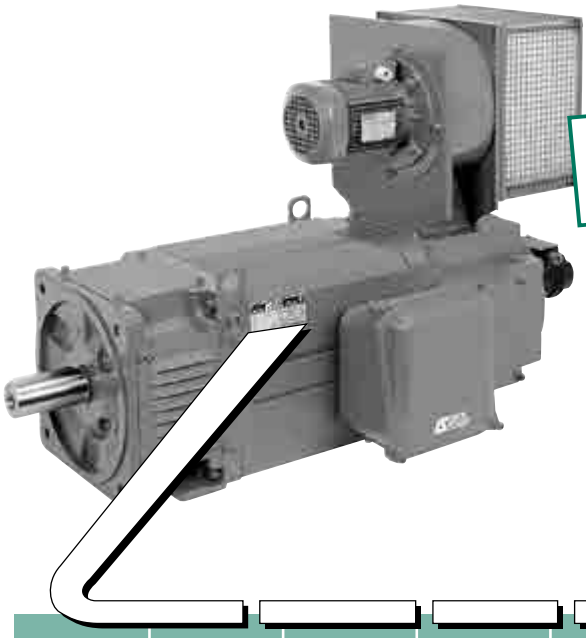
LSK

D.C. motors
2 to 750 kW

LEROY-SOMER™

Nidec
All for dreams

LSK
D.C. motors
2 to 750 kW



IP 23S - IC 06*
Cl. H

Use the **complete motor designation** when placing your order, see page 160.

Simply go through the complete designation step by step.

*Optional : IP 55 - IC 416

LSK	1604	S 02	440 V	1150 min^{-1}	36.3 kW	IM 1001 IM B3	360 V	IC 06	IP 23S

Range identification

Frame size IEC 72 No. of poles
Section E P. 85 to 133

Stator type and construction code
Section E P. 85 to 133

Armature voltage
Section D2 Page 63

Rated speed
Section D5 Page 68

Rated power IEC 34-7
Section D4 Page 65

Mounting arrangements IEC 34-7
Section C1 Page 26

Field voltage
Section D2 Page 62

Cooling IEC 34-6
Section C4.1 Pages 51-52

Protection IEC 34-5
Section B1 Page 19

Complete description on page 160

For **direct selection**, see section: D9 Page 80

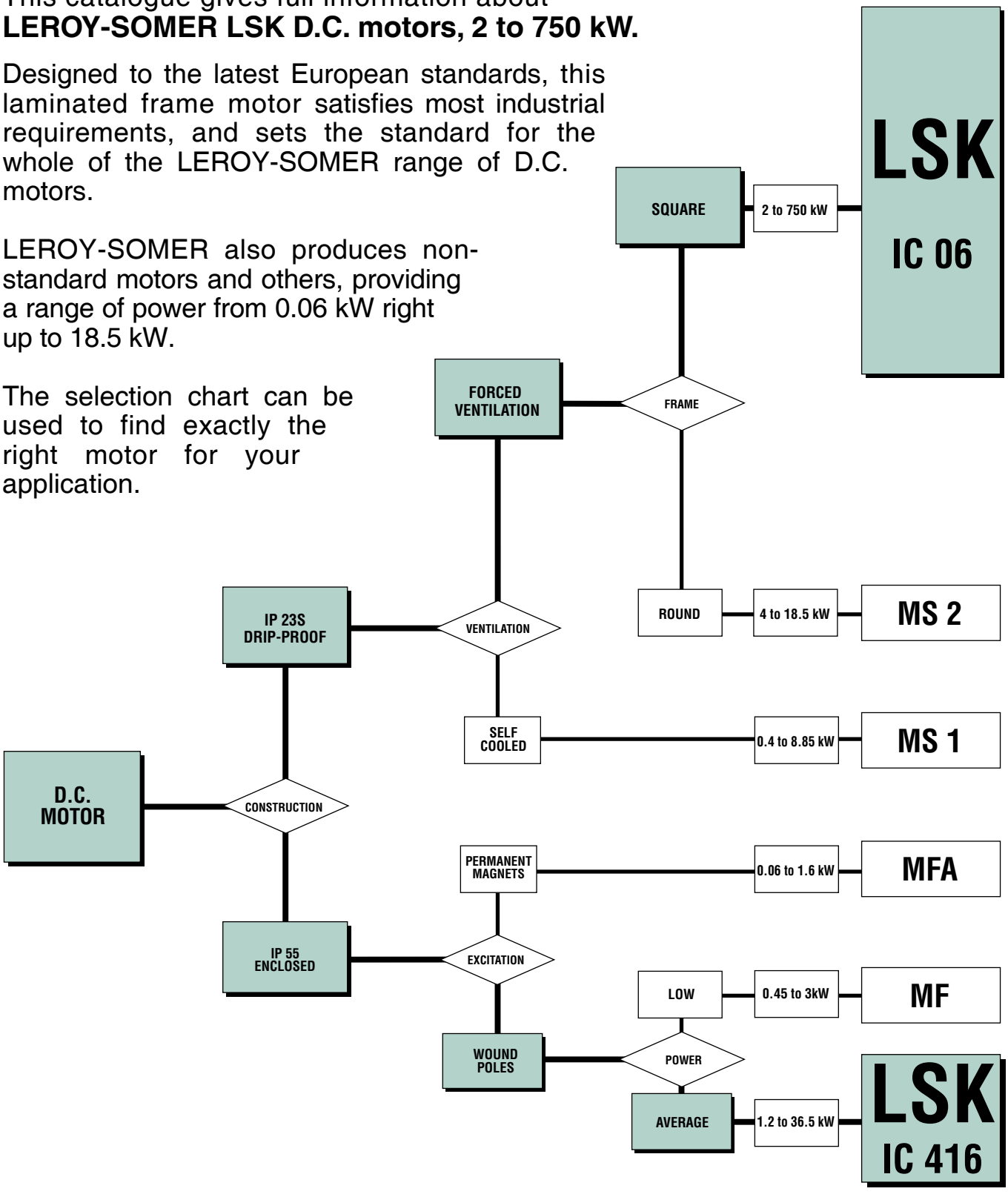
LSK
D.C. motors
2 to 750 kW

This catalogue gives full information about **LEROY-SOMER LSK D.C. motors, 2 to 750 kW.**

Designed to the latest European standards, this laminated frame motor satisfies most industrial requirements, and sets the standard for the whole of the LEROY-SOMER range of D.C. motors.

LEROY-SOMER also produces non-standard motors and others, providing a range of power from 0.06 kW right up to 18.5 kW.

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



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D.C. motors

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Enclosed and drip-proof D.C. motors 0.06 to 750 kW

The LEROY-SOMER range

LSK range

Enclosed permanent magnet motor

Enclosed wound motor

Drip-proof wound motor

Drip-proof, force-cooled wound motor

DELIVERY
WITH GUARANTEED AVAILABILITY

LEROY-SOMER offer their clients the opportunity to fix their own delivery dates, **without prior consultation.**

Information regarding products & availability can be found in CATALOGUE ref: 3641 or CD Rom ref: 3709

Guaranteed delivery dates thanks to unique, high performance logistics.

LSK
D.C. motors
General information

A1 - Quality commitment

A

LEROY-SOMER's quality management system is based on :

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

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

- indicators used to monitor procedure performance.

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

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

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

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

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 **ISO 9001: 2000 certification from the DNV**. Similarly, our environmental approach has enabled us to obtain ISO 14001: 2004 certification.

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

LSK
D.C. motors
General information

A2 - Standards and approvals

ORGANIZATION OF STANDARDS AUTHORITIES

International bodies:

<table>
<tr>
<td>Worldwide
  </td>
<td>General standardization
ISO
International Standards Organisation
TC Technical Committees
SC Sub-committees
WG Working Groups</td>
<td>Electronics and Electrotechnical Certification
IEC
International Electrotechnical Commission
TC Technical Committees
SC Sub-committees
WG Working Groups</td>
</tr>
<tr>
<td>Europe
  </td>
<td>ECS / CEN
European Committee for Standardization
ECISS
European Committee for Iron and Steel Standards
TC Technical Committees</td>
<td>CENELEC
European Committee for Electrotechnical Standardization
TC Technical Committees
SC Sub-committees
AHG Ad-hoc Groups</td>
</tr>
</table>

Country	Initials	Designation
AUSTRALIA	**SAA**	**S**tandards **A**ssociation of **A**ustralia
BELGIUM	**IBN**	**I**nstitut **B**elge de **N**ormalisation
CIS (ex-USSR)	**GOST**	**Go**sudarstvenne Komitet **St**andartov
DENMARK	**DS**	**D**ansk **S**tandardisieringsraad
FINLAND	**SFS**	**S**uomen **S**tandardisoimisliitto
FRANCE	**AFNOR including UTE**	**A**ssociation **F**rançaise de **N**ormalisation including: **U**nion **T**echnique de l'**É**lectricité
GERMANY	**DIN/VDE**	**V**erband **D**eutscher **E**lektrotechniker
GREAT BRITAIN	**BSI**	**B**ritish **S**tandards **I**nstitution
ITALY	**IEC**	**C**omitato **E**lecttrotechnico **I**taliano
JAPAN	**JIS**	**J**apanese **I**ndustrial **S**tandard
NETHERLANDS	**NNI**	**N**ederlands **N**ormalisatie - **I**nstituut
NORWAY	**NFS**	**N**orges **S**tandardisieringsforbund
SAUDI ARABIA	**SASO**	**S**audi **A**rabian **S**tandards **O**rganization
SPAIN	**UNE**	**U**na **N**orma **E**spañola
SWEDEN	**SIS**	**S**tandardisieringskommissionen **I** **S**verige
SWITZERLAND	**SEV or ASE**	**S**chweizerischer **E**lektrotechnischer **V**erein
UNITED STATES	**ANSI including NEMA**	**A**merican **N**ational **S**tandards **I**nstitute including: **N**ational **E**lectrical **M**anufacturers

A2 - Standards and approvals

A

Approvals:

Certain countries recommend or insist on approval from national organizations.

Approved products must carry the recognized mark on their identification plates.

Country	Initials	Organization
USA	**UL or** ᖵU	Underwriters Laboratories
CANADA	**CSA**	Canadian Standards Association
etc...		

Approvals for LEROY-SOMER motors (versions developed from standard construction):

Country	Initials	Certification N°	Application
CANADA	**CSA**	LR 57 008 - 16 LR 57 008 - 20	Standard

International and National Standard equivalents:

International reference standards		National Standard				
IEC	**Title** (summary)	**FRANCE**	**GERMANY**	**U.K.**	**ITALY**	**SWITZERLAND**
60034-1	Ratings and operating characteristics	NFEN 60034-1 NFC 51-120 NFC 51-200	DIN/VDE O530	BS 4999	CEI 2.3.VI.	SEV ASE 3009
60034-2	Determination of losses and efficiency	NFEN 60034-2	DIN/EN 60034-2	BS 4999-102		
60034-5	Classification of degrees of protection	NFEN 60034-5	DIN/EN 60034-5	BS EN 60034-5	UNEL B 1781	
60034-6	Cooling methods	NFEN 60034-6	DIN/EN 60034-6	BS EN 60034-6		
60034-7	Mounting arrangements and assembly layouts	NFEN 60034-7	DIN/EN 60034-7	BS EN 60034-7		
60034-8	Terminal markings and direction of rotation	NFC 51 118	DIN/VDE 0530 Teil 8	BS 4999-108		
60034-9	Noise limits	NFEN 60034-9	DIN/EN 60034-9	BS EN 60034-9		
60034-12	Start characteristics for single speed motors powered from voltages ≤ 660 V	NFEN 60034-12	DIN/EN 60034-12	BS EN 60034-12		SEV ASE 3009-12
60034-14	Mechanical vibration in machines of frame size > 56 mm	NFEN 60034-14	DIN/EN 60034-14	BS EN 60034-14		
60072-1	Dimensions and output powers for machines of between 56 and 400 frame and for flanges of between 55 and 1080	NFC 51 104 NFC 51 105	DIN 748 (~) DIN 42672 DIN 42673 DIN 42631 DIN 42676 DIN 42677	BS 4999		
60085	Evaluation and thermal classification of electrical insulation	NFC 26206	DIN/EN 60085	BS 2757		SEV ASE 3584

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

A2 - Standards and approvals

LSK motors comply with the standards quoted in this catalogue

List of standards quoted in this catalogue

Reference		Date	International Standards
IEC 60034-1	**EN 60034-1**	1999	Electrical rotating machines: ratings and operating characteristics.
IEC 60034-5	**EN 60034-5**	2000	Electrical rotating machines: classification of degrees of protection provided by casings.
IEC 60034-6	**EN 60034-6**	1993	Electrical rotating machines (except traction): cooling methods.
IEC 60034-7	**EN 60034-7**	2000	Electrical rotating machines (except traction): symbols for structural shapes and assembly layout.
IEC 60034-8		2001	Electrical rotating machines: terminal markings and direction of rotation.
IEC 60034-9	**EN 60034-9**	1997	Electrical rotating machines: noise limits.
IEC 60034-14	**EN 60034-14**	1996	Electrical rotating machines: mechanical vibrations of certain machines. Measurement, evaluation and limits of vibrational intensity.
IEC 60038		1999	IEC standard voltages.
IEC 60072-1		1991	Dimensions and flanges between 55 and 1080.
IEC 60085		1984	Evaluation and thermal classification of electrical insulation.
IEC 60721-2-1		1987	Classification of outdoor environmental conditions. Temperature and humidity.
IEC 60892		1987	Effects of an imbalance in the voltage system on the characteristics of three-phase squirrel-cage induction motors.
IEC 61000 2-0/11 & 2-2		1999	Electromagnetic compatibility (EMC): environment.
IEC guide 106		1989	Guidelines on the specification of environmental conditions for the determination of equipment operating characteristics.
ISO 281		2000	Bearings - Basic dynamic loadings and nominal bearing life.
ISO 1680-1 and 2	**EN 21680**	1999	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		1999	Mechanical vibration - Balancing. Conventions on shaft keys and related parts.

A3 - Tolerances on main performance parameters

A

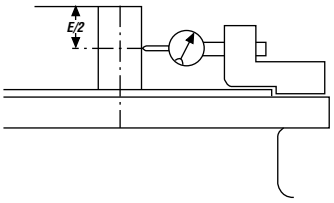
Tolerances for electromechanical characteristics

IEC 60034-1 specifies standard tolerances for electromechanical characteristics.

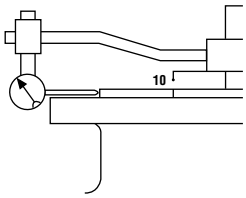
Parameters		Tolerances
Efficiency	machines P ≤ 50 kW	**– 15 % (1 – η)**
	machines P > 50 kW	**– 10 % (1 – η)**
Speed (separate excitation):	a = kW per 1000 min^{-1}	
	a < 0.67	**± 15 %**
	0.67 ≤ a < 2.5	**± 10 %**
	2.5 ≤ a < 10	**± 7.5 %**
	10 ≤ a	**± 5 %**
Moment of inertia		**± 10 %**
Noise		**+ 3 dB (A)**
Vibration		**+ 10 % of guaranteed classification**

Tolerances and adjustments

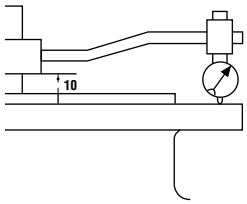
The standard tolerances shown below are applicable to the drawing dimensions given in our catalogues. They fully comply with IEC standard 60072-1.



① ***Excentricity of shaft in flanged motors***



② ***Concentricity of spigot diameter***



③ ***Perpendicularity of mating surface of flange in relation to shaft***

Characteristics	Tolerances
Frame size: H ≤ 250	**0 — 0.5 mm**
H ≥ 280	**0 — 1 mm**
Diameter ∅ of shaft extension:	
- 11 to 28 mm	**j6**
- 32 to 48 mm	**k6**
- 55 mm and over	**m6**
Diameter N of flange spigot:	**j6 up to F 500, js6 for FF 600 and upwards**
Key width:	**h9**
Width of driveshaft keyway: (normal keying)	**N9**
Key depth:	
- square section	**h9**
- rectangular section	**h11**
① ***Excentricity of shaft in flanged motors*** (standard class)	
- diameter > 10 up to 18 mm	**0.035 mm**
- diameter > 18 up to 30 mm	**0.040 mm**
- diameter > 30 up to 50 mm	**0.050 mm**
- diameter > 50 up to 80 mm	**0.060 mm**
- diameter > 80 up to 120 mm	**0.070 mm**
② ***Concentricity of spigot diameter*** and ③ ***perpendicularity of mating surface of flange in relation to shaft*** (standard class)	
Flange (FF) or Faceplate (FT):	
- F 55 to F 115	**0.08 mm**
- F 130 to F 265	**0.10 mm**
- FF 300 to FF 500	**0.125 mm**
- FF 600 to FF 740	**0.16 mm**
- FF 940 to FF 1080	**0.20 mm**

A4 - Units of measurement and standard formulae

A4.1 - ELECTRICITY AND ELECTROMAGNETISM

Quantity				Units		Units and expressions not recommended
Name	**French name**	**Symbol**	**Definition**	**SI**	**Non SI, but accepted**	**Conversion**
Frequency	Fréquence Période	f T	$f = \frac{1}{T}$	Hz (hertz)		
Electric current	Courant électrique (intensité de)	I		A (ampere)		
Electric potential **Voltage** **Electromotive force**	Potentiel électrique Tension Force électromotrice	V U E		V (volt)		
Phase angle	Déphasage	φ	$U = U_m \cos \omega t$ $i = i_m \cos (\omega t - \varphi)$	rad	° degree	
Power factor	Facteur de puissance	$\cos \varphi$				
Impedance **Resistance** **Reactance**	Impédance Résistance Réactance	Z R X	$Z = \lvert Z \rvert e^{j\varphi}$ $= R + jX$ $\lvert Z \rvert = \sqrt{R^2 + X^2}$ $X = L\omega - \frac{1}{C\omega}$	Ω (ohm)		j is defined as $j^2 = -1$ ω pulsation = $2\pi . f$
Self inductance	Inductance propre (self)	L	$L = \frac{\Phi}{I}$	H (henry)		
Capacitance	Capacité	C	$C = \frac{Q}{V}$	F (farad)		
Quantity of electricity	Charge électrique, Quantité d'électricité	Q	$Q = \int I \, dt$	C (coulomb)	A.h 1 A.h = 3600 C	
Resistivity	Résistivité	ρ	$\rho = \frac{R \cdot S}{l}$	Ω.m		Ω/m
Conductance	Conductance	G	$G = \frac{1}{R}$	S (siemens)		1/ Ω = 1S
N° of turns (coil) **N° of phases** **N° of pairs of poles**	Nombre de tours, (spires) de l'enroulement Nombre de phases Nombre de paires de pôles	n m p				
Magnetic field	Champ magnétique	H		A/m		
Magnetic potential difference **Magnetomotive force**	Différence de potentiel magnétique Force magnétomotrice Solénation, courant totalisé	U_m F, F_m H	 $F = \phi H_s d_s$ $H = NI$	A		The unit AT (ampere-turns) is incorrect because it treats "turn" as a physical unit
Magnetic induction **Magnetic flux density**	Induction magnétique Densité de flux magnétique	B		T (tesla) = Wb/m^2		(gauss) 1 G = 10^{-4} T
Magnetic flux	Flux magnétique Flux d'induction magnétique	Φ	$\Phi = \int\int_s Bn \, ds$	Wb (weber)		(maxwell) 1 max = 10^{-8} Wb
Magnetic vector potential	Potentiel vecteur magnétique	A		Wb/m		
Permeability **Permeability of vacuum**	Perméabilité d'un milieu Perméabilité du vide	$\mu = \mu_o \mu_r$ μ_o	$B = \mu H$ $\mu_o = 4\pi 10^{-7}$ H/m	H/m		
Permittivity	Permittivité	$\varepsilon = \varepsilon_o \varepsilon_r$	$\varepsilon_o = \frac{1}{36\pi 10^9}$ F/m	F/m		
Form factor	Facteur de forme	FF	$FF = \frac{I_{rms}}{I_{av}}$			

A4 - Units of measurement and standard formulae

A

A4.2 - THERMODYNAMICS

Quantity				Units		Units and expressions not recommended
Name	**French name**	**Symbol**	**Definition**	**SI**	**Non SI, but accepted**	**Conversion**
Temperature **Thermodynamic**	Température Thermodynamique	T		K (kelvin)	temperature Celsius, t, °C $T = t + 273.15$	°C: degree Celsius $t_C =$ temp. in °C $t_F =$ temp. in °F f temperature Fahrenheit °F $t = \frac{f - 32}{1,8}$ $t_C = \frac{t_F - 32}{1,8}$
Temperature rise	Écart de température	ΔT		K	°C	1 °C = 1 K
Heat flux density	Densité de flux thermique	q, φ	$q = \frac{\Phi}{A}$	W/m^2		
Thermal conductivity	Conductivité thermique	λ		W/m.K		
Total heat transmission thermal capacity	Coefficient de transmission thermique global	K	$\varphi = K\,(Tr_2 - Tr_1)$	W/m^2.K		
Heat capacity	Capacité thermique	C	$C = \frac{dQ}{dT}$	J/K		
Specific heat capacity	Capacité thermique massique	c	$c = \frac{C}{m}$	J/kg.K		
Internal energy	Energie interne	U		J		

A4.3 - NOISE AND VIBRATION

Quantity				Units		Units and expressions not recommended
Name	**French name**	**Symbol**	**Definition**	**SI**	**Non SI, but accepted**	**Conversion**
Sound power level	Niveau de puissance acoustique	L_w	$L_w = 10 \lg (P/P_o)$ $(P_o = 10^{-12}$ W)	dB (decibel)		lg logarithm to base 10 lg10 = 1
Sound pressure level	Niveau de pression acoustique	L_P	$L_P = 20 \lg (P/P_o)$ $(P_o = 2 \times 10^{-5}$ Pa)	dB		

A4.4 - DIMENSIONS

Quantity				Units		Units and expressions not recommended
Name	**French name**	**Symbol**	**Definition**	**SI**	**Non SI, but accepted**	**Conversion**
Angle (plane angle)	Angle (angle plan)	α, β, T, φ		rad	degree: ° minute: ′ second: ″	180° = π rad = 3.14 rad
Length **Breadth** **Height** **Radius**	Longueur Largeur Hauteur Rayon Longueur curviligne	l b h r s		m (meter)	micrometer	cm, dm, dam, hm 1 inch = 1″ = 25.4 mm 1 foot = 1′ = 304.8 mm µm micron µ angström: A = 0,10 N.m
Area	Aire, superficie	A, S		m^2		1 square inch = 6.45 10^{-4} m^2
Volume	Volume	V		m^3	litre: l liter: L	UK galon = 4.546 10^{-3} m^3 US galon = 3.785 10^{-3} m^3

A4 - Units of measurement and standard formulae

A4.5 - MECHANICS

Quantity				Units		Units and expressions not recommended
Name	**French name**	**Symbol**	**Definition**	**SI**	**Non SI, but accepted**	**Conversion**
Time **Time interval / duration** **Period (duration of a cycle)**	Temps Intervalle de temps, durée Période (durée d'un cycle)	t T		s (second)	minute: min hour: h day: d	Symbols ′ and ″ are reserved for angles. minute not written as mn
Angular velocity **Rotational frequency**	Vitesse angulaire Pulsation	ω	$\omega = \frac{d\varphi}{dt}$	rad/s		
Angular acceleration	Accélération angulaire	α	$\alpha = \frac{d\omega}{dt}$	rad/s^2		
Speed **Velocity**	Vitesse Célérité	$u, v, w,$ c	$v = \frac{ds}{dt}$	m/s	1 km/h = 0.277778 m/s 1 m/min = 0.0166 m/s	
Acceleration **Acceleration due to gravity**	Accélération Accélération de la pesanteur	a $g = 9.81$ m/s^2	$a = \frac{dv}{dt}$ (approx)	m/s^2		
Speed of rotation	Vitesse de rotation	N		s^{-1}	min^{-1}, rpm	tr/mn, RPM, TM...
Mass	Masse	m		kg (kilogram)	tonne: t 1 t = 1000 kg	kilo, kgs, KG... 1 pound: 1 lb = 0.4536 kg
Density	Masse volumique	ρ	$\frac{dm}{dV}$	kg/m^3		
Linear density	Masse linéique	ρ_e	$\frac{dm}{dL}$	kg/m		
Surface density	Masse surfacique	ρ_A	$\frac{dm}{dS}$	kg/m²		
Momentum	Quantité de mouvement	P	$p = m.v$	kg.m/s		
Moment of inertia	Moment d'inertie	J, I	$I = \sum m.r^2$	kg.m^2		$J = \frac{MD^2}{4}$ kg.m^2 pound per square foot = 1 lb.ft^2 $= 42.1 \times 10^{-3}$ kg.m^2
Force **Weight**	Force Poids	F G	 $G = m.g$	N (newton)		kgf = kgp = 9.81 N pound force = lbF = 4.448 N
Moment of force **Torque**	Moment d'une force	M T	$M = F.r$	N.m		mdaN, mkg, m.N 1 mkg = 9.81 N.m 1 ft.lbF = 1.356 N.m 1 in.lbF = 0.113 N.m
Pressure	Pression	p	$p = \frac{F}{S} = \frac{F}{A}$	Pa (pascal)	bar 1 bar = 10^5 Pa	1 kgf/cm^2 = 0.981 bar 1 psi = 6894 N/m^2 = 6894 Pa 1 psi = 0.06894 bar 1 atm = 1.013×10^5 Pa
Normal stress **Shear stress**	Contrainte normale Contrainte tangentielle, Cission	σ τ		Pa MPa = 10^6 Pa is used		kg/mm^2, 1 daN/mm^2 = 10 MPa psi = pound per square inch 1 psi = 6894 Pa
Friction coefficient	Facteur de frottement	μ				incorrectly = friction coefficient f
Work **Energy** **Potential energy** **Kinetic energy** **Quantity of heat**	Travail Énergie Énergie potentielle Énergie cinétique Quantité de chaleur	W E Ep Ek Q	$W = F.l$	J (joule)	Wh = 3600 J (watt-hour)	1 N.m = 1 W.s = 1 J 1 kgm = 9.81 J (calorie) 1 cal = 4.18 J 1 Btu = 1 055 J (British thermal unit)
Power	Puissance	P	$P = \frac{W}{t}$	W (watt)		1 ch = 736 W 1 HP = 746 W
Volumetric flow	Débit volumique	q_v	$q_v = \frac{dV}{dt}$	m^3/s		
Efficiency	Rendement	η		< 1		%
Dynamic viscosity	Viscosité dynamique	η, μ		Pa.s		poise, 1 P = 0.1 Pa.s
Kinematic viscosity	Viscosité cinématique	ν	$\nu = \frac{\eta}{\rho}$	m^2/s		stokes, 1 St = 10^{-4} m^2/s

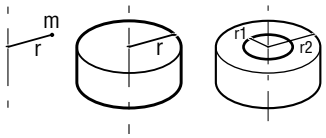
A5 - Unit conversions

A

Units	MKSA (international system)	AGMA (US system)
Length	1 m = 3.2808 ft 1 mm = 0.03937 in	1 ft = 0.3048 m 1 in = 25.4 mm
Mass	1 kg = 2.2046 lb	1 lb = 0.4536 kg
Torque	1 N.m = 0.7376 lb.ft 1 N.m = 141.6 oz.in	1 lb.ft = 1.356 N.m 1 oz.in = 0.00706 N.m
Force	1 N = 0.2248 lb	1 lb = 4.448 N
Moment of inertia	1 $kg.m^2$ = 23.73 $lb.ft^2$	1 $lb.ft^2$ = 0.04214 $kg.m^2$
Power	1 kW = 1.341 HP	1 HP = 0.746 kW
Pressure	1 kPa = 0.14505 psi	1 psi = 6.894 kPa
Magnetic flux	1 T = 1 Wb / m^2 = 6.45210^4 line / in^2	1 line / in^2 = 1.55010^{-5} Wb / m^2
Magnetic losses	1 W / kg = 0.4536 W / lb	1 W / lb = 2.204 W / kg

A6 - Standard formulae used in electrical engineering

A6.1 - MECHANICAL FORMULAE

Title	Formula	Units	Definitions / Notes
Force	$F = m \cdot \gamma$	F in N m in kg γ in m/s^2	A force F is the product of a mass m multiplied by an acceleration γ
Weight	$G = m \cdot g$	G in N m in kg g = 9.81 m/s^2	
Torque (moment)	$M = F \cdot r$	M in N.m F in N r in m	The torque (moment) M of a force in relation to an axis is the product of that force multiplied by the distance r of the point of application of F in relation to the axis.
Power - Rotation	$P = M \cdot \omega$	P in W M in N.m ω in rad/s	Power P is the quantity of work yielded per unit of time $\omega = 2\pi N/60$ where N is the speed of rotation in min^{-1} (rpm)
- Linear	$P = F \cdot V$	P in W F in N V in m/s	V = linear velocity
Acceleration time	$t = J \cdot \frac{\omega}{M_a}$	t in s J in kg.m^2 ω in rad/s M_a in N.m	J is the moment of inertia of the system M_a is the moment of acceleration Note: All the calculations refer to a single rotational speed ω where the inertias at ω' are corrected to speed ω by the following calculation: $J_\omega = J_{\omega'} \cdot \left(\frac{\omega}{\omega}\right)^2$
Moment of inertia Centre of gravity	$J = m \cdot r^2$	J in kg.m^2 m in kg r in m	
Solid cylinder around its shaft	$J = m \cdot \frac{r^2}{2}$		
Hollow cylinder around its shaft	$J = m \cdot \frac{r_1^2 + r_2^2}{2}$		
Inertia of a mass in linear motion	$J = m \cdot \left(\frac{v}{\omega}\right)^2$	J in kg.m^2 m in kg v in m/s ω in rad/s	The moment of inertia of a mass in linear motion transformed to a rotating motion.

A6 - Standard formulae used in electrical engineering

A

A6.2 - MOTOR FORMULAE

Title	Formula	Units	Definitions / Notes
Accelerating torque (couple)	$M_a = \frac{M_D + 2M_A + 2M_M + M_N}{6} - M_r$ *General formula:* $M_a = \frac{1}{N_N}\int_0^{N_N}(M_{mot} - M_r)dN$	*N.m*	The moment of acceleration M_a is the difference between the motor torque M_m (estimated), and the resistive torque of the load M_r. N = instantaneous speed N_N = rated speed
Torque (moment)	$M = \frac{9549 \cdot P \cdot \eta}{n}$	M in N.m P in kW n in min^{-1} η no unit	Torque (moment) available at the motor shaft.
Power required by the machine	$P = \frac{M \cdot \omega}{\eta_A}$	P in W M in N.m ω in rad/s η_A no unit	η_A expreses the efficiency of the driven machine. M is the torque required by the driven machine.
Power drawn by the motor (rectified current)	$P = U_{ind} \cdot I_{ind}$	P in W U_{ind} in V I_{ind} in A	U armature voltage. I armature current.
Power supplied by the motor (rectified current)	$P = U_{ind} \cdot I_{ind} \cdot \eta$	P in W U_{ind} in V I_{ind} in A	η expresses motor efficiency at the point of operation under consideration.
Efficiency	$\eta = \frac{P}{U_{ind} \cdot I_{ind}}$	P in W U_{ind} in V I_{ind} in A	P is the power rating shown in the selection tables.

B1 - Definition of "Index of protection" (IP)

Indices of protection of electrical equipment enclosures in accordance with IEC 60034-5 - EN 60034-5 (IP) - EN 50102 (IK)

LSK motors are IP 23S as standard

First number: protection against solid objects		
IP	**Tests**	**Definition**
0		**No protection**
1	∅ 50 mm	**Protection against solid objects of over 50 mm (e.g. accidental hand contact)**
2	∅ 12 mm	**Protected against solid objects of over 12 mm (e.g : finger)**
3	∅ 2.5 mm	**Protected against solid objects of over 2.5 mm (e.g. : tools, wire)**
4	∅ 1 mm	**Protected against solid objects of over 1 mm (e.g. : thin wire)**
5		**Protected against dust (no deposits of harmful material)**
6		**Protected against any dust penetration**

Second number: protection against liquids		
IP	**Tests**	**Definition**
0		**No protection**
1		**Protected against vertically dripping water (condensation)**
2	15°	**Protected against water dripping up to 15° from the vertical**
3	60°	**Protected against water dripping up to 60° from the vertical**
4		**Protected against water splashes from all directions**
5		**Protected against jets of water from all directions**
6		**Protected against jets of water comparable to heavy seas**
7	0,15 m / 1 m	**Protected against the effects of immersion to depths of between 0.15 and 1 m**
8	..m	**Protected against the effects of prolonged immersion at depth**

Third number: mechanical protection		
IK	**Tests**	**Definition**
00		**No protection**
01	150 g / 10 cm	**Impact energy : 0.15 J**
02	200 g / 10 cm	**Impact energy : 0.20 J**
03	250 g / 15 cm	**Impact energy : 0.37 J**
04	250 g / 20 cm	**Impact energy : 0.50 J**
05	350 g / 20 cm	**Impact energy : 0.70 J**
06	250 g / 40 cm	**Impact energy : 1 J**
07	0.5 kg / 40 cm	**Impact energy : 2 J**
08	1.25 kg / 40 cm	**Impact energy : 5 J**
09	2.5 kg / 40 cm	**Impact energy : 10 J**
10	5 kg / 40 cm	**Impact energy : 20 J**

Example:

IP 55 / IK 08 machine

IP : Index of protection

5 : Machine protected against dust and accidental contact.
Test result: ***no dust enters*** *in harmful quantities, no risk of direct contact with rotating parts.*
The test should last for 2 hours (test result: no talc enters which could affect the running of the motor).

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

IK 08: Machine **resistant to impacts** of 5 Joules (impact of a 1.25 kg hammer dropped from a height of 0.4 metres). *Test result: damage caused by impacts does not affect the running of the motor.*

Atmospheric protection index (S): indicates that tests for water penetration damage have been performed on the machine while it is stopped. This degree of protection is shown by the letter **S** placed after the index numbers.
Atmospheric protection index (W): a machine is said to be weatherproof when its construction reduces the penetration of rain, snow and airborne particles to a value compatible with the correct running of the machine.
This degree of protection is shown by the letter **W** inserted between IP and the index numbers.

B2 - Environmental limitations

B2.1 - NORMAL OPERATING CONDITIONS

Under IEC standard 60034-1, 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.
- please note that continuous operation in under-load (<50%) may require an adaptation. Please consult Leroy-Somer.

B2.2 - CORRECTION DEPENDING ON ALTITUDE AND AMBIENT TEMPERATURE

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

B2.3 - 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.

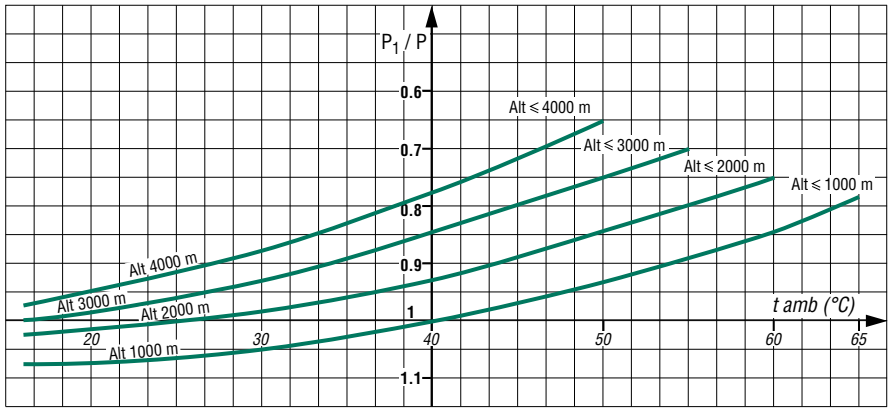
The brushes are designed to be used in conditions of widely ranging humidity. Thus their selection must be based on an average measurement.

Definitions:

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

When the pressure of water vapour contained in the atmosphere is equal to the maximum pressure (increasing function of temperature) of water vapour at ambient temperature, saturation will be reached.

Correction coefficients depending on altitude and ambient temperature.



Absolute humidity (in g/m^3) H_a:

weight of water vapour in the air.

Relative humidity (%) H_r:

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.

If there is no specific measuring device available, the following method using two thermometers can be adopted.

Measuring humidity:

Humidity can be measured using the "wet and dry bulb thermometer" method (the bulb of the wet thermometer is wrapped in wet cotton wool).

The drier the atmosphere, the greater the temperature difference.

Absolute humidity, calculated from the readings taken on the two thermometers, can be determined using the chart opposite.

To determine humidity correctly, a good air flow is required for stable readings, and accurate readings must be taken on the thermometers.

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 the table in section B3.

B2.4 - DRAIN HOLES

Holes are provided at the lowest points of the machine enclosure (LSK 1124 to 1604) to drain off any moisture which may have accumulated inside machines used in version IP 54 or IP 55, which must be specified in the order.

After draining, the plastic plugs must be refitted in order to maintain the level of protection.

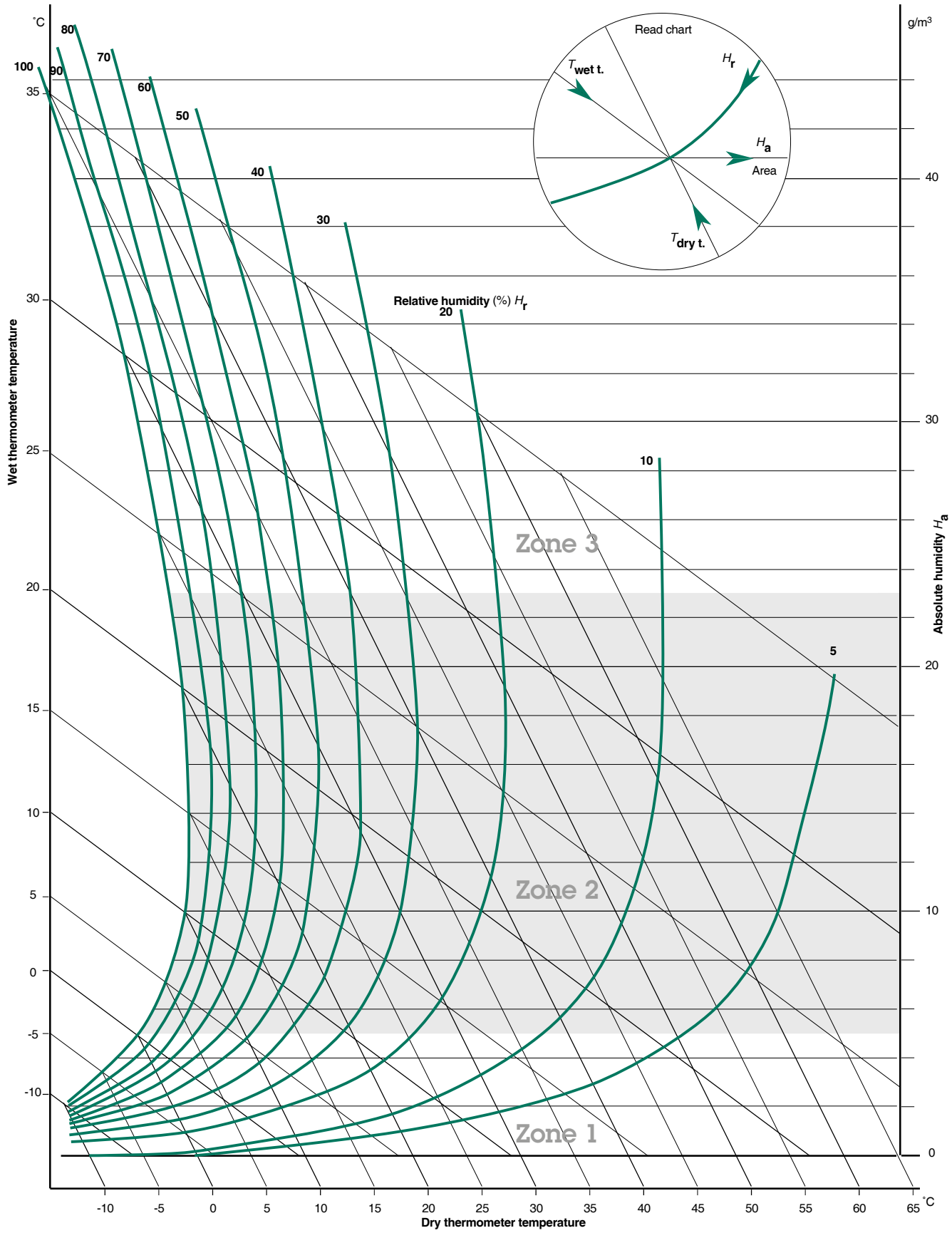
B2.5 - DRIP COVERS

For machines operating vertically outdoors with the drive shaft downwards, drip covers are recommended.

This is an option and should be mentioned on the order if required.

B2 - Environmental limitations

Chart for determining operating zone according to humidity and temperature.



B3 - 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 below shows the protection which is appropriate to the operating zone (see chart in section B2.3 on the previous 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".

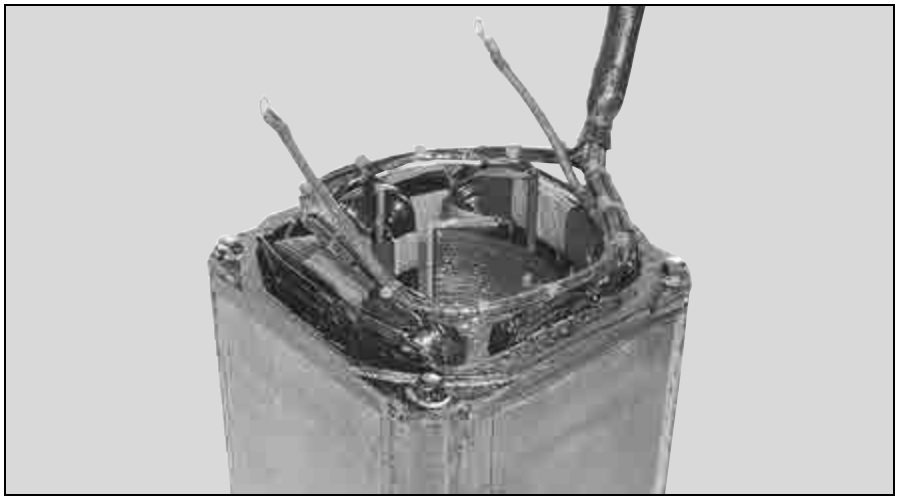
For high humidity environments, we advise that the windings are preheated (see opposite page).

	Operating zones*			
Ambient temperature	**Z1**	**Z2**	**Z3**	**Influence on manufacturing**
$t < -16$ °C	ask for estimate (quotation)	ask for estimate (quotation)	-	
$-16 \leq t < +5$ °C	Ta 1	T1	-	
$+5 \leq t < +40$ °C	Ta	T	TC	
$+5 \leq t \leq +65$ °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**			

Increased derating

Standard impregnation

**: see chart on previous page.*



B4 - Heaters

B4.1 - SPACE HEATERS (OPTION)

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.

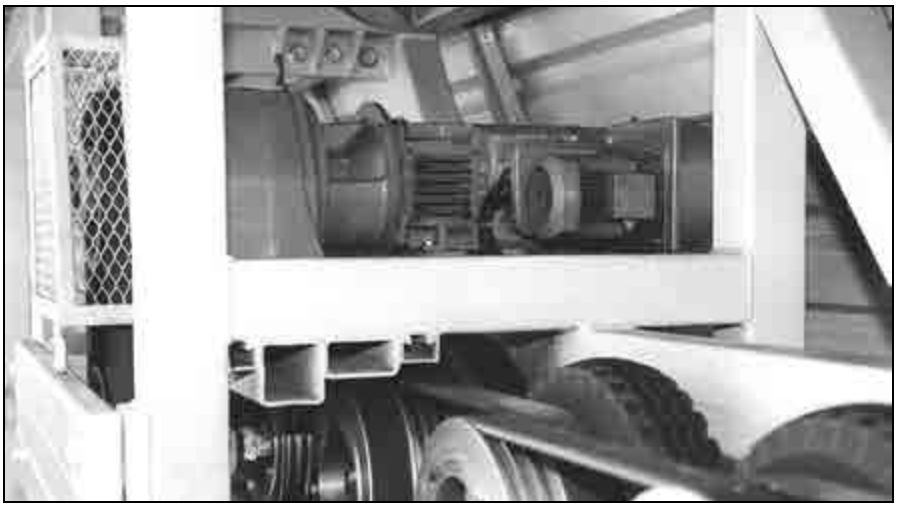
LSK motor model	Type of heater	Number and power (in W)
1124	ACM 004	2 x 25
1324	ACM 004	2 x 25
1604	ACM 004	2 x 25
1804 & 1804C	ACM 004	2 x 50
2004	ACM 004	2 x 50
2254	ACM 004	2 x 50
2504C	ACM 004	4 x 50
2804C	ACM 004	4 x 50
3554C	ACM 004	6 x 50

The space heaters use 200/240V, single phase.

B4.2 - D.C. INJECTION

An alternative to the use of space heaters is reduced voltage supply (20% of the rated value) to the field coils. This is often sufficient and avoids the use of space heaters.

LEROY-SOMER Mentor MP speed controllers provide this facility. Alternatively power can be supplied via a transformer (with a rectifier if required) and separate connections.



B5 - External finish

LEROY-SOMER motors are protected with a wide range of surface finishes.
The surfaces receive appropriate special treatments, as shown below.

Standard LSK motors conform to System Ia

B

Preparation of surfaces

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

Painting systems

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

System **Ia** is for moderate climates and system **IIa** for general climates, as defined in IEC 721.2.1.

LEROY-SOMER standard paint colour reference :

RAL 6000

B6 - Interference suppression

Application of the Electromagnetic Compatibility Directive 89-336 EEC modified by Directives 92/31 and 93/68

Airborne interference

Emission

For standard motors, the housing acts as an electromagnetic screening, reducing electromagnetic emissions measured at 0.25 metres from the motor to approximately 5 gauss (5×10^{-4} T).

However, electromagnetic emissions may be noticeably reduced by a special construction of aluminium alloy end shields and a stainless steel shaft.

Immunity

The construction of motor housings (especially the finned aluminium alloy housing) isolates external electromagnetic sources to the extent that any field penetrating the casing and magnetic circuit will be too weak to interfere with the operation of the motor.

Power supply interference

The use of electronic systems for starting, speed control or power supply can create harmonics on the supply lines which may interfere with the operation of machines. These phenomena are taken into account in determining the machine dimensions, which act as quenching chokes in this respect.

Standard IEC 61000, currently in preparation, will define permissible rejection and immunity rates. Only then will machines for general distribution (especially single-phase and commutator motors) have to be fitted with interference suppression systems.

Interference normally produced during operation usually occurs in transient states. If the motor casing acts as an electromagnetic screen, radiation may occur via the motor power cables (+ and -). This radiation can be prevented either by using screened cables, or by the use of a filter on the armature for small motors.

According to the Machinery Directive 89/392/EEC, D.C. motors or generators are components designed to be incorporated in machines (refer to EN 60204-1 for installation). As far as EMC (89/336/EEC) is concerned, however, equipment for connecting to the mains (contactor) may require interference suppression protection. Follow the controller manufacturer's instructions. Contact LEROY-SOMER if necessary.

Application of Directive 89-336 modified by Directives 92-31 and 93-68 concerning electromagnetic compatibility (EMC).

a - for motors only

Our motors meet the requirements of the standard in that they do not generate electromagnetic interference exceeding the limits fixed by the directive (ref. IEC 2/922/CD) and corresponding to that of the standard EN 50081-2.

Our D.C. motors are not affected by external electromagnetic interference.

Our D.C. motors meet the requirements of standard EN 50081-2 concerning electro-magnetic emission.

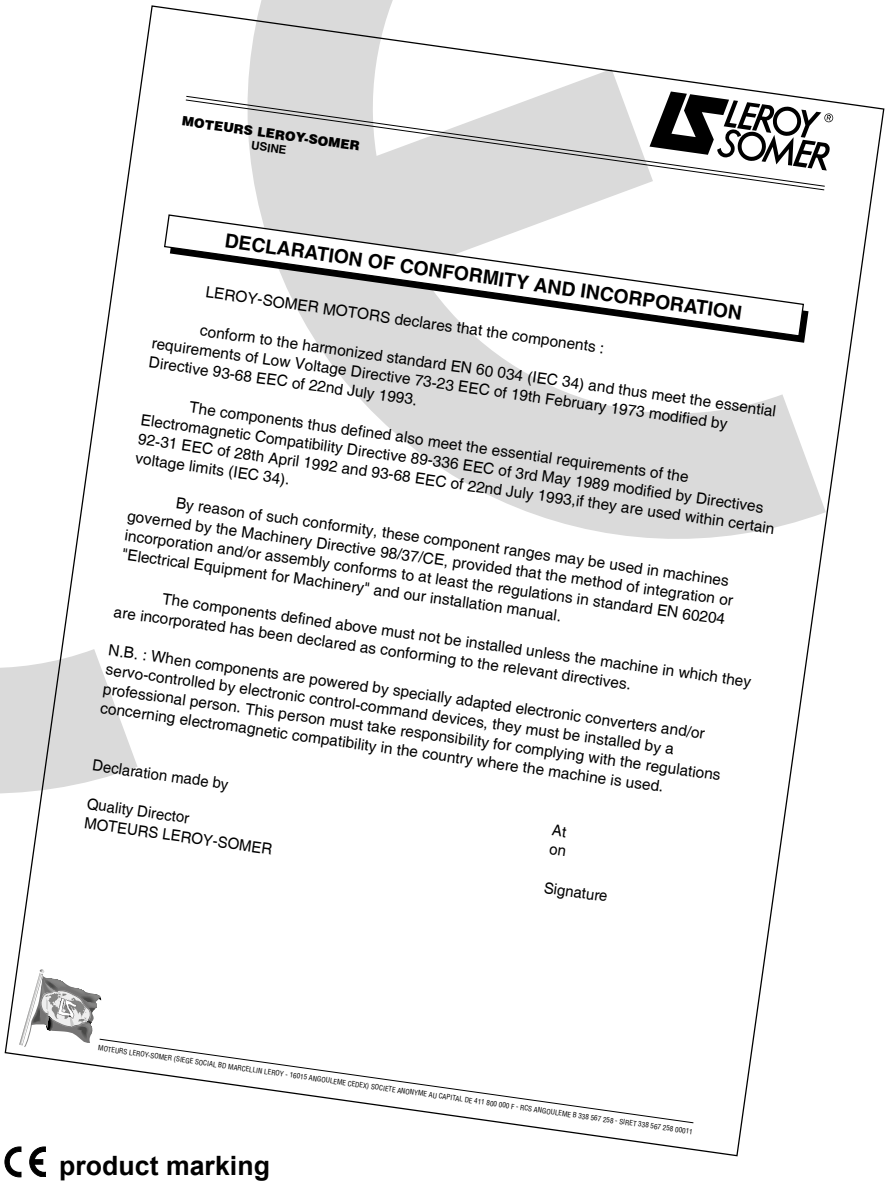
D.C. motors satisfy the requirements of standard EN 50082-2 concerning immunity in industrial environments.

b - for motors supplied by variable speed controllers

In this case, the motor is only a subassembly of a device which the system builder must ensure conforms to the essential requirements of the EMC directives.

Application of the Low Voltage Directive 73-23 EEC modified by Directive 93/68

All motors have been subject to this directive since 1-07-97. The main requirements concern the protection of people, animals and property against risks caused by operation of the motors (see the commissioning and maintenance manual for precautions to be taken).



MOTEURS LEROY-SOMER
USINE

LEROY SOMER

DECLARATION OF CONFORMITY AND INCORPORATION

LEROY-SOMER MOTORS declares that the components :

conform to the harmonized standard EN 60 034 (IEC 34) and thus meet the essential requirements of Low Voltage Directive 73-23 EEC of 19th February 1973 modified by Directive 93-68 EEC of 22nd July 1993.

The components thus defined also meet the essential requirements of the Electromagnetic Compatibility Directive 89-336 EEC of 3rd May 1989 modified by Directives 92-31 EEC of 28th April 1992 and 93-68 EEC of 22nd July 1993,if they are used within certain voltage limits (IEC 34).

By reason of such conformity, these component ranges may be used in machines governed by the Machinery Directive 98/37/CE, provided that the method of integration or incorporation and/or assembly conforms to at least the regulations in standard EN 60204 "Electrical Equipment for Machinery" and our installation manual.

The components defined above must not be installed unless the machine in which they are incorporated has been declared as conforming to the relevant directives.

N.B. : When components are powered by specially adapted electronic converters and/or servo-controlled by electronic control-command devices, they must be installed by a professional person. This person must take responsibility for complying with the regulations concerning electromagnetic compatibility in the country where the machine is used.

Declaration made by

Quality Director
MOTEURS LEROY-SOMER

At
on

Signature

MOTEURS LEROY-SOMER (SIEGE SOCIAL BD MARCELLIN LEROY - 16015 ANGOULEME CEDEX) SOCIETE ANONYME AU CAPITAL DE 411 800 000 F - RCS ANGOULEME B 338 567 258 - SIRET 338 567 258 00011

CE product marking

The fact that motors conform to the essential requirements of the Directives is shown by the CE mark on their nameplates and/or packaging and documentation.

C1 - Mounting arrangements

The various mounting arrangements for machines are defined in IEC 60034-7. Below is an extract from the standard which shows equivalent terms in current use.

Code I	Code II
IM B 3	IM 1001
IM V 5	IM 1011
IM V 6	IM 1031
IM B 6	IM 1051
IM B 7	IM 1061
IM B 8	IM 1071
IM B 20	IM 1101
IM B 15	IM 1201
IM B 35	IM 2001
IM V 15	IM 2011
IM V 36	IM 2031
IM B 34	IM 2101
IM B 5	IM 3001
IM V 1	IM 3011
IM V 21	IM 3051
IM V 3	IM 3031
IM V 4	IM 3211
IM V 2	IM 3231
IM B 14	IM 3601
IM V 18	IM 3611
IM V 19	IM 3631
IM B 10	IM 4001
IM V 10	IM 4011
IM V 14	IM 4031
IM V 16	IM 4131
IM B 9	IM 9101
IM V 8	IM 9111
IM V 9	IM 9131
IM B 30	IM 9201
IM V 30	IM 9211
IM V 31	IM 9231

Codes I and II are interchangeable. It should however be noted that the above code list is not exhaustive and you should therefore refer to IEC 60034-7 for other designations.

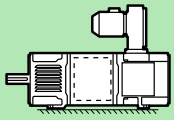
On the next page you will find the standard mounting arrangements, with line drawings and an explanation of the standard symbols used.

C1 - Mounting arrangements

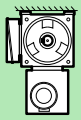
Mountings and positions (IEC standard 60034-7)

Foot mounted motors

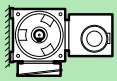
IM 1001 (IM B3)
- Horizontal shaft
- Feet on floor



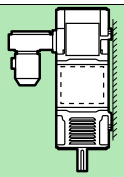
IM 1071 (IM B8)
- Horizontal shaft
- Feet on ceiling



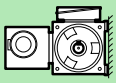
IM 1051 (IM B6)
- Horizontal shaft
- Foot wall mounted with feet on left hand side when viewed from drive end



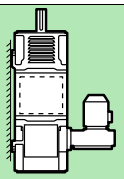
IM 1011 (IM V5)
- Vertical shaft facing down
- Feet on wall



IM 1061 (IM B7)
- Horizontal shaft
- Foot wall mounted with feet on right hand side when viewed from drive end

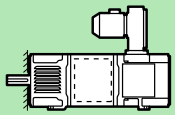


IM 1031 (IM V6)
- Vertical shaft facing up
- Feet on wall

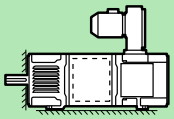


(FF) flange mounted motors
Foot and (FF) flange mounted motors

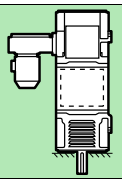
IM 3001 (IM B5)
- Horizontal shaft



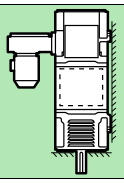
IM 2001 (IM B35)
- Horizontal shaft
- Feet on floor



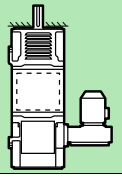
IM 3011 (IM V1)
- Vertical shaft facing down



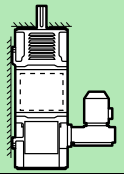
IM 2011 (IM V15)
- Vertical shaft facing down
- Feet on wall



IM 3031 (IM V3)
- Vertical shaft facing up



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



Mounting options according to the frame size
Some operating positions are not permitted for motors in the standard range.
Select the possible configurations for installation in the machine from the table below.
In case of difficulty, please consult Leroy-Somer.

Frame size	Mounting position											
	IM 1001	IM 1051	IM 1061	IM 1071	IM 1011	IM 1031	IM 3001	IM 3011	IM 3031	IM 2001	IM 2011	IM 2031
112	●	●	●	●	●	●	●	●	●	●	●	●
132	●	●	●	●	●	●	●	●	●	●	●	●
160	●	●	●	●	●	●		●	●	●	●	●
180	●	●	●	●	●	●		●		●	●	●
200	●							●		●	●	
225	●							●		●	●	
250	●							●		●	●	
280	●							●		●	●	
355	●									●		

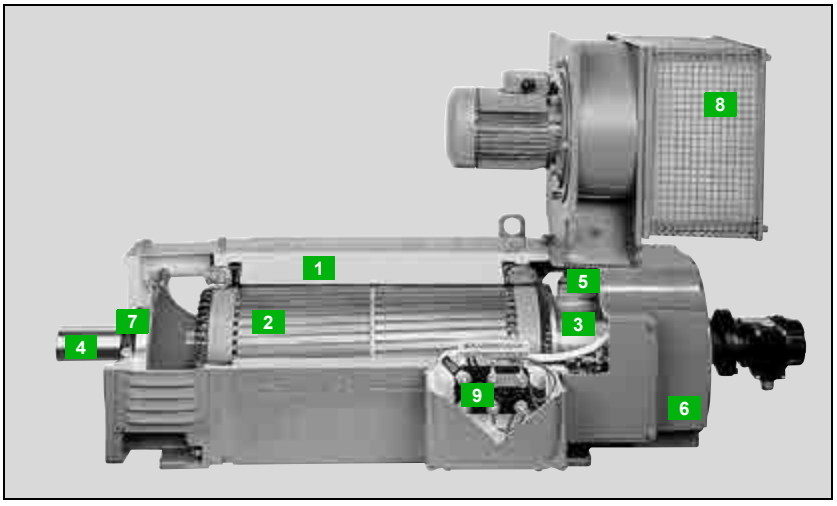
●: Possible positions. Please consult Leroy-Somer about any other positions.

LSK
D.C. motors
Construction

C2 - Components

Description of LEROY-SOMER LSK D.C. motors (IC 06)

Component	Materials	Remarks
1 Stator (or body)	Insulated low-carbon magnetic steel laminations. Class H insulated electro-plated copper	- low carbon content guarantees long-term lamination pack stability - laminations prestressed and welded using MIG process - main poles built into all of the range (except LSK 1324C & 1604C) - auxiliary poles built in up to LSK 1604, above that they are separate - class H insulation
2 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 - cooling ducts - class H insulation
3 Commutator	Silver-plated copper on plastic	- toothed type - large number of segments - cooled via ducts
4 Shaft	Steel	- open keyway - round-ended key
5 Brush holder Brushes	Thermoset plastic and bronze Electrographite compound	- moulded, rigid, can be rotated - adjustment position marked in relation to neutral axis - evenly-spaced accurate brush holders - as an option: detection of wear limit on brush holders - brushes with dampers
6 End shields	FGL cast iron	- flange built into front end shield (manufactured on request: LSK 1124 to 1804) - feet built into front and rear end shields - inspection doors on front end shield: 3 on LSK 1124 to 1604, 4 on larger models - 4 inspection doors on rear end shield - square inspection doors, all with identical mounting to allow accessories to be fixed at 90° (LSK 1124 to 1324)
7 Bearings and lubrification	Steel	- ball bearings, series 6300 (wide), C3 play, with high load capacity - type 2RS, dust and damp protected, permanently greased up to LSK 2004, and above this, open with a greasing system - front bearing preloaded - translational movement of rear bearing blocked
8 Fan	Sheet steel	- multivoltage, multifrequency, 2 pole, IP55 fan motor - multiposition fan, separate from the position of the terminal box - axial fan cooling kit
9 Terminal box	Aluminium alloy Cast iron Steel	- multiposition - removable cable gland support plate - can be located at the rear (LSK 1124 to 1604) - IP 55 (dust and damp protected) - 6 terminals + connector for options



C3 - Bearings and lubrication

C3.1 - BEARINGS AND BEARING LIFE

Definitions

Load ratings

- Basic static load C_o:

This is the load for which permanent deformation at point of contact between a bearing race and the ball (or roller) with the heaviest load reaches 0.01% of the diameter of the ball or (roller).

- Basic dynamic load C:

This is the load (constant in intensity and direction) for which the nominal lifetime of the bearing will reach one million revolutions.

The static load rating C_o and the dynamic load rating C are obtained for each bearing by following the method in ISO 281.

Lifetime

The lifetime of a bearing is the number of revolutions (or number of operating hours at a constant speed) that the bearing can accomplish before the first signs of fatigue (spalling) begin to appear on a ring or rolling component.

- Nominal lifetime L_{10h}

According to the ISO recommendations, the nominal lifetime is the length of time completed or exceeded by 90% of apparently identical bearings operating under the conditions specified by the manufacturer.

Note: The majority of bearings last much longer than the nominal lifetime; the length of time achieved or exceeded by 50% of bearings is around 5 times longer than the nominal lifetime.

Determination of nominal lifetime

Constant load and rotation speed

The nominal lifetime of a bearing expressed in operating hours L_{10h}, the dynamic load C expressed in daN and the load applied (radial load F_r and axial load F_a) are related by the following equation

$$L_{10h} = \frac{1000000}{60 \cdot N} \cdot \left(\frac{C}{P}\right)^p$$

where N = rotational speed (min^{-1})

P ($P = X F_r + Y F_a$) : Equivalent Dynamic Load (F_r, F_a, P in daN)

p: an index which depends on the type of contact between the races and the rolling elements

p = 3 for ball bearings

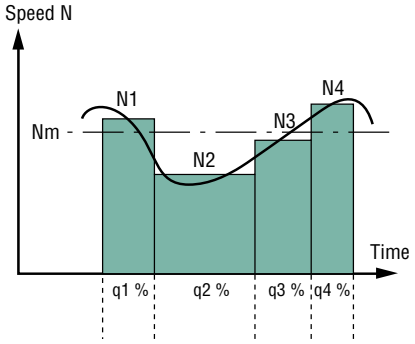
p = 10/3 for roller bearings

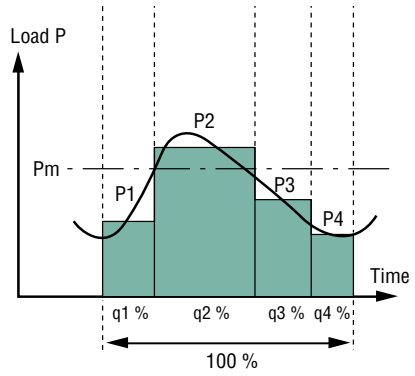
The formulae that give Equivalent Dynamic Load (values of factors X and Y) for different types of bearing may be obtained from their respective manufacturers.

Variable load and rotation speed

For bearings with periodically variable load and speed, the nominal lifetime is established using the equation:

$$L_{10h} = \frac{1000000}{60 \cdot N_m} \cdot \left(\frac{C}{P_m}\right)^p$$





N_m: the average rotational speed in min^{-1}

$$N_m = N_1 \cdot \frac{q_1}{100} + N_2 \cdot \frac{q_2}{100} + \ldots (min^{-1})$$

P_m: the average Equivalent Dynamic Load in daN

$$P_m = \sqrt[P]{P_1^P \cdot \left(\frac{N_1}{N_m}\right) \cdot \frac{q_1}{100} + P_2^P \cdot \left(\frac{N_2}{N_m}\right) \cdot \frac{q_2}{100} + \ldots (daN)}$$

where q_1, q_2, etc. are in %

Nominal lifetime L_{10h} is applicable to bearings made of bearing steel and normal et operating conditions (lubricating film present, no pollution, correctly fitted, etc.).

Situations and data differing from those given above will lead to either a reduction or an increase in lifetime compared to the nominal lifetime.

Corrected nominal lifetime

If the ISO recommendations (DIN ISO 281) are used, improvements to bearing steel, manufacturing processes and the effects of operating conditions may be integrated into the nominal lifetime calculation.

The theoretical pre-fatigue lifetime L_{nah} is thus calculated using the formula:

$L_{nah} = a_1\, a_2\, a_3\, L_{10h}$

where:

a_1: the failure probability factor.

a_2: the factor for the characteristics and tempering of the steel.

a_3: the factor for the operating conditions (lubricant quality, temperature, rotational speed, etc.).

Under normal operating conditions for LSK motors the corrected nominal lifetime, calculated with a failure probability factor $a_1 = 1$ (L_{10ah}), is longer than the nominal lifetime L_{10h}.

C

C3 - Bearings and lubrication

C3.2 - TYPES OF BEARING AND STANDARD FITTING ARRANGEMENTS

On the standard version, except for LSK 1124 and LSK 3554, the bearings are identical for drive end (DE bearing) and non drive end (NDE bearing).

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). The bearings are pre-loaded by using a flexible washer device 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, up to the LSK 2004C inclusive, and with grease nipple for the larger models, allowing a lifetime L_{10h} of 20,000 hours in good environmental conditions.

For difficult environments or intensive use at high speed, LEROY-SOMER recommends using the option of bearings fitted with grease nipples (LSK 1124 to 2004C) which enables relubrication from time to time: see section C3.4.

Optional waterproof flange

For bearings fitted with grease nipples, on motors in the upright position with shaft facing down, LEORY-SOMER recommends the optional waterproof seal to avoid possible seepage of grease between the end shield and the shaft.

Note: Leroy-Somer recommend the use of roller bearings in cases where the shaft is subjected to a permanent radial load which exceeds the capacity of the ball bearing (this often occurs with pulley and belt driven machines): refer to section C3.3.

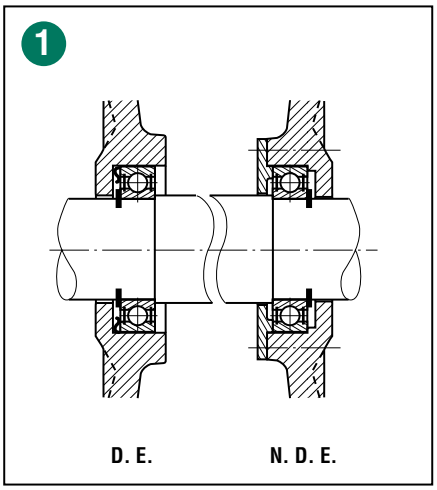
Important: When ordering, state which option is required, if any.

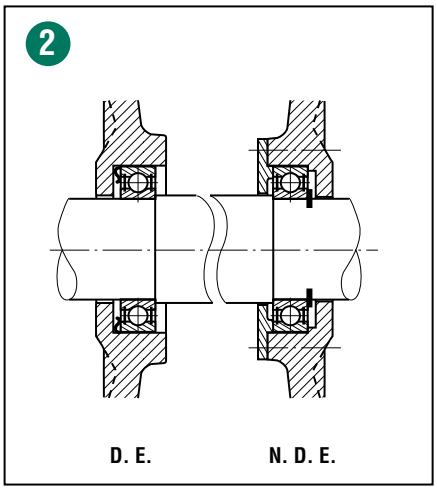
LSK motor model	Drive end bearing (D.E.)	Non drive end bearing (N.D.E.)	Fitting arrangement			Assembly
			Waterproof bearing	Bearing with grease nipple	With optional seal	diagram reference
1124	6308 2RS C3	6308 2RS C3	●			1
1124	6308 C3	6308 C3		●		4
1124	6308 2RS C3	6308 2RS C3	●		●	5
1124	6308 C3	6308 C3		●	●	7
1324	6310 2RS C3	6310 2RS C3	●			1
1324	6310 C3	6310 C3		●		4
1324	6310 2RS C3	6310 2RS C3	●		●	5
1324	6310 C3	6310 C3		●	●	7
1604	6312 2RS C3	6312 2RS C3	●			1
1604	6312 C3	6312 C3		●		4
1604	6312 2RS C3	6312 2RS C3	●		●	5
1604	6312 C3	6312 C3		●	●	7
1804	6313 2RS C3*	6313 2RS C3*	●			2
1804	6313 C3	6313 C3		●		3
1804	6313 2RS C3*	6313 2RS C3*	●		●	6
1804	6313 C3	6313 C3		●	●	8
2004	6314 2RS C3*	6314 2RS C3*	●			2
2004	6314 C3	6314 C3		●		3
2004	6314 2RS C3*	6314 2RS C3*	●		●	6
2004	6314 C3	6314 C3		●	●	8
2254	6317 C3	6317 C3		●		3
2254	6317 C3	6317 C3		●	●	8
2504	6322 C3	6322 C3		●		3
2504	6322 C3	6322 C3		●	●	8
2804	6324 C3	6324 C3		●		3
2804	6324 C3	6324 C3		●	●	8
3554	6326 C3	6324 C3		●		9

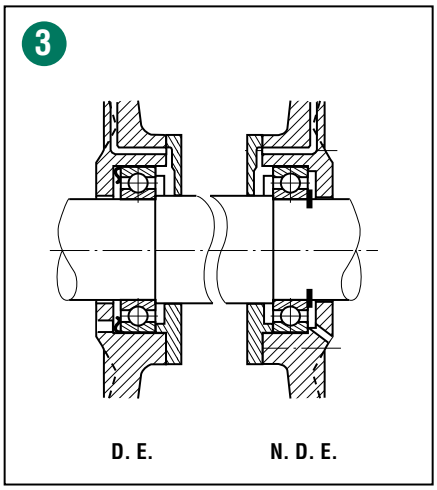
*: If these motors are to be used at high speed on a regular basis, use of type ZZ bearings or bearings with grease nipples is recommended.

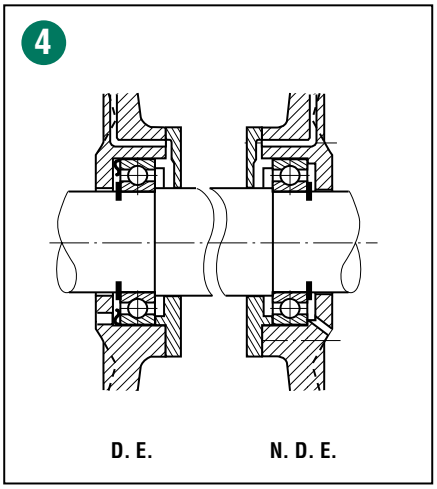
C3 - Bearings and lubrication

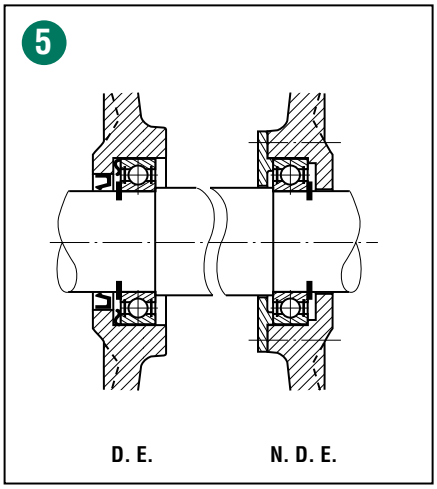
C3.2.1 - Bearing assembly diagrams (DE: Drive End / NDE: Non Drive End)

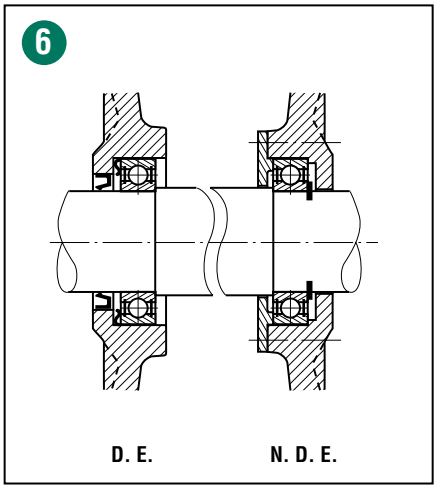


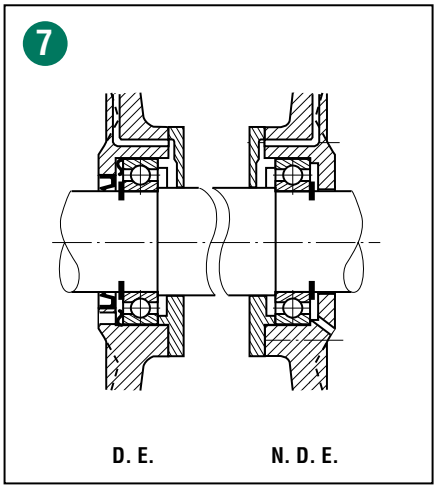


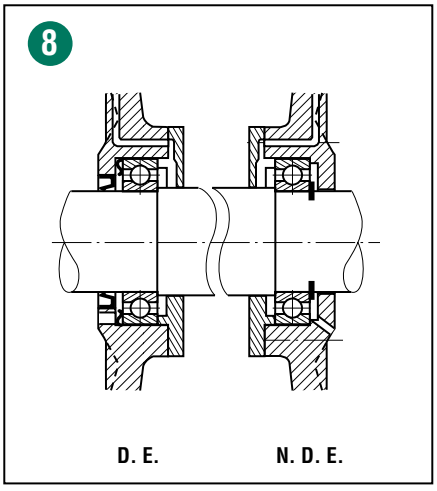


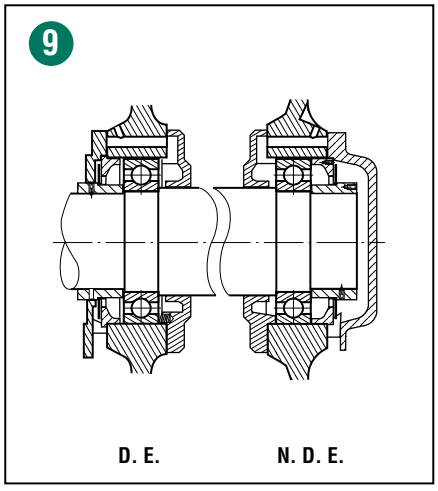






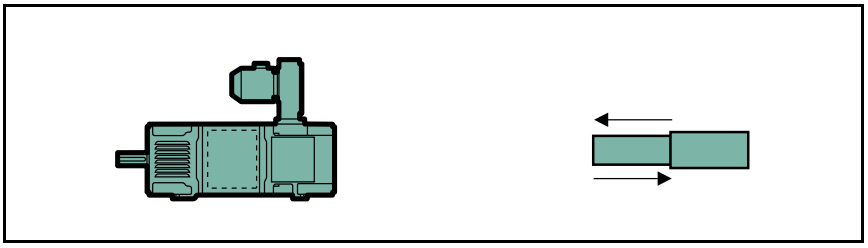






C3 - Bearings and lubrication

C3.2.2 - Permissible axial load (in daN) on main shaft extension for standard bearing assembly



Horizontal motor

Nominal ball bearing lifetime L_{10h}: 20000 hours

LSK motor Model	Direction of load application									
	→	←	→	←	→	←	→	←	→	←
	Speed n = 1000 min^{-1}		Speed n = 1800 min^{-1}		Speed n = 2500 min^{-1}		Speed n = 3200 min^{-1}		Vitesse n = 4000 min^{-1}	
1124 M	269	235	210	177	182	149	162	130	148	116
1124 L	257	225	201	169	173	141	155	123	141	109
1124 VL	249	220	191	161	165	133	147	115	133	101
1324 S	387	338	312	264	274	226	247	199	225	177
1324 M	392	343	306	258	265	217	239	191	217	169
1324 VL	380	320	287	235	246	196	219	171	197	149
1324 XVL	342	296	256	210	218	170	192	143	172	124
1604 S	537	468	416	350	361	295	235	260	295	231
1604 M	520	456	306	342	352	288	317	253	288	224
1604 L	510	446	397	333	343	279	308	244	279	215
1604 VL	485	423	369	307	317	253	282	217	254	190
	Speed n = 800 min^{-1}		Speed n = 1400 min^{-1}		Speed n = 2100 min^{-1}		Speed n = 2800 min^{-1}		Speed n = 3600 min^{-1}	
1804 M	614	574	480	437	399	355	349	305	310	267
1804 L	591	554	459	417	380	337	331	288	293	251
1804 VL	530	500	403	365	330	290	283	243	248	210
1804C M	614	574	480	437	399	355	349	305	310	267
1804C L	591	554	459	417	380	337	331	288	293	251
	Speed n = 600 min^{-1}		Speed n = 1000 min^{-1}		Speed n = 1500 min^{-1}		Speed n = 2200 min^{-1}		Vitesse n = 3000 min^{-1}	
2004 M	776	733	636	583	531	477	445	391	385	334
2004 L	755	716	611	559	507	452	422	369	364	312
2254 M	1054	933	833	722	692	589	577	483	498	413
2254 L	1017	908	805	701	666	568	556	466	481	396
2254 VL	984	874	706	596	579	469	464	354	-	-
	Speed n = 400 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1200 min^{-1}		Speed n = 1600 min^{-1}		Speed n = 2000 min^{-1}	
2504C M	1569	1238	1124	872	928	708	812	610	736	540
2504C L	1516	1214	1094	850	908	687	797	588	718	523
2804C SM	1515	1191	1125	818	949	647	843	544	766	476
2804C M	1619	1161	1173	803	977	642	860	544	773	483
2804C SL	1460	1170	1087	797	917	627	813	523	742	452
2804C L	1560	1125	1129	774	940	616	827	520	747	457
	Speed n = 500 min^{-1}		Speed n = 600 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1000 min^{-1}		Vitesse n = 1200 min^{-1}	
3554 VS	1500	1500	1420	1420	1280	1280	1160	1160	1060	1060
3554 S	1540	1540	1435	1435	1260	1260	1130	1130	1040	1040
3554 M	1530	1530	1420	1420	1240	1240	1120	1120	1030	1030
3554 L	1520	1520	1400	1400	1220	1220	1100	1100	1040	1040
3554 VL	1470	1470	1340	1340	1170	1170	1050	1050	980	980

The axial loads shown above assume a zero radial load.

C3 - Bearings and lubrication

C3.2.2 - Permissible axial load (in daN) on main shaft extension for standard bearing assembly

Vertical motor
Shaft end down

Nominal ball bearing
lifetime L_{10h}: 20000 hours

LSK Motor Model	Direction of load application									
	Speed n = 1000 min^{-1}		Speed n = 1800 min^{-1}		Speed n = 2500 min^{-1}		Speed n = 3200 min^{-1}		Speed n = 4000 min^{-1}	
1124 M	224	280	167	222	141	194	122	175	108	160
1124 L	215	274	158	218	131	190	113	172	98	157
1124 VL	210	268	149	212	120	186	102	169	87	154
1324 S	300	385	224	306	189	271	166	248	147	229
1324 M	325	418	242	333	201	292	174	265	151	243
1324 VL	293	426	210	327	172	285	146	256	126	234
1324 XVL	271	386	184	301	143	263	116	238	96	216
1604 S	429	576	317	458	265	405	229	368	201	337
1604 M	417	578	304	462	250	408	214	372	185	342
1604 L	407	581	289	462	235	408	199	372	170	343
1604 VL	369	562	252	446	197	396	160	362	134	333
	Speed n = 800 min^{-1}		Speed n = 1400 min^{-1}		Speed n = 2100 min^{-1}		Speed n = 2800 min^{-1}		Speed n = 3600 min^{-1}	
1804 M	514	688	379	572	296	491	246	442	209	401
1804 L	504	679	357	559	274	481	224	433	189	391
1804 VL	464	719	317	599	234	521	184	473	149	431
1804C M	514	688	379	572	296	491	246	442	209	401
1804C L	504	679	357	559	274	481	224	433	189	391
	Speed n = 600 min^{-1}		Speed n = 1000 min^{-1}		Speed n = 1500 min^{-1}		Speed n = 2200 min^{-1}		Speed n = 3000 min^{-1}	
2004 M	648	862	495	754	393	664	310	574	254	509
2004 L	635	845	472	760	359	662	278	571	223	507
2254 M	758	1254	570	1027	452	877	362	750	304	655
2254 L	741	1243	552	1030	431	881	338	754	275	665
2254 VL	726	1229	448	951	321	824	206	709	-	-
	Speed n = 400 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1200 min^{-1}		Speed n = 1600 min^{-1}		Speed n = 2000 min^{-1}	
2504C M	921	1923	634	1398	503	1170	424	1036	365	956
2504C L	893	1912	598	1420	463	1208	380	1083	329	990
2804C SM	856	1850	523	1466	368	1295	274	1191	217	1106
2804C M	713	2142	451	1604	328	1372	251	1236	215	1119
2804C SL	840	1824	494	1478	335	1319	237	1221	169	1153
2804C L	668	2166	409	1633	287	1403	211	1270	167	1166
	Speed n = 500 min^{-1}		Speed n = 600 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1000 min^{-1}		Speed n = 1200 min^{-1}	
3554 VS	-	-	-	-	-	-	-	-	-	-
3554 S	-	-	-	-	-	-	-	-	-	-
3554 M	-	-	-	-	-	-	-	-	-	-
3554 L	-	-	-	-	-	-	-	-	-	-
3554 VL	-	-	-	-	-	-	-	-	-	-

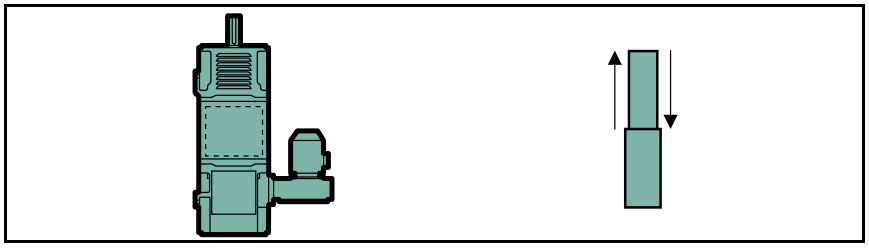
The axial loads shown above assume a zero radial load.

C3 - Bearings and lubrication

C3.2.2 - Permissible axial load (in daN) on main shaft extension for standard bearing assembly

Vertical motor
Shaft end up

Nominal ball bearing
lifetime L_{10h}: 20000 hours



C

LSK motor model	Direction of load application									
	↓	↑	↓	↑	↓	↑	↓	↑	↓	↑
	Speed n = 1000 min^{-1}		Speed n = 1800 min^{-1}		Speed n = 2500 min^{-1}		Speed n = 3200 min^{-1}		Speed n = 4000 min^{-1}	
1124 M	258	245	200	189	173	161	154	143	140	128
1124 L	251	246	190	186	163	158	145	140	130	125
1124 VL	238	240	179	182	152	155	134	137	119	122
1324 S	349	335	272	258	237	223	214	200	195	181
1324 M	374	369	290	285	249	244	222	217	199	195
1324 VL	352	367	262	275	222	235	195	207	174	186
1324 XVL	317	340	231	254	191	215	164	189	144	168
1604 S	497	507	383	392	330	339	294	303	265	273
1604 M	482	513	368	398	314	344	278	308	249	278
1604 L	471	517	353	398	299	344	263	308	234	279
1604 VL	431	500	315	383	261	332	225	297	198	269
	Speed n = 800 min^{-1}		Speed n = 1400 min^{-1}		Speed n = 2100 min^{-1}		Speed n = 2800 min^{-1}		Speed n = 3600 min^{-1}	
1804 M	553	648	422	529	340	447	290	398	252	358
1804 L	540	643	399	517	317	438	267	389	231	349
1804 VL	500	683	359	557	277	478	227	429	191	389
1804C M	553	648	422	529	340	447	290	398	252	358
1804C L	540	643	399	517	317	438	267	389	231	349
	Speed n = 600 min^{-1}		Speed n = 1000 min^{-1}		Speed n = 1500 min^{-1}		Speed n = 2200 min^{-1}		Speed n = 3000 min^{-1}	
2004 M	-	-	-	-	-	-	-	-	-	-
2004 L	-	-	-	-	-	-	-	-	-	-
2254 M	-	-	-	-	-	-	-	-	-	-
2254 L	-	-	-	-	-	-	-	-	-	-
2254 VL	-	-	-	-	-	-	-	-	-	
	Speed n = 400 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1200 min^{-1}		Speed n = 1600 min^{-1}		Speed n = 2000 min^{-1}	
2504C M	-	-	-	-	-	-	-	-	-	-
2504C L	-	-	-	-	-	-	-	-	-	-
2804C SM	-	-	-	-	-	-	-	-	-	-
2804C M	-	-	-	-	-	-	-	-	-	-
2804C SL	-	-	-	-	-	-	-	-	-	-
2804C L	-	-	-	-	-	-	-	-	-	-
	Speed n = 500 min^{-1}		Speed n = 600 min^{-1}		Speed n = 800 min^{-1}		Speed n = 1000 min^{-1}		Speed n = 1200 min^{-1}	
3554 VS	-	-	-	-	-	-	-	-	-	-
3554 S	-	-	-	-	-	-	-	-	-	-
3554 M	-	-	-	-	-	-	-	-	-	-
3554 L	-	-	-	-	-	-	-	-	-	-
3554 VL	-	-	-	-	-	-	-	-	-	-

The axial loads shown above assume a zero radial load.

C3 - Bearings and lubrication

C3.2.3 - 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 tension** of the belts must be **less than** the value of the load C_o (see section C3.1).

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:

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

with:

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

(*) A more accurate figure for factor k can be obtained from the transmission suppliers.

Permissible radial load on the drive shaft extension: F_R

The charts on the following pages indicate, for each type of motor, the radial force F_R, at a distance x, permissible on the drive end shaft extension for a bearing life L_{10h} of 20000 hours.

Distance x is defined by the formula:

$$x = a + \frac{b}{2} \quad \text{where } x \leq E$$

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 = 6 mm for LSK 1124

a = 7 mm for LSK 1324 to 3554.

Caution: check that the diameter of the pulley is greater than the minimum required by the motor. Minimum diameters of V-belt pulleys for mounting on the drive shaft according to the type of bearing, and for average power and speed, for a force applied to the centre of the shaft, are shown for information in tables 1 and 2.

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

$$\varnothing_{min} = \frac{2 \times M_N}{F_R} \times 2{,}5 \times 10^3$$

with

$\varnothing_{min}$: 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 with ball bearings, select the roller bearings option.

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).

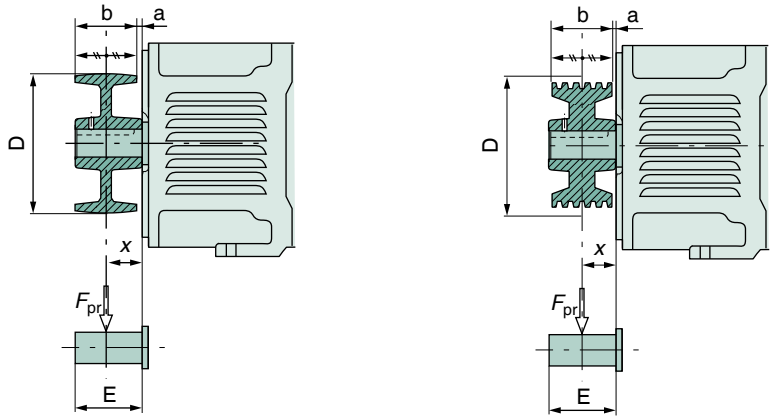


Table 1. - Minimum pulley diameter as a function of average power and speed. - Ball bearings

LSK moteur model	P kW	n min^{-1}	$\varnothing_{min.}$ mm	P kW	n min^{-1}	$\varnothing_{min.}$ mm	P kW	n min^{-1}	$\varnothing_{min.}$ mm	P kW	n min^{-1}	$\varnothing_{min.}$ mm
1124	12	1080	210	18	1610	250	24	2500	280	26	2710	295
1324	27.5	1040	365	40	1640	440	62	2550	565	-	-	-

For models 1604 to 3554C, when the calculation gives a large, and therefore unrealistic, minimum pulley diameter, it is recommended that the roller bearing option is selected: see table 2 on the next page.

C3 - Bearings and lubrication

Table 2. - Minimum pulley diameter as a function of average power and speed. - Roller bearings

LSK motor model	P kW	n min^{-1}	$Ø_{min.}$ mm	P kW	n min^{-1}	$Ø_{min.}$ mm	P kW	n min^{-1}	$Ø_{min.}$ mm	P kW	n min^{-1}	$Ø_{min.}$ mm
1124	12	1080	120	18	1610	120	24	2500	125	26	2710	130
1324	27.5	1040	170	40	1640	180	62	2550	210	80	3330	240
1604	64	1060	270	94	1590	300	138	2360	350	156	3060	340
1804, 1804C	66	620	310	90	1210	320	130	1730	385	158	2370	380
2004	88	800	360	131	1190	440	188	1860	470	196	2330	425
2254	91	650	300	160	1100	400	268	1820	465	308	2320	460
2504C	122	660	280	215	1120	360	342	1770	420	367	2030	400
2804C	230	805	385	316	1100	450	424	1550	470	-	-	-
3554C	Ask for estimate (quotation)											

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 below 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 kR 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.

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):

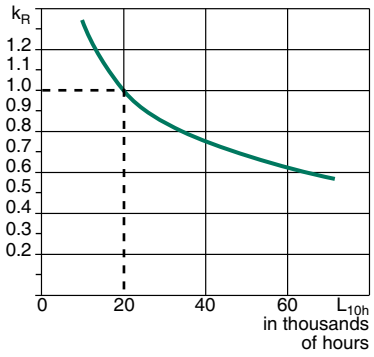
the force is exerted by pulling on the drive shaft (from the interior of the motor towards the exterior).

Negative axial load (graph 4):

the force pushes on the drive shaft (from the exterior towards the interior).

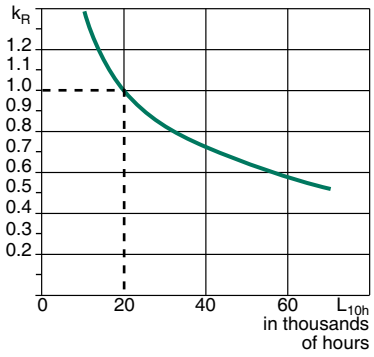
Changes in bearing life L_{10h} depending on load factor k_R for standard assembly.

▼ Graph 1



▲ ***Radial load factor***

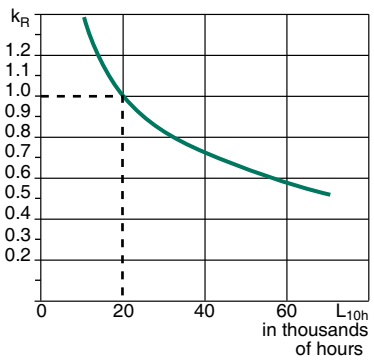
▼ Graph 2



▲ ***Axial load factor***

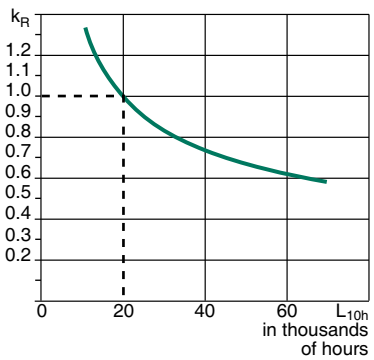
If K_R > 1.05
consult Leroy-Somer

▼ Graph 3



▲ ***Positive axial load factor***

▼ Graph 4

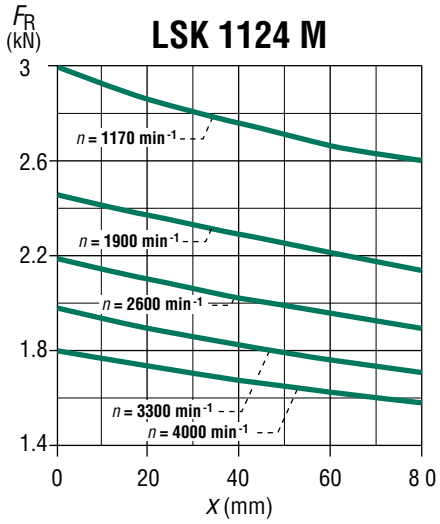


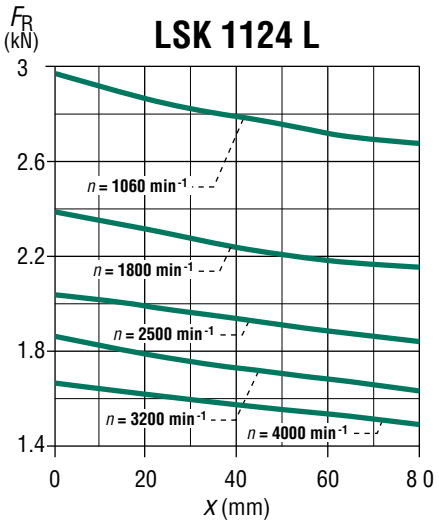
▲ ***Negative axial load factor***

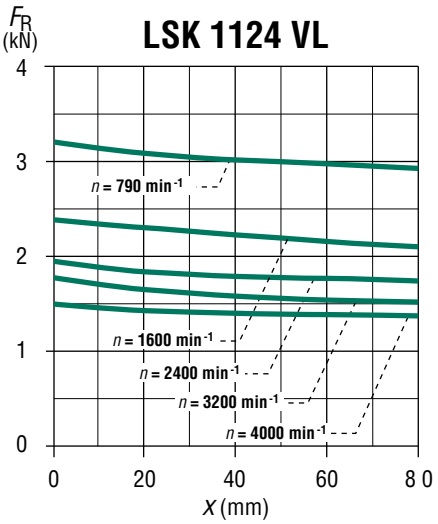
C3 - Bearings and lubrication

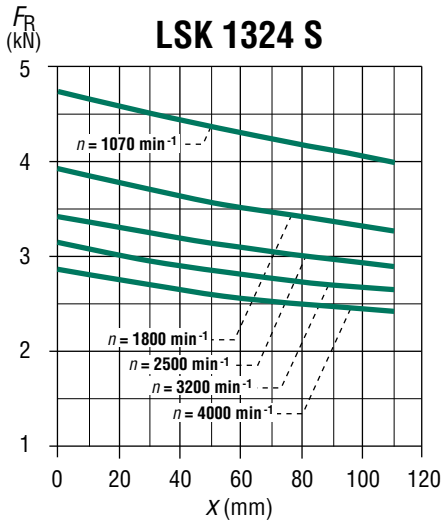
C3.2.4 - Standard assembly: horizontal position

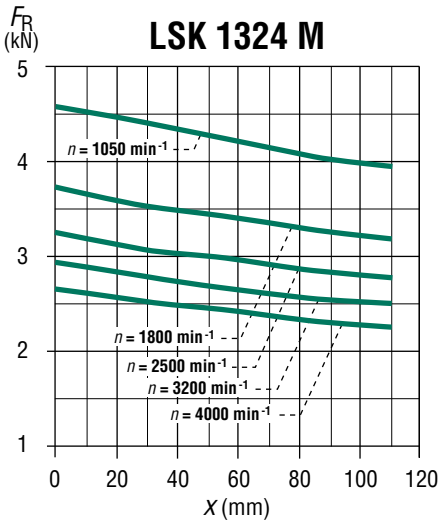
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

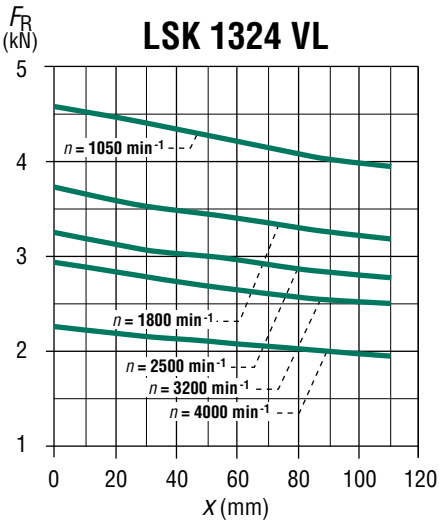


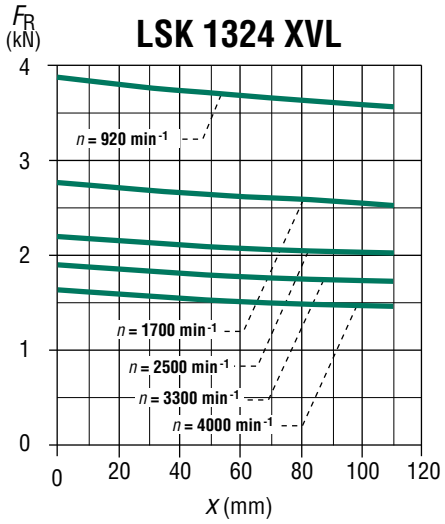


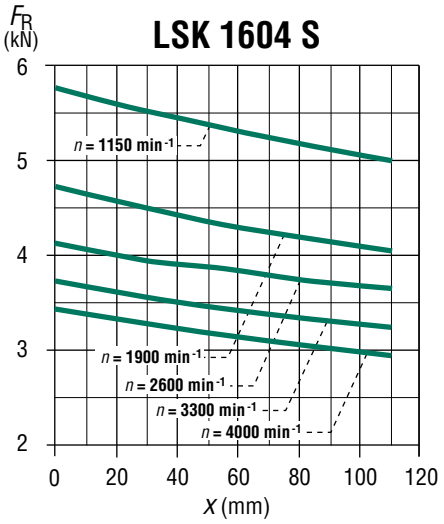


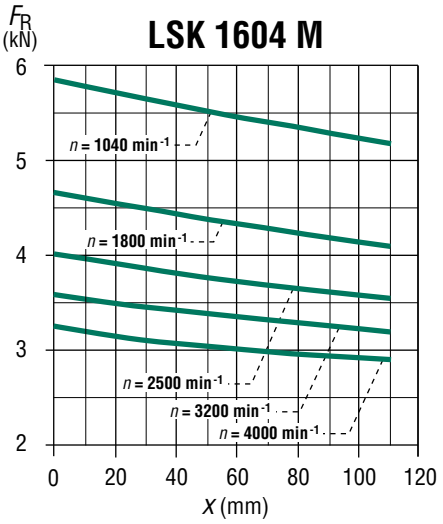










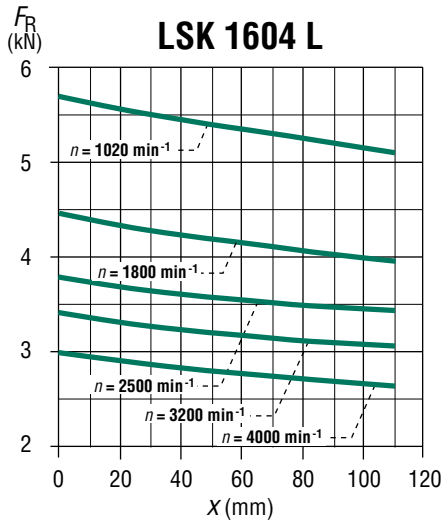


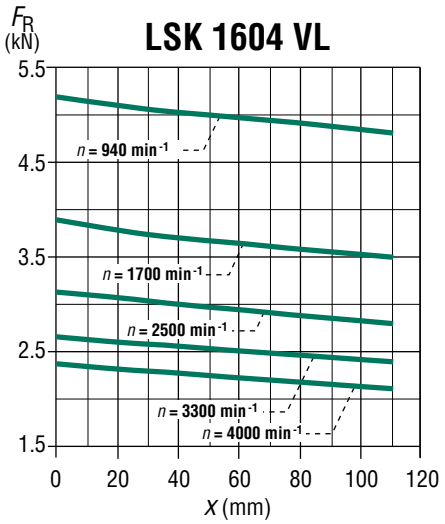
C

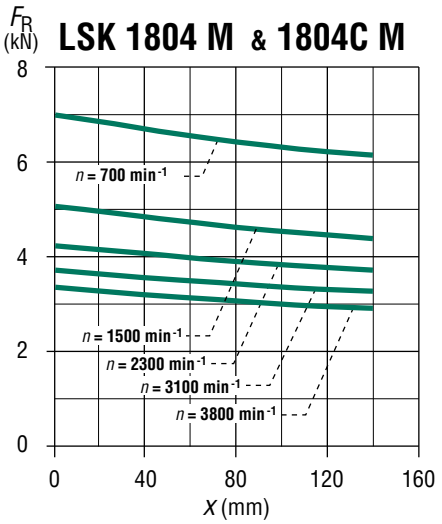
C3 - Bearings and lubrication

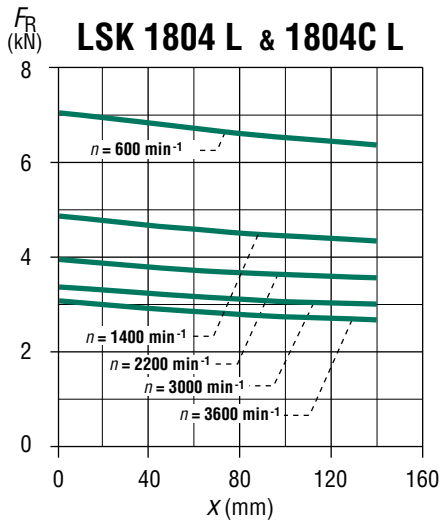
C3.2.4 - Standard assembly: horizontal position

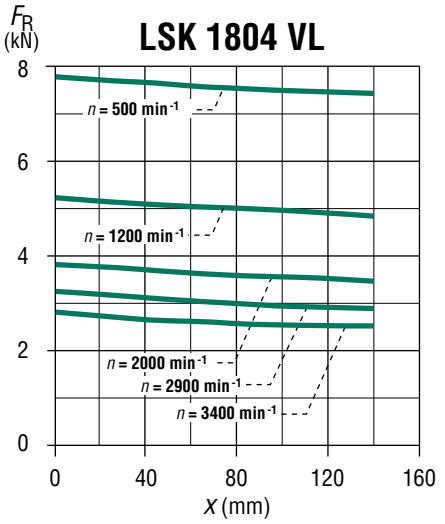
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

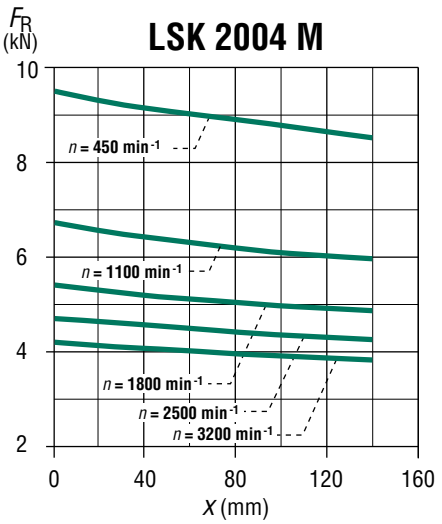


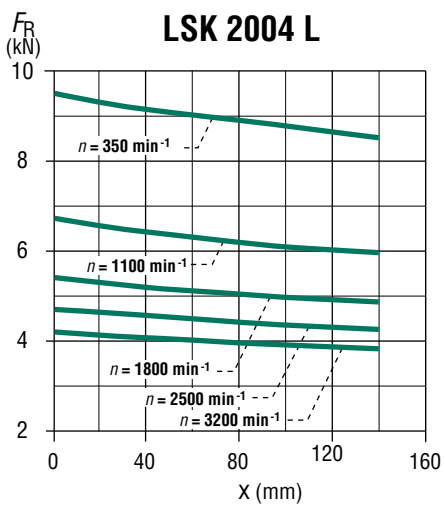


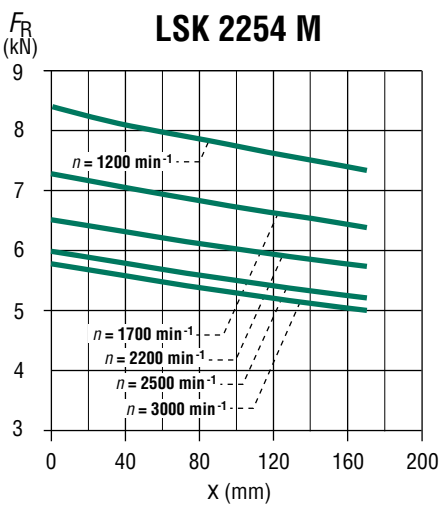


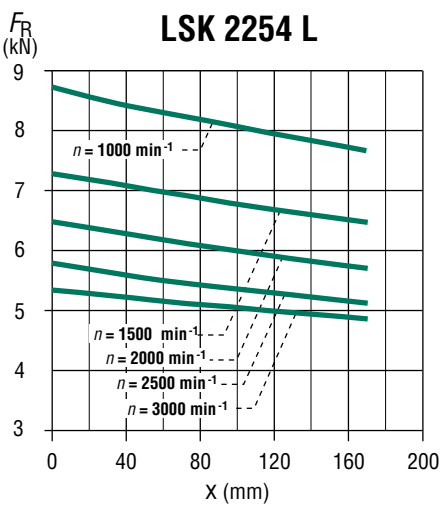








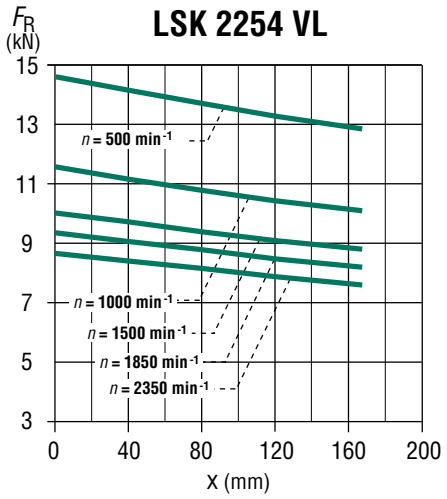


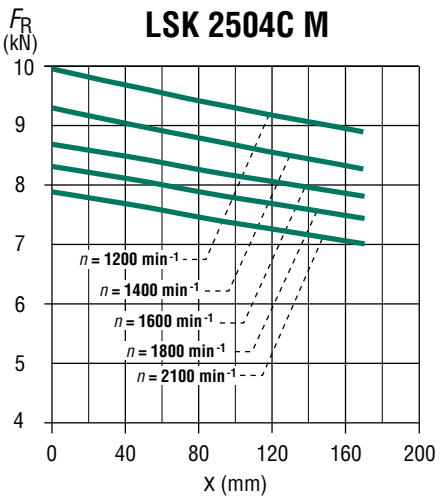


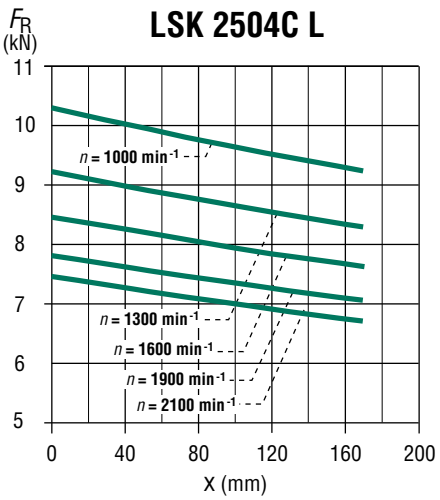
C3 - Bearings and lubrication

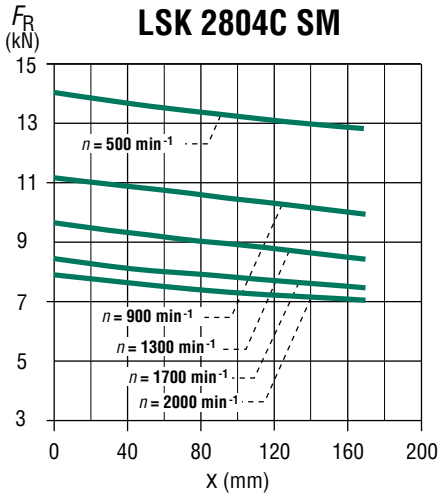
C3.2.4 - Standard assembly: horizontal position

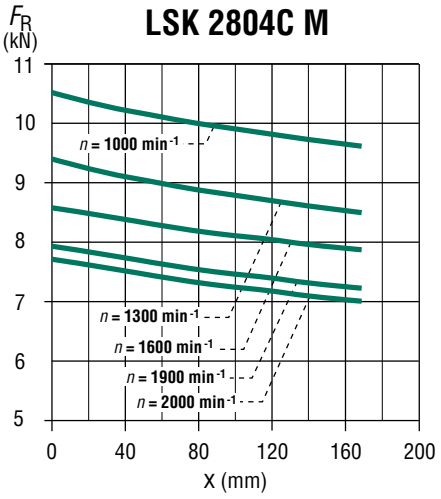
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

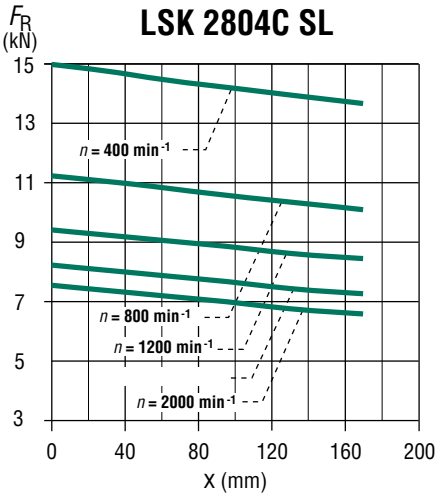


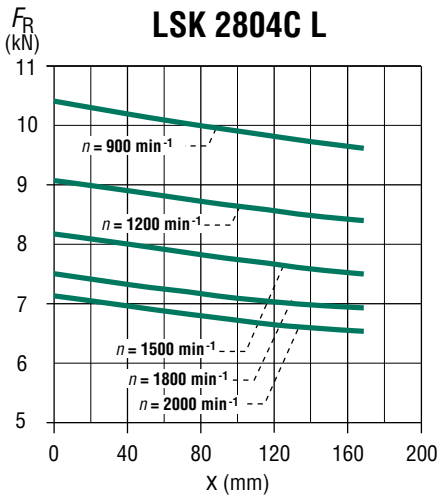


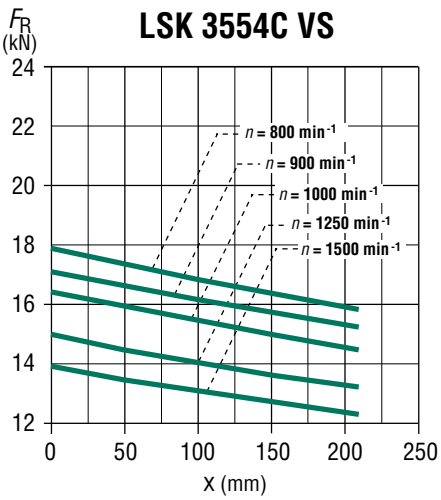


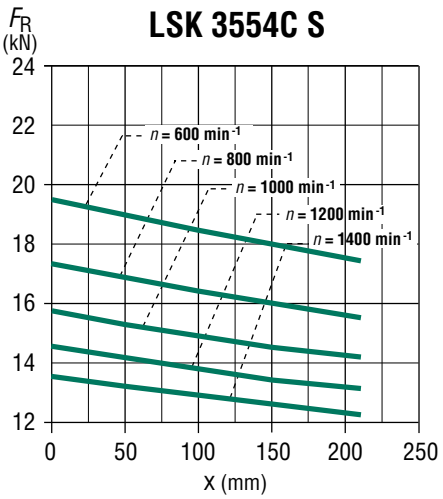








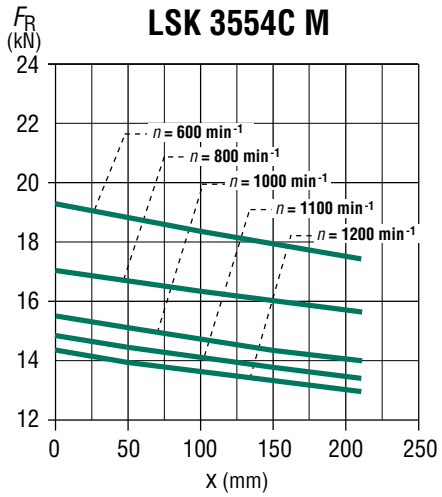


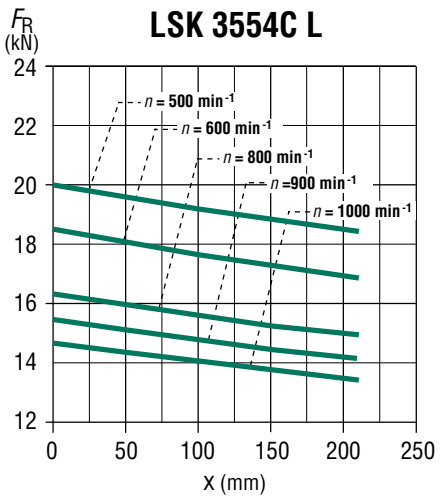


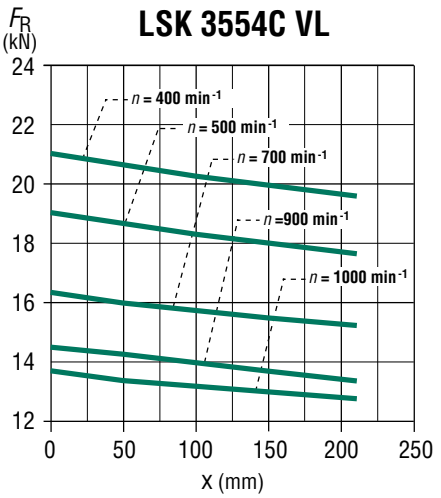
C3 - Bearings and lubrication

C3.2.4 - Standard assembly: horizontal position

Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.



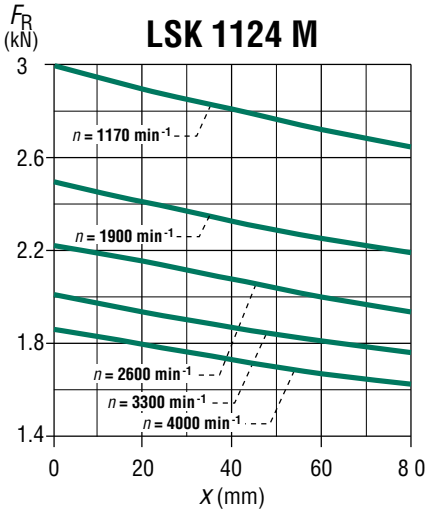


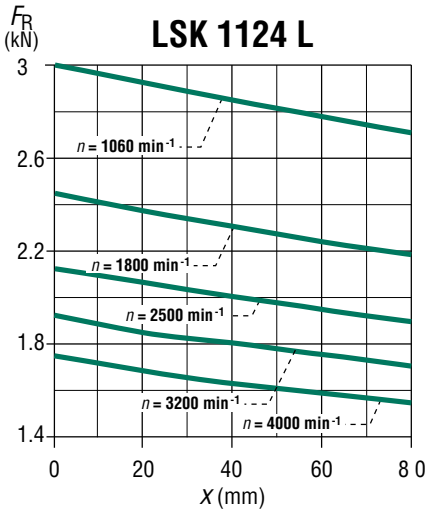


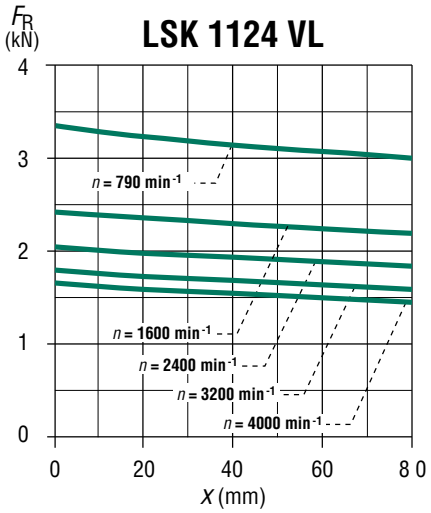
C3 - Bearings and lubrication

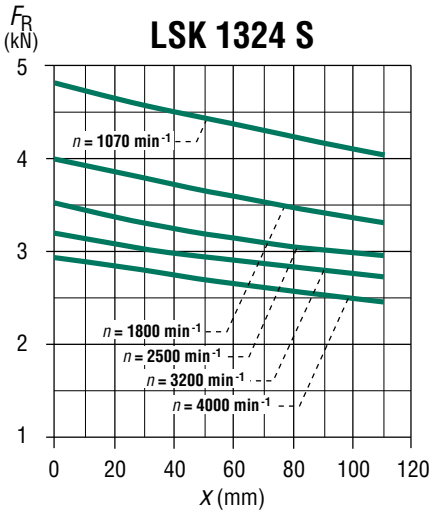
C3.2.5 - Standard assembly: vertical position

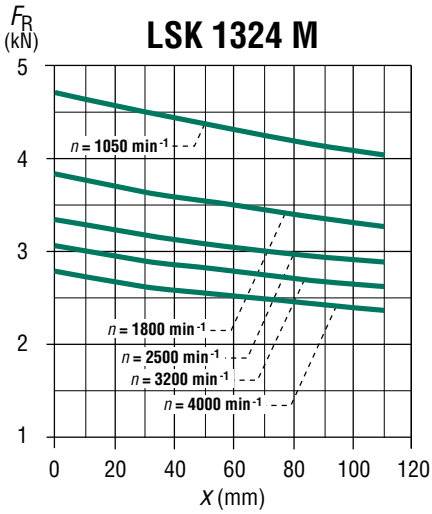
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

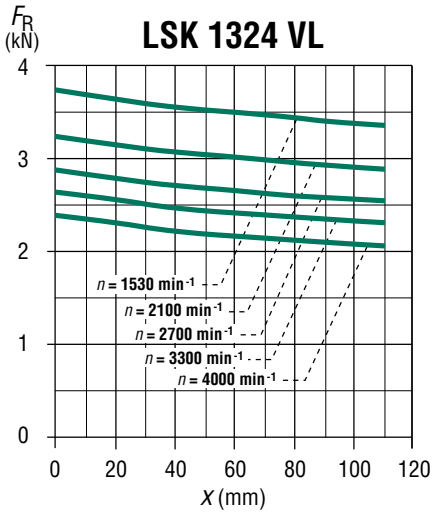


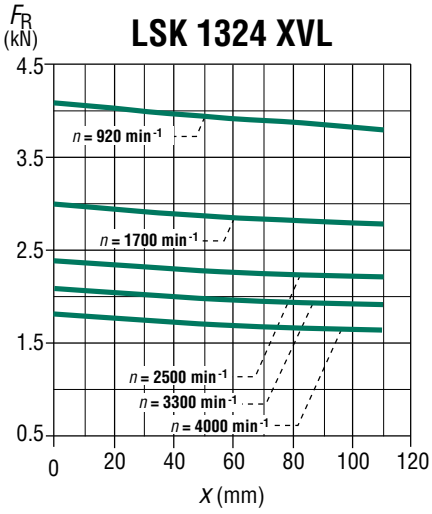


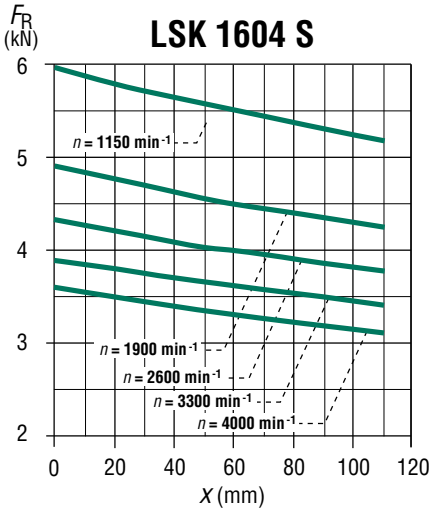


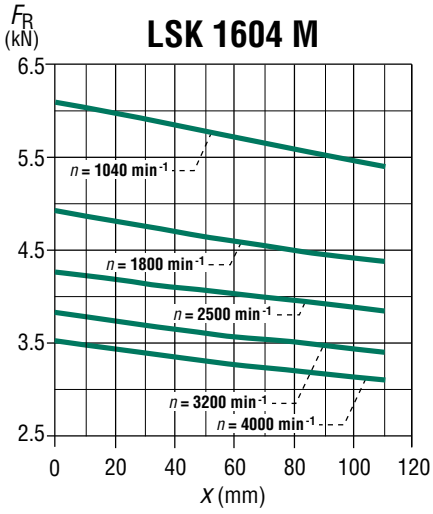








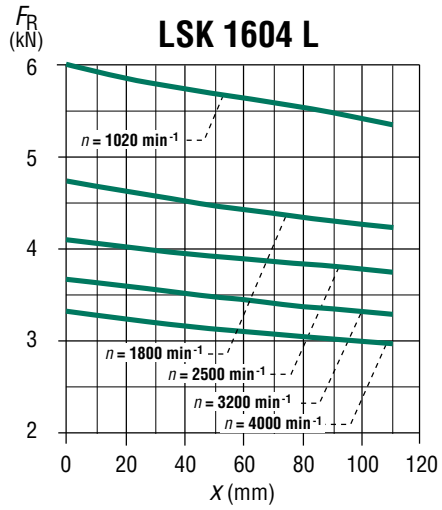


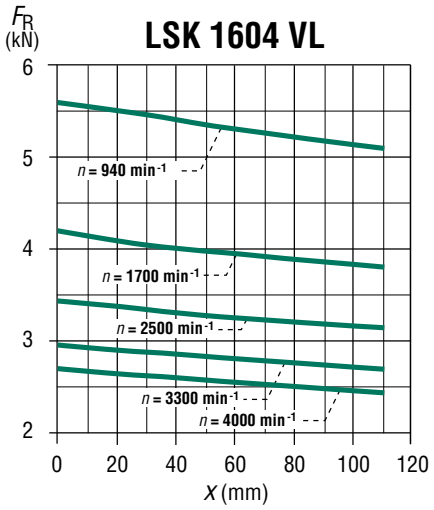


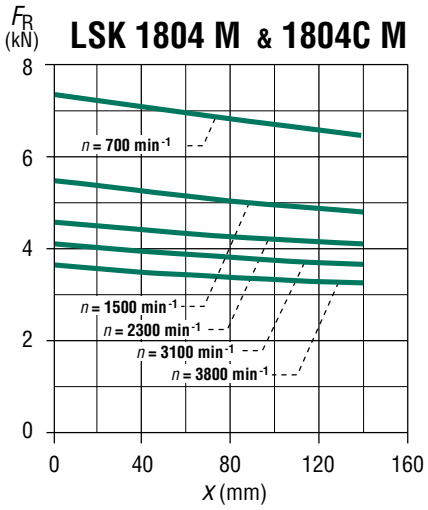
C3 - Bearings and lubrication

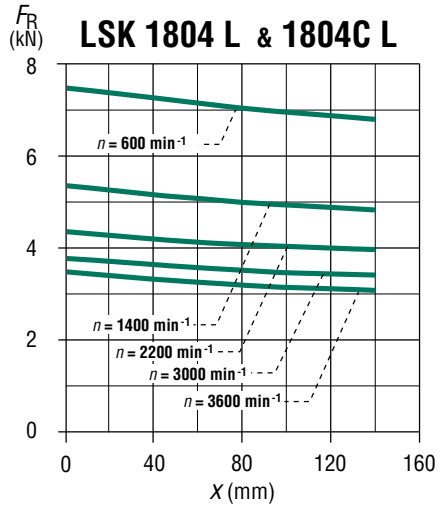
C3.2.5 - Standard assembly: vertical position

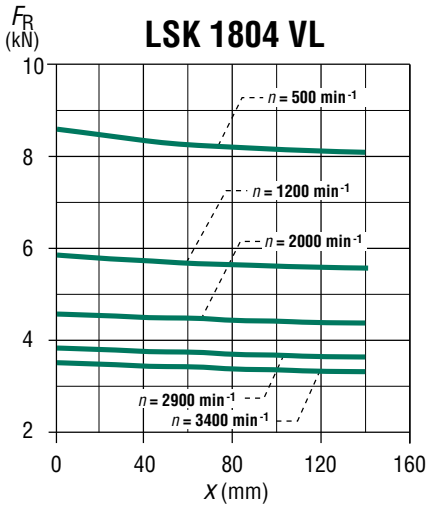
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

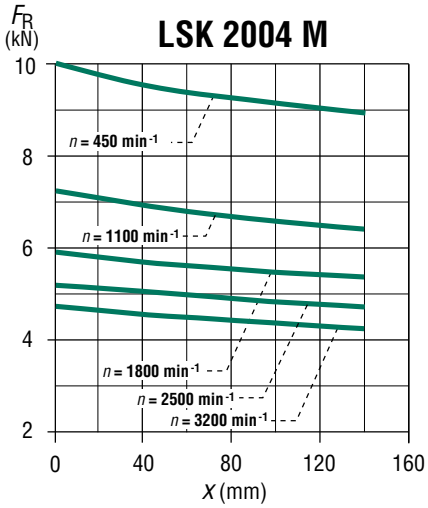


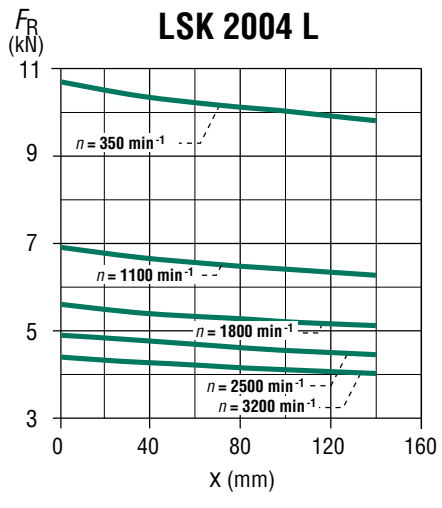


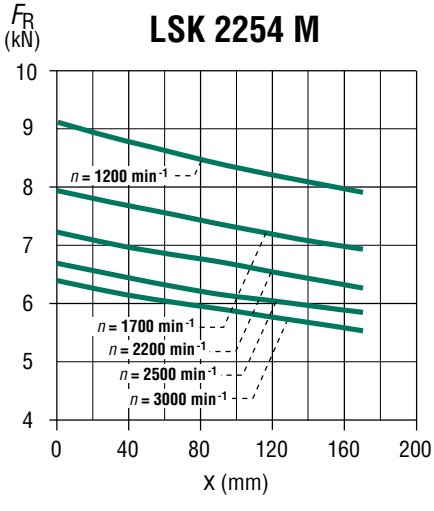


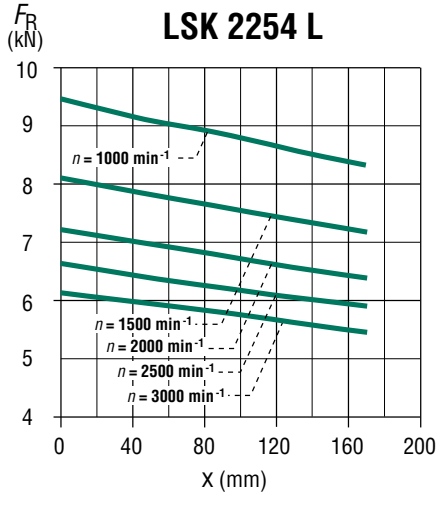










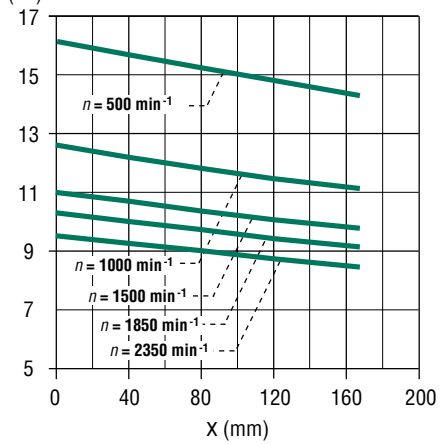


C3 - Bearings and lubrication

C3.2.5 - Standard assembly: vertical position

Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

LSK 2254 VL



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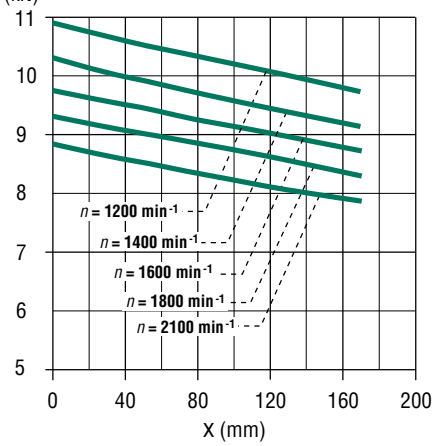

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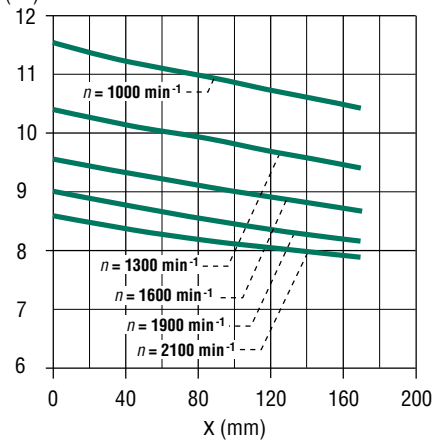

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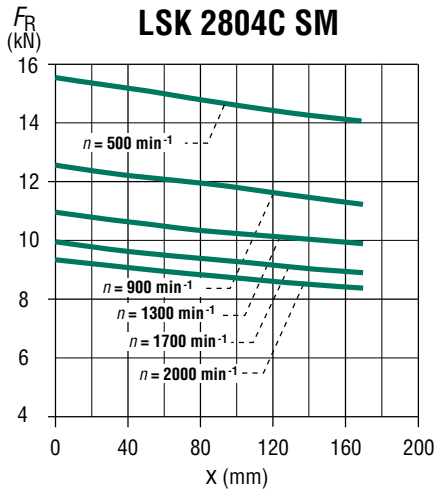

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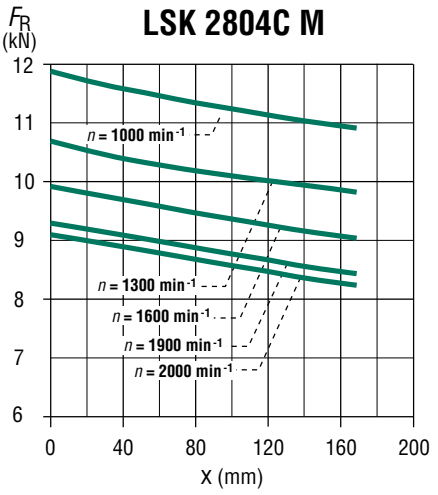

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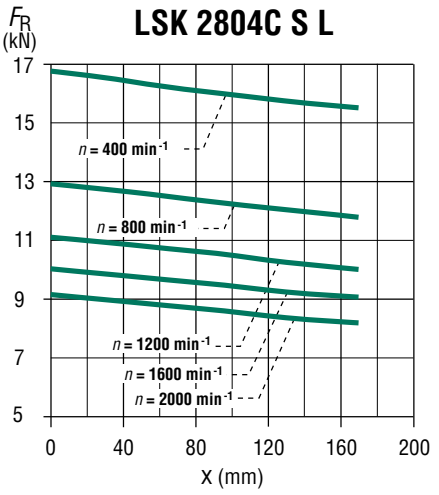

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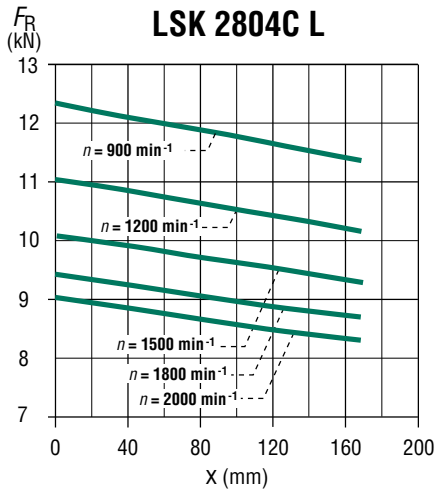


C3 - Bearings and lubrication

C3.3 - TYPES AND FITTING ARRANGEMENTS FOR DRIVE END ROLLER BEARINGS

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

Preventing translational movement of the armature is performed at the commutator end (NDE bearing). The bearings are preloaded by using a flexible washer which is inserted between the end shield and the DE bearing.

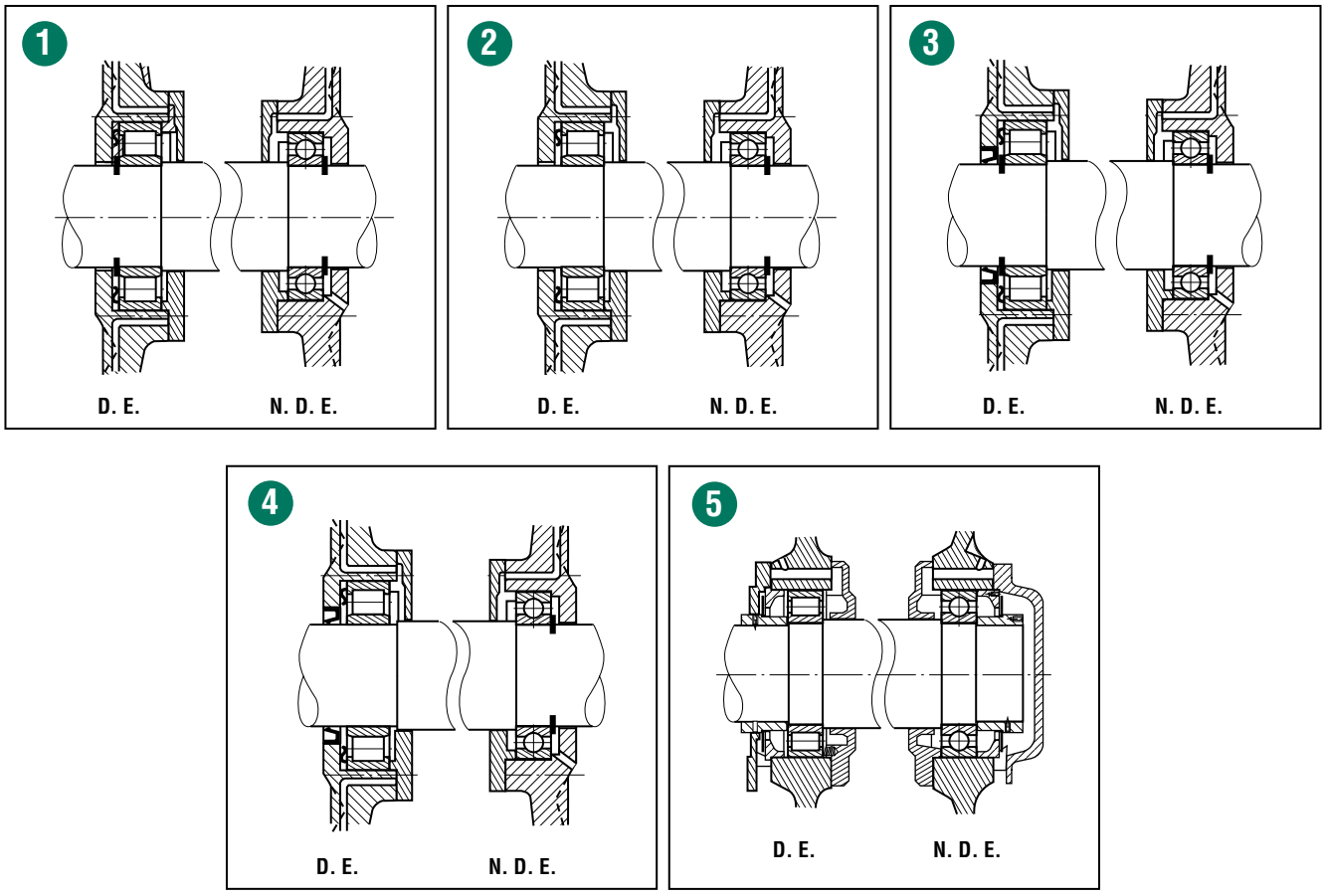
The graphs in section C3.3.2 show the force permitted by the drive shaft. The force calculated (refer to section C3.2.3) should be less than that shown in the graphs.

For lubrication, refer to section C3.4.

Important: When ordering, state which option is required, if any.

LSK motor model	Drive end bearing (D.E.)	Non drive end bearing (N.D.E.)	Assembly diagram reference	
			Roller bearing	Roller bearing with waterproof seal option
1124	NU 308 EC C3	6308 C3	1	3
1324	NU 310 EC C3	6310 C3	1	3
1604	NU 312 EC C3	6312 C3	1	3
1804	NU 313 C3	6313 C3	2	4
2004	NU 314 C3	6314 C3	2	4
2254	NU 317 C3	6317 C3	2	4
2504	NU 322 C3	6322 C3	2	4
2804	NU 324 C3	6324 C3	2	4
3554	NU 326 C3	6324 C3	5	

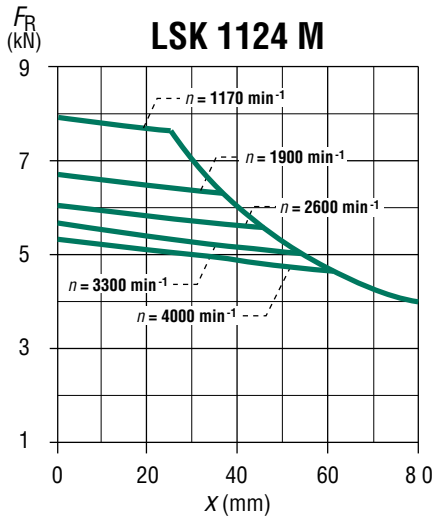
C3.3.1 - Assembly diagrams

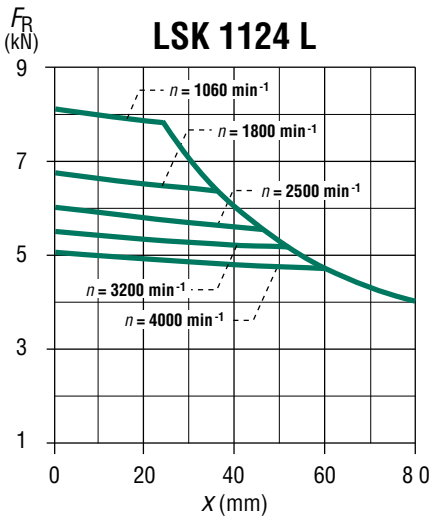


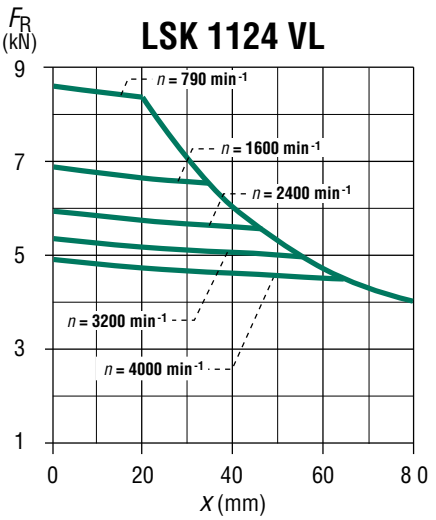
C3 - Bearings and lubrication

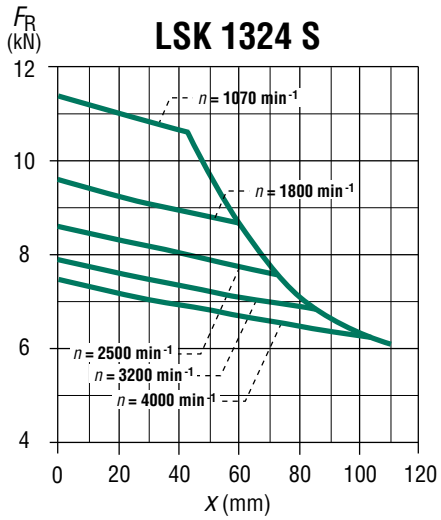
C3.3.2 - Roller bearing assembly

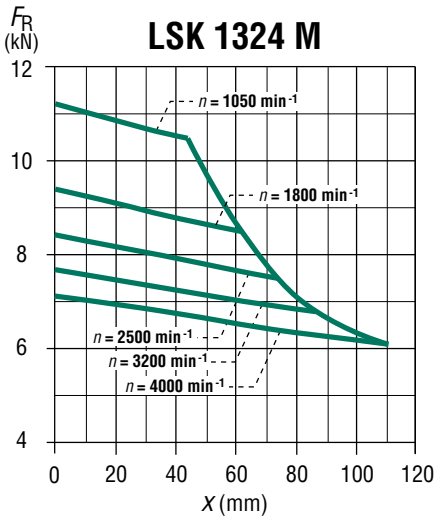
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

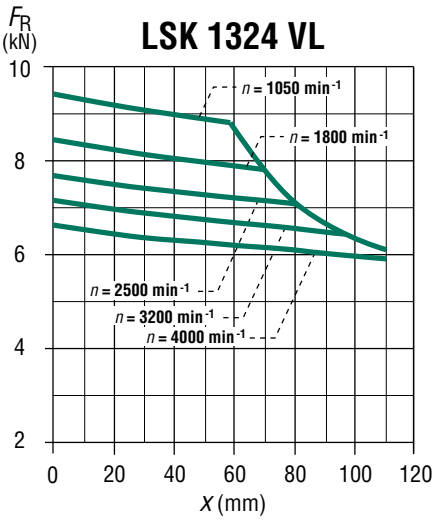


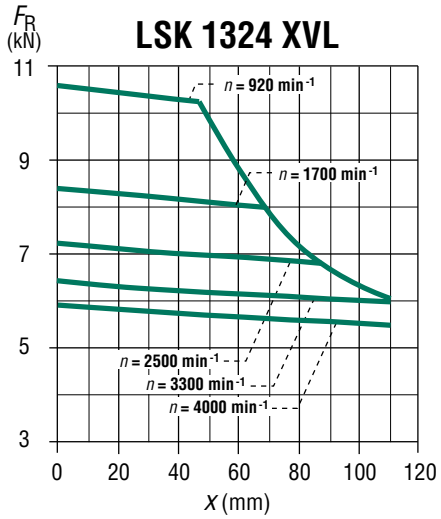


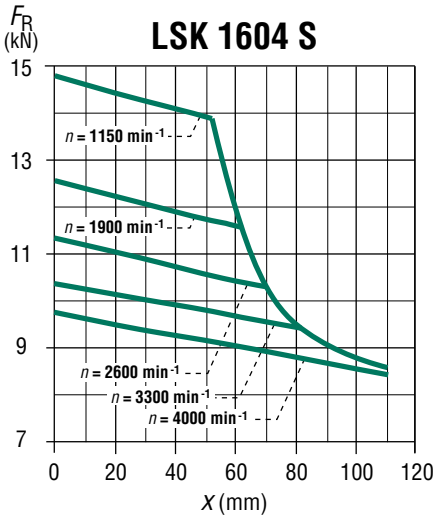


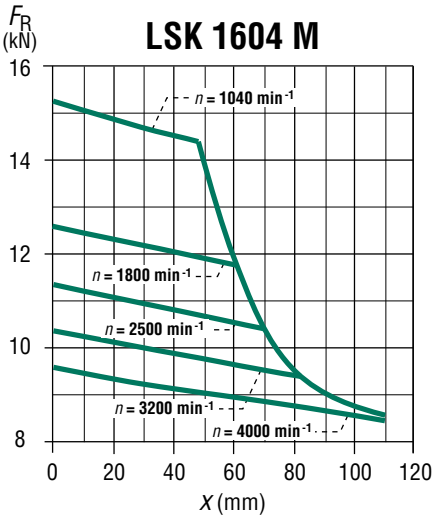








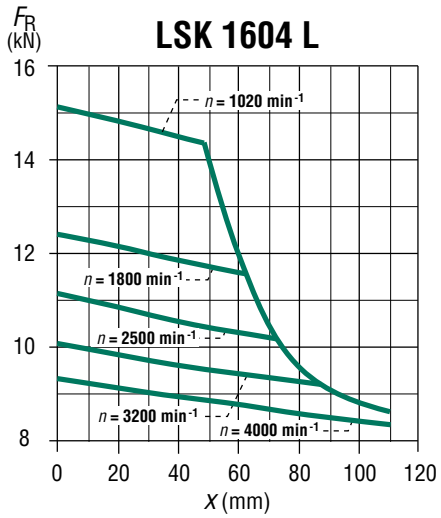


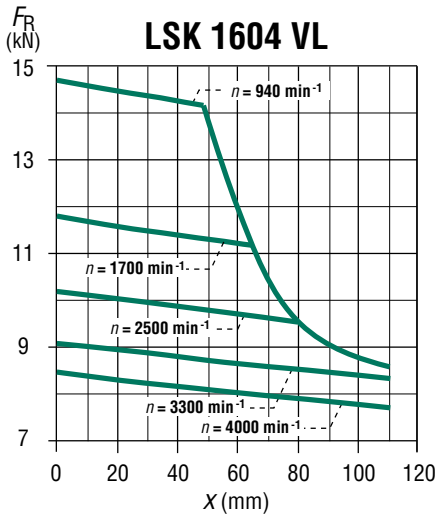


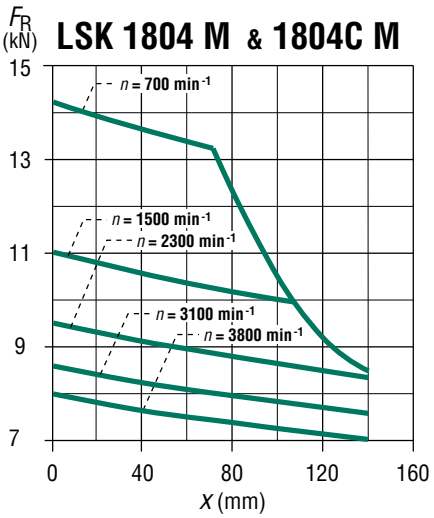
C3 - Bearings and lubrication

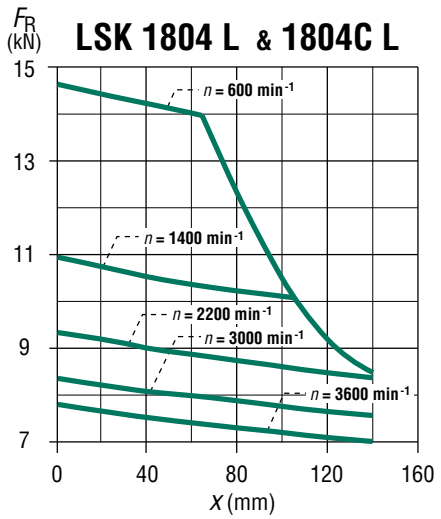
C3.3.2 - Roller bearing assembly

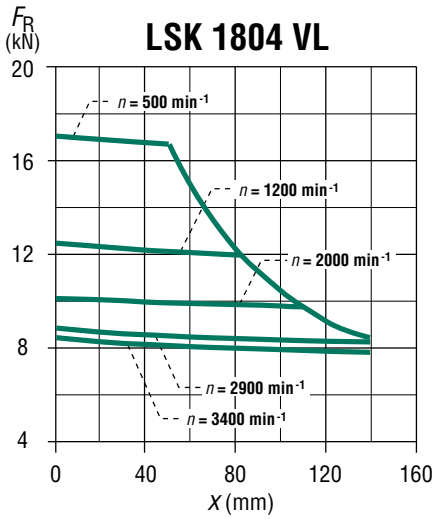
Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.

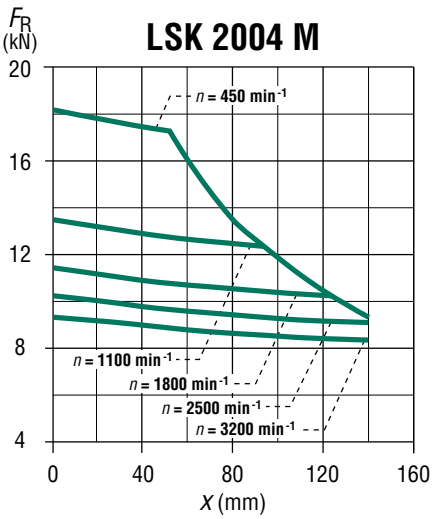


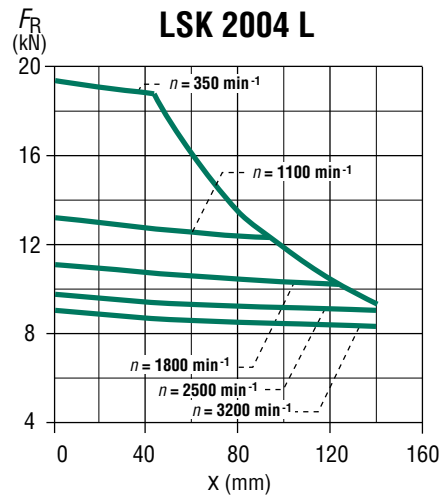


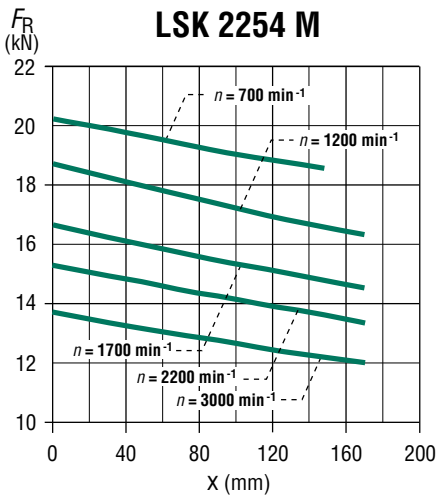


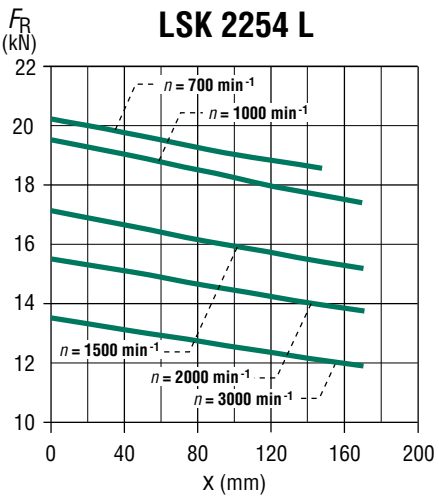








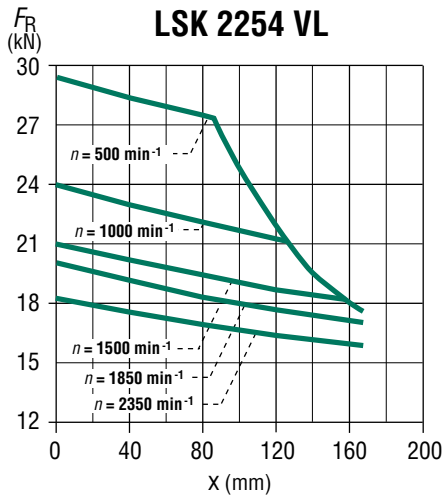


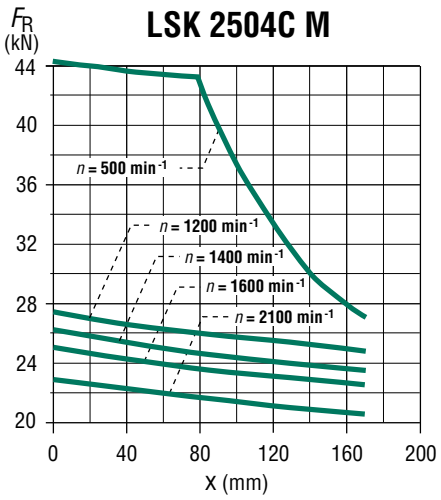


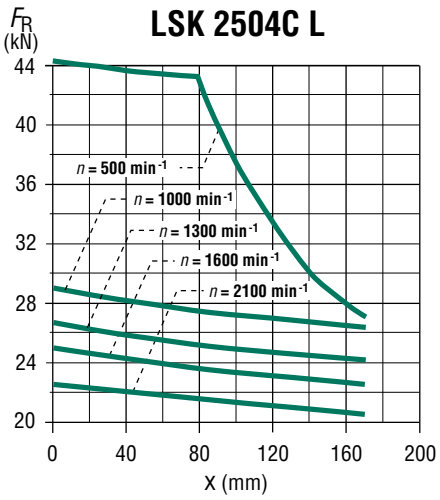
C3 - Bearings and lubrication

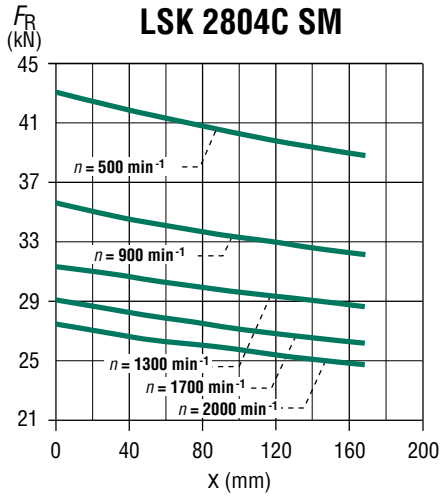
C3.3.2 - Roller bearing assembly

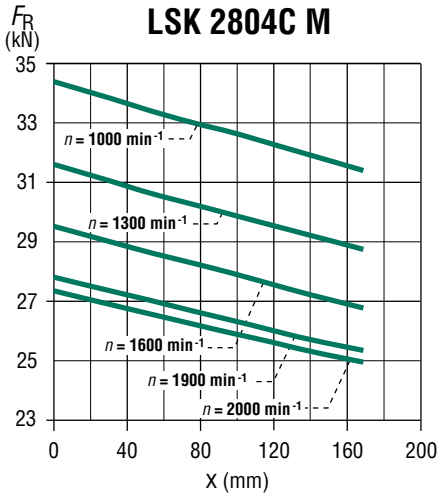
Permissible radial load on main shaft extension for a bearing life L10h of 20000 hours.

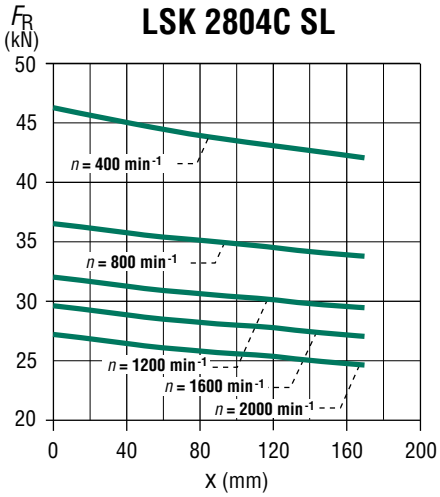


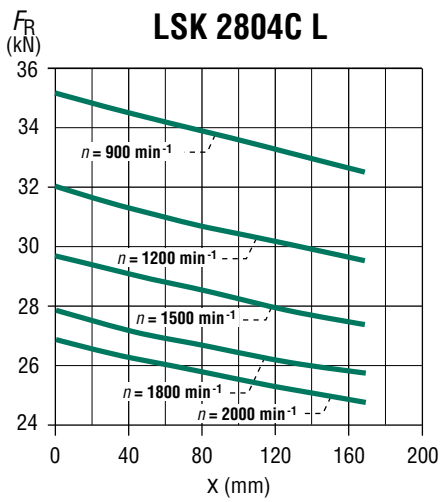


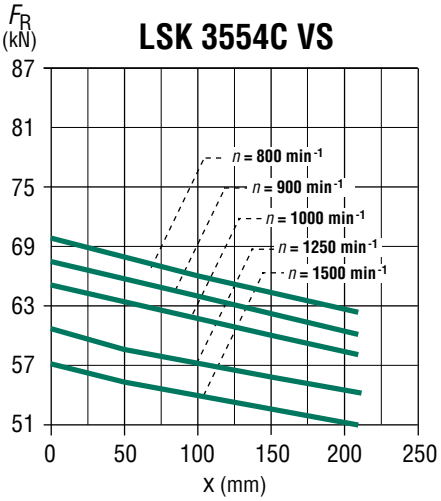


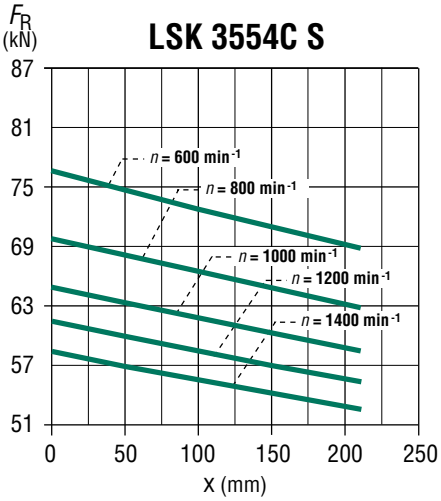








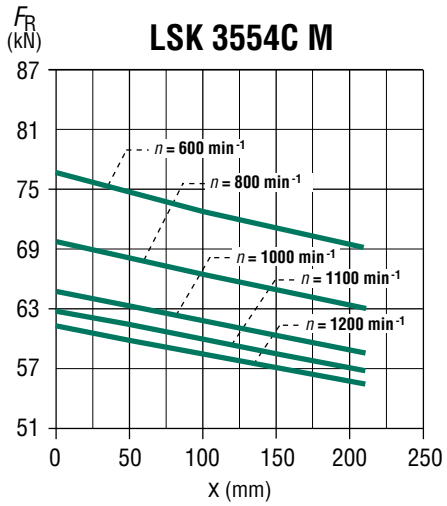


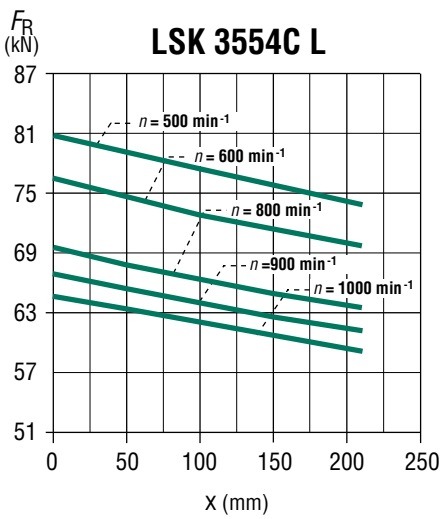


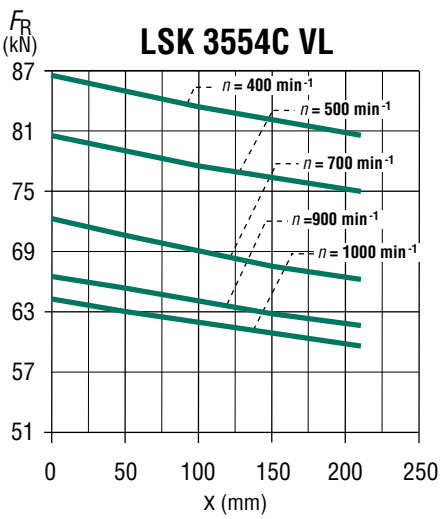
C3 - Bearings and lubrication

C3.3.2 - Roller bearing assembly

Permissible radial load on main shaft extension for a bearing life L_{10h} of 20000 hours.







C3 - Bearings and lubrication

C3.4 - LUBRICATION AND MAINTENANCE OF BEARINGS

Role of the lubricant

The principal role of the lubricant is to avoid direct contact between the metal parts in motion: balls or rollers, rings, cages, etc. It also protects the bearing against wear and corrosion.

The quantity of lubricant needed by a bearing is normally quite small. There should be enough to provide good lubrication without undesirable overheating. As well as lubrication itself and the operating temperature, the amount of lubricant should be judged by considerations such as sealing and heat dissipation.

The lubricating power of a grease or an oil lessens with time owing to mechanical constraints and straightforward ageing. Used or contaminated lubricants should therefore be replaced or topped up with new lubricant at regular intervals.

C3.4.1 - Greasing

A lubricating grease can be defined as a product of semi-fluid consistency obtained by the dispersion of a thickening agent in a lubricating fluid and which may contain several additives to give it particular properties.

Composition of a grease
base oil: 85 to 97%
thickener: 3 to 15%
additives: 0 to 12%

The base oil lubricates

The oil making up the grease is **of prime importance**. It is the oil that lubricates the moving parts by coating them in a protective film which prevents direct contact. The thickness of the lubricating film is directly linked to the viscosity of the oil, and the viscosity itself depends on temperature. The two main types used to make grease are mineral oils and synthetic oils. Mineral oils are suitable for normal applications in a range of temperatures from –30°C to +150°C.

Synthetic oils have the advantage of being effective in severe conditions (extreme variations of temperature, harsh chemical environments, etc.).

The thickener gives the grease consistency

The more thickener a grease contains, the 'harder' it will be. Grease consistency varies with temperature. In falling temperatures, the grease hardens progressively, and the opposite happens when temperatures rise.

The consistency of grease can be quantified using the NLGI (National Lubricating Grease Institute) classification. There are 9 NLGI grades, from 000 for the softest greases up to 6 for the hardest. Consistency is expressed by the depth to which a cone may be driven into a grease maintained at 25°C.

If we only consider the chemical nature of the thickener, lubricating greases fall into three main categories:

- **Conventional greases with a metallic soap base** (calcium, sodium, aluminium, lithium). Lithium soaps have several advantages over other metallic soaps - a high melting point (180° to 200°C), good mechanical stability and good water resistant properties.
- **Greases with a complex soap base**. The main advantage of this type of soap is a very high melting point (over 250°C).
- **Soapless greases**. The thickener is an inorganic compound, such as clay. Their main property is the absence of a melting point, which makes them practically nonliquifying.

Additives improve some properties of greases

Additives fall into two types, depending on whether or not they are soluble in the base oil.

The most common insoluble additives - graphite, molybdenum disulphide, talc, mica, etc., improve the friction characteristics between metallic surfaces. They are therefore used in applications where heavy pressure occurs.

The soluble additives are the same as those used in lubricating oils: antioxidants, anti-rust agents, etc.

C3.4.2 - Grease life

The lifetime of a lubricating grease depends on:

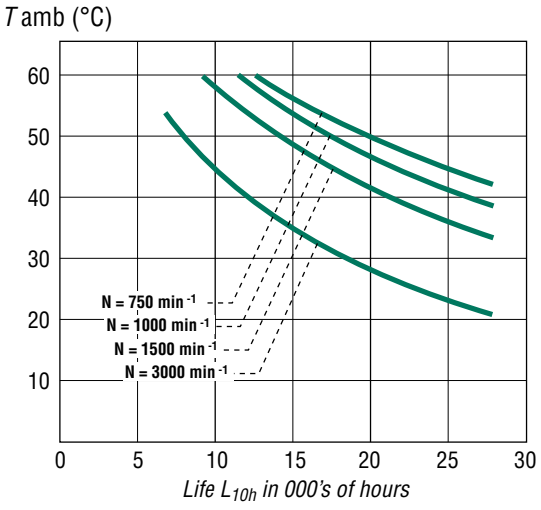
- the characteristics of the grease (type of soap and base oil, etc.),
- service stress (type and size of bearing, speed of rotation, operating temperature, etc.),
- contamination.

C3.4.2.1 - Permanently greased bearings

For this type (2 RS or ZZ) the configuration and size make for long grease life and therefore lubrication for the lifetime of the machine.

The graphs opposite show the grease lifetime as a function of the speed of rotation of the motor and the ambient temperature.

Grease life L_{10h} in 000's of hours



C3 - Bearings and lubrication

C3.4.2.2 - Bearings with grease nipples

The regreasing intervals for standard bearing assemblies are shown in the table below. To obtain regreasing intervals, expressed in hours, for roller bearings, divide the values given in the table by 2.

The intervals are given for:

- a high performance lithium grease such as ESSO UNIREX N3 (used by LEROY-SOMER when the machine is first assembled) or any other equivalent miscible type of grease,
- a bearing temperature of 90°C.

Note: The quality and quantity of grease and the regreasing interval are shown on the machine identification plate.

Because of contamination of the grease, it is necessary to regrease at least once a year, even if the theoretical regreasing interval is longer.

The regreasing interval for vertical shaft machines is approximately 80% of those shown in the table below.

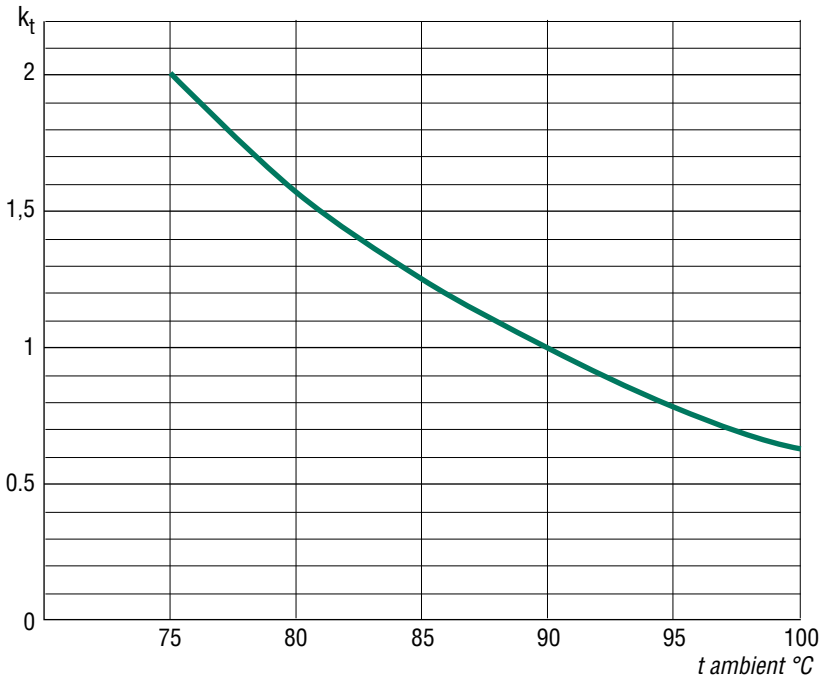
Regreasing intervals (ball bearings), expressed in hours, according to motor size and rotational speed.

LSK motor Model	Rotational speed less than or equal to			
	1000 min^{-1}	1500 min^{-1}	2000 min^{-1}	3000 min^{-1}
1124	22 000	20 000	15 000	12 000
1324	20 000	17 000	12 000	8 000
1604	18 000	13 000	10 000	6 000
1804	14 800	9 200	7 200	3 200
2004	14 000	8 400	6 400	2 800
2254	12 000	6 800	5 200	2 000
2504	9 000	4 500	2 500	-
2804	8 000	3 500	1 500	-
3554	5 000	2 000	-	-

*: for roller bearings, divide these values by 2.

For different bearing temperatures, multiply the intervals given in the above table by correction factor k_t on the graph opposite for the corresponding temperature.

Correction factor k_t as a function of the bearing temperature.



The chart opposite is valid for LSK motors lubricated with ESSO UNIREX N3 grease, which is used as standard.

LSK
D.C. motors
Construction

C4 - Cooling

LSK motors are of standard configuration IC 06

The new IC (International Cooling) classification in IEC standard 34.6 for describing the cooling system comprises:

- A number, placed at the beginning, indicating the cooling circuit layout for both the primary and secondary circuits.
- Each circuit is designated by a letter, indicating the cooling medium, followed by a number indicating the method of circulation.
- The letter and number for the first fluid are placed first, then those for the secondary cooling fluid.

Example: IC 8 A1 W7:
8: layout; A1: primary circuit; W7: secondary circuit.

Circuit layout

Characteristic number	Designation	Description
0(1)	Free circulation	The coolant enters and leaves the machine *freely*. It is taken from and returned to the fluid round the machine.
1(1)	Machine with an intake pipe	The coolant is taken up elsewhere than from the fluid round the machine, brought into the machine through an *intake pipe* and emptied into the fluid round the machine.
2(1)	Machine with an outlet pipe	The coolant is taken up from the fluid round the machine, brought away from the machine by an *outlet pipe* and does not go back into the fluid round the machine.
3(1)	Machine with two pipes (intake and outlet)	The coolant is taken up elsewhere than from the fluid round the machine, brought to the machine through an *intake pipe*, then taken away from the machine through an *outlet pipe* and does not go back into the fluid round the machine.
4	Surface cooled machine using the fluid round the machine	The primary coolant circulates in a closed circuit, transferring its heat to a secondary coolant (the one surrounding the machine) through the machine casing. The casing surface is either smooth or finned to improve heat transmission.
5(2)	Built-in heat exchanger (using the surrounding environment)	The primary coolant circulates in a *closed* circuit, transferring its heat to a secondary coolant (the one surrounding the machine) in an integral heat exchanger inside the machine.
6(2)	Machine-mounted heat exchanger (using the surrounding environment)	The primary coolant circulates in a closed circuit, transferring its heat to a secondary coolant (the one surrounding the machine) in a heat exchanger that forms an independent unit, mounted on the machine.
7(2)	Built-in heat exchanger (not using the surrounding environment)	The primary coolant circulates in a closed circuit, transferring its heat to a secondary coolant (which is not the one round the machine) in an integral heat exchanger inside the machine.
8(2)	Machine-mounted heat exchanger (not using the surrounding environment)	The primary coolant circulates in a closed circuit, transferring its heat to a secondary coolant (which is not the one round the machine) in a heat exchanger that forms an independent unit, mounted on the machine.
9(2)(3)	Separate heat exchanger (using / not using the surrounding environment)	The primary coolant circulates in a closed circuit, transferring its heat to the secondary fluid in a heat exchanger that forms an independent unit, away from the machine.

Cooling fluid

Characteristic letter	Type of fluid
A	Air
F	Freon
H	Hydrogen
N	Nitrogen
C	Carbon dioxide
W	Water
U	Oil
S	Any other fluid (must be identified separately)
Y	The fluid has not yet been selected (used temporarily)

Method of circulation

Characteristic number	Designation	Description
0	Free convection	The circulation of the coolant is due only to differences in temperature. Ventilation caused by the rotor is negligible.
1	Self-circulating	The circulation of the coolant depends on the rotational speed of the main machine, and is caused either by the action of the rotor alone, or the device mounted directly on it.
2, 3, 4		Not yet defined.
5(4)	Built-in, independent device	The coolant is circulated by a built-in device which is powered independently from the rotational speed of the main machine.
6(4)	Machine-mounted independent device	The coolant is circulated by a device mounted on the machine which is powered independently from the rotational speed of the main machine.
7(4)	Entirely separate, independent device or using the pressure of the coolant circulation system	The coolant is circulated by a separate electrical or mechanical device, independent and not mounted on the machine, or by the pressure in the coolant circulation system.
8(4)	Relative displacement	The circulation of the coolant is produced by the relative movement between the machine and the coolant, either by displacement of the machine in relation to the coolant, or by the flow of the surrounding coolant.
9	Any other device	The coolant is circulated using a method other than those defined above: it must be described in full.

(1) Filters or labyrinth seals for dust removal or noise protection can be fitted inside the casing or in the ducting. The first designation numbers 0 to 3 also apply to machines in which the coolant is taken up at the outlet of a watercooler designed to lower the temperature of the ambient air or recirculated through a watercooler so as not to increase the ambient temperature.

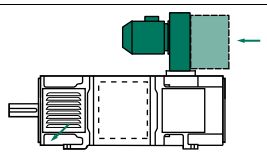
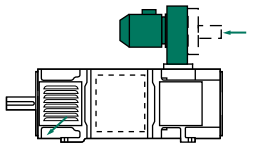
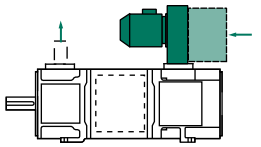
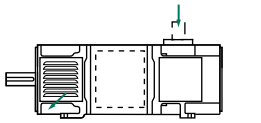
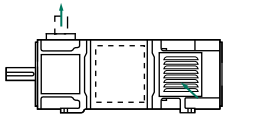
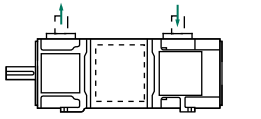
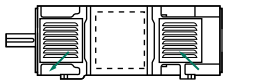
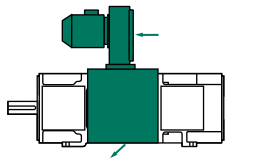
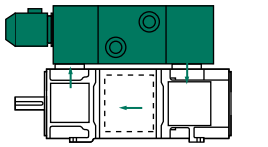
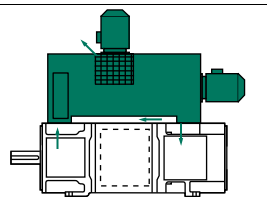
(2) The nature of the heat exchanger elements is not specified (smooth or finned tubes, corrugated surfaces, etc.).

(3) A separate heat exchanger can be installed near to or at a distance from the machine. A secondary gas coolant may or may not be the surrounding medium.

(4) Use of such a device does not exclude the ventilating action of the rotor or the addition of a supplementary fan mounted directly on the rotor.

C4 - Cooling

C4.1 - STANDARD CODES

	Cooling methods	Mechanical protection**
	**Simplified code** **Standard code** **IC06** **IC0A6** Fan mounted on motor and free circulation of air with or without filter	**IP 23S**
	**IC16*** **IC1A6** Fan mounted on motor with ducted air intake, free outlet	**IP 23**
	**IC26*** **IC2A6** Fan mounted on motor with free air intake, with or without filter, and ducted outlet	**IP 23S**
	**IC17*** **IC1A7** Air supply via ducted intake and free outlet	**IP 23**
	**IC27*** **IC2A7** Air supply via free intake and ducted outlet	**IP 23S**
	**IC37*** **IC3A7** Air supply via ducted intake and outlet	**IP 54 or IP 55**
	**IC01** **IC0A1** Self-cooling motor	**IP 23S**
	**IC416** **IC4A1A6** Fan blowing on the motor body	**IP 54 or IP 55**
	**IC86W6** **IC7A6W6** Air/water heat exchanger mounted on the motor *Model 1604 upwards*	**IP 54 or IP 55**
	**IC666** **IC6A6A6** Air/air heat exchanger mounted on the motor *Model 1324 upwards*	**IP 54 or IP 55**

*: *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 in the following pages.

**: See definitions on page 19.

C4 - Cooling

C4.2 - VENTILATION

C4.2.1 - Standard cooling method

In compliance with IEC standard 60034 - 6, the standard motors in this catalogue are cooled using method IC 06, i.e. "machine cooled by forced ventilation, using the ambient air circulating inside the machine".

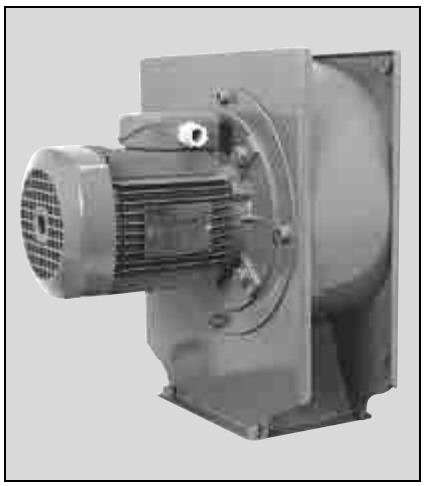
LSK series motors, unless otherwise specified, are designed for cooling air at a temperature between +5 and +40°C, with a humidity corresponding to 5 to 23 g/m^3 (grammes of water in suspension in the air: see pages 20 & 21), free from harmful dust and chemically neutral.

Fresh air enters at the commutator as standard (for low load operation, please consult Leroy-Somer).

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

Where space is a problem, and under certain operating conditions, it is possible to mount the forced ventilation unit at the front (consult Leroy-Somer for models 2504C to 3554C). In this case, reverse the front and rear inspection doors and anticipate a 10% reduction in the power indicated in the selection tables

.



It is advisable to check that the machine outlets are not blocked, as this would cause the cooling air to be recycled, raising its temperature and possibly causing an abnormal rise in machine temperature.

For other environments, refer to section C4.2.2 below and the section on options.

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.
If, due to lack of available space, the ambient motor temperature is higher than 40°C, despite cooling air which is lower than 40°C, please consult LEROY-SOMER.

C

C4.2.2 - Other cooling methods

For cooling methods IC 16, 17, 26, 27, 37, the cooling circuit must be taken into account when calculating the cross-section of the ducts, in order to ensure that the flow rate and pressure of the cooling air given in the table opposite (flow rate and pressure required at the air inlet) is maintained.

LSK motors can also be supplied with the following cooling methods:

- IC416: fan blowing on the motor body,
- IC 01: self-cooled,
- IC 86W6: air/water exchanger,
- IC 666: air/air exchanger, etc…

for these cooling methods refer to section G2 "Ventilation" pages 140 to 143.

LSK motor model	Rate	Pressure	LSK motor model	Rate	Pressure
	m^3/h	Pa		m^3/h	Pa
1124 M	310	610	**1804 M**	1230	1470
1124 L	290	600	**1804 L**	1200	1470
1124 VL	280	600	**1804 VL**	1800	1650
1324 S	560	745	**1804C M**	1230	1470
1324 M	520	740	**1804C L**	1200	1470
1324 VL	470	730	**2004**	2400	1600
1324 XVL	460	730	**2254**	2850	1650
1604 S	1270	1530	**2504**	3120	2500
1604 M	1160	1520	**2804**	4270	2770
1604 L	1110	1520	**3554**	6550	1800
1604 VL	1080	1510			

These air flows are produced by ventilation units mounted in series. They are valid for normal working conditions as described in section B2.1, page 20.

LSK
D.C. motors
Construction

C4 - Cooling

Characteristics of A.C. induction motors for forced vent unit

LSK motor model		A.C. cooling motor - 2 poles - 3000 min^{-1}							
Cooling		Rated power	Permissible voltage	Rate current	Frequency	LS type	Flange	Shaft	Weight
IC06	IC 416	kW	V	A	Hz		mm	mm	kg
1124	1124 1324	0.25	Δ 207 to 250 Y 360 to 440	Δ 1,25 (at 230V) Y 0,74 (at 400V)	50	71 L	FF 130	14 x 30	6.4
		0.3	Δ 240 to 290 Y 420 to 510	Δ 1,25 (at 250V) Y 0,77 (at 440V)	60	71 L	FF 130	14 x 30	6.4
1324	1604 S 1604 M 1604 L	0.37	Δ 207 to 250 Y 360 to 440	Δ 1,65 (at 230V) Y 0,95 (at 400V)	50	71 L	FF 165	19 x 40	6.4
		0.44	Δ 240 to 290 Y 420 to 510	Δ 1,65 (at 250V) Y 0,95 (at 440V)	60	71 L	FF 165	19 x 40	6.4
1604	1604 VL	1.1	Δ 207 to 250 Y 360 to 440	Δ 4,6 (at 230V) Y 2,6 (at 400V)	50	80 L	FF 165	19 x 40	10.5
		1.3	Δ 240 to 290 Y 420 to 510	Δ 4,6 (at 250V) Y 2,6 (at 440V)	60	80 L	FF 165	19 x 40	10.5
1804 M & 1804 L		1.5	Δ 207 to 250 Y 360 to 440	Δ 6 (at 230V) Y 3,4 (at 400V)	50	80 L	FF 165	19 x 40	11.5
		1.8	Δ 240 to 290 Y 420 to 510	Δ 6 (at 250V) Y 3,8 (at 440V)	60	80 L	FF 165	19 x 40	11.5
1804 VL	1804 VL	2.2	Δ 207 to 250 Y 360 to 440	Δ 7,8 (at 230V) Y 4,5 (at 400V)	50	90 L	FF 165	19 x 40	18
		2.65	Δ 240 to 290 Y 420 to 510	Δ 7,8 (at 250V) Y 4,5 (at 440V)	60	90 L	FF 165	19 x 40	18
1804C		1.5	Δ 207 to 250 Y 360 to 440	Δ 6 (at 230V) Y 3,4 (at 400V)	50	80 L	FF 165	19 x 40	11.5
		1.8	Δ 240 to 290 Y 420 to 510	Δ 6 (at 250V) Y 3,8 (at 440V)	60	80 L	FF 165	19 x 40	11.5
2004 & 2004C		2.2	Δ 207 to 250 Y 360 to 440	Δ 7,6 (at 230V) Y 4,4 (at 400V)	50	90 L	FT 115	24 x 50	18
		2.7	Δ 240 to 290 Y 420 to 510	Δ 7,5 (at 250V) Y 4,4 (at 440V)	60	90 L	FT 115	24 x 50	18
2254 & 2254C		3	Δ 207 to 250 Y 360 to 440	Δ 11 (at 230V) Y 6,3 (at 400V)	50	100 L	FT 130	28 x 60	21
		3.6	Δ 240 to 290 Y 420 to 510	Δ 11 (at 250V) Y 6,3 (at 440V)	60	100 L	FT 130	28 x 60	21
2504C		3	Δ 207 to 250 Y 360 to 440	Δ 11 (at 230V) Y 6,3 (at 400V)	50	100 L	FT 130	28 x 60	21
		3.6	Δ 240 to 290 Y 420 to 510	Δ 11 (at 250V) Y 6,3 (at 440V)	60	100 L	FT 130	28 x 60	21
2804C		4	Δ 207 to 250 Y 360 to 440	Δ 14,2 (at 230V) Y 8,2 (at 400V)	50	112 M	FT 130	28 x 60	26
		6.6	Δ 240 to 290 Y 420 to 510	Δ 18,9 (at 250V) Y 10,7 (at 440V)	60	112 MG	FT 130	28 x 60	36
3554C		11	Δ 207 to 250 Y 360 to 440	Δ 35,5 (at 230V) Y 20,5 (at 400V)	50	132 M	FF 265	38 x 80	54
		13.2	Δ 240 to 290 Y 420 to 510	Δ 37,8 (at 250V) Y 21,5 (at 440V)	60	132 M	FF 265	38 x 80	54

*: upper and lower limits of the operating voltage range.

Note: the forced vent unit motors operate on the following power supplies:

50 Hz: 220/380 V ± 5%, 230/400 V ± 10%, 240/415 V ± 5%, and

60 Hz: 255/440 V ± 5%, 265/460 V ± 10%, 280/480 V ± 5%.

For other distribution systems, specify the frequency and voltage values when placing an order.

C5 - Mains connection

C5.1 - TERMINAL BOX

C5.1.1 - IC 06 motor

The terminal box (TB) is made of metal and is dust and damp protected. Its standard position is on the right as seen from the drive end (see figure opposite). It has a cable gland support plate which can be removed to enable the user to drill the fixing holes for the cable gland according to the connection cables used.

If required, it can be positioned as shown in the configurations below.

For the forced vent motor (FV) the terminal box is positioned on the top, with the cable gland on the right.

Options

- The terminal box may be moved to the back for models 1124 to 1604.

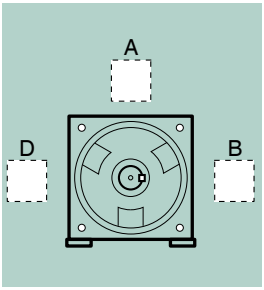
- The forced cooling fan may be fitted in an axial position: refer to section G2.3, page 141.

C5.1.2 - IC 416 motor

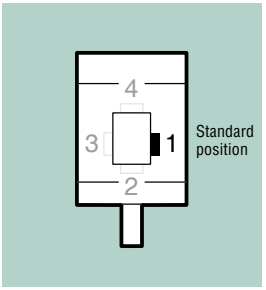
The only possible position for the vent and the terminal box is: TB: **A1**, FV: **A1**, while the cable gland support plate can be placed in any of the four positions (see figure opposite).

*: The cable gland support plate is position 2 as standard from the LSK 2004 upwards.

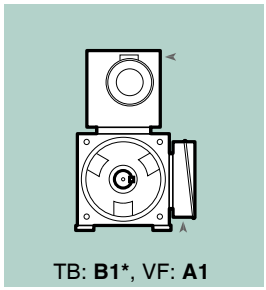
Positions of the terminal box and the forced ventilation unit in relation to the drive end of the LSK motor



Positions of the cable gland support plate (and of the cable gland for the FV motor) in relation to the drive end of the LSK motor

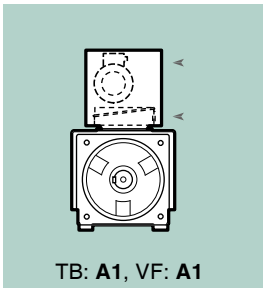


Standard LSK configuration (IC 06)



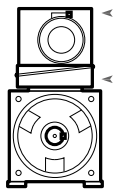
TB: **B1***, VF: **A1**

IC 416 LSK configuration

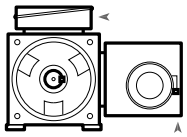


TB: **A1**, VF: **A1**

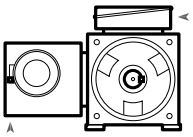
Possible configurations: IC 06 motor only



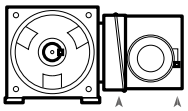
TB: **A1**, VF: **A1**
TB: **A2** for LSK 1124



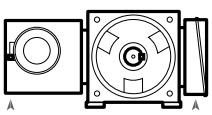
TB: **A1**, VF: **B1**



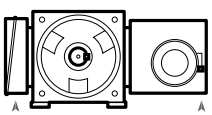
TB: **A1**, VF: **D3**



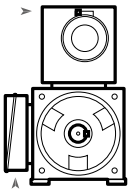
TB: **B1***, VF: **B1**
TB: **B2** pour LSK 1124



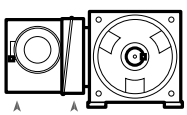
TB: **B1***, VF: **D3**



TB: **D3***, VF: **B1**



TB: **D3***, VF: **A3**



TB: **D3***, VF: **D3**
TB: **D2** for LSK 1124

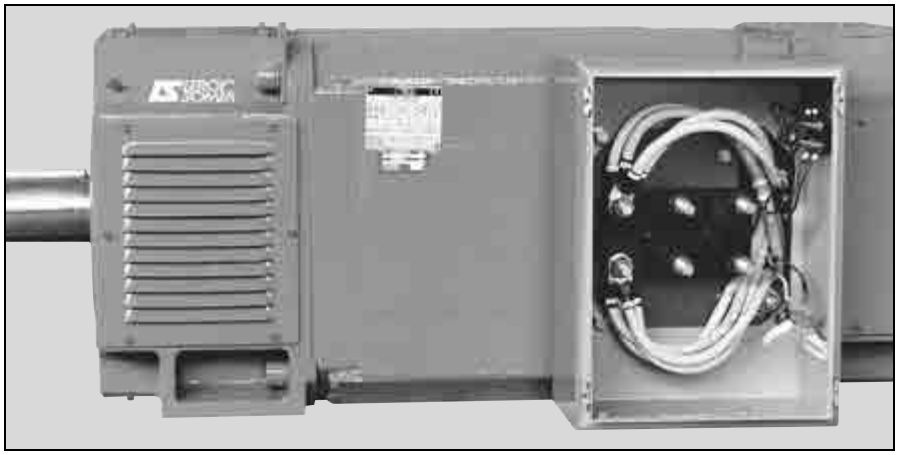
Note: The arrows show the intake of the supply current at the cable gland support plate for the LSK, and at the cable gland for the force cooled motor (FV).

C5 - Mains connection

C5.2 - TERMINAL BLOCKS

Standard motors are fitted with a block of 6 terminals. The terminal markings comply with IEC standard 60034 - 8 (or NFC51 118).

LSK 3554C terminals A1 and B2 are not on the terminal block, they are situated on two copper bars.



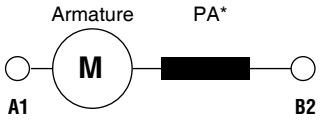
Tightening torque for the nuts on the terminal blocks ➔

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

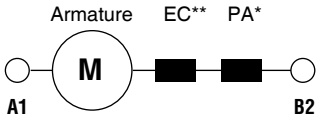
C5.3 - WIRING DIAGRAMS

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

• non compensated motor:



• compensated motor:



• dual voltage field coils with 4 output terminals, and with serial or parallel connection:

• single voltage field coils with 2 output terminals:

*PA: auxiliary poles
**EC: compensating windings

C5.4 - EARTH TERMINAL

This is situated inside the terminal box.

It is a threaded stud with a hexagonal nut, and 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 crosssection 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: ⏚ on the terminal box moulding.

For power of 100 kW or greater, an earthing terminal is added to the exterior of the terminal box.

C6 - Motor connection

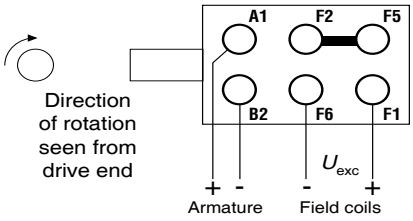
C6.1 - MOTOR

To change the direction of rotation, reverse the field excitation polarity.

C6.1.1 - Field coils with 4 output terminals

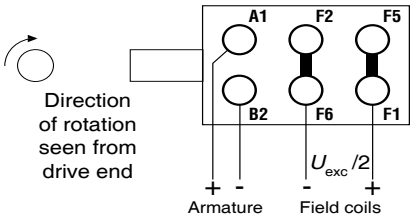
• Serial connection (clockwise rotation seen from the drive end (DE)):

Example: for a motor plate indicating 180 - 360: the field voltage will be 360 V.



• Parallel connection (clockwise rotation seen from the drive end):

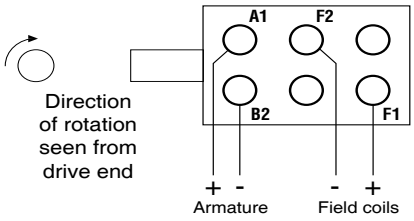
Example: For a motor plate indicating 180 - 360: the field voltage will be 180 V.



The motors are connected in the factory when the field voltage is specified in the order.

C6.1.2 - Field coils with 2 output terminals

• (clockwise rotation seen from drive end).



C6.2 - CONNECTING ACCESSORIES (options)

Accessories are connected at the terminal box. They include:
- thermal probes,
- heating resistances,
- brush wear probes,
- probes in the end shields.

All accessory outputs are marked with a "flag-type" label, and are connected in the terminal box as follows:

1 - 2: detection of brush wear limit with non-isolated contact requiring a special relay.

3 - 4: space heaters

5 - 6: detection of brush wear limit with isolated contact

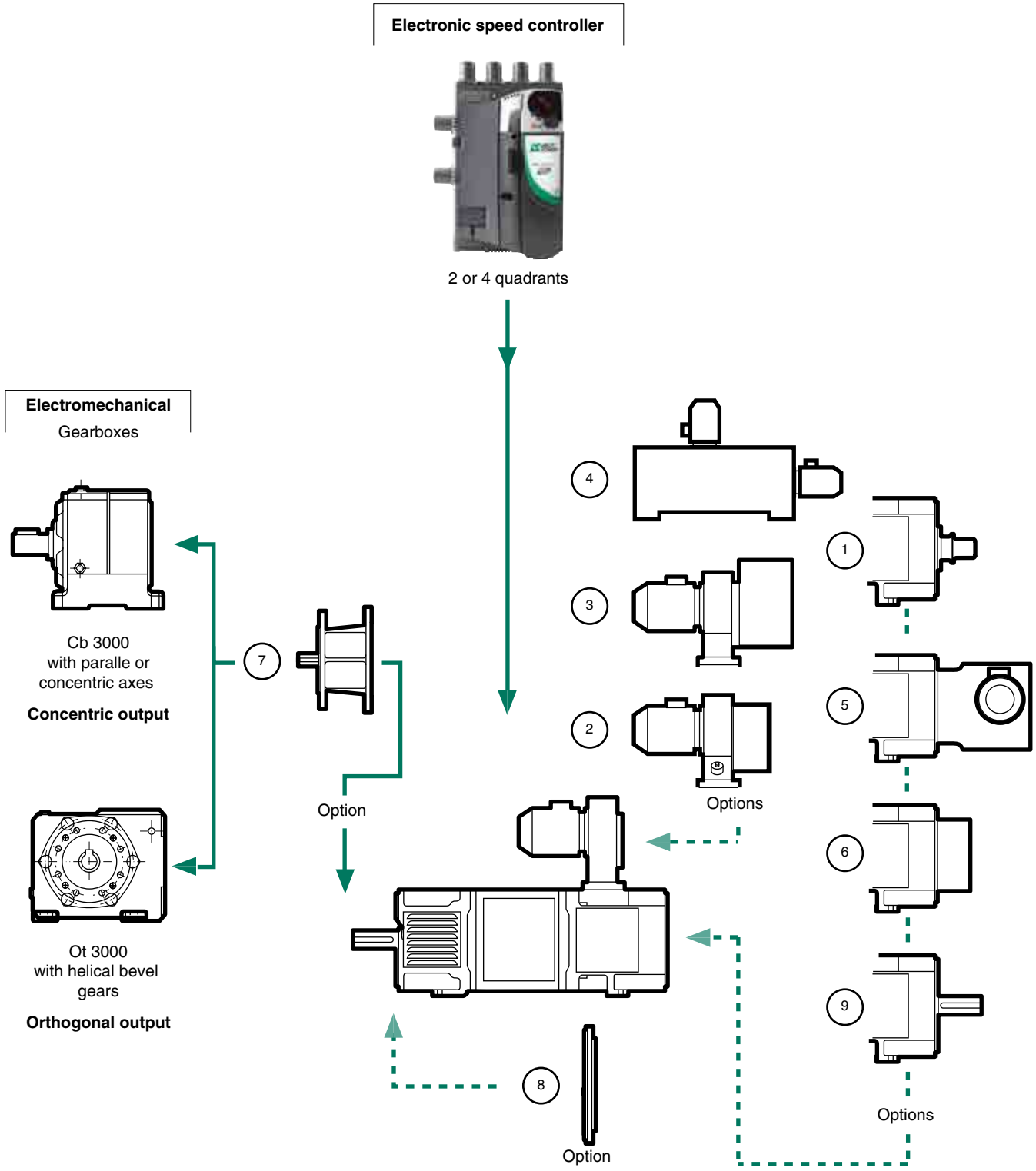
1T7 - 2T7: front end shield probes (DE)
1T8 - 2T8: rear end shield probes (NDE)

Winding thermal detection device

• single level:
T1 - T2: release;

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

C7 - Adaptations



Options

① - D.C. tachogenerator (section G3 p 144)
- Pulse generator (section G3 p 145)

② - Air flow detector (section G2 p 140)
- Air filter (section G2 p 140)

③ - Sound screens

④ - Heat air or water exchanger (IP 55)

⑤ - Axial forced cooling fan (section G2 p 141)

⑥ - No current brake with or without D.C. tachometer (sections D8 p 77 to 79, G2 p 146)

⑦ - Universal mounting for connection to speed reduction gear

⑧ - Back flange (section G1 p 139)

⑨ - Second drive shaft

D1 - Duty Cycle - Definition

Definitions (IEC 34-1)

The duty cycles are defined as follows:

1 - Continuous duty - Type S1

Operation at constant load for a sufficient amount of time for thermal equilibrium to be reached (see figure 1).

2 - Short-time duty - Type S2

Operation at constant load for a fixed amount of time, less than that required for thermal equilibrium to be reached, followed by a rest and de-energized period long enough to equalize the temperatures of the machine and the coolant to within 2 K (see figure 2).

3 - Intermittent periodic duty - Type S3

A succession of identical duty cycles, each containing a period of operation at constant load and a rest and de-energized period (see figure 3). Here, the cycle is such that the starting current does not significantly affect the temperature rise.

4 - Intermittent periodic duty with starting - Type S4

A succession of identical duty cycles consisting of an appreciable starting period, a period of operation at constant load and a rest and de-energized period (see figure 4).

5 - Intermittent periodic duty with electrical braking - Type S5

A succession of periodic duty cycles, each containing a starting period, a period of operation at constant load, a period of rapid electrical braking and a rest and de-energized period (see figure 5).

6 - Periodic continuous duty with intermittent load - Type S6

A succession of identical duty cycles, each containing a period of operation at constant load and a period of operation at no-load. There is no rest and de-energized period (see figure 6).

7 - Periodic continuous duty with electrical braking - Type S7

A succession of identical duty cycles, each containing a starting period, a period of operation at constant load and a period of electrical braking. There is no rest and de-energized period (see figure 7).

8 - Continuous-operation periodic duty with related changes of load and speed - Type S8

A succession of identical duty cycles, each containing a period of operation at a constant load corresponding to a predetermined rotation speed, followed by one or more periods of operation at other constant loads corresponding to different rotation speeds (in induction motors, this can be done by changing the number of poles). There is no rest and de-energized period (see figure 8).

9 - Duty with non-periodic variations in load and speed - Type S9

This is a duty in which the load and speed generally vary non-periodically within the permissible operating range. This duty frequently includes applied overloads which may be much higher than the full load or loads (see figure 9).

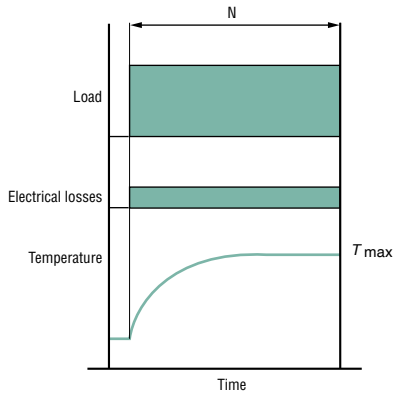
Note: for this type of duty, the appropriate full load values must be used as the basis for calculating overload.

10 - Operation at discrete constant loads - Type S10

This duty consists of a maximum of 4 discrete load values (or equivalent loads), each value being applied for sufficient time for the machine to reach thermal equilibrium. The minimum load during a load cycle may be zero (no-load operation or rest and de-energized period) (see figure 10).

D

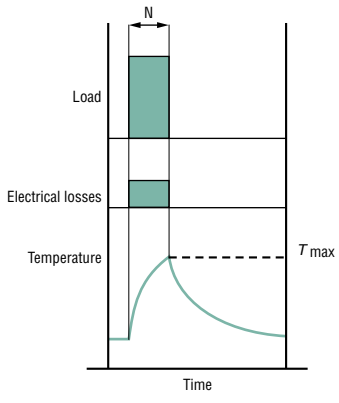
Fig. 1. - Continuous duty. Type S1.



N = operation at constant load

T_{max} = maximum temperature attained

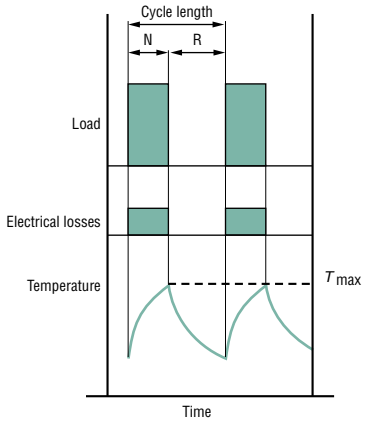
Fig. 2. - Short-time duty. Type S2.



N = operation at constant load

T_{max} = maximum temperature attained

Fig. 3. - Intermittent periodic duty. Type S3.



N = operation at constant load

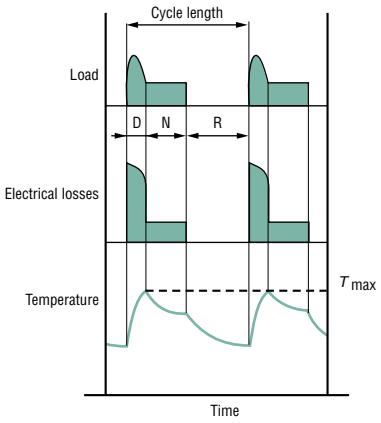
R = rest

T_{max} = maximum temperature attained

$$\text{Duty cycle (\%)} = \frac{N}{N+R} \bullet 100$$

D1 - Duty Cycle - Definition

Fig. 4. - Intermittent periodic duty with starting. Type S4.



D = starting

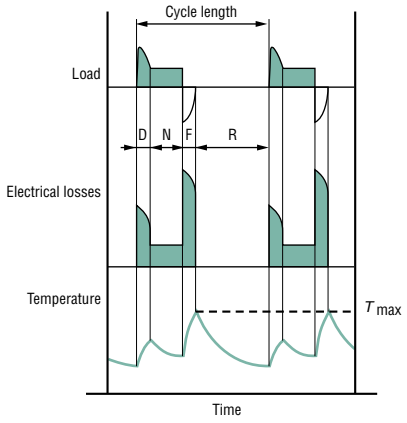
N = operation at constant load

R = rest

T_{max} = maximum temperature attained during cycle

$$\text{Duty cycle (\%)} = \frac{D + N}{N + R + D} \bullet 100$$

Fig. 5. - Intermittent periodic duty with electrical braking. Type S5.



D = starting

N = operation at constant load

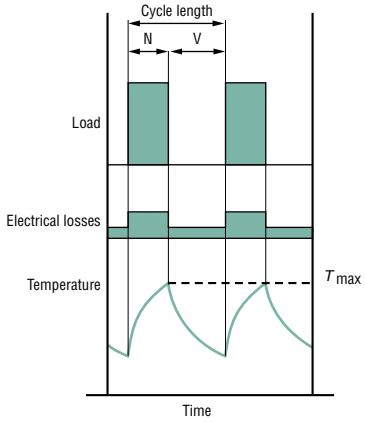
F = electrical braking

R = rest

T_{max} = maximum temperature attained during cycle

$$\text{Duty cycle (\%)} = \frac{D + N + F}{D + N + F + R} \bullet 100$$

Fig. 6. - Periodic continuous duty with intermittent load. Type S6.



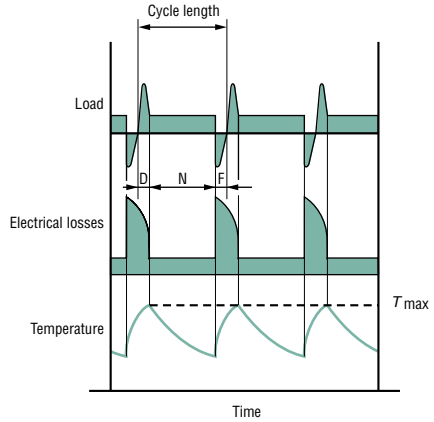
N = operation at constant load

V = no-load operation

T_{max} = maximum temperature attained during cycle

$$\text{Duty cycle (\%)} = \frac{N}{N + V} \bullet 100$$

Fig. 7. - Periodical continuous duty with electrical braking. Type S7.



D = starting

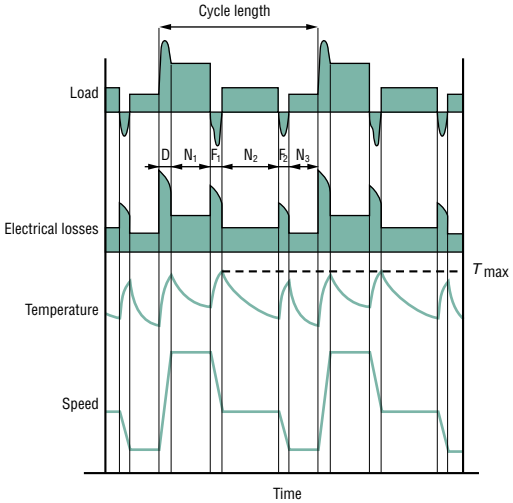
N = operation at constant load

F = electrical braking

T_{max} = maximum temperature attained during cycle

Duty cycle = 1

Fig. 8. - Continuous-operation periodic duty with related changes of load and speed. Type S8.



F_1F_2 = electrical braking

D = starting

$N_1N_2N_3$ = operation at constant loads

T_{max} = maximum temperature attained during cycle

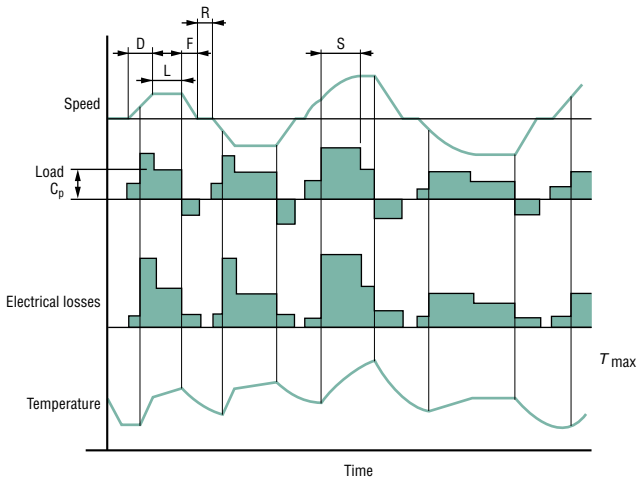
$$\text{Duty cycle} = \frac{D + N_1}{D + N_1 + F_1 + N_2 + F_2 + N_3}\ 100\%$$

$$\frac{F_1 + N_2}{D + N_1 + F_1 + N_2 + F_2 + N_3}\ 100\%$$

$$\frac{F_2 + N_3}{D + N_1 + F_1 + N_2 + F_2 + N_3}\ 100\%$$

D1 - Duty Cycle - Definition

Fig. 9. - Duty with non-periodic variations in load and speed. Type S9.



D = starting.

L = operation at variable loads.

F = electrical braking.

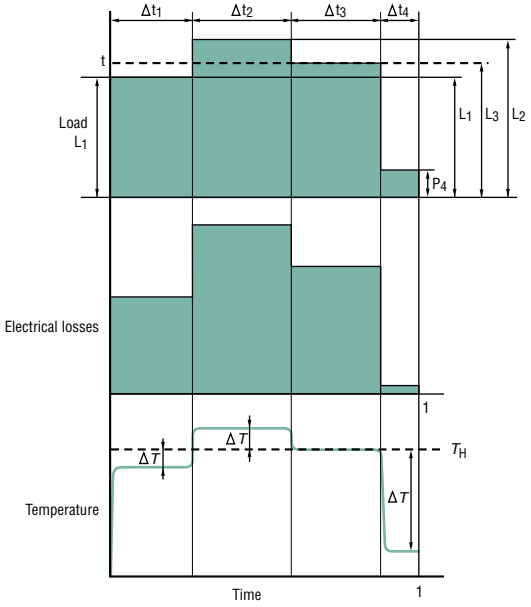
R = rest.

S = operation at overload.

C_p = full load.

T_{max} = maximum temperature attained.

Fig. 10 - Duty at discrete constant loads. Type S10.



L = loads.

N = power rating for duty type S1.

p = $p = \frac{L}{N}$ = reduced load.

t = time.

T_p = total cycle time.

t_i = discrete period within a cycle.

Δt_i = t_i / T_p = relative duration of period within a cycle.

P_u = electrical losses.

H_N = temperature at power rating for duty type S1.

ΔH_i = increase or decrease in temperature rise at the i^{th} period of a cycle.

D

D2 - Supply voltage

D2.1 - REGULATIONS AND STANDARDS (mains supply)

The statement by the electricity consultative committee dated 25th June 1982, and the 6th edition (1983) of publication no. 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.

IEC guide 106 also gives tolerances for power supplies:

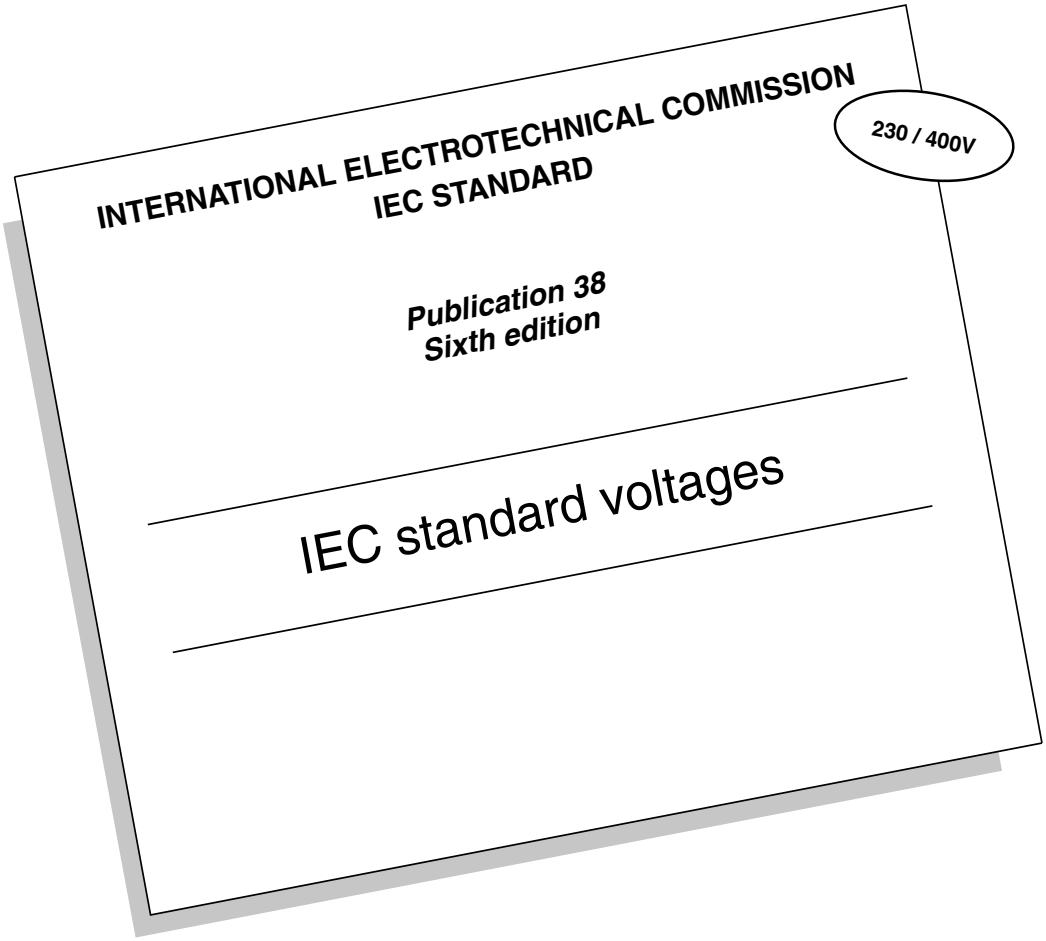
- Maximum line drop between customer delivery point and customer usage point: 4%.
- Variation in frequency around nominal frequency:
  - continuous state : ±1%
  - transient state : ±2%
- Three-phase mains phase-balance error:
  - zero-sequence component and/or negative phase sequence component compared to positive phase sequence component: < 2%
- Harmonics:
  - relative harmonic content: < 10%
  - individual harmonic voltages: to be established.
- Surges and transient power cuts: to be established.

D2.2 - POWER SUPPLY (rectified voltage)

D2.2.1 - Field excitation

Motors with series or parallel field windings, labelled 180 - 360 V on the motor plate (LSK standard), can be used in a voltage range of 160 to 190 V or 320 to 380 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. Other rated field voltages are possible.

Field excitation can be used with full wave rectified D.C. power supplies (possibly with half wave for sizes 1124 to 1604).



D2 - Supply voltage

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.

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

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

D2.2.2 - 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 1. - 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
240	270
400	440
415	460
460	500
500	570
660	750

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

D2.3 - DEFINITIONS

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 current imbalance (ΔI) of up to 10% (see curve 1).

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.

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

The value is generally expressed as:

$v_v = 200 \times I_n$ in A/s for sizes 1124 to 1804C,

$v_v = 150 \times I_n$ in A/s for sizes 2004C to 2804C

Form factor (FF)

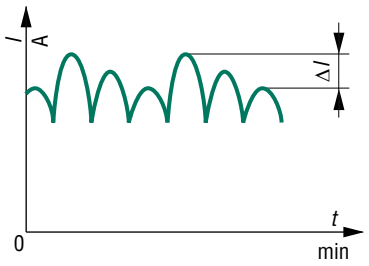
The form factor must be less than 1.04. It is the relationship between rms voltage and average voltage:

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

U_{rms}: rms voltage

U_{av}: average voltage.

Curve 1. - Current imbalance



D3 - Insulation class

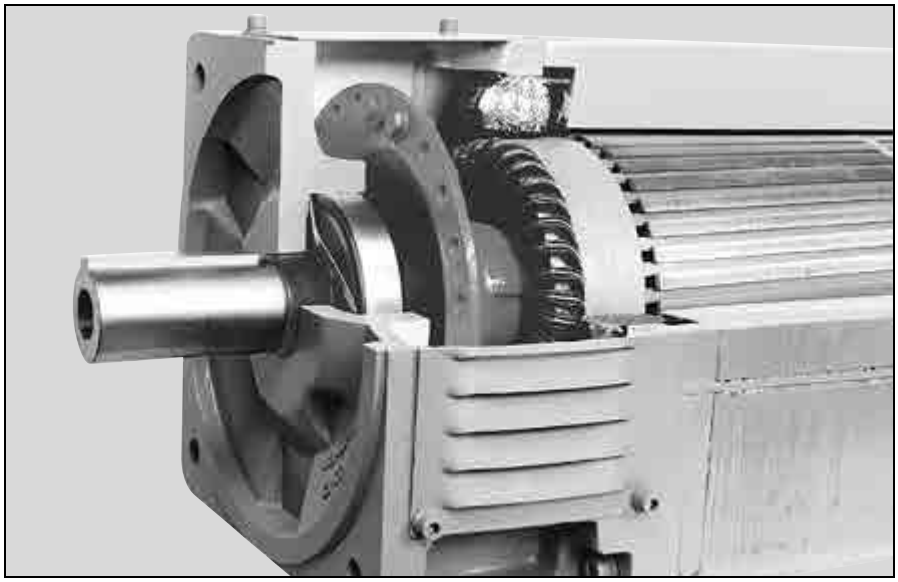
Insulation class

The machines in this catalogue have been designed with a Class H insulation system for the windings.

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 60085 and IEC 60034-1).

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 section B3), 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 60034-1).

	ΔT^*	T_{max}
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.

D4 - Power - Torque - Efficiency

D4.1 - DEFINITIONS

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

$$P_u = M.\omega$$

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}:

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

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:

$$P_u = U.I.\ \eta$$

where
P_u : output power in W,
U : armature voltage in V,
I : armature current in A,
η : efficiency of the machine.

D4.2 - CALCULATION OF ACCELERATING TORQUE AND STARTING TIME

Starting time can be calculated using a simplified formula:

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

t_d: is the starting time in seconds;

J_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: resistive torque in N.m.

Chart 1 on the following page can also be used to determine 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:

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

D4.3 - PERMISSIBLE STARTING TIMES AND LOCKED ROTOR TIMES

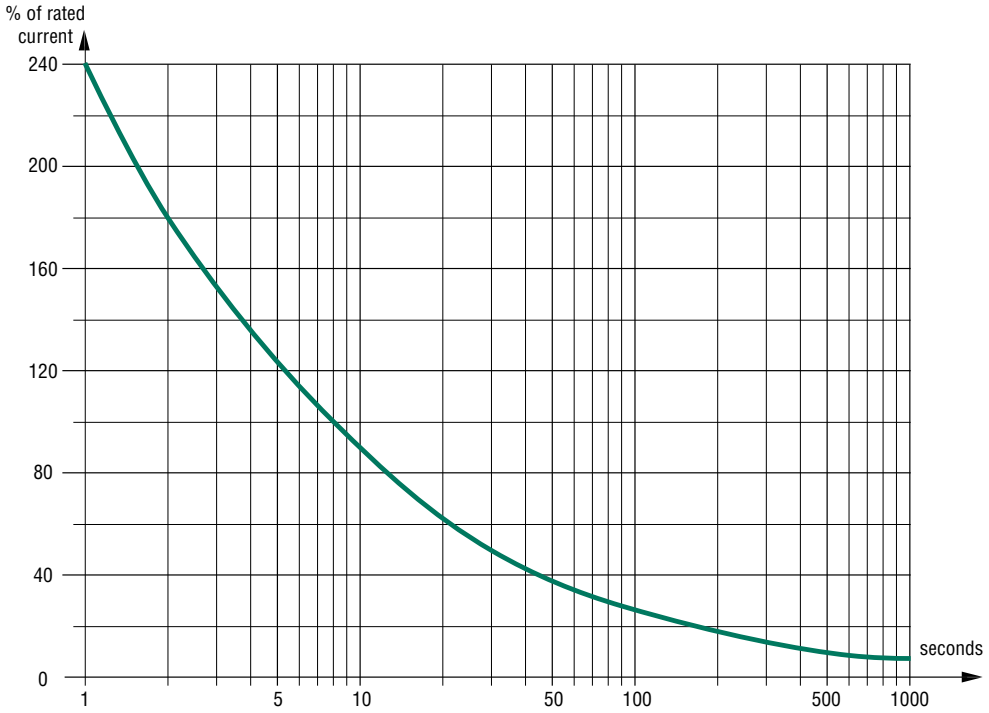
Starting is managed by the speed controller which usually has an adjustable starting ramp with current limitation, generally at 1.5 times the rated current.

When operating with locked armature 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.

D

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



D4 - Power - Torque - Efficiency

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}.

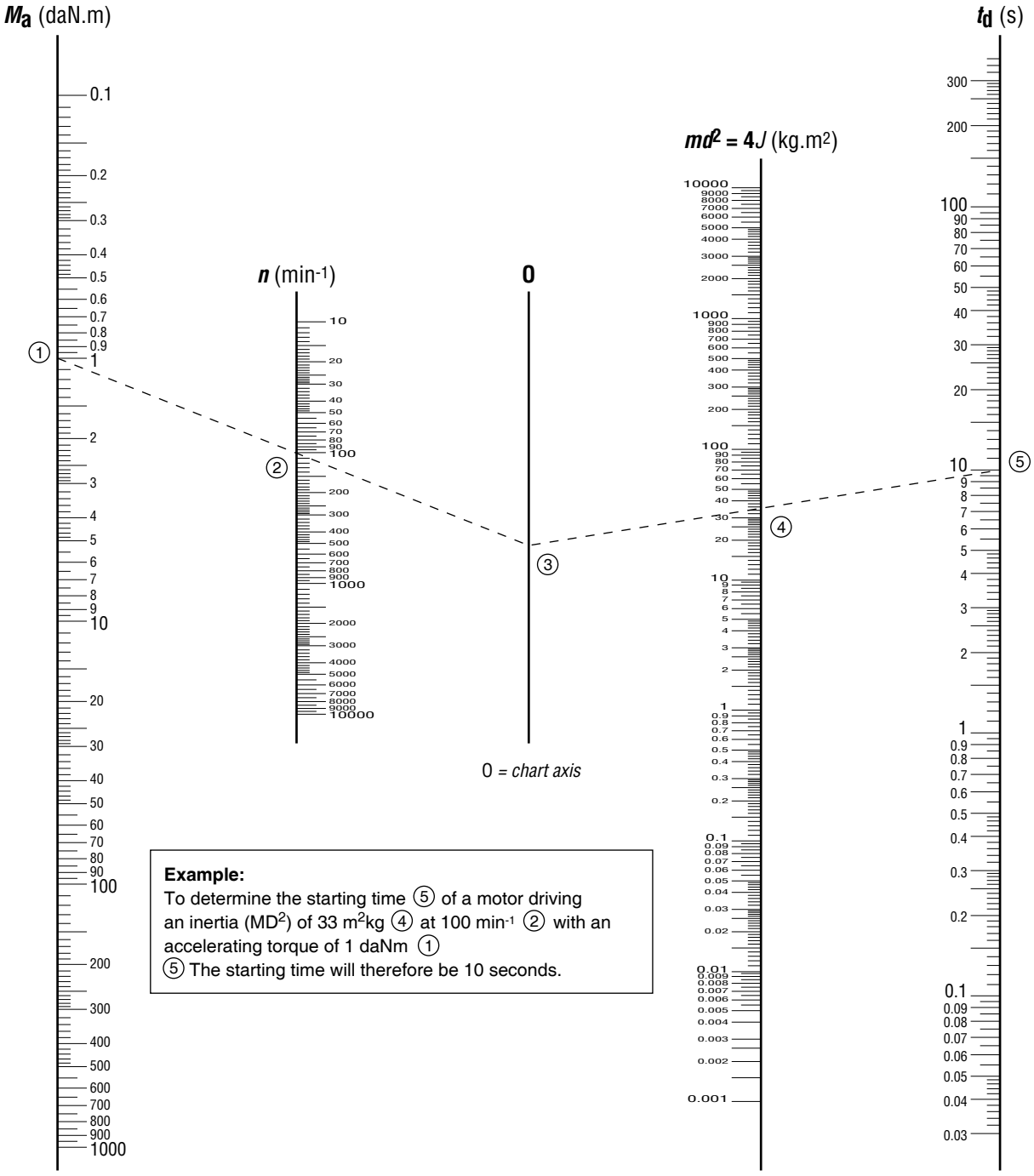
Draw a line from the point corresponding to the accelerating torque (1 daN.m in the first column of the chart below) to that of the speed (100 min^{-1} on the second column), and continue it to column 0, the chart axis.

Then draw a line from the point where it meets 0 to the corresponding value in the third column ($md^2 = 4 \times 9$ 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 seconds

Starting time calculation chart



D4 - Power - Torque - Efficiency

D4.4 - 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:

$$M_m = \sqrt{\frac{\sum_1^n (M_i^2 \cdot t_i)}{\sum_1^n t_i}} = \sqrt{\frac{M_1^2 \cdot t_1 + M_2^2 \cdot t_2 ... + M_n^2 \cdot t_n}{t_1 + t_2 + ... + t_n}}$$

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 (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.

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

$$I_m = \sqrt{\frac{\sum_1^n (I_i^2 \cdot t_i)}{\sum_1^n t_i}} = \sqrt{\frac{I_1^2 \cdot t_1 + I_2^2 \cdot t_2 ... + I_n^2 \cdot t_n}{t_1 + t_2 + ... + t_n}}$$

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:

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

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.

Note: When selecting the motor, check that overloads resulting from the operating cycle do not exceed the overload capacity shown in section D5.3 on page 70. Alternatively, use a larger motor which has adequate overload capacity.

D5 - Speed of rotation

D5.1 - DEFINITIONS

D5.1.1 - Rated speed *n*

Rated speed *n* assumes:

- armature and field coils powered at rated voltage,

- stabilized motor temperature,

- IEC standard tolerances (separate excitation motor) equal to:

± 7.5%
if $2.5 \leq P_{ct} < 10$

± 5%
if $P_{ct} \geq 10$

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

Example: power required is 50 kW to a speed of 2000 min^{-1}.

P_{ct} will = 50 × 1000 / 2000 = 25 therefore

$P_{ct} > 10$, and the tolerance will be ±5%.

D5.1.2 - Maximum electrical speed $n_{max\ elec}$

This is the maximum operating speed permitted by field weakening at constant power. The armature is powered at constant rated voltage.

A higher speed can be achieved by reducing the armature current and therefore the power. However it must be lower than the maximum mechanical speed $n_{max\ mech}$.

The study should take into account the application and real operating cycle, $M = f(n)$, et $M_{max} = f(n)$.

D5.1.3 - Maximum mechanical speed $n_{max\ mech}$

This is the maximum permissible operating speed within the mechanical limitations (it permits an accidental overspeed of 20%). See table 1.

D5.1.4 - Speed range

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

D5.1.5 - Operating range

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

D5.2 - OPERATION

See figures 1 and 2.

D5.2.1 - Operation at constant torque: a

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

D5.2.2 - Operation at constant power by field weakening: b

This is the speed range between the rated speed n_N and $n_{max\ elec}$ by varying the field voltage at constant armature voltage and current.

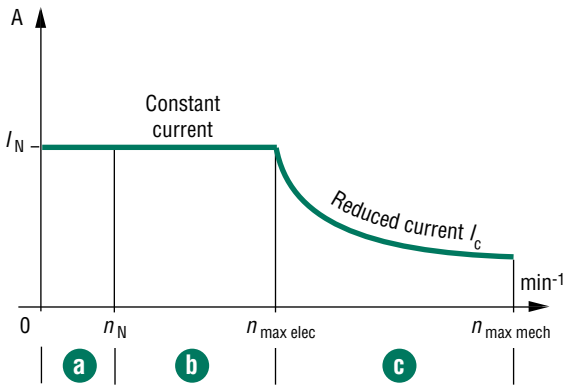
D5.2.3 - Operation at decreasing power by field weakening: c

This is the speed range between the maximum electrical speed $n_{max\ elec}$ and mechanical speed $n_{max\ mech}$ by varying the field voltage with the constant armature voltage (see section D5.2.6) and decreasing armature current.

D5.2.4 - Overcurrent

Occasional overcurrents are permitted. Their value is given by table 2 depending on the speed range in question (The use of a speed sensor will give better stability, especially when de-energized).

Curve 1. - Current as a function of the speed



Curve 2. - Power as a function of the speed

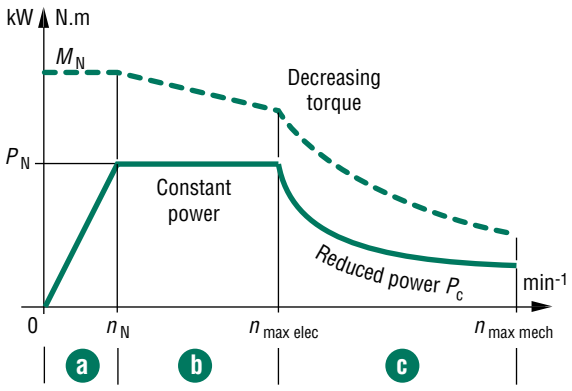


Table 1. - Maximum mechanical speed by frame size

Frame size	Speed min^{-1}	Frame size	Speed min^{-1}
112	4000	**225**	3000
132	4000	**250**	2100
160	4000	**280**	2000
180	3600	**355**	2000
200	3200		

Table 2. - Change of working speed: permitted overcurrent as a function of the speed range

Duty	a	b	c
Continuous (duty S 1)	I_N	I_N	$I_{N\ decreasing}$
Intermittent (NC motor*)	1.8 I_N	1.8 I_N Ù 1.1 I_N	1.1 I_c
Intermittent (C motor*)	1.6 I_N	1.6 I_N Ù 1.1 I_N	1.1 I_c

*: NC: non compensated; C: compensated.

D5 - Speed of rotation

D5.2.5 - Compensation

Compensation enables the speed range to be increased **b**.

This winding permits an overshoot of about 60% (see curve 3).

For non-compensated motors, please note that in the case of overload the torque is no longer proportional to the armature current. This can be remedied by selecting a compensated motor (see curve 4).

In the selection tables the motor indices with the sign "▼" are only available in the "compensated" version for the power rating in question.

Example: LSK 1324 M8, 27.6 kW, 1770 min^{-1}, 440 V, $n_{max\ elec}$ = 2830 min^{-1}

With compensation, $n_{max\ elec}$ becomes:

$n_{max\ elec\ comp}$ = 2830 × 1.6 = 4520 min^{-1}

$n_{max\ mech}$ = 4000 min^{-1} for standard operation. Speed $n_{max\ elec\ comp}$ will therefore be limited to 4000 min^{-1} due to mechanical limitations.

D5.2.6 - Calculating power P_c in the decreasing phase

In the speed range **c** power can be determined using the following calculation:

$P_c = P \cdot k$

where

P_c : *power* to speed n_c

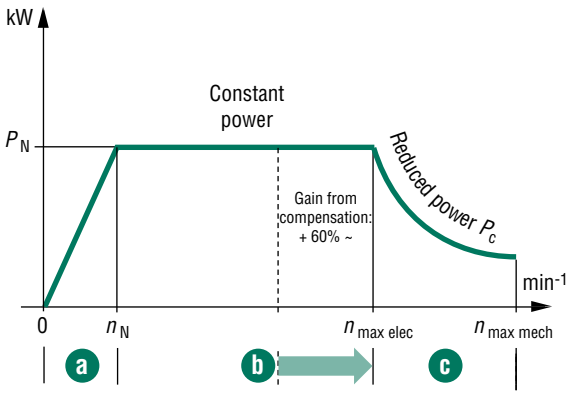
P : catalogue power (given in selection tables)

k : correction coefficient (calculated on curve 5).

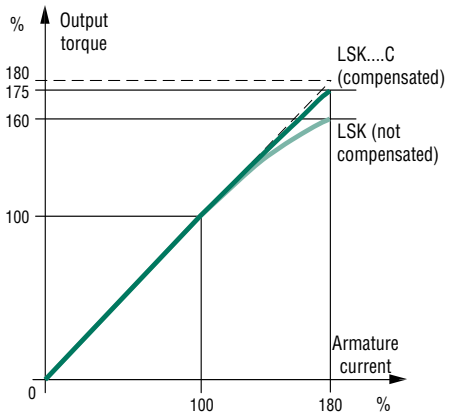
Note: n_c is such that:

$$n_{max\ elec} < n_c < n_{max\ mech}$$

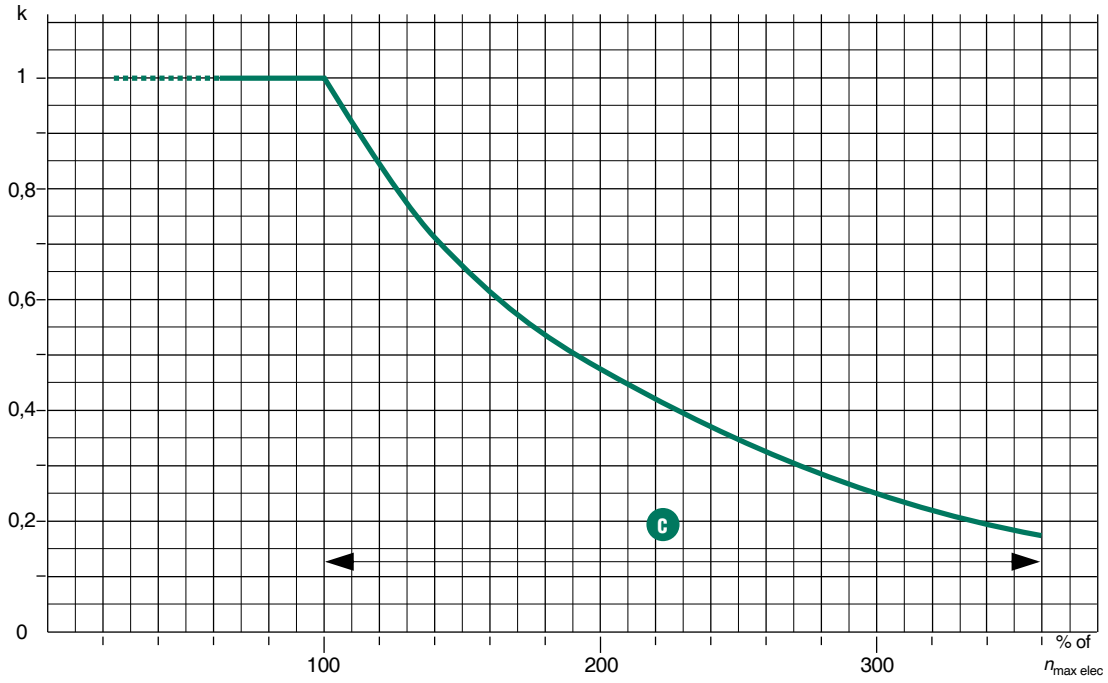
Curve 3. - Power as a function of speed: compensated motor



Curve 4. - Torque as a function of current: comparison between compensated and non-compensated motors



Curve 5. - Power correction coefficient k as a function of speed variation by field



D5 - Speed of rotation

D5.3 - 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, twice an hour.

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

The curve I_{max} / I_n enables calculation of permitted overloads as a function of operating times.

Curve 1 defines a short overload current as a percentage of the rated torque (for continuous duty) 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 rms current of 100% of rated current during the cycle.

D

Curve 1. - Permitted overcurrent as a function of time

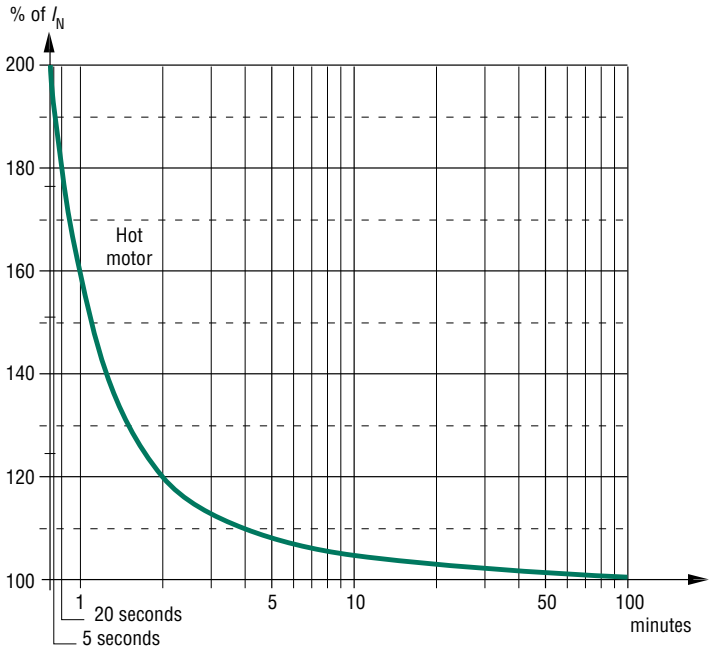


Table 1. - Permitted overload in steady state as a function of the duration

Overload	Duration	Number of overloads per	
		20 min	100 min
1.8 I_N	20 s	1	5*
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.

Permitted current with rotor switched off

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

Consult previous section: D4 Power rating - Torque - Efficiency section D4.3 (page 65): curve 1 gives the permitted current as a function of the time.

D5 - Speed of rotation

D5.4 - VARIABLE SPEEDS

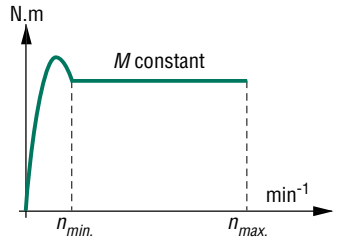
For manufacturing processes which require several different speed adjustments or for production processes on the same machine but with different loads, variable speed control is the ideal solution.

D5.4.1 - Applications

The majority of applications can be grouped into the following three families:

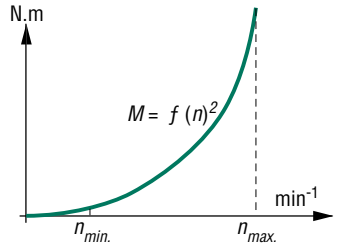
- constant torque machines

The torque remains constant throughout the speed range, inertia is low and generally limited to that of the motor. E.g. extrusion machines, printing machines (except winding and unwinding machines), horizontal conveyors, etc.



- centrifugal machines

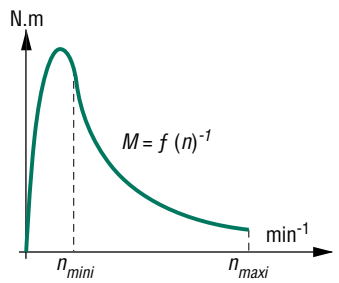
torque varies as a function of the square of the speed and acceleration is generally low: fans, pumps, etc.



In the above two cases, the separate excitation motor operates at constant flux.

- variable torque machines

The torque varies as an inverse function of speed, and the machine has high inertia; accelerating and decelerating times are determinant. This is generally the case with winders, unwinders, machine tool drills, and the solution is often to vary the flux over part of the range.



D5.4.2 - 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.

D5.4.3 - Speed controllers

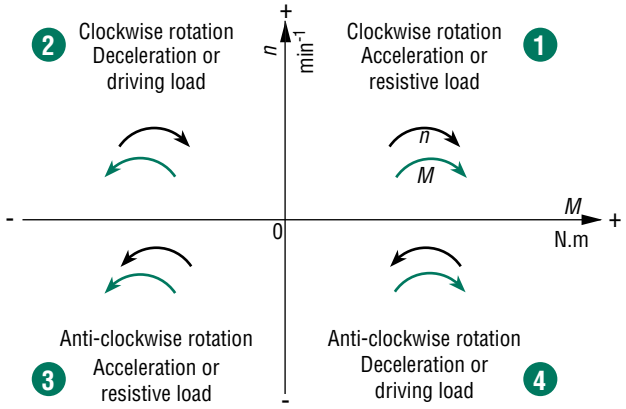
Designed to supply D.C. motors with separate excitation, LEROY-SOMER introduces a new range which can be powered by a three-phase supply of 220V to 480 V, 575V or 690V ±10%. These controllers adapt automatically to the voltage and frequency of the supply. They control armature current, speed and, as an option, field current (variable excitation power supply).

Mentor MP integrates the control platform from the UNIDRIVE SP with an internal programmable motion controller. Optimum performances combined with a flexible system interfacing capability make the Mentor MP the most advanced DC drive available.

Quick commissioning is due to an easy configuring by removable keypad, Smartcard or PC commissioning tools. Auto tune features and easy parameter set up allow getting the best performances, by measuring the motor and the machine characteristics, and automatic parameters control optimisation.

D

Direction of rotation	1 way	2 way	1 way	2 way
Load	resistive	resistive	driving	driving
Operation	motor	motor	motor + generator	motor + generator
Quadrant	1	1 3	1 2	1 2 3 4



D6 - Noise and vibration

D6.1 - NOISE LEVELS

Noise emitted by rotating machines

In a compressible medium, the mechanical vibrations of an elastic body create pressure waves which are characterized by the amplitude and frequency. The pressure waves constitute an audible noise if they have a frequency of between 16 and 16000 Hz.

Noise is measured by a microphone connected to a frequency analyzer. Measurements are taken in an anechoic chamber on machines on no-load, and a sound pressure level L_p or a sound power level L_w can then be established. Measurement can also be carried out in situ on machines which may be on-load, using an acoustic intensity meter which can differentiate between sound sources and identify the sound emissions from the machine.

The concept of noise is linked to hearing. The auditory sensation is determined by integrating weighted frequency components with isosonic curves (giving a sensation of constant sound level) according to their intensity.

The weighting is performed in sound meters using filters whose bandwidth takes into account, to a certain extent, the physiology of the human ear:

Filter A: *used for low and medium noise levels. High attenuation, narrow bandwidth.*
Filter B: *used for very high noise levels. Wide bandwidth.*
Filter C: *very low attenuation over the whole of the audible frequency range.*
Filter A is used most frequently for sound levels emitted by rotating machinery. It is this filter which is used when determining the characteristics.

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

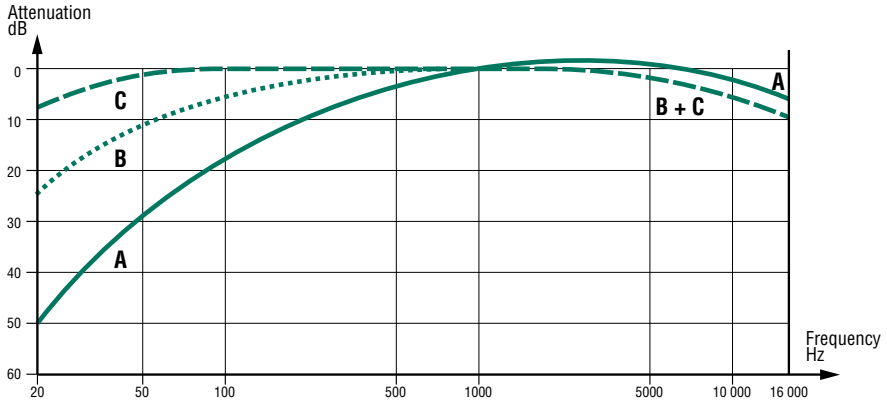
$L_p = 20\log_{10}\left(\frac{P}{P_0}\right)$ where $p_0 = 2.10^{-5}$ Pa

Sound intensity level in dB

$L_W = 10\log_{10}\left(\frac{P}{P_0}\right)$ where $p_0 = 10^{-12}$ W

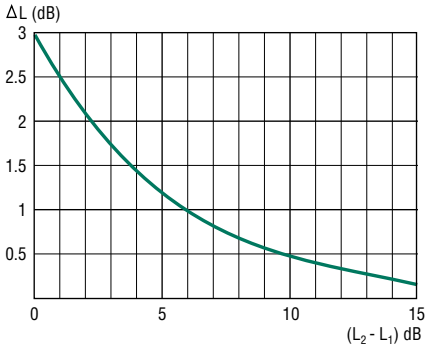
Sound intensity level in dB

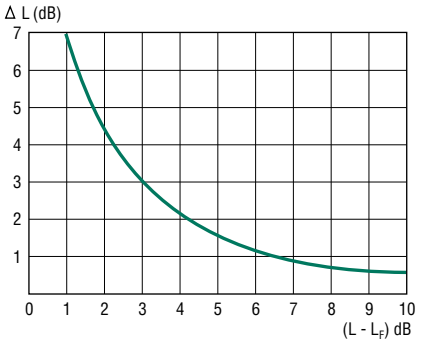
$L_W = 10\log_{10}\left(\frac{I}{I_0}\right)$ where $I_0 = 10^{-12}$ W/m^2



Correction of measurements

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





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 s.

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 s

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

D6 - Noise and vibration

Under IEC 60034-9, the guaranteed values are given for a machine operating on no-load under normal supply conditions (IEC 60034-1), in the actual operating position, or sometimes in the direction of rotation as 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.

Weighted sound level [dB(A)]

Expressed as sound power level (Lw) in accordance with the standard, the sound levels of LSK motors (version IC 06) are also shown as sound pressure levels (Lp) in the table below. Values are shown for ventilation induction motors with two poles and 50 Hz power supply.

Table 1. - Sound levels (without sound screens)

IC 06 cooling

LSK motor model	Power level L_w dB (A)	Pressure L_p dB (A)
1124	76	67
1324	80	71
1604	87	76
1804 M-L, 1804C M-L	90	79
1804 VL	93	82
2004	91	80
2254	92	81
2504C	95	83
2804C	97	85
3554C	99	88

IC 416 cooling

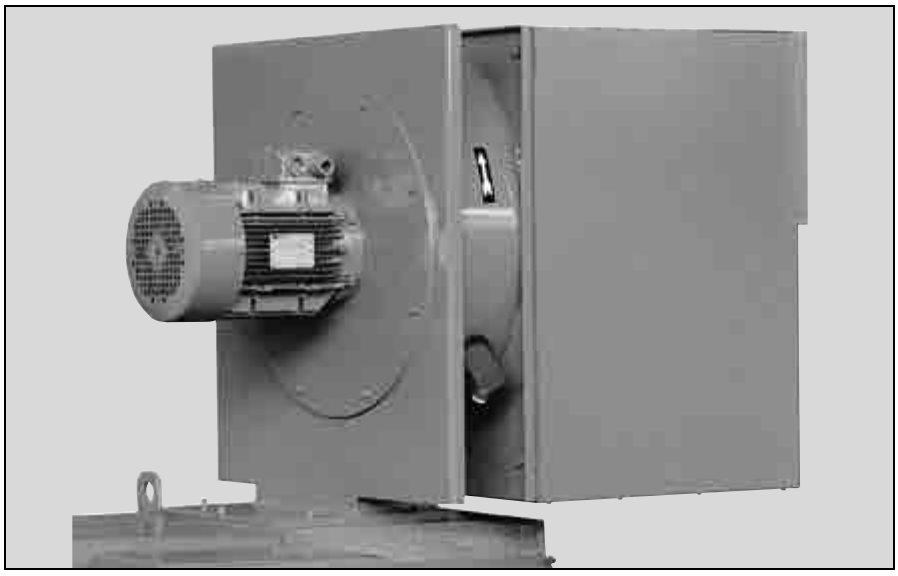
LSK motor model	Power level L_w dB (A)	Pressure L_p dB (A)
1124	88	78
1324	88	78
1604 S-M-L	94	83
1604 VL	97	85
1804 VL	98	87

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

Decreasing sound levels

If lower sound levels are required, the IC 37 method of cooling may be used whereby the cooling system can be installed in a less sensitive area.

Sound screens are available on request. (ask for estimate). They reduce the noise level by 5 dB(A) to 10 dB(A) (depending on LSK type).



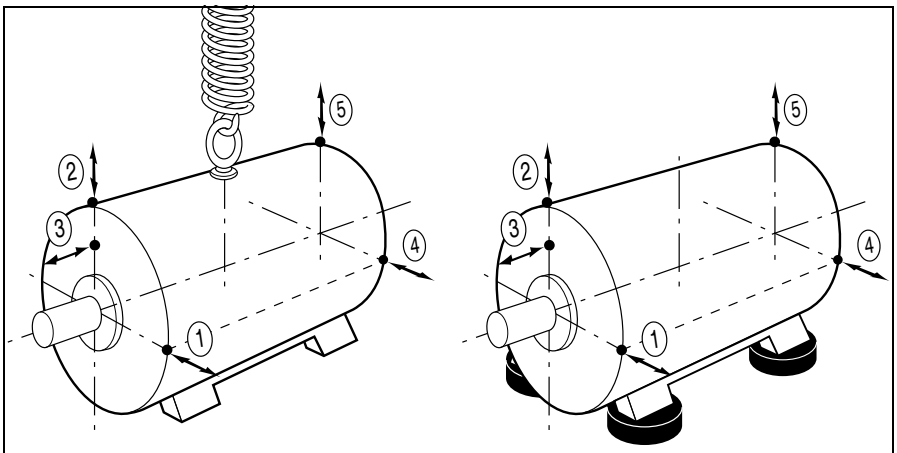
D6 - Noise and vibration

The LSK machines in this catalogue are classed A level, half-key balancing

D6.2 - 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 incorrect 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 machines in this catalogue are classed A level. B level 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".

Measured parameters

The vibration speed can be chosen as the variable to be measured. This is the speed at which the machine moves either side of its static position. (Measured in mm/s).

As the vibratory movements are complex and non-harmonic, it is the quadratic average (rms value) of the speed of vibration which is used to express the vibration level.

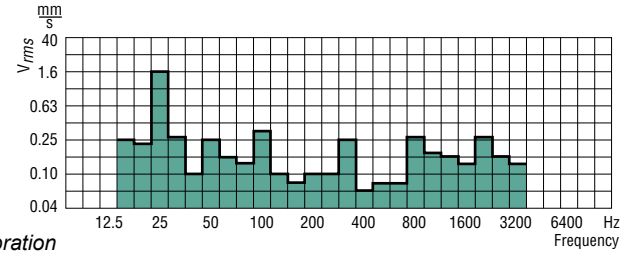
Other variables that could be measured are the vibratory displacement amplitude (in microns) or vibratory acceleration (in m/s^2).

If the vibratory displacement is measured against frequency, the measured value decreases with the frequency: high frequency vibrations are not taken into account.

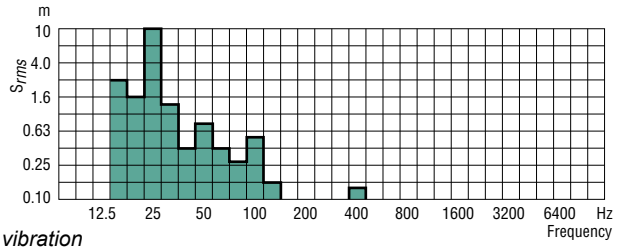
If the vibratory acceleration is measured against frequency, the measured value increases with the frequency: low frequency vibrations (unbalanced loads) are not taken into account.

The rms speed of vibration is the variable chosen by the standards.

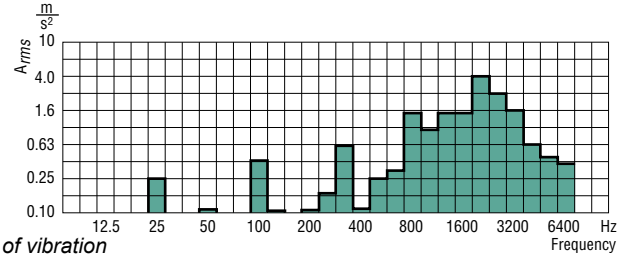
However, if preferred, the table of vibration amplitudes may still be used for measuring sinusoidal and similar vibrations.



Speed of vibration



Amplitude of vibration



Acceleration of vibration

D6 - Noise and vibration

MAXIMUM VIBRATION MAGNITUDE LIMITS, FOR DISPLACEMENT, SPEED AND ACCELERATION IN RMS VALUES FOR FRAME SIZE H (IEC 60034-14)

Vibration level	Frame size H (mm)								
	56 < H ≤ 132			132 < H ≤ 280			H > 280		
	Displacement µm	Speed mm/s	Acceleration m/s^2	Displacement µm	Speed mm/s	Acceleration m/s^2	Displacement µm	Speed mm/s	Acceleration m/s^2
A	25	1.6	2.5	35	2.2	3.5	45	2.8	4.4
B	11	0.7	1.1	18	1.1	1.7	29	1.8	2.8

For large machines and special requirements with regard to vibration, balancing can be carried out *in situ* (finished assembly).
Prior consultation is essential, as the machine dimensions may be modified by the addition to the drive ends of the balancing disks required in this situation.

D

D7 - Performance

The LSK motors in this catalogue are equipped as standard with PTC probes

D7.1 - 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;

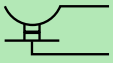
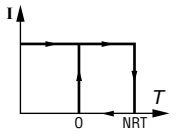
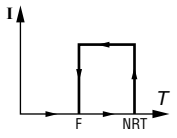
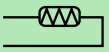
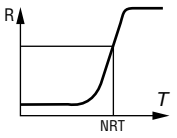
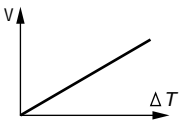
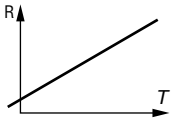
- and protection against overspeeds (lack of field excitation, speed control fault, etc).

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 do not themselves protect the motor.

D

D7.2 - BUILT-IN THERMAL DETECTION

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 (O) 		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 (C) 		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
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
Thermocouples	T (T < 150 °C) copper constantan K (T < 1000 °C) copper copper-nickel	Peltier effect		0	continuous surveillance at hot spots	1 per hot spot
Platinum resistance thermometer	PT 100	variable, non-linear resistor, indirectly heated		0	high accuracy continuous surveillance at key hot spots	1 per hot spot

- 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 Mentor MP speed controllers include direct connection for probes;

- PT 100 or Thermocouples, with associated reading equipment (or recorder), in the control panel of the installation, for continuous surveillance.

Alarm and Early Warning

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

D8 - Methods of braking

D8.1 - 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.

D8.1.1 - 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.

D8.1.2 - 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.

D8.2 - 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.

D8.2.1 - Definitions

Dynamic load

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

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.

D8.2.2 - Parameters

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:

$$Q = 5{,}5 \times 10^{-3} \cdot \frac{\Sigma J \cdot n^2 \cdot M_F}{M_F + M_c}$$

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

where:

Q : work due to friction in J

ΣJ : 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

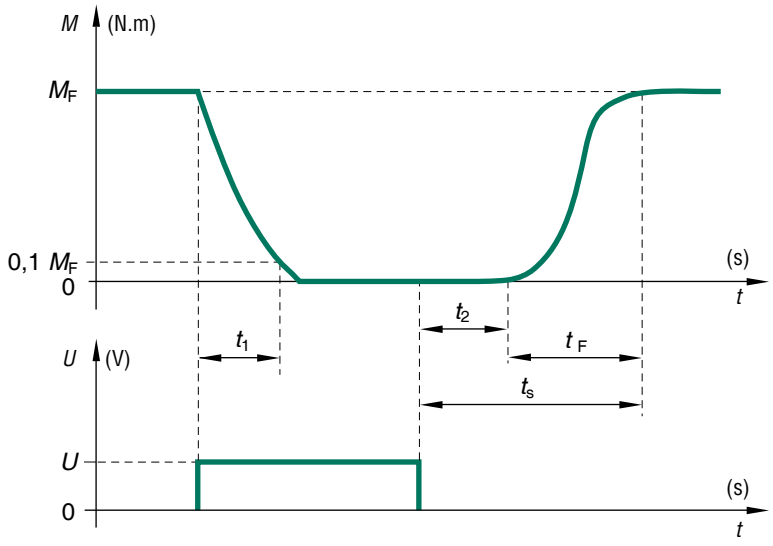
J_m : motor inertia in m^2kg

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 curve 2 (see page 78). Conversely braking frequency may be calculated if work due to friction is known.

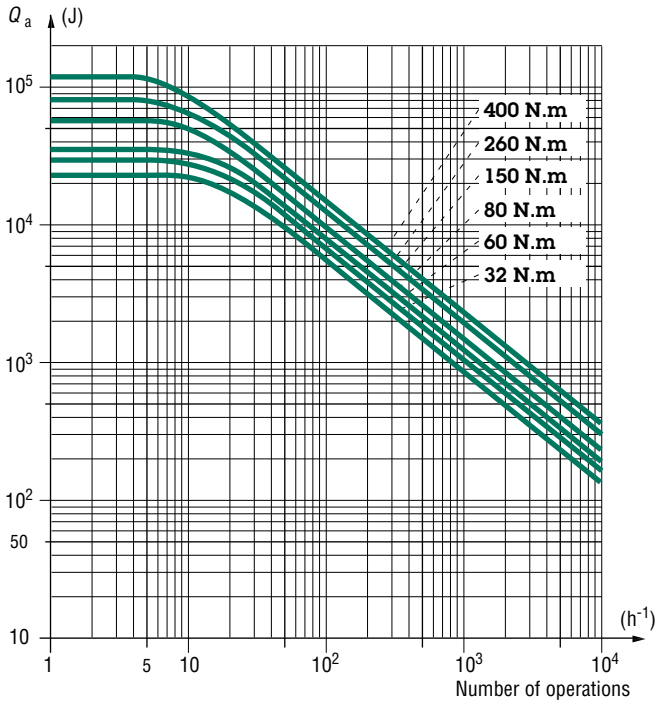
Curve 1. - Response time of an electromagnetic brake

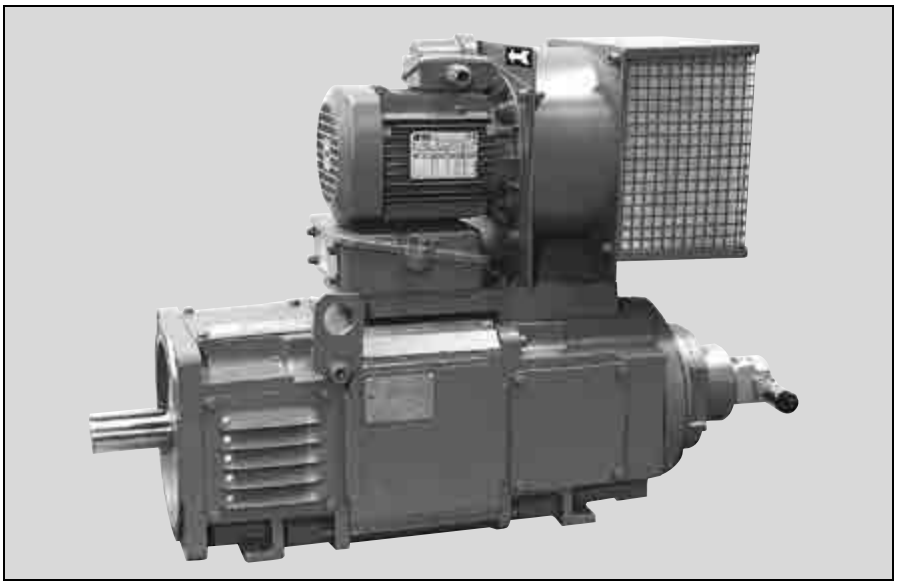


M_F : braking torque
t_1 : brake releasing response time
t_2 : braking response time
t_s : braking time
t_F : torque rise time
U : brake voltage
t : time

D8 - Methods of braking

Curve 2. - Permitted work as a function of the number of operations Brake type 458.





Adjustment and lifetime

Operational lifetime without adjustment of the equipment and associated lifetimes 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.

Stopping time and braking time

Stopping time is calculated by the following equation:

$$t_s = t_2 + t_F$$

t_s : braking time

t_2 : braking response time

t_F : torque rise 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:

$$t_F = \frac{\Sigma J \cdot \omega}{M_F + M_c}$$

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

and

t_F : braking time in s

ΣJ : sum of the moments of inertia in m^2kg

ω : speed of angular rotation in rad/s

M_F : braking torque of motor brake in N.m

M_c : load torque in N.m

$M_c < 0$ if driving load

$M_c > 0$ if resistive load

J_m : motor inertia in m^2kg

J_F : brake inertia in m^2kg

J_c : load inertia in m^2kg.

D8 - Methods of braking

D8.2.3 - Brake types

Brake: type 458

(delivery time "P": see delivery section page 84)

With normal duty, for keeping the motor stopped or for occasional dynamic braking with low inertia these brakes are:

- protected to IP 54,
- operational in any position,
- powered separately at 24 V D.C. or rectified current, cable exit. As an option it can be fitted with:
- manual brake release (using a 'dead man' type lever),
- adaptation for fitting a D.C. tacho.

Released brake contact option

This option, available on request for brake model 458, involves special machining for the brakes and should therefore be specified in the tender.

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

For dynamic and intensive use please consult Leroy-Somer.

D

Table 1. - Electrical and mechanical characteristics of brakes

Brake type	Motor frame size	Characteristics								
		J_F	M_F	$n_{s\ max.}$	P_F	t_1*	t_2*	t_F*	U_F	Weight
		10^{-3} m^{2}kg	N.m	min^{-1}	W	ms	ms	ms	V	kg
458	112	0.45	32	3000	40	111	29	28	24	3.5
458	112 - 132	0.63	60	3000	50	213	15	23	24	5.2
458	112 - 132	1.5	80	3000	55	221	23	30	24	7.9
458	132 - 160	2.9	150	3000	85	272	32	53	24	12
458	160	7.3	260	3000	100	320	50	100	24	19.3
458	160	20	400	3000	110	375	108	111	24	29.1

For other brake sizes, consult LEROY-SOMER.

*: given as an example only, these times prevent the brakes being worn unnecessarily by delaying the motor starting.

Energization times correspond to D.C. switching.

They can be increased slightly depending on the air gap. They also take account of the brake coil voltage.

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 : torque rise 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.

D9 - Method and guide to selection

D9.1 - ENVIRONMENT

Select your motor protection according to environmental conditions. Please consult sections B1 to B5.

D9.2 - GUIDE TO MOTOR SELECTION

The diagram showing the LSK range (page 85) helps you to select the model of motor required according to power and speed.

D9.2.1 - Power level

Using the selection tables in section E, pages 87 to 133 for full bridge three-phase power supplies, select the model of motor with the same power level as the machine or the one just above.

D9.2.2 - Armature voltage

The mains voltage dictates a maximum voltage for the armature power supply which should conform to the speed controller. Table 1 on page 63 (sub-section D2.2.2) shows the maximum permitted voltages for the mains supply.

D9.2.3 - 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 and the field excitation can be reduced. This will increase the rated speed within a permitted limit maintaining constant power (sub-section D2.2.1 page 62).

D9.2.4 - Corrections

In some cases equivalent output power P_e and speed n_e will have to be calculated:

$$P_e = P.\ k,$$

$$n_e = n.\ k'$$

where

P : power required for driving

n : catalogue speed (pages 87 to 133)

k, 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 sub-section D9.5 Correction factors on following page).

D9.3 - MOTOR + CONTROLLER

D9.3.1 - Questionnaire

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

• in which quadrant(s)?	Section D5.4.2 page 71
• constant torque?	Section D5.4.1 page 71
• constant power?	Section D5.4.1 page 71
• minimum speed?	Section D5.1 page 68
• maximum speed?	Section D5.1 page 68
• speed precision?	Section G3 pages 144 & 145
• maximum torque?	Section D5.3 page 70
• duty?	Section D1 pages 59 to 61
• mains supply voltage?	Section D2 pages 62 & 63
• environment?	Section B2 pages 20 & 21

D9.3.2 - Selection

Define average torque for intermittent duty or rated equivalent torque for continuous duty	Section D4.4 page 67
Select frame size with the help of the diagram	Section E page 85
Proceed as for single motor	Section D9.2
Indicate armature voltage,	Section D2 page 63
motor index,	Section E pages 87 to 133
rated current,	Section E pages 87 to 133
l'excitation,	Section D2.2.1 pages 62 & 63
maximum current,	Section D5.3 page 70 & D5.4.3 page 71
Indicate if any different accessories are required.	Section G1 to G4 pages 139 to147

D9.4 - EXAMPLES OF SELECTION

Example 1:

The machine to be driven requires a power of 38 kW at a rated speed of 2000 min^{-1}.
The voltage of the three-phase mains supply is 400 V at 50 Hz.

The diagram on page 85 indicates model 1324.

The mains supply dictates an armature voltage of 440 V. For this voltage, the selection table on page 92 indicates an **LSK 1324 VL 10, 40.5 kW** at 2100 min^{-1}. The same motor, powered with an armature voltage of 420 V for a power level of 38.8 kW at 2000 min^{-1}, may also be selected.

Remark:

To achieve 2000 min^{-1} the armature must be supplied with a voltage of 440 × 2000 / 2100 = 420 V which is obtained by regulation using the speed controller. The motor will then provide a power of P = 40.5 x 2000 / 2100 = 38.6 kW.

Example 2:

A motor with a power of 160 kW at a rated speed of 1650 min^{-1} is required. Armature voltage is 500 V.

The diagram on page 85 indicates model 2004.

On page 109 calculate speed in the 500 V armature voltage column. The selection table indicates an LSK 2004 L 08, 168 kW at 1590 min^{-1}.

Speed is adjusted by reducing the field coil voltage (by adjusting the voltage provided by the controller or inserting a current-limiting resistor 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.

Example 3:

Output power of 40 kW at a rated speed of 1800 min^{-1}. Armature voltage is 440 V. IC 666 cooling method. Ambient temperature of 40°C. IP 54 protection.

The diagram on page 85 indicates model 1324.
Calculation for equivalent output power (Sub-section D9.2.4). Table 2 on page 82 gives k = 1.43 for model 1324: $P_e = 40 \times 1.43 = 57.2$ kW

D9 - Method and guide to selection

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.

Taking into account flux reduction, the speed found in tables n_t will be :

$n_t = 1800 / 1.15 = 1565$ min^{-1}

With this new data, we can see from the diagram on page 85 that an LSK 1604 is required. Using the selection tables on page 94 select the type of motor nearest to the LSK 1604, which is an LSK1604 M06.

Factor k selected is also suitable for this type.

Operating speed will be:

$n = 1530 \times 1.15 = 1760$

The **LSK 1604 M06** motor, (65.2 kW, IP 23s, IC 06, 1530 min^{-1}) will be operated at 40 kW, 1760 min^{-1} in IP 54, IC 666.

Example 4:

Equipment has to be driven at variable speeds:

• operation	4 quadrant
• constant torque?	yes: 500 N.m
• constant power?	yes: 100 kW, range 1 to 1.2
• minimum speed?	30 min^{-1}
• maximum speed?	2500 min^{-1} *
• speed precision?	< 1% n_N: implies DC tacho
• maximum torque?	1.6 × M_N
• duty?	S1
• mains supply?	3-phase 50 Hz, 380 V
• atmosphere?	< 40°C, clean air

The torque indicates an LSK 1604 VL12, 123 kW for 563 N.m. The rated current of this motor is 305 A and the operating current will be:

$I = 305 \times 500 / 563 = 271$ A

Operation in 4 quadrants (reversibility) requires a Mentor MP R type speed controller and the armature current requires a 350 rating (see Mentor MP documentation).

Maximum current in the speed controller will be:

$I_{max\ var} = 271 \times 1.6 = 434$ A

Maximum current for the speed controller is 350 x 1.5 = 525 A, therefore the **MP 350 A 4R** speed controller is the correct one.

The motor can tolerate an overload of 1.6 I_N for 60 seconds (Sub-section D5.3 page 70 'Overload capacities').

*: NB: 2500 / 1.2 = 2083 min^{-1}

equivalent to 2080 min^{-1} rated speed of the motor, 1.2 maximum speed coefficient of the range.

D9.5 - CORRECTION FACTORS

D9.5.1 - 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. See section B2, sub-section B2.2, where the correction factor is calculated using the graphs on page 20.

D9.5.2 - Correction according to duty

For S2, S3 & S6 duties in accordance with IEC 60034-1, 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

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 : periodic continuous operation with intermittent duty	1.6	1.4	1.3	1.2

D9 - Method and guide to selection

D9.5.3 - Correction according to method of cooling

The use of cooling methods which differ from standard IC 06 decreases the power of the motor (IC 06 selection tables). Correction factor k is given by tables 2 and 3 depending on the method of ventilation.

The speed modification shown in each section should also be taken into account.

Note: Speed increases due to field weakening, as shown in the section below, are average values which are used to enable the drive to be calculated. If more exact values are required, the needs of the customer and the performance of the motor will need to be examined.

• IC 666 Ventilation

With this method of cooling, the output power of the motor must be multiplied by factor k as shown in table 2.

The necessary flux reduction is performed at the factory by adapting the field coils.

The rated speed of the motor will be higher than those shown in the selection tables. This value should be multiplied by factor k'

1.15 for line (1),
1.2 for line (2),
1.15 for line (3).

Table 2. - Correction factor k according to ambient temperature : IC 666 ventilation

LSK motor model	Ambient temperature		
	40 °C	30 °C	20 °C
(1) 1324 S, M, VL - 1604 S, M, L	1.43	1.33	1.25
(2) 1324 XVL - 1604 VL	1.49	1.41	1.33
(3) 1804 M to 2804C L	1.54	1.52	1.49
3554C VS to 3554C VL	on request (ask for quotation)		

• IC 416 Ventilation

Please consult Leroy-Somer for this option.

• IC 01 Ventilation

The output power of the motor must be multiplied by factor k as shown in table 3.

The necessary flux reduction is performed at the factory by adapting the field coils.

The rated speed of the motor will be higher than those shown in the selection tables. This value should be multiplied by factor k'

1.3 for LSK 1124 to 1324 VL,
1.5 for LSK 1324 XVL to 1604 VL,
1.3 for LSK 1804 M to 2804C L.

Remark: for S1 duty, minimum operating speed at constant torque should not be less than 1500 min^{-1} and at quadratic torque ($M = kn^2$) it should not be less than 300 min^{-1}.

Table 3. - Correction factor k according to ambient temperature: IC 01 ventilation

LSK motor model	Ambient temperature		
	40°C	30°C	20°C
1124 M, L	2.5	2.17	2
1124 VL - 1324 S, M, VL	2.86	2.44	2.22
1324 XVL - 1604 S, M, L	2.94	2.56	2.33
1604 VL	3.33	2.94	2.7
1804 M to 3554C VL	on request (ask for quotation)		

D9.5.4 - Insulation class F

To select motors in insulation class F, multiply the power level by factor 0.9.

LSK
D.C. motors
Electrical characteristics

PAGES

E

For dimensions, see section F pages 134 to 138, section G pages 139 to 143.

LSK
D.C. motors
Electrical characteristics

E1 - Availability according to construction

LEROY-SOMER has set up an industrial organisation which meets the requirements of its customers in terms of delivery times and construction.
Three Service levels are available (the stars appear in the selection tables):

- Dispatch within 24 hours: ***
- Dispatch of special products within 10 days: **
- Delivery to be agreed for any special manufacture according to specification: *

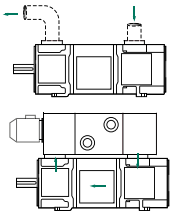
E

Adaptation to the environment

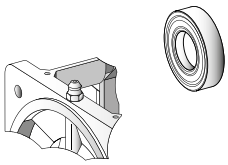
♦ **Field voltage:**
- 180 / 360 V : ***
- Other : *

♦ **Thermal detection:**
- PTC : ***
- PTO, 2nd set of probes: **

♦ **Environment:**
- TC impregnation: **
- Space heaters: *

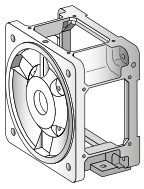


Protection
- IP 23S, IP 44R: ***
- IP 55R: **
- IP55 with exchangers air/air or air/water: *



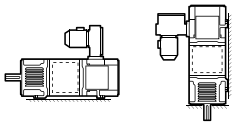
Bearings
- Standard ball bearings: ***
- Roller bearings: ***
- Ball bearings with grease nipple (Frame size <180): *

Main shaft extension
- Standard: ***
- Special: *

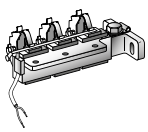


Mounting
- Foot, standard flange: ***
- Foot & standard flange: ***
- Special flange: *
- Non IEC dimensions: *

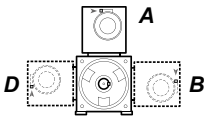
IM 1001 IM 2011 ...

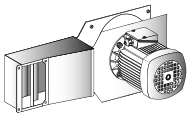


All mounting positions: *



Brush wear limit sensor: **





Forced Ventilation FV

♦ **Radial: ***
- Possible positions: D, A, B

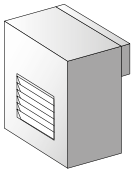
♦ **Axial: ***

FV equiped with

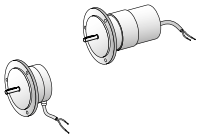
♦ **Standard filter: ***

♦ **Renewable filter: ***

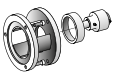
♦ **Stoped air flow detector: ***



♦ **Sound screen: ***

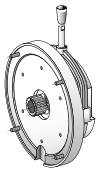


Sensor
- D.C. tachogenerator 60 V 1000 min^{-1}: ***
- 1024 ppt encoder: ***

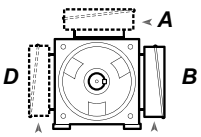


Support & coupling: * (for mounting a speed detector)**

2nd shaft extension: *



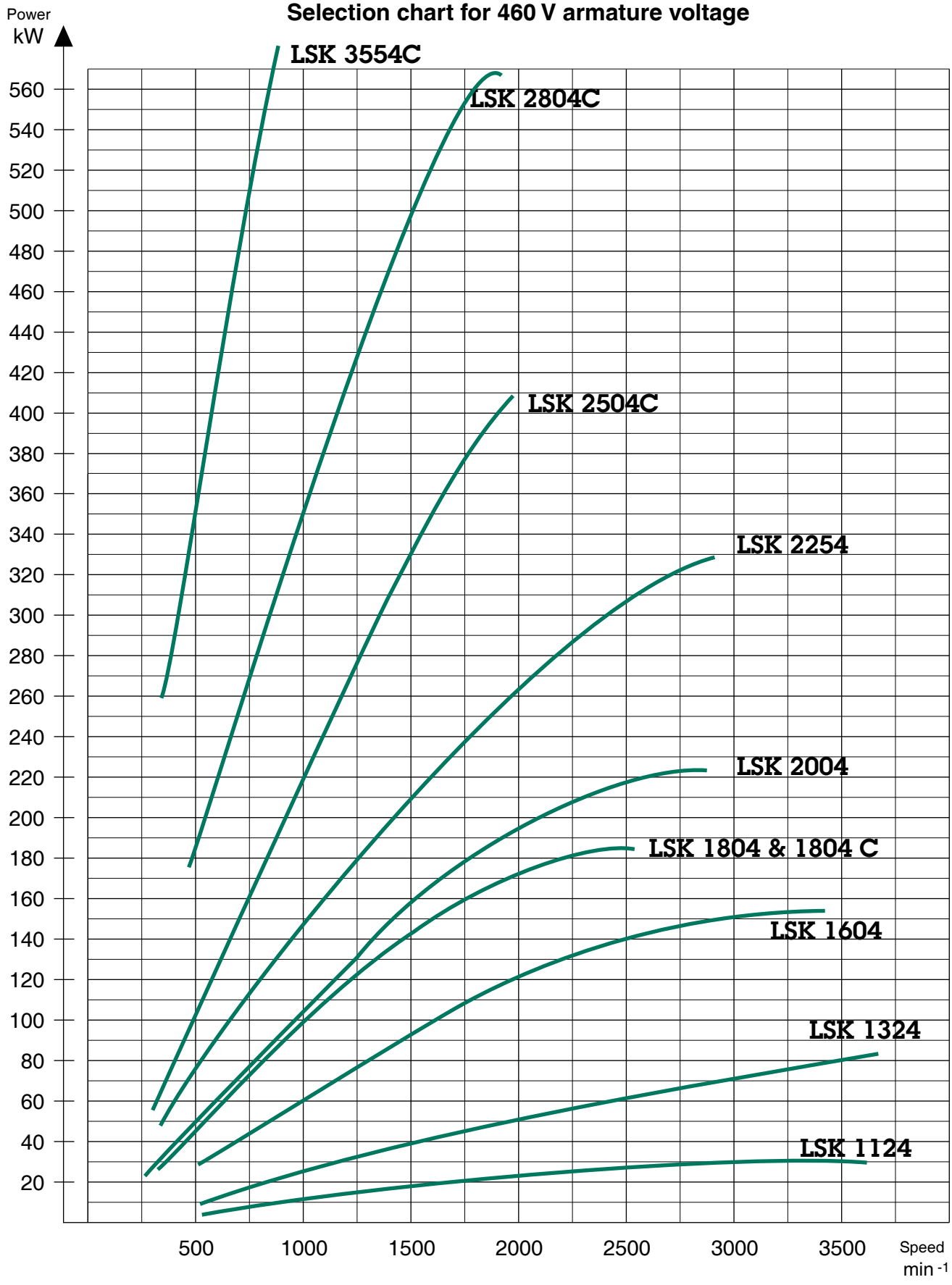
Mechanical brake
- without speed detection: *
- with speed detection: *



Terminal box positions
- D, A: **
- B: ***

LSK
D.C. motors
Electrical characteristics

E2 - Drip-proof motors - The complete range



E

LSK
D.C. motors
Electrical characteristics

E3 - Selection table abbreviations

All the selection tables (pages 87 to 133) 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 23S: see sections B1 & B2 pages 19 onwards
- cooling method IC 06 (F.V.): see section C4 pages 51 & 52
- continuous S1 duty conforming to IEC 34-1: see section D1 page 59
- ambient temperature ≤ 40°C: see section B2 pages 20 onwards
- altitude 1000 m or lower : see section B2 pages 20 onwards
- 3-phase supply rectified by a full bridge (form factor 1.04 or lower) for section E2 pages 87 to 133
- insulation class H : see section D3 page 64
- field excitation power shown in the selection tables is an average value (360 V supply).

Option: enclosed motors:

- degree of protection IP 55 : see sections B1 & B2 pages 19 onwards
- cooling method IC 416 (F.V.) : see section C4 pages 51 & 52
- 3-phase supply rectified by a full bridge (form factor 1.04 or lower) : Please consult Leroy-Somer
- other standards as above.

E

The motors are designed to operate at a current ranging from 50 to 100% of I_N in continuous operation, and above this in transient operation: see overload capacity section D5.3 page 70.

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 63) expressed in V
$n_{max\ elec.}$	: maximum electrical speed expressed in min^{-1}: see section D5.1.2 page 68
$n_{max\ mech.}$	: maximum mechanical speed expressed in min^{-1}: see table 1 page 68
N.C.	: motor not compensated: see section D5.2.5 page 68
C.	: motor compensated
M	: rated torque expressed in N.m
I	: permitted current in permanent operation expressed in A (S1 duty)
η	: efficiency (does not take account of field excitation)
L	: armature circuit choke expressed in mH for non compensated motors (except LSK 1804C and LSK 2504C to LSK 3554C)
R	: resistance of the armature circuit expressed in Ω
U_{max}	: maximum permitted voltage on the armature terminals expressed in V

Excitation power: Values given are for non compensated motors (except LSK 1804C and LSK 2504C to LSK 3554C)

Motor designation: see fold-out inside cover

Delivery: ✶, ✶✶, ✶✶✶: see page 84

Comments

The reader should refer to section D9 "Method and Guide to Selection" on pages 80 & 81 for the selection procedure together with some examples. The correction factors depending on the type of use and the various options are listed on pages 81 & 82.

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

LSK 1124 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 101 kg
Moment of inertia: 0.053 kg.m^2
Field power: 0.65 kW

64 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	220 V	260 V	400 V	420 V	440 V	460 V	500 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
3.5	570							1120	59	24	0.67	41	3.76	500		
4.4		670						1320	63	24	0.71	41	3.76	500		
7.1			1070					1650	63	23.5	0.76	41	3.76	500		
7.6				1120				1730	65	23.5	0.77	41	3.76	500	03	✶
8					1170			1810	65	23.5	0.78	41	3.76	500		
8.5						1230		1900	66	23.5	0.79	41	3.76	500		
9.2							1330	2060	66	23	0.80	41	3.76	500		
4.7	730							1440	61	30	0.71	25	2.54	500		
5.9		860						1710	66	29.5	0.77	25	2.54	500		
9			1370					2120	63	29	0.78	25	2.54	500		
9.5				1440				2230	63	28.5	0.79	25	2.54	500	04	✶
10					1510			2340	63	28.5	0.80	25	2.54	500		
10.5						1580		2440	63	28.5	0.80	25	2.54	500		
11.6							1710	2650	65	28.5	0.81	25	2.54	500		
6.7	1020							2000	63	40.5	0.77	14	1.39	500		
8.2		1200						2380	65	40	0.79	14	1.39	500		
13			1910					2960	65	39.5	0.82	14	1.39	500		
13.5				2000				3100	64	39	0.83	14	1.39	500	05	✶✶✶
14.2					2100			3250	65	38.5	0.84	14	1.39	500		
14.9						2200		3410	65	38.5	0.84	14	1.39	500		
16.3							2390	3700	65	38.5	0.85	14	1.39	500		
11	1580							3070	66	60.5	0.83	6.5	0.61	500		
13.1		1860						3600	67	60	0.84	6.5	0.61	500		
20.2			2950					4000	65	59	0.85	6.5	0.61	500		
21.1				3100				4000	65	58.5	0.86	6.5	0.61	500	06	✶✶✶
22					3250			4000	65	58	0.86	6.5	0.61	500		
23.2						3400		4000	65	58	0.87	6.5	0.61	500		
25.3							3690	4000	65	58	0.87	6.5	0.61	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1124 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 126 kg
Moment of inertia: 0.066 kg.m^2
Field power: 0.65 kW

80 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	220 V	260 V	400 V	420 V	440 V	460 V	500 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
4	510							1000	75	28	0.66	35	3.26	500		
5.1		600						1200	81	28	0.70	35	3.26	500		
8.3			960					1480	83	27.5	0.75	35	3.26	500		
8.8				1010				1560	83	27.5	0.76	35	3.26	500	04	✶
9.3					1060			1640	84	27.5	0.77	35	3.26	500		
9.8						1110		1720	84	27.5	0.77	35	3.26	500		
10.7							1200	1860	85	27	0.79	35	3.26	500		
5.9	710							1420	79	36.5	0.74	20	1.79	500		
7.2		840						1700	82	36	0.77	20	1.79	500		
11.4			1350					2090	81	35.5	0.80	20	1.79	500		
12				1420				2200	81	35.5	0.81	20	1.79	500	05	✶
12.7					1490			2300	81	35.5	0.81	20	1.79	500		
13.4						1560		2410	82	35.5	0.82	20	1.79	500		
14.5							1700	2630	81	35	0.83	20	1.79	500		
9.7	1150							2200	81	55	0.80	9.5	0.787	500		
11.6		1350						2640	82	54.5	0.82	9.5	0.787	500		
18.2			2180					3280	80	54	0.84	9.5	0.787	500		
19.3				2290				3440	80	54	0.85	9.5	0.787	500	06	✶
20.4					2400			3610	81	54	0.86	9.5	0.787	500		
21.4						2500		3780	82	54	0.86	9.5	0.787	500		
23.3							2720	4000	82	53.5	0.87	9.5	0.787	500		
11.4	1430							2840	76	61	0.85	4.3	0.47	500		
13.7		1680						3280	78	60.5	0.87	4.3	0.47	500		
21.4			2730					4000	75	60	0.89	4.3	0.47	500		
22.6				2870				4000	75	60	0.90	4.3	0.47	500	21	✶
23.8					3000			4000	76	60	0.90	4.3	0.47	500		
24						3130		4000	73	58	0.90	4.3	0.47	500		
25.3							3400	4000	71	56	0.90	4.3	0.47	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1124 VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 152 kg
Moment of inertia: 0.085 kg.m^2
Field power: 0.75 kW

104 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	220 V	260 V	400 V	420 V	440 V	460 V	500 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
3.6	370							650	93	27.5	0.63	40	3.64	500		
4.9		440						780	106	27	0.70	40	3.64	500		
8.1			720					970	107	26.5	0.76	40	3.64	500		
8.7				760				1020	109	26	0.79	40	3.64	500	04	✶
9.2					790			1060	111	26	0.79	40	3.64	500		
9.8						830		1120	113	26	0.81	40	3.64	500		
10.9							900	1210	116	26	0.83	40	3.64	500		
5.7	530							930	103	37	0.74	23	1.93	500		
7.4		630						1120	112	36.5	0.78	23	1.93	500		
11.5			1030					1390	107	34.5	0.83	23	1.93	500		
12.2				1080				1450	108	34	0.85	23	1.93	500	05	✶
12.9					1120			1510	110	34	0.86	23	1.93	500		
13.6						1180		1590	110	34	0.86	23	1.93	500		
14.9							1280	1720	111	34	0.87	23	1.93	500		
9.9	840							1410	113	55	0.82	10.2	0.832	500		
12		1000						1680	115	54.5	0.85	10.2	0.832	500		
18.2			1610					2500	108	53	0.86	10.2	0.832	500		
19.2				1700				2550	108	52.5	0.87	10.2	0.832	500	06	✶
20.2					1770			2600	109	52	0.88	10.2	0.832	500		
21.3						1850		2600	110	52	0.89	10.2	0.832	500		
23							2000	2600	110	52	0.89	10.2	0.832	500		
10.7	1140							1980	90	58.5	0.83	6.6	0.57	500		
12.6		1350						2360	89	58	0.83	6.6	0.57	500		
20.6			2180					2830	90	57	0.90	6.6	0.57	500		
22				2280				2960	92	57	0.92	6.6	0.57	500	21	✶✶
23					2400			3120	92	57	0.92	6.6	0.57	500		
24.2						2500		3250	92	57	0.92	6.6	0.57	500		
26.3							2710	3520	93	57	0.92	6.6	0.57	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1324 S - LSK 1324C S
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:
- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 155 kg
Moment of inertia: 0.12 kg.m^2
Field power: 0.7 kW

104 - 120 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec*}$		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
6.9	630							1000	1600	105	39	0.68	41	2.23	550		
12.2		970						1550	2480	120	38.5	0.79	41	2.23	550		
12.7			1020					1630	2610	119	38	0.79	41	2.23	550	03	✶
13.3				1070				1710	2740	119	38	0.79	41	2.23	550		
14					1120			1790	2860	119	38	0.80	41	2.23	550		
15.5						1220		1950	3120	121	38	0.81	41	2.23	550		
17.9							1460		3740	117	36.5	0.82	25	2.69	600	▼	
9.7	890							2000	3200	104	49.5	0.75	22	1.3	550		
16.5		1310						2200	3520	120	49.5	0.83	22	1.3	550		
17.3			1440					2320	3710	115	49	0.83	22	1.3	550	05	✶✶
18				1510				2410	3860	114	49	0.83	22	1.3	550		
18.7					1580			2520	4000	113	48.5	0.84	22	1.3	550		
20.6						1720		2750	4000	114	48.5	0.85	22	1.3	550		
23.6							2060		4000	109	46	0.86	14	1.59	600	▼	
15.6	1470							2350	3760	101	73.5	0.82	10	0.56	550		
25.4		2260						3610	4000	107	72.5	0.87	10	0.56	550		
26.6			2380					3800	4000	107	72	0.88	10	0.56	550	08	✶
27.9				2490				3980	4000	107	72	0.88	10	0.56	550		
29.3					2600			4000	4000	108	72	0.88	10	0.56	550		
32						2830		4000	4000	108	72	0.89	10	0.56	550		
36.8							3390		4000	104	69	0.89	6.3	0.64	600	▼	
19.9	1850							2400	4000	103	90	0.85	6.5	0.35	460		
32		2840						3260	4000	108	89.5	0.89	6.5	0.35	460		
33.4			2990					3400	4000	107	89	0.89	6.5	0.35	460	09	✶
34.4				3130				3400	4000	105	87.5	0.89	6.5	0.35	460		
35.3					3270			3470	4000	103	86	0.89	6.5	0.35	460		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1324C S.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1324 M - LSK 1324C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:
- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 175 kg
Moment of inertia: 0.15 kg.m^2
Field power: 0.8 kW

121 - 152 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec*}$		M	I	η	L	$R_{115°}$	U_{max}		
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.				Code	Deliv-ery
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
8.9	620							990	1580	137	48.5	0.71	29.5	1.57	550		
15.3		960						1530	2450	152	48	0.79	29.5	1.57	550		
15.8			1000					1600	2560	151	47	0.80	29.5	1.57	550	05	✶
16.5				1050				1680	2690	150	47	0.80	29.5	1.57	550		
17.3					1100			1760	2820	150	47	0.80	29.5	1.57	550		
18.8						1200		1920	3070	150	47	0.80	29.5	1.57	550		
21.5							1430		4000	144	44.5	0.81	16.8	1.8	600	▼	
15.1	1040							1660	2660	139	75	0.77	12.6	0.68	550		
24.8		1600						2560	4000	148	73.5	0.84	12.6	0.68	550		
26.3			1690					2700	4000	149	73	0.85	12.6	0.68	550	08	✶✶✶
27.6				1770				2830	4000	149	73	0.86	12.6	0.68	550		
29					1850			2960	4000	150	73	0.86	12.6	0.68	550		
31.5						2010		3210	4000	150	73	0.86	12.6	0.68	550		
36.4							2410		4000	144	70	0.87	7.2	0.77	600	▼	✶✶
19.2	1380							1790	2860	133	88	0.84	8	0.4	460		
30.5		2130						2450	4000	137	88	0.87	8	0.4	460		
32			2230					2500	4000	137	87.5	0.87	8	0.4	460	09	✶✶
33.6				2340				2500	4000	137	87.5	0.87	8	0.4	460		
35.5					2450			2600	4000	138	87.5	0.88	8	0.4	460		
38.5						2660			4000	138	87.5	0.88	4.5	0.49	500	▼	
23.6	1870							2990	4000	121	108	0.84	4.6	0.25	600		
37.3		2870						4000		124	106	0.88	4.6	0.25	600		
39.2			3020					4000		124	106	0.88	4.6	0.25	600	10	✶✶✶
41.5				3160				4000		125	106	0.89	4.6	0.25	600		
42.6					3300			4000		123	104	0.89	4.6	0.25	600		
45.4						3590		4000		121	101	0.90	4.6	0.25	600		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1324CM.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1324 VL - LSK 1324C VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:
- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 215 kg
Moment of inertia: 0.2 kg.m²
Field power: 0.85 kW

154 - 189 N.m

$n_{max\ mech}$: 4000 min⁻¹

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec}$*		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	N.m	A	excitation	mH	Ω	V		
12.7	700							960	1470	173	67	0.73	21.4	0.88	550	08	✶
21.4		1070						1460	2240	191	66	0.81	21.4	0.88	550		
22.7			1120					1530	2350	194	65	0.83	21.4	0.88	550		
24.2				1170				1600	2450	198	65	0.84	21.4	0.88	550		
24.9					1220			1670	2560	195	64.5	0.84	21.4	0.88	550		
26.9						1320		1800	2770	195	64	0.84	21.4	0.88	550		
32.1							1580		3300	194	63	0.85	10.1	0.88	600	▼	
16.8	910							1180	1890	176	80	0.80	13.8	0.57	460	09	✶
27.3		1390						1600	2560	188	79.5	0.86	13.8	0.57	460		
28.8			1460					1650	2640	188	79	0.87	13.8	0.57	460		
30.2				1530				1650	2640	189	79	0.87	13.8	0.57	460		
30.5					1600			1700	2720	182	76.5	0.87	13.8	0.57	460		
33						1730			2960	182	75	0.88	7.8	0.68	500	▼	
23.5	1240							1980	3170	181	105.5	0.85	8	0.33	550	10	✶✶
36.8		1910						3050	4000	184	105	0.87	8	0.33	550		
38.8			2000					3200	4000	185	104.5	0.88	8	0.33	550		
40.5				2100				3360	4000	184	104.5	0.88	8	0.33	550		
41.8					2190			3500	4000	182	101.5	0.89	8	0.33	550		
44						2380		3570	4000	177	99	0.89	8	0.33	550		
51.5							2860		4000	172	96.5	0.89	4.6	0.37	600	▼	
28.1	1500							3200	4000	179	127	0.85	4.6	0.23	550	11	✶✶✶
44.7		2300						3400	4000	186	126.5	0.88	4.6	0.23	550		
46.6			2420					3500	4000	184	126	0.88	4.6	0.23	550		
49				2530				3500	4000	185	126	0.88	4.6	0.23	550		
49.5					2640			3500	4000	179	121	0.89	4.6	0.23	550		
52.7						2870		3500	4000	175	116	0.89	4.6	0.23	550		
61.4							3450		4000	170	111.5	0.89	2.6	0.26	600	▼	✶✶
30.6	1830							2920	4000	160	135.5	0.87	3.2	0.15	460	13	✶✶
48		2820						4000		163	134	0.89	3.2	0.15	460		
49.8			2960					4000		161	133	0.89	3.2	0.15	460		
52.5				3100				4000		162	132	0.90	3.2	0.15	460		
53.2					3240			4000		157	128.5	0.90	3.2	0.15	460		
56.7						3520			4000	154	126	0.90	1.9	0.17	500	▼	

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1324C VL.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1324 XVL - LSK 1324C XVL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 249 kg

Moment of inertia: 0.24 kg.m^2

Field power: 1.2 kW

221 - 253 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec*}$		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
12.9	550							750	1200	224	67	0.74	20.5	1.03	550		
21.8		840						1150	1840	248	66	0.83	20.5	1.03	550		
23			880					1210	1940	250	65	0.84	20.5	1.03	550	08	✶
24				920				1260	2020	249	64.5	0.84	20.5	1.03	550		
25.2					960			1320	2110	251	64.5	0.85	20.5	1.03	550		
27.5						1040		1430	2290	253	64	0.86	20.5	1.03	550		
32.5							1250		2750	248	63	0.86	13	1.15	600	▼	
16.8	720							990	1580	223	81.5	0.79	13	0.64	460		
28		1100						1270	2030	243	81	0.86	13	0.64	460		
29.5			1160					1330	2130	243	80.5	0.87	13	0.64	460	09	✶
31				1210				1330	2130	245	80.5	0.87	13	0.64	460		
32.5					1260			1360	2180	246	80.5	0.88	13	0.64	460		
35.2						1370			2620	245	80	0.88	8.3	0.72	500	▼	
22.4	970							1330	2130	221	107	0.80	7.4	0.39	550		
36.2		1490						2050	3280	232	106	0.85	7.4	0.39	550		
38.3			1570					2160	3460	233	106	0.86	7.4	0.39	550	10	✶✶
40				1640				2260	3620	233	105.5	0.86	7.4	0.39	550		
42					1710			2350	3760	235	105.5	0.87	7.4	0.39	550		
45.8						1860		2410	3860	235	105	0.87	7.4	0.39	550		
54.5							2230		4000	233	104	0.88	4.8	0.44	600	▼	
27.3	1190							2200	3520	219	125	0.84	5.5	0.28	550		
43.8		1830						2400	3840	229	123	0.89	5.5	0.28	550		
45.6			1920					2500	4000	227	121.5	0.89	5.5	0.28	550	11	✶
47.3				2010				2610	4000	225	120	0.90	5.5	0.28	550		
49.5					2100			2730	4000	225	119.5	0.90	5.5	0.28	550		
53.8						2280		2960	4000	225	118.5	0.91	5.5	0.28	550		
64.3							2740		4000	224	118	0.91	3.5	0.32	600	▼	
34	1450							2000	3200	224	149.5	0.87	3.7	0.17	460		
53.7		2220						2880	4000	231	147.5	0.90	3.7	0.17	460		
56.4			2330					3020	4000	231	147	0.91	3.7	0.17	460	13	
59.2				2440				3170	4000	232	147	0.91	3.7	0.17	460		✶✶
61.8					2550			3310	4000	231	146.5	0.92	3.7	0.17	460		
67.3						2770			4000	232	146.5	0.92	2.3	0.18	600	▼	
80.2							3330		4000	230	145	0.92	2.3	0.18	600	▼	

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1324C XVL.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor

C : Compensated motor

LSK 1604 S - LSK 1604C S
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 285 kg

Moment of inertia: 0.45 kg.m²

Field power: 1.3 kW

269 - 306 N.m

$n_{max\ mech}$: 4000 min⁻¹

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec}$*		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	N.m	A	excitation	mH	Ω	V		
20.4	680							1020	1630	287	99	0.79	9.8	0.63	600		
33.6		1050						1570	2510	306	98	0.86	9.8	0.63	600		
34.9			1100					1650	2640	303	96	0.86	9.8	0.63	600		
36.3				1150				1720	2750	301	95.5	0.86	9.8	0.63	600	02	✶
37.1					1200			1800	2880	295	93	0.87	9.8	0.63	600		
39.2						1300		1950	3120	288	89	0.88	9.8	0.63	600		
46.2							1560	2100	3360	283	87.5	0.88	9.8	0.63	600		
24.8	850							1270	2030	279	118	0.81	6.6	0.46	500		
40.4		1310						1960	3140	295	116.5	0.87	6.6	0.46	500		
42.3			1380					2070	3310	293	115	0.87	6.6	0.46	500		
44.1				1440				2160	3460	292	114.5	0.97	6.6	0.46	500	04	✶
45.2					1500			2250	3600	288	112	0.88	6.6	0.46	500		
47						1630		2400	3840	275	106	0.89	6.6	0.46	500		
55.8							1960		4000	272	104.5	0.89	3.8	0.57	600	▼	
29.6	1010							1510	2420	280	137.5	0.83	4.9	0.35	460		
47.8		1550						2320	3710	295	136	0.88	4.9	0.35	460		
49.6			1630					2440	3900	291	134	0.88	4.9	0.35	460	05	✶✶
52				1700				2550	4000	292	133.5	0.89	4.9	0.35	460		
53					1770			2600	4000	286	130	0.89	4.9	0.35	460		
55						1930			4000	272	124	0.89	2.9	0.43	600	▼	
65.6							2310		4000	271	121.5	0.90	2.9	0.43	600	▼	
37.5	1250							1870	2990	287	166.5	0.87	3.3	0.2	600		
59.9		1910						2670	4000	300	165	0.90	3.3	0.2	600		
62			2010					2800	4000	295	162.5	0.90	3.3	0.2	600		
64.7				2100				2940	4000	294	162	0.91	3.3	0.2	600	06	✶✶✶
66.4					2190			3000	4000	290	158	0.91	3.3	0.2	600		
68.5						2380		3300	4000	275	150.5	0.91	3.3	0.2	600		
80.5							2860	4000		269	147.5	0.91	3.3	0.2	600		
45.5	1460							2190	3500	298	197	0.88	2.4	0.14	600		
71		2240						3100	4000	303	195	0.91	2.4	0.14	600		
73.5			2350					3290	4000	299	192	0.91	2.4	0.14	600		
77.4				2460				3400	4000	300	191	0.92	2.4	0.14	600	07	✶
79.1					2570			2590	4000	294	187	0.92	2.4	0.14	600		
81.9						2790		3900	4000	280	178	0.92	2.4	0.14	600		
96.6							3350	4000		275	175	0.92	2.4	0.14	600		
54.2	1860							2600	4000	278	234	0.89	2	0.09	500		
84.7		2860						4000		283	230	0.92	2	0.09	500		
87.7			3000					4000		279	227	0.92	2	0.09	500		
91				3140				4000		277	225	0.92	2	0.09	500	09	✶
95.8					3280			4000		279	224	0.93	2	0.09	500		
102						3570		4000		274	220	0.93	2	0.09	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

▼: motor available in compensated version only: LSK 1604C S.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1604 M - LSK 1604C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 325 kg

Moment of inertia: 0.55 kg.m²

Field power: 1.6 kW

323 - 421 N.m

$n_{max\ mech}$: 4000 min⁻¹

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec}$*		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	N.m	A	excitation	mH	Ω	V		
24.3	620							930	1490	374	121.5	0.77	8.8	0.562	500		
40.2		950						1330	2130	404	119.5	0.84	8.8	0.562	500		
42.3			990					1380	2210	408	118.5	0.85	8.8	0.562	500	04	✶
44.1				1040				1450	2320	405	117.5	0.86	8.8	0.562	500		
45.4					1080			1510	2420	401	114.5	0.86	8.8	0.562	500		
47.8						1180		1650	2640	387	110	0.87	8.8	0.562	500		
56.2							1410		3170	381	107.5	0.87	5	0.562	600	▼	
29	740							1110	1780	374	140	0.80	6.5	0.429	460		
47.4		1130						1580	2530	401	138	0.85	6.5	0.429	460		
49.4			1190					1660	2660	396	136.5	0.86	6.5	0.429	460		
52				1240				1730	2770	400	135.5	0.87	6.5	0.429	460	05	✶
53.2					1290			1800	2880	394	132.5	0.87	6.5	0.429	460		
56.3						1400			3110	384	128	0.88	3.7	0.53	600	▼	
65.5							1690		3730	370	124	0.88	3.7	0.53	600	▼	
37.9	910							1360	2180	398	171.5	0.85	4.4	0.249	600		
60.3		1390						1940	3100	414	169.5	0.89	4.4	0.249	600		
62.8			1460					2040	3260	411	168	0.89	4.4	0.249	600		
65.2				1530				2140	3420	407	166.5	0.89	4.4	0.249	600	06	✶
67					1590			2220	3550	402	162	0.90	4.4	0.249	600		
70.2						1730		2400	3840	388	156	0.90	4.4	0.249	600		
82.4							2080	2700	4000	378	152.5	0.90	4.4	0.249	600		
46	1070							1710	2740	411	203	0.87	4.1	0.169	600		
72.7		1650						2360	3780	421	201.5	0.90	4.1	0.169	600		
75			1730					2400	3840	414	198.5	0.90	4.1	0.169	600		
78.3				1800				2500	4000	415	197.5	0.90	4.1	0.169	600	07	✶✶✶
81					1870			2610	4000	414	193	0.91	4.1	0.169	600		
83.8						2040		2840	4000	392	184	0.91	4.1	0.169	600		
98.3							2450	3400	4000	383	180	0.91	4.1	0.169	600		
65	1580							2370	3790	393	280	0.89	1.57	0.08	460		
101		2420						3140	4000	399	275	0.92	1.57	0.08	460		
105			2540					3300	4000	395	272	0.92	1.57	0.08	460		
109				2660				3450	4000	392	270	0.92	1.57	0.08	460	10	✶
114					2780			3600	4000	392	269.5	0.92	1.57	0.08	460		
123						3020			4000	388	264	0.93	0.9	0.1	600	▼	
145							3620		4000	383	260	0.93	0.9	0.1	600	▼	
74	1770							2440	3900	399	315	0.90	1.77	0.07	500		
108		2740						3750	4000	376	295	0.91	1.77	0.07	500		
111			2870					3930	4000	369	290	0.91	1.77	0.07	500	11	✶✶
117				3000				4000		372	289	0.92	1.77	0.07	500		
122					3130			4000		372	286	0.93	1.77	0.07	500		
131						3400		4000		368	281	0.93	1.77	0.07	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

▼: motor available in compensated version only: LSK 1604C M.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1604 L - LSK 1604C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 375 kg

Moment of inertia: 0.6 kg.m^2

Field power: 1.4 kW

379 - 508 N.m

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

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec}$*		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
26.4	610							910	1460	413	130	0.78	8.25	0.49	460		
43.7		930						1300	2080	449	130	0.84	8.25	0.49	460		
46.4			980					1370	2190	452	130	0.85	8.25	0.49	460	05	✶
49				1020				1420	2270	459	130	0.86	8.25	0.49	460		
50.5					1060			1480	2370	455	127	0.86	8.25	0.49	460		
52.5						1150			2560	436	121	0.87	4.7	0.61	600	▼	
62							1390		3070	426	118.5	0.87	4.7	0.61	600	▼	
36.7	740							1100	1760	474	170	0.83	5.22	0.284	600		
59.2		1130						1580	2530	500	170	0.87	5.22	0.284	600		
62.8			1190					1660	2660	504	170	0.88	5.22	0.284	600		
66				1240				1730	2770	508	170	0.88	5.22	0.284	600	06	✶
68					1290			1800	2880	503	166	0.89	5.22	0.284	600		
70.8						1400		1960	3140	483	158.5	0.90	5.22	0.284	600		
82.8							1690	2190	3500	468	155	0.90	5.22	0.284	600		
41.6	970							1530	2450	410	198	0.85	3.83	0.193	600		
66.2		1480						2180	3490	427	198	0.88	3.83	0.193	600		
70.3			1560					2290	3660	430	198	0.89	3.83	0.193	600		
74.4				1620				2390	3820	439	198	0.89	3.83	0.193	600	07	✶
76.5					1690			2490	3980	432	193.5	0.90	3.83	0.193	600		
80.2						1840		2650	4000	416	185.5	0.91	3.83	0.193	600		
94.5							2210	3020	4000	408	182	0.91	3.83	0.193	600		
52.4	1160							1740	2780	431	231.5	0.87	2.53	0.132	500		
83.3		1780						2450	3920	447	231.5	0.90	2.53	0.132	500		
88.5			1870					2430	3890	452	231.5	0.91	2.53	0.132	500		
92.7				1950				2530	4000	454	231.5	0.91	2.53	0.132	500	09	✶
96.9					2030			2630	4000	456	230	0.91	2.53	0.132	500		
104						2210		2870	4000	449	226	0.92	2.53	0.132	500		
123							2650		4000	441	222	0.92	1.4	0.16	600	▼	
62.7	1310							2070	3310	457	271	0.89	1.92	0.093	460		
98.7		2020						2760	4000	467	271	0.91	1.92	0.093	460		
105			2120					2890	4000	472	271	0.92	1.92	0.093	460	10	
110				2230				3020	4000	470	271	0.92	1.92	0.093	460		✶✶
113					2330			3150	4000	462	266.5	0.92	1.92	0.093	460		
118						2530			4000	447	257	0.92	1.1	0.11	600	▼	
139							3040		4000	436	251.5	0.92	1.1	0.11	600	▼	
70.6	1780							2490	3980	379	305	0.89	1.62	0.06	600		
111		2730						3540	4000	388	305	0.91	1.62	0.06	600		
117			2870					3730	4000	388	305	0.91	1.62	0.06	600		
124				3000				3900	4000	393	305	0.92	1.62	0.06	600	12	✶
130					3130			4000		397	304	0.93	1.62	0.06	600		
140						3400		4000		392	300	0.93	1.62	0.06	600		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1604C L.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1604 VL - LSK 1604C VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 450 kg
Moment of inertia: 0.65 kg.m²
Field power: 2.1 kW

486 - 594 N.m

$n_{max\ mech}$: 4000 min⁻¹

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							$n_{max\ elec}$*		M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	N.C.	C.			Not inc.					
kW	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	min⁻¹	N.m	A	excitation	mH	Ω	V		
30.3	560							840	1340	517	151.5	0.77	7	0.35	600		
50.3		860						1160	1860	559	151.5	0.83	7	0.35	600		
53.5			900					1215	1940	568	151.5	0.84	7	0.35	600		
56.2				940				1270	2030	571	151.5	0.84	7	0.35	600	06	✶
58.8					980			1320	2110	573	151	0.85	7	0.35	600		
64.2						1060		1430	2290	578	150	0.86	7	0.35	600		
75.8							1280	1720	2750	566	147	0.86	7	0.35	600		
37.4	650							970	1550	549	179.5	0.80	7.5	0.249	600		
61.8		1000						1350	2160	590	179.5	0.86	7.5	0.249	600		
64.8			1050					1410	2260	589	179.5	0.86	7.5	0.249	600		
68.4				1100				1480	2370	594	179.5	0.87	7.5	0.249	600	07	✶
71.5					1150			1550	2480	594	179	0.87	7.5	0.249	600		
77.4						1250		1680	2690	591	177	0.88	7.5	0.249	600		
92.1							1500	2000	3200	586	174.5	0.88	7.5	0.249	600		
47.4	830							1240	1980	545	219.5	0.83	4.8	0.16	500		
75.5		1280						1720	2750	563	219.5	0.86	4.8	0.16	500		
79.3			1340					1800	2880	565	219.5	0.86	4.8	0.16	500	09	✶
84.6				1400				1890	3020	577	219.5	0.87	4.8	0.16	500		
88.5					1460			1970	3150	579	219	0.88	4.8	0.16	500		
95.4						1590		2140	3420	573	217	0.88	4.8	0.16	500		
114							1900		4000	573	213.5	0.89	1.7	0.2	600	▼	
55.5	990							1480	2370	535	254	0.84	3.5	0.12	460		
88.4		1510						2030	3250	559	254	0.87	3.5	0.12	460		
93.9			1590					2140	3420	564	254	0.88	3.5	0.12	460	10	✶
99				1660				2240	3580	570	254	0.88	3.5	0.12	460		
104					1730			2300	3680	571	253	0.89	3.5	0.12	460		
111						1880			3970	565	250	0.89	1.3	0.14	600	▼	
133							2260		4000	562	246.5	0.90	1.3	0.14	600	▼	
69	1230							1840	2940	536	305	0.87	2.4	0.083	600		
110		1900						2310	3700	552	305	0.90	2.4	0.083	600		
115			1990					2420	3870	553	305	0.90	2.4	0.083	600		
123				2080				2530	4000	563	305	0.91	2.4	0.083	600	12	✶✶✶
128					2170			2640	4000	561	304	0.91	2.4	0.083	600		
138						2360		2800	4000	558	300	0.92	2.4	0.083	600		
163							2830	3400	4000	551	296	0.92	2.4	0.083	600		
81.4	1600							1950	3120	486	360	0.87	1.5	0.04	500		
130		2460						3000	4000	503	360	0.90	1.5	0.04	500		
136			2580					3140	4000	503	360	0.90	1.5	0.04	500	13	✶✶
145				2700				3290	4000	512	360	0.91	1.5	0.04	500		
147					2820			3430	4000	496	350	0.91	1.5	0.04	500		
156						3060		3730	4000	488	340	0.92	1.5	0.04	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.
▼: motor available in compensated version only: LSK 1604C VL.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage
N. C. : Non-compensated motor
C : Compensated motor

LSK 1804 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 480 kg
Moment of inertia: 0.7 kg.m^2
Field power: 1.9 kW

443 - 643 N.m

$n_{max\ mech}$: 3600 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
40.8	680							1290	573	194	0.81	7	0.19	600		
67.2		1050						1780	611	193	0.87	7	0.19	600		
71			1100					1870	616	192	0.88	7	0.19	600		
74.3				1150				1950	617	192	0.88	7	0.19	600	03	✶
76.1					1200			2040	606	188	0.88	7	0.19	600		
81.6						1300		2170	599	185	0.88	7	0.19	600		
96							1560	2300	588	180	0.89	7	0.19	600		
51.5	810							1010	607	240	0.83	4.9	0.13	550		
83.5		1240						1550	643	237	0.88	4.9	0.13	550		
87.3			1300					1620	641	234	0.89	4.9	0.13	550	04	✶
90.9				1360				1700	638	232	0.89	4.9	0.13	550		
94.9					1420			1770	638	230	0.90	4.9	0.13	550		
102						1540		1920	631	226	0.90	4.9	0.13	550		
57.5	940							1320	584	260	0.85	3.6	0.1	500		
91.2		1450						2040	601	256	0.89	3.6	0.1	500		
96			1520					2140	603	254	0.90	3.6	0.1	500	05	✶✶
100				1590				2240	602	253	0.90	3.6	0.1	500		
104					1660			2300	597	248	0.91	3.6	0.1	500		
112						1800		2340	592	245	0.91	3.6	0.1	500		
77.8	1240							1550	599	340	0.88	2.2	0.055	600		
122		1910						2290	610	335	0.91	2.2	0.055	600		
127			2010					2410	601	330	0.91	2.2	0.055	600		
131				2100				2520	596	325	0.92	2.2	0.055	600	06	✶
135					2190			2620	588	320	0.92	2.2	0.055	600		
143						2380		2850	573	310	0.92	2.2	0.055	600		
169							2860	3430	564	305	0.92	2.2	0.055	600		
89.2	1420							1980	600	390	0.88	1.8	0.045	600		
132		2180						2700	577	370	0.89	1.8	0.045	600		
142			2290					2840	593	368	0.92	1.8	0.045	600		
148				2390				2960	591	366	0.92	1.8	0.045	600	10	✶
150					2490			3080	575	354	0.92	1.8	0.045	600		
157						2710		3360	553	340	0.92	1.8	0.045	600		
183							3250	3800	538	330	0.93	1.8	0.045	600		
82.4	1600							2000	492	360	0.88	1.6	0.038	550		
114		2460						2830	443	320	0.89	1.6	0.038	550		
122			2580					2970	452	316	0.92	1.6	0.038	550	11	✶
128				2700				3110	451	315	0.92	1.6	0.038	550		
132					2820			3200	447	312	0.92	1.6	0.038	550		
143						3060		3300	445	310	0.92	1.6	0.038	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 515 kg
Moment of inertia: 0.8 kg.m^2
Field power: 2 kW

497 - 727 N.m

$n_{max\ mech}$: 3600 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
40.4	600							1260	643	194	0.80	9.2	0.223	600		
66.4		920						1560	689	193	0.86	9.2	0.223	600		
70.2			970					1650	691	192	0.87	9.2	0.223	600		
74.2				1010				1710	703	192	0.88	9.2	0.223	600	03	✶
76.1					1050			1760	692	188	0.88	9.2	0.223	600		
81.6						1140		1800	684	185	0.88	9.2	0.223	600		
96							1370	2020	669	180	0.89	9.2	0.223	600		
50.7	710							880	682	238	0.82	6.4	0.16	550		
83		1090						1360	727	236	0.88	6.4	0.16	550		
86.5			1150					1430	718	234	0.88	6.4	0.16	550	04	✶
90.9				1200				1500	723	232	0.89	6.4	0.16	550		
94.2					1250			1560	720	230	0.89	6.4	0.16	550		
102						1360		1700	714	226	0.90	6.4	0.16	550		
57.5	830							1170	662	260	0.85	4.7	0.128	500		
91.2		1280						1790	680	256	0.89	4.7	0.128	500		
96			1340					1880	684	254	0.90	4.7	0.128	500	05	✶
100				1400				1960	684	253	0.90	4.7	0.128	500		
103					1460			2000	672	248	0.90	4.7	0.128	500		
112						1590		2070	670	245	0.91	4.7	0.128	500		
77.8	1100							1370	675	340	0.88	2.6	0.065	600		
122		1690						2110	689	335	0.91	2.6	0.065	600		
126			1770					2210	681	330	0.91	2.6	0.065	600		
130				1850				2220	671	325	0.91	2.6	0.065	600	06	✶✶
135					1930			2310	666	320	0.91	2.6	0.065	600		
143						2100		2520	648	310	0.92	2.6	0.065	600		
169							2520	3020	640	305	0.92	2.6	0.065	600		
89.2	1250							1750	681	390	0.88	2	0.053	600		
132		1920						2380	655	370	0.89	2	0.053	600		
142			2020					2500	672	368	0.92	2	0.053	600		
148				2110				2610	670	366	0.92	2	0.053	600	10	✶
150					2200			2720	651	354	0.92	2	0.053	600		
157						2390		2900	627	340	0.92	2	0.053	600		
183							2870	3500	610	330	0.93	2	0.053	600		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804 VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
28.3	280							600	965	145	0.75	27	0.54	500	02	✶
46.3		420						650	1053	143	0.81	27	0.54	500		
49.1			440					680	1066	143	0.82	27	0.54	500		
51.5				460				700	1069	143	0.82	27	0.54	500		
54.6					480			740	1086	143	0.83	27	0.54	500		
58.8						520		800	1080	140	0.84	27	0.54	500		
43.8	400							960	1046	213	0.79	11	0.23	600	03	✶
71.3		680						1200	1001	205	0.87	11	0.23	600		
76.6			720					1250	1016	205	0.89	11	0.23	600		
81.6				750				1300	1039	205	0.90	11	0.23	600		
82.8					780			1360	1014	200	0.90	11	0.23	600		
87.8						850		1470	986	195	0.90	11	0.23	600		
103							1010	1760	970	190	0.90	11	0.23	600		
49	480							730	975	235	0.80	9.3	0.19	550	04	✶
79.4		800						1130	948	223	0.89	9.3	0.19	550		
84.2			850					1200	946	223	0.90	9.3	0.19	550		
88.3				880				1240	958	223	0.90	9.3	0.19	550		
91.5					910			1280	960	221	0.90	9.3	0.19	550		
98.7						1000		1400	943	217	0.91	9.3	0.19	550		
54.8	560							860	935	257	0.82	6.9	0.14	500	05	✶
87.6		920						1310	909	246	0.89	6.9	0.14	500		
93			970					1380	916	246	0.90	6.9	0.14	500		
98.5				1010				1440	931	246	0.91	6.9	0.14	500		
101					1050			1490	918	241	0.91	6.9	0.14	500		
109						1150		1630	903	239	0.91	6.9	0.14	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804 VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 620 kg

Moment of inertia: 1 kg.m^2

Field power: 2.1 kW

613 - 1086 N.m

$n_{max\ mech}$: 3600 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
79.5	750							1050	1012	360	0.85	3.2	0.07	600		
118		1230						1540	916	334	0.90	3.2	0.07	600		
126			1290					1600	933	334	0.91	3.2	0.07	600		
134				1350				1680	948	334	0.92	3.2	0.07	600	06	✶
140					1400			1750	955	332	0.92	3.2	0.07	600		
150						1520		1900	942	327	0.92	3.2	0.07	600		
178							1830	2280	929	322	0.92	3.2	0.07	600		
81.8	900							1280	868	370	0.85	2.6	0.06	600		
129		1380						1690	893	360	0.91	2.6	0.06	600		
136			1460					1780	890	360	0.92	2.6	0.06	600		
143				1520				1860	898	360	0.92	2.6	0.06	600	10	✶
144					1580			1930	870	348	0.92	2.6	0.06	600		
151						1720		2000	838	334	0.92	2.6	0.06	600		
179							2060	2420	830	325	0.92	2.6	0.06	600		
89.4	1160							1620	736	395	0.87	1.9	0.045	570		
136		1790						2140	726	382	0.89	1.9	0.045	570		
148			1870					2240	756	382	0.92	1.9	0.045	570		
155				1960				2350	755	382	0.92	1.9	0.045	570	11	✶✶✶
161					2040			2400	754	379	0.92	1.9	0.045	570		
175						2210		2600	756	375	0.93	1.9	0.045	570		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
25.4	440							790	551	130	0.75	1.8	0.49	550		
43.2		680						1225	607	130	0.83	1.8	0.49	550		
45.9			710					1280	617	130	0.84	1.8	0.49	550	01	✶
48.3				740				1330	623	130	0.85	1.8	0.49	550		
50.8					780			1390	622	130	0.85	1.8	0.49	550		
55.9						850		1510	628	130	0.86	1.8	0.49	550		
29.6	490							880	577	147	0.78	1.5	0.39	500		
49.7		750						1350	633	147	0.85	1.5	0.39	500		
52.5			790					1420	635	147	0.85	1.5	0.39	500	02	✶
55.3				830				1490	636	147	0.86	1.5	0.39	500		
58.2					870			1560	639	147	0.86	1.5	0.39	500		
63.9						940		1690	649	147	0.87	1.5	0.39	500		
34.3	560							1010	585	165	0.80	1.2	0.306	500		
56.8		860						1550	631	165	0.86	1.2	0.306	500		
59.9			900					1620	636	165	0.87	1.2	0.306	500	03	✶
63.2				950				1710	635	165	0.87	1.2	0.306	500		
66.4					990			1790	641	165	0.88	1.2	0.306	500		
72.6						1080		1940	642	165	0.88	1.2	0.306	500		
42.8	680							1225	601	200	0.82	0.83	0.217	700		
70		1050						1890	637	200	0.88	0.83	0.217	700		
73.9			1100					1980	642	200	0.88	0.83	0.217	700		
77.6				1150				2070	644	200	0.88	0.83	0.217	700	04	✶
81.4					1200			2160	648	200	0.89	0.83	0.217	700		
89						1310		2350	649	200	0.89	0.83	0.217	700		
107							1570	2820	650	200	0.89	0.83	0.217	700		
53	850							1530	595	240	0.85	0.55	0.146	600		
85.4		1310						2360	623	240	0.89	0.55	0.146	600		
89.7			1370					2470	625	240	0.89	0.55	0.146	600		
94				1440				2590	623	240	0.89	0.55	0.146	600	05	✶
99.4					1500			2710	633	240	0.90	0.55	0.146	600		
109						1630		2940	636	240	0.91	0.55	0.146	600		
131							1960	3530	638	240	0.91	0.55	0.146	600		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 480 kg
Moment of inertia: 0.7 kg.m^2
Field power: 1.9 kW

473 - 650 N.m

$n_{max\ mech}$: 3600 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
59.5	940							1690	604	266	0.86	0.46	0.123	550	06	✶
94.7		1450						2610	624	266	0.89	0.46	0.123	550		
99.4			1520					2740	625	266	0.89	0.46	0.123	550		
104				1590				2860	626	266	0.89	0.46	0.123	550		
110					1660			2990	633	266	0.90	0.46	0.123	550		
120						1810		3250	635	266	0.91	0.46	0.123	550		
66.7	1050							1890	607	295	0.87	0.37	0.097	500	07	✶
106		1620						2920	626	295	0.90	0.37	0.097	500		
112			1700					3060	626	295	0.90	0.37	0.097	500		
118				1780				3200	630	295	0.91	0.37	0.097	500		
123					1860			3340	632	295	0.91	0.37	0.097	500		
134						2020		3600	634	295	0.91	0.37	0.097	500		
75.5	1200							2160	601	330	0.88	0.3	0.076	500	08	✶
118		1850						3330	608	325	0.91	0.3	0.076	500		
120			1940					3490	593	315	0.91	0.3	0.076	500		
124				2030				3600	584	310	0.91	0.3	0.076	500		
128					2120			3600	575	305	0.91	0.3	0.076	500		
137						2310		3600	566	300	0.91	0.3	0.076	500		
87.9	1410							2540	595	383	0.88	0.22	0.061	700	10	✶
130		2170						3600	571	357	0.91	0.22	0.061	700		
130			2280					3600	544	340	0.91	0.22	0.061	700		
132				2390				3600	528	330	0.91	0.22	0.061	700		
132					2490			3600	507	315	0.91	0.22	0.061	700		
139						2710		3600	490	305	0.91	0.22	0.061	700		
161							3250	3600	473	294	0.91	0.22	0.061	700		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
24.9	380							685	626	130	0.74	2.1	0.52	550		
42.7		580						1045	703	130	0.82	2.1	0.52	550		
45.3			610					1100	709	130	0.83	2.1	0.52	550	01	✶
47.8				640				1150	713	130	0.84	2.1	0.52	550		
50.3					670			1200	717	130	0.84	2.1	0.52	550		
55.3						730		1310	723	130	0.85	2.1	0.52	550		
29.2	430							775	649	147	0.77	1.7	0.412	500		
49.4		660						1190	715	147	0.84	1.7	0.412	500		
52.2			690					1240	722	147	0.85	1.7	0.412	500	02	✶
55				730				1310	720	147	0.85	1.7	0.412	500		
57.8					760			1370	726	147	0.86	1.7	0.412	500		
63.6						830		1490	732	147	0.87	1.7	0.412	500		
33.9	490							880	661	165	0.79	1.35	0.324	500		
56.4		750						1350	718	165	0.86	1.35	0.324	500		
59.6			790					1420	720	165	0.86	1.35	0.324	500	03	✶
62.8				830				1490	723	165	0.87	1.35	0.324	500		
66					870			1560	724	165	0.87	1.35	0.324	500		
72.4						940		1690	736	165	0.88	1.35	0.324	500		
42.4	600							1190	675	200	0.82	0.94	0.23	700		
69.6		920						1660	722	200	0.87	0.94	0.23	700		
73.5			970					1750	724	200	0.88	0.94	0.23	700		
77.4				1020				1840	725	200	0.88	0.94	0.23	700	04	✶
81.4					1060			1920	733	200	0.89	0.94	0.23	700		
89						1150		2090	739	200	0.89	0.94	0.23	700		
107							1380	2510	739	200	0.89	0.94	0.23	700		
52.5	750							1350	669	240	0.84	0.63	0.155	600		
85		1150						2070	706	240	0.89	0.63	0.155	600		
89.7			1210					2180	708	240	0.89	0.63	0.155	600		
94.3				1270				2290	709	240	0.89	0.63	0.155	600	05	✶
98.9					1330			2390	710	240	0.90	0.63	0.155	600		
108						1440		2600	717	240	0.90	0.63	0.155	600		
130							1730	3120	715	240	0.90	0.63	0.155	600		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 1804C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 515 kg

Moment of inertia: 0.8 kg.m^2

Field power: 2 kW

626 - 739 N.m

$n_{max\ mech}$: 3600 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
58.9	820							1480	686	266	0.85	0.52	0.13	550	06	✶
94.8		1260						2270	719	266	0.89	0.52	0.13	550		
100			1320					2380	723	266	0.90	0.52	0.13	550		
105				1390				2500	722	266	0.90	0.52	0.13	550		
110					1450			2610	725	266	0.90	0.52	0.13	550		
120						1580		2840	728	266	0.91	0.52	0.13	550		
66	920							1660	685	295	0.86	0.42	0.103	500	07	✶
102		1420						2560	687	295	0.87	0.42	0.103	500		
109			1490					2680	699	295	0.88	0.42	0.103	500		
117				1560				2810	718	295	0.90	0.42	0.103	500		
123					1630			2930	721	295	0.91	0.42	0.103	500		
134						1770		3190	724	295	0.91	0.42	0.103	500		
75.2	1040							1870	691	330	0.88	0.34	0.081	500	08	✶
120		1600						2880	713	330	0.91	0.34	0.081	500		
126			1680					3020	715	330	0.91	0.34	0.081	500		
132				1760				3170	716	330	0.91	0.34	0.081	500		
138					1840			3310	717	330	0.91	0.34	0.081	500		
146						2000		3600	699	320	0.92	0.34	0.081	500		
87	1230							2210	675	383	0.87	0.25	0.064	700	10	✶
129		1890						3400	650	365	0.88	0.25	0.064	700		
139			1990					3580	668	365	0.91	0.25	0.064	700		
145				2080				3600	663	360	0.91	0.25	0.064	700		
149					2180			3600	654	355	0.91	0.25	0.064	700		
158						2370		3600	637	345	0.92	0.25	0.064	700		
188							2840	3600	631	340	0.92	0.25	0.064	700		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2004 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
49.3	570							750	826	224	0.85	4.2	0.16	750		
79.9		880						1100	867	224	0.89	4.2	0.16	750		
83.9			920					1150	871	224	0.89	4.2	0.16	750		
87.9				960				1200	874	224	0.89	4.2	0.16	750	06	✶
92.9					1010			1270	878	224	0.90	4.2	0.16	750		
102						1100		1375	883	224	0.91	4.2	0.16	750		
122							1320	1600	885	224	0.91	4.2	0.16	750		
71.5	790							1000	864	310	0.89	2.2	0.081	550		
113		1220						1500	886	310	0.91	2.2	0.081	550		
119			1280					1550	889	310	0.92	2.2	0.081	550		
125				1340				1650	892	310	0.92	2.2	0.081	550	07	✶
131					1400			1700	895	310	0.92	2.2	0.081	550		
143						1520		1830	899	310	0.92	2.2	0.081	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

E

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2004 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 630 kg

Moment of inertia: 1.3 kg.m^2

Field power: 2.4 kW

569 - 899 N.m

$n_{max\ mech}$: 3200 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
83.9	940							1500	852	363	0.89	1.55	0.063	500		
133		1490						2200	852	363	0.92	1.55	0.063	500		
140			1570					2250	852	363	0.92	1.55	0.063	500		
147				1650				2300	851	363	0.92	1.55	0.063	500	08	✶✶
154					1730			2350	851	363	0.92	1.55	0.063	500		
168						1885		2500	852	363	0.93	1.55	0.063	500		
93.6	1130							1400	791	400	0.90	1.25	0.048	750		
148		1740						2100	810	400	0.92	1.25	0.048	750		
151			1830					2200	789	390	0.92	1.25	0.048	750		
153				1910				2300	763	375	0.93	1.25	0.048	750	10	✶
156					2000			2400	743	365	0.93	1.25	0.048	750		
162						2170		2600	714	350	0.93	1.25	0.048	750		
184							2610	3000	674	330	0.93	1.25	0.048	750		
102	1560							1900	624	430	0.91	0.85	0.03	650		
155		2400						2800	615	420	0.92	0.85	0.03	650		
160			2520					2900	606	410	0.93	0.85	0.03	650	11	✶
163				2640				3000	591	400	0.93	0.85	0.03	650		
171					2865			3200	569	400	0.93	0.85	0.03	650		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2004 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
48.6	455							590	1020	224	0.84	5	0.175	750		
79.4		745						870	1018	224	0.89	5	0.175	750		
83.7			790					910	1012	224	0.89	5	0.175	750		
88.1				830				960	1014	224	0.89	5	0.175	750	06	✶
92.4					870			1000	1014	224	0.90	5	0.175	750		
101						955		1080	1011	224	0.90	5	0.175	750		
121							1160	1300	999	224	0.90	5	0.175	750		
70.5	670							840	1005	310	0.88	2.6	0.09	550		
113		1030						1250	1046	310	0.91	2.6	0.09	550		
119			1080					1300	1051	310	0.91	2.6	0.09	550		
125				1130				1350	1055	310	0.92	2.6	0.09	550	07	✶
131					1190			1430	1050	310	0.92	2.6	0.09	550		
143						1290		1550	1057	310	0.92	2.6	0.09	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2004 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 710 kg

Moment of inertia: 1.5 kg.m^2

Field power: 2.7 kW

621 - 1057 N.m

$n_{max\ mech}$: 3200 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
83.3	785							1200	1013	363	0.88	1.85	0.07	500		
133		1255						1800	1010	363	0.91	1.85	0.07	500		
140			1325					1900	1007	363	0.92	1.85	0.07	500		
147				1390				2000	1007	363	0.92	1.85	0.07	500	08	✶
154					1455			2100	1008	363	0.92	1.85	0.07	500		
168						1590		2250	1007	363	0.92	1.85	0.07	500		
95.8	910							1090	1005	412	0.89	1.45	0.053	750		
152		1400						1680	1034	412	0.92	1.45	0.053	750		
160			1470					1765	1036	412	0.92	1.45	0.053	750		
167				1540				1850	1034	410	0.92	1.45	0.053	750	10	✶✶✶
173					1610			1930	1029	407	0.93	1.45	0.053	750		
184						1750		2100	1001	395	0.93	1.45	0.053	750		
209							2100	2500	949	374	0.93	1.45	0.053	750		
119	1210							1450	942	505	0.91	0.95	0.033	650		
187		1860						2230	960	503	0.93	0.95	0.033	650		
188			1950					2350	921	481	0.93	0.95	0.033	650		
189				2050				2500	880	462	0.93	0.95	0.033	650	11	✶✶
190					2140			2600	848	444	0.93	0.95	0.033	650		
196						2330		2700	802	420	0.93	0.95	0.033	650		
220							2790	3200	752	393	0.93	0.95	0.033	650		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
43.3	400							600	1034	205	0.81	6	0.187	650		
71		655						900	1035	205	0.87	6	0.187	650		
74.7			690					950	1034	205	0.87	6	0.187	650		
79.1				730				1000	1035	205	0.88	6	0.187	650	07	✶
82.9					765			1050	1035	205	0.88	6	0.187	650		
91						840		1150	1035	205	0.88	6	0.187	650		
112							1030	1400	1035	205	0.89	6	0.187	650		
61.6	560							1200	1051	275	0.86	3.3	0.102	650		
100		900						1900	1061	275	0.90	3.3	0.102	650		
104			950					1950	1049	275	0.90	3.3	0.102	650		
110				1000				2000	1051	275	0.91	3.3	0.102	650	08	✶
116					1050			2050	1051	275	0.91	3.3	0.102	650		
125						1140		2150	1050	275	0.91	3.3	0.102	650		
151							1390	2400	1035	275	0.91	3.3	0.102	650		
85.7	790							1100	1036	365	0.90	1.85	0.053	500		
135		1220						1650	1059	365	0.93	1.85	0.053	500		
142			1280					1750	1062	365	0.93	1.85	0.053	500		
150				1340				1800	1065	365	0.93	1.85	0.053	500	09	✶
157					1400			1900	1069	365	0.93	1.85	0.053	500		
171						1520		2050	1072	365	0.94	1.85	0.053	500		
105	970							1350	1029	438	0.92	1.25	0.034	750		
164		1490						2000	1051	438	0.94	1.25	0.034	750		
172			1570					2100	1049	438	0.94	1.25	0.034	750		
181				1640				2200	1053	438	0.94	1.25	0.034	750	10	✶
186					1720			2300	1031	430	0.94	1.25	0.034	750		
200						1870		2400	1020	425	0.94	1.25	0.034	750		
234							2240	2800	996	414	0.94	1.25	0.034	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 810 kg

Moment of inertia: 2.2 kg.m^2

Field power: 2.7 kW

760 - 1072 N.m

$n_{max\ mech}$: 3000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
120	1140							1500	1006	500	0.92	1	0.026	700		
188		1750						2300	1024	500	0.94	1	0.026	700		
197			1840					2350	1024	500	0.94	1	0.026	700		
198				1930				2500	981	480	0.94	1	0.026	700	11	✶
203					2020			2600	961	470	0.94	1	0.026	700		
216						2280		2800	906	460	0.94	1	0.026	700		
251							2740	3000	875	445	0.94	1	0.026	700		
130	1260							1650	983	540	0.92	0.85	0.023	650		
195		1940						2500	960	520	0.94	0.85	0.023	650		
201			2040					2550	941	510	0.94	0.85	0.023	650		
207				2130				2600	926	500	0.94	0.85	0.023	650	12	✶
213					2230			2800	912	493	0.94	0.85	0.023	650		
227						2540		3000	854	484	0.94	0.85	0.023	650		
141	1410							1850	956	584	0.93	0.7	0.019	600		
216		2170						2700	947	575	0.94	0.7	0.019	600		
217			2280					2800	909	550	0.94	0.7	0.019	600		
219				2390				2900	875	529	0.94	0.7	0.019	600	13	✶
223					2540			3000	839	516	0.94	0.7	0.019	600		
236						2880		3000	784	503	0.94	0.7	0.019	600		
155	1550							2050	954	640	0.93	0.6	0.017	550		
225		2380						2900	903	600	0.94	0.6	0.017	550		
223			2500					3000	853	567	0.94	0.6	0.017	550	14	✶
227				2620				3000	827	550	0.94	0.6	0.017	550		
232					2750			3000	806	537	0.94	0.6	0.017	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
47.2	320							450	1409	225	0.83	6.85	0.215	650		
75.5		525						700	1373	225	0.86	6.85	0.215	650		
82			555					750	1411	225	0.87	6.85	0.215	650		
86.4				585				800	1410	225	0.88	6.85	0.215	650	07	✶
91.5					620			850	1409	225	0.89	6.85	0.215	650		
99.6						675		950	1409	225	0.89	6.85	0.215	650		
122							825	1200	1412	225	0.90	6.85	0.215	650		
66.7	445							1000	1431	300	0.86	3.75	0.117	650		
108		720						1500	1433	300	0.90	3.75	0.117	650		
114			760					1550	1433	300	0.91	3.75	0.117	650		
120				800				1600	1433	300	0.91	3.75	0.117	650	08	✶
126					840			1700	1433	300	0.91	3.75	0.117	650		
138						920		1800	1433	300	0.92	3.75	0.117	650		
166							1120	2200	1415	300	0.92	3.75	0.117	650		
91.1	650							900	1338	394	0.89	2.1	0.061	500		
143		1000						1350	1362	394	0.91	2.1	0.061	500		
152			1050					1450	1384	394	0.92	2.1	0.061	500		
160				1100				1500	1389	394	0.92	2.1	0.061	500	09	✶
168					1150			1550	1392	394	0.93	2.1	0.061	500		
183						1250		1700	1395	394	0.93	2.1	0.061	500		
112	790							1100	1355	475	0.91	1.4	0.039	750		
177		1220						1650	1385	475	0.93	1.4	0.039	750		
186			1280					1750	1388	475	0.93	1.4	0.039	750		
195				1340				1800	1393	475	0.94	1.4	0.039	750	10	✶
205					1400			1900	1395	475	0.94	1.4	0.039	750		
223						1520		2050	1401	475	0.94	1.4	0.039	750		
268							1820	2450	1406	475	0.94	1.4	0.039	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 920 kg

Moment of inertia: 2.4 kg.m^2

Field power: 3.2 kW

1150 - 1433 N.m

$n_{max\ mech}$: 3000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Delivery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
129	900							1200	1364	540	0.92	1.1	0.03	700		
202		1380						1800	1398	540	0.94	1.1	0.03	700		
212			1450					1900	1398	540	0.94	1.1	0.03	700		
223				1520				2000	1400	540	0.94	1.1	0.03	700	11	✶✶✶
233					1590			2100	1401	540	0.94	1.1	0.03	700		
254						1750		2300	1387	540	0.94	1.1	0.03	700		
294							2100	2750	1335	520	0.94	1.1	0.03	700		
139	970							1300	1367	582	0.92	0.95	0.027	650		
218		1490						1950	1395	582	0.94	0.95	0.027	650		
227			1570					2050	1378	575	0.94	0.95	0.027	650		
237				1640				2150	1378	573	0.94	0.95	0.027	650	12	✶
247					1720			2250	1369	571	0.94	0.95	0.027	650		
265						1930		2400	1311	563	0.94	0.95	0.027	650		
308							2320	2800	1269	546	0.94	0.95	0.027	650		
152	1075							1400	1349	633	0.92	0.8	0.022	600		
238		1650						2150	1376	633	0.94	0.8	0.022	600		
250			1740					2250	1372	633	0.94	0.8	0.022	600		
257				1820				2300	1347	620	0.94	0.8	0.022	600	13	✶
262					1930			2400	1295	604	0.94	0.8	0.022	600		
280						2150		2700	1242	593	0.94	0.8	0.022	600		
324							2600	3000	1189	572	0.94	0.8	0.022	600		
167	1180							1600	1348	693	0.92	0.66	0.019	550		
254		1820						2300	1330	675	0.94	0.66	0.019	550		
261			1910					2400	1303	660	0.94	0.66	0.019	550	14	✶✶
269				2050				2600	1254	650	0.94	0.66	0.019	550		
276					2170			2700	1215	637	0.94	0.66	0.019	550		
294						2440		2900	1150	624	0.94	0.66	0.019	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
48.7	300							400	1549	225	0.83	7.5	0.212	650		
75.9		480						650	1510	225	0.84	7.5	0.212	650		
81.3			500					675	1552	225	0.86	7.5	0.212	650		
86				530				700	1550	225	0.87	7.5	0.212	650	07	✶
90.8					560			750	1549	225	0.88	7.5	0.212	650		
98.9						610		850	1549	225	0.88	7.5	0.212	650		
121.9							750	1050	1552	225	0.90	7.5	0.212	650		
65.9	400							550	1573	300	0.84	4.13	0.116	650		
107		650						900	1575	300	0.89	4.13	0.116	650		
114			690					950	1575	300	0.90	4.13	0.116	650		
119				720				1000	1575	300	0.90	4.13	0.116	650	08	✶
125					760			1050	1575	300	0.91	4.13	0.116	650		
137						830		1150	1575	300	0.91	4.13	0.116	650		
166							1020	1400	1555	300	0.92	4.13	0.116	650		
90.9	590							800	1471	395	0.88	2.28	0.068	500		
141		900						1250	1498	395	0.89	2.28	0.068	500		
151			950					1300	1522	395	0.91	2.28	0.068	500	09	✶
158				990				1350	1527	395	0.91	2.28	0.068	500		
168					1050			1450	1531	395	0.93	2.28	0.068	500		
185						1150		1600	1534	395	0.94	2.28	0.068	500		
111	710							1000	1490	475	0.90	1.55	0.049	750		
175		1100						1475	1523	475	0.92	1.55	0.049	750		
184			1150					1550	1526	475	0.92	1.55	0.049	750		
194				1210				1600	1531	475	0.93	1.55	0.049	750	10	✶
202					1260			1700	1534	475	0.93	1.55	0.049	750		
221						1370		1850	1540	475	0.93	1.55	0.049	750		
267							1650	2200	1546	475	0.94	1.55	0.049	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2254 VL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 1000 kg

Moment of inertia: 2.7 kg.m^2

Field power: 3.2 kW

1295 - 1575 N.m

$n_{max\ mech}$: 3000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
127	810							1100	1500	540	0.91	1.2	0.038	700		
200		1240						1675	1537	540	0.92	1.2	0.038	700		
211			1310					1750	1537	540	0.93	1.2	0.038	700		
221				1370				1850	1539	540	0.93	1.2	0.038	700	11	✶
232					1440			1950	1540	540	0.93	1.2	0.038	700		
251						1570		2100	1525	540	0.93	1.2	0.038	700		
292							1900	2500	1468	520	0.94	1.2	0.038	700		
138	870							1250	1510	585	0.90	1.03	0.031	650		
216		1340						1800	1541	585	0.92	1.03	0.031	650		
224			1410					1900	1520	575	0.93	1.03	0.031	650		
239				1500				2000	1520	575	0.94	1.03	0.031	650	12	✶
248					1560			2100	1520	575	0.94	1.03	0.031	650		
265						1750		2300	1446	565	0.94	1.03	0.031	650		
309							2100	2600	1406	550	0.94	1.03	0.031	650		
150	965							1300	1488	635	0.91	0.88	0.029	600		
235		1480						1900	1517	635	0.93	0.88	0.029	600		
247			1560					2000	1513	635	0.93	0.88	0.029	600		
254				1640				2150	1481	620	0.93	0.88	0.029	600	13	✶
260					1740			2250	1425	605	0.93	0.88	0.029	600		
278						1940		2500	1370	595	0.94	0.88	0.029	600		
323							2350	2800	1314	575	0.94	0.88	0.029	600		
166	1060							1400	1498	695	0.92	0.72	0.024	550		
253		1640						2150	1475	675	0.94	0.72	0.024	550		
263			1720					2250	1460	670	0.93	0.72	0.024	550	14	✶✶
273				1850				2400	1410	665	0.93	0.72	0.024	550		
281					1960			2500	1370	650	0.94	0.72	0.024	550		
298						2200		2700	1295	635	0.94	0.72	0.024	550		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2504C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
51	310							430	1571	260	0.75	1.85	0.25	650		
86		510						710	1610	260	0.83	1.85	0.25	650		
92			540					760	1627	260	0.84	1.85	0.25	650		
97				570				800	1625	260	0.85	1.85	0.25	650	0A	✶
103					610			840	1613	260	0.86	1.85	0.25	650		
113						660		910	1635	260	0.87	1.85	0.25	650		
136							810	1090	1603	260	0.87	1.85	0.25	650		
88	530							740	1586	400	0.85	0.74	0.092	650		
142		870						1220	1559	400	0.89	0.74	0.092	650		
151			910					1270	1585	400	0.90	0.74	0.092	650		
158				960				1340	1572	400	0.90	0.74	0.092	650	0B	✶
167					1010			1400	1579	400	0.91	0.74	0.092	650		
182						1100		1520	1580	400	0.91	0.74	0.092	650		
221							1320	1830	1599	400	0.92	0.74	0.092	650		
139	780							1090	1702	600	0.89	0.38	0.044	750		
218		1200						1680	1735	600	0.91	0.38	0.044	750		
232			1260					1760	1758	600	0.92	0.38	0.044	750		
243				1320				1850	1758	600	0.92	0.38	0.044	750	01	✶
257					1380			1930	1779	600	0.93	0.38	0.044	750		
279						1500		2100	1776	600	0.93	0.38	0.044	750		
335							1800	2100	1777	600	0.93	0.38	0.044	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2504C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 1400 kg

Moment of inertia: 4.1 kg.m^2

Field power: 3 kW

1559 - 1779 N.m

$n_{max\ mech}$: 2100 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
161	910							1270	1690	690	0.90	0.28	0.034	550		
251		1400						1960	1712	690	0.91	0.28	0.034	550		
267			1470					2060	1735	690	0.92	0.28	0.034	550	02	✶
282				1540				2100	1749	690	0.93	0.28	0.034	550		
295					1610			2100	1750	690	0.93	0.28	0.034	550		
321						1750		2100	1752	690	0.93	0.28	0.034	550		
189	1110							1540	1626	800	0.91	0.2	0.023	550		
294		1710						2100	1642	800	0.92	0.2	0.023	550		
312			1790					2100	1665	800	0.93	0.2	0.023	550	03	✶✶
319				1880				2100	1620	800	0.93	0.2	0.023	550		
333					1960			2100	1623	800	0.94	0.2	0.023	550		
208	1200							1680	1655	870	0.92	0.17	0.0184	500		
324		1850						2100	1673	870	0.93	0.17	0.0184	500	04	✶
340			1940					2100	1674	860	0.94	0.17	0.0184	500		
343				2080				2100	1575	830	0.94	0.17	0.0184	500		
227	1360							1900	1594	950	0.92	0.13	0.015	500	06	✶

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2504C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
51	260							360	1873	260	0.75	2.2	0.27	650		
86		430						600	1910	260	0.83	2.2	0.27	650		
92			450					630	1952	260	0.84	2.2	0.27	650		
97				480				670	1930	260	0.85	2.2	0.27	650	0A	✶
103					510			710	1929	260	0.86	2.2	0.27	650		
113						560		760	1927	260	0.87	2.2	0.27	650		
136							690	920	1882	260	0.87	2.2	0.27	650		
88	450							630	1868	400	0.85	0.88	0.1	650		
142		730						1020	1858	400	0.89	0.88	0.1	650		
151			770					1080	1873	400	0.90	0.88	0.1	650		
158				810				1130	1863	400	0.90	0.88	0.1	650	0B	✶
167					850			1180	1876	400	0.91	0.88	0.1	650		
182						930		1280	1869	400	0.91	0.88	0.1	650		
221							1120	1540	1884	400	0.92	0.88	0.1	650		
139	660							920	2011	600	0.89	0.44	0.048	750		
218		1020						1430	2041	600	0.91	0.44	0.048	750		
232			1070					1500	2071	600	0.92	0.44	0.048	750		
243				1120				1570	2072	600	0.92	0.44	0.048	750	01	✶
257					1170			1640	2098	600	0.93	0.44	0.048	750		
279						1270		1780	2098	600	0.93	0.44	0.048	750		
335							1520	2100	2105	600	0.93	0.44	0.048	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2504C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

Total weight: 1500 kg

Moment of inertia: 4.6 kg.m^2

Field power: 3 kW

1822 - 2105 N.m

$n_{max\ mech}$: 2100 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
161	770							1080	1997	690	0.90	0.33	0.038	550	02	✶
251		1180						1650	2031	690	0.91	0.33	0.038	550		
267			1240					1740	2056	690	0.92	0.33	0.038	550		
282				1300				1820	2072	690	0.93	0.33	0.038	550		
295					1360			1900	2072	690	0.93	0.33	0.038	550		
321						1480		2100	2071	690	0.93	0.33	0.038	550		
189	920							1080	1962	800	0.91	0.23	0.025	550	03	✶✶✶
294		1420						1650	1977	800	0.92	0.23	0.025	550		
312			1490					1740	2000	800	0.93	0.23	0.025	550		
327				1560				1820	2002	800	0.93	0.23	0.025	550		
342					1630			1900	2004	800	0.93	0.23	0.025	550		
376						1770		2070	2029	800	0.94	0.23	0.025	550		
208	1020							1430	1947	870	0.92	0.17	0.0184	500	04	✶
324		1570						2100	1971	870	0.93	0.17	0.0184	500		
340			1650					2100	1968	870	0.93	0.17	0.0184	500		
360				1730				2100	1987	870	0.94	0.17	0.0184	500		
376					1800			2100	1995	870	0.94	0.17	0.0184	500		
409						1960		2100	1993	870	0.94	0.17	0.0184	500		
230	1200							1680	1830	950	0.93	0.15	0.016	500	06	✶
353		1850						2100	1822	950	0.93	0.15	0.016	500		
375			1940					2100	1846	950	0.94	0.15	0.016	500		
393				2030				2100	1849	950	0.94	0.15	0.016	500		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2804C SM
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 1800 kg

Moment of inertia: 5.75 kg.m^2

Field power: 5.5 kW

2828 - 2992 N.m

$n_{max\ mech}$: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
98	325							600	2880	430	0.88	0.96	0.109	650		
151		500						900	2884	430	0.88	0.96	0.109	650		
161			530					950	2901	430	0.89	0.96	0.109	650		
168				550				1000	2917	430	0.89	0.96	0.109	650	01	✶
176					580			1040	2898	430	0.89	0.96	0.109	650		
194						630		1130	2941	430	0.90	0.96	0.109	650		
235							750	1350	2992	430	0.91	0.96	0.109	650		
130	435							590	2854	560	0.89	0.52	0.074	750		
199		670						870	2836	560	0.89	0.52	0.074	750		
209			700					910	2851	560	0.89	0.52	0.074	750		
222				740				960	2865	560	0.90	0.52	0.074	750	02	✶
232					770			1000	2877	560	0.90	0.52	0.074	750		
252						840		1090	2865	560	0.90	0.52	0.074	750		
309							1000	1300	2951	560	0.92	0.52	0.074	750		
151	510							910	2828	640	0.91	0.36	0.047	750		
233		780						1300	2853	640	0.91	0.36	0.047	750		
245			820					1460	2853	640	0.91	0.36	0.047	750		
256				860				1550	2843	640	0.91	0.36	0.047	750	03	✶
271					900			1610	2876	640	0.92	0.36	0.047	750		
294						980		1750	2865	640	0.92	0.36	0.047	750		
357							1180	2000	2889	640	0.93	0.36	0.047	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2804C M
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 1800 kg

Moment of inertia: 5.75 kg.m^2

Field power: 5.5 kW

2757 - 2980 N.m

$n_{max\ mech}$: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
199	650							910	2924	830	0.92	0.23	0.03	650		
305		1000						1400	2913	830	0.92	0.23	0.03	650		
321			1050					1470	2920	830	0.92	0.23	0.03	650		
340				1100				1540	2952	830	0.93	0.23	0.03	650	04	✶
355					1150			1610	2948	830	0.93	0.23	0.03	650		
386						1250		1750	2949	830	0.93	0.23	0.03	650		
468							1500	2000	2980	830	0.94	0.23	0.03	650		
235	810							1050	2771	970	0.93	0.16	0.02	550		
361		1250						1620	2758	970	0.93	0.16	0.02	550		
379			1310					1700	2763	970	0.93	0.16	0.02	550	05	✶
397				1375				1790	2757	970	0.93	0.16	0.02	550		
419					1440			1870	2779	970	0.94	0.16	0.02	550		
456						1560		2000	2792	970	0.94	0.16	0.02	550		
269	920							1250	2792	1100	0.94	0.125	0.0136	500		
414		1420						1920	2784	1100	0.94	0.125	0.0136	500		
434			1490					2000	2782	1100	0.94	0.125	0.0136	500	06	✶✶
455				1560				2000	2785	1100	0.94	0.125	0.0136	500		
476					1630			2000	2789	1100	0.94	0.125	0.0136	500		
517						1775		2000	2782	1100	0.94	0.125	0.0136	500		
318	1090							1300	2786	1300	0.94	0.13	0.0082	460		
489		1680						2000	2780	1300	0.94	0.13	0.0082	460		
513			1765					2000	2776	1300	0.94	0.13	0.0082	460	07	✶
538				1850				2000	2777	1300	0.94	0.13	0.0082	460		
562					1930			2000	2781	1300	0.94	0.13	0.0082	460		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2804C SL
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 1900 kg

Moment of inertia: 6.9 kg.m^2

Field power: 5.5 kW

3383 - 3562 N.m

$n_{max\ mech}$: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
98	270							500	3466	430	0.88	1.14	0.12	650		
151		420						750	3433	430	0.88	1.14	0.12	650		
161			440					790	3494	430	0.89	1.14	0.12	650		
168				460				830	3488	430	0.89	1.14	0.12	650	01	✶
176					480			870	3502	430	0.89	1.14	0.12	650		
194						525		940	3529	430	0.90	1.14	0.12	650		
235							630	1120	3562	430	0.91	1.14	0.12	650		
130	360							490	3449	560	0.89	0.62	0.081	750		
199		560						725	3394	560	0.89	0.62	0.081	750		
209			590					760	3383	560	0.89	0.62	0.081	750		
222				620				800	3420	560	0.90	0.62	0.081	750	02	✶
232					650			830	3409	560	0.90	0.62	0.081	750		
252						700		910	3438	560	0.90	0.62	0.081	750		
309							840	1080	3513	560	0.92	0.62	0.081	750		
151	425							760	3393	640	0.91	0.43	0.052	750		
233		650						1080	3423	640	0.91	0.43	0.052	750		
245			680					1220	3441	640	0.91	0.43	0.052	750		
256				720				1290	3396	640	0.91	0.43	0.052	750	03	✶
271					750			1340	3451	640	0.92	0.43	0.052	750		
294						820		1460	3424	640	0.92	0.43	0.052	750		
357							980	1750	3479	640	0.93	0.43	0.052	750		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 2804C L
D.C. motors
Electrical characteristics

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

Total weight: 1900 kg

Moment of inertia: 6.9 kg.m^2

Field power: 5.5 kW

3297 - 3576 N.m

$n_{max\ mech}$: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	260 V	400 V	420 V	440 V	460 V	500 V	600 V	Elec.*			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
199	540							760	3519	830	0.92	0.28	0.033	650		
305		830						1170	3509	830	0.92	0.28	0.033	650		
321			875					1220	3503	830	0.92	0.28	0.033	650		
340				920				1280	3529	830	0.93	0.28	0.033	650	04	✶
355					960			1340	3532	830	0.93	0.28	0.033	650		
386						1040		1460	3545	830	0.93	0.28	0.033	650		
468							1250	1750	3576	830	0.94	0.28	0.033	650		
235	675							875	3325	970	0.93	0.19	0.022	550		
361		1040						1350	3315	970	0.93	0.19	0.022	550		
379			1090					1420	3321	970	0.93	0.19	0.022	550	05	✶
397				1150				1490	3297	970	0.93	0.19	0.022	550		
419					1200			1560	3335	970	0.94	0.19	0.022	550		
456						1300		1700	3350	970	0.94	0.19	0.022	550		
269	770							1040	3336	1100	0.94	0.15	0.015	500		
414		1180						1600	3351	1100	0.94	0.15	0.015	500		
434			1240					1680	3343	1100	0.94	0.15	0.015	500	06	✶
455				1300				1760	3343	1100	0.94	0.15	0.015	500		
476					1360			1840	3343	1100	0.94	0.15	0.015	500		
517						1480		2000	3336	1100	0.94	0.15	0.015	500		
318	910							1080	3337	1300	0.94	0.155	0.0099	460		
489		1400						1670	3336	1300	0.94	0.155	0.0099	460		
513			1470					1750	3333	1300	0.94	0.155	0.0099	460	07	✶
538				1540				1830	3336	1300	0.94	0.155	0.0099	460		
562					1610			1920	3334	1300	0.94	0.155	0.0099	460		

*: greater speed ranges by use of field weakening may be considered depending on the application: please consult us.

P : Rated output power
M : Rated torque

I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C VS
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
225	660							1060	3260	630	0.89	0.69	0.056	700		
249		730						1140	3260	630	0.90	0.69	0.056	700		
263			770					1190	3260	630	0.91	0.69	0.056	700		
287				840				1260	3260	630	0.91	0.69	0.056	700	03	✶
299					875			1300	3260	630	0.91	0.69	0.056	700		
348						1020		1430	3260	630	0.92	0.69	0.056	700		
410							1200	1560	3260	630	0.93	0.69	0.056	700		
243	715							1140	3250	684	0.89	0.58	0.046	700		
271		795						1240	3250	684	0.90	0.58	0.046	700		
282			830					1280	3250	684	0.90	0.58	0.046	700		
310				910				1370	3250	684	0.91	0.58	0.046	700	04	✶
323					950			1410	3250	684	0.91	0.58	0.046	700		
376						1105		1550	3250	684	0.92	0.58	0.046	700		
442							1300	1690	3250	684	0.92	0.58	0.046	700		
266	770							1230	3295	734	0.90	0.51	0.04	700		
293		850						1330	3295	734	0.91	0.51	0.04	700		
307			890					1370	3295	734	0.91	0.51	0.04	700		
336				975				1460	3295	734	0.92	0.51	0.04	700	05	✶
350					1015			1500	3295	734	0.92	0.51	0.04	700		
407						1180		1650	3295	734	0.92	0.51	0.04	700		
480							1390	1810	3295	734	0.93	0.51	0.04	700		
284	830							1330	3265	780	0.91	0.45	0.036	700		
313		915						1430	3265	780	0.91	0.45	0.036	700		
328			960					1480	3265	780	0.91	0.45	0.036	700		
359				1050				1580	3265	780	0.92	0.45	0.036	700	06	✶
374					1095			1620	3265	780	0.92	0.45	0.036	700		
434						1270		1780	3265	780	0.93	0.45	0.036	700		
511							1495	1940	3265	780	0.94	0.45	0.036	700		
323	925							1480	3330	880	0.92	0.36	0.029	700		
356		1020						1590	3330	880	0.92	0.36	0.029	700		
373			1070					1650	3330	880	0.92	0.36	0.029	700		
408				1170				1760	3330	880	0.93	0.36	0.029	700	07	✶
425					1220			1810	3330	880	0.93	0.36	0.029	700		
493						1415		1980	3330	880	0.93	0.36	0.029	700		
581							1665	2000	3330	880	0.94	0.36	0.029	700		

*: Higher power ratings, speeds and field weakening range on quotation.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C VS
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

Total weight: 2250 kg

Moment of inertia: 16.8 kg.m^2

Field power: 1.8 kW

3215 - 3330 N.m

$n_{max\ mech}$**: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
354	1025							1640	3295	957	0.92	0.34	0.026	650	08	✶
392		1135						1770	3295	957	0.93	0.34	0.026	650		
411			1190					1830	3295	957	0.93	0.34	0.026	650		
449				1300				1950	3295	957	0.94	0.34	0.026	650		
468					1355			2000	3295	957	0.94	0.34	0.026	650		
543						1575		2000	3295	957	0.95	0.34	0.026	650		
378	1105							1770	3265	1020	0.93	0.29	0.023	600	09	✶
419		1225						1910	3265	1020	0.93	0.29	0.023	600		
438			1280					1970	3265	1020	0.93	0.29	0.023	600		
479				1400				2000	3265	1020	0.94	0.29	0.023	600		
499					1460			2000	3265	1020	0.94	0.29	0.023	600		
579						1695		2000	3265	1020	0.95	0.29	0.023	600		
411	1210							1940	3245	1105	0.93	0.22	0.017	550	10	✶
454		1335						2000	3245	1105	0.93	0.22	0.017	550		
476			1400					2000	3245	1105	0.94	0.22	0.017	550		
518				1525				2000	3245	1105	0.94	0.22	0.017	550		
540					1590			2000	3245	1105	0.94	0.22	0.017	550		
446	1325							2000	3215	1200	0.93	0.18	0.014	500	11	✶
493		1465						2000	3215	1200	0.93	0.18	0.014	500		
515			1530					2000	3215	1200	0.93	0.18	0.014	500		
562				1670				2000	3215	1200	0.94	0.18	0.014	500		
501	1445							2000	3310	1340	0.93	0.15	0.012	460	12	✶
553		1595						2000	3310	1340	0.94	0.15	0.012	460		
579			1670					2000	3310	1340	0.94	0.15	0.012	460		

*: Higher power ratings, speeds and field weakening range on quotation.

**: For $n_{max\ mech}$ for roller bearings: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C S
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
224	525							840	4080	630	0.89	0.81	0.064	700		
250		585						910	4080	630	0.90	0.81	0.064	700		
261			610					940	4080	630	0.90	0.81	0.064	700		
286				670				1010	4080	630	0.91	0.81	0.064	700	03	✶
299					700			1040	4080	630	0.91	0.81	0.064	700		
348						815		1140	4080	630	0.92	0.81	0.064	700		
410							960	1250	4080	630	0.93	0.81	0.064	700		
244	575							920	4060	684	0.89	0.67	0.053	700		
270		635						990	4060	684	0.90	0.67	0.053	700		
283			665					1020	4060	684	0.90	0.67	0.053	700		
310				730				1100	4060	684	0.91	0.67	0.053	700	04	✶
323					760			1120	4060	684	0.91	0.67	0.053	700		
376						885		1240	4060	684	0.92	0.67	0.053	700		
444							1045	1360	4060	684	0.93	0.67	0.053	700		
263	610							980	4120	734	0.90	0.6	0.047	700		
293		680						1060	4120	734	0.91	0.6	0.047	700		
308			715					1100	4120	734	0.91	0.6	0.047	700		
337				780				1170	4120	734	0.92	0.6	0.047	700	05	✶
352					815			1210	4120	734	0.92	0.6	0.047	700		
410						950		1330	4120	734	0.93	0.6	0.047	700		
481							1115	1450	4120	734	0.94	0.6	0.047	700		
282	660							1060	4080	780	0.90	0.51	0.04	700		
312		730						1140	4080	780	0.91	0.51	0.04	700		
329			770					1190	4080	780	0.92	0.51	0.04	700		
359				840				1260	4080	780	0.92	0.51	0.04	700	06	✶
374					875			1300	4080	780	0.92	0.51	0.04	700		
436						1020		1430	4080	780	0.93	0.51	0.04	700		
513							1200	1560	4080	780	0.94	0.51	0.04	700		
320	735							1180	4160	880	0.91	0.41	0.033	700		
355		815						1270	4160	880	0.92	0.41	0.033	700		
372			855					1320	4160	880	0.92	0.41	0.033	700		
407				935				1400	4160	880	0.93	0.41	0.033	700	07	✶
425					975			1440	4160	880	0.93	0.41	0.033	700		
494						1135		1590	4160	880	0.94	0.41	0.033	700		
579							1330	1730	4160	880	0.94	0.41	0.033	700		

*: Higher power ratings, speeds and field weakening range on quotation.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C S
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

Total weight: 2600 kg

Moment of inertia: 19.7 kg.m^2

Field power: 1.9 kW

4020 - 4160 N.m

$n_{max\ mech}$**: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
354	820							1310	4120	957	0.92	0.33	0.026	650	08	✶
393		910						1420	4120	957	0.93	0.33	0.026	650		
410			950					1460	4120	957	0.93	0.33	0.026	650		
449				1040				1560	4120	957	0.94	0.33	0.026	650		
468					1085			1610	4120	957	0.94	0.33	0.026	650		
544						1260		1760	4120	957	0.95	0.33	0.026	650		
378	885							1420	4080	1020	0.93	0.29	0.023	600	09	✶
419		980						1530	4080	1020	0.93	0.29	0.023	600		
438			1025					1580	4080	1020	0.93	0.29	0.023	600		
478				1120				1680	4080	1020	0.94	0.29	0.023	600		
498					1165			1720	4080	1020	0.94	0.29	0.023	600		
579						1355		1900	4080	1020	0.95	0.29	0.023	600		
410	965							1540	4060	1105	0.93	0.24	0.019	550	10	✶
453		1065						1660	4060	1105	0.93	0.24	0.019	550		
476			1120					1720	4060	1105	0.94	0.24	0.019	550		
519				1220				1830	4060	1105	0.94	0.24	0.019	550		
540					1270			1880	4060	1105	0.94	0.24	0.019	550		
444	1055							1690	4020	1200	0.93	0.2	0.016	500	11	✶
493		1170						1830	4020	1200	0.93	0.2	0.016	500		
516			1225					1890	4020	1200	0.93	0.2	0.016	500		
562				1335				2000	4020	1200	0.94	0.2	0.016	500		
501	1155							1850	4140	1340	0.93	0.17	0.013	460	12	✶
553		1275						1990	4140	1340	0.94	0.17	0.013	460		
579			1335					2000	4140	1340	0.94	0.17	0.013	460		

*: Higher power ratings, speeds and field weakening range on quotation.

**: For $n_{max\ mech}$ for roller bearings: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C M
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
223	475							760	4490	630	0.89	0.85	0.067	700		
249		530						830	4490	630	0.90	0.85	0.067	700		
261			555					850	4490	630	0.90	0.85	0.067	700		
287				610				920	4490	630	0.91	0.85	0.067	700	03	✶
299					635			940	4490	630	0.91	0.85	0.067	700		
350						745		1040	4490	630	0.93	0.85	0.067	700		
411							875	1140	4490	630	0.93	0.85	0.067	700		
243	520							830	4465	684	0.89	0.71	0.056	700		
271		580						900	4465	684	0.90	0.71	0.056	700		
283			605					930	4465	684	0.90	0.71	0.056	700		
311				665				1000	4465	684	0.91	0.71	0.056	700	04	✶
325					695			1030	4465	684	0.91	0.71	0.056	700		
379						810		1130	4465	684	0.92	0.71	0.056	700		
447							955	1240	4465	684	0.93	0.71	0.056	700		
264	555							890	4535	734	0.90	0.63	0.05	700		
294		620						970	4535	734	0.91	0.63	0.05	700		
309			650					1000	4535	734	0.91	0.63	0.05	700		
337				710				1070	4535	734	0.92	0.63	0.05	700	05	✶
351					740			1100	4535	734	0.92	0.63	0.05	700		
411						865		1210	4535	734	0.93	0.63	0.05	700		
482							1015	1320	4535	734	0.94	0.63	0.05	700		
282	600							960	4490	780	0.90	0.55	0.043	700		
313		665						1040	4490	780	0.91	0.55	0.043	700		
329			700					1080	4490	780	0.92	0.55	0.043	700		
360				765				1150	4490	780	0.92	0.55	0.043	700	06	✶
376					800			1180	4490	780	0.93	0.55	0.043	700		
437						930		1300	4490	780	0.93	0.55	0.043	700		
515							1095	1420	4490	780	0.94	0.55	0.043	700		
321	670							1070	4580	880	0.91	0.43	0.034	700		
355		740						1150	4580	880	0.92	0.43	0.034	700		
374			780					1200	4580	880	0.92	0.43	0.034	700		
408				850				1280	4580	880	0.93	0.43	0.034	700	07	✶
424					885			1310	4580	880	0.93	0.43	0.034	700		
494						1030		1440	4580	880	0.94	0.43	0.034	700		
580							1210	1570	4580	880	0.94	0.43	0.034	700		

*: Higher power ratings, speeds and field weakening range on quotation.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C M
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

Total weight: 2800 kg

Moment of inertia: 21.1 kg.m^2

Field power: 2 kW

4440 - 4580 N.m

$n_{max\ mech}$**: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
354	745							1190	4535	957	0.92	0.36	0.028	650	08	✶
392		825						1290	4535	957	0.93	0.36	0.028	650		
411			865					1330	4535	957	0.93	0.36	0.028	650		
449				945				1420	4535	957	0.94	0.36	0.028	650		
468					985			1460	4535	957	0.94	0.36	0.028	650		
544						1145		1600	4535	957	0.95	0.36	0.028	650		
378	805							1290	4490	1020	0.93	0.3	0.024	600	09	✶
418		890						1390	4490	1020	0.93	0.3	0.024	600		
440			935					1440	4490	1020	0.94	0.3	0.024	600		
480				1020				1530	4490	1020	0.94	0.3	0.024	600		
501					1065			1580	4490	1020	0.94	0.3	0.024	600		
581						1235		1730	4490	1020	0.95	0.3	0.024	600		
411	880							1410	4465	1105	0.93	0.25	0.02	550	10	✶
454		970						1510	4465	1105	0.93	0.25	0.02	550		
475			1015					1560	4465	1105	0.93	0.25	0.02	550		
519				1110				1670	4465	1105	0.94	0.25	0.02	550		
540					1155			1710	4465	1105	0.94	0.25	0.02	550		
446	960							1540	4440	1200	0.93	0.22	0.017	500	11	✶
495		1065						1660	4440	1200	0.94	0.22	0.017	500		
518			1115					1720	4440	1200	0.94	0.22	0.017	500		
565				1215				1820	4440	1200	0.94	0.22	0.017	500		
501	1050							1680	4555	1340	0.93	0.18	0.014	460	12	✶
553		1160						1810	4555	1340	0.94	0.18	0.014	460		
580			1215					1870	4555	1340	0.94	0.18	0.014	460		

*: Higher power ratings, speeds and field weakening range on quotation.

**: For $n_{max\ mech}$ for roller bearings : please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C L
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
222	400							640	5305	630	0.88	0.96	0.076	700		
247		445						690	5305	630	0.89	0.96	0.076	700		
261			470					720	5305	630	0.90	0.96	0.076	700		
286				515				770	5305	630	0.91	0.96	0.076	700	03	✶
300					540			800	5305	630	0.92	0.96	0.076	700		
350						630		880	5305	630	0.93	0.96	0.076	700		
414							745	970	5305	630	0.94	0.96	0.076	700		
242	440							700	5250	684	0.88	0.81	0.064	700		
269		490						760	5250	684	0.90	0.81	0.064	700		
283			515					790	5250	684	0.90	0.81	0.064	700		
311				565				850	5250	684	0.91	0.81	0.064	700	04	✶
324					590			870	5250	684	0.91	0.81	0.064	700		
379						690		970	5250	684	0.92	0.81	0.064	700		
448							815	1060	5250	684	0.94	0.81	0.064	700		
264	470							750	5355	734	0.90	0.72	0.057	700		
292		520						810	5355	734	0.90	0.72	0.057	700		
308			550					850	5355	734	0.91	0.72	0.057	700		
336				600				900	5355	734	0.92	0.72	0.057	700	05	✶
350					625			930	5355	734	0.92	0.72	0.057	700		
409						730		1020	5355	734	0.93	0.72	0.057	700		
482							860	1120	5355	734	0.94	0.72	0.057	700		
283	510							820	5305	780	0.91	0.62	0.049	700		
314		565						880	5305	780	0.91	0.62	0.049	700		
331			595					920	5305	780	0.92	0.62	0.049	700		
361				650				980	5305	780	0.93	0.62	0.049	700	06	✶
378					680			1010	5305	780	0.93	0.62	0.049	700		
439						790		1110	5305	780	0.94	0.62	0.049	700		
517							930	1210	5305	780	0.95	0.62	0.049	700		
320	565							900	5410	880	0.91	0.5	0.039	700		
354		625						980	5410	880	0.91	0.5	0.039	700		
374			660					1020	5410	880	0.92	0.5	0.039	700		
408				720				1080	5410	880	0.93	0.5	0.039	700	07	✶
425					750			1110	5410	880	0.93	0.5	0.039	700		
496						875		1230	5410	880	0.94	0.5	0.039	700		
583							1030	1340	5410	880	0.95	0.5	0.039	700		

*: Higher power ratings, speeds and field weakening range on quotation.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C L
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

Total weight: 3200 kg

Moment of inertia: 23.9 kg.m^2

Field power: 2.1 kW

5250 - 5410 N.m

$n_{max\ mech}$**: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
353	630							1010	5355	957	0.92	0.41	0.032	650	08	✶
393		700						1090	5355	957	0.93	0.41	0.032	650		
409			730					1120	5355	957	0.93	0.41	0.032	650		
449				800				1200	5355	957	0.94	0.41	0.032	650		
468					835			1240	5355	957	0.94	0.41	0.032	650		
544						970		1360	5355	957	0.95	0.41	0.032	650		
378	680							1090	5305	1020	0.93	0.34	0.027	600	09	✶
419		755						1180	5305	1020	0.93	0.34	0.027	600		
439			790					1220	5305	1020	0.94	0.34	0.027	600		
481				865				1300	5305	1020	0.94	0.34	0.027	600		
500					900			1330	5305	1020	0.94	0.34	0.027	600		
583						1050		1470	5305	1020	0.95	0.34	0.027	600		
409	740							1180	5275	1105	0.92	0.30	0.023	550	10	✶
453		820						1280	5275	1105	0.93	0.30	0.023	550		
475			860					1320	5275	1105	0.93	0.30	0.023	550		
519				940				1410	5275	1105	0.94	0.30	0.023	550		
541					980			1450	5275	1105	0.94	0.30	0.023	550		
448	815							1300	5250	1200	0.93	0.24	0.019	500	11	✶
495		900						1400	5250	1200	0.94	0.24	0.019	500		
520			945					1460	5250	1200	0.94	0.24	0.019	500		
566				1030				1550	5250	1200	0.94	0.24	0.019	500		
502	890							1420	5385	1340	0.94	0.2	0.016	460	12	✶
555		985						1540	5385	1340	0.94	0.2	0.016	460		
581			1030					1590	5385	1340	0.94	0.2	0.016	460		

*: Higher power ratings, speeds and field weakening range on quotation.

**: For $n_{max\ mech}$ for roller bearings: please consult us.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C VL
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

The electrical characteristics are given for:

- 3-phase supply with full bridge
- degree of protection IP 23S
- cooling method IC 06 (FV)
- continuous S1 duty
- ambient temperature ≤ 40°C

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
222	325							520	6530	630	0.88	1.18	0.088	700		
250		365						570	6530	630	0.90	1.18	0.088	700		
260			380					590	6530	630	0.90	1.18	0.088	700		
287				420				630	6530	630	0.91	1.18	0.088	700	03	✶
301					440			650	6530	630	0.92	1.18	0.088	700		
352						515		720	6530	630	0.93	1.18	0.088	700		
417							610	790	6530	630	0.95	1.18	0.088	700		
240	355							570	6460	684	0.88	1	0.075	700		
271		400						620	6460	684	0.90	1	0.075	700		
284			420					650	6460	684	0.90	1	0.075	700		
311				460				690	6460	684	0.91	1	0.075	700	04	✶
325					480			710	6460	684	0.91	1	0.075	700		
382						565		790	6460	684	0.93	1	0.075	700		
450							665	860	6460	684	0.94	1	0.075	700		
262	380							610	6590	734	0.89	0.89	0.067	700		
293		425						660	6590	734	0.91	0.89	0.067	700		
307			445					690	6590	734	0.91	0.89	0.067	700		
338				490				740	6590	734	0.92	0.89	0.067	700	05	✶
352					510			750	6590	734	0.92	0.89	0.067	700		
414						600		840	6590	734	0.94	0.89	0.067	700		
486							705	920	6590	734	0.95	0.89	0.067	700		
284	415							660	6530	780	0.91	0.76	0.058	700		
315		460						720	6530	780	0.92	0.76	0.058	700		
332			485					750	6530	780	0.92	0.76	0.058	700		
362				530				800	6530	780	0.93	0.76	0.058	700	06	✶
379					555			820	6530	780	0.94	0.76	0.058	700		
441						645		900	6530	780	0.94	0.76	0.058	700		
523							765	990	6530	780	0.96	0.76	0.058	700		
321	460							740	6660	880	0.91	0.5	0.039	700		
356		510						800	6660	880	0.92	0.61	0.045	700		
373			535					820	6660	880	0.92	0.61	0.045	700		
408				585				880	6660	880	0.93	0.61	0.045	700	07	✶
425					610			900	6660	880	0.93	0.61	0.045	700		
495						710		990	6660	880	0.94	0.61	0.045	700		
586							840	1090	6660	880	0.95	0.61	0.045	700		

*: Higher power ratings, speeds and field weakening range on quotation.

P : Rated output power
M : Rated torque
I : Permissible current in continuous operation
R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK 3554C VL
D.C. motors
Electrical characteristics*

E4 - Selection tables (IC 06)

Total weight: 3800 kg

Moment of inertia: 28.3 kg.m^2

Field power: 2.2 kW

6460 - 6660 N.m

$n_{max\ mech}$**: 2000 min^{-1}

Key to abbreviations: see page 86.

P	Speed of rotation n for armature voltage U							n_{max}	M	I	η	L	$R_{115°}$	U_{max}	Code	Deliv-ery
	400 V	440 V	460 V	500 V	520 V	600 V	700 V	Elec.			Not inc.					
kW	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	min^{-1}	N.m	A	excitation	mH	Ω	V		
352	510							820	6590	957	0.92	0.5	0.038	650	08	✶
390		565						880	6590	957	0.93	0.5	0.038	650		
411			595					920	6590	957	0.93	0.5	0.038	650		
449				650				980	6590	957	0.94	0.5	0.038	650		
469					680			1010	6590	957	0.94	0.5	0.038	650		
545						790		1110	6590	957	0.95	0.5	0.038	650		
376	550							880	6530	1020	0.92	0.42	0.031	600	09	✶
417		610						950	6530	1020	0.93	0.42	0.031	600		
438			640					990	6530	1020	0.93	0.42	0.031	600		
479				700				1050	6530	1020	0.94	0.42	0.031	600		
499					730			1080	6530	1020	0.94	0.42	0.031	600		
581						850		1190	6530	1020	0.95	0.42	0.031	600		
408	600							960	6490	1105	0.92	0.36	0.027	550	10	✶
452		665						1040	6490	1105	0.93	0.36	0.027	550		
476			700					1080	6490	1105	0.94	0.36	0.027	550		
520				765				1150	6490	1105	0.94	0.36	0.027	550		
544					800			1180	6490	1105	0.95	0.36	0.027	550		
446	660							1060	6460	1200	0.93	0.24	0.019	500	11	✶
494		730						1140	6460	1200	0.94	0.29	0.022	500		
517			765					1180	6460	1200	0.94	0.29	0.022	500		
565				835				1250	6460	1200	0.94	0.29	0.022	500		
499	720							1150	6625	1340	0.93	0.25	0.019	460	12	✶
552		795						1240	6625	1340	0.94	0.25	0.019	460		
579			835					1290	6625	1340	0.94	0.25	0.019	460		

*: Higher power ratings, speeds and field weakening range on quotation.

**: For $n_{max\ mech}$ for roller bearings: please consult us.

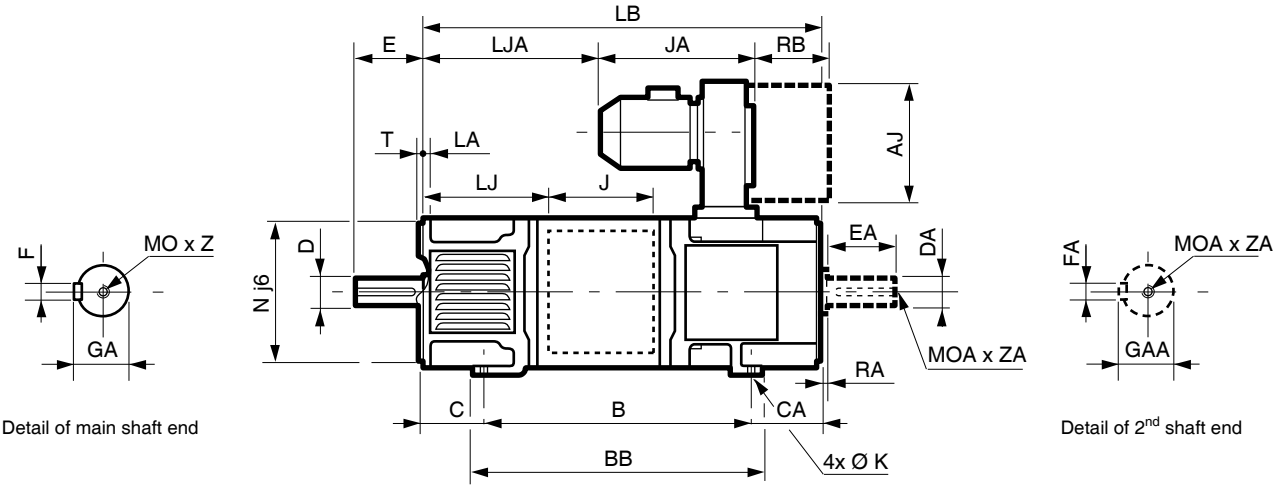
P : Rated output power
M : Rated torque
I : Permissible current in continuous operation

R : Armature resistance at 115°C
U_{max} : Maximum armature voltage

LSK
D.C. motors
Dimensions

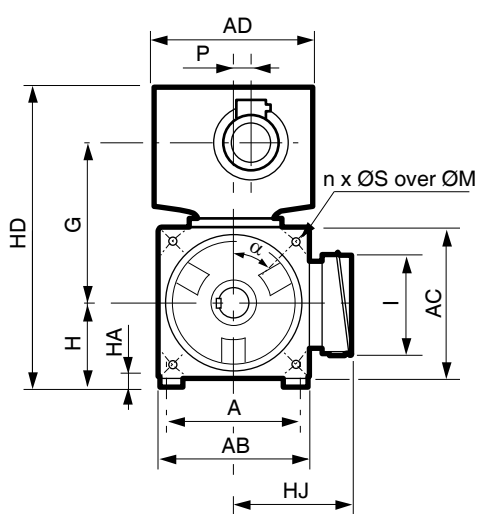
F1 - Foot, Flange, or Foot and flange mounted

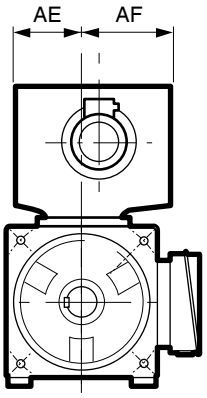
Dimensions of LSK D.C. motors IP 23S - IC 06



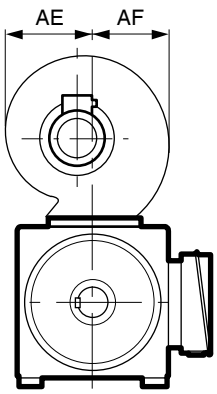
Detail of main shaft end

Detail of 2nd shaft end

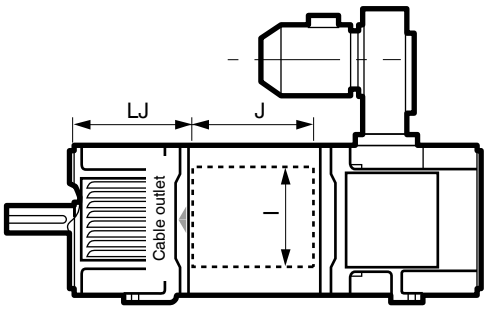




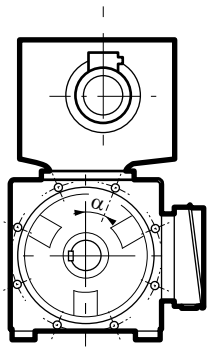
Configuration for **LSK 2004 to 2804**



Configuration for **LSK 3554**



Details of terminal box: **LSK 1804 to 2804C**



Flange configuration for **LSK 2254 to 3554**

LSK
D.C. motors
Dimensions

F1 - Foot, Flange, or Foot and flange mounted

Dimensions in millimetres

Dimensions of LSK IP 23S - IC 06 D.C. motors

Type	Main dimensions																						
	A	AB	AC	AD	AE	AF	B	BB	C	CA	G	H	HA	HD	HJ	I	J	JA	K	LB	LJ	LJA	P
LSK 1124 M	190	220	220	220	-	-	380	404	70	96	248	112	10	472	202	168	182	297	12	546	183	199	17
LSK 1124 L	190	220	220	220	-	-	450	474	70	96	248	112	10	472	202	168	182	297	12	616	253	269	17
LSK 1124 VL	190	220	220	220	-	-	520	544	70	96	248	112	10	472	202	168	182	297	12	686	323	339	17
LSK 1324 S	216	245	260	260	-	-	432	462	89	69	290	132	12	552	248	200	178	315	12	590	165	205	18
LSK 1324 M	216	245	260	260	-	-	482	512	89	69	290	132	12	552	248	200	178	315	12	640	215	255	18
LSK 1324 VL	216	245	260	260	-	-	582	612	89	69	290	132	12	552	248	200	178	315	12	740	315	355	18
LSK 1324 XVL	216	245	260	260	-	-	652	682	89	69	290	132	12	552	248	200	178	315	12	810	385	425	18
LSK 1604 S	254	300	316	318	-	-	425	469	103	222	361	160	15	678	313	250	217	353	14	750	271	293	20
LSK 1604 M	254	300	316	318	-	-	505	549	103	222	361	160	15	678	313	250	217	353	14	830	351	373	20
LSK 1604 L	254	300	316	318	-	-	565	609	103	222	361	160	15	678	313	250	217	353	14	890	411	433	20
LSK 1604 VL	254	300	316	318	-	-	665	709	103	222	361	160	15	678	313	250	217	353	14	990	511	533	20
LSK 1804 M	279	356	356	318	-	-	653	738	121	115	396	180	15	735	317	230	270	353	14	889	340	434	20
LSK 1804 L	279	356	356	318	-	-	698	783	121	115	396	180	15	735	317	230	270	353	14	934	385	481	20
LSK 1804 VL	279	356	358	356	-	-	883	968	121	95	405	180	15	760	317	230	270	415	14	1099	505	554	23
LSK 1804C M	279	356	356	318	-	-	653	738	121	115	396	180	15	735	317	230	270	353	14	889	340	434	20
LSK 1804C L	279	356	356	318	-	-	698	783	121	115	396	180	15	735	317	230	270	353	14	934	385	481	20
LSK 2004 M	318	396	396	-	197	298	737	830	133	130	471	200	18	921	335	230	270	410	18	1000	420	489	73
LSK 2004 L	318	396	396	-	197	298	802	895	133	130	471	200	18	921	335	230	270	410	18	1065	485	554	73
LSK 2254 M	356	445	445	-	207	341	793,5	888	149	147,5	491	225	21	993	360	262	320	427	18	1090	452	515	92
LSK 2254 L	356	445	445	-	207	341	863,5	958	149	147,5	491	225	21	993	360	262	320	427	18	1160	522	585	92
LSK 2254 VL	356	445	445	-	207	341	913,5	1008	149	147,5	491	225	21	993	360	262	320	427	18	1210	572	635	92
LSK 2504C M	406	494	494	-	240	360	1018	1216	168	174	624	250	22	1180	495	470	340	416	22	1360	400	776	90
LSK 2504C L	406	494	494	-	240	360	1078	1276	168	174	624	250	22	1180	495	470	340	416	22	1420	460	836	90
LSK 2804C SM	457	550	550	-	275	380	1106	1248	190	182	660	280	29	1300	530	470	340	485	22	1477	655	871	62
LSK 2804C M	457	550	550	-	275	380	1106	1315	190	249	660	280	29	1300	530	470	340	485	22	1544	655	836	62
LSK 2804C SL	457	550	550	-	275	380	1216	1358	190	182	660	280	29	1300	530	470	340	485	22	1587	765	981	62
LSK 2804C L	457	550	550	-	275	380	1216	1425	190	249	660	280	29	1300	530	470	340	485	22	1654	765	946	62
LSK 3554C VS	610	700	700	-	374	331	700	1536	254*	617	815	355	22,5	1521	680	434	520	621	27	1580*	336*	680*	72
LSK 3554C S	610	700	700	-	374	331	800	1636	254*	617	815	355	22,5	1521	680	434	520	621	27	1680*	436*	785*	72
LSK 3554C M	610	700	700	-	374	331	850	1686	254*	617	815	355	22,5	1521	680	434	520	621	27	1730*	486*	835*	72
LSK 3554C L	610	700	700	-	374	331	950	1786	254*	617	815	355	22,5	1521	680	434	520	621	27	1830*	586*	935*	72
LSK 3554C VL	610	700	700	-	374	331	1100	1936	254*	617	815	355	22,5	1521	680	434	520	621	27	1980*	736*	1085*	72

Type	Drive shafts													Filter		Standard flange**					
	D	DA	E	EA	F	FA	GA	GAA	O	OA	RA	Z	ZA	AJ	RB	LA	M	N j6	n ◊	S	T
LSK 1124	38 k6	38 k6	80	80	10	10	41	41	12	12	3	28	28	220	135	20	265	230	4	14	4
LSK 1324	48 k6	48 k6	110	110	14	14	51,5	51,5	16	16	3	36	36	260	135	22	300	250	4	18	5
LSK 1604	55 m6	55 m6	110	110	16	16	59	59	20	20	3	42	42	318	185	24	350	300	4	18	5
LSK 1804 M-L	60 m6	60 m6	140	140	18	18	64	64	20	20	6	42	42	318	185	20	350	300	4	18	5
LSK 1804 VL	60 m6	60 m6	140	140	18	18	64	64	20	20	6	42	42	356	200	20	350	300	4	18	5
LSK 1804C	60 m6	60 m6	140	140	18	18	64	64	20	20	6	42	42	318	185	20	350	300	4	18	5
LSK 2004	65 m6	65 m6	140	140	18	18	69	69	20	20	3	42	42	490	189	20	400	350	4	18	5
LSK 2254	80 m6	80 m6	170	170	22	22	85	85	20	20	1,5	36	36	500	230	31	400	350	8	18	5
LSK 2504C	100 m6	100 m6	170	170	28	28	106	106	24	24	1,5	50	50	460	356	35	400	350	8	18	5
LSK 2804C	110 m6	110 m6	170	170	28	28	116	116	24	24	1,5	50	50	620	180	46	500	450	8	26	6
LSK 3554C	125 m6	110 m6	210*	210	32	28	132	116	24	24	-	50	50	600	400	28	940	880	8	25	6

*: The dimensions at the front (D.E.) are given for the shaft shoulder.
**: other versions: see section G1 page 139.

◊: a = 45 degrees if n=4, a = 22 degrees 30 if n=8.

F

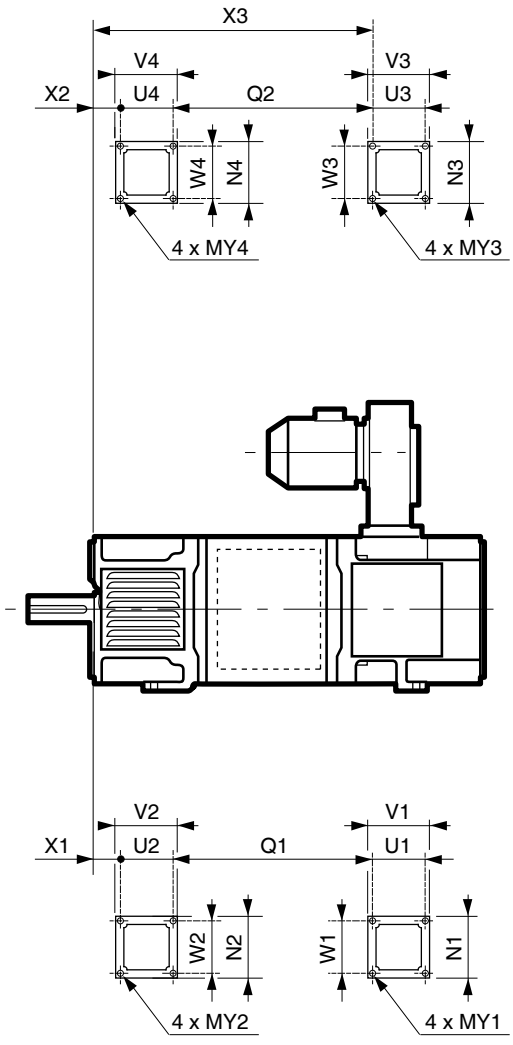
LSK
D.C. motors
Dimensions

F2 - Air outlet connections

Dimensions of inspection doors or air outlet connections:
IC 17 - IC 26 - IC 27 - IC 37

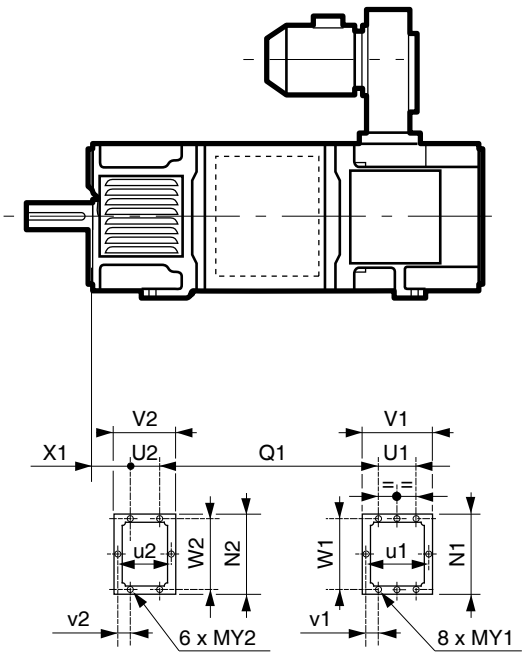
LSK 1124 to 2254
and LSK 3554C

Brush inspection door on base
or air outlet connections
on base



Air outlet connections
on top and sides

LSK 2504C & 2804C



Air outlet connections
on top, sides and base

F2 - Air outlet connections

Dimensions in millimetres

Dimensions of inspection doors or air outlet connections:
IC 17 - IC 26 - IC 27 - IC 37

Type	Main dimensions																						
	N1/N2	N3/N4	Q1	Q2	U1	U2	U3	U4	V1	V2	V3	V4	W1	W2	W3	W4	X1	X2	X3	Y1	Y2	Y3	Y4
LSK 1124 M	130	130/-	225	-	114	114	114	-	130	130	130	-	114	114	114	-	30	30	369	6	6	6	-
LSK 1124 L	130	130/-	296	-	114	114	114	-	130	130	130	-	114	114	114	-	30	30	440	6	6	6	-
LSK 1124 VL	130	130/-	366	-	114	114	114	-	130	130	130	-	114	114	114	-	30	30	510	6	6	6	-
LSK 1324 S	160	130/-	216	-	140	140	114	-	160	160	130	-	140	140	114	-	22	22	378	8	8	8	-
LSK 1324 M	160	130/-	266	-	140	140	114	-	160	160	130	-	140	140	114	-	22	22	428	8	8	8	-
LSK 1324 VL	160	130/-	366	-	140	140	114	-	160	160	130	-	140	140	114	-	22	22	528	8	8	8	-
LSK 1324 XVL	160	130/-	436	-	140	140	114	-	160	160	130	-	140	140	114	-	22	22	611	8	8	8	-
LSK 1604 S	190	190/-	346	-	135	135	135	-	150	150	150	-	175	175	175	-	23	23	504	8	8	8	-
LSK 1604 M	190	190/-	426	-	135	135	135	-	150	150	150	-	175	175	175	-	23	23	584	8	8	8	-
LSK 1604 L	190	190/-	486	-	135	135	135	-	150	150	150	-	175	175	175	-	23	23	644	8	8	8	-
LSK 1604 VL	190	190/-	586	-	135	135	135	-	150	150	150	-	175	175	175	-	23	23	744	8	8	8	-
LSK 1804 M	215	215	479	479	140	140	140	140	180	180	180	180	200	200	200	200	25	25	644	6	6	6	6
LSK 1804 L	215	215	524	524	140	140	140	140	180	180	180	180	200	200	200	200	25	25	689	6	6	6	6
LSK 1804 VL	215	215	659	659	140	140	140	140	180	180	180	180	200	200	200	200	25	25	824	6	6	6	6
LSK 1804C M	215	215	479	479	140	140	140	140	180	180	180	180	200	200	200	200	25	25	644	6	6	6	6
LSK 1804C L	215	215	524	524	140	140	140	140	180	180	180	180	200	200	200	200	25	25	689	6	6	6	6
LSK 2004 M	225	225	539	539	165	165	165	165	205	205	205	205	205	205	205	205	24	24	728	6	6	6	6
LSK 2004 L	225	225	604	604	165	165	165	165	205	205	205	205	205	205	205	205	24	24	793	6	6	6	6
LSK 2254 M	250	250	572	572	170	170	170	170	210	210	210	210	230	230	230	230	31	31	773	6	6	6	6
LSK 2254 L	250	250	642	642	170	170	170	170	210	210	210	210	230	230	230	230	31	31	843	6	6	6	6
LSK 2254 VL	250	250	692	692	170	170	170	170	210	210	210	210	230	230	230	230	31	31	893	6	6	6	6
LSK 3554C VS	396	396	649	649	326	326	326	326	356	356	356	356	366	366	366	366	39*	39*	1014*	8	8	8	8
LSK 3554C S	396	396	749	749	326	326	326	326	356	356	356	356	366	366	366	366	39*	39*	1114*	8	8	8	8
LSK 3554C M	396	396	799	799	326	326	326	326	356	356	356	356	366	366	366	366	39*	39*	1164*	8	8	8	8
LSK 3554C L	396	396	899	899	326	326	326	326	356	356	356	356	366	366	366	366	39*	39*	1264*	8	8	8	8
LSK 3554C VL	396	396	1049	1049	326	326	326	326	356	356	356	356	366	366	366	366	39*	39*	1414*	8	8	8	8

*: The dimensions at the front (D.E.) are given for the shaft shoulder.

Type	Main dimensions															
	N1	N2	Q1	U1	U2	u1	u2	V1	V2	v1	v2	W1	W2	X1	Y1	Y2
LSK 2504C M	300	300	730	180	190	292	240	320	260	56	25	280	280	44	6	6
LSK 2504C L	300	300	790	180	190	292	240	320	260	56	25	280	280	44	6	6
LSK 2804C SM	350	350	895	187	187	247	247	277	277	30	30	320	320	50	8	8
LSK 2804C M	350	350	860	289	187	349	247	380	277	30	30	320	320	50	8	8
LSK 2804C SL	350	350	1005	187	187	247	247	277	277	30	30	320	320	50	8	8
LSK 2804C L	350	350	970	289	187	349	247	380	277	30	30	320	320	50	8	8

F

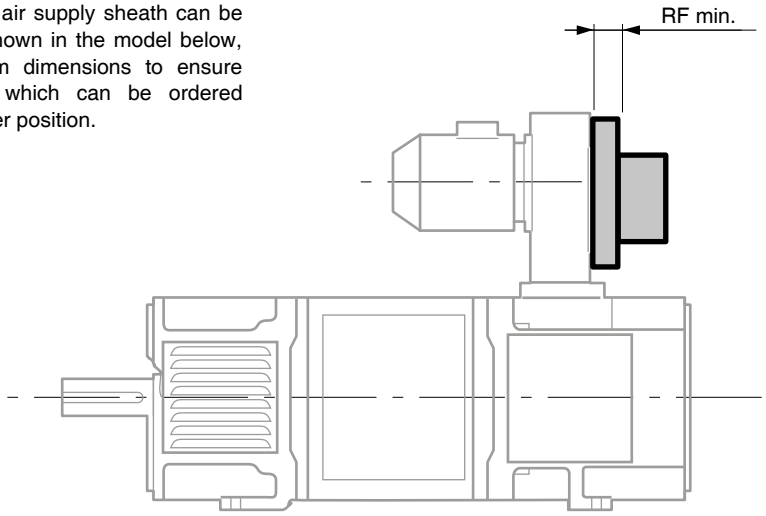
LSK
D.C. motors
Dimensions

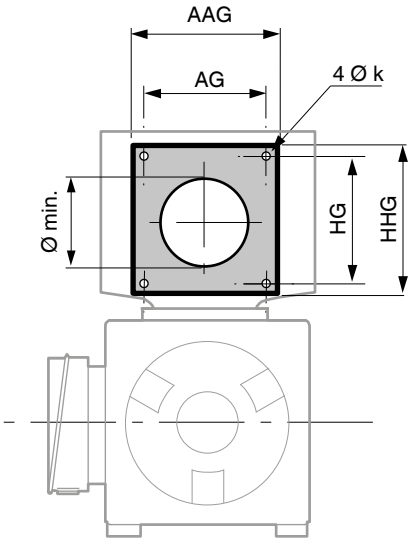
F2 - Air outlet connections

Dimensions in millimetres

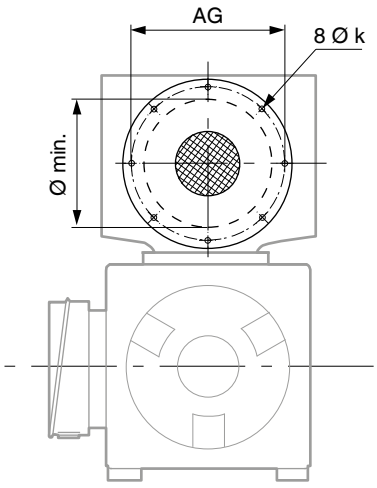
Dimensions of air outlet connections:
IC 16

In this configuration, the fresh air supply sheath can be connected to an adaptor as shown in the model below, while respecting the minimum dimensions to ensure correct air flow. This part, which can be ordered specially, fits in the optional filter position.

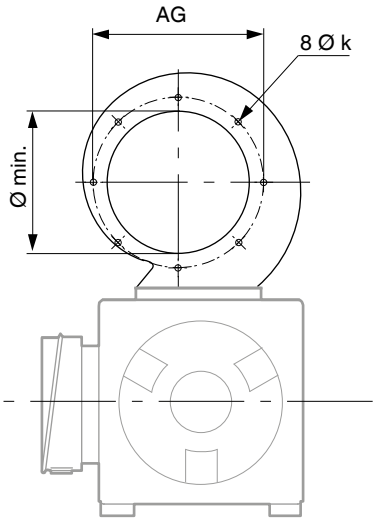




Configuration for **LSK 1124 to 1804**



Configuration for **LSK 2004 to 2804**
(the fan inlet should not be removed)



Configuration for **LSK 3554**

LSK motor model	Main dimensions						
	AG	AAG	HG	HHG	k	RF	Ø
1124	195	210	195	210	9	50	155
1324	235	250	235	250	9	50	188
1604	285	300	285	300	9	50	230
1804 M - L	285	300	285	300	9	50	230
1804 VL	325	356	325	356	9	50	268
1804C M - L	400	450	400	440	8	50	230
2004	365	-	-	-	6	-	280
2254	395	-	-	-	6	-	280
2504C	432	-	-	-	6	-	410
2804C	520	-	-	-	12	-	470
3554C	550	-	-	-	6	-	460

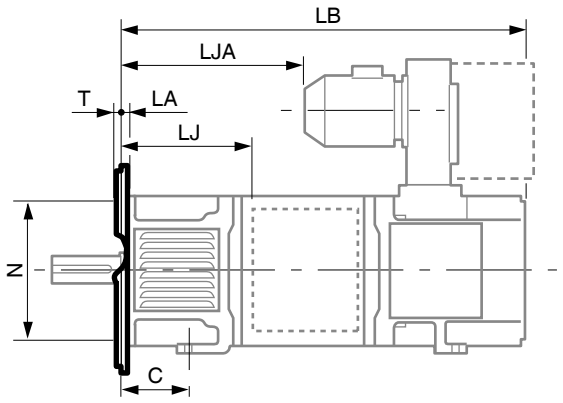
LSK
D.C. motors
Optional features

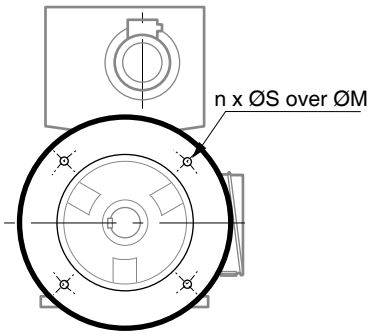
G1 - Non standard flanges

Optionally, LEROY-SOMER motors can be fitted with flange adapters that are larger or smaller than standard. This means that motors can be adapted to all types of situation without the need for costly and time-consuming modifications.

The bearing remains standard. Only those dimensions shown below differ from those for the standard motor.

Dimensions of flange adapters (FF)





LSK motor model	IEC symbol	Flange dimensions					
		LA	M	N	n	S	T
1124	FF 215	55	215	180	4	14	4
1324	FF 215	54	215	180	4	14	4
1324	FF 400	54	400	350	4	14	4
1604	FF 265	64	265	230	4	14	4
1604	FF 300	64	300	250	4	18	5

LSK motor model	Flange dimensions			
	C	LB	LJ	LJA
1124 M	95	571	208	224
1124 L	95	641	278	294
1124 VL	95	711	348	364
1324 S	121	622	197	237
1324 M	121	672	247	287
1324 VL	121	772	347	387
1324 XVL	121	842	417	457
1604 S	143	790	311	333
1604 M	143	870	391	413
1604 L	143	930	451	473
1604 VL	143	1030	551	573

G

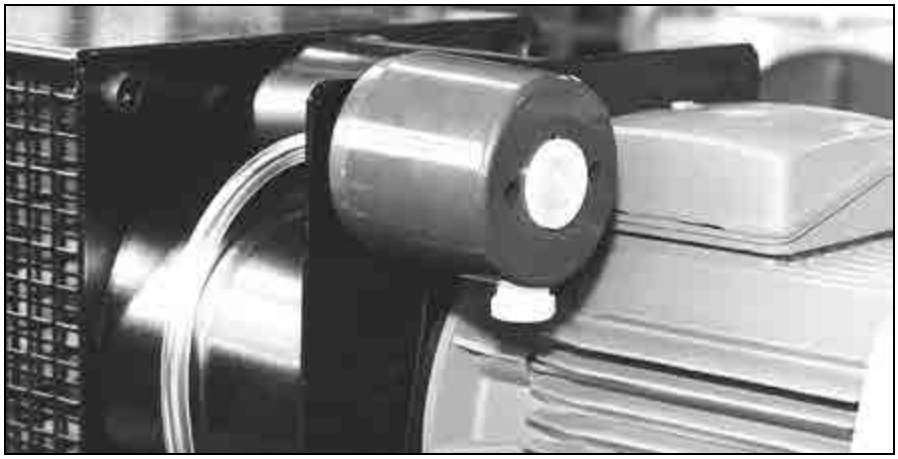
G2 - Ventilation

G2.1 - 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.



G2.2 - 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 methods described on the next page.

For comparatively dusty conditions a suction filter can be fitted to the fan housing (from LSK 1804C M, IP 20 protection; fit a drip cover for IP 23S).

This has interchangeable, flame-resistant (DIN 53438, class F1) polyester filter components, with an ASHRAE 52/76 average gravimetric efficiency 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.

The dimensions are given in section F1, pages 135 and 135.

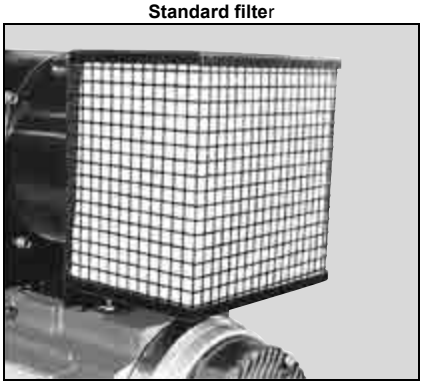
Note: On request the motor can be fitted with a vinyl chloride type filter, with an adaptor for fixing onto a standard fan.

This type of long life filter can be changed in a few seconds (1 wing nut) and is totally restored by rinsing it in a bath of dilute detergent. After cleaning, the cartridge is dried and then lightly sprayed with oil (viscosity SAE30) on the air intake side. The average filtration rate (gravimetric) is around 85%. Dimensions: see table 1 (diagram on page 134).

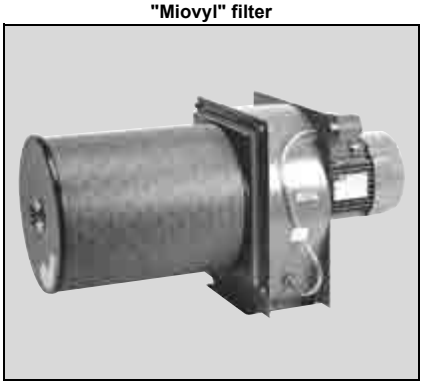
Table 1. - Dimensions of "Miovyl" filter option

LSK motor model	Filter	
	AJ	RB
1124	Ø 211	155
1324	Ø 272	286
1604	Ø 272	340
1804 to 3554C	Ask for quotation	

Standard filter



"Miovyl" filter

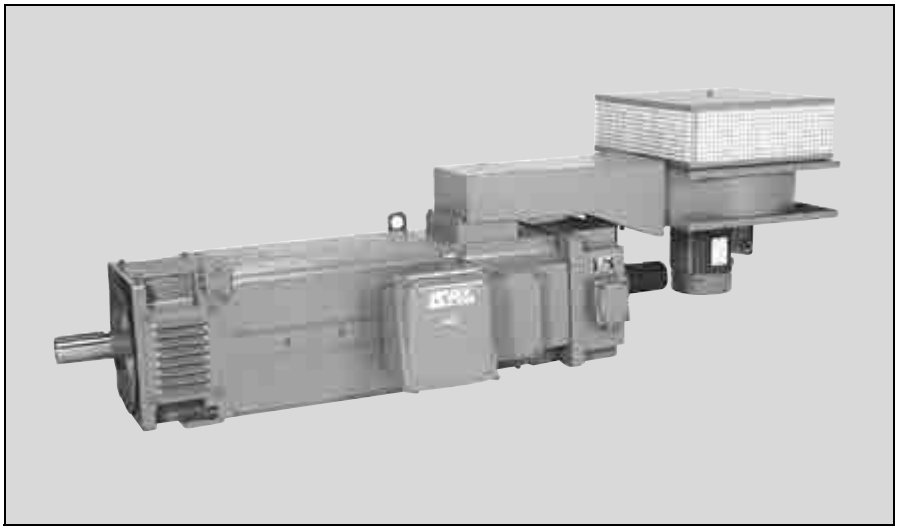


G2 - Ventilation

G2.3 - AXIAL VENTILATION

When there is little vertical space for installing the motor, a connection kit can be used to mount the standard forced coling unit in an axial position.

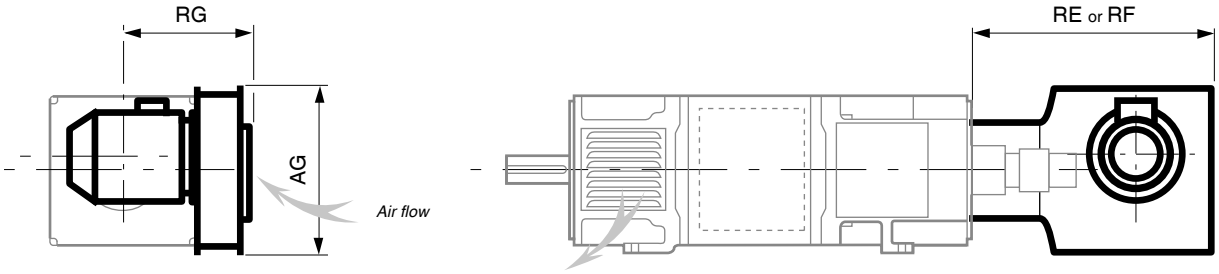
The dimensions are given below.



Dimensions of axial forced cooling unit

LSK motor model	Axial forced cooling unit			
	AG	RE	RG	RF*
1124	220	400	220	520
1324	260	413	258	556
1604	318	450	320	595
1804 to 3554C	Ask for quotation			

*: motor with brake

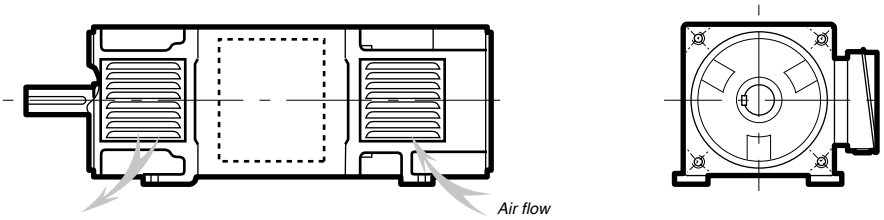


G

G2.4 - SELF-COOLED MOTOR: IP 23S / IC 01

The power rating shown in the selection tables must be modified for this motor configuration : see section on "Correction factors" on pages 81 & 82.

The dimensions are identical to the standard IC 06 motor without those for the forced cooling unit. See pages 135 and 135.



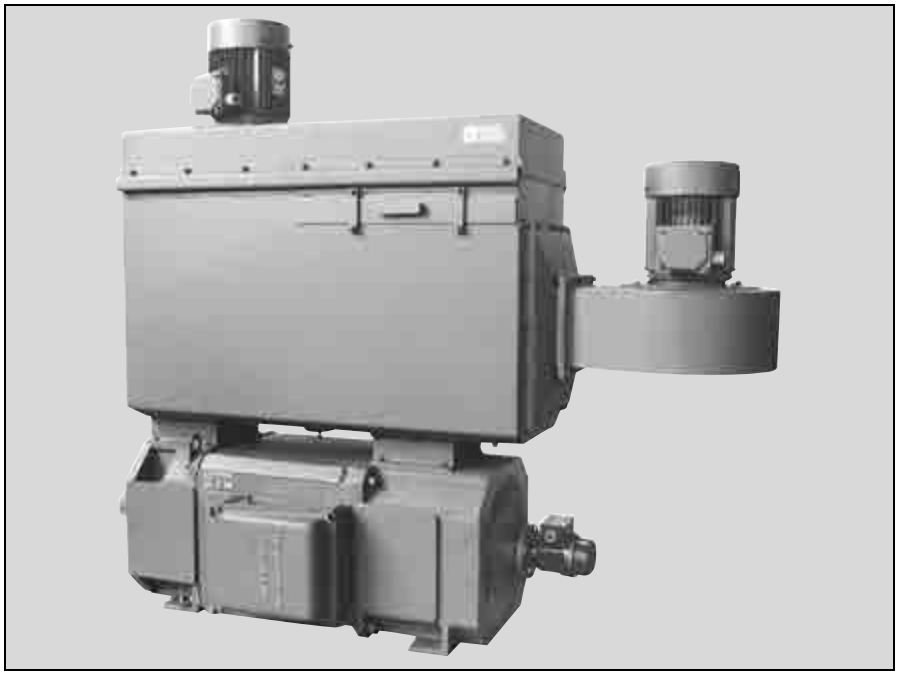
LSK
D.C. motors
Optional features

G2 - Ventilation

G2.5 - VENTILATION SYSTEMS

For corrosive or very heavily polluted atmospheres, ventilation must be selected from methods IC 37, IC 666 or IC 86W6.

It is important to prevent air from the corrosive environment from entering the motor when it is stopped.

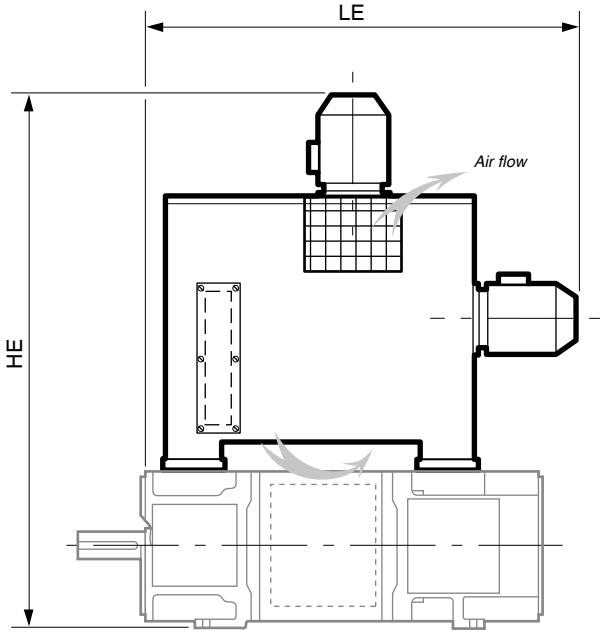


G2.5.1 - Air-air exchanger: IP 55/IC 666

is available from model 1324 upwards. A power correction factor must be taken into account : see section on "Correction factors" on pages 81 & 82.

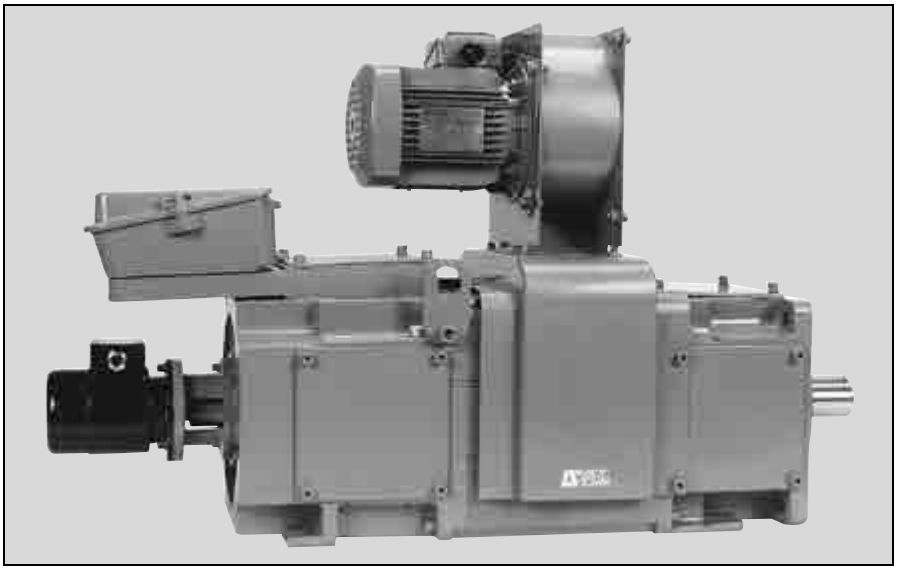
Dimensions with air - air exchanger (IC 666)

LSK motor model	IC 666 fan	
	HE	LE
1324 S	1080	725
1324 M	1080	775
1324 L	1080	825
1324 VL	1080	875
1324 XVL	1080	945
1604 S	1285	855
1604 M	1285	935
1604 L	1285	995
1604 VL	1285	1095
1804 - 1804C	1305	1355
1804 VL	ask for quotation	
2004	1330	1484
2254	1410	1540
2504C	ask for quotation	
2804C	ask for quotation	
3554C	ask for quotation	



LSK
D.C. motors
Optional features

G2 - Ventilation



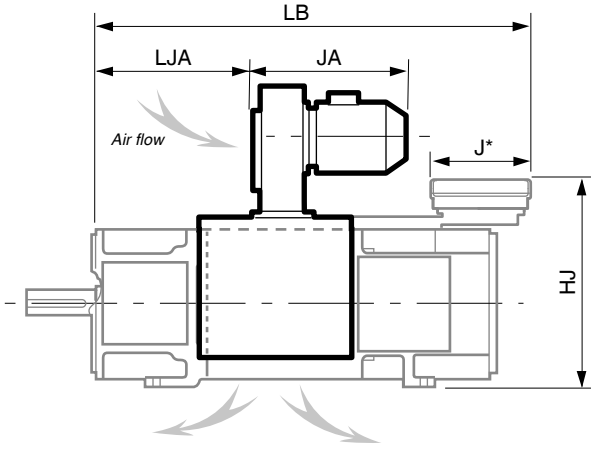
G2.5.2 - Ventilation blowing on the body: IP 55/IC 416

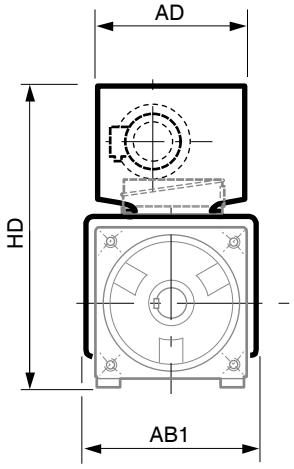
Option available for models LSK 1124, 1324, 1604, non compensated 1804: please consult Leroy-Somer to determine the size of the motor. The dimensions for IC 06 motors are given on page 134 and 135.

G2.5.3 - Air-water exchanger: IP 55 / IC 86W6

This option is available from model 1604 upwards, and does not involve any derating. For satisfactory operation of the heat exchanger, it is essential to accurately specify the cooling water temperature (min. and max.) and type (fresh water, sea water, etc.) and its anticipated flow rate. Consult Leroy-Somer.

Dimensions with forced cooling unit blowing on the body (IC 416)





LSK motor model	IC 416 forced cooling unit						
	AB1	AD	HD	HJ	JA	LB	LJA
1124 L	270	220	520	314	297	745	224
1124 VL	270	220	520	314	297	815	259
1324 M	310	220	557	380	297	777	232
1324 VL	310	220	557	380	297	877	282
1604 S	390	260	651	473	315	875	238
1604 M	390	260	651	473	315	955	278
1604 L	390	260	651	473	315	1015	308
1604 VL	390	318	721	473	353	1115	355
1804 VL	420	356	858	535	632	1472	195

*J & other dimensions: see pages 134 and 135.

This option is available on request for models LSK 1804 M to 3554C VL.

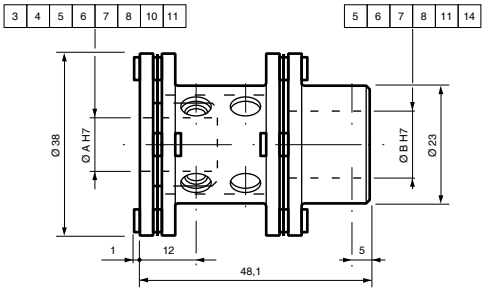
LSK
D.C. motors
Optional features

G3 - Speed detection

G3.1 - MOUNTING FOR SPEED MEASUREMENT DEVICE

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

Dimensions of G5000C driver



G3.2 - D.C. TACHOGENERATOR

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

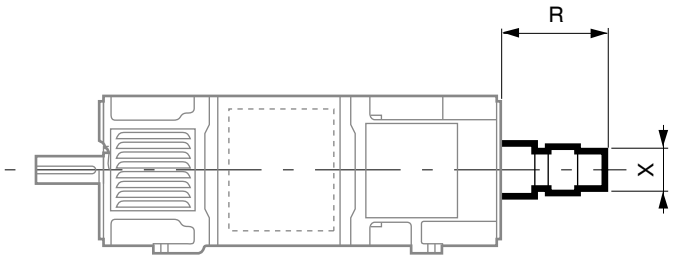
REO 444 L1

Characteristics of D.C. tachogenerators

Type	REO 444N normal or equivalent	REO 444R reinforced or equivalent	REO 444 L1 or equivalent	RDC 15 or equivalent
Maximum current	0.18 A	0.18 A	0.12 A	0.1 A
Weight	1.8 kg	2.8 kg	1 kg	1.6 kg
Mounting	Coupling	Coupling	Coupling	Hollow shaft
Number of outputs	1 or 2 comm.	1 or 2 comm.	1 commutator	1 commutatorr
Ø drive end	7 mm	11 mm	11 mm	16 mm hollow
Protection	IP 44	IP 54	IP 44	IP 44
Connection	via wires	terminal box	terminal box	terminal box
Voltage*	60 V	60 V	60 V	60 V

*: at 1000 min^{-1}

Dimensions of D.C. tachogenerators



LSK motor model	REO 444				REO 444R				REO 444 L1		RDC 15	
	1 Commutator		2 Commutators		1 Commutator		2 Commutators		1 Commutator		1 Commutator	
	R	X	R	X	R	X	R	X	R	X	R	X
1124	192	75	208	75	200	94	219	94	135.5	88	66	98
1324	192	75	208	75	200	94	219	94	135.5	88	66	98
1604	192	75	208	75	200	94	219	94	135.5	88	66	98
1804	180	75	196	75	188	94	207	94	123.5	88	75	98
2004	180	75	196	75	188	94	207	94	123.5	88	71	98
2254	180	75	196	75	188	94	207	94	123.5	88	71	98
2504C	182	75	198	75	190	94	209	94	125.5	88	71	98
2804C	182	75	198	75	190	94	209	94	125.5	88	71	98
3554C	185	75	201	75	190	94	209	94				

G3 - Speed detection

G3.3 - PULSE GENERATOR (PG OR ENCODER)

Maximum resolution R_{max} (fonction of drive)

$$R_{max} = 60 \times F_{max} / n$$

where :

F_{max} maximum frequency permitted by the drive (500 kHz for the LEROY-SOMER Mentor MP) in Hz,

n : motor speed in min^{-1}.

For distances above 20 m, the cables must be twisted pairs. The maximum cable length (screened) must not exceed 100 m on an opto-coupler input.

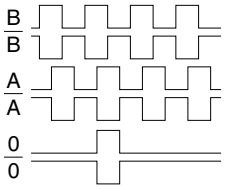
Characteristics of pulse generators

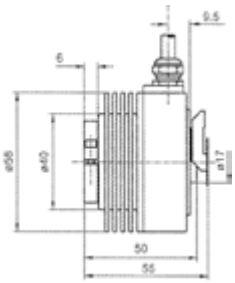
PG type	IN58/LER	GHM5 10 59 6R or equivalent
Max. current	20 mA	40 mA
Max. ripple	200 mV	500 mV
Max. no load current	75 mA	90 mA
Number of outputs	3+complement	3+complement
Ø drive end	14 mm hollow	10 mm
Protection	IP 64	IP 44
Connection	Connector**	Connector**
Voltage*	5 V RS422	11 to 30 V "push pull"

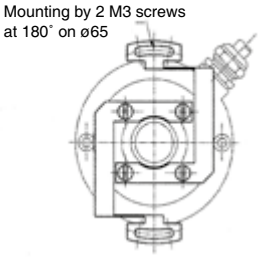
** : Male and female connector

Dimensions of pulse generator IN58/LER

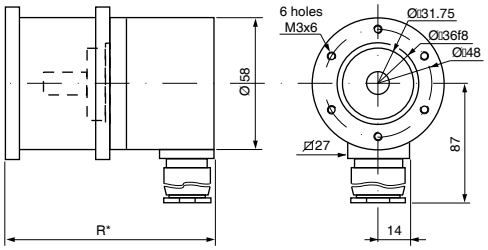
Signal wave form







Dimensions of pulse generator GHM5 10 59 6R



*: overall length = LB (see page 134) + R
LSK 1124 to 1604: R = 113.5; LSK 1804: R = 101.5

G3.4 - D.C. TACHOGENERATOR 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:

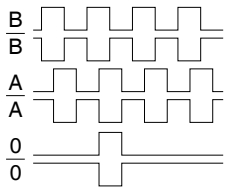
REO 444R 1C (or 2C) 54 B 1x0,06 (or 2x0.06) CA / AK 56 5 9 …(Resolution).

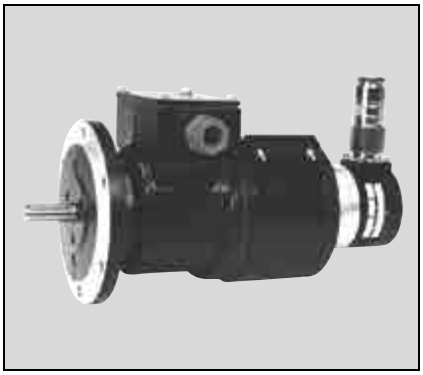
The characteristics of the tacho are the same as those given in section G3.2.

The pulse generator has 3 complementary channels, and a rectified voltage of 11 to 30 V. The resolution is calculated as in the preceding sub-section.

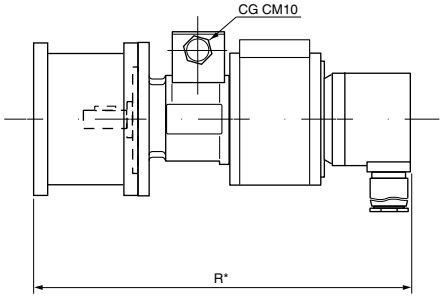
Dimensions: see previous page.

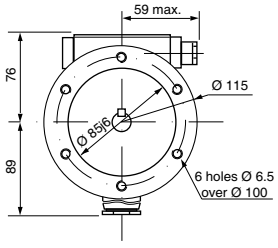
Signal wave form

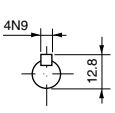




Dimensions of D.C. tachogenerator plus pulse generator







*: overall length = LB (see page 134) + R (LSK 1122 to 1604: R = 283.2; LSK 1804: R = 271.2)

G4 - Mechanical options

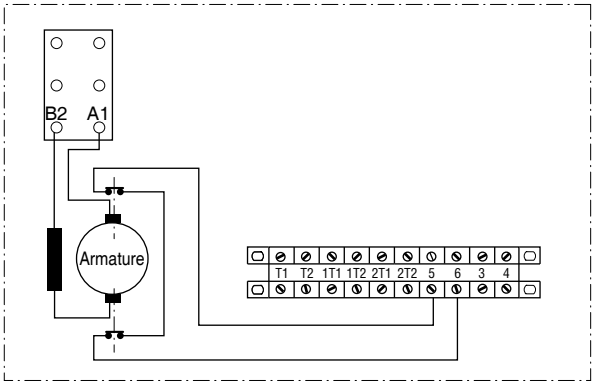
G4.1 - DETECTION OF BRUSH WEAR LIMIT

As an option, the brush holders can be equipped with detection of brush wear limit with:

- load distribution (for two or more brushes per line for LSK 1124 up to 1804),
- volt-free opening contact.

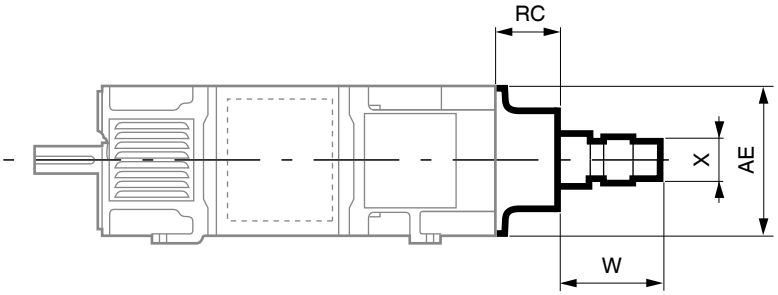
The microswitches are set as shown in diagram 1 below.

Diagram 1. - Connection of the brush wear limit probe
For LSK 1124 to 2254 (for LSK 2504 to 3554 : diagram on request)



G4.2 - MECHANICAL BRAKE

Maximum dimensions of brake type 458

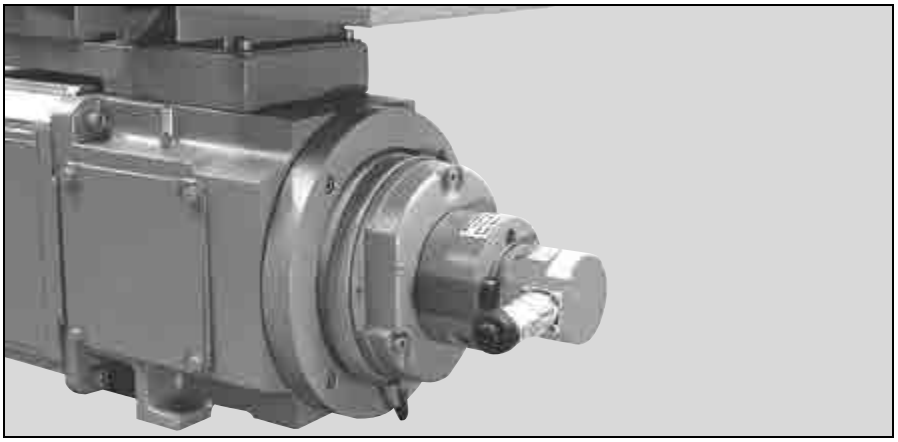


LSK motor model	Type 458			
	AE	RC	X(1)	W(1)
1124	215	88	*	R-36
1324	254	100	*	R-34
1604	305	127	*	R-44
1804 & 1804C	-	-	-	-
2004	-	-	-	-
2254	-	-	-	-
2504C	-	-	-	-
2804C	-	-	-	-
3554C	-	-	-	-

(1) : for R & X, see dimensions of D.C. tachos on pages 144 and 145.

G4 - Mechanical options

Brake type 458 + PG



G4.3 - TRANSPARENT INSPECTION DOORS

1 or 2 transparent doors can be fitted on request, in order to facilitate maintenance operations, such as inspecting the brushes without removing the inspection doors, etc.

G4.4 - CONFORMITY TO NEMA STANDARDS

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

G4.5 - 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).

Details of this option and the gearboxes are given in the Leroy-Somer catalogues "COMPABLOC" ref. 3521 and "ORTHOBLOC" ref. 3981.

G

LSK
D.C. motors
Installation and maintenance

H1 - Voltage drop along cables (standard NFC 15.100)

Voltage drop can occur in two ways:
- The speed controller is separate from the motor and provides power to it via a cable whose length is l. The voltage drop along the conductors is given by Ohm's law:

$$u = R \cdot I$$

where
u is the voltage drop in Volts,
R is the resistance of the cables in Ω,
I is the current along the cables in A.

- The speed controller is located near the motor. The power cable carries the A.C. supply, as does the fan motor power cable.

The voltage drops are calculated using the formula:

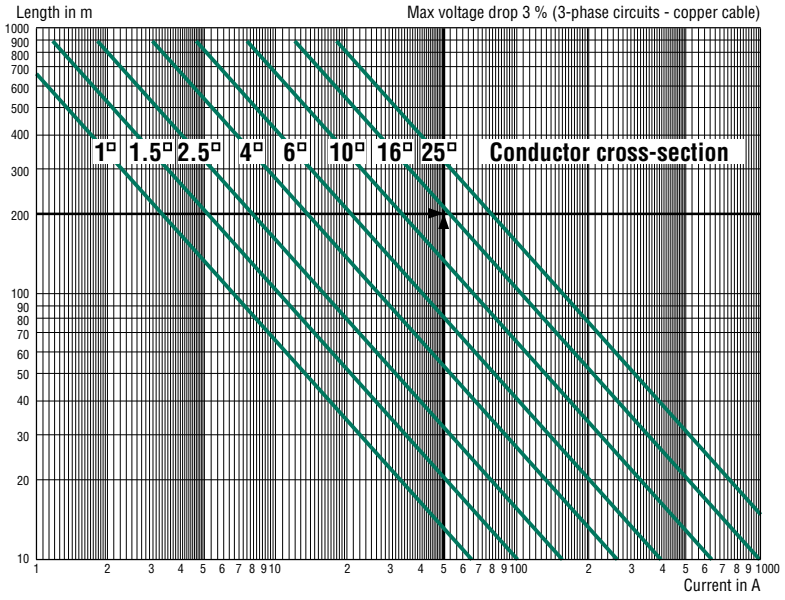
$$u = b\left(\rho_1 \frac{L}{S} \cos\varphi + \lambda L \sin\varphi\right) I_s$$

where
u is the voltage drop in Volts,
b is a factor of 1 for 3-phase circuits, and 2 for single phase circuits,
ρ_1 is the resistivity of the conductors for normal duty, taken as being equal to the resistivity at the normal duty temperature, i.e. 1.25 times the resistivity at 20°C, giving 0.0225 $\Omega mm^2/m$ for copper and 0.036 $\Omega mm^2/m$ for aluminium,
L is the length of the cabling conduit in m,
S is the cross-section of the conductors in mm^2,
cos φ is the power factor: if the exact figure is not available, the power factor is taken to be 0.8 (sin φ = 0.6),
λ is the linear reactance of the conductors, taken as being 0.08 mΩ / m if the exact figure is not available,
I_s is the operating current (in use) in A.

Note: 3-phase circuits with a neutral that is completely out of balance (loss of two phases) are treated as single phase circuits.

The higher the current, the bigger the voltage drop will be. The voltage drop should therefore be calculated for the starting current (fan induction motor) or for the maximum operating current (speed controller).

Chart 1. - Cross-section of power cables as a function of length and current carried



H2 - Earthing impendance

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 rms 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 din highly conductive workplaces, or
- 50 V in other cases.
(Reference: UTE standard C 12.100 - page 12, Article 32)

This may be written:

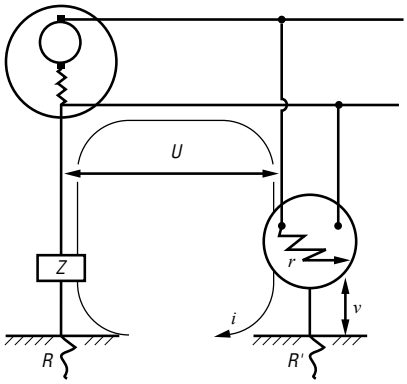
$$v = R' i$$

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

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

and consequently:

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



- 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

Example 1
Highly conductive premises with:

R = 3 Ω
R' = 20 Ω
r = 10 Ω
U = 440 V

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

Example 2
Less conductive premises with:

R = 6 Ω
R' = 10 Ω
r = 0 Ω
U = 600 V

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

H3 - Cable gland mounting

H3.1 - CABLE GLAND MOUNTING SURFACE

The dimensions of the surface available for mounting the cable gland(s) on the support plate are given in the table below for the diagrams depending on the type of terminal box.

Figure 1

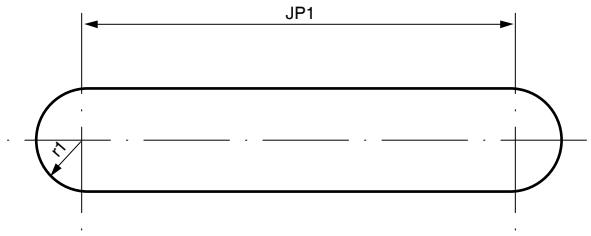


Figure 2

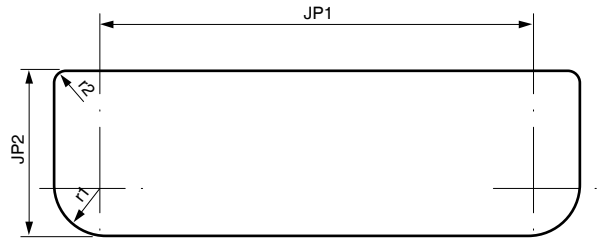


Figure 3

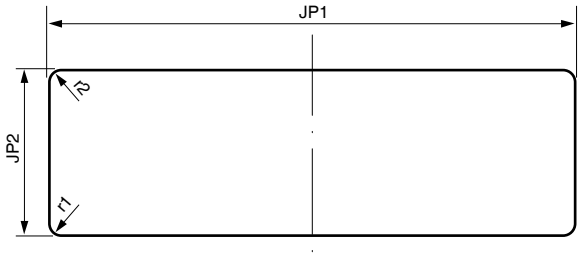
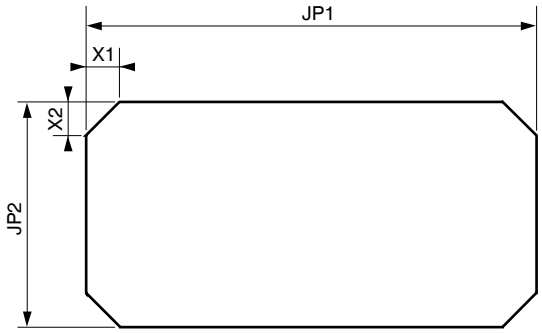


Figure 4



LSK motor model	Main dimensions						Figure n°
	JP1	JP2	r1	r2	X1	X2	
1124	70	-	17	-	-	-	1
1324	62	-	29	-	-	-	1
1604	72	-	34	-	-	-	1
1804	122	65	22	4	-	-	2
2004	94	-	39	-	-	-	1
2254	122	-	44	-	-	-	1
2504C	274	104	12	12	-	-	3
2804C	274	104	12	12	-	-	3
3554C	330	165	-	-	25	25	4

H4 - Packaging weights and dimensions

Dimensions in millimetres

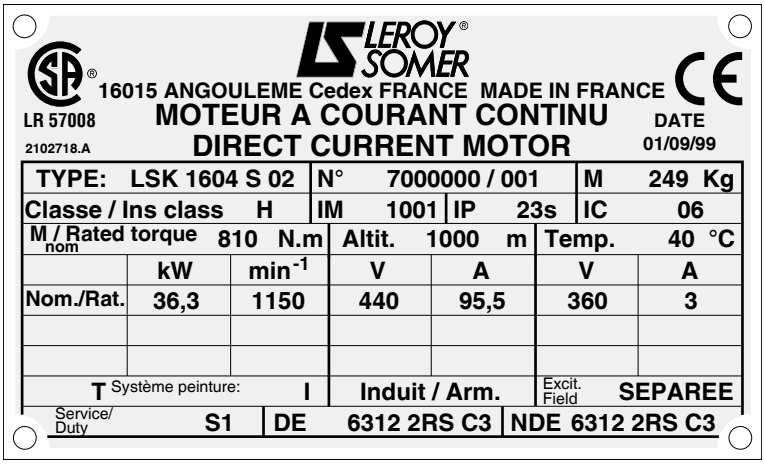
LSK motor model	ROAD TRANSPORT			
	IM B3		IM B5 - IM V1	
	Tare (kg)	Dimensions in mm (L x W x H)	Tare (kg)	Dimensions in mm (L x W x H)
	Open type pallet box or laths			
1124	35	1280 x 580 x 725	35	1280 x 580 x 725
1324	35	1280 x 580 x 725	35	1280 x 580 x 725
1604	50	1380 x 680 x 825	-	-
	Pallets			
1804	25	1600 x 800	25	1600 x 800
2004	25	1600 x 800	25	1600 x 800
2254	25	1600 x 800	25	1600 x 800
2504C	35	1700 x 850	35	1700 x 850
2804C	40	2010 x 830	40	2010 x 830
3554C	80	2250 x 1200	-	-

LSK motor model	SEA TRANSPORT			
	IM B3		IM B5 - IM V1	
	Tare (kg)	Dimensions in mm (L x W x H)	Tare (kg)	Dimensions in mm (L x W x H)
	Plywood crates			
1124	on request		on request	
1324	on request		on request	
1604	75	1300 x 700 x 960	75	1300 x 700 x 960
1804	85	1300 x 770 x 1100	85	1300 x 770 x 1100
2004	125	1420 x 810 x 1250	125	1420 x 810 x 1250
2254	145	1550 x 860 x 1350	145	1550 x 860 x 1350
2504C	190	1800 x 970 x 1530	190	1800 x 970 x 1530
2804C	230	2050 x 1030 x 1680	230	2050 x 1030 x 1680
3554C	250	2250 x 1200 x 1700	250	2250 x 1200 x 1700

Note: the weights and dimensions given in the above tables are for LSK motors in IC06, IP 23s, configuration with terminal box and fan in standard position (section C5.1, page 55). As there are a large number of possible options, the dimensions of the motors, with the options fitted, will be supplied on request.

H5 - Identification, exploded views and parts list

H5.1 - IDENTIFICATION PLATE



Explanation of symbols used on identification plates

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

LSK	: Range
160	: Frame size
4	: No. of poles
S	: Stator symbol
02	: Construction code
T	: Impregnation index
I	: Painting system
Date	: Dispatch date

M...kg	: Weight
Ins class H	: Insulation class H
IM 1001	: Operating position
IP 23S	: Index of protection
IC 06	: Index of cooling
M_{nom}	: Rated torque
Altit.	: Maximum operating altitude in metres
Temp.	: Maximum ambient operating temperature

Bearings

DE	: Drive end bearing
NDE	: Non drive end bearing
50 g*	: Amount of grease at each regreasing (in grammes)
3900 h*	: Regreasing interval (in hours)
UNIREX N3	: Type of grease

Motor number

N°	: Motor batch number
001	: Serial number

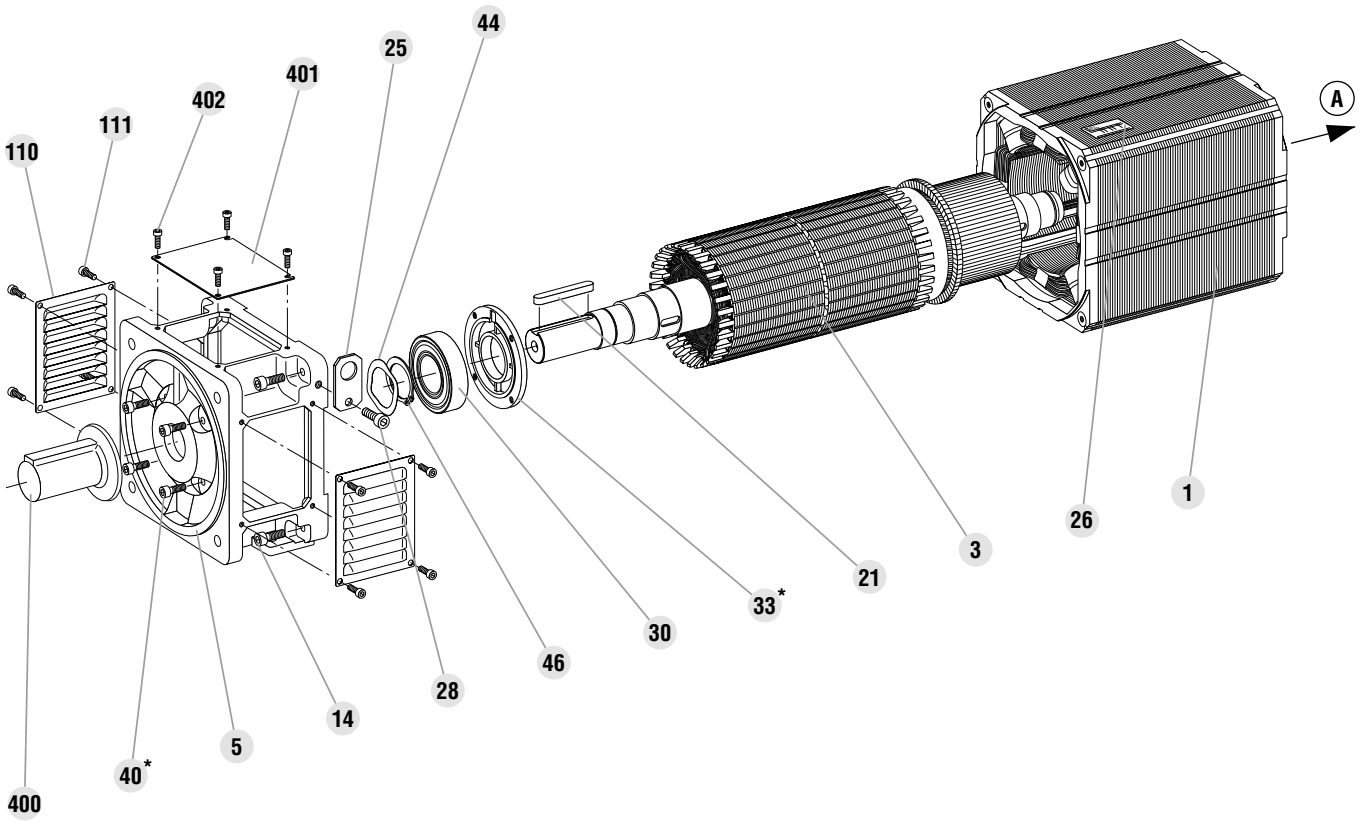
Nom	: Rated characteristics
kW	: Power factor
min^{-1}	: Revolutions per minute
V	: Armature voltage
A	: Armature current
V	: Field voltage
A	: Field current
	: Other operating points

*: indicated for non-sealed bearings

Please quote when ordering spare parts

H5 - Identification, exploded views and parts list

H5.2 - LSK 1124, 1324 & 1604



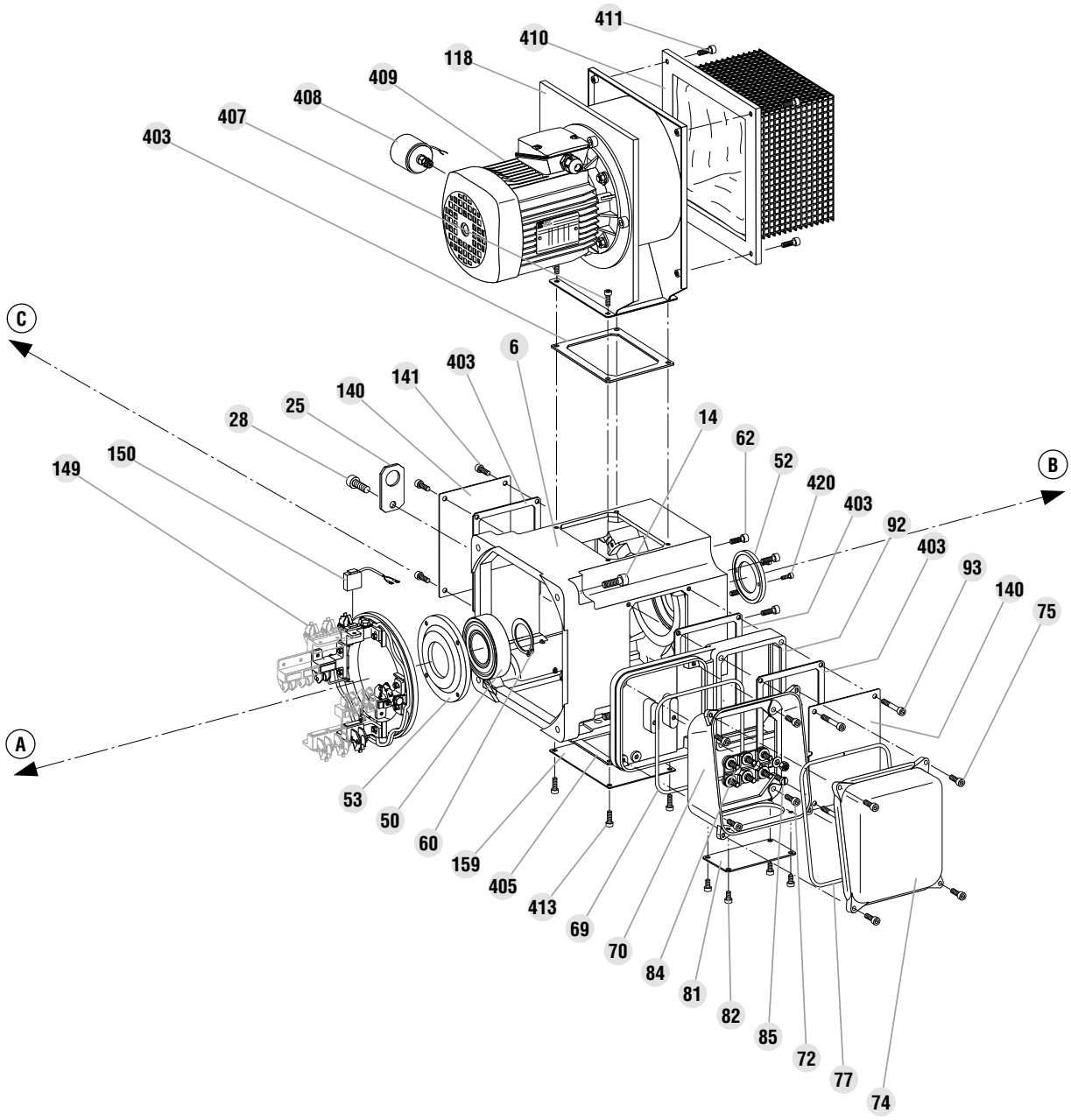
H

LSK motor models 1124 to 1604					
No.	**Description**	**No.**	**Description**	**No.**	**Description**
1	Wound stator	**33**	DE bearing retainer (lubrication option for ZZ bearing or roller bearing)	**70**	Terminal box
3	Wound armature	**40**	Fixing screw for bearing retainer no. 33	**72**	Fixing screw for no. 70
5	Drive end shield (DE)	**44**	DE bearing preloading (wavy) washer	**74**	Terminal box lid
6	Non drive end shield (NDE)	**46**	DE bearing circlip	**75**	Screw for lid no. 74
14	DE shield fixing screw	**50**	Non drive end bearing	**77**	Seal for lid no. 74
21	Shaft extension key	**52**	Bearing retainer (for motor with no option fitted on rear end shield)	**81**	Cable gland support plate
25	Lifting ring	**53**	NDE bearing retainer (lubrication option for ZZ bearing or roller bearing)	**82**	Fixing screw for plate no. 81
26	Identification plate	**60**	NDE bearing circlip	**84**	Terminal block
28	Lifting ring fixing screw	**62**	Fixing screw for bearing retainer no. 52	**85**	Set screw
30	Drive end bearing	**69**	Terminal box seal	**92**	Terminal box base plate

* number linked to an option.

H5 - Identification, exploded views and parts list

H5.2 - LSK 1124, 1324 & 1604

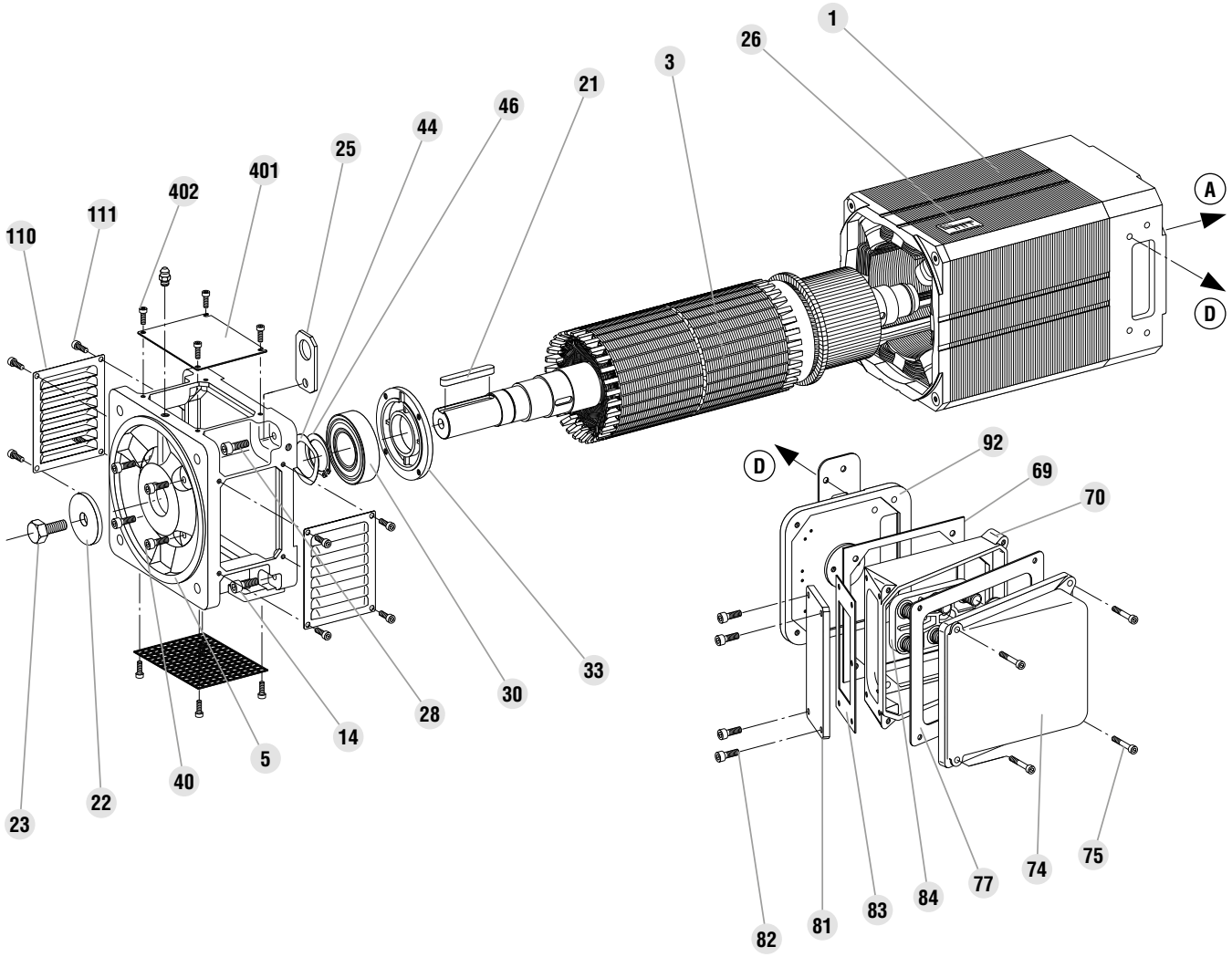


LSK motor models 1124 to 1604					
No.	**Description**	**No.**	**Description**	**No.**	**Description**
93	Fixing screw for nos 92 +140	**150**	Brush	**407**	Fixing screw for fan housing
110	Fan grille	**159**	Lower inspection door	**408**	Air flow detector
111	Fixing screw for grille no. 110	**400**	Drive end cover	**409**	Fan motor
118	Fan housing	**401**	DE bearing inspection door	**410**	Filter (optional)
140	NDE shield inspection door	**402**	Fixing screw for inspection door no. 401	**411**	Fixing screw for filter
141	Fixing screw for no. 140 (opp. terminal box)	**403**	Seal for inspection door no. 140	**413**	Fixing screw for inspection door no. 159
149	Brush holder	**405**	Seal for door no. 159	**420**	Fixing screw for retaining plate no. 52

* number linked to an option.

H5 - Identification, exploded views and parts list

H5.3 - LSK 1804, 1804C, 2004, 2254, 2504C & 2804C



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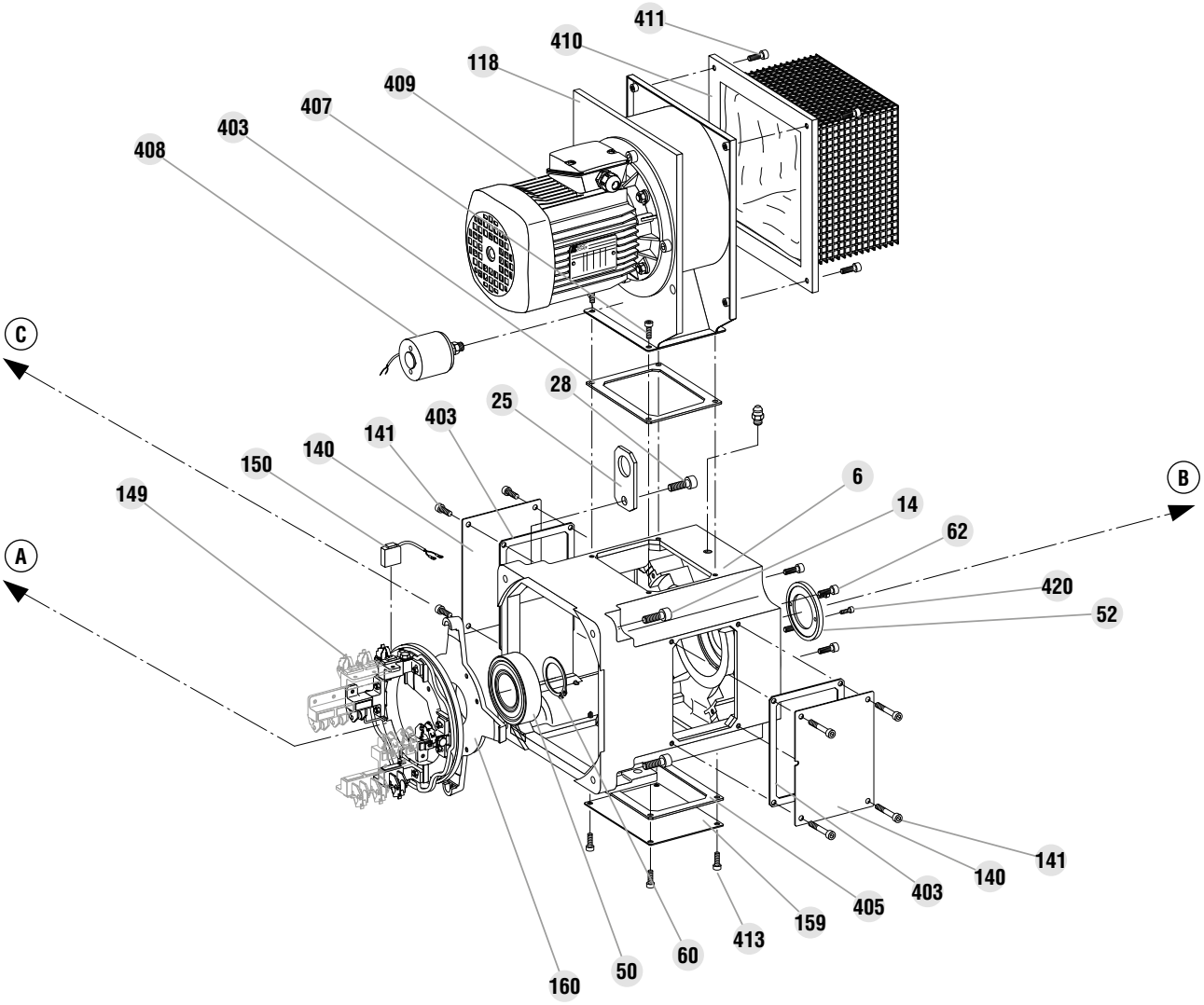
LSK motor models 1804 to 2804C

No.	Description	No.	Description	No.	Description
1	Wound stator	30	DE bearing	72	Fixing screw for no. 70
3	Wound armature	33	DE bearing retainer	74	Terminal box lid
5	Drive end shield (DE)	40	Fixing screw for retainer no. 33	75	Screw for lid no. 74
6	Non drive end shield (NDE)	44	DE bearing preloading (wavy) washer	77	Seal for lid no. 74
14	DE shield fixing screw	46	DE bearing circlip	81	Cable gland support plate
21	Shaft extension key	50	NDE bearing	82	Fixing screw for plate no. 81
22	Shaft extension washer	52	Retainer (for motor with no options fitted)	83	Seal for plate no. 81
23	Shaft extension screw	60	NDE bearing circlip	84	Terminal block
25	Lifting ring	62	Fixing screw for retainer no. 52 and/or 160	92	Terminal box base plate
26	Identification plate	69	Terminal box seal	110	Fan grille
28	Fixing screw	70	Terminal box	111	Fixing screw for grille no. 110

* number linked to an option.

H5 - Identification, exploded views and parts list

H5.3 - LSK 1804, 1804C, 2004, 2254, 2504C & 2804C

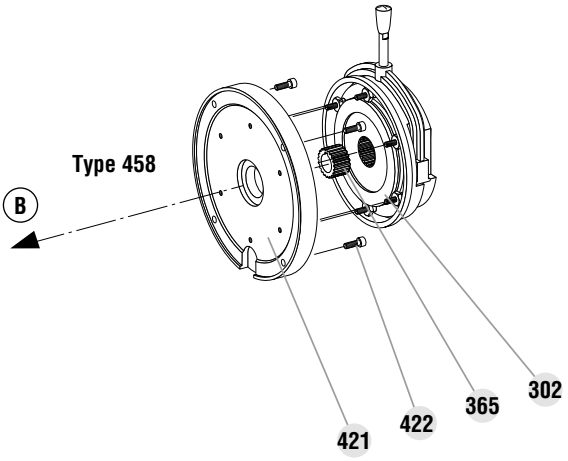


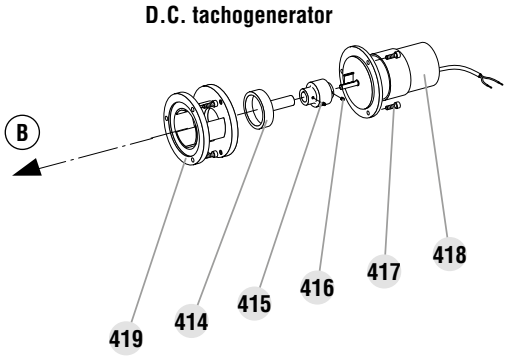
LSK motor models 1804 to 2804C					
No.	**Description**	**No.**	**Description**	**No.**	**Description**
118	Fan housing	**160**	Housing for holder no. 149	**408**	Air flow detector
140	NDE shield inspection door	**401**	DE shield inspection door	**409**	Fan motor
141	Fixing screw for no. 140	**402**	Fixing screw for inspection door no. 401	**410**	Filter (optional)
149	Brush holder	**403**	Seal for inspection door no. 140	**411**	Fixing screw for filter
150	Brush	**405**	Seal for door no. 159	**413**	Fixing screw for inspection door no. 159
159	Lower inspection door	**407**	Fixing screw for fan housing	**420**	Fixing screw for bearing retainer no. 52

* number linked to an option.

H5 - Identification, exploded views and parts list

H5.4 - BRAKE TYPE 458 - D.C. TACHOGENERATOR





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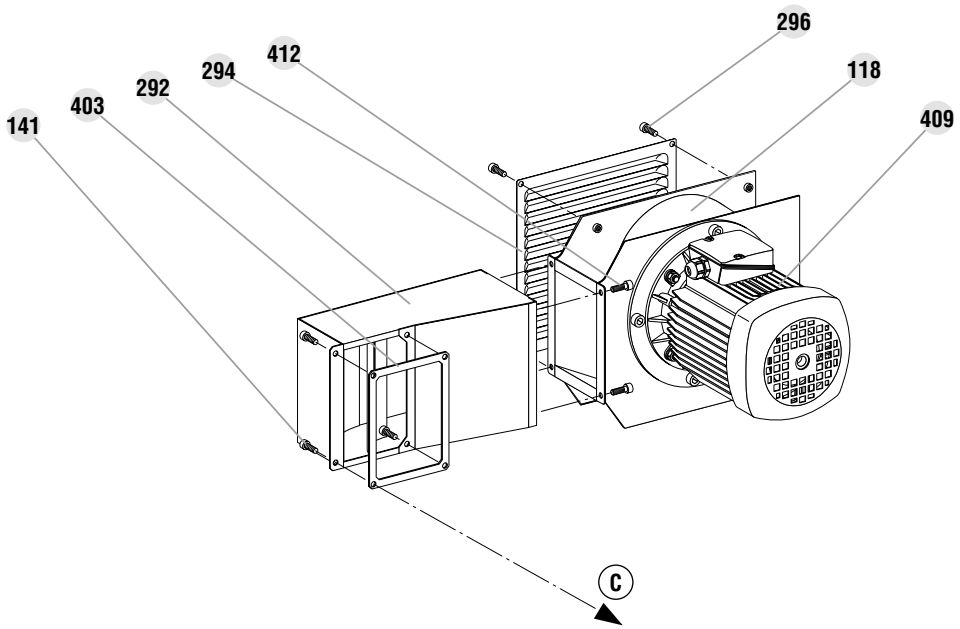
Brake type 458	
No.	**Description**
302	Brake block
365	Spline bore hub
421	Fixing flange for block
422	Fixing screw for block

D.C. tachogenerator	
No.	**Description**
414	Drive shaft
415	Sleeve coupling
416	Locking screw
417	D.C. tacho fixing screw
418	D.C. tacho
419	U-mount

H5 - Identification, exploded views and parts list

H5.5 - AXIAL FORCED VENTILATION UNIT



Axial forced ventilation unit					
No.	**Description**	**No.**	**Description**	**No.**	**Description**
118	Fan housing	**294**	Protection grille	**409**	Fan motor
141	Fixing screw for duct	**296**	Fixing screw for grille	**412**	Fixing screw for housing
292	Connecting duct	**403**	Gasket		

LSK
D.C. motors
Installation and maintenance

H6 - 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.

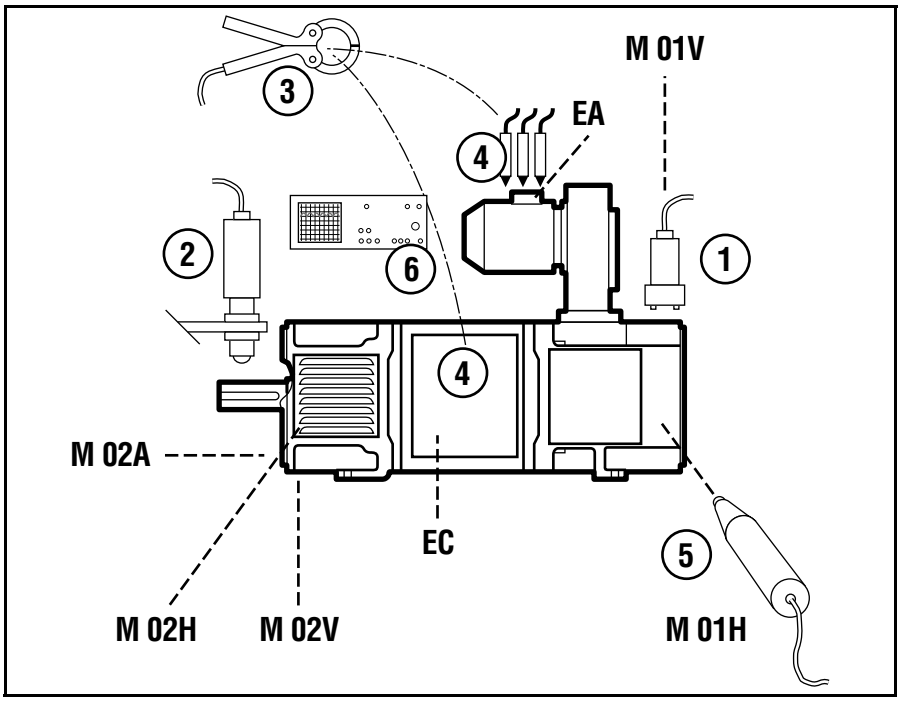
When asking for technical documents, please quote the full reference of the machine.

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								●

LSK
D.C. motors
Summary of the standard LSK motor

STANDARD MODEL

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

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 large number of options for the LSK range which can rapidly be adapted to individual requirements. Please consult section G pages 139 to 146 "Optional features" and section E1 page 84 "Availability according to construction type".

SELECTION

Please see section D9 "Method and guide to selection" on pages 80 to 82 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. We recommend 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.

LSK
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

Coupling : ☐ direct* ☐ sleeve* ☐ pulleys/belts* — Ø pulley (mm)

Environmental conditions
(section B2 page 20)

Atmosphere : ☐ clean ☐ dusty ☐ explosive ☐ damp (%)

☐ Max. temperature (°C) ☐ Temperature rise ☐ Altitude (if (m) ☐ Other

Power supply
(section D2 page 62, etc)

☐ single phase* ☐ three-phase* — Voltage (V) — Frequency (Hz)

Type of speed controller : ☐ 1 quadrant* ☐ 4 quadrants*

Bridge : ☐ mixed* ☐ full*

Duty
(section D1 page 59, etc)

Cycle in accordance with IEC 34-1 ☐ S1 ☐ S2 — Other — Operating factor (%) — Starts/hour

Motor characteristics
(sections D2 page 62, D4 page 65, D5 page 68, etc)

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

$U_{armature}$: V — U_{field} : V

Starting : Duration : Number / h :

Overload M_M / M_N : Duration : Number / h :

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

Mechanical requirements
(sections C1 page 27, C4.2 page 53, etc)

Mounting : ☐ foot* ☐ flange* ☐ foot and flange*

Position : ☐ horizontal* ☐ vertical* Designation : IM

Position : ventilation — terminal box — IP Protection Designation : IC

Options
(section G pages 139 to 146)

☐ Ventilation filter*

Adapt. for DC tacho — DC tacho — Brake — Other options

No. of commuta- — N.m Braking torque

Notes

* place a cross in the relevant box.

Notes

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