INDUCTION MOTORS
CF-CM-HE
For axial fans

Technical catalogue

Fan motors
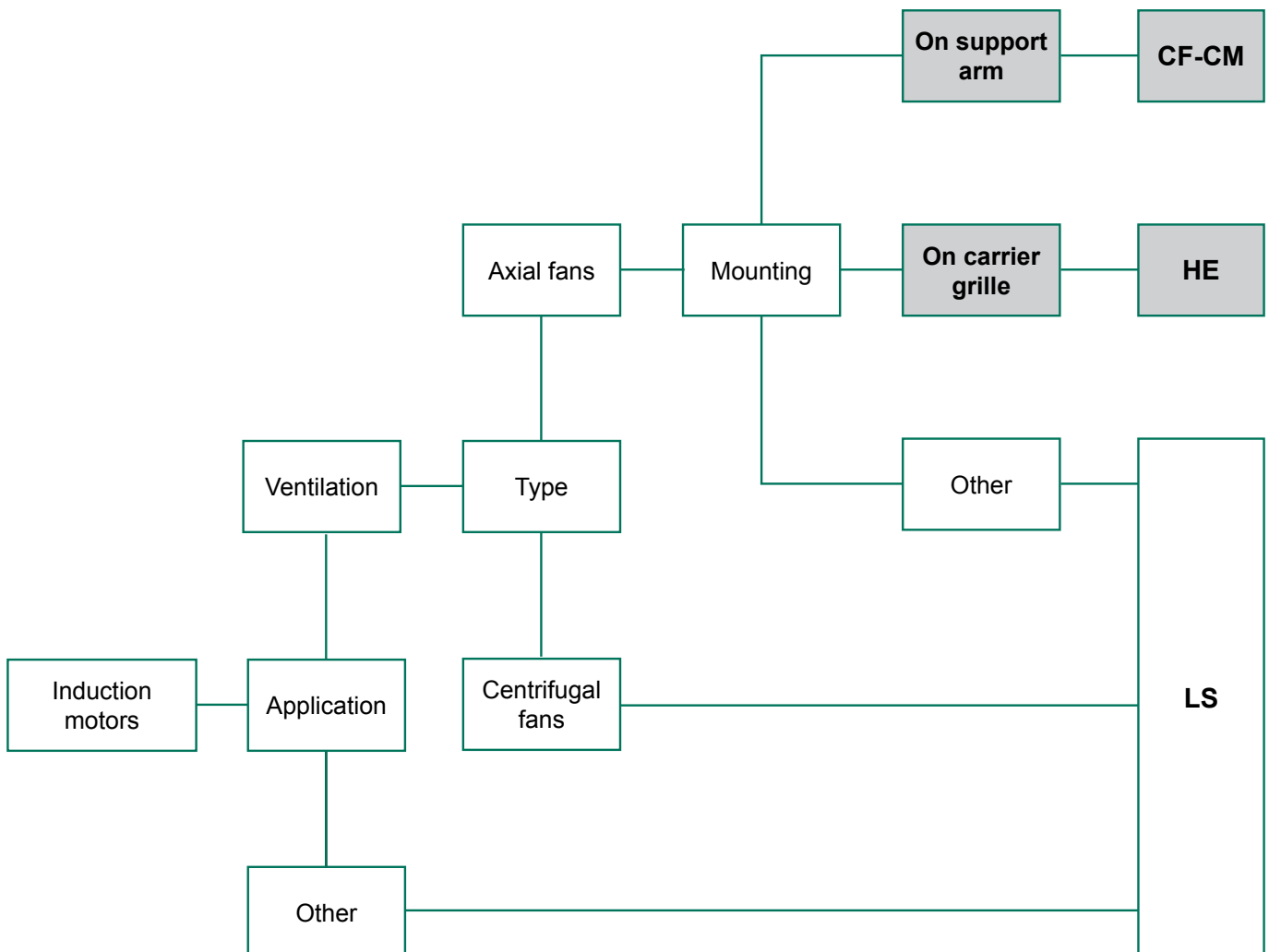# CF-CM-HE

LS LEROY SOMER

Fan motors
CF-CM-HE

In this catalogue, LEROY-SOMER describes the CF - CM - HE induction motors dedicated to driving axial fans for industries such as:

• Air conditioning/refrigeration: condensers, evaporators, cooling towers, etc.

• Ventilation: air treatment chambers, exhaust fans, air heaters, etc.

These motors in aluminium alloy housing have been designed to incorporate the latest European standards, and can satisfy most of the demands of these industries.

These motors are the result of many years of research and development in collaboration with the main players in the profession.

The selection table below can be used to locate their specific features.

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Induction          Application      Ventilation      Type
motors

                   Other

Axial fans ── Mounting ──┬── On support arm ── CF-CM
                         ├── On carrier grille ── HE
                         └── Other ── LS

Centrifugal fans ──────────────────── LS
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Fan motors
CF-CM-HE

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Fan motors
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General information

A1 - Quality assurance

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 analyses and actions for continuous improvement of our 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.

A2 - Standards and approvals

ORGANIZATION OF STANDARDS AUTHORITIES

International bodies

Worldwide	General standardization **ISO** International Standards Organisation	Electronics/electrotechnical standardization **IEC** International Electrotechnical Commission
	TC Technical committees / SC Sub-committees / WG Working groups	TC Technical committees / SC Sub-committees / WG Working groups
European	**CEN** European Committee for Standards **ECISS** European Committee for Iron and Steel Standardization TC Technical committees	**CENELEC** European Committee for Electrotechnical Standardization TC Technical committees / SC Sub-committees / AHG Ad hoc groups

Country	Initials	Name
AUSTRALIA	SAA	Standards Association of Australia
BELGIUM	IBN	Institut Belge de Normalisation
CIS (formerly USSR)	GOST	Gosudarstvenne Komitet Standartov
CHINA	CCC	China Compulsory certification
DENMARK	DS	Dansk Standardisieringsraad
FINLAND	SFS	Suomen Standardisoimisliitto
FRANCE	AFNOR including UTE	Association Française de Normalisation including: Union Technique de l'Électricité
GERMANY	DIN/VDE	Verband Deutscher Elektrotechniker
GREAT BRITAIN	BSI	British Standards Institution
ITALY	CEI	Comitato Electtrotechnico Italiano
JAPAN	JIS	Japanese Industrial Standard
NETHERLANDS	NNI	Nederlands Normalisatie - Instituut
NORWAY	NFS	Norges Standardisieringsforbund
SAUDI ARABIA	SASO	Saudi Arabian Standards Organization
SPAIN	UNE	Una Norma Española
SWEDEN	SIS	Standardisieringskommissionen I Sverige
SWITZERLAND	SEV or ASE	Schweizerischer Elektrotechnischer Verein
UNITED STATES	ANSI including NEMA	American National Standards Institute including: National Electrical Manufacturers

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A2 - Standards and approvals

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
for the USA	UL	Underwriters Laboratories
CANADA	CSA	Canadian Standards Association
CHINA	CCC	China Compulsory certification
etc.		

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

Country	Initials	Certification No.	Application
for the USA	Я.	E 68554	Impregnation systems
SAUDI ARABIA	SASO		CF22 and CM29 range

For approved specific products, see the relevant documents.

International and national standard equivalents

International reference standards		National standards				
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	Starting characteristics for single-speed motors for supply voltages ≤ 660 V	NFEN 60034-12	DIN/EN 60034-12	BS EN 60034-12		SEV ASE 3009-12
60034-14	Mechanical vibration in machines frame size > 56 mm	NFEN 60034-14	DIN/EN 60034-14	BS EN 60034-14		
60085	Evaluation and thermal classification of electrical insulation	NFC 26206	DIN/EN 60085	BS 2757		SEV ASE 3584

A2 - Standards and approvals

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List of standards quoted in this document

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 of rotating machines.
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 mounting positions and assembly layouts.
IEC 60034-9	EN 60034-9	1997	Electrical rotating machines: noise limits.
IEC 60034-12	EN 60034-12	1999	Starting characteristics for single-speed three-phase cage induction motors for supply voltages less than or equal to 660 V.
IEC 60034-14	EN 60034-14	1996	Electrical rotating machines: mechanical vibrations of certain machines with a frame size above or equal to 56 mm. Measurement, evaluation and limits of vibrational intensity..
IEC 60038		1999	IEC standard voltages.
IEC 60085		1984	Evaluation and thermal classification of electrical insulation.
IEC 60721-2-1		1987	Classification of natural 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 61000-2-10/11 and 2-2		1999	Electromagnetic compatibility (EMC): environment.
IEC guide 106		1989	Guidelines on the specification of environmental conditions for the determination of operating characteristics of equipment.
ISO 281		2000	Bearings - Basic dynamic loadings and nominal bearing life.
ISO 1680	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.
	EN 50102	1998	Degree of protection provided by electrical housings against extreme mechanical impacts.

A3 - Tolerance on main performance parameters

Tolerances on electromechanical characteristics

IEC 60034-1 specifies standard tolerances for electromechanical characteristics.

Parameters		Tolerances
Efficiency	machines P ≤ 50 kW machines P > 50 kW	-15% (1 – η) -10% (1 – η)
Cos φ		– 1/6 (1 – cos φ) (min 0.02 - max 0.07)
Slip	machines P < 1 kW machines P ≥ 1 kW	± 30% ± 20%
Locked rotor torque		-15%, +25% of rated torque
Starting current		+ 20%
Run-up torque		-15% of rated torque
Maximum torque		-10% of rated torque > 1.5 M_N
Moment of inertia		± 10%
Noise		+ 3 dB (A)
Vibration		+ 10% of the guaranteed class

Note: IEC 60034-1 does not specify tolerances for current
      - the tolerance is ± 10% in NEMA-MG1

A4 - Units of measurement and standard formulae

A4.1 - ELECTRICITY AND ELECTROMAGNETISM

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Parameters				Unit		Units and expressions not recommended
English name	French name	Symbol	Definition	SI	Non SI, but accepted	Conversion
Frequency	Fréquence Période	f	$f = \dfrac{1}{T}$	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	$U = Um \cos \omega t$ $i = im\cos (\omega t - \varphi)$	rad	° degree	
Power factor	Facteur de puissance	cos φ				
Reactance Resistance Impedance	Réactance Résistance Impédance	X R Z	$Z = \lvert Z \rvert^{\lvert\varphi}$ $= R + jX$ $\lvert Z \rvert = \sqrt{R^2 + X^2}$ $X = L\omega - \dfrac{1}{C\omega}$	Ω (ohm)		j is defined as $j^2 = -1$ ω rotational frequency = $2\pi \cdot f$
Self inductance	Inductance propre (self)	L	$L = \dfrac{\Phi}{I}$	H (henry)		
Capacitance	Capacité	C	$C = \dfrac{Q}{V}$	F (farad)		
Quantity of electricity	Charge électrique, Quantité d'électricité	Q	$Q = Idt$	C (coulomb)	A.h 1 A.h = 3600 C	
Resistivity	Résistivité	ρ	$\rho = \dfrac{R \cdot S}{l}$	Ω.m		Ω/m
Conductance	Conductance	G	$G = \dfrac{1}{R}$	S (siemens)		1/ Ω = 1 S
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	Um F, Fm 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	$\Phi = ff_s\, Bn\, ds$	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	$B = \mu H$ $\mu_o = 4\,10^{-7}\ H/m$	H/m		
Permittivity	Permittivité	$\varepsilon = \varepsilon_o \varepsilon_r$	$\varepsilon_o = \dfrac{1}{36\,10^9}\ F/m$	F/m		

A4 - Units of measurement and standard formulae

A4.2 - HEAT

Parameters				Unit		Units and expressions not recommended
English 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 $t = \dfrac{f-32}{1,8}$ $t_C = \dfrac{t_F - 32}{1,8}$
Temperature rise	Écart de température	ΔT		K	°C	$1\,°C = 1\,K$
Heat flux density	Densité de flux thermique	q, φ	$q = \dfrac{\varphi}{A}$	W/m²		
Thermal conductivity	Conductivité thermique	λ		W/m.K		
Total heat transmission coefficient	Coefficient de transmission thermique global	K	$\varphi = K\,(Tr_2 - Tr_1)$	W/m².K		
Heat capacity	Capacité thermique	C	$C = \dfrac{dQ}{dT}$	J/K		
Specific heat capacity	Capacité thermique massique	c	$c = \dfrac{C}{m}$	J/kg.K		
Internal energy	Energie interne	R		J		

A4.3 - NOISE AND VIBRATION

Parameters				Unit		Units and expressions not recommended
English 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	$L_p = 20\,\lg(P/P_o)$ $(P_o = 2\times10^{-5}\,Pa)$	dB		

A4.4 - DIMENSIONS

Parameters				Unit		Units and expressions not recommended
English name	French name	Symbol	Definition	SI	Non SI, but accepted	Conversion
Angle (plane angle)	Angle (angle plan)	α, β, T, φ		rad	degree: °	$180° = \pi\,rad$ $= 3.14\,rad$
Length Breadth Height Radius	Longueur Largeur Hauteur Rayon Longueur curviligne	l b h r s		m (metres)	micrometre	cm, dm, dam, hm 1 inch = 1" = 25.4 mm 1 foot = 1' = 304.8 mm µm micron µ angström: A = 0.10 nm
Area	Aire, superficie	A, S		m²		1 square inch = $6.45\ 10^{-4}$ m²
Volume	Volume	V		m³	litre: l liter: L	UK gallon = $4.546\ 10^{-3}$ m³ US gallon = $3.785\ 10^{-3}$ m³

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A4 - Units of measurement and standard formulae

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A4.5 - MECHANICS AND MOVEMENT

Parameters				Unit		Units and expressions not recommended
English name	French name	Symbol	Definition	SI	Non SI, but accepted	Conversion
Time Period (periodic time)	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 Circular frequency	Vitesse angulaire Pulsation	ω	$\omega = \dfrac{d\varphi}{dt}$	rad/s		
Angular acceleration	Accélération angulaire	α	$a = \dfrac{d\omega}{dt}$	rad/s²		
Speed Velocity	Vitesse Célérité	u, v, w, c	$v = \dfrac{ds}{dt}$	m/s	1 km/h = 0.277,778 m/s 1 m/min = 0.0166 m/s	
Acceleration Acceleration of free fall	Accélération Accélération de la pesanteur	a g = 9.81m/s²	$a = \dfrac{dv}{dt}$ in Paris	m/s²		
Revolution per minute	Vitesse de rotation	N		s⁻¹	min⁻¹	tr/mn, RPM, TM, etc
Mass	Masse	m		kg (kilogram)	tonne: t 1 t = 1000 kg	kilo, kgs, KG, etc 1 pound: 1 lb = 0.4536 kg
Mass density	Masse volumique	ρ	$\dfrac{dm}{dV}$	kg/m³		
Linear density	Masse linéique	ρ_e	$\dfrac{dm}{dL}$	kg/m		
Surface mass	Masse surfacique	ρ_A	$\dfrac{dm}{dS}$	kg/m²		
Momentum	Quantité de mouvement	P	$p = m.v$	kg. m/s		
Moment of inertia	Moment d'inertie	J, I	$I = m.r^2$	kg.m²		$J = \dfrac{MD^2}{4}$ kg.m pound per square foot = 1 lb.ft² = 42.1 x 10⁻³ kg.m²
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	$p = \dfrac{F}{S} = \dfrac{F}{A}$	Pa (pascal)	bar 1 bar = 10⁵Pa	1 kgf/cm² = 0.981 bar 1 psi = 6894 N/m² = 6894 Pa 1 psi = 0.06894 bar 1 atm = 1.013 x 10⁵Pa
Normal stress Shear stress	Contrainte normale Contrainte tangentielle, Cission	σ τ		Pa Leroy-Somer use the MPa = 10⁶Pa		kg/mm², 1 daN/mm² = 10 MPa psi = pound per square inch 1 psi = 6894 Pa
Friction coefficient	Facteur de frottement	µ				incorrectly = cœfficient friction 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 = 1055 J (British thermal unit)
Power	Puissance	P	$P = \dfrac{W}{t}$	W (watt)		1 ch = 736 W 1 HP = 746 W
Volumetric flow	Débit volumique	qᵥ	$q_v = \dfrac{dV}{dt}$	m³/s		
Efficiency	Rendement	η		< 1		%
Dynamic viscosity	Viscosité dynamique	η, µ		Pa.s		poise, 1 P = 0.1 Pa.s
Kinematic viscosity	Viscosité cinématique	v	$v = \dfrac{\eta}{\rho}$	m²/s		stokes, 1 St = 10⁻⁴ m²/s

LEROY-SOMER

A4 - Units of measurement and standard formulae

Unit	MKSA (IS 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
Weight	1 kg = 2.2046 lb	1 lb = 0.4536 kg
Torque	1 Nm = 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 = 6.452 10^4 line / in^2	1 line / in^2 = 1.550 10^{-5} Wb / m^2
Magnetic losses	1 W / kg = 0.4536 W / lb	1 W / lb = 2.204 W / kg
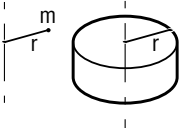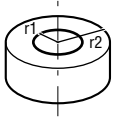
Multiples and sub-multiples		
Factor by which the unit is multiplied	Prefix to be placed before the unit name	Symbol to be placed before that of the unit
10^{18} or 1,000,000,000,000,000,000	exa	E
10^{15} or 1,000,000,000,000,000	peta	P
10^{12} or 1,000,000,000,000	tera	T
10^9 or 1,000,000,000	giga	G
10^6 or 1,000,000	mega	M
10^3 or 1,000	kilo	k
10^2 or 100	hecto	h
10^1 or 10	deca	da
10^{-1} or 0.1	deci	d
10^{-2} or 0.01	centi	c
10^{-3} or 0.001	milli	m
10^{-6} or 0.000,001	micro	µ
10^{-9} or 0.000,000,001	nano	n
10^{-12} or 0.000,000,000,001	pico	p
10^{-15} or 0.000,000,000,000,001	femto	f
10^{-18} or 0.000,000,000,000,000,001	atto	a

Fan motors
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General information

A4 - Units of measurement and standard formulae

A4.6 - MECHANICAL FORMULAE

Title	Formula	Unit	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 by an acceleration γ
Weight	$G = m \cdot g$	G in N m in kg g = 9.81 m/s^2	
Moment	$M = F \cdot r$	M in N.m F in N r in m	The moment M of a force in relation to an axis is the product of that force multiplied by the distance r from the point of application of F in relation to the axis.
Power - Rotating	$P = M \cdot \omega$	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}
- Linear	$P = F \cdot V$	P in W F in N V in m/s	V = linear velocity
Acceleration time	$t = J \cdot \dfrac{\omega}{M_a}$	t in s J in kg.m^2 ω in rad/s M$_a$ in Nm	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 speed ω'' are corrected to speed ω by the following calculation: $J_\omega = J_{\omega'} \cdot \left(\dfrac{\omega'}{\omega}\right)^2$
Moment of inertia Centre of gravity	$J = m \cdot r^2$		
Solid cylinder around its shaft	$J = m \cdot \dfrac{r^2}{2}$	J in kg.m^2 m in kg r in m	
Hollow cylinder around its shaft	$J = m \cdot \dfrac{r_1^2 + r_2^2}{2}$		
Inertia of a mass in linear motion	$J = m \cdot \left(\dfrac{V}{\omega}\right)^2$	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.

A4 - Units of measurement and standard formulae

A4.7 - ELECTRICAL FORMULAE

Title	Formula	Unit	Definitions / notes
Accelerating torque	$M_a = \dfrac{M_D + 2M_A + 2M_M + M_N}{6} - M_r$ General formula: $M_a = \dfrac{1}{N_N}\displaystyle\int_0^{N_N} (M_{mot} - M_r)\,dN$	Nm	The accelerating torque M_A is the difference between the motor torque M_{mot} (estimated), and the resistive torque M_r. (M_D, M_A, M_M, M_N, see curve below) N = instantaneous speed N_N = rated speed
Power required by the machine	$P = \dfrac{M \cdot \omega}{\eta_A}$	P in W M in N.m ω in rad/s η_A no units	η_A expresses the efficiency of the driven machine. M is the torque required by the driven machine.
Power drawn by the 3-phase motor	$P = \sqrt{3} \cdot U \cdot I \cdot \cos\varphi$	P in W U in V I in A	φ phase angle by which the current lags or leads the voltage. U armature voltage. I line current.
Reactive power absorbed by the motor	$Q = \sqrt{3} \cdot U \cdot I \cdot \sin\varphi$	Q in VAR	
Reactive power supplied by a bank of capacitors	$Q = \sqrt{3} \cdot U^2 \cdot C \cdot \omega$	U in V C in µ F ω in rad/s	U = voltage at the capacitor terminals C = capacitor capacitance ω = rotational frequency of supply phases ($\omega = 2\pi f$)
Apparent power	$S = \sqrt{3} \cdot U \cdot I$ $S = \sqrt{P^2 + Q^2}$	S in VA	
Power supplied by 3-phase motor	$P = \sqrt{3} \cdot U \cdot I \cdot \cos\varphi \cdot \eta$		η expresses motor efficiency at the point of operation under consideration.
Slip	$g = \dfrac{N_S - N}{N_S}$		Slip is the difference between the actual motor speed N and the synchronous speed N_S
Synchronous speed	$N_S = \dfrac{120 \cdot f}{p}$	N_S in min^{-1} f in Hz	p = number of poles f = frequency of the power supply

Parameters	Symbol	Unit	Torque and current curve according to speed
Starting current Rated current No-load current	I_D I_N I_O	A	
Starting torque* Run up torque	M_D M_A	Nm	
Maximum breakdown torque	M_M		
Rated torque	M_N		
Rated speed Synchronous speed	N_N N_S	min^{-1}	

* Torque is the usual term for expressing the moment of a force.

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A4 - Units of measurement and standard formulae

A4.8 - AIR FLOW

Parameter				Unit		Units and expressions not recommended
English name	French name	Symbol	Definition	SI	Non SI but accepted	Conversion
Volumetric airflow	Débit d'air volumique	Qvm		m3/s	m3/h m3/mn CFM	1 CFM = 1.699m3/h
Static pressure	Pression statique	pe				1 bar = 105 x Pa
Dynamic pressure	Pression dynamique	pd	$0.5 \times \rho \times V^2$	Pa		1mmCE = 9.81 x Pa
Total pressure	Pression totale	Δp	pe + pd			1 atm = 1.013*105 x Pa
Velocity	Vitesse de l'air	V	Qvm/S	m/s	m/mn	
Power absorbed by the impeller (Motor nominal power)	Puissance absorbée par la roue hélicoïde (Puissance utile du moteur)	Pu	Qvm x Δp / η air flow	W	kW	

Laws relating to proportional fans

Parameter	Change in the rotation speed	Change in the fan diameter
Flow rate (Qvm)	$Qvm_2 = Qvm_1 \times (N2/N1)$	$Qvm_2 = Qvm_1 \times (D2/D1)^3$
Pressure (Δp)	$\Delta p_2 = \Delta p_1 \times (N2/N1)^2$	$\Delta p_2 = \Delta p_1 \times (D2/D1)^2$
Motor output power (Pu)	$Pu_2 = Pu_1 \times (N2/N1)^3$	$Pu_2 = Pu_1 \times (D2/D1)^5$
Sound level (Lp)	$Lp_2 = Lp_1 + 50 \log (N2/N1)$	$Lp_2 = Lp_1 + 70 \log (D2/D1)$

N1: initial speed of rotation
N2: final speed of rotation

D1: initial fan diameter
D2: second proportional fan diameter

Fan motors CF-CM-HE Environment

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)

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

Example:

Example of a machine **IP 55**

IP: Degree of protection

5.: Machine protected against dust and accidental contact.

*Test result: **no dust enters** in harmful quantities, no risk of direct contact with rotating parts.* The test will last for 2 hours.

.5: Machine protected against jets of water from all directions from hoses at 3 m distance with a flow rate of 12.5 l/min at 0.3 bar. The test will last for 3 minutes.

Test result: no damage from water projected onto the machine.

B

Fan motors
CF-CM-HE
Environment

B2 - Environmental limitations

B2.1 - OPERATING CONDITIONS

According to IEC 60034-1, motors can operate in the following normal conditions

- ambient temperature within the range -16 to +40°C
- altitude less than 1000 m
- atmospheric pressure: 1050 hPa (mbar) = (750 mm Hg)

CF - CM - HE fan motors often operate outside the temperature limits fixed by standard IEC 60034-1, especially with condenser and exchanger applications.
Leroy-Somer fan motors are designed to operate in an ambient temperature range of -30°C to +60°C.

For different operating conditions, please contact us.
Note: However, unless otherwise specified, the motors are rated for ambient conditions of 40°C.

B2.2 - MINIMUM AIR FLOW OVER THE MOTOR

Motors for driving axial fans are not self-cooled (IC410), but are designed to be placed in the air flow of the driven propeller (IC 418).

These motors are capable of achieving their power rating if the air flow around the motor complies with the figures in the table opposite.

Motor polarity	Minimum air speed (m/s)	
	CF-CM-HE	CM34
2P	-	21
4P	4	10.5
6P	3	7
8P	3	7
12P	2	-
16P	2	-
4/8P	4	10.5
6/12P	3	7

B2.3 - DRAIN HOLES

Holes are provided at the lowest points of the enclosure to drain off any condensation from the machine.
Unless requested otherwise, the motors are supplied with the drain holes blocked.
On request, the motors can be supplied with the drain holes open, depending on the operating position.

Fan motors
CF-CM-HE
Environment

B3 - Heating

B3.1 - USING SPACE HEATERS

Severe climatic conditions, for example T amb < - 40°C, RH > 95%, may require the use of space heaters (fitted to the motor windings) which serve to maintain the average temperature of the motor, provide trouble-free starting, and eliminate problems caused by condensation (loss of insulation).

The heater supply wires are brought out to a terminal block in the motor terminal box. The heaters must be switched off while the motor is running.

Motor type	Power rating (230V) W
CM29	16
HE29	16
CF32	16
CM34	25

B3.2 - USING D.C. INJECTION

An alternative to the use of space heaters is to inject direct current into two of the phases wired in series from a D.C. voltage source which can give the total power indicated in the table above. This method can only be used on motors of less than 10 kW.

This is easily calculated: if R is the resistance of the windings in series, the D.C. voltage will be given by the equation (Ohm's law):

$$U_{(V)} = \sqrt{P_{(w)}} + R_{(\Omega)}$$

Resistance should be measured with a micro-ohmmeter.

B3.3 - USING A.C. INJECTION

A single-phase A.C. voltage (from 10 to 15% of rated voltage), can be applied between 2 phases placed in series.

B

Fan motors
CF-CM-HE
Construction

C1 - Mains connection

C1.1 - TABLE OF TERMINAL BOXES AND CABLE GLANDS FOR RATED SUPPLY VOLTAGE

Motor type	Terminal box material	Power supply				Cable gland for accessories PTO/ PTF/etc
		Three-phase			Single-phase	
		Single-speed	Two-speed slipping	Two-speed	Single-speed	
CF22	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
HE22	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
HE25	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
CM29	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
HE29	Aluminium	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
CF32	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6
CM34	Plastic	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 20 No. 7	1xISO 16 No. 6

Cable gland type	Tightening capacity	
	Min. cable ø (mm)	Max. cable ø (mm)
1xISO 16 No. 6	6	10
1xISO 20 No. 7	8	13

Cable gland clamping capacity (Standard NFC 68 311 and 312)

C1.2 - TERMINAL BLOCKS

The motors are fitted with a terminal block complying with standard NFC 51 120.

If the motor is fitted with accessories (thermal protection or space heater), these must be connected on screw dominos with labelled wires.

Motor type	Power supply			
	Three-phase			Single-phase
	Single-speed	Two-speed slipping	Two-speed	Single-speed
CF22	M4	M4	M4	M4
HE22	M4	M4	M4	M4
HE25	M4	M4	M4	M4
CM29	M4	M4	M4	M4
HE29	M4	M4	M4	M4
CF32	M4	M4	M4	M4
CM34	M5	M5	M5	M5

Recommended tightening torques for the nuts on the terminal blocks.

Terminal	Torque (Nm)
M4	2
M5	3.2

LEROY SOMER

Fan motors
CF-CM-HE
Construction

C1 - Mains connection

C1.3 - WIRING DIAGRAMS

All motors are supplied with a wiring diagram in the terminal box.
The diagrams normally used are shown below.

Single-speed three-phase motor

Δ connection (230 V)   Y connection (400 V)

W2	U2	V2
U1	V1	W1
L1	L2	L3
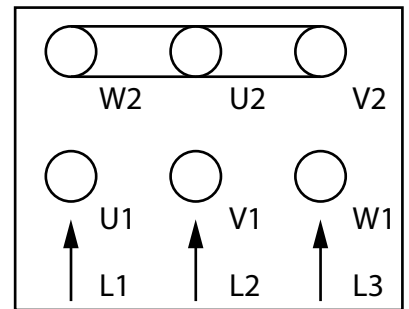
Three-phase/two-speed motor
using slip
(Eg. CM29G)
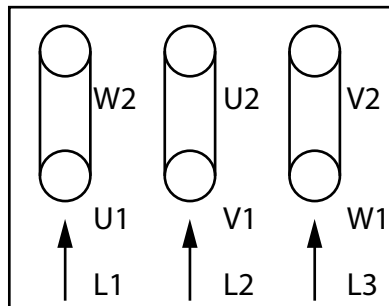
High speed
Δ connection (400V)   Low speed
Y connection (400 V)
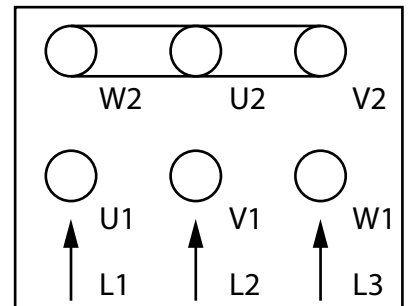
Three-phase/two-speed
Dahlander motor
For 400 V mains supply
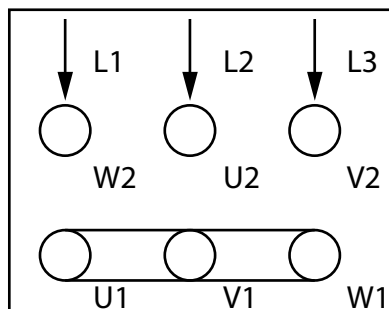
High speed
Y connection (400 V)   Low speed
YY connection (400 V)

C

C1 - Mains connection

C
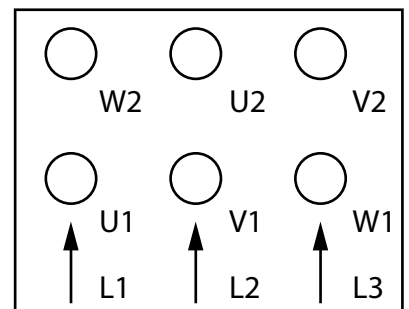
Three-phase/two-speed PAM motor
For 400 V mains supply

High speed
Y connection (400 V)
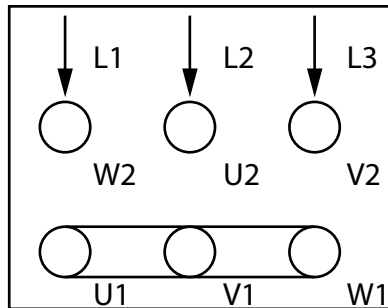
Low speed
YY connection (400 V)
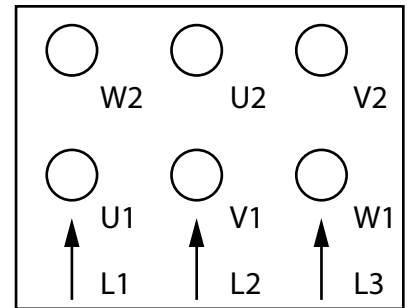
Single-speed motor for use on three-phase and/or single-phase supplies
(Eg. HE22TP)

230 V three-phase supply
Δ connection
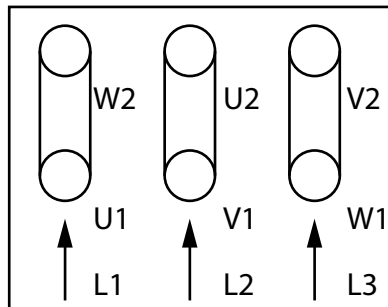
400 V three-phase supply
Y connection
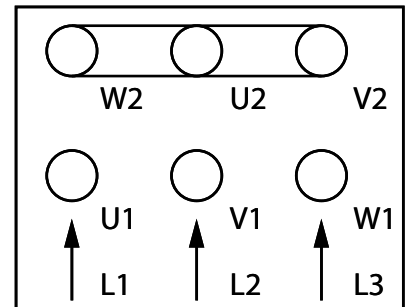
230 V single-phase supply
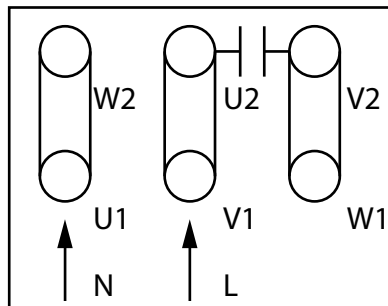
The permanent capacitor is supplied separately for mounting by the user in ambient conditions < 85°C.

C1.4 - EARTH TERMINAL

This is situated on a boss inside the terminal box. Consisting of a threaded stud with a hexagonal nut or a TORX recessed head screw, it is used to connect cables with cross-sections at least as large as the cross-section of the phase conductors.

It is indicated by the symbol ⏚ in the terminal box moulding.
On request, a second earth terminal can be fitted on one of the feet or on one of the cooling fins.

LEROY SOMER

Fan motors
CF-CM-HE
Construction

C2 - Mechanical fixing

C2.1 - FIXING CF - CM MOTORS

The fixing arms can be used to support the motor and centre the propeller in its ferrule.
We strongly recommend using the fixing holes closest to the motor shaft extension.
CF22 motors are designed to be fixed with 2 screws per arm on 3 arms (120°) or 4 arms (90°), the other motors are designed to be fixed on 4 arms (90°) with a minimum of 2 screws per arm for the short CM29, 3 screws for the long CM29.

Recommendation for tightening the arms

The size of the locking screws depends on the thickness of the arm and the washers to be locked in place.

$$(P_{min} + e) \leq h \leq (P_{max} + e)$$
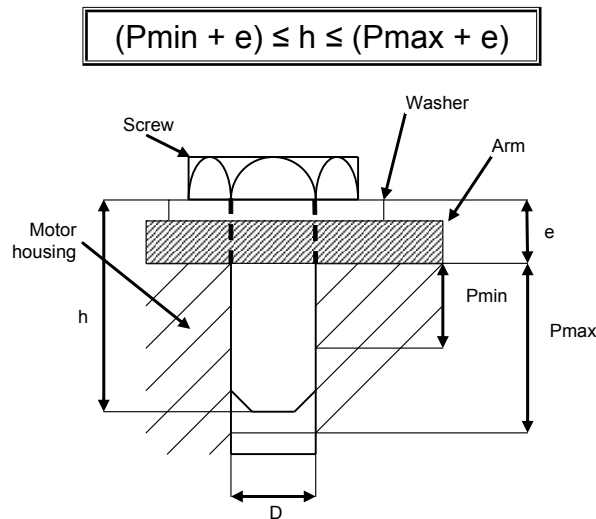
	Type of screw	Minimum screw depth	Maximum screw depth	Tightening torque	Thread destruction torque	Untightening torque
		Pmin (mm)	Pmax (mm)	Nm	Nm	Nm
CF22	M5 Standard thread	6	9	6	-	-
CM29	M6 Self-tapping	12	18	12-14	22	10
CF32	M6 Standard thread	6	9	10	-	-
CM34	M8 Self-tapping	10	15	13	30	

Fixing with self-tapping screw

Some motors are fixed by means of self-tapping screws, and these motor housings therefore have bosses with calibrated holes obtained by direct casting so that there is a huge choice of modular fixings.

Provision of fixing screws

As an option, Leroy-Somer is able to supply various types of approved screw to be defined according to the installation.

C2 - Mechanical fixing

C2.2 - FIXING THE MOTORS

THE motors are fixed with screws or screws and nuts on the motorised fan protective grille.
There are two options for mounting the HE motor in relation to the grille:

• Grille opposite the shaft extension

• Grille on the same side as the shaft extension
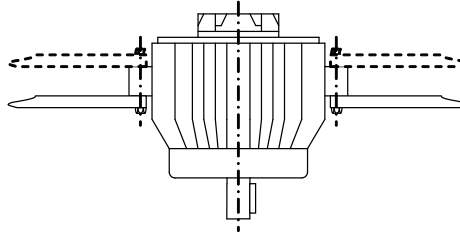
Recommendations for mounting the grille.

Screw fixing (HE22, HE25)
The size of the locking screws depends on the thickness of the grille, or possibly the grille and washers to be locked in place.
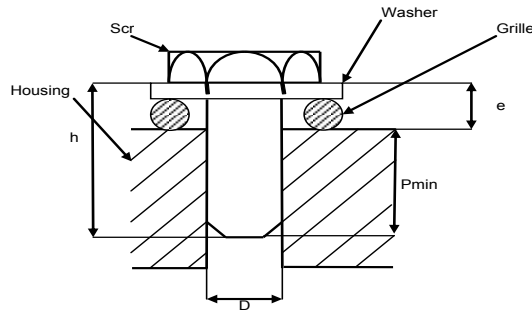
$$h \geq (Pmin + e)$$

	Type of screw	Minimum screw depth Pmin (mm)	Tightening torque Nm	Form D
HE22	M6 Self-tapping	12	12-14	M6
HE25	M8 Standard thread	16	22	M8

Screw/nut fixing (HE29)
Leroy-Somer recommends the use of lock nuts to be placed in specially designed slots in the housing when assembling the motor on the motorised fan grille.
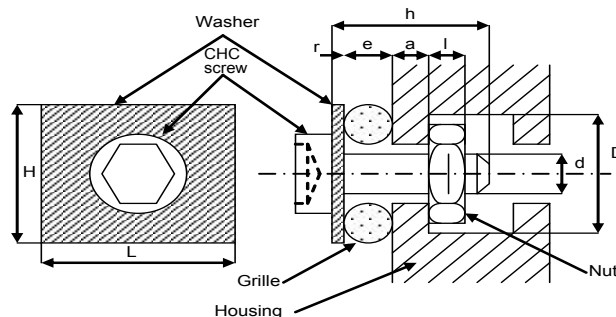
$$h \geq (r + e + a + l)$$

	Type of screw	Thickness of motor reinforcement a (mm)	Max. screw length l (mm)	Max. screw width D (mm)	Max. screw diameter d (mm)
HE29	M10 CHC standard thread + nut	8.25	10.5	16	10

Fan motors CF-CM-HE Construction

C2 - Mechanical fixing

Provision of fixing screws

As an option, Leroy-Somer is able to supply various types of screw or a fixing kit of approved screws/nuts (screw, nut and square plate).

	Screw height h (mm)	Form D	Screw length l	"Washer or Plate"		
				L	H	r
HE22	20	M6	-	-	-	-
HE25	25	M8	-	-	-	-
HE29	35	M10	10	30	21.5	4

C2.3 - DISMANTLING/ REASSEMBLING THE MOTOR

If self-tapping screws are used, they can be refitted several times provided that the screw is replaced in the existing thread by hand.

For screw/nut assembly, since the lock nuts can only be used once, they must be replaced with a new lock nut when the motor is dismantled.

Fan motors
CF-CM-HE
Operation

D1 - Supply voltage

D1.1 - RATED SUPPLY VOLTAGE

The motors described in this catalogue are designed to operate at European reference rated voltages (IEC 60038) ie. 230/400 V three-phase and 230 V single-phase with a tolerance of ±10% and rated frequency of 50 Hz ±1% in continuous operation.

However, CF - CM - HE motors on a three-phase 280/480 V supply with tolerance of ±10% and rated frequency of 60 Hz can only operate at constant power. Since the electrical characteristics have been modified, this change of rated supply voltage means the motor nameplate must be changed.

Changing from 50 Hz to 60 Hz involves redefining the size of the driven propeller.

D1.2 - SPECIAL VOLTAGES

In addition to the standard voltages, Leroy-Somer can on request adapt the windings of its motors to different voltages and frequencies.

D1.3 - OPERATING A THREE-PHASE MOTOR FROM A SINGLE-PHASE POWER SUPPLY (STEINMETZ CONNECTION)

It is possible to run three-phase motors from a single-phase power supply under certain conditions:
• low-power motor, wound for 230/400 V - 50 Hz

• single-phase supply 230 V - 50 Hz
• derated for power
• reduced starting torque

Outline diagram

Cp: permanent capacitor

220 / 230 V - 50 Hz

D2 - Use with variable speed control

D2.1 - TWO-SPEED MOTORS USING A Δ/Y CONNECTION (SLIPPING TYPE G)

The operating principle of two-speed motors using slip comes from supplying insufficient voltage to the windings via a Δ/Y connection.

High speed (Ns1) is obtained by applying the rated voltage (Un, Δ connection) to the winding terminals.

By applying reduced voltage (Y connection, i.e. Un/√3) to the winding terminals, the motor torque decreases and the motor low speed is thus obtained (N2). The

operating point obtained is at the intersection of the torque curve of the driven propeller and the motor torque curve.

In order to find the exact equilibrium for the driven load, a prototype must be built and approved.
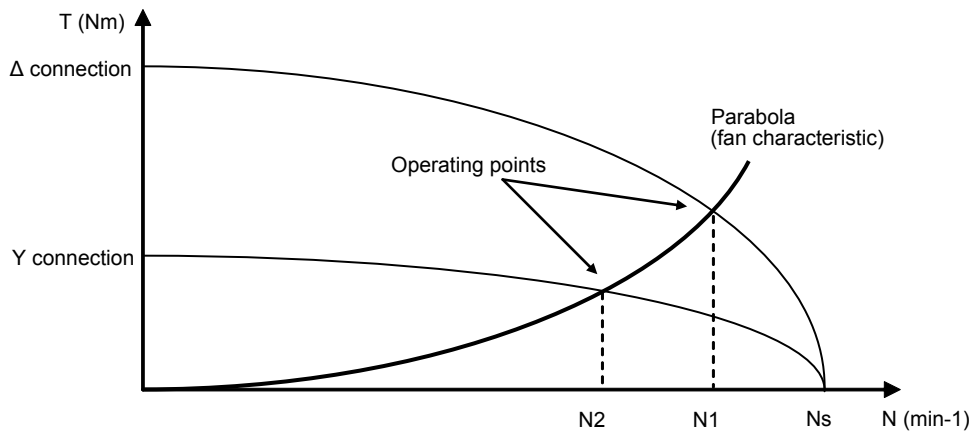
Two-speed motors using a Δ/Y connection are not designed to operate with additional variable speed systems.

D2.2 - TWO-SPEED MOTORS USING A Y/YY CONNECTION (DAHLANDER)

The operating principle for two-speed Dahlander motors is based on the use of two half-windings connected differently according to the desired speed. This winding principle only permits Ns and Ns/2 speeds.

High speed (Ns1) is obtained by applying the rated voltage (Un, YY connection) to the winding terminals connected in parallel.

Application of the rated voltage to the windings in series (Un, Y connection) can be used to obtain low speed (N2).
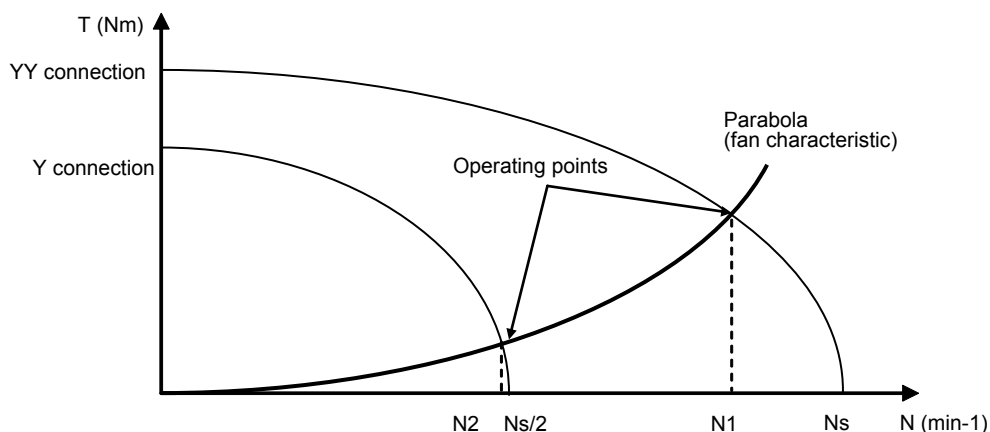
D2 - Use with variable speed control

D2.3 - TWO-SPEED MOTORS USING A DOUBLE WINDING

The operating principle for two-speed motors using a double winding is based on the use of two separate windings.

This winding principle allows the motor to run at two distinct speeds.

High speed (Ns1) is obtained by applying the rated voltage to the terminals of the first winding.

Supplying power to the second winding enables low speed (Ns2) to be obtained.

D
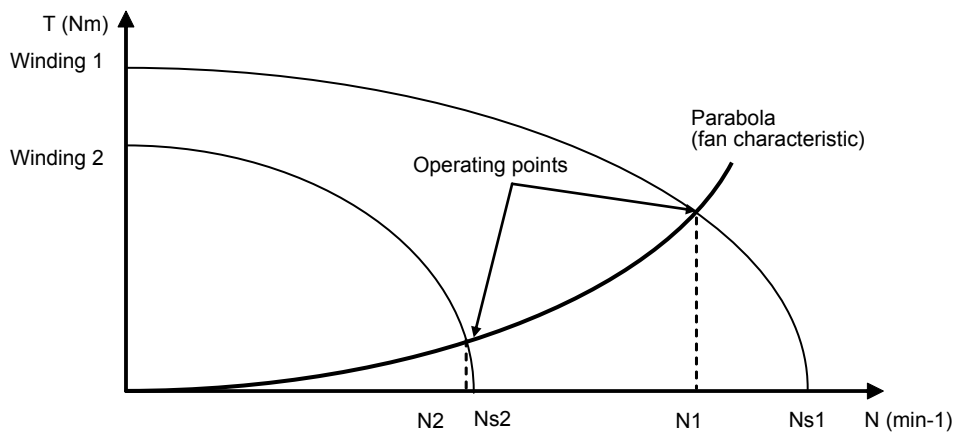
D2.4 - VARIABLE SPEED WITH FREQUENCY INVERTER

Single-speed motors (non-slipping) can be controlled by frequency inverters, thus excluding any possibility of overspeed.
However, when using a drive controlling a number of motors, special adaptations must be made to the motor, and for this particular operating scenario please contact Leroy-Somer.

D2.5 - OTHER PRINCIPLES

Leroy-Somer has expertise in designing motors for a large number of other variable speed operating principles; if you have any specific requirements please contact us.

D3 - Performance

D3.1 - THERMAL PROTECTION

Motors are protected by a manual or automatic overcurrent relay, placed between the isolating switch and the motor.
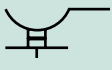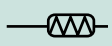
These protection devices provide total protection of the motor against overloads.

If a shorter reaction time is required, if you want to detect transient overloads, or if you wish to monitor temperature rises at "hot spots" in the motor or at strategic points in the installation for maintenance purposes, it would be advisable to install heat sensors.

The various types are shown in the table below, with a description of each.

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

Built-in indirect thermal protection

Type	Symbol	Operating principle	Operating curve	Breaking capacity (A)	Protection provided	Mounting Number of devices*
Normally closed thermal protection	PTO	Bimetallic strip, indirectly heated, with normally closed (NC) contact		2.5 A at 250 V with cos φ 0.4	General monitoring for non-transient overloads	2 or 3 in series
Positive temperature coefficient thermistor	PTC	Non-linear variable resistor, indirectly heated		0	General monitoring for transient overloads	3 in series

- NRT: nominal running temperature.
- The NRTs are chosen according to the position of the sensor in the motor and the temperature rise class.
* The number of devices depends on the type of winding.

Fitting thermal protection
• PTO, in the control circuits.
• PTC, with relay, in the control circuits.

Built-in direct thermal protection
For single-phase motors at low rated currents, bimetallic strip-type protection may be used. The line current passes through the strip, The design of this type of protection allows for automatic reset.

Approval must be obtained in accordance with current standards. This type of protection is prohibited for use with power electronics.

D

E1 - CF-CM selection

E1.1 - GENERAL

These motors are optimised for driving axial fans. Our in-depth knowledge of the application and policy of continuous improvement have resulted in a tried and tested product that is particularly reliable.

The special design of these motors placed in the air flow of the driven propeller ensures particularly effective heat exchange.

The bosses incorporated in the body allow mounting directly on the motorised fan support arms.

Optimised performance in the application can significantly reduce the motor weight and dimensions.

The technical features enable operation at high temperature, and in harsh outdoor environments.

E1.2 - CONSTRUCTION

Designation	Materials	Remarks
Housing	Aluminium alloy	Extruded monobloc aluminium housing with high energy dissipation (CF) or pressure die-cast (CM) Motor in the air flow, mounting on bosses
Stator	Insulated low-carbon magnetic steel laminations Electroplated copper	Low carbon content guarantees long-term lamination pack stability Welded laminations Semi-enclosed slots
Rotor	Insulated low-carbon magnetic steel laminations Aluminium	Inclined cage bars Rotor cage pressure die-cast in aluminium (or alloy for slipping application) Rotor protected against corrosion Dynamically balanced rotor, class G 6.3 - 1/2 key Shrink-fitted to shaft
Insulation class		Class F insulation system, with lower temperature rise enabling use in conditions up to 60°C
Shaft	Steel	Standard diameters according to the main standards for the propeller bores. Phosphate-treated shaft for excellent resistance to corrosion (except CM34) Shaft end fitted with screw and washer Drive key
End shields	Aluminium	End shields incorporating directly cast drain holes, available for all operating positions
Bearings		Ball bearings permanently greased with special grease for the application.
Operating temperatures		Minimum temperature: -30°C Maximum temperature: +60°C
Storage temperatures		Minimum temperature: -30°C Maximum temperature: +60°C
Protection		IP 55, with special protection at the drive end adapted to vertical mounting, shaft facing up
Shocks and vibrations		IK 07
Cooling		IC 418
Lipseals	Neoprene/ labyrinth seal	Enabling multi-position operation
Relative humidity		Up to 90% as standard or 100% with the encased stator option
Connection	Composite material or aluminium alloy	Composite terminal cover with connection terminal block in standard version, with optional aluminium terminal box and/or fast-on connectors.
External finish		Unpainted

E1 - CF-CM selection

E1.3 - OPTIONS

Leroy-Somer offers complete drive systems which are suitable for the very wide-ranging needs in the field of ventilation.

Electronics	Motor	Options

The options:

PTO, PTF or PTC protection with additional cable gland

Special mains voltages and frequencies

Aluminium terminal box

3-wire + earth or 6-wire + earth fast-on connector

Special coating

Space heater

Special shafts

Encased stator

UL-CSA compatibility

Varmeca

Digidrive SK

Fast-on connector

Brushless

Foot mounted
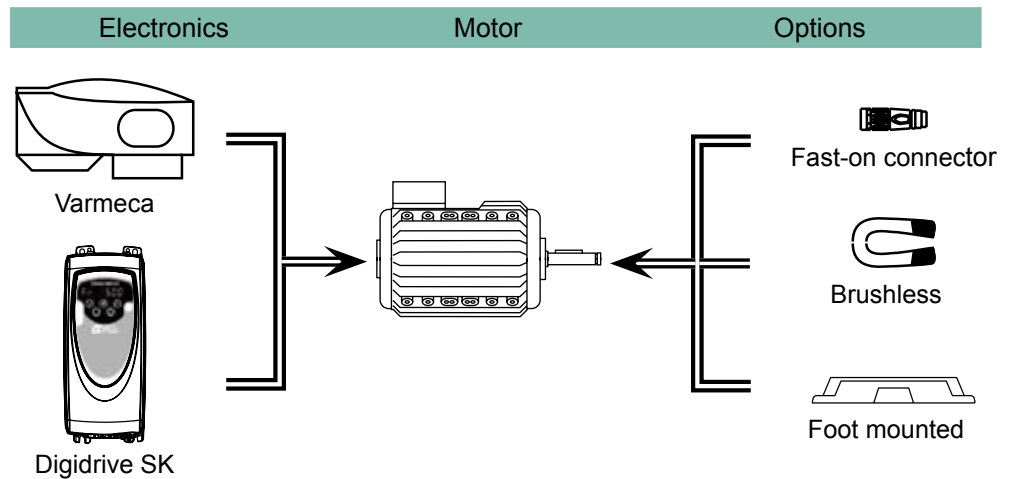
E1.4 - DESIGNATION / CODING

6P 1000 min⁻¹	CM29	G	1600 W	Z	230/400V	50Hz
Polarity Speed	Motor type	Electrical type of motor	Rated output power	Code	Mains voltage	Mains frequency

Example of coding:

CM two-speed slipping motor, 1000 min⁻¹, 1500 watts, power supply 230/400 V - 50 Hz
Designation:
6P CM29G - 1500W - Z - 230/400V - 50Hz

The table opposite is an example.
It is used to construct the designation of the desired product.

Fan motors CF-CM-HE Selection

E1 - CF-CM selection

E1.5 - THREE-PHASE / SINGLE-SPEED SELECTION

Class F - IP55 - 50Hz - Δ230 / Y400V ±10% - S1

2 poles 3000 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) Y400V	Rated current In (A) Y400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM34	-	5500			Please consult Leroy-Somer			
CM34	-	7500	2910	134.0	15.90	0.80	84.9	-
CM34	-	9000			Please consult Leroy-Somer			

4 poles 1500 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) Y400V	Rated current In (A) Y400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CF22	C	90	1450	1.9	0.49	0.48	54.0	4.5
CF22	C	120	1440	1.9	0.52	0.55	60.0	4.5
CF22	D	200	1430	3.3	0.79	0.57	61.0	5.0
CF22	F	250	1430	3.7	0.80	0.66	69.4	5.5
CF22	H	370	1420	5.3	1.08	0.68	72.1	6.5
CF22	K	550	1400	7.6	1.60	0.71	70.4	7.5
CM29	F	750	1420	9.5	1.80	0.80	75.6	9.5
CM29	G	900	1410	13.6	2.30	0.81	74.6	10.5
CM29	G	1100	1400	13.6	2.60	0.82	77.3	10.5
CM29	L	1500	1410	21.4	3.70	0.81	76.9	12.5
CM29	R	2000	1420	27.0	4.47	0.81	81.3	16.0
CM29	W	2600	1410	38.0	6.20	0.81	76.0	18.5
CM29	Z	3000	1420	43.6	7.05	0.84	77.7	20.5
CM34	-	4000	1425	51.0	8.90	0.73	76.6	-
CM34	-	5500	1450	80.0	11.50	0.81	83.6	-
CM34	-	7500			Please consult Leroy-Somer			

6 poles 1000 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) Y400V	Rated current In (A) Y400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CF22	D	90	920	1.2	0.45	0.62	46.9	5.0
CF22	F	120	920	1.8	0.64	0.56	48.7	5.5
CF22	H	180	890	2.2	0.82	0.62	51.6	6.5
CF22	K	250	940	2.7	1.04	0.70	49.7	7.5
CM29	F	370	950	5.5	1.20	0.69	65.7	9.5
CM29	G	550	940	7.5	1.70	0.67	71.8	10.5
CM29	L	750	940	9.9	2.20	0.70	74.4	12.5
CM29	L	900	920	9.9	2.40	0.75	72.2	12.5
CM29	R	1100	920	15.8	3.50	0.66	71.5	16.0
CM29	W	1500	930	18.5	4.30	0.72	75.6	18.5
CM29	Z	2000	920	24.2	5.50	0.70	75.5	20.5
CM29	9	2200			Please consult Leroy-Somer			
CF32	9E	2400			Please consult Leroy-Somer			
CM34	-	2200	930	21.0	5.20	0.80	77.5	-
CM34	-	3000	955	42.0	7.30	0.75	78.6	-
CM34	-	4000	955	55.0	9.70	0.74	83.5	-

Fan motors CF-CM-HE Selection

E1 - CF-CM selection

E1.5 - THREE-PHASE / SINGLE-SPEED SELECTION

Class F - IP55 - 50Hz - Δ230 / Y400V ±10% - S1

8 poles 750 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
CF22	K	120	700	2.0	0.87	0.50	41.5	7.5
CM29	F	250	700	3.9	1.25	0.65	60.3	9.5
CM29	G	370	690	4.7	1.70	0.67	61.5	10.5
CM29	L	550	690	7.1	2.20	0.70	63.0	12.5
CM29	R	750	690	8.2	2.62	0.63	65.5	16.0
CM29	W	900	700	9.3	3.20	0.66	66.1	18.5
CM29	Z	1100	710	16.6	5.30	0.49	61.6	20.5
CF32	9	1300	Please consult Leroy-Somer					
CF32	9E	1500	Please consult Leroy-Somer					
CM34	-	1100	705	13.5	3.50	0.65	68.9	-
CM34	-	1500	705	19.0	5.00	0.63	70.7	-
CM34	-	2200	Please consult Leroy-Somer					

12 poles 500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
CM29	G	120	450	1.6	0.90	0.49	37.0	10.5
CM29	L	180	460	2.7	1.25	0.49	43.0	12.5
CM29	R	250	455	3.7	1.80	0.49	45.3	16.0
CM29	W	370	450	4.7	2.30	0.49	47.6	18.5
CM29	Z	450	450	7.0	3.20	0.45	44.6	20.5
CF32	9	550	Please consult Leroy-Somer					

16 poles 375 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
CM29	Z	180	350	4.1	2.40	0.43	18.8	20.5

E

Fan motors CF-CM-HE Selection

E1 - CF-CM selection

E1.6 - THREE-PHASE/TWO-SPEED SLIPPING MOTOR SELECTION

Class F - IP55 - 50Hz - Δ400 / Y400V ±10% - S1

4 poles 1500 min⁻¹

Type	Code	Rated output power Pn (W) Δ400V	Rated output power Pn (W) Y400V	Rated speed Nn (Min-1)	Starting current Id (A) Δ400V	Rated current In (A) Δ400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM29G	G	750	320	1390	9.9	1.85	0.79	75.8	10.5
CM29G	L	1100	460	1390	13.8	2.60	0.83	76.2	12.5
CM29G	R	1500	630	1390	18.0	3.40	0.81	76.0	16.0
CM29G	W	1800	750	1390	21.4	4.10	0.81	76.1	18.5
CM29G	Z	2000	840	1390	25.3	4.80	0.82	76.0	20.5

6 poles 1000 min⁻¹

Type	Code	Rated output power Pn (W) Δ400V	Rated output power Pn (W) Y400V	Rated speed Nn (Min-1)	Starting current Id (A) Δ400V	Rated current In (A) Δ400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM29G	D	250	100	890	2.6	0.84	0.71	62.1	9.0
CM29G	F	370	150	890	4.2	1.32	0.71	63.5	9.5
CM29G	G	550	230	890	5.8	1.80	0.71	65	10.5
CM29G	L	750	310	890	7.3	2.10	0.74	69.9	12.5
CM29G	R	1100	460	900	11.0	2.40	0.61	74	16.0
CM29G	W	1300	540	900	13.0	4.00	0.65	68	18.5
CM29G	Z	1600	670	890	16.0	4.80	0.70	69	20.5
CM29G	ZE	1800	800	910	20.0	5.41	0.66	72.8	22.0
CM29G	9E	2000	900	900	21.8	6.00	0.68	71.4	24.0
CF32G	9E	2200	950	Please consult Leroy-Somer					

8 poles 750 min⁻¹

Type	Code	Rated output power Pn (W) Δ400V	Rated output power Pn (W) Y400V	Rated speed Nn (Min-1)	Starting current Id (A) Δ400V	Rated current In (A) Δ400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM29G	L	370	150	660	3.7	1.36	0.65	59.7	12.5
CM29G	R	550	230	680	5.4	2.10	0.59	64	16.0
CM29G	W	750	310	670	7.8	2.90	0.60	60.8	18.5
CM29G	Z	900	370	660	10.3	3.70	0.61	57.6	20.5
CM29G	9E	1100	460	Please consult Leroy-Somer					
CF32G	9E	1300	540	Please consult Leroy-Somer					

E

LEROY SOMER

Fan motors
CF-CM-HE
Selection

E1 - CF-CM selection

E1.6 - THREE-PHASE/TWO-SPEED SLIPPING MOTOR SELECTION

Class F - IP55 - 50Hz - Δ400 / Y400V ±10% - S1

10 poles
600 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
CM29G	9E	500	250	535	6.8	2.67	0.49	54.3	23.0

12 poles
500 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
CM29G	G	90	37	450	1.5	0.80	0.46	36.5	10.5
CM29G	L	120	50	440	1.8	1.00	0.48	37.7	12.5
CM29G	R	180	75	430	2.2	1.30	0.53	40.1	16.0
CM29G	W	250	100	440	3.3	1.70	0.49	43.8	18.5
CM29G	Z	370	150	430	4.8	2.40	0.48	47	20.5
CF32G	9E	550	230	Please consult Leroy-Somer					

E

Fan motors
CF-CM-HE
Selection

E1 - CF-CM selection

E1.7 - THREE-PHASE/TWO-SPEED DAHLANDER MOTOR SELECTION

Class F - IP55 - 50Hz - Y400 / YY400V ±10% - S1

2-4 poles
3000-1500 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) 400V	Rated current In (A) 400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM34	-	4500						
		1300	Please consult Leroy-Somer					
CM34	-	6000						
		1600	Please consult Leroy-Somer					

4-8 poles
1500-750 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) 400V	Rated current In (A) 400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM29	G	750	1420	11.0	2.30	0.72	65.0	10.5
		90	720	1.60	0.51	0.48	52.0	
CM29	L	1100	1410	12.9	2.80	0.83	75.1	12.5
		120	730	3.50	1.00	0.40	43.3	
CM29	R	1500	1420	18.0	3.70	0.74	74.0	16
		180	730	4.50	1.30	0.40	46.0	
CM29	W	1800	1440	21.8	4.40	0.76	74.0	18.5
		250	730	5.70	2.60	0.42	49.0	
CM29	Z	2200	1440	27.0	5.30	0.78	79.9	20.5
		370	740	7.80	2.20	0.44	54.4	
CM34	-	4000						
		750	Please consult Leroy-Somer					
CM34	-	5500						
		1100	Please consult Leroy-Somer					

6-12 poles
1000-500 min⁻¹

Type	Code	Rated output power Pn (W)	Rated speed Nn (Min-1)	Starting current Id (A) 400V	Rated current In (A) 400V	Power factor Cos φ (100%)	Efficiency η (100%)	Weight Kg
CM29	R	750	910	8.0	2.10	0.82	64.0	16
		150	420	1.70	0.80	0.68	42.0	
CM29	W	1100	910	13.5	3.20	0.77	65.0	18.5
		180	450	2.80	1.20	0.54	40.0	
CM29	Z	1500	910	18.0	4.00	0.79	68.0	20.5
		250	450	3.60	1.50	0.55	44.0	
CM34	-	2200						
		370	Please consult Leroy-Somer					
CM34	-	3000						
		500	Please consult Leroy-Somer					

LEROY SOMER

Fan motors
CF-CM-HE
Selection

E1 - CF-CM selection

E1.8 - THREE-PHASE/TWO-SPEED PAM MOTOR SELECTION

Class F - IP55 - 50Hz - Y400 / YY400V ±10% - S1

4-6 poles 1500-1000 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) 400V	In (A) 400V	Cos φ (100%)	η (100%)	Kg
CM34	-	4000						
		1500	Please consult Leroy-Somer					
CM34	-	5500						
		1800	Please consult Leroy-Somer					

6-8 poles 1000-750 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) 400V	In (A) 400V	Cos φ (100%)	η (100%)	Kg
CM34	-	2200						
		1100	Please consult Leroy-Somer					
CM34	-	3000						
		1250	Please consult Leroy-Somer					

E

Fan motors CF-CM-HE Selection

E1 - CF-CM selection

E1.9 - THREE-PHASE/SINGLE-PHASE SELECTION

| Classe F - IP55 - 50Hz - Δ230 / 230V - Y400 / 230V ±10% - S1 | | | | | | | | | |

4 poles 1500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Permanent capacitor	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V 230V	In (A) Y400V 230V	Cos φ (100%)	η (100%)	μF	Kg
CF22TP	D	90 / -			Please consult Leroy-Somer				5.0
CF22TP	D	120 / -			Please consult Leroy-Somer				5.0
CF22TP	F	180 / -			Please consult Leroy-Somer				5.5
CF22TP	H	250 / -			Please consult Leroy-Somer				6.5

6 poles 1000 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Permanent capacitor	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V 230V	In (A) Y400V 230V	Cos φ (100%)	η (100%)	μF	Kg
CF22TP	H	120 / -			Please consult Leroy-Somer				6.5

E

LEROY SOMER

E1.10 - CF 22 DIMENSION
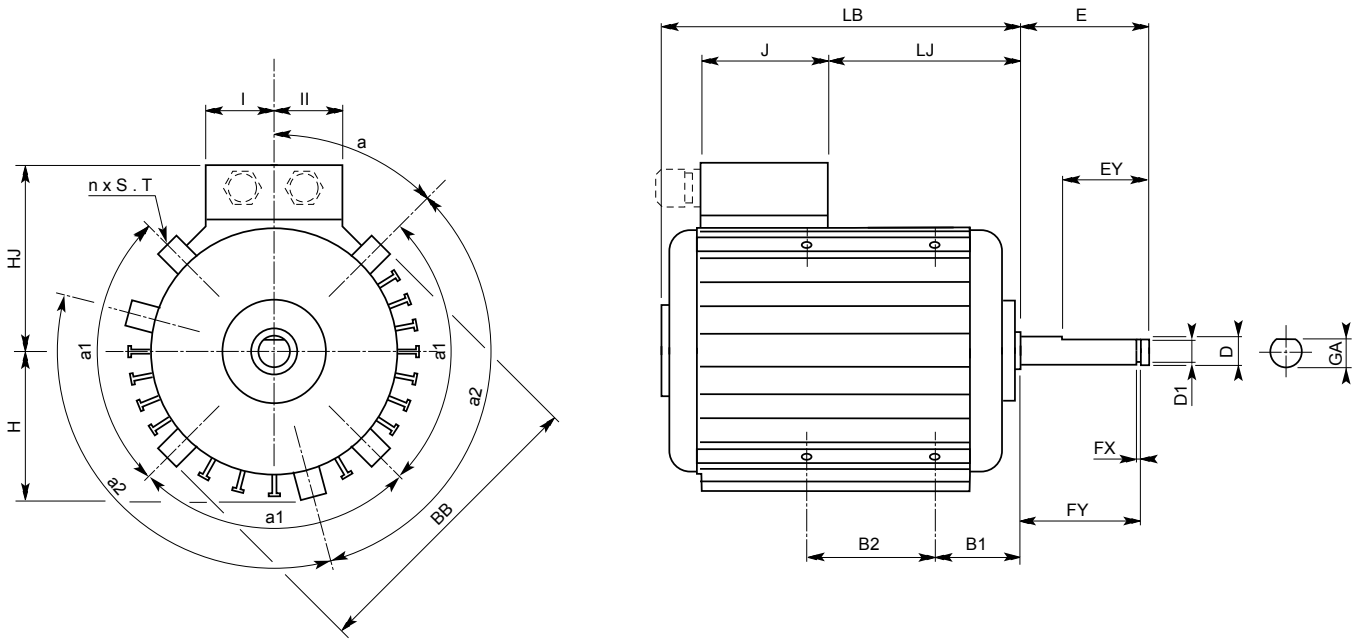
Type	Code	Main dimensions												
		LB	BB	H	HJ	LJ	J	I	II	a	a1	a2	n	S	T
CF22	C	147	146	72	94	52	75	39	39	45	90	120	2	12	M5
CF22	D	147	146	72	94	52	75	39	39	45	90	120	2	12	M5
CF22	F	157	146	72	94	62	75	39	39	45	90	120	2	12	M5
CF22	H	172	146	72	94	77	75	39	39	45	90	120	2	12	M5
CF22	K	182	146	72	94	87	75	39	39	45	90	120	2	12	M5
CF22P	D	147	146	72	94	52	75	39	39	45	90	120	2	12	M5
CF22P	F	157	146	72	94	62	75	39	39	45	90	120	2	12	M5
CF22P	H	172	146	72	94	77	75	39	39	45	90	120	2	12	M5

Fixing	
B1	B2
48	45

Compatible shaft extension						
D	E	EY	GA	D1	FX	FY
12h8	48	37	10	10	2.15	43

E

39

E1 - CF-CM selection

E1.11 - SHORT CM 29 DIMENSION
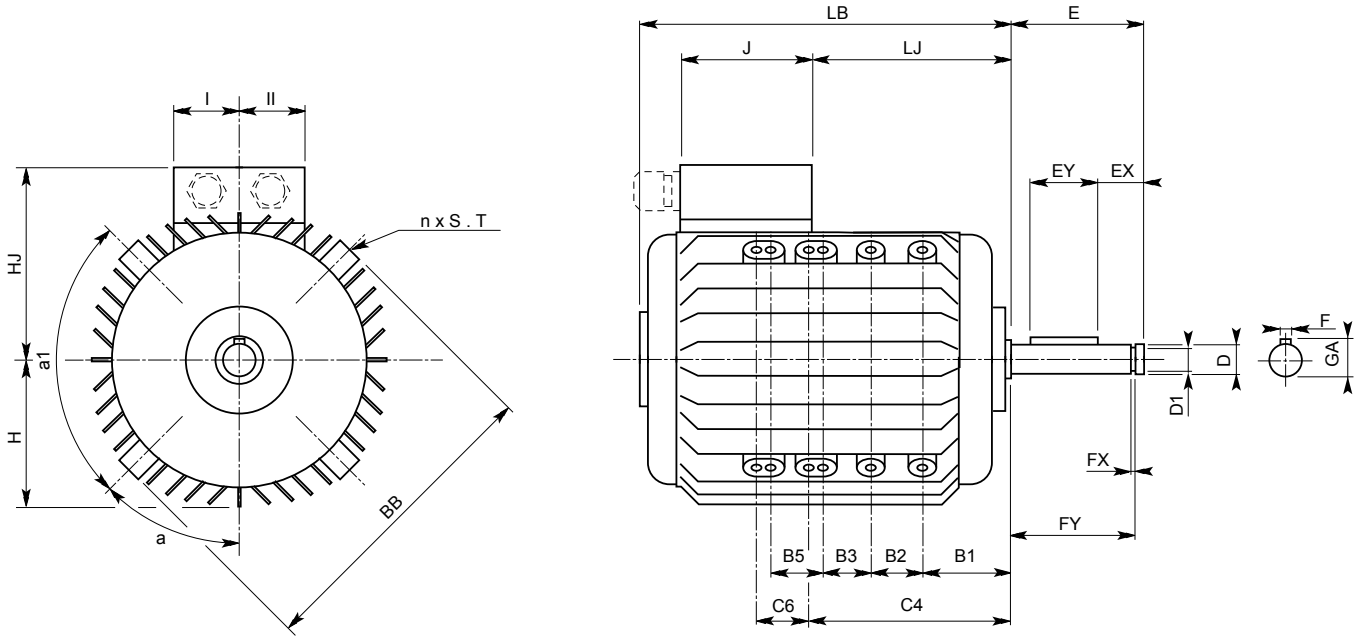
Type	Code	Main dimensions											
		LB	BB	H	HJ	LJ	J	I	II	a	a1	n	S	T
CM29	F	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29	G	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29	L	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29G	G	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29G	L	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29P	D	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29P	G	195	190	90	118	90	82.5	42	42	45	90	6	M6	20
CM29P	L	195	190	90	118	90	82.5	42	42	45	90	6	M6	20

Fixing					
B1	B2	B3	B5	C4	C6
53	31	29	31	122	31

Compatible shaft extensions								
D	E	EX	EY	F	GA	D1	FX	FY
16h7	81	30	45	5	18	13	2.15	76
19h7	81	25	50	6	21.5	15.7	2.15	76

E1 - CF-CM selection

E1.12 - LONG CM 29 DIMENSION
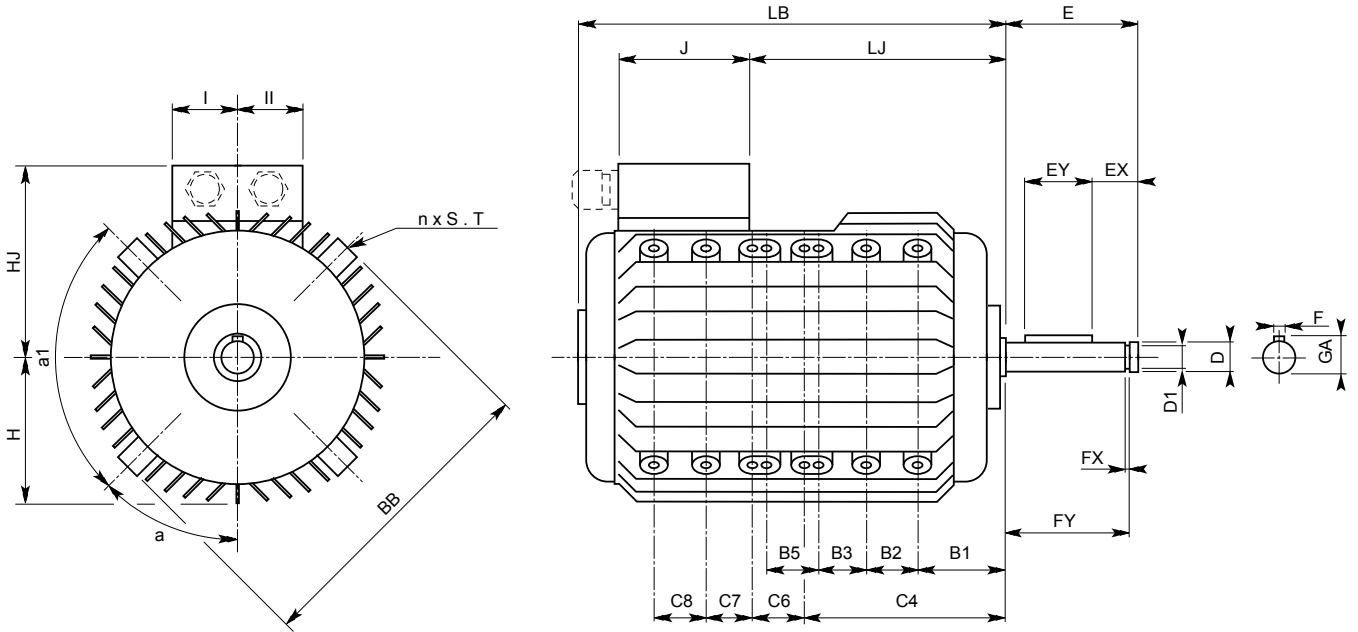
Type	Code	Main dimensions												
		LB	BB	H	HJ	LJ	J	I	II	a	a1	n	S	T
CM29	R	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29	W	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29	Z	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29G	R	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29G	W	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29G	Z	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29G	ZE	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29G	9E	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29P	R	260	190	90	118	155	82.5	42	42	45	90	8	M6	20
CM29P	W	260	190	90	118	155	82.5	42	42	45	90	8	M6	20

Fixing							
B1	B2	B3	B5	C4	C6	C7	C8
53	31	29	31	122	31	29	31

Compatible shaft extensions								
D	E	EX	EY	F	GA	D1	FX	FY
19h7	81	25	50	6	21.5	15.7	2.15	76
24h7	50	6	40	8	27	-	-	-

E

E1 - CF-CM selection

E1.13 - CF 32 DIMENSION
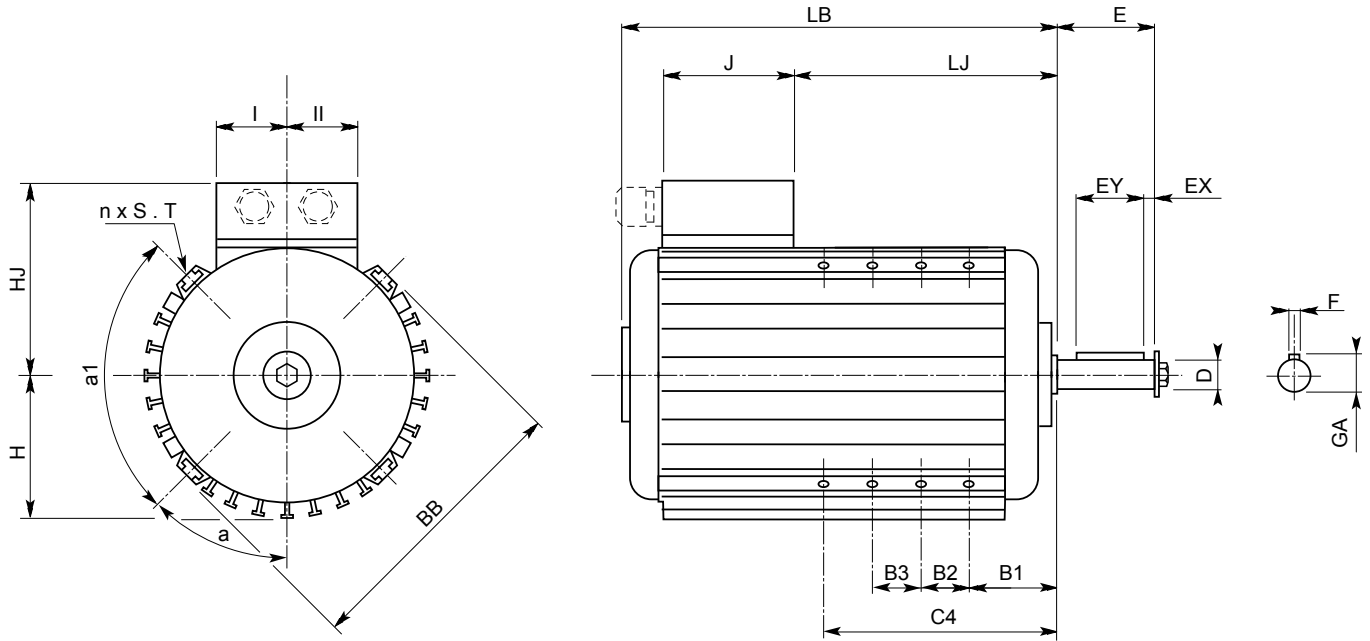
Type	Code	Main dimensions											
		LB	BB	H	HJ	LJ	J	I	II	a	a1	n	MS
CF32	W	251	190	94	122	144	84	42	42	45	90	4	M6
CF32	Z	272	190	94	122	165	84	42	42	45	90	4	M6
CF32	9	286	190	94	122	179	84	42	42	45	90	4	M6
CF32	9E	286	190	94	122	179	84	42	42	45	90	4	M6
CF32G	9E	286	190	94	122	179	84	42	42	45	90	4	M6

Fixing			
B1	B2	B3	C4
53	31	29	144

Compatible shaft extensions					
D	E	EX	EY	F	GA
24h7	50	6	40	8	27

E1 - CF-CM selection

E1.14 - CM 34 DIMENSION
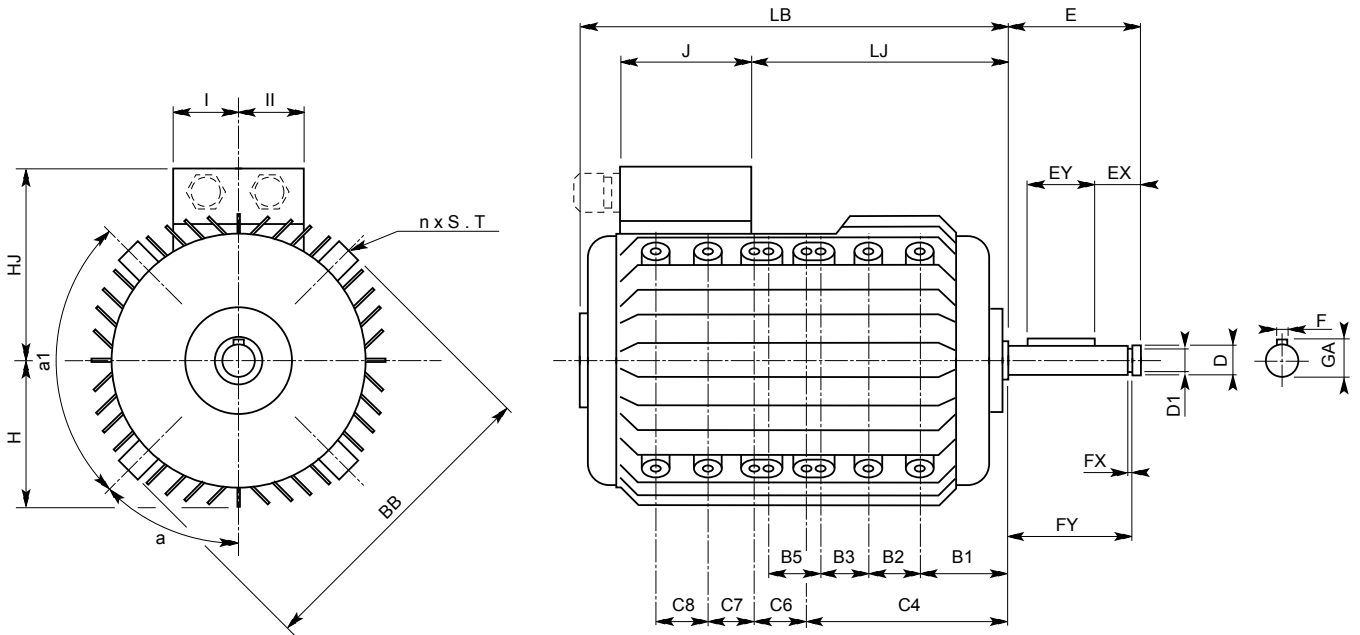
Main dimensions

Type	Code	LB	BB	H	HJ	LJ	J	I	II	a	a1	n	S	T
CM34	-	315	222		147	199	86	43	43	45	90	8	M8	15

Fixing

B1	B2	B3	B5	C4	C6	C7	C8
57.5	30	30	60	90	60	30	30

Compatible shaft extensions

D	E	EX	EY	F	GA
24j6	50	4	40	8	27

E

Fan motors
CF-CM-HE
Selection

E2 - HE selection

E2.1 - GENERAL

These motors are optimised for driving axial fans. Our in-depth knowledge of the application and policy of continuous improvement have resulted in a tried and tested product that is particularly reliable.

The special design of these motors placed in the air flow of the driven propeller ensures particularly effective heat exchange.

The special form of the HE motors allows them to be mounted directly on the reinforcements of a grille holding the motorised fan.

Thanks to this special form, the propeller hub can envelop the motor drive end, making the assembly more compact.

Optimised performance in the application can significantly reduce the motor weight and dimensions.

The technical features enable operation at high temperature, and in harsh outdoor environments.

E2.2 - CONSTRUCTION

Description	Materials	Remarks
Housing	Aluminium alloy	Pressure die-cast monobloc aluminium housing with high energy dissipation Motor in the air flow, compact mounting on carrier grille
Stator	Insulated low-carbon magnetic steel laminations Electroplated copper	Low carbon content guarantees long-term lamination pack stability Welded laminations Semi-enclosed slots
Rotor	Insulated low-carbon magnetic steel laminations Aluminium	Inclined cage bars Rotor cage pressure die-cast in aluminium (or alloy for slipping application) Rotor protected against corrosion Dynamically balanced rotor, class G 6.3 - 1/2 key Shrink-fitted to shaft
Insulation class		Class F insulation system, with lower temperature rise enabling use in conditions up to 60°C
Shaft	Steel	Standard diameters according to the main standards for the propeller bores Phosphate-treated shaft for excellent resistance to corrosion Shaft end fitted with screw and washer Drive key
End shields	Aluminium	End shields incorporating directly cast drain holes, available for all operating positions NDE shield with integrated terminal box
Bearings		Ball bearings permanently greased with special grease for the application
Operating temperatures		Minimum temperature: -30°C Maximum temperature: +60°C
Storage temperatures		Minimum temperature: -30°C Maximum temperature: +60°C
Protection		IP 55, with special protection at the drive end adapted to vertical mounting
Shocks and vibrations		IK 07
Cooling		IC418
Lipseals	Neoprene	Enabling multi-position operation
Relative humidity		Up to 90% as standard or 100% with the encased stator option
Connection	Composite material or aluminium alloy	Composite terminal cover except for HE29 (aluminium) with connection terminal block in standard version, with optional aluminium terminal box and/or fast-on connectors.
External finish		Unpainted

E

Fan motors
CF-CM-HE
Selection

E2 - HE selection

E2.3 - OPTIONS

Leroy-Somer offers complete drive systems which are suitable for the very wide-ranging needs in the field of ventilation.

Electronics	Motor	Options

The options:

PTO, PTF or PTC protection with additional cable gland

Special mains voltages and frequencies

Aluminium terminal box

3-wire + earth or 6-wire + earth fast-on connector

Flying leads

Special coating

Space heater

Special shafts

Encased stator

UL-CSA compatibility

Digidrive SK

Fast-on connector

Brushless
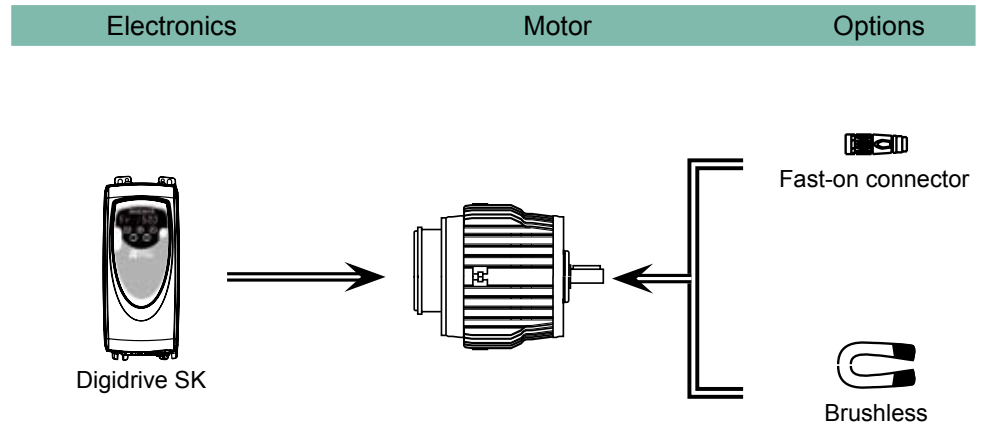
E2.4 - DESIGNATION / CODING

6P 1000 min^{-1}	HE29	G	1600 W	Z	230/400V	50Hz
Polarity Speed	Motor type	Electrical type of motor	Rated output power	Code	Mains voltage	Mains frequency

Example of coding:

HE two-speed slipping motor, 1000 min^{-1}, 1500 watts, power supply 230/400 V - 50 Hz

Designation:

6P HE29G - 1500W - Z - 230/400V - 50Hz

The table opposite is an example.
It is used to construct the designation of the desired product.

Fan motors CF-CM-HE Selection

E2 - HE selection

E2.5 - THREE-PHASE/SINGLE-SPEED SELECTION

Class F - IP55 - 50Hz - Δ230 / Y400V ±10% - S1

4 poles 1500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
HE22	C	150	1420	1.9	0.53	0.67	61.4	3.3
HE22	D	200	1430	3.3	0.79	0.57	61.0	4.1
HE25	D	250	1420	3.2	0.74	0.69	70.7	5.9
HE25	F	370	1420	4.8	1.15	0.70	71.8	6.6
HE25	H	550	1420	7.7	1.60	0.72	70.5	7.6
HE25	M	750	1400	9.7	2.10	0.76	72.7	9.2
HE29	G	900	1410	13.6	2.30	0.81	74.6	10.7
HE29	G	1100	1400	13.6	2.60	0.82	77.3	10.7
HE29	L	1500	1410	21.4	3.70	0.81	76.9	12.7
HE29	R	2000	1420	27.0	4.47	0.81	81.3	15.8

E

6 poles 1000 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
HE22	C	90	880	0.8	0.37	0.69	43.1	3.3
HE22	D	120	880	1.3	0.54	0.70	46.3	4.1
HE25	D	180	910	2.0	0.64	0.72	58.7	5.9
HE25	F	250	950	3.9	0.85	0.67	63.0	6.6
HE25	H	370	950	4.3	1.10	0.72	66.0	7.6
HE25	M	550	930	6.4	1.65	0.74	65.6	9.2
HE29	L	750	940	9.9	2.20	0.70	74.4	12.7
HE29	L	900	920	9.9	2.40	0.75	72.2	12.7
HE29	R	1100	920	15.8	3.50	0.66	71.5	15.8

8 poles 750 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
HE25	M	250	700	3.3	1.25	0.57	50.6	9.2
HE29	G	370	690	4.7	1.70	0.67	61.5	10.7
HE29	L	550	690	7.1	2.20	0.70	63.0	12.7
HE29	R	750	690	8.2	2.62	0.63	65.5	15.7

12 poles 500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V	In (A) Y400V	Cos φ (100%)	η (100%)	Kg
HE29	L	180	460	2.7	1.25	0.49	43.0	12.7
HE29	R	250	455	3.7	1.80	0.49	45.3	15.8

LEROY SOMER

Fan motors
CF-CM-HE
Selection

E2 - HE selection

E2.6 - THREE-PHASE/TWO-SPEED SLIPPING MOTOR

Class F - IP55 - 50Hz - Δ400 / Y400V ±10% - S1

4 poles 1500 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
HE29G	G	750	320	1390	9.9	1.85	0.79	75.8	10.7
HE29G	L	1100	460	1390	13.8	2.60	0.83	76.2	12.7
HE29G	R	1500	630	1390	18.0	3.40	0.81	76.0	15.8

6 poles 1000 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
HE29G	G	550	230	890	5.8	1.80	0.71	65	10.7
HE29G	L	750	310	890	7.3	2.10	0.74	69.9	12.7
HE29G	R	1100	460	900	11.0	2.40	0.61	74	15.8

8 poles 750 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
HE29G	L	370	150	660	3.7	1.36	0.65	59.7	12.7
HE29G	R	550	230	680	5.4	2.10	0.59	64.0	15.8

12 poles 500 min⁻¹

Type	Code	Rated output power	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W) Δ400V	Pn (W) Y400V	Nn (Min-1)	Id (A) Δ400V	In (A) Δ400V	Cos φ (100%)	η (100%)	Kg
HE29G	G	90	37	450	1.5	0.80	0.46	36.5	10.7
HE29G	L	120	50	440	1.8	1.00	0.48	37.7	12.7
HE29G	R	180	75	430	2.2	1.30	0.53	40.1	15.8

E

Fan motors
CF-CM-HE
Selection

E2 - HE selection

E2.7 - DAHLANDER THREE-PHASE/TWO-SPEED SELECTION

Class F - IP55 - 50Hz - Y400 / YY400V ±10% - S1

2-4 poles
3000-1500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) 400V	In (A) 400V	Cos φ (100%)	η (100%)	Kg
HE29	G	750	1420	11.0	2.30	0.72	65.0	10.7
		90	720	1.60	0.51	0.48	52.0	
HE29	L	1100	1410	12.9	2.80	0.83	75.1	12.7
		120	730	3.50	1.00	0.40	43.3	
HE29	R	1500	1420	18.0	3.70	0.74	74.0	15.8
		180	730	4.50	1.30	0.40	46.0	

6-12 poles
1000-500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Weight
		Pn (W)	Nn (Min-1)	Id (A) 400V	In (A) 400V	Cos φ (100%)	η (100%)	Kg
HE29	R	750	910	8.0	2.10	0.82	64.0	15.8
		150	420	1.70	0.80	0.68	42.0	

E

LEROY SOMER

Fan motors
CF-CM-HE
Selection

E2 - HE selection

E2.8 - THREE-PHASE/SINGLE-PHASE SELECTION

| Class F - IP55 - 50Hz - Δ230 / 230V - Y400 / 230V ±10% - S1 |

2 poles 3000 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Permanent capacitor	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V 230V	In (A) Y400V 230V	Cos φ (100%)	η (100%)	µF	Kg
HE22TP	D	250			Please consult Leroy-Somer				
HE25TP	F	490			Please consult Leroy-Somer				
HE25TP	H	690 -			Please consult Leroy-Somer				

4 poles 1500 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Permanent capacitor	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V 230V	In (A) Y400V 230V	Cos φ (100%)	η (100%)	µF	Kg
HE22TP	C	100			Please consult Leroy-Somer				
HE22TP	D	150			Please consult Leroy-Somer				
HE22TP	D	180			Please consult Leroy-Somer				
HE25TP	F	250			Please consult Leroy-Somer				
HE25TP	H	370			Please consult Leroy-Somer				
HE25TP	M	550			Please consult Leroy-Somer				

6 poles 1000 min⁻¹

Type	Code	Rated output power	Rated speed	Starting current	Rated current	Power factor	Efficiency	Permanent capacitor	Weight
		Pn (W)	Nn (Min-1)	Id (A) Y400V 230V	In (A) Y400V 230V	Cos φ (100%)	η (100%)	µF	Kg
HE22TP	C	75			Please consult Leroy-Somer				
HE22TP	D	100			Please consult Leroy-Somer				
HE25TP	D	120			Please consult Leroy-Somer				
HE25TP	F	180			Please consult Leroy-Somer				
HE25TP	H	250			Please consult Leroy-Somer				
HE25TP	M	370			Please consult Leroy-Somer				

E

LEROY SOMER
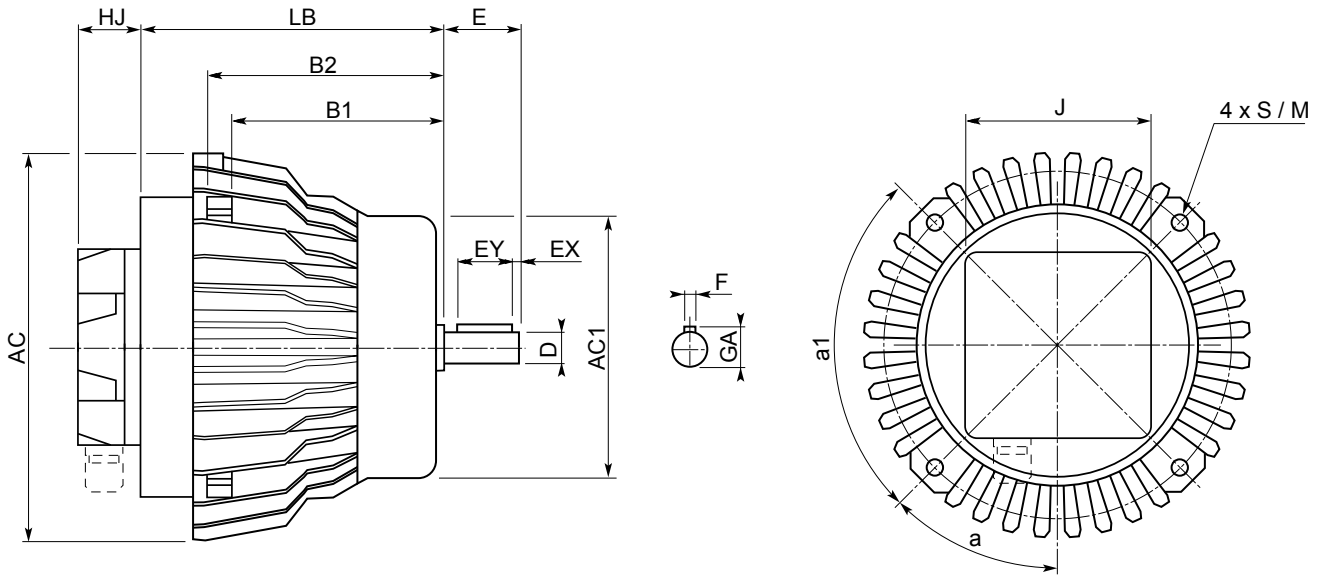
E2.9 - HE 22 DIMENSION

Type	Code	Main dimensions										
		LB	B1	B2	HJ	AC	AC1	J	a	a1	S	M
HE22	B	117	72	86	37	148	112	84	90	45	M6	135
HE22	C	127	72	86	37	148	112	84	90	45	M6	135
HE22	D	127	72	86	37	148	112	84	90	45	M6	135
HE22P	C	127	72	86	37	148	112	84	90	45	M6	135
HE22P	D	127	72	86	37	148	112	84	90	45	M6	135

Compatible shaft extension					
D	E	EY	EX	F	GA
14h7	30	25	2	5	16

E2 - HE selection

E2.10 - HE 25 DIMENSION
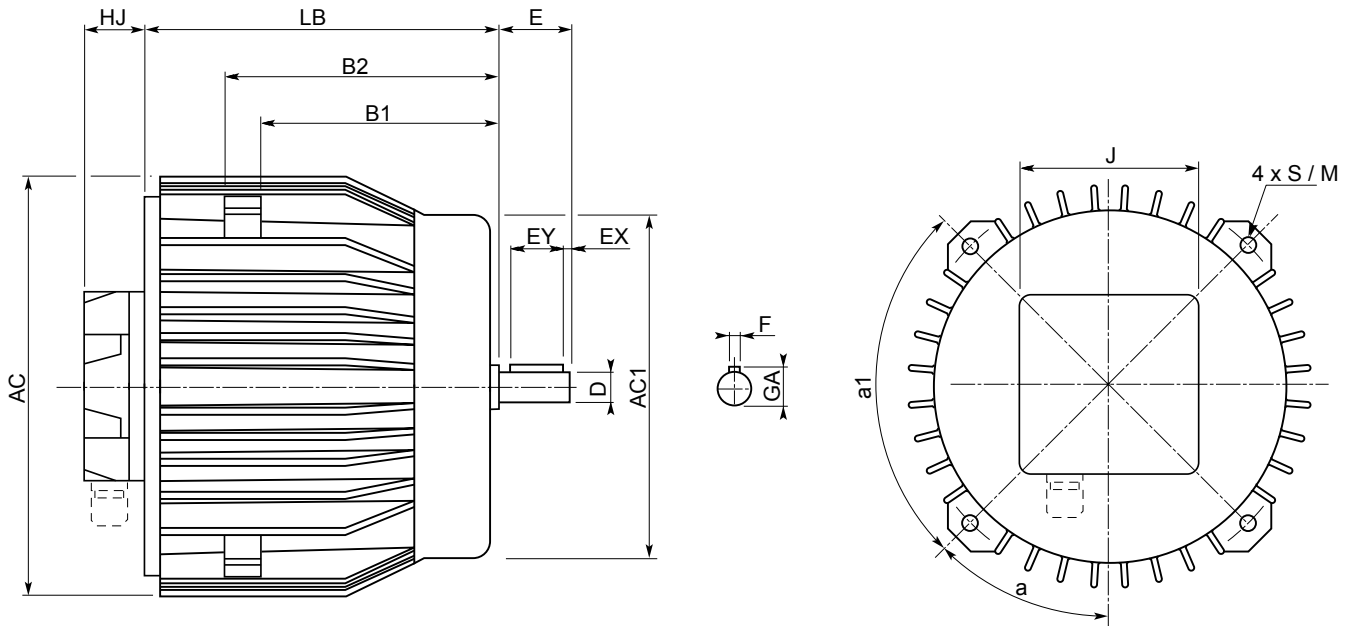
Type	Code	Main dimensions										
		LB	B1	B2	HJ	AC	AC1	J	a	a1	S	M
HE25	D	138	86	103	37	154	128	84	45	90	M8	154
HE25	F	138	86	103	37	154	128	84	45	90	M8	154
HE25	H	173	86	103	37	154	128	84	45	90	M8	154
HE25	M	173	86	103	37	154	128	84	45	90	M8	154
HE25P	D	138	86	103	37	154	128	84	45	90	M8	154
HE25P	F	138	86	103	37	154	128	84	45	90	M8	154
HE25P	H	173	86	103	37	154	128	84	45	90	M8	154
HE25P	M	173	86	103	37	154	128	84	45	90	M8	154

Compatible shaft extension					
D	E	EY	EX	F	GA
14h7	30	25	2	5	16

E2.11 - HE 29 DIMENSION
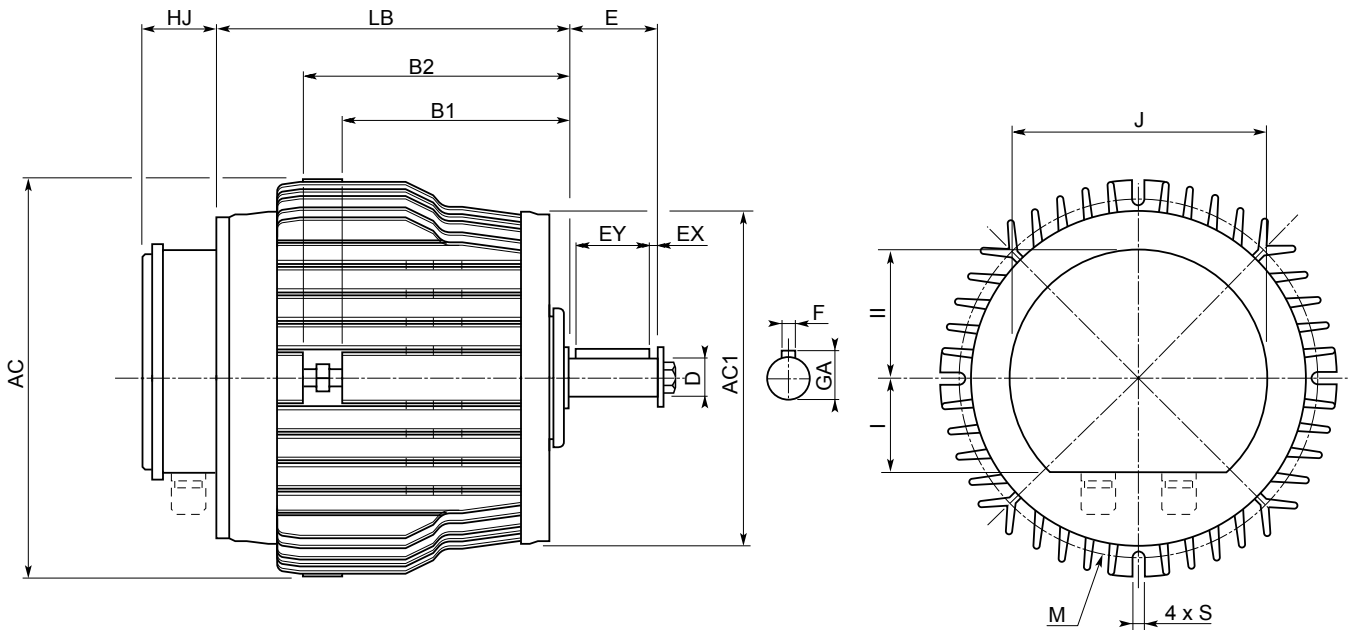
Type	Code	Main dimensions										
		LB	B1	B2	HJ	AC	AC1	J	I	II	S	M
HE29	G	181	118.5	145.5	47	196	158	120	49	58	10.5	176
HE29	L	181	118.5	145.5	47	196	158	120	49	58	10.5	176
HE29	R	206	118.5	145.5	47	196	158	120	49	58	10.5	176
HE29G	G	181	118.5	145.5	47	196	158	120	49	58	10.5	176
HE29G	L	181	118.5	145.5	47	196	158	120	49	58	10.5	176
HE29G	R	206	118.5	145.5	47	196	158	120	49	58	10.5	176

Compatible shaft extension					
D	E	EY	EX	F	GA
19h7	35	25	2	6	21.5
24h7	50	40	6	8	27

F1 - Identification

Single-phase motor

LEROY SOMER	1 ~ HE 25P	CE
	N° 123456 2006	
cl.F	60°C amb cp:	16/400 µF/ V
S1 c:h	IP kg cd:	µF/ V

V	Hz	min-1	kW	Cos φ	A
230	50	925	0,2	0,75	2,00

Three-phase motor

LEROY SOMER	1 ~ HE 25P	CE
	N° 123456 2006	
cl.F IP	kg 60°C amb	S1 c:h

V	Hz	min-1	kW	Cos φ	A
Δ400	50	900	1,10	0,65	3,50
Y400	50	700	0,45	0,82	2,00
Δ230	50	700	0,45	0,82	3,50

1~/3~:	Number of phases
HE/CM:	Series
25/29: Size	
P/G:	Type of operation
N° 123456:	Serial number
2006:	Year of manufacture
cl. F:	Insulation class
60°C amb:	Maximum operating temperature
S1-…%:	Duty - Duty (operating) factor
c/h:	Number of cycles per hour
IP:	Degree of protection
kg:	Motor weight
cp:	Permanent capacitor value
V:	Supply voltage

Hz:	Supply frequency
Min^{-1}:	Revolutions per minute (rpm)
kW:	Rated output power
Cos φ:	Power factor
A:	Rated current
Δ:	Delta connection
Y:	Star connection

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

F

F2 - Packaging weights and dimensions

F2.1 - OVERLAND TRANSPORT

Motor type	Number of motors in each layer	Maximum number of layers	Maximum number of motors	Tare (kg)	Max. dimensions L x W x H
			Full pallet		
CF22	15	2	30	33	1200 x 800 x 702
HE22	30	3	90	35	1200 x 800 x 930
HE25	20	3	60	35	1200 x 800 x 930
Short CM29	15	3	45	66	1200 x 800 x 1120
Long CM29	15	2	30	69	1200 x 800 x 1120
HE29	15	3	45	66	1200 x 800 x 1120
CF32	15	2	30	66	1200 x 800 x 1120
CM34	9	3	27	-	1200 x 800 x 1120

F2.2 - SEA TRANSPORT

Motor type	Number of motors in each layer	Maximum number of layers	Maximum number of motors	Tare (kg)	Max. dimensions L x W x H
			Full pallet		
CF22	15	2	30	33	1200 x 800 x 702
HE22	30	3	90	35	1200 x 800 x 930
HE25	20	3	60	35	1200 x 800 x 930
Short CM29	15	3	45	66	1200 x 800 x 1120
Long CM29	15	2	30	69	1200 x 800 x 1120
HE29	15	3	45	66	1200 x 800 x 1120
CF32	15	2	30	66	1200 x 800 x 1120
CM34	9	3	27	-	1200 x 800 x 1120

F

Fan motors
CF-CM-HE

LEROY SOMER

Fan motors
CF-CM-HE

Fan motors
CF-CM-HE

I - SCOPE OF APPLICATION

These General Conditions of Sale («GCS») shall apply to the sale of all products, components, software and services (referred to as «Products») proposed or sold by the Seller to the Client. Said GCS shall also apply to all quotation or offers made by the Seller, and are an integral part all orders. «Seller» is understood to mean all companies directly or indirectly controlled by LEROY-SOMER. As a complementary measure, orders are also subject to the latest version in force of the Inter-Union General Conditions of Sale for France of the F.I.E.E.C. (*Fédération des Industries Electriques, Electroniques et de Communication* [Federation of Electrical, Electronic and Communication Industries]), inasmuch as they are not contrary to the GCS.

The acceptance of the Seller's offers or quotations, or any order, entails the acceptance without reservation of these GCS and rules out all contrary provisions shown on all other documents and, in particular, on the Client's order forms and the Client's General Conditions of Purchase.

If the sale concerns castings, by way of derogation to Paragraph 1 above, said castings shall be subject to the latest version in force of the *Conditions Générales Contractuelles des Fonderies Européennes* [General Contractual Conditions of European Foundries].

The Products and services sold pursuant to these GCS may under no circumstances be used for applications in the nuclear field, as such sales expressly fall under technical specifications and specific contracts that the Seller reserves the right to refuse.

II - ORDERS

All orders, even those taken by the Seller's agents and representatives, and regardless of the transmission method, shall only bind the Seller after written acceptance thereby of the order.

The Seller reserves the option of modifying the characteristics of its Products without notice. However, the Client shall retain the possibility of specifying the characteristics on which its commitment is contingent. In the absence of any such express stipulation, the Client may not refuse delivery of new, modified Products.

The Seller may not be held liable for an unsatisfactory selection of Products if said selection results from conditions of use that are incomplete and/or mistaken, or not disclosed to the Seller by the Client.

Except in the event of a stipulation to the contrary, the offers and quotations remitted by the Seller shall only be valid for thirty days as from the date on which they are drawn up.

Where the Products must comply with standards, specific regulations and/or be received by control and inspection agencies, the price request must be accompanied by the technical specification, all terms and conditions the Seller must comply with. Reference shall be made thereto on the quotation or offer. Approval and attendance costs shall always be borne by the Client.

III - PRICES

Tariffs are expressed exclusive of tax and may be revised without notice.

Prices are either deemed to be firm for the period of validity specified on the quotation, or subject to a revision formula attached to the offer and which specifies, according to the regulations, parameters pertaining to the materials, products, various services and salaries for which the indices are published in the B.O.C.C.R.F. (Bulletin Officiel de la Concurrence, de la Consommation et de la Répression des Fraudes [French Official Journal of Competition and Consumer Matters, and Anti-Fraud Measures]).

All additional costs, in particular approval costs, specific checks, etc., shall be invoiced in addition.

IV - DELIVERY

Sales are governed by the latest edition in force of the INCOTERMS published by the Internal Chamber of Commerce («I.C.C. INCOTERMS»).

The Products shall be dispatched according to the conditions stated on the order acknowledgement issued by the Seller for all orders of Products.

Except in the event of specific provisions, the prices correspond to Products that are made available in the Seller's factories, including basic packaging.

Except in the event of a provision to the contrary, the Products shall always be transported at the risk of the addressee. In all cases, it shall be the responsibility of the addressee to make any claims to the carrier, within the delivery time and in the forms specified by law, concerning the state or number of parcels received, and to concomitantly provide the Seller with a copy of such declaration. Failure to comply with said procedure shall exempt the Seller from any liability. In any event, the Seller's liability may not exceed the amount of the indemnities received from its insurers.

If the provisions concerning transportation are amended by the Client subsequent to the acceptance of the order, the Seller reserves the right to invoice any supplemental costs that may result therefrom.

Except in the event of a contractual or statutory obligation to the contrary, packaging shall not be returnable.

In the event that a delivery of Products is delayed for a reason not attributable to the Seller, the Products stored on the Seller's premises shall be insured at the exclusive risk of the Client. Consideration for storage, costs will be invoiced at a rate of 1% (*one per cent*) of the total amount of the order, per week or partial week of storage, with no deductible or de minimis amount, as from the date of Products availability provided for in the contract. Upon expiration of a period of thirty days as from said date, the Seller may, at its discretion, either freely dispose of the Products and/or agree with the Client on a new delivery date for said Products, or invoice the Client in full for payment, according to the timeframes and amount provided for contractually. In any event, down payments shall inure to the Seller as indemnities, without prejudice to any other action the Seller may take.

V - DELIVERY TIME

The Seller shall only be bound by the delivery time mentioned on its order acknowledgement. Said delivery time shall only start to run as from the date of issuance of the order acknowledgement by the Seller, and subject to the fulfilment of the conditions provided for on the confirmation receipt, in particular receipt of the down payment for the order, notification of the opening of an operative irrevocable and confirmed documentary credit that complies in all respects to the Seller's request (*in particular regarding the amount , currency, validity and licence*), acceptance of the payment conditions accompanied by the implementation of any guarantees requested, etc.

Exceeding delivery time shall not grant the Client entitlement to damages and/or penalties.

Except in the event of a specific condition to the contrary, the Seller reserves the right to make partial deliveries.

Delivery times shall be interrupted by right and without the need for any judicial formalities, by any failure to pay or late payment by the Client.

VI - TESTS - QUALIFICATION

The Products manufactured by the Seller are checked and tested before leaving its factories. Clients may be present at said tests if specified on the order.

Specific tests and/or trials, as well as approval of Products, requested by the Client, whether carried out on the Client's premises or in the Seller's factories, on site, or by control and inspection agencies, must be specified on the order and are always at Client's expense.

Prototypes for Products specially developed or adapted for a Client must be qualified by the Client before serial production in order to ensure that it is compatible with the other components that make up its equipment, and that it is adapted to the intended use. Said qualification will also enable the Client to ensure that the Products comply with the technical specification. In this respect, the Client and Seller shall sign a Product Approval Form in two original, one of which shall be retained by the Client and one by the Seller.

In the event that the Client requires delivery without having firstly qualified the Products, said Products shall be delivered as they stand and shall always be deemed to be prototypes ; the Client shall then be solely liable for using the Products or delivering them to its own clients. However, the Seller may also decide not to deliver the Products that have not received the Client's prior approval.

VII - PAYMENT CONDITIONS

All sales shall be deemed to be completed and payable at the Seller's registered office, without any possible derogation, regardless of the payment method, where the contract was concluded and where delivery was made.

Where the Client is located out of French territory, invoices shall be payable in cash upon receipt, or by a bank draft or a bill of exchange, within 30 (thirty) days net.

All early payment compared to the deadline fixed shall give right to a discount of 0.2% (*nought point two per cent*) per month, of the amount concerned of the invoice.

Except in the event of provisions to the contrary, where the Client is located outside of French Territory, invoices shall be payable in cash against remittance of shipping documents, or by irrevocable documentary credit confirmed by a first rate French bank, at Client's expense.

Payment shall be understood to mean the funds being made available on the Seller's bank account and must imperatively be made in the invoicing currency.

Pursuant to French Law no. 2008-776 of 4 August 2008, failure to pay an invoice when due shall trigger, after service of formal notice that has remained without effect, payment to the Seller of a flat-rate penalty on the due date of the receivable, which shall be applied to amount inclusive of tax of monies owed if the invoice is liable to VAT (*Value Added Tax*), and the suspension of pending orders. Said penalty is equal to the European Central Bank interest rate on the main refinancing operations + 10 basis points.

The collection of said monies via litigation shall trigger an increase of 15% (*fifteen per cent*) of the amount claimed, with a minimum of Euros 500 exclusive of tax (*five hundred euros exclusive of tax*), with tax in addition if due.

Moreover, subject to compliance with the statutory provisions in force, in the event of total or partial failure to pay any invoice or instalment whatsoever, regardless of the payment method used, all amounts that remain owed to the Seller (*including its subsidiaries, affiliated or allied companies, whether French or foreign*) for all deliveries and services, regardless of the due date originally provided for, shall immediately become due.

Notwithstanding any specific payment conditions provided for between the parties, the Seller reserves the right to require, in the event of a decline in the Client's credit rating, a payment incident or bankruptcy of the Client :
- the payment in cash, before the Products leave the factory, for all orders currently being fulfilled,
- down payments to be made on all orders,
- alternative or different payment guarantees.

VIII - PAYABLE AND RECEIVABLE BALANCE

Except where prohibited by law, the Seller and the Client expressly agree to balance their payables and receivables arising from their trade relations, even if all conditions defined by law for legal balancing are not met.

For the application of said clause, the Seller shall mean any company of the LEROY-SOMER Group.

IX - TRANSFER OF RISK / RESERVE OF TITLE

Risk shall be transferred as soon as the Products are made available, according to the delivery conditions stipulated on the order acknowledgement.

The transfer to the Client of title shall take place after payment in full. In the event that the restitution of the Products delivered is claimed by the Seller, the Seller is entitled to retain any down payment as compensation.

Remittance of a bill that creates an obligation to pay (*bill of exchange or other*) shall not constitute payment and discharge.

For as long as the price has not been paid in full, the Client is required to inform the Seller, within twenty-four hours, of the sequestration, requisition or confiscation of the Products for the benefit of a third party, and to take all protective measures to make known the Seller's property right in the event of action by creditors, and to cause such right to be respected.

X - CONFIDENTIALITY

Each of the parties undertakes to maintain the confidentiality of all technical, trade, financial or other information received from the other party, whether orally, in writing or by any other means of communication, when any order is negotiated and/or fulfilled.

This confidentiality obligation shall apply throughout the period during which the order is fulfilled and for 5 (five) years subsequent to completion or cancellation thereof, regardless of the reasons therefor.

XI - INDUSTRIAL AND INTELLECTUAL PROPERTY

Data, studies, results, information or software, whether patentable or not obtained by the Seller when any order is fulfilled shall remain the exclusive property of the Seller.

With the exception of instruction and maintenance manuals, documents of any nature remitted to the Client shall remain the exclusive property of the Seller and must be returned to it upon request, even if the Client was invoiced for part of the cost of the study, and said documents may not be disclosed to third parties or used without the Seller's prior written agreement.

XII - CANCELLATION / TERMINATION

The Seller reserves the right to cancel or terminate immediately, at the Seller's discretion, by right and without the need for any judicial formalities, the contract in the event of failure to pay any portion whatsoever of the price, when due, or in the event of any breach of any of the Client's contractual obligations. Down payments and any amount already paid shall remain in Seller's hands in the form of indemnities, without prejudice to the Seller's right to claim damages. In the event that the contract is cancelled, the Products must be returned to the Seller immediately, regardless of where the Products are located, at Client's expense and risk, under penalty of 10% (*ten per cent*) of the value thereof, per week's delay.

XIII - WARRANTY

The Seller warrants the Products against all operating defects caused by a material or manufacturing fault, for a period of twelve months as from the date on which the Products are made available, unless a different statutory provision subsequently applies, under the conditions defined below.

The warranty may only be triggered insofar as the Products have been stored, used and maintained in accordance with the Seller's instructions and manuals. The warranty does not apply where the defect results, in particular, from :
- inadequate monitoring, maintenance or storage,
- normal wear and tear on the Products,
- servicing or modification of the Products without the Seller's prior written authorisation,
- abnormal use of the Products or use of the Products for a purpose other than that intended,
- faulty installation of the Products on the premises of the Client and/or the end user,
- failure by the Client to disclose the purpose or conditions of use of the Products,
- failure to use genuine spare parts,
- force majeure or any event that is beyond the control of the Seller.

In any case, the warranty is limited to the replacement or repair of the parts or Products deemed faulty by the Seller's technical departments. If the repair is entrusted to a third party, the repair shall only be carried out once the Seller has agreed to the quotation for the repair.

All Products returns must have been given the Seller's prior, written authorisation.

The Products to be repaired must be dispatched carriage paid, to the address given by the Seller. If the Products are not accepted under warranty, their return to the Client shall be invoiced to the Client or the end user.

This warranty shall apply to the Seller's Products that are made readily available and therefore does not cover the de-installation and re-installation of said Products in the equipment into which it is mounted.

Repair, modification or replacement of any part or Product during the warranty period may not result in the warranty period being extended.

The provisions of this article constitute the Seller's sole obligation concerning the warranty of the Products delivered.

XIV - LIABILITY

The Seller's liability is strictly limited to the obligations stipulated in these GCS and those expressly accepted by the Seller. All penalties and indemnities provided for therein constitute lump sum damages that include discharge for the Seller and are exclusive of any other penalty or indemnification.

With the exception of the Seller's gross negligence and the compensation of bodily injury, the Seller's liability shall be limited, in total, to the contractual amount, exclusive of tax, of the Product(s) that give(s) right to compensation.

The Seller may under no circumstances be required to indemnify consequential, indirect and / or punitive damages that the Client may use as the basis for a claim; as a result, the Seller may not be required to indemnify, in particular, production losses, operating losses or lost profit or, in general, any damage eligible for indemnification other than bodily injury or damage to property.

The Client undertakes to hold harmless the Seller and / or its insurers from any and all claims made by its insurers and/or any third party in a contractual relation with the Client, in excess of the limit and for the exclusions listed above.

XV - SPARE PARTS AND ACCESSORIES

Spare parts and accessories shall be supplied upon request, to the extent of their availability. Associated costs shall be invoiced in addition. The Seller reserves the right to require a minimum quantity or invoicing amount per order.

XVI - WASTE MANAGEMENT

The Products that form the purpose of the sale does not fall within the scope of the European Directive 2002/96/EC (WEEE) dated January 27th, 2003, and all related legislation of Member States of the European Union that result therefrom, on the composition of electrical and electronic equipment and the disposal of waste from such equipment.

In accordance with Article L 541-2 of the French Environment Code, it is the responsibility of the waste holder to ensure the disposal thereof or to cause the disposal thereof at its own expense.

XVII - FORCE MAJEURE

With the exception of the Client's obligation to pay the monies owed to the Seller in respect of an order, the Client and Seller may not be held liable for the total or partial failure to perform their contractual obligations if such failure results from the occurrence of a force majeure. Delays or disturbances in production that totally or partially result from war (whether declared or not), terrorist act, strikes, riots, accidents, fires, floods, natural disasters, transportation delays, shortage of components or materials, governmental decision or action (including prohibition on import/export or the withdrawal of an import/export licence) shall, in particular, be deemed a force majeure.

If one of the parties is delayed or prevented from performing its obligations by reason of this Article for a period in excess of 180 consecutive days, each party may then terminate, by right and without any need for judicial formalities, the unperformed part of the order, by written notice to the other party, without liability. However, the Client shall be required to pay the price agreed pertaining to the Products already delivered on the date of termination.

XVIII - PROHIBITION ON UNLAWFUL PAYMENTS

The Client shall refrain from being engaged in any activity that would expose the Seller or any of its affiliates to a risk of penalties under laws and regulations of any relevant jurisdiction prohibiting improper payments, including but not limited to bribes or gifts of an obviously unreasonable amount, to any government or agency officials, to political parties or their officials or candidates for public office, or to any employee of any customer or supplier.

XIX - TRADE COMPLIANCE LAWS

The Client agrees that all applicable import, export control and sanctions laws, regulations, orders and requirements, as they may be amended from time to time, including without limitation those of the European Union, the United States of America, and the jurisdictions in which the Seller and the Client are established or from which Products may be supplied, and the requirements of any licences, authorisations, general licences or licence exceptions relating thereto ("Trade Compliance Laws") will apply to its receipt and use of Products, as well as related services and technology. In no event shall the Client use, transfer, release, export or re-export the Products, related services or technology in violation of Trade Compliance Laws.

Seller shall have no obligation to supply any Products, or services unless and until it has received any necessary licences or authorisations or has qualified for general licences or licence exceptions under Trade Compliance Laws.

If for any reason any such licences, authorisations or approvals are denied or revoked, or if there is a change in any Trade Compliance Laws that would prohibit Seller from fulfilling the contract, or would in the reasonable judgement of Seller otherwise expose Seller and/or Seller's Affiliate(s) to a risk of liability under Trade Compliance Laws, Seller shall be relieved without liability of all obligations under the contract.

XX - SEVERABILITY

All clauses and/or provisions of these General Conditions that are deemed or become null or void shall not cause the nullity or voidance of the contract, but solely the clause and/or provision concerned.

XXI - DISPUTES

THIS CONTRACT SHALL BE GOVERNED BY AND INTERPRETED IN ACCORDANCE WITH THE LAWS OF FRANCE.
ANY DISPUTE IN RELATION TO THE INTERPRETATION OR THE EXECUTION OF THIS CONTRACT NOT AMICABLY SETTLED BETWEEN THE PARTIES WITHIN A 30 DAY PERIOD, SHALL BE SETTLED BY THE COMPETENT COURT OF ANGOULÊME (FRANCE), EVEN IN THE CASE OF INTRODUCTION OF THIRD PARTIES OR THE ENVOLVEMENT OF SEVERAL DEFENDANTS. HOWEVER, THE SUPPLIER RESERVES THE EXCLUSIVE RIGHT TO BRING THE DISPUTE TO THE COMPETENT COURTS OF THE SELLER OR THE CLIENT.

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