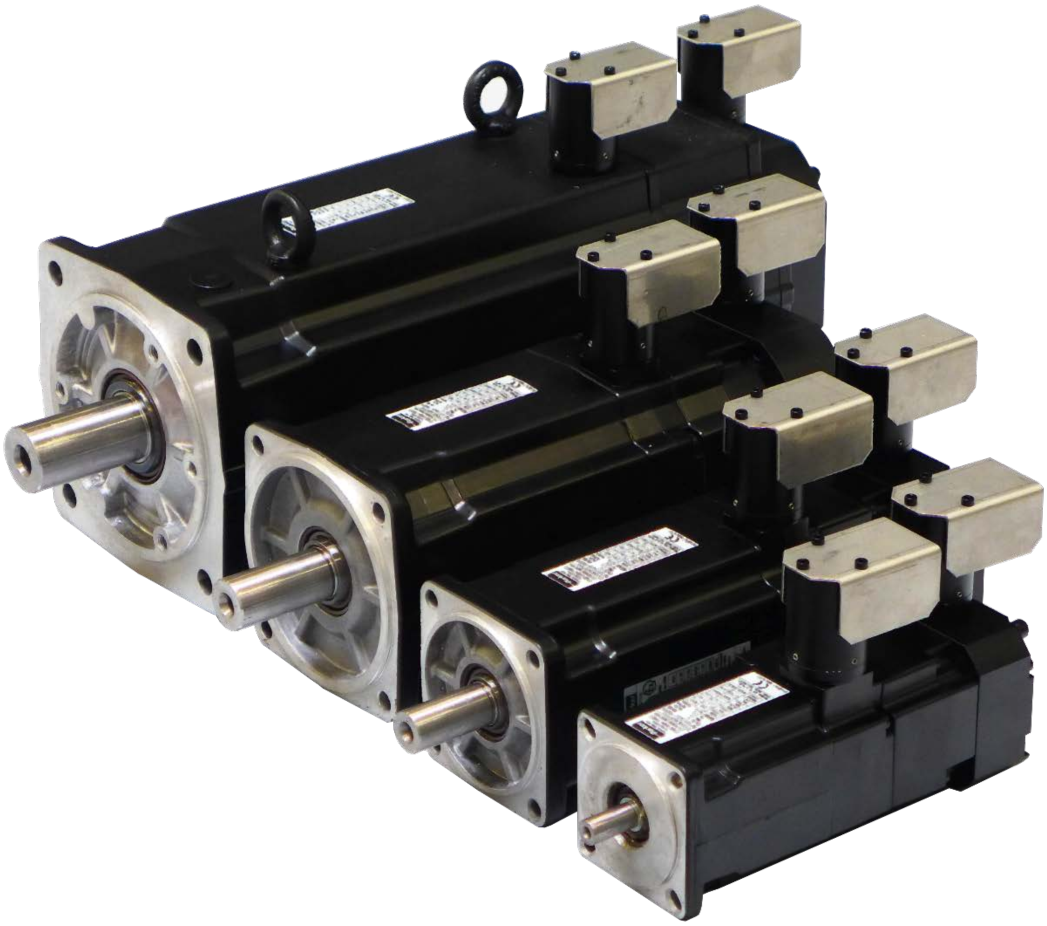
Servomotors

EY Series

Technical Manual

PVD 3675 – EY Series



EU DECLARATION OF CONFORMITY

We ,

Parker Hannifin Manufacturing France SAS
Electromechanical & Drives Division Europe
Etablissement de Longvic
4 Boulevard Eiffel - CS40090
21604 LONGVIC Cedex - France

manufacturer, with brand name **Parker**, declare under our sole responsibility that the products,

SERVOMOTORS TYPE EY3 - EY4 - EY6 - EY8 with the following marking :

II 3 GD Ex nA IIC T3 Gc IP65 / Ex tc IIIC T200°C Dc IP65

satisfy the arrangements of the directives :

Directive 2014/35/EU : "Low Voltage Directive", LVD
Directive 2011/65/EU : "Restriction of Hazardous Substances", RoHS
Directive 2014/34/EU : "Equipment and protective systems intended for use in potentially explosive atmospheres"

and meet standards or normative document according to :

EN 60034-1:2010/AC:2010 : Rotating electrical machines - Part 1 : Rating and performance.
EN 60034-5:2001/A1:2007 : Rotating electrical machines - Part 5 : Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification.
EN 60079-0:2012/A11:2013 : Explosive atmospheres - Part 0 : Equipment - General requirements.
EN 60079-15:2010 : Explosive atmospheres - Part 15 : Equipment protection by type of protection "n".
EN 60079-31:2014 : Explosive atmospheres - Part 31 : Equipment dust ignition protection by enclosure "t".

The undersigned certify that the above mentioned model is procured in accordance with the above directives and standards.

Further information :

For an ambient temperature of -20°C to +40°C the servomotors shall be mounted on a mechanical support providing good
heat conduction and not exceeding 40° C in the vicinity of the motor flange.
For an ambient temperature of -20°C to +60°C the servomotors shall be mounted on a mechanical support providing good heat conduction and not exceeding 60° C in the vicinity of the motor flange.

The product must be installed in accordance with the instructions and recommendations contained in the operating instructions PVD3675 supplied with the product.

1st Motor CE marking :

EY3 CE Marking : March 31st 2016
EY4 CE Marking : March 31st 2016
EY6 CE Marking : March 31st 2016
EY8 CE Marking : March 31st 2016

Longvic, November 21st 2016

In the name of Parker
A. ANDRIOT
Quality Manager

Ref : DCE-EY-001rev1

Table of Content

1. INTRODUCTION

1.1. Purpose and intended audience

This manual contains information that must be observed to select, install, operate and maintain PARKER EY servomotors.

Installation, operation and maintenance of the equipment should be carried out by qualified personnel. A qualified person is someone who is technically competent and familiar with all safety information and established safety practices; with the installation process, operation and maintenance of this equipment; and with all the hazards involved.

Reading and understanding the information described in this document is mandatory before carrying out any operation on the motors. If any malfunction or technical problem occurs, that has not been dealt with in this manual, please contact PARKER for technical assistance. In case of missing information or doubts regarding the installation procedures, safety instructions or any other issue tackled in this manual, please contact PARKER as well.

PARKER's responsibility is limited to its servomotors and does not encompass the whole user's system. Data provided in this manual are for product description only and may not be guaranteed, unless expressly mentioned in a contract.

	DANGER: PARKER declines responsibility for any accident or material damage that may arise, if the procedures and safety instructions described in this manual are not scrupulously followed.
	Motors for ATEX zones : Servomotors type EY manufactured for the European market are designed to operate in ATEX classified zones.

1.2. Safety

1.2.1. Principle

To operate safely, this equipment must be transported, stored, handled, installed and serviced correctly. Following the safety instructions described in each section of this document is mandatory. Servomotors usage must also comply with all applicable standards, national directives and factory instructions in force.

	DANGER: Non-compliance with safety instructions, legal and technical regulations in force may lead to physical injuries or death, as well as damages to the property and the environment.

1.2.2. General Safety Rules

	**Generality** DANGER: The installation, commission and operation must be performed by qualified personnel, in conjunction with this documentation. The qualified personnel must know the safety (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations. They must be authorized to install, commission and operate in accordance with established practices and standards.
	**Electrical hazard** Servo drives may contain non-insulated live AC or DC components. Respect the drives commissioning manual. Users are advised to guard against access to live parts before installing the equipment. Some parts of the motor or installation elements can be subjected to dangerous voltages, when the motor is driven by the inverter , when the motor rotor is manually rotated, when the motor is driven by its load, when the motor is at standstill or stopped. For measurements use only a meter to IEC 61010 (CAT III or higher). Always begin using the highest range. CAT I and CAT II meters must not be used on this product. Allow at least 5 minutes for the drive's capacitors to discharge to safe voltage levels (<50V). Use the specified meter capable of measuring up to 1000V dc & ac rms to confirm that less than 50V is present between all power terminals and between power terminals and earth. The motor must be permanently connected to an appropriate safety earth.The continuity of the grounding circuit has to be checked on the complete circuit : the resistance between any conductive point and the grounding conductor shall not exceed more than100mΩ. To prevent any accidental contact with live components, it is necessary to check that cables are not damaged, stripped or not in contact with a rotating part of the machine. The work place must be clean, dry. General recommendations : - Check the wiring circuit - Lock the electrical cabinets - Use standardized equipment.

	**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.
	**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. Operating category and marking of EY servomotors

1.2.3.1. ATEX/IECEx gazeous atmospheres

II 3 G Ex nA IIC T3 Gc IP65

<table>
<tr><th>II</th><th>3</th><th>G</th><th>Ex</th><th>nA</th><th>II</th><th>C</th><th>T3</th><th>Gc</th><th>IP65</th></tr>
<tr><td rowspan="2">I Mines</td><td>M1
Very high level of protection</td><td rowspan="6">G Gas/Vapour</td><td rowspan="6">ATEX protection</td><td>nC
Equipment with protection against sparks</td><td rowspan="2">I Mines</td><td rowspan="2">Methane</td><td>T1 450 °C</td><td>Ma
Very high level of protection</td><td rowspan="6">IP65</td></tr>
<tr><td>M2
High level of protection</td><td>nR
Equipment with restricted breathing</td><td>T2 300 °C</td><td>Mb
High level of protection</td></tr>
<tr><td rowspan="4">II Surface</td><td>1
Very high level of protection</td><td rowspan="4">nA
Equipment not generating sparks</td><td rowspan="4">II Surface Gas</td><td>A
Propane</td><td>T3 200 °C</td><td>Ga
Very high level of protection</td></tr>
<tr><td>2
High level of protection</td><td>B
Ethylene</td><td>T4 135 °C</td><td>Gb
High level of protection</td></tr>
<tr><td rowspan="2">3
Normal level of protection</td><td rowspan="2">C
Hydrogen Acetylene</td><td>T5 100 °C</td><td rowspan="2">Gc
Normal level of protection</td></tr>
<tr><td>T6 85 °C</td></tr>
</table>

(shaded)	Suitable for ATEX/IECEX servomotors

1.2.3.2. ATEX/IECEx dusty atmospheres

II 3 GD Ex nA IIC T3 Gc IP65 / Ex tc IIIC T200°C Dc IP65

<table>
<tr><th>II</th><th>3</th><th>D</th><th>Ex</th><th>tc</th><th>III</th><th>C</th><th>T200 °C</th><th>Dc</th><th>IP65</th></tr>
<tr><td rowspan="2">I Mines</td><td>M1
Very high level of protection</td><td rowspan="6">D Combustible dust</td><td rowspan="6">ATEX protection</td><td>ta
Protection by enclosure</td><td rowspan="6">III Dust</td><td rowspan="2">A
Combustible flying</td><td>T1 450 °C</td><td>Ma
Very high level of protection</td><td rowspan="6">IP65</td></tr>
<tr><td>M2
High level of protection</td><td>tb / tc
Protection by enclosure</td><td>T2 300 °C</td><td>Mb
High level of protection</td></tr>
<tr><td rowspan="4">II Surface</td><td>1
Very high level of protection</td><td>pb / pc
Pressurized enclosure</td><td rowspan="2">B
Non conductive dust</td><td>T3 200 °C</td><td>Da
Very high level of protection</td></tr>
<tr><td>2
High level of protection</td><td>ia / ib / ic
Intrinsic safety</td><td>T4 135 °C</td><td>Db
High level of protection</td></tr>
<tr><td rowspan="2">3
Normal level of protection</td><td rowspan="2">ma / mb / mc
Encapsulation</td><td rowspan="2">C
Conductive dust</td><td>T5 100 °C</td><td rowspan="2">Dc
Normal level of protection</td></tr>
<tr><td>T6 85 °C</td></tr>
</table>

(shaded)	Suitable for ATEX/IECEX servomotors

1.2.4. Special conditions for the ATEX/IECEx 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 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.

2. PRODUCT DESCRIPTION

2.1. Quick URL

All informations and datas are avaible on :

http://www.parker.com/eme/**ey**

2.2. Overview

The EY servomotors from Parker are specifically designed to operate in explosive atmospheres for industrial applications.
The EY motors are brushless synchronous servomotors, with permanent magnets, based on NX active parts.

A large set of torque / speed characteristics, options and customization possibilities are available, making EY servomotors the ideal solution for most servosystems applications in explosive atmospheres.

Advantages

- High precision
- High motion quality
- High dynamic performances
- Low cogging
- Compact dimensions and robustness
- Large set of options and customization possibilities
- CE marking certification available.

2.3. Applications

Painting applications
Packaging machinery
Robot applications
Special machines
Cleaning applications
Printing applications
Actuator for valve in Energy applications

2.4. General Technical Data for ATEX motors

	EY3, EY4, EY6	EY8
Motor type	Permanent-magnet synchronous motor	
Magnets material	Neodymium Iron Boron (Nd-Fe-B)	
Number of poles	10	
Type of construction	IMB5 – IMV1 – IMV3 (CEI 60034-7)	
Degree of protection	IP65	
Cooling	Natural cooling	
Rated voltage	230 VAC, 400 VAC	
Insulation of the stator winding	Class F according to CEI 60034-1	Class F according to CEI 60034-1 with potting
Altitude	Up to 1000m (IEC 60034-1) Contact us for higher altitude	
Ambiant temperature	-20°C à +40°C -20°C to +60°C with performances derating	
Storage temperature	-20°C à +60°C	
Connexions	Connectors with disconnecting protection for ATEX	
Marking	CE	
Paint	Black RAL9005	
Sensor	Resolver as a standard Sensorless as an option	
Brake	Parking brake as an option	
Thermal protection	PTC, Thermoswitches or KTY as an option	
Remark	Numerous customization are possible on request (special shaft, special flange,…)	

2.5. Product Code

The EY 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.

Code	**E Y**	**3**	**1 0**	**E**	**A**	**K**	**B**	**7**	**1**	**1 0**

Product Series

Motor size
3, 4, 6 or 8 in relation with the motor diameter

Motor length
up to 60 depending on size

Motor version
E: ATEX/IECEx motor

Feedback Sensor
A: Resolver 2 poles, transformation ratio = 0.5
K: without sensor
Y: Sensorless series with Parker AC servodrive

Torque / Speed Characteristics
See motor datasheet

Painting
B: Black RAL9005

Electric connection
7: Connector

Brake and thermal probe option

Thermal probe on power connector (for AC890, AC30)	***Thermal probe on signal connector (for Compax3, SLVD, PSD)***
1: PTC sensor	A: PTC sensor
4: with brake and PTC sensor	C: KTY sensor
6: KTY84-130 sensor	D: with brake and PTC sensor
7: with brake and KTY84-130 sensor	F: with brake and KTY sensor

Mechanical Interface
10: IP65 with plain shaft
11: IP65 with key on shaft
Other: custom code

3. TECHNICAL DATA

3.1. Motor selection

3.1.1. ATEX standard atmospheric conditions

EY 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
Above 1000 m : please contact Parker for these specific applications.

3.1.3. Temperature derating

EY 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 of motor. 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 :

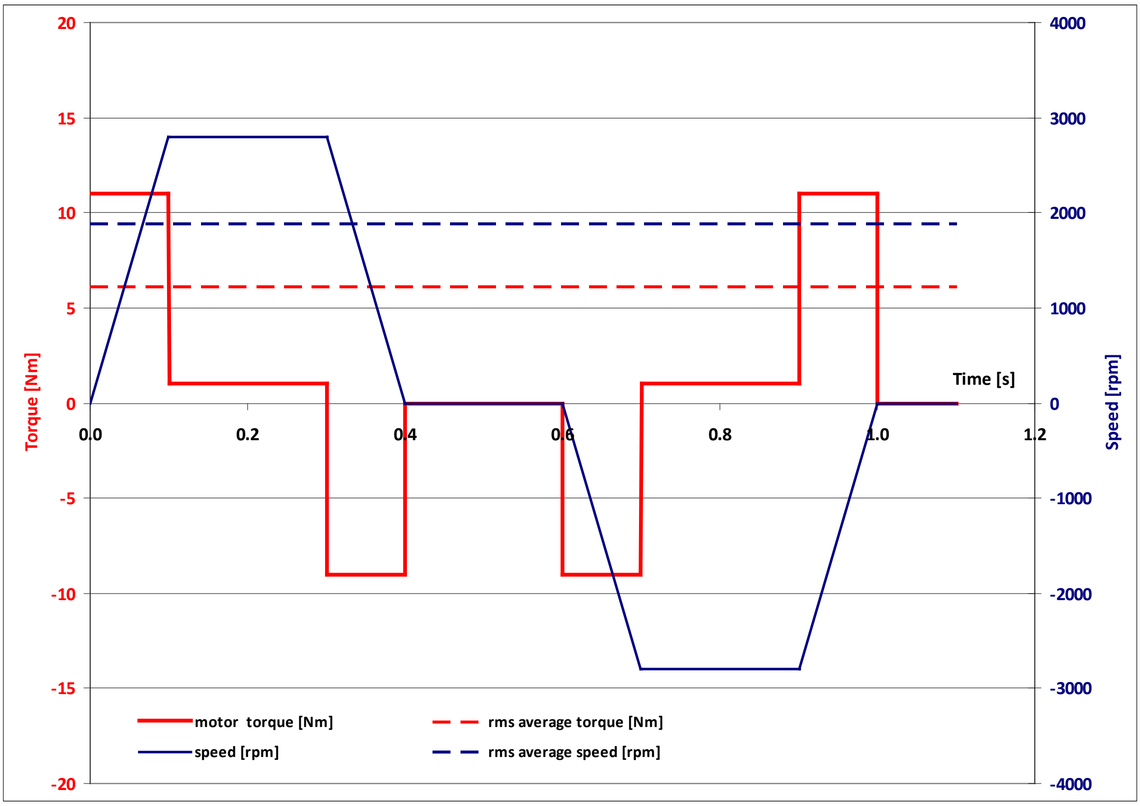
$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^{n} M_i^2 \Delta t_i}$$

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

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

Illustration :

Acceleration-deceleration torque:	10 Nm for 0,1 s.
Resistant torque:	1 Nm during all the movement.
Max-min speed:	± 2800 rpm during 0,2 s.
Max torque provided by the motor:	11 Nm.
rms torque:	6 Nm.



The maximal torque M_i delivered by the motor at each segment i of movement is obtained by the algebric sum of the acceleration-deceleration torque and the resistant torque. Therefore, M_{max} corresponds to the maximal value of M_i.

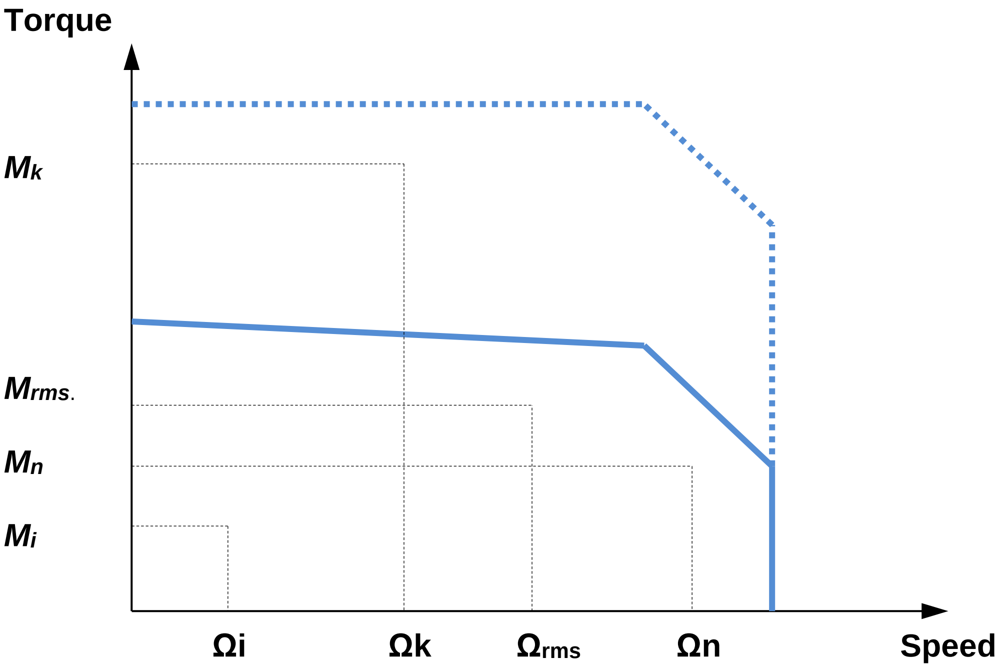
Selection of the motor :

The motor adapted to the duty cycle has to provide the rms torque M_{rms} at the rms speed (*) without extra heating. This means that the permanent torque M_n available at the average speed presents a sufficient margin regarding the rms torque M_{rms}.

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

(*) rms speed is calculated thanks to the same formula as that used for the rms torque. The mean speed cannot be used (in general mean speed is equal to zero).
Only use the rms speed.

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.

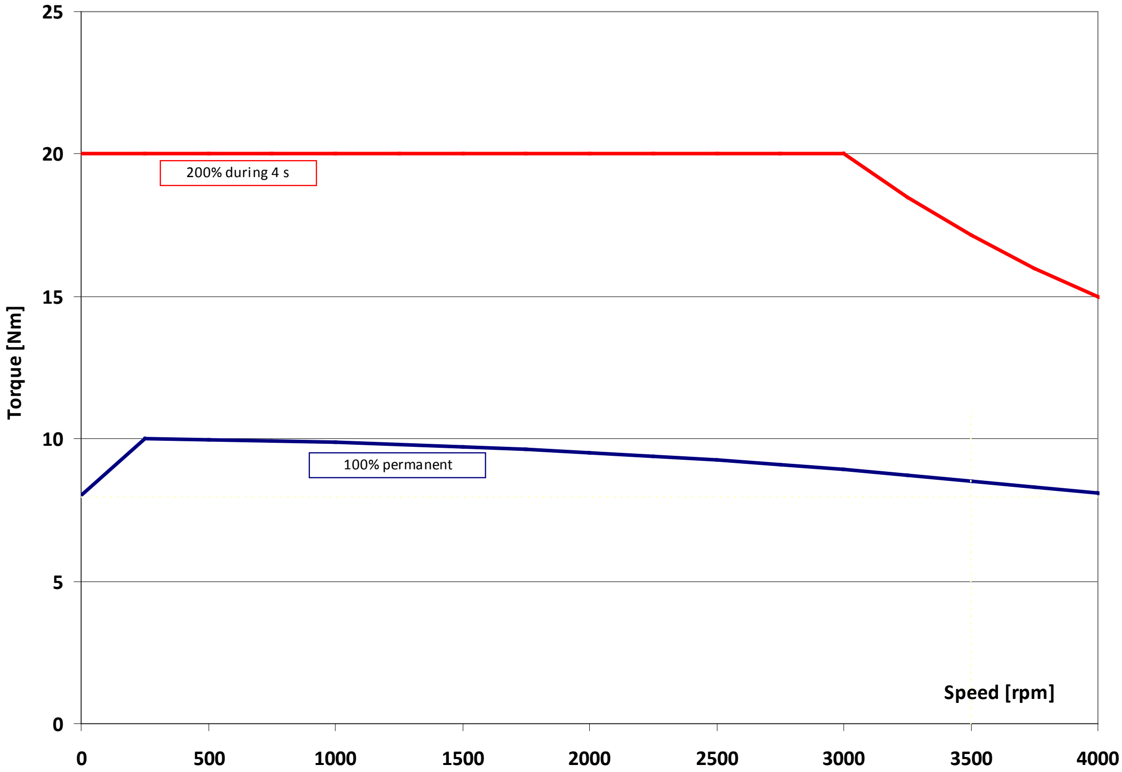
	Please refer to the drive technical documentation for any further information in order to select the best motor and drive association.

AC30 PARKER drive example:

With EY servomotors, the power is usually < 37 kW, the rated current corresponds to 100 %.

Power of servo drive AC30	**< 37 kW**
Mode	Servo
Overload capability [%]	200 % during 4 s

Illustration:



Example :

The application needs:

- a rms torque of **6 Nm** at the rms speed of 4000 rpm,
- an acceleration torque of **25 Nm**,
- a maximal speed of 4500 rpm.

Selection of motor:

The selected motor is the type **EY630EAK**.
The nominal speed is equals to 4800 rpm.
The maximal speed is equals to 4800 rpm.
The torque sensitivity is equals to 1.17 Nm/Arms.

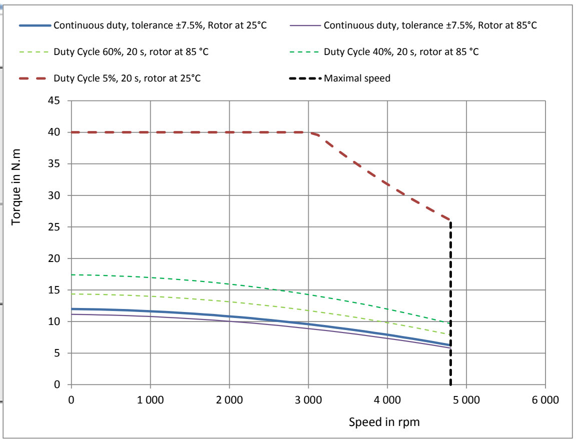
BRUSHLESS MOTOR
EY630EAK
ELECTRONIC DRIVE
DRIVE 11 / 40 Arms

No UL certification

Preliminary

Pn	**Rated power ****	3.14	kW	
Mn	**Rated torque ****	6.25	Nm	**Cooling type :**
Nn	**Rated speed**	4800	rpm	Natural Air cooling
In	**Rated current**	5.56	A_{rms}	Flange 400*400*12mm(ALU)
Un	**Rated voltage ***	354	V_{rms}	
UR	**Voltage of the mains**	400	Vrms	
U	DC voltage supply when motor is loaded	540	V	
M_0	**Low speed torque ****	12	N.m	**Environment :**
I_0	**Permanent current at low speed**	10.3	A_{rms}	Ambient temperature : 40°C MAX
M_p	Max. torque **	40	Nm	Altitude : < 1000 m
I_p	Max. current	39	A_{rms}	Thermal class : F
N_p	Max. speed	4800	rpm	(according to IEC 60034-1)
J	Rotor inertia	0.00147	kg.m²	Number of poles : 10
Ke	Back emf constant at 1000 rpm (25°C)*	73	V_{rms}	
Kt	Torque sensitivity (25°C)	1.17	Nm/A_{rms}	**Efficiency :**
Rb	Winding resistance(25°C) *	0.674	Ω	at rated torque : 92.9 %
L	Winding inductance *	7.26	mH	at 75% of rated torque : 91.5 %

All data are given in typical values under standard conditions.
Characteristics are given for an optimal drive of the motor.
* Phase to Phase
** General tolerances ±7.5 %, rotor at 25°C



The permanent current I_0 of the motor is **10.3 Arms** for **M_0=12 Nm** at low speed.
The nominal current I_n of the motor is **5.56 Arms** for **M_n = 6.25 Nm** at the nominal speed.

Selection of the drive:

The drive has to provide at least a permanent current equals to I_0 (10.3 Arms). In order to obtain an acceleration torque of **25 Nm**, the current will be about 25/1.17=22 Arms. This means that the drive has to provide at least 22 Arms as transient current.

→ Therefore, we can select the drive **AC30** 31V-4D0012 which delivers under 400 VAC:
12 Arms as permanent current and about,
12***200%**=24 Arms as maximal transient current during 4 s.
The drive is set with **“Servo Mode”**.

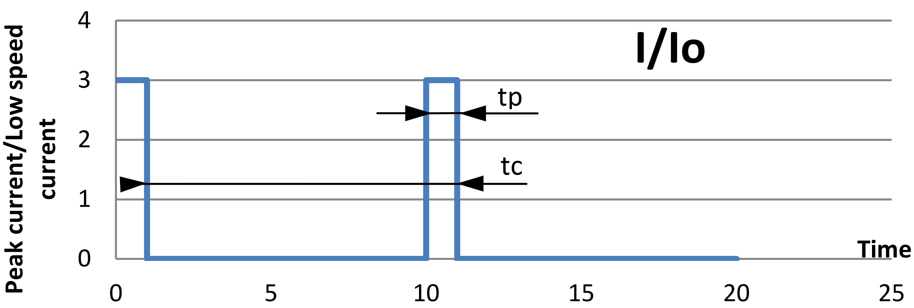
3.1.6. Current limitation at stall conditions (i.e. speed < 3 rpm)

Recommended reduced current at speed < 3 rpm:

$$I_{reduced} = \frac{1}{\sqrt{2}} * I_0 \cong 0.7 * I_0$$

⚠	Warning: The current must be limited to the prescribed values. If the nominal torque has to be maintained at stop or low speed (< 3 rpm), imperatively limit the current to 70% of I_0 (permanent current at low speed), in order to avoid an excessive overheating of the motor.
⚠	Please refer to the drive technical documentation for any further information and to choose functions to program the drive.

3.1.7. Peak current limitation



It is possible to use the EY motors with a current higher than the permanent current. However, to avoid any overheating, the following rules must be respected.

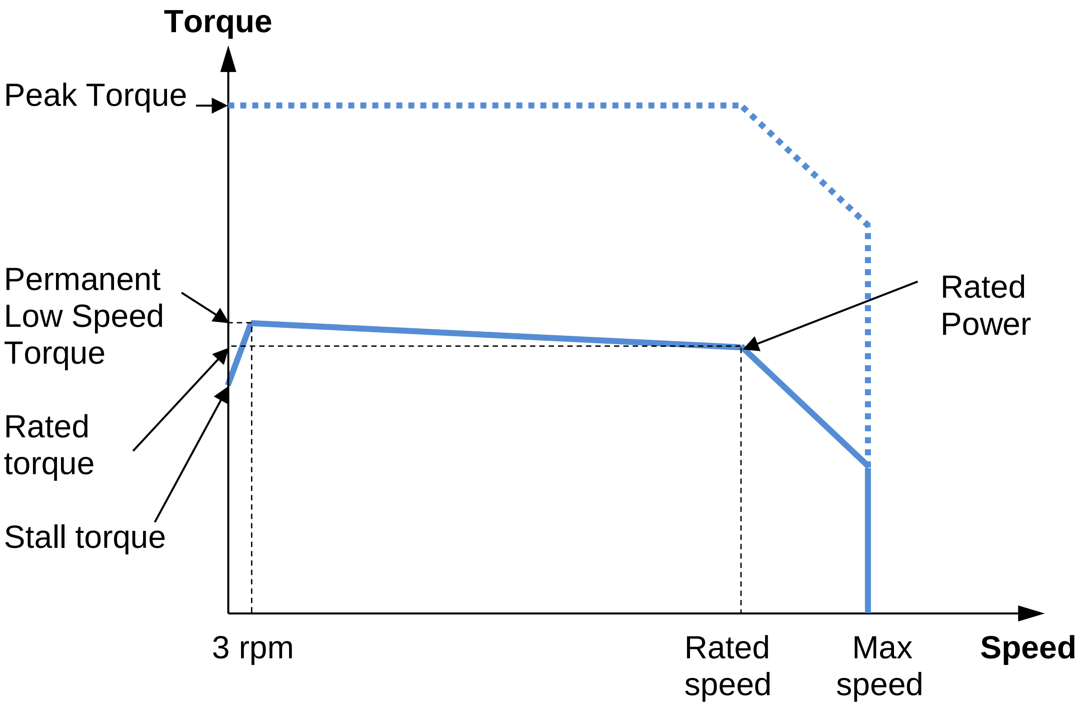
1) The peak currents and peak torques given in the data sheet must never be exceeded.
2) The thermal equivalent torque must be respected (§3.1.4).
3) If 1) and 2) are respected (it can limit the peak current value or duration), the peak current duration (*tp*) must be limited, in addition, accordingly to the following table (Io is the permanent current at low speed).

	I_{pi}/Io =2	I_{pi}/Io = 3	I_p/Io = 4	I_{pi}/Io >5
EY310	tp<0.8 s	tp<0.3s	tp<0.15s	tp<0.1s
EY420				
EY430				
EY620	tp<1.5s	tp<0.6s	tp<0.3s	tp<0.2s
EY630				
EY820				
EY840				
EY860				

The peak current duration is calculated for a temperature rise of 3°C
Consult us for more demanding applications.

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

The torque vs speed graph below explains different intrinsic values given in next tables.



3.2.1. ATEX/IECEx 230V

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									
EY310EAP	0,46	1,9	2300	1,4	2	1,4	4.7	3.6	2300
EY310EAK	0,72	1,7	4000	2,2	2	2,5	4.7	6.3	4000
EY420EAP	0,9	3,8	2300	2.7	4	2.8	9.5	7.0	2300
EY420EAJ	1,4	3,4	4000	4,2	4	4,9	9.5	12.2	4000
EY430EAL	1,2	5,0	2300	3,5	5,5	3,8	13.1	9.4	2300
EY430EAF	1,7	4,1	4000	5,1	5,5	6,6	13.1	16.5	4000
EY620EAV	0,9	7,9	1100	2,8	8	2,8	18.9	7.0	1100
EY620EAR	1,7	7,4	2200	5,0	8	5,3	18.9	13.2	2200
EY630EAR	1,7	11,3	1450	5,2	12	5,5	28.4	13.7	1450
EY630EAN	2,5	10,5	2300	7,3	12	8,3	28.4	20.6	2300
EY820EAR	3,3	14,5	2200	9,7	16	10,7	36.8	26.7	2200
EY840EAK	4,9	23,5	2000	13,7	28	16,2	65.8	40.4	2000
EY860EAJ	5,2	34,4	1450	14,9	41	17,7	96.7	44.2	1450

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									
EY310EAP	0,40	1,7	2300	1,2	1,8	1,3	4.3	3.2	2300
EY310EAK	0,61	1,5	4000	1,9	1,8	2,3	4.3	5.6	4000
EY420EAP	0,8	3,1	2300	2.2	3.5	2.5	8.4	6.1	2300
EY420EAJ	1,1	2,7	4000	3,4	3,5	4,3	8.4	10.6	4000
EY430EAL	1,1	4,4	2300	3,1	5,0	3,4	12.0	8.5	2300
EY430EAF	1,4	3,4	4000	4,2	5,0	6,0	12.0	15.0	4000
EY620EAV	0,8	7,0	1100	2,5	7,2	2,5	17.3	6.3	1100
EY620EAR	1,5	6,4	2200	4,3	7,2	4,8	17.3	11.9	2200
EY630EAR	1,5	10,1	1450	4,6	10,8	4,9	25.9	12.3	1450
EY630EAN	2,2	9,1	2300	6,3	10,8	7,4	25.9	18.6	2300
EY820EAR	2,7	11,7	2200	7,9	14,0	9,3	32.9	23.3	2200
EY840EAK	3,9	18,4	2000	10,8	25,5	14,7	60.8	36.8	2000
EY860EAJ	4,4	29,0	1450	12,6	37,0	15,9	88.5	39.8	1450

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									
EY310EAP	0,72	1,7	4000	1,3	2	1,4	4.7	3.6	4000
EY310EAK	0,87	1,2	6800	1,6	2	2,5	4.7	6.3	6800
EY420EAP	1,1	3,6	3000	2.6	4	2.8	9.5	7.0	3000
EY420EAJ	1,7	2,6	6000	3,4	4	4,9	9.5	12.2	6000
EY430EAL	1,7	4,1	4000	2,9	5,5	3,8	13.1	9.4	4000
EY430EAF	1,6	2,7	5800	3,4	5,5	6,6	13.1	16.5	5800
EY620EAV	1,6	7,5	2000	2,7	8	2,8	18.9	7.0	2000
EY620EAR	2,5	6,2	3900	4,2	8	5,3	18.9	13.2	3900
EY630EAR	2,8	10,0	2700	4,6	12	5,5	28.4	13.7	2700
EY630EAN	3,3	7,9	4000	5,6	12	8,3	28.4	20.6	4000
EY820EAR	5,3	12,9	3900	8,8	16	10,7	36.8	26.7	3900
EY840EAK	6,8	18,6	3500	11,0	28	16,2	65.8	40.4	3500
EY860EAJ	6,3	23,0	2600	10,2	41	17,7	96.7	44.2	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									
EY310EAP	0,61	1,5	4000	1,1	1,8	1,3	4.3	3.2	4000
EY310EAK	0,67	0,9	6800	1,3	1,8	2,3	4.3	5.6	6800
EY420EAP	0,9	3,0	3000	2.1	3.5	2.5	8.4	6.1	3000
EY420EAJ	1,2	2,0	6000	2,6	3,5	4,3	8.4	10.6	6000
EY430EAL	1,4	3,4	4000	2,4	5,0	3,4	12.0	8.5	4000
EY430EAF	1,3	2,6	4900	3,3	5,0	6,0	12.0	15.0	4900
EY620EAV	1,4	6,5	2000	2,3	7,2	2,5	17.3	6.3	2000
EY620EAR	2,0	4,9	3900	3,3	7,2	4,8	17.3	11.9	3900
EY630EAR	2,4	8,4	2700	3,9	10,8	4,9	25.9	12.3	2700
EY630EAN	2,4	5,8	4000	4,1	10,8	7,4	25.9	18.6	4000
EY820EAR	3,2	7,8	3900	5,4	14,0	9,3	32.9	23.3	3900
EY840EAK	3,9	14,1	2600	8,4	25,5	14,7	60.8	36.8	2600
EY860EAJ	4,8	21,8	2100	9,6	37,0	15,9	88.5	39.8	2100

3.2.3. Further Data

Motor	Kt [Nm/Arms]	Ke [Vrms/krpm]	Inductance [mH]	Winding Resistance [ohms]	Moment of Inertia J [kgmm²]	Polarity p [-]	Motor Thermal Time Constant tth [s]
EY310EAP	1,4	88,4	58,6	20,7	79	10	55,9
EY310EAK	0,8	50,6	19,2	6,58	79	10	57,7
EY420EAP	1.42	89.5	33	7.2	290	10	71
EY420EAJ	0,821	51,7	11,0	2,31	290	10	73,7
EY430EAL	1,46	91,8	22,6	4,22	426	10	76,3
EY430EAF	0,833	52,3	7,34	1,38	426	10	75,7
EY620EAV	2,84	177	67,6	7,9	980	10	137
EY620EAR	1,51	94,4	19,2	2,24	980	10	137
EY630EAR	2,19	137	25,6	2,43	1470	10	158
EY630EAN	1,45	90,7	11,2	1,12	1470	10	150
EY820EAR	1,5	93,7	8,57	1,01	3200	10	137
EY840EAK	1,73	108	5,42	0,493	6200	10	170
EY860EAJ	2,32	145	6,76	0,499	9200	10	209

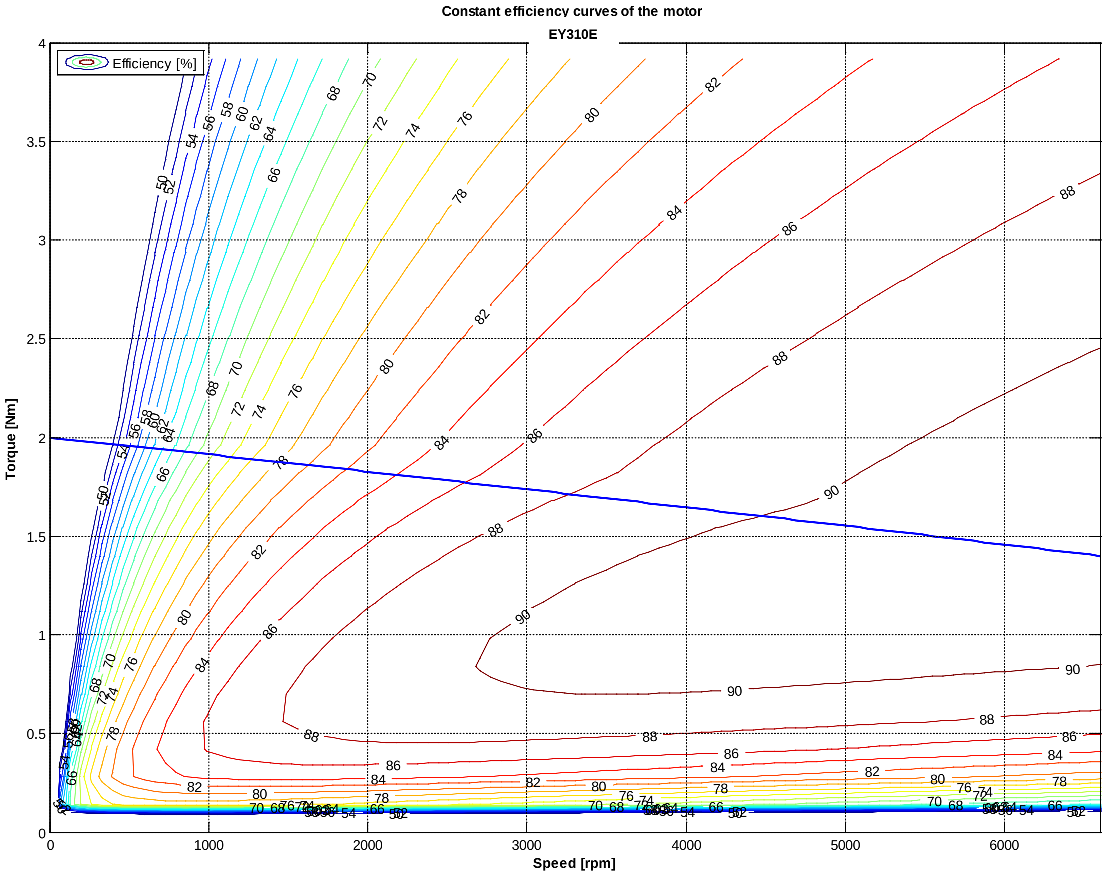
3.2.4. Efficiency curves

Caution: The efficiency curves are typical values. They may vary from one motor to another.

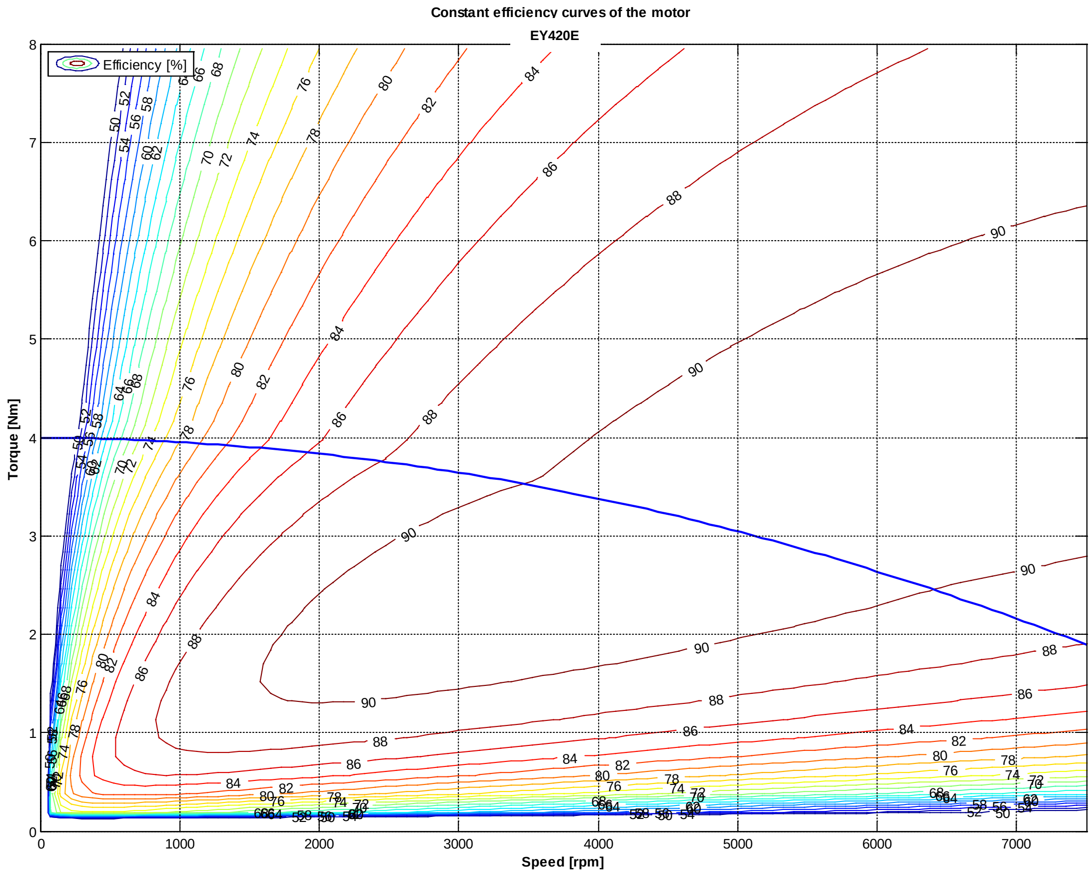
Caution: The efficiency curves are given for an optimal motor control (no voltage saturation and optimal phase between current and EMF)

Caution: The efficiency curves do not include the losses due to the switching frequency.

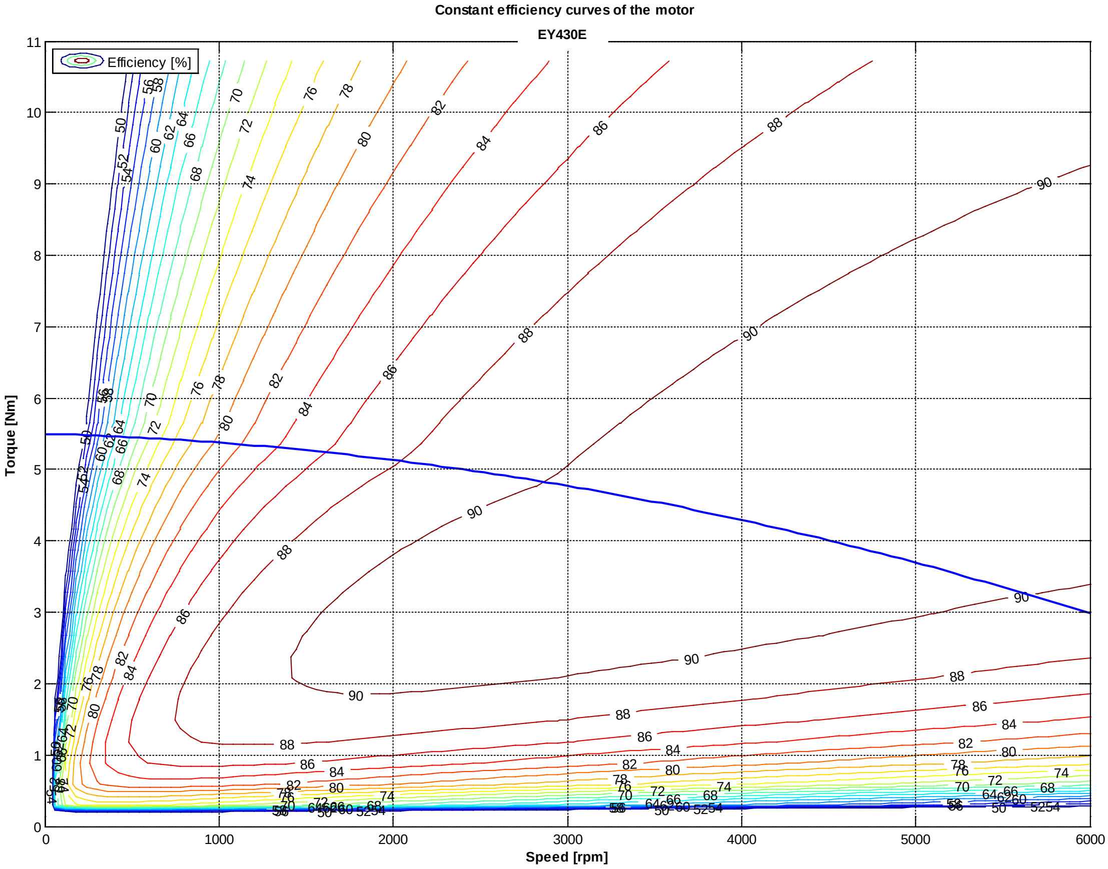
3.2.4.1. Series EY310E



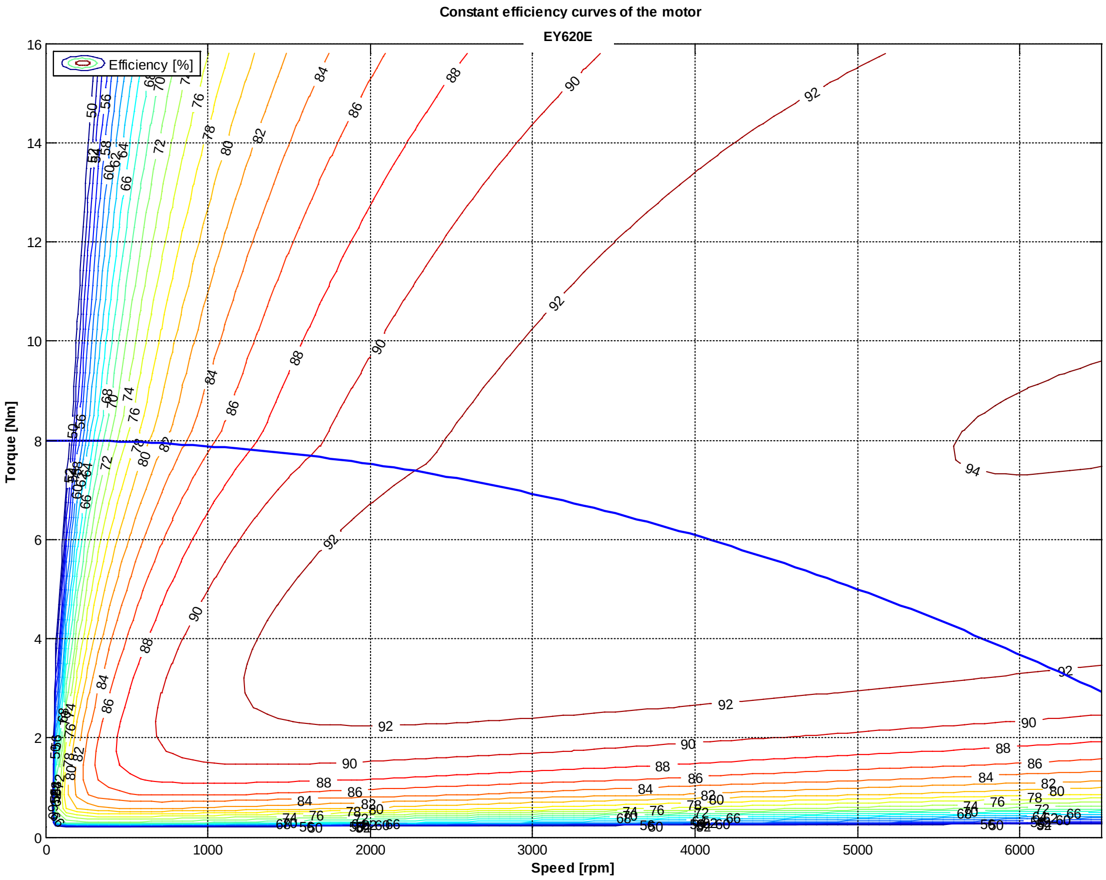
3.2.4.2. Series EY420E



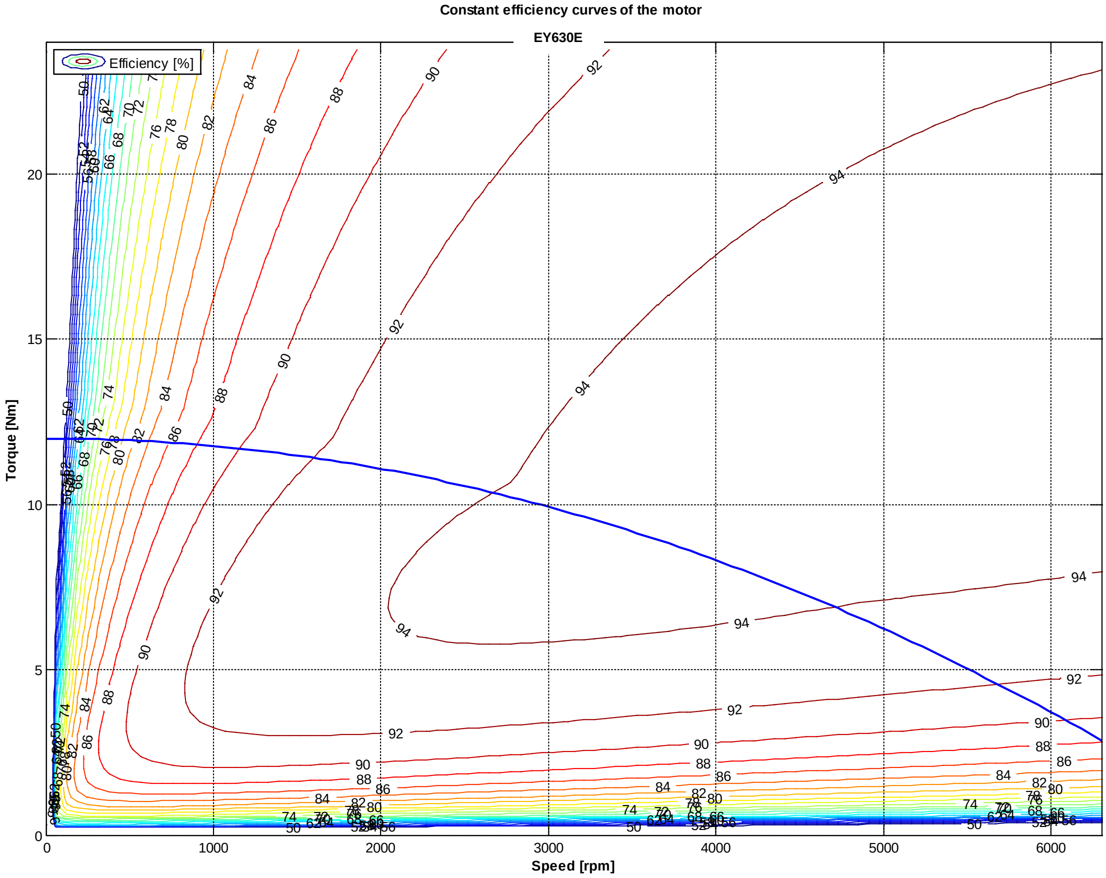
3.2.4.3. Series EY430E



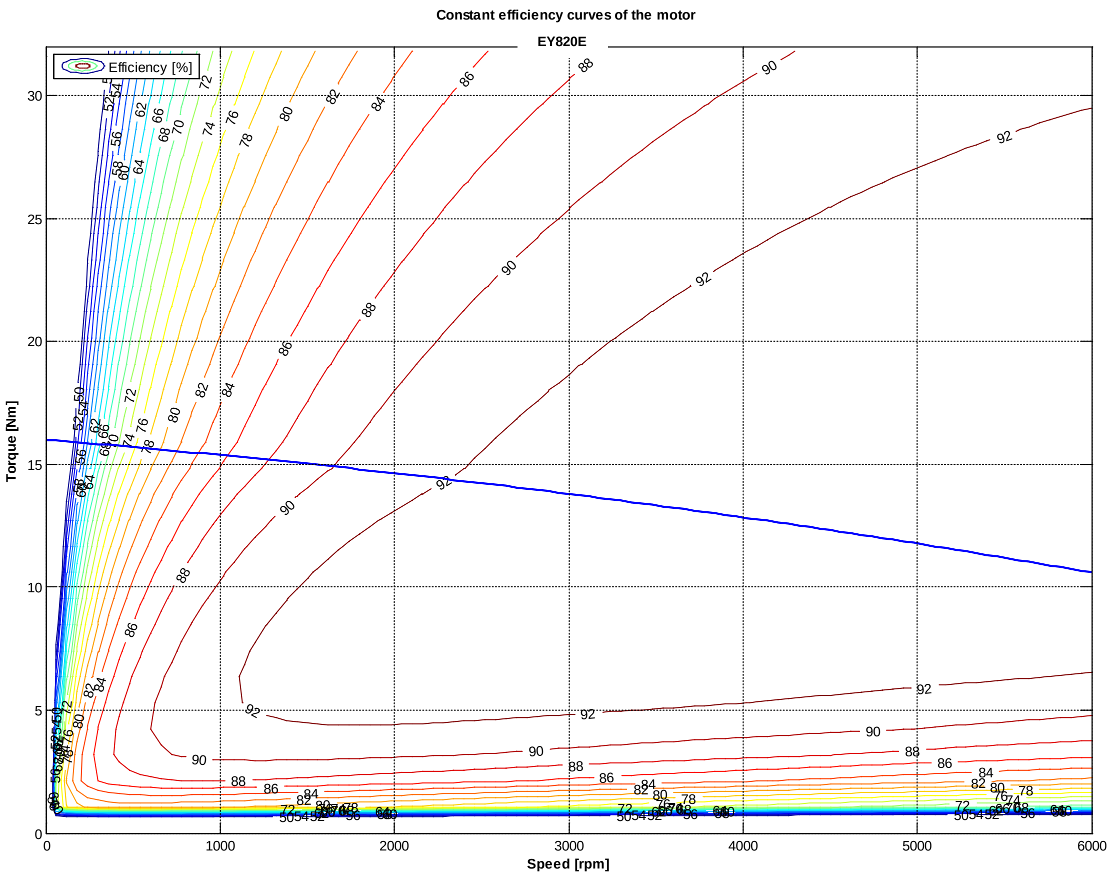
3.2.4.4. Series EY620E



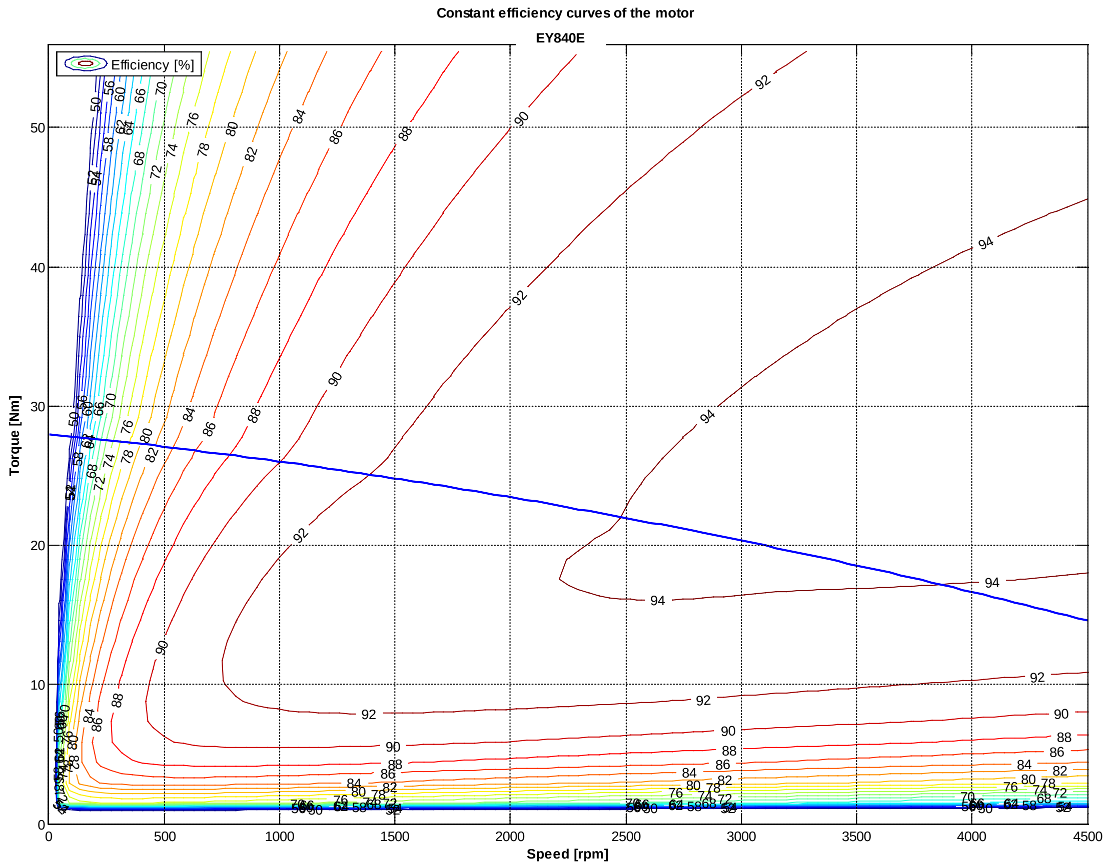
3.2.4.5. Series EY630E



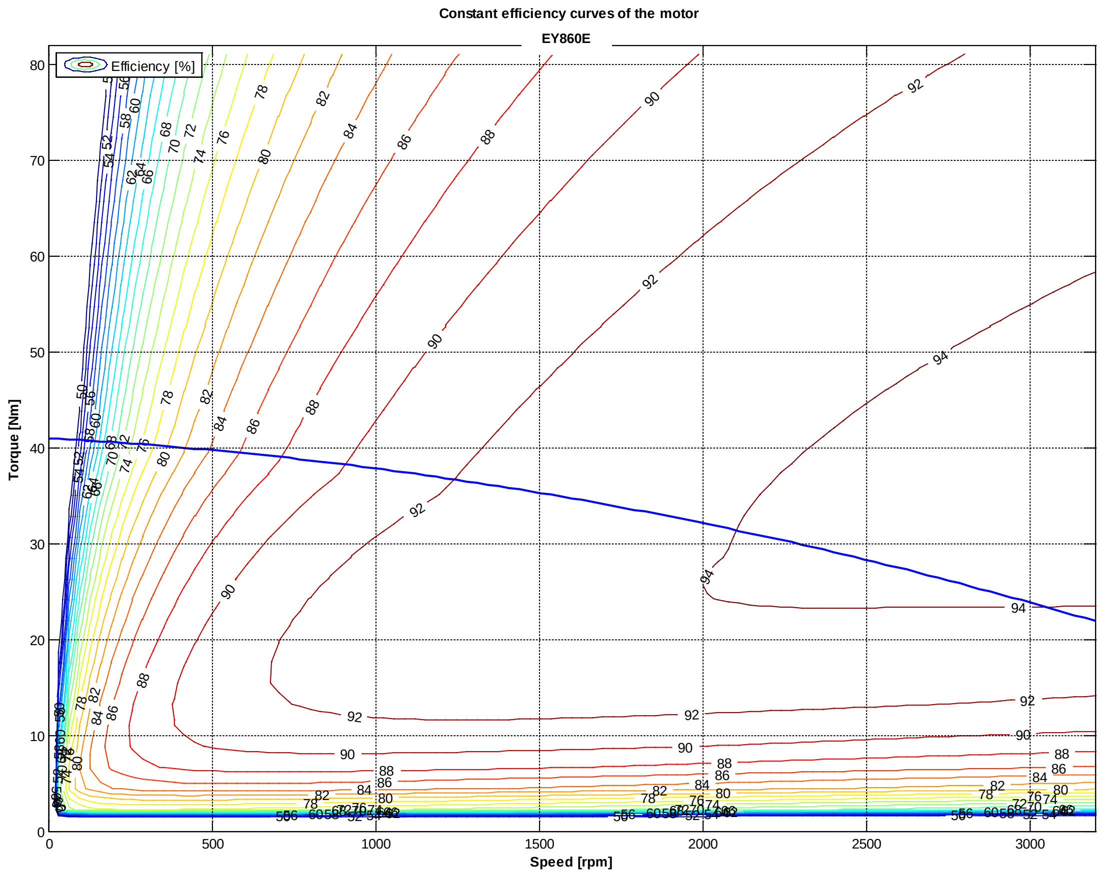
3.2.4.6. Series EY820E



3.2.4.7. Series EY840E



3.2.4.8. Series EY860E



3.2.5. Electromagnetic losses

⚠	Caution: Following data result from our best estimations but are indicative. They can vary from one motor to another and with temperature. No responsibility will be accepted for direct or indirect losses or damages due to the use of these data.

Following data are indicative, without any friction coming from lip seals.

Type	Tf [Nm]	Kd [Nm/1000rpm]
EY310	0.032	0.012
EY420	0.055	0.022
EY430	0.073	0.029
EY620	0.068	0.032
EY630	0.108	0.050
EY820	0.141	0.065
EY840	0.290	0.133
EY860	0.438	0.201

Torque losses (N.m) = Tf + Kd x *speed(rpm)*/1000

3.2.6. Time constants of the motor

3.2.6.1. 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 EY630EAK
L_{ph_ph} = 7.26 mH or 7.26.10^{-3} H
R_{ph_ph} at 25°C = 0.674 Ohm
→ σ_{elec} = 7.26.10^{-3}/0.674 = **10.8 ms**

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

3.2.6.2. 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:

$$Ke_{ph\_ph[V_{rms}/rad/s]} = \frac{Ke_{ph\_ph[V_{rms}/1000tr.min-1]}}{\frac{2 * \pi * 1000}{60}}$$

Example :
Motor series EY630EAK
R_{ph_ph} at 25°C = 0.674 Ohm
J = 147.10^{-5} kgm²
Ke_{ph_ph} [$V_{rms}/1000 tr.min^{-1}$] = 73 [$V_{rms}/1000 tr.min^{-1}$]
→ Ke_{ph_ph} [$V_{rms/rad/s}$] = 73/(2*π*1000/60) = 0.697 [$V_{rms/rad/s}$]
→ σ_{mech}=0.5*0.674*147.10^{-5} /(0.697²) = **1.02 ms**

Remarks :

For a DC motor, the mechanical time constant σ_{mech} represents the duration needed to reach 63% of the final speed when applying a voltage step without any resistant torque. However this value makes sense only if the electric time constant σ_{elec} is much smaller than the mechanical time constant σ_{mech} (for the motor EY630EAK taken as illustration, it is not the case because we obtain $\sigma_{mech} < \sigma_{elec}$.).

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

3.2.6.3. Constante de temps thermique du cuivre :

$$\tau_{therm} = Rth * Cth_{cuivre}$$

$$Cth_{cuivre[J/°K]} = Masse_{cuivre[Kg]} * 389_{[J/kg°K]}$$

With:

Rth	thermal resistance between copper and ambient temperature [°K/W]
Cth $_{copper}$	thermal capacity of the copper [J/°K]
Mass $_{copper}$	mass of the copper (winding) [kg]

Hereunder is given an overall summary of motor time constants:

Type	Electric time constant [ms]	Mechanical time constant [ms]	Thermal time constant of copper [s]
EY310	3.0	1.1	56
EY420	4.6	1.4	72
EY430	5.2	1.1	76
EY620	8.6	1.3	137
EY630	10.3	1.0	158
EY820	8.5	2.1	135
EY840	11.0	1.5	171
EY860	12.9	1.3	206

3.2.7. Speed ripple

The typical speed ripple for a EY 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).

3.2.8. Cogging torque

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

Motor	Cogging Maxi [N.cm]
EY310	2.5
EY420	4.4
EY430	5.7
EY620	5.3
EY630	6.8
EY820	9
EY840	16
EY860	20

3.2.9. Rated data according to rated voltage variation

The nominal characteristics and especially the rated speed, maximal speed, rated power, rated torque, depend on the nominal voltage supplying the motor considered as the rated voltage. The rated data mentioned in the data sheet are given for each association of motor and drive. Therefore, if the supply voltage changes, the rated values will also change. As long as the variation of the rated voltage remains limited, for instance to ±**10%** of the nominal value, it is possible to correctly evaluate the new rated values as illustrated below.

Example:
Extract of EY630EAK datasheet

BRUSHLESS MOTOR
EY630EAK
ELECTRONIC DRIVE
DRIVE 11 / 40 Arms

No UL certification

Preliminary

P_n	**Rated power ****	3.14	kW	
M_n	**Rated torque ****	6.25	Nm	**Cooling type :**
N_n	**Rated speed**	4800	rpm	Natural Air cooling
I_n	**Rated current**	5.56	A_{rms}	Flange 400*400*12mm(ALU)
U_n	**Rated voltage ***	354	V_{rms}	
UR	**Voltage of the mains**	400	Vrms	
U	DC voltage supply when motor is loaded	540	V	
M_0	**Low speed torque ****	12	N.m	**Environment :**
I_0	**Permanent current at low speed**	10.3	A_{rms}	Ambient temperature : 40°C MAX
M_p	Max. torque **	40	Nm	Altitude : < 1000 m
I_p	Max. current	39	A_{rms}	Thermal class : F
N_p	Max. speed	4800	rpm	(according to IEC 60034-1)
J	Rotor inertia	0.00147	kg.m²	Number of poles : 10
Ke	Back emf constant at 1000 rpm (25°C)*	73	V_{rms}	
Kt	Torque sensitivity (25°C)	1.17	Nm/A_{rms}	**Efficiency :**
Rb	Winding resistance(25°C) *	0.674	Ω	at rated torque : 92.9 %
L	Winding inductance *	7.26	mH	at 75% of rated torque : 91.5 %

All data are given in typical values under standard conditions. * Phase to Phase
Characteristics are given for an optimal drive of the motor. ** General tolerances ±7.5 %, rotor at 25°C

If we suppose that the rated voltage U_n=400 V_{rms} decreases of **10%** ; this means that the new rated voltage becomes U_{n2}=360 V_{rms}.

Rated speed:
The former rated speed N_n=4800 rpm obtained with a rated voltage U_n=400 V_{rms} and an efficiency η=92% leads to the new rated speed N_{n2} given as follows:

$$N_{n2} = N_n * \frac{\frac{U_{n2}}{U_n} - 1 + \eta}{\eta} \qquad N_{n2} = 4800 * \frac{\frac{360}{400} - 1 + 0.92}{0.92} = 4278 rpm$$

Maximum speed:

The former maximum speed N_{max} = 4800 rpm obtained with U_n =400 V_{rms} and a speed N_n =4800 rpm leads to the new maximum speed N_{max2} given as follows:

$$N_{\max 2} = N_{\max} * \frac{N_{n2}}{N_n} \qquad N_{\max 2} = 4800 * \frac{4278}{4800} = 4278 rpm$$

N.B.

If the rated voltage increases (U_{n2} > U_n), the new rated speed N_{n2} and the new maximum speed N_{max2} will be greater than the former ones N_n and N_{max}. Moreover you will have to check that the drive still shows able to deal with the new maximum electric frequency.

	Warning: If the main supply decreases, you must reduce the maximum speed accordingly in order not damage the motor. In case of doubt, consult us.

Rated power:

The former rated power P_n=3140 W obtained with U_n=400 V_{rms} to the new rated power P_{n2} given as follows:

$$P_{n2} = P_n * \frac{U_{n2}}{U_n} \qquad P_{n2} = 3140 * \frac{360}{400} = 2826 W$$

Rated torque:

The former rated torque M_n = 6.25 Nm obtained with U_n =400 V_{rms} leads to the new rated torque M_{n2} given as follows:

$$M_{n2} = \frac{P_{n2}}{\frac{2 * \pi * N_{n2}}{60}} \qquad M_{n2} = \frac{2826}{\frac{2 * \pi * 4278}{60}} = 6.3 Nm$$

3.2.10. Voltage withstand characteristics of EY 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 EY 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).

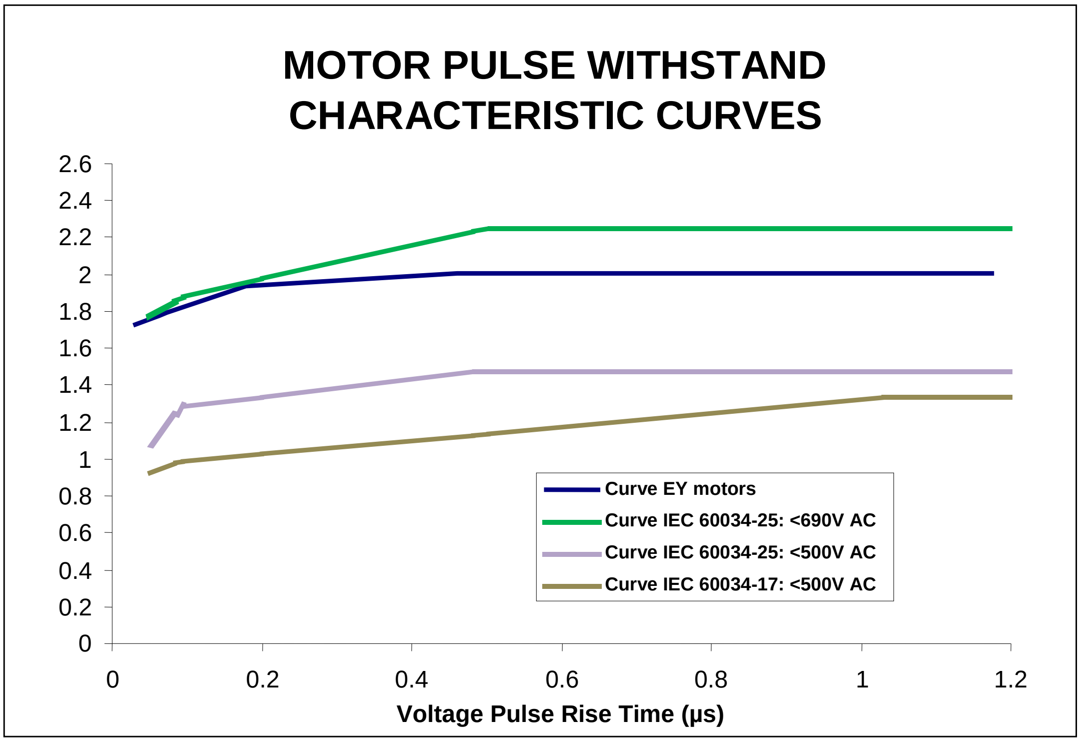


Figure 1: Minimum Voltage withstands characteristics for motors insulations according to IEC standards. At the top are the typical capabilities for the EY motors.

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

The EY motors can be used with a supply voltage up to 400 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 EY motors*" in dark blue.

3.2.11. Voltage and current during operating

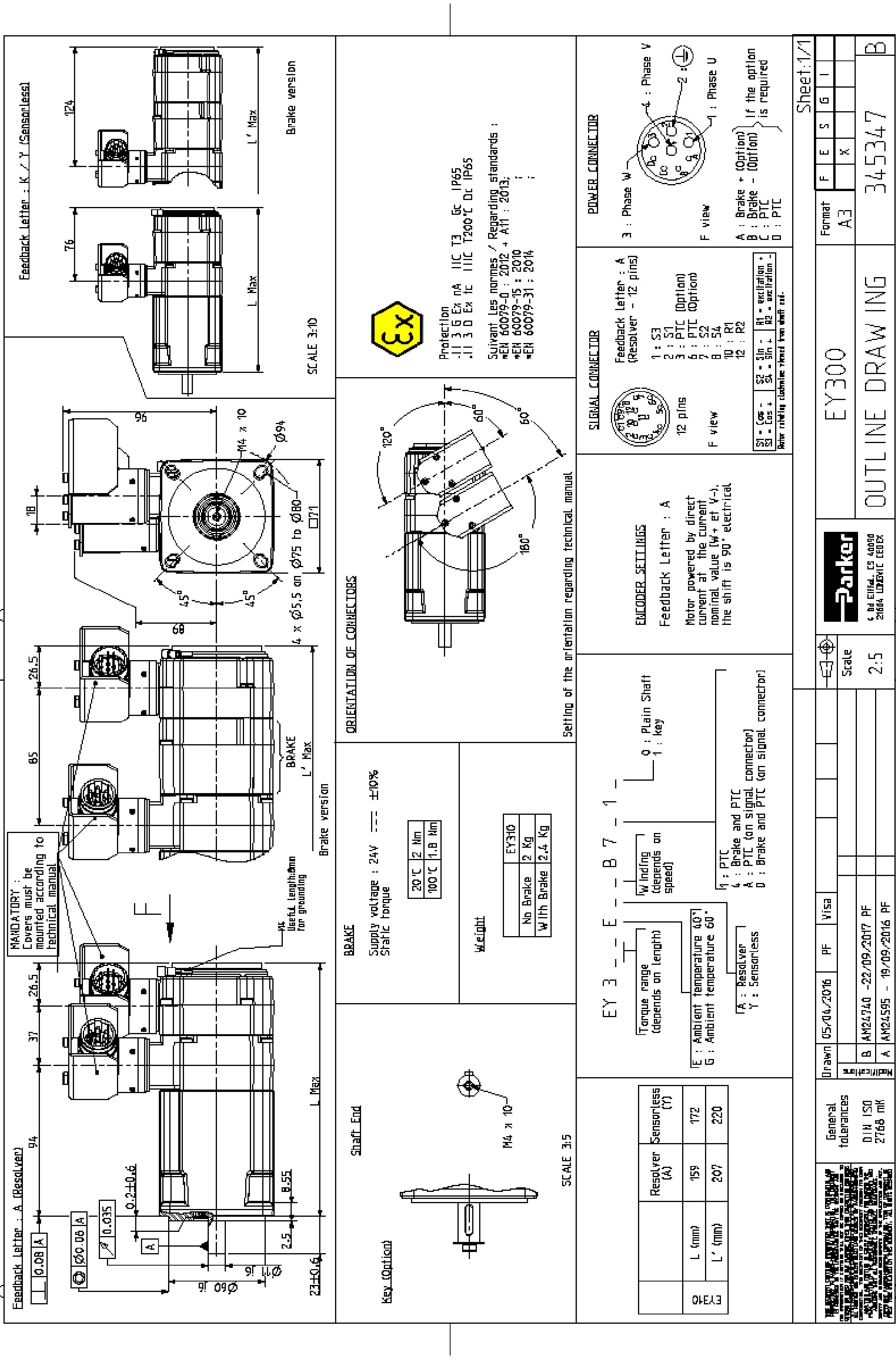
EY motors present an ATEX/IECEx certification and due to this certificate are subjected to strict rules regarding their use. One of such rules is the use of a servoamplifier that meets specific characteristics.These characteristics are valid for an ambient temperature comprised between -20°C and 40°C. For an ambient temperature comprised between 40°C and 60°C, a derating of performances has to be applied.

Supply voltage of combined servo drive [Vrms]	**230 V one-phase / three-phase**	**400 V three-phase**
Supply Direct Current voltage [Vdc]	310 ±10%	550 ±10%
Electric frequency of motor [Hz]	0 à 700	0 à 700
Permanent current in one phase $\mathbf{I_0}$ [Arms] with T° ambient=+40°C EY310…* EY430…* EY630…* EY860…*	 4.7 Maxi 10.2 Maxi 14.5 Maxi 21.3 Maxi	 2.5 Maxi 6.6 Maxi 10.3 Maxi 20.2 Maxi
Permanent current in one phase $\mathbf{I_0}$ [Arms] with T° ambient =+60°C EY310…* EY430…* EY630…* EY860…*	 4.2 Maxi 9.3 Maxi 13.1 Maxi 16.6 Maxi	 2.25 Maxi 6 Maxi 8.4 Maxi 15.9 Maxi
Maximum current in one phase [Arms] EY310…* EY430…* EY630…* EY860…*	 17.6 Maxi 39 Maxi 55.2 Maxi 80.0 Maxi	 9.4 Maxi 25.1 Maxi 39 Maxi 78.4 Maxi
Maximum **permanent** power of motor [W] EY310…* EY430…* EY630…* EY860…*	 876 Maxi 1757 Maxi 3304 Maxi 5542 Maxi	 876 Maxi 1628 Maxi 3142 Maxi 6011 Maxi

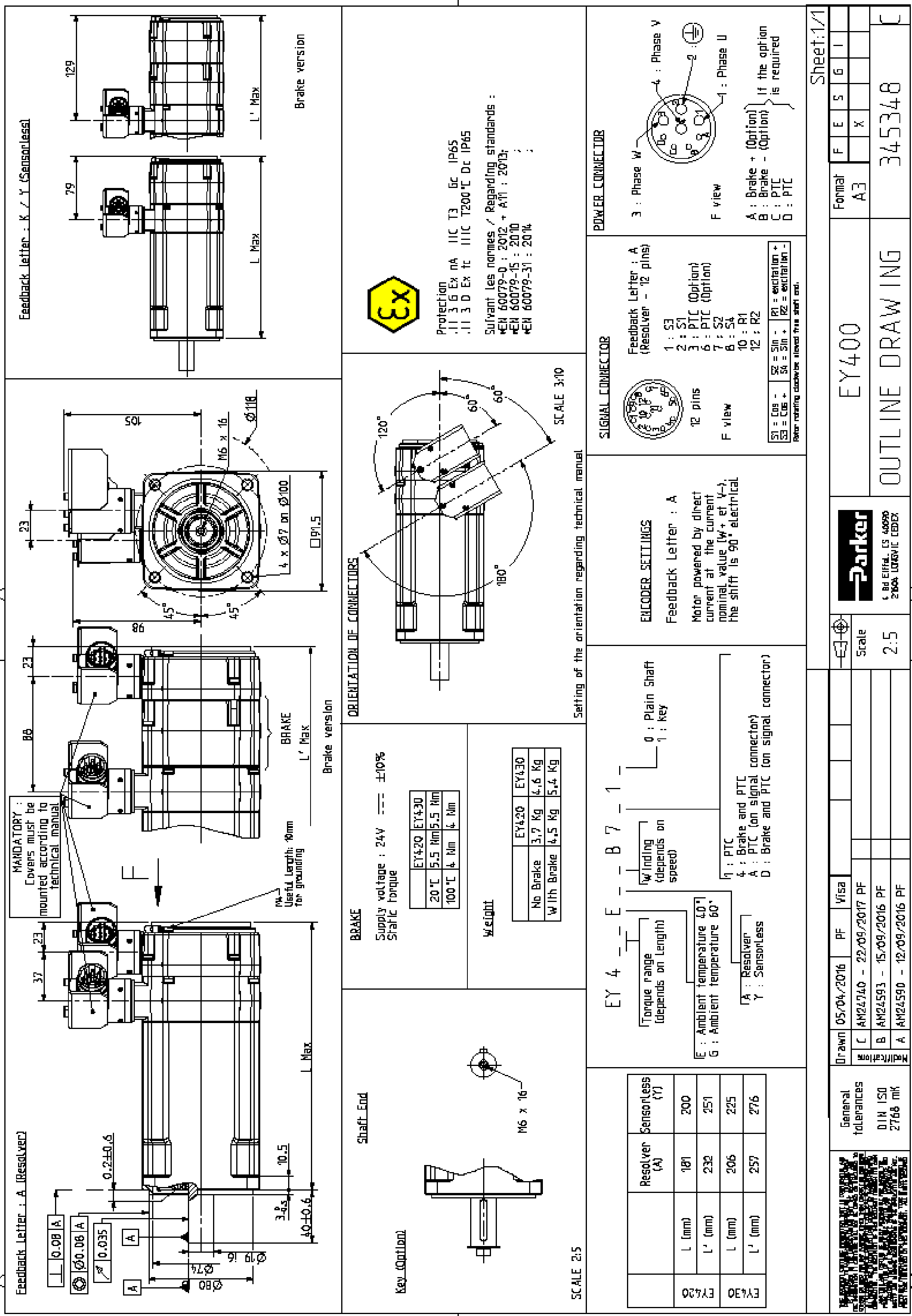
Attention: EY motors must be connected in accordance with the diagrams given in chapter §4.3.5

3.3. Outline drawings

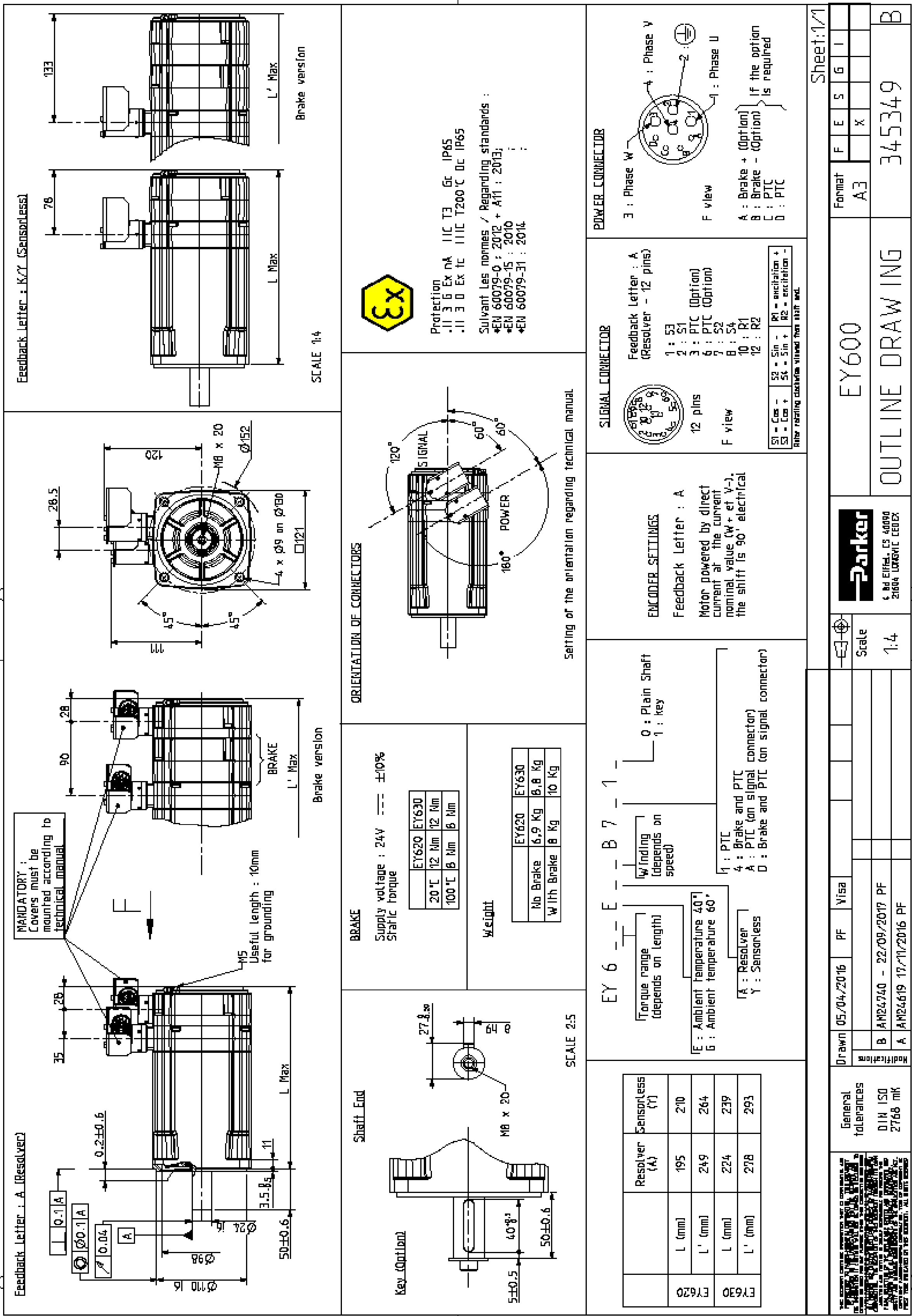
3.3.1. EY310E



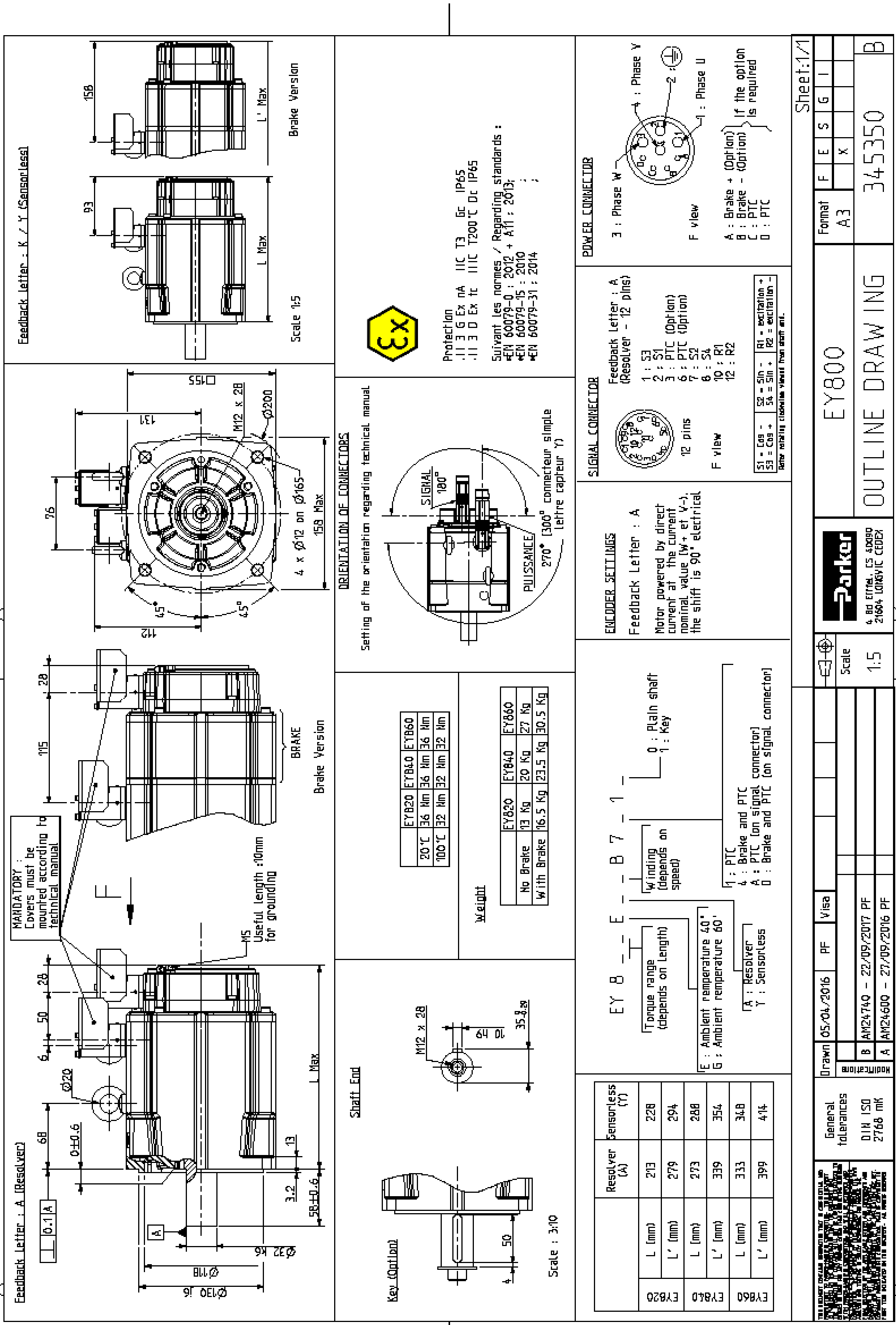
3.3.2. EY420E EY430E



3.3.3. EY620E EY630E



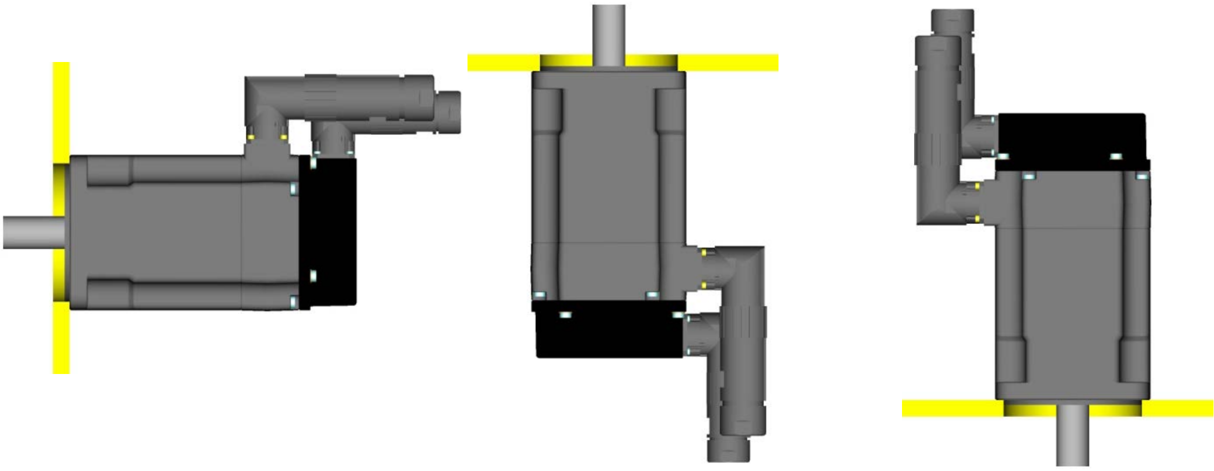
3.3.4. EY820E EY840E EY860E



3.4. Motor mounting

3.4.1. Motor mounting

By flange in any direction.



3.4.2. Installation of ATEX machines

Keep in mind that EY motors are equipments with protect mode "nA" non sparking for hazardous area of gas and with protection by enclosure "tc" for hazardous area of dust ignition.

	When installing electric systems in hazardous locations, carefully observe the corresponding country regulations.

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 EY 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 toshaft end

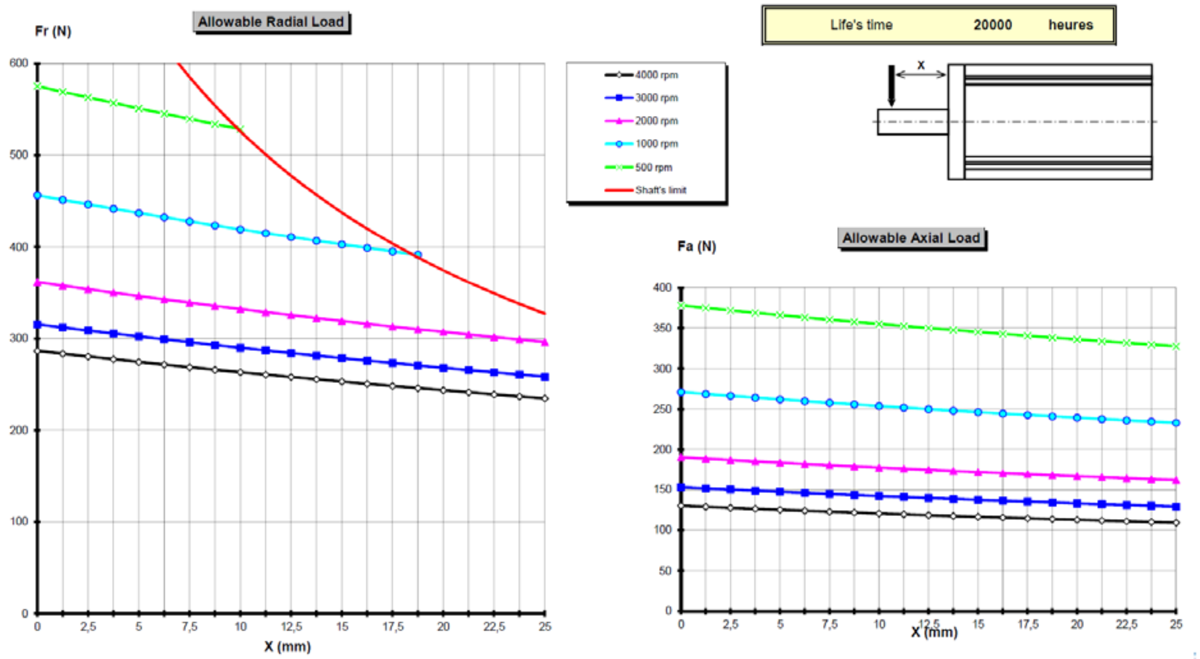
Frequency domain :10 to 55 Hz according to EN 60068 -2-6
Vibration resistance to the shaft end :
- radial 3 g
- axial 1 g

3.5.2. Maximum load acceptable on the shaft

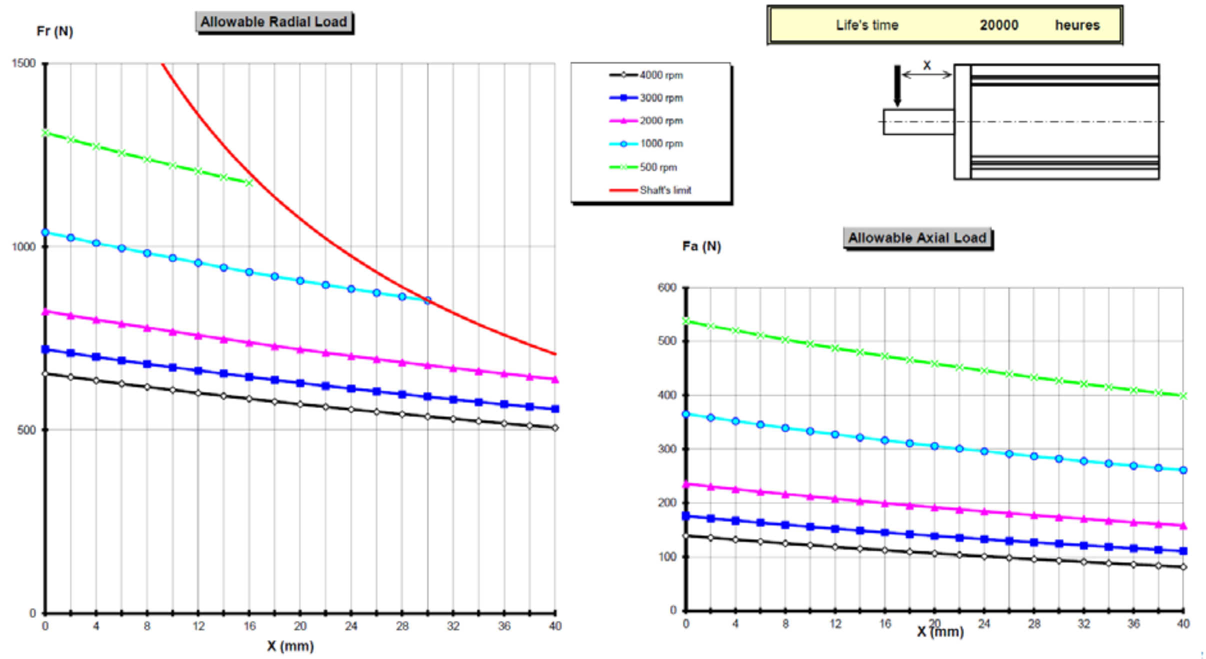
	Notice: Curves below are valid only for horizontal mounting and a life time L10 of 20 000h at constant speed in accordance with ISO281. Notice: Radial and Axial Loads are not additive.

	The bearing arrangement is made with 2 ball bearings (one on the shaft end + another on the rear). The rear bearing is blocked in axial translation and the front one is free in translation to avoid any stress from the shaft thermal expansion during the running. So, it is important not to block in translation the shaft expansion by any extra bearing or similar device.

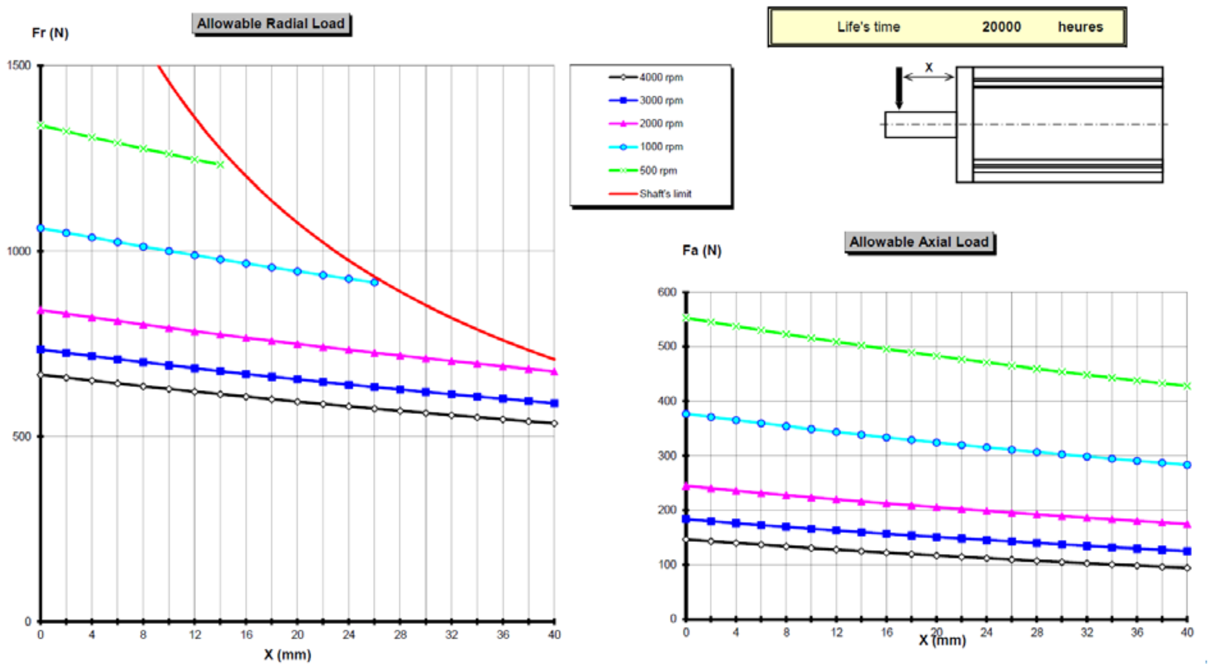
3.5.2.1. EY310



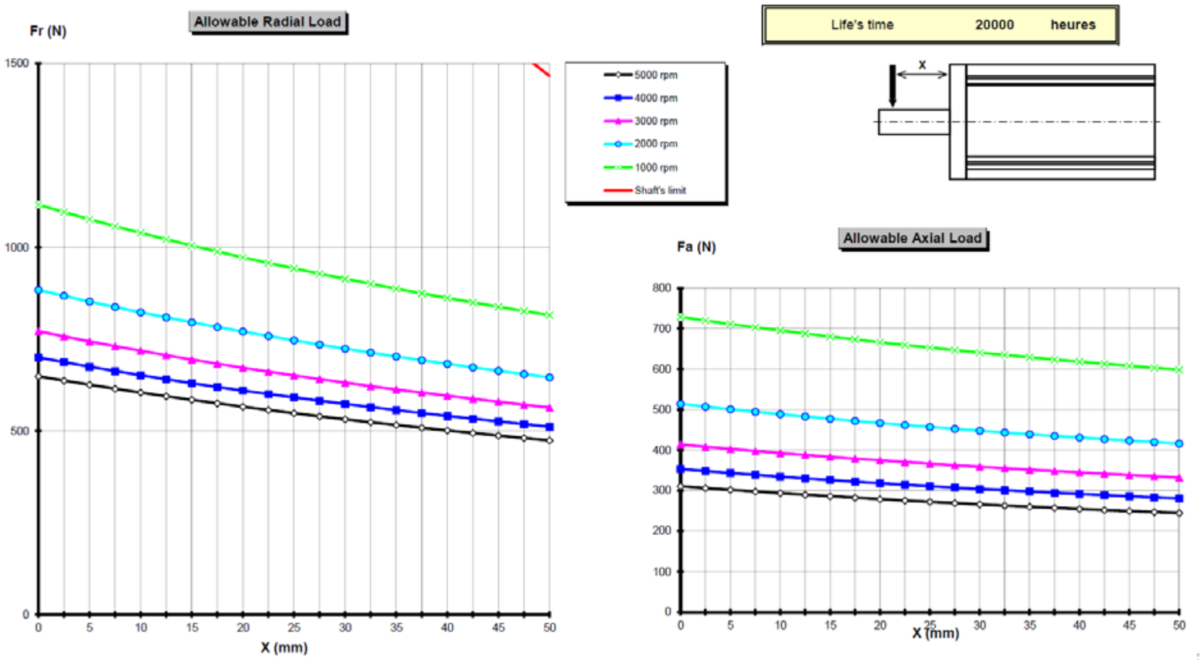
3.5.2.2. EY420



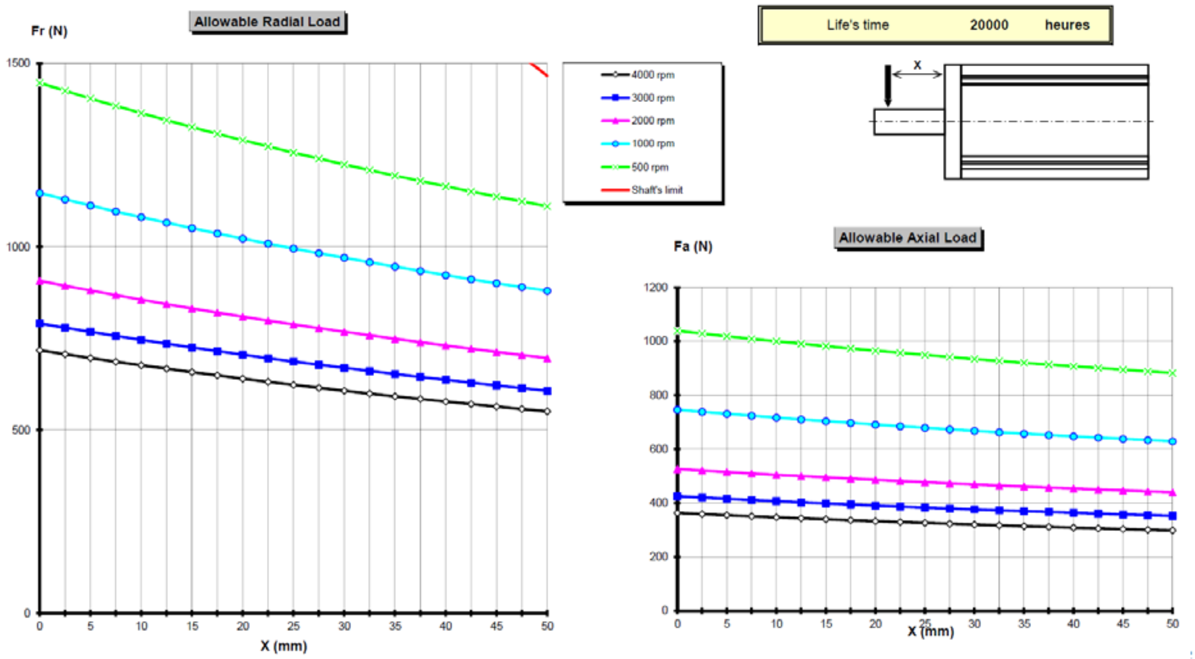
3.5.2.3. EY430



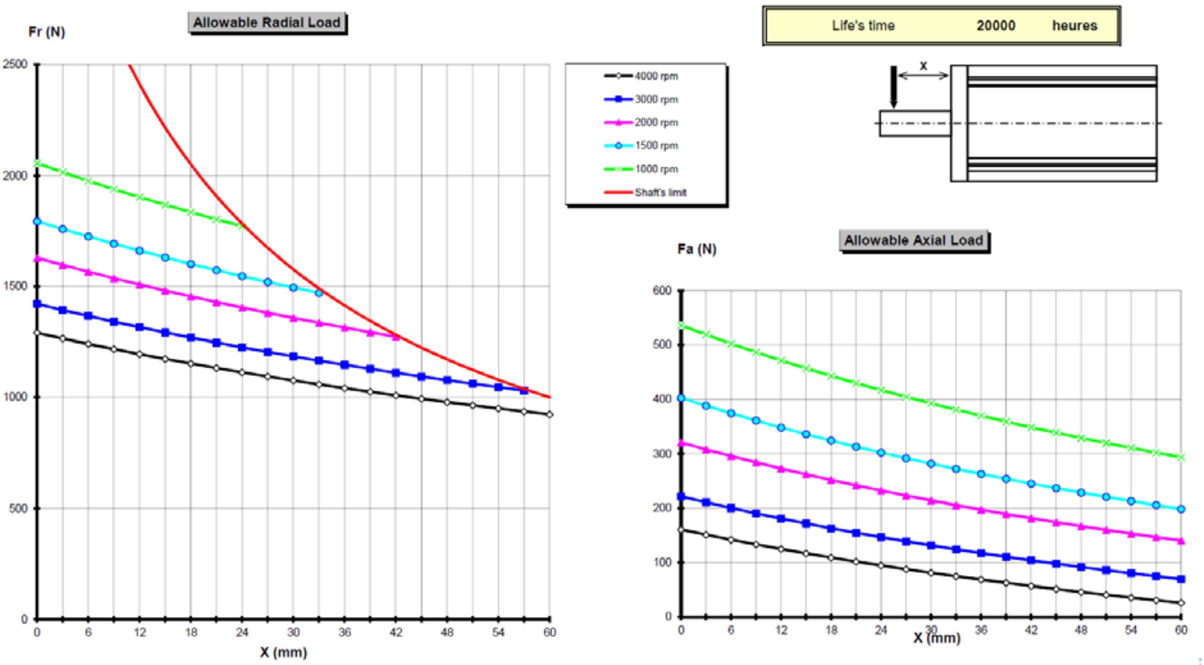
3.5.2.4. EY620



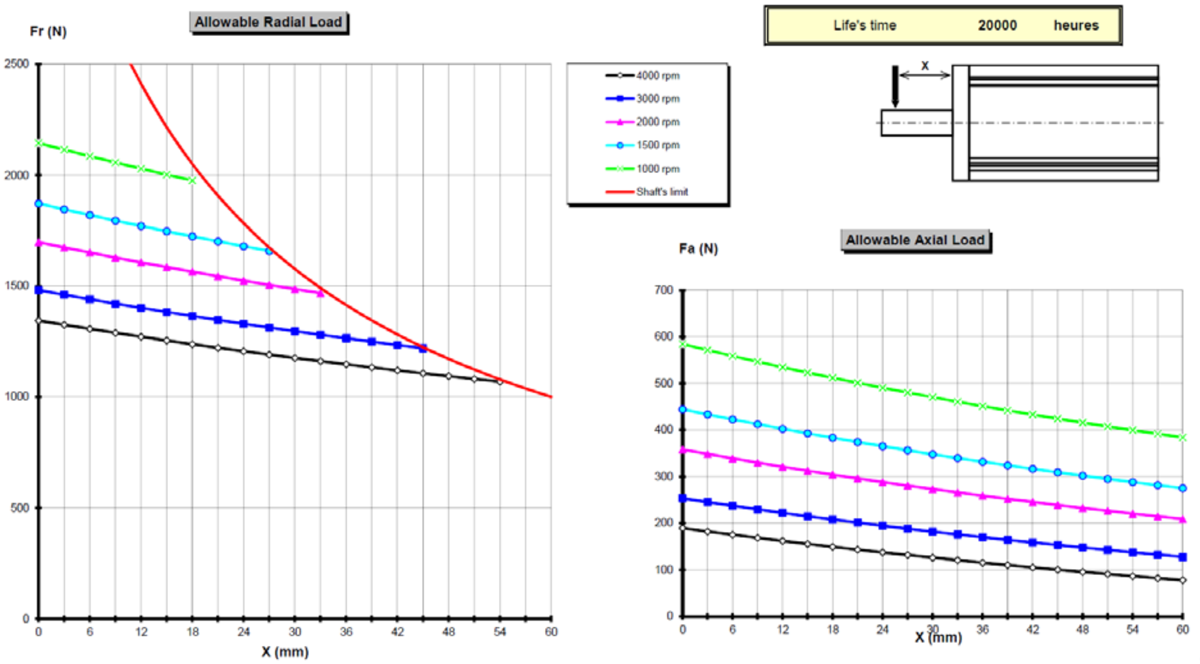
3.5.2.5. EY630



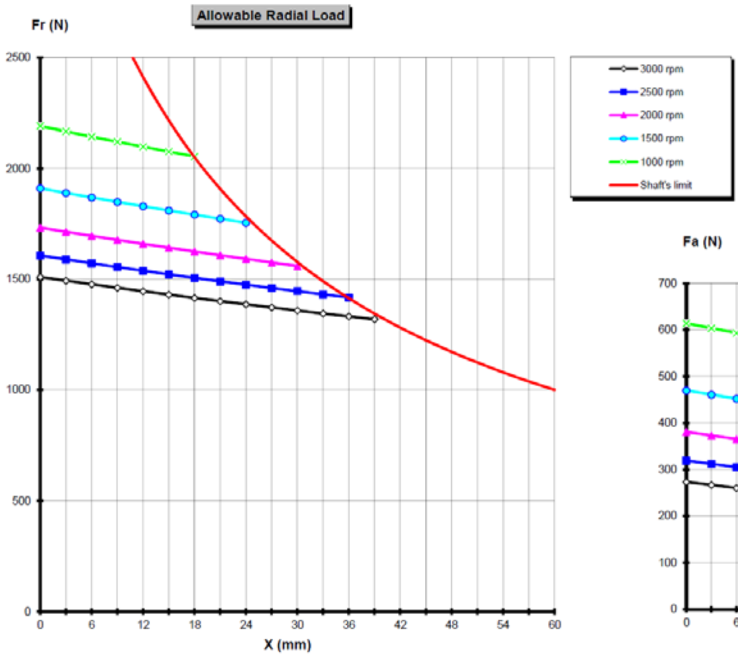
3.5.2.6. EY820



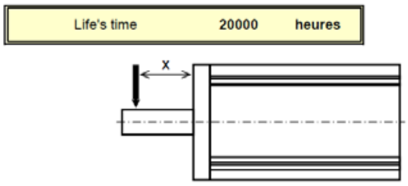
3.5.2.7. EY840



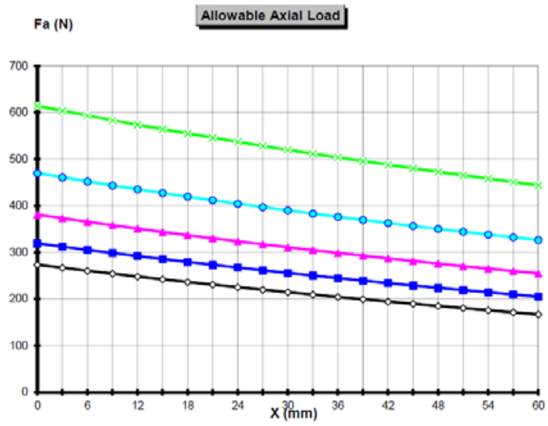
3.5.2.8. EY860



Allowable Radial Load
Fr (N)
2500
2000
1500
1000
500
0
0
6
12
18
24
30
36
42
48
54
60
X (mm)
3000 rpm
2500 rpm
2000 rpm
1500 rpm
1000 rpm
Shaft's limit



Life's time
20000
heures
X



Allowable Axial Load
Fa (N)
700
600
500
400
300
200
100
0
0
6
12
18
24
30
36
42
48
54
60
X (mm)

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 (see motor characteristics §3.2)

	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.

3.7. Thermal Protection

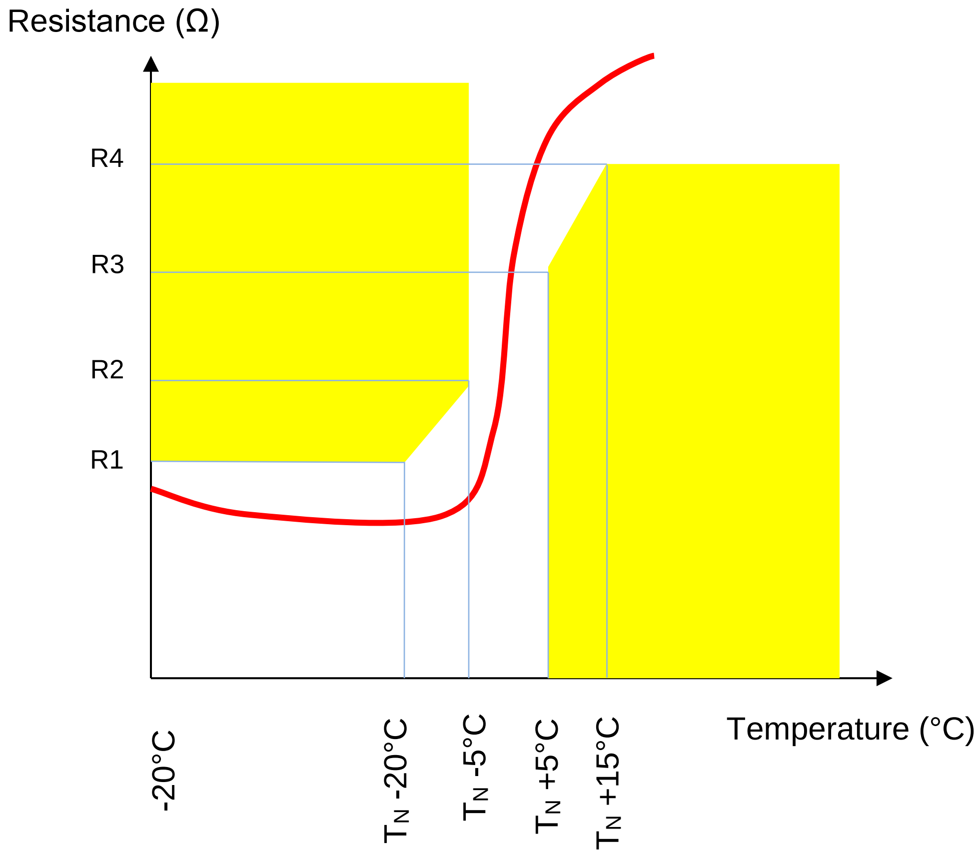
Different protections against thermal overloading of the motor are proposed: Thermoswitches (as an option), PTC thermistors (as standard) or KTY temperature (as an option) built into the stator winding. The thermal sensors, due to their thermal inertia, are unable to follow very fast winding temperature variations. They acheive their thermal steady state after a few minutes.

Warning: To protect correctly the motor against very fast overload, please refer to §3.1.6. Peak current limitations

3.7.1. Alarm tripping with PTC thermistors

Once thermal probe (PTC thermistors) fitted in the EY servomotor winding, trips the electronic system at **150° ± 5° C** for class F version. When the rated tripping temperature is reached, the PTC thermistor undergoes a step change in resistance. This means that a limit can be easily and reliably detected by the drive.

The graph and tab below show PTC sensor resistance as a function of temperature (T_N is nominal temperature)

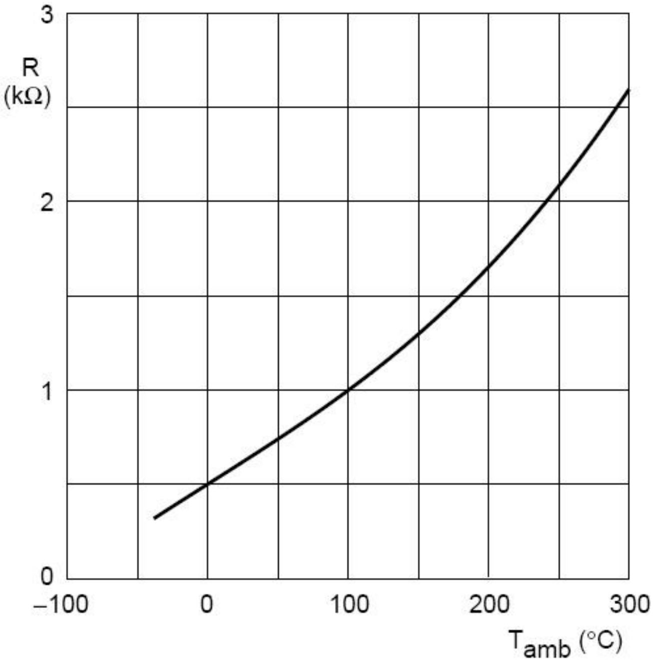


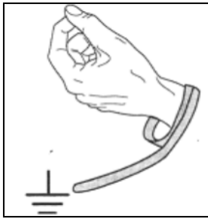
Temperature	Resistance value for EY6 andEY8	Resistance value for EY3 andEY4
from -20°C to T_N-20°C	R1≤500 Ω	R1≤750 Ω
from T_N-20°C to T_N-5°C	R2≤1100 Ω	R2≤1650 Ω
from T_N+5°C to T_N+15°C	R3≥2660 Ω	R3≥3990 Ω
greater than T_N+15°C	R4≥8000 Ω	R4≥12000 Ω

3.7.2. Temperature measurement with KTY sensors:

Motor temperature can also be continuously monitored by the drive using a KTY 84-130 thermal sensor built in to the stator winding. KTY sensors are semiconductor sensors that change their resistance according to an approximately linear characteristic. The required temperature limits for alarm and tripping can be set in the drive.

The graph below shows KTY sensor resistance vs temperature, for a measuring current of 2 mA:



	Warning: KTY sensor is sensitive to electrostatic discharge. So, always wear an antistatic wrist strap during KTY handling.

	Warning: KTY sensor is polarized. Do not invert the wires.

	Warning: KTY sensor is sensitive. Do not check it with an Ohmmeter or any measuring or testing device.

3.8. Power Electrical Connections

3.8.1. 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.

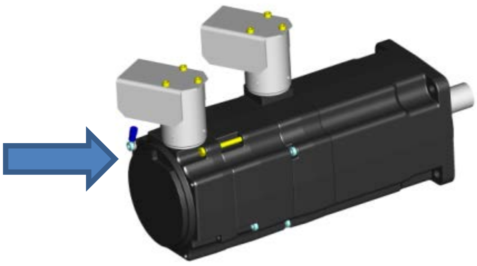
Cable selection

At standstill, the current must be limited at 80% of the low speed current I_0 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 $\sqrt{2}$ x 0.8 Io $\cong$ **1,13 x I_0**..

For the ATEX installations, you have to use special cables C2 type auto-extinguish regarding the standard EN 50265-2-1.

It is mandatory to connect 2 (green-yellow) ground cables between the motor frame and machine.

- the first one is connected to the ground pin #2 of power connector,
- the other one is connected to the external motor housing



The connecting of these two grounding devices is mandatory in order to comply with ATEX standard IEC/EN 60079-0.
The ground cable cross-section must be the same as the power cable cross-section

3.8.2. Conversion Awg/kcmil/mm²:

Awg	kcmil	mm²
	500	253
	400	203
	350	177
	300	152
	250	127
0000 (4/0)	212	107
000 (3/0)	168	85
00 (2/0)	133	67.4
0 (1/0)	106	53.5
1	83.7	42.4
2	66.4	33.6
3	52.6	26.7
4	41.7	21.2
5	33.1	16.8
6	26.3	13.3
7	20.8	10.5
8	16.5	8.37
9	13.1	6.63
10	10.4	5.26
11	8.23	4.17
12	6.53	3.31
14	4.10	2.08
16	2.58	1.31
18	1.62	0.82
20	1.03	0.52
22	0.63	0.32
24	0.39	0.20
26	0.26	0.13

3.8.3. Motor cable length

For motors windings which present low inductance values or low resistance values, the own cable inductance, respectively own resistance, in case of large cable length can greatly reduce the maximum speed of the motor. Please contact PARKER for further information.

Caution: It might be necessary to fit a filter at the servo-drive output if the length of the cable exceeds 25 m. Consult us.

3.9. Feeback system

3.9.1. Direction of shaft rotation regarding electrical connections

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. Sensorless connection

EY servomotors in sensorless version do not have a feedback cable. The connection of power cable has to be made according to the connection diagrams given in this documentation. In the detailed diagrams see §4.3.5, do not take into account the connection of the feedback cable and please keep the same connections for the other devices.

3.9.3. Resolveur 2 poles transformation ratio = 0.5 – code A

	EY3	**EY4, EY6 et EY8**
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	
Sensor accuracy	± 10’ Maximum	
Transformation 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	

3.10. Cables

You can connect EY motors to PARKER servo drives : AC30, AC890, COMPAX3, PSD or SLVD.
You can use complete cables with part numbers given as follows.
The "xxx" in the part number must be replaced by the length in meter.
Ex : for 20m cable, "xxx" = 020.

Special requirements for ATEX servomotors

	For the ATEX installations, you have to use special cables C2 type auto-extinguish regarding the standard EN 50265-2-1.
	Caution : For an ambient temperature of 40°C, the standard cables withstand a maximum surface temperature of 80°C. For an ambient temperature of 60°C, cables able to withtand a greater maximum surface temperature have to be provided. Please consult us.

3.10.1. Resolver signal cable

Cable reference for PSD with resolver	Cable reference for COMPAX3	Cable reference for SLVD
CP1UA1F1R0xxx	CC3UA1F1R0xxx	CS5UA1F1R0xxx

Cable reference for AC890	Cable reference for AC30 with resolver
CS4UA1F1R0xxx	CS7UA1F1R0xxx

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

Cable reference	Plug reference
6537P0047	220065R4621

3.10.2. Power cable with or without brake and thermal sensor

Motor size	Cable reference for PSD	Cable reference for COMPAX3	Cable reference for SLVD
Current ≤ 12Amps @40°C Current ≤ 9Amps @60°C	CP1UQ1F1R0xxx	CC3UQ1F1R0xxx	CS5UQ1F1R0xxx
Current ≤ 24Amps @40°C Current ≤ 17Amps @60°C	CP1UQ2F1R0xxx	CC3UQ2F1R0xxx	CS5UQ2F1R0xxx

Motor size	Cable reference for AC890	Cable reference for AC30
Current ≤ 12Amps @40°C Current ≤ 9Amps @60°C	CS4UQ1F1R0xxx	CS7UQ1F1R0xxx
Current ≤ 24Amps @40°C Current ≤ 17Amps @60°C	CS4UQ2F1R0xxx	CS7UQ2F1R0xxx

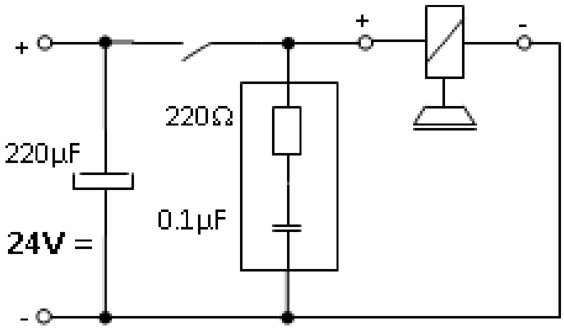
For other drive, you can assembly cable and plug by soldering with part number on the tab below:

	Cable reference	Plug reference
Current ≤ 12Amps @40°C Current ≤ 9Amps @60°C	6537P0043	220065R1610
Current ≤ 24Amps @40°C Current ≤ 17Amps @60°C	6537P0046	220065R1610

3.11. Brake option

⚠	Caution: The holding brake is used to completely immobilize the servomotor under load. It is not designed to be used for repeated dynamic braking ; dynamic braking must only be used in the case of an emergency stop and with a limited occurance depending on the load inertia and speed.

The standard brake power supply is 24 Vcc DC ± 10%.
Follow the polarity and the permissible voltage, and use shielded cables.
A 220 µF capacitor avoids untimely braking if the 24 V voltage is disturbed by the external relay. Check the voltage value once this capacitor has been fitted. The RC network (220 Ω, 0.1 µF) is needed to eliminate interference produced by the brake coil.
Position the contactor in the DC circuit to reduce brake response times. Follow the connection instructions taking the brake polarisation into account.



Motor	Static torque @20°C (N.m)	Static torque @100°C (N.m)	Power (W)	Engaging time (ms)	Disengaging time (ms)	Extra Inertia ($Kg.m^2.10^{-5}$)	Angular backlash (°)
EY3	2	1.8	11	13	25	0.68	0
EY4	5.5	4	12	17	35	1.8	0
EY6	12	8	18	28	40	5.4	0
EY8	36	32	26	45	100	55.6	0

Table with typical values

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.

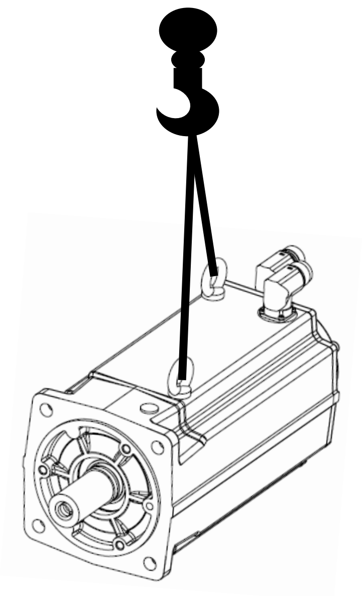
Warning: In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h.

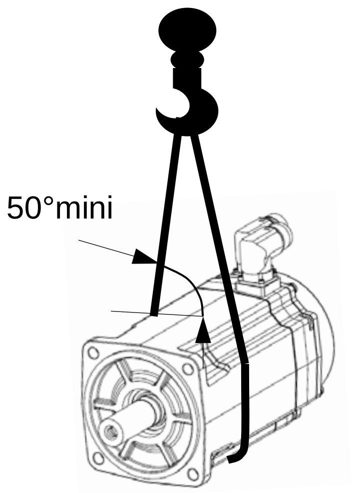
4.1.2. Handling

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 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. (Any slinging must be done according to current standards and regulations in each country.)

4.1.3. Storage

Before being mounted, the motor has to be stored in a dry place, without rapid or important temperature variations in order to avoid condensation.
During storage, the ambient temperature must be kept between -20 and +60°C.
If the torque motor has to be stored for a long time, verify that the shaft end, feet and the flange are coated with corrosion proof product.
After a long storage duration (more than 3 month), run the motor at low speed in both directions, in order to blend the bearing grease spreading.

4.2. Installation

4.2.1. Mounting

Foundation must be even, sufficiently rigid and shall be dimensioned in order to avoid vibrations due to resonance. Before bolting the motor, the foundation surface must be cleaned and checked in order to detect any excessive height difference between the motor locations. The surface variation shall not exceed 0,1 mm. In all cases, we recommend using shims in order to compensate small irregularities.

Caution: The user bears the entire responsibility for the preparation of the foundation.

4.2.2. Torque value for the screws

The table below gives the average tightening torques required regarding the fixing screw diameter. These values are valid for both motor's feet and flange bolting.

Diamètre de vis	Couple de serrage
M2 x 0.35	0.35 N.m
M2.5 x 0.4	0.6 N.m
M3 x 0.5	1.1 N.m
M3.5 x 0.6	1.7 N.m
M4 x 0.7	2.5 N.m
M5 x 0.8	5 N.m
M6 x1	8.5 N.m
M7 x 1	14 N.m
M8 x 1.25	20 N.m

Diameter de vis	Couple de serrage
M9 x 1.25	31 N.m
M10 x 1.5	40 N.m
M11 x 1.5	56 N.m
M12 x 1.75	70 N.m
M14 x 2	111 N.m
M16 x 2	167 N.m
M18 x 2.5	228 N.m
M20 x 2.5	329 N.m
M22 x 2.5	437 N.m
M24 x 3	564 N.m

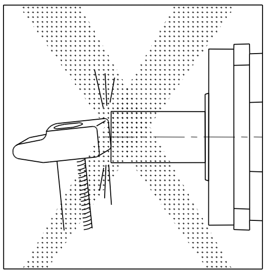
Warning: After 15 days, check all tightening torques on all screw and nuts.

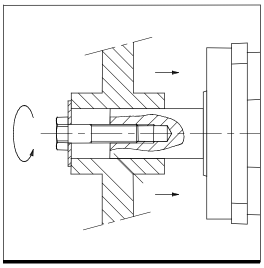
4.2.3. Preparation

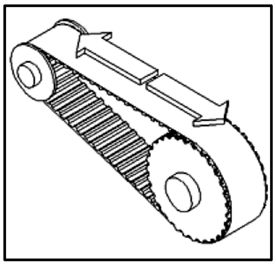
Once the motor is installed, it must be possible to access the wiring, and read the manufacturer's plate. Air must be able to circulate around the motor for cooling purposes.
Clean the shaft using a cloth soaked in white spirit or alcohol. Pay attention that the cleaning solution does not get on to the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

	Caution : Do not step on the motor, on the connectors or on the connector protectors
	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.

Warning : a misalignment of the coupling device makes stress and load on the motor shaft depending the rigidity of the installation.
The variations of the temperature makes stress and load due to the dilatation. These loads (axials and radiale) do not exceed the load written (§ 3.5).

Warning : The misalignment of the coupling device makes vibration who can realize a destruction of the motor shaft.

We cannot be held responsible for wear on the drive shaft resulting from excessive strain.

4.3. Electrical connections

Danger: Check that the power to the electrical cabinet is off prior to making any connections.

Caution: The wiring must comply with the drive commissioning manual and with recommended cables, as well as local regulations and standards.

Caution: The motor has to be connected to both grounding connections available (one is linked to an internal part of motor through a pin of connector, the other one to the external housing by dedicated lug).

Caution: After 15 days, check all tightening torques on cable connection Incorrect connections may cause overheating or fire.

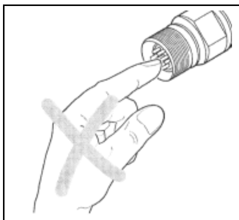
4.3.1. Cable connection

Please read **§3.8 "Electrical connection"** and **§3.3 "outline drawings"** to get information about cables connection.
Many useful informations are already available in the drive documentations.

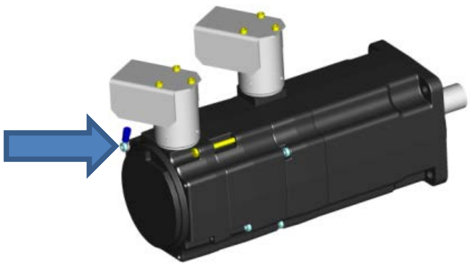
4.3.2. Cable handling

	Danger: before any intervention the drive must be stopped in accordance with the procedure.

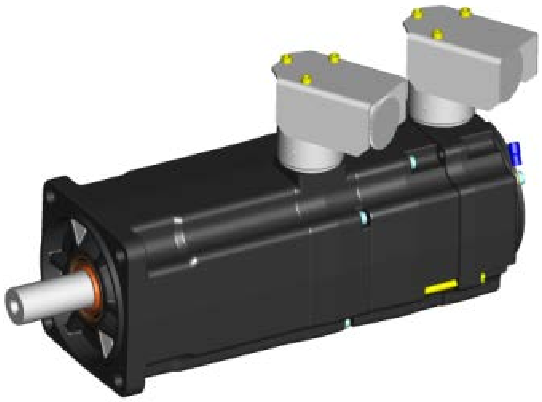
	Danger: It is forbidden to disconnect any cable under voltage (high risk of explosion, damage and sensor destruction).

	Warning: Do not touch contacts (risk of damage due to electrostatic discharges ESD

4.3.3. Use of two grounding devices with EY servomotors

	EY servomotors have two equipotential connections for grounding : • the first one is connected to the ground pin #2 of power connector, • the other one is connected to the external motor housing (see below).  The connecting of these two grounding devices is mandatory in order to comply with standard IEC/EN 60079-0.

4.3.4. Protection of connectors – Mounting recommendations



After connecting male and femal part of connector, cover the assembly of connector with its protection.The protection is foreseen to be adjusted on the connector.

Once the assembly correctly positioned, lock the device through a dedicated fixing screw - The tightening torque of this screw is comprised between 0.9 and 1.2 Nm.

Protections of connector shall be capable of being released or removed only with the aid of a tool according to standard IEC/EN 60079-0.
The protections are designed

- To absorb an impact energy of 7 joules.
- to prevent any disconnection when the motor run

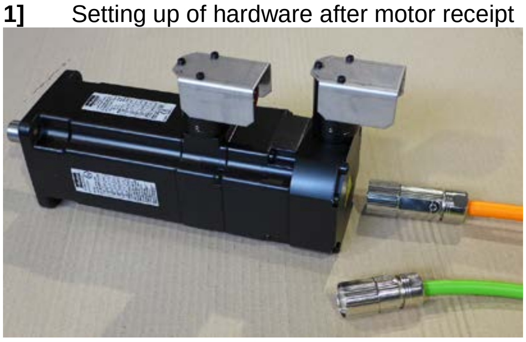
	Caution : Check the mechanical integrity of connector protectors before their mounting. The use of connector protectors is mandatory in order to be in accordance with standard IEC/EN 60079-0.

	Caution : The connector protector is a **single-use**. In case of shock on the latter, be sure to replace it with a new connector protector. Parker part number: 345352P0001

	Caution : The connector protector is a **Mandatory for ATEX compliance**

Instructions for mounting protectors on their connector basis

1] Setting up of hardware after motor receipt

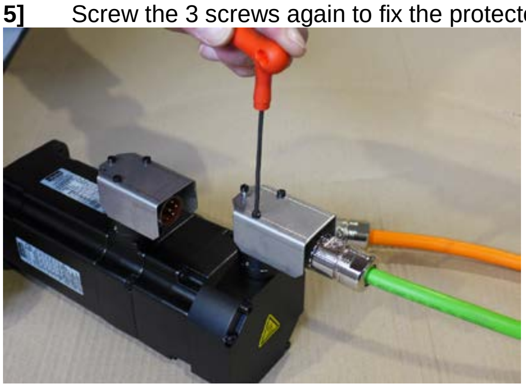


2] Unscrew the 3 screws of protector mounted on the command connector basis

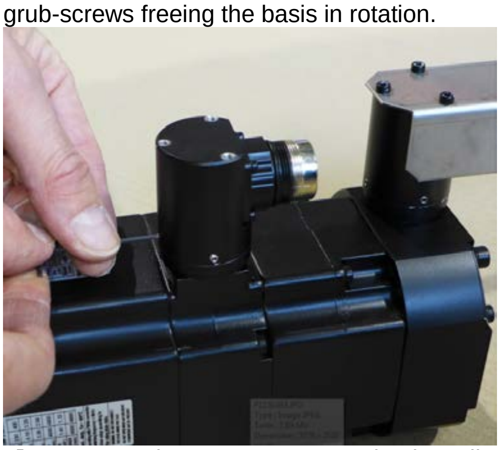
3] Situation obtained after protector removing

4] Screw the control plug on its connector

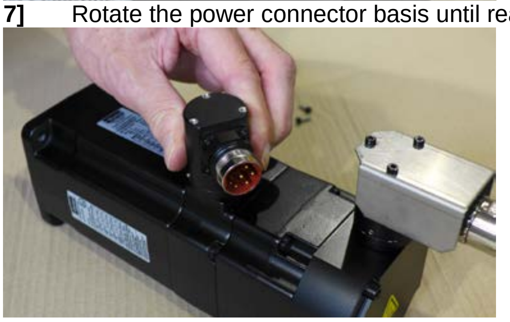
5] Screw the 3 screws again to fix the protector on the command connector basis



6] Previous operations 2, 3, 4, 5 are to be carried out with the power connector ; then unscrew slightly the 4 grub-screws freeing the basis in rotation.



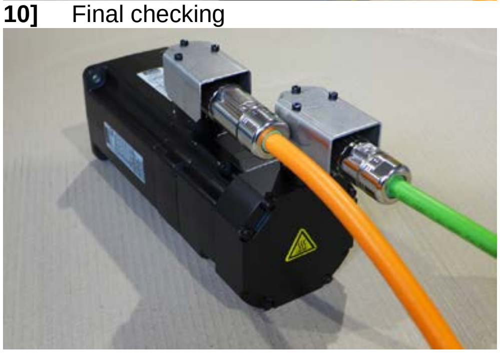
7] Rotate the power connector basis until reaching the needed orientation



8] Screw the power plug on its connector and immobilize the basis screwing the 4 grub-screws again

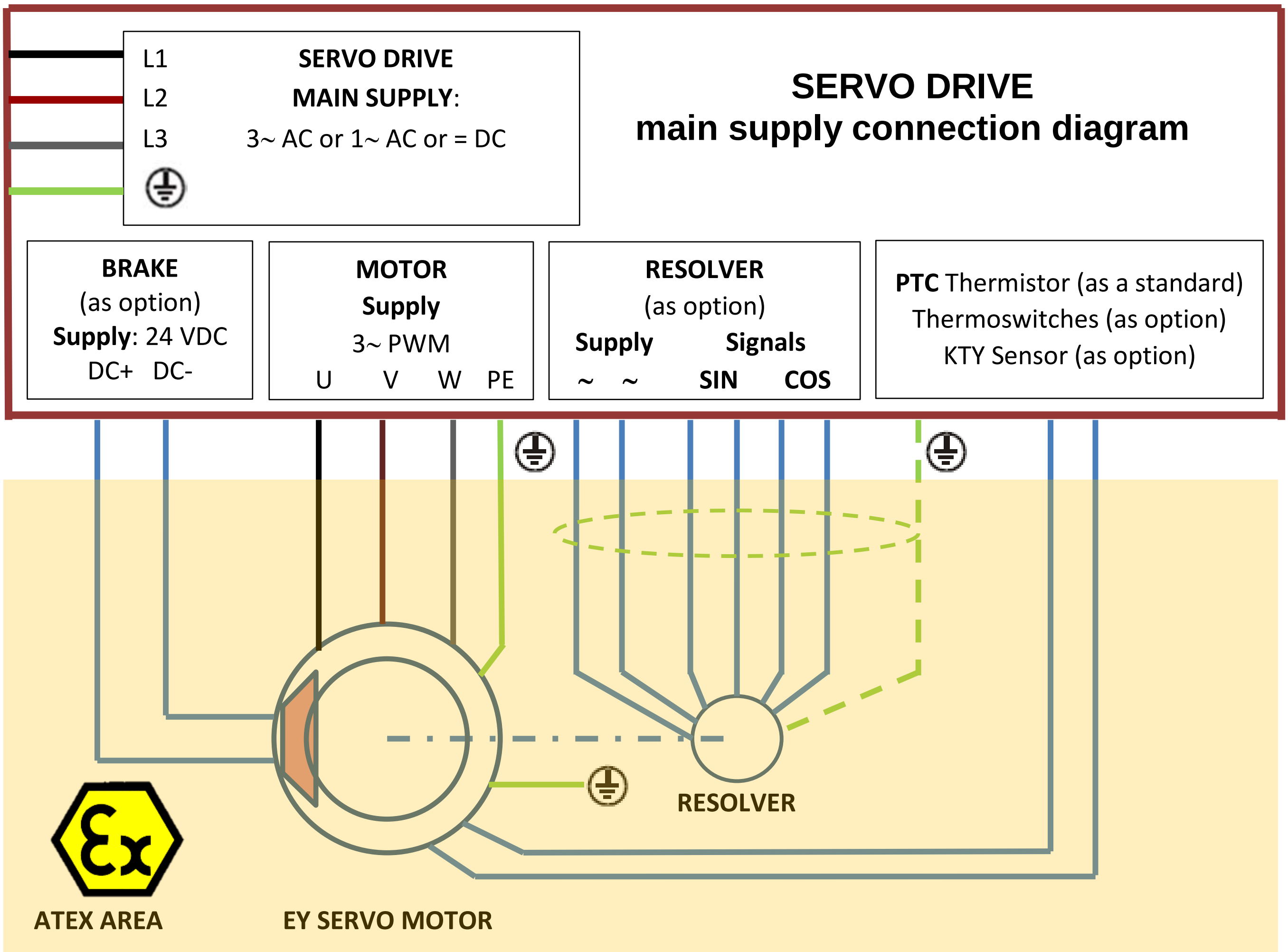
9] Screw the 3 screws again to fix the protector on the power connector basis

10] Final checking



4.3.5. Connection diagrams

⚠	Caution: The wiring must comply with the drive commissioning manual and with recommended cables.
⚠	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, overheating or/and breakdown - . Please consult us



Ex	It is mandatory to connect 2 (green-yellow) ground cables between the motor frame and machine. • the first one is connected to the ground pin #2 of power connector, • the other one is connected to the external motor housing (see below). The connecting of these two grounding devices is mandatory in order to comply with ATEX standard IEC/EN 60079-0. The ground cable cross-section must be the same as the power cable cross-section

4.4. Maintenance Operations

4.4.1. Summary maintenance operations

Generality

DANGER: The installation, commission and maintenance operations must be performed by qualified personnel, in conjunction with this documentation.

The qualified personnel must know the safety (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations.

They must be authorized to install, commission and operate in accordance with established practices and standards.

Please contact PARKER for technical assistance.

Danger: Before any intervention, the motor must be disconnected from the power supply.
Due to the presence of permanent magnets, a voltage is generated at the terminals when the motor shaft is turning.

Special requirements for ATEX servomotors

If an assembly screw of enclosure has to be replaced, the new one screw must present a quality 8.8 or higher.

If the motor is used in dust explosive atmospheres, do not forget to do a regular cleaning in order to avoid the deposits of dusts.

Operation	Periodicity
Clean the motor	Every year
Motor inspection (vibration changes, temperature changes, tightening torques on all scews)	Every year
Cable inspection, no degradation (colour, flexibility, cracks…)	Every year
Bearing replacement	Every 20 000h

4.5. Troubleshooting

Some symptoms and their possible causes are listed below. This list is not comprehensive. Whenever an operating incident occurs, consult the relevant servo drive installation instructions (the troubleshooting display indications will help you in your investigation) or contact us at: http://www.parker.com/eme/repairservice.

You note that the motor does not turn by hand when the motor is not connected to the drive.	• Check there is no mechanical blockage or if the motor terminals are not short-circuited. • Check the power supply to the brake.
You have difficulty starting the motor or making it run	• Check on the fuses, the voltage at the terminals (there could be an overload or the bearings could be jammed), also checks on the load current. • Check the power supply to the brake (+ 24 V ± 10 %) and its polarity. • Check on any thermal protection, its connection and how it is set in the drive. • Check on the servomotor insulation (if in doubt, carry out hot and cold measurements). The minimum insulation resistance value measured under a max. 50V DC is 50 MΩ: • Between the phase and the casing • Between the thermal protection and the casing • Between the brake coil and the casing • Between the resolver coils and the casing.
You find that the motor speed is drifting	• Reset the offset of the servoamplifier after having given a zero instruction to the speed setpoint input.
You notice that the motor is racing	• Check the speed setpoint of the servo drive. • Check you are well and truly in speed regulation (and not in torque regulation). • Check the feedback sensor setting • Check on the servomotor phase order: U, V, W
You notice vibrations	• Check the encoder and tachometer connections, the earth connections (carefully) and the earthing of the earth wire, the setting of the servo drive speed loop, tachometer screening and filtering. • Check the stability of the secondary voltages. • Check the rigidity of the frame and motor support..

You think the motor is becoming unusually hot	• It may be overloaded or the rotation speed is too low : check the current and the operating cycle of the motor. • Check if the mounting surface is enough or if this surface is not a heat source – see §3.6 cooling. • Friction in the machine may be too high : - Test the motor current with and without a load. - Check the motor does not have thermal insulation. - Check that there is no friction from the brake when the brake power is on.
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