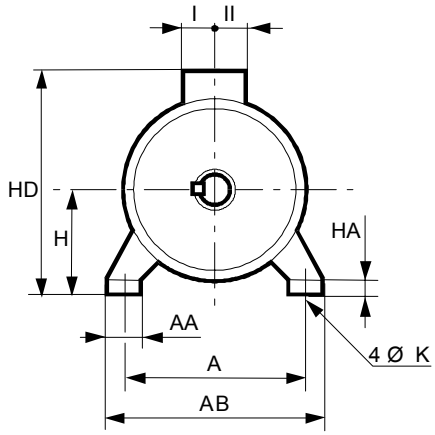
Dimensions in millimeters

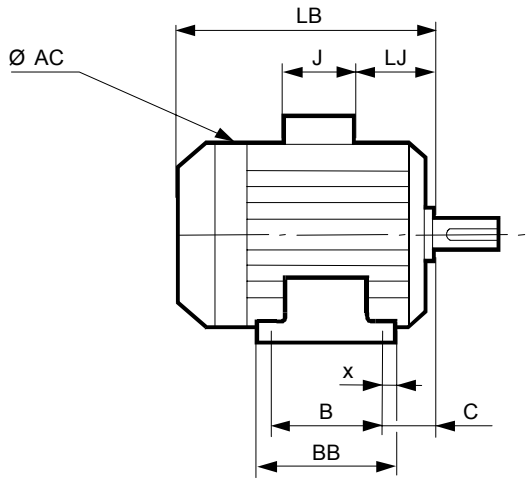


Type	Main shaft dimensions								
	1500 to 5500 range								
	F	GD	D	G	E	O	p	L	LO
LSRPM 90 SL	8	7	28j6	24	60	10	22	50	6
LSRPM 100 L	10	8	32k6	27	80	12	28	63	8.5
LSRPM 132 M	10	8	38k6	33	80	12	28	63	7
LSRPM 160 MP/LR	14	9	48k6	42.5	110	16	36	98	6
LSRPM 200 L/L1/L2/LU/LU2	16	10	55m6	49	110	20	42	97	13
LSRPM 225 ST1/ST2/SR2/SG/MR1	18	11	60m6	53	140	20	42	126	14
LSRPM 250 SE/SE1/ME/ME1/MY	18	11	65m6	58	140	20	42	126	14
LSRPM 280 SC/SD/SD1	20	12	70m6	62.5	140	20	42	125	15
LSRPM 280 MK1/SCM	20	12	75m6	67.5	140	20	42	125	15
LSRPM 315 SP1/SN	22	14	80m6	71	170	20	42	155	15
LSRPM 315 MR1/MP1/SR1	22	14	85m6	76	170	20	42	155	15

Foot mounted IM B3 (IM 1001) motor dimensions

Dimensions in millimeters

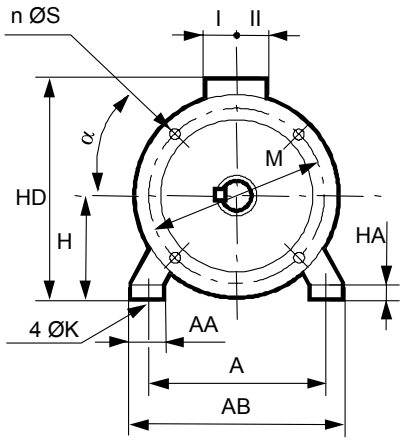


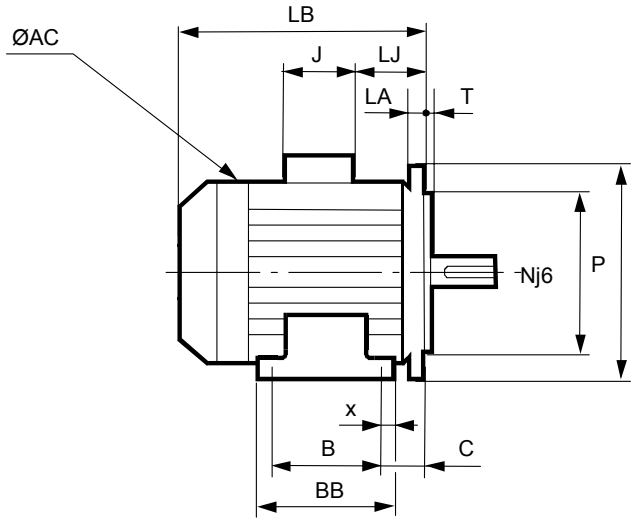


Type	Main dimensions																
	A	AB	B	BB	C	X	AA	K	HA	H	AC	HD	LB	LJ	J	I	II
LSRPM 90 SL	140	172	100	166	56	29	39	10	11	90	200	245	329	14	160	55	55
LSRPM 100 L	160	196	140	167	63	13	40	13	13	100	236	260	376	15	160	55	55
LSRPM 132 M	216	250	178	211	89	16	50	12	15	132	280	341	461	23	194	79	78
LSRPM 160 MP	254	294	254	298	108	22	64	14	25	160	310	391	555	53	186	112	95
LSRPM 160 LR	254	294	254	298	108	22	64	14	25	160	310	391	571	53	186	112	95
LSRPM 200 L	318	388	305	375	133	35	103	18.5	36	200	390	476	621	77	186	112	98
LSRPM 200 L1	318	388	305	375	133	35	103	18.5	36	200	390	510	621	55	231	119	141
LSRPM 200 L2	318	388	305	375	133	35	103	18.5	36	200	390	564	621	59	292	151	181
LSRPM 200 LU	318	388	305	375	133	35	103	18.5	36	200	390	476	669	77	186	112	98
LSRPM 200 LU2	318	388	305	375	133	35	103	18.5	36	200	390	564	669	59	292	151	181
LSRPM 225 ST1	356	431	286	386	149	50	127	18.5	36	225	390	535	627	61	231	119	141
LSRPM 225 ST2	356	431	286	386	149	50	127	18.5	36	225	390	589	627	66	292	151	181
LSRPM 225 SR2	356	431	286	386	149	50	127	18.5	36	225	390	589	676	66	292	151	181
LSRPM 225 MR1	356	431	311	386	149	50	127	18.5	36	225	390	535	676	68	231	119	141
LSRPM 225 SG	356	420	286	375	149	30	65	18.5	33	225	479	630	810	68	292	151	181
LSRPM 250 MY	406	470	349	449	168	70	150	24	47	250	390	560	627	61	231	119	141
LSRPM 250 SE	406	470	311	420	168	35	90	24	36	250	479	655	810	68	292	151	181
LSRPM 250 SE1	406	470	311	420	168	35	90	24	36	250	479	744	810	4	420	180	235
LSRPM 250 ME	406	470	349	420	168	35	90	24	36	250	479	655	810	68	292	151	181
LSRPM 250 ME1	406	470	349	420	168	35	90	24	36	250	479	744	810	4	420	180	235
LSRPM 280 SC	457	520	368	478	190	35	90	24	35	280	479	685	810	68	292	148	180
LSRPM 280 SCM	457	520	368	478	190	35	90	24	35	280	479	685	810	68	292	151	181
LSRPM 280 SD	457	520	368	478	190	35	90	24	35	280	479	685	870	68	292	148	180
LSRPM 280 SD1	457	520	368	478	190	35	90	24	35	280	479	774	870	4	420	180	235
LSRPM 280 MK1	457	533	419	495	190	40	85	24	35	280	586	835	921	35	420	180	235
LSRPM 315 SN	508	594	406	537	216	40	140	28	50	315	479	720	870	68	292	151	181
LSRPM 315 SP1	508	594	406	537	216	40	114	28	70	315	586	870	947	61	420	180	235
LSRPM 315 SR1	508	594	406	537	216	40	114	28	70	315	586	870	1017	62	420	180	235
LSRPM 315 MP1	508	594	457	537	216	40	114	28	70	315	586	870	947	61	420	180	235
LSRPM 315 MR1	508	594	457	537	216	40	114	28	70	315	586	870	1017	61	420	180	235

Foot and flange mounted IM B35 (IM 2001) motor dimensions

Dimensions in millimeters

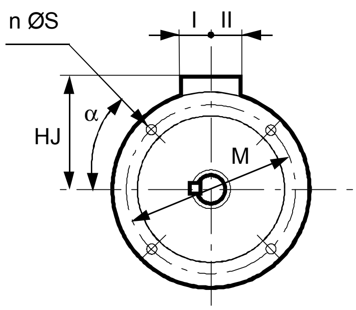


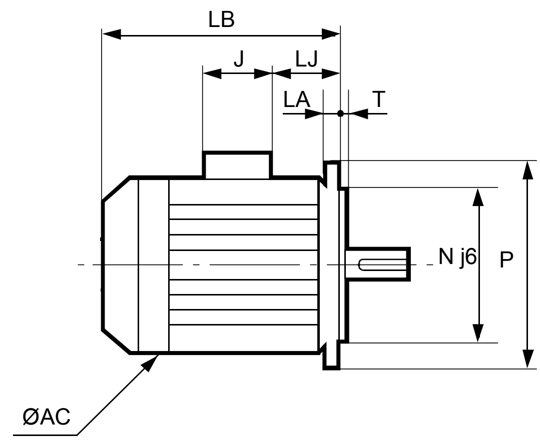


Type	Main dimensions																	
	A	AB	B	BB	C	X	AA	K	HA	H	AC	HD	LB	LJ	J	I	II	Sym.
LSRPM 90 SL	140	172	100	166	56	29	39	10	11	90	200	245	351	14	160	55	55	FF165
LSRPM 100 L	160	196	140	167	63	13	40	13	13	100	236	260	376	15	160	55	55	FF215
LSRPM 132 M	216	250	178	211	89	16	50	12	15	132	280	341	461	23	194	79	78	FF265
LSRPM 160 MP	254	294	254	298	108	22	64	14	25	160	310	391	555	53	186	112	95	FF300
LSRPM 160 LR	254	294	254	298	108	22	64	14	25	160	310	391	571	53	186	112	95	FF300
LSRPM 200 L	318	388	305	375	133	35	103	18.5	36	200	390	476	621	77	186	112	98	FF350
LSRPM 200 L1	318	388	305	375	133	35	103	18.5	36	200	390	510	621	55	231	119	141	FF350
LSRPM 200 L2	318	388	305	375	133	35	103	18.5	36	200	390	571	621	59	292	148	180	FF350
LSRPM 200 LU	318	388	305	375	133	35	103	18.5	36	200	390	476	669	77	186	112	98	FF350
LSRPM 200 LU2	318	388	305	375	133	35	103	18.5	36	200	390	571	669	59	292	148	180	FF350
LSRPM 225 ST1	356	431	286	386	149	50	127	18.5	36	225	390	535	627	62	231	119	141	FF400
LSRPM 225 ST2	356	431	286	386	149	50	127	18.5	36	225	390	596	627	66	292	148	180	FF400
LSRPM 225 SR2	356	431	286	386	149	50	127	18.5	36	225	390	596	676	66	292	148	180	FF400
LSRPM 225 MR1	356	431	311	386	149	50	127	18.5	36	225	390	535	676	68	231	119	141	FF400
LSRPM 225 SG	356	420	286	375	149	50	65	18.5	30	225	479	629	810	68	292	148	180	FF400
LSRPM 250 MY	406	470	349	449	168	70	150	24	47	250	390	560	628	61	231	119	142	FF500
LSRPM 250 SE	406	470	311	420	168	35	90	24	36	250	479	655	810	68	292	148	180	FF500
LSRPM 250 SE1	406	470	311	420	168	35	90	24	36	250	479	744	810	4	420	180	235	FF500
LSRPM 250 ME	406	470	349	420	168	35	90	24	36	250	479	655	810	68	292	148	180	FF500
LSRPM 250 ME1	406	470	349	420	168	35	90	24	36	250	479	744	810	4	420	180	235	FF500
LSRPM 280 SC	457	520	368	478	190	35	90	24	35	280	479	685	810	68	292	148	180	FF500
LSRPM 280 SCM	457	520	368	478	190	35	90	24	35	280	479	686	810	68	292	151	181	FF500
LSRPM 280 SD	457	520	368	478	190	35	90	24	35	280	479	685	870	68	292	148	180	FF500
LSRPM 280 SD1	457	520	368	478	190	35	90	24	35	280	479	774	870	4	420	180	235	FF500
LSRPM 280 MK1	457	520	419	495	190	40	85	24	35	280	586	834	921	35	420	180	235	FF500
LSRPM 315 SN	508	594	406	537	216	40	140	28	50	315	479	721	870	68	292	151	181	FF600
LSRPM 315 SP1	508	594	406	537	216	40	114	28	70	315	586	870	947	61	420	180	235	FF600
LSRPM 315 SR1	508	594	406	537	216	40	114	28	70	315	586	867	1017	62	418	180	235	FF600
LSRPM 315 MP1	508	594	457	537	216	40	114	28	70	315	586	867	947	62	418	180	235	FF600
LSRPM 315 MR1	508	594	457	537	216	40	114	28	70	315	586	870	1017	61	420	180	235	FF600

Flange mounted IM B5 (IM 3001)* IM V1 (IM 3011) motor dimensions

Dimensions in millimeters





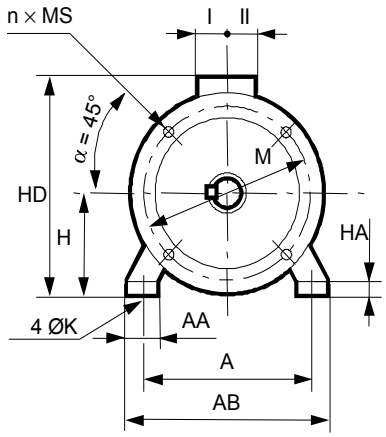
Type	Main dimensions						
	AC	LB	HJ	LJ	J	I	II
LSRPM 90 SL	200	351	155	34	160	55	55
LSRPM 100 L	200	376	160	15	160	55	55
LSRPM 132 M	264	461	209	23	194	79	78
LSRPM 160 MP	264	555	231	53	186	112	95
LSRPM 160 LR	264	571	231	53	186	112	95
LSRPM 200 L	390	621	276	77	186	112	98
LSRPM 200 L1	390	621	310	55	231	119	141
LSRPM 200 L2	390	621	364	59	292	148	180
LSRPM 200 LU	390	669	276	77	186	112	98
LSRPM 200 LU2	390	669	364	59	292	148	180
LSRPM 225 ST1	390	627	310	61.5	231	119	141
LSRPM 225 ST2	390	627	364	-	292	148	180
LSRPM 225 SR2	390	676	364	-	292	148	180
LSRPM 225 MR1	390	535	276	61.5	231	119	141
LSRPM 225 SG	479	810	405	68	292	148	180
LSRPM 250 MY	390	627.5	310	61	231	119	142
LSRPM 250 SE	479	810	405	68	292	148	180
LSRPM 250 SE1	479	810	494	4	420	180	235
LSRPM 250 ME	479	810	405	68	292	148	180
LSRPM 250 ME1	479	810	494	4	420	180	235
LSRPM 280 SC	479	810	405	68	292	148	180
LSRPM 280 SCM	479	810	405	67.5	292	151	181
LSRPM 280 SD	479	870	405	68	292	148	180
LSRPM 280 SD1	479	870	494	4	420	180	235
LSRPM 280 MK1	586	921	555	35	420	180	235
LSRPM 315 SN	479	870	405	67.5	292	151	181
LSRPM 315 SP1	586	947	554	61	420	180	235
LSRPM 315 SR1	586	1017	555	61.5	418	180	235
LSRPM 315 MP1	586	947	555	61.5	418	180	235
LSRPM 315 MR1	586	1017	555	61	420	180	235

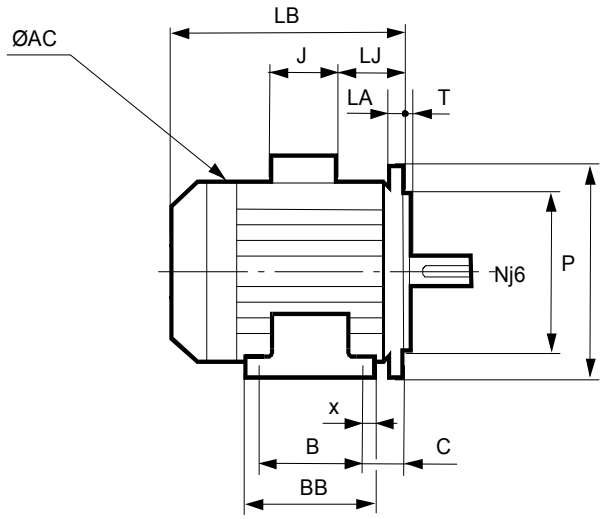
IEC symbol	Flange dimensions							
	M	N	P	T	n	a	S	LA
FF165	165	130	200	3.5	4	45	12	10
FF215	215	180	250	4	4	45	14.5	12
FF265	265	230	300	4	4	45	14.5	14
FF300	300	250	350	5	4	45	18.5	14
FF300	300	250	350	5	4	45	18.5	14
FF350	350	300	400	5	4	45	18.5	15
FF350	350	300	400	5	4	45	18.5	15
FF350	350	300	400	5	4	45	18.5	15
FF350	350	300	400	5	4	45	18.5	15
FF350	350	300	400	5	4	45	18.5	15
FF400	400	350	450	5	8	22.5	18.5	16
FF400	400	350	450	5	8	22.5	18.5	15
FF400	400	350	450	5	8	22.5	18.5	15
FF400	400	350	450	5	8	22.5	18.5	16
FF400	400	350	450	5	8	22.5	18.5	16
FF500	500	450	550	5	8	22.5	18.5	18
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	5	8	22.5	18.5	22
FF500	500	450	550	6	8	22.5	18.5	18
FF600	600	550	660	6	8	22.5	24	22
FF600	600	550	660	6	8	22.5	24	22
FF600	600	550	660	6	8	22.5	24	22
FF600	600	550	660	6	8	22.5	24	22
FF600	600	550	660	6	8	22.5	24	22

* For a frame size above 250 mm for IM 3001 use, please consult Leroy-Somer.
Shaft dimensions are identical to those for foot mounted motors.

Foot and face mounted IM B34 (IM 2101) motor dimensions

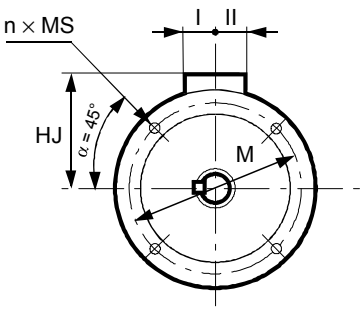
Dimensions in millimeters

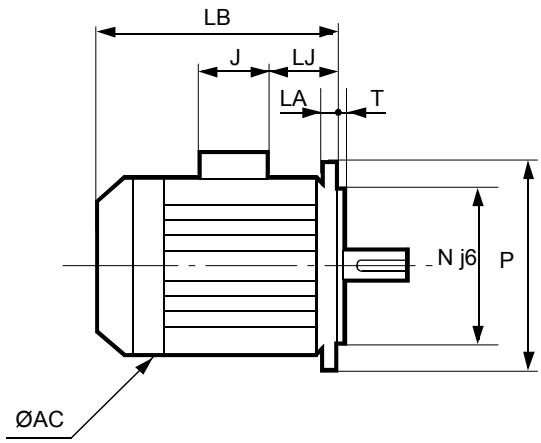




Type	Main dimensions																	
	A	AB	B	BB	C	X	AA	K	HA	H	AC	HD	LB	LJ	J	I	II	Sym.
LSRPM 90 SL	140	172	100	166	56	29	39	10	11	90	200	245	329	14	160	55	55	FT115
LSRPM 100 L	160	196	140	167	63	13	40	13	13	100	236	260	376	15	160	55	55	FT130
LSRPM 132 M	216	250	178	211	89	16	50	12	15	132	264	341	461	23	194	79	78	FT215

Face mounted IM B14 (IM 3601)





Type	Main dimensions						
	AC	LB	HJ	LJ	J	I	II
LSRPM 90 SL	200	329	155	14	160	55	55
LSRPM 100 L	236	376	160	15	160	55	55
LSRPM 132 M	264	461	209	23	194	79	78

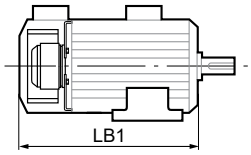
IEC symbol	Faceplate dimensions					
	M	N	P	T	n	MS
FT115	115	95	140	3	4	M8
FT130	130	110	160	3.5	4	M8
FT215	215	180	250	4	4	M12

Shaft dimensions are identical to those for foot mounted motors.

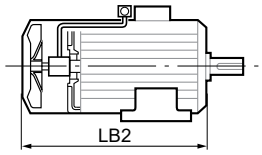
Motor options

Dimensions in millimeters

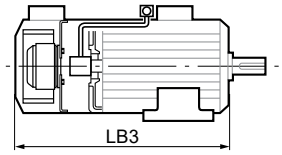
Forced ventilation unit
B3 & B5



Incremental encoder
B3 & B5



Forced ventilation unit and incremental encoder
B3 & B5

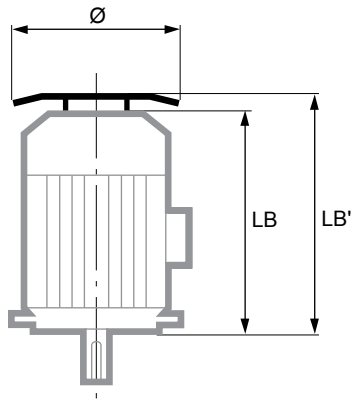


Type	LB1	LB2	LB3
LSRPM 90 SL	-	329	383
LSRPM 100 L	-	376	431
LSRPM 132 M	-	461	499
LSRPM 160 MP	-	555	710
LSRPM 160 LR	-	571	730
LSRPM 200 L/L1/L2	802	674	802
LSRPM 200 LU/LU2	847	723	847
LSRPM 225 ST1/ST2	808	680	808
LSRPM 225 SR2	854	730	854
LSRPM 225 MR1	854	730	854
LSRPM 225 SG	1012	860	1012
LSRPM 250 MY	808	680	808
LSRPM 250 SE/SE1	1012	860	1012
LSRPM 250 ME/ME1	1012	860	1012
LSRPM 280 SC/SCM	1012	860	1012
LSRPM 280 SD/SD1	1072	920	1072
LSRPM 280 MK1	1111	965	1111
LSRPM 315 SP1/MP1	1181	991	1181
LSRPM 315 SN	1072	920	1072
LSRPM 315 MR1/SR1	1251	1061	1251

Note: Dimensions of motors with single-turn and multi-turn absolute encoders are available on request

Drip cover for operation in vertical position, shaft end facing down

Motor type	LB'	Ø
LSRPM 90 SL	LB + 20	185
LSRPM 100 L	LB + 20	185
LSRPM 132 M	LB + 30	240
LSRPM 160 MP/LR	LB + 30	236
LSRPM 200 L/L1/L2/LU/LU2	LB + 36.5	350
LSRPM 225 ST1/ST2/MR1/SR2	LB + 36.5	350
LSRPM 225 SG	LB + 55	350
LSRPM 250 MY	LB + 36.5	350
LSRPM 250 SE/SE1	LB + 55	350
LSRPM 280 SCM/SC/SD/SD1	LB + 55	350
LSRPM 280 MK1	LB + 76.5	505
LSRPM 315 SN	LB + 55	350
LSRPM 315 SP1/MP1/MR1/SR1	LB + 76.5	505



General information

AC supply considerations

Each industrial power supply has its own intrinsic characteristics (short-circuit capability, voltage value and fluctuation, phase imbalance, etc.) and supplies equipment some of which can distort its voltage either permanently or temporarily (notches, voltage dips, overvoltage, etc.). The quality of the AC supply has an impact on the performance and reliability of electronic equipment, especially variable speed drives. Control Techniques drives are designed to operate with the AC supplies typically found on industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the AC supply so that you can take corrective steps in the event of abnormal conditions.

Transient overvoltages

There are numerous sources of overvoltages in an electrical installation:

- Connection/disconnection of banks of power factor correction capacitors
- High-power SCR-controlled equipment (oven, DC drive, etc.)
- Overhead power supplies

Connection/disconnection of a bank of correction capacitors cos

Connecting power factor correction capacitors on the drive power supply line when the drive is running can generate transient overvoltages that may trip the drive safety devices, or even damage it in extreme cases. If banks of power factor correction capacitors are used on the power supply line, make sure that:

- The difference between steps is low enough to avoid causing overvoltage on the line
- The capacitors are not permanently connected

Presence of commutation notches on the line

When high-power SCR-controlled equipment is connected on the same supply as the drive, it is essential to ensure that the harmonics generated by the commutation notches do not excessively distort the AC voltage and do not create voltage peaks with amplitude higher than 1.6 x line Vrms. If this is the case, it is essential to take corrective measures to guarantee the line supply quality.

Unbalanced power supply

In the same way as can be seen on an electric motor, the line voltage imbalance of a drive can have consequences on its operation. Please refer to the drive installation manual.

Equipotential bonding

The equipotential earth bonding of some industrial sites is not always observed. This lack of equipotentiality leads to leakage currents that flow via the ground cables, the machine frame, the pipework, etc., and also via the electrical equipment. In some extreme cases, these currents can trip the drive.

It is essential that the ground network is designed and implemented by the installation supervisor so that its impedance is as low as possible, so as to distribute the fault currents and high-frequency currents without them passing through electrical equipment.

Metal grounds must be mechanically connected to each other with the largest possible electrical contact area.

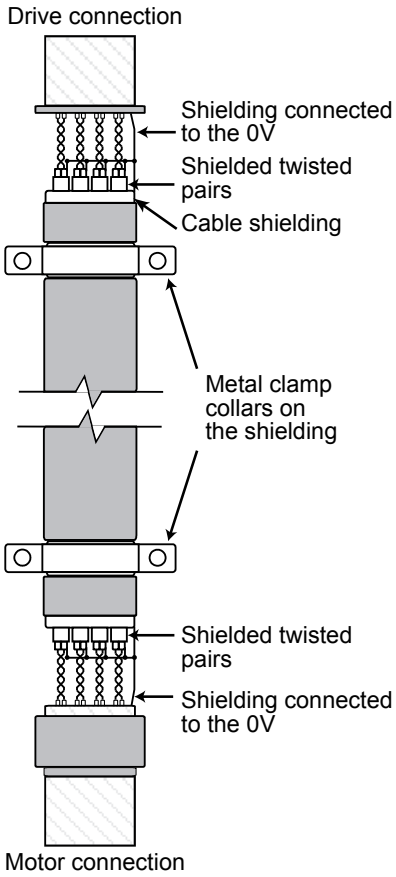
Under no circumstances can ground connections designed to protect people, by linking metal grounds to earth via a cable, serve as a substitute for ground connections (see IEC 61000-5-2).

The immunity and radio-frequency emission levels are directly linked to the quality of the ground connections.

Good wiring practice

Connection of control cables and encoder cables

CAUTION: Strip back the shielding on the metal clamp collars in order to ensure 360° contact.



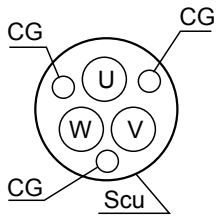
Power cable

It is the responsibility of the user and/or the installer to connect the motor-drive system in accordance with the current legislation and regulations in the country of use. This is particularly important as concerns cable size and connection of earths and grounds.

The following information is given for guidance only, and should never be used as a substitute for the current standards, nor does it relieve the installation company of their responsibility. For more information, please refer to technical specification IEC 60034-25.

To ensure the safety of personnel, the size of the earthing cables should be determined individually in accordance with local regulations.

For compliance with standard EN 61800-3, the power conductors between drive and motor must be shielded. Use a special variable speed cable: shielded with low stray capacity and with 3 protective earth (PE) conductors arranged at 120° (diagram below). There is no need to shield the drive power supply cables.



The motor-drive unit wiring must be symmetrical (U,V,W at the motor end must correspond to U,V,W at the drive end) with the cable shielding grounded at both the drive end and motor end over 360°.

In the second industrial environment (if an HV/LV transformer belongs to the user), the shielded motor power supply cable can be replaced with a 3-core + ground cable placed in a fully-enclosed metal conduit (metal cable duct for example). This metal conduit should be mechanically connected to the electrical cabinet and the structure supporting the motor. **If the conduit consists of several pieces, these should be interconnected by braids to ensure ground continuity.** The cables must be fixed securely at the bottom of the conduit.

The motor earth terminal (PE) must be connected directly to the drive earth terminal. A separate protective earth (PE) conductor is mandatory if the conductivity of the cable shielding is less than 50% of the conductivity of the phase conductor.

Typical motor-drive unit installation

The following information is given for guidance only, and should never be used as a substitute for the current standards, nor does it relieve the installation company of their responsibility. Depending on the installation, more optional elements can be added:

Switch-fuse: a padlockable breaking device must be installed to isolate the installation if operator intervention becomes necessary. This device must provide protection against overheating and short-circuits. The fuse rating is stated in the drive documentation. The switch-fuse can be replaced with a circuit-breaker (with appropriate breaking capacity).

RFI filter: Its role is to reduce the drive electromagnetic emissions, and thus comply with EMC standards. Our drives are, as standard, equipped with an internal RFI filter. Some environments require the addition of an external filter. Please consult the drive documentation to find out the drive conformance levels, with and without an external RFI filter.

Drive power supply cables: These cables do not necessarily need shielding. Their cross-section is recommended in the drive documentation, however, it can be adapted according to the type of cable, installation method, the cable length (voltage drop), etc. See below "Sizing the power cables".

Line reactor: Its role is to reduce the risk of damage to drives following phase imbalance or significant disturbance on the AC supply. The line reactor can also reduce low-frequency harmonics.

Motor power supply cables: These cables must be shielded to ensure EMC conformance of the installation. The cable shielding must be connected over 360° at both ends. At the motor end, special EMC cable glands are available as an option. The cable cross-section is recommended in the drive documentation, however, it can be adapted according to the type of cable, installation method, the cable length (voltage drop), etc. See below "Sizing the power cables".

Encoder cables: The encoder cable shielding is important due to interference with the power cables. This cable must be laid at least 12 inches away from any power cables. See "Encoders" section.

Sizing the power cables: The drive and motor power supply cables must be sized according to the applicable standard, and according to the design current stated in the drive documentation.

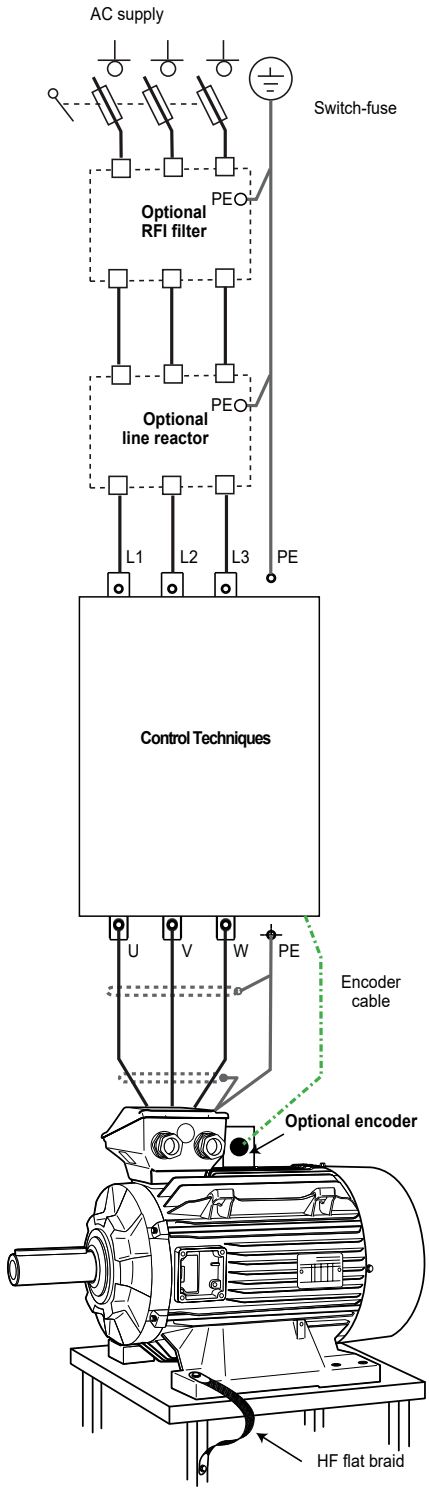
The different factors to be taken into account are:

- The installation method: in a conduit, a cable tray, suspended, etc.

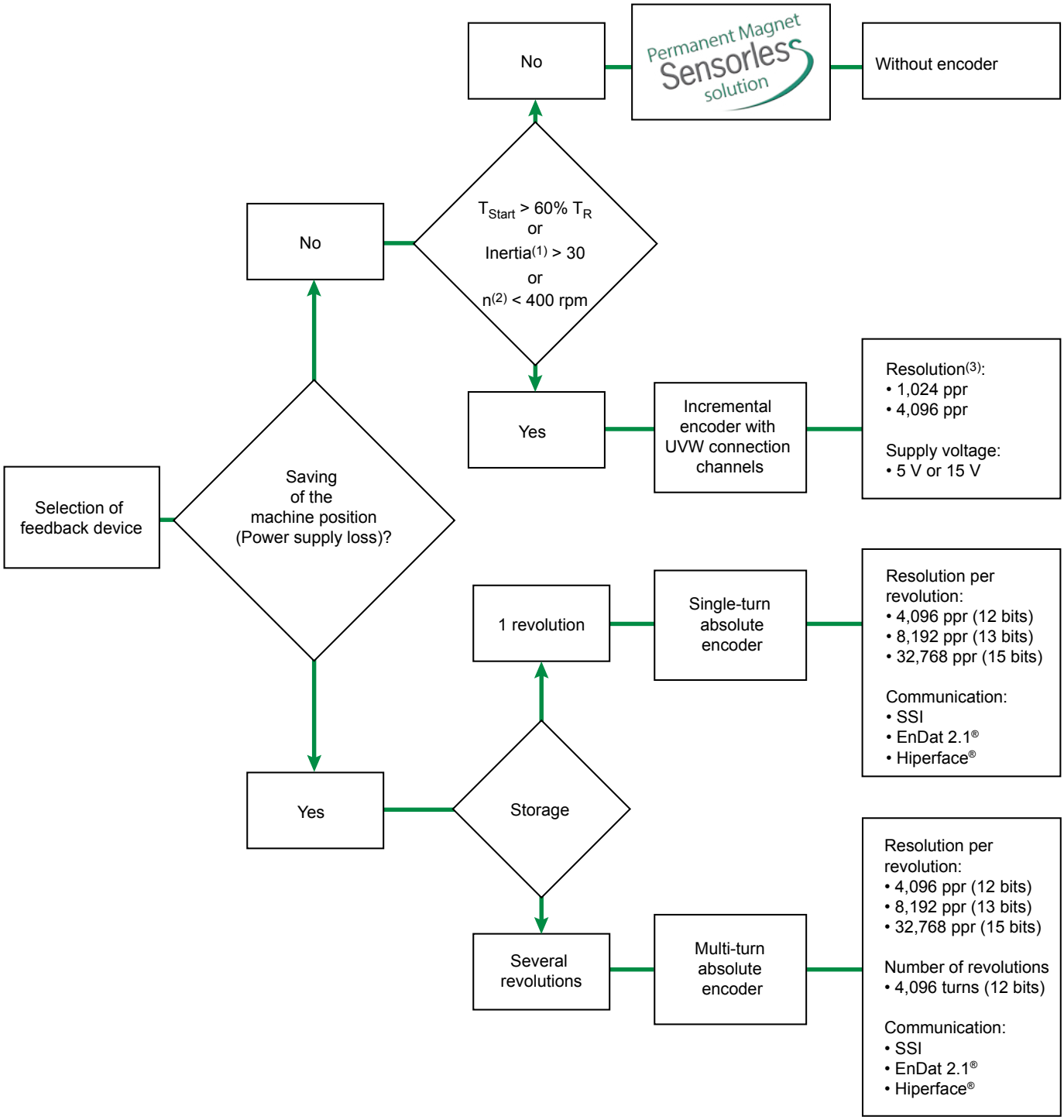
- The type of conductor: copper or aluminum

Once the cable cross-section has been determined, check the voltage drop at the motor terminals. A significant voltage drop results in increased current and additional losses in the motor (temperature rise).

Equipotential bonding between the frame, motor, drive, transformer and ground carried out in accordance with good practice will significantly help reduce the voltage on the shaft and the motor casing, resulting in fewer high-frequency leakage currents. Premature failure of bearings and auxiliary equipment, such as encoders, should also be avoided wherever possible.



Selection of feedback encoder



(1) Ratio between the driven load inertia related to the motor speed and the motor inertia
(2) Minimum speed
(3) Caution, if the speed is greater than or equal to 3000 rpm, the resolution must not exceed 1,024 ppr.

Installation options

Encoders

SENSORLESS mode

Drives in the Unidrive M600/700 range enable operation in sensorless mode (without encoder) in the majority of applications. The Unidrive M600 is specially dedicated to this type of motor control. In this operating mode, the rotor position feedback is calculated using the electrical measurements taken by the drive.

When using permanent magnet synchronous machines in sensorless mode, ensure that:

- **The starting torque is < 60% than Trated**
- **The ratio between the load inertia and the motor inertia is < 30**
- **The machine's minimum speed is > 400 rpm**

UVW incremental encoders

This pulse generator supplies a number of pulses on channels A,A/, B,B/, 0 marker, 0/ marker proportional to the speed. The information on commutation channels UVW enables the position of the rotor to be known to within about 60° (electrical degrees).

A 1,024 ppr encoder is sufficient for most applications. However, where stability at very low speed (<10 rpm) is required, use of a higher-resolution encoder is recommended. For motors with frame sizes 200 and above, the encoder is galvanically isolated as standard in relation to the motor shaft.

Absolute encoders

Absolute encoders save the position in the revolution, or over several revolutions, in the event of a power loss. A reference point is no longer necessary. Data is transmitted via different communication protocols (EnDat, Hiperface, SSI, etc.). In certain cases, SinCos or incremental data is also available.

Single-turn absolute encoders

The single-turn absolute encoder converts the rotation of the drive shaft into a series of "encoded electrical steps". The number of steps per revolution is determined by an optical disk. In general, one shaft rotation consists of 8,192 steps, corresponding to 13 bits. At the end of a complete encoder shaft revolution, the same values are repeated.

Multi-turn absolute encoders

The multi-turn absolute encoder saves the position within a revolution and also over several revolutions, with a maximum of 4,096 revolutions.

Encoder - drive connecting cables

For each encoder type, order the appropriate cable from Control Techniques, guaranteeing optimum performance of the drive connection.

Encoder characteristics

Encoder type	UVW INCREMENTAL ENCODERS		ABSOLUTE ENCODERS							
			Single-turn				Multi-turn (4,096)			
Data interface			EnDat 2.1®	SSI		SinCos Hiperface®	EnDat 2.1®	SSI		SinCos Hiperface®
Encoder reference	KHO5	KHK5S (2)	ECN 413	ECN 413	AFS 60	SFS60	EQN 425	EQN 425	AFM 60	SFM 60
Supply voltage	5/30 VDC	5/30 VDC	3.6/14 VDC	10/30 VDC	4.5/32 VDC	7/12 VDC	3.6/14 VDC	10/30 VDC	4.5/32 VDC	7/12 VDC
Positions per revolution	1,024 or 4,096	1,024 or 4,096	4,096 max: 8,192	4,096 max: 8,192	4,096 max: 8,192	4,096 max: 32,768	4,096 max: 8,192	4,096 max: 8,192	4,096 max: 8,192	4,096 max: 32,768
Output stage	TTL (RS422)	TTL (RS422)	1 V ~	1 V ~	1 V ~	1 V ~	1 V ~	1 V ~	1 V ~	1 V ~
Max. current (no load)	140 mA	140 mA	110 mA	45 mA	30 mA	80 mA	140 mA	55 mA	30 mA	80 mA
Max. mechanical speed in continuous operation	6,000 rpm	6,000 rpm	12,000 rpm		9,000 rpm	6,000 rpm	12,000 rpm		9,000 rpm	6,000 rpm
Shaft diameter	14 mm (1)	14 mm (1)	14 mm (1)		14 mm (1)	14 mm (1)	14 mm (1)		14 mm (1)	14 mm (1)
Protection	IP65	IP67	IP64		IP65	IP65	IP64		IP65	IP65
Operating temperature	-30° +80°C	-30° +80°C	-40° +100°C		-30° +100°C	-30° +115°C	-40° +100°C		-30° +100°C	-30° +115°C
Certification	CE	CE	CE, cURus, UL/CSA		CE, cURus	CE, cURus	CE, cURus, UL/CSA		CE, cURus	CE, cURus
Motor end finish	M23 17 pins	M23 17 pins	M23 17 pins	M23 17 pins	M23 12 pins	M23 12 pins	M23 17 pins	M23 17 pins	M23 12 pins	M23 12 pins
Drive end finish	HD15	HD15	HD15	HD15	HD15	HD15	HD15	HD15	HD15	HD15

(1) THS: Through Hollow Shaft, closed
Resolver: please consult Leroy-Somer
——: standard encoder type

(2) Reinforced encoder, recommended for severe environments (dusty atmospheres).

Reinforced insulation

Motors fitted with insulated bearings are listed on page 41

Standard motors are compatible with power supplies with the following characteristics:

- V rms = 480 V max.
- Value of voltage peaks generated at the terminals: 1500 V max.

However, they can be supplied under more severe conditions if additional protection is provided.

Reinforced winding insulation

The main effect associated with supplying power via an electronic drive is overheating of the motor due to the non-sinusoidal shape of the waveform. In addition, this can result in accelerated aging of the winding through the voltage peaks generated at each pulse in the power supply waveform (see Figure 1).

For peak values greater than 1500 V, a super-insulation option for the winding is available over the entire range.

Insulated bearings

Supplying power via a drive can affect the mechanism and lead to premature wear of the bearings.

This is because, in any motor, a shaft voltage exists with respect to earth. This voltage, due to electromechanical asymmetries, creates a potential difference between the rotor and the stator. This effect can generate electrical discharges between balls and race and lead to a reduction in bearing life.

If power is supplied via a PWM drive, a second effect is added: high-frequency currents generated by the IGBT output bridges of the drives. These currents "attempt" to spread towards the drive and therefore flow through the stator and via earth where the link between the casing, machine frame and earth is correctly made.

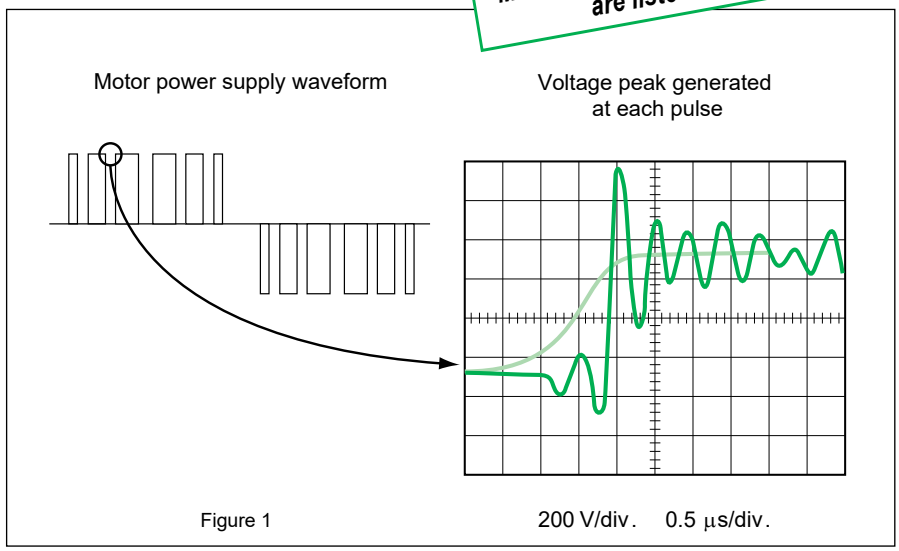
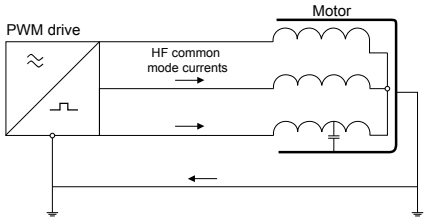


Figure 1



Otherwise, it will flow via the least resistive path: end shields/bearings/shaft/machine coupled to the motor. In these situations, therefore, protection for the bearings must be provided.

For this reason, an "insulated bearing" option is available over the entire range from a frame size of 200.

Insulated bearing characteristics

The outer races of the bearings are coated with a layer of electrically insulating ceramic or the bearings incorporate ceramic balls.

The dimensions and tolerances of these bearings are identical to the standard ones used and can therefore be fitted instead, with no modifications to the motors. The breakdown voltage is 500 V. To find out which type of bearings are fitted as standard, see the "Bearings and lubrication" section.

Aegis Ring at DE side†

Recommended winding protection

AC voltage	Cable length	Frame size	Winding protection
≤ 480 V	< 20 m	All frame sizes	Standard*
	> 20 m and < 100 m	< 315	Standard*
		≥ 315	RIS or drive filter**
> 480 V and ≤ 690 V	< 20 m	< 250	Standard*
		≥ 250	RIS or drive filter**
	> 20 m and < 100 m	< 250	RIS or drive filter**
		≥ 250	RIS or drive filter**

* Standard insulation = 1,500 V peak and 3,500 V/µs

** RIS: Reinforced insulation system. Do not use a drive filter in Sensorless mode.

†Aegis groundings rings are also fitted at the DE of certain motors to further protect the motor bearings.

Forced ventilation units (TEFV) or (TEPV)

To maintain the rated torque over the entire speed range, a forced ventilation unit may be required.

Characteristics of forced ventilation units

(please consult Leroy-Somer for motors ≥ 225 SG in speed ranges ≥ 2,400 rpm)

Motor type	Supply voltage[1] FV	FV consumption			Ingress protection[2] FV
		P (W)	P (HP)	I (A)	
LSRPM 90 to 132	single-phase 230 or 400 V	100	0.13	0.43/0.25	IP 55
LSRPM 160	three-phase 230/400 V 50 Hz 265/460 V 60 Hz	48 57	0.06 0.07	0.25/0.14 0.22/0.13	IP 55
LSRPM 250 MY LSRPM 200 to 225 except LSRPM 225 SG	three-phase 230/400 V 50 Hz 254/460 V 60 Hz	150	0.2	0.94/0.55	IP 55
LSRPM 225 SG LSRPM 315 SN LSRPM 250 and 280 except LSRPM 280 MK/250 MY	three-phase 230/400 V 50 Hz 254/460 V 60 Hz	200	0.27	1.4/0.8	IP55
LSRPM 280 MK1 LSRPM 315 except LSRPM 315 SN	three-phase 230/400 V 50 Hz 254/460 V 60 Hz	750	1.0	3.6/2.1	IP55

1. ± 10% for voltage, ± 2% for frequency.
2. Ingress protection of the forced ventilation unit installed on the motor.

The motors are self-cooled as standard

Cable glands

To guarantee protection of the installation in accordance with EMC directive 2004/108/EC, there must be ground continuity between the cable and the motor ground. An optional cable gland that clamps on to shielded cable is therefore available over the entire range.

The motors are supplied with pre-drilled and tapped terminal boxes or an undrilled mounting plate for mounting cable glands **see page 42**

Type and cable size of cable glands

Cable gland type	Cable size	
	Min. cable Ø (mm) W	Max. cable Ø (mm) A
ISO 16	6	11
ISO 20	7.5	13
ISO 25	12.5	18
ISO 32	17.5	25
ISO 40	24.5	33.5
ISO 50	33	43
ISO 63	42.5	55

Thermal protection

The motors are fitted with PTC sensors as standard

Motors are protected by the variable speed drive, placed between the isolating switch and the motor.

The drive provides total protection of the motor against overloads.

Dyneo motors are fitted with PTC sensors in the winding as standard. As an option, specific thermal protection sensors can be selected from the table below.

It must be emphasized that under no circumstances can these sensors be used for direct regulation of the motor operating cycles.

Fitting thermal protection

- PTO or PTF, in the control circuits

- PTC, with relay, in the control circuits

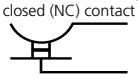
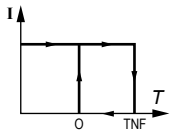
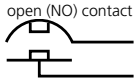
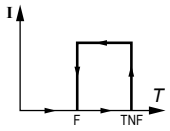
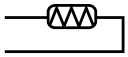
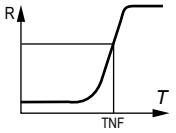
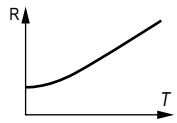
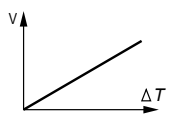
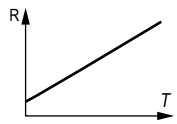
- PT 100 or thermocouples, with reading equipment or recorder, in the installation control panels for continuous surveillance

Motor thermal sensors must be connected in order to maintain optimum motor 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).

Built-in indirect thermal protection

Type	Operating principle	Operating curve	Breaking capacity (A)	Protection provided	Mounting Number of devices*
Normally closed thermal protection PTO	Bimetallic strip, indirectly heated, with normally closed (NC) contact 		2.5 A at 250 V with cos φ 0.4	General surveillance for non-transient overloads	Mounted in control circuit 2 or 3 in series
Normally open thermal protection PTF	Bimetallic strip, indirectly heated, with normally open (NO) contact 		2.5 A at 250 V with cos φ 0.4	General surveillance for non-transient overloads	Mounted in control circuit 2 or 3 in parallel
Thermistor with positive temperature coefficient PTC	Non-linear variable resistor, indirectly heated 		0	General surveillance for transient overloads	Mounted with associated relay in control circuit 3 in series
Thermal sensor KTY	Resistance depends on the winding temperature		0	High accuracy continuous surveillance of key hot spots	Mounted in control panels with associated reading equipment (or recorder) 1 per hot spot
Thermocouples T (T < 150°C) Copper Constantan K (T < 1000°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	Linear variable resistor, indirectly heated		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.
- Standard KTY = 84/130

* The number of devices relates to the winding protection.

Definition of “Index of Protection” (IP/IK)

In standard configuration the motors are IP 55/IK 08 for LSRPM

Ingress protection of electrical equipment enclosures

In accordance with IEC 60034-5 - EN 60034-5 (IP) - IEC 62262 (IK)

1st number: Protection against solid objects			2nd number: Protection against liquids			3rd number: Mechanical protection		
IP	Tests	Definition	IP	Tests	Definition	IK	Tests	Definition
0		No protection	0		No protection	00		No protection
1	Ø 50 mm	Protected against solid objects larger than 50 mm (e.g. accidental contact with the hand)	1		Protected against water drops falling vertically (condensation)	01	150 g, 10 cm	Impact energy: 0.15 J
2	Ø 12 mm	Protected against solid objects larger than 12 mm (e.g. a finger)	2	15°	Protected against water drops falling at up to 15° from the vertical	02	200 g, 10 cm	Impact energy: 0.20 J
3	Ø 2.5 mm	Protected against solid objects larger than 2.5 mm (e.g. tools, wires)	3	60°	Protected against rain falling at up to 60° from the vertical	03	250 g, 15 cm	Impact energy: 0.37 J
4	Ø 1 mm	Protected against solid objects larger than 1 mm (e.g. thin tools, small wires)	4		Protected against projected water from all directions	04	250 g, 20 cm	Impact energy: 0.50 J
5		Protected against dust (no deposits of harmful material)	5		Projected against jets of water from all directions from a hose	05	350 g, 20 cm	Impact energy: 0.70 J
6		Protected against any dust penetration	6		Protected against projected water comparable to big waves	06	250 g, 40 cm	Impact energy: 1 J
			7	0.15 m, 1 m	Protected against the effects of immersion between 0.15 and 1 m	07	0.5 kg, 40 cm	Impact energy: 2 J
			8 . . m	..m	Protected against prolonged effects of immersion under pressure	08	1.25 kg, 40 cm	Impact energy: 5 J
						09	2.5 kg, 40 cm	Impact energy: 10 J
						10	5 kg, 40 cm	Impact energy: 20 J

Example:

Example of an IP55 machine

IP :Index of protection

5. :Machine protected against dust and accidental contact.
Test result: no dust enters in harmful quantities, no risk of direct contact with rotating parts. The test will last for 2 hours.

.5 :Machine protected against jets of water from all directions from hoses at 3 m distance with a flow rate of 12.5 l/min at 0.3 bar.
The test will last for 3 minutes.
Test result: no damage from water projected onto the machine.

External finish

Surface protection is defined in standard ISO 12944. This standard defines the expected life of a paint system until the first major application of maintenance paint. Standard EN ISO 12944 is divided into 8 parts. Part 2 discusses the classification of environments Leroy-Somer motors are protected with a range of surface finishes. Surfaces receive appropriate special treatments, as shown below.

Preparation of surfaces

SURFACE	PARTS	TREATMENT
Cast iron	End shields	Shot blasting + Primer
Steel	Accessories	Phosphate treatment + Primer
	Terminal boxes - Fan covers	Electrostatic painting or Epoxy powder
Aluminum alloy	Housings - Terminal boxes	Shot blasting

Classification of environments

Leroy-Somer paint systems according to category.

ATMOSPHERIC CORROSIVITY CATEGORIES	CORROSIVITY CATEGORY* ACC. TO ISO 12944-2	Durability class	ISO 6270	ISO 9227	Leroy-Somer system equivalent
			Water condensation Number of hours	Neutral saline mist Number of hours	
Average	C3	Limited	48	120	Ia
		Average	120	240	IIa
		High	240	480	IIb
High	C4	Limited	120	240	-
		Average	240	480	IIIa
		High	480	720	IIIb**
Very high (Industry)	C5-I	Limited	240	480	IVb**
		Average	480	720	Ve**
		High	720	1440	-
Very high (Marine)	C5-M	Limited	240	480	-
		Average	480	720	-
		High	720	1440	161b**

Standard for LSRPM aluminum and PLSRPM steel motors

* Values given for information only since the substrates vary in nature whereas the standard only takes account of steel substrates.
** Assessment of degree of rusting in accordance with standard ISO 4628 (rust over 1 to 0.5% of the surface).

Standard paint color reference of LSRPM-PLSRPM motors:

RAL 3005

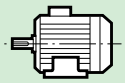
Mounting arrangements

Mountings and positions (IEC standard 60034-7)

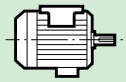
Foot mounted motors

• all frame sizes

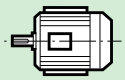
IM 1001 (IM B3)
- Horizontal shaft
- Feet on floor



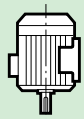
IM 1071 (IM B8)
- Horizontal shaft
- Feet on top



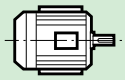
IM 1051 (IM B6)
- Horizontal shaft
- Wall mounted with feet on left when viewed from drive end



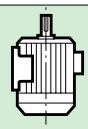
IM 1011 (IM V5)
- Vertical shaft facing down
- Feet on wall



IM 1061 (IM B7)
- Horizontal shaft
- Wall mounted with feet on right when viewed from drive end



IM 1031 (IM V6)
- Vertical shaft facing up
- Feet on wall

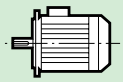


(FF) flange mounted motors

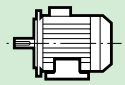
• all frame sizes

(except IM 3001, which is limited to frame size 225 mm)

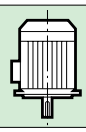
IM 3001 (IM B5)
- Horizontal shaft



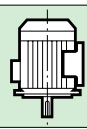
IM 2001 (IM B35)
- Horizontal shaft
- Feet on floor



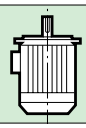
IM 3011 (IM V1)
- Vertical shaft facing down



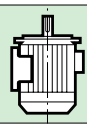
IM 2011 (IM V15)
- Vertical shaft facing down
- Feet on wall



IM 3031 (IM V3)
- Vertical shaft facing up



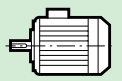
IM 2031 (IM V36)
- Vertical shaft facing up
- Feet on wall



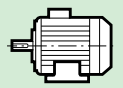
(FT) face mounted motors

• all frame sizes ≤ 132 mm

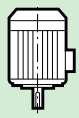
IM 3601 (IM B14)
- Horizontal shaft



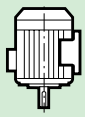
IM 2101 (IM B34)
- Horizontal shaft
- Feet on floor



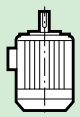
IM 3611 (IM V18)
- Vertical shaft facing down



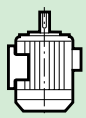
IM 2111 (IM V58)
- Vertical shaft facing down
- Feet on wall



IM 3631 (IM V19)
- Vertical shaft facing up



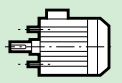
IM 2131 (IM V69)
- Vertical shaft facing up
- Feet on wall



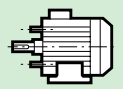
Motors without drive end shield

Caution: The protection (IP) specified on the IM B9 and IM B15 motor nameplates is provided by the customer when the motor is assembled

IM 9101 (IM B9)
- Threaded tie rods
- Horizontal shaft



IM 1201 (IM B15)
- Foot mounted with threaded tie rods
- Horizontal shaft



Frame size (mm)	Mounting positions											
	IM 1001	IM 1051	IM 1061	IM 1071	IM 1011	IM 1031	IM 3001	IM 3011	IM 3031	IM 2001	IM 2011	IM 2031
≤ 200	●	●	●	●	●	●	●	●	●	●	●	●
225 and 250	●	●	●	●	●	●	■	●	●	●	●	●
≥ 280	●	■	■	■	■	■	■	●	●	●	●	■

● : possible positions
■ : please consult Leroy-Somer specifying the coupling method and the axial and radial loads if applicable

Bearings and lubrication

Type of grease

When the bearings are not greased for life, the type of grease is indicated on the nameplate.

Avoid mixing greases and adhere to the quantities stated

Permanently greased bearings

Under normal operating conditions, the service life (L10h) of the lubricant is 25,000 hours for a machine installed horizontally and for temperatures less than 77 °F.

Bearings with grease nipples

The bearings are lubricated in the factory

The end shields are fitted with bearings lubricated by Técalémit grease nipples.

The frequency of lubrication and the quantity and quality of grease are given on the nameplates. Refer to these to ensure correct bearing lubrication.

Even in the event of prolonged storage or downtime, the interval between two greasing operations must never exceed 2 years.

Permissible loads

Permissible loads: Motors in the 1800 series are designed to operate with direct or indirect coupling: permissible loads on request.

Motors in the 3600 series are designed to operate with direct coupling. For other cases, please consult Leroy-Somer.

CAUTION: Transmission via belt pulleys is only authorized up to series 1800.

Precautions

For the 3600 series, a running-in period is necessary. Please refer to installation and maintenance manual reference 4155.

Bearings fitted as standard

Voltage	Speed (rpm)	Power (kW)	NDE bearing	DE bearing
< 460 V	1500 ≤ N ≤ 2400	< 160	Standard	Standard
		≥ 160	Insulated outer ring	
	2400 < N ≤ 3600	< 145	Standard	Standard
		145 ≤ P < 325	Insulated outer ring	
		≥ 325		Insulated outer ring
	3600 < N ≤ 4500	< 55	Standard	Standard
		≥ 55	Insulated outer ring	Insulated outer ring
	N > 4500	< 55	Standard	Standard
		≥ 55	Insulated ceramic balls	Insulated ceramic balls
≥ 460 V	≥ 1500	< 55	Standard	Standard
		≥ 55	Insulated ceramic balls	Standard + ground ring

Greasing (standard)

Frame size	Speed (rpm)	Lubrication type	Grease
< 225	All	Permanently greased bearings	ENS, WT or BQ 72-72
≥ 225	N ≤ 3600	Bearings with grease nipples	Polyrex EM 103
	N > 3600	Bearings with grease nipples	BQ 72-72

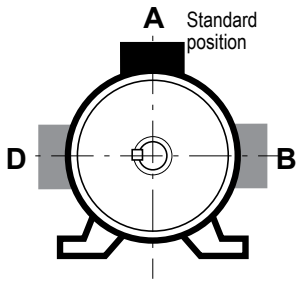
Connection

Terminal box

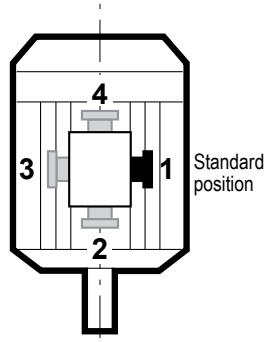
Placed as standard on the top of the motor near the drive end, the terminal box has IP55 protection.

The standard position of the cable gland baseplate is on the right, seen from the drive end, position A1.

▼ *Terminal box positions in relation to the drive end*



▼ *Cable gland positions in relation to the drive end*



Only positions 1 and 3 are possible

Dimensions of motor connection terminals

Motors with frame size ≤ 160

Frame size	Speed (rpm)	Terminals
90	all	M5
100 and 132	all	M6
160	N ≤ 2400	M6
	N > 2400	M8

Motors with frame size ≥ 200

Motor current (A)	Terminals
≤ 63	M6
63 < I ≤ 125	M10
200 < I ≤ 320	M12
I > 320	M16

Terminal box drilling for cable glands

Motor type	Power + auxiliaries	
	Number of drill holes	Drill hole diameter
LSRPM 90 SL	2	ISO M25x1.5 + 1xM16
LSRPM 100 L		
LSRPM 132 M		ISO M40x1.5 + 1xM16
LSRPM 160 LR/MP		ISO M50x1.5 + 1xM16 for speed ≤ 2,400 rpm: ISO M40x1.5 + 1xM16
LSRPM 200 L/LU	3	2xM40 + 1xM16
LSRPM 200 L1		2xM50 + 1xM16
LSRPM 200 L2/LU2		2xM63 + 1xM16
LSRPM 225 ST1/MR1, LSRPM 250 MY		2xM50 + 1xM16
LSRPM 225 SG/ST2/SR2		2xM63 + 1xM16
LSRPM 250 SE/ME		2xM63 + 1xM16
LSRPM 250 SE1/ME1		Removable undrilled mounting plate
LSRPM 280 SD/SC/SCM		2xM63 + 1xM16
LSRPM 280 SD1/MK1	0	Removable undrilled mounting plate
LSRPM 315 SP1/MR1/SN/MP1/SR1		

Motor vibration levels

Maximum vibration magnitude limits (rms values) in terms of displacement, speed and acceleration for a frame size H (IEC 60034-14)

The machines in this catalog are in vibration class:
- level A as standard
- level B as option for n ≤ 3600 rpm
and half-key balancing (H)

Vibration level	Frame size H (mm)								
	90 < H ≤ 132			132 < H ≤ 280			H > 280		
	Displacement mm	Speed mm/s	Acceleration m/s2	Displacement mm	Speed mm/s	Acceleration m/s2	Displacement mm	Speed mm/s	Acceleration m/s2
A	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
B	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8

Dyneo motors are balanced with a half-key in accordance with standard ISO 8821.
Any coupling element (pulley, coupling sleeve, slip-ring, etc.) must therefore be balanced accordingly.

Quality commitment

Leroy-Somer's quality management system is based on:

- Control of procedures right from the initial sales offering until delivery to the customer, including design, manufacturing start-up and production

- A total quality policy based on making continuous progress in improving operational procedures, involving all departments in the company in order to give customer satisfaction as regards delivery times, conformity and cost

- Indicators used to monitor procedural performance

- Corrective actions and advancements with tools such as FMECA, QFD, MAVP, MSP/MSQ and Hoshin type improvement workshops on flows, process re-engineering, plus Lean Manufacturing and Lean Office

- Annual surveys, opinion polls and regular visits to customers in order to ascertain and detect their expectations.

Personnel are trained and take part in the analyses and the actions for continuously improving the procedures.

Leroy-Somer has entrusted the certification of its expertise to various international organizations.

Certification is granted by independent professional auditors, and recognizes the high standards of the company's quality assurance procedures. All activities resulting in the final version of the machine have therefore received official ISO 9001: 2008 certification from the DNV. Similarly, our environmental approach has enabled us to obtain ISO 14001: 2004 certification.

Products for particular applications or those designed to operate in specific environments are also approved or certified by the following organizations: LCIE, DNV, INERIS, EFECTIS, UL, BSRIA, TUV, GOST, which check their technical performance against the various standards or recommendations.

Standards and approvals

Our motors comply with the standards quoted in this catalog

List of standards quoted in this document

Reference		International standards
IEC 60034-1	EN 60034-1	Rotating electrical machines: rating and performance.
IEC 60034-2-1		Rotating electrical machines: methods for determining losses and efficiency from tests (measured additional losses)
IEC 60034-5	EN 60034-5	Rotating electrical machines: classification of degrees of protection provided by casings of rotating machines
IEC 60034-6	EN 60034-6	Rotating electrical machines (except traction): methods of cooling
IEC 60034-7	EN 60034-7	Rotating electrical machines (except traction): symbols for mounting positions and assembly layouts
IEC 60034-8		Rotating electrical machines: terminal markings and direction of rotation
IEC 60034-9	EN 60034-9	Rotating electrical machines: noise limits
IEC 60034-12	EN 60034-12	Starting performance of single-speed three-phase cage induction motors for supply voltages up to and including 660 V.
IEC 60034-14	EN 60034-14	Rotating electrical machines: mechanical vibrations of certain machines with a frame size above or equal to 56 mm. Measurement, evaluation and limits of vibration severity
IEC 60034-17		Cage induction motors when fed from converters - Application guide
IEC 60034-30-1		Rotating electrical machines: efficiency classes of single-speed, three-phase cage induction motors (Code IE)
IEC 60038		IEC standard voltages.
IEC 60072-1		Dimensions and output powers for rotating electrical machines: designation of casings between 56 and 400 and flanges between 55 and 1080
IEC 60085		Evaluation and thermal classification of electrical insulation.
IEC 60721-2-1		Classification of environmental conditions appearing in nature. Temperature and humidity
IEC 60892		Effects of unbalanced voltages on the performance of 3-phase cage induction motors
IEC 61000-2-10/11 and 2-2		Electromagnetic compatibility (EMC): environment.
IEC guide 106		Guidelines on the specification of environmental conditions for the determination of operating characteristics of equipment
ISO 281		Bearings - Dynamic load ratings and nominal bearing life
ISO 1680	EN 21680	Acoustics - Test code for the measurement of airborne noise emitted by rotating electrical machines: a method for establishing an expert opinion for free field conditions over a reflective surface
ISO 8821		Mechanical vibration - Balancing. Shaft and fitment key convention
	EN 50102	Degree of protection provided by electrical enclosures against extreme mechanical impacts
ISO 12944-2		Corrosion protection

Standards and approvals

Approvals

Certain countries recommend or insist on approval from national organizations.
Approved products must carry the recognized mark on their nameplates.

Country	Acronym	Organization
USA	UL	Underwriters Laboratories
CANADA	CSA	Canadian Standards Association
etc.		

Approvals for Leroy-Somer motors (versions derived from standard construction):

Country	Acronym	Certification No.	Application
CANADA	CSA	LR 57 008	Standard adapted range (see "Supply voltage" section)
USA	UL or ᖇU	E 68554 SA 6704 E 206450	Impregnation systems Stator/rotor assemblies for sealed units Complete motors up to 160 size
USA + Canada	c ᖇU us	E 68554	Impregnation systems
SAUDI ARABIA	SASO		Standard range
FRANCE	LCIE INERIS	Various nos.	Sealing, shocks, safety

For specific approved products, see the relevant documents.

International and national standard equivalents

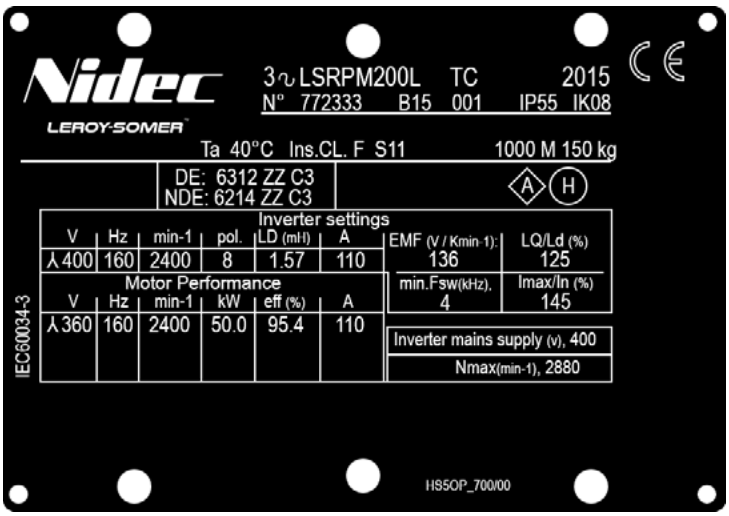
International reference standards		National standards				
IEC	Title (summary)	FRANCE	GERMANY	UK	ITALY	SWITZERLAND
60034-1	Ratings and operating characteristics	NFEN 60034-1 NFC 51-120 NFC 51-200	DIN/VDE O530	BS 4999	CEI 2.3.VI.	SEV ASE 3009
60034-5	Classification of degrees of protection	NFEN 60034-5	DIN/EN 60034-5	BS EN 60034-5	UNEL B 1781	
60034-6	Methods of cooling	NFEN 60034-6	DIN/EN 60034-6	BS EN 60034-6		
60034-7	Mounting arrangements and assembly layouts	NFEN 60034-7	DIN/EN 60034-7	BS EN 60034-7		
60034-8	Terminal markings and direction of rotation	NFC 51 118	DIN/VDE 0530 Teil 8	BS 4999-108		
60034-9	Noise limits	NFEN 60034-9	DIN/EN 60034-9	BS EN 60034-9		
60034-12	Starting characteristics for single-speed motors for supply voltages ≤ 660 V	NFEN 60034-12	DIN/EN 60034-12	BS EN 60034-12		SEV ASE 3009-12
60034-14	Mechanical vibration in machines frame size ≥ 56 mm	NFEN 60034-14	DIN/EN 60034-14	BS EN 60034-14		
60072-1	Dimensions and output powers for machines of between 56 and 400 frame and flanges of between 55 and 1080	NFC 51 104 NFC 51 105	DIN 748 (~) DIN 42672 DIN 42673 DIN 42631 DIN 42676 DIN 42677	BS 4999		
60085	Evaluation and thermal classification of electrical insulation	NFC 26206	DIN/EN 60085	BS 2757		SEV ASE 3584

Note: DIN 748 tolerances do not conform to IEC 60072-1.

Nameplates

Identification

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



Definition of symbols used on nameplates:

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

3 ~ : Three-phase AC motor

LSRPM : Series

200 : Frame size

L : Housing designation and manufacturer code

TC : Impregnation index

Motor

785601 : Motor serial number

M : Month of production

15 : Year of production

001 : Batch number

IP55 IK08 : Protection index

Ins. cl. F : Insulation class F

Ta 40°C : Ambient operating temperature

S : Duty

% : Operating factor

1000 m : Maximum altitude without derating

kg : Weight

RI : Insulated bearing

DE : Drive end bearing

NDE : Non drive end bearing

12 g : Amount of grease at each re-greasing

2200 h : Re-greasing interval (in hours) for the ambient temperature (Ta)

QUIET BQ 72-72 : Type of grease

A : Vibration level

H : Balancing mode

Inverter settings : Parameters to be entered in the drive

EMF (V / kmin^{-1}) : Electromotive force

Lq/Ld % : Cogging ratio

min.Fsw (kHz) : Minimum switching frequency

Imax/In % : Maximum current ratio/ Rated current

V : Voltage

Hz : Supply frequency

min^{-1} : Revolutions per minute (rpm)

pol. : Number of poles

Ld (mH) : Transient inductance

A : Rated current

Motor performance : Motor characteristics

V : Voltage

Hz : Supply frequency

min^{-1} : Revolutions per minute (rpm)

kW : Rated power

Eff % : Efficiency

A : Rated current

Inverter mains supply (V) : Drive AC supply voltage

Nmax (min^{-1}) : Maximum speed (rpm)

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Nidec

All for dreams

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