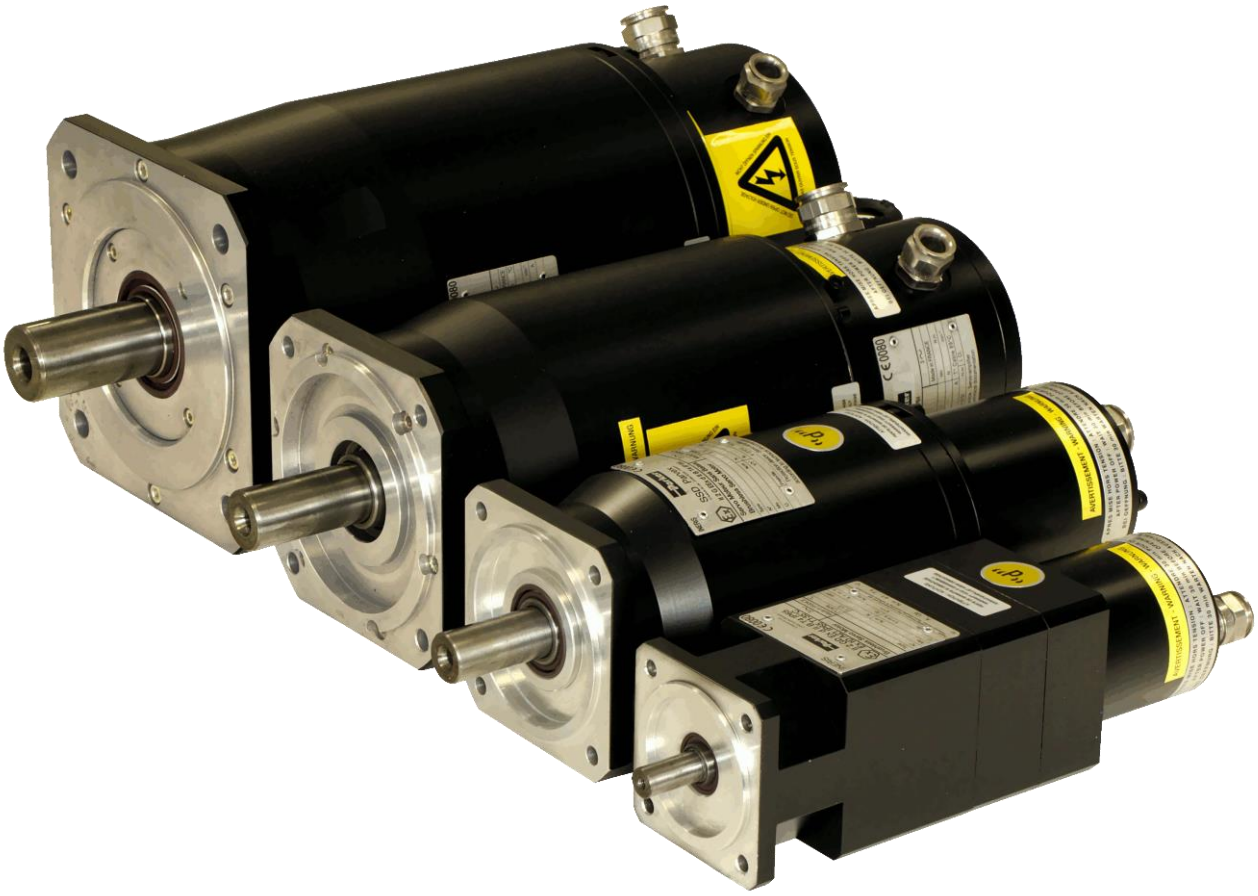
Servomotors

EX Series

Technical Manual

PVD 3665 - EX



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Compliance with «UL» standards

Table of Content

	Mechanical hazard Servomotors can accelerate in milliseconds. Running the motor can lead to other sections of the machine moving dangerously. Moving parts must be screened off to prevent operators coming into contact with them. The working procedure must allow the operator to keep well clear of the danger area.
	Burning Hazard Always bear in mind that some parts of the surface of the motor can reach a temperature of 135°C.
	Generality The installation and operation must be made with the *Commissioning and use manual* given with the motor. Commissioning and use manual of the EX motor series : - EX8 Atex : PVD 3571
	**Atex servomotors** This motor can be used in hazardous areas. May particular attention to the notes marked with .
	European directive 99/92/EC makes explicit the responsibility of employers to protect employees who may be exposed to risk of ATEX environments (Explosive Atmosphere). The employer must assess the risk and classify potentially dangerous areas. Equipment and materials must also be suited for use in dangerous areas in accordance with ATEX directives 94/9/EC and 2014/34/EU.

1.2.3. Safe Torque Off function

The safe torque off function in accordance with the standards EN ISO 13849-1 : 2006 and EN 61800-5-2 : 2006 is an electronic system set up on some drives certified by a notified body. This is an unlocked input placed on the drive that must be connected (see the commissioning and use manual of the drive).

The servomotors EX are equiped with a thermal protection which is checked by a safety analysis and is a key element of the ATEX/IECEx safety. It is possible to connect this protection to the unlocked input or through a safety system in accordance to the drive specifications. This connection allows to maintain the drive power on, but disable the motor after the activation of the thermal protection.

After an activation of this security device, the system must not restart automatically and without a checking of the installation.

In all cases, the connection of this device must be checked and certified by a notified body.

1.2.4. Operating category and marking of EX servomotors

1.2.4.1. EX3-EX4-EX6 ATEX/IECEx gazeous atmospheres

II 2 G Ex db IIB T4 Gb IP64

II	2	G	Ex	db	II	B	T4	Gb	IP65
I Mines	M1 Very high level of protection	**G** Gas/Vapour	ATEX protection	o Oil immersion	I Mines	Methane	T1 450 °C	Ma Very high level of protection	**IP64**
	M2 High level of protection			p Pressurized apparatus			T2 300 °C	Mb High level of protection	
II Surface	1 Very high level of protection			**db** Flameproof enclosure	**II** Surface Gas	**A** Propane	T3 200 °C	Ga Very high level of protection	
	2 High level of protection			e Increased safety		**B** Ethylene	**T4** 135 °C	**Gb** High level of protection	**IP65**
	3 Normal level of protection			m Encapsulation		C Hydrogen Acetylene	T5 100 °C	Gc Normal level of protection	
				i Intrinsic safety			T6 85 °C		

	Suitable for ATEX/IECEX servomotors

1.2.5. Special conditions for the ATEX servomotors

	The EC certifications are marked with a **X**. It seems the using of the motor must be in accordance with special conditions explained below: In case of fail of a screw used to assemble the parts of the flameproof enclosure, the new part must have a quality class superior or equal to 8.8. In case of an using in dusty explosive atmospheres, the user must perform regular cleaning operations on the motor to avoid dust deposits.

1.2.5.1. UL

Class1 group C&D Code T4A

<table>
<tr><th>Class I</th><th>Division 1</th><th>Group C&D</th><th>T4A</th><th>IP65</th></tr>
<tr><td rowspan="8">Class I
Gaz, vapours ou liquids</td><td rowspan="4">Division 1
Explosive atmospheres can exist all the time or some of the time under normal operating conditions</td><td>A
Acetylene</td><td>T1
450°C</td><td rowspan="8">IP65</td></tr>
<tr><td>B
Hydrogen</td><td>T2
300°C</td></tr>
<tr><td></td><td>T3
200°C</td></tr>
<tr><td rowspan="2">C
Ethylene</td><td>T4
135°C</td></tr>
<tr><td rowspan="4">Division 2
Explosive atmospheres cannot exist under normal operating conditions</td><td>T4A
120°C</td></tr>
<tr><td rowspan="2">D
Propane</td><td>T5
100°C</td></tr>
<tr><td>T6
85°C</td></tr>
</table>

	Suitable for UL servomotors

2.4. General Technical Data for ATEX motors

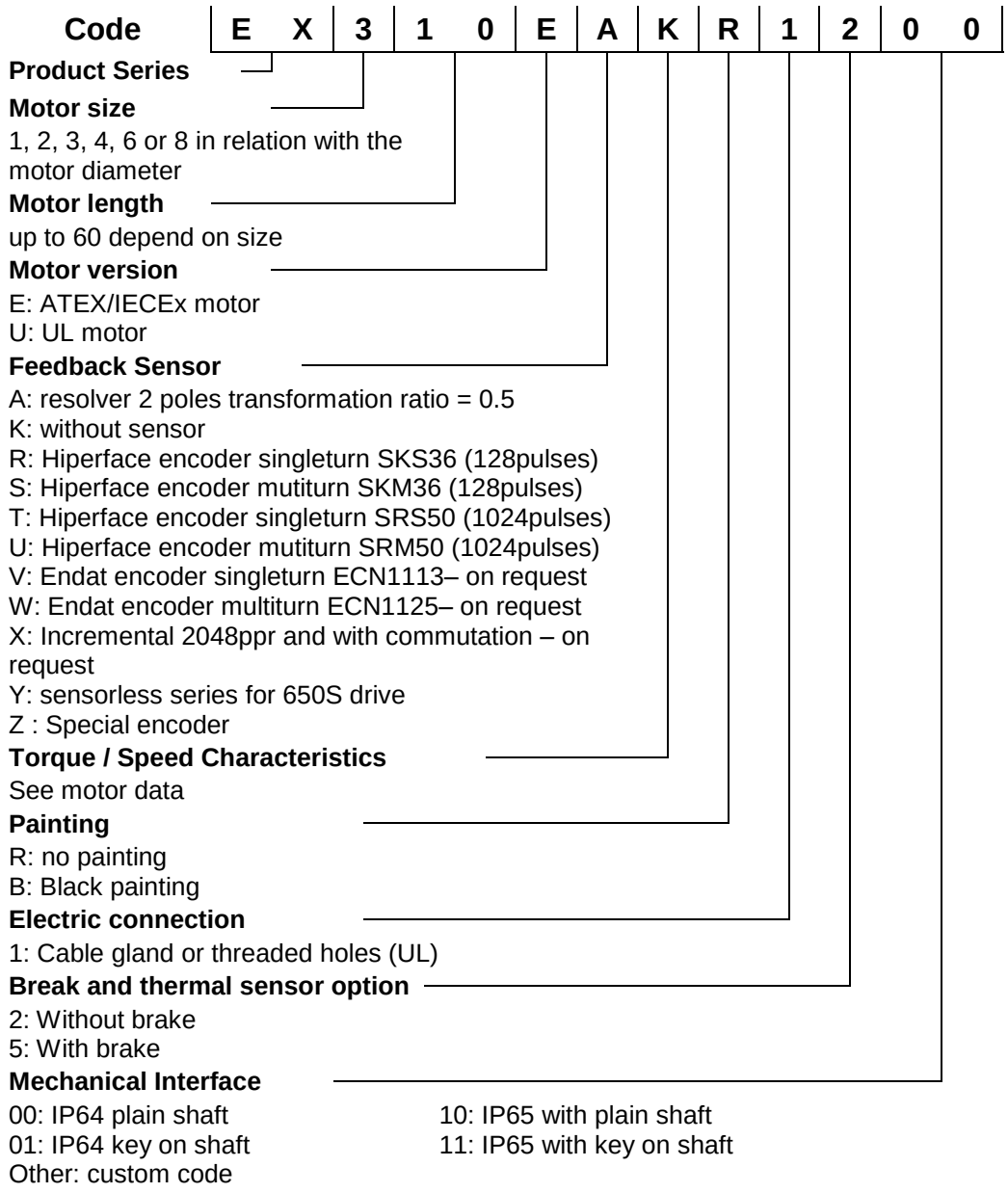
	EX3, EX4, EX6	EX8
Motor type	Permanent-magnet synchronous motor	
Magnets material	Neodymium Iron Boron	
Number of poles	10	
Type of construction	IMB5 – IMV1 – IMV3 (EN60034-7)	
Degree of protection	• Gazeous atmosphere : IP64, IP65 • Combustible dust atmosphere : IP65	
Cooling	Natural cooling	
Rated voltage	230VAC, 400 VAC	
Insulation of the stator winding	Class F according to IEC 60034-1	Class F according to IEC 60034-1 with potting
Altitude	Up to 1000m (IEC 60034-1) No allowed for higher altitude	
Ambiant temperature	-20°C to +40°C -20°C to +60°C with performances derating	
Storage temperature	-20°C to +60°C	
Connection	Electronic plate with cable glands	
Marking	CE and IECEx	
Paint	Black RAL9005	
Sensor	• Resolver as a standard • Sick encoder - Hiperface: SKS36 and SKM36 SRS50 and SRM50 – on request and not available for EX3 • Heidenhain Endat encoder: ECN1113 and EQN1125 – on request and not available for EX3 and EX4 • Sensorless • Incremental 2048 pulses and with commutation (10 poles) – on request	
Brake	Parking brake as an option	
Thermal protection	Thermoswitches + thermofuse	
Remark	Numerous customization are possible on request (special shaft, special flange,…)	

2.5. General Technical Data for UL motors

	EX3, EX4, EX6	EX8
Motor type	Permanent-magnet synchronous motor	
Magnets material	Neodymium Iron Boron	
Number of poles	10	
Type of construction	IMB5 – IMV1 – IMV3 (CEI 60034-7)	
Degree of protection	IP65	
Cooling	Natural cooling	
Rated voltage	230VAC, 400 VAC, 480 VAC	
Insulation of the stator winding	Class F according to IEC 60034-1	Class F according to IEC 60034-1 with potting
Altitude	Up to 1000m (IEC 60034-1)	
Ambiant temperature	-20°C to +40°C	
Storage temperature	-20°C to +60°C	
Connection	Electronic plate with threaded holes	
Marking	UL	
Paint	Without	
Sensor	• Resolver as a standard • Sick encoder - Hiperface: SKS36 and SKM36 SRS50 and SRM50 – on request and not available for EX3 • Heidenhain Endat encoder: ECN1113 and EQN1125 – on request and not available for EX3 and EX4 • Sensorless	
Brake	Parking brake in option	
Thermal protection	Thermoswitches + thermofuse	
Remark	Numerous customization are possible on request (special shaft, special flange,…)	

2.6. Product Code

The EX servomotors are defined by its electrical and mechanical characteristics, by its accompanying accessories and by any customer specificity. This information is coded and entered in the “Type” column on the manufacturer’s plate for the basic codification; the specificities are entered in a separate column.



3. TECHNICAL DATA

3.1. Motor selection

3.1.1. ATEX standard atmospheric conditions

EX motors are designed to operate in area:

- with a pressure between 80 kPa (0.8 bar) and 110 kPa (1.1 bar).
- air with normal oxygen content, typically 21 % v/v.
- air with a maximum relative humidity of 80%, without condensation.

In other conditions, please consult us.

3.1.2. Altitude derating

From 0 to 1000 m : no derating
> 1000 m : the EX motors are not designed to operate in hazardous area for this altitude.

3.1.3. Temperature derating

EX servomotors are designed to operate with a maximum ambient temperature of 40°C. In case of using with an ambient temperature above 40°C and less or equal than 60°C, a derating of performances is applied according to data recommended by Parker.

3.1.4. Thermal equivalent torque (rms torque)

The selection of the right motor can be made through the calculation of the rms torque M_{rms} (i.e. root mean squared torque) (sometimes called equivalent torque).
This calculation does not take into account the thermal time constant. It can be used only if the overload time is much shorter than the copper thermal time constant.
The rms torque M_{rms} reflects the heating of the motor during its duty cycle.

Let us consider:
- the period of the cycle ***T*** *[s],*
- the successively samples of movements ***i*** characterized each ones by the maximal torque M_i *[Nm]* reached during the duration Δt_i *[s]*.

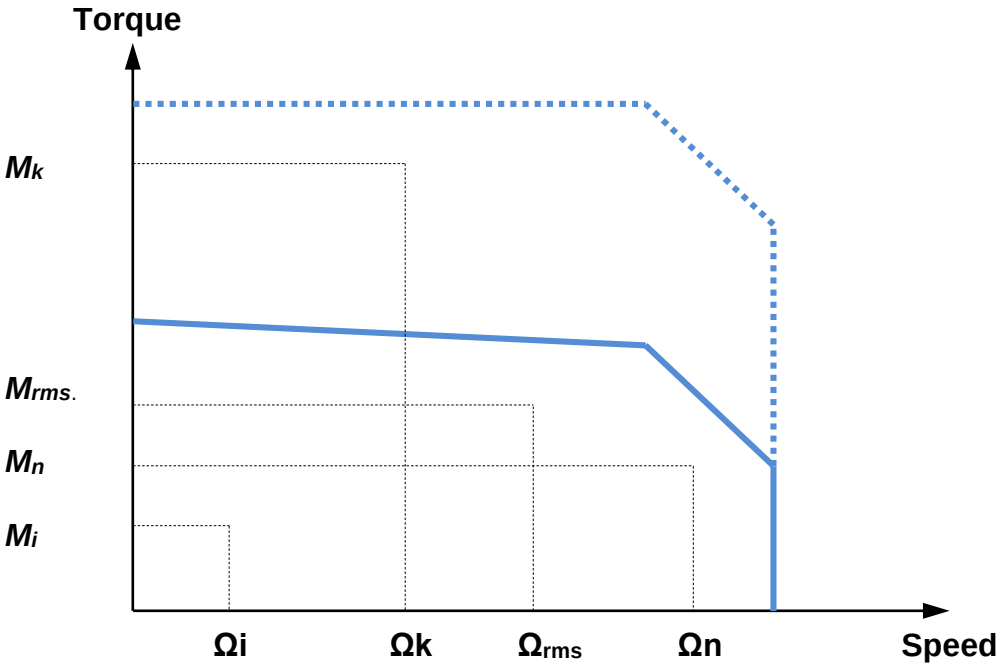
So, the rms torque M_{rms} can be calculated through the following basic formula:

$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^{n} M_i^2 \Delta t_i}$$

Example:
For a cycle of 2s at 0 Nm and 2s at 10Nm and a period of 4 s, the rms torque is

$$M_{rms} = \sqrt{\frac{1}{4} * 10^2 * 2} = 7{,}07 Nm$$

Furthermore, each Mi and speed associated Ωi of the duty cycle has to be located in the operational area of the torque vs speed curve.



3.1.5. Servo drive selection

Selection of drive depends on its rated power, rated current and its mode selection which leads to the maximal current duration.

	Please refer to the drive technical documentation for any further information and to select the best motor and drive association.

AC890 PARKER drive example:

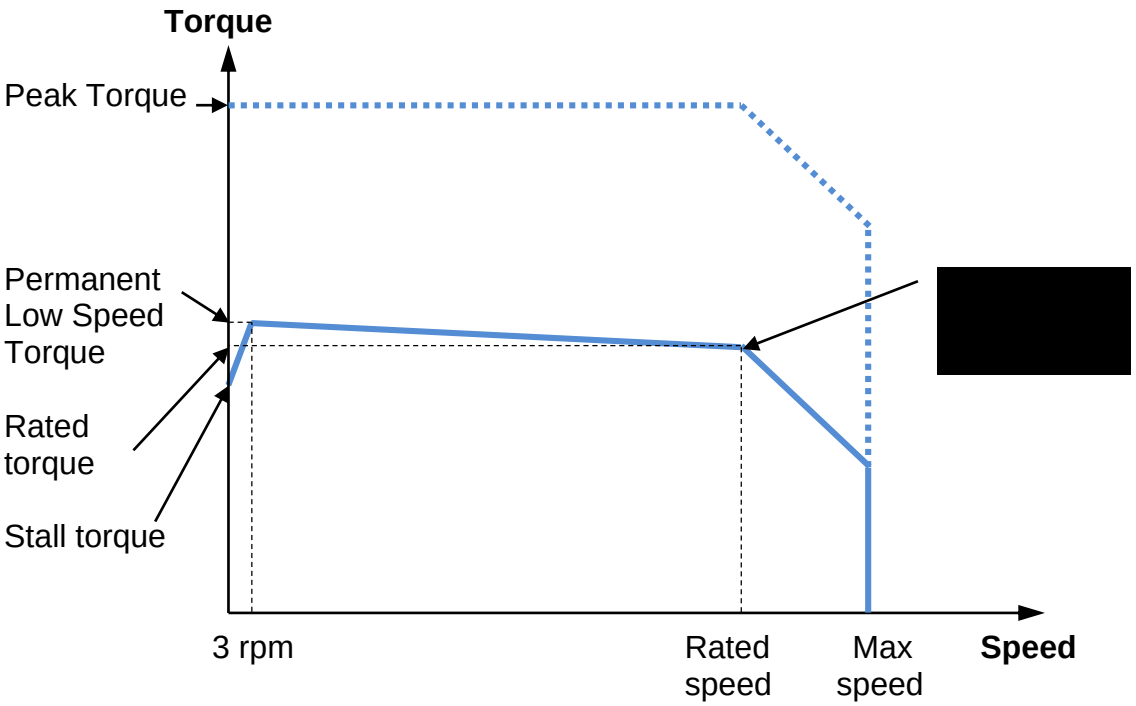
The rated current provided by the AC890 drive depends on its rated power and its mode selection. “Vector mode” is used for induction motors while “Servo mode” is used for brushless AC motors. With EX motors the power is usually < 37 kW, the rated current corresponds to 100 %.

Power of Drive AC890 [kW]	**< 37 kW**
Mode	Servo mode
Overload capability [%]	200 % during 4 s

Illustration:

3.2. EX Characteristics: Torque, speed, current, power…

The torque vs speed graph below explains different intrinsic values of the next tables.

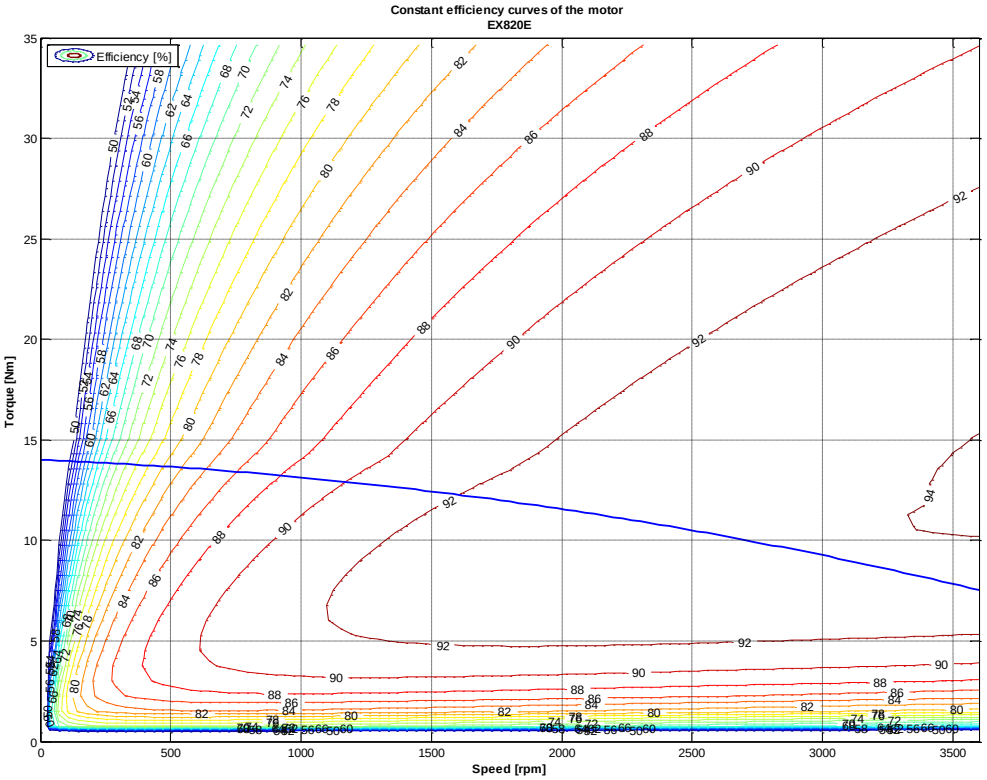


3.2.2. ATEX/IECEx 400V

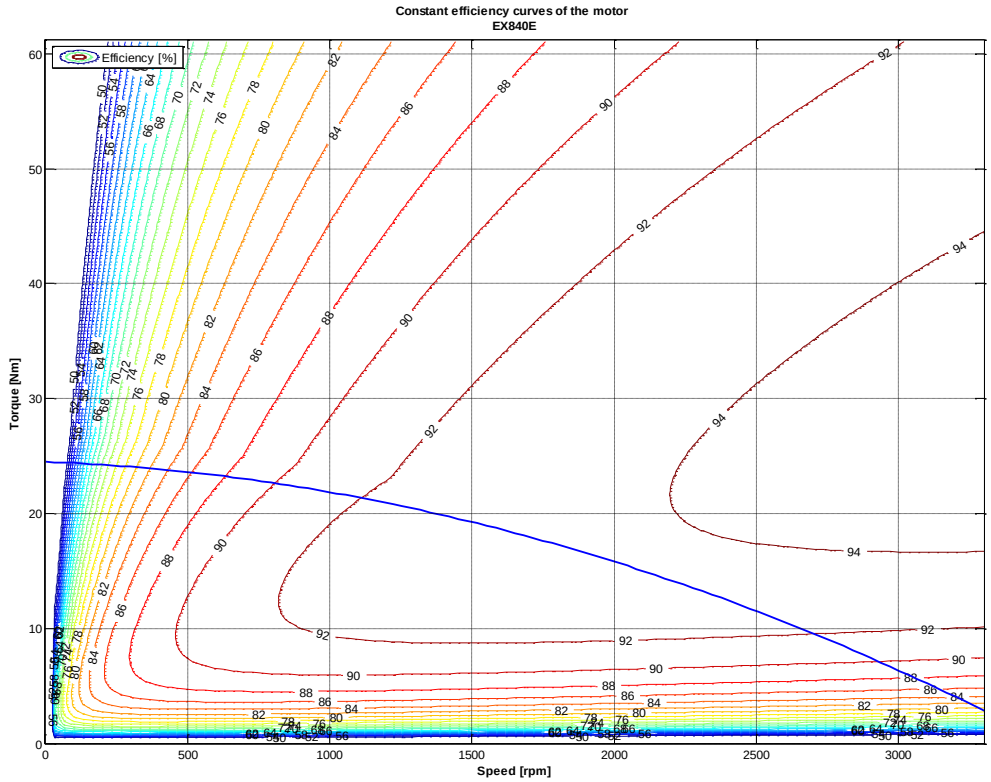
Motor	Rated Power Pn (kW)	Rated Torque Mn (Nm)	Rated Speed Nn [rpm]	Rated Current In [Arms]	Low Speed Torque Mo [Nm]	Low speed Current Io [Arms]	Peak Torque Mpeak [Nm]	Peak Current I peak [Arms]	Max. Speed Nmax [rpm]
With 40°C ambiant temperature									
EX310EAP	0.64	1.54	4000	1.1	1.75	1.2	4.2	3.1	4000
EX310EAK	0.87	1.23	6800	1.6	1.75	2.2	4.2	5.4	6800
EX420EAP	0.94	3	3000	2.1	3.5	2.5	8.3	6.2	3000
EX420EAJ	1.11	1.8	6000	2.3	3.5	4.3	8.3	10.7	6000
EX430EAL	1.37	3.3	4000	2.3	4.8	3.3	11.5	8.3	4000
EX430EAF	1.37	3.3	4000	4.1	4.8	5.8	11.5	14.5	5800
EX620EAV	1.25	6.0	2000	2.2	6.7	2.4	16.7	6.0	2000
EX620EAR	1.53	3.8	3900	2.7	6.7	4.5	16.7	11.2	3900
EX630EAR	2.19	7.8	2700	3.5	10.4	4.6	25.9	11.5	2700
EX630EAN	2.18	5.2	4000	3.8	10.4	6.9	25.9	17.3	4000
EX820EAR	2.84	7.5	3600	5.2	14	9.3	32.5	23.2	3900
EX840EAK	0.99	2.9	3300	2.1	24.5	14.3	58.2	35.6	3500
EX860EAJ	2.35	9.0	2500	4.4	35	15.7	83.3	39.2	2600

Motor	Rated Power Pn (kW)	Rated Torque Mn (Nm)	Rated Speed Nn [rpm]	Rated Current In [Arms]	Low Speed Torque Mo [Nm]	Low speed Current Io [Arms]	Peak Torque Mpeak [Nm]	Peak Current I peak [Arms]	Max. Speed Nmax [rpm]
With 60°C ambiant temperature									
EX310EAP	0.40	0.95	4000	0.7	1.8	1.2	4.2	3.1	4000
EX310EAK	0.40	0.95	4000	1.3	1.8	2.2	4.2	5.4	6800
EX420EAP	0.66	2.1	3000	1.5	3.0	2.1	7.3	5.3	3000
EX420EAJ	0.63	1.5	4000	1.9	3.0	3.7	7.3	9.1	6000
EX430EAL	0.90	2.9	3000	2.0	4.2	2.9	10.2	7.2	4000
EX430EAF	0.90	2.9	3000	3.6	4.2	5.1	10.2	12.7	4900
EX620EAV	0.88	4.2	2000	1.6	6.0	2.2	15.0	5.3	2000
EX620EAR	0.84	3.2	2500	2.4	6.0	4.1	15.0	9.9	3900
EX630EAR	1.18	4.5	2500	2.2	9.0	4.0	22.5	9.8	2700
EX630EAN	1.18	4.5	2500	3.3	9.0	6.1	22.5	14.7	4000
EX820EAR	1.65	8.5	1850	5.8	11.0	7.3	26.6	18.3	3900
EX840EAK	2.22	11.5	1850	6.9	21.0	12.2	51.0	30.6	2600
EX860EAJ	2.60	15.5	1600	7.2	31.0	13.9	75.1	34.8	2100

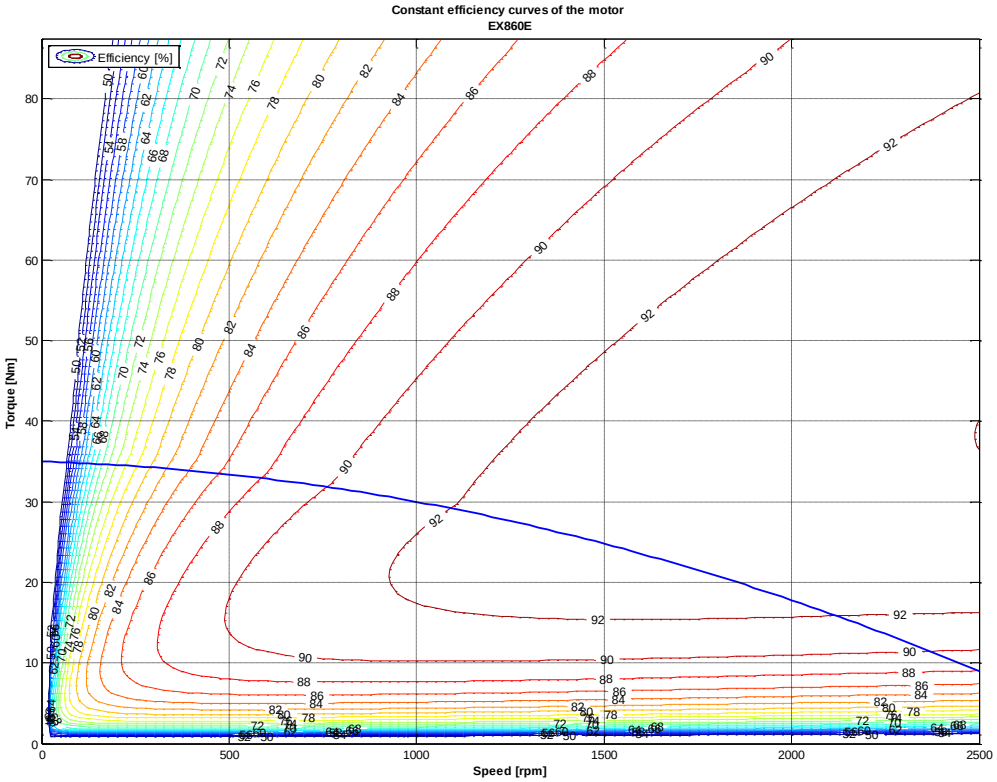
3.2.6.6. Series EX820E (EX820EAR)



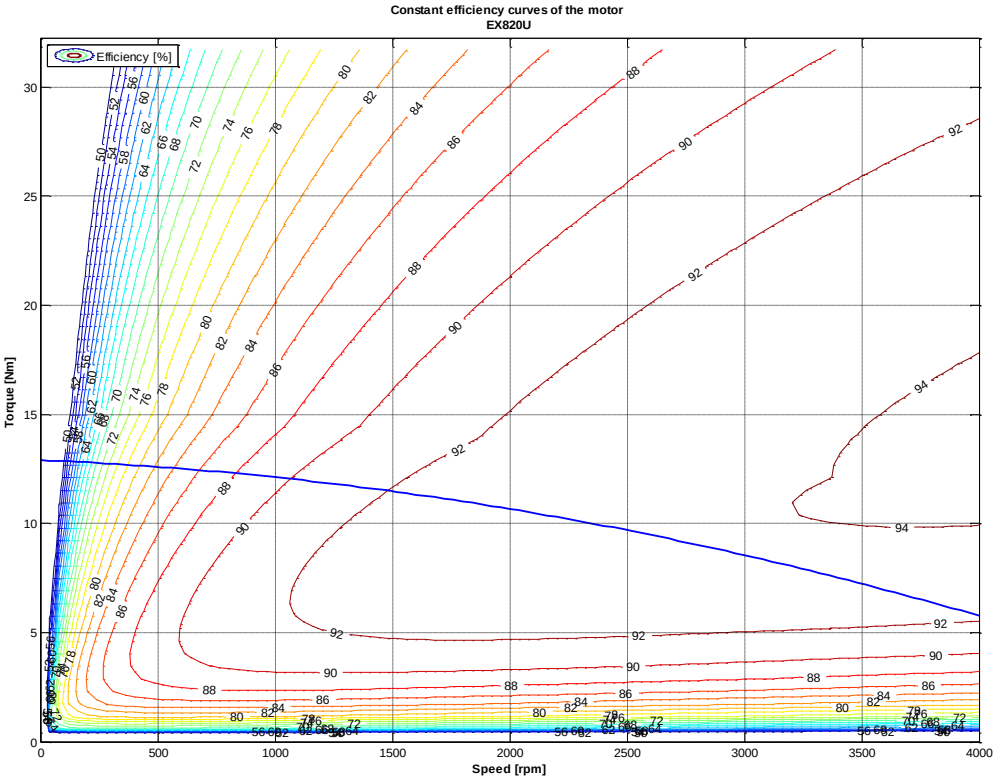
3.2.6.7. Series EX840E (EX840EAK)



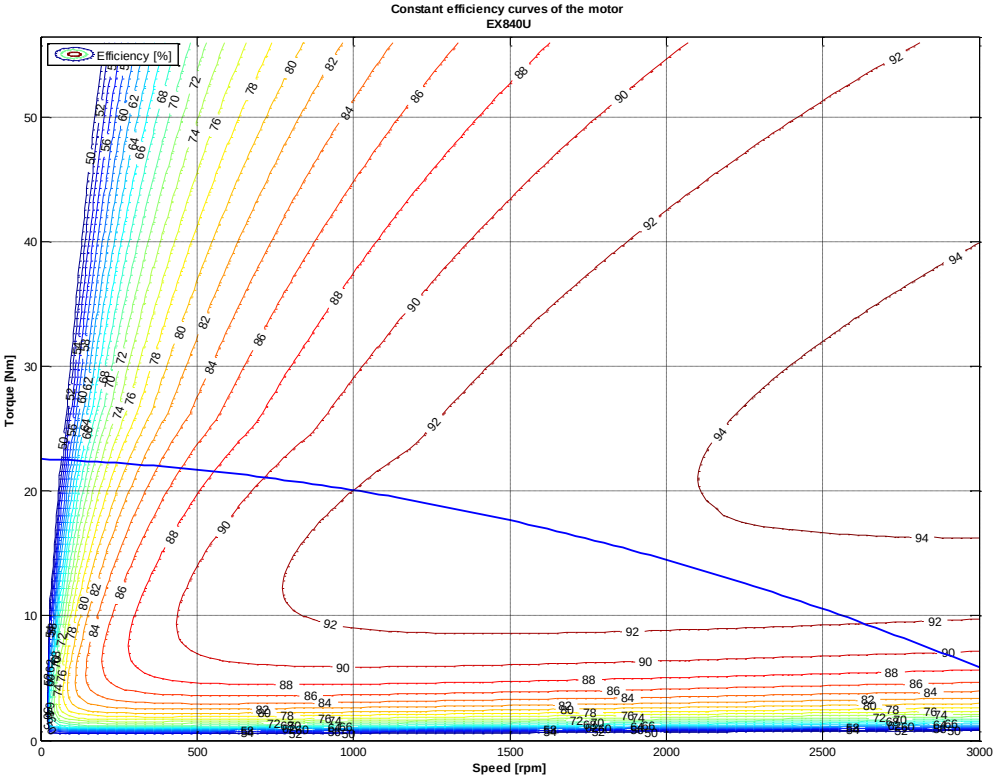
3.2.6.8. Series EX860E (EX860EAJ)



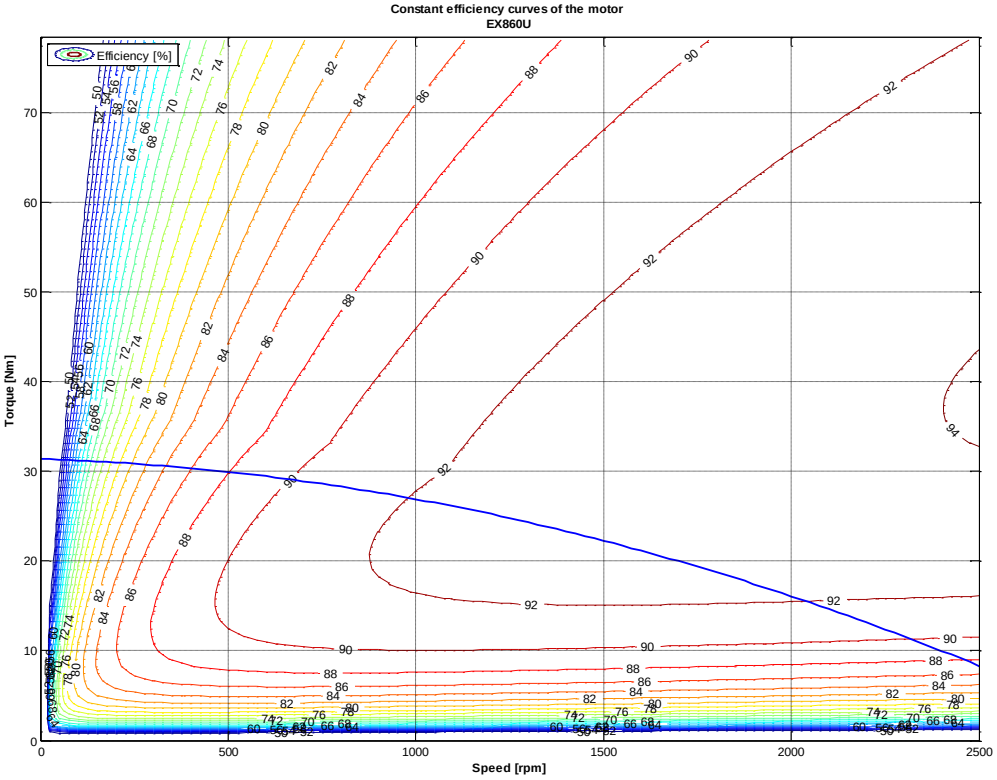
3.2.6.14. Series EX820U (EX820UAQ)



3.2.6.15. Series EX840U (EX840UAL)



3.2.6.16. Series EX860U (EX860UAJ)



3.2.8. Time constants of the motor

3.2.8.1. Electric time constant:

$$\tau_{elec} = \frac{L_{ph\_ph}}{R_{ph\_ph}}$$

With following values given in the motor data sheet
***L*ph_ph** inductance of the motor phase to phase [H],
***R*ph_ph** resistance of the motor phase to phase at 25°C [Ohm].

Example:
Motor series EX620EAO
L_{ph_ph} = 14 mH or 14.10^{-3} H
R_{ph_ph} at 25°C = 1.63 Ohm
→ $\sigma_{elec} = 14.10^{-3}/1.63$ = **8.6 ms**

An overall summary of motor time constants is given a little further.

3.2.8.2. Mechanical time constant:

$$\tau_{mech} = \frac{R_{ph\_n} * J}{Kt * Ke_{ph\_n}} = \frac{0.5 * R_{ph\_ph} * J}{(3 * \frac{Ke_{ph\_ph}}{\sqrt{3}}) * \frac{Ke_{ph\_ph}}{\sqrt{3}}}$$

$$\tau_{mech} = \frac{0.5 * R_{ph\_ph} * J}{(Ke_{ph\_ph})^2}$$

With following values obtained from the motor data sheet:
***R*ph_ph** resistance of the motor phase to phase at 25°C [Ohm],
J inertia of the rotor [kgm²],
***Ke*ph_ph** back emf coefficient phase to phase [V_{rms}/rad/s].

The coefficient ***Ke*ph_ph** in the formula above is given in [V_{rms}/rad/s]
To calculate this coefficient from the datasheet, use the following relation:

$$Ke_{ph\_ph[V_{rms}/rad/s]} = \frac{Ke_{ph\_ph[V_{rms}/1000rpm]}}{\frac{2 * \pi * 1000}{60}}$$

Example:
Motor series EX620EAO
R_{ph_ph} at 25°C = 1.63 Ohm
J = 98.10^{-5} kgm²
Ke_{ph_ph} [V_{rms}/1000rpm] = 81.7 [V_{rms}/1000rpm]
→ Ke_{ph_ph} [$V_{rms/rad/s}$] = 81.7/(2*π*1000/60) = 0.7802 [$V_{rms/rad/s}$]
→ σ_{mech}=0.5*1.63*98.10^{-5} /(0.7802²) = **1.3 ms**

3.2.9. Speed ripple

The typical speed ripple for a EX motor with a resolver at 4000rpm is 3% peak to peak. This value is given as indicative data because depending on the settings of the drive (gains of both speed and current regulation loops, presence of filtering or not, load inertia, resistant torque and type of sensor in use), without external load (neither external inertia nor resistant torque).

3.2.10. Cogging torque

The typical cogging for a EX series below is the maximum value peak to peak in N.cm:

Motor	Cogging Maxi [N.cm]
EX310	2.5
EX420	4.4
EX430	5.7
EX620	5.3
EX630	6.8
EX820	9
EX840	16
EX860	20

3.2.12. Voltage withstand characteristics of EX series

The motors fed by converters are subject to higher stresses than in case of sinusoidal power supply. The combination of fast switching inverters with cables will cause overvoltage due to the transmission line effects. The peak voltage is determined by the voltage supply, the length of the cables and the voltage rise time. As an example, with a rise time of 200 ns and a 30 m (100 ft) cable, the voltage at the motor terminals is twice the inverter voltage.
The insulation system of the servomotors EX is designed to withstand high repetitive pulse voltages and largely exceeds the recommendations of the IEC/TS 60034-25 ed 2.0 2007-03-12 for motors without filters up to 500V AC (See figure 1).

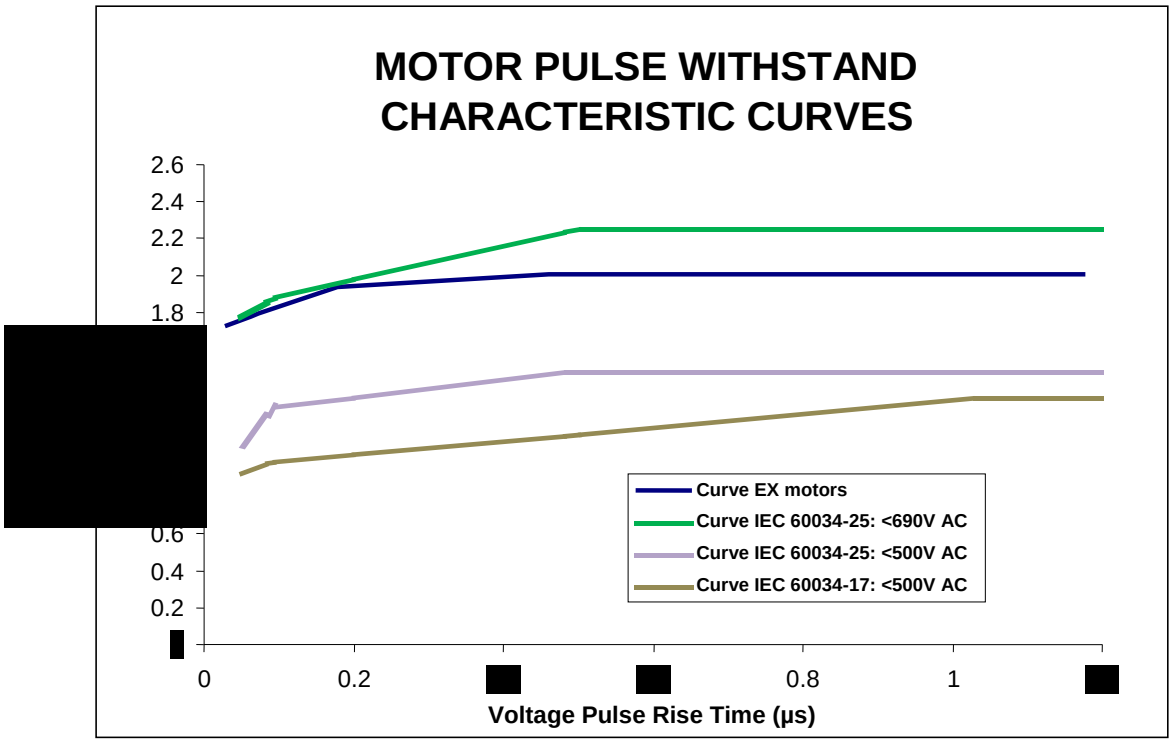


Figure 1: Minimum Voltage withstands characteristics for motors insulations according to IEC standards. At the top are the typical capabilities for the EX motors.

Note: The pulse rise times are defined in accordance with the IEC/TS 60034-17 ed4.0 2006-05-09.

The EX motors can be used with a supply voltage up to 480 V under the following conditions:

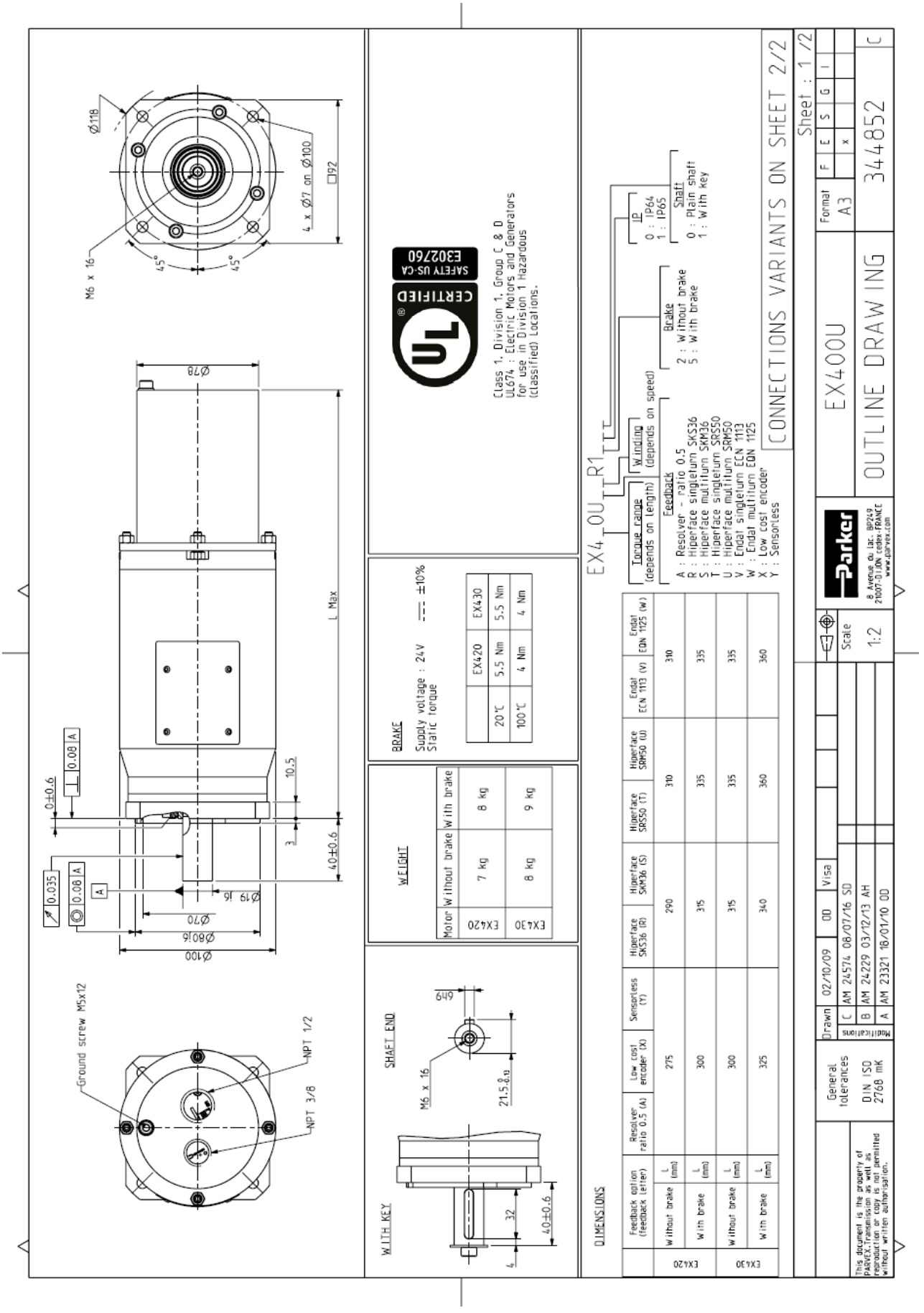
- The pulse rise times must be longer than 50 ns.
- The repetitive pulse voltages must not exceed the values given in figure 1, "*Curve EX motors*" in dark blue.

3.3. Dimension drawings

3.3.1. EX310E

3.3.4. EX820E EX840E EX860E

3.3.5. EX310U


EX400U
OUTLINE DRAWING
CONNECTIONS VARIANTS ON SHEET 2/2
Sheet : 1/2
344852
Format A3
Scale 1:2
Parker
8 Avenue du Lac BP249 21007-DIJON Cedex-FRANCE
www.parker.com
EX4_0U_R1
Torque range (depends on length)
Winding (depends on speed)
Feedback
A : Resolver - ratio 0.5
R : Hiperface singleturn SKS36
S : Hiperface multiturn SKM36
T : Hiperface singleturn SRS50
U : Hiperface multiturn SRM50
V : Endat singleturn ECN 1113
W : Endat multiturn EQN 1125
X : Low cost encoder
Y : Sensorless
Brake
2 : without brake
5 : With brake
IP
0 : IP64
1 : IP65
Shaft
0 : Plain shaft
1 : With key
CERTIFIED
SAFETY US-CA
E302760
Class 1, Division 1, Group C & D
UL674 : Electric Motors and Generators
for use in Division 1 Hazardous
(classified) Locations.
BRAKE
Supply voltage : 24V ⎓ ±10%
Static torque
EX420 5.5 Nm 4 Nm
EX430 5.5 Nm 4 Nm
WEIGHT
EX420 without brake 7 kg with brake 8 kg
EX430 without brake 8 kg with brake 9 kg
SHAFT END
WITH KEY
M6 x 16
21.5±0.13
40±0.6
32
6h9
DIMENSIONS
Feedback option (feedback letter) | Resolver ratio 0.5 (A) | Low cost encoder (X) | Sensorless (Y) | Hiperface SKS36 (R) | Hiperface SKM36 (S) | Hiperface SRS50 (T) | Hiperface SRM50 (U) | Endat ECN 1113 (V) | Endat EQN 1125 (W)
EX420 without brake L (mm) 275 290 310 310
EX420 with brake L (mm) 300 315 335 335
EX430 without brake L (mm) 300 315 335 335
EX430 with brake L (mm) 325 340 360 360
General tolerances DIN ISO 2768 mK
Drawn 02/10/09 DD Visa
Modifications
C AM 24574 08/07/16 SD
B AM 24229 03/12/13 AH
A AM 23321 18/01/10 DD
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Ø119
4 x Ø7 on Ø100
□92
M6 x 16
45°
45°
Ø78
L Max
0±0.6
0.08 A
10.5
3
40±0.6
0.035
0.08 A
A
Ø19 j6
Ø70
Ø80j6
Ø100
Ground screw M5x12
NPT 1/2
NPT 3/8

3.3.6. EX420U EX430U

3.4.3. Frame recommendation

	Warning : The user has the entire responsibility to design and prepare the support, the coupling device, shaft line alignment, and shaft line balancing.

Foundation must be even, sufficiently rigid and shall be dimensioned in order to avoid vibrations due to resonances.
The servomotors need a rigid support, machined and of good quality.
The maximum flatness of the support has to be lower than 0.05mm.

The motor vibration magnitudes in rms value are in accordance with IEC 60034-14 grade A:

- maximum rms vibration velocity for EX is 1.3mm/s for rigid mounting

	Warning : A grade A motor (according to IEC 60034-14) well-balanced, may exhibit large vibrations when installed in-situ arising from various causes, such as unsuitable foundations, reaction of the driven motor, current ripple from the power supply, etc. Vibration may also be caused by driving elements with a natural oscillation frequency very close to the excitation due to the small residual unbalance of the rotating masses of the motor. In such cases, checks should be carried out not only on the machine, but also on each element of the installation. (See ISO 10816-3).

	Warning : A bad setting of the electronic control of the close loop (gain too high, incorrect filtring …) can occur an instability of the shaft line, vibration or/and breakdown - . Please consult us

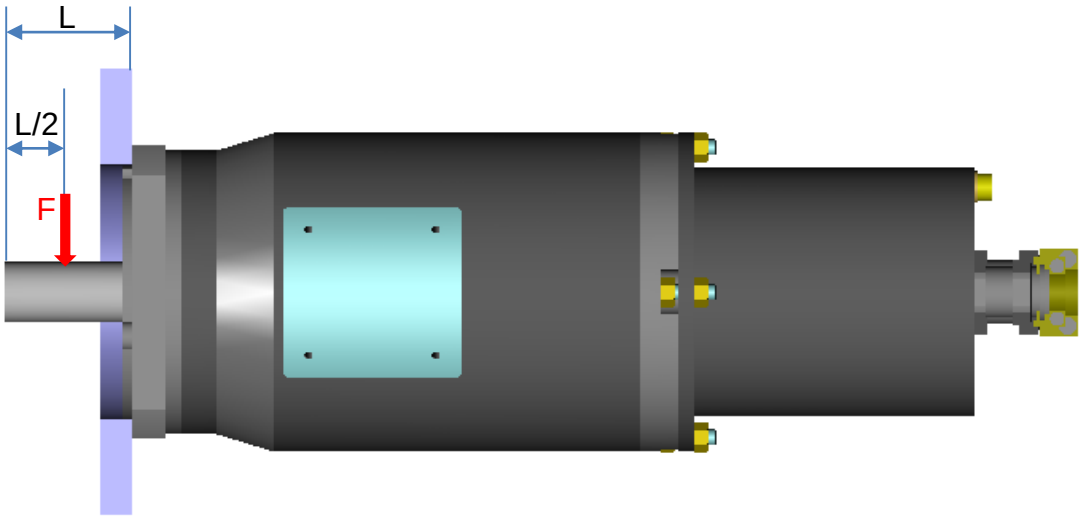
3.5. Shaft Loads

3.5.1. Vibration resistance to shaft end

Frequency domain :10 to 55 Hz according to EN 60068 -2-6
Vibration resistance to the shaft end :
- radial 3 g
- axial 1 g

3.5.2. Maximum load acceptable on the shaft

	Warning : The values written in the table are given for a load placed on the middle of the shaft like the picture below.



	Warning : Due to the small ATEX airgap requirements between the shaft and the front flange, the radial loads on the shaft are lower than standard NX motors. The ATEX airgap requirements depend on the volume of the motor and can lead to lower radial loads for bigger motors.

	Warning : Regarding to these shaft loads, you must'nt use a pulley belt system without a load take-up system.

Type	Maximum shaft load F [N]
EX310	100
EX430	500
EX630	500
EX860	250

3.6. Cooling

In compliance with the IEC 60034-1 standards:
The ambient air temperature shall not be less than **-20°C** and more than **40°C.**

	It is possible to use the motors in an higher ambient temperature between **40°C** to **60°C** but with an associated derating to the motor performances.

	Warning: To reach the motor performances calculated, the motor must be thermally well connected to a aluminium flange with a dimension of 400 mm x 400 mm and with a thickness of 12 mm.

	Caution: the ambient air temperature shall not exceed 40°C (respectively 60°C with associated derating) in the vicinity of the motor flange

	Warning: A significant part of the heat produced by the motor is evacuated through the flange. • if the air is not able to circulate freely around the motor, • if the motor is mounted on a surface that dissipates not well the heating (surface with little dimensions for instance), • if the motor is thermally isolated, • if the motor is mounted on a warm surface (mounted on a gearbox for instance), then the motor has to be used at a torque less than the rated torque.

3.8. Power Electrical Connections

3.8.1. Inlet cables for ATEX/IECEx version.

The servomotors EX have two cable glands with metric thread :one for the feedback cable and the other for the power. These cable glands are place in axial or radial position on the feedback cover depending the motor option.
The informations of these cable glands are placed in the §4.4.
The cable gland expected for the feedback cable could be replace by an ATEX thread cap in case of a servomotor in sensorless.
It is forbidden to change a cable gland without the Parker agreement.

3.8.2. Wires sizes

	In every country, you must respect all the local electrical installation regulations and standards.

Not limiting example in France: NFC 15-100 or IEC 60364 as well in Europe.

	Cable selection depends on the cable construction, so refer to the cable technical documentation to choose wire sizes

	Some drives have cable limitations or recommendations; please refer to the drive technical documentation for any further information.

Cable selection

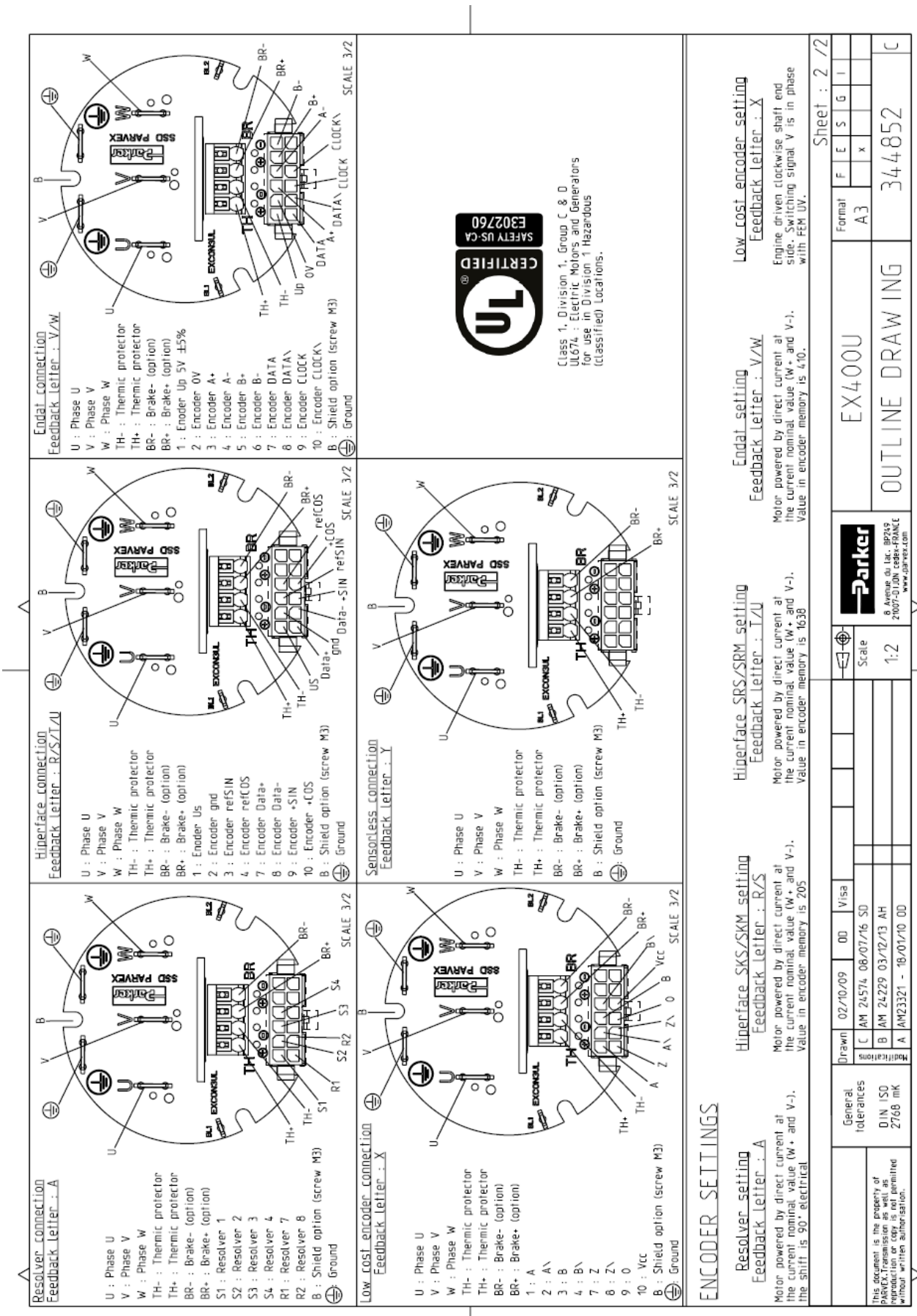
	At standstill, the current must be limited at 80% of the low speed current I_o and cable has to support peak current for a long period. So, if the motor works at standstill, the current to select wire size is $\sqrt{2} \times 0.8\ Io \cong$ **1,13 x I_o**.

	For the ATEX installations in ambient temperature of 40°C or 60°C, you have to use special cables C2 type auto-extinguish regarding the standard EN 50265-2-1. Warning : the cables used in the : • EX3 can reach a temperature of 80°C, • EX4 can reach a temperature of 91°C, • EX6 can reach a temperature of 95°C, • EX8 can reach a temperature of 95°C Warning : for a safe use, the EX3 servomotors has to be used with cable which withstand a maximum temperature of 80°C. Warning : for a safe use, the EX4/EX6/EX8 servomotors has to be used with cable which withstand a maximum temperature of 100°C.

3.8.5. Mains supply connection diagrams

3.8.5.1. EX310E

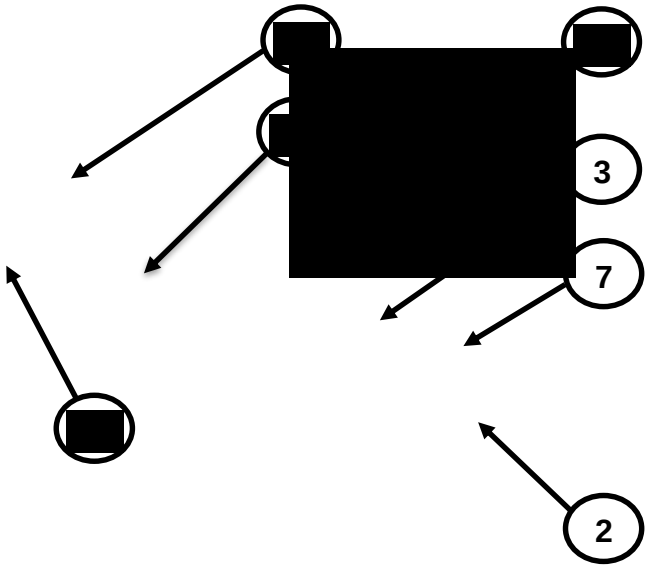
3.8.5.6. EX420U, EX430U



3.8.5.7. EX620U, EX630U

3.8.7. EX3-EX4 UL connection

3.8.7.1. Connection of the feedack and power cable with connector:



Step 1 – Remove the rear cover:

1. Unscrew the 4 nuts Ref 1.
2. Unscrew the cable gland caps Ref 2.
3. Remove the cover Ref 3.

Step 2 – Connection of the feedback cable :

1. Insert the cable in the cable gland or conduit stop Ref 2.
2. Strip the wires on 3 mm and crimp them on the contacts supplied in the terminal part kit with the manual crimp tooling Molex N°0638190000 for wire diameter AWG 20-24.
3. Place the contacts in the connector Ref 8.
4. Place the connector inside the PCB connector Ref 4.
5. Crimp the shielding wire in the connector and plug the connector in the terminal Ref 5.
6. If the shielding connection is not necessary, cut the wire short the cable.

Step 3 – Connection of the power cable :

1. Insert the cable in the cable gland or conduit stop Ref 2.
2. Strip the wires on 5mm and crimp the wires U, V, W and Ground in the faston terminals 6,8x0,8.
3. Place the wire U, V, W and Ground on the terminals and plug the wires TH+ and TH- and also BR+ and BR- in a case of a motor with a brake equiped in the terminal of the PCB Ref 4 .
4. Crimp the shielding wire in the faston terminal 2,8x0,8 and plug it on the terminal Ref 5.
5. If the shielding connection is not necessary, cut the wire short the cable.

Step 4 – Fitting of the rear cover :

1. Slowly take up any slack in the cables and close the cover Ref 3.
2. Tighten the cable gland caps or conduits stop Ref 2.
3. Tighten the screws of the connection modules Ref 6 at the torque value of 0,5 N.m.
7. Place the rear cover Ref 3 and take care to don't hurt the toric seal placed on the rear flange.
4. Tighten the 4 nuts Ref 1 at the torque value of 5,6 N.m.
5. Connect the outside ground with the screw Ref 7 and tighten it at the torque value of:

Motor size	Torque value (N.m)
EX3 M4 screw	2,5
EX4 M5 screw	5,6

3.9. Feedback system

3.9.1. Shaft rotation regarding the connection.

With the connection explained in the documentation and with a positive speed request on the drive, the shaft will turn in clockwise direction (see customer shaft end).

3.9.2. Resolver 2 poles transformation ratio = 0.5 – code A

	EX3	EX4, EX6 & EX8
Parker part number	220005P1001	220005P1002
Electrical specification	Values @ 8 kHz	
Polarity	2 poles	
Input voltage	7 Vrms	
Input current	86mA maximum	
Zero voltage	20mV maximum	
Encoder accuracy	± 10’ maxi	
Ratio	0,5 ± 5 %	
Output impedance (primary in short circuit whatever the position of the rotor)	Typical 120 + 200j Ω	
Dielectric rigidity (50 – 60 Hz)	500 V – 1 min	
Insulation resistance	≥ 100MΩ	
Rotor inertia	~30 g.cm²	
Operating temperature range	-55 to +155 °C	

3.9.3. Sensorless – code K or Y.

The servomotors EX in sensorless version do not have a feedback cable. The connection of the power cable has to be made regading the connection diagrams in this documentation. In these detailed diagrams §4.3.3, do not take care the connection of the feedback cable and keep the same connections for the other devices.

3.9.8. Endat encoder singleturn ECN1113 – code V

	EX3 & EX4 ATEX	EX3 UL, EX4 UL, EX6 & EX8
Model	N/A	ECN 1113 (Heidenhain)
Type		Absolute single turn encoder
Parker part number		220165P0002
Line count		512 sine/cosine periods per revolution
Electrical interface		Endat2.2
Position values per revolution		8 192 (13 bits)
System accuracy		± 60”
Operating speed		12 000 rpm
Power Supply Current consumption (without load)		3.6VDC to 14VDC 85mA @ 5VDC
Cutoff frequency – 3 dB		≥ 190kHz typical
Operating temperature range		-40°C to +115 °C

3.9.9. Endat encoder multiturn ECN1125 – code W

	EX3 & EX4 ATEX	EX3 UL, EX4 UL, EX6 & EX8
Model	N/A	ECN 1125 (Heidenhain)
Type		Absolute multi turn encoder
Parker part number		220165P0001
Line count		512 sine/cosine periods per revolution
Electrical interface		Endat2.2
Position values per revolution		8 192 (13 bits)
Revolutions		4 096
System accuracy		± 60”
Operating speed		12 000 rpm
Power Supply Current consumption (without load)		3.6VDC to 14VDC 105mA @ 5VDC
Cutoff frequency – 3 dB		≥ 190kHz typical
Operating temperature range		-40°C to +115 °C

	With unregulated power supply (AC890 PARKER drive for instance), the max cable length is **65m** with 0.25mm² power supply wire due to the voltage drop into the cable itself.

3.10.1. Cable option Max 80°C on the surface ATEX/IECEx

The servomotors EX are available on demand with cables withstanding a temperature of 80°C on the outside surface.
With this option the EX servomotors must be placed in an area with controlled temperature following the informations written in the tables just below. An over temperature must cut off the power of the motor.

Size EX4 :

	EX4 certified for an ambient temperature of -20 to +60°C
Ambient temperature for a Parker standard cable using (Max 100°C)	-20 to +60°C
Ambient temperature for an using of cables withstanding a max temperature of 80°C.	-20 to +49°C

Size EX6 :

	EX6 certified for an ambient temperature of -20 to +40°C	**EX6 certified for an ambient temperature of -20 to +60°C**
Ambient temperature for Parker standard cable using (Max 100°C)	-20 to +40°C	-20 to +60°C
Ambient temperature for an using of cables withstanding a max temperature of 80°C.	-20 to +37°C	-20 to +45°C

Size EX8 :

	EX8 certified for an ambient temperature of -20 to +40°C
Ambient temperature for Parker standard cable using (Max 100°C)	-20 to +40°C
Ambient temperature for an using of cables withstanding a max temperature of 80°C.	-20 to +25°C

3.10.6. Resolver cable connection for SLVD

Cable reference :
CS5UA1D1R0xxx

Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	S1 / Cos -	White	12
2	S2 / Sin -	Black (Black/Blue pair)	8
3	S3 / Cos +	Black (Black/White pair)	11
4	S4 / Sin -	Blue	7
5	R1 / Ref +	Red	4
6	R2 / Ref -	Black (Black/Red pair)	15

3.10.7. Resolver cable connection for 637/638

Cable reference :
CS1UA1D1R0xxx

Feedback cable **6537P0059**
Male 9 pins SUB-D connector reference **220029P0020**
SUB-D cover reference **220029P0039**
Pins reference **220029P0021**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	S1 / Cos -	Black (Black/White pair)	7
2	S2 / Sin -	Black (Black/Blue pair)	4
3	S3 / Cos +	White	3
4	S4 / Sin -	Blue	8
5	R1 / Ref +	Red	5
6	R2 / Ref -	Black (Black/Red pair)	9

3.10.8. Hiperface encoder cable connection for 637/638

Cable reference :
CS2UR1D1R0xxx

Feedback cable **6537P0059**
Male 9 pins SUB-D connector reference **220029P0020**
SUB-D cover reference **220029P0039**
Pins reference **220029P0021**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	Us	Green	2
2	Gnd	Black (Black/ Green pair)	1
3	refSin	Blue	4
4	refCos	Black (Black/White pair)	7
5	Data +	Red	9
6	Data -	Black (Black/Red pair)	5
7	Sin +	Black (Black/Blue pair)	8
8	Cos +	White	3

3.10.9. Feedback cable reference

For other drive, you can assembly cable and plug by soldering with part number on the tab below:

Feedback Sensor	Cable reference (C2 / 100°C)
Resolver	6537P0059
Hiperface Encoder	
EnDat Encoder	

3.10.14. Power cable reference

For other drive, you can assembly cable and plug by soldering with part number on the tab below:

Ampacity	Cable reference (C2 / 100°C)
Current ≤ 12Amps @40°C Current ≤ 9Amps @60°C	6537P0057
Current ≤ 24Amps @40°C Current ≤ 17Amps @60°C	6537P0058

4. COMMISSIONING, USE AND MAINTENANCE

4.1. Instructions for commissioning, use and maintenance

4.1.1. Equipment delivery

All servomotors are strictly controlled during manufacturing, before shipping.
While receiving it, it is necessary to verify motor condition and if it has not been damaged in transit. Remove it carefully from its packaging. Verify that the data written on the label are the same as the ones on the acknowledgement of order, and that all documents or needed accessories for user are present in the packaging.

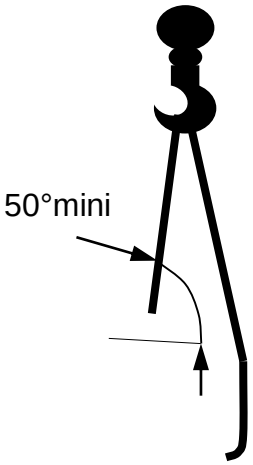
	Warning: In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h..

4.1.2. Handling

The servomotors EX8 are equipped with two lifting rings intended for handling.

	Caution: Use only servomotors lifting rings, if present, or slings to handle the motor. Do not handle the motor with the help of electrical cables, connectors and water inputs/outputs, or use any other inappropriate method.

The drawings below show the correct handling procedure.



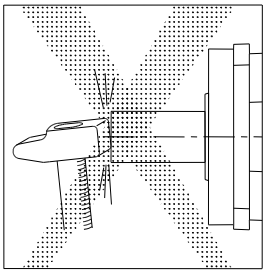
	DANGER: Choose the correct slings for the motor weight. The two slings must the same length and a minimum angle of 50° has to be respected between the motor axis and the slings.

4.2.3. Preparation

Once the motor is installed, it must be possible to access the wiring, and read the manufacturer's plate. Air must be able to circulate around the motor for cooling purposes.
Clean the shaft using a cloth soaked in white spirit or alcohol. Pay attention that the cleaning solution does not get on to the bearings.
The motor must be in a horizontal position during cleaning or running.

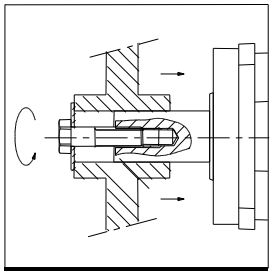
	Caution: Do not step on the motor or the cable glands.
	Caution: Always bear in mind that some parts of the surface of the motor can reach a temperature of 135°C

4.2.4. Mechanical assembly



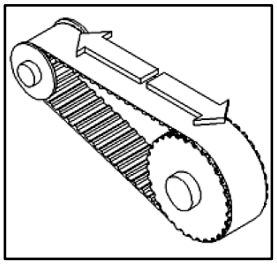
The operation life of servomotor bearings depends largely on the care and attention given to this operation.

- In the event that the servomotor shaft has a cotter pin, make sure that the coupling components have been balanced correctly without the cotter pin, the servomotor having been balanced with its cotter pin.



- Prohibit any impact on the shaft and avoid press fittings which could mark the bearing tracks. If press fitting cannot be avoided, it is advisable to immobilize the shaft in motion; this solution is nevertheless dangerous as it puts the resolver at risk.

- Use the thread at the end of the shaft in accordance with the diagram for fitting pulleys or accessories. It is possible to put pressure on the shoulder of the shaft located in front of the bearing.

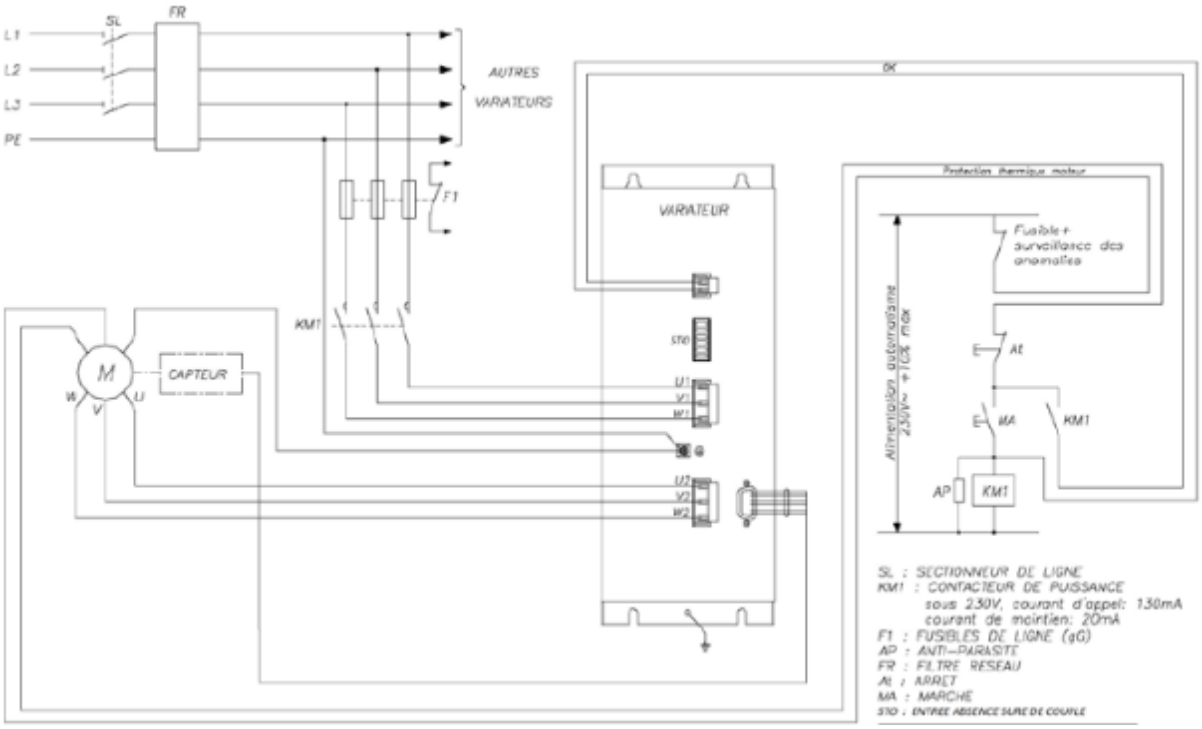


- In the event that the front bearing block is sealed by a lip seal which rubs on the rotating section (version IP 65), we recommended that you lubricate the seal with grease thus prolonging its operational life.

- In the event that the drive system uses a pulley and belt, the drive pulley must be fixed as close as possible to the flange. The pulley diameter is to be selected so that the radial load does not exceed the limits given in the catalog.

- CAUTION: Any equipment such as gearbox, mechanical speed drives, brakes, forced ventilation, integrated frequency converters, sensors, actuators, etc. associated with the motor must also have ATEX certification.

4.3.3.3. EX three phase



The safe torque off function is an alternative solution for the motor temperature monitoring.

The safe torque off function in accordance with the standards EN ISO 13849-1 : 2006 and EN 61800-5-2 : 2006 is an electronic system set up on some drives certified by a notified body. This is an unlocked input placed on the drive that must be connected (see the commissioning and use manual of the drive).

The servomotors EX are equiped with a thermal protection which is checked by a safety analysis and is a key element of the ATEX/IECEx safety. It is possible to connect this protection to the unlocked input or through a safety system in accordance to the drive specifications. This connection allows to maintain the drive power on, but disable the motor after the activation of the thermal protection.

After an activation of this security device, the system must not restart automatically and without a checking of the installation.

In all cases, the connection of this device must be checked and certified by a notified body.

4.3.4.2. Torque value

M16 Cable glands ADE N°5 :
Torque value for the cap = 12,5 N.m
Torque value for the connection module = 0,5 N.m

M20 Cable gland ADE N°6 :
Torque value for the cap = 20 N.m
Torque value for the connection module = 0,5 N.m

4.4.2. Informations about the flameproof enclosure components

The Ex motors of Parker Hannifin France has a traceability on the frameprood enclosure compotents. It is forbidden to replace on of these components without consulting Parker Hannifin.
If a cover exchange between two identical motors is required, the customer must make a new traceability on these components. To make the traceability, the customer must refer to the number written on the cover.

4.4.1. ATEX flameproof joints informations ATEX/IECEx

In accordance with the standards for explosive atmospheres, find below the detail of the ATEX/IECEx flameproof joints

Size EX3 :

Flameproof joints	Joint length	Joint gap
Joint between the shaft and the housing	9,5 mm min	0,245 mm Max
Joint between the housing and the rear flange	13,4 mm min	0,177 mm Max
Joint between the rear flange and the cover	12,7 mm min	0,087 mm Max

Size EX4 :

Flameproof joints	Joint length	Joint gap
Joint between the shaft and the front flange	12,5 mm min	0,239 mm Max
Joint between the front flange and the housing	14,3 mm min	0,059 mm Max
Joint between the housing and the rear flange	12,9 mm min	0,069 mm Max
Joint between the rear flange and the cover	12,9 mm min	0,106 mm Max

Size EX6 :

Flameproof joints	Joint length	Joint gap
Joint between the shaft and the front flange	12,5 mm min	0,239 mm Max
Joint between the front flange and the housing	13,7 mm min	0,069 mm Max
Joint between the housing and the rear flange	13,4 mm min	0,069 mm Max
Joint between the rear flange and the cover	13,42 mm min	0,069 mm Max

Taille EX8 :

Flameproof joints	Joint length	Joint gap
Joint between the shaft and the end flange	12,5 mm min	0,178 mm Max
Joint between the end flange and the front flange	16,7 mm min	0,007 Max
Joint between the front flange and the housing	12,7 mm min	0,079 mm Max
Joint between the housing and the rear flange	13,5 mm min	0,079 mm Max
Joint between the rear flange and the cover	14,1 mm min	0,146 mm Max

You find that the motor is too noisy	Several possible explanations : • Unsatisfactory mechanical balancing • There is friction from the brake: mechanical jamming. • Defective coupling • Loosening of several pieces • Poor adjustment of servo drive or position loop : check rotation in open loop