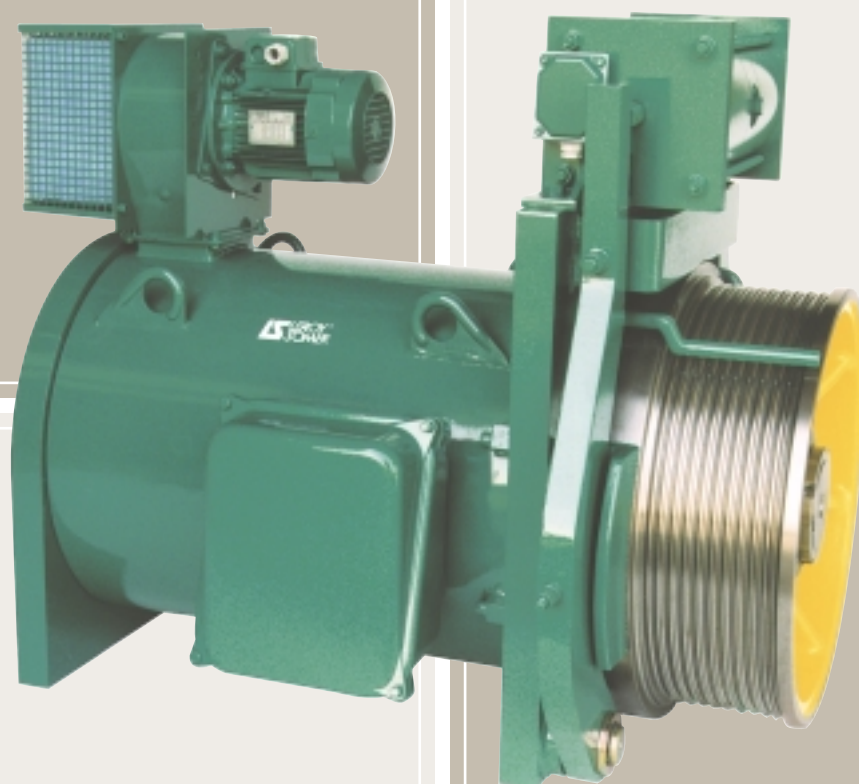




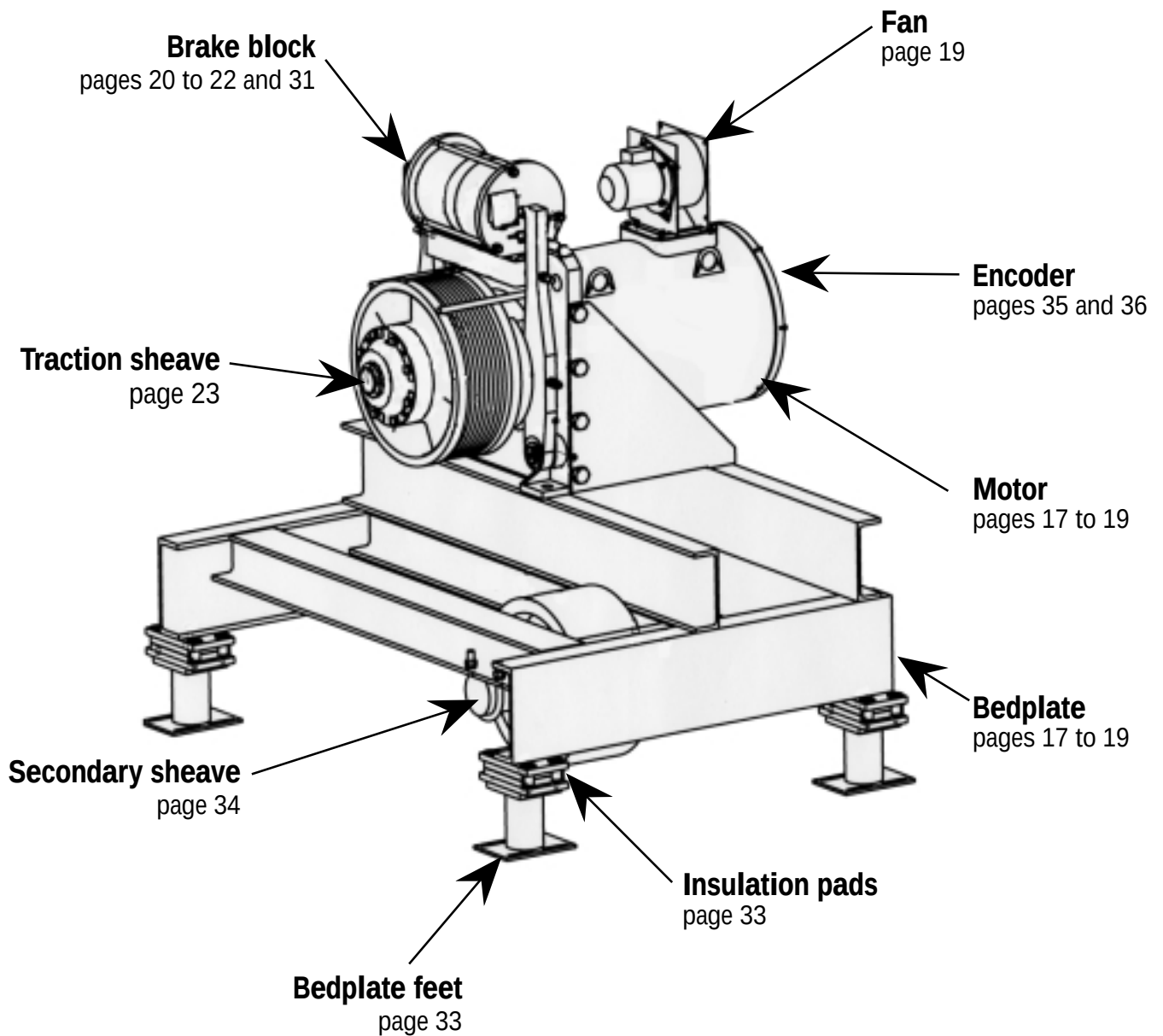
GEARLESS

A.C. drive for lifts

GEARLESS A.C. motors Contents

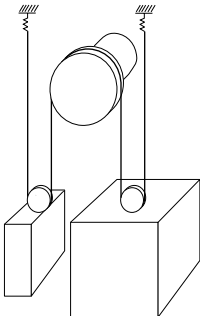
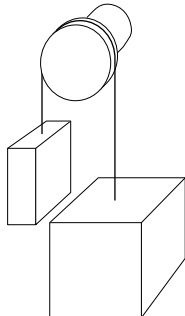
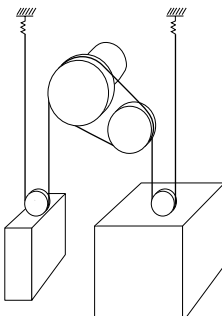
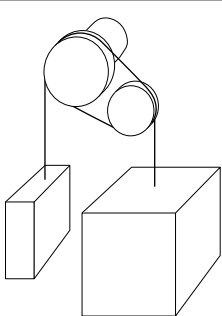
	PAGES		PAGES
GENERAL INFORMATION		TRACTION SHEAVE	
Quality assurance	6	Characteristics	23
Standards and approvals	7		
Interference suppression	9	DIMENSIONS	
Power - Torque - Efficiency - Power Factor	10	Type X2 - X3	24
Electrical formulae	10	Type X5	25
Unit conversions	11	Type X8	26
Units and standard formulae	11	Type X13A	27
		Type X20	28
ENVIRONMENT		Type X30	29
Environmental constraints	14	Type X36	30
CONSTRUCTION		OPTIONAL FEATURES	
Mounting arrangements and components	16	Accessories	31
		Bedplate	32
MACHINE CHARACTERISTICS		Characteristics of secondary sheave	34
General characteristics	17	Incremental encoder	35
Cooling	17	SinCos encoder	36
ELECTRICAL CHARACTERISTICS		QUESTIONNAIRE (metric)	37
Motor power supply and electrical connection	18		
BRAKES			
Holding brake	20		
Electrical brake characteristics	21		
Recommended wiring diagram	22		
Braking sequences	22		

GEARLESS A.C. motors



GEARLESS A.C. motors

Machine quick selection table

LIFTS	LIFT CAR LOAD						
	450-650 kg	1 000 kg	1 200 kg	1 600 kg	2000 kg	2 500 kg	> 2 500 kg
	X2 - X3						
							
							
							

CAUTION : Selection of a machine should always be confirmed by calculating its characteristics.

GEARLESS A.C. motors General information

Quality Assurance

Industrial concerns are having to cope with an ever more competitive environment. Productivity depends to a considerable degree on the right investment at the right time.

LEROY-SOMER has the answer, building motors to precise standards of quality.

When carrying out quality checks on a machine's performance, the first step is to **measure the level of customer satisfaction**.

Careful study of this information tells us which points need looking at, improving and monitoring.

From the moment you place your order with our administrative staff until the motor is up and running (after design studies, launch and production activities) we keep you informed and involved.

Our own procedures are constantly under review, using both "hoshin" production improvement programmes and improved engineering techniques.

All our staff are involved in both operational process analysis and continuous training programmes. These initiatives help them serve you better, and increased skills bring increased motivation.

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

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

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

All activities resulting in the final version of the machine have therefore received official ISO 9001 accreditation. Products are also approved by official bodies who inspect their technical performance with regard to the various standards.

This is a fundamental requirement for a company of international standing.



ATTESTATION



GEARLESS A.C. motors General information

Standards and approvals

ORGANIZATION OF STANDARDS AUTHORITIES

International bodies:

Worldwide 	General standardization ISO International Standards Organization TC Technical Committees SC Sub-committees WG Working Groups	Electronics and Electrotechnical Certification IEC International Electrotechnical Commission TC Technical Committees SC Sub-committees WG Working Groups
Europe 	ECS / CEN European Committee for Standardization ECISS European Committee for Iron and Steel Standards 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 (ex-USSR)	GOST	Gosudarstvenno Komitet Standartov
DENMARK	DS	Dansk Standardiseringsraad
FINLAND	SFS	Suomen Standardisoimisliitto
FRANCE	AFNOR including UTE	Association Française de Normalisation including: Union Technique de l'Electricite
GERMANY	DIN / VDE	Verband Deutscher Elektrotechniker
ITALY	CEI	Comitato Electrotechnico Italiano
JAPAN	JIS	Japanese Industrial Standard
NETHERLANDS	NNI	Nederlands Normalisatie - Instituut
NORWAY	NFS	Norges Standardiseringsforbund
SAUDI ARABIA	SASO	Saudi Arabian Standards Organization
SPAIN	UNE	Una Norma Española
SWEDEN	SIS	Standardiseringskommissionen i Sverige
SWITZERLAND	SEV or ASE	Schweizerischer Elektrotechnischer Verein
UNITED KINGDOM	BSI	British Standards Institute
USA	ANSI including NEMA	American National Standards Institute including: National Electrical Manufacturers

GEARLESS A.C. motors General information

Approvals:

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

Certification of LEROY-SOMER GEARLESS motors:

Country	Initials	Certification No.	Application
USA	CSA	LR 57 008 - 26	Gearless
EUROPE	CE	Self-certification	Electric motors

List of standards quoted in this document

Reference	Date	International standards
IEC/EN 60 034-1	1996	Electrical rotating machines: ratings and operating characteristics
IEC/EN 60 034-5	1991	Electrical rotating machines: classification of degrees of protection provided by casings
IEC/EN 60 034-6	1991	Electrical rotating machines (except traction): cooling methods
IEC/EN 60 034-7	1995	Electrical rotating machines (except traction): symbols for mounting positions and assembly layout
IEC/EN 60 034-9	1995	Electrical rotating machines: noise limits
IEC/EN 60 034-12	1996	Starting characteristics for single-speed 3-phase cage induction motors for supply voltages less than or equal to 660 V.
IEC/EN 60 034-14	1996	Electrical rotating machines: mechanical vibrations of certain machines with a frame size of 56 mm or over. Measurement, evaluation and limits of vibrational intensity
IEC 60 085	1984	Evaluation and thermal classification of electrical insulation
IEC/EN 60 529	1989	Degrees of protection provided by enclosures
IEC/EN 60 034-17	1998	Cage induction motors supplied by an inverter.
European Directive 89-336 modified by Directives 92-31 & 93-68	1990	Electromagnetic compatibility (EMC): environment
EN 50102	1998	Degree of protection provided by the electrical housing against extreme mechanical impacts
EN 81-1	1998	Safety regulations for lift construction and installation
ASME A17.1 (USA)	1993	Safety code for elevators and escalators

GEARLESS A.C. motors General information

Interference suppression

Airborne interference

Emission

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

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

Immunity

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

Power supply interference

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

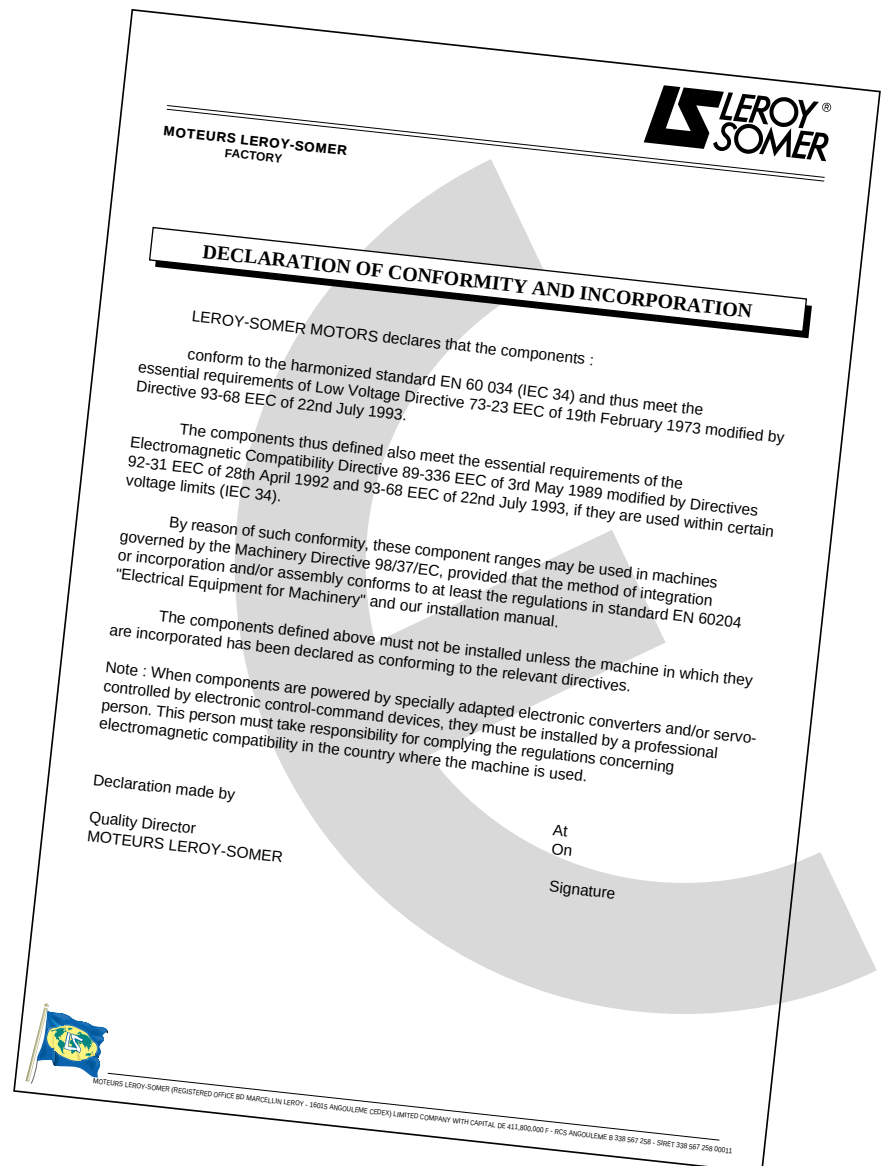
Standard IEC 1000, currently in preparation, will define permissible rejection and immunity rates. Only then will machines for general distribution (especially single-phase and commutator motors) have to be fitted with suppression systems.

Brushless 3-phase A.C. machines do not in themselves produce interference of this type. Mains connection equipment (contactor) may, however, need interference protection.

Application of Directive 89-336 modified by Directives 92-31 and 93-68 concerning electromagnetic compatibility (EMC) and concerning motors supplied by inverters (at fixed or variable fundamental frequency): in this case, the motor is only a sub-assembly of a device which the system builder must ensure conforms to the essential requirements of the EMC directives.

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

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



CE product marking

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

GEARLESS A.C. motors General information

Power - Torque - Efficiency - Power Factor

DEFINITIONS

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

$$P_u = M \cdot \omega$$

where P_u is in W, M is in N.m, ω is in rad/s and where ω is expressed as a function of the speed of rotation N in min^{-1} by the equation:

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

The active power (P) drawn from the mains supply is expressed as a function of the apparent power (S) and the reactive power (Q) by the equation:

$$S = \sqrt{P^2 + Q^2}$$

(S in VA, P in W and Q in VAR)

The power P is related to the output power P_u by the equation:

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

where η is the efficiency of the machine.

The output power P_u on the motor shaft is expressed as a function of the voltage phase-to-phase mains voltage (U), of the line current absorbed (I in amps) by the equation:

$$P_u = U \cdot I \cdot \sqrt{3} \cdot \cos \varphi \cdot \eta$$

where $\cos \varphi$ is the power factor found from the ratio:

$$\cos \varphi = \frac{P}{S}$$

Electrical formulae

Title	Formulae	Units	Definitions / Notes
Accelerating torque	$M_a = \frac{M_D + 2 M_A + 2 M_M + M_N}{6} - M_r$ General formula: $M_a = \frac{1}{N_N} \int_0^{N_N} (M_{mot} - M_r) dN$	Nm	Moment of acceleration M_a is the difference between the motor torque (estimated) and the resistive torque of the load M_r (M_D, M_A, M_M, M_N, see curve below) N = instantaneous speed N_N = rated speed
Power required by machine	$P = \frac{M \cdot \omega}{\eta_A}$	P in W M in Nm ω in rad/s η_A no unit	η_A expresses the efficiency of the driven machine. M is the torque required by the driven machine.
Power drawn by the three-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 phase to phase 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	$Q = \sqrt{3} \cdot U^2 \cdot C \cdot \omega$	C capacitance in μf ω angular velocity of supply phases	
Apparent power	$S = \sqrt{3} \cdot U \cdot I$ $S = \sqrt{P^2 + Q^2}$	S in VA	
Power supplied by three-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	$g = \frac{N_s - N}{N_s}$		Slip is the difference between the actual motor speed N and the synchronous speed N_s .
Synchronous speed	$N_s = \frac{120 \cdot f}{p}$	N_s in min^{-1} f in Hz	p = number of poles. f = frequency of the power supply

GEARLESS A.C. motors General information

Unit conversions

Units	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
Mass	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 = 6.45210 ⁴ line / in ²	1 line / in ² = 1.55010 ⁻⁵ Wb / m ²
Magnetic losses	1 W / kg = 0.4536 W / lb	1 W / lb = 2.204 W / kg

Units of measurement and standard formulae

NOISE AND VIBRATION

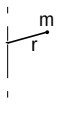
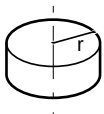
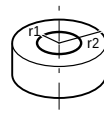
Quantity				Unites		Units and expressions not recommended
Name	French name	Symbol	Definition	SI	Non SI, but accepted	Conversion
Sound power level	Niveau de puissance acoustique	L_w	$L_w = 10 \lg (P/P_0)$ ($P_0 = 10^{-12} \text{ W}$)	dB (decibel)		$\lg$ logarithm to base 10 $\lg 10 = 1$
Sound pressure level	Niveau de pression acoustique	L_p	$L_p = 20 \lg (P/P_0)$ ($P_0 = 2 \times 10^{-5} \text{ Pa}$)	dB		

DIMENSIONS

Quantity				Unit		Units and expressions not recommended
Name	French name	Symbol	Definition	SI	Non SI, but accepted	Conversion
Angle (plane angle)	Angle (angle plan)	$\alpha, \beta, T, \varphi$		rad	degree: ° minute: ' second: ''	180°: π rad ≈ 3.14 rad
Length	Longueur	l		m (metre)	micrometre	cm, dm, dam, hm
Width	Largeur	b				1 inch = 1" = 25.4 mm
Height	Hauteur	h				1 foot = 1' = 304.8 mm
Radius	Rayon	r				μm
	Longueur curviligne	s				micron μ angström: Å = 0.10 nm
Area	Aire, superficie	A, S		m ²		1 square inch = 6.45 10 ⁻⁴ m ²
Volume	Volume	V		m ³	litre: l liter: L	UK gallon = 4.546 10 ⁻³ m ³ US gallon = 3.785 10 ⁻³ m ³

GEARLESS A.C. motors General information

MECHANICAL FORMULAE

Title	Formulae	Units	Definitions / Notes
Force	$F = m \cdot \gamma$	F in N m in kg γ in m/s ²	A force F is the product of a mass m multiplied by an acceleration γ
Weight	$G = m \cdot g$	G in N m in kg $g = 9.81$ m/s ²	
Moment	$M = F \cdot r$	M in Nm 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 of the point of application of F in relation to the axis.
Power - Rotation	$P = M \cdot \omega$	P in W M in Nm 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	$t = J \cdot \frac{\omega}{M_a}$	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 ω' are corrected to speed ω by the following calculation: $J_{\omega} = J_{\omega'} \cdot \left(\frac{\omega'}{\omega}\right)^2$
Moment of inertia Centre of gravity	$J = m \cdot r^2$	J in kg.m ² m in kg r in m	
Solid cylinder	$J = m \cdot \frac{r^2}{2}$		
Hollow cylinder	$J = m \cdot \frac{r_1^2 + r_2^2}{2}$		
Inertia of a mass in linear motion	$J = m \cdot \left(\frac{V}{\omega}\right)^2$	J in kg.m ² m in kg v in m/s ω in rad/s	The moment of inertia of a mass in linear motion transformed to a rotating motion.

GEARLESS A.C. motors Notes

GEARLESS A.C. motors Environment

Environment

NORMAL OPERATING CONDITIONS

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

- ambient temperature of between + 5 and + 40 °C,
- altitude of less than 1000 m,
- atmospheric pressure: 1050 m bar,
- operating zone 2 (absolute humidity of between 5 and 23 g/m³: see chart on next page),
- chemically neutral and dust-free atmosphere.

DERATING FACTORS

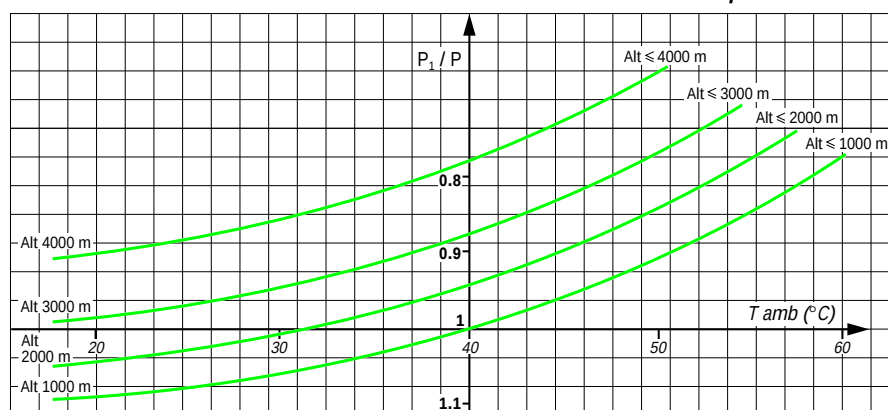
For operating conditions different to those listed above, apply the power correction coefficient shown in the chart on the right which retains the thermal reserve.

The ratio P_1 / P gives the correction coefficient.

P_1 : corrected power

P : catalogue power

▼ Correction coefficients as a function of the attitude and ambient temperature



RELATIVE AND ABSOLUTE HUMIDITY

It is vital to take account of climatic conditions during operation. The humidity contained in the atmosphere and the ambient temperature require different types of construction.

LEROY-SOMER has established procedures for manufacturing machines according to the different parameters. To simplify your selection and be sure of acquiring a machine that conforms to your environment, you will find hereafter all the information you need to determine the zone for your machine.

Definitions:

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

When the pressure of the water vapour contained in the atmosphere equals the maximum pressure (increasing as a function of the temperature) of the water vapour at ambient temperature, saturation occurs.

Absolute humidity (in g/m³):
weight of water vapour contained in the air.

Relative humidity (%):
relationship between the weight of water vapour in a given volume of air and that which the same volume would contain, at the same temperature and pressure, if it were saturated. This is sometimes referred to as the hygrometric state, and can be calculated using the most basic measuring equipment.

These two measurements are connected. If there is no specific measuring device available, the "two-thermometer" method, described below, can be used.

Measuring humidity:

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

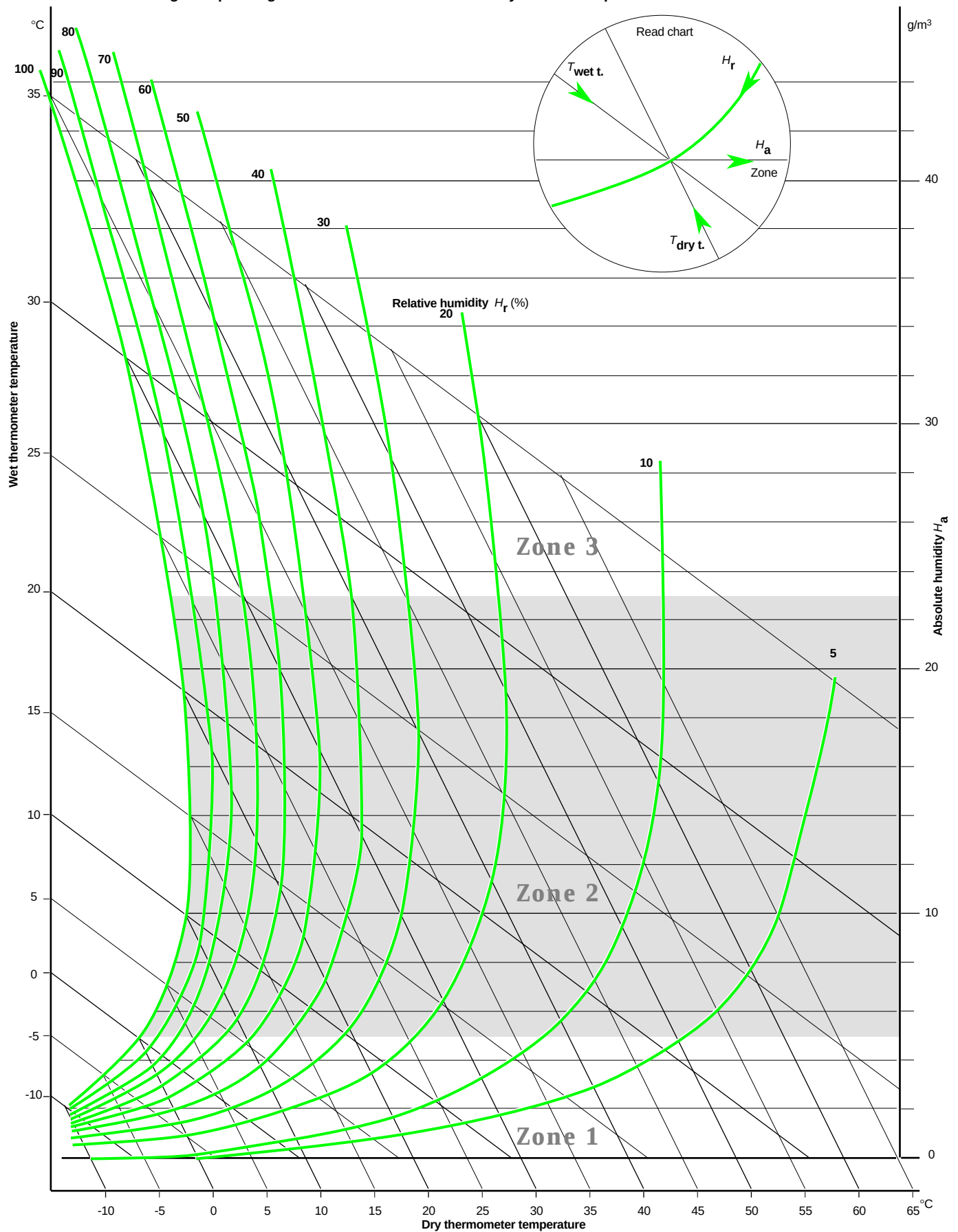
The drier the atmosphere, the greater the temperature.

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

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

GEARLESS A.C. motors Environment

▼ Chart for determining the operating zone as a function of the humidity and the temperature.



GEARLESS A.C. motors Construction

Mounting arrangements and components

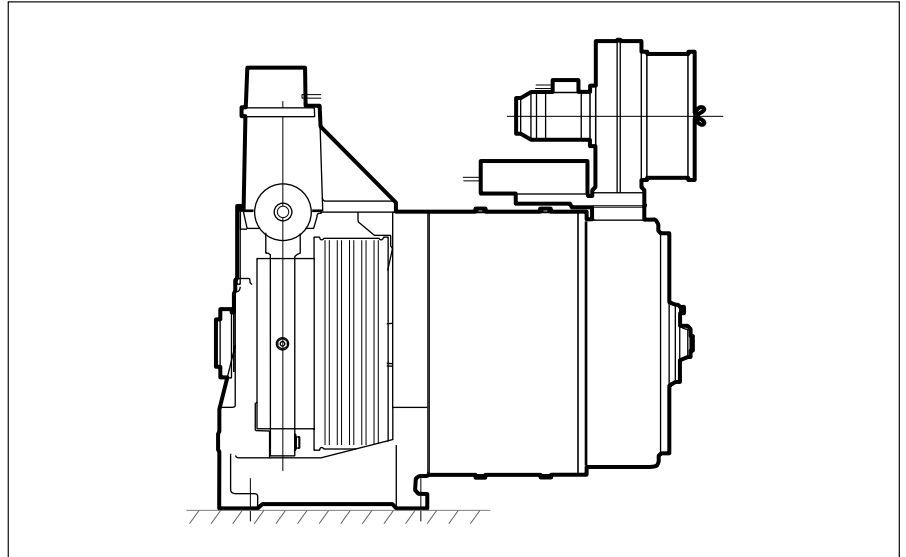
OPERATING POSITION

Standard position: horizontal shaft, feet on floor, load underneath the machine.

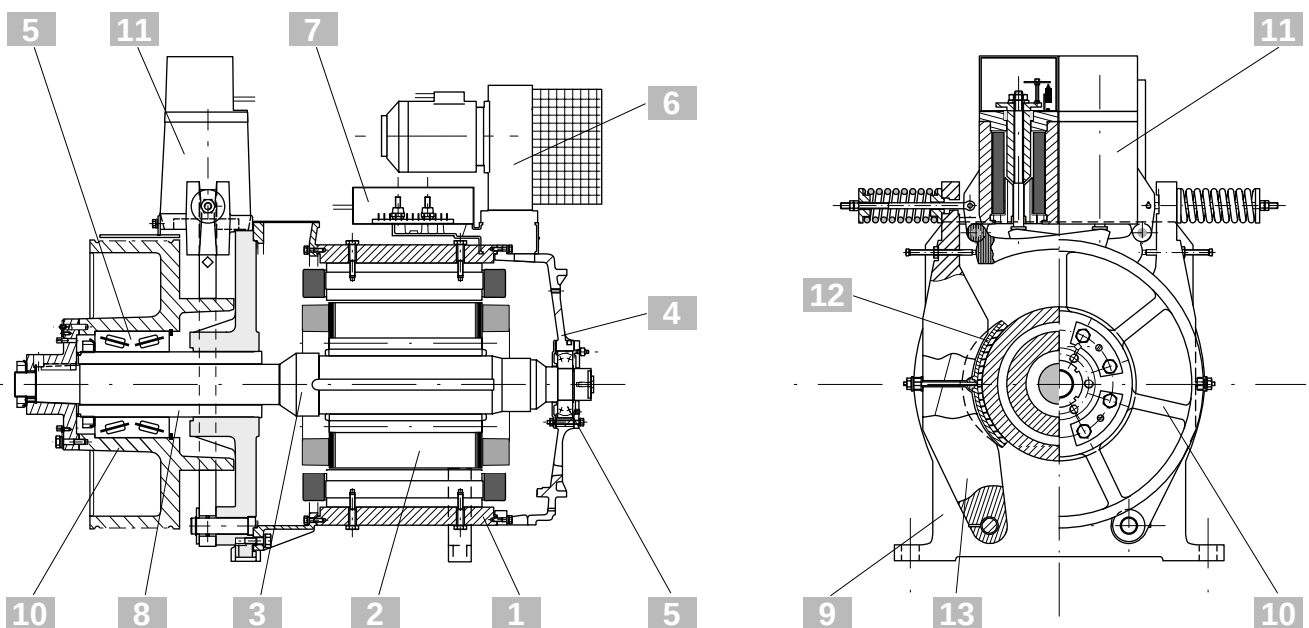
X2 - X3 motors can be fixed on the side.

X2 - X3 - X5 - X8 - X13 motors can be placed in the basement, using additional anchorage points.

Please contact LEROY-SOMER for more detailed information.



Designation		
1 - Stator	6 - Fan	11 - Brake block
2 - Rotor	7 - Terminal box	12 - Linings
3 - Motor shaft	8 - Sheave shaft	13 - Brake arm
4 - Shield	9 - Frame	
5 - Bearings	10 - Sheave	



GEARLESS A.C. motors Machine characteristics

General characteristics

MOTOR SIZE AND MAXIMUM LOAD

Our machines are designed and manufactured to conform to the main lift safety codes.

Each machine is defined by a maximum load on the shaft and a maximum braking torque. The driving torques depend on the motor selected.

Motor mounting options on Gearless

Gearless	Load on shaft	Motor size				
		250	280	315	450	560
X 2	2 300	*				
X 3	3 300	*				
X 5	5 000	*	*			
X 8	8 500	*	*	*		
X 13A	13 000		*	*		
X 20	20 000			*	*	
X 30	30 000				*	*
X 36	36 000				*	*

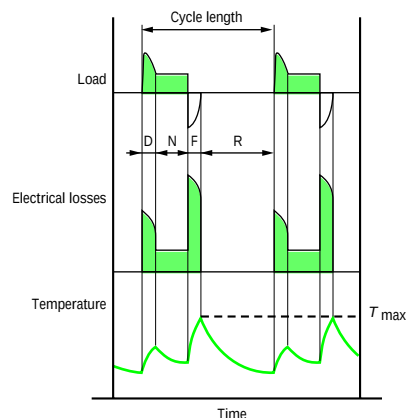
Operating cycle

The characteristics indicated in the tables (next page) are based on an intensive use of 180 starts per hour with S5 intermittent duty type - 60%.

X2-X3-X5 motors, in the non-ventilated version, are defined for S5 intermittent duty - 40%.

For more restrictive use, please consult Leroy-Somer.

Periodic intermittent duty
with electrical braking. Duty type S5. ►



D = starting

N = operation at constant load

F = electrical braking

R = rest

T_{max} = maximum temperature reached during cycle

$$\text{Operating factor (\%)} = \frac{D + N + F}{D + N + F + R} \cdot 100$$

Cooling

STANDARD CODES

IC 00	Self-cooling drip-proof machine.	
IC 06	Fan mounted on the machine and free circulation of air with or without filter.	

GEARLESS A.C. motors Electrical characteristics

Motor power supply and electrical connection

MOTORS

Designed and manufactured to operate with low-speed frequency inverters.

They are calculated specifically to suit your application (speed, voltage).

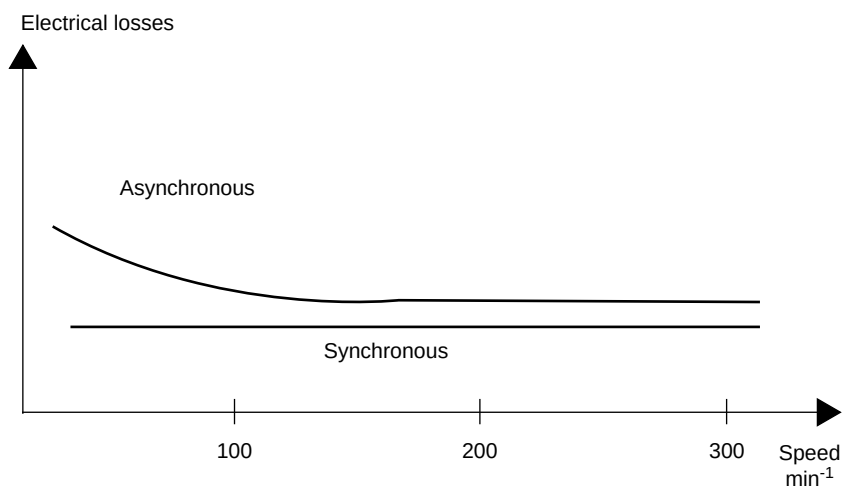
Power/Efficiency

We offer a range of asynchronous motors which are extremely well suited to "High speed - High rise" applications, and for which most drive manufacturers are confident with the control technology.

Synchronous motors with permanent magnets offer a higher power/volume ratio and better efficiency, especially at low speed.

LEROY-SOMER and CONTROL TECHNIQUES drives have been performance-tested for controlling these types of motor.

▼ Electrical losses in Synchronous/Asynchronous motors as a function of the speed

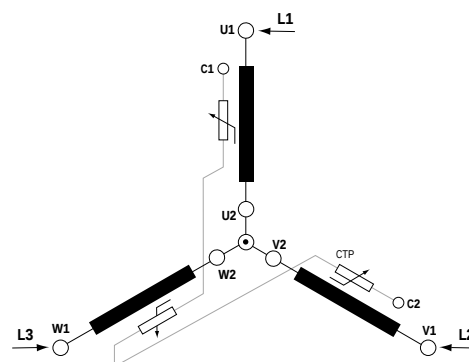


MOTOR ELECTRICAL CONNECTIONS

Electrical diagram included for information only; refer to the diagrams located in the terminal box.

Factory-supplied with star connection.

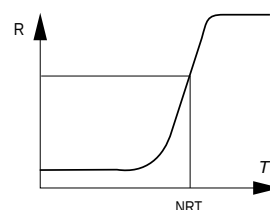
The outputs marked on these diagrams can be found on the machine terminal blocks.



Thermal protection

The motors are fitted with a PTC (positive temperature coefficient) thermal protection device with the following characteristics :

- 1 probe per phase wired in series
- max. voltage = 2.5 V
- resistance = 250 Ω max (ambient θ)



Insulation class

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

Class F allows for temperature rises of 105 K (measured by the resistance variation method) and maximum temperatures of 155 °C at the hot spots in the machine (Ref. IEC 85 and IEC 34-1).

Complete impregnation with tropicalized varnish of thermal class 180 °C gives

protection against attacks from the environment, such as 90% relative humidity, interference, etc.

Some drives, especially those operating with IGBT, generate high-frequency voltage peaks. These overvoltages should be limited to 1000 V at the motor terminals for star wiring or 800 V per winding.

GEARLESS A.C. motors Electrical characteristics

8-POLE ASYNCHRONOUS MOTORS

Motor type	Mechanical			Electrical			Cooling
	Rated values			Values (indicative) for an application at 400V and at speed indicated			
	$M_{acc. max.}$ Nm	$M_{N max.}$ Nm	J kg.m ²	n_N min ⁻¹	$I_{acc. max.}$ A	$I_{N max.}$ A	
250 L	1800	1080	2.28	110	51	28	IC 06
280 S	2000	1200	2.98	110	58	31	IC 06
280 M	2650	1590	3.99	110	74	41	IC 06
280 VL	3300	1980	4.9	110	94	52	IC 06
315 M	4000	2400	8.02	110	114	63	IC 06
315 L	4450	2670	8.91	110	127	70	IC 06
315 VL	5000	3000	9.97	110	139	78	IC 06
450 S	6000	3600	27.2	125	165	107	IC 06
450 M	8200	4920	36.68	125	223	145	IC 06
450 VL	10000	6000	45.53	125	279	178	IC 06
560 S	12000	7200	115.34	155	407	264	IC 06
560 M	14000	8400	134.76	155	476	308	IC 06
560 L	16000	9600	152.89	155	542	352	IC 06

16-POLE SYNCHRONOUS MOTORS

Motor type	Mechanical			Electrical			Cooling	
	Rated values			Values (indicative) for an application at 400V and at speed indicated				
	$M_{acc. max.}$ Nm	$M_{N max.}$ Nm	J kg.m ²	n_N min ⁻¹	$I_{acc. max.}$ A	$I_{N max.}$ A	V<230 min ⁻¹	V≥230 min ⁻¹
250 ZS	950	600	0.9	95	24	15	IC 00	IC 06
250 ZM	1260	800	1.2	95	32	20	IC 00	IC 06
250 ZML	1580	1000	1.5	95	41	26	IC 00	IC 06
250 ZL	1890	1200	1.8	95	48	30	IC 00	IC 06
250 ZVL	2520	1600	2.4	95	64	40	IC 00	IC 06
250 ZTVL	3100	2000	3.0	95	80	50	IC 00	IC 06

$M_{acc. max.}$: Max. accelerating torque - $M_{N max.}$: Max. rated torque - J : Inertia - n_N : Rated speed - $I_{acc. max.}$: Max. accelerating current - $I_{N max.}$: Max. rated current

- Torque tolerances ± 10%
- Accelerating torques guaranteed up to 90% of rated speed

FORCED VENTILATION MOTORS

Gearless motor	Fan motors
250 L to 315 VL	3-phase 0.55 kW at 50 Hz and 0.66 kW at 60 Hz
450 S to 560 L	3-phase 1.1 kW at 50 Hz and 1.3 kW at 60 Hz
250 ZS to 250 ZTVL	3-phase 0.15 kW at 50 Hz and 0.18 kW at 60 Hz

Supply voltages

- 3-phase, 50 Hz: 220/380V ±5%, 230/400V ±10%, 240/415V ±5%
- 3-phase, 60 Hz: 255/440V ±5%, 265/460V ±10%, 280/480V ±5%

GEARLESS A.C. motors Brakes

Holding brake

CHARACTERISTICS

The motor is fitted with a failsafe brake designed and manufactured to conform to the main lift safety codes. Their purpose is to hold the lift car still and, in exceptional circumstances, to stop it in an emergency.

The brakes include:

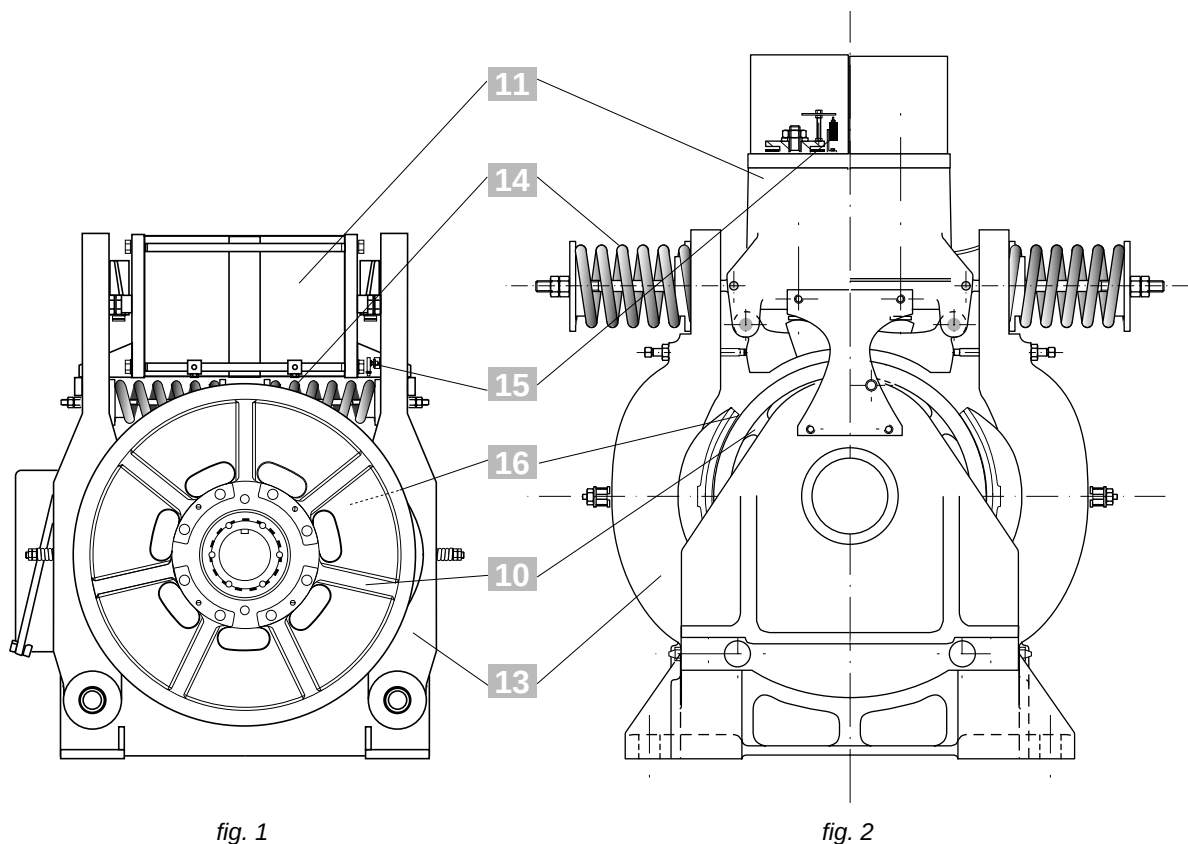
- two independently-controlled coils (11),
- two totally self-contained arms (13),
- two springs (14) on which the pressure can be adjusted in order to adapt the braking torque (see maintenance manual),

- two microcontacts (15) indicating the position of each arm (optional on X2-X3),
- a brake drum (16) as an integral part of the pulley (10) to avoid any intervening objects and ensure better safety.
- Manual brake release: Release lever incorporated in the brake on X2 and X3. Requires a 19 mm spanner for X5, X8 and X13A and a special lever on X20, X30 and X36 (see options on page 31).

BRAKING TORQUES

Machine		X 2 - X3	X 5 - X8	X 8 - X13A	X 20	X 30	X 36
Maximum braking torque	N.m	1 500	3 500	5 000	10 000	15 000	15 000
		<i>fig. 1</i>	<i>fig. 1</i>	<i>fig. 1</i>	<i>fig. 2</i>	<i>fig. 2</i>	<i>fig. 2</i>

▼ Gearless brake



GEARLESS A.C. motors Brakes

Electrical brake characteristics

CONNECTIONS

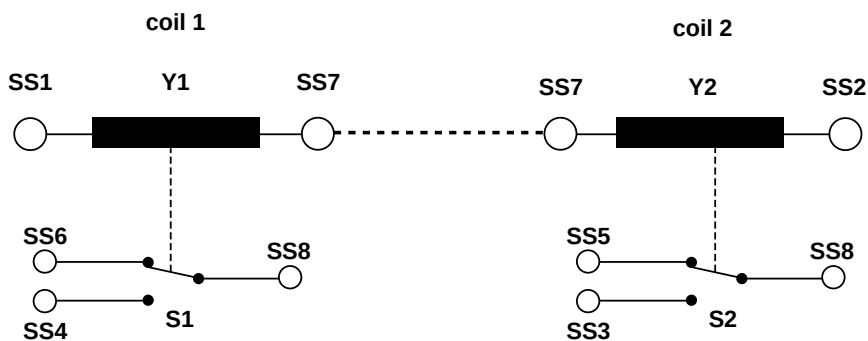
Standard coils are designed to be supplied with rated voltage U_N to open the brake and a voltage for holding the brakes open U_h which differ according to the machine.

With the voltages indicated below, enough current can be obtained to hold the brake open when hot. The coil resistance (RL) increases with the temperature:

$\Delta T = +70\text{ }^{\circ}\text{C}$ therefore $\Delta R \sim +30\%$.

The current drawn by the brake coils varies proportionally to the thrust force on the arms and therefore to the braking torque.

The values below are given for maximum torque.



Rated values for each coil (X36 - X30 - X13 - X8 - X5) and for the complete brake (X2 - X3)

Values	X20 - X30 - X36	X13	X8	X5	X2 - X3
U_N	~ 100 VDC	~ 100 VDC	~ 100 VDC	~ 100 VDC	-
U_h	~ 55 VDC	~ 65 VDC	~ 75 VDC	~ 75 VDC	230 VAC
I_N	3.3 A	4.5 A	4.2 A	4.2 A	6.5 A
I_h	1.7 A	3 A	3.5 A	3.5 A	2.4 A
RL at 20 °C	26 Ω	14.3 Ω	15.8 Ω	15.8 Ω	-

Current tolerances: $\pm 10\%$

Characteristics of the brake position contacts

Microcontacts	X20 - X30 - X36	X5 - X8 - X13A	X2 - X3 (optional)
Voltage	380 VAC max.	250 VAC max.	250 VAC max.
Current	15 A max.	5 A max.	5 A max.

GEARLESS A.C. motors Brakes

Recommended wiring diagram

RECOMMENDED DIAGRAM

For safety reasons, we recommend that the brakes are supplied in series.

Both A.C. and D.C. power supplies can be used.

Formulae:

- Overvoltage:

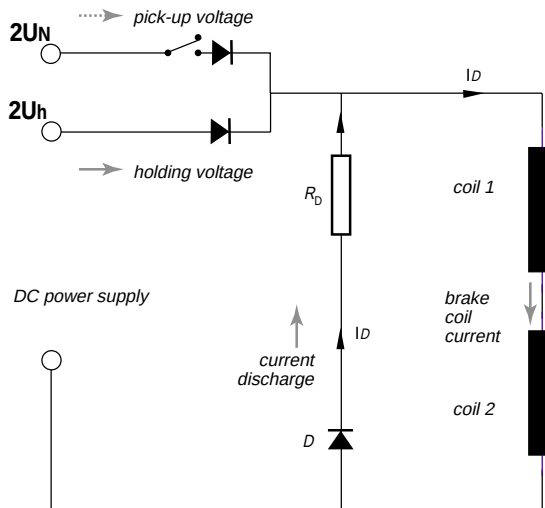
$$U_{\text{overvoltage}} = \text{approx. } (RD \cdot I_{\text{brake}}(t_4))$$

- Diode current:

$$I_{\text{discharge}} \text{ max} = \text{approx. } (I_{\text{brake}}(t_4))$$

- Response time on brake closing:

$$\text{proportional to: } \frac{\text{Coil inductances}}{RD}$$



Braking sequences

BRAKING SEQUENCES

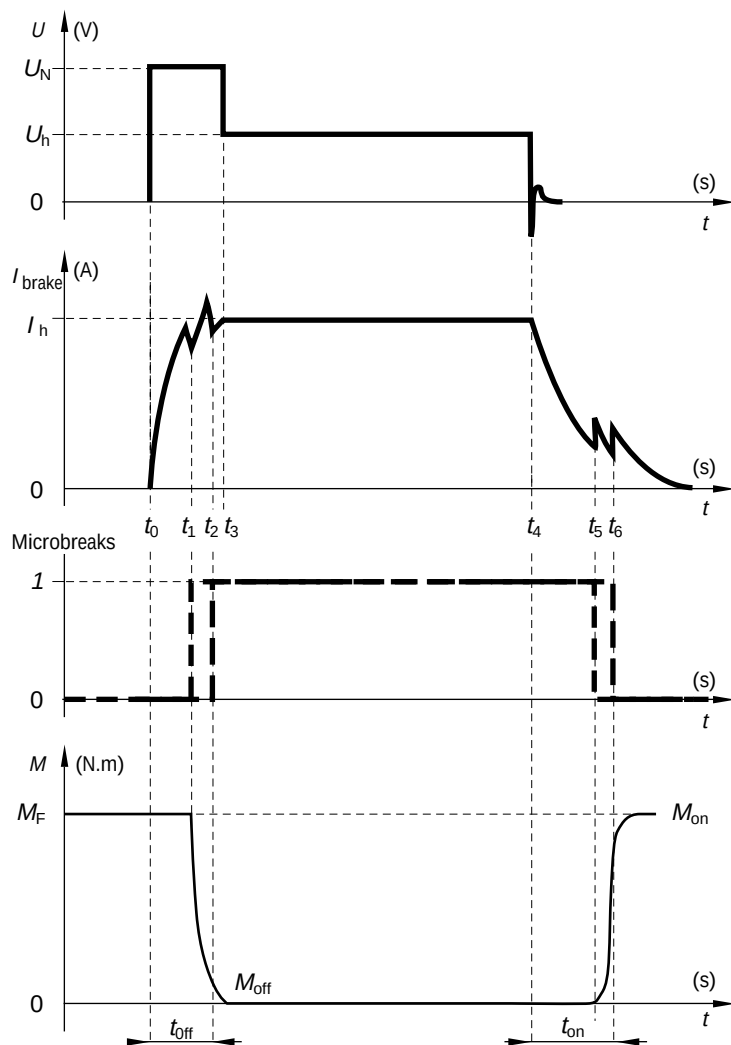
Description

- t_0 : apply rated voltage (pull-in current)
- t_1 & t_2 : decisive movement (brake release)
- t_3 : switch to holding current
- t_4 : switch off power supply
- t_5 & t_6 : decisive movement (braking)

Definition of values

- U_N : rated voltage: approximately 100 VDC per coil (voltage peak)
- U_h : holding voltage: should be calculated so as to obtain the holding current (to be adjusted when the coil temperature has stabilized)
- I_h : holding current
- M_{on} : adjusted braking torque
- t_{on} : braking time
- t_{off} : brake release time

The braking and brake release times are not constant. They vary as a function of the voltage, the coil temperatures, the adjustment of the springs, wear on the linings, etc.

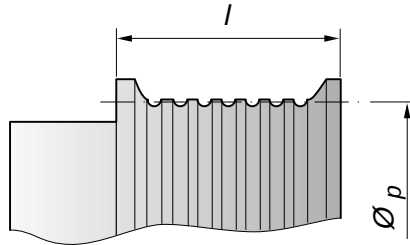


GEARLESS A.C. motors Traction sheave

Characteristics

Our sheaves are made of cast iron alloy, and we can therefore guarantee the defined hardness at the heart of the material. We can produce sheaves with the specific hardness required for your applications.

Standard hardness: 200 to 240 Hb
Groove profile according to customer specification.



SHEAVE WIDTH *l* (mm)

Primary sheave Sheave diameter Øp (mm)	Gearless size						
	x2 - X3	X5	X8	X13A	X20	X30	X36
400	94	190					
520		190					
560			190	232			
610			190	232	276	357	357
640					265		
660				232			
680				232			
700						365	365
710				240			
860					237	365	365

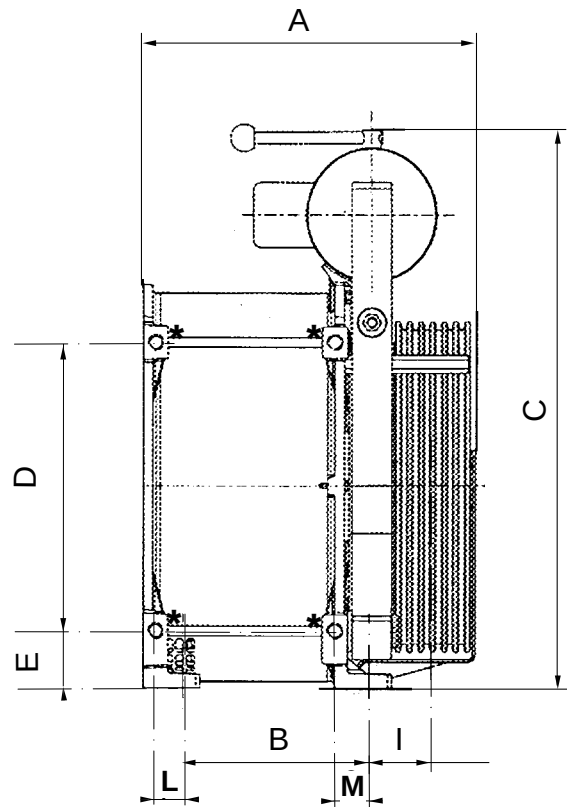
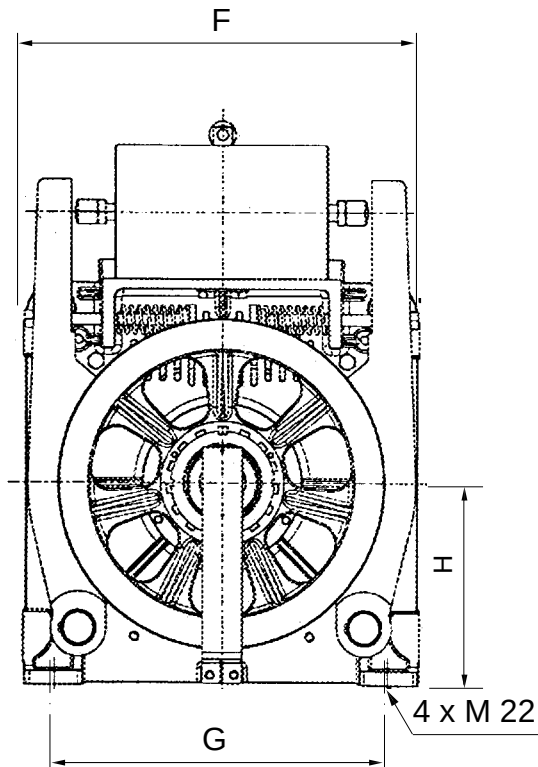
INERTIA (kg.m²)

Size Gearless	Sheave diameter Øp (mm)									
	400	520	560	610	640	660	680	700	710	860
X2 - X3	2.8									
X5	3	5								
X8			9.7	11.7						
X13A			11.1	12.6		14,4	16.6		19.9	
X20				22.7	25,9					53
X30				27.5				40,4		74.8
X36				27.5				40,4		74.8

GEARLESS A.C. motors Dimensions

Type X2 - X3

Dimensions in millimetres



* M20 threaded holes to order

Type	Main dimensions											Weight kg
	A	B	C	D	E	F	G	H	I	L	M	
X2-X3 250 ZS	421,5	235	693	360	70	500	450	250	78	36	46	450
X2-X3 250 ZM	466,5	280	693	360	70	500	450	250	78	36	46	510
X2-X3 250 ZML	511,5	320	693	360	70	500	450	250	78	36	46	570
X2-X3 250 ZL	556,5	370	693	360	70	500	450	250	78	36	46	630

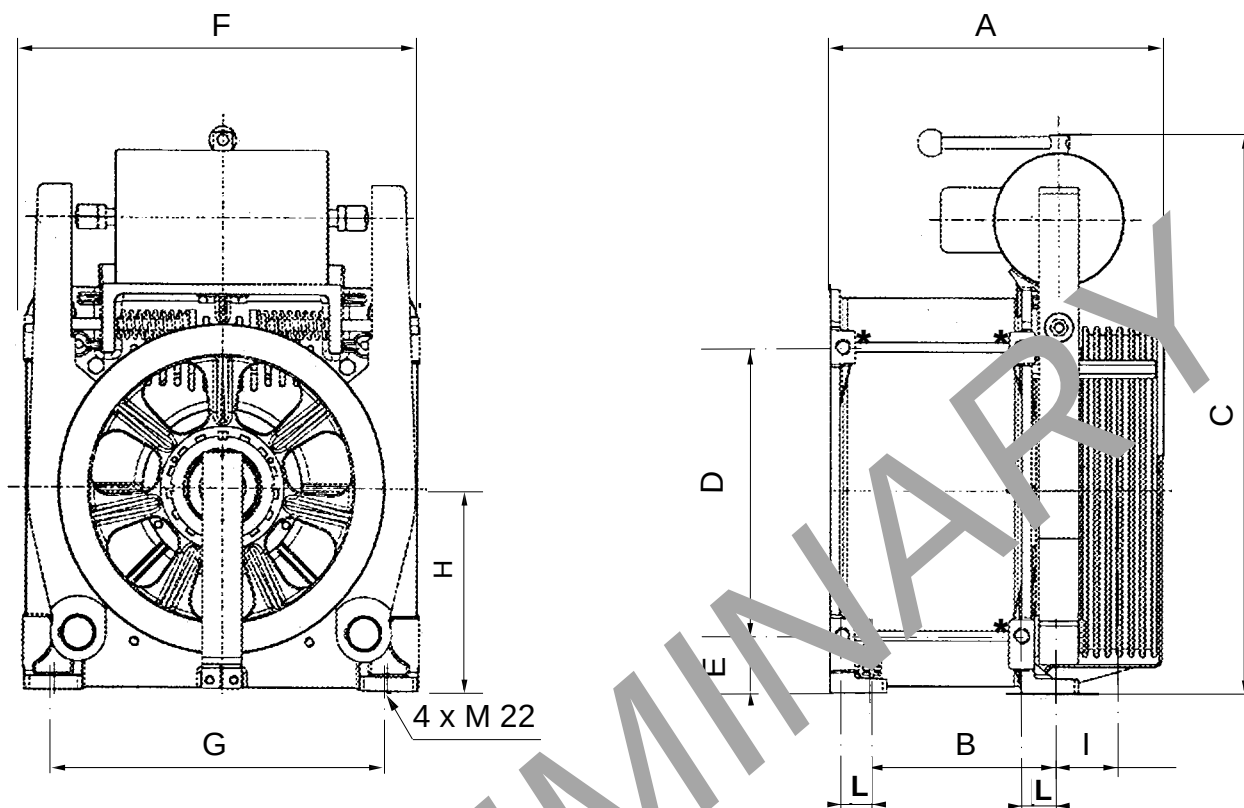
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X5

Dimensions in millimetres



Type	Main dimensions							Weight
	A	B	C	F	G	H	I	kg
X5 250 ZS	712	350	978	996	400	250	216	1 000
X5 250 ZM	712	350	978	996	400	250	216	1 060
X5 250 ZL	812	450	978	996	400	250	216	1 120
X5 250 ZVL	812	450	978	996	400	250	216	1 200
X5 250 L	986	654	978	996	400	250	216	1 200
X5 280 S	1016	624	978	996	400	250	216	1 300
X5 280 M	1086	724	978	996	400	250	216	1 400
X5 280 VL	1126	764	978	996	400	250	216	1 600

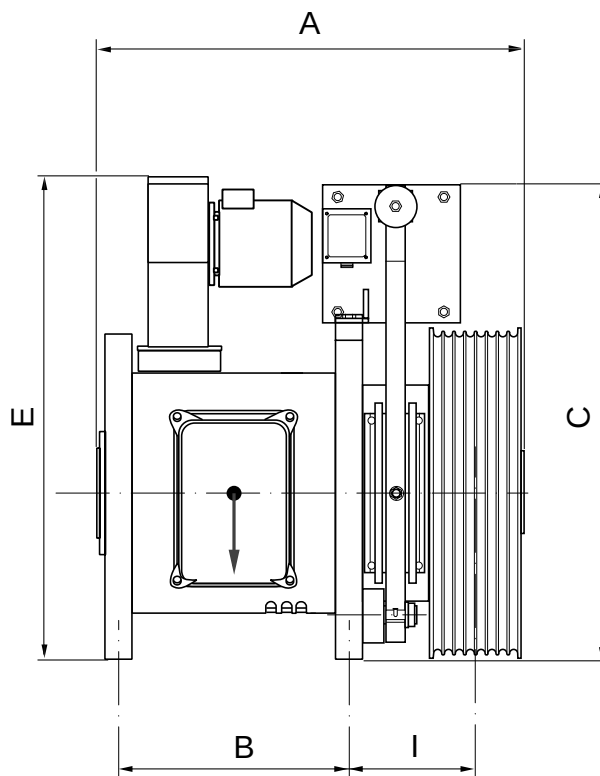
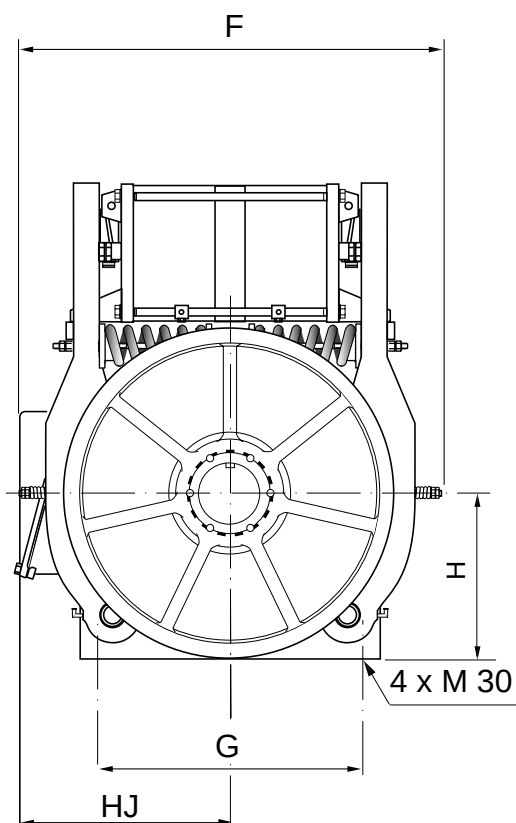
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X8

Dimensions in millimetres



Type	Main dimensions									Weight kg
	A	B	C	E	F	G	H	HJ	I	
X 8 250 L	1016	654	970	970	996	400	315	475	216	1 200
X 8 280 S	997	624	970	970	996	400	315	475	216	1 300
X 8 280 M	1097	724	970	970	996	400	315	475	216	1 400
X 8 280 VL	1187	764	970	970	996	400	315	475	216	1 600
X 8 315 M	1039	677	970	1 012	996	400	315	505	216	1 900
X 8 315 L	1089	727	970	1 012	996	400	315	505	216	2 100
X 8 315 VL	1149	787	970	1 012	996	400	315	505	216	2 300

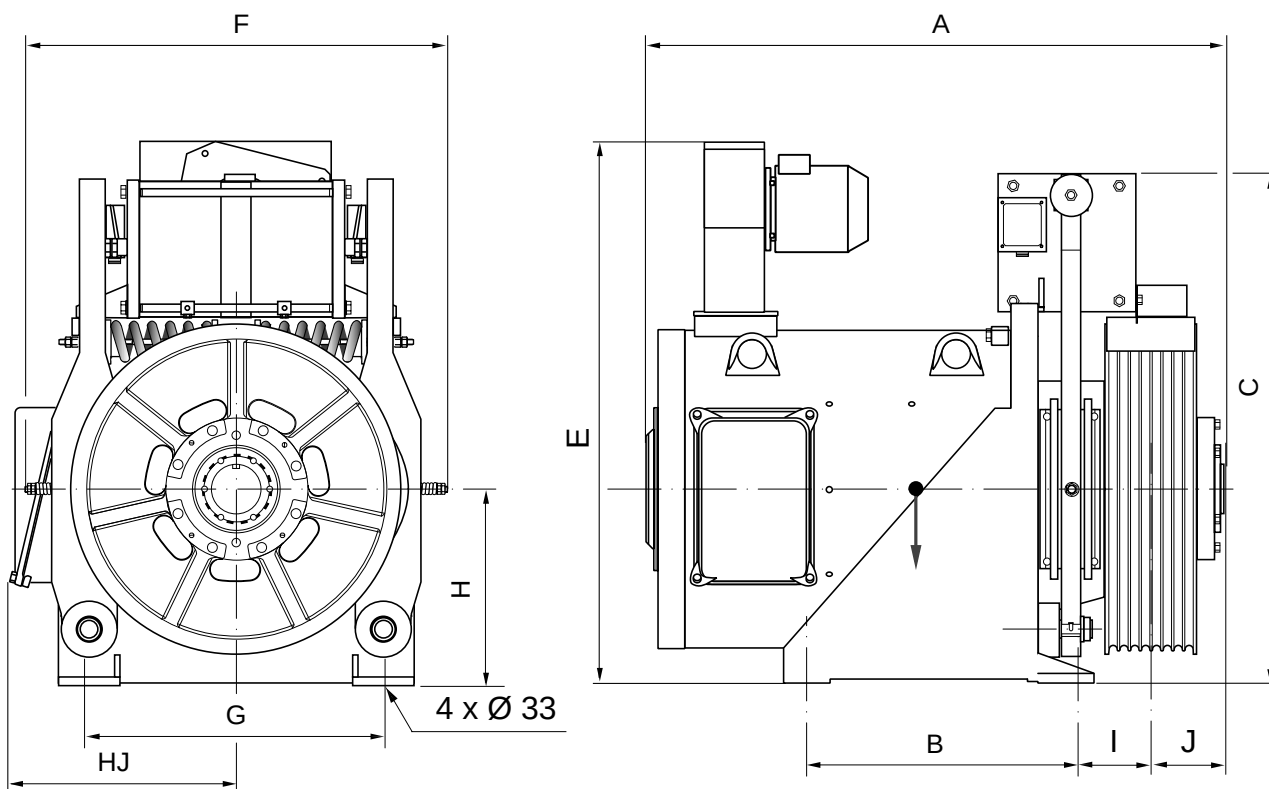
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X13A

Dimensions in millimetres



Type	Main dimensions										Weight kg
	A	B	C	E	F	G	H	HJ	I	J	
X13A 280 S	1236	600	1 025	1 030	806	600	365	475	198	254	1 500
X13A 280 M	1336	600	1 025	1 030	806	600	365	475	198	254	1 600
X13A 280 VL	1426	600	1 025	1 030	806	600	365	475	198	254	1 700
X13A 315 M	1389	600	1 025	1 062	806	600	365	505	198	254	2 100
X13A 315 L	1439	600	1 025	1 062	806	600	365	505	198	254	2 300
X13A 315 VL	1499	600	1 025	1 062	806	600	365	505	198	254	2 500

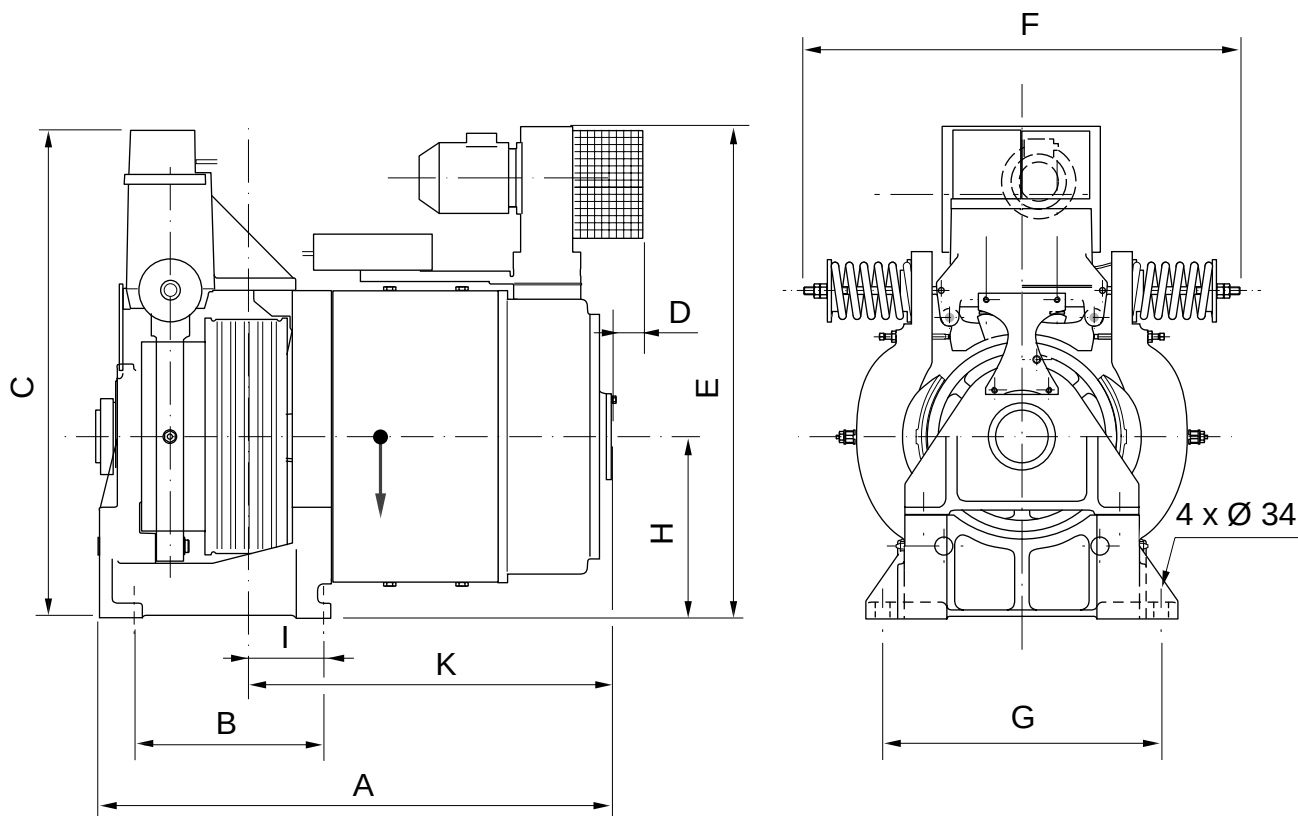
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X20

Dimensions in millimetres



Type	Main dimensions										Weight
	A	B	C	D	E	F	G	H	I	K	kg
X 20 315 M	1562	660	1 380	83	1 376	1 295	813	558,8	342	1176	3 100
X 20 315 L	1612	660	1 380	83	1 376	1 295	813	558,8	342	1226	3 200
X 20 315 VL	1672	660	1 380	83	1 376	1 295	813	558,8	342	1286	3 300
X 20 450 S	1665	660	1 380	150	1 665	1 295	813	558,8	342	1278	3 600
X 20 450 M	1815	660	1 380	150	1 665	1 295	813	558,8	342	1428	4 000
X 20 450 VL	1955	660	1 380	150	1 665	1 295	813	558,8	342	1568	4 700

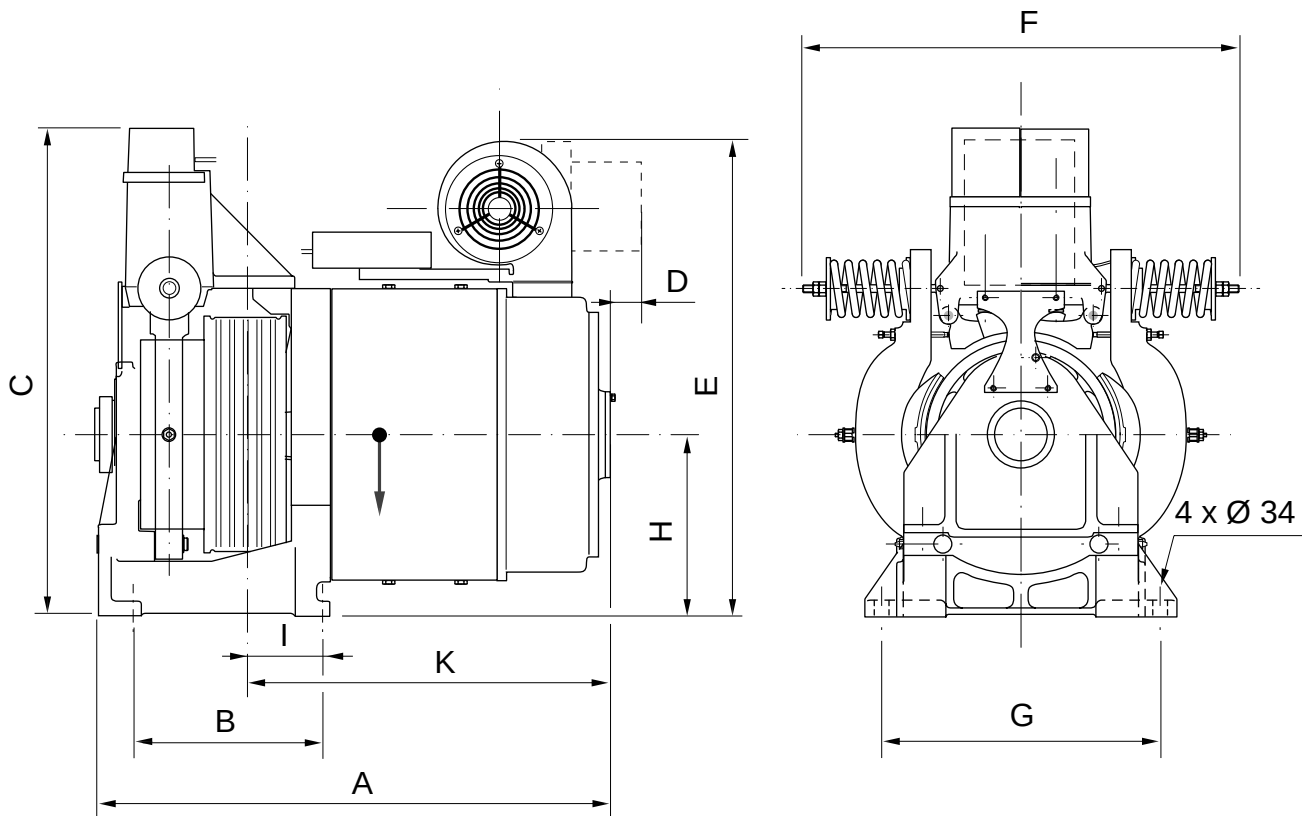
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X30

Dimensions in millimetres



Type	Main dimensions										Weight kg
	A	B	C	D	E	F	G	H	I	K	
X30 450 S	1742	746	1 517	150	1 664	1 292	900	558,8	364	1302	3 800
X30 450 M	1892	746	1 517	150	1 664	1 292	900	558,8	364	1452	4 200
X30 450 VL	2032	746	1 517	150	1 664	1 292	900	558,8	364	1592	4 500
X30 560 S	1960	746	1 517	0	1 450	1 292	900	558,8	364	1519	5 800
X30 560 M	2065	746	1 517	0	1 450	1 292	900	558,8	364	1624	6 100
X30 560 L	2165	746	1 517	0	1 450	1 292	900	558,8	364	1724	6 300

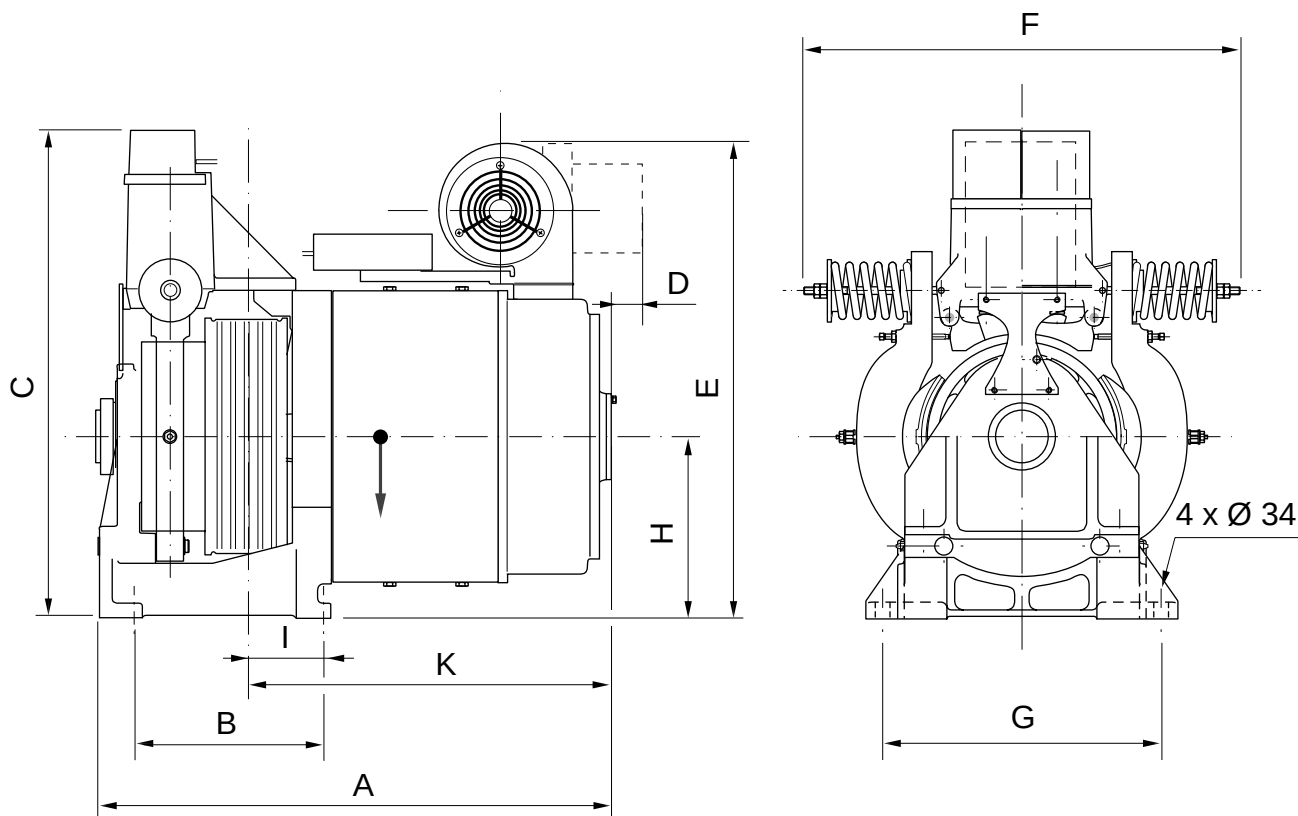
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

GEARLESS A.C. motors Dimensions

Type X36

Dimensions in millimetres



Type	Main dimensions										Weight kg
	A	B	C	D	E	F	G	H	I	K	
X36 450 S	1742	746	1 517	150	1 664	1 292	900	558,8	364	1302	4 000
X36 450 M	1892	746	1 517	150	1 664	1 292	900	558,8	364	1452	4 500
X36 450 VL	2032	746	1 517	150	1 664	1 292	900	558,8	364	1592	5 000
X36 560 S	1960	746	1 517	0	1 450	1 292	900	558,8	364	1519	5 900
X36 560 M	2065	746	1 517	0	1 450	1 292	900	558,8	364	1624	6 200
X36 560 L	2165	746	1 517	0	1 450	1 292	900	558,8	364	1724	6 400

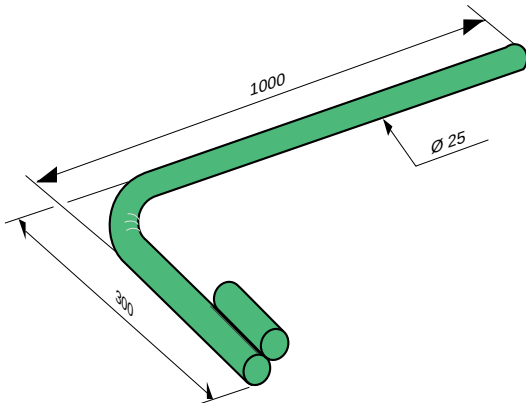
General tolerances: ± 1 cm

Appearance and dimensions may be subject to modification.
When ordering, to get exact dimensions, ask for a certified drawing.

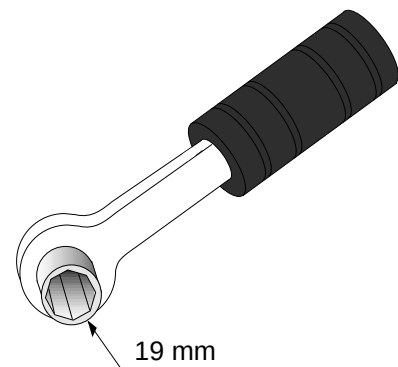
GEARLESS A.C. motors Optional features

Accessories

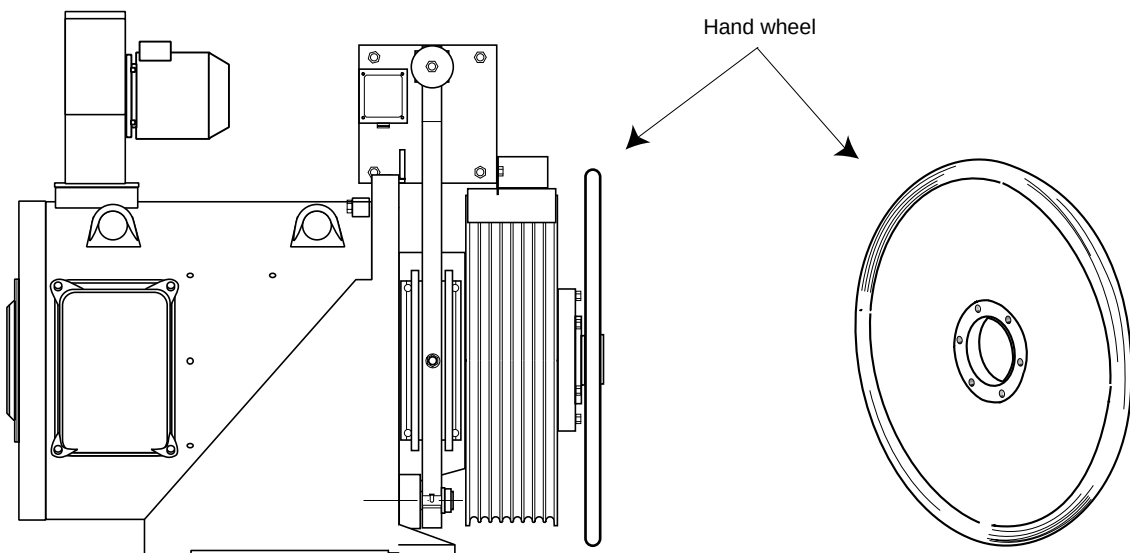
▼ Brake release lever (X20, X30 and X36)



▼ 19 mm spanner (X8 and X13A)



▼ Hand wheel

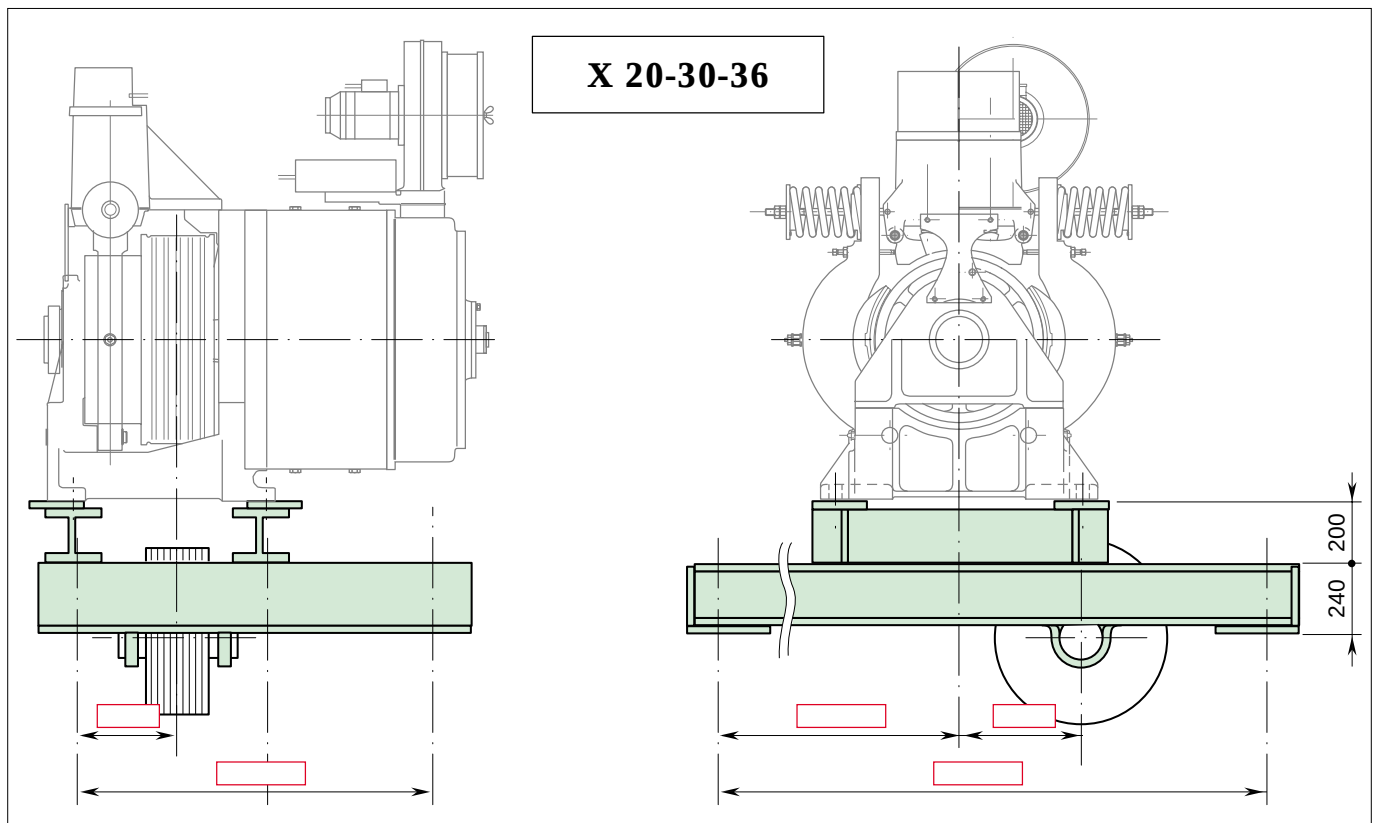
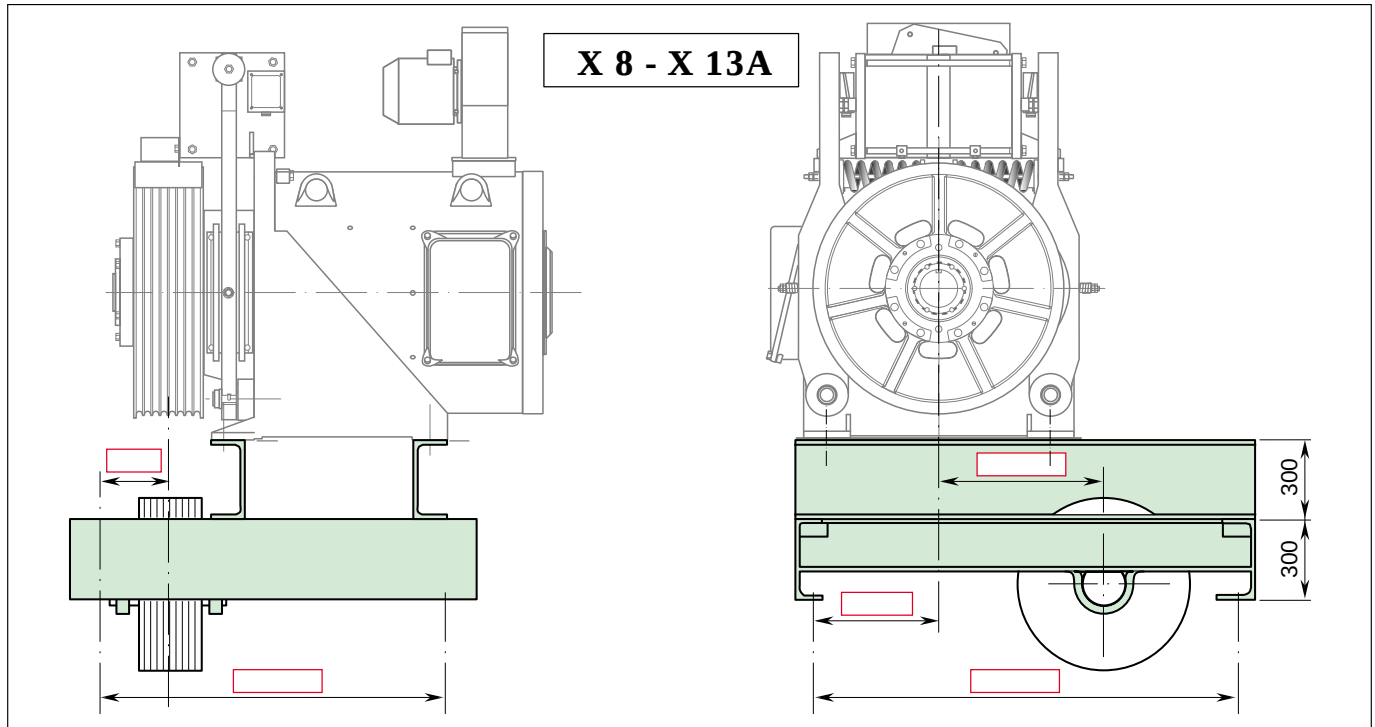


GEARLESS A.C. motors Optional features

Bedplate

Dimensions required: please complete all 5 boxes. Please also check the box corresponding to the position of the secondary sheave:

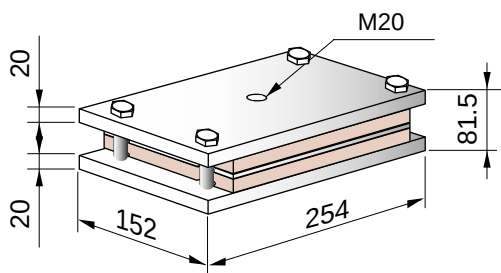
- on right (diagrams below) ☐
- on left ☐



Note: Gearless with secondary sheave on right viewed from drive end.

GEARLESS A.C. motors Optional features

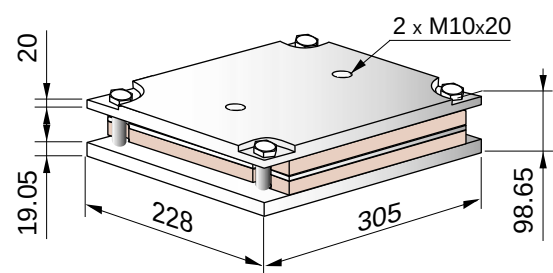
Bedplate



◀ **Bedplate isolation pads**

Quantity: 4

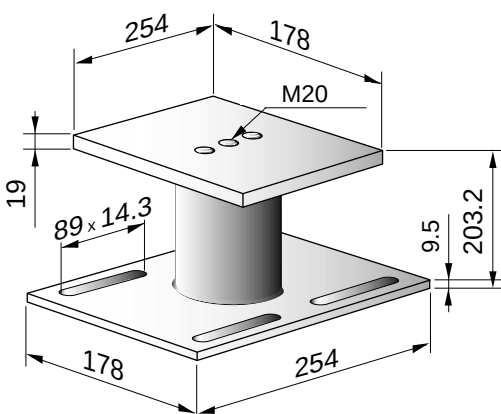
X 13A



◀ **Bedplate isolation pads**

Quantity: 6

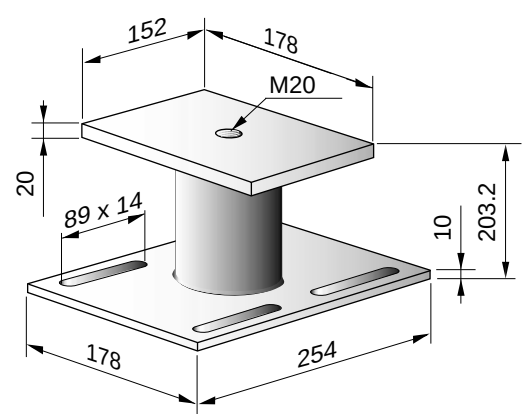
X 20 - 30 - 36



◀ **Bedplate fixing feet**

Quantity: 4

X 13A



◀ **Bedplate fixing feet**

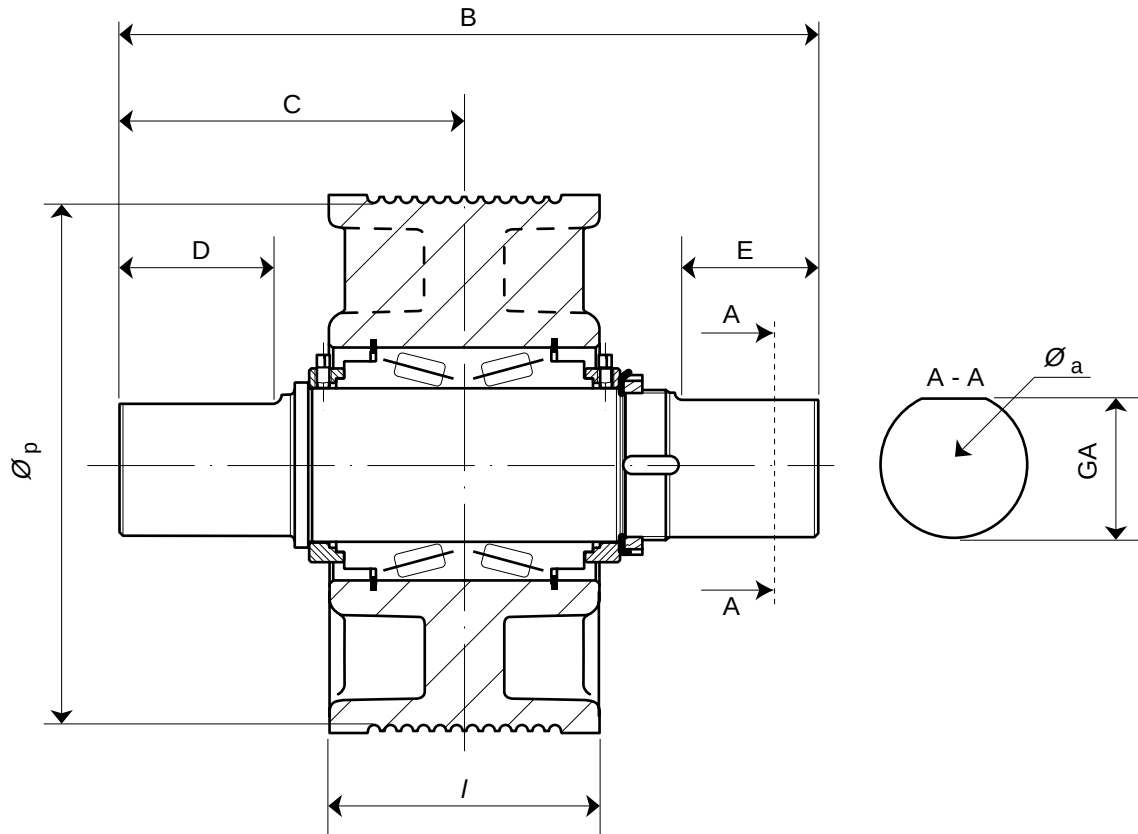
Quantity: 6

X 20 - 30 - 36

GEARLESS A.C. motors Optional features

Characteristics of secondary sheave

▼ Secondary sheave



CHARACTERISTICS OF SECONDARY SHEAVE

▼ Maximum load 20 tonnes

Pitch diameter $\varnothing_p$	Width	Weight	Dimensions (mm)					
mm	I	kg	B	C	D	E	$\varnothing_a$	GA
520	254	260	663.4	331.47	124	111	133.35	116.65
610	259	425						

▼ Maximum load 30 tonnes

Pitch diameter $\varnothing_p$	Width	Weight	Dimensions (mm)					
mm	I	kg	B	C	D	E	$\varnothing_a$	GA
610	259	425						
700	330	525	787.5	393.5	190	175	140	114
860	330	695						

GEARLESS A.C. motors Optional features

Incremental encoder

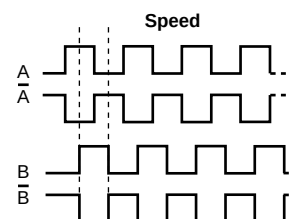
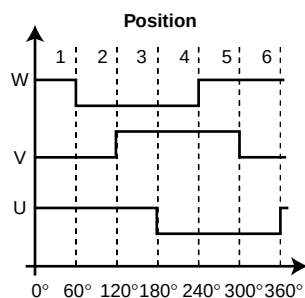
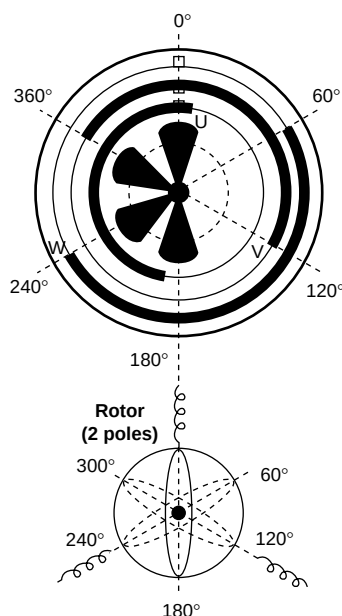
Our synchronous GEARLESS motors can be fitted as standard with an incremental encoder with switching channels. The use of incremental channels to monitor the speed is a simple, reliable solution. The switching channels are needed to find out the rotor position.

The encoder, fitted with an RS422 link, is in a metal case to ensure adequate protection from electrical interference.

Characteristics

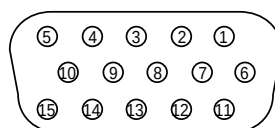
Outputs	Two complementary quadrature channels Three complementary switching channels
Output interface	RS 422
Number of points per revolution	4096
Switching channels	3 x 8 tracks/revolution on 16-pole motors 3 x 4 tracks/revolution on 8-pole motors
Supply voltage	5V $\pm 10\%$
Output current	20mA maximum

Encoder principle



Connecting the incremental encoder

SUB D 15 HD connector pins	Wire colours	Functions
15	Not used	Not used
7	Grey	Channel U
8	Red	Channel $\bar{U}$
9	Black	Channel V
10	Purple	Channel $\bar{V}$
11	White / Brown	Channel W
12	White / Green	Channel $\bar{W}$
1	Green	Channel A
5	Not connected	Not connected
6	Not connected	Not connected
2	Pink	Channel $\bar{A}$
3	Yellow	Channel B
4	Blue	Channel $\bar{B}$
13	Brown	+5V dc
14	White + Ground	0V
		Screening



SUB-D 15HD connector
(rear view)

GEARLESS A.C. motors Optional features

SinCos encoder

The SinCos encoder is an alternative to the incremental encoder which offers high resolution, and hence excellent monitoring of movement and maximum ease of use.

Sine and cosine information are used to calculate the rotor position. As with a resolver, the position information is absolute and non-volatile, so that the position can be read on power-up without turning the motor. However, the SinCos encoder offers the advantage of combining analogue and digital techniques, producing a high-resolution signal with excellent immunity to noise.

The SRS 660 encoder indicates the absolute position of the rotor through 360° via the serial link (32768 increments per turn).

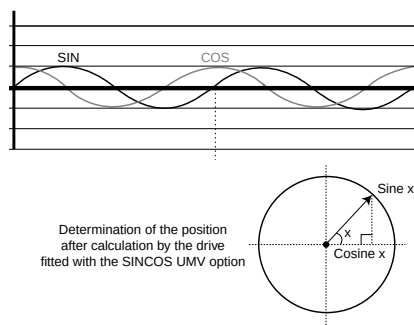
The Sin and Cos analogue signals give a very precise speed and direction of rotation signal.

The encoder is compatible with version 3.2.11 and later of Leroy-Somer and CT inverters.

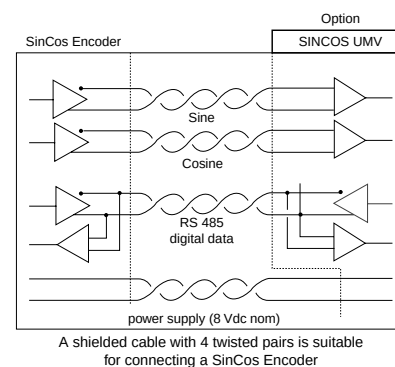
Characteristics

Sine and Cosine analogue outputs	1024 ppt
Absolute value	32768 ppt
Type of code used for the absolute value	binary
Evolution of the binary code with rotation in clockwise direction as viewed from shaft end	Ascending
Supply voltage range	7 Vdc to 12 Vdc
Rated supply voltage	8 Vdc
No-load current consumption	100 to 130 mA

SinCos encoder principle



Connection



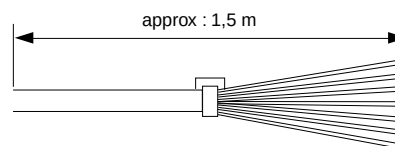
Sin Cos encoder connection

PIN	Wire colours	Signal
1	Black	REFCOS
2	Grey	+ 485
3	N.C.	N.C.
4	N.C.	N.C.
5	White	SIN
6	Brown	REFSIN
7	Green	- 485
8	Pink	COS
9*	N.C./screen	N.C./screen
10	Blue	Gnd
11	N.C.	N.C.
12	Red	8 V

* PIN 9 can be connected to the cable screening to provide continuity with the encoder casing.

N.C. = Not connected

Cable output



GEARLESS A.C. motors Questionnaire (metric)

Customer: LS representative:
 Project: Reference: Qty:
 Defined by: Date: Signed:

• MECHANICAL SPECIFICATIONS

1. Gearless

MAXIMUM LOAD: kg
 TORQUE ON MOTOR SHAFT N.m
 Rated
 MOTOR SPEED: min⁻¹
 BRAKING TORQUE: N.m
 acceleration: N.m
 TRACTION SHEAVE DIAM: mm
specific references for groove profile: (please enclose)

Gearless POSITION: top ☐ or bottom of shaft ☐

2. Lift

LIFT CAR Load: kg weight: kg COUNTERWEIGHT %
 speed: m/s acceleration: m/s²
 TRACTION CABLE: diam: mm number: weight: kg/m
 WRAP: single ☐ or double ☐ ROPING 2:1 ☐ or 1:1 ☐
 COMPENSATION: (% of traction cable) % Compensating sheave weight kg
 LENGTH OF TRAVEL: m EFFICIENCY OF INSTALLATION: %

lift safety code or specifications to follow:

• ELECTRICAL SPECIFICATIONS

MOTOR: voltage: V frequency: Hz
 MAINS: rated voltage: VAC max. current: A
 (at rated speed) (if limited)
 DRIVE: voltage of drive DC bus V
 PROTECTION AGAINST VOLTAGE PEAKS: the **maximum** voltage peak per phase should be limited to **1000 V**.
 length of cable between lift car/motor: m Measured voltage peak: V $\partial v / \partial t$: V/ms
 (on drive)

Other specifications if necessary:

- Max. ambient temperature: 40°C or
- Hardness of traction pulley: 200 to 240 Hb or
- Brake coil voltage: 2 x 100 V or
- External finish : green (RAL 6000) or
- Packaging: machine supplied on a pallet and protected with plastic film
- Others:

OPTIONS :

- Specifications for encoder ☐ yes, ☐ no
adaptation:
- Encoder:
- Secondary sheave ☐ yes, ☐ no,
if yes, diameter: mm
- Brake release lever: ☐ yes, ☐ no
- Safety hand wheel: ☐ yes, ☐ no
- Bedplate: ☐ yes, ☐ no
see attached documents
- Bedplate fixing feet: ☐ yes, ☐ no
- Isolation pads: ☐ yes, ☐ no

GEARLESS A.C. motors

Other products

All types of drive can be considered in order to satisfy our customers' requirements:

- Asynchronous
- Synchronous
(with permanent magnets)
- Variable reluctance
- D.C.

For any type of application:

- Traction
- Door control
- Etc.

Notes

Notes

Notes

GENERAL CONDITIONS OF SALE

I - APPLICATION AREA

Acceptance of our tenders or the placing of any order with us implies acceptance of the following conditions without exception or reservation. These conditions of sale shall prevail over all stipulations appearing on the customer's purchase order, his general conditions of purchase or any other document emanating from him and / or a third party. A dispensation from these General Conditions of Sale applies to sales concerning foundry parts, which are subject to the European Foundries General Conditions of Sale, latest edition.

II - ORDERS

All orders, including those taken by our agents and representatives, by whatever mode of transmission, become valid only after we have accepted them in writing. We reserve the right to modify the characteristics of our goods without prior warning.

However, the customer reserves the possibility to specify technical specifications in the order.

Unless such requirements have been notified in writing, the customer will not be able to refuse delivery of new modified goods.

Our company will not accept responsibility for an incorrect choice of goods if this incorrect choice results from incomplete and / or erroneous conditions of use, or conditions that have not been conveyed to the vendor by the customer.

Unless otherwise specified, our tenders and estimates are only valid for thirty days from the date of issue.

When the goods have to satisfy standards, particular regulations and / or be inspected by standards or control organisations, the price request must be accompanied by full specifications with which we must comply with. This is mentioned in the estimate. All test and inspection fees are the customer's responsibility.

III - PRICE

Our prices and price lists are shown exclusive of tax and may be revised without prior notice.

Our prices are either firm for the duration specified on the estimate, or subject to revision according to a formula accompanying the tender which, depending on the regulations, covers a change in the cost of raw materials, products, various services and salaries, an index of which is published in the B.O.C.C.R.F. ("Bulletin Officiel de la Concurrence, de la Consommation et de la Répression des Fraudes").

For any order of goods not found in our catalogue, requiring special manufacture, the invoice will include a minimum fixed sum of 600 FRF (six hundred French Francs) exclusive of tax, to cover start - up costs. Any tax due will be charged to the customer.

All related costs, such as customs clearance and special inspections, will be added on.

Customers should remember that the French Franc (or other currency) is being replaced by the Single European Currency (EURO) according to a European Community ruling. In accordance with the general principles of monetary law, references to the French Franc will then as of right be considered to refer to the Euro. This substitution will be enforced on the date and in accordance with the conditions defined by the European Community ruling.

IV - DELIVERY

Our export sales are governed by the INCOTERMS published by the International Chamber of Commerce ("I.C.C. INCOTERMS"), latest edition. Goods are despatched in accordance with the conditions indicated on our order acknowledgement, sent out in response to any order for goods and / or services.

Unless otherwise specified, our prices refer to goods put at customer's disposal in our factories, and include standard packaging.

Unless otherwise specified, goods are always transported at the consignee's risk. Without exception, it is up to the purchaser to raise with the transporter, in the legal form and time limits, any claim concerning the condition or the number of packages received and also to send us at the same time a copy of this declaration. Failure to respect this procedure will relieve us of all responsibility.

In the case of CIF (Cost, Insurance & Freight) or CIP (Carriage & Insurance Paid to) sales, etc..., in the event of damage, our responsibility will only be engaged if any reservations and required declarations have been notified in the required time period, and will not in any case exceed the indemnity sum received from our insurers.

If the arrangements for despatch are modified, we reserve the right to invoice any additional costs arising from such changes.

Packages cannot be returned.

Should the delivery of goods be delayed for a reason not attributable to the vendor, goods will be stored on the vendor's premises, at the own risk of the customer, at a charge for storage of 1% (one per cent) of the total order sum per week, beginning, without a grace period, on the day after the scheduled date of delivery indicated in the contract. After thirty days from this date, the vendor has the right to dispose of these goods as he wishes and arrange a new delivery date for the said goods with the customer. In all instances, all down payments received remain the property of the vendor as indemnity, without prejudice to other claims for damages that the vendor may wish to bring.

V - DELIVERY DATES

Delivery times are stated for information only, and do not include the month of August.

Delivery dates are counted from the issue date of the order acknowledgement from the vendor and are subject to compliance with the provisions indicated on the order acknowledgement, notably receipt of the down payment for the order, notification of the issuance of an irrevocable letter of credit conforming to all vendor requirements (especially as regards the amount, currency, validity, licence, etc...) and acceptance of the terms of payment with any guarantees which may be required, etc...

In no case does late delivery automatically entitle the customer to damages and / or penalties.

Unless otherwise specified, we reserve the right to make partial deliveries.

Delivery dates are automatically suspended without formal notice, and the vendor shall have no responsibility in cases of Force Majeure, or events beyond the control of the vendor or his suppliers such as delays, saturation, or unavailability of the planned transport methods, energy, raw materials etc..., serious accidents such as fires, explosions, strikes, lock out, or emergency measures taken by the Authorities occurring after

the conclusion of the order and preventing its normal execution.

Similarly, delivery dates are automatically suspended without formal notice in all cases of failure to perform or late payment by the customer.

VI - TESTS

All goods manufactured by the vendor are tested before leaving the factory in accordance with vendor's ISO 9001 certifications. Customers may attend these tests : they simply have to convey the wish to do so in writing when the order is placed.

Specific tests and acceptance tests requested by the customer, whether conducted on the customer's premises, in our factories, on-site, or by inspection organisations, must be noted on the order and are to be paid for by the customer.

Goods specially developed for a customer will have to be approved by the latter before any delivery of mass - produced goods, notified by signing and returning to us the Product Approval Schedule reference Q1. T. 034.

In the event of the customer's insistence on delivery without having signed this form beforehand, the goods will then still be considered as prototypes and the customer will assume sole responsibility for using it or supplying it to his own customers.

VII - TERMS OF PAYMENT

All our sales are considered as carried out and payable at the registered office of the vendor, without exception, whatever the method of payment, the place of conclusion of the sale and delivery.

When the customer is based in France, our invoices are payable on receipt in cash, by banker's draft, or by L.C.R. ("Lettre de Change - Relevé"), within thirty days from the end of the month following the invoice date, net and without discount.

When the customer is based outside France, our invoices are payable in cash against delivery of the dispatching documents or by irrevocable documentary credit confirmed by a first class French bank with all bank charges payable by the customer.

Payments must be made in the currency of the invoice.

In accordance with French Law N° 92.1442 dated December 31,1992, non-payment of an invoice by its due date will give rise, after formal notice, to a penalty equal to one and a half times (1.5) the official rate of interest, and to late payment interest at the bank base rate plus five per cent. If the invoice carries V.A.T. (Value Added Tax), this is calculated on the amount, inclusive of tax, of the remaining sum due and comes into force from the due date.

Should steps have to be taken to recover the said amount, a surcharge of 15% (fifteen per cent) of the sum demanded will be payable.

Moreover, as a consequence of non - payment of an invoice or any term of payment, whatever the method of payment envisaged, the customer shall pay immediately for the whole of the outstanding amount owed to the vendor (including his subsidiaries, sister or parent companies, whether in France or overseas) for all deliveries or services, whatever their initial due date.

Notwithstanding any particular terms of payment arranged between the parties concerned, the vendor reserves the right to demand :

- payment in cash, before the goods leave the factory, for all orders in the process of manufacture, in the event of a problem with payment, or if the customer's financial situation justifies it,
- a down payment for the order.

Unless we are at fault, all down payments are non - returnable, without prejudice to our right to claim damages.

Any payment made in advance of the fixed payment date will lead to a discount of 0.2 % (zero point two per cent) per month of the amount concerned.

VIII - COMPENSATION CLAUSE

Unless prohibited by law, the vendor and the customer expressly agree between one another to compensate their respective debts arising from their commercial relationship, even if the conditions defined by law for legal compensation are not all satisfied.

In applying this clause, by vendor we mean any company in the LEROY SOMER group.

IX - TRANSFER OF RISKS - TRANSFERT OF TITLE

Transfer of risks occurs upon the handing over of the goods, according to the delivery conditions agreed at the time of ordering.

THE TRANSFER OF TITLE OF THE GOODS SOLD TO THE CUSTOMER OCCURS UPON PAYMENT OF THE WHOLE PRINCIPAL SUM AND INTEREST.

The provision of a document creating an obligation to pay (bank draft or similar) does not constitute payment.

So long as the price has not been paid in full, the customer is obliged to inform the vendor, within twenty - four hours, of the seizure, requisition or confiscation of goods to the benefit of a third party, and to take all safety measures to acquaint others with and respect our right of title in the event of intervention by creditors.

Failure to pay the amount due, whether total or partial, on the due date, for whatever reason and on whatever grounds, authorises the vendor to demand as of right and without formal notice, the return of the goods, wherever they may be, at the customer's expense and risk.

Return of the goods does not imply to cancellation of the sale .However, we reserve the option to apply the cancellation clause contained in these General Conditions of Sale.

X - CONFIDENTIALITY

The vendor and the customer undertake to maintain confidentiality of information of a technical, commercial or other nature, obtained during negotiations and / or the execution of any order.

XI - INDUSTRIAL AND INTELLECTUAL PROPERTY RIGHTS

The results, data, studies and information (whether patentable or not), or software developed by the vendor during execution of any order, and delivered to the customer, are the sole property of the vendor.

Apart from the instructions for use, servicing and maintenance, reports and documents of any type that we deliver to our customers remain our property and must be returned to us on request, even when design fees have been charged for them, and they shall not be communicated to third parties or used without the prior written agreement of the vendor.

XII - CANCELLATION CLAUSE

We reserve the right to cancel immediately, as of right and without formal notice, the sale of our goods in case of non-payment of any part of the price by the due date, or in case of any breach in the contractual

obligations of the customer. In this case, the goods will have to be returned to us immediately, at the customer's own risk and expense, subject to a penalty of 10% (ten per cent) of its value per week of delay. All payments already received shall remain our property as indemnity, without prejudice to our rights to claim damages.

XIII - WARRANTY

The vendor warrants the goods against any defect, arising from a default in material or in workmanship, for twelve months starting from the date on which they are made available, according to the conditions defined below.

The warranty for goods with special applications, or goods used 24 hours a day, is automatically reduced by half.

On the other hand, parts or accessories of other origin, which bear their own brand name, are included in our warranty only to the extent of the warranty conditions granted by the suppliers of these parts.

The vendor's warranty will only apply insofar as the goods have been stored, used and maintained in accordance with the vendor's instructions and documentation. It cannot be invoked when the default results from :

- failure to monitor, maintain or store the goods correctly,
- normal wear and tear of goods,
- intervention on or modification to the goods without the vendor's prior authorisation in writing,
- abnormal use, or use not conforming to the intended purpose,
- defective installation at the customer's and / or the final user's premises,
- non-communication, by the customer, of the intended purpose or the conditions of use of the goods,
- failure to use original manufacturer's spare parts,
- Force Majeure or any event beyond the control of the vendor,
- etc ...

In all cases, the warranty is limited to the replacement or the repair of parts or goods recognised as defective by our technical departments. If the repair is entrusted to a third party, it should only be carried out after acceptance by the vendor of the estimate for repair.

No goods should be returned without the vendor's prior authorisation in writing .

Goods to be repaired should be sent prepaid, to the address indicated by the vendor. If the goods have not been repaired under warranty, the cost of dispatching it back will be invoiced to the customer or to the end purchaser.

This warranty applies to our goods in accessible form and therefore does not cover the cost of dismantling and reinstallation of the said goods in the equipment in which they are integrated .

Repair, modification, or replacement of spare parts or goods during the warranty period will not extend the duration of the warranty.

The provisions of this article constitute the only obligation on the part of the vendor concerning the warranty for the goods supplied.

XIV -LIABILITY

The vendor will be liable for bodily injury caused by his goods or personnel.

The repair of property damages attributable to the vendor is expressly limited to a sum which may not exceed the amount of the goods found as defective.

It is expressly agreed that the vendor and the customer each waive any right to claim for indirect, consequential and / or punitive damages of any kind, such as loss of production, loss of profit, costs of withdrawal from the market or costs of recall, costs of dismantling and reinstallation of goods, loss of contracts, etc ...

XV - SPARE PARTS AND ACCESSORIES

Spare parts and accessories are provided on request insofar as they are available. Related costs (carriage and any other costs) are always added to the invoice.

We reserve the right to demand a minimum quantity or invoice a minimum per order.

XVI - PARTIAL INVALIDITY

If any provision of these General Conditions of Sale is held to be unenforceable for any reason, it shall be adjusted rather than voided, if possible, in order to achieve the intent of the parties to the extent possible. In any event, all other provisions shall be deemed valid and enforceable to the full extent possible.

XVII -DISPUTES

THESE GENERAL CONDITIONS OF SALE ARE GOVERNED BY FRENCH LAW.

ANY DISPUTE RELATING TO OUR SALES, EVEN IN THE CASE OF MULTIPLE DEFENDANTS, SHALL BE, IN THE ABSENCE OF AMICABLE SETTLEMENT AND NOTWITHSTANDING ANY CLAUSE TO THE CONTRARY, SUBJECT TO THE JURISDICTION OF THE COURTS OF ANGOULEME (France).

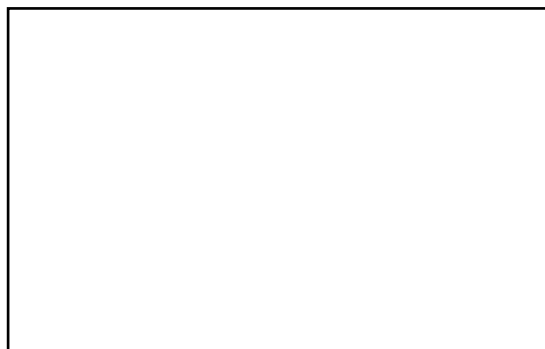


WORLD LEADER IN INDUSTRIAL DRIVE SYSTEMS

**ELECTRIC MOTORS - GEARBOXES - ELECTRONICS
ALTERNATORS - ASYNCHRONOUS GENERATORS - DC MACHINES**



**36 PRODUCTION UNITS
470 SALES & SERVICE CENTRES WORLDWIDE**



MOTEURS LEROY-SOMER 16015 ANGOULÊME CEDEX - FRANCE

RCS ANGOULÊME N° B 671 820 223
S.A. au capital de 131 910 700 F
<http://www.leroy-somer.com>