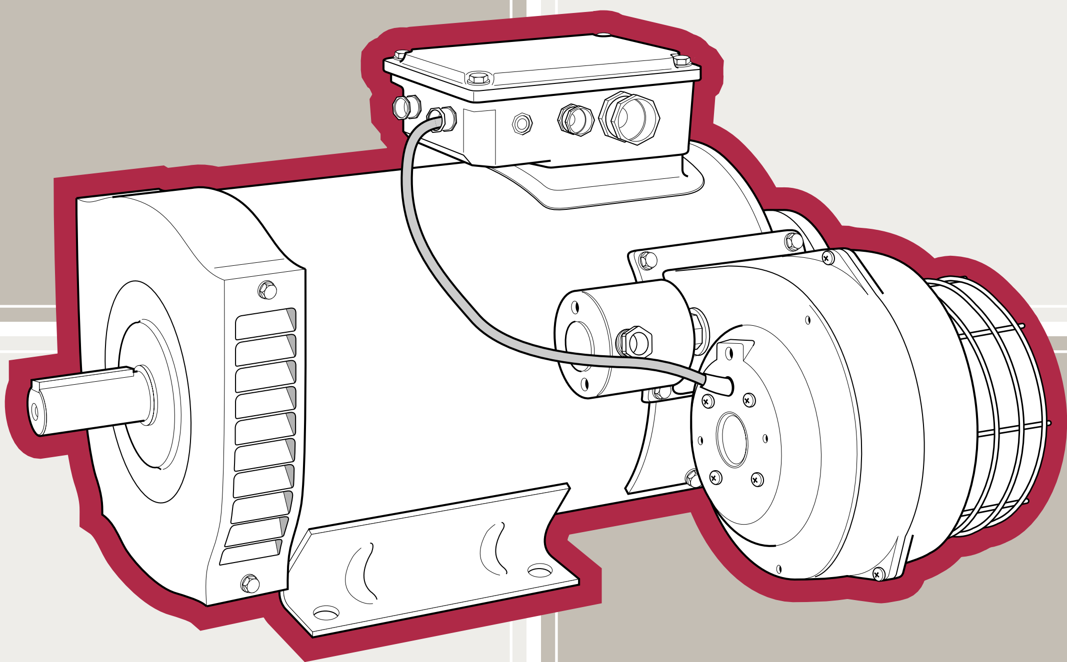
LEROY SOMER®

Réf. 1680 - 2.33 / b - 5.96



- MS1 - MS2 -

D.C. motors - 0.44 to 18.5 kW

Technical catalogue

Enclosed and drip-proof D.C. motors 0.06 to 560 kW

The LEROY-SOMER range

MS1 - MS2 range

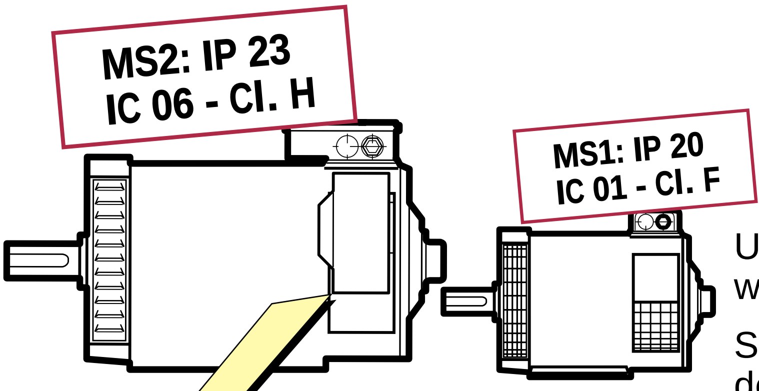
Enclosed permanent magnet motor

Enclosed wound motor

Cast iron wound motor

Drip-proof wound motor

MS1 - MS2
D.C. motors
Designation



Use the complete motor **designation** when placing your order, see page 59.

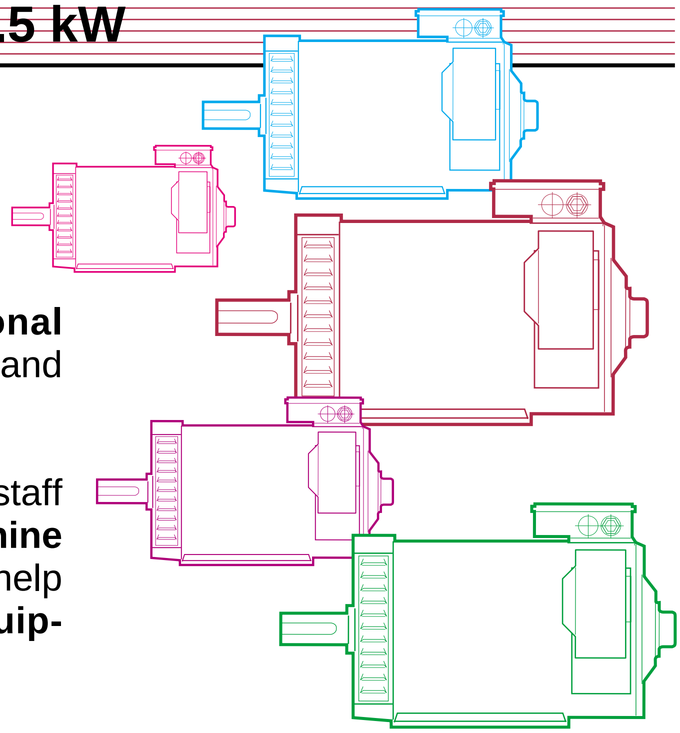
Simply go through the complete designation step by step.

MS	1122	M 06	440 V	2270 min^{-1}	6.1 kW	IM 1001 IM B3	340 V	IC 06	IP 23
Range identification	Frame size IEC 72 Range	Stator type and construction code	Armature voltage	Rated speed	Rated power IEC 34-7	Mounting arrangements IEC 34-7	Field voltage	Cooling IEC 34-6	Protection IEC 34-5
	P. 42 to 45	P. 42 to 45	Page 26	Page 31	Page 28	Page 13	Page 25	Page 19	Page 13

Complete description on page 59

For **direct selection**, see section **D8** Page 38

MS1 - MS2
D.C. motors
0.44 to 18.5 kW

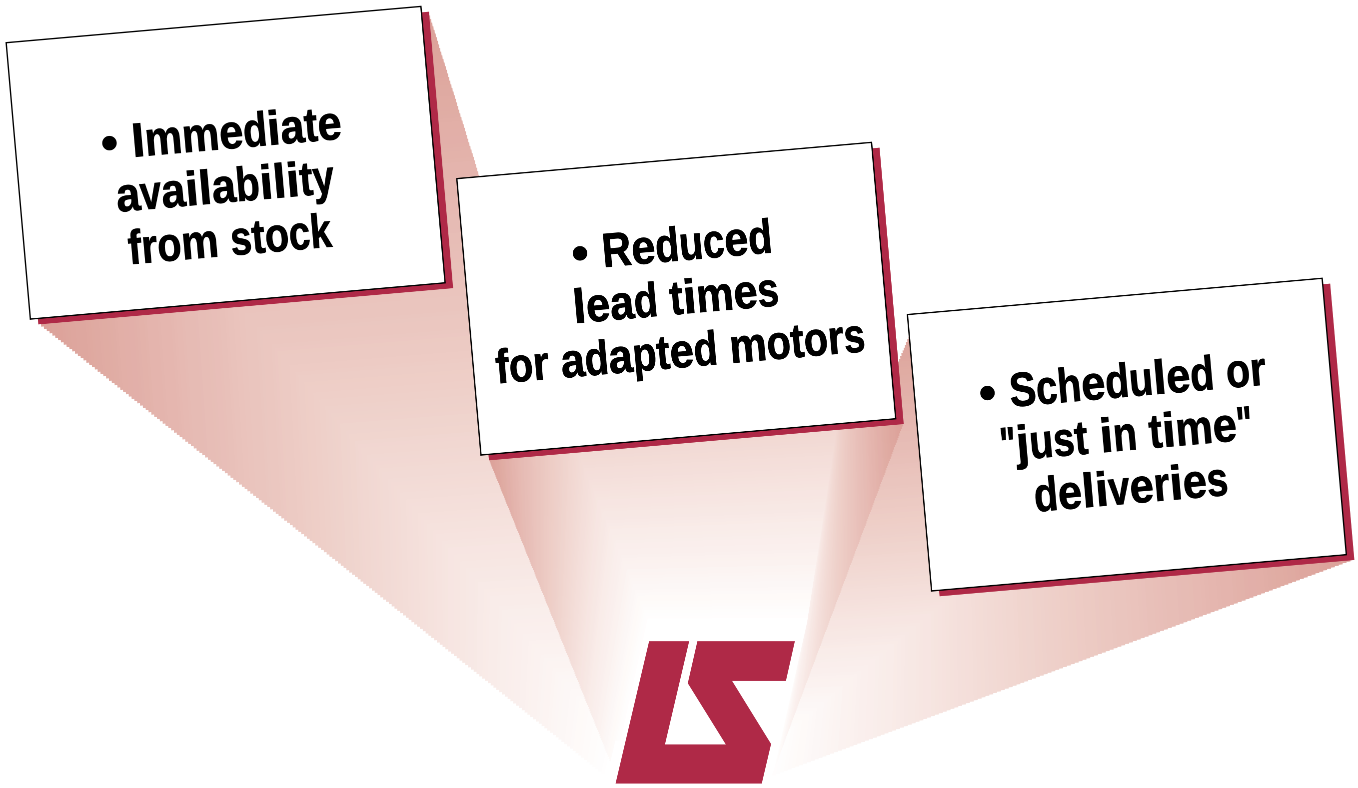


LEROY-SOMER's **International organization** provides local support and assistance to our customers.

Highly-qualified technical commercial staff provide **direct support** to both **machine manufacturers and end users** and help them select the **most suitable equipment**.

LEROY-SOMER presence in all industrial countries means that exporting customers have an **unequalled service,** both in the area of **manufacturing standards** and in the **availability of local support**.

LEROY-SOMER's sophisticated **product availability system** can be tailored to suit the **specific needs of our customers** :



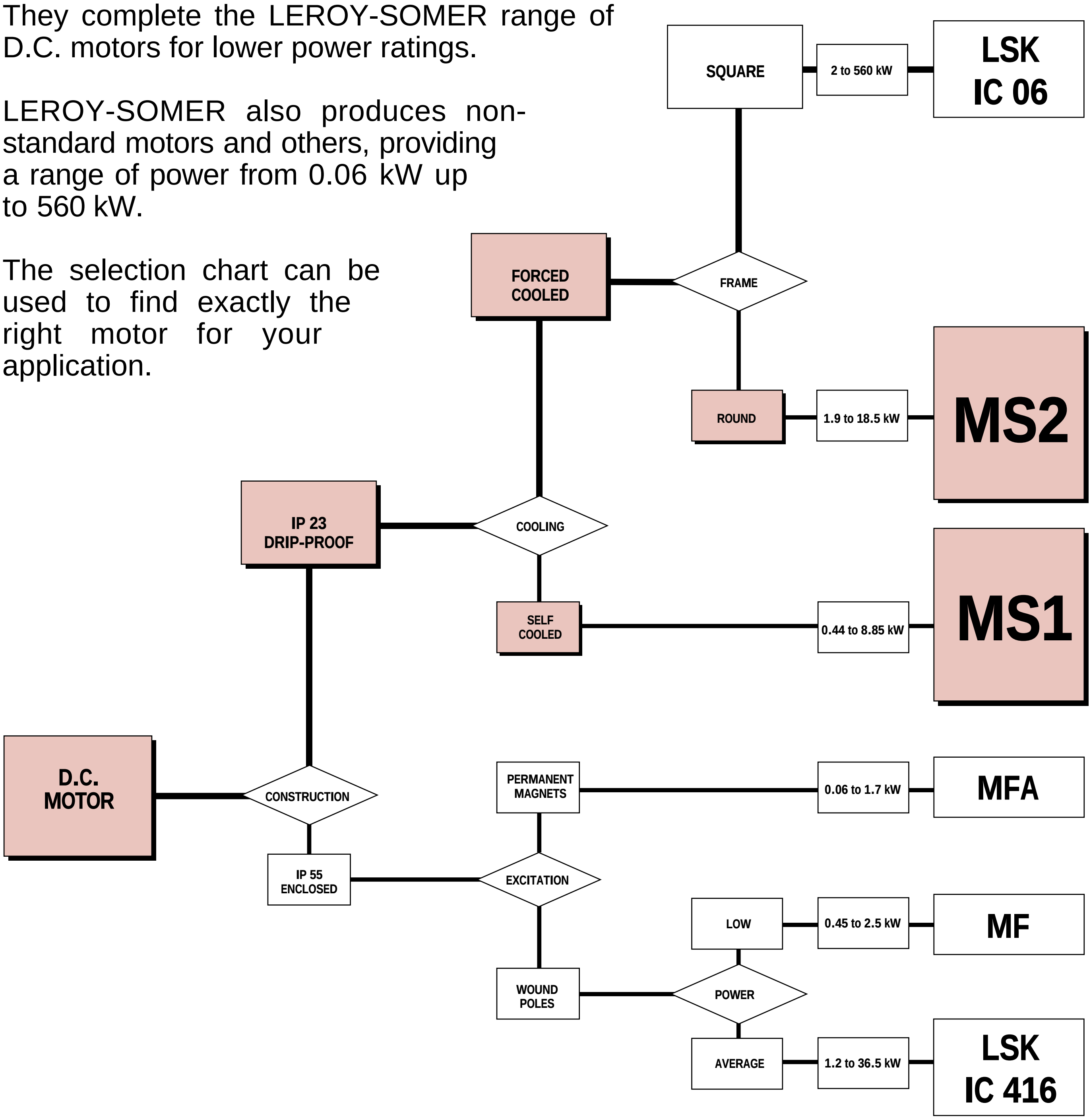
MS1 - MS2
D.C. motors
0.44 to 18.5 kW

This catalogue gives full information about
LEROY-SOMER MS D.C. motors, 0.44 to 18.5 kW.

The simple design concept of these laminated frame motors satisfies most industrial requirements.
They complete the LEROY-SOMER range of D.C. motors for lower power ratings.

LEROY-SOMER also produces non-standard motors and others, providing a range of power from 0.06 kW up to 560 kW.

The selection chart can be used to find exactly the right motor for your application.



MS1 - MS2
D.C. motors
Contents

MS1 - MS2
D.C. motors
Contents

MS1 - MS2
D.C. motors
Index

MS1 - MS2
D.C. motors
Index

A1 - Quality assurance

Industrial concerns are having to cope with an ever more competitive environment. Productivity depends to a considerable degree on the right investment at the right time.
LEROY-SOMER has the answer, building motors to precise standards of quality.

When carrying out quality checks on a machine's performance, the first step is to **measure the level of customer satisfaction**.
Careful study of this information tells us which points need looking at, improving and monitoring.
From the moment you place your order with our administrative staff until the motor is up and running (after design studies, launch and production activities) we keep you informed and involved.
Our own procedures are constantly under review. All our staff are involved in continuous training programmes to help them serve you better, and increased skills bring increased motivation.

Our concept of quality cannot however be reduced to a training programme alone
- it is a reality which inspires each employee to give of his best.

At LEROY-SOMER, we think it vital for our customers to know the importance we attach to quality.

LEROY-SOMER has entrusted the certification of its expertise to various international organizations.

Certification is granted by independent professional auditors, and recognises the high standards of the **company's quality assurance procedures**.

All activities resulting in the final version of the machine have therefore received official accreditation.

ISO 9001 confirms an adherence to standards as befits a company of international standing.

A2 - Conformity to standards

MS motors comply with the following standards insofaras they affect D.C. powered machines.

Reference	Date	International standards
IEC 34-1	1990	Electrical rotating machines: ratings and operating characteristics
IEC 34-5	1981	Electrical rotating machines: classification of degrees of protection provided by casings
IEC 34-6	1991	Electrical rotating machines (except traction): cooling methods
IEC 34-7	1972	Electrical rotating machines (except traction): symbols for structural shapes and assembly layout
IEC 34-8	1990	Electrical rotating machines: terminal markings and direction of rotation
IEC 34-9	1990	Electrical rotating machines: noise limits
IEC 34-14	1988	Electrical rotating machines: mechanical vibrations of certain machines with a frame size of 56 mm or over. Measurement, evaluation and limits of vibrational intensity.
IEC 38	1983	IEC standard voltages
IEC 72-1	1991	Dimensions of flanges between 55 and 1080.
IEC 85	1984	Evaluation and thermal classification of electrical insulation.
IEC 721-2-1	1982	Classification of outdoor environmental conditions. Temperature and humidity.
IEC 1000 2-1 and 2	1990	Electromagnetic compatibility (EMC): environment.
IEC guide 106	1989	Guidelines on the specification of environmental conditions for the determination of equipment operating characteristics.
ISO 281	1990	Bearings - Basic dynamic loadings and nominal bearing life
ISO 1680-1 and 2	1986	Acoustics - Test code for measuring airborne noise emitted by electrical rotating machines: a method for establishing an expert opinion for free field conditions over a reflective surface
ISO 8821	1989	Mechanical vibration - Balancing. Conventions on shaft keys and related parts.

MS1 - MS2
D.C. motors
Environment

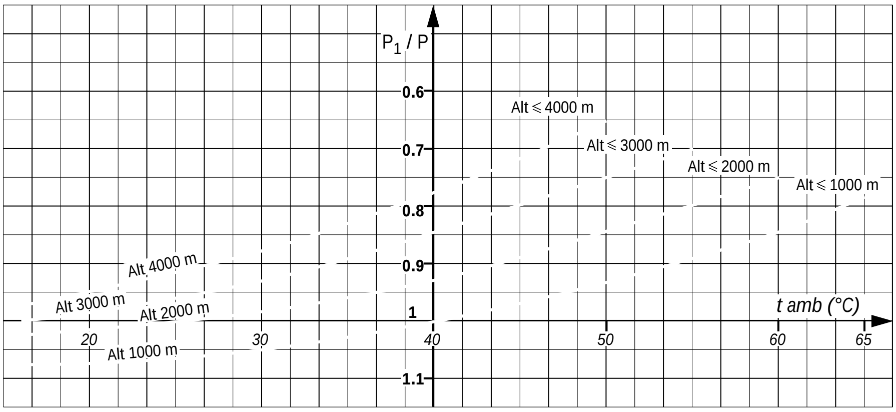
B1 - Environmental limitations

B1.1 - NORMAL OPERATING CONDITIONS

Under IEC standard 34-1, standard motors must be able to operate under the following conditions :

- ambient temperature of between + 5 and + 40 °C,
- altitude of under 1000 m,
- atmospheric pressure 1050 hPa (m bar),
- operating zone 2 (absolute humidity of between 5 and 23 g/m^3 : see chart on next page),
- chemically neutral and dust free atmosphere.

▼ ***Correction cœfficients depending on altitude and ambient temperature***



B1.2 - DERATING FACTORS

For operating conditions different to those listed above, apply the power correction coefficient shown in the chart on the right **which retains the thermal reserve.**
The ratio P_1 / P gives the correction coefficient.
P_1 : corrected power
P : catalogue power

B1.3 - RELATIVE AND ABSOLUTE HUMIDITY

Humidity plays an important part in motor operation as it contributes to the formation of the patina at the commutator. The level of humidity in the atmosphere must be taken into account to obtain maximum operating efficiency. This level will determine the operating zone for the machine. These zones are shown in the chart on the next page.
The brushes are designed to be used in conditions of widely ranging humidity. Thus their selection must be based on an average measurement.

Definitions:
The humidity level depends on the quantity of water vapour in the air, and therefore on the climatic conditions.

Absolute humidity (in g/m^3) :
weight of water vapour in the air.
Relative humidity (%) :
relationship between the weight of water vapour in a given volume of air and that which the same volume would contain, at the same temperature and pressure, if it were saturated. This is sometimes referred to as the hygrometric state, and can be calculated using the most basic measuring equipment.
These two measurements are connected (see page 11).

Note : in temperate climates the relative humidity is generally between 60 and 90 %. For the relationship between relative humidity and motor impregnation, especially where humidity and temperature are high, see table 1 on page 12.

B1.4 - IMPREGNATION AND ENHANCED PROTECTION

Climatic operating conditions must be taken into account as different types of construction must be employed depending on the level of humidity in the atmosphere and the ambient temperature.
LEROY-SOMER has set up various machine design procedures depending on the different parameters. To simplify selection of a machine suitable for a particular environment, the table on page 12 shows the protection which is appropriate to the operating zone (see chart on the next page) and the ambient temperature. The symbols used refer to permutations of components, types of brush, impregnation methods and finishes (varnish or paint).

The protection of the windings is generally described under the term "tropicalization".

B1.5 - HEATERS

B1.5.1 - Space heaters (OPTION for MS2 only)

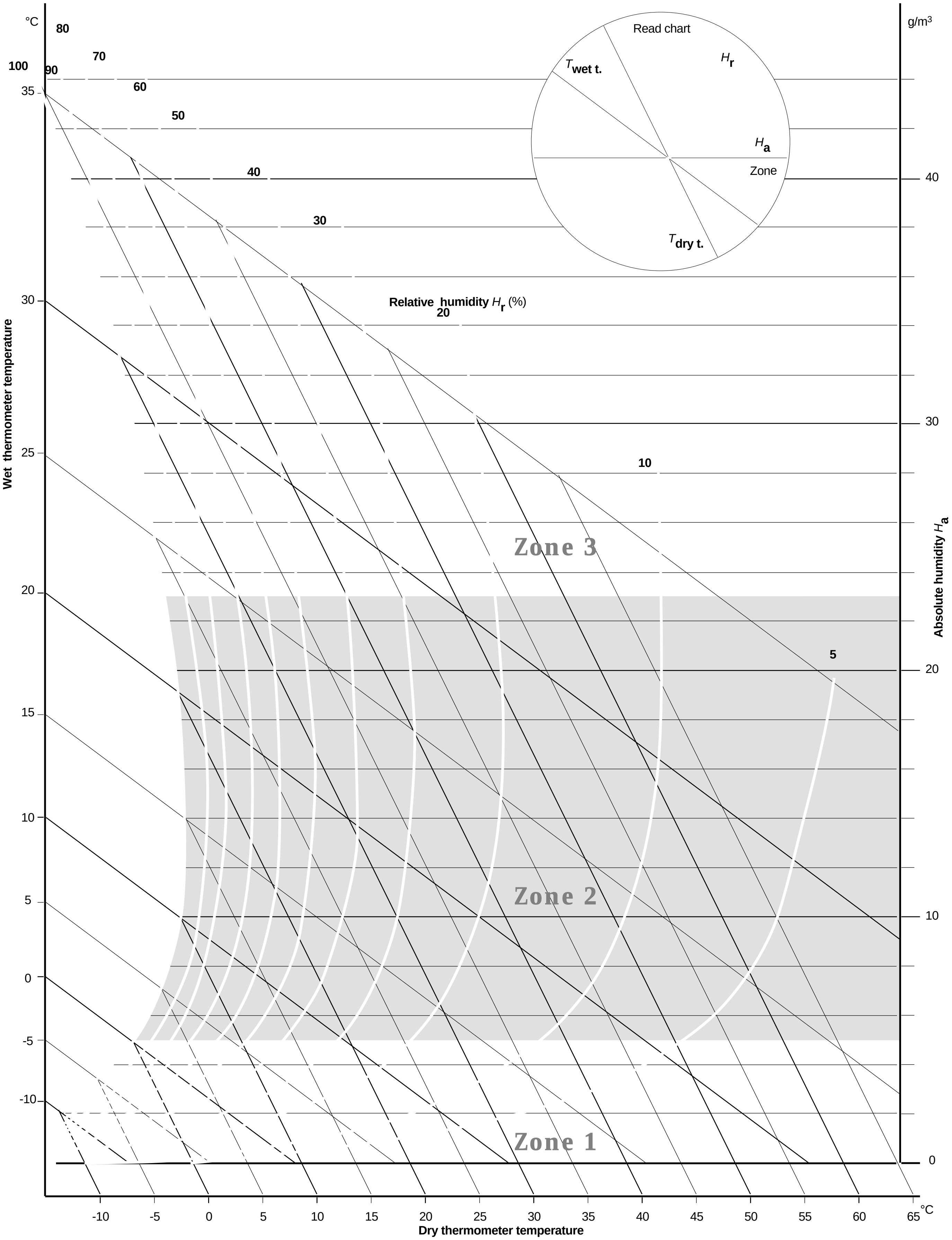
High humidity environments with widely varying temperatures require the use of space heaters to prevent condensation. These are in the form of fibre glass insulated ribbons on the end windings, which maintain the average temperature of the motor, provide trouble-free starting and eliminate problems caused by condensation (loss of insulation).
The heaters must be switched on when the machine stops and switched off while the machine is in operation.
The heater supply wires are brought out to the motor terminal box.

B1.5.2 - D.C. injection

An alternative to the use of space heaters is reduced voltage supply (20% of the rated value) to the field coils.
LEROY-SOMER DMV 2322 speed controllers provide this facility. Alternatively power can be supplied via a transformer (with a rectifier if required) and separate connections.

MS1 - MS2
D.C. motors
Environment

▼ ***Selection chart of the operating zone according to humidity and temperature.***



MS1 - MS2
D.C. motors
Environment

B2 - Impregnation and enhanced protection (1)

Ambient temperature	Operating zones* Z1	Z2	Z3	Influence on manufacturing
t < - 16°C	ask for estimate (quotation)	ask for estimate (quotation)	-	
- 16 ≤ t < + 5°C	Ta 1	T1	-	
+ 5 ≤ t < + 40°C	Ta	T	TC	**Increased derating**
+ 5 ≤ t ≤ + 65°C	Ta 2	T2	TC 2	
t > + 65°C	ask for estimate (quotation)	ask for estimate (quotation)	ask for estimate (quotation)	
Plate mark	**Ta**	**T**	**TC**	
Influence on manufacturing	**Increased protection of windings**			

Standard impregnation (shaded cells: Ta 1, T1, Ta, T, Ta 2, T2)

*:see chart on previous page.

(1): MS 1 motors are only manufactured in version T (zone 2).

LEROY-SOMER motors are protected against hostile environments.
Specialized finishes are available for each type of surface to ensure the same level of protection.

B3 - External finish

Preparation of surfaces

SURFACE	PARTS	TREATMENT
Cast iron	End shields	Shot blasting + Primer
Steel	Accessories	Phosphatization + Primer
	Terminal box - Fan covers - Grilles	Electrostatic painting
Aluminium alloy	Forced ventilation - Terminal box (MS2)	Shot blasting
Plastic	Terminal box (MS1)	None, but must be free from grease, casting mould coatings, and dust that would affect paint adhesion.

Painting systems

PRODUCTS	ENVIRONMENT	SYSTEM	APPLICATIONS
MS1 - MS2	Clean, dry, under cover, temperate climate.	System I	1 coat polyurethane vinyl finish 25/30 µ
MS2	Humid, tropical climate.	System II	1 base coat Epoxy 30 to 40 µ 1 coat polyurethane vinyl finish 25/30 µ
MS2	Maritime, coastal	System III	1 base coat Epoxy 30 to 40 µ 1 intermediate coat Epoxy 30 to 40 µ 1 coat polyurethane vinyl 25/30 µ
MS2	Chemical, harsh or special	Special System (consult Leroy-Somer)	Naval - Nuclear Frequent contact with alkalis, acids, etc.

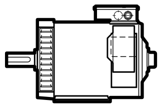
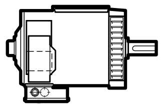
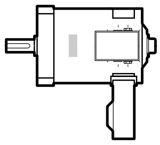
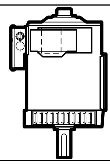
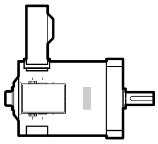
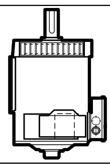
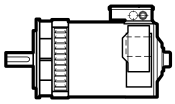
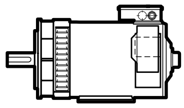
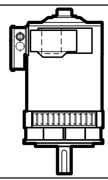
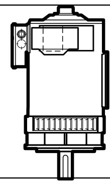
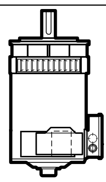
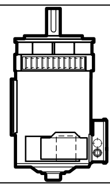
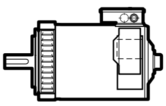
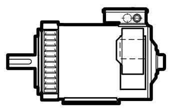
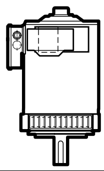
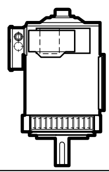
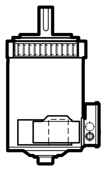
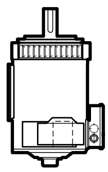
System I is for moderate climates and system II for general climates,
as defined in IEC 721.2.1.

LEROY-SOMER MS1 standard paint reference : RAL 7035
LEROY-SOMER MS2 standard paint reference : RAL 9005

MS1 - MS2
D.C. motors
Construction

C1 - Mounting and fixing indices - Protection indices

Protection indices as a function of mounting and fixing indices (as defined in IEC 34-7)

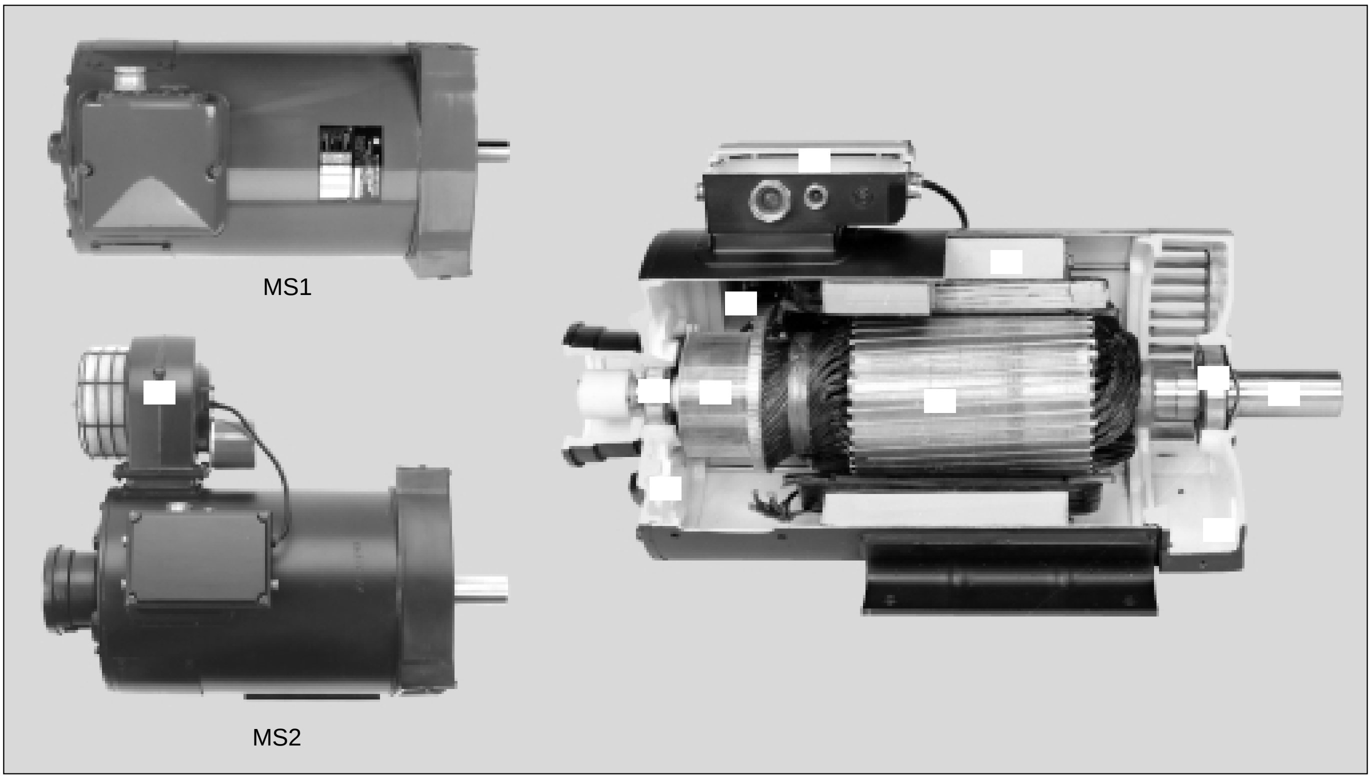
	MS 1	MS 2	Positions		MS 1	MS 2	Positions	
Foot-mounted motors	IP 21	IP 23	**IM 1001** (IM B3) - Horizontal shaft - Feet on floor		IP 20	IP 20	**IM 1071** (IM B8) - Horizontal shaft - Feet on ceiling	
	IP 20	IP 20	**IM 1051** (IM B6) - Horizontal shaft - Foot wall mounted with feet on left hand side when viewed from drive end		IP 21	IP 20	**IM 1011** (IM V5) - Vertical shaft facing down - Feet on wall	
	IP 20	IP 20	**IM 1061** (IM B7) - Horizontal shaft - Foot wall mounted with feet on r. h. side when viewed from drive end		IP 21	IP 21	**IM 1031** (IM V6) - Vertical shaft facing up - Feet on wall	
(FF) flange mounted motors **Foot and (FF) flange mounted motors**	IP 21	IP 23	**IM 3001** (IM B5) - Horizontal shaft		IP 21	IP 23	**IM 2001** (IM B35) - Horizontal shaft - Feet on floor	
	IP 21	IP 20	**IM 3011** (IM V1) - Vertical shaft facing down		IP 21	IP 20	**IM 2011** (IM V15) - Vertical shaft facing down - Feet on wall	
	IP 21	IP 21	**IM 3031** (IM V3) - Vertical shaft facing up		IP 21	IP 21	**IM 2031** (IM V36) - Vertical shaft facing up - Feet on wall	
(FT) face mounted motors **Foot and (FT) face mounted motors :** **MS 2 only**		IP 23	**IM 3601** (IM B14) - Horizontal shaft			IP 23	**IM 2101** (IM B34) - Horizontal shaft - Feet on floor	
		IP 20	**IM 3611** (IM V18) - Vertical shaft facing down			IP 20	**IM 2111** (IM V58) - Vertical shaft facing down - Feet on wall	
		IP 21	**IM 3631** (IM V19) - Vertical shaft facing up			IP 21	**IM 2131** (IM V69) - Vertical shaft facing up - Feet on wall	

Note : in the designation IM, the fourth figure indicates the number of shaft extensions. Eg : IM 1002: horizontal motor, foot mounted, with second shaft extension.

C2 - Components

Description of LEROY-SOMER MS1 - MS2 D.C. motors

Component	Materials	Comments
Stator (or body)	Welded steel laminations Class H insulated electro-plated copper	- laminations prestressed and welded using TIG process - main poles built into all of the range - separate auxiliary poles (MS 1001, 1121 & 1122), or integral (MS 1321 & 1322) - Class F (MS 1) or H (MS 2) insulation system
Armature	Insulated low-carbon magnetic steel laminations Class H insulated electro-plated copper	- low carbon content guarantees long-term lamination pack stability - semi-enclosed inclined slots - bindings reinforced with heat-treated polymerized fiber glass - Class F (MS 1) or H (MS 2) insulation system
Collector	Silver-plated copper on plastic	- toothed type - large number of segments
Shaft	Steel	- open keyway - open keyway (MS 1), closed keyway (MS 2)
Brush-holder Brushes	Thermoset plastic and treated steel Electrographite compound	- moulded, rigid - adjustment position marked - evenly-spaced accurate brush holders
End shields	FGL cast iron	- FF flange mounted end shields (MS 801 to 1321) - FF flange mounted or FT face mounted (MS 1122 to 1322) end shields
Bearings and lubrication	Steel	- ball bearings, C3 play - type 2RS, dust and damp protected, permanently greased - front bearing preloaded - translational movement of rear bearing blocked
Fan	Composite material (MS1) Aluminium alloy or steel (MS2)	- self-cooled motor (MS 801 to 1121 & 1321) - radial fan cooling kit (MS 1122 & 1322)
Terminal box	Composite material (MS1) or aluminium alloy (MS2)	- IP 55 (dust and damp protected) - can be fixed in one of 4 directions - 4 terminals (MS 801 to 1121, 1122 & 1321) - 6 terminals (for series parallel field excitation (MS 1322) - options connected on connection blocks (MS 2)



C3 - Bearings

C3.1 - TYPES OF BEARING AND STANDARD FITTING ARRANGEMENTS

The table below shows the types of bearings used and the possible options for each model.

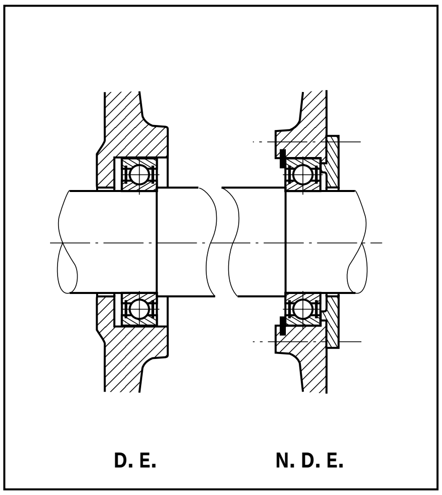
Translational movement of the armature is blocked at the commutator end (NDE bearing). On MS2 motors, the bearings are pre-loaded by using a flexible washer which is inserted between the end shield and the DE bearing.

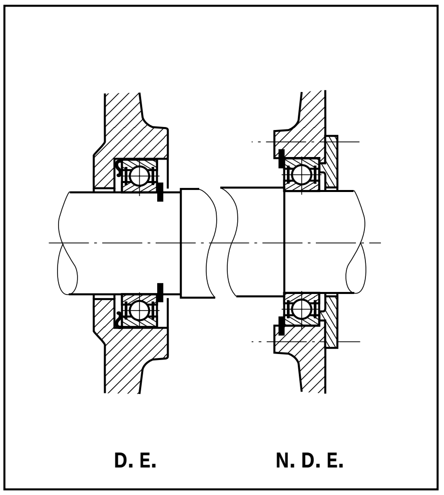
The type of bearings used are waterproof, with deep ball tracks, high temperature, permanently lubricated with high quality grease, allowing a lifetime L_{10h} of 20000 hours in good environmental conditions.

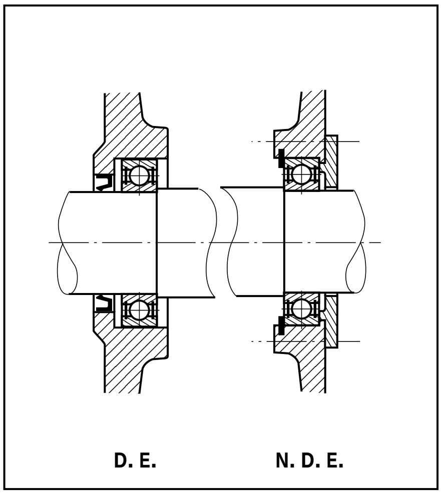
Optional waterproof flange
For some types of applications, LEROY-SOMER MS motors can be supplied with an optional waterproof seal on the flange.

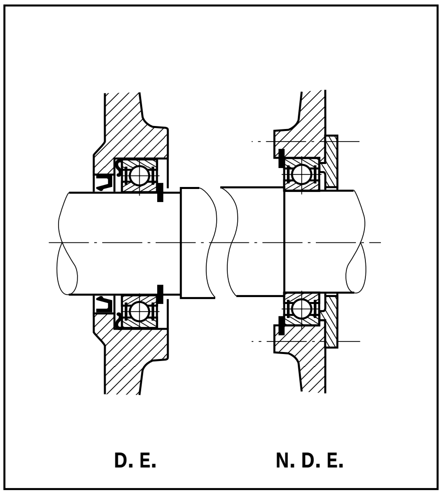
Important : When ordering, be sure to include any options required.

Bearing assembly diagrams (DE : Drive End / NDE : Non Drive End)









Motor MS Model	Drive end bearing (D.E.)	Non drive end bearing (N.D.E.)	Fitting arrangement: Waterproof bearing	Fitting arrangement: With optional seal	Assembly diagram reference
801	6204 2RS C3	6203 2RS C3	●		
801	6204 2RS C3	6203 2RS C3	●	●	
1001	6204 2RS C3	6203 2RS C3	●		
1001	6204 2RS C3	6203 2RS C3	●	●	
1121	6205 2RS C3	6204 2RS C3	●		
1121	6205 2RS C3	6204 2RS C3	●	●	
1122	6207 2RS C3	6204 2RS C3	●		
1122	6207 2RS C3	6204 2RS C3	●	●	
1321	6306 2RS C3	6305 2RS C3	●		
1321	6306 2RS C3	6305 2RS C3	●	●	
1322	6208 2RS C3	6305 2RS C3	●		
1322	6208 2RS C3	6305 2RS C3	●	●	

C3.1.1 - Permissible radial load on main shaft extension

In pulley and belt couplings, the shaft carrying the pulley is subjected to a radial force F_{pr} applied at a distance *x* (mm) from the shoulder of the shaft extension.

N.B.: the **installed voltage** of the belts must be **less than** the value of the static load rating $\boldsymbol{C_o}$ (obtained using the method defined in ISO 281).

● **Radial force applied to drive shaft extension : F_{pr}**

The radial force F_{pr} expressed in daN applied to the shaft extension is calculated by the formula :

$$F_{pr} = 1.91 \times 10^6 \frac{P_N \cdot k}{D \cdot n_N} \pm P_P$$

where :

P_N : rated motor power (kW)

D : external diameter of the drive pulley (mm)

n_N : rated speed of the motor (min^{-1})

k : factor depending on the type of transmission

P_P : weight of the pulley (daN)

The weight of the pulley is positive when it acts in the same direction as the tension force in the belt, and negative when it acts in the opposite direction.

Range of values for factor k *:

- toothed belts : k = 1 to 1.5
- V-belts : k = 2 to 2.5
- flat belts
  - with tensioner : k = 2.5 to 3
  - without tensioner : k = 3 to 4.

● **Permissible radial load on the drive shaft extension : F_R**

The tables on the next page indicate, for each type of motor, the radial force F_R, at a distance *x*, permissible on the centre of the shaft for a bearing life L_{10h} of 20000 hours.

For a distance *x* the permissible radial force F_{pr} is defined by the formula :

$$F_{pr} = F_R \times \frac{0.5 \times E}{x}$$

where $x \leq E$

* For a more accurate figure for factor k contact the transmission suppliers.

Note : the width of the pulley must not exceed twice the length of the drive shaft extension.

To avoid friction of the pulley on the end shield, measurement "a" must be at least :

a = 3mm.

A pulley and belt assembly should not be used on MS 1 motors with an IM 1071 (IM B8) mounting.

Caution : check that the diameter of the pulley is greater than the minimum required by the motor.

For an initial estimation of the minimum pulley diameter, the following formula can be used :

$$Ø_{mini} = \frac{2 \times M_N}{F_R} \times 2.5 \times 10^3$$

where

$Ø_{min}$: minimum diameter in mm

M_N : rated torque in N.m

F_R : radial force at *x* in N.

If the calculation is not satisfactory, modify the diameter of the pulley and check the calculation again.

● **Changes in bearing life depending on load factor k_R**

If the load factor k_R is greater than 1.05, you should consult our technical department, stating assembly position and direction of force before opting for a special assembly.

The graphs on the next page give the load factor depending on the bearing life, for each type of load (radial, radial and axial, positive or negative axial).

● **Radial load with or without axial load**

For a radial load F_{pr} ($F_{pr} \neq F_R$), applied at distance *x*, changes in the bearing life L_{10h} can be roughly estimated using the ratio k_R, as shown in the graphs on the next page for standard assembly ($k_R = F_{pr} / F_R$, the two values being expressed in the same units).

For a radial load with no axial component, the value of factor k_R corresponding to the selected bearing life can be read off graph 1.

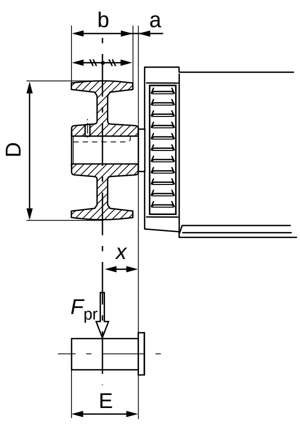
If there is an axial component, perform the same procedure for the value of radial factor k_R on graph 1, and for the axial value on graph 2. The value of the factor to be taken into account will be the smaller of the two.

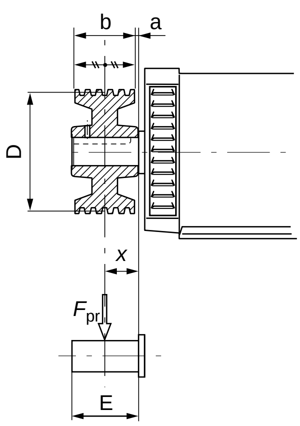
C3.1.2 - Axial load

If there is no radial load, read the value of factor k_R for the selected bearing life from either graph 3 or 4 depending on the direction of the axial force.

Positive axial load (graph 3) :
the force is exerted by pulling on the drive shaft (from the interior of the motor towards the exterior).

Negative axial load (graph 4) :
the force pushes on the drive shaft (from the exterior towards the interior).



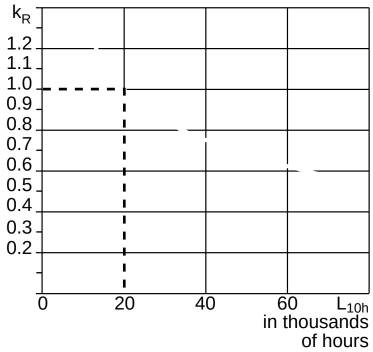


C3.2 - PERMISSIBLE VALUES

C3.2.1 - Bearing life

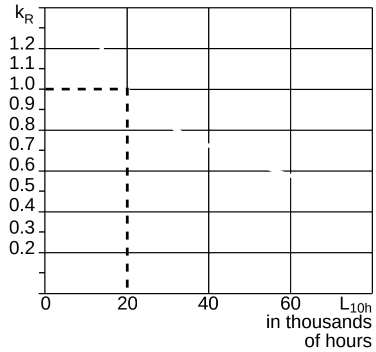
▼ ***Change in bearing life L_{10h} depending on the load factor k_R for standard assemblies***

▼ Graph 1



▲ ***Radial load factor***

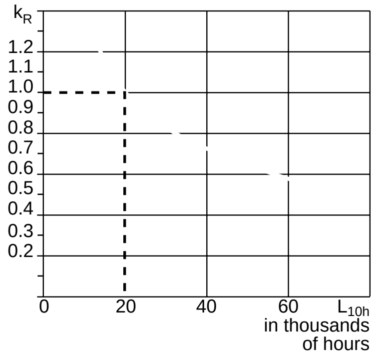
▼ Graph 2



▲ ***Axial load factor***

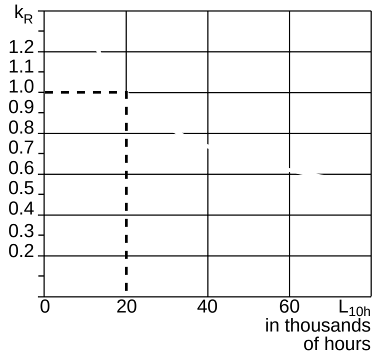
If k_R > 1.05
consult Leroy-Somer

▼ Graph 3



▲ ***Positive axial load factor***

▼ Graph 4



▲ ***Negative axial load factor***

C3.2.2 - Permissible radial load (in N, with no axial load) on main shaft extension

Nominal ball bearing life L_{10h} :
20000 hours ▶

Standard assembly, horizontal position
Foot mounted motor,
FT face mounted motor,
or foot and FT face mounted motor.

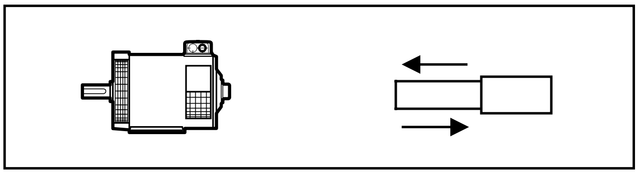
F_r	Rotation speed in min^{-1}				
Motor type	1000	1500	2000	2500	3000
MS 801	579	471	412	363	334
MS 1001	883	716	638	569	520
MS 1121	893	736	647	579	520
MS 1122	1815	1550	1373	1256	1167
MS 1321 S	2109	1815	1628	1491	1393
MS 1321 M	2070	1766	1570	1432	1324
MS 1322 S	2276	1952	1756	1619	1501
MS 1322 M	2246	1923	1717	1570	1462

Nominal ball bearing life L_{10h} :
20000 hours ▶

Standard assembly, horizontal position
FF flange mounted motor
or foot and FF flange mounted motor

F_r	Rotation speed in min^{-1}				
Motor type	1000	1500	2000	2500	3000
MS 801	540	441	383	343	304
MS 1001	520	520	520	520	520
MS 1121	834	697	598	540	491
MS 1122	1697	1452	1295	1177	1089
MS 1321 S	1334	1334	1334	1334	1285
MS 1321 M	1334	1334	1334	1334	1256
MS 1322 S	2080	1795	1609	1481	1383
MS 1322 M	2090	1785	1599	1462	1354

C3.2.3 - Permissible axial load (in N, with no radial load) on main shaft extension



Horizontal motor
Nominal ball bearing life L_{10h} :
20,000 hours

MS Motor Model	→	←	→	←	→	←	→	←	→	←
	Speed *n* = 1000 min^{-1}		Speed *n* = 1500 min^{-1}		Speed *n* = 2000 min^{-1}		Speed *n* = 2500 min^{-1}		Speed *n* = 3000 min^{-1}	
MS 801	549	549	441	441	383	383	343	343	314	314
MS 1001	549	549	451	451	392	392	343	343	314	314
MS 1121	716	716	589	589	510	510	451	451	412	412
MS 1122	814	598	697	481	618	402	559	343	520	304
MS 1321 S	1373	1373	1158	1158	1020	1020	922	922	853	853
MS 1321 M	1364	1364	1128	1128	981	981	883	883	804	804
MS 1322 S	1462	1207	1246	991	1118	863	1030	775	961	706
MS 1322 M	1462	1207	1246	991	1118	863	1030	775	961	706

Direction of load application

Vertical motor
Shaft end down
Nominal ball bearing life L_{10h} :
20,000 hours

MS Motor Model	↓	↑	↓	↑	↓	↑	↓	↑	↓	↑
	Speed *n* = 1000 min^{-1}		Speed *n* = 1500 min^{-1}		Speed *n* = 2000 min^{-1}		Speed *n* = 2500 min^{-1}		Speed *n* = 3000 min^{-1}	
MS 801	423	604	340	486	294	421	264	378	241	345
MS 1001	423	604	347	496	302	432	264	378	241	345
MS 1121	551	788	453	647	392	561	347	496	317	453
MS 1122	460	896	370	766	309	680	264	615	234	572
MS 1321 S	1056	1511	890	1273	785	1122	709	1014	657	939
MS 1321 M	1049	1500	868	1241	755	1079	679	971	619	885
MS 1322 S	928	1608	762	1370	664	1230	596	1133	543	1058
MS 1322 M	928	1608	762	1370	664	1230	596	755	543	1058

Direction of load application

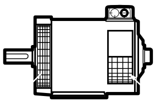
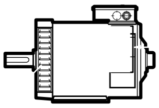
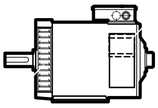
Vertical motor
Shaft end up
Nominal ball bearing life L_{10h} :
20,000 hours

MS Motor Model	↓	↑	↓	↑	↓	↑	↓	↑	↓	↑
	Speed *n* = 1000 min^{-1}		Speed *n* = 1500 min^{-1}		Speed *n* = 2000 min^{-1}		Speed *n* = 2500 min^{-1}		Speed *n* = 3000 min^{-1}	
MS 801	423	604	340	486	294	421	264	378	241	345
MS 1001	423	604	347	496	302	432	264	378	241	345
MS 1121	551	788	453	647	392	561	347	496	317	453
MS 1122	626	658	536	529	475	442	430	378	400	335
MS 1321 S	1056	1511	890	1273	785	1122	709	1014	657	939
MS 1321 M	1049	1500	868	1241	755	1079	679	971	619	885
MS 1322 S	1124	1327	958	1090	860	950	792	852	740	777
MS 1322 M	1124	1327	958	1090	860	950	528	852	740	777

Direction of load application

C4 - Cooling

C4.1 - STANDARD CODES

	Cooling methods		Mechanical protection
	Simplified code	**Standard code**	
	**IC01** Self-cooling motor	**IC0A1**	**MS 1: IP 20****
	**IC06** Fan mounted on motor and free circulation of air with or without filter	**IC0A6**	**MS 2: IP 23 or IP 20****
	**IC17*** Air supply via ducted intake and free outlet	**IC1A7**	**MS 2: IP 23 or IP 20****

*: The ducts and associated adaptors are not supplied by LEROY-SOMER. They must have a large enough cross-section and be sufficiently short to avoid reducing the rate of air flow indicated below : see the section on ventilation characteristics.
**: code depends on operating position ; see page 13.

Standard cooling method

In compliance with IEC standard 34 - 6, the standard motors in this catalogue are cooled using method IC 01 (self-cooled) for the MS 1 range or, for the MS 2 range, IC 06, i.e. "machine cooled by forced ventilation, using the ambient air circulating inside the machine".

MS series motors, unless otherwise specified, are designed for cooling air at a temperature between +5 and +40°C, with a humidity corresponding to 5 to 23 g/m^3 (grammes of water in suspension in the air : see pages 10 & 11), free from harmful dusts and chemically neutral.
Fresh air enters at the commutator as standard.

Important : there is a risk of frost forming at temperatures below 0°C, particularly on the fan blades.

Do not place the motor against a wall or any other obstacle as this would cause the cooling air to be recycled, raising its temperature and possibly causing an abnormal rise in machine temperature.

Note : Obstruction, even accidental, of the ventilation grilles (motor pushed against a wall or grilles clogged, etc.) has an adverse effect on the motor cooling process.

C4.2 - FORCED VENTILATION CHARACTERISTICS

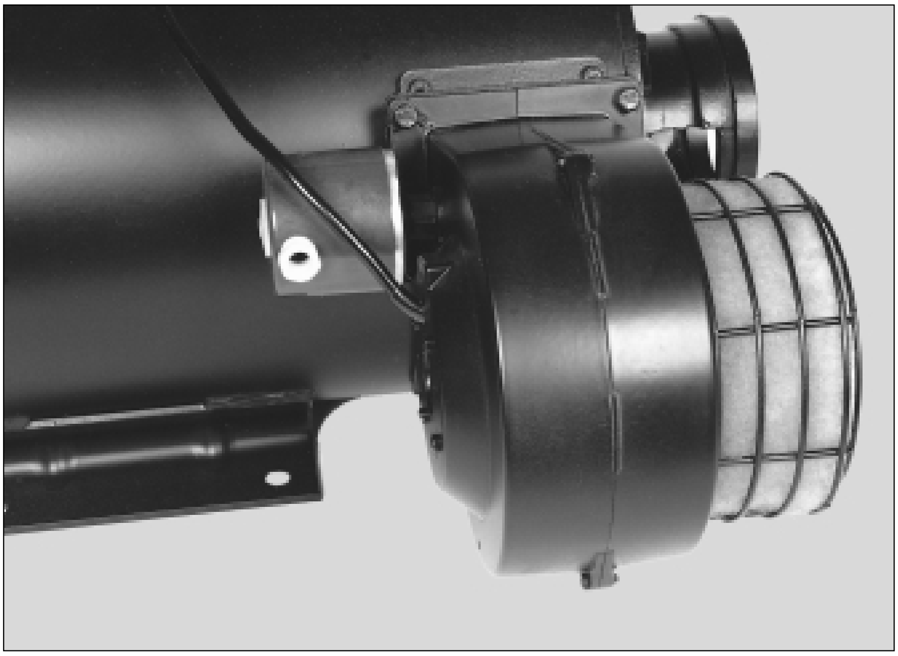
The fan is radial, squirrel cage type, and is driven by a single phase induction motor.

The casing may be aluminium alloy or steel.

As standard it is fitted in position B; on request it can be fitted in position D. The motor supply wires are brought out to the MS motor terminal box.

• Single phase motor :
Mains voltage .... 220-240 V max., 50 Hz
.... 200-220 V max., 60 Hz
Power drawn ....73 W
Current drawn .... 0.34 A
Rotation speed .... 2500 min^{-1}
Capacity .... 2 µF

• Fan :
Air flow rate ....120 m^3/h
Pressure ....290 Pa
Sound level .... 55 dB(A)

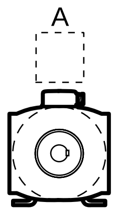


C5 - Mains connection

C5.1 - TERMINAL BOX

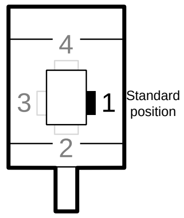
MS 801, 1001, 1121 & 1321:
The terminal box (TB) is made of composite material, and is protected against dust and damp. It has a cable gland (CG) which can swivelled in four directions at 90 degree turns.

▼ ***MS 1***
Standard position



TB: **A1**

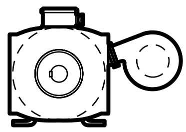
▼ ***CG positions in relation to the MS 1 motor drive end***



MS 1122 & 1322:
Made of metal, and dust and damp protected, this is placed on top, as seen from the drive end (see diagram opposite).

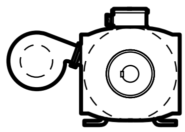
*: power supply for the forced ventilation (FV) brought out to the MS motor terminal box.

▼ ***MS 2 : Position of the terminal box and forced ventilation.***
Standard position



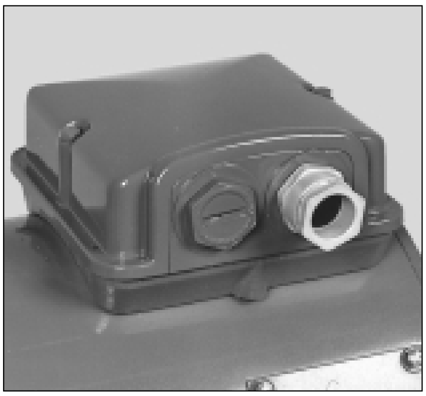
TB: **A1**, FV: **B***

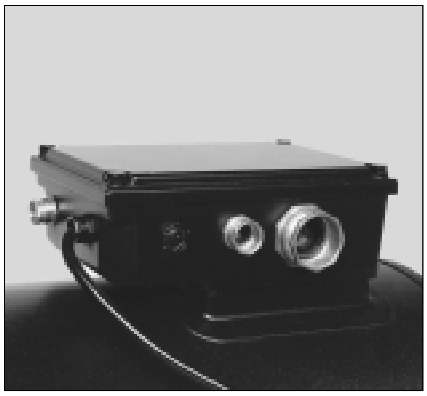
▼ ***MS 2 : Position of the terminal box and forced ventilation.***
Other option



TB: **A3**, FV: **D** *

MS2 motor configuration	Cable glands : number and size depending on position							
	FV position B				FV position D			
	1	2	3	4	1	2	3	4
standard motor	21 + 9	7	–	7	–	7	21 + 9	7
with Tachogenerator	21 + 9	2 x 7		2 x 7		2 x 7	21 + 9	2 x 7
with Brake	21 + 9	7	–	9 + 7	–	7	21 + 9	9 + 7
with Brake and Tachogenerator	21 + 9	9 + 2 x 7		9 + 2 x 7		9 + 2 x 7	21 + 9	9 + 2 x 7

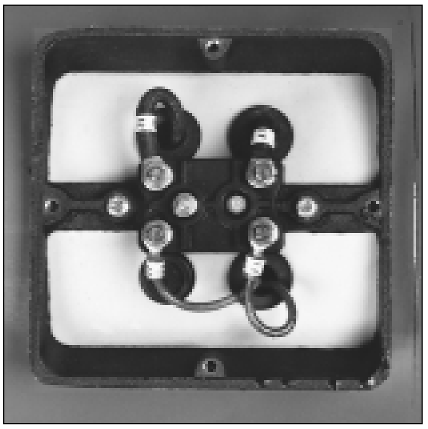




C5.2 - TERMINAL BLOCKS

MS 801, 1001, 1121, 1122, 1321 and 1322 motors are fitted as standard with a block of 4 terminals.

The terminal markings comply with IEC standard 34 - 8 (or NFC51 118).



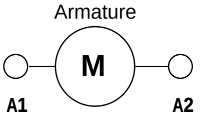
Tightening torque for the nuts on the terminal blocks. ▶

Terminal	M4	M5	M6	M8	M10	M12	M14
Torque N.m	2	3.2	5	10	20	35	50

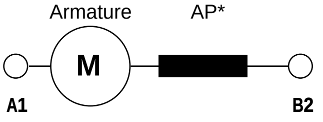
C5.3 - WIRING DIAGRAMS

These electrical wiring diagrams are provided for information only. Refer to the diagrams in the terminal box.

• motor with main poles only :



• motor with auxiliary poles :



• single voltage field coils with 2 output terminals

*AP : auxiliary poles

C5.4 - EARTH TERMINAL

This is situated inside the terminal box.

It will take cables with cross-sections at least as large as the cross-section of the supply conductors.

As a general rule, for the same metal as that of the main conductors, its cross-section is :

- that of the power conductor for a cross-section up to 25 mm^2,
- 25 mm^2 for a cross-section between 25 and 50 mm^2,
- 50 % for cross-sections above 50 mm^2.

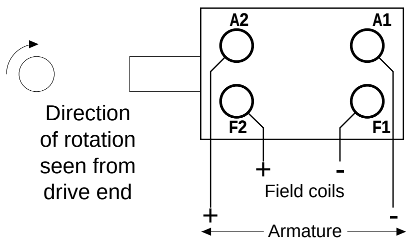
It is indicated by the sign : ⏚.

C6 - Motor connection

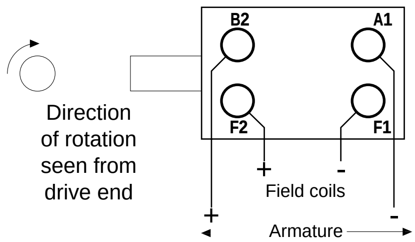
C6.1 - MOTOR

To change the direction of rotation, reverse the field excitation polarity. This operation must be performed with the power off and the motor stopped.

• Field coils with 2 output terminals (clockwise rotation seen from the drive end (DE)).



MS 801



MS 1001, 1121, 1122, 1321, 1322

C6.2 - CONNECTING ACCESSORIES

(MS 2 only : optional)

Accessories are connected on the connecting blocks. They include :

- thermal probes
- heating resistances.

All accessory outputs are marked with a "flag-type" label.

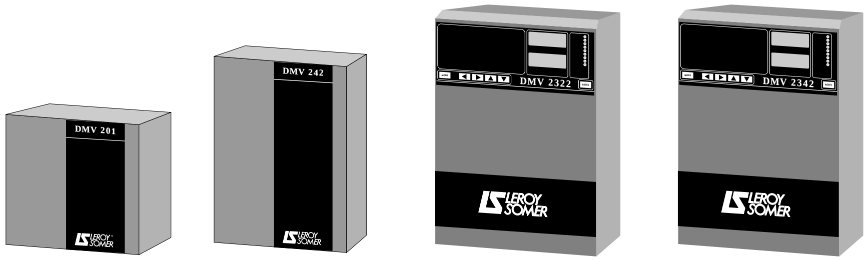
Winding thermal detection device

• single level :
T1 - T2 : release;

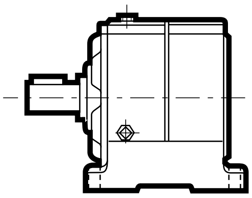
• two-level labelled as follows :
1T1 - 1T2 : alarm
2T1 - 2T2 : release.

C7 - Adaptations

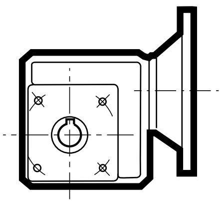
Electronic speed controllers



Electromechanical
Gearboxes

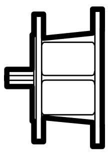


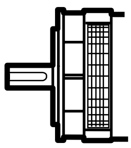
Cb 2000
with parallel or concentric axes
Concentric output



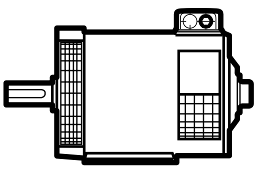
Mb 2000
worm gear
Orthogonal output

7



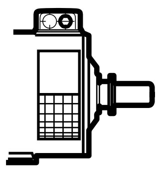


Mub 2000
with parallel axes
Hollow shaft output

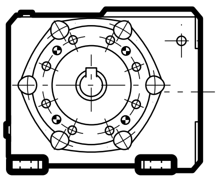


MS1 motor

2



Option

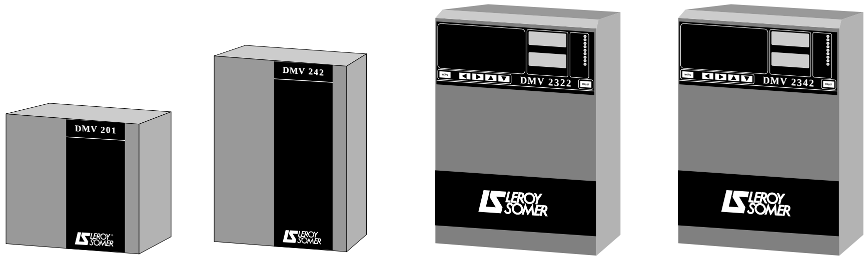


Ot 2000
with helical bevel gears
Orthogonal output

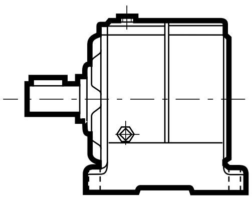
Options
② - D.C. tachometer (p 49)
⑦ - Universal mounting for connection to speed reduction gear (p 51)

MS2
D.C. motors
Construction

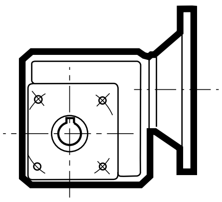
Electronic speed controllers



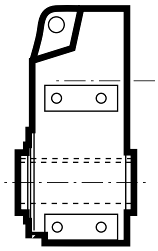
Electromechanical
Gearboxes



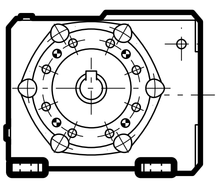
Cb 2000
with parallel or concentric axes
Concentric output



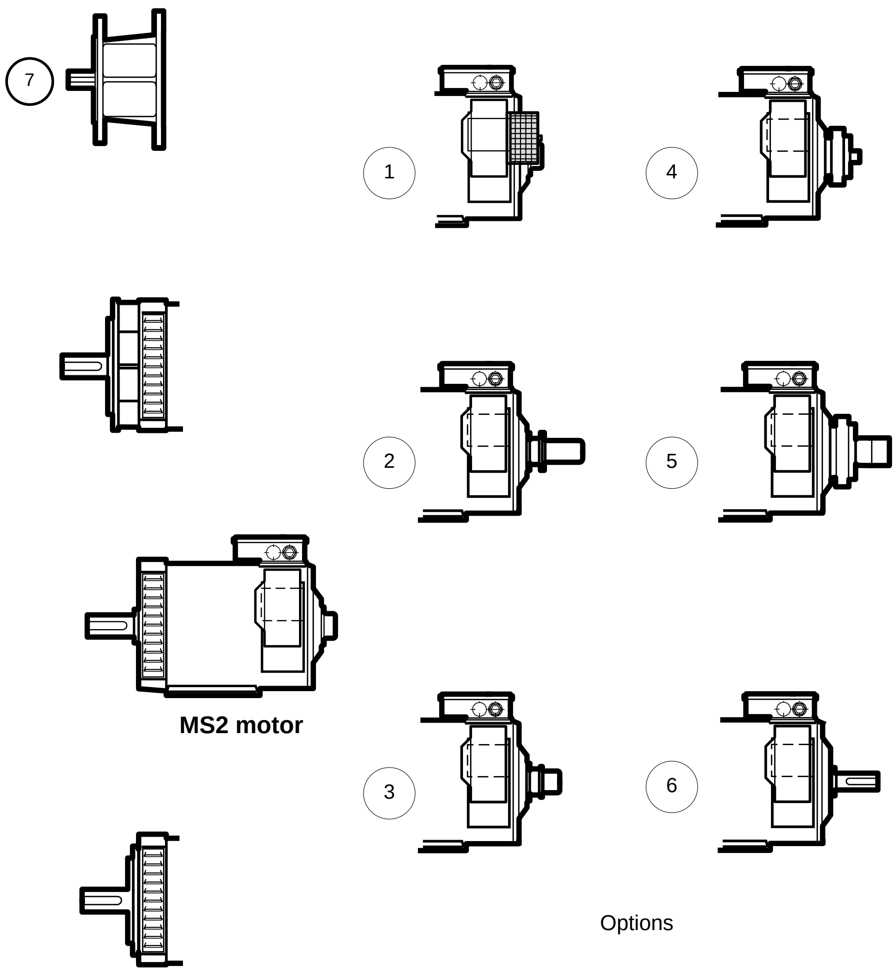
Mb 2000
worm gear
Orthogonal output



Mub 2000
with parallel axes
Hollow shaft output



Ot 2000
with helical bevel gears
Orthogonal output



MS2 motor

Options

Options
① - Air filter (p 48)
② - D.C. tachometer (p 49)
③ - Pulse generator (p 50)
④ - No current brake (p 36 & 51)
⑤ - Brake + tachodetector (p 49)
⑥ - Secondary drive end (p 51)
⑦ - Universal mounting for connection to speed reduction gear (p 51)

Air flow detector (p 48)
Flange

D1 - Supply voltage

D1.1 - REGULATIONS AND STANDARDS (mains supply)

The statement by the electricity consultative committee dated 25th June 1982, and the 6th edition (1983) of publication N° 38 of the International Electrotechnical Committee (IEC) have laid down time scales for the harmonization of standard voltages in Europe.

By 1986, voltages at the point of delivery will have to be maintained between the following extreme values :

- ***Single-phase current: 207 to 244 V***
- ***Three-phase current: 358 to 423 V***

The IEC 38 standard gives the European reference voltage as 230/400 V three-phase, 230 V single phase, with a tolerance of +6% to -10% until 2003, and ±10% from then on.

D1.2 - POWER SUPPLY (rectified voltage)

D1.2.1 - Field

The nameplate rated field voltage is 190 V; these motors can accept a voltage of up to 210 V.

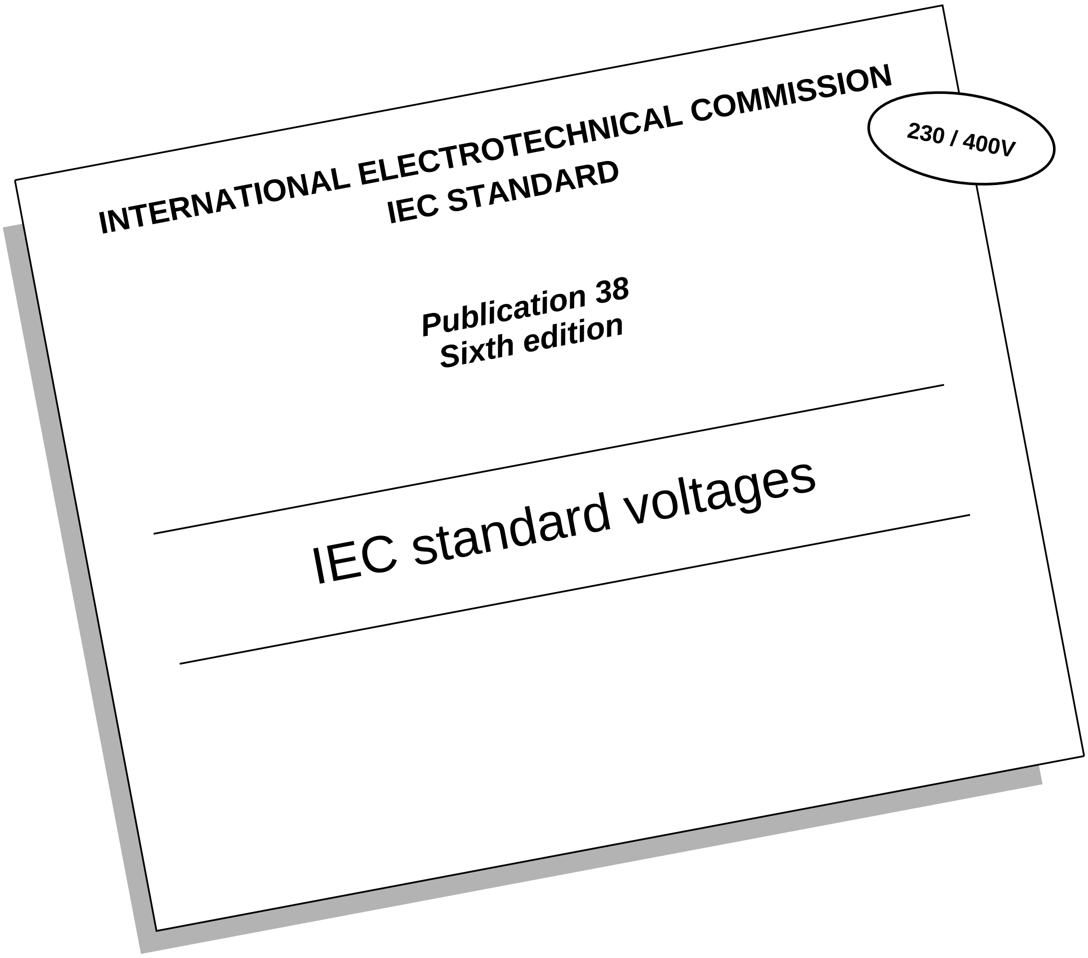
Catalogue characteristics are given for the labelled rated field excitation values; they will vary slightly depending on the actual voltage of the mains supply.

Field excitation can be used with full wave rectified D.C. power supplies. The field excitation powers shown are calculated for the motor in thermal equilibrium. The field current value in thermal equilibrium is marked on the motor plate; it is usually about 25% less than the ambient temperature value.

▼ ***Table 1. - Relationship between field voltage and mains supply voltage***

Single phase mains supply

Mains voltage V	Field excitation voltage V
230	210
240	220
380	340 (1322 only)
400	360 (1322 only)
415	380 (1322 only)



MS1 - MS2
D.C. motors
Operation

The motor cannot be started until field excitation has been powered up to its rated voltage. Moreover, the power supply will include protection against field excitation faults (no-load motor : lack of field excitation causes the motor to race).

Caution: *if no cooling method is in use, field excitation must be switched off.*

D1.2.2 - Armature

Table 1 below shows the maximum armature voltages available as a function of the voltage of the mains supply powering the speed controller.

▼ ***Table 2. - Relationship between armature and mains voltages***

Single phase mains supply

Mains voltage	Maximum armature voltage
V	**V**
220 - 230	180 - 190
380 - 400	310 - 320
415	340

Three-phase mains supply

Mains voltage	Maximum armature voltage
V	**V**
220	250
230	260
240	270
380	440
400	460
415	470
440	500
500	570
660	750

The maximum armature voltage values include standard tolerances for power supply voltages.

D1.3 - DEFINITIONS

D1.3.1 - Current imbalance

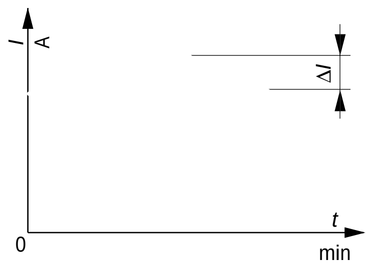
The A.C. components in the rectified supply current affect the losses and, consequently, temperature rise and commutation.

The machines are designed to take into account delta current imbalance of up to 10% (see curve 1).

D1.3.2 - Speed of variation of current v_v

The speed of variation of current v_v (in amps per second) must be as low as possible depending on the type of operation to ensure good commutation.

▼ ***Curve 1. - Current imbalance***



$$v_v = \frac{\partial I}{\partial t}$$

The value is generally expressed as :

$v_v = 200 \times I_n$ in A/s.

D1.3.3 - Form factor FF

D1.3.3.1 - Three-phase power supply

The form factor must be less than 1.04.

It is the relationship between rms current and average current :

$$FF = \frac{I_{rms}}{I_{av}} \quad \text{where}$$

I_{rms}: rms current

I_{av}: average current.

D1.3.3.2 - Single phase power supply

The current coming from a thyristor speed controller for a single phase power supply, rectified to half or full wave, may involve the use of a smoothing choke.

By decreasing the peak current, the choke improves the form factor and commutation, limits vibration and noise and thus extends the life of the machine. The value of the additional choke L_a is given by the following equation :

$$L_a = L_2 - L_1$$

$$L_2 = \frac{\sqrt{FF_1^2 - 1}}{\sqrt{FF_2^2 - 1}} \cdot L_1$$

where

L_1: motor choke (catalogue)

L_2: intermediate value of the additional choke (value used to calculate L_a)

FF_1: power supply from factor

FF_2: optimum form factor.

D2 - Insulation class

Insulation class

The machines in this catalogue have been designed with a Class F insulation system for MS1 windings, and a Class H insulation system for MS2 windings.

Class F allows for temperature rises of 105 K (by the resistance variation method) and maximum temperatures of 155 °C at the hot spots in the machine. Class H allows for temperature rises of 125 K (by the resistance variation method) and maximum temperatures of 180°C at the hot spots in the machine (cf IEC 85 and IEC 34–1).
Complete impregnation with tropicalized varnish of thermal class 180°C gives protection against attacks from the environment, such as 95% relative humidity, etc.
For special constructions (see table in "Environment" section, page 12), the winding is of Class H and is impregnated with special varnishes which enable it to operate in conditions of high temperatures with relative air humidity of up to 100%.

Temperature rise (ΔT*) and maximum temperatures at hot spots (T_{max}) for insulation classes (IEC 34-1).

	ΔT*	Tmax
Class B	80 K	130°C
Class F	105 K	155°C
Class H	125 K	180°C

* Measured using the winding resistance variation method.

D3 - Power factor - Torque - Efficiency

D3.1 - DEFINITIONS

The (catalogue) output power at the motor shaft is linked to the torque by the equation :

$$P_u = M \cdot \omega$$

where

P_u : output power in W,

M : torque in N.m,

ω : angular speed in rad/s.

ω is a function of the speed of rotation n in min^{-1}:

$$\omega = 2\pi \cdot n / 60$$

The power drawn is linked to the output power by the equation :

$$P = \frac{P_u}{\eta}$$

where

P : active power in W,

P_u : output power in W,

η : efficiency of the machine.

The output power at the drive shaft is expressed as a function of the armature voltage and of the current drawn, by the equation

$$P_u = U \cdot I \cdot \eta$$

where

P_u: output power in W,

U : armature voltage in V,

I : armature current in A,

η : efficiency of the machine.

D3.2 - CALCULATION OF ACCELERATING TORQUE AND STARTING TIME

Starting time can be calculated using a simplified formula :

$$t_d = \frac{\pi}{30} \times \frac{n.\Sigma J_n}{M_a}$$, where :

t_d : is the starting time in seconds;

ΣJ_n : is the moment of inertia in kg.m^2 of the motor plus the load, corrected, if necessary, to the speed of the shaft that develops torque M_a;

n : is the speed to be achieved in min^{-1} ;

M_a or M_{acc}: is the average accelerating torque in N.m.

In general, accelerating torque is provided by the equation :

$$M_a = M_m - M_R$$

where

M_a: accelerating torque in N.m,

M_m: torque provided by the motor in N.m,

M_R: resistant torque in N.m.

Chart 1 on the following page can also be used to determine the starting time.

Here again is the formula by which the moment of inertia of the driven machine turning at speed n' is equalized with the speed n of the motor :

$$J_n = J_{n'} \cdot \left(\frac{n'}{n}\right)^2$$

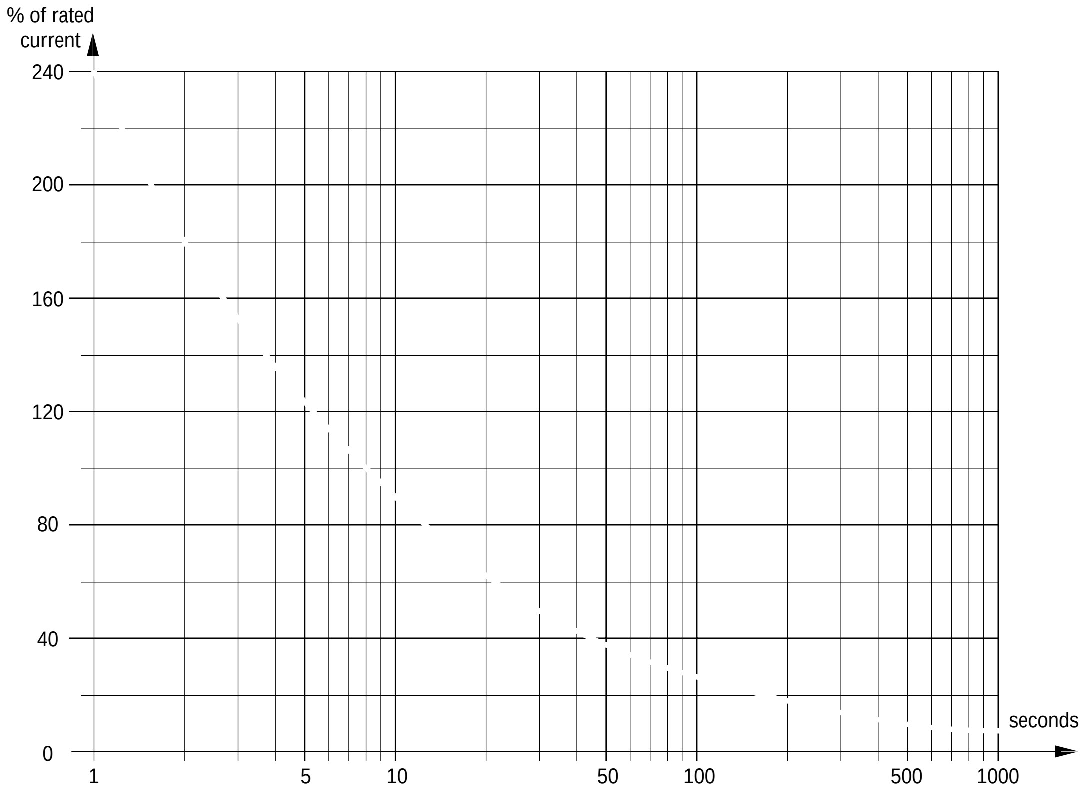
D3.3 - PERMISSIBLE STARTING TIMES AND LOCKED ROTOR TIMES

Starting is managed by the speed controller which usually has an adjustable starting ramp with current limitation, generally at 1.5 times the rated current.

When operating with locked armature (MS 2 only) and low current, the ventilation system must remain switched on. Curve 1 below can be used to determine locked rotor times as a function of the armature current and vice versa.

To avoid marking the commutator it is advisable to run a rotation cycle after each rotor lock time. Please consult Leroy-Somer.

▼ *Curve 1 - Locked rotor operating times as a function of the current*



MS1 - MS2
D.C. motors
Operation

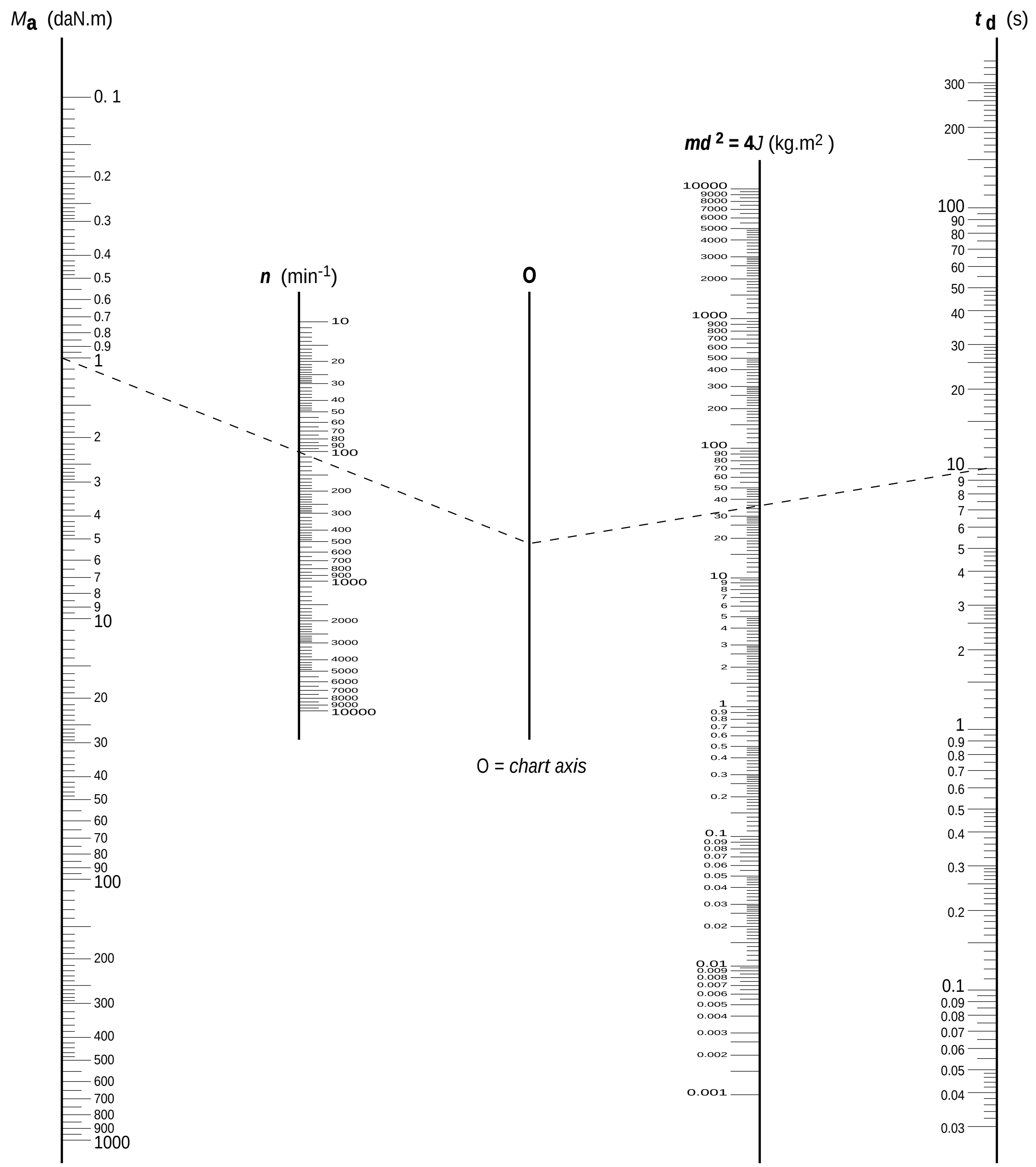
Example
The speed of a mass with a moment of inertia of J : 9 kg.m^2 is increased by an accelerating torque of 10 N.m up to a speed of 100 min^{-1}.

Draw a line from the point corresponding to the accelerating torque (1 daN.m in the first column of the chart below) to that of the speed (100 min^{-1} on the second column), and continue it to column 0, the chart axis.
Then draw a line from the point where it meets 0 to the corresponding value in the third column (md^2 = 4 x 9 i.e. 36 kg.m^2) and continue it to the starting times column.

The starting time t_d calculated from the chart is :

t_d = 10 secondes.

▼ ***Starting time calculation chart***



D3.4 - DETERMINING TORQUE FOR INTERMITTENT DUTY CYCLES

Average torque in intermittent duty

This is the rated torque exerted by the driven machine and is generally determined by the manufacturer.

If the torque exerted by the machine varies during a cycle, the average torque M_m is calculated using the equation :

$$M_m = \sqrt{\frac{\Sigma_1^n (M_i^2 . t_i)}{\Sigma_1^n t_i}} = \sqrt{\frac{M_1^2 . t_1 + M_2^2 . t_2 \dots + M_n^2 . t_n}{t_1 + t_2 \dots + t_n}}$$

if during the working time the power drawn is :

M_1 for period t_1
M_2 for period t_2
– – – – – – – – – – – – – –
M_n for period t_n

Torque values of less than 0.5 M_N are replaced by 0.5 M_N in the calculation of average torque M_m (a particular feature of no-load operation).

It is also necessary to check that, for a particular motor of rated torque M_N :

• the maximum torque of the cycle is less than twice the rated torque M_N.

• there is still sufficient accelerating torque during starting time.

Caution: when choosing a motor, check that the overloads caused by the operating cycle do not exceed the overload capacities shown on page 32. If they do, choose a larger motor which meets the overload capacity requirements.

The average current I_m is often used instead of torque, and the equation would then be :

$$I_m = \sqrt{\frac{\Sigma_1^n (I_i^2 . t_i)}{\Sigma_1^n t_i}} = \sqrt{\frac{I_1^2 . t_1 + I_2^2 . t_2 \dots + I_n^2 . t_n}{t_1 + t_2 \dots + t_n}}$$

where :

I_1 applies for period t_1
I_2 applies for period t_2
– – – – – – – – – – – – – –
I_n applies for period t_n

Load factor (LF)

Expressed as a percentage, this is the ratio of the period of operating time with a load during the cycle to the total duration of the cycle where the motor is energized.

Duty cycle (DC)

Expressed as a percentage, this is the ratio of the period of actual operating time to the total duration of the cycle

Calculations

- Starting time :

$$t_d = \frac{\pi}{30} \times n \times \frac{(J_e + J_i)}{M_{mot} - M_r}$$

where

t_d : starting time
n : speed of rotation in min^{-1}
J_e : driven inertia corrected to drive shaft in $kg.m^2$
J_i : armature inertia in $kg.m^2$
M_{mot} : motor torque in N.m
M_r : resistive torque in N.m.

D4 - Speed - Overload

D4.1 - DEFINITIONS

D4.1.1 - Rated speed *n*

Rated speed *n* assumes :
- armature and field coils powered below rated voltage,
- stabilized motor temperature,
- IEC standard tolerances (separate excitation motor) equal to :
  ± 15%
  if $P_{ct} < 0.67$
  ± 10%
  if $0.67 \leq P_{ct} < 2.5$

P_{ct} is expressed in kW / 1000 min^{-1}.

Example: power required is 2 kW to a speed of 2000 min^{-1}.
P_{ct} will = 2 x 1000 / 2000 = 1 therefore $0.67 \leq P_{ct} < 2.5$, and the tolerance will be ± 10%.

D4.1.2 - Maximum mechanical speed $n_{max\ mech}$

This is the maximum permissible operating speed within the mechanical limitations: it is 4000 min^{-1}.

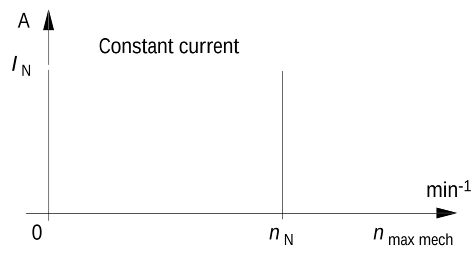
D4.1.3 - Speed range

This is the range between 0 and the highest operating speed.

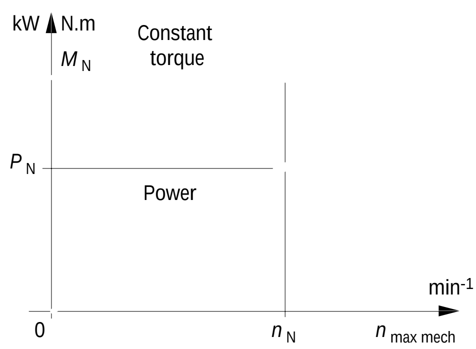
D4.1.4 - Operating range

This is the operating range between the highest and lowest operating speeds.

▼ ***Curve 1. - Current as a function of the speed***



▼ ***Curve 2. - Power as a function of speed***



D4.2 - OPERATION

See figures 1 and 2.

D.4.2.1 - Operation at constant torque

This range depends on the method of controlling speed by varying the armature voltage with constant separate excitation voltage. It is between 30 min^{-1} and the rated speed.

D.4.2.2 - Overcurrent

Occasional overcurrents are permitted. Their value is given in table 1.

▼ ***Table 1. - Permitted overload in steady state as a function of time (MS 2).***

		Number of overloads per	
Overload	**Time**	**20 minutes**	**100 minutes**
1.6 I_N	**1 min**	1	5*
1.2 I_N	**2 min**	1	5*
1.1 I_N	**4 min**	1	5*
1.05 I_N	**10 min**	-	1

*: not consecutive.

D4.3 - OVERLOAD CAPACITY

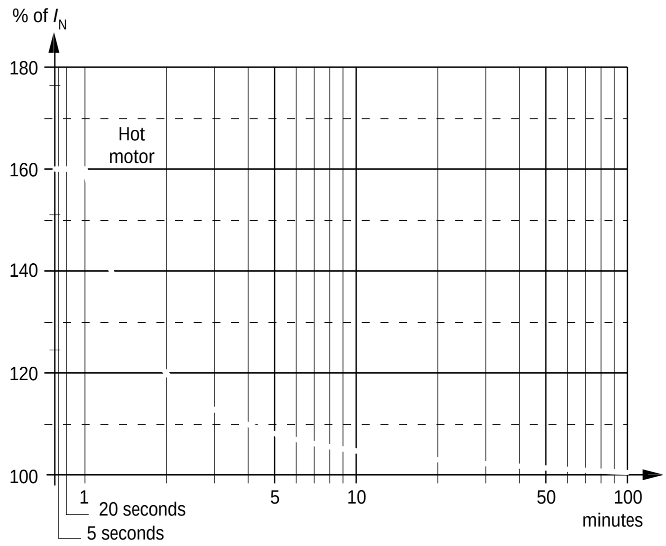
Motors can tolerate an overload between 0 and the rated speed of :
- 1.6 times the rated torque for about 20 seconds every 5 minutes or
- 1.6 times the rated torque for 1 minute, 3 times an hour.

Tolerance of smaller overload capacities over longer periods of time can be arranged on request.

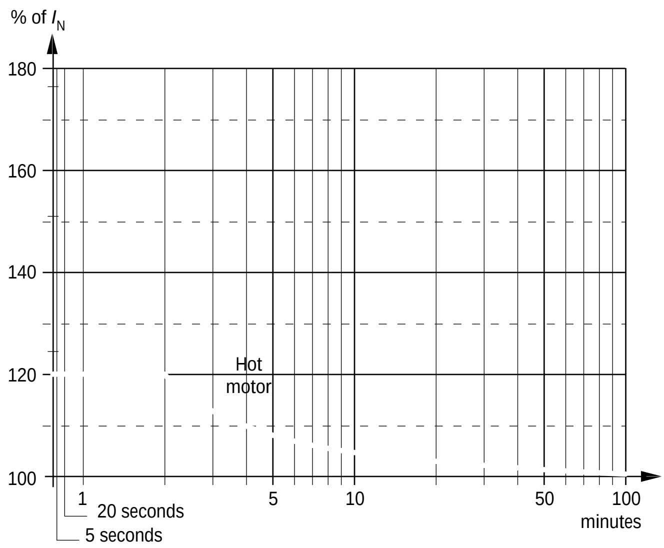
The curves 1 & 2 on the following page enable calculation of permitted overloads as a function of operating times. They define a short overload current as a percentage of the rated torque (for continuous service) as a function of the duration.
Overloads should never be consecutive.
With the help of table 1 the user will be able to determine the number and duration of overloads as a function of the duty cycle time.

Important: repeated overloads will be followed by a period of low load operation in order to maintain an average current of 100% of rated current during the cycle.

▼ ***Curve 1. - Permitted current as a function of time : speed controlled by tachogenerator feedback.***



▼ ***Curve 2. - Permitted current as a function of time : without tachogenerator feedback.***



Permitted current with rotor switched off

This low current operation requires forced ventilation to be maintained while the machine is powered up.

See Curve 1 on page 28 which gives the permitted current as a function of time.

D4.4 - VARIABLE SPEEDS

For manufacturing processes which require several different speed adjustments or for production processes on the same machine but with different loads, variable speed control is the ideal solution.

D4.4.1 - Operation

Depending on the application, motors can operate in 1, 2 or 4 quadrants. The table and graph below show the operation of the motor and controller as a function of the torque due to the load and the rotational speed of the motor.

A speed controller which operates in the first and third quadrants is generally referred to as "one-way" and one which can operate in all four quadrants "4Q" as "two-way".

The term regenerative refers to the restoration of power to the power supply.

D4.4.2 - D.C. controllers

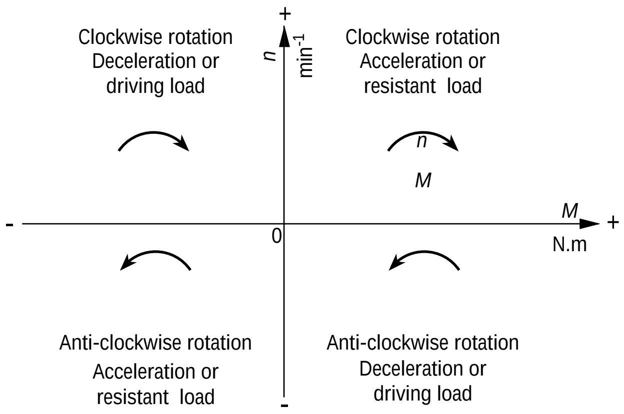
Designed to supply D.C. motors with separate excitation, LEROY-SOMER supplies the following controllers :

- DMV 201 one-way, non-regenerative, single phase mixed bridge
- DMV 242 two-way, non-regenerative, single phase full double bridge
- DMV 2322 one-way, non-regenerative, three-phase full single bridge
- DMV 2342 two-way, regenerative, three-phase full double bridge.

The DMV 2322 and 2342 digital controllers with values and regulation by 8-bit microprocessor, enable user programming and dialogue, using keys and 7-segment display for set-up adjustments, maintenance and error message display.

Several parameters (physical size, selections or logic values) arranged in 16 write-protected menus with two access levels, simplify set-up and maintenance.

Direction of rotation	1 way	2 way	1 way	2 way
Load	resistive	resistive	driving	driving
Operation	motor	motor	motor + generator	motor + generator
Quadrant				



D5 - Noise and vibration

D5.1 - NOISE LEVELS

D5.1.1 - A few basic definitions

The unit of reference is the bel, and the sub-multiple decibel (dB) is used here.

Sound pressure level in dB

$L_p = 20 \log_{10}\left(\frac{P}{P_0}\right)$ where $P_0 = 2.10^{-5}$ Pa

Sound intensity level in dB

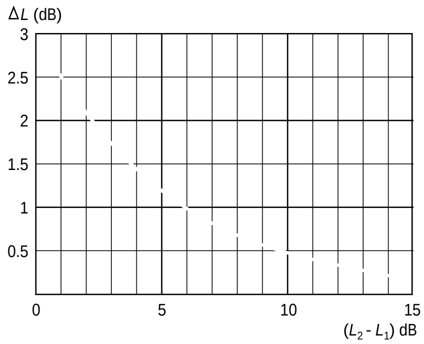
$L_W = 10 \log_{10}\left(\frac{P}{P_0}\right)$ where $P_0 = 10^{-12}$ W

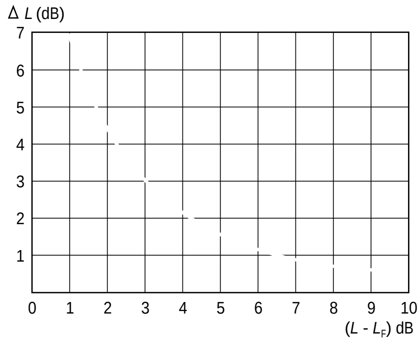
Sound intensity level in dB

$L_W = 10 \log_{10}\left(\frac{I}{I_0}\right)$ where $I_0 = 10^{-12}$ W/m^2

D5.1.2 - Correction of measurements

For differences of less than 10 dB between 2 sound sources or where there is background noise, corrections can be made by addition or subtraction using the following rules :





▲ ***Addition***
If L_1 and L_2 are the separately measured levels ($L_2 \geq L_1$), the resulting sound level L_R is obtained by the formula :

$L_R = L_2 + \Delta L$

ΔL *is found by using the curve above .*

▲ ***Subtraction****
This is most commonly used to eliminate background noise from measurements taken in a "noisy" environment.
If L is the measured level and L_F the background noise level, the actual sound level L_R will be obtained by the calculation :

$L_R = L - \Delta L$

ΔL is found by using the curve above.

**This method is the one normally used for measuring sound power and pressure levels. It is also an integral part of sound intensity measurement.*

Under IEC 34 - 9, the guaranteed values are given for a machine operating on no-load under normal supply conditions (IEC 34 - 1), in the actual operating position, or sometimes in the direction of rotation specified in the design.

Measurements were taken in conformity with standards ISO 1680-1 and 1680-2.
It is generally sound pressure which is measured and its values are shown in table 1 below. As DC machines often operate in different states and at different speeds, the specific noise level required must be agreed between the parties in accordance with the standard.

Expressed as sound power level (Lw) in accordance with the standard, the sound level of MS motors is also shown as a sound pressure level (Lp), which is the most frequently used value.

▼ ***Table 1. - Weighted sound level expressed in dBA***

MS1 - MS2 motor model	Power level L_w dB (A)	Pressure L_p dB (A)	MS1 - MS2 motor model	Power level L_w dB (A)	Pressure L_p dB (A)
801	69	60	**1122**	79	70
1001	72	63	**1321**	77	68
1121	76	67	**1322**	79	70

The maximum standard tolerance for all these values is + 3 dB(A)

D5.2 - VIBRATION LEVELS - BALANCING

Inaccuracies due to construction (magnetic, mechanical and air-flow) lead to sinusoidal or pseudo-sinusoidal vibrations in a wide range of frequencies. Other sources of vibration can also affect motor operation, such as bad mounting, incorrect drive coupling, end shield misalignment and so on.

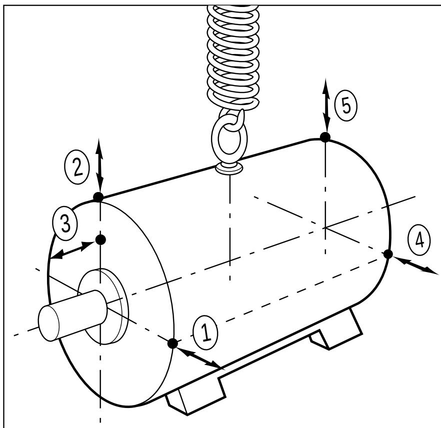
We shall first of all look at the vibrations emitted at the operating frequency, corresponding to an unbalanced load whose amplitude swamps all other frequencies and on which the dynamic balancing of the mass in rotation has a decisive effect.

Under standard ISO 8821, rotating machines can be balanced with or without a key or with a half-key on the shaft extension**.**

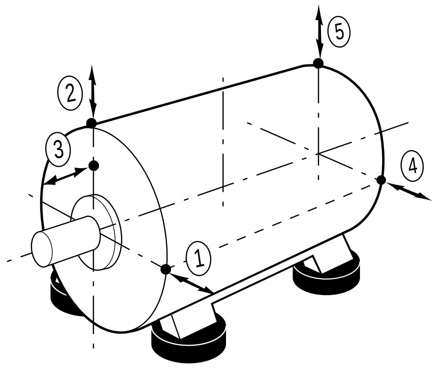
ISO 8821 requires the balancing method to be marked on the drive end as follows :
- half-key balancing : letter H
- full key balancing : letter F
- no-key balancing : letter N

The MS motors in this catalogue are classed N

The machines in this catalogue are classed N. Class R is available on request.



▲ ***Measuring system for suspended machines***



▲ ***Measuring system for machines on flexible mountings.***

The measurement points quoted in the standards are the ones indicated in the drawings above.

At each point, the results should be lower than those given in the tables below for each balancing class, and only the highest value is to be taken as the "vibration level".

Maximum value of rms speed of vibration expressed in mm/s (NFC51 - 111)

Class	Speed	Frame size H (mm)
	n **(min⁻¹)**	**H ≤ 132**
N (normal)	600 < *n* ≤ 3 600	1.76
R (reduced)*	600 < *n* ≤ 1 800 1 800 < *n* ≤ 3 600	0.70 1.13

*: only with ball bearings.

Maximum value of the simple displacement amplitude expressed in µm (for sinusoidal vibrations only)

Class	Speed	Frame size H (mm)
	n **(min⁻¹)**	H ≤ **132**
N (normal)	1 000	24
	1 500	16
	3 000	8
R (reduced)	1000	9
	1500	6.3
	3000	5

Note: for class "S", consult Leroy-Somer giving details of the application.

D6 - Performance

D6.1 - PROTECTION

In the motor power circuit we recommend that there is :
- thermal protection by integration of overload (100% of supply current) ;
- instantaneous protection (200% of supply current) ;
- protection against ground faults ;
- protection against field overvoltages. If there is a short-circuit in the field coil supply, place a parallel resistance R_p across the field coil terminal as follows :

$$R_p = 800 \times U_{exc} / P_{exc}$$

where
R_p parallel resistance in Ω,
U_{exc} field voltage in V,
P_{exc} field power supply in W ;

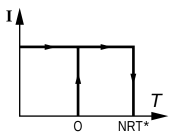
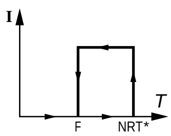
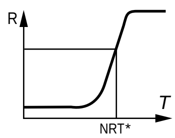
- and protection against overspeeds (lack of field excitation, speed control fault, etc).

If a shorter reaction time is required, or if you want to detect transient overloads, or monitor temperature rises at "hot spots" in the motor or at strategic points in the installation for maintenance purposes, installation of heat sensors at "sensitive" points is recommended. The various types are shown in the table below.

Heat sensors themselves do not protect the motor.

D6.2 - BUILT-IN THERMAL DETECTION (MS2 only)

The MS 1122 & 1322 motors are supplied as standard with normally closed PTO thermal detectors. They can be supplied with other types of detectors as an option (see table below).

Type	Symbol	Operating principle	Operating curve	Cut-off	Protection provided	No. required
Thermal detection on opening (normally closed)	PTO	bimetallic strip indirectly heated contact on opening (0)		2.5 A under 250 V with cos φ 0.4	general surveillance for non-transient overloads	2 in series 1 for main poles 1 for auxiliary poles
Thermal detection on closing (normally open)	PTF	bimetallic strip indirectly heated contact on closing (F)		2.5 A under 250 V with cos φ 0.4	general surveillance for non-transient overloads	2 in parallel 1 for main poles 1 for auxiliary poles
Positive temperature coefficient thermistor	PTC	variable, non-linear resistor, indirectly heated		0	general surveillance for transient overloads ventilation motor stop rotation direction of ventilation motor not respected	2 in series 1 for main poles 1 for auxiliary poles

*: NRT = nominal running temperature : according to the position of the sensor in the motor and the class of temperature rise.

Connection of different heat sensors
- PTO or PTF, in control circuits
- PTC, with relay, not supplied by LEROY–SOMER

LEROY-SOMER DMV 2322 & 2342 speed controllers include direct connection for probes.

Alarm and Early Warning
All detection equipment can be backed up (with different N.O.T.s) : the first will then act as an early warning system (light or audible warning signals, emitted without shutting down the power circuits), and the second device will actually trip the motor (shutting down the power circuits).

D7 - Methods of braking

D7.1 - ELECTRICAL BRAKING

Used when a machine's natural stopping time is too long due to excessive inertia (eg. centrifuges, cylinders, etc). D.C. motor reversibility should be sufficient in these cases.

By maintaining field excitation after a break in the power supply to the armature, the motor becomes a generator and energy is then potentially available at the terminals ; this energy reduces to zero when the machine stops.

There are two methods of electrical braking.

D7.1.1 - Resistance braking

To speed up the dispersal of this energy and thus slowdown to a stop, the energy is spent by closing the field coil circuit with a resistor.

This system is not adjustable and torque is not constant throughout deceleration. All the energy is dissipated as heat which can mean a significant wastage if there is a high number of braking operations.

This method of braking is only used for rapid stopping with no slowdown braking. Another drawback is that braking torque is nil at stop.

This method involves the field coil being energised throughout the entire braking process.

D.7.1.2 - Regenerative braking

Providing power to a motor using an inverse-parallel double bridge speed controller (reversible or 4 quadrant) enables the energy available at the motor terminals to be restored to the supply if the motor is running faster than required :

- if it is temporarily driven by its load (e.g. slowing down) or continually (e.g. restraining operation in unwinders) ;
- if it has to be stopped quickly under control.

Energy generated during braking is restored to the supply via the speed controller.

This method of braking is adjustable and efficiency is constant throughout deceleration.

Caution: this method of braking is not possible if there is no power supply to the speed controller. In some cases emergency stop mechanical braking can be used, eg. safety braking.

D7.2 - MECHANICAL BRAKING OPTION

This method of braking is used when the motor is in rotation. It is dynamic braking, or at stopping, static braking. The higher the temperature and/or the inertia, the more significant the amount of energy spent during braking will be.

To calculate braking the following elements should be taken into account :

- mass to be braked (inertia),
- relative speed,
- braking time,
- number of operations,
- lifetime.

Ambient temperature should also be taken into consideration.

D7.2.1 - Definitions

D7.2.1.1 - Dynamic load

This mainly occurs with rotation inertia braking (drums, cylinders, etc) with negligible static torque.

D7.2.1.2 - Dynamic and static load

This occurs with the majority of applications.

To simplify calculations, it is possible to determine appropriate braking torque using output power :

$M_F = 9550 \cdot P \cdot k / n$

where :

M_F: braking torque in N.m

P : output power in kW

k : safety coefficient (from 1 to 3 depending on the application and the current standards for the operation in question)

n : speed of rotation in min^{-1}.

Braking torque should be higher than or equal to the calculated value.

D7.2.2 - Parameters

D7.2.2.1 - Determination of the work spent

Material friction causes temperature rises by the transformation of kinetic energy. The spent work is calculated using the following formula :

$$Q = 5.5 \times 10^{-3} \cdot \frac{\sum J \cdot n^2 \cdot M_F}{M_F + M_c}$$

where $\sum J = J_m + J_F + J_c$

where :

Q : work due to friction in J

$\sum J$: sum of inertia in m^2kg

n : speed of rotation in min^{-1}

M_F: braking torque in N.m

M_c: load torque :

$M_c > 0$ for driving load

$M_c < 0$ for resistive load

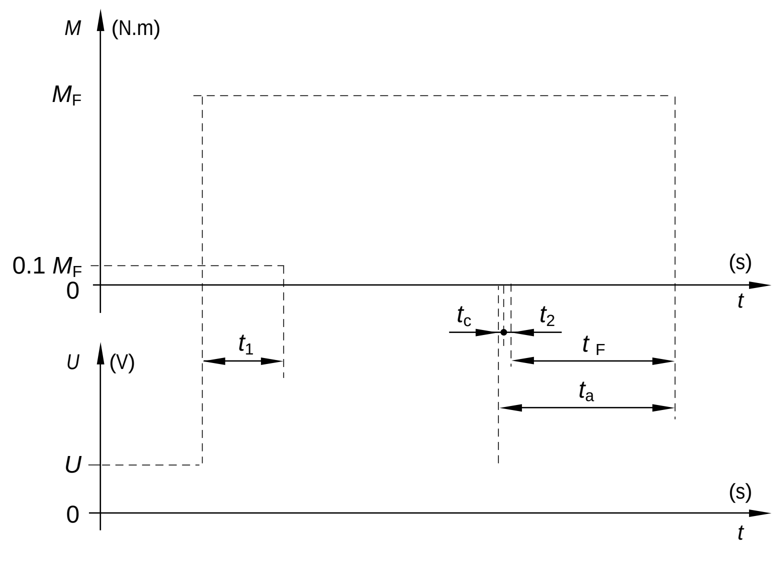
J_m: motor inertia in m^2kg

J_F: braking inertia in m^2kg

J_c: load inertia in m^2kg.

When braking frequency is known, it is possible to calculate the work permitted for each operation using curves 2 and 3. Conversely braking frequency may be calculated if work due to friction is known.

▼ ***Curve 1. - Response time of an electromagnetic brake***



M_F : braking torque

t_1 : brake releasing response time

t_2 : braking response time

t_a : stopping time

t_c : control equipment response times

t_F : braking time

U : brake voltage

t : time

D7.2.2.2 - Adjustment and lifetime

The lifetime of the equipment depends on a number of parameters:
- mass to be braked,
- number of operations and cycle,
- braking time,
- ambient temperature, etc.

It is therefore important to know the exact operating conditions if such a calculation is required.

D7.2.2.3 - Stopping time and braking time

Stopping time is calculated by the following equation :

$$t_a = t_c + t_2 + t_F$$

t_a : stopping time

t_c : response time of control equipment (contactors, position detectors, etc)

t_2 : braking response time

t_F : braking time. See curve 1 on previous page.

Braking time, or the time required for a motor to go from a given speed n to stop, is calculated by :

$$t_F = \frac{\sum J \, . \, \omega}{M_F + M_c}$$

where $\sum J = J_m + J_F + J_c$

and

t_F : braking time in s

$\sum J$: sum of the moments of inertia in m^2kg

ω : speed of angular rotation in rad/s

M_F : braking torque in N.m

M_c : load torque in N.m

$M_c < 0$ if driving load

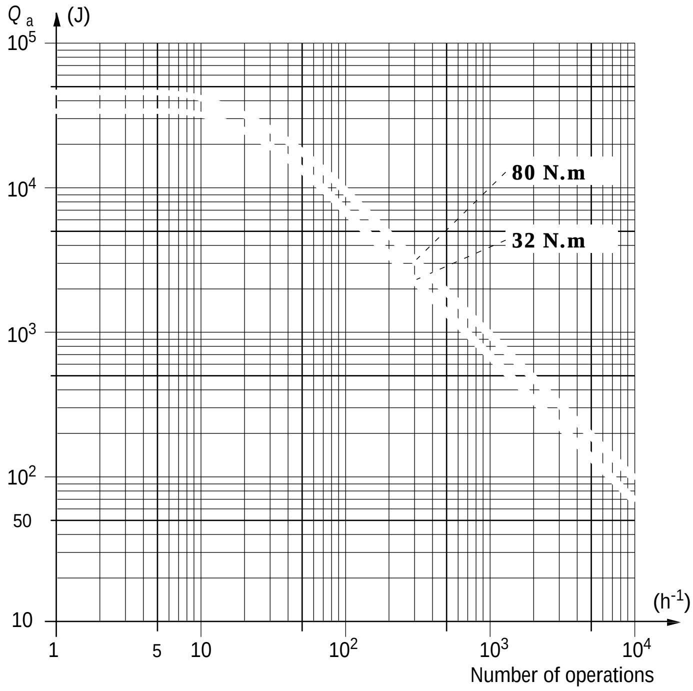
$M_c > 0$ if resistant load

J_m : motor inertia in m^2kg

J_F : brake inertia in m^2kg

J_c : load inertia in m^2kg.

▼ *Curve 2. - Permitted work as a function of the number of operations : Brake type 450.*



D7.2.3 - Brake type 450 (MS 2)

With normal duty, for keeping the motor stopped or for dynamic braking with low inertia these brakes are :
- non-adjustable for wear,
- protected to IP 54,
- operational in any position,
- powered separately at 24 V D.C. or rectified current, cable brought into the terminal box. It should be powered according to the voltage shown in table 1.

As an option it can be fitted with :
- manual brake release (using a "dead man" type lever),
- adaption for fitting a D.C. tacho.

Release brake contact option

This option, available on request, involves special machining for the brakes and should therefore be specified on order.

Note : We recommend that you do not mount a sleeve shaft D.C. tacho behind a brake.

▼ ***Table 1. - Electrical and mechanical characteristics of brakes (MS 2)***

Brake	Motor	Characteristics								
	MS	J_F	M_F	$n_{s\,max}$	P_F	t_1*	t_2*	t_F*	U_F	Weight
type	size	10^{-3} m^2kg	N.m	min^{-1}	W	ms	ms	ms	V	kg
450	1122	0.45	32	3000	40	120	10	40	24	4
450	1322	1.5	80	3000	55	180	20	70	24	8.4

*: given as an example only, these times prevent the brakes being worn unnecessarily by delaying the motor starting.
They can be increased slightly depending on the air gap. They also take account of the brake coil voltage.
**: included in t_F

J_F : brake inertia

M_F : braking torque

$n_{s\,max}$: maximum* permitted braking speed

P_F : brake coil power rating

t_1 : brake release response time

t_2 : braking response time

t_F : braking time

U_F : power supply voltage (D.C. or rectified current)

*: braking beyond a maximum speed $n_{s\,max}$ is likely to destroy equipment and cause damage to mechanical parts by excessive temperature rises.
If emergency braking is necessary in the event of machine breakdown, we recommend that the brakes are thoroughly inspected afterwards.

D8 - Method and guide to selection

D8.1 - ENVIRONMENT

See pages 10 to 12.

D8.2 - GUIDE TO MOTOR SELECTION

D8.2.1 - Power level

Using the selection tables on pages 42 to 45, select the model of motor with the same power level as the machine or the one just above.

D8.2.2 - Armature voltage

The mains voltage dictates a maximum voltage for the armature power supply which should conform to the speed controller. Table 1 (page 26) shows the maximum permitted voltages for the mains supply.

D8.2.3 - Characteristics

Read the required information on the line corresponding to the selected power rating and speed listed.

Note : the rated characteristics listed may differ slightly from those required. The rated voltage of the armature can easily be adjusted by ± 10% with proportional correction of speed and power.

D8.2.4 - Corrections

In some cases, equivalent output power P_e will have to be calculated :

$$P_e = P / k,$$

where

P: power required for driving

k: correction factors taking into account type of operation and environment when operating conditions differ from those used to define the values given in the selection tables (see subsection 5 'Correction factors' on the following page).

D8.3 - MOTOR AND CONTROLLER

D8.3.1 - Questionnaire

To select a servodrive combination, answer the following questions relating to the operation of the motor :

• in which quadrant(s)?	page 32
• constant torque?	page 28
• constant power?	page 28
• minimum speed?	page 31
• maximum speed?	page 31
• speed precision?	pages 49 & 50
• maximum torque?	page 31
• duty?	
• mains supply voltage?	pages 25 to 26
• environment?	pages 10 to 12

D8.3.2 - Selection

Define average torque for intermittent duty or	
rated equivalent torque for continuous duty	page 30
Proceed as for single motor	subsection 2 opposite
Indicate armature voltage,	page 26
motor index,	pages 42 to 45
rated current,	pages 42 to 45
field,	pages 25 & 26
maximum current,	page 32
Indicate if any different accessories are required.	pages 48 to 51

D8.4 - EXAMPLES OF SELECTION

Example 1 :

The machine to be driven requires a power of 0.6 kW at a rated speed of 2500 min^{-1}. The voltage of the single phase mains supply is 380 V at 50 Hz.

The mains supply dictates an armature voltage of 310 V (page 26). For this voltage, the selection table on page 42 indicates an **MS 801 L 08 - 0.8 kW** at 2750 min^{-1}.

Remark :

To achieve 2500 min^{-1} the armature must be supplied with a voltage of 310 x 2500 / 2750 = 282 V, which is obtained by regulation using the speed controller. The motor will then provide a power of P = 0.8 x 2500 / 2750 = 0.72 kW.

Example 2 :

A motor with a power of 9 kW at a rated speed of 1775 min^{-1} is required. Armature voltage is 460 V.

On page 45 calculate speed in the 460 V armature voltage column. The selection table indicates an MS 1322 M 34 9.2 kW at 1740 min^{-1}.

Speed is adjusted by reducing the field coil voltage (by adjusting the voltage provided by the controller or inserting a "dropping" resistance in series with the field coil) while maintaining the power level.

If the motor is driven by pulleys and belts it is possible to adjust the pulley connection (1740 / 1775 = 2%).

Example 3 :

Drive power of an 8 kW machine at a rated speed of 2400 min^{-1}, for a 30 minute S2 duty cycle. Armature voltage is 400 V. Ambient temperature of 40°C at an altitude of 2000 metres.

Calculation for equivalent output power (subsection 'Corrections'): the chart in table 1 on page 10 plots a factor k of 0.93; on page 39 the correction factor for the duty is k = 1.3: this then gives $P_e = 8 / (1.3 \times 0.93) = 6.6$ kW

Using the selection tables, choose the nearest motor to this, which is an MS 1122 M05, 6.9 kW at 2480 min^{-1} (on page 43).

Real power will be :

P = 6.9 x 1.3 x 0.93 = 8.34 kW

The **MS 1122 M05** motor (6.9 kW, IC 06, 2480 min^{-1}) will be operated at 8 kW, during S2 30 minute duty.

Example 4:

Equipment has to be driven at variable speeds :

• operation	4 quadrant
• constant torque?	yes : 48N.m
• constant power?	yes : 11 kW, range 1 to 1.2
• minimum speed?	30 min^{-1}
• maximum speed?	2700 min^{-1} *
• speed precision?	< 1% n_N : implies DC tacho
• maximum torque?	1.6 x M_N
• duty?	S1
• mains supply?	3-phase 50 Hz, 380 V
• atmosphere?	< 40°C, clean air

The torque indicates an MS 1322 M33, 11.7 kW for 50 N.m (page 44). The rated current o f this motor is 32 A; the operating current will be :

I = 32 x 48 / 50 = 30.7 A

Operation in 4 quadrants (reversibility) requires a DMV 2342 type speed controller and the armature current requires a 45 rating (see DMV documentation).

Maximum current in the speed controller will be :

$I_{max\ var}$ = 30.7 x 1.6 = 49.2 A

Maximum permissible current for the speed controller is 45 x 1.5 = 67.5 A: therefore the **DMV 2342-45** speed controller is the correct one.

The motor can tolerate an overload of 1.6 I_N for 60 seconds (Subsection 3, 'Overload capacities' on pages 31 and 32).

*:NB : 2700 / 1.2 = 2250 min^{-1} equivalent to 2240 min^{-1} rated speed of the motor, 1.2 maximum speed coefficient of the range.

Checks

In the case of derating it is necessary to check the associated characteristics of the motor selected and that it is suitable for the operating conditions.

D8.5 - CORRECTION FACTORS

D8.5.1 - Correction according to altitude and ambient temperature

With different values for ambient temperature and altitude, multiply output power by the correcting coefficient corresponding to the ambient characteristics : the correction factor is calculated using the graphs on page 20.

D8.5.2 - Correction according to duty (MS 2)

For S2, S3 & S6 duties in accordance with IEC 34-1, rated power in the selection tables should be multiplied by the factor in table 1 without exceeding 1.6 for the ratio between starting torque and rated torque.

▼ ***Table 1. - Correction factor according to duty (MS 2)***

Duty type	Operating time			
	10 min	**30 min**	**60 min**	**90 min**
S2: short time duty	1.6	1.3	1.1	1
Duty type	Operating factor			
	15%	**25%**	**40%**	**60%**
S3: periodic intermittent duty	1.6	1.4	1.2	1.1
S6: continuous operation with periodic duty	1.6	1.4	1.3	1.2

MS1 - MS2
D.C. motors
Schedule of availability

E0 - Availability according to construction type

The letters **D**, **P** and **C** in the table opposite indicate the availability of MS motors :

: Motors issued by a "short order" dept, which leave the factory 10 working days from date of order.
Option (certain countries only) :
- *Product delivered to customer within 24 hours of leaving the factory.*

: Motors which can be produced within a short time, subject to confirmation.

: Produced to estimate, with delivery by agreement.

Delivery time depends on a combination of :
- the electrical characteristics :
- power,
- speed,
- armature voltage.

✶✶✶ / ✶✶ / ✶
(The stars appear in the selection tables)

- the mechanical characteristics and field coil voltage
■■■ / ■■ / ■
Correspondence of the mechanical characteristics is shown in the table below :

Reference	Construction characteristics
■■■	
p. 13	• IP 20 or 23 protection
p. 20	• Forced ventilation unit in position B or D (MS2)
p. 13	• Foot-mounted, flange-mounted
p. 20	• Terminal box in position A
p. 46-47	• Standard main drive end
p. 15	• Waterproof ball bearings
p. 34	• Normal type balancing N
p. 48	• Sensor for lack of air (MS2)
p. 49	• Plate and fittings for assembly of REO D.C. generator or similar
p. 49	• Supply and assembly of standard D.C. tacho
p. 48	• Filter (MS2)
p. 25	• Separate 190 V voltage field coil
p. 35	• PTO thermal detectors (MS2)
■■ (MS2)	
p. 13	• Foot and flange-mounted
p. 25	• Field coil 210 V*
p. 34	• Reduced type balancing R
p. 35	• Thermal sensor PTC
■ (MS2)	
	• Special drive shaft - subject to quotation
p. 51	• Optional 2 nd drive shaft
p. 37 & 51	• Optional brake
p. 49	• Optional brake with D.C. tacho or encoder
p. 47	• Special flange
	• Version other than IEC

* For other field coil voltages, please consult us (see p. 25).

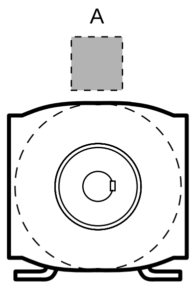
Table of expected delivery times

Mechanical characteristics	Electrical characteristics ✶✶✶	✶✶	✶
■■■			
■■			
■			

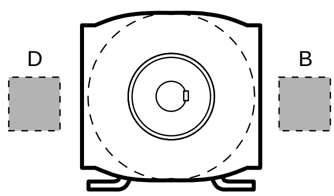
Note: the MS1 range is only produced in category

Reminder of the positions for the forced cooling unit or the terminal box in relation to the motor (drive end view)

Terminal box



Forced ventilation (MS2)



Example
An MS 1322 M34, 9.2 kW motor at 1740 min^{-1} with 460 V (✶✶) armature voltage, 190 V field coil, foot-mounted with cooling unit and terminal box in position D and terminal box in position A, filter D.C tacho (■■■) will be delivered per category **P**.

Note: Motors which are produced to customer specifications will be delivered per category **C**.

ABBREVIATIONS USED IN THE SELECTION TABLES

All the selection tables (pages 42 to 45) use the same symbols for the electrical and mechanical characteristics. The abbreviations used in these tables are explained below.

Reference standards for characteristics shown in the selection tables

The selection tables are based on :

- degree of protection IP 20 or 23: see page 13
- cooling method IC 01 (self-cooling) for MS 801, 1001, 1121 & 1321: see page 19
- cooling method IC 06 (F. V.) for MS 1122 & 1322: see page 19
- continuous S1 duty conforming to IEC 34-1
- ambient temperature ≤ 40°C : see page 10
- altitude 1000 m or lower : see page 10
- single phase supply rectified by a mixed bridge or
- 3-phase supply rectified by a full bridge (form factor 1.04 or lower)
- insulation class F for MS 801, 1001, 1121 & 1321: see page 27
- insulation class H for MS 1122 & 1322: see page 27

The motors are designed to operate at a current ranging from 50 to 100% of I_N in continuous state, and above this in transient state : see overload capacity pages 31 & 32.

Note : for prolonged underload operation, please consult us.

Abbreviations used in the selection table headings

P	: rated power in kW
n	: rated speed for the armature voltage shown in the heading, warm motor, expressed in min^{-1}
U	: armature voltage (see page 26) expressed in V
$n_{max\ mech.}$	: maximum mechanical speed expressed in min^{-1}: see table 1 page
M	: rated torque expressed in N.m
I	: permitted current in permanent state expressed in A (S1 duty)
η	: efficiency (does not take account of field excitation)
L	: armature circuit choke expressed in mH
R	: resistance of the armature circuit expressed in Ω
U_{max}	: maximum permitted voltage on the armature terminals expressed in V
L_a	: value of the additional choke needed to achieve the power stated in the first column expressed in mH : see page 26.

Note : the field powers given are average powers

Motor designation : see fold-out inside cover

Delivery time : ✶, ✶✶, ✶✶✶ : see page 40

Comments

The reader should refer to pages 38 & 39 for the selection procedure together with some examples. The correction factors depending on the type of use and the various options are listed on page 39.

The value of the torque shown at the top of the page is the average value for each model of motor.

E1 - Selection table : MS1

The electrical characteristics are given for :

- single phase, mixed bridge supply or three-phase, full bridge supply
- degree of protection IP 20
- cooling method IC 01 (self-cooled)
- continuous S1 duty
- ambient temperature ≤ 40°C.

Field power

Motor size	W
801	65
1001	80
1121	130
1321 S	140
1321 M	190

Delivery
✶✶✶

$n_{max\ mech}$: 4000 min^{-1}

Key to abbreviations: see page 41.

P with choke * kW	*P* no choke kW	Single phase network: Speed of rotation *n* for armature voltage U 170 V min^{-1}	260 V min^{-1}	310 V min^{-1}	3-phase network 440 V min^{-1}	Additional inductance FF = 1.2* mH	MS motor size	Description of stator & index	*J* kg.m^2	*M* N.m	*I* no choke FF = 1.6* A	*η* Not inc. excitation	*L* mH	$R_{115°}$ Ω	U_{max} V
0,5	0,44	1500				30	**801**	**L 08**	0,003	3	3,5	0,74	94	5,5	440
0,7	0,6	995				50	**1001**	**L 09**	0,006	6	4,4	0,81	130	5,1	310
0,8	0,7		2300			30	**801**	**L 08**	0,003	3	3,5	0,77	94	5,5	420
0,92	0,8			2750		30	**801**	**L 08**	0,003	3	3,5	0,74	94	5,5	420
1,03	0,9		1530			50	**1001**	**L 09**	0,006	6	4,4	0,79	130	5,1	310
1,07	0,93	3000				10	**801**	**L 04**	0,003	3	7	0,79	23	1,35	170
1,1	0,93	1500				20	**1001**	**L 06**	0,006	6	6,5	0,84	57	2,35	420
1,26	1,1	1800				15	**1001**	**L 05**	0,006	6	7,5	0,86	43	1,75	310
1,26	1,1			1830		50	**1001**	**L 09**	0,006	6	4,4	0,81	130	5,1	310
	1,2				3870		**801**	**L 08**	0,003	3	3,5	0,79	94	5,5	440
1,5	1,3	900				30	**1121**	**M 06**	0,02	14	9	0,85	80	3,01	420
1,61	1,4		2300			20	**1001**	**L 06**	0,006	6	6,5	0,83	57	2,35	420
1,96	1,7		2750			15	**1001**	**L 05**	0,006	6	7,5	0,87	43	1,75	310
1,96	1,7			2740		20	**1001**	**L 06**	0,006	6	6,5	0,85	57	2,35	420
2,13	1,85	3000				5	**1001**	**L 03**	0,006	6	12,5	0,87	15	0,5	170
2,3	2	1400				10	**1121**	**M 04**	0,02	14	13,5	0,87	34	1,26	420
2,3	2		1400			30	**1121**	**M 06**	0,02	14	9	0,86	80	3,01	420
2,3	2			3300		15	**1001**	**L 05**	0,006	6	7,5	0,86	43	1,75	310
	2,41				3870		**1001**	**L 06**	0,006	6	6,5	0,85	57	2,35	440
2,76	2,4	1300				15	**1321**	**S 33**	0,04	18	16,5	0,86	37	1,14	420
2,76	2,4	950				20	**1321**	**M 33**	0,05	24	17	0,83	54	1,32	420
2,82	2,45			1700		30	**1121**	**M 06**	0,02	14	9	0,87	80	3,01	420
2,82	2,6	1850				5	**1121**	**M 03**	0,02	13	18	0,85	20	0,8	310
3,57	3,1		2150			10	**1121**	**M 04**	0,02	14	13,5	0,88	34	1,26	420
	3,46				2410		**1121**	**M 06**	0,02	14	9	0,87	80	3,01	440
4,26	3,7		2000			10	**1321**	**S 33**	0,04	18	16,5	0,86	37	1,14	420
4,31	3,75			2600		10	**1121**	**M 04**	0,02	14	13,5	0,88	34	1,26	420
4,49	3,9		1450			20	**1321**	**M 33**	0,05	26	17	0,88	54	1,32	420
4,6	4	2900				3	**1121**	**M 02**	0,02	13	28	0,84	9	0,34	170
4,6	4		2800			5	**1121**	**M 03**	0,02	14	18	0,86	20	0,8	310
5	4,35			2350		10	**1321**	**S 33**	0,04	18	16,5	0,85	37	1,14	420
5,29	4,6			1800		20	**1321**	**M 33**	0,05	24	17	0,87	54	1,32	420
5,64	4,9			3400		5	**1121**	**M 03**	0,02	14	18	0,83	20	0,8	310
	5,24				3670		**1121**	**M 04**	0,02	14	13,5	0,88	34	1,26	440
	6,18				3350		**1321**	**S 33**	0,04	18	16,5	0,85	37	1,14	440
6,9	6	2250				3	**1321**	**M 22**	0,05	25	40	0,88	11	0,34	260
	6,7				2510		**1321**	**M 33**	0,05	25	17	0,89	54	1,32	440
10,2	8,85		3300			3	**1321**	**M 22**	0,05	26	40	0,85	11	0,34	260

*: for single phase supply.

E2 - Selection tables : MS2

The electrical characteristics are given for:

- single-phase, mixed bridge supply or three-phase, full bridge supply
- degree of protection IP 23
- cooling method IC 06 (F.V.)
- continuous S1 duty
- ambient temperature ≤ 40°C.

Weight: foot-mounted motor :	56 kg
Weight: flange-mounted motor :	59 kg
Moment of inertia :	0.02 $kg.m^2$
Field power :	0.25 kW

23 N.m

$n_{max\ mech}$: 4000 min^{-1}

Key to abbreviations: see page 41.

	P		Single phase network				3-phase network			Additional inductance	*M*	*I*	*η*	*L*	$R_{115°}$	U_{max}		
			Speed of rotation *n* for armature voltage *U*															
FF=1.05	with choke	no choke	160 V	180 V	260 V	310 V	400 V	440 V	460 V	FF=1.2			Not inc.				Index	Delivery
kW	kW	kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	mH	N.m	A	excitation	mH	Ω	V		
1,9							890				20	6.5▲	0,72	430	16,5	460		
2,1								970			21	6.4▲	0,73	430	16,5	460	14	✶✶
2,2									1000		21	6.4▲	0,73	430	16,5	460		
3,4							1380				24	10.3▲	0,81	171	6,63	460		
3,7								1500			24	10.3▲	0,82	171	6,63	460	09	✶✶
3,8									1570		23	10▲	0,82	171	6,63	460		
	1,4	1,2	630							30	21	10.5*	0,7	110	3,82	460		
	1,5	1,3		720						30	20	10*	0,73	110	3,82	460		
	2,2	1,9			1080					30	19	9.5*	0,78	110	3,82	460		
	2,8	2,4				1320				30	20	9.5*	0,81	110	3,82	460	07	✶✶
4,7							1760				26	14▲	0,83	110	3,82	460		
5,3								1940			26	14▲	0,85	110	3,82	460		
5,3									2020		25	13.5▲	0,86	110	3,82	460		
	1,7	1,5	730							25	22	11.5*	0,73	90	3,01	460		
	1,9	1,6		830						25	22	11*	0,78	90	3,01	460		
	2,7	2,3			1260					25	20	11*	0,81	90	3,01	460		
	3,2	2,8				1530				25	20	11*	0,83	90	3,01	460	06	✶✶
5,5							2060				25	16▲	0,86	90	3,01	460		
6,1								2270			26	16▲	0,86	90	3,01	460		
6,2									2370		25	15.5▲	0,87	90	3,01	460		
	2,3	2	880							15	25	14.5*	0,78	62	1,97	460		
	2,3	2		1000						15	22	14*	0,8	62	1,97	460		
	3,5	3			1520					15	22	13.6*	0,84	62	1,97	460		
	4,2	3,6				1840				15	22	13.6*	0,85	62	1,97	460	05	✶✶
6,9							2480				27	20▲	0,86	62	1,97	460		
7,7								2720			27	20▲	0,87	62	1,97	460		
7,8									2840		26	19.5▲	0,87	62	1,97	460		
	2,6	2,3	1100							10	23	17.5*	0,82	38	1,26	460		
	3	2,6		1250						10	23	17*	0,84	38	1,26	460		
	4,4	3,8			1900					10	22	17*	0,85	38	1,26	460		
	5,3	4,6				2300				10	22	17*	0,86	38	1,26	460	04	✶✶✶
8,6							3090				27	24.7▲	0,87	38	1,26	460		
9,5								3400			27	24.7▲	0,88	38	1,26	460		
9,5									3550		26	23.5▲	0,88	38	1,26	460		

*: current corresponding to a supply without choke (FF = 1.6).

▲: **Maximum permissible overload** : 1.2 I_N for motor without tacho, and 1.6I_N for motor fitted with tacho.

MS 1322 S
D.C. motors
Electrical characteristics

The electrical characteristics are given for:

- single phase, mixed bridge supply or three-phase, full bridge supply
- degree of protection IP 23
- cooling method IC 06 (F.V.)
- continuous S1 duty
- ambient temperature ≤ 40°C.

Weight : foot-mounted motor	76 kg
Weight : flange-mounted motor	79 kg
Moment of inertia :	0.04 kg.m^2
Field power :	0.3 kW

36 N.m

$n_{max\ mech}$: 4000 min^{-1}

Key to abbreviations: see page 41.

P			Single phase network				3-phase network			Additional inductance	*M*	*I*	*η*	*L*	$R_{115°}$	U_{max}	Index	Delivery
			Speed of rotation *n* for armature voltage *U*															
FF=1.05	with choke	no choke	160 V	180 V	260 V	310 V	400 V	440 V	460 V	FF=1.2			Not inc.					
kW	kW	kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	mH	N.m	A	excitation	mH	Ω	V		
3,3							840				38	11▲	0,74	325	10,3	460		
3,4								920			35	10.5▲	0,74	325	10,3	460	39	✶✶
3,5									960		35	10▲	0,75	325	10,3	460		
	2,9	2,5			870					50	32	12.5*	0,75	133	4,53	460		
	3,5	3				1040				50	32	12.4*	0,79	133	4,53	460		
5,6							1350				40	16.5▲	0,84	133	4,53	460	36	✶✶
5,9								1490			38	16▲	0,85	133	4,53	460		
5,9									1550		36	15▲	0,85	133	4,53	460		
	2,8	2,4	760							20	35	20.5*	0,73	57	1,96	460		
	3,4	2,9		850						20	38	20*	0,78	57	1,96	460		
	5	4,3			1320					20	36	20*	0,82	57	1,96	460		
	6	5,2				1570				20	36	20*	0,84	57	1,96	460	34	✶✶
8,6							2050				40	25▲	0,86	57	1,96	460		
9,5								2250			40	25▲	0,86	57	1,96	460		
9,6									2360		39	24▲	0,87	57	1,96	460		
	3,8	3,3	1040							15	35	26*	0,79	37	1,14	460		
	4,2	3,7		1170						15	34	25.5*	0,80	37	1,14	460		
	6,2	5,4			1810					15	33	25*	0,83	37	1,14	460		
	7,6	6,6				2150				15	34	25*	0,85	37	1,14	460	33	✶✶✶
11,2							2830				38	32▲	0,87	37	1,14	460		
12,3								3100			38	32▲	0,88	37	1,14	460		
12,3									3240		36	30.5▲	0,88	37	1,14	460		
	5,4	4,7	1540							10	33	35.2*	0,83	32	0,52	460		
	6,2	5,4		1720						10	34	35*	0,85	32	0,52	460	32	✶✶
	9,1	7,9			2690					10	32	34.7*	0,87	32	0,52	460		
	10,8	9,4				3190				10	32	34.7*	0,88	32	0,52	460		

*: Current corresponding to supply without choke (FF = 1.6).

▲: **Maximum permissible overload** : 1.2 I_N for motor without tacho, and 1.6I_N for motor fitted with tacho.

MS 1322 M
D.C. motors
Electrical characteristics

The electrical characteristics are given for:

- single phase, mixed bridge supply or three-phase, full bridge supply
- degree of protection IP 23
- cooling method IC 06 (F.V.)
- continuous S1 duty
- ambient temperature ≤ 40°C.

Weight : foot-mounted motor	91 kg
Weight : flange-mounted motor	94 kg
Moment of inertia :	0.05 kg.m^2
Field power :	0.35 kW

47 N.m

$n_{max\ mech}$: 4000 min^{-1}

Key to abbreviations: see page 41.

P			Single phase network				3-phase network			Additional	*M*	*I*	*η*	*L*	$R_{115°}$	U_{max}		
			Speed of rotation *n* for armature voltage *U*							inductance								
FF=1.05	with choke	no choke	160 V	180 V	260 V	310 V	400 V	440 V	460 V	FF=1.2			Not inc.				Index	Delivery
kW	kW	kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	mH	N.m	A	excitation	mH	Ω	V		
4,1							840				47	14▲	0,73	271	6,92	460		
4,5								920			47	14▲	0,73	271	6,92	460	37	✶✶
4,6									960		46	13.5▲	0,74	271	6,92	460		
	3,6	3,1			820					50	42	16*	0,74	131	3,52	460		
	4,4	3,8				980				50	43	15.6*	0,78	131	3,52	460		
6,4							1270				48	19.2▲	0,83	131	3,52	460	35	✶✶
7,1								1390			49	19.2▲	0,84	131	3,52	460		
7,2									1460		47	18.5▲	0,84	131	3,52	460		
	4,7	4,1			980					30	46	20.5*	0,76	104	2,28	460		
	5,8	5				1170				30	47	20*	0,80	104	2,28	460		
8,1							1520				51	24▲	0,84	104	2,28	460	34	✶✶
9,2								1670			53	24▲	0,85	104	2,28	460		
9,2									1740		50	23.5▲	0,85	104	2,28	460		
	3,5	3	750							15	45	26*	0,72	49	1,32	460		
	4	3,5		840						15	45	25.5*	0,77	49	1,32	460		
	6,1	5,3			1310					15	44	25*	0,81	49	1,32	460		
	7,4	6,4				1560				15	45	25*	0,83	49	1,32	460	33	✶✶
10,9							2030				51	32▲	0,85	49	1,32	460		
11,7								2240			50	32▲	0,86	49	1,32	460		
12									2320		49	30.5▲	0,86	49	1,32	460		
	5,2	4,5	1120							10	44	35.2*	0,79	21	0,33	460		
	5,8	5,1		1260						10	44	35*	0,81	21	0,33	460		
	8,7	7,6			1960					10	42	34.7*	0,84	21	0,33	460		
	10,6	9,2				2340				10	43	34.7*	0,86	21	0,33	460	32	✶✶✶
16,8							3050				53	48▲	0,88	21	0,33	460		
18,5								3350			53	48▲	0,88	21	0,33	460		
18,5									3500		50	46▲	0,88	21	0,33	460		

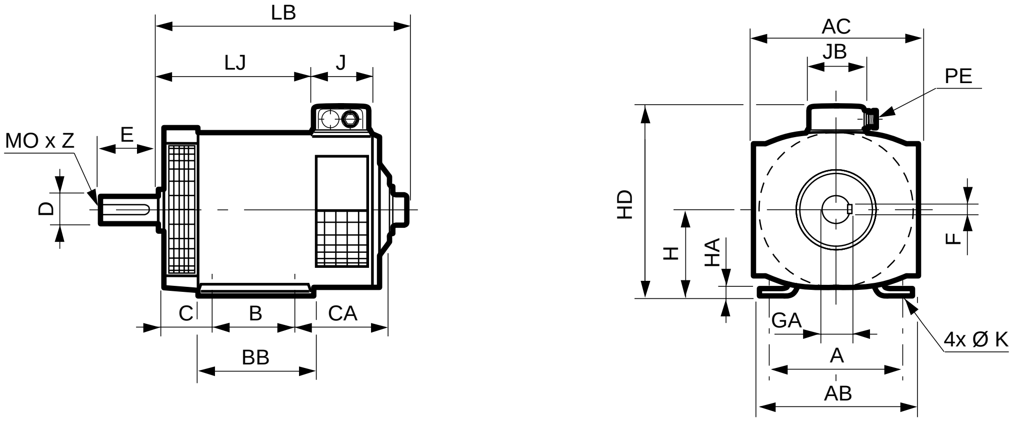
*: Current corresponding to supply without choke (FF = 1.6).

▲: **Maximum permissible overload** : 1.2 I_N for motor without tacho, and 1.6I_N for motor fitted with tacho.

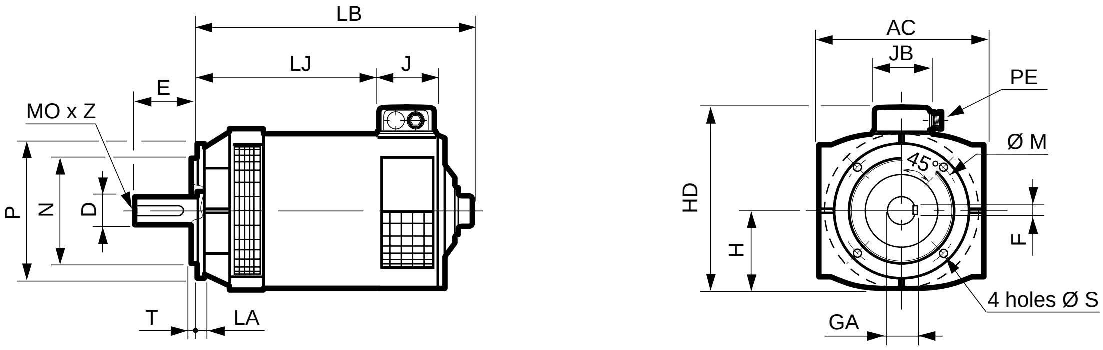
F1 - MS1 overall dimensions

Dimensions of MS 801 to 1321 drip-proof D.C. motors

- foot mounted



- flange mounted (FF)



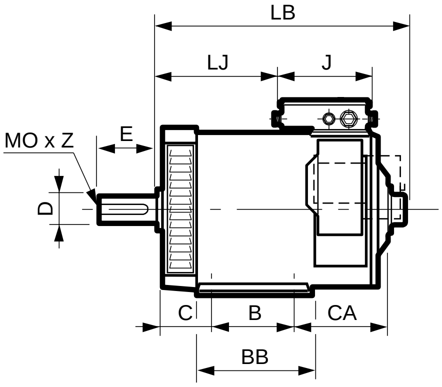
MS1 motor	Main dimensions															Weight (kg)	
size	A	AB	AC	B	BB	C	CA	H	HA	HD	J	JB	K	LB	LJ	PE	foot	flange
801 L	125	150	160	100	120	50	151	80	2	204	80	80	9	316	167	16	20	21
1001 L	160	185	200	140	170	63	161	100	3	248	80	80	10	364	227	16	37	38
1121 M	190	220	225	140	170	70	205	112	3	272	80	80	12	414	278	16	54	57
1321 S	216	250	260	140	180	89	202	132	3	332	163	163	12	471	218	21	74	77
1321 M	216	250	260	178	218	89	224	132	3	332	163	163	12	491	278	21	89	92

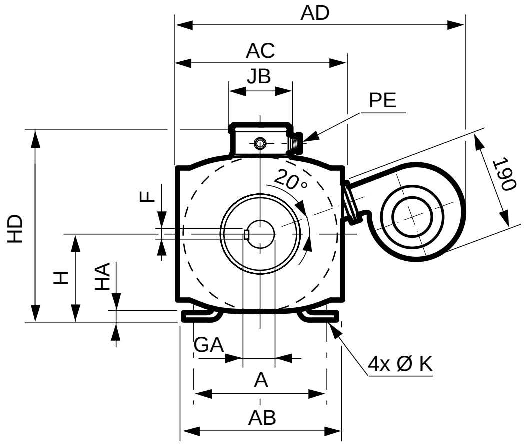
MS1 motor	Flange mounted							Drive end					
size	LB	M	N j6	P	LA	S	T	D j6	E	F	GA	O	Z
801 L	353	115	95	140	10	9	3	14	30	5	16	M5	12
1001 L	402	130	110	160	10	9	3,5	19	40	6	21,5	M6	12
1121 M	456	165	130	200	12	11	3,5	24	50	8	27	M8	15
1321 S	518	215	180	250	14	14	4	28	60	8	31	M10	20
1321 M	538	215	180	250	14	14	4	28	60	8	31	M10	20

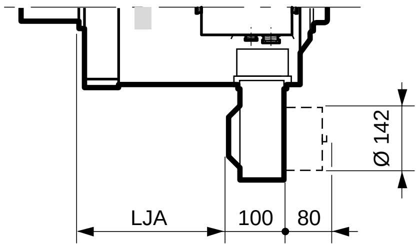
F2 - MS2 overall dimensions

Dimensions of MS 1122 & 1322 enclosed D.C. motors

- foot mounted

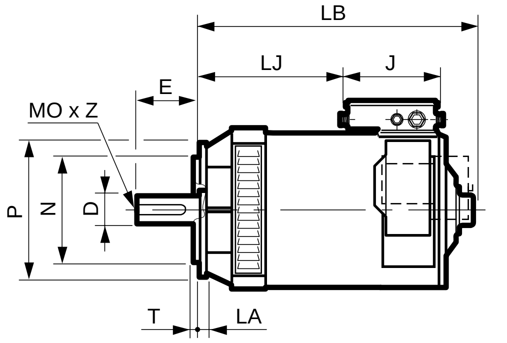


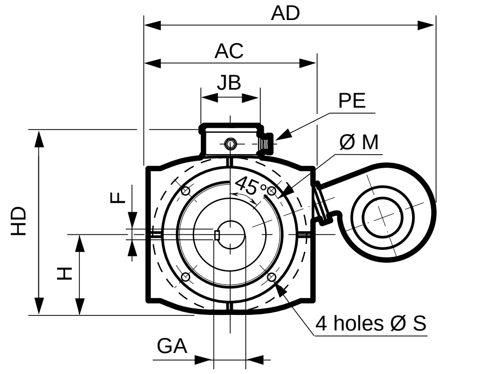




1/2 top view

- flange mounted (FF) or face mounted (FT)





MS2 motor	Main dimensions																
size	A	AB	AC	AD	B	BB	C	CA	H	HA	HD	J	JB	K	LB	LJ	LJA	PE
1122 M	190	220	223	427	140	170	70	179	112	4	290	160	110	12	417	210	257	*
1322 S	216	250	260	460	140	180	89	200	132	5	329	160	110	12	454	213	290	*
1322 M	216	250	260	460	178	218	89	202	132	5	329	160	110	12	494	253	330	*

*: see positions on page 20.

MS2 motor	Flange mounted FF							Face mounted FT							Drive end					
size	LB	M	N j6	P	LA	S	T	LB	M	N j6	P	LA	S	T	D j6	E	F	GA	O	Z
1122 M	462	215	180	250	12	15	4	420	165	130	200	-	M10	3,5	28	60	8	31	M10	22
1322 S	501	265	230	300	14	15	4	454	215	180	250	-	M12	4	38	80	10	41	M12	28
1322 M	544	265	230	300	14	15	4	494	215	180	250	-	M12	4	38	80	10	41	M12	28

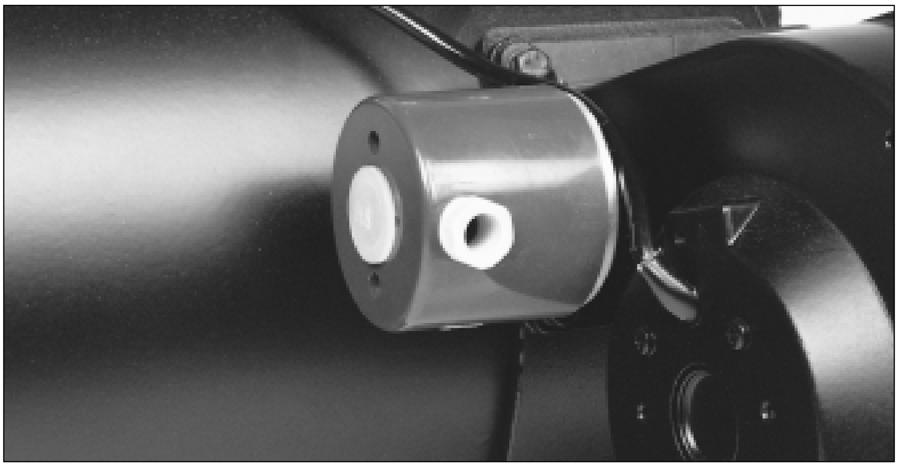
G1 - Ventilation (MS2)

G1.1 - DETECTION OF AIR FLOW

A pressure switch detects if the ventilation motor stops. It is a pressure switch which monitors air flow. However, it cannot provide satisfactory protection against a reduction in the rate of flow (caused by clogging of the filter or partial obstruction of the air intake or outlet).

It operates a single pole lever which is factory set and has a breaking capacity of 1 A at 250 V. It has a "Faston" type connector.

This detector is mounted on the forced cooling unit.



G1.2 - AIR FILTER

In dusty conditions, it is essential to select cooling method IC 06 with the "Air filter" option. This should only be selected if it can be regularly serviced (to prevent the filter becoming clogged). Otherwise use the other cooling method IC 17.

For comparatively dusty conditions a suction filter can be fitted to the fan housing (IP 20 protection ; fit a drip cover for IP 23).

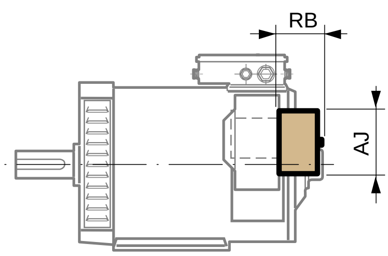
This has interchangeable, flame resistant (DIN 53438, class F1) polyester filter elements, with an ASHRAE 52/76 average gravimetric effectiveness of 88%. It can be reused after cleaning :

- quick clean : shake or use a jet of compressed air
- full clean : soak for several hours in a bath of mild detergent, then rinse in clean water and dry before reassembling.

It is advisable to replace the filter elements after two or three washes.

Filter dimensions

MS2 motor	Filter	
size	AJ	RB
1122	Ø 142	80
1322	Ø 142	80



MS1 - MS2
D.C. motors
Optional features

G2 - Speed detection

G2.1 - D.C. TACHOMETER

A D.C. tacho is required for most speed variation devices. It supplies a D.C. voltage which is proportional to its speed and changes polarity with the direction of rotation.

All MS motors can be fitted with optional flange adapters and non-backlash splined sleeve couplings (Tacke Junior M14 type or equivalent) for connecting the most commonly used D.C. tachos.

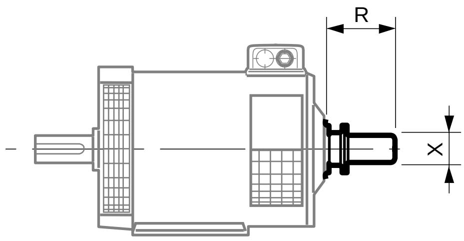
Characteristics of D.C. tachometers

Type	REO 444N or equivalent	REO 444R or equivalent	RDC 15* or equivalent
Maximum current	0.18 A	0.18 A	0.1 A
Weight	1.8 kg	2.8 kg	1.6 kg
Mounting	Coupling	Coupling	Hollow shaft
Number of outputs	1 or 2 comm.	1 or 2 comm.	1 commutator
Ø drive end	7 mm	11 mm	16 mm hollow
Protection	IP 44	IP 54	IP 44
Connection	via wires	terminal box	terminal box
Voltage (at 1000 min^{-1}**)**	60 V	60 V	60 V

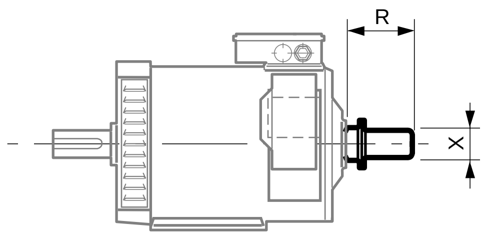
*: only with models 1122 & 1322.

Dimensions of D.C. tachometers

▼ ***MS 801, 1001, 1121 & 1321***



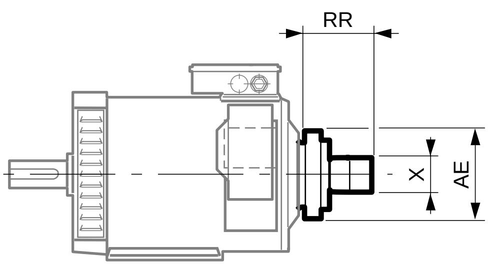
▼ ***MS 1122 & 1322***



MS motor model	REO 444				REO 444R				RDC 15	
	1 Commutator		2 Commutators		1 Commutator		2 Commutators		1 Commutator	
	R	X	R	X	R	X	R	X	R	X
801	159	75	175	75	169	94	188	94	-	-
1001	158	75	174	75	168	94	187	94	-	-
1121	158	75	174	75	168	94	187	94	-	-
1122	157	75	173	75	167	94	186	94	43	90
1321	158	75	174	75	168	94	187	94	-	-
1322	159	75	175	75	169	94	188	94	51	90

Dimensions for brake + tachogenerator (MS2)

▼ ***MS 1122 & 1322***



MS motor model	REO 444						REO 444R					
	1 Commutator			2 Commutators			1 Commutator			2 Commutators		
	AE	RR	X	AE	RR	X	AE	RR	X	AE	RR	X
1122	162	226	75	162	242	75	162	236	75	162	181	75
1322	204	240	75	204	256	75	204	250	75	204	223	75

MS motor model	RDC 15				TD3				KTD3			
	1 Commutator				1 Commutator				1 Commutator			
	AE	RR	XA	XB	AE	RR	XA	XB	AE	RR	XA	XB
1122	162	103	90	90	162	71	50	52	162	91	50	70
1322	204	132	90	90	204	90	50	52	204	109	50	70

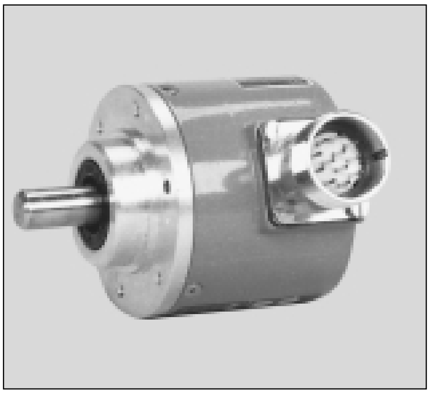
MS1 - MS2
D.C. motors
Optional features

G2.2 - PULSE GENERATOR (PG or encoder)

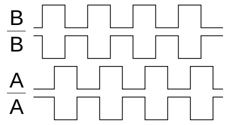
Mounted only on models 1122 & 1322, this generates a number of pulses in proportion to the speed of the motor.
It is a "push - pull" type pulse generator, type PB1 057 6R (Hohner or equivalent), with a 2–channel output + an additional output. It can be energised with a rectified voltage in the range of 11 to 30 volts.
For distances above 20 m, the cables must be twisted pairs. The maximum cable length (screened) must not exceed 500 m on an opto-coupler input.

Characteristics of pulse generators

PG type	PB1 057 6R or equivalent
Max. current	40 mA
Max. ripple	500 mV
Max. no load current	90 mA
Number of outputs	2+ additional
Ø drive end	10 mm
Protection	IP 44
Connection	9416 connector
Voltage*	11 to 30 V



Forme du signal

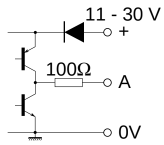


Resolution *R*
This is calculated using the following formula:

$R \leq 60 \times F_{max} / n$

where
F_{max} : maximum frequency permitted by the speed controller (100 kHz for the LEROY-SOMER DMV 2342) in Hz
n : motor speed in min^{-1}.

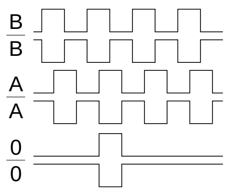
Etages de sortie

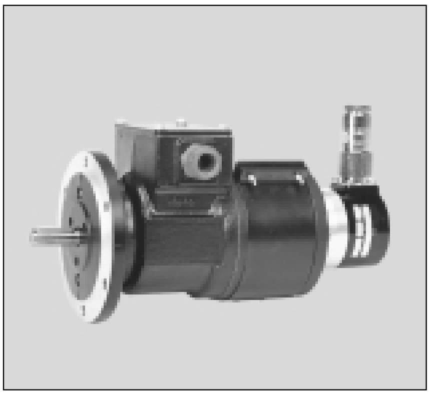


G2.3 - D.C. TACHOMETER PLUS PULSE GENERATOR

This is a combination of a D.C. tacho and a pulse generator mounted directly on the tacho.
The designation of this combination is as follows :
REO 444R 1C (or 2C) 54 B 1 x 0.06
(or 2 x 0.06) CA / AK 56 5 9 …(Resolution).
The characteristics of the tacho are the same as those given in subsection 1.
The pulse generator has 3 complementary channels, and a rectified voltage of 11 to 30 V. The resolution is calculated as in the preceding subsection.
This option is only available for models 1122 & 1322.

Forme du signal

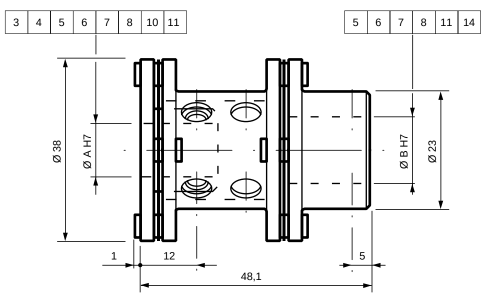




G2.4 - MOUNTING FOR SPEED MEASUREMENT DEVICE

The fixing flange and the driver must be rigid, metallic type with no angular play, such as the G5000C driver. It can be used for all speed measurement sensors in this catalogue.

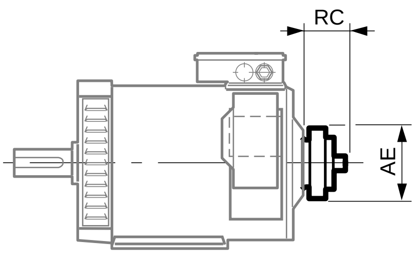
Dimensions of G5000C driver

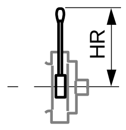


G3 - Mechanical options

G3.1 - MECHANICAL BRAKE

Dimensions of brake type 450





Optional brake release lever

MS motor size	Type 450*		
	AE	HR	RC max
1122	162	146	70
1322	204	196	85

*: see dimensions of D.C. tachos on page 49.

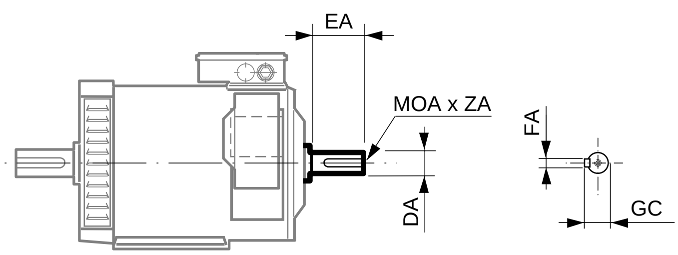
G3.2 - OPTIONAL FLANGES AVAILABLE

The flange mounted and face mounted dimensions given in the table below are available as an option : see diagrams on pages 46 & 47.

MS motor model		Flange mounted FF														Face mounted FT					
	LB	M	N j6	P	LA	S	T	M	N j6	P	LA	S	T	LB	M	N j6	P	LA	S	T
801	353	130	110	160	10	10	3,5	165	130	200	10	12	4	316	115	95	140	-	M8	3
1001	402	165	130	200	10	12	4	-	-	-	-	-	-	364	165	130	200	-	M10	4
1121	475	215	180	250	12	15	4	-	-	-	-	-	-	415	165	130	200	-	M10	4
1122	462	165	130	200	12	11	3,5	-	-	-	-	-	-	-	-	-	-	-	-	-
1321 S	478	165	130	200	10	12	14	-	-	-	-	-	-	-	-	-	-	-	-	-
1321 M	538	165	130	200	10	12	14	-	-	-	-	-	-	-	-	-	-	-	-	-
1322 S	501	165	130	200	10	12	14	215	180	250	14	14	4	-	-	-	-	-	-	-
1322 M	544	165	130	200	10	12	4	215	180	250	14	14	4	-	-	-	-	-	-	-

G3.3 - SECOND DRIVE END

Dimensions



MS motor model	Drive end					
	DA	EA	FA	GC	OA*	ZA
1122	19 j6	40	6	21,5	M6	16
1322	22 j6	50	6	24,5	M8	19

*: conforming to the DIN 332 standard.

Brake + D.C. tacho: see page 49.

G3.4 - CONFORMITY TO NEMA STANDARDS

LSK series motors can be manufactured to conform to Nema standards if customers request this. Consult Leroy-Somer.

G3.5 -UNIVERSAL MOUNTING

This enables motors in this range (IEC flange and drive end) to be connected to LEROY-SOMER gearboxes :

- Compabloc 2000 range (parallel gears)
- Orthobloc 2000 range (helical/bevel gears)
- Manubloc 2000 range (parallel axes and hollow shaft output).

Details of this option and of the gearboxes are given in the Leroy Somer catalogues "Cb 2000 concentric shaft geared motors" reference 490, "MANUBLOC 2000 compact hollow shaft geared motors" reference 1031 and "Ot 2000 helical bevel geared motors and gear units" reference 806.

H1 - Voltage drop along cables

Check that cables conform to voltage and current carrying capacities with respect to the lengths used. Refer to standard C15.100.

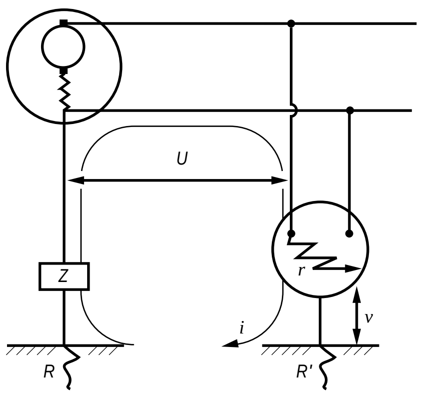
H2 - Earthing impedance

The French government decree 62.1454 of 14 November 1962 concerning the protection of operatives in workplaces in which electrical currents are used, requires that when the neutral is connected to the earth by a limiting impedance, the effective value of the fault current multiplied by the resistance of the earth terminal of the mass in which the fault occurs must not exceed :

- 24 V in highly conductive workplaces, or

- 50 V in other cases.

(Reference : UTE standard C 12.100 - page 12, Article 32)



U : armature voltage

Z : limiting impedance

R : resistance of neutral earth

R': resistance of the earth of the mass where the fault occurs

r : internal fault resistance

i : fault current

v : potential of the mass in relation to the earth

v_L: maximum value imposed for that potential

This may be written :

$$v = R'i$$

and $U = (Z + R + R' + r)\, i$

whence

$$Z = R' \times \frac{U}{v} - (R + R' + r)$$

and consequently :

$$Z \geq R' \times \frac{U}{v_L} - (R + R' + r)$$

Example 1

Highly conductive premises with :

$R = 3\ \Omega$
$R' = 20\ \Omega$
$r = 10\ \Omega$
$U = 440$ V

$$Z \geq 20 \times \frac{440}{24} - (3 + 20 + 10) = 334\ \Omega$$

Example 2

Less conductive premises with :

$R = 6\ \Omega$
$R' = 10\ \Omega$
$r = 0\ \Omega$
$U = 600$ V

$$Z \geq 10 \times \frac{600}{50} - (6 + 10 + 0) = 104\ \Omega$$

H3 - Packaging weights and dimensions

MS motor model	ROAD TRANSPORT			
	IM B3		IM B5 - IM V1	
	Tare (kg)	Dimensions in mm (L x l x H)	Tare (kg)	Dimensions in mm(L x l x H)
	Box			
801	5	434 x 160 x 225	5	434 x 160 x 225
1001	6	504 x 200 x 262	6	504 x 200 x 262
	Crate on pallet			
1121	15	600 x 260 x 300	15	600 x 260 x 300
1122	15	600 x 260 x 300	15	600 x 260 x 300
1321	20	720 x 260 x 350	20	720 x 260 x 350
1322	20	720 x 260 x 350	20	720 x 260 x 350

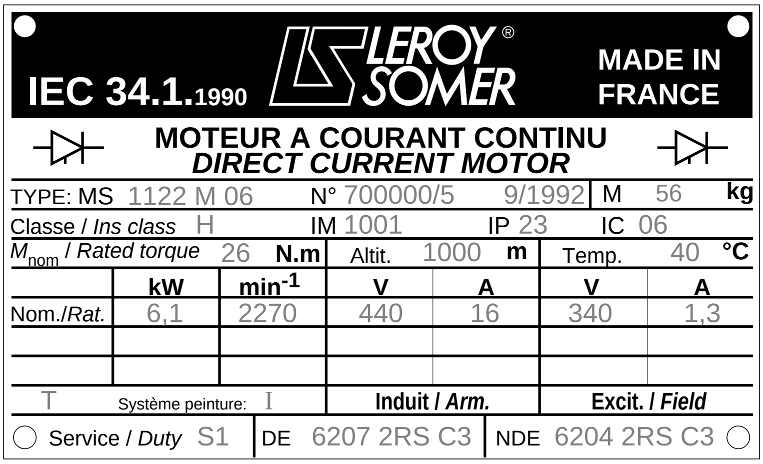
MS motor model	SEA TRANSPORT			
	IM B3		IM B5 - IM V1	
	Tare (kg)	Dimensions in mm (L x l x H)	Tare (kg)	Dimensions in mm (L x l x H)
	Plywood crates			
801	10	450 x 170 x 230	10	450 x 170 x 230
1001	12	520 x 220 x 270	12	520 x 220 x 270
1121	20	600 x 260 x 300	20	600 x 260 x 300
1122	20	600 x 260 x 300	20	600 x 260 x 300
1321	26	720 x 260 x 350	26	720 x 260 x 350
1322	26	720 x 260 x 350	26	720 x 260 x 350

Note: the weights and dimensions given in the above tables are for MS motors with terminal box and fan in standard position (page 20). As there are a number of possible options, the dimensions of the motors, with the options fitted, will be supplied on request.

The values given are for individual packages. If ordering in bulk, please contact us if packaging dimensions are needed.

H4 - Identification

H4.1 - IDENTIFICATION PLATE



▼ ***Explanation of symbols used on identification plates***

MS : Type
112 : Frame size
2 : Range
M : Stator symbol
06 : Construction code
T : Impregnation index
I : Painting system

: Weight
: Insulation class H
: Operating position
: Index of protection
: Index of cooling
: Rated torque
: Maximum operating altitude in metres
: Maximum ambient operating temperature

Bearings

:Drive end Bearing
:Non drive end Bearing

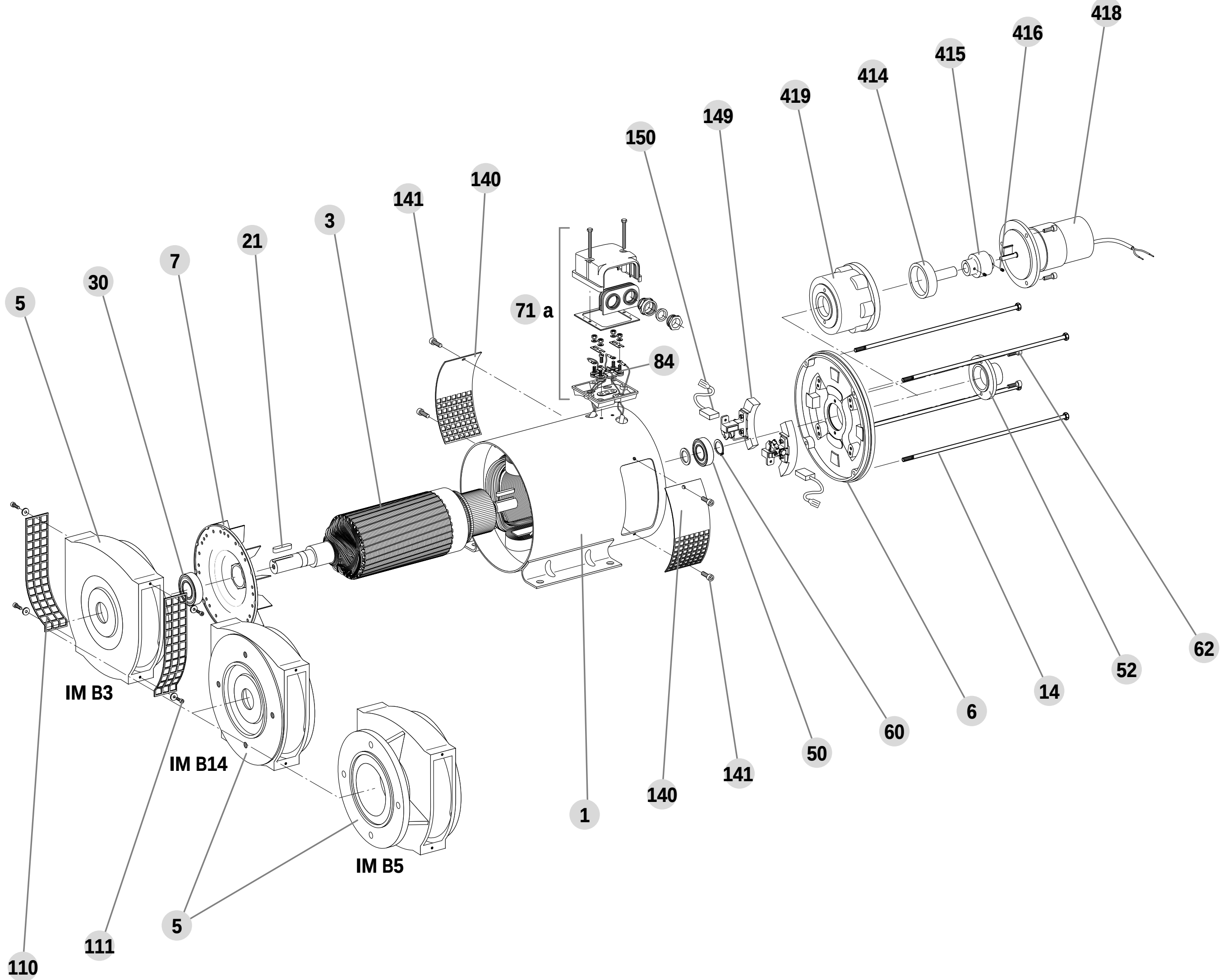
Motor number

N° : Motor batch number
5 : Serial number
9 : Month of manufacture
1992 : Year of manufacture

Nom : Rated characteristics
kW : Power factor
min^{-1} : Revolutions per minute
V : Armature voltage
A : Armature current
V : Field voltage
A : Field current
: Other operating points

Please quote when ordering spare parts

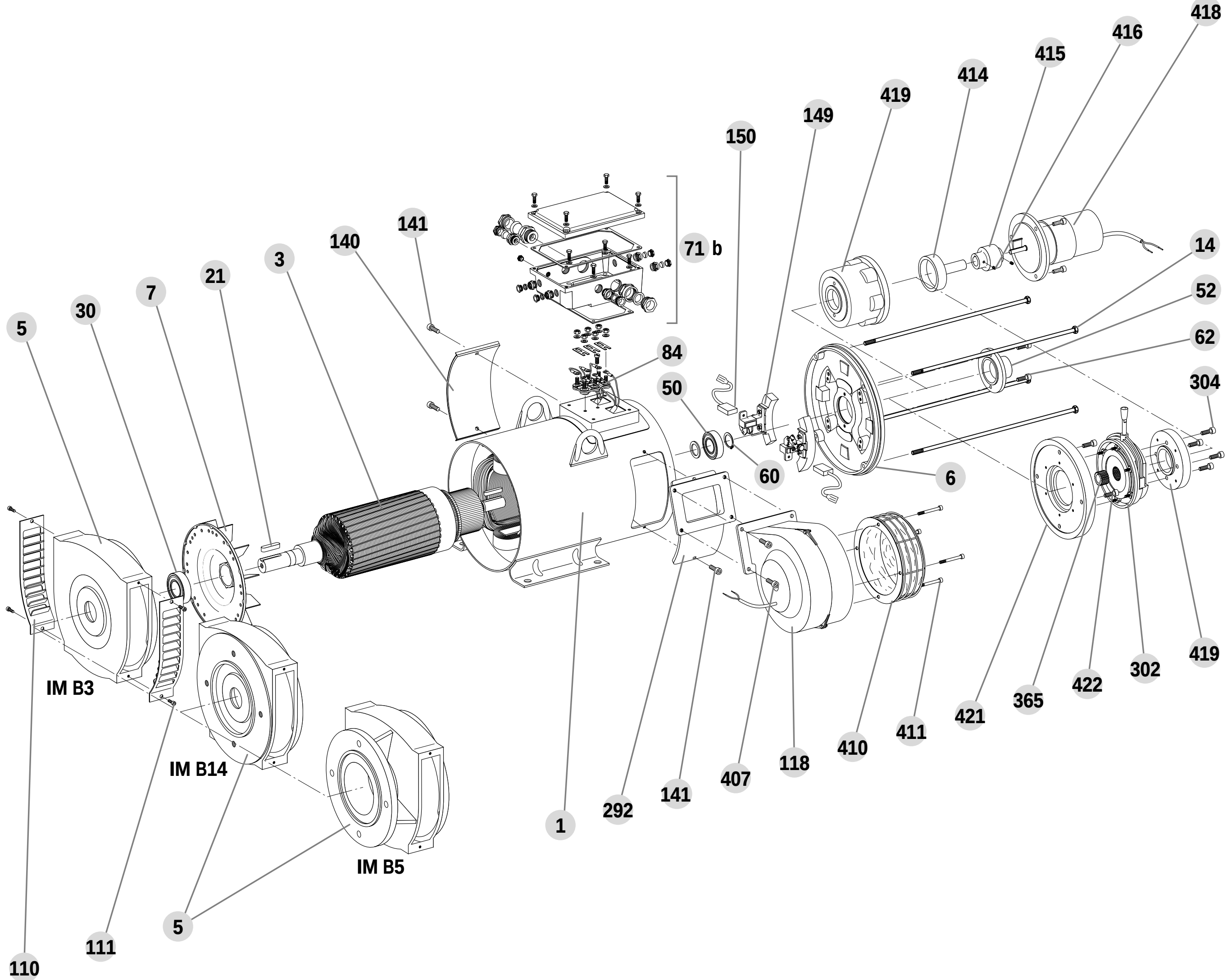
H4.2 - MS1



MS1 motor

No.	Description	No.	Description	No.	Description
1	Wound stator	52	Retainer (for motor with no options fitted)	149	Brush-holder
3	Wound armature	60	NDE bearing circlip	150	Brush
5	Drive end shield (DE)	62	Fixing screw for 52 and/or 160	414	Drive shaft
6	Non drive end shield (NDE)	71 a	Plastic terminal box	415	Sleeve coupling
7	Fan	84	Terminal block	416	Locking screw
14	Tie rods	110	Fan grille	418	D.C. tacho
21	Shaft extension key	111	Fixing rivets for grille no. 110	419	U-mount
30	Drive end bearing (DE)	140	NDE bearing inspection door		
50	Non drive end bearing (NDE)	141	Fixing screw for no. 140		

H4.3 - MS2



MS2 motor

No.	Description	No.	Description	No.	Description
1	Wound stator	71 b	Metal terminal box	365	Spline bore hub
3	Wound armature	84	Terminal block	407	Fixing screw for fan housing
5	Drive end shield (DE)	110	Fan shutter	410	Filter (optional)
6	Non drive end shield (NDE)	111	Fixing screw for grille no. 110	411	Fixing screw for filter
7	Fan	118	Forced ventilation	414	Drive shaft
14	Tie rods	140	NDE shield inspection door	415	Sleeve coupling
21	Shaft extension key	141	Fixing screw for no. 140	416	Locking screw
30	Drive end bearing (DE)	149	Brush-holder	418	D.C. tacho
50	Non drive end bearing (NDE)	150	Brush	419	U-mount
52	Retainer (for motor with no options fitted)	292	Connecting duct	421	Fixing flange for block
60	NDE bearing circlip	302	Brake block	422	Flange fixing screw
62	Fixing screw for 52 and/or 160	304	Fixing screw for brake block		

H5 - Maintenance

LEROY-SOMER can provide installation and maintenance information on each type of product or product range.

These documents plus other technical information on our products are obtainable from LEROY-SOMER sales offices.

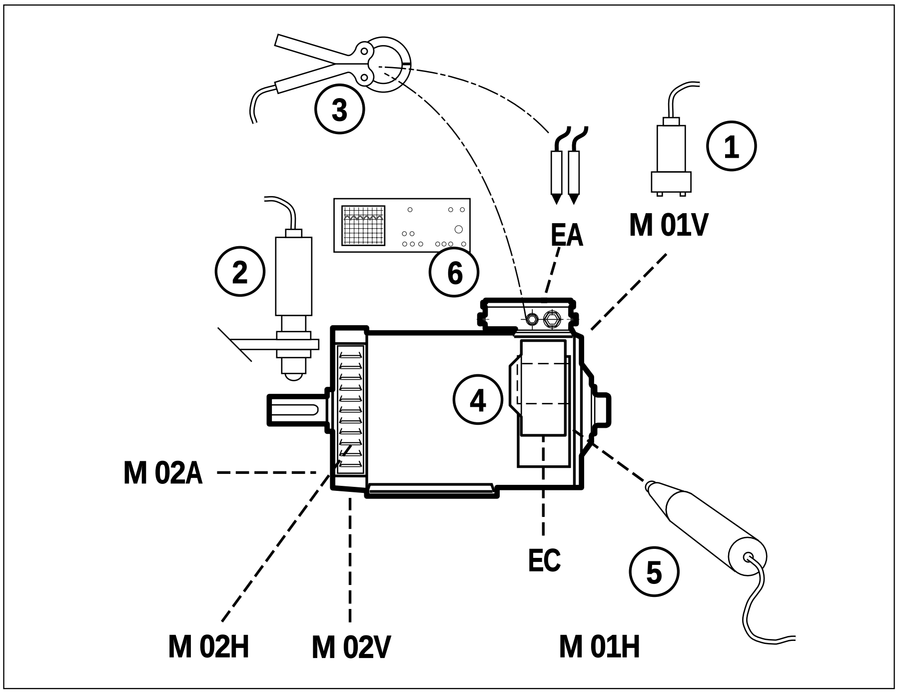
When asking for technical documents, please quote the full reference of the machine.

LEROY-SOMER, in its continuous search for ways to help our customers, provides a preventive maintenance system and maintenance contracts.

This system enables the on-site acquisition of data at the different points and parameters described in the table below.

This data is then analysed by computer and a report on the operating status of the installation is produced.

This report shows imbalance, misalignment, the state of the bearings, any structural problems, or electrical problems (current waveform, etc.), as well as many others.



Visual checks (maintenance) plus :

① Accelerometer : for measuring vibrations

② Photo-electric cell : for measuring speed and phase balancing

③ Clamp ammeter (Hall effect) :

for measuring current (3-phase, fan motor, and D.C.)

④ Voltage probe : for measuring voltage

⑤ Infrared probe : for measuring temperature

⑥ Oscilloscope : for checking armature current

Measuring device	Measurement points							
	M 01V	M 01H	M 02V	M 02H	M 02A	Shaft	EA	EC
① Accelerometer	●	●	●	●	●			
② Photo-electric cell						●		
③ Clamp ammeter							●	●
④ Voltage probe							●	●
⑤ Infrared probe	●		●					
⑥ Oscilloscope								●

D.C. motors
Summary of standard MS1 - MS2 motors

STANDARD MODEL

Motors in the MS1 range conform to the standards listed below, unless otherwise indicated :

- Conformity to standards...p.9
- IP 20 protection p.13
- External finish (RAL 7035) p.12
- Foot or flange mounted construction (FF) p.13
- Ball bearings ....p.15…
- IC 01 cooling method p.19
- Terminal box in position A1 (above) p.20
- Reverse rotation...p.22
- Class F insulation p.27
- Rotor balancing class N p.34
- 1 standard shaft p.46

Motors in the MS2 range conform to the standards listed below, unless otherwise indicated :

- Conformity to standards...p.9
- IP 23 protection p.13
- T (tropicalisation) protection system p.12
- External finish (RAL 9005 black) p.12
- Foot or flange mounted construction (FF or FT)....................................p.13
- Ball bearings ....p.15…
- IC 06 cooling method p.19
- Terminal box in position A1 (above) p.20
- Forced ventilation unit in position B (to right as seen from drive end) ...p.20
- Reverse rotation...p.22
- Class H insulation p.27
- Rotor balancing class N...p.34
- PTO thermal probes...p.35
- 1 standard shaft p.47

A quality process is applied throughout manufacture, the final stage of which is a routine test on all motors when assembly is complete. A test report is available on request.
There are a number of options for the MS2 range which can rapidly be adapted to individual requirements. Please consult the "Optional features" section, pages 48 to 51, and the "Availability according to construction type" section on page 40.

SELECTION

Please see the "Method and guide to selection" section on pages 38 & 39 for selection procedure and examples. Correction factors may have to be taken into account depending on the environment or the application, and these are shown in the relevant sections.

Note : On the following page you will find a guide entitled, "Information required when ordering" which simplifies selection by identifying actual operational requirements. LEROY-SOMER recommends that you fill in this questionnaire to ensure that you have the best motor for your needs.
Any information not provided when the order is placed cannot be raised later if there is a problem with conformity or operation due to lack of information.
Do not hesitate to consult your LEROY-SOMER agent for advice. We have 450 agencies, sales offices and service centres throughout the world to guarantee you the best possible service.

MS1 - MS2
D.C. motors
Information required when ordering

Information needed by LEROY-SOMER to find the best motor for your requirements.

Application ______________________ Motor Generator

Quantity

Machine driven

mm

Coupling direct* sleeve* pulleys/belts* Ø pulley

Environmental conditions
(page 10)

Atmosphere: clean, dusty, explosive, damp %

Max. temperature °C, Temperature rise, Altitude (if >1000m) m, Other

Power supply
(page 25, etc)

single phase, three-phase*, Voltage V, Frequency Hz

Type of speed controller : 1 quadrant* 4 quadrants*

Bridge : mixed* full*

Duty

Cycle in accordance with IEC 34-1

S1, S2, Other, Operating factor %, Starts/hour

Motor characteristics
(page 42, etc)

	min. in production state		rated	maximum	
Speed :					min^{-1}
Power :					kW
Armature voltage :					V

$U_{armature}$: V U_{field}: V

Starting MD / M_N: Duration : Number / h:

Overload M_M / M_N: Duration : Number / h:

Rotation direction seen from the drive end: clockwise* anti-clockwise* bi-directional*

Mechanical requirements
(page 20, etc)

Mounting : foot* flange* foot and flange*

Position : horizontal* vertical* Description : IM

Position : ventilation, terminal box, IP Protection, Description : IC

Options
(pages 48 to 51)

Ventilation filter*

Adapt. for DC tacho, D.C. tacho, Brake, Other options

No. of commutators, Braking torque N.m

Notes

*: place a cross in the relevant box.