Servomotors

EX Series

Technical Manual

PVD 3665 - EX

Compliance with «CE» directives

The explosive atmosphere EX..0E motors Series comply with the Directives **94/9/CE** and **2006/95/CE** and also meets the Standards EN 60034-1 and IEC 34-1/1994.
If the motors are used in a gazeous atmosphere, they meet EN 60079-0:2006 and EN 60079-1:2004. For a combustible dust atmosphere using, they meet EN 61241-0:2006 and EN 61241-1:2004 + corrigendum 2006.
Compliance with these standards requires explosive atmosphere EX motors to be mounted in accordance with the recommendations given in this commissioning and use manual.
Equipment shall furthermore be mounted on a mechanical support that conducts heat effectively and does not exceed 40°C.

PARKER HANNIFIN MANUFACTURING FRANCE SAS
8, avenue du Lac – BP30749
F-21007 DIJON CEDEX
Tel : +33 (0)3 80 42 41 40
Fax : +33 (0)3 80 42 41 23
www.parker.com

Compliance with «UL» standards

The explosive atmosphere EX..0U motors Series comply with the UL standards UL1004-1 and UL674

Compliance with these standards requires explosive atmosphere EX motors to be mounted in accordance with the recommendations given in this commissioning and use manual.
Equipment shall furthermore be mounted on a mechanical support that conducts heat effectively and does not exceed 40°C.

PARKER HANNIFIN MANUFACTURING FRANCE SAS
8, avenue du Lac – BP30749
F-21007 DIJON CEDEX
Tel : +33 (0)3 80 42 41 40
Fax : +33 (0)3 80 42 41 23
www.parker.com

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 EX 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 industrial accident or material damage that may arise, if the procedures and safety instructions described in this manual are not scrupulously followed.
	Motors for ATEX locations : EX servomotors manufactured for the CE market are designed to operate in ATEX classified areas.
	Motors for hazardous classified locations : EX servomotors manufactured for the North American market are designed to operate in harzardous classified areas.

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. Check the drive recommendations. The motor must be permanently connected to an appropriate safety earth. 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.

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 :

- EX3 Atex : PVD 3559
- EX4 Atex : PVD 3566
- EX6 Atex : PVD 3562
- EX8 Atex : PVD 3571
- EX3 UL to EX8 UL : PVD 3628

Atex servomotors
This motor can be used in hazardous areas. May particular attention to the notes marked with .

1.2.3. Using Category of the EX motors

Version	ATEX locations	UL Hazardous locations
Gazeous atmosphere	- **II** Outside industries - **2** Intermittent presence of gas - **d** Explosionproof - **II B** Ethylene or propane - **T4** 135°C for the Max. temperature on the motor surface - **IP64 or IP65** Protection index	- **Class 1** Flammable gases, vapours and liquids - **Division 1** Explosionproof - **Groups C & D** Ethylene or propane - **T4A** 120°C for the Max. temperature on the motor surface - **IP65** Protection index
Combustible dust atmosphere	- **tD** Protection by enclosure - **A21** Protection with seal - **T135°C** 135°C for the Max. temperature on the motor surface - **IP65** Protection index	**Not available**

1.2.4. 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.

2. PRODUCT DESCRIPTION

2.1. Overview

The EX servomotors from Parker are specifically designed to operate in explosive atmospheres for industrial applications.
The EX 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 EX servomotors the ideal solution for most servosystems applications in explosive atmospheres.

Advantages

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

2.2. Applications

Painting applications
Packaging machinery
Robot applications
Special machines
Cleaning applications
Printing applications

2.3. 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	
Storage temperature	-20°C to +40°C	
Connection	Electronic plate with cable glands	
Marking	CE	
Paint	Without	
Sensor	• Resolver in standard • Sick encoder - Hiperface: SKS36 and SKM36 SRS50 and SRM50 (Not available for EX3) • Heidenhain encoder – Endat: ECN1113 and EQN1125 (Not available for EX3 and EX4) • Sensorless	
Brake	Parking brake in option	
Thermal protection	Temperature sensors + thermofuse	
Remark	Numerous customization are possible on request (special shaft, special flange,…)	

2.4. 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	IMB3 (EN60034-7)	
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 +40°C	
Connection	Electronic plate with threaded holes	
Marking	UL	
Paint	Without	
Sensor	• Resolver in standard • Sick encoder - Hiperface: SKS36 and SKM36 SRS50 and SRM50 (Not available for EX3) • Heidenhain encoder – Endat: ECN1113 and EQN1125 • Sensorless	
Brake	Parking brake in option	
Thermal protection	Temperature sensors + thermofuse	
Remark	Numerous customization are possible on request (special shaft, special flange,…)	

2.5. 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.

Code	E X	3	1 0	E	A	K	R	1	2	0 0

Product Series

Motor size
1, 2, 3, 4, 6 or 8 in relation with the motor diameter

Motor length
up to 60 depend on size

Motor version
E: ATEX motor
U: UL motor

Feedback Sensor
A: resolver 2 poles transformation ratio = 0.5
R: Hiperface encoder singleturn SKS36 (128pulses)
S: Hiperface encoder mutiturn SKM36 (128pulses)
T: Hiperface encoder singleturn SRS50 (1024pulses)
U: Hiperface encoder mutiturn SRM50 (1024pulses)
V: Endat encoder singleturn ECN1113
W: Endat encoder multiturn ECN1125
Y: sensorless series for 650S drive
Z : Special encoder

Torque / Speed Characteristics
See motor data

Painting
R: no painting

Electric connection
1: Cable gland

Break and thermal sensor option
2: Without brake
5: With brake

Mechanical Interface
00: IP64 plain shaft
01: IP64 key on shaft
10: IP65 with plain shaft
11: IP65 with key on shaft
Other: custom code

3. TECHNICAL DATA

3.1. Motor selection

3.1.1. 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.

3.1.2. Pressure

The EX motors are designed to operate in area with a pressure between 80 kPa (0.8 bar) and 110 kPa (1.1 bar).

3.1.3. Temperature derating

The maximal ambient temperature for these motor is 40°C. In case of a maximal ambient temperature above 40°C is needed, a special certification is mandatory, please contact 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 $\boldsymbol{M_{rms}}$ (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 $\boldsymbol{M_{rms}}$ 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 $\boldsymbol{M_i}$ *[Nm]* reached during the duration $\boldsymbol{\Delta t_i}$ *[s]*.

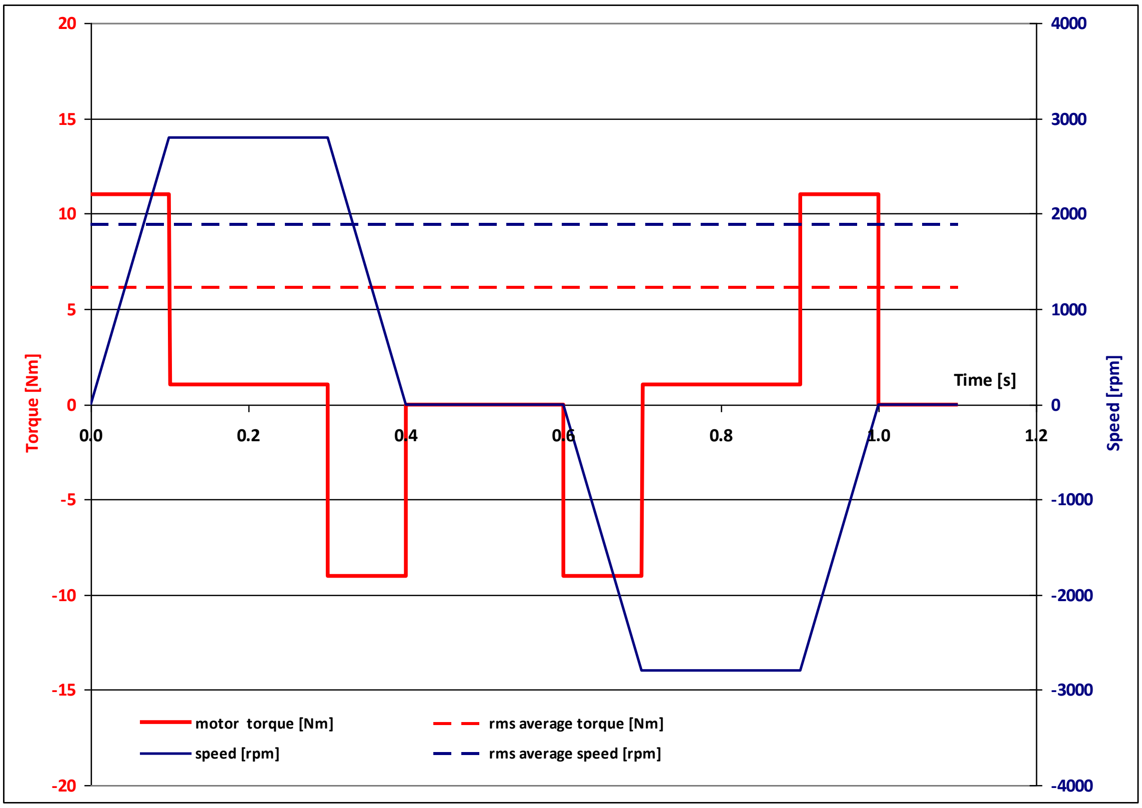
So, the rms torque $\boldsymbol{M_{rms}}$ can be calculated through the following basic formula:

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

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

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

<u>**Illustration :**</u>
Acceleration-deceleration torque:10 Nm during 0.1 s. Resistant torque: 1 Nm during 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.

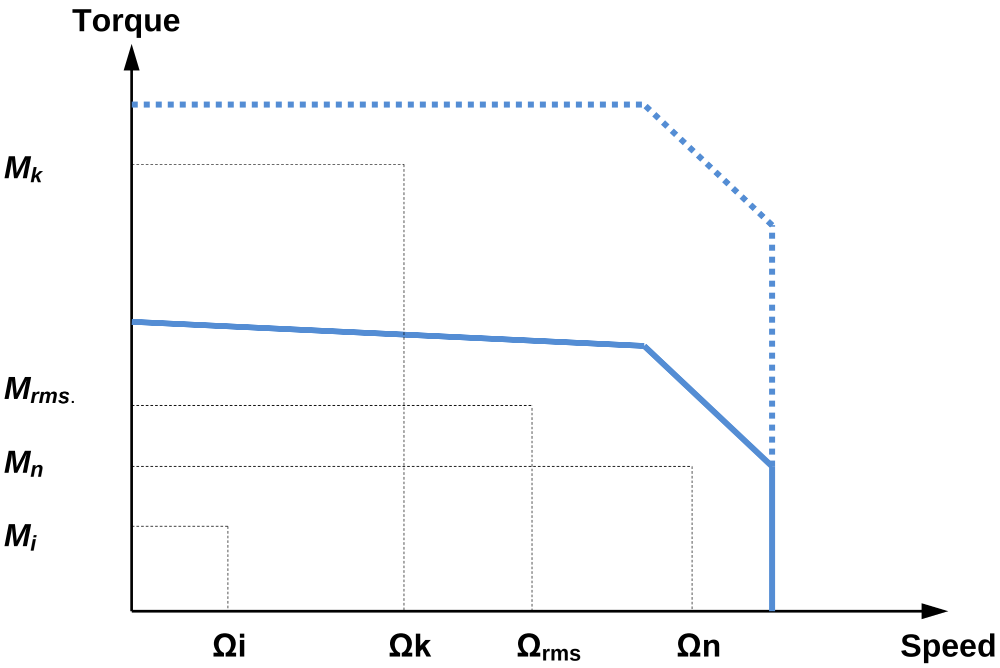
Selection of the motor :

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.



Drive selection

Drive selection depends on its rated power and its mode selection which leads to the maximal current duration.

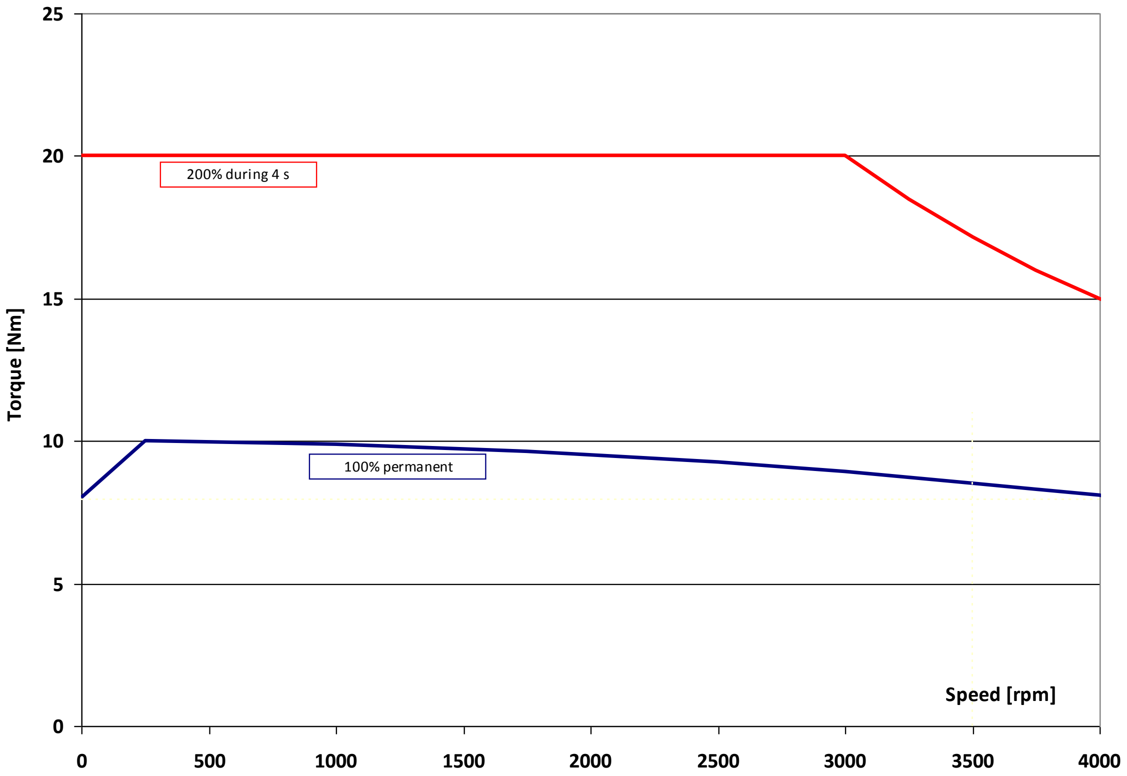
⚠	Please refer to the drive technical documentation for any further information and to select the best motor and drive association.

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	Vector mode	Servo mode
Overload capability [%]	150 % during 60 s	200 % during 4 s

Illustration:



Example n°1 :

The application needs:

- a rms torque of **7 Nm** at the rms speed of 2000 rpm,
- an acceleration torque of **10 Nm**,
- a maximal speed of 2800 rpm.

Selection of the motor:

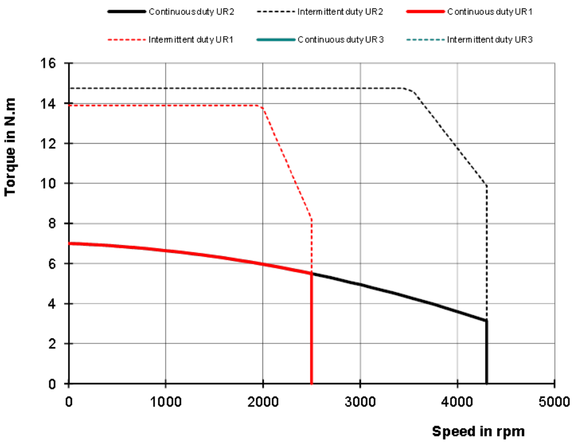
The selected motor is the type **EX620EAO**.
The nominal speed is equals to 4300 rpm.
The maximal speed is equals to 4300 rpm.
The torque sensitivity is equals to 1.27 Nm/Arms.

BRUSHLESS MOTORS
EX620EAO
ELECTRONIC DRIVE
DIGIVEX 7.5/15 et DIGIVEX 8/16
(230V) (400V)

No UL certification

Torque at low speed	M_o	Nm		7	
Permanent current at low speed	I_o	A_{rms}		5.51	
Peak torque	M_p	Nm		14.7	--
Current for the peak torque	I_p	A_{rms}		11.3	--
Back emf constant at 1000 rpm (25°C)*	Ke	V_{rms}		81.7	
Torque sensitivity	Kt	Nm/A_{rms}		1.27	
Winding resistance (25°C)*	Rb	Ω		1.63	
Winding inductance*	L	mH		14	
Rotor inertia	J	kgm^2x10^{-5}		98	
Thermal time constant	Tth	min		27	
Motor mass	M	kg		11.3	
Voltage of the mains	UR1 UR2 UR3	V_{rms}	230	400	-
Rated speed	Nn1 Nn2 Nn3	rpm	2500	4300	-
Rated torque	Mn1 Mn2 Mn3	Nm	5.49	3.13	-
Rated current	In1 In2 In3	A_{rms}	4.47	2.75	-
Rated power	Pn1 Pn2 Pn3	W	1440	1410	-

All data are given in typical values under standard conditions
* *Phase to phase*
Voltages and currents are given in rms values



The permanent current I_0 of the motor is **5.51 Arms** for $\mathbf{M_0}$**=7 Nm** at low speed.
The nominal current I_n of the motor is **2.46 Arms** for $\mathbf{M_n}$ **= 3.13 Nm** at the nominal speed.

Selection of the drive:

The drive has to provide at least a permanent current equals to I_0 (5.51 Arms).
In order to obtain an acceleration torque of **10 Nm**, the current will be about 8 Arms. This means that the drive has to provide at least 8 Arms as transient current.

→ Therefore, we can select the drive **AC890SD-53 2100 B** which delivers under 400 VAC:
6 Arms as permanent current and
6***200%**=12 Arms as maximal transient current during 4 s.
The drive is set with **"Servo Mode"**.

→ We also can select the drive **DIGIVEX 8/16 Â** which delivers under 400 VAC:
5.6 Arms as permanent current and
5.6***200%**=11.3 Arms as maximal transient current during 2 s.

Example n°2 :

This times; the application needs :

- a permanent torque of 5 Nm at low speed,
- a rms torque of 5 Nm at the rms speed of 1890 rpm,
- an acceleration torque of **7.6 Nm,**
- a maximal speed of 2800 rpm.

Selection of the motor:

The selected motor is the type **EX620EAO**.
The nominal speed is equals to 4300 rpm.
The maximal speed is equals to 4300 rpm.
The torque sensitivity is equals to 1.27 Nm/Arms.

Selection of the drive:

The drive has to provide a permanent current equals to 4 Arms to obtain 5 Nm.
In order to obtain an acceleration torque of **7.6 Nm**, the current will be of about 6 Arms
This means that the drive has to provide at less 6 Arms as transient current.

Compared to the previous example n°1, it is now possible to decrease the size of drive.
→ Therefore, we can select the drive **AC890SD-53 1600 B** which delivers under 400 VAC:
4 Arms as permanent current and
4***200%**=**8 Arms** as maximal transient current during 4 s.
The drive is set with **"Servo Mode"**.

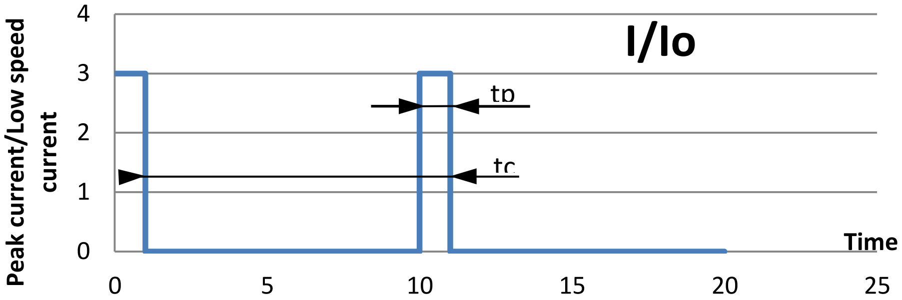
3.1.5. Current limitation at stall conditions (i.e. speed < 3 rpm)

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.

3.1.6. Peak current limitations



It is possible to use the EX motor with a current higher than the permanent current. But, to avoid any overheating, the following rules must be respected.

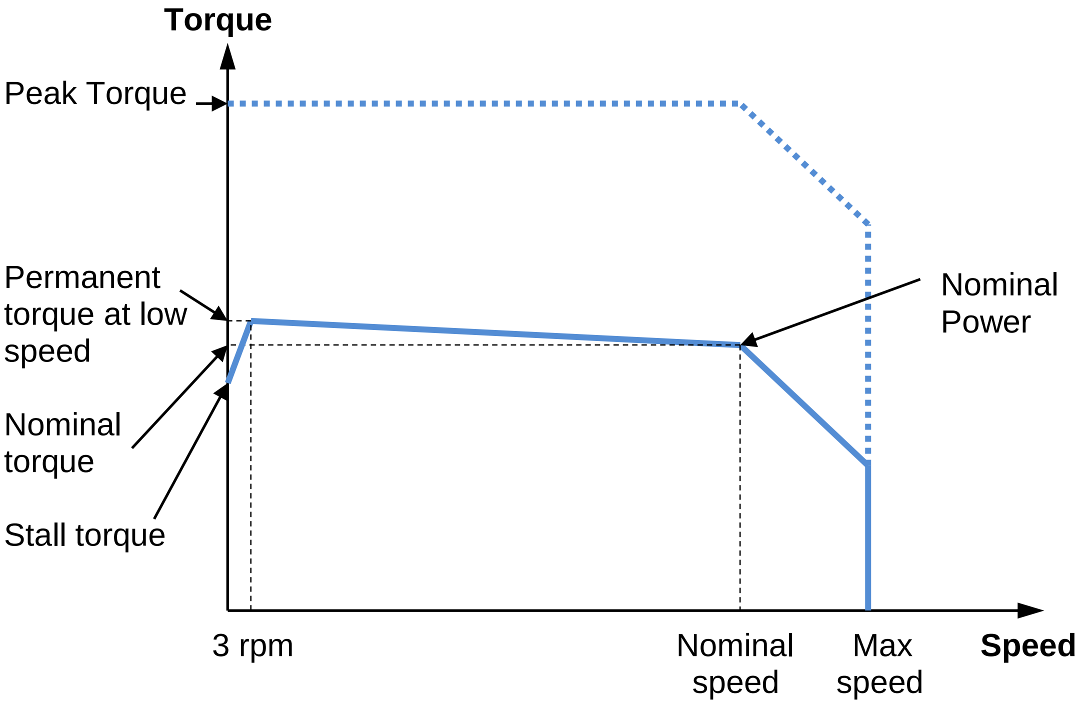
1) The peak currents and peak torques given in the data sheet must never be exceeded
2) The thermal equivalent torque must be respected (§3.1.3)
3) If 1) and 2) are respected (it can limit the peak current value or duration), the peak current duration (tp) must be limited, in addition, accordingly to the following table (Io is the permanent current at low speed):

Ipeak/In	Ip/Io =2	Ip/Io = 3
EX310	tp<0.8 s	tp<0.3s
EX420		
EX430		
EX620	tp<1.5s	tp<0.6s
EX630		
EX820		
EX840		
EX860		

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

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

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



Motor	Electronic Drive	Torque at low speed	Current at low speed	Peak Torque	Peak current	Back emf constant at 1000rpm	Torque sensitivity	Winding resistance	Winding inductance	Rotor inertia	Voltage of the mains	Rated speed and max speed	Rated torque	Rated current	Rated power
Name	Type	Mo (Nm)	Io (Arms)	Mp (Nm)	Ip (Arms)	Ke (V)	Kt (Nm/A)	Rb (Ω)	L (mH)	J (10^{-5}.kg.m²)	UR (V)	Nn (rpm)	Mn (Nm)	In (Arms)	Pn (W)
EX310EAK	DRIVE 2.2/5.7 - 230	1,75	2,16	4,37	5,66	50,9	0,81	6,6	20,3	7,9	230	4000	1,54	1,96	640
EX310EAM	DRIVE 1.9/4.8 - 400	1,75	1,81	4,38	4,76	60,7	0,97	9,9	28,9	7,9	400	6000	1,33	1,45	830
EX310EAP	DRIVE 1.3/2.9 - 230	1,75	1,24	3,89	2,83	88,9	1,42	20,7	62,0	7,9	230	2300	1,66	1,19	400
EX310EYP	DRIVE 1.3/2.9 - 230	1,75	1,24	3,89	2,83	88,9	1,42	20,7	62,0	7,9	230	1700	1,69	1,21	300
EX310EAG	DRIVE 5/11 - 230	1,75	4,05	4,37	10,6	27,2	0,43	2,0	5,8	7,9	230	7600	1,11	2,80	890
EX310UAU	DRIVE 2.5/6.4 - 230	1,6	2,46	4	6,33	41	0,65	4,3	13,2	7,9	230	4200	1,41	2,24	620
EX310UAP	DRIVE 1.2/3 - 230	1,6	1,13	4	2,92	88,9	1,41	20,7	62,0	7,9	230	1700	1,56	1,12	280
EX420EAJ	DRIVE 5/11 - 230	3,5	4,26	8,31	10,6	51,4	0,82	2,3	11,0	29	230	4000	2,67	3,33	1120
EX420EAP	DRIVE 2.5/5.7 - 230	3,5	2,46	7,76	5,66	89	1,42	7,2	33,0	29	230	2300	3,18	2,26	770
EX420EAP1	DRIVE 2.4/5.7 - 400	3,25	2,3	7,73	5,66	89	1,42	7,2	33,0	29	400	4000	2,30	1,67	960
EX420EAP2	DRIVE 2.2/5.4 - 230	3	2,13	7,3	5,32	89	1,41	7,2	33,0	29	230	2300	2,60	1,86	630
EX420EAV	DRIVE 1.3/2.9 - 400	3,5	1,24	7,73	2,83	177	2,83	28,4	131,0	29	400	2000	3,25	1,16	680
EX430EAJ	DRIVE 5/11 - 230	4,8	4,57	10,8	10,6	65,6	1,05	2,2	10,9	42,6	230	3200	3,79	3,68	1270
EX430EAF	DRIVE 6/15 - 230	4,8	5,79	11,6	14,5	51,8	0,83	1,4	6,8	42,6	230	4000	3,28	4,07	1370
EX430EAP	DRIVE 2.5/5.7 - 230	4,8	2,46	10,7	5,63	122	1,95	7,3	37,8	42,6	230	1500	4,53	2,34	710
EX430EAL	DRIVE 3.4/8.3 - 400	4,8	3,3	11,6	8,28	90,9	1,45	4,2	21,0	42,6	400	4000	3,28	2,32	1370
EX420UAI	DRIVE 5/11 - 230	3,2	4,15	7,97	10,7	48,3	0,77	1,9	9,7	29	230	4000	2,45	3,25	1030
EX430UAG	DRIVE 5/13 - 230	4,4	4,88	11	12,6	56,4	0,90	1,6	8,1	42,6	230	3200	3,48	3,94	1170
EX430UAG	DRIVE 5/13 - 230	4,4	4,88	11	12,6	56,4	0,90	1,6	8,1	42,6	230	3200	3,48	3,94	1170

Motor	Electronic Drive	Torque at low speed	Current at low speed	Peak Torque	Peak current	Back emf constant at 1000rpm	Torque sensitivity	Winding resistance	Winding inductance	Rotor inertia	Voltage of the mains	Rated speed and max speed	Rated torque	Rated current	Rated power
Name	Type	Mo (Nm)	Io (Arms)	Mp (Nm)	Ip (Arms)	Ke (V)	Kt (Nm/A)	Rb (Ω)	L (mH)	J (10-5.kg.m^2)	UR (V)	Nn (rpm)	Mn (Nm)	In (Arms)	Pn (W)
EX620EAO	DRIVE 6/12 - 230	7	5,51	14,7	11,3	81,7	1,27	1,6	14,0	98	230	2500	5,49	4,47	1440
EX630EAI	DRIVE 10/22 - 230	10,4	9,28	24,1	21,2	68,2	1,12	0,6	6,1	147	230	3000	7,24	6,75	2270
EX630EAY	DRIVE 6/12 - 230	10,4	5,11	23,5	11,3	124	2,03	1,9	20,0	147	230	1600	9,27	4,63	1550
EX630EAN	DRIVE 7/18 - 230	10,4	6,92	26	17,2	91,6	1,50	1,1	10,9	147	230	2200	8,52	5,81	1960
EX630EYN	DRIVE 7/16 - 230	10,4	6,92	23	15	91,6	1,50	1,1	10,9	147	230	2000	8,79	5,97	1840
EX620UAM	DRIVE 7/15 - 230	6,4	6,02	16	14,7	68,8	1,06	1,1	9,9	98	230	2750	4,76	4,67	1370
EX630UAK	DRIVE 8/20 - 230	9,5	7,91	23,8	19,4	73,6	1,20	0,7	7,1	147	230	2700	7,12	6,16	2010
EX820EAL	DRIVE 15/41 - 230	14	14,9	35	40,4	58,1	0,94	0,4	3,4	320	230	3600	7,53	8,30	2840
EX820EAR	DRIVE 10/23 - 230	14	9,28	32,1	22,6	93	1,51	1,0	8,6	320	230	2200	11,16	7,49	2570
EX820EAW	DRIVE 6/12 - 400	14	5,4	28,3	11,3	160	2,59	3,0	25,3	320	400	2200	11,16	4,36	2570
EX820UAQ	DRIVE 10/23 - 230	12,9	9,1	29,9	22,7	87,2	1,42	0,9	7,5	320	230	2300	10,10	7,21	2430
EX840EAJ	DRIVE 17/43 - 230	24,5	16	61,3	42,3	94,2	1,53	0,4	4,3	620	230	2200	14,18	9,54	3270
EX840EAQ	DRIVE 9/22 - 400	24,5	8,55	58,6	21,4	177	2,87	1,4	15,1	620	400	2100	15,01	5,37	3300
EX840EAK	DRIVE 15/38 - 400	24,5	14,3	61,3	37,6	106	1,72	0,5	5,4	620	400	3300	2,85	2,07	990
EX840UAL	DRIVE 13/33 - 230	22,6	12	56,5	32,1	118	1,89	0,6	6,7	620	230	1650	16,80	9,00	2900
EX860EAD	DRIVE 28/71 - 230	35	27,9	84,9	70,7	78,7	1,26	0,2	2,0	920	230	2500	9,00	7,82	2360
EX860EAJ	DRIVE 16/40 - 230	35	15,7	83,8	39,2	140	2,23	0,5	6,4	920	230	1500	24,80	11,28	3900
EX860UAJ	DRIVE 14/37 - 230	31,4	13,9	78,5	36,8	140	2,26	0,5	6,4	920	230	1500	22,30	10,01	3500
EX840EAM	DRIVE 12/23 - 400	24,5	11,2	48,8	22,6	135	2,20	0,8	8,9	620	400	2500	11,50	5,46	3010

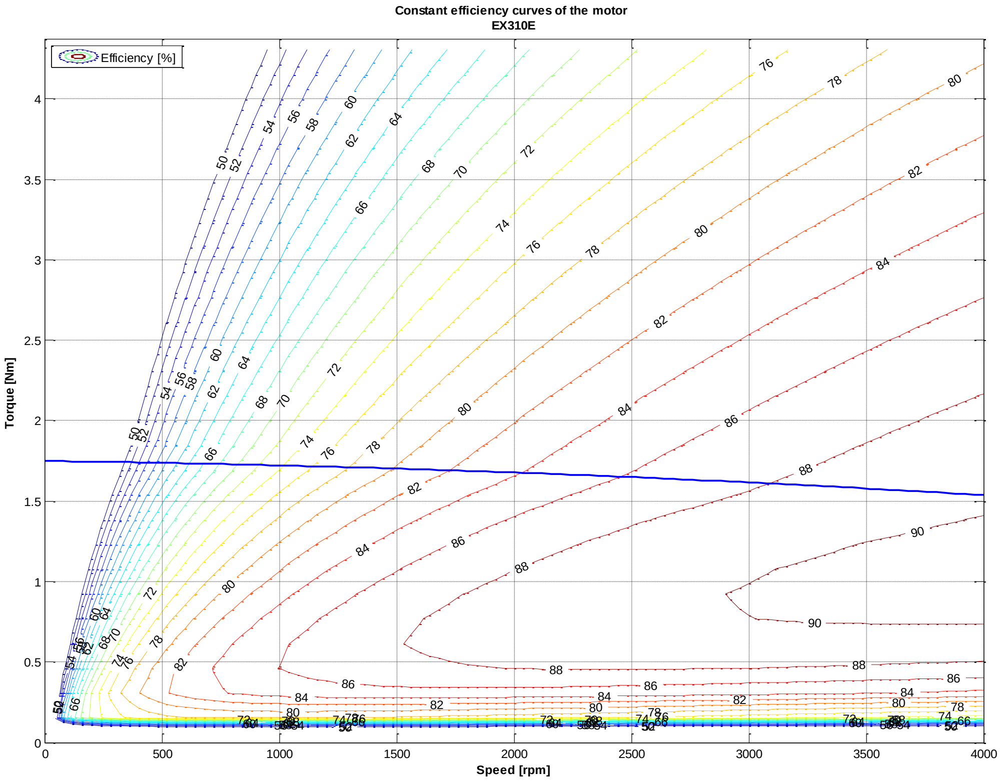
3.2.1. Efficiency curves

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

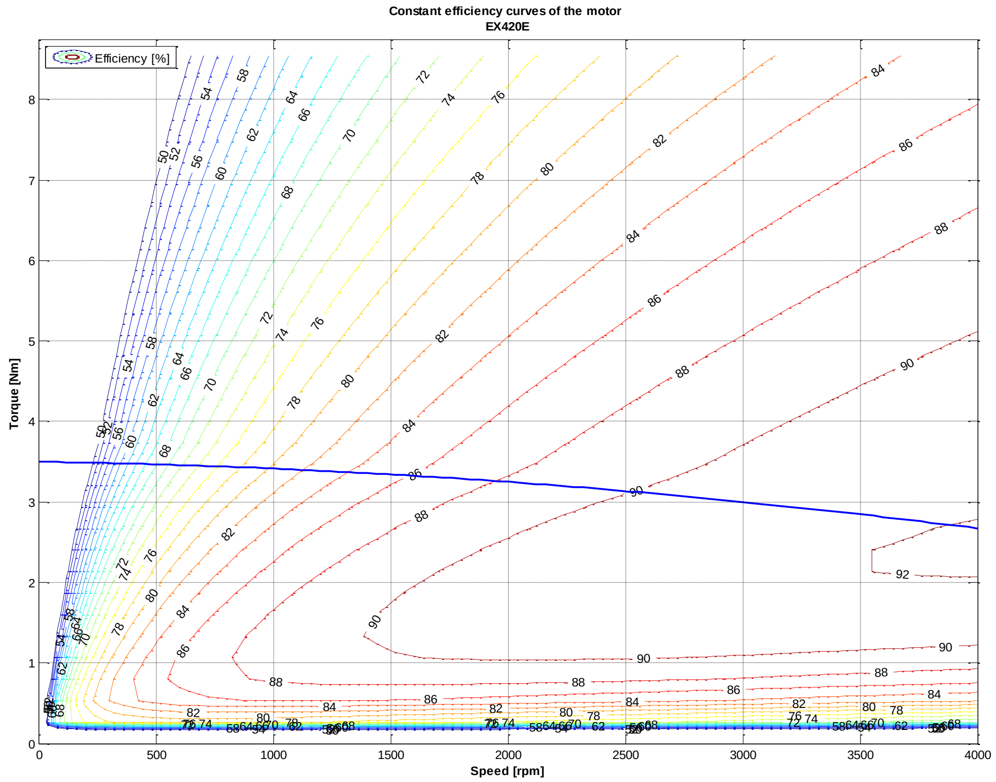
⚠	Caution: The efficiency curves are given for an optimal motor control (no voltage saturation and optimal phase between current and EMF)

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

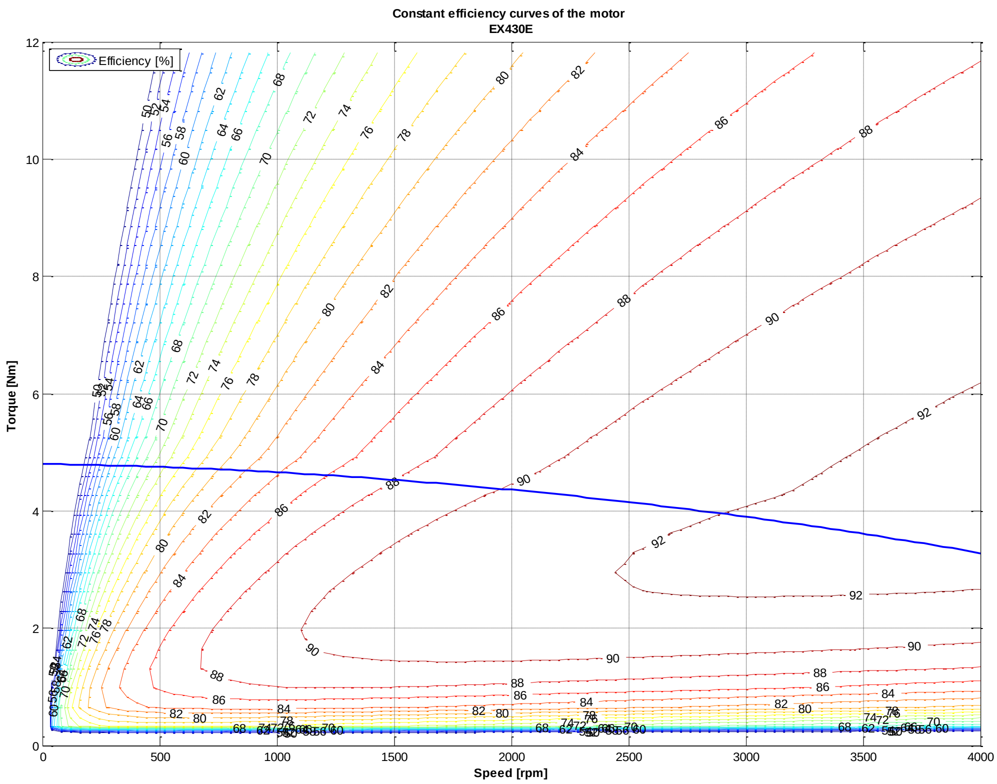
3.2.1.1. Series EX310E (EX310EAP)



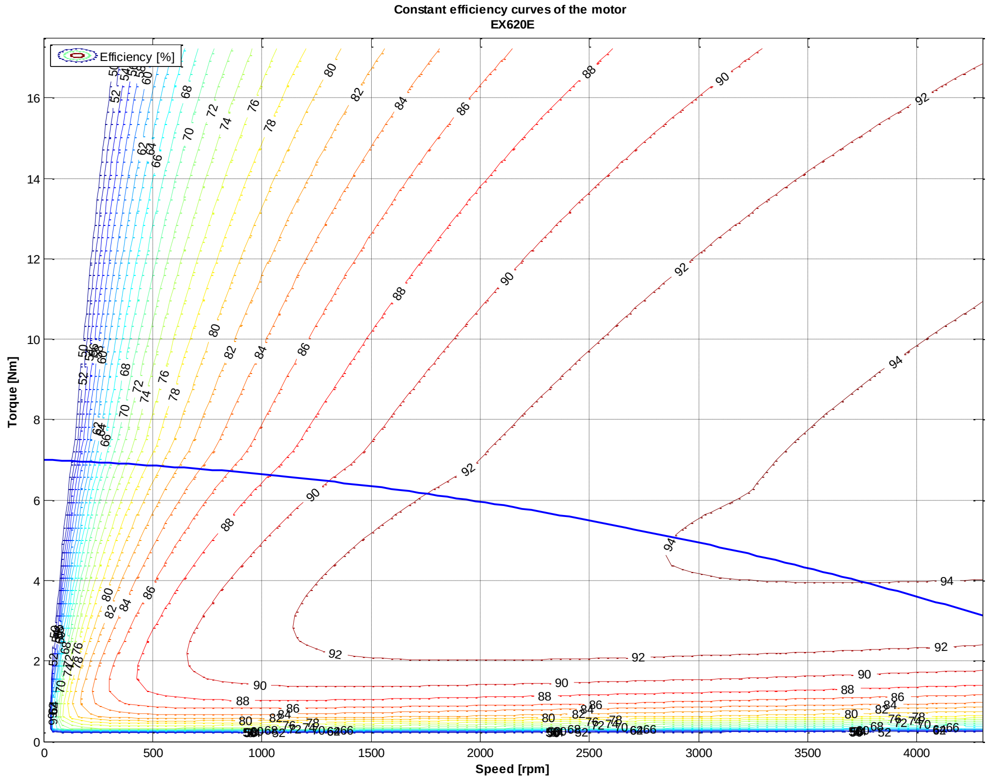
3.2.1.2. Series EX420E (EX420EAP)



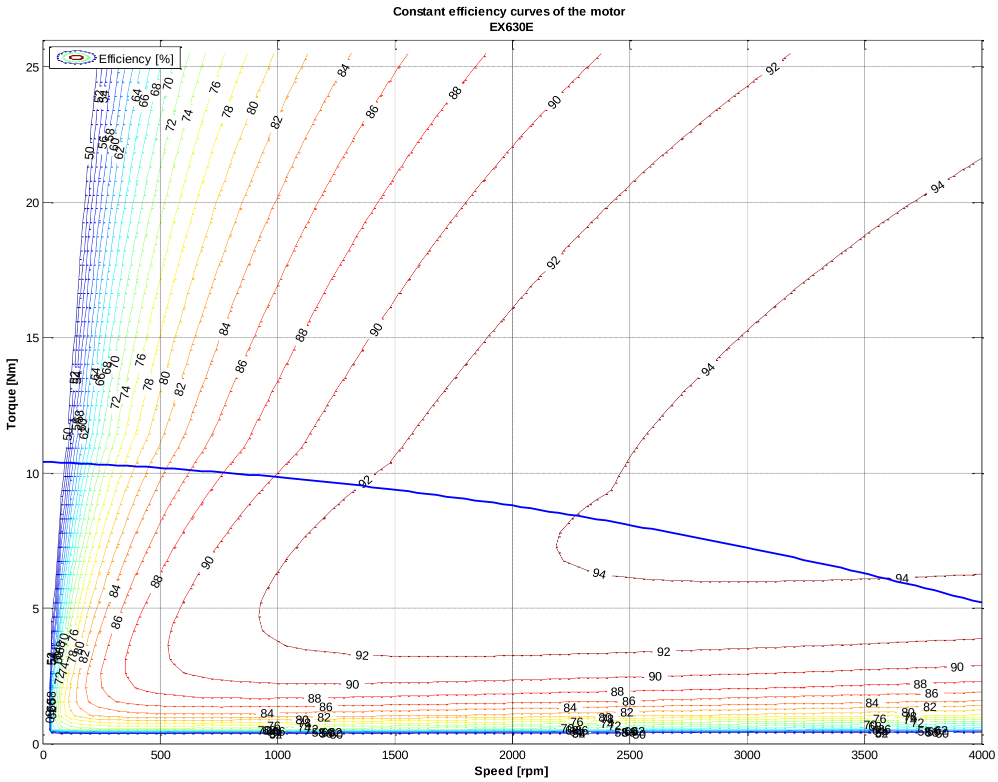
3.2.1.3. Series EX430E (EX430EAL)



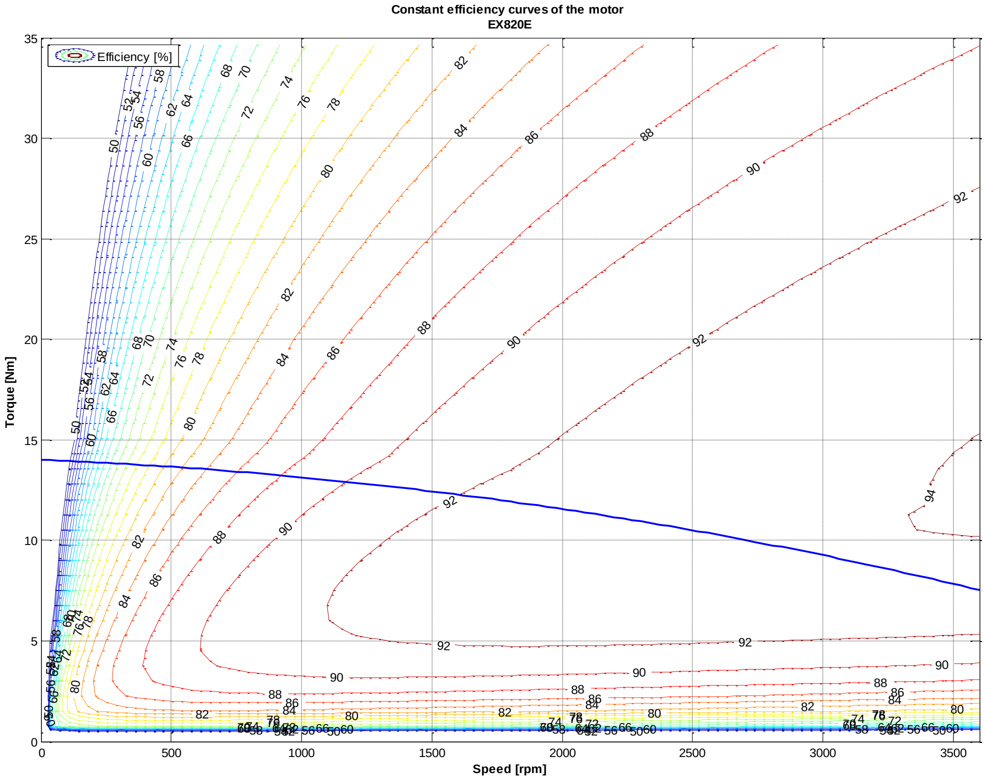
3.2.1.4. Series EX620E (EX620EAO)



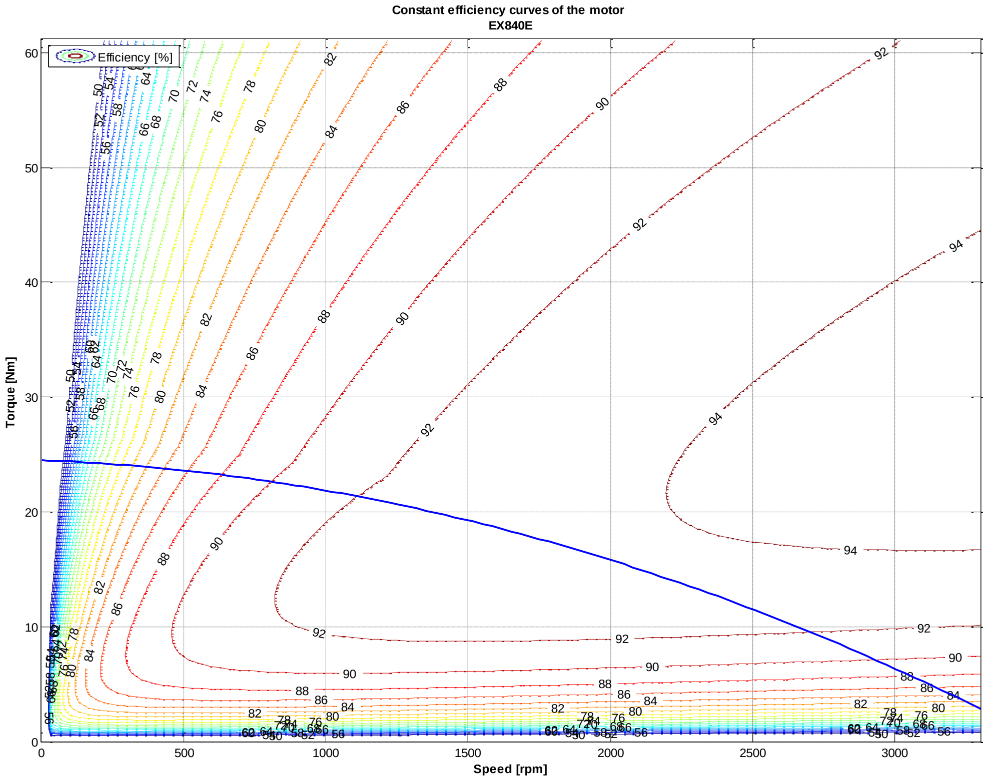
3.2.1.5. Series EX630E (EX630EAN)



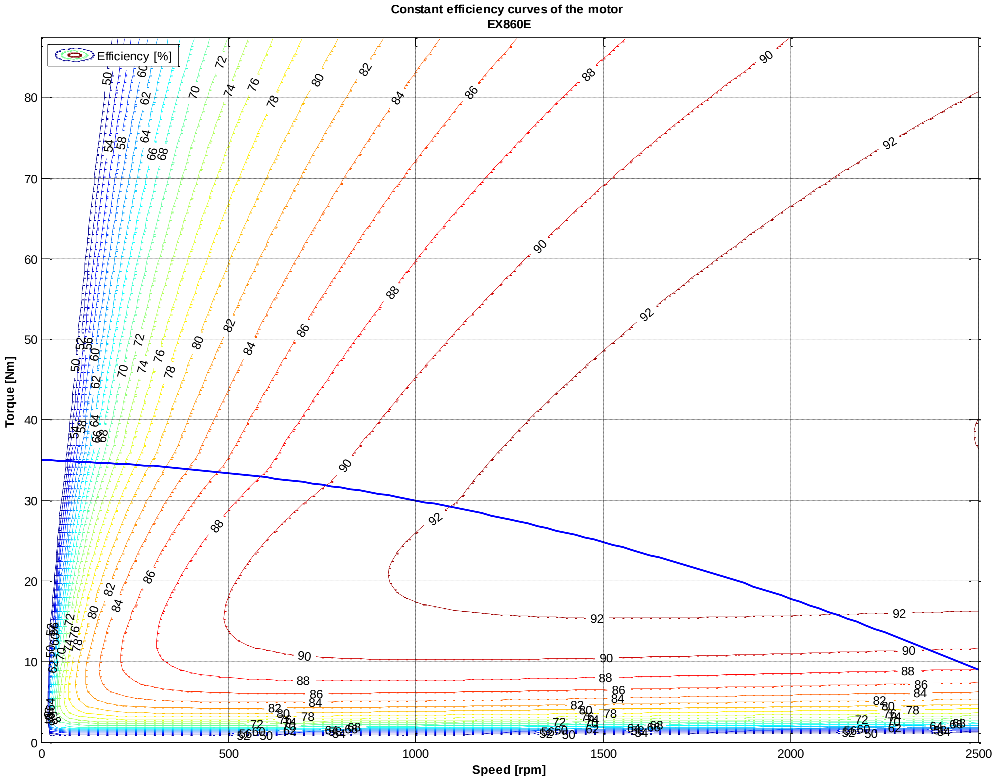
3.2.1.6. Series EX820E (EX820EAR)



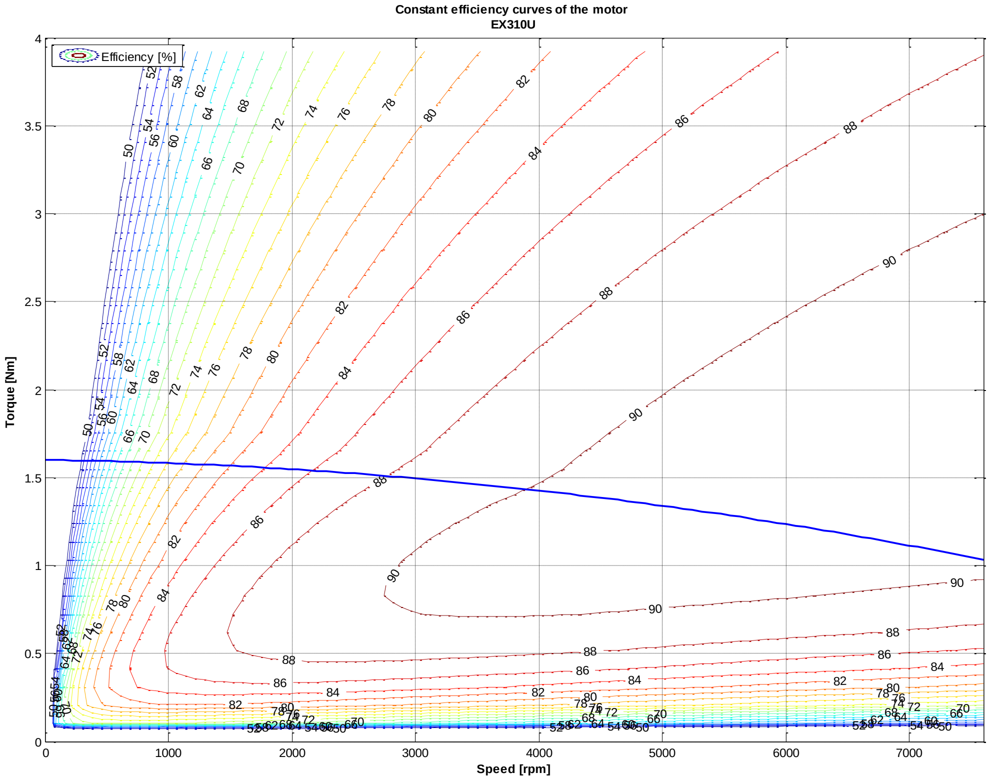
3.2.1.7. Series EX840E (EX840EAK)



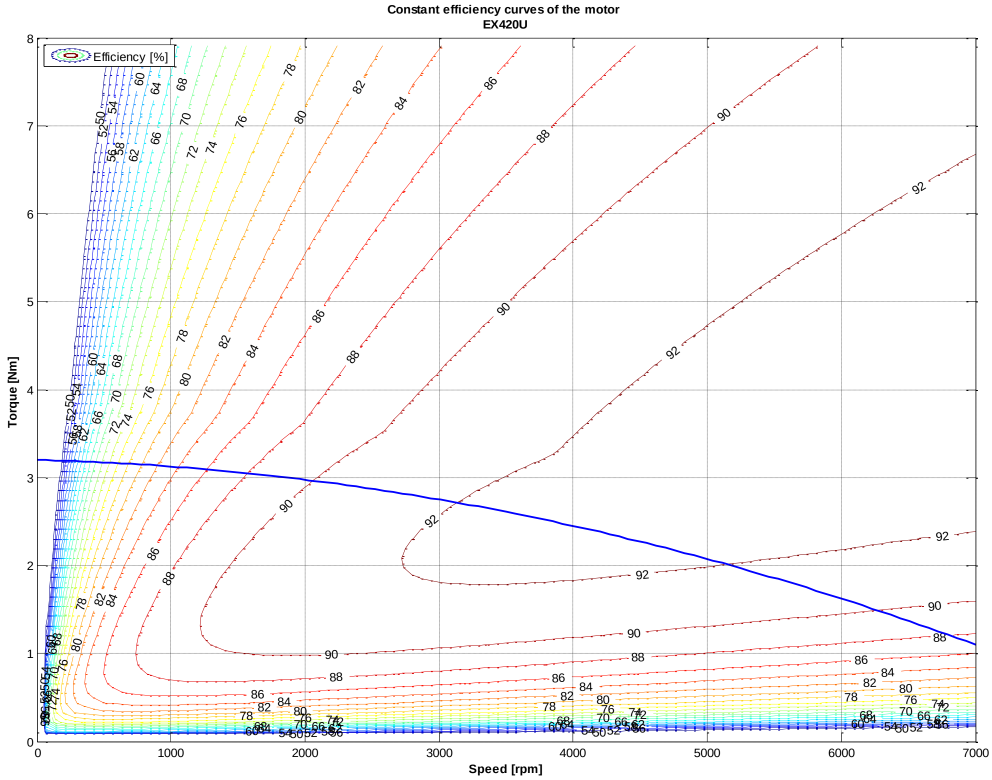
3.2.1.8. Series EX860E (EX860EAJ)



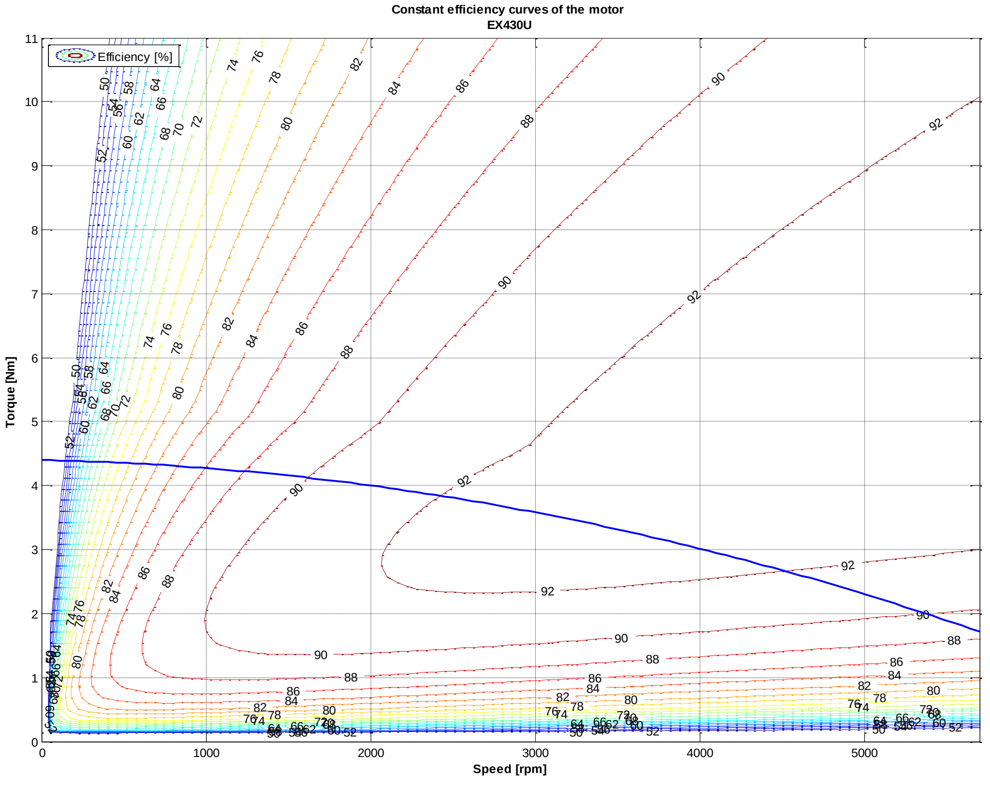
3.2.1.9. Series EX310U (EX310UAU)



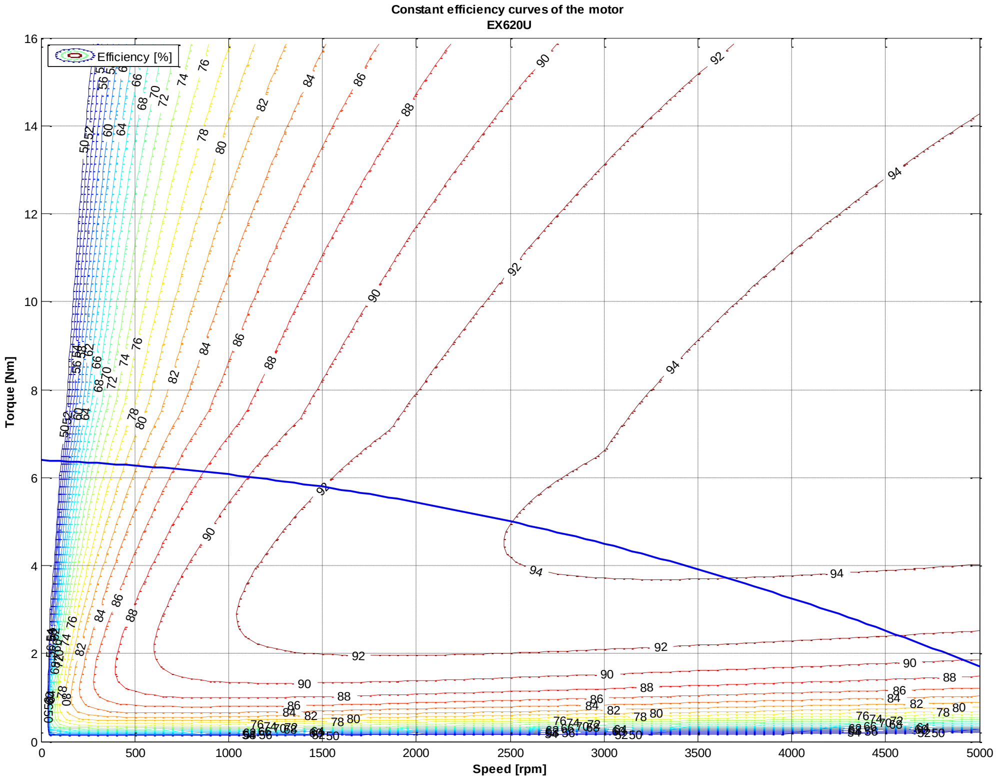
3.2.1.10. Series EX420U (EX420UAI)



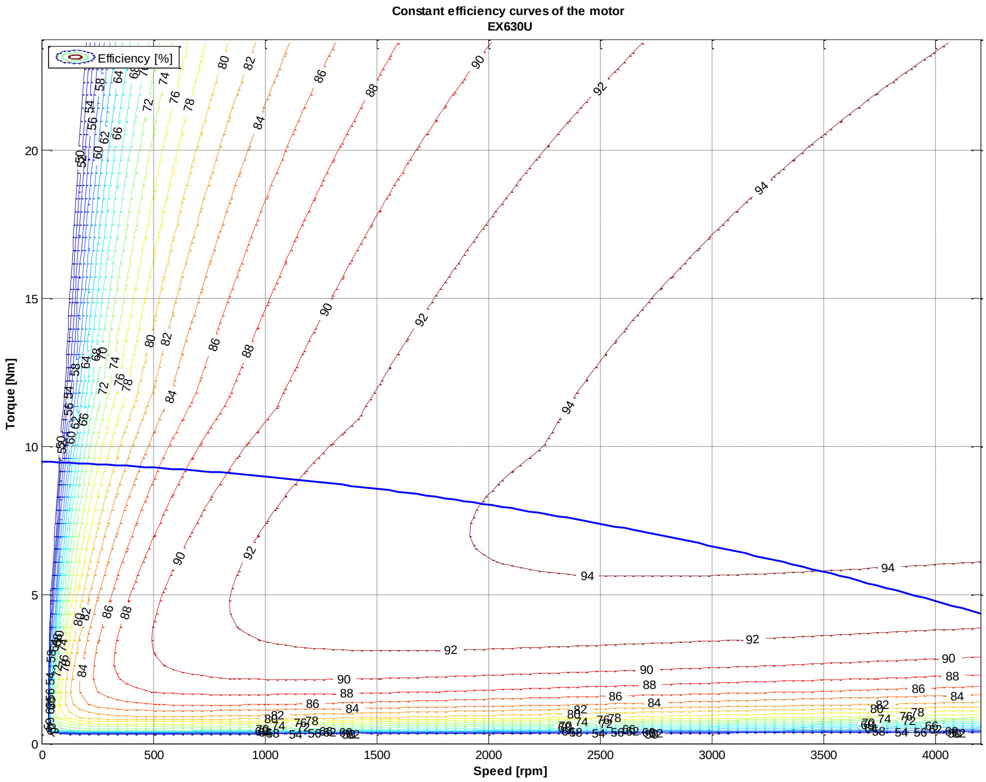
3.2.1.11. Series EX430U (EX430UAG)



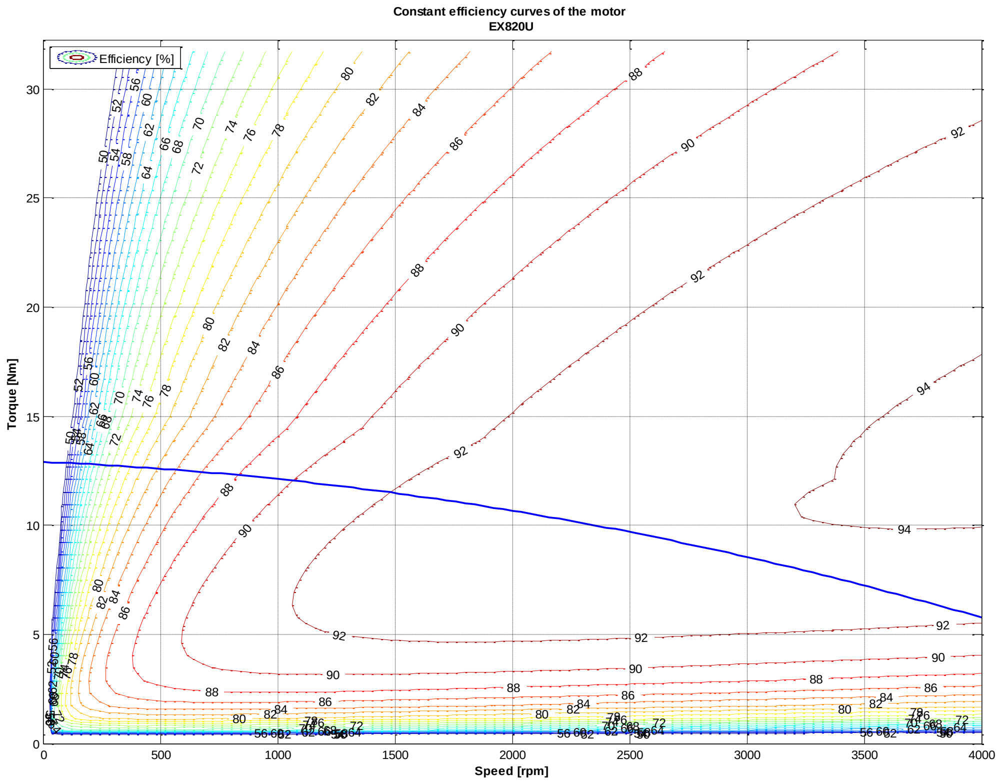
3.2.1.12. Series EX620U (EX620UAM)



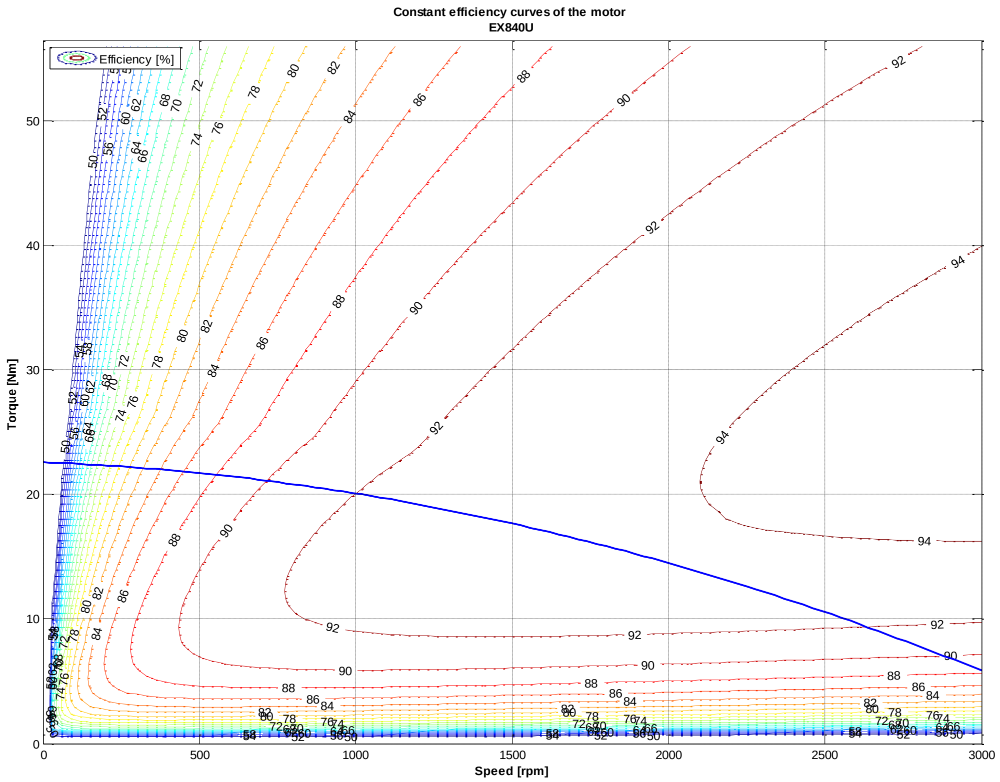
3.2.1.13. Series EX630U (EX630UAK)



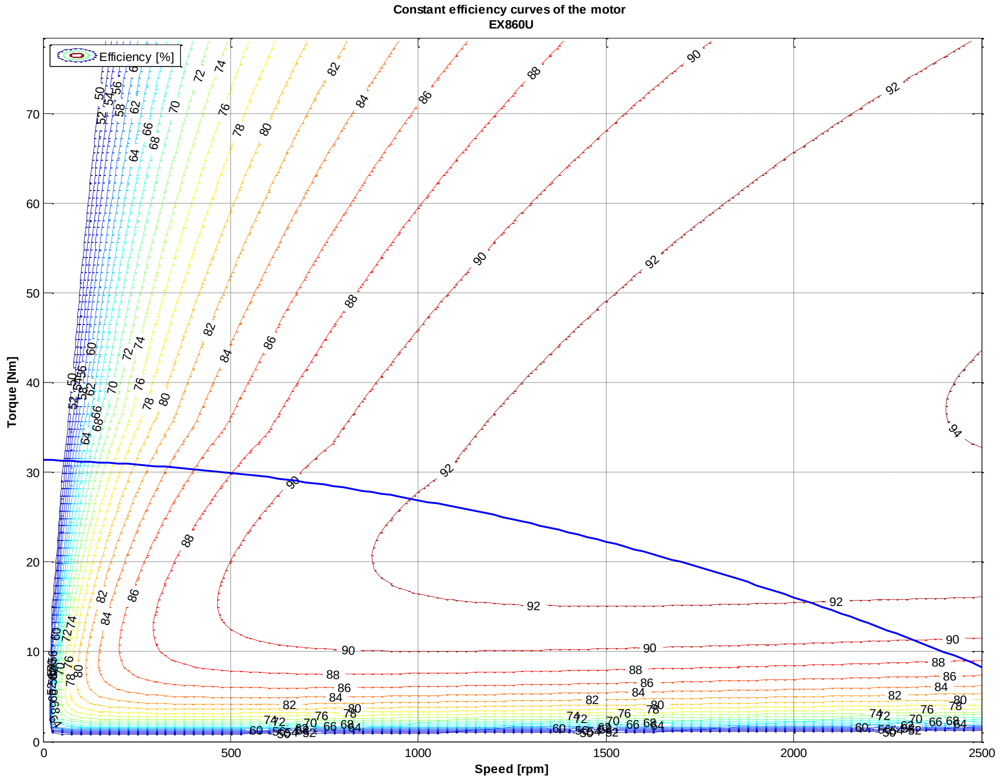
3.2.1.14. Series EX820U (EX820UAQ)



3.2.1.15. Series EX840U (EX840UAL)



3.2.1.16. Series EX860U (EX860UAJ)



3.2.2. 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)

Type	Tf [Nm]	Kd [Nm/1000rpm]
EX310EAP	0.024	0.012
EX420EAP	0.045	0.013
EX430EAP	0.059	0.020
EX620EAR	0.080	0.034
EX630EAR	0.120	0.040
EX820EAR	0.104	0.083
EX840EAK	0.208	0.166
EX860EAJ	0.485	0.160

Torque losses = Tf + Kd x speed/1000 *Speed in rpm*

3.2.3. Time constants of the motor

3.2.3.1. 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
→ σ_{elec} = 14.10^{-3}/1.63 = **8.6 ms**

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

3.2.3.2. 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**

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 EX620EAO 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.

3.2.3.3. Thermal time constant of the copper:

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

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

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]
EX310EAP	3.0	1.0	11.6
EX420EAP	4.6	1.2	31.1
EX430EAP	5.2	1.3	32.6
EX620EAR	8.6	1.2	59.5
EX630EAR	10.2	1.3	53.9
EX820EAR	8.5	1.9	67.3
EX840EAK	11.0	1.5	29.9
EX860EAJ	12.9	1.7	28.1

3.2.4. 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).

3.2.5. 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 ±**10%** of the nominal value, it is possible to correctly evaluate the new rated values as illustrated below.

Example:

Extract of EX620EAO datasheet

BRUSHLESS MOTORS
EX620EAO
ELECTRONIC DRIVE
DIGIVEX 7.5/15 et DIGIVEX 8/16
(230V) (400V)

No UL certification

Torque at low speed	M_0	Nm		7	
Permanent current at low speed	I_0	A_{rms}		5.51	
Peak torque	M_p	Nm		14.7	--
Current for the peak torque	I_p	A_{rms}		11.3	--
Back emf constant at 1000 rpm (25°C)*	Ke	V_{rms}		81.7	
Torque sensitivity	Kt	Nm/A_{rms}		1.27	
Winding resistance (25°C)*	Rb	Ω		1.63	
Winding inductance*	L	mH		14	
Rotor inertia	J	kgm^2x10^{-5}		98	
Thermal time constant	Tth	min		27	
Motor mass	M	kg		11.3	
Voltage of the mains	UR1 UR2 UR3	V_{rms}	230	400	-
Rated speed	Nn1 Nn2 Nn3	rpm	2500	4300	-
Rated torque	Mn1 Mn2 Mn3	Nm	5.49	3.13	-
Rated current	In1 In2 In3	A_{rms}	4.47	2.75	-
Rated power	Pn1 Pn2 Pn3	W	1440	1410	-

All data are given in typical values under standard conditions

** Phase to phase*

Voltages and currents are given in rms values

- 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=4300 rpm obtained with a rated voltage U_n=400 V_{rms} and an efficiency of η=92% leads to the new rated speed N_{n2} given as follows:

$$N_{n2} = N_n * \frac{\frac{U_{n2}}{U_n} - 1 + \eta}{\eta} \qquad N_{n2} = 4300 * \frac{\frac{360}{400} - 1 + 0.92}{0.92} = 3832 rpm$$

Maximum speed:

The former maximum speed N_{max} = 4300 rpm obtained with U_n =400 V_{rms} and N_n =4300 rpm leads to the new maximum speed N_{max2} given as follows:

$$N_{max\,2} = N_{max} * \frac{N_{n2}}{N_n} \qquad N_{max\,2} = 4300 * \frac{3832}{4300} = 3832 rpm$$

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=1410 W obtained with U_n =400 V_{rms} leads to the new rated power P_{n2} given as follows:

$$P_{n2} = P_n * \frac{U_{n2}}{U_n} \qquad P_{n2} = 1410 * \frac{360}{400} = 1269 W$$

Rated torque:

The former rated torque M_n = 3.13 Nm obtained with U_n =400 V_{rms} leads to the new rated torque M_{n2} given as follows:

$$M_{n2} = \frac{P_{n2}}{\frac{2 * \pi * N_{n2}}{60}} \qquad M_{n2} = \frac{1269}{\frac{2 * \pi * 3832}{60}} = 3.16 Nm$$

3.2.6. 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).

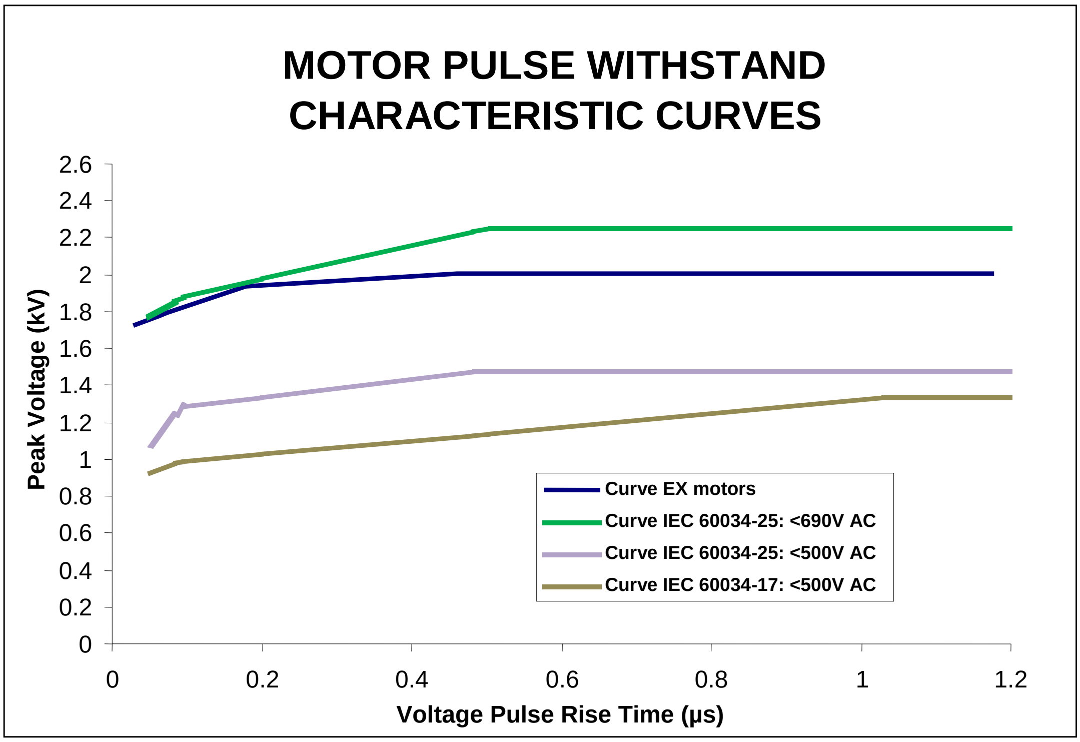


Figure 1: Minimum Voltage withstands characteristics for motors insulations according to IEC standards. At the top are the typical capabilities for the EX motors.

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 500 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.

3.2.7. Voltage and current during the operating

The EX motors carry ATEX and UL certification and due to this certificate, they are subjected to strict rules regarding their use. One of such rules is the us of a servoamplifier that meets specific characteristics.

EX310 ATEX :

Voltage of the associated speed drive	24V direct current	48V direct current	230V single / three phase	400V three phase
Power supply direct current voltage (V)	24 ±10%	48 ±10%	310 ±10%	550 ±10%
Motor electrical frequency (Hz)	0 à 500	0 à 500	0 - 500	0 - 500
Steady peak current in a phase (Â/Arms)	Max. 17/12	Max. 17/12	Max. 7.5/5.3	Max. 4/2.8
Maximum peak current in a phase (Â/Arms)	Max. 34/24	Max. 34/24	Max. 15/10.6	Max. 8/5.6
Maximum steady motor power (W)	Max. 250	Max. 500	Max. 1900	Max. 1800

EX4 ATEX :

Voltage of the associated speed drive	24V direct current	48V direct current	230V single / three phase	400V three phase
Power supply direct current voltage (V)	24 ±10%	48 ±10%	310 ±10%	550 ±10%
Motor electrical frequency (Hz)	0 à 500	0 à 500	0 to 500	0 to 500
Steady peak current in a phase (Â/Arms)	Max. 17/12	Max. 17/12	Max. 14/9.9	Max. 8/5.6
Maximum peak current in a phase (Â/Arms)	Max. 34/24	Max. 34/24	Max. 28/19.8	Max. 16/11.3
Maximum steady motor power (W)	Max. 200	Max. 400	Max. 3400	Max. 3400

EX6 ATEX :

Voltage of the associated speed drive	230V single / three phase	400V three phase
Power supply direct current voltage (V)	310 ±10%	550 ±10%
Motor electrical frequency (Hz)	0 to 500	0 to 500
Steady peak current in a phase (Â/Arms)	Max. 25/17.7	Max. 16/11.3
Maximum peak current in a phase (Â/Arms)	Max. 50/35.3	Max. 32/22.6
Maximum steady motor power (W)	Max. 6000	Max. 6000

EX8 ATEX :

Voltage of the associated speed drive	230V single / three phase	400V three phase
Power supply direct current voltage (V)	310 ±10%	550 ±10%
Motor electrical frequency (Hz)	0 to 500	0 to 500
Steady peak current in a phase (Â/Arms)	Max 100/70.7	Max 50/35.3
Maximum peak current in a phase (Â/Arms)	Max 200/141.4	Max 100/70.7
Maximum steady motor power (W)	Max 10 000	Max 10 000

EX310 UL :

Voltage of the associated speed drive	230V single / three phases	400-480V three phases
Nominal Power supply direct current voltage(v)	310 ±10%	550-660 ±10%
Motor electrical frequency (Hz)	0 to 650	0 to 650
Steady peak current in a phase (Â/Arms)	Max. 7.5/5.3	Max. 4/2.8
Maximum peak current in a phase (Â/Arms)	Max. 15/10.6	Max. 8/5.6
Maximum steady motor power (W)	Max. 1900	Max. 1800

EX4 UL :

Voltage of the associated speed drive	230V single / three phases	400-480V three phases
Nominal Power supply direct current voltage (V)	310 ±10%	550-660 ±10%
Motor electrical frequency (Hz)	0 to 650	0 to 650
Steady peak current in a phase (Â/Arms)	Max. 14/9.9	Max. 8/5.6
Maximum peak current in a phase (Â/Arms)	Max. 28/19.8	Max. 16/11.3
Maximum steady motor power (W)	Max. 3400	Max. 3400

EX6 UL :

Voltage of the associated speed drive	230V single / three phases	400- 480V three phases
Nominal Power supply direct current voltage (V)	310 ±10%	550-660 ±10%
Motor electrical frequency (Hz)	0 to 650	0 to 650
Steady peak current in a phase (Â)	Max. 25	Max. 16
Maximum peak current in a phase (Â)	Max. 50	Max. 32
Maximum steady motor power (W)	Max. 6000	Max. 6000

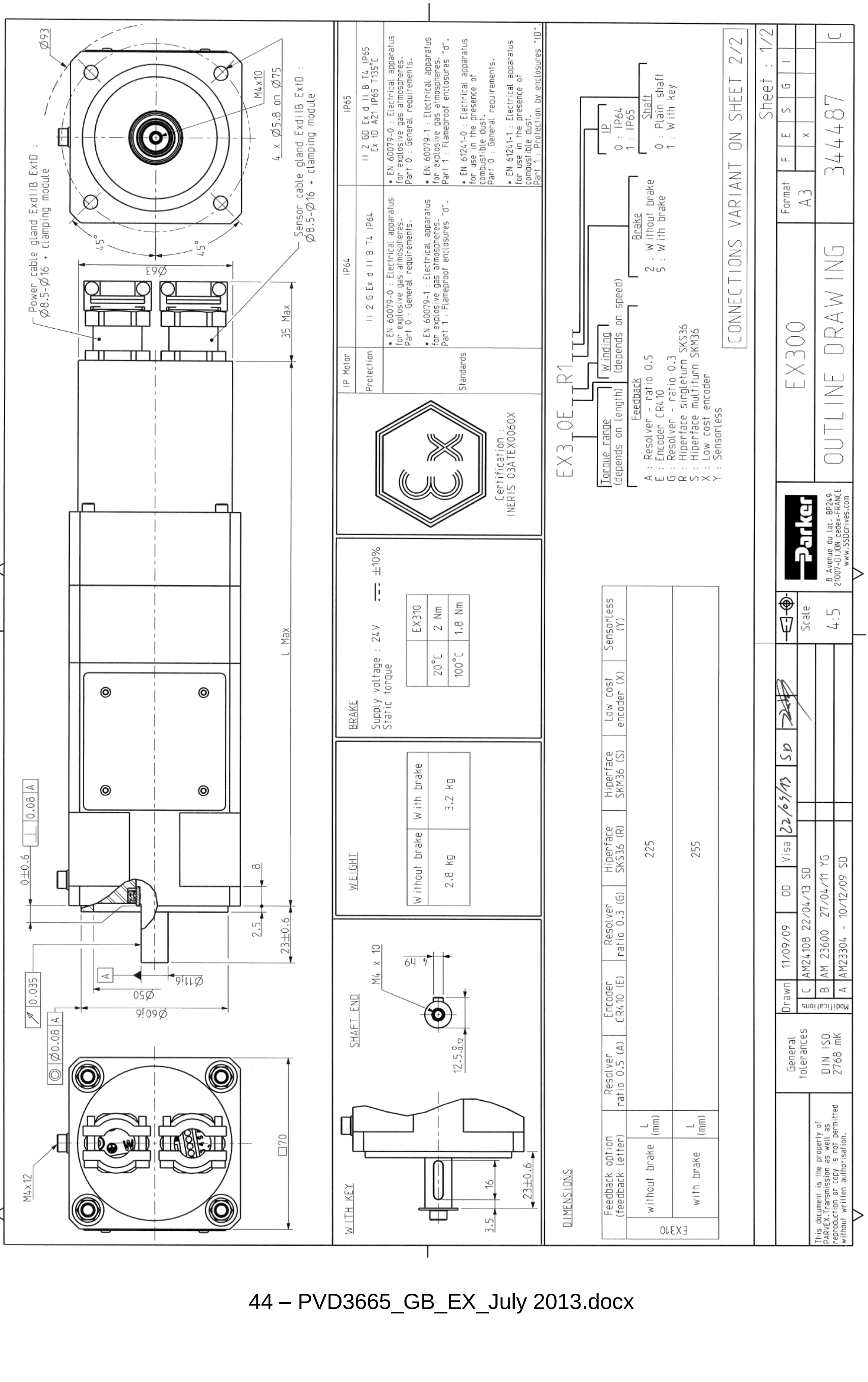
EX8 UL :

Voltage of the associated speed drive	230V single / three phases	400-480V three phases
Nominal Power supply direct current voltage (V)	310 ±10%	550-660 ±10%
Motor electrical frequency (Hz)	0 to 500	0 to 500
Steady peak current in a phase (Â)	Max 100	Max 50
Maximum peak current in a phase (Â)	Max 200	Max 100
Maximum steady motor power (W)	Max 10 000	Max 10 000

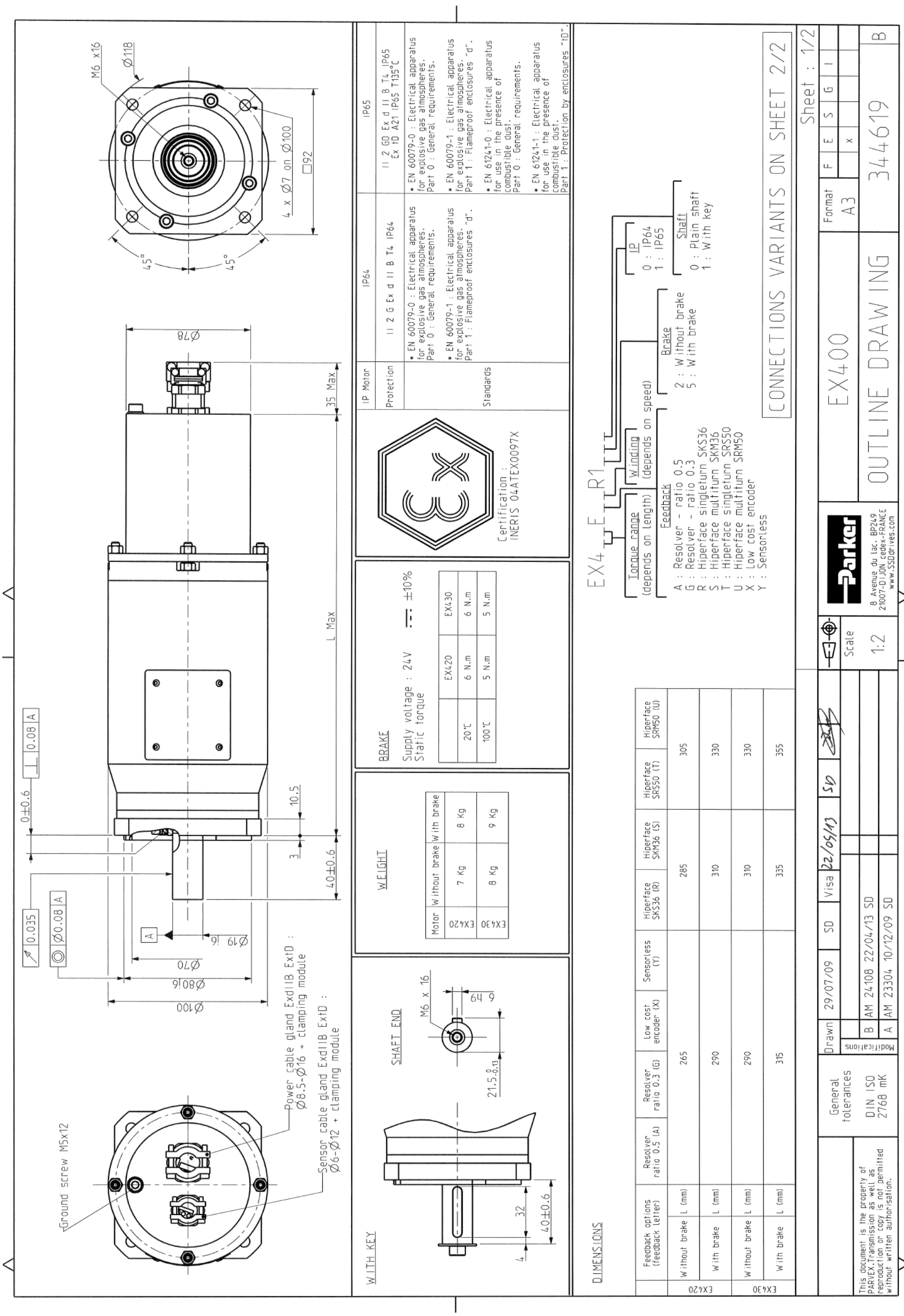
The EX motors must be connected in accordance with the diagrams in the commissioning and use manual supplied with the motor.

3.3. Dimension drawings

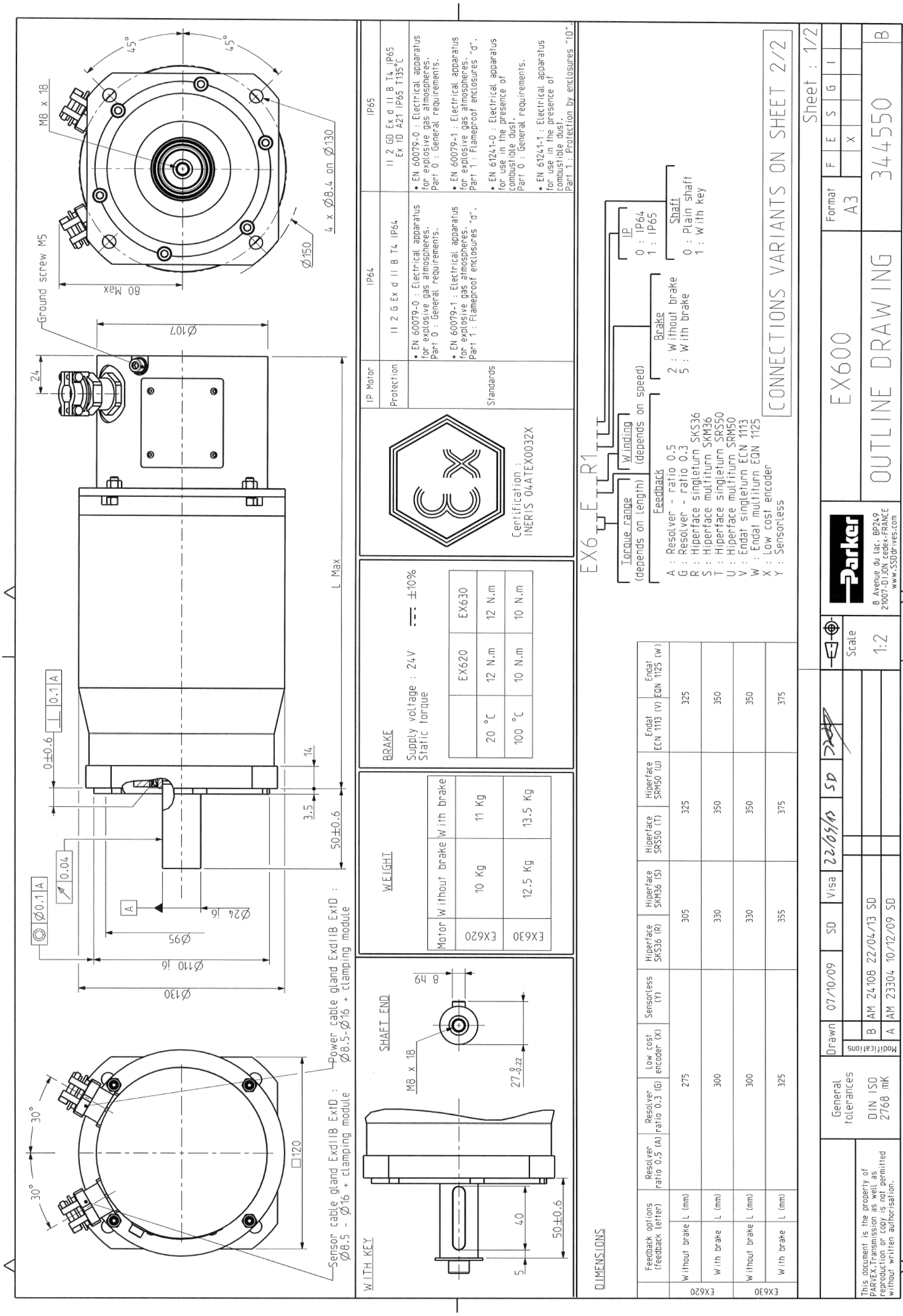
3.3.1. EX310E



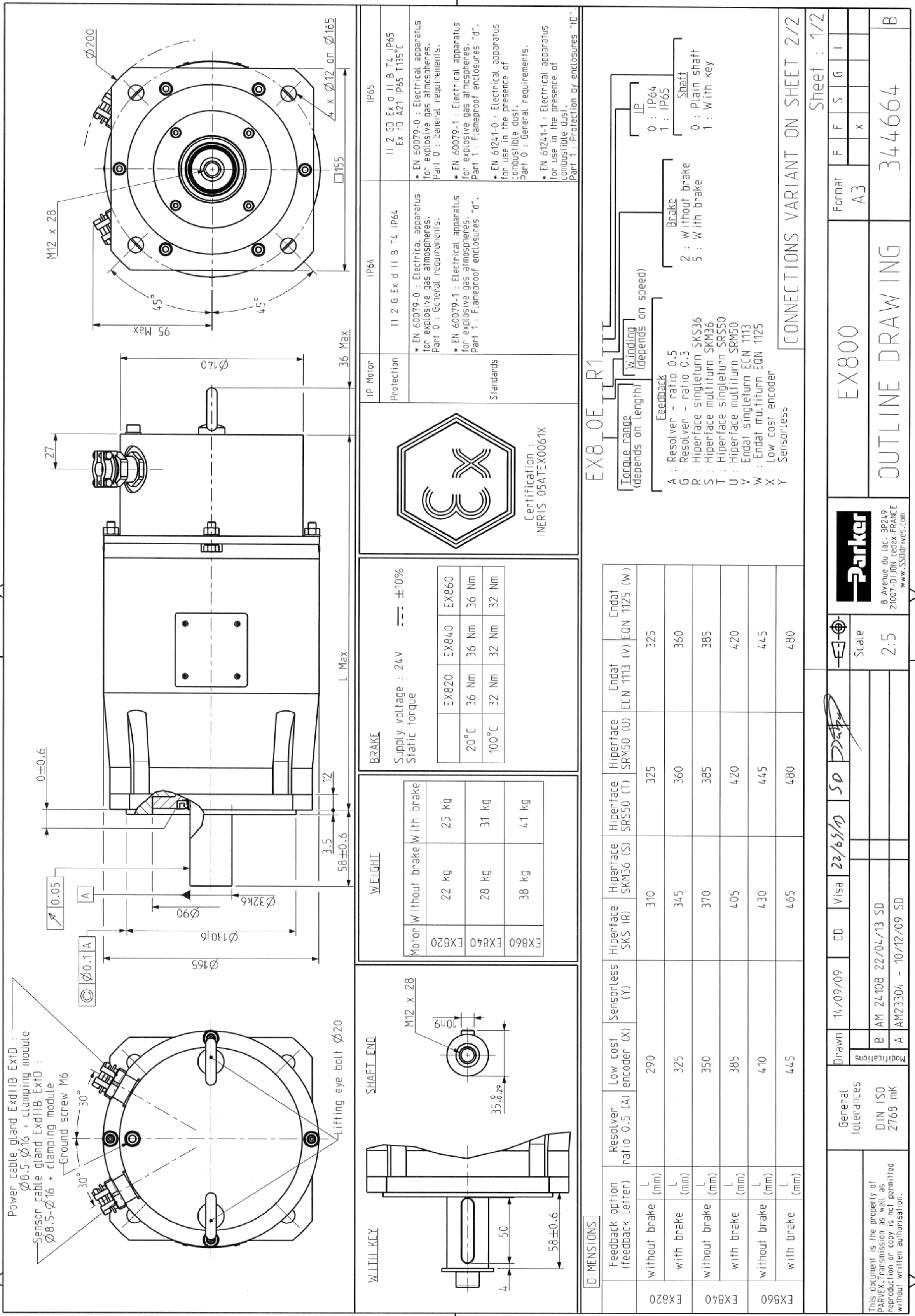
3.3.2. EX420E EX430E



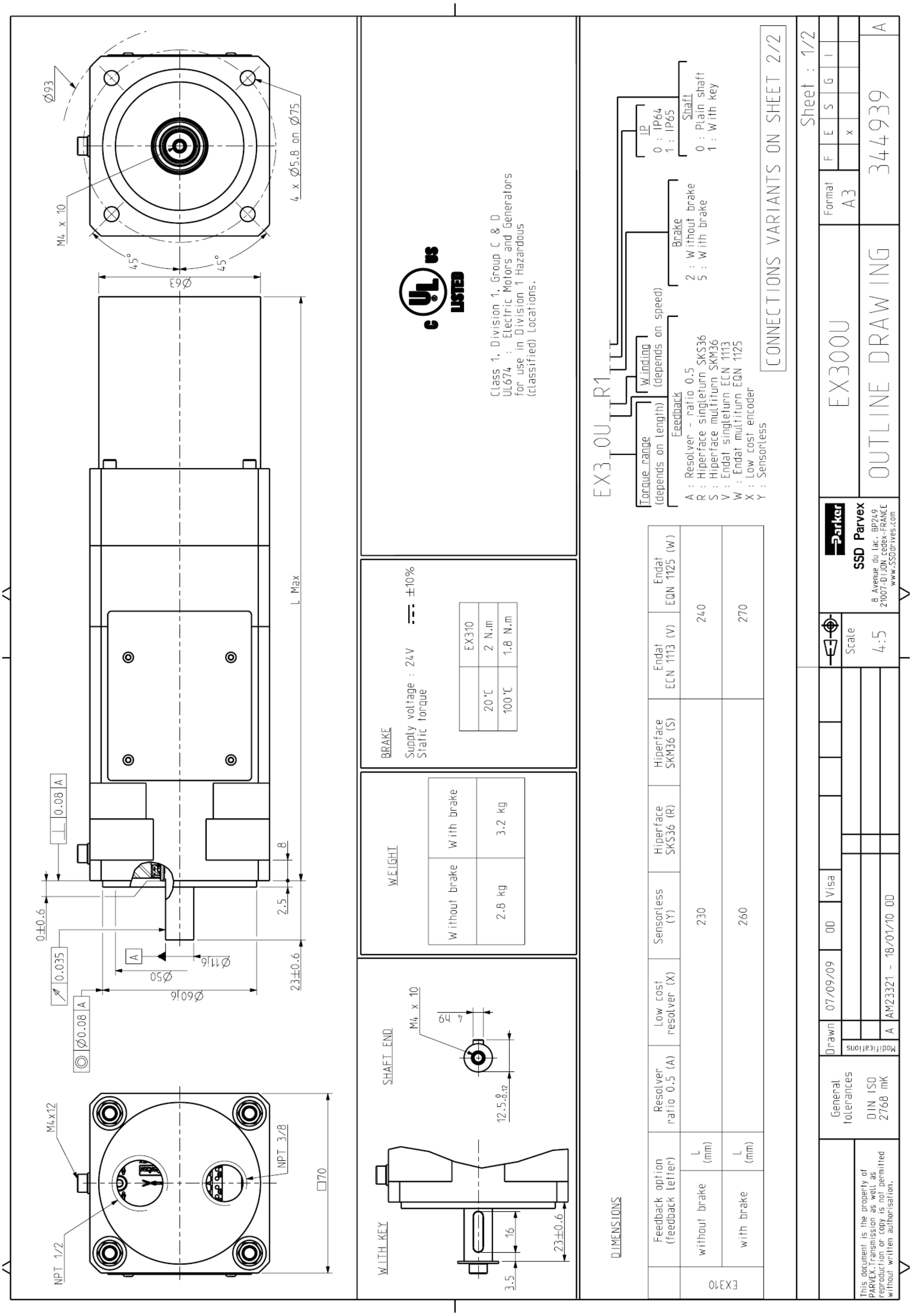
3.3.3. EX620E EX630E



3.3.4. EX820E EX840E EX860E

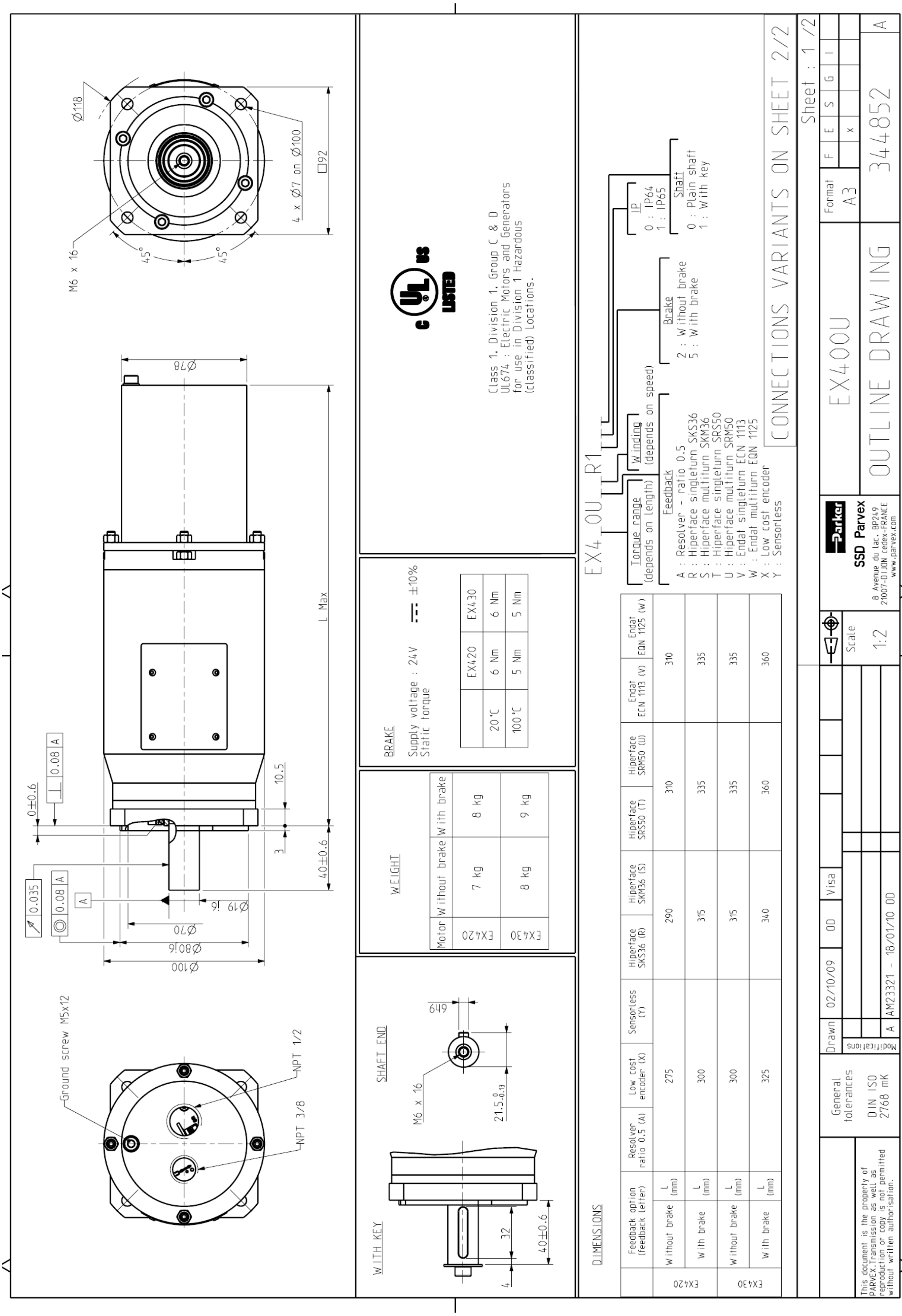


3.3.5. EX310U

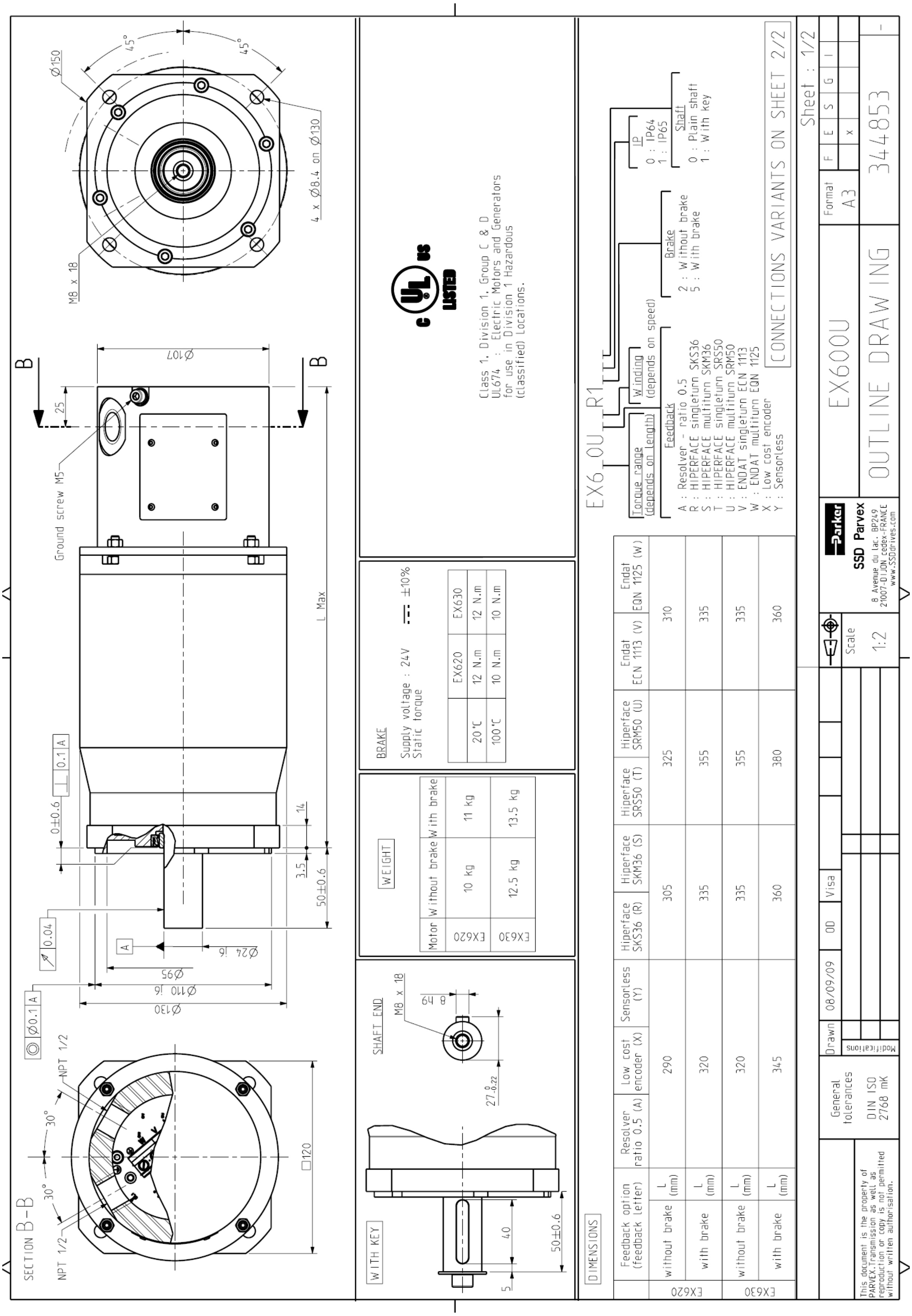


Ø93
4 x Ø5.8 on Ø75
M4 x 10
45°
45°
Ø63
L Max
0.08 A
8
2.5
0±0.6
0.035
A
Ø11j6
Ø50
Ø60j6
23±0.6
Ø0.08 A
M4x12
NPT 3/8
□70
NPT 1/2
WITH KEY
3.5
16
23±0.6
SHAFT END
M4 x 10
12.5
Class 1, Division 1, Group C & D
UL674 : Electric Motors and Generators
for use in Division 1 Hazardous
(classified) Locations.
LISTED
BRAKE
Supply voltage : 24V ±10%
Static torque
EX310
20°C 2 N.m
100°C 1.8 N.m
WEIGHT
Without brake 2.8 kg
With brake 3.2 kg
DIMENSIONS
Feedback option (feedback letter)
Resolver ratio 0.5 (A)
Low cost resolver (X)
Sensorless (Y)
Hiperface SKS36 (R)
Hiperface SKM36 (S)
Endat ECN 1113 (V)
Endat EQN 1125 (W)
EX310 without brake L (mm) 230 240
EX310 with brake L (mm) 260 270
EX3_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
V : Endat singleturn ECN 1113
W : Endat multiturn EQN 1125
X : Low cost resolver
Y : Sensorless
Brake
2 : Without brake
5 : With brake
IP
0 : IP64
1 : IP65
Shaft
0 : Plain shaft
1 : With key
CONNECTIONS VARIANTS ON SHEET 2/2
Sheet : 1/2
Format A3
EX300U
OUTLINE DRAWING
344939
SSD Parvex
8 Avenue du lac, BP249
21007-DIJON cedex-FRANCE
www.SSDdrives.com
Scale 4:5
General tolerances DIN ISO 2768 mK
Drawn 07/09/09 OD Visa
A AM23321 - 18/01/10 OD
Modifications
This document is the property of PARVEX. Transmission as well as reproduction or copy is not permitted without written authorisation.

3.3.6. EX420U EX430U



3.3.7. EX620U EX630U

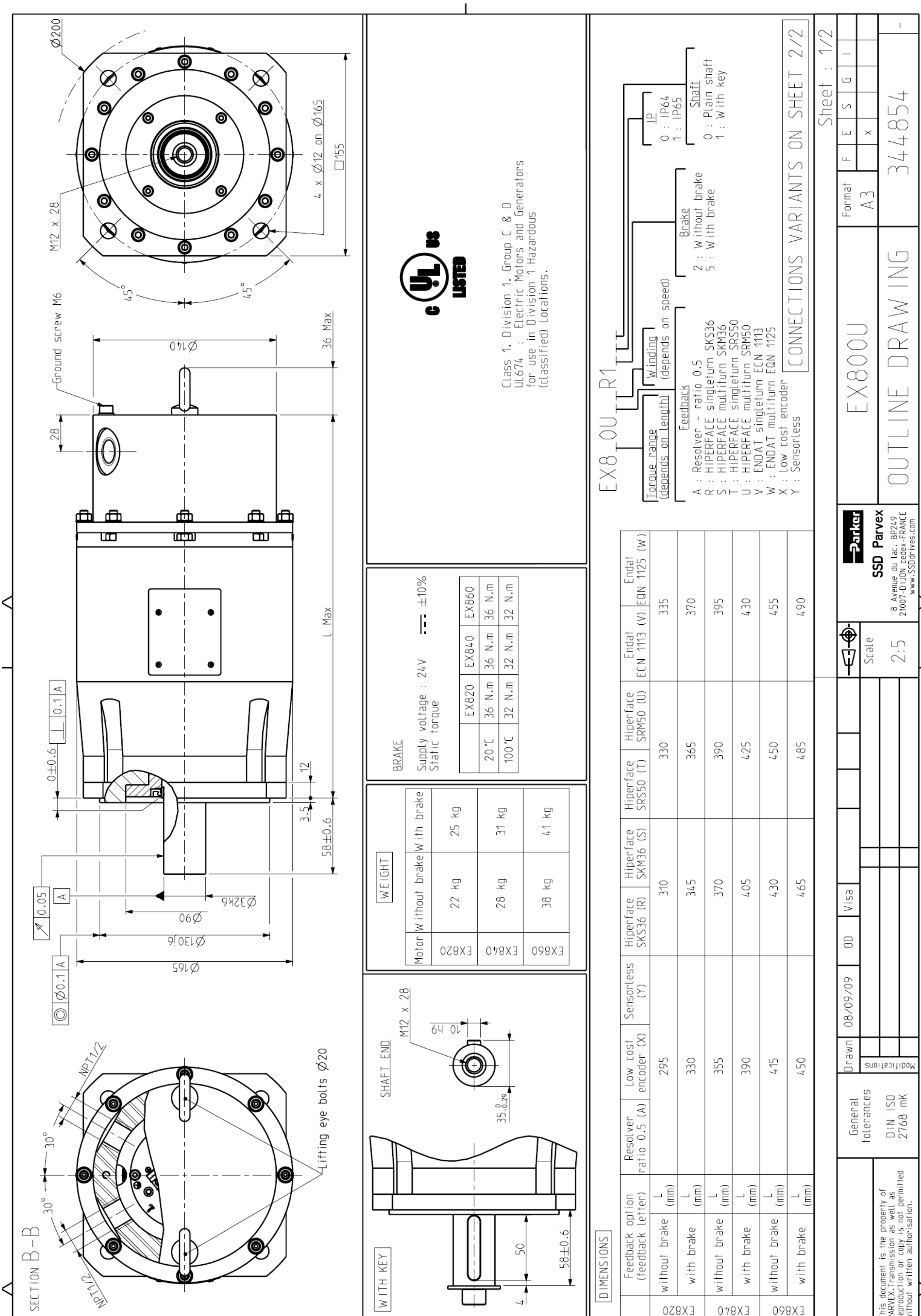


Motor	Without brake	With brake
EX620	10 kg	11 kg
EX630	12.5 kg	13.5 kg

	EX620	EX630
20°C	12 N.m	12 N.m
100°C	10 N.m	10 N.m

	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)
EX620	without brake	L (mm)	290	305	325	310
	with brake	L (mm)	320	335	355	335
EX630	without brake	L (mm)	320	335	355	335
	with brake	L (mm)	345	360	380	360

3.3.8. EX820U EX840U EX860U



WEIGHT

Motor	Without brake	With brake
EX820	22 kg	25 kg
EX840	28 kg	31 kg
EX860	38 kg	41 kg

BRAKE

Supply voltage : 24V ⎓ ±10%
Static torque

	EX820	EX840	EX860
20°C	36 N.m	36 N.m	36 N.m
100°C	32 N.m	32 N.m	32 N.m

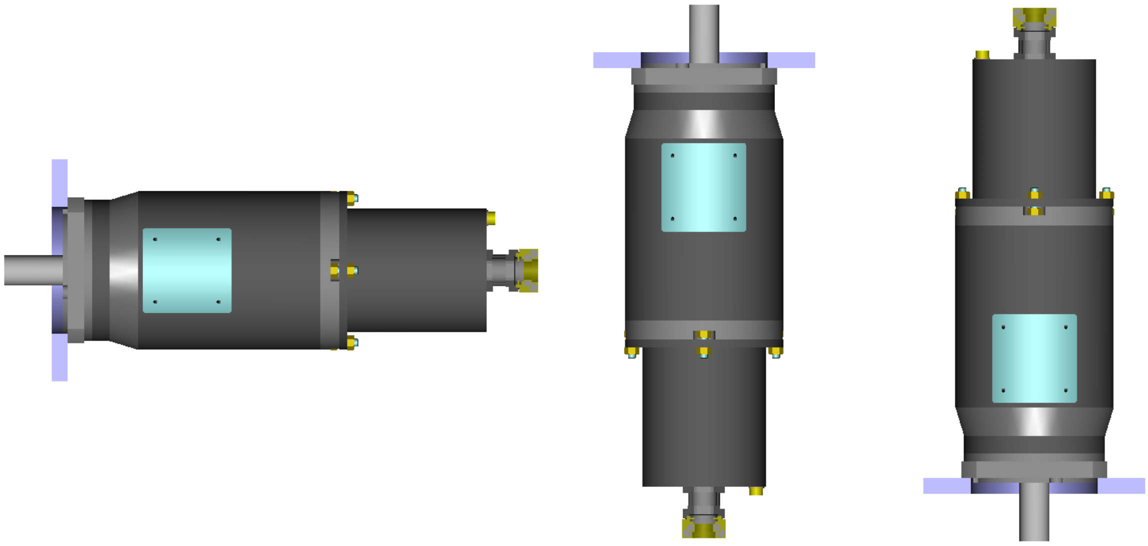
DIMENSIONS

	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)
EX820	without brake	L (mm)	295			310		330		335	
	with brake	L (mm)	330			345		365		370	
EX840	without brake	L (mm)	355			370		390		395	
	with brake	L (mm)	390			405		425		430	
EX860	without brake	L (mm)	415			430		450		455	
	with brake	L (mm)	450			465		485		490	

3.4. Motor Mounting

3.4.1. Motor mounting

By flange in any direction



3.4.2. Installation of explosionproof machines

When installing electrical 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 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).

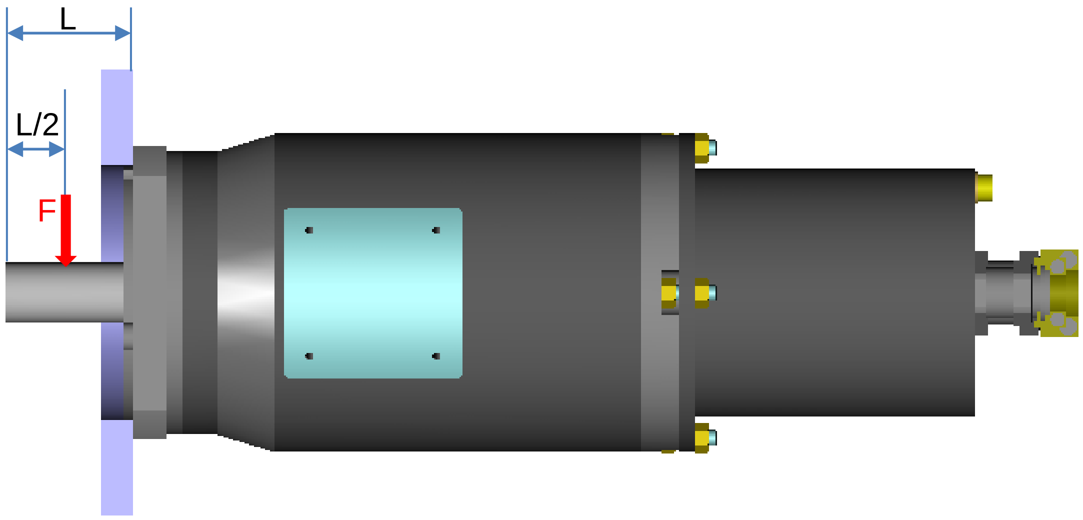
3.5. Shaft Loads

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:

3.6.1. Natural cooled motor

The ambient air temperature shall not be less than **-20°C** and more than **40°C.**

3.7. Thermal Protection

The drive guarantees a 1st level of safety but it is not sufficient. Safety is guaranteed by the independent relay system described in the connection diagram (in the PVD3559_EX3, PVD3566_EX4, PVD3562_EX6, PVD3571_EX8 and PVD3628_EXUL) which constitutes an independent protection circuit meeting safety classification SIL2 in accordance with the standard IEC 61508.
The drive can be equipped with a Safe Torque Off function in accordance with EN ISO13849-1 : 2006 and EN 61800-5-2:2006 and validated by a notified organization. In this case the safety system can be connected to this function with a validation of a notified organization.

In the motor, there are 2 kinds of thermal sensors used for the safety. Both devices are wired in-series with the coil of the drive power contactor.

- Two thermoswitches fitted in the servomotor coil mean that the circuit is mechanically opened on a basis at 125°C±5°C. This protection is reversible, after a decreasing of the temperature under the basis, the circuit is mechanically closed.
- A thermofuse fitted with a contact on the servomotor frame means that the circuit is mechanically opened on a permanent basis at 130°C-5°C. In case of an over temperature and thermoswitches default, the thermo fuse cuts off permanently the power supply to the contactor coil.

Caution : (see diagrams in the commisionning and use manuals PVD3559_EX3, PVD3566_EX4, PVD3562_EX6, PVD3571_EX8 and PVD3628_EXUL) :

- Make sure the parameters of the contactor and the connecting are strictly followed.
- The motor is out of order if the thermofuse is activated!
- The power contactor KM1 should be replaced in accordance with its operation lifespan and number of manoeuvres. A yearly test, intended to check on the ability of the contactor to detect condition changes, should also be carried out.
- 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

3.8. 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 $\sqrt{2} \times 0.8\ Io \cong \mathbf{1{,}13 \times I_0}$.

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

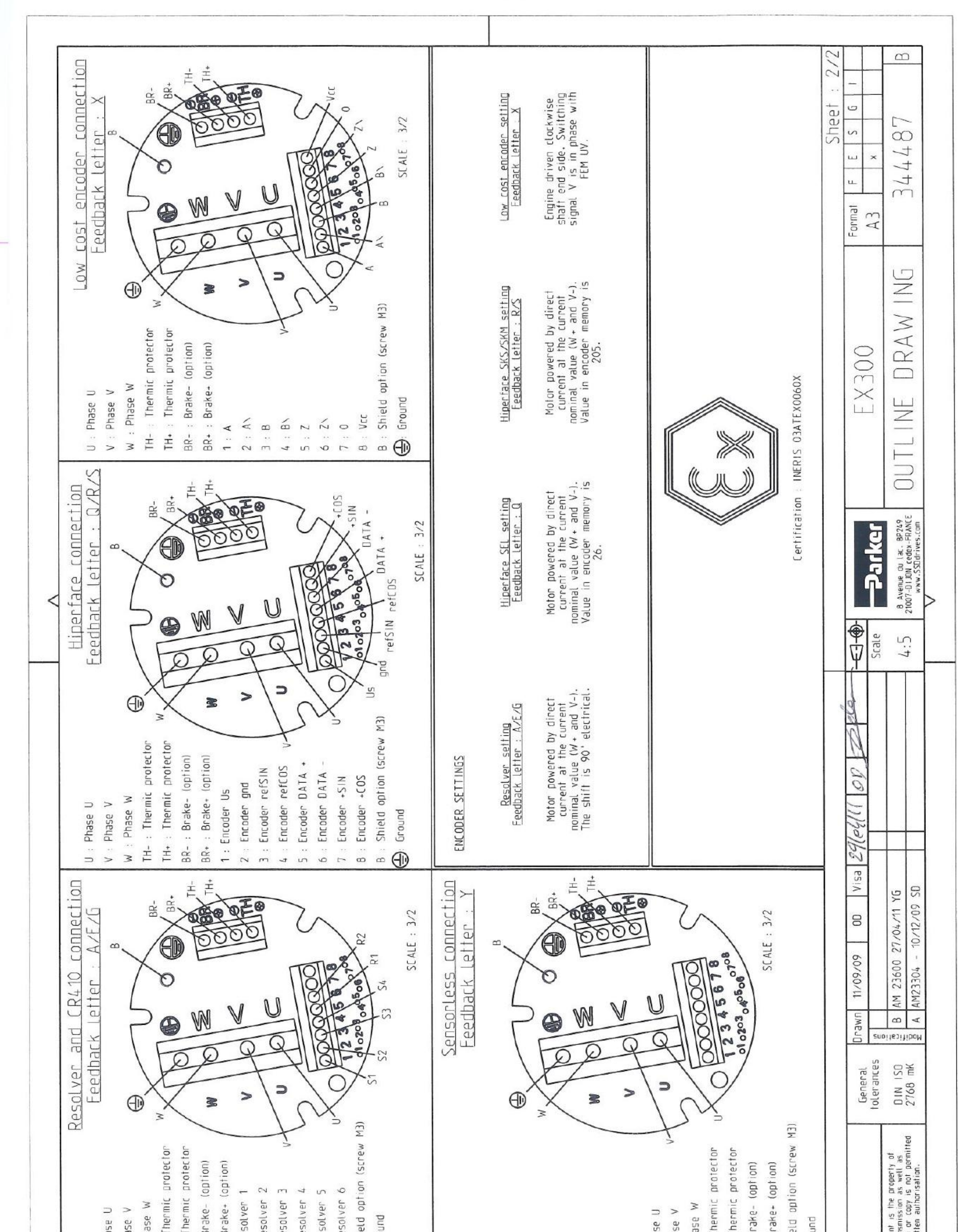
For motors windings which present low inductance values or low resistance values, the own cable inductance, respectively own resistance, in case of large cable length can greatly reduce the maximum speed of the motor. Please contact PARKER for further information.

	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.

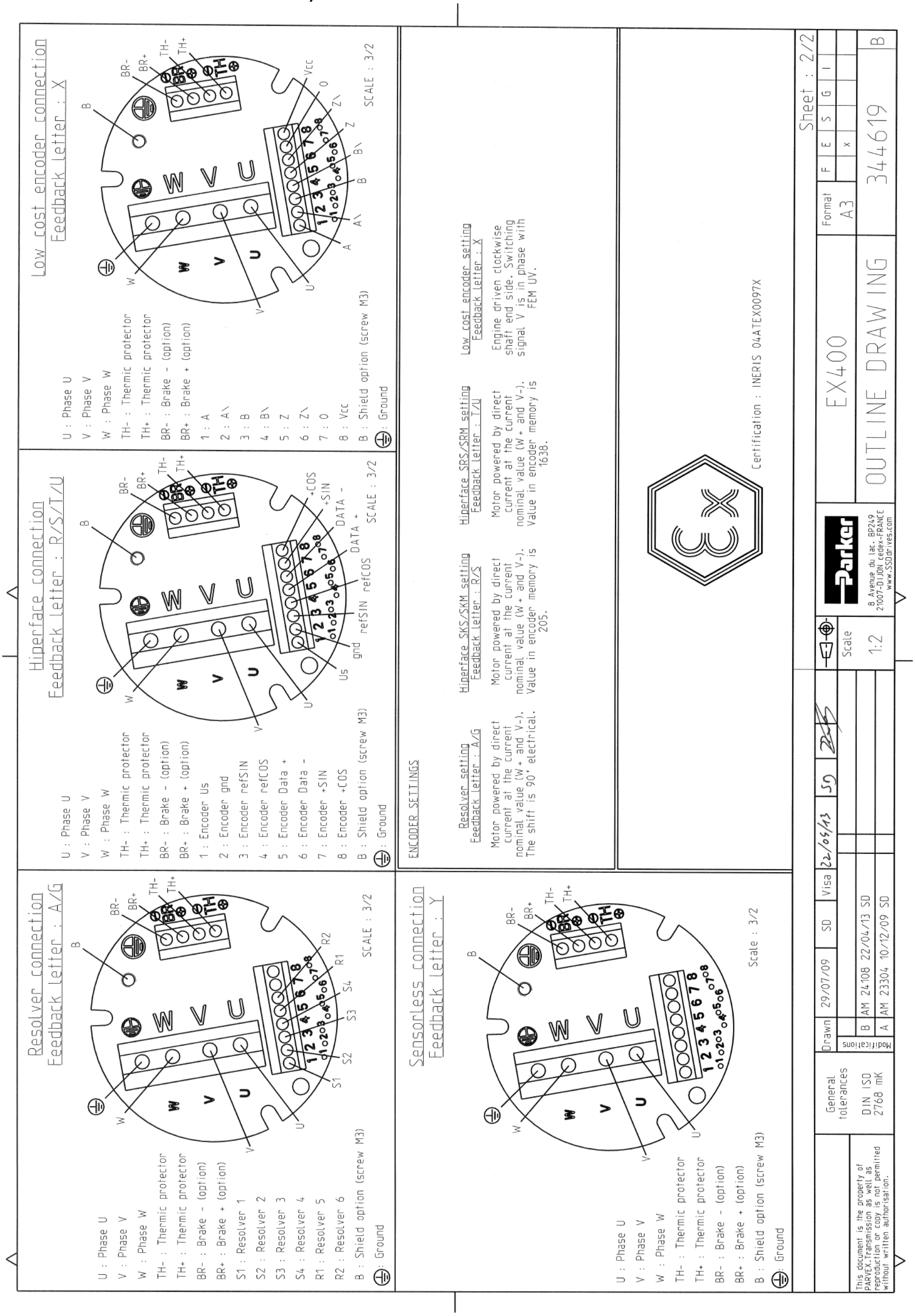
![Parker logo]

3.8.4. Mains supply connection diagrams

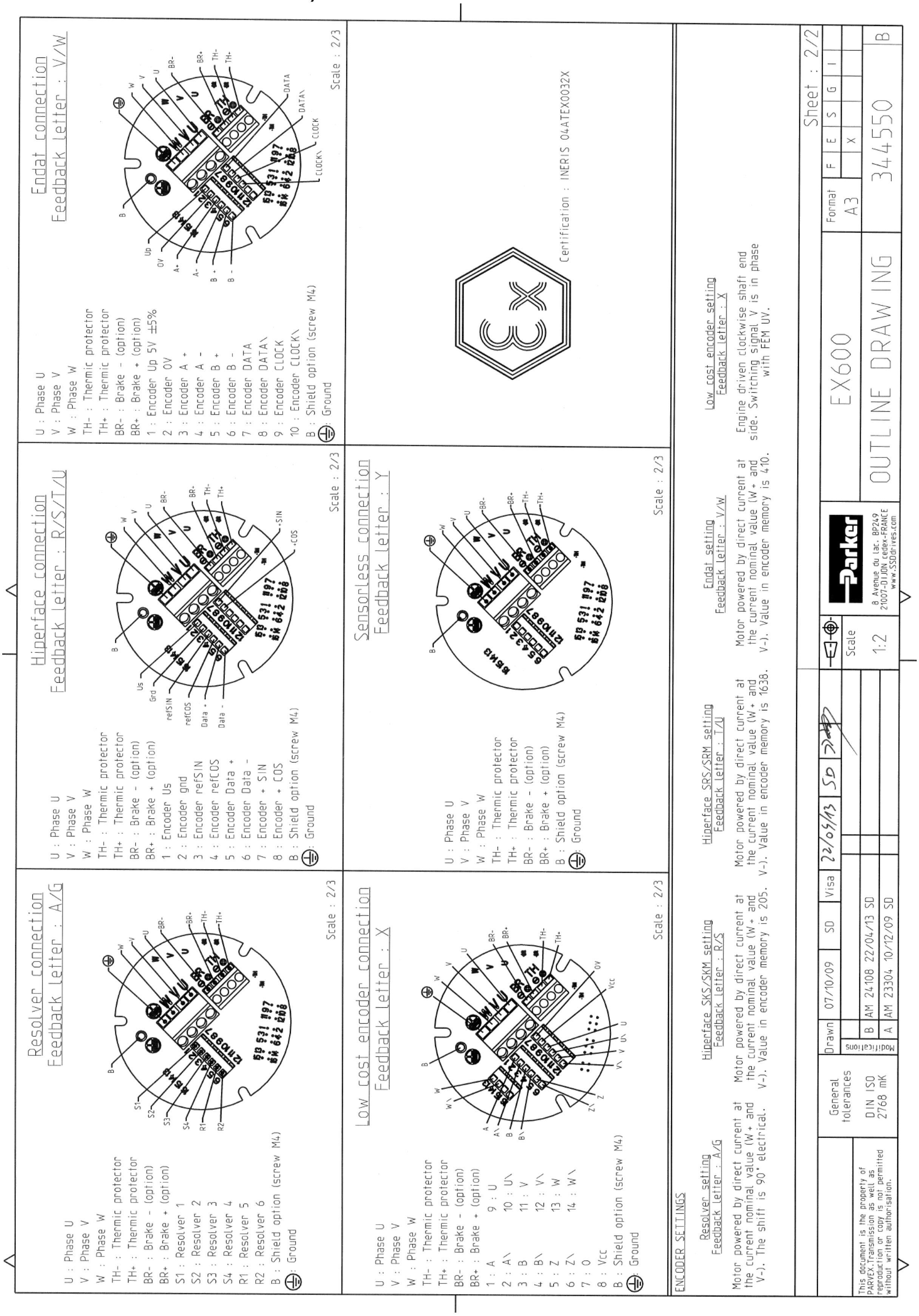
3.8.4.1. EX310E



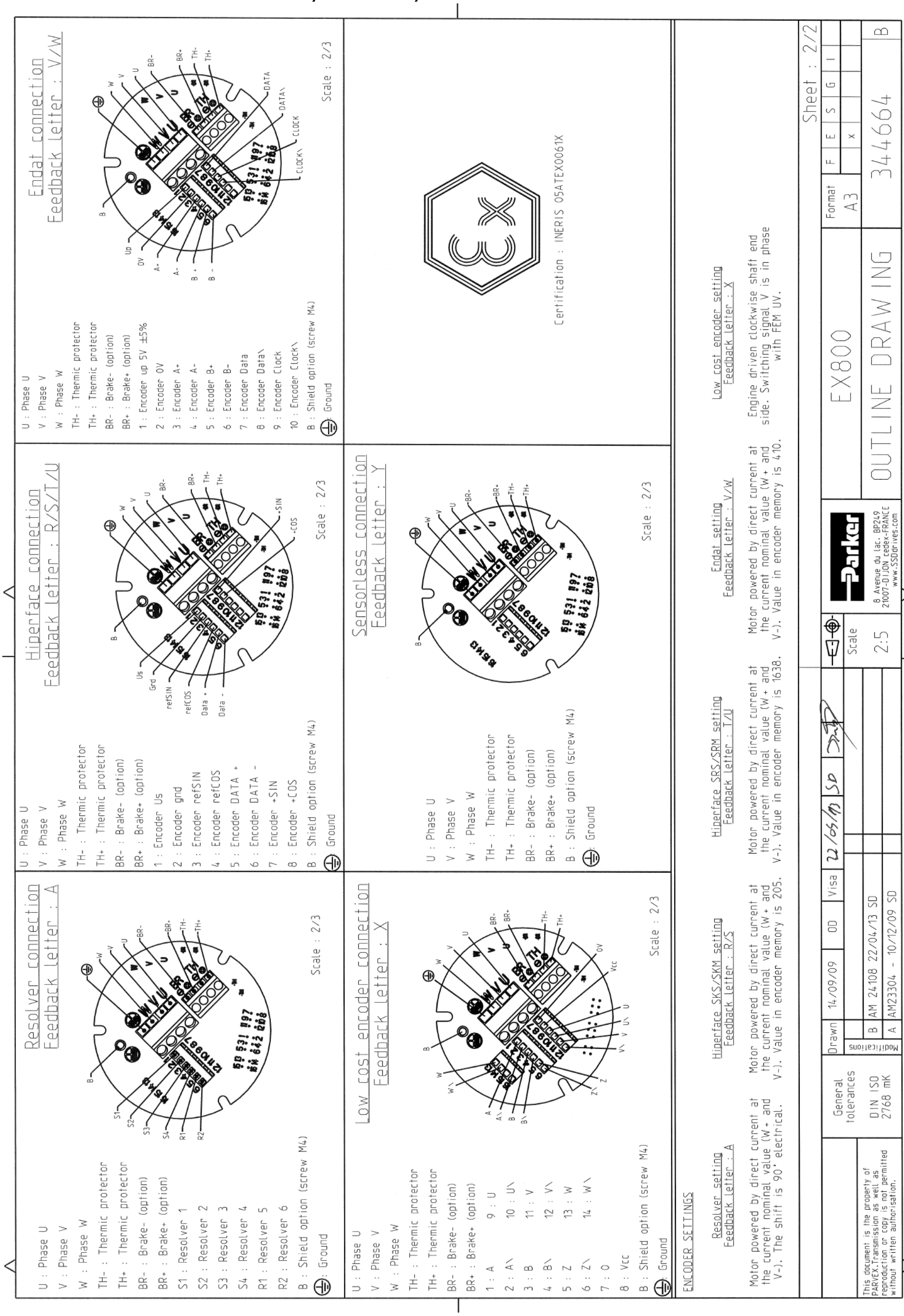
3.8.4.2. EX420E, EX430E



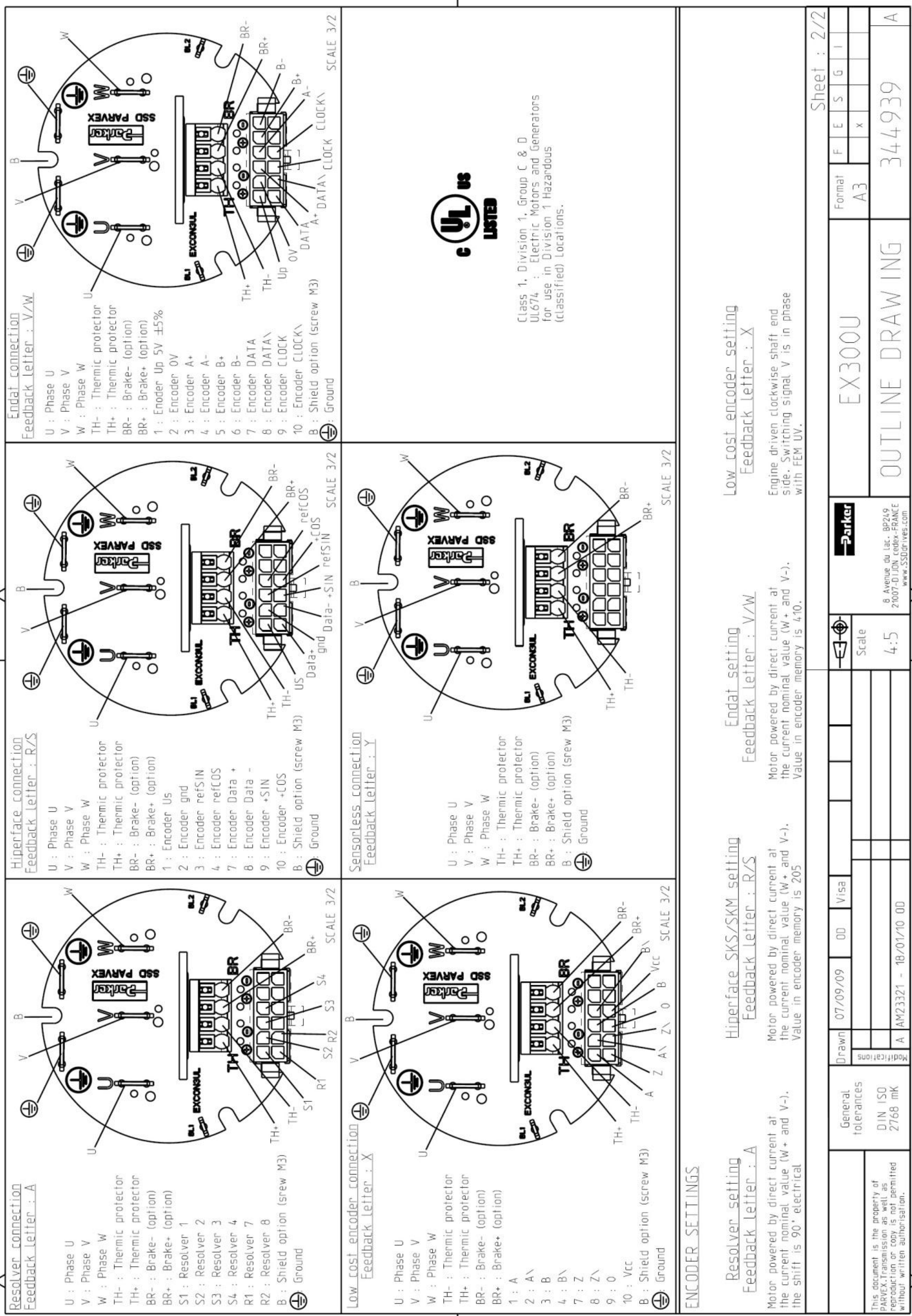
3.8.4.3. EX620E, EX630E



3.8.4.4. EX820E, EX840E, EX860E

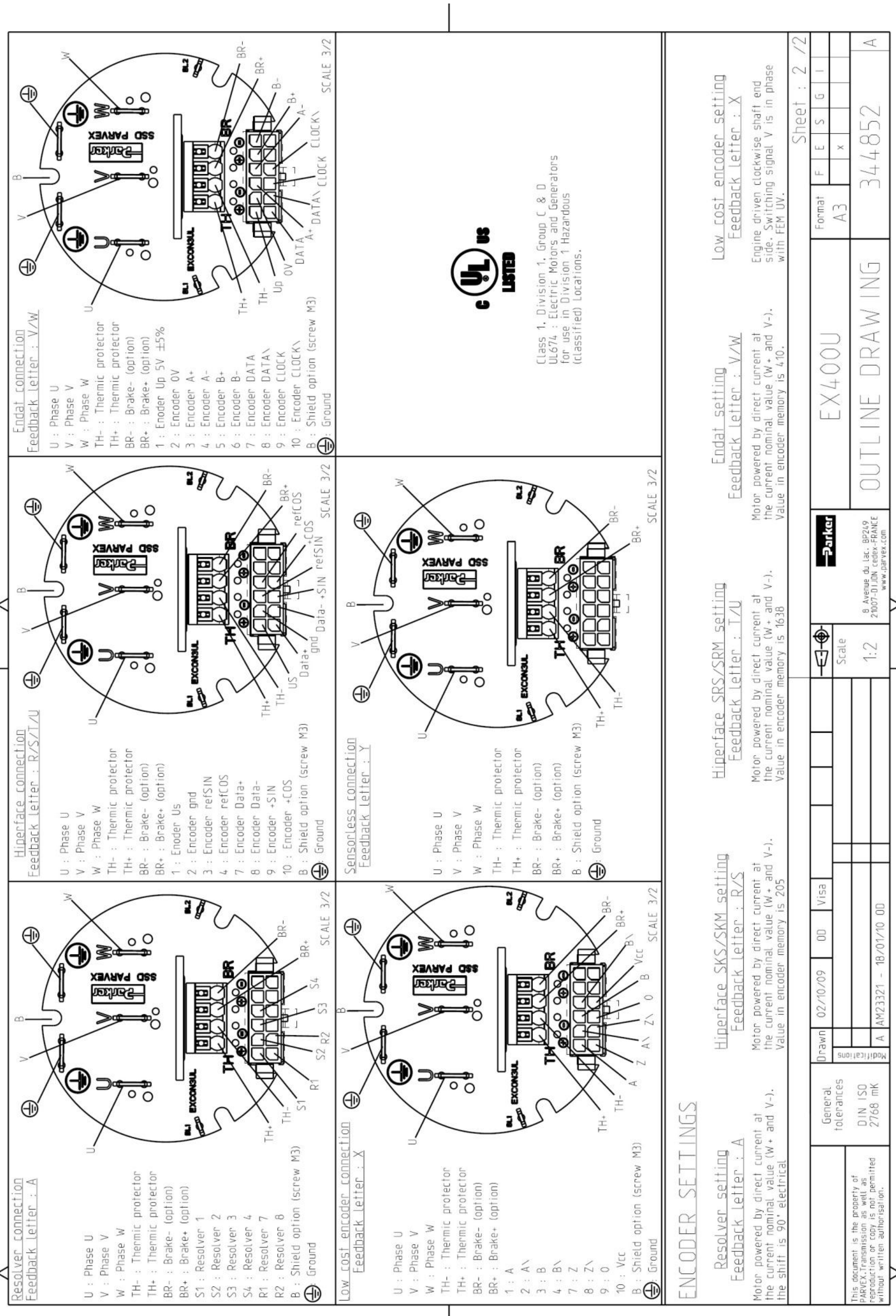


3.8.4.5. EX310U

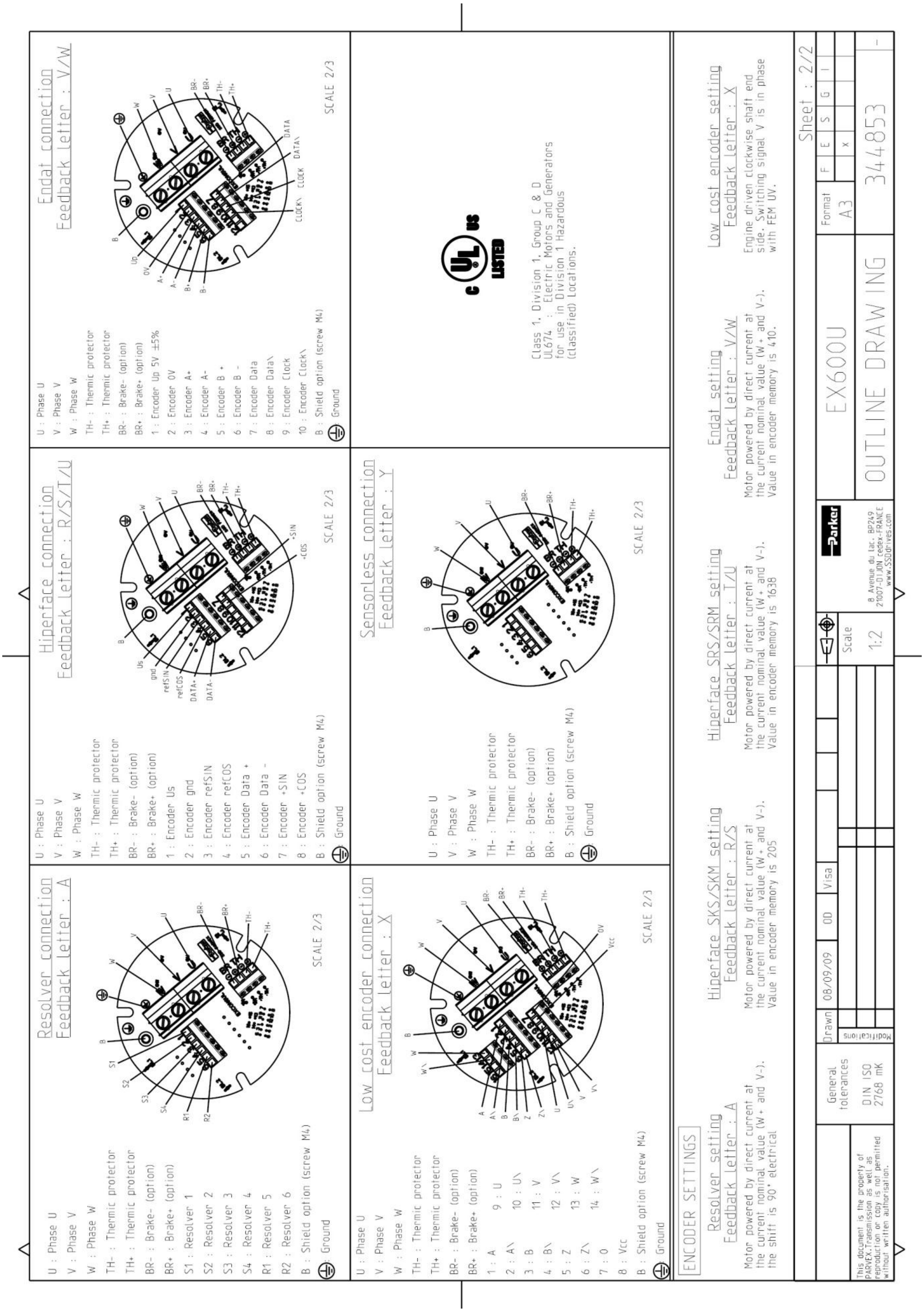


Resolver connection
Feedback letter : A
U : Phase U
V : Phase V
W : Phase W
TH- : Thermic protector
TH+ : Thermic protector
BR- : Brake- (option)
BR+ : Brake+ (option)
S1 : Resolver 1
S2 : Resolver 2
S3 : Resolver 3
S4 : Resolver 4
R1 : Resolver 7
R2 : Resolver 8
B : Shield option (screw M3)
Ground
Hiperface connection
Feedback letter : R/S
U : Phase U
V : Phase V
W : Phase W
TH- : Thermic protector
TH+ : Thermic protector
BR- : Brake- (option)
BR+ : Brake+ (option)
1 : Encoder Us
2 : Encoder gnd
3 : Encoder refSIN
4 : Encoder refCOS
7 : Encoder Data +
8 : Encoder Data -
9 : Encoder +SIN
10 : Encoder +COS
B : Shield option (screw M3)
Ground
Endat connection
Feedback letter : V/W
U : Phase U
V : Phase V
W : Phase W
TH- : Thermic protector
TH+ : Thermic protector
BR- : Brake- (option)
BR+ : Brake+ (option)
1 : Enoder Up 5V ±5%
2 : Encoder 0V
3 : Encoder A+
4 : Encoder A-
5 : Encoder B+
6 : Encoder B-
7 : Encoder DATA
8 : Encoder DATA\
9 : Encoder CLOCK
10 : Encoder CLOCK\
B : Shield option (screw M3)
Ground
Low cost encoder connection
Feedback letter : X
U : Phase U
V : Phase V
W : Phase W
TH- : Thermic protector
TH+ : Thermic protector
BR- : Brake- (option)
BR+ : Brake+ (option)
1 : A
2 : A\
3 : B
4 : B\
7 : Z
8 : Z\
9 : 0
10 : Vcc
B : Shield option (screw M3)
Ground
Sensorless connection
Feedback letter : Y
U : Phase U
V : Phase V
W : Phase W
TH- : Thermic protector
TH+ : Thermic protector
BR- : Brake- (option)
BR+ : Brake+ (option)
B : Shield option (srew M3)
Ground
SCALE 3/2
SSD PARVEX
EXCONSUL
Class 1, Division 1, Group C & D
UL674 : Electric Motors and Generators
for use in Division 1 Hazardous
(classified) Locations.
ENCODER SETTINGS
Resolver setting
Feedback letter : A
Motor powered by direct current at the current nominal value (W+ and V-). the shift is 90° electrical
Hiperface SKS/SKM setting
Feedback letter : R/S
Motor powered by direct current at the current nominal value (W+ and V-). Value in encoder memory is 205
Endat setting
Feedback letter : V/W
Motor powered by direct current at the current nominal value (W+ and V-). Value in encoder memory is 410.
Low cost encoder setting
Feedback letter : X
Engine driven clockwise shaft end side. Switching signal V is in phase with FEM UV.
This document is the property of PARVEX.Transmission as well as reproduction or copy is not permitted without written authorisation.
General tolerances
DIN ISO 2768 mK
Drawn 07/09/09 OD Visa
A AM23321 - 18/01/10 OD
Scale 4:5
8 Avenue du lac. BP249 21007-DIJON cedex-FRANCE www.SSDdrives.com
EX300U
OUTLINE DRAWING
Format A3
Sheet : 2/2
344939
A

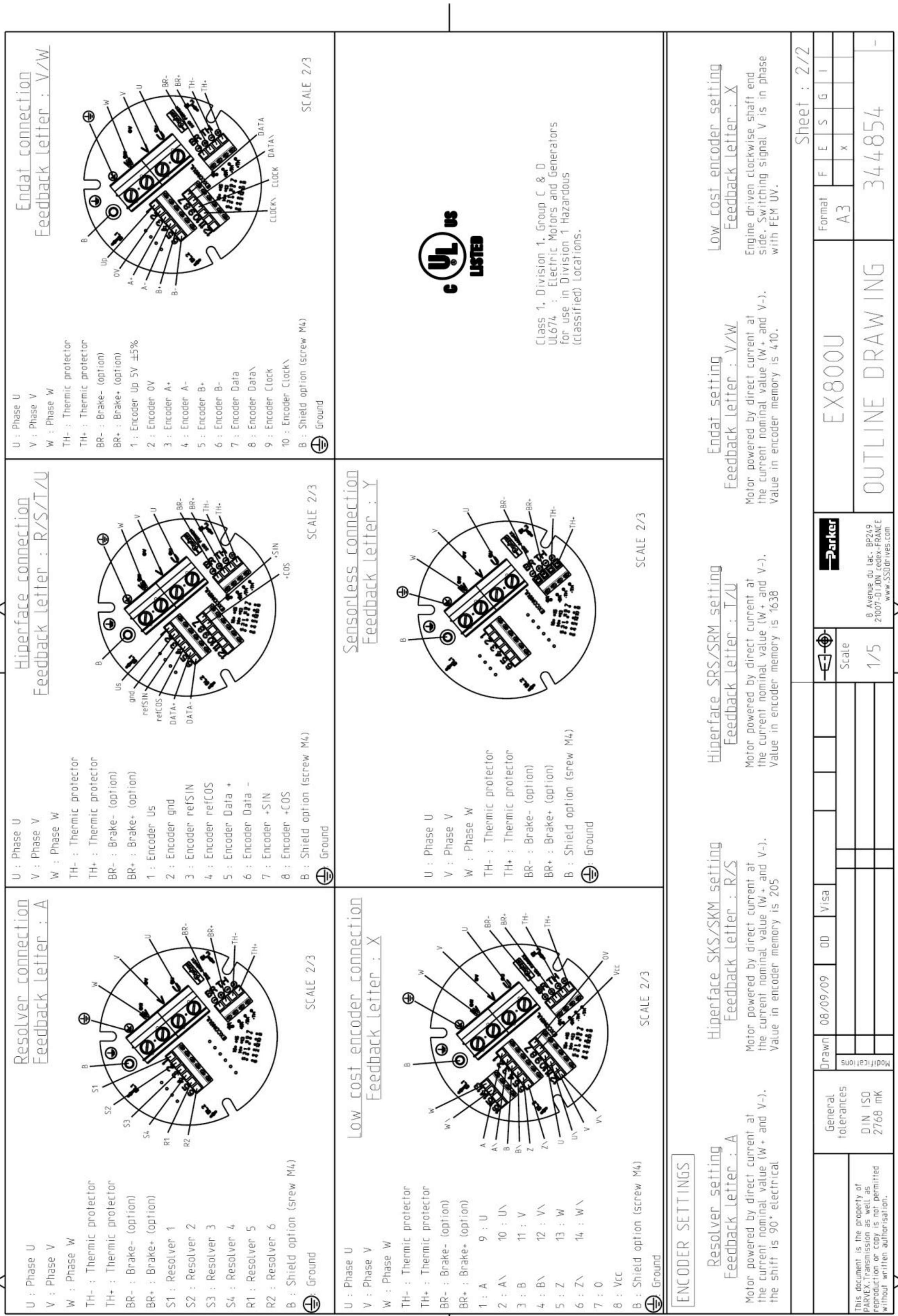
3.8.4.6. EX420U, EX430U



3.8.4.7. EX620U, EX630U



3.8.4.8. EX820U, EX840U, EX860U



3.8.5. Conversion resolver connection

Parker connection	Standard connection
S1	Cos -
S2	Sin -
S3	Cos +
S4	Sin -
R1	Ref +
R2	Ref -

3.9. Feedback system

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

	EX3	NX4, NX6 & NX8
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 $g.cm^2$	
Operating temperature range	-55 to +155 °C	

3.9.2. Hiperface encoder singleturn SKS36 (128pulses) – code R

	EX3, EX4, EX6 & EX8
Model	SKS36 (Sick)
Type	Absolute single turn encoder
Parker part number	220174P0003
Line count	128 sine/cosine periods per revolution
Electrical interface	Hiperface
Position values per revolution	4096
Error limits for the digital absolute value	± 320*”(via RS485)*
Integral non-linearity	± 80*”(Error limits for evaluating sine/cosine period)*
Differential non-linearity	± 40*” (Non-linearity within a sine/cosine period)*
Perating speed	12 000 rpm
Power Supply Current consumption (without load)	7VDC to 12VDC 60mA
Output frequency	0kHz – 65kHz
Operating temperature range	-20°C to +110 °C

3.9.3. Hiperface encoder multiturn SKM36 (128pulses) – code S

	EX3, EX4, EX6 & EX8
Model	SKM36 (Sick)
Type	Absolute multi turn encoder
Parker part number	220174P0004
Line count	128 sine/cosine periods per revolution
Electrical interface	Hiperface
Position values per revolution	4 096
Revolutions	4 096
Error limits for the digital absolute value	± 320*”(via RS485)*
Integral non-linearity	± 80*”(Error limits for evaluating sine/cosine period)*
Differential non-linearity	± 40*” (Non-linearity within a sine/cosine period)*
Perating speed	9000 rpm
Power Supply Current consumption (without load)	7VDC to 12VDC 60mA
Output frequency	0kHz – 65kHz
Operating temperature range	-20°C to +110 °C

3.9.4. Hiperface encoder singleturn SRS50 (1024pulses) – code T

	EX4, EX6 & EX8
Model	SRS50 (Sick)
Type	Absolute single turn encoder
Parker part number	220174P0007
Line count	1024 sine/cosine periods per revolution
Electrical interface	Hiperface
Position values per revolution	32 768
Integral non-linearity	± 45''*(Error limits for evaluating sine/cosine period)*
Differential non-linearity	± 7'' *(Non-linearity within a sine/cosine period)*
Perating speed	6 000 rpm
Power Supply Current consumption (without load)	7VDC to 12VDC 80mA
Output frequency	0kHz – 200kHz
Operating temperature range	-30°C to +115 °C

3.9.5. Hiperface encoder multiturn SRM50 (1024pulses) – code U

	EX4	EX6 & EX8
Model	SRM50 (Sick)	
Type	Absolute multi turn encoder	
Parker part number	220174P0009	220174P0005
Line count	1024 sine/cosine periods per revolution	
Electrical interface	Hiperface	
Position values per revolution	32 768	
Revolutions	4 096	
Integral non-linearity	± 45''*(Error limits for evaluating sine/cosine period)*	
Differential non-linearity	± 7'' *(Non-linearity within a sine/cosine period)*	
Perating speed	6 000 rpm	
Power Supply Current consumption (without load)	7VDC to 12VDC 80mA	
Output frequency	0kHz – 200kHz	
Operating temperature range	-30°C to +115 °C	

3.9.6. Endat encoder singleturn ECN1113 – code V

	EX3 & EX4 ATEX	EX3UL, EX4UL, EX6 & EX8
Model		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	N/A	± 60”
Perating 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

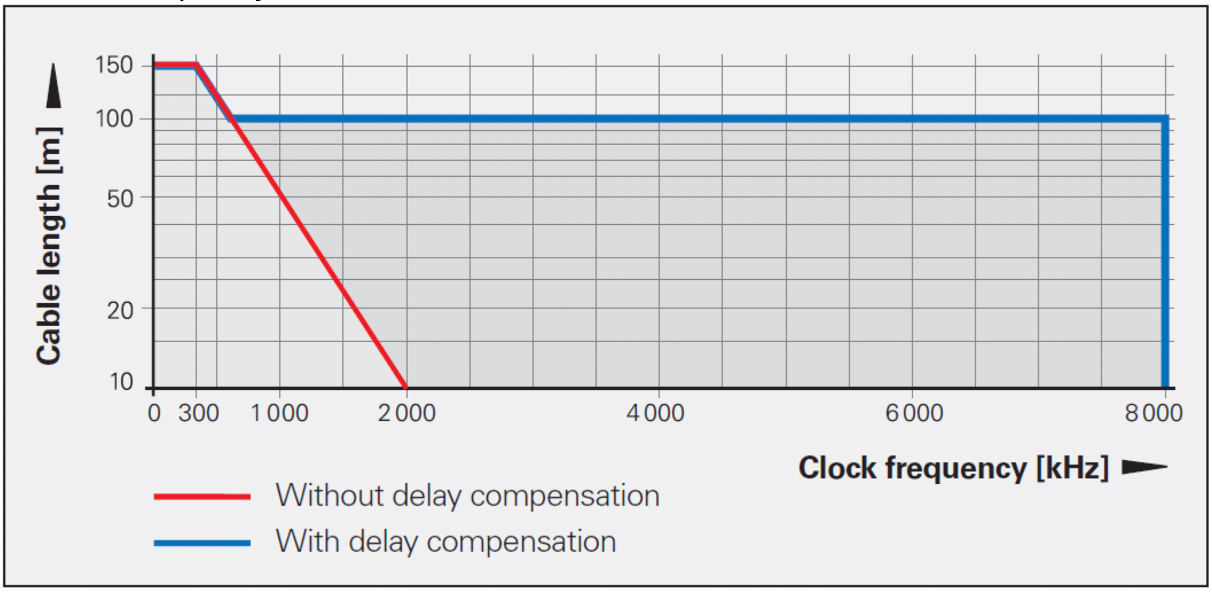
3.9.7. Endat encoder multiturn ECN1125 – code W

	EX3 & EX4 ATEX	EX3UL, EX4UL, EX6 & EX8
Model		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	N/A	4 096
System accuracy		± 60”
Perating 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.

Maximum Endat cable length

Please refer to the following curve to calculate the max cable length depending on the clock frequency



AC890 PARKER Wiring – EnDat encoder

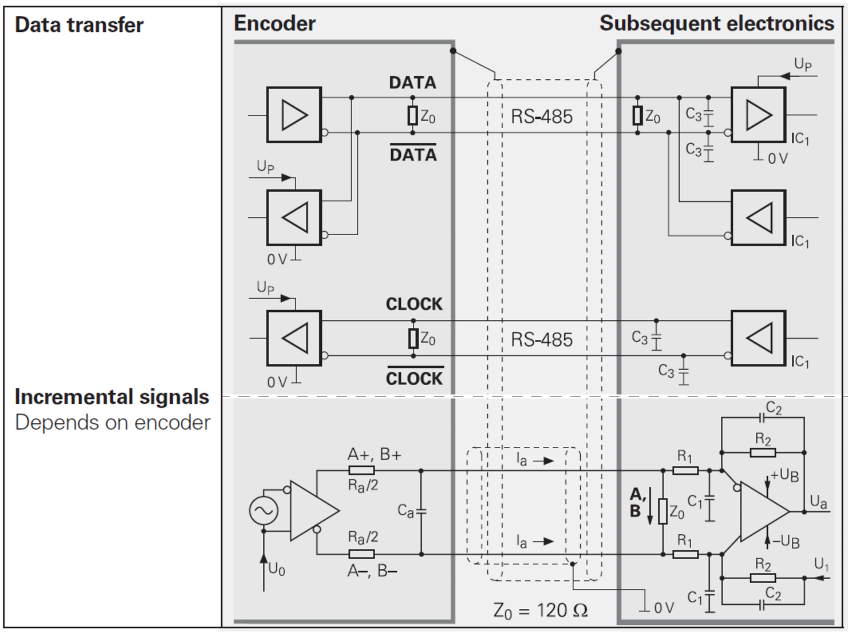
<u>From Heidenhain</u>

Data (measured values or parameters) can be transferred bidirectionally between position encoders and subsequent electronics with transceiver components in accordance with RS-485 (differential signals), in synchronism with the clock signal produced by the subsequent electronics.

Dimensioning

IC_1 = RS 485 differential line receiver and driver

C_3 = 330 pF
Z_0 = 120 Ω



3.9.8. Cables

You can connect EX motor to PARKER drive : AC890, COMPAX3 or SLVD, you can use complete cable with part number on the tabs below.
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

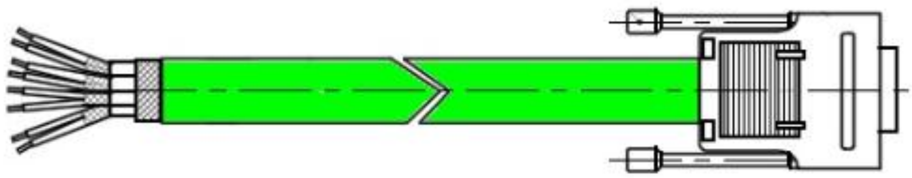
For ATEX installations, you must use special type of cable : self extinguish according to EN 50265-2-1.

Warning, the temperature of the cables used for the :

- EX3 can reach a temperature of 80°C,
- EX4 can reach a temperature of 85°C,
- EX6 can reach a temperature of 89°C,
- EX8 can reach a temperature of 95°C.

3.9.8.1. Resolver cable connection for AC890

Cable reference :
CS4UA1D1R0xxx



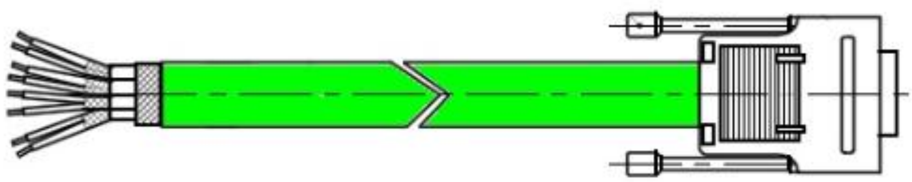
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	S1 / Cos -	Black (Black/White pair)	3
2	S2 / Sin -	Black (Black/Blue pair)	1
3	S3 / Cos +	White	11
4	S4 / Sin -	Blue	9
5	R1 / Ref +	Red	8
6	R2 / Ref -	Black (Black/Red pair)	15

3.9.8.2. Endat cable connection for AC890

Cable reference :
CS4UV1D1R0xxx



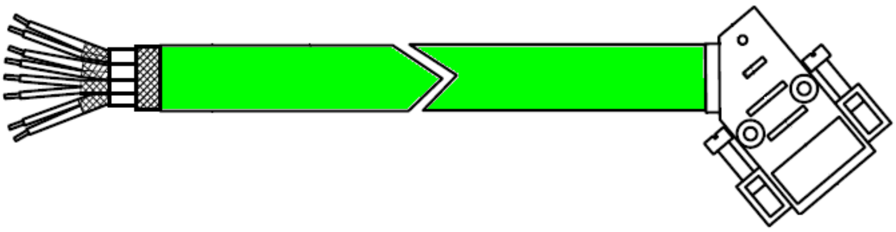
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	up	Red	10
2	0V	Black (Black/Red pair)	2
3	A+	Green	3
4	A-	Black (Black/Green pair)	11
5	B+	Blue	1
6	B-	Black (Black/Blue pair)	9
7	Data	White	4
8	Data\	Black (Black/White pair)	12
9	Clock	Yellow	5
10	Clock\	Black (Black/Yellow pair)	13

3.9.8.3. Resolver cable connection for COMPAX3

Cable reference :
CC3UA1D1R0xxx



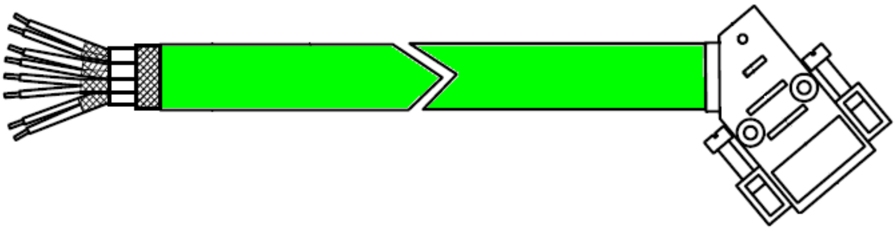
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

Cable arrangement :

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

3.9.8.4. Hiperface encoder cable connection for COMPAX3

Cable reference :
CC3UR1D1R0xxx



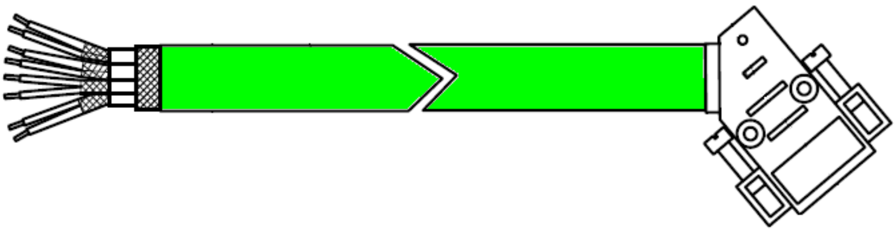
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

Cable arrangement :

EX terminals	Identification	Wire colour	SUB-D terminals
1	Us	Red	4
2	Gnd	Black (Black/Red pair)	15
3	refSin	Black (Black/White pair)	7
4	refCos	Black (Black/Blue pair)	1
5	Data +	Yellow	13
6	Data -	Black (Black/Yellow pair)	14
7	Sin +	White	8
8	Cos +	Blue	12

3.9.8.5. Resolver cable connection for SLVD

Cable reference :
CS5UA1D1R0xxx



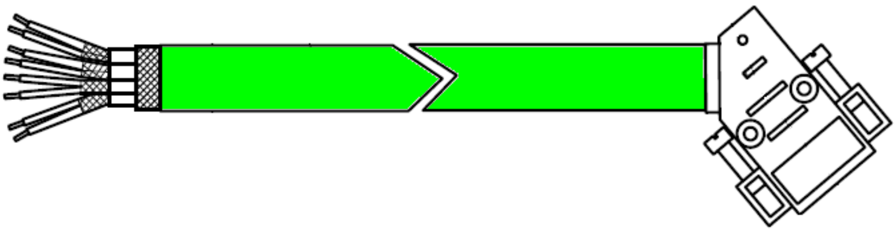
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

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

3.9.8.6. Resolver cable connection for 637/638

Cable reference :
CS1UA1D1R0xxx



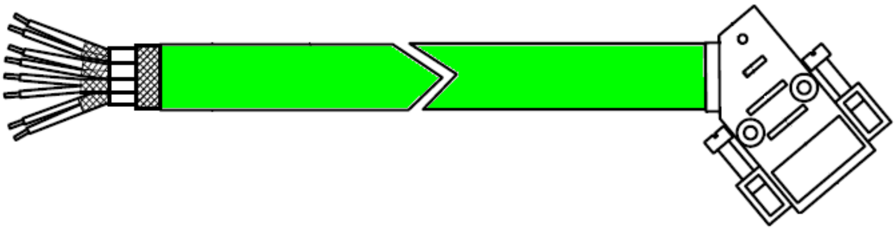
Feedback cable **6537P0059**
Male 9 pins SUB-D connector reference **220029P0020**
SUB-D cover reference **220029P0039**
Pins reference **220029P0021**

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

3.9.8.7. 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

3.9.8.8. Feedback cable reference

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

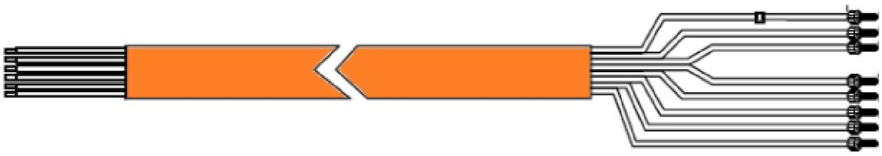
Feedback Sensor	Cable reference
Resolver	6537P0059
Hiperface Encoder	
EnDat Encoder	

3.9.8.9. Power cable for AC890

Cable reference :

CS4UQ1D1R0xxx for current ≤ 12Amps
Power cable **6537P0057**

CS4UQ2D1R0xxx for current ≤ 30Amps
Power cable **6537P0058**



Cable arrangement :

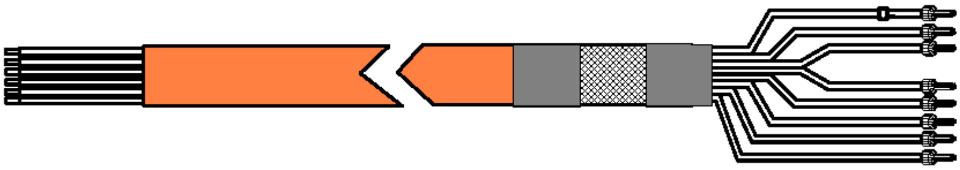
EX terminals	Identification	Wire colour	Markings with labels on wires
U	U phase	Black 1	U
V	V phase	Black 2	V
W	W phase	Black 3	W
⏚	Ground	Green/Yellow	
Br+	Brake +	Black 5	B +
Br-	Brake -	Black 6	B -
TH+	Thermal sensor +	Black 7	T+
TH-	Thermal sensor -	Black 8	T -

3.9.8.10. **Power cable for COMPAX3**

Cable reference :

CC3UQ1D1R0xxx for current ≤ 12Amps
Power cable **6537P0057**

CC3UQ2D1R0xxx for current ≤ 30Amps
Power cable **6537P0058**



Cable arrangement :

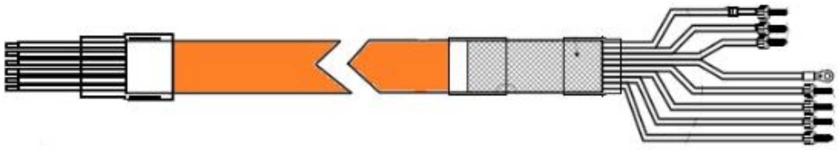
EX terminals	Identification	Wire colour	Markings with labels on wires
U	U phase	Black 1	U
V	V phase	Black 2	V
W	W phase	Black 3	W
⏚	Ground	Green/Yellow	
Br+	Brake +	Black 5	B +
Br-	Brake -	Black 6	B -
TH+	Thermal sensor +	Black 7	T+
TH-	Thermal sensor -	Black 8	T -

3.9.8.11. Power cable for SLVD

Cable reference :

CS5UQ1D1R0xxx for current ≤ 12Amps
Power cable **6537P0057**

CS5UQ2D1R0xxx for current ≤ 30Amps
Power cable **6537P0058**



Cable arrangement :

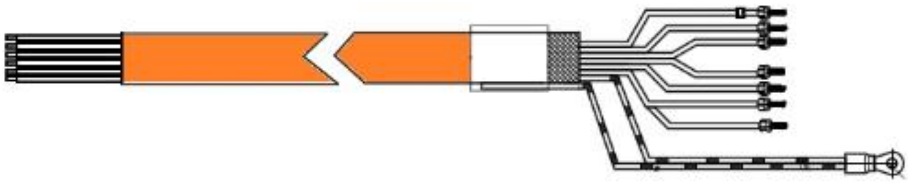
EX terminals	Identification	Wire colour	Markings with labels on wires
U	U phase	Black 1	U
V	V phase	Black 2	V
W	W phase	Black 3	W
⏚	Ground	Green/Yellow	
Br+	Brake +	Black 5	B +
Br-	Brake -	Black 6	B -
TH+	Thermal sensor +	Black 7	T+
TH-	Thermal sensor -	Black 8	T -

3.9.8.12. Power cable for 637/638

Cable reference :

CS2UQ1D1R0xxx for current ≤ 12Amps
Power cable **6537P0057**

CS2UQ2D1R0xxx for current ≤ 30Amps
Power cable **6537P0058**



Cable arrangement :

EX terminals	Identification	Wire colour	Markings with labels on wires
U	U phase	Black 1	U
V	V phase	Black 2	V
W	W phase	Black 3	W
⏚	Ground	Green/Yellow	
Br+	Brake +	Black 5	B +
Br-	Brake -	Black 6	B -
TH+	Thermal sensor +	Black 7	T+
TH-	Thermal sensor -	Black 8	T -

3.9.8.13. Power cable reference

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

Feedback Sensor	Cable reference
Current ≤ 12Amps	6537P0057
Current ≤ 30Amps	6537P0058

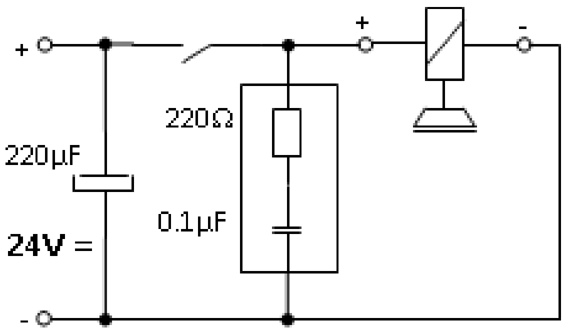
3.9.9. Cable connection

⚠	The EX motors must be carefully connected according to the connection diagrams placed in the commissionning and use manuals PVD3559_EX3, PVD3566_EX4, PVD3562_EX6, PVD3571_EX8 and PVD3628_EXUL. To avoid other problems due to the connections (cable glands, connections, cover etancheity…) the EX motors must be carefully connected according the chapter “Final connection” placed in the commissioning and use manuals.

3.10. 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.m².10^{-5})	Angular backlash (°)
EX3	2	1.8	11	13	25	0.68	0
EX4	5.5	4	12	17	35	1.8	0
EX6	12	8	18	28	40	5.4	0
EX8	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.

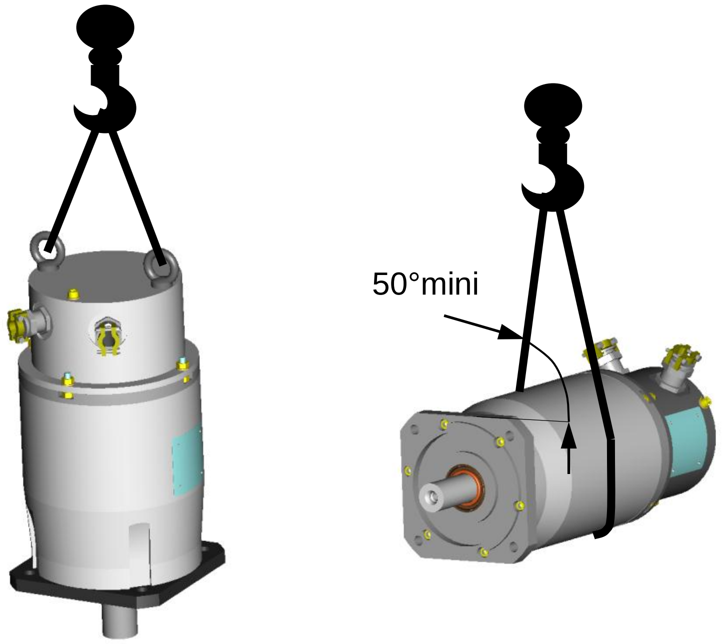
	Warning: In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h..

4.1.2. Handling

Servomotors 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.

4.1.3. 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.
The motor is delivered with caps for the water inlet and outlet to protect the cooling circuit. Keep them on place until the motor commissioning.

4.2. Installation

4.2.1. Mounting

	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 : - EX3 Atex : PVD 3559 - EX4 Atex : PVD 3566 - EX6 Atex : PVD 3562 - EX8 Atex : PVD 3571 - EX3 UL to EX8 UL : PVD 3628

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.

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

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.

Screw diameter	Tightening torque
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

Screw diameter	Tightening torque
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.

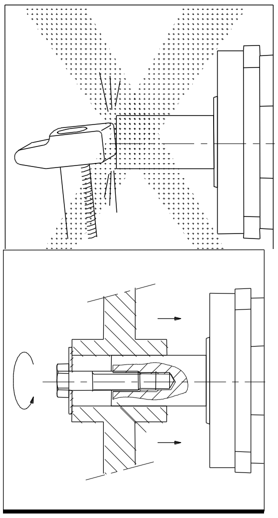
4.2.2. Preparation

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

4.2.3. Mechanical installation



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

- Carefully check the alignment of the motor shaft with that of the machine to be driven thus avoiding vibration, irregular rotation or putting too much strain on the shaft.
- 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 encoder at risk.
- In the event that the front bearing block is sealed by a lip seal which rubs on the rotating section, we recommend that you lubricate the seal with grease thus prolonging its operational life.

⚠	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.

	Danger: The motor must be earthed by connecting to an unpainted section of the motor.

	Caution: After 15 days, check all tightening torques on cable connection.

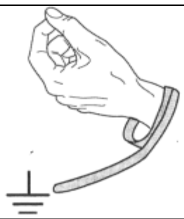
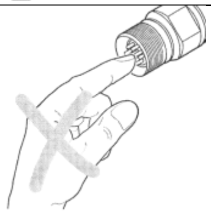
4.3.1. Cable connection

Please, read **§3.8 "Electrical connection"** to have information about cable connection
A lot of information are already available in the drive documentations.

4.3.2. Encoder cable handling

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

	Caution: It is forbidden to disconnect the Encoder cable under voltage (high risk of damage and sensor destruction).

	Warning: Always wear an antistatic wrist strap during encoder handling.
	Warning: Do not touch encoder contacts (risk of damage due to electrostatic discharges ESD.

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 te power supply.
Due to the permanent magnets, a voltage is generated at the terminals when the motor shaft is turned

Special requirements for ATEX servomotors

If a screw assembly of the enclosure need to be replaced, the new screw will must be quality 8.8 or higher. For the EX8 in UL version the screw must be quality 14.9 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
Bearing replacement	Every 20 000h

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.

4.5. 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).

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. • 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 input.
You notice that the motor is racing	• Check the speed set-point of the servo drive. • Check you are well and truly in speed regulation (and not in torque regulation). • Check the encoder 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 torque motor • 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 the servo drive or the position loop : check rotation with the loop open.