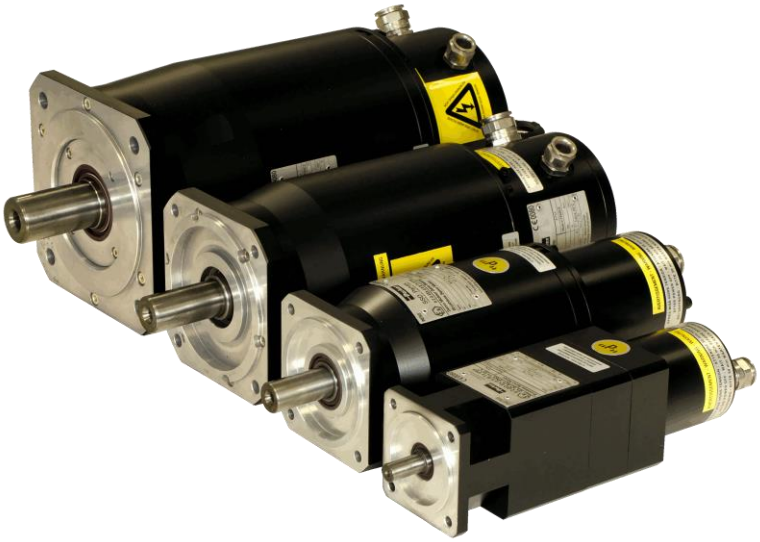
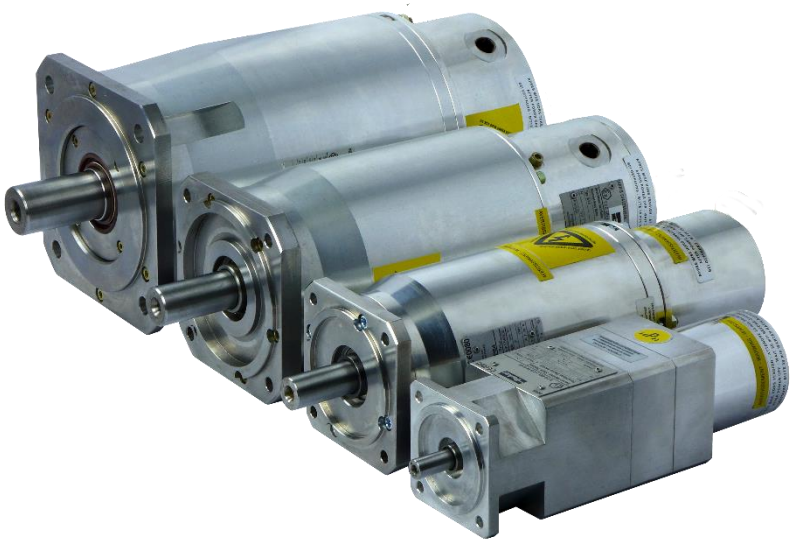
Servomotors

EX Series

Technical Manual

PVD 3665 - EX





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 EX3 - EX4 - EX6 - EX8 with the following marking :

II 2 G Ex db IIB T4 Gb IP64
or
II 2 GD / Ex db IIB T4 Gb IP65 / Ex tb IIIC T135°C Db 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 :

IEC 60034-1:2010 / EN 60034-1:2011 : Rotating electrical machines - Part 1 : Rating and performance.
IEC 60034-5:2006 / 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.
IEC 60079-0:2011 / EN 60079-0:2012/A11:2013 : Explosive atmospheres - Part 0 : Equipment - General requirements.
IEC 60079-1:2014 / EN 60079-1:2014 : Explosive atmospheres - Part 1 : Equipment protection by flameproof enclosures "d".
IEC 60079-31:2013 / EN 60079-31:2014 : Explosive atmospheres - Part 31 : Equipment dust ignition protection by enclosure "t".

EX3 EC-Type Examination certificate : INERIS 03ATEX0060X + additions 1 to 4.
EX4 EC-Type Examination certificate : INERIS 04ATEX0097X + additions 1 to 6.
EX6 EC-Type Examination certificate : INERIS 04ATEX0032X + additions 1 to 5.
EX8 EC-Type Examination certificate : INERIS 05ATEX0061X + additions 1 to 5.
Quality system notification : **INERIS** body EC 0080.

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

The servomotors type EX3 - EX4 - EX6 - EX8 are also certified IECEx.
IECEx Certification : INE 15.0060X

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 PVD3665 supplied with the product.

1st Motor CE marking :

EX3 CE Marking in : June 04th 2003
EX4 CE Marking in : January 24th 2005
EX6 CE Marking in : March 09th 2004
EX8 CE Marking in : May 30th 2005

Longvic, September 27th 2017

Ref : DCE-EX-003rev4

In the name of Parker
F. ALPIOVEZZA
Business Unit Manager

Compliance with «UL» standards

CERTIFICATE OF COMPLIANCE

Certificate Number	20151001-E302760
Report Reference	E302760-20090203
Issue Date	2015-OCTOBER-01
Issued to:	PARKER HANNIFIN MANUFACTURING FRANCE SAS ESTABLISHMENT LONGVIC 4 Bld EIFFEL 21600 LONGVIC FRANCE
This is to certify that representative samples of	MOTORS, SPECIALTY FOR USE IN HAZARDOUS LOCATIONS Brushless servo motors - Models EX310, EX420, EX430, EX620, EX630, EX 820, EX 840, EX 860 followed by U, followed by A through Z, followed by A through Z, followed by R, followed by 1, followed by 2 or 5, followed by code 02 through 99, for use in Hazardous (Classified) Locations, Class I, Groups C & D. Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 674, Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations. CAN/CSA C22.2 No. 145-M1986, Motors and Generators for Use in Hazardous Locations .
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

Compliance with «UL» standards

CERTIFICATE OF COMPLIANCE

Certificate Number	20151001-E242959
Report Reference	E242959-20070608
Issue Date	2015-OCTOBER-01
Issued to:	PARKER HANNIFIN MANUFACTURING FRANCE SAS ESTABLISHMENT LONGVIC 4 Bld EIFFEL 21600 LONGVIC FRANCE
This is to certify that representative samples of	COMPONENT - INCOMPLETE ROTATING MACHINES AND ROTATING MACHINE PARTS COMPONENT - SERVO AND STEPPER MOTORS Brushless servo motor - Models EX310, EX420, EX430, EX620, EX630, EX 820, EX 840, EX 860 followed by U; followed by A through Z, followed A through Z, followed by R, followed by code 1 for EX3-EX4-EX6-EX8 motors, followed by code 2 or 5 and B or E, followed by code 02 through 99
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 1004-1, Rotating Electrical Machines - General Requirements C22.2 No. 100-04, Motors and Generators
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

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 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 EX manufactured for the European market are designed to operate in ATEX classified zones
	Motors for hazardous classified locations : EX servomotors manufactured for the North American market are designed to operate in harzardous classified areas.
	Motors for Ex zones : Servomotors type EX manufactured off European and North American markets are designed to operate in Ex 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. Safe Torque Off function

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

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

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

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

1.2.4. Operating category and marking of EX servomotors

1.2.4.1. EX ATEX/IECEx gazeous atmospheres

II 2 G Ex db IIB T4 Gb IP64

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

	Suitable for ATEX/IECEX servomotors

1.2.4.2. EX ATEX/IECEx gazeous or dusty atmospheres

II 2 GD Ex db IIB T4 Gb IP65 / Ex tb IIIC T135°C Db IP65

II	2	D	Ex	tb	III	C	T135 °C	Db	IP65
I Mines	M1 Very high level of protection	**D** Combustible dust	ATEX protection	ta Protection by enclosure	**III** Dust	A Combustible flying	T1 450 °C	Ma Very high level of protection	**IP65**
	M2 High level of protection			**tb** / tc Protection by enclosure			T2 300 °C	Mb High level of protection	
II Surface	1 Very high level of protection			pb / pc Pressurized enclosure		B Non conductive dust	T3 200 °C	Da Very high level of protection	
	2 High level of protection			ia / ib / ic Intrinsic safety			**T4** 135 °C	Db High level of protection	
	3 Normal level of protection			ma / mb / mc Encapsulation		**C** Conductive dust	T5 100 °C	**Dc** Normal level of protection	
							T6 85 °C		

	Suitable for ATEX/IECEX servomotors

1.2.5. Special conditions for the ATEX servomotors

	The EC certifications are marked with a **X**. It seems the using of the motor must be in accordance with special conditions explained below: In case of fail of a screw used to assemble the parts of the flameproof enclosure, the new part must have a quality class superior or equal to 8.8 for EX3-EX4-EX6 and superior or equal to 12.9 for EX8. In case of an using in dusty explosive atmospheres, the user must perform regular cleaning operations on the motor to avoid dust deposits.

1.2.5.1. UL

Class1 group C&D Code T4A

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

	Suitable for UL servomotors

2. PRODUCT DESCRIPTION

2.1. Quick URL

All informations and datas are avaible on :

http://www.parker.com/eme/ex

2.2. 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
- Low cogging
- Compact dimensions and robustness
- Large set of options and customization possibilities
- CE, IECEx and UL marking certification available.

2.3. Applications

Painting applications
Packaging machinery
Robot applications
Special machines
Cleaning applications
Printing applications
Actuator for valve in Oil&Gas and Energy applications

2.4. General Technical Data for ATEX motors

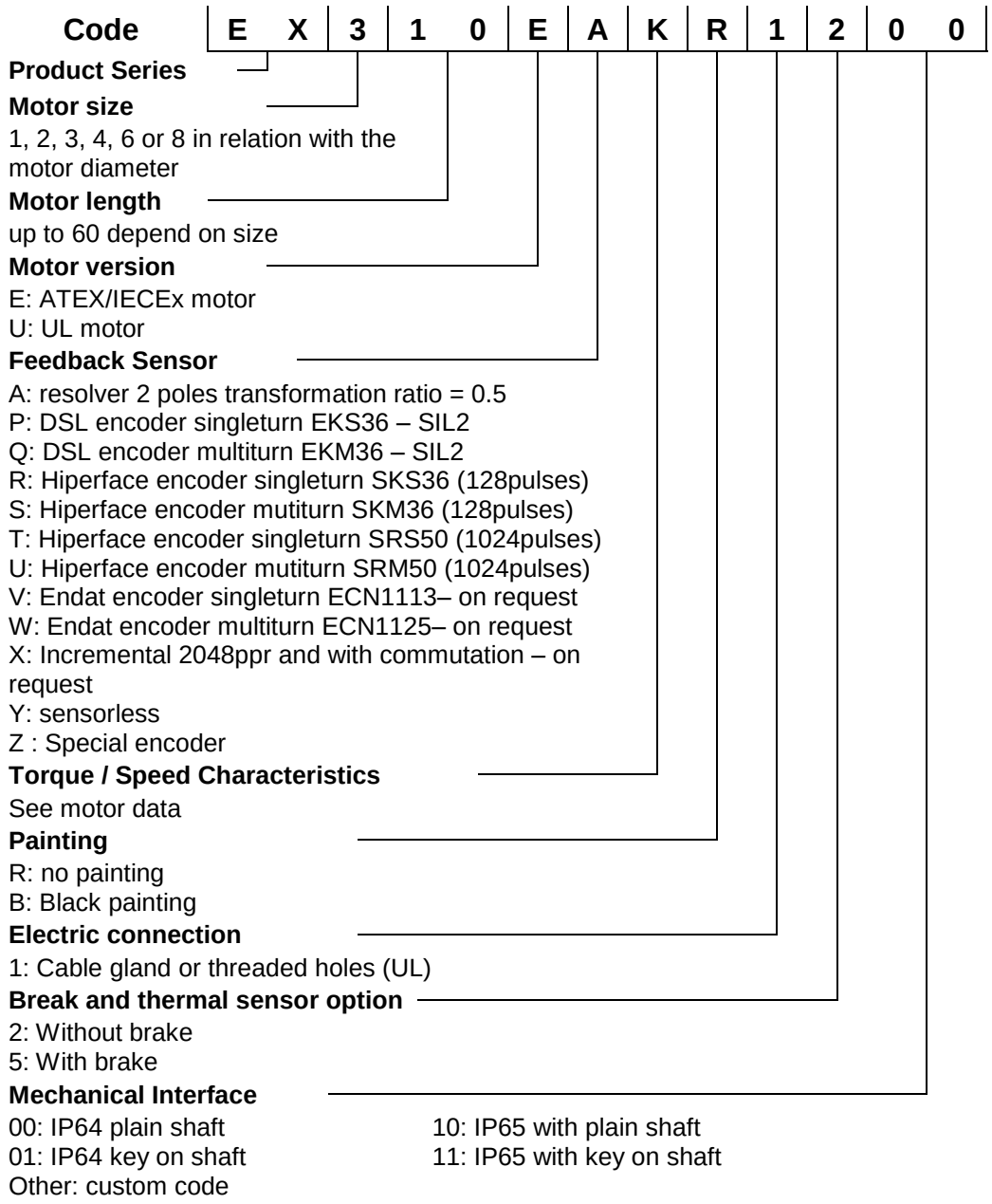
	EX3, EX4, EX6	EX8
Motor type	Permanent-magnet synchronous motor	
Magnets material	Neodymium Iron Boron	
Number of poles	10	
Type of construction	IMB5 – IMV1 – IMV3 (EN60034-7)	
Degree of protection	• Gazeous atmosphere : IP64, IP65 • Combustible dust atmosphere : IP65	
Cooling	Natural cooling	
Rated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

2.5. General Technical Data for UL motors

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

2.6. Product Code

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



3. TECHNICAL DATA

3.1. Motor selection

3.1.1. ATEX standard atmospheric conditions

EX motors are designed to operate in area:

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

In other conditions, please consult us.

3.1.2. Altitude derating

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

3.1.3. Temperature derating

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

3.1.4. Thermal equivalent torque (rms torque)

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

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

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

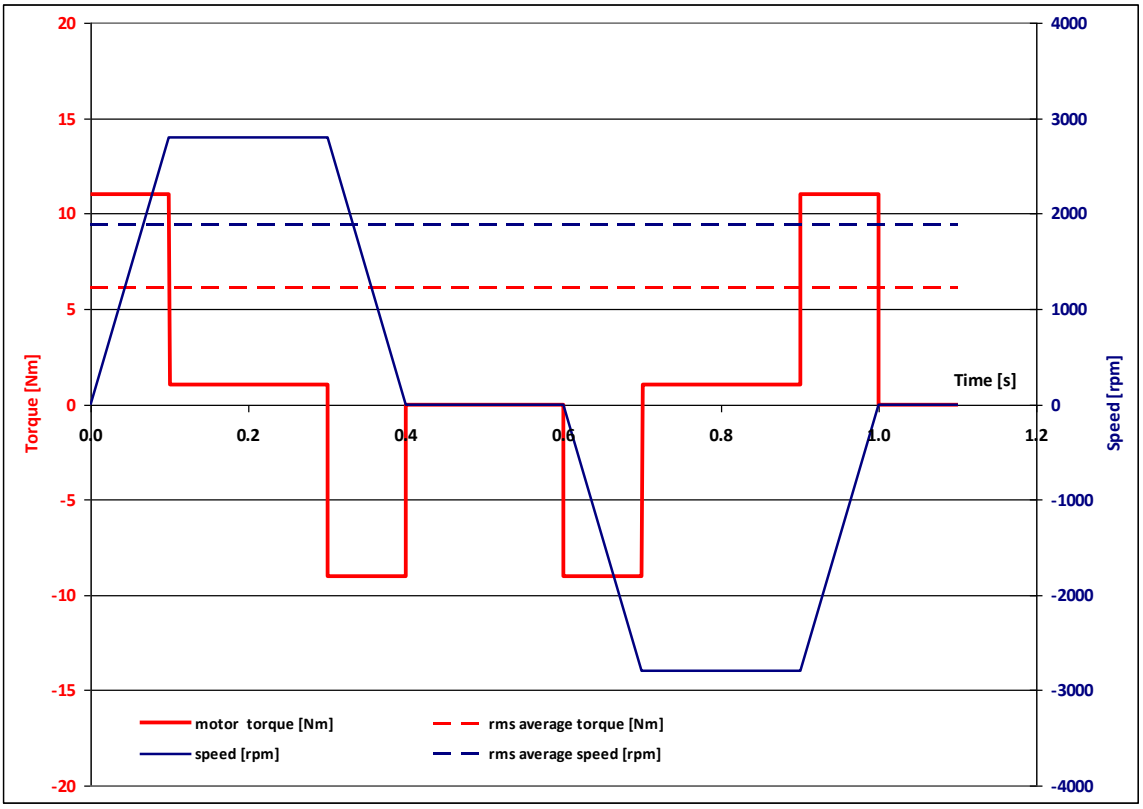
$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^{n} M_i^2 \Delta t_i}$$

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

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

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.

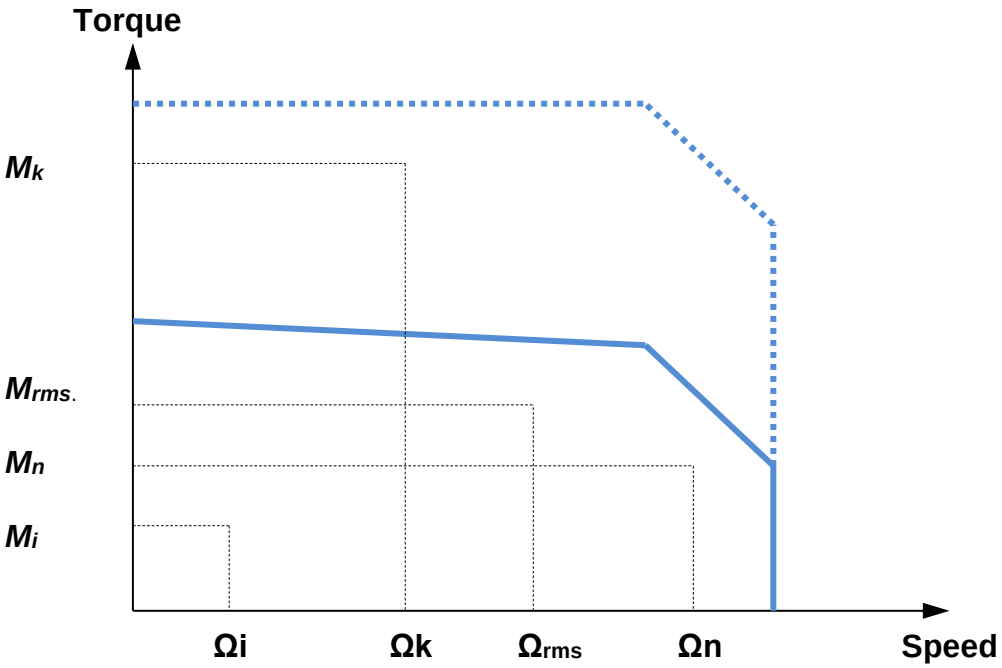
Selection of the motor :

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 and to select the best motor and drive association.

AC890 PARKER drive example:

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

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

Illustration:

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.

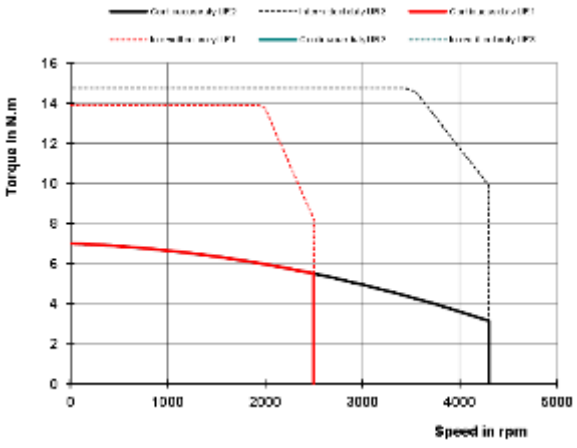
Selection of the motor:

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 9/18

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_c	Nm		14.0	–
Current for the peak torque	I_c	A_{rms}		11.3	–
Back emf constant at 1000 rpm (25°C)*	Ke	V_{rms}		91.7	
Torque sensitivity	Kt	Nm/A_{rms}		1.27	
Winding resistance (25°C)*	Rb	Ω		1.63	
Winding inductance*	L	mH		14	
Rotor inertia	J	$kgm^2 10^{-4}$		98	
Thermal time constant	Th	min		27	
Motor mass	M	kg		11.3	
Voltage of the mains		V_{rms}	230	400	-
Rated speed		rpm	2600	4300	-
Rated torque		Nm	3.49	3.13	-
Rated current		A_{rms}	4.47	2.75	-
Rated power		W	1440	1410	-



The permanent current I_0 of the motor is **5.51 Arms** for M_0**=7 Nm** at low speed.
The nominal current I_n of the motor is **2.46 Arms** for 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"**.

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"**.

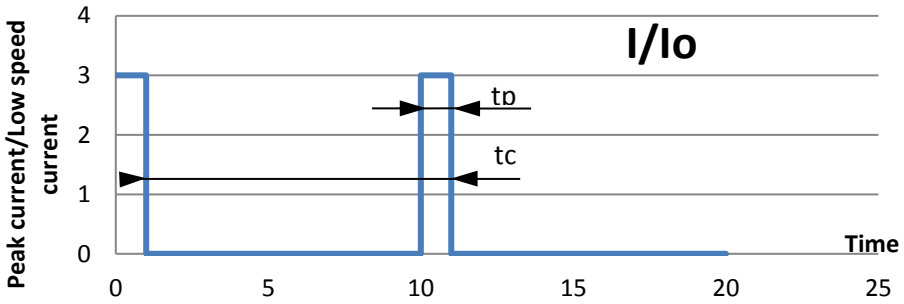
3.1.6. Current limitation at stall conditions (i.e. speed < 3 rpm)

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 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.

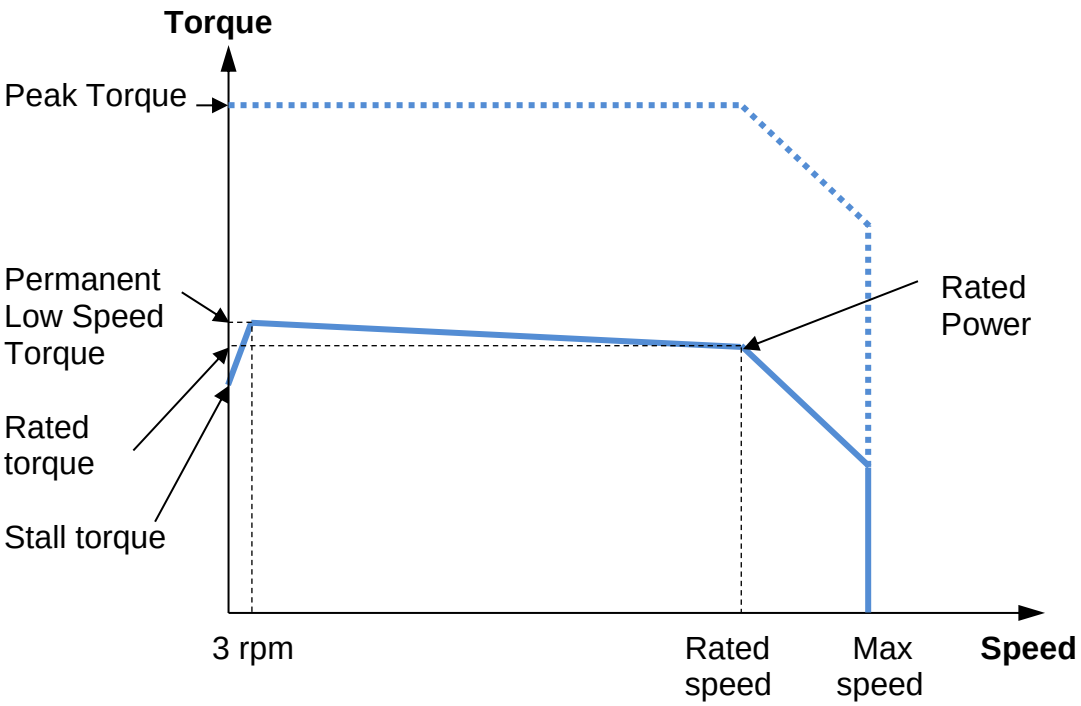
1) The peak currents and peak torques given in the data sheet must never be exceeded
2) The thermal equivalent torque must be respected (§3.1.3)
3) If 1) and 2) are respected (it can limit the peak current value or duration), the peak current duration (tp) must be limited, in addition, accordingly to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



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									
EX310EAP	0.40	1.66	2300	1.2	1.75	1.2	4.2	3.1	2300
EX310EAK	0.64	1.54	4000	2.0	1.75	2.2	4.2	5.4	4000
EX420EAP	0.77	3.18	2300	2.3	3.5	2.5	8.3	6.2	2300
EX420EAJ	1.12	2.67	4000	3.3	3.5	4.3	8.3	10.7	4000
EX430EAL	1.02	4.2	2300	3.0	4.8	3.3	11.5	8.3	2300
EX430EAF	1.37	3.3	4000	4.1	4.8	5.8	11.5	14.5	4000
EX620EAV	0.76	6.6	1100	2.4	6.7	2.4	16.7	6.0	1100
EX620EAR	1.33	5.8	2200	4.0	6.7	4.5	16.7	11.2	2200
EX630EAR	1.43	9.4	1450	4.2	10.4	4.6	25.9	11.5	1450
EX630EAN	2.02	8.4	2300	5.7	10.4	6.9	25.9	17.3	2300
EX820EAR	2.57	11.2	2200	7.5	14	9.3	32.5	23.2	2200
EX840EAK	3.31	15.8	2000	9.4	24.5	14.3	58.2	35.6	2000
EX860EAJ	3.86	25.4	1450	11.5	35	15.7	83.3	39.2	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									
EX310EAP	0.31	1.30	2300	0.9	1.5	1.1	3.7	2.7	2300
EX310EAK	0.40	0.95	4000	1.3	1.5	1.9	3.7	4.6	4000
EX420EAP	0.59	2.45	2300	1.8	3	2.1	7.3	5.3	2300
EX420EAJ	0.63	1.5	4000	1.9	3	3.7	7.3	9.1	4000
EX430EAL	0.82	3.4	2300	2.4	4.2	2.9	10.2	7.2	2300
EX430EAF	0.90	2.9	3000	3.6	4.2	5.1	10.2	12.7	4000
EX620EAV	0.63	5.5	1100	2.0	6	2.2	15.0	5.3	1100
EX620EAR	0.88	3.8	2200	2.8	6	4.1	15.0	9.9	2200
EX630EAR	1.12	7.35	1450	3.4	9	4.0	22.5	9.8	1450
EX630EAN	1.24	5.15	2300	3.7	9	6.1	22.5	14.7	2300
EX820EAR	1.65	8.5	1850	5.8	11	7.3	26.6	18.3	2200
EX840EAK	2.23	11.5	1850	6.9	21	12.2	51.0	30.6	2000
EX860EAJ	2.74	18.0	1450	8.3	31	13.9	75.1	34.8	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									
EX310EAP	0.64	1.54	4000	1.1	1.75	1.2	4.2	3.1	4000
EX310EAK	0.87	1.23	6800	1.6	1.75	2.2	4.2	5.4	6800
EX420EAP	0.94	3	3000	2.1	3.5	2.5	8.3	6.2	3000
EX420EAJ	1.11	1.8	6000	2.3	3.5	4.3	8.3	10.7	6000
EX430EAL	1.37	3.3	4000	2.3	4.8	3.3	11.5	8.3	4000
EX430EAF	1.37	3.3	4000	4.1	4.8	5.8	11.5	14.5	5800
EX620EAV	1.25	6.0	2000	2.2	6.7	2.4	16.7	6.0	2000
EX620EAR	1.53	3.8	3900	2.7	6.7	4.5	16.7	11.2	3900
EX630EAR	2.19	7.8	2700	3.5	10.4	4.6	25.9	11.5	2700
EX630EAN	2.18	5.2	4000	3.8	10.4	6.9	25.9	17.3	4000
EX820EAR	2.84	7.5	3600	5.2	14	9.3	32.5	23.2	3900
EX840EAK	0.99	2.9	3300	2.1	24.5	14.3	58.2	35.6	3500
EX860EAJ	2.35	9.0	2500	4.4	35	15.7	83.3	39.2	2600

Motor	Rated Power Pn (kW)	Rated Torque Mn (Nm)	Rated Speed Nn [rpm]	Rated Current In [Arms]	Low Speed Torque Mo [Nm]	Low speed Current Io [Arms]	Peak Torque Mpeak [Nm]	Peak Current I peak [Arms]	Max. Speed Nmax [rpm]
With 60°C ambiant temperature									
EX310EAP	0.40	0.95	4000	0.7	1.5	1.1	3.7	2.7	4000
EX310EAK	0.40	0.95	4000	1.3	1.5	1.9	3.7	4.6	6800
EX420EAP	0.66	2.1	3000	1.5	3.0	2.1	7.3	5.3	3000
EX420EAJ	0.63	1.5	4000	1.9	3.0	3.7	7.3	9.1	6000
EX430EAL	0.90	2.9	3000	2.0	4.2	2.9	10.2	7.2	4000
EX430EAF	0.90	2.9	3000	3.6	4.2	5.1	10.2	12.7	4900
EX620EAV	0.88	4.2	2000	1.6	6.0	2.2	15.0	5.3	2000
EX620EAR	0.84	3.2	2500	2.4	6.0	4.1	15.0	9.9	3900
EX630EAR	1.18	4.5	2500	2.2	9.0	4.0	22.5	9.8	2700
EX630EAN	1.18	4.5	2500	3.3	9.0	6.1	22.5	14.7	4000
EX820EAR	1.65	8.5	1850	5.8	11.0	7.3	26.6	18.3	3900
EX840EAK	2.22	11.5	1850	6.9	21.0	12.2	51.0	30.6	2600
EX860EAJ	2.60	15.5	1600	7.2	31.0	13.9	75.1	34.8	2100

3.2.3. UL 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									
EX310UAU	0.62	1.4	4200	2.2	1.60	2.5	4.0	6.3	4200
EX420UAI	1.03	2.5	4000	3.3	3	4.2	8.0	10.8	4000
EX430UAG	1.17	3.5	3200	3.9	4.4	4.9	10.0	11.3	3200
EX620UAM	1.37	4.8	2750	4.7	6	6.0	16.0	14.8	2750
EX630UAK	2.01	7.1	2700	6.2	10	7.9	23.7	19.4	2700
EX820UAQ	2.43	10.1	2300	7.2	13	9.1	29.7	22.8	2300
EX840UAL	2.90	16.8	1650	9.0	23	12.0	56.5	32.3	1650
EX860UAJ	3.50	22.3	1500	10.0	31	13.9	78.5	37.1	1500

3.2.4. UL 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									
EX310UAU	0.82	1.0	7600	1.7	1.6	2.5	4.0	6.3	7600
EX420UAI	0.81	1.1	7000	1.6	3.2	4.2	8.0	10.8	7000
EX430UAG	1.02	1.7	5700	2.1	4.4	4.9	10.0	11.3	5700
EX620UAM	1.27	2.8	4300	3.0	6.4	6.0	16.0	14.8	4300
EX630UAK	1.92	4.4	4200	4.0	9.5	7.9	23.7	19.4	4200
EX820UAQ	2.62	7.0	3600	5.1	12.9	9.1	29.7	22.8	3600
EX840UAL	2.08	6.8	2900	3.9	22.6	12.0	56.5	32.3	2900
EX860UAJ	2.18	8.3	2500	4.0	31.4	13.9	78.5	37.1	2500

3.2.5. 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]
ATEX / IECEx							
EX310EAP	1.42	88.9	62	20.7	79	10	55.9
EX310EAK	0.81	50.9	20.3	6.58	79	10	57.7
EX420EAP	1.42	89	33	7.2	290	10	71
EX420EAJ	0.821	51.4	11	2.31	290	10	73.7
EX430EAL	1.45	90.9	21	4.22	426	10	76.3
EX430EAF	0.828	51.8	6.8	1.38	426	10	75.7
EX620EAV	2.78	180	67.6	7.9	980	10	137
EX620EAR	1.48	95.7	19.2	2.24	980	10	137
EX630EAR	2.27	138	24.9	2.43	1470	10	158
EX630EAN	1.5	91.6	10.9	1.12	1470	10	150
EX820EAR	1.51	93	8.57	1.01	3200	10	137
EX840EAK	1.72	106	5.42	0.493	6200	10	170
EX860EAJ	2.23	140	6.43	0.499	9200	10	209
UL							
EX310UAU	0.652	41	13.2	4.29	79	10	61.8
EX420UAI	0.772	48.3	9.72	1.94	290	10	86
EX430UAG	0.902	56.4	8.07	1.55	426	10	93.1
EX620UAM	1.06	68.8	9.92	1.08	980	10	147
EX630UAK	1.2	73.6	7.06	0.674	1470	10	161
EX820UAQ	1.42	87.2	7.53	0.889	3200	10	154
EX840UAL	1.89	118	6.69	0.579	6200	10	207
EX860UAJ	2.26	140	6.43	0.499	9200	10	242

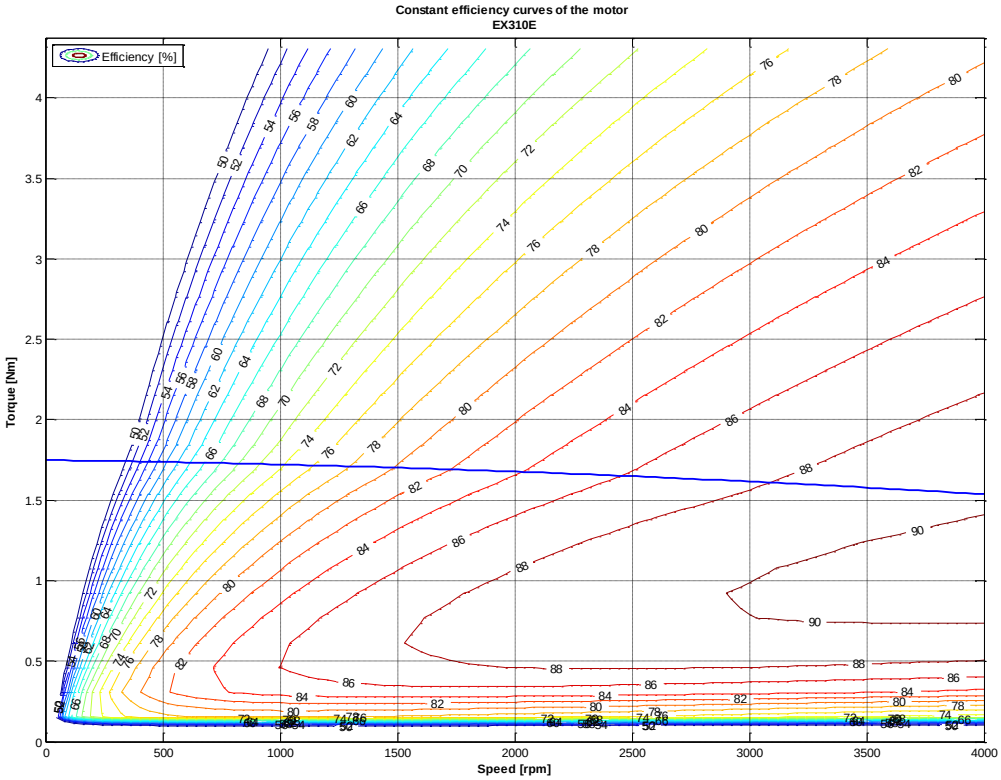
3.2.6. Efficiency curves

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

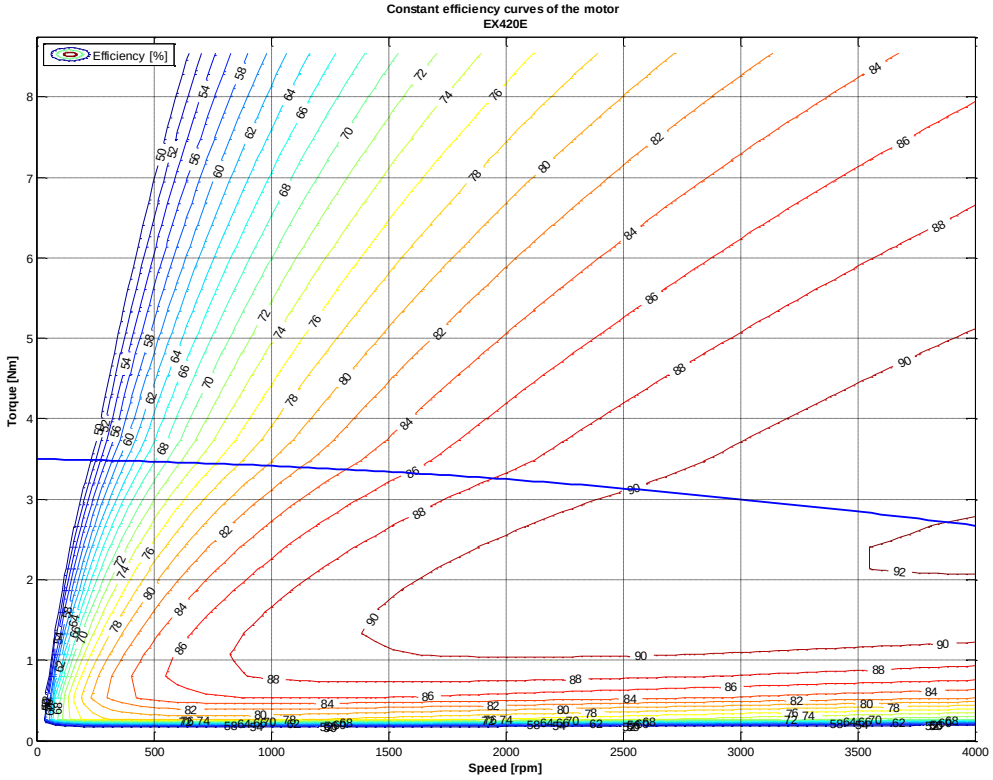
	Caution: The efficiency curves are given for an optimal motor control (no voltage saturation and optimal phase between current and EMF)

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

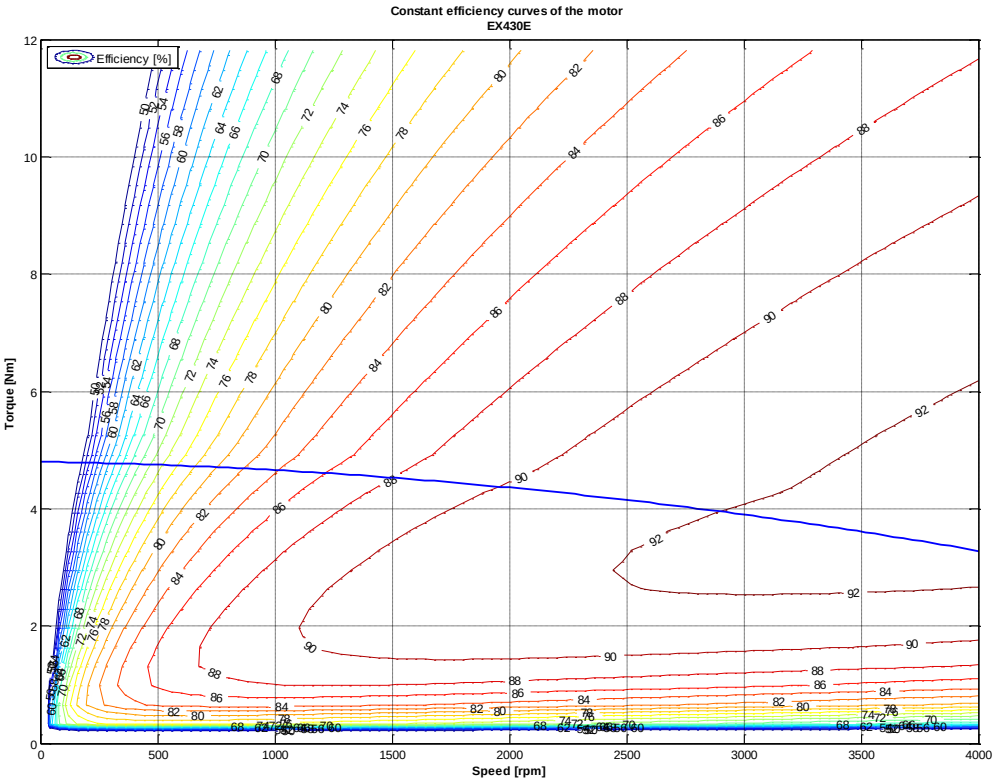
3.2.6.1. Series EX310E (EX310EAP)



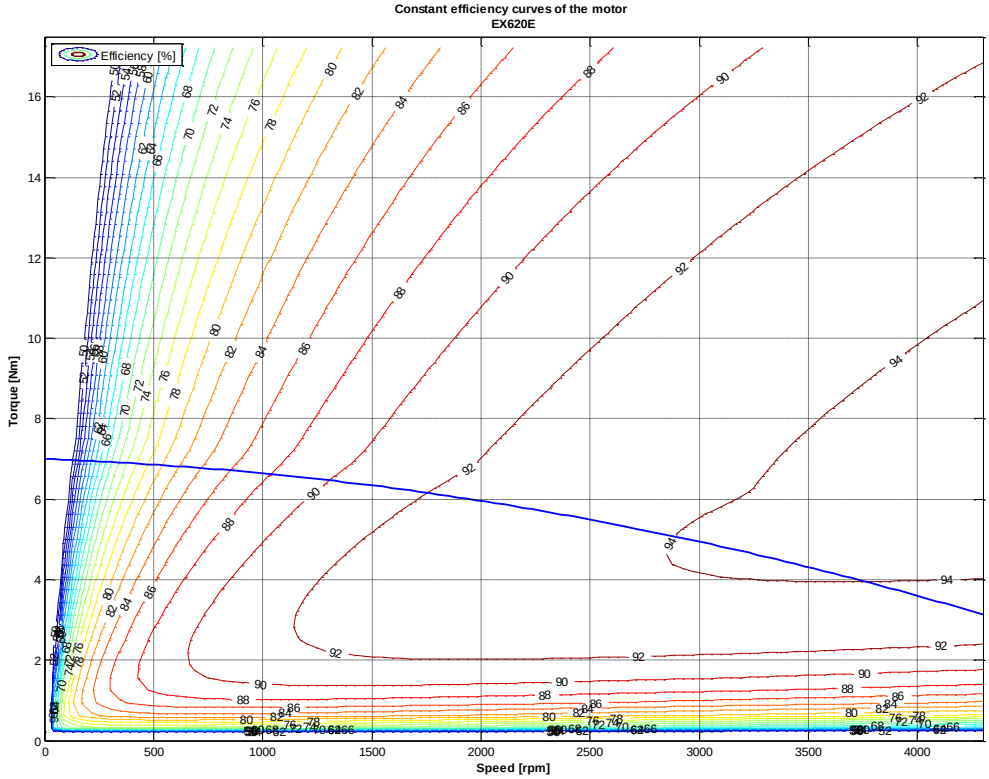
3.2.6.2. Series EX420E (EX420EAP)



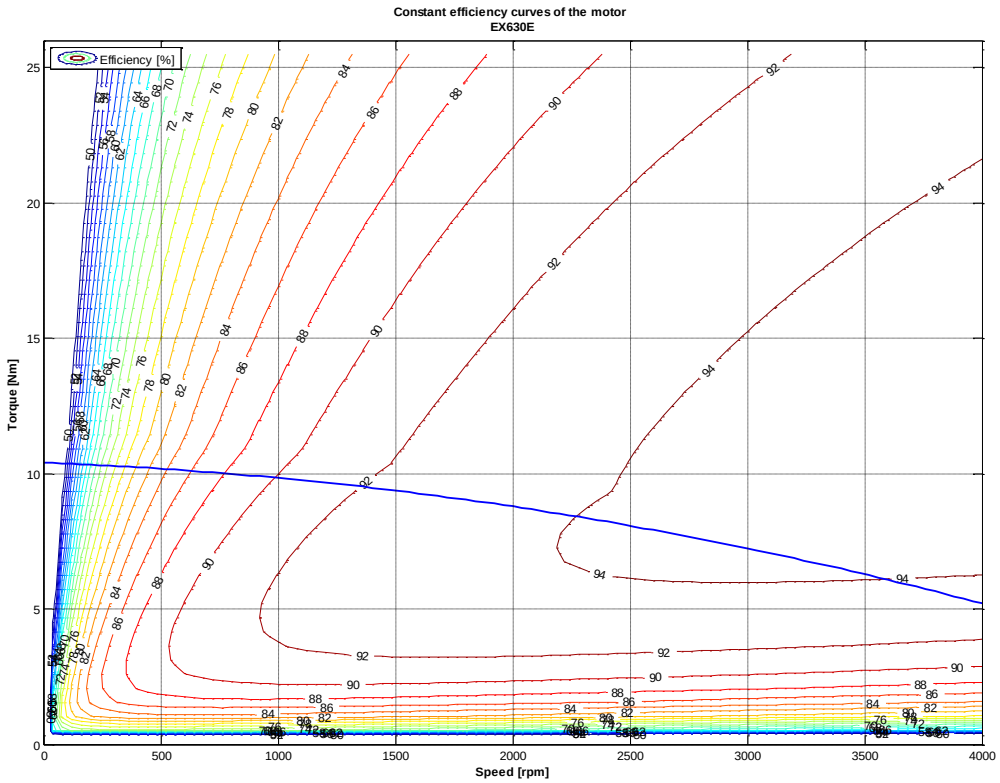
3.2.6.3. Series EX430E (EX430EAL)



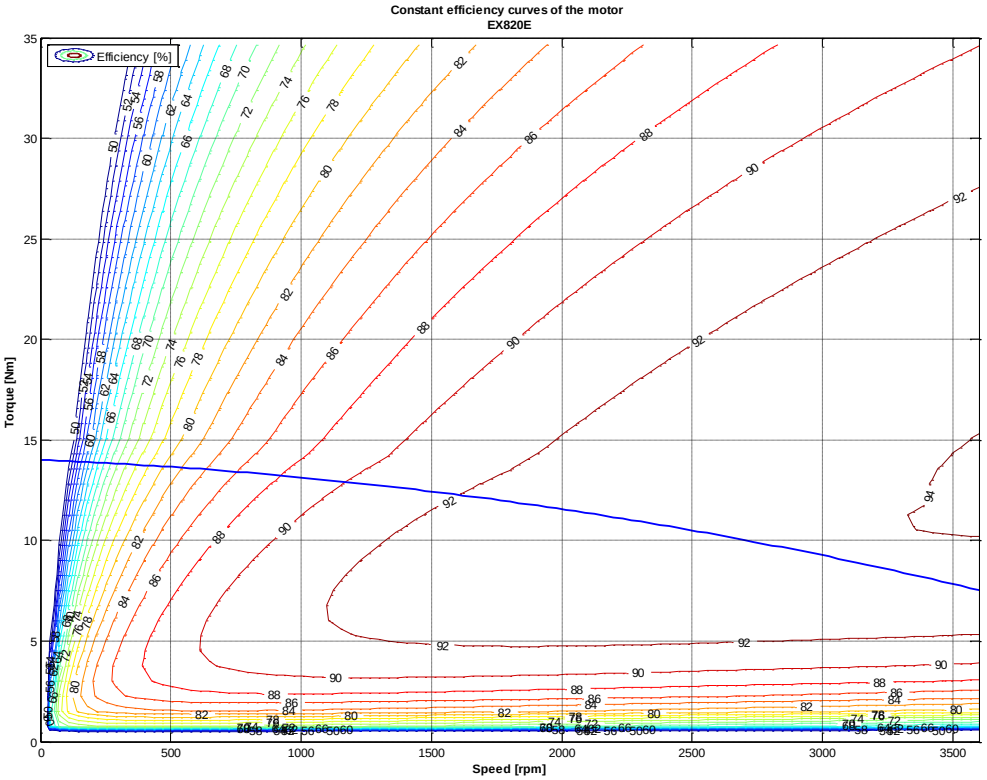
3.2.6.4. Series EX620E (EX620EAO)



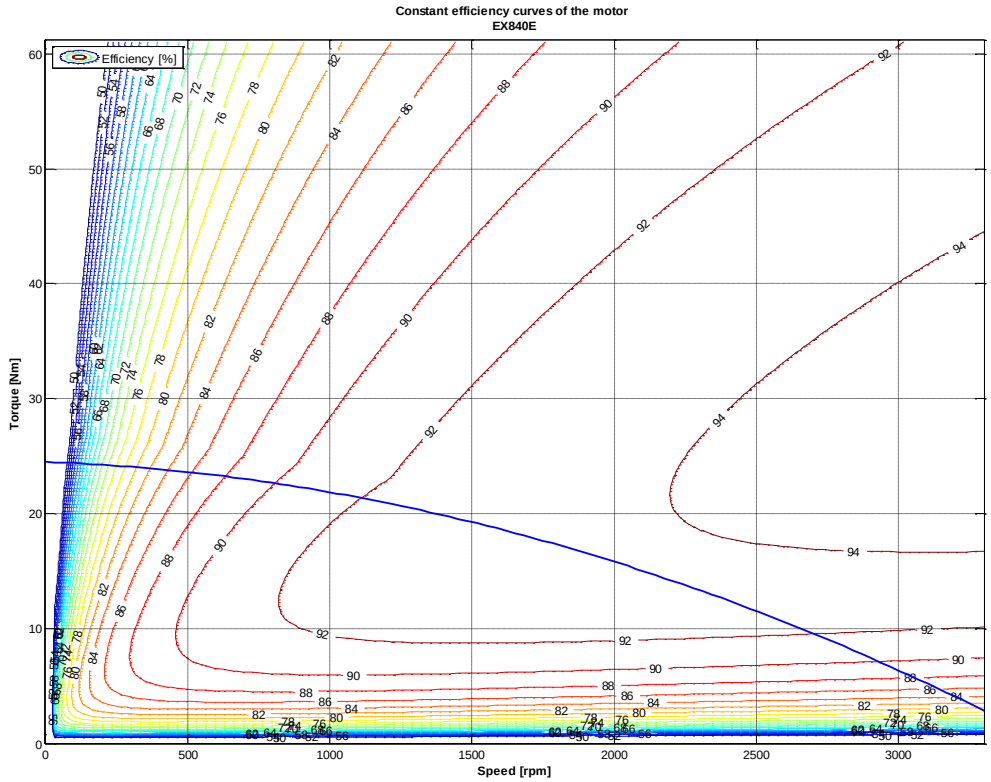
3.2.6.5. Series EX630E (EX630EAN)



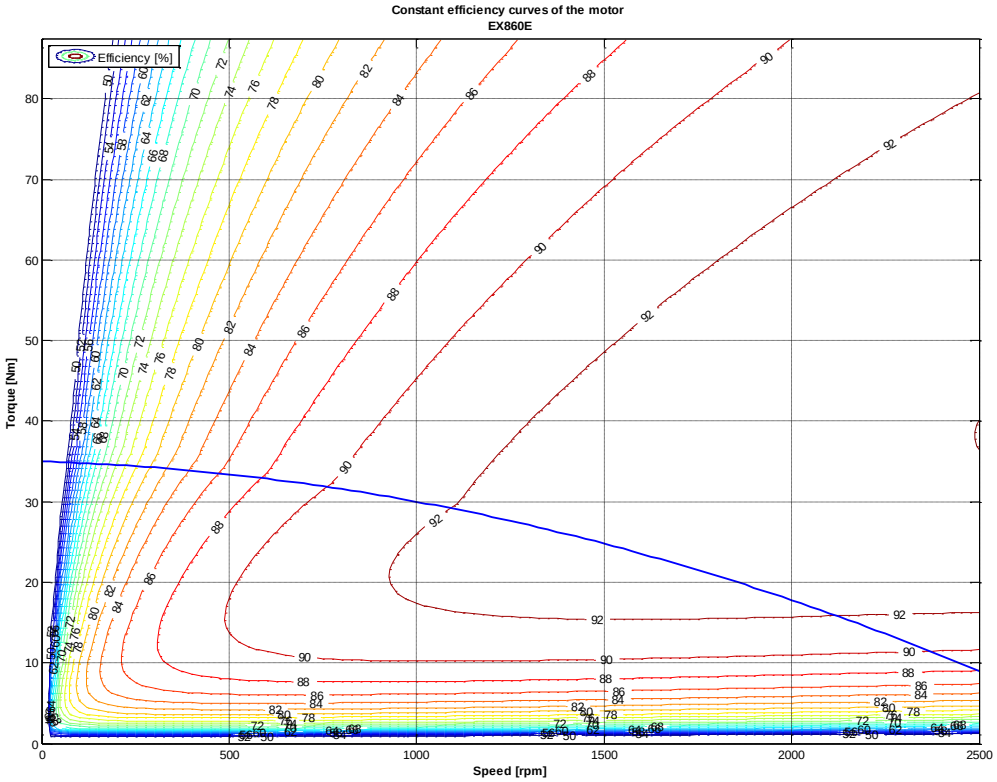
3.2.6.6. Series EX820E (EX820EAR)



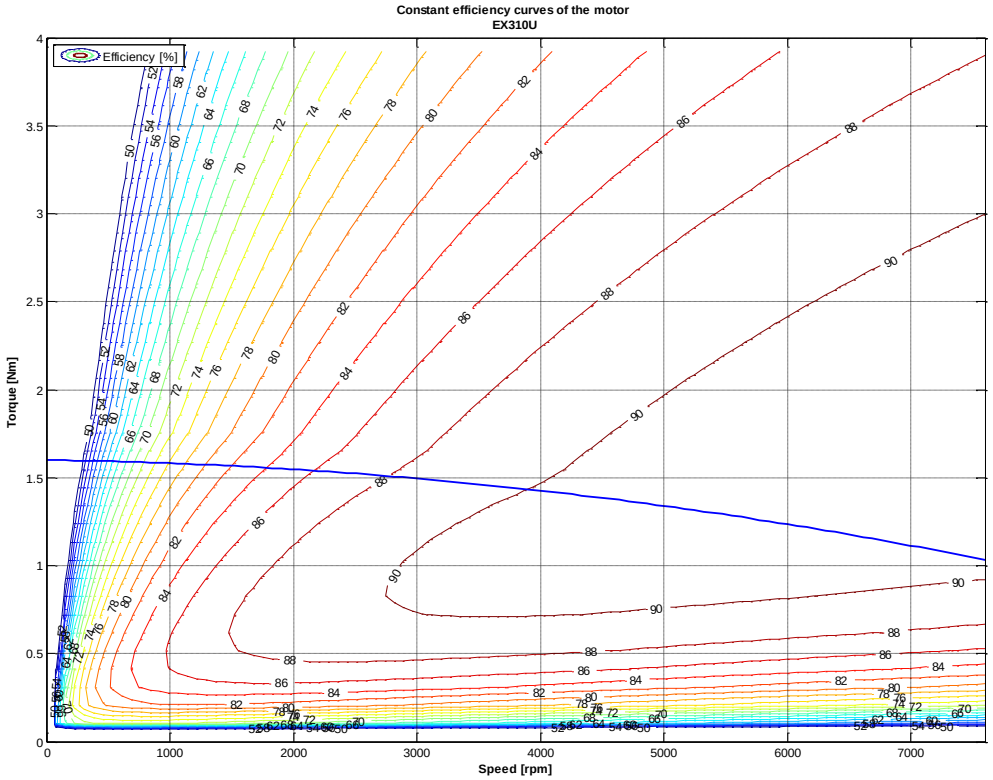
3.2.6.7. Series EX840E (EX840EAK)



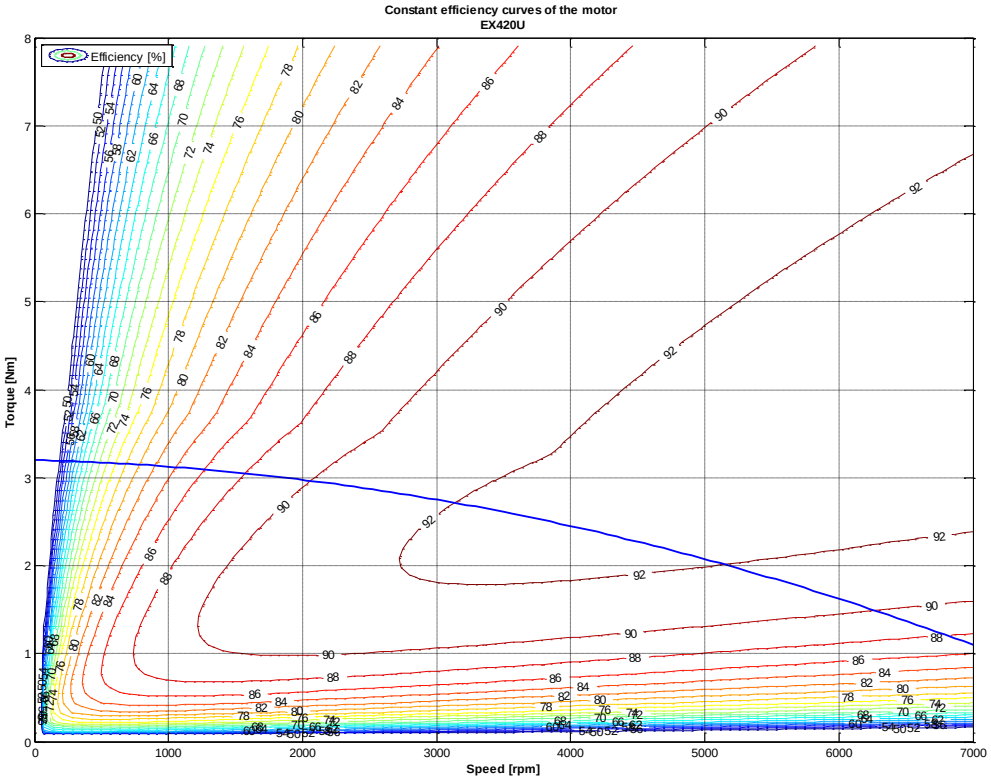
3.2.6.8. Series EX860E (EX860EAJ)



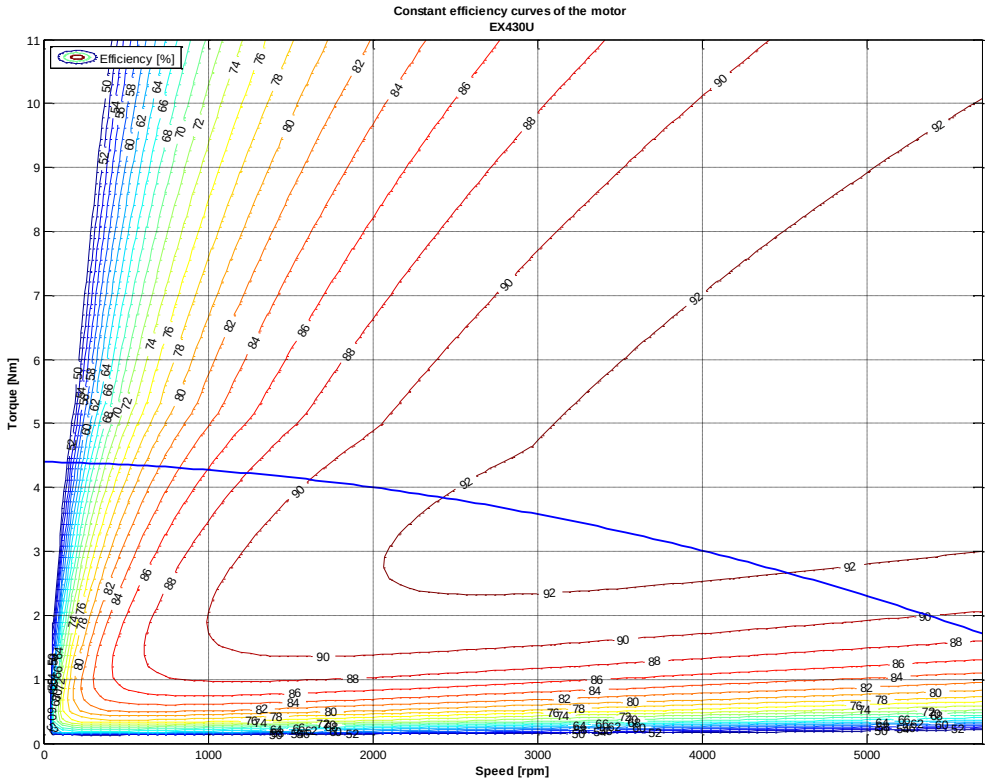
3.2.6.9. Series EX310U (EX310UAU)



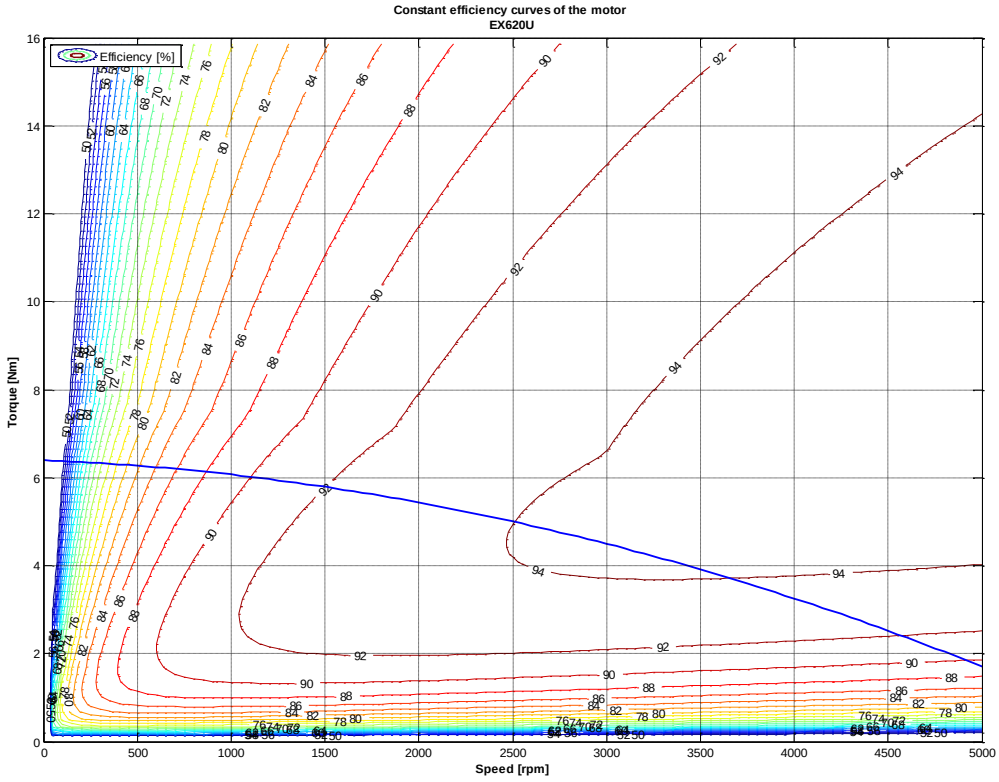
3.2.6.10. Series EX420U (EX420UAI)



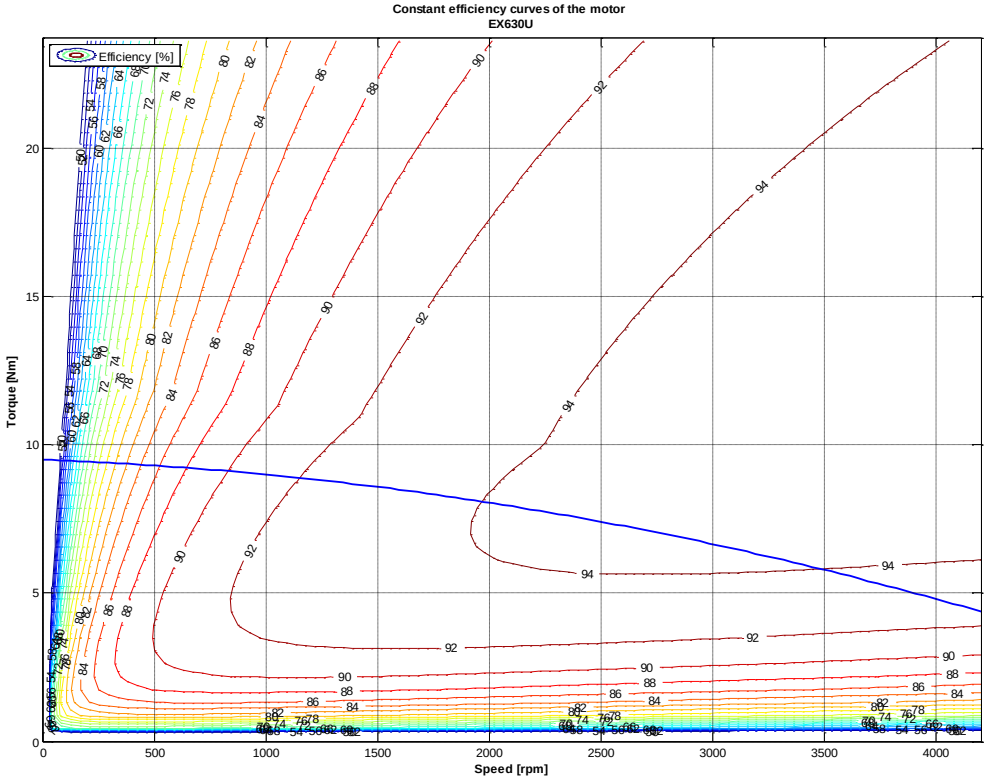
3.2.6.11. Series EX430U (EX430UAG)



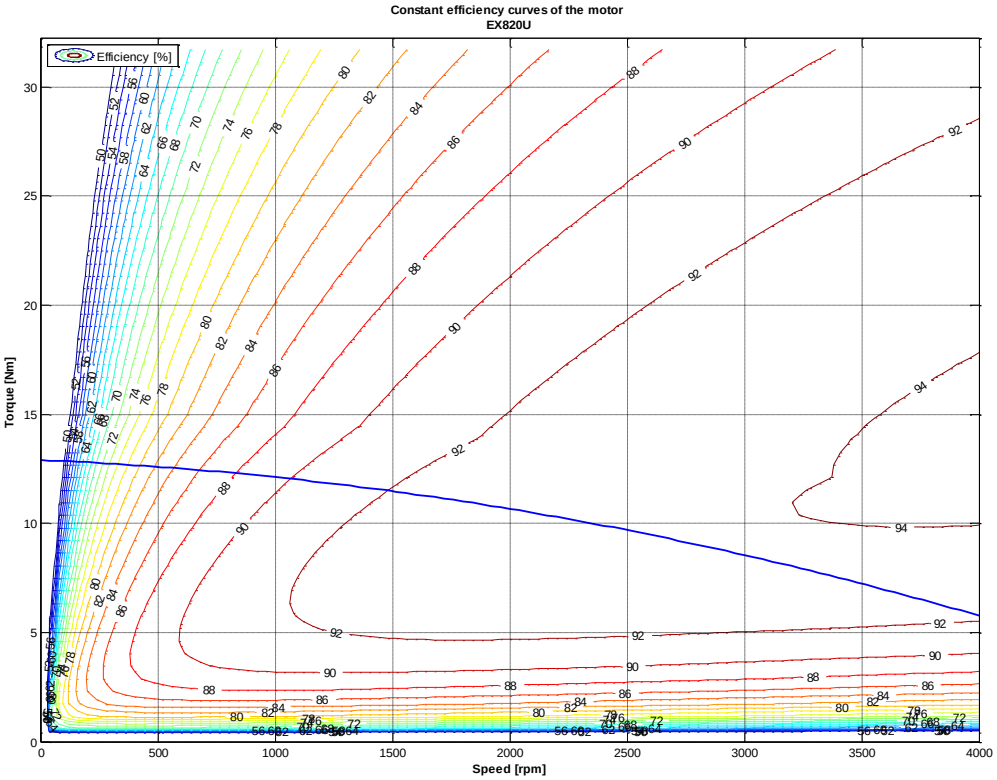
3.2.6.12. Series EX620U (EX620UAM)



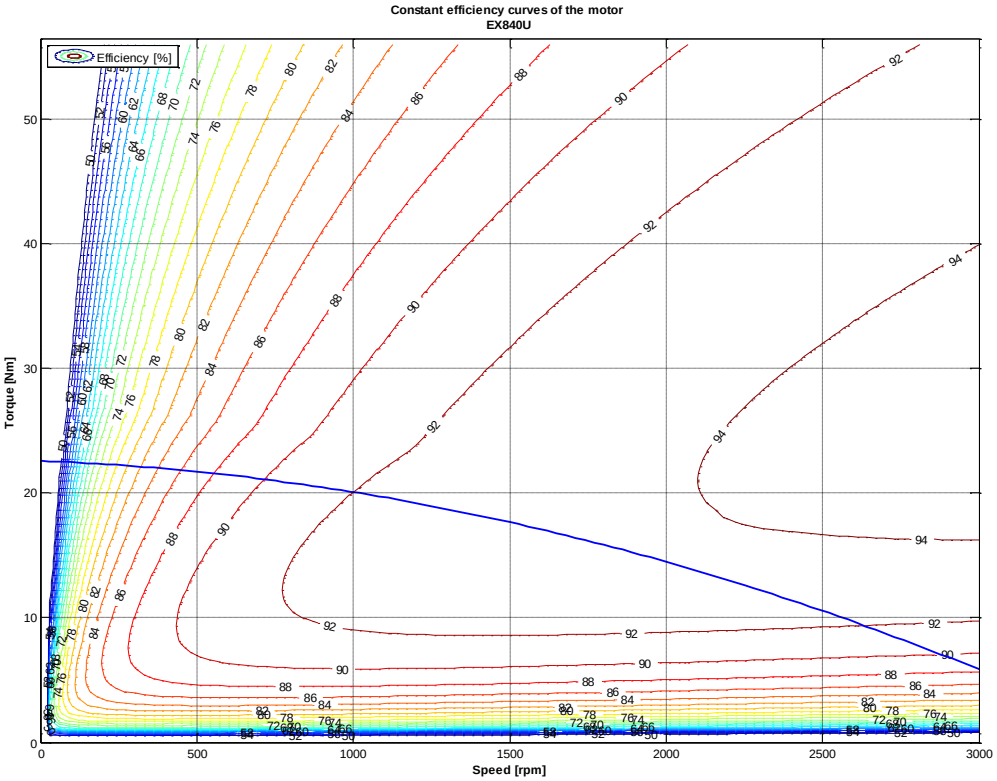
3.2.6.13. Series EX630U (EX630UAK)



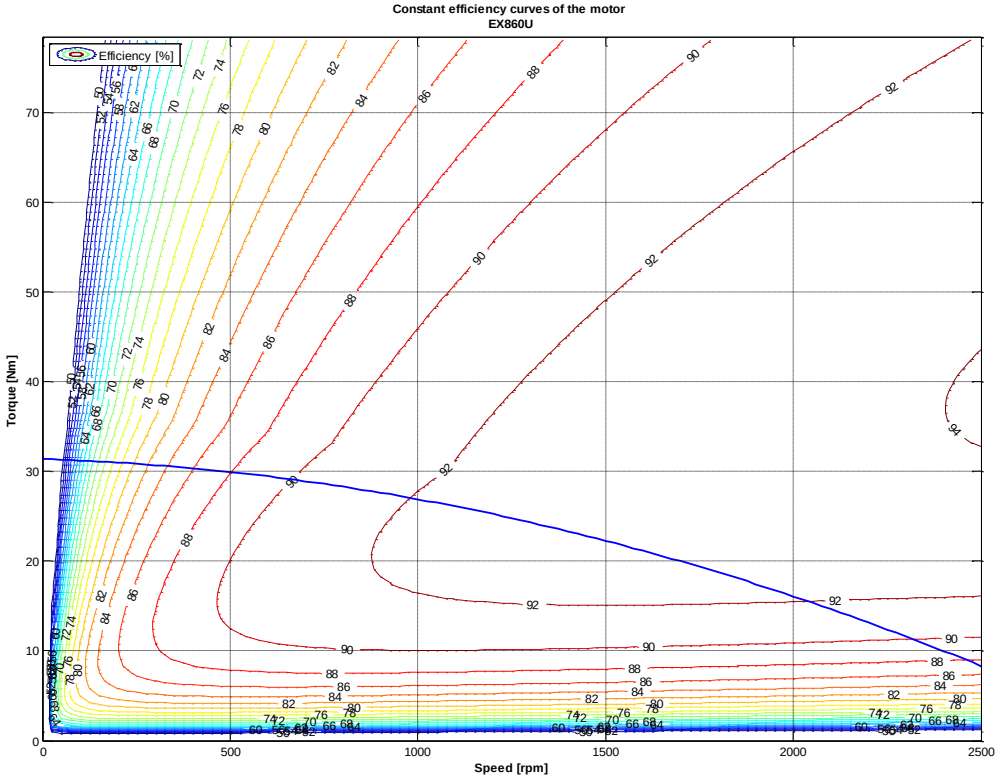
3.2.6.14. Series EX820U (EX820UAQ)



3.2.6.15. Series EX840U (EX840UAL)



3.2.6.16. Series EX860U (EX860UAJ)



3.2.7. 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 lip seal, IP64 motor)

Type	Tf [Nm]	Kd [Nm/1000rpm]
EX310EAP	0.067	0.033
EX420EAP	0.090	0.114
EX430EAP	0.106	0.149
EX620EAR	0.106	0.196
EX630EAR	0.131	0.245
EX820EAR	0.160	0.300
EX840EAK	0.190	0.380
EX860EAJ	0.220	0.460

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

3.2.8. Time constants of the motor

3.2.8.1. Electric time constant:

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

With following values given in the motor data sheet
***L*$_{ph\_ph}$** inductance of the motor phase to phase [H],
***R*$_{ph\_ph}$** resistance of the motor phase to phase at 25°C [Ohm].

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

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

3.2.8.2. Mechanical time constant:

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

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

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

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

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

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

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.

3.2.8.3. 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]
EX310	3.0	1.1	60.2
EX420	4.6	1.4	71.0
EX430	5.2	1.1	79.8
EX620	8.6	1.3	137
EX630	10.3	1.0	158
EX820	8.5	2.1	135
EX840	11.0	1.5	171
EX860	12.9	1.3	206

3.2.9. Speed ripple

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

3.2.10. Cogging torque

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

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

3.2.11. 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 Ex630EAI datasheet

BRUSHLESS MOTOR
EX630EAI
ELECTRONIC DRIVE
DRIVE 10/36 Arms 230 Vac

No UL certification

Pn	**Rated power ****	2.27	*kW*	
Mn	**Rated torque ****	7.24	*Nm*	**Cooling type :**
Nn	**Rated speed**	3000	*rpm*	Natural Air cooling
In	**Rated current**	6.75	A_{rms}	Flange 400*400*12mm(ALU)
Un	**Rated voltage**	205	V_{rms}	
UR	**Voltage of the mains**	230	*Vrms*	
U	DC voltage supply when motor is loaded	310	*V*	
M_0	**Low speed torque ****	10.4	*N.m*	**Environment :**
I_0	**Permanent current at low speed**	9.28	A_{rms}	Ambient temperature : 40°C MAX
M_p	Max. torque **	25.9	*Nm*	Altitude : < 1000 m
I_p	Max. current	23.2	A_{rms}	Thermal class : F
N_p	Max. speed	3000	*rpm*	(according to IEC 60034-1)
J	Rotor inertia	0.0015	$kg.m^2$	Number of poles : 10
Ke	Back emf constant at 1000 rpm (25°C)*	68.2	V_{rms}	
Kt	Torque sensitivity (25°C) *	1.12	Nm/A_{rms}	**Efficiency :**
Rb	Winding resistance(25°C) *	0.595	Ω	at rated torque : 94.4 %
L	Winding inductance *	6.06	*mH*	at 75% of rated torque : 93.9 %

All data are given in typical values under standard conditions

* Phase to Phase

** 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=3000 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:

$$N_{n2} = N_n * \frac{\frac{U_{n2}}{U_n} - 1 + \eta}{\eta} \qquad N_{n2} = 3000 * \frac{\frac{360}{400} - 1 + 0.92}{0.92} = 2674 rpm$$

Maximum speed:
The former maximum speed N_{max} = 3000 rpm obtained with U_n =400 V_{rms} and a speed N_n =3000 rpm leads to the new maximum speed N_{max2} given as follows:

$$N_{\max 2} = N_{\max} * \frac{N_{n2}}{N_n} \qquad N_{\max 2} = 3000 * \frac{2674}{3000} = 2674 rpm$$

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 to do not damage the motor. In case of doubt, consult us.

Rated power:
The former rated power P_n=2270 W obtained with U_n=400 V_{rms} leads to the new rated power P_{n2} given as follows:

$$P_{n2} = P_n * \frac{U_{n2}}{U_n} \qquad P_{n2} = 2270 * \frac{360}{400} = 2043 W$$

Rated torque:
The former rated torque M_n = 7.24 Nm obtained with U_n =400 V_{rms} leads to the new rated torque M_{n2} given as follows:

$$M_{n2} = \frac{P_{n2}}{\frac{2 * \pi * N_{n2}}{60}} \qquad M_{n2} = \frac{2043}{\frac{2 * \pi * 2674}{60}} = 7.3 Nm$$

3.2.12. Voltage withstand characteristics of EX series

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

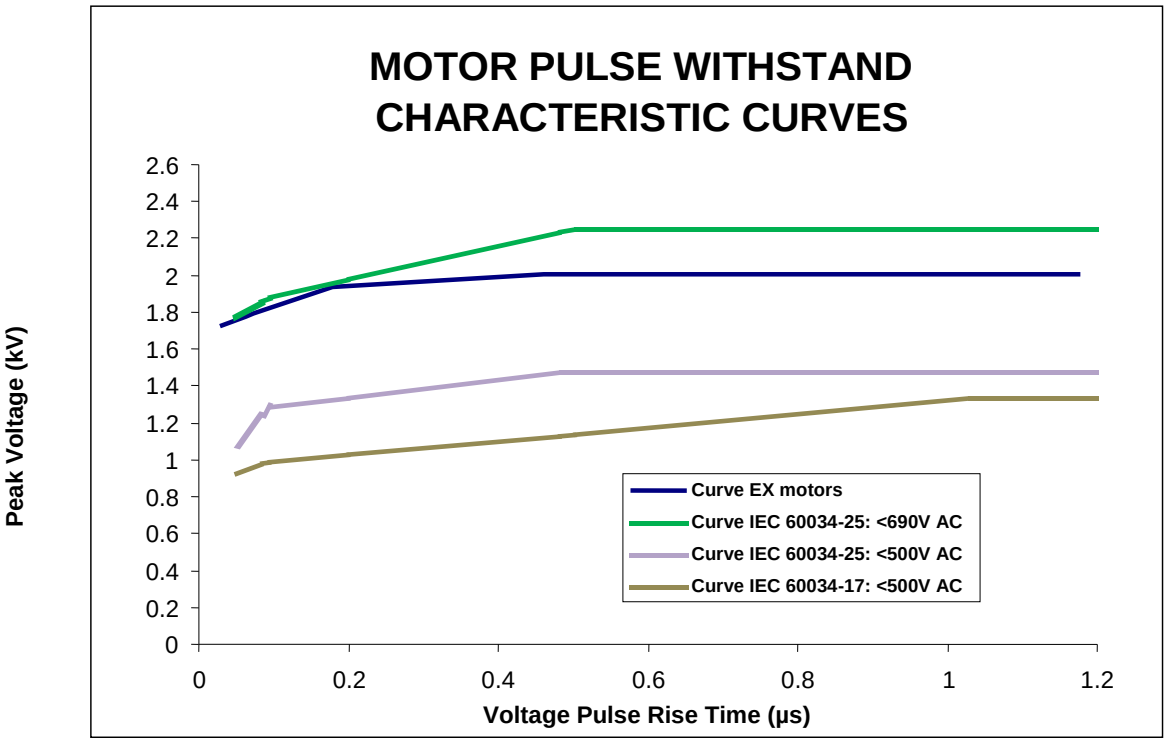


Figure 1: Minimum Voltage withstands characteristics for motors insulations according to IEC standards. At the top are the typical capabilities for the EX motors.

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

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

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

3.2.13. 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 to 700	0 to 700	0 to 700	0 to 700
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 to 600	0 to 600	0 to 600	0 to 600
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

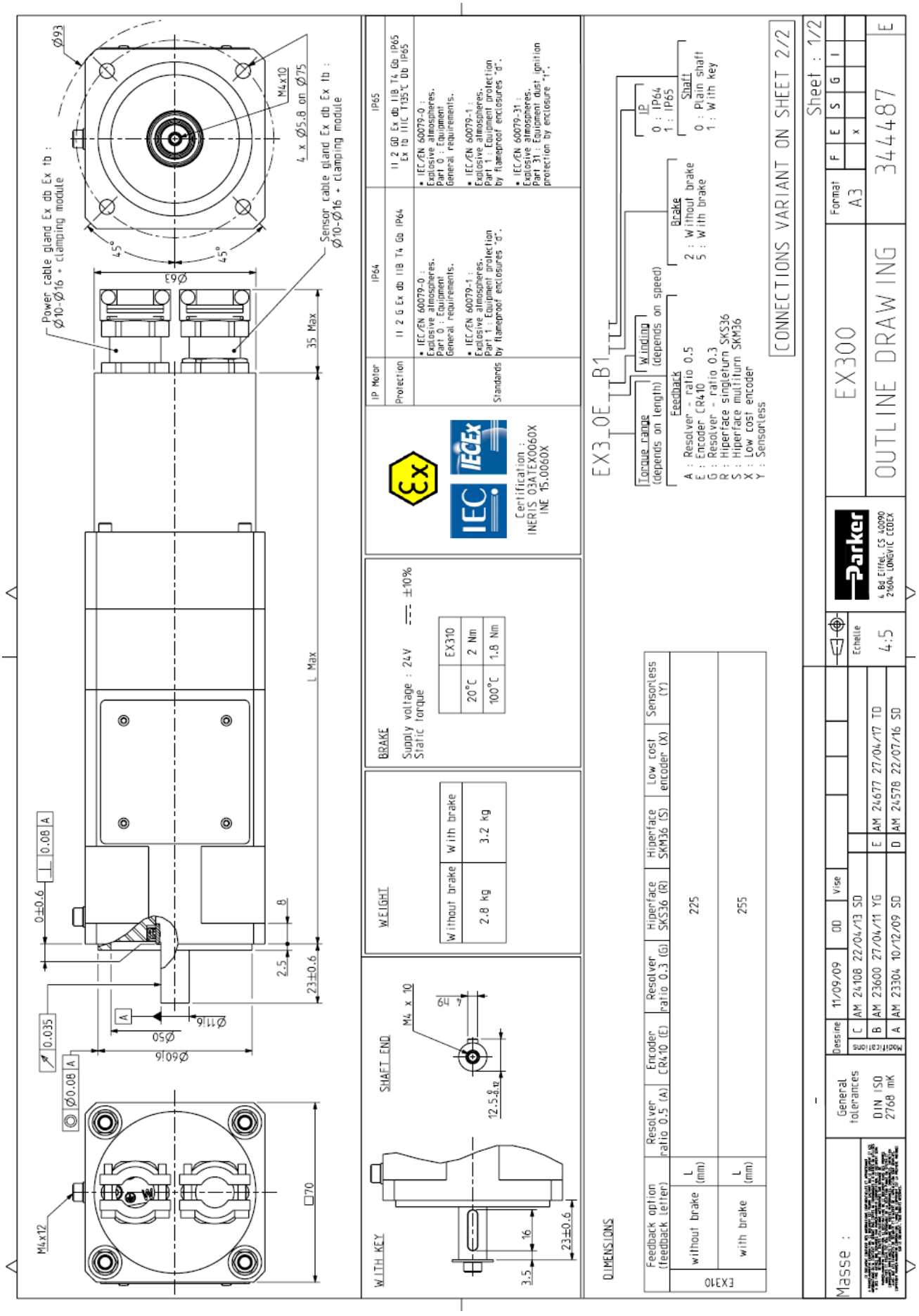
EX8 UL :

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

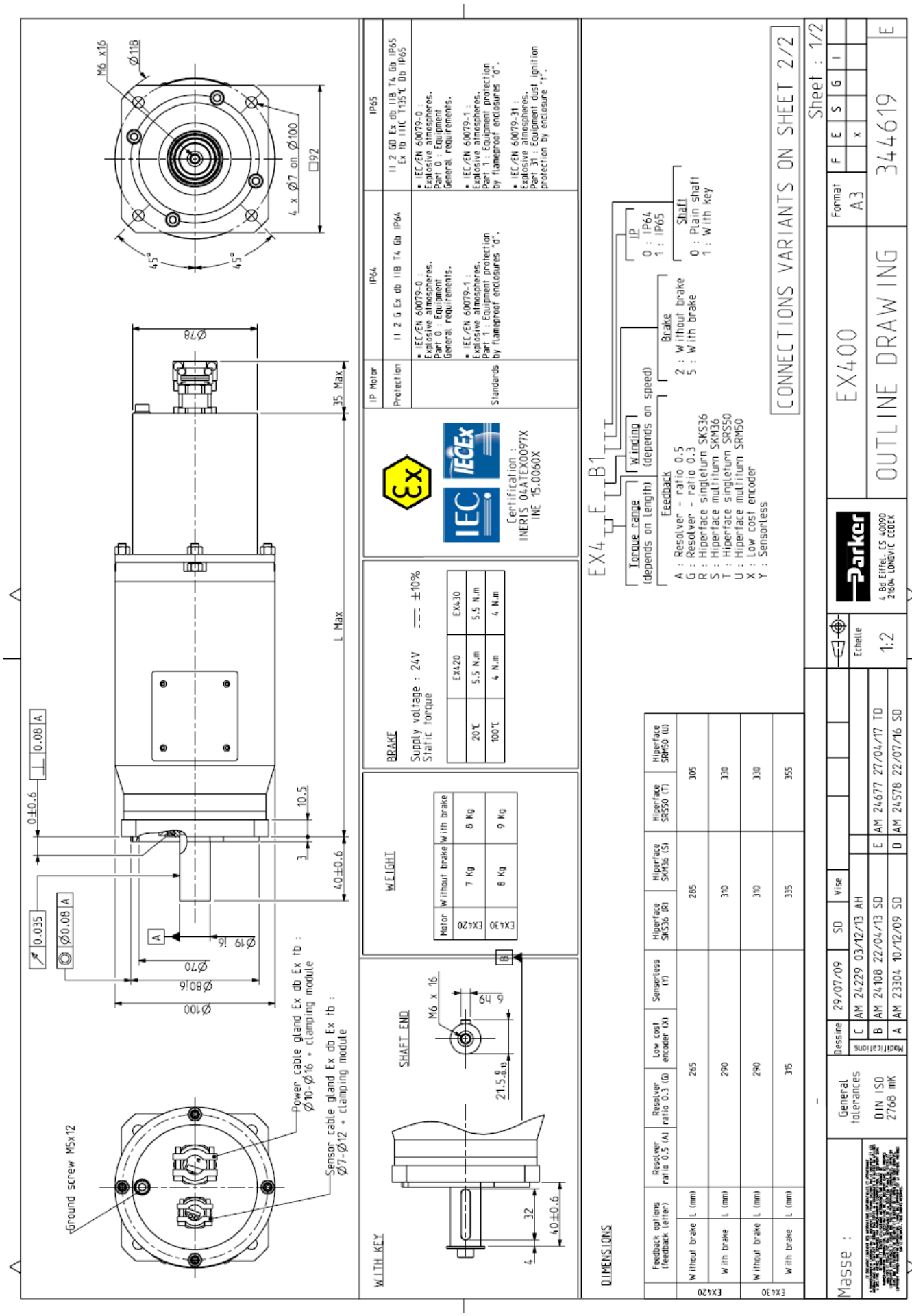
	Warning : EX motors must be connected in accordance with the diagrams given in chapter §4.3.3

3.3. Dimension drawings

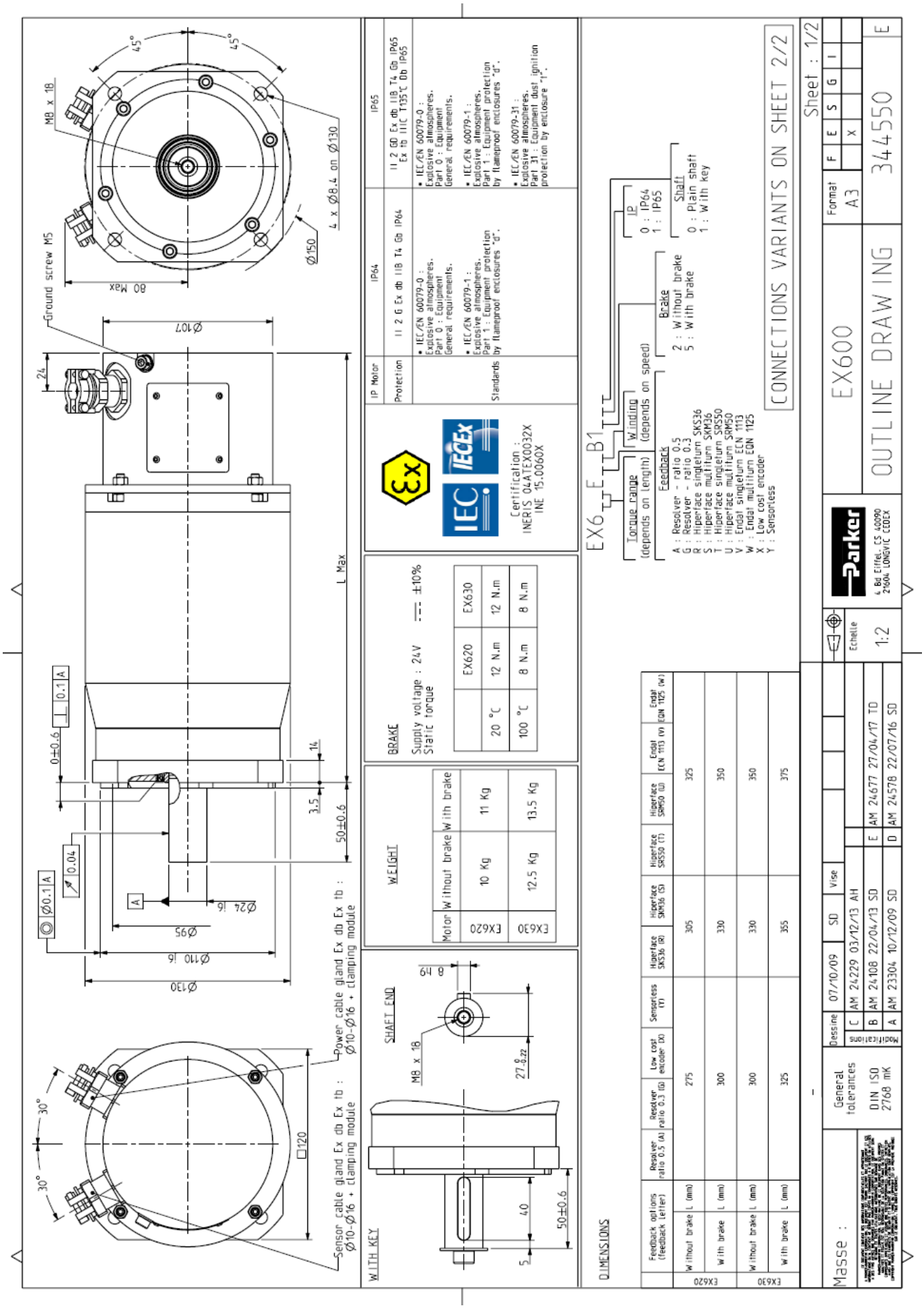
3.3.1. EX310E



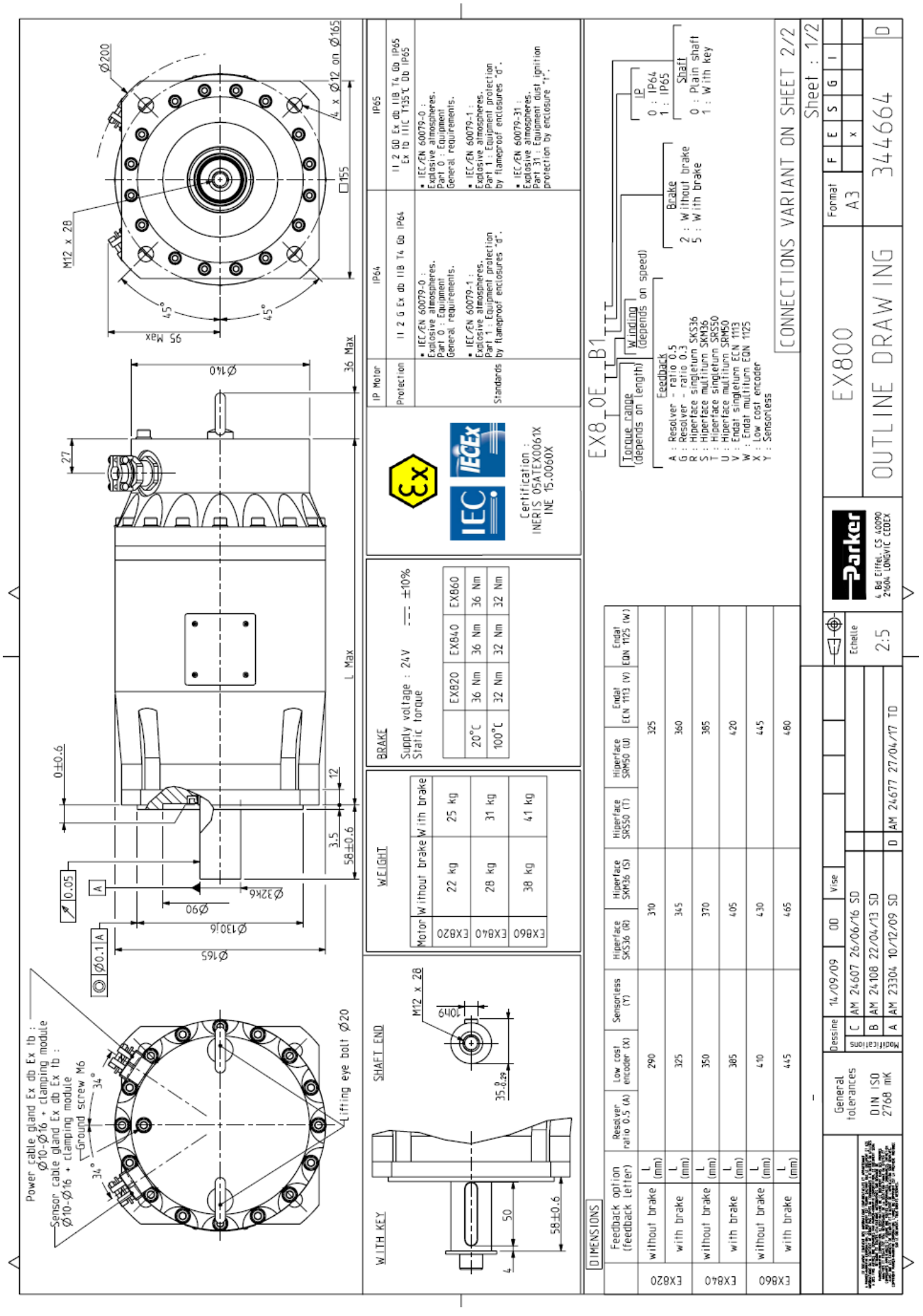
3.3.2. EX420E EX430E



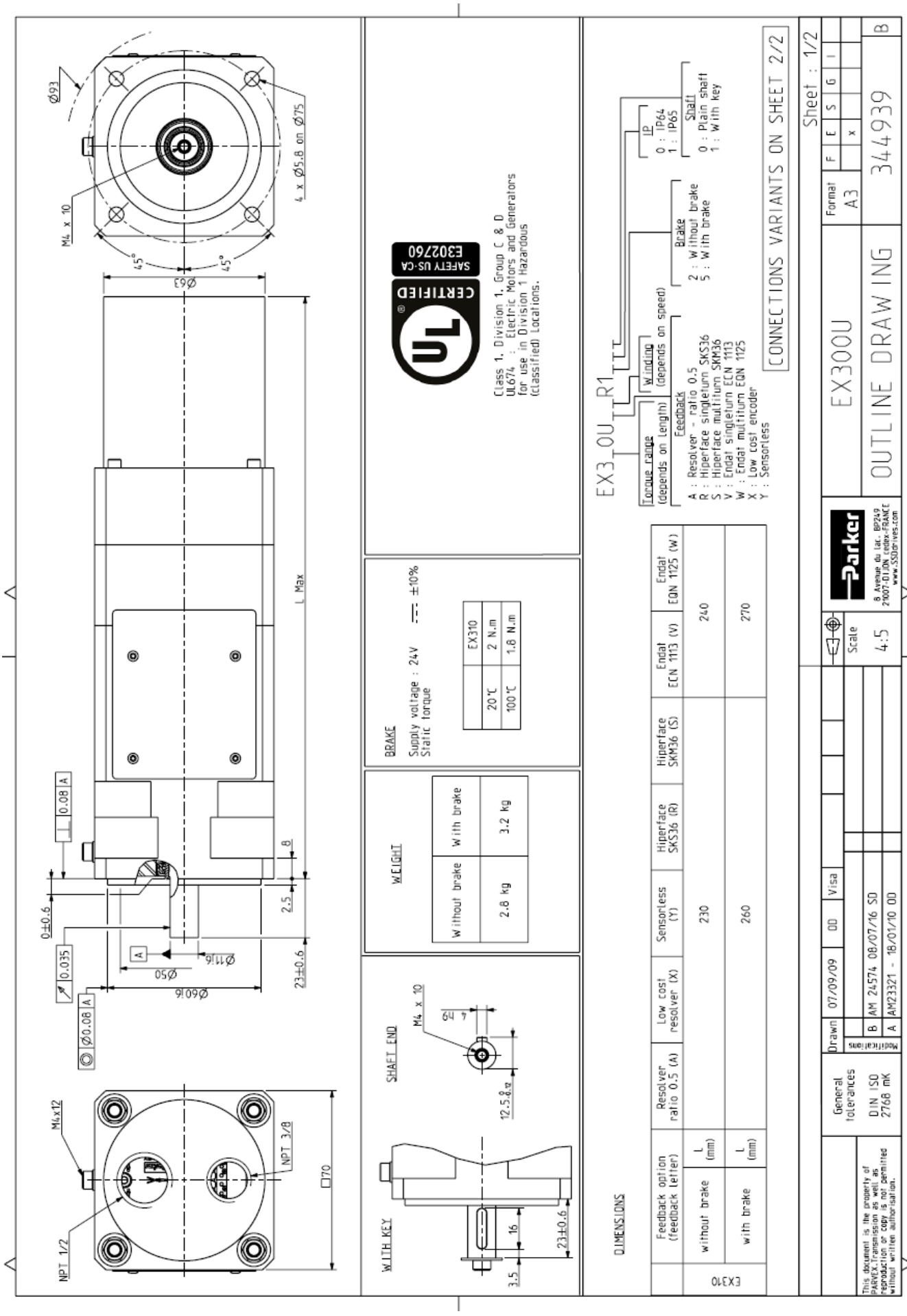
3.3.3. EX620E EX630E



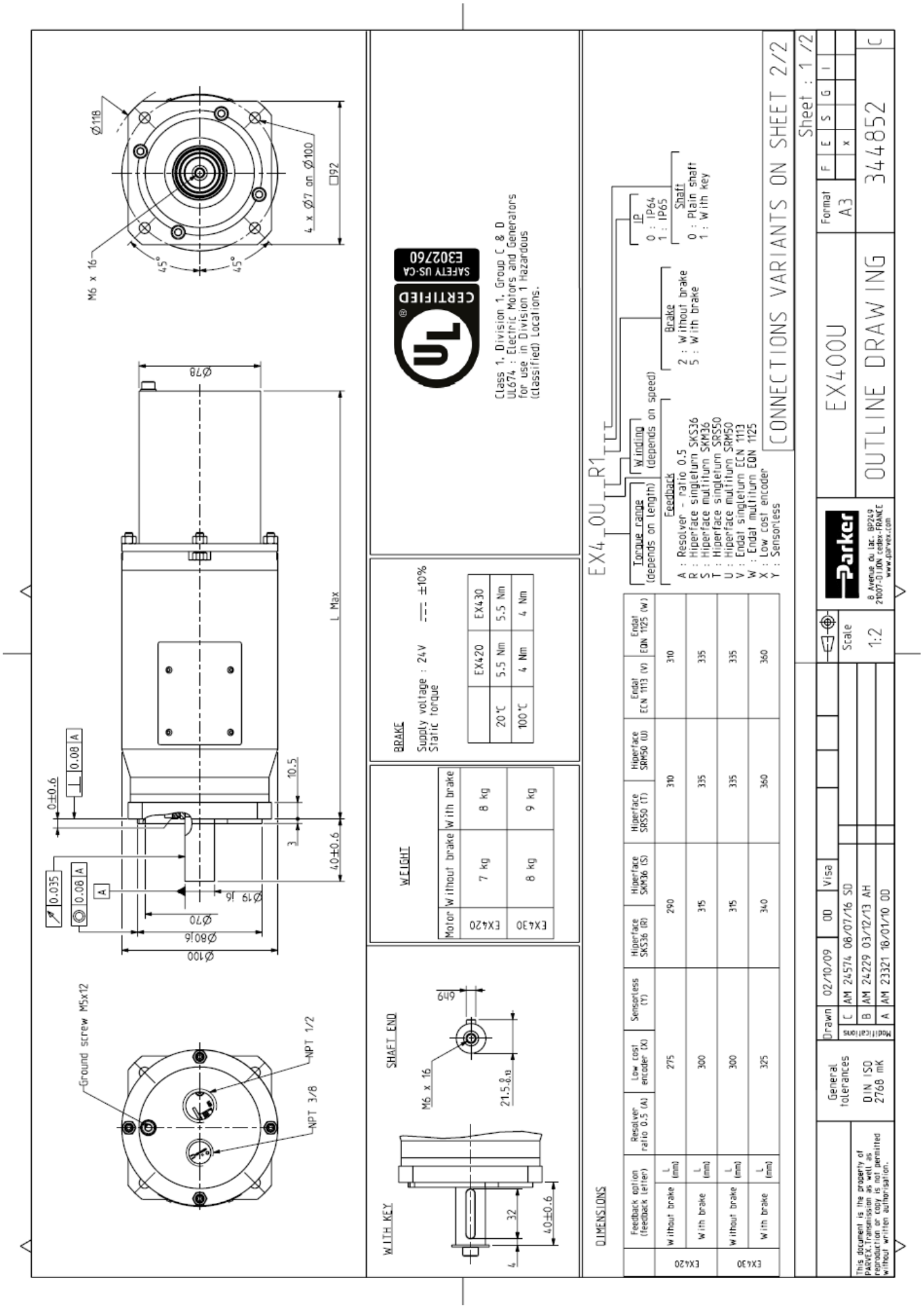
3.3.4. EX820E EX840E EX860E



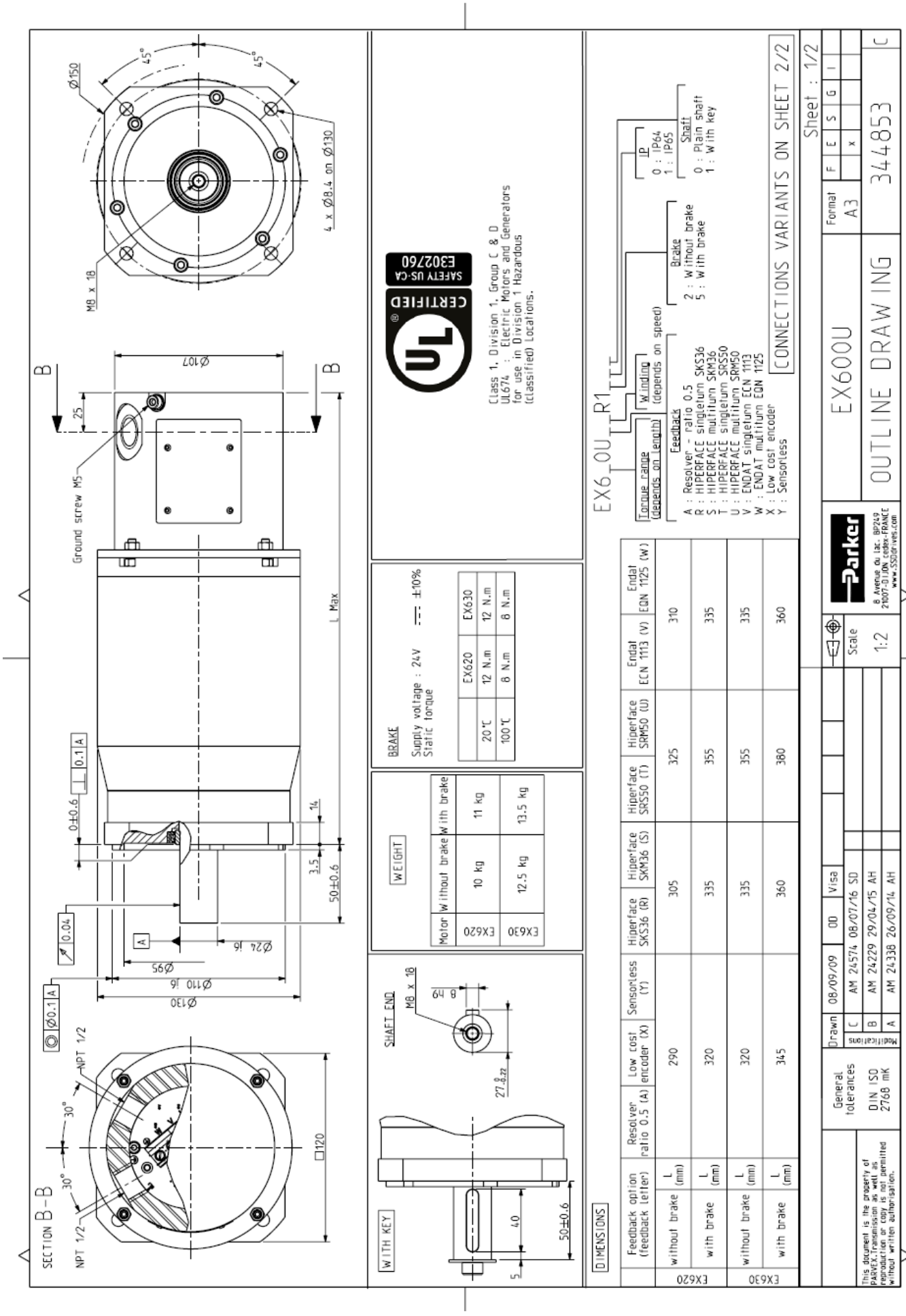
3.3.5. EX310U


EX300U
OUTLINE DRAWING
344939
Sheet : 1/2
CONNECTIONS VARIANTS ON SHEET 2/2
EX3_0U_ _R1
Torque range (depends on length)
Feedback
Winding (depends on speed)
Brake
IP
Shaft
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 encoder
Y : Sensorless
2 : without brake
5 : with brake
0 : IP64
1 : IP65
0 : Plain shaft
1 : With key
CERTIFIED
SAFETY US-CA
E302760
Class 1, Division 1, Group C & D
UL674 : Electric Motors and Generators
for use in Division 1 Hazardous
(classified) Locations.
BRAKE
Supply voltage : 24V ⎓ ±10%
Static torque
EX310
20°C 2 N.m
100°C 1.8 N.m
WEIGHT
Without brake 2.8 kg
With brake 3.2 kg
SHAFT END
WITH KEY
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
with brake L (mm) 260 270
Ø93
4 x Ø5.8 on Ø75
M4 x 10
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
NPT 1/2
□70
M4 x 10
4.7
12.5.8.7
16
3.5
23±0.6
Parker
8 Avenue du Lac BP249
21007 DIJON cedex FRANCE
www.SSDgroves.com
Scale 4:5
Format A3
F E S G I
x
Drawn 07/09/09 OD Visa
B AM 24574 08/07/16 SD
A AM23321 - 18/01/10 OD
Modifications
General tolerances
DIN ISO 2768 mK
This document is the property of PARKEX. Transmission as well as reproduction or copy is not permitted without written authorisation.
B

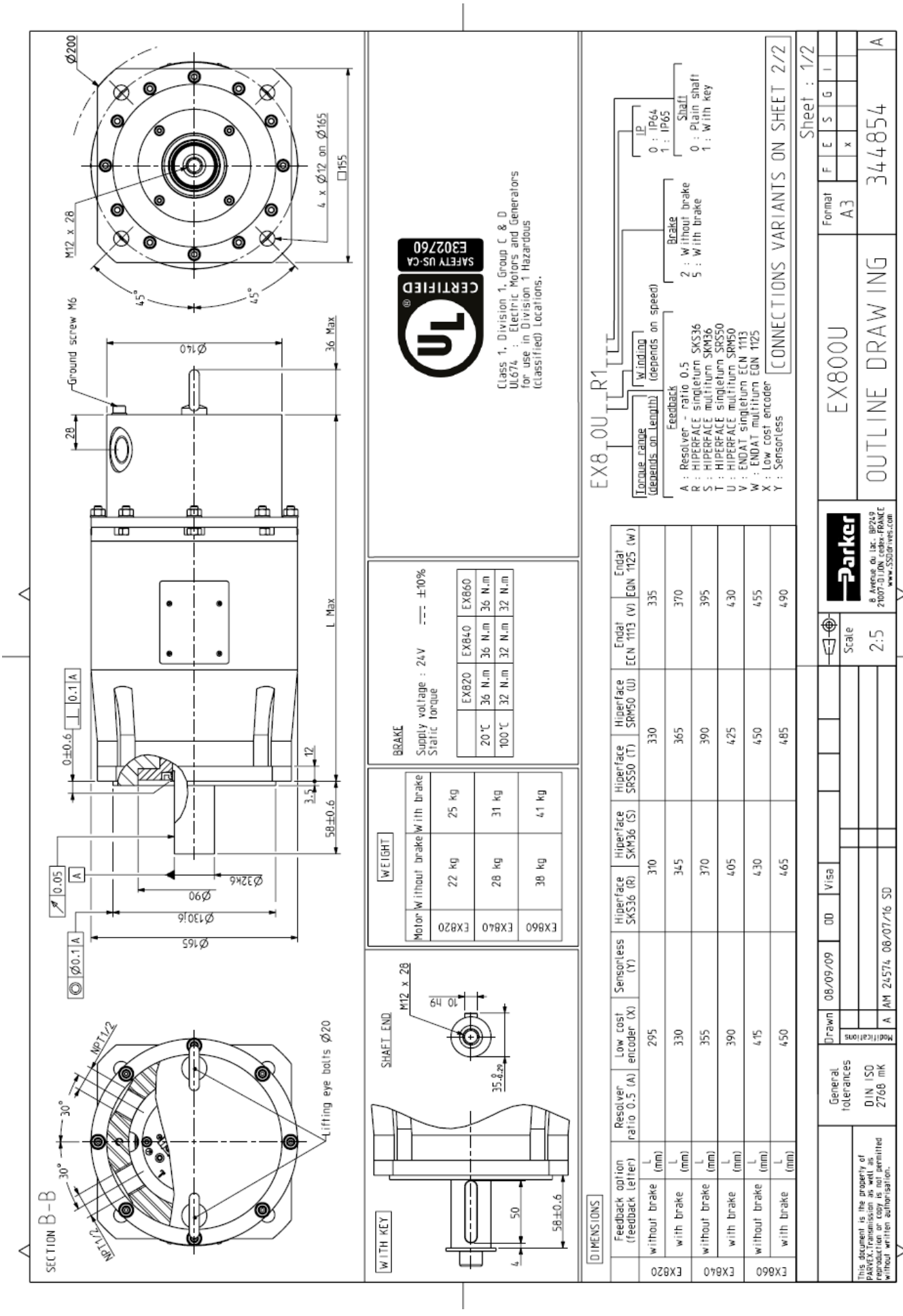
3.3.6. EX420U EX430U



3.3.7. EX620U EX630U



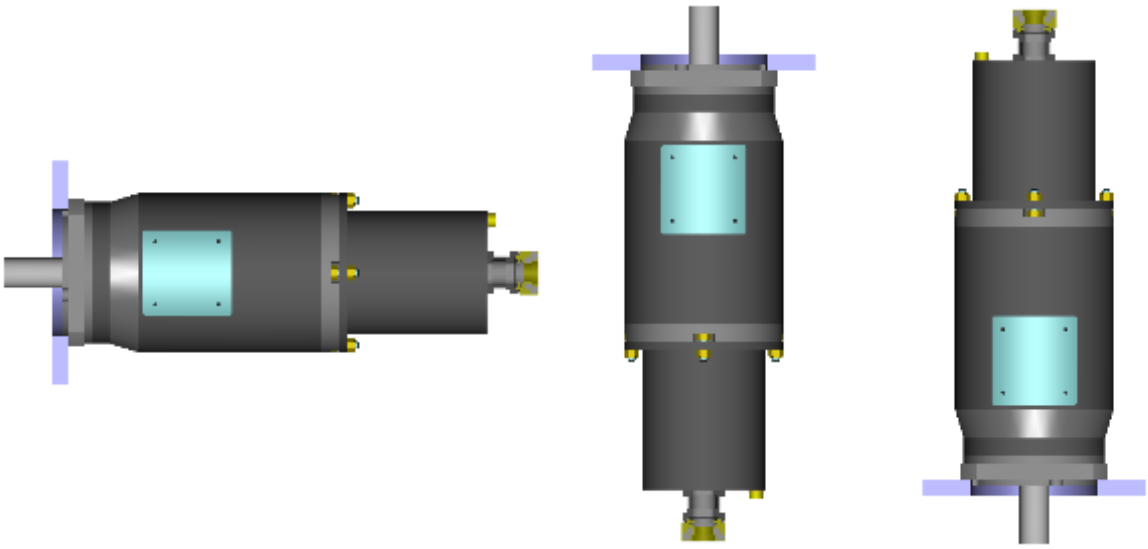
3.3.8. EX820U EX840U EX860U



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 EX motors are equipments with protect mode “db” flameproof enclosure for hazardous area of gas and with protection by enclosure "tb" for hazardous area of dust ignition.

	When installing electris system 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).

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

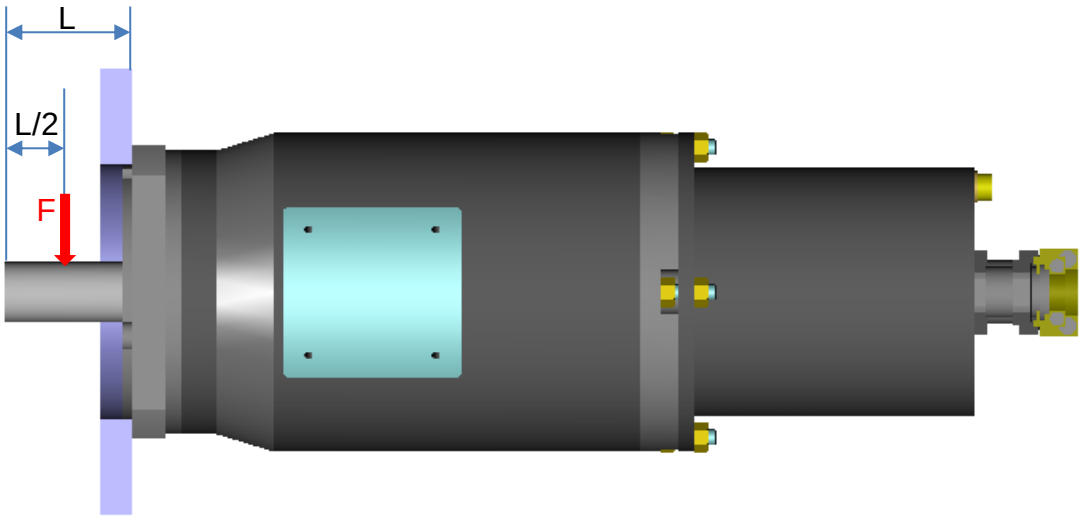
3.5. Shaft Loads

3.5.1. Vibration resistance to shaft end

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

3.5.2. Maximum load acceptable on the shaft

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



	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.

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

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

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

3.6. Cooling

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

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

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

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

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

3.7. 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 (§4.3.3) which constitutes an independent protection circuit meeting safety classification SIL2 in accordance with the standard IEC 61508.

In the motor, there are two 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.

Both thermoswitches and thermofuse are wired in-series with the coil of the drive power contactor. If the maximum temperature is reached, the thermoswitches are opened and temporarily cut off the power supply to the contactor coil. If the temperature reaches a dangerous level (thermoswitches default), the thermofuse melts; permanently cutting off the power supply to the contactor coil.

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.

Caution : (see diagrams §4.3.3) :

- 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. Inlet cables for ATEX/IECEx version.

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

3.8.2. Wires sizes

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

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

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

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

Cable selection

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

	For the ATEX installations in ambient temperature of 40°C or 60°C, you have to use special cables C2 type auto-extinguish regarding the standard EN 50265-2-1. Warning : the cables used in the : • EX3 can reach a temperature of 80°C, • EX4 can reach a temperature of 91°C, • EX6 can reach a temperature of 95°C, • EX8 can reach a temperature of 94°C. Warning : for a safe use, the EX3 servomotors has to be used with cable which withstand a maximum temperature of 80°C. Warning : for a safe use, the EX4/EX6/EX8 servomotors has to be used with cable which withstand a maximum temperature of 100°C.

	It is mandatory to connect 2 (green-yellow) ground cables between the motor frame and machine. • the first one is connected to ground screw on the PCB inside the motor, • 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

3.8.3. 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

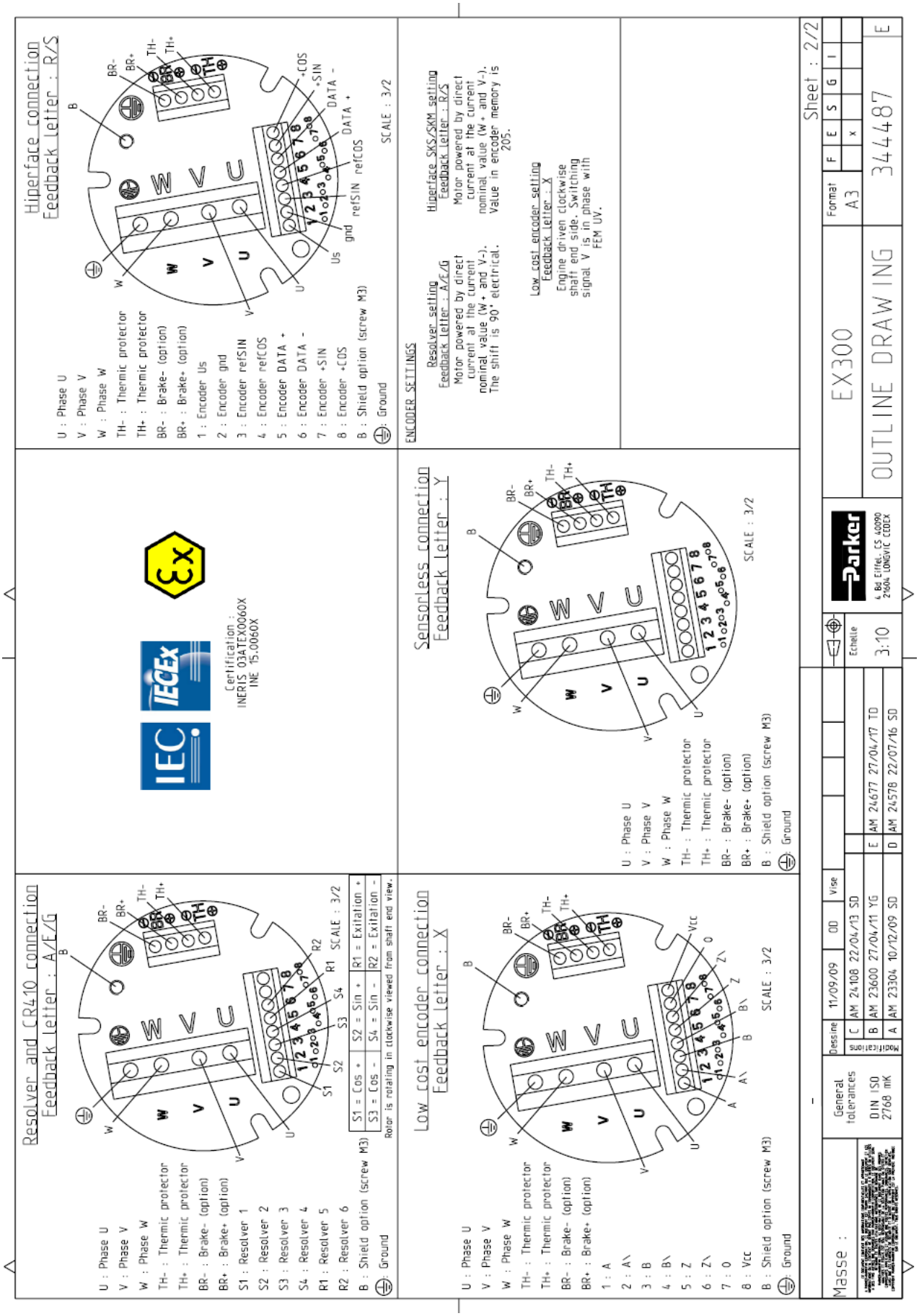
3.8.4. Motor cable length

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.

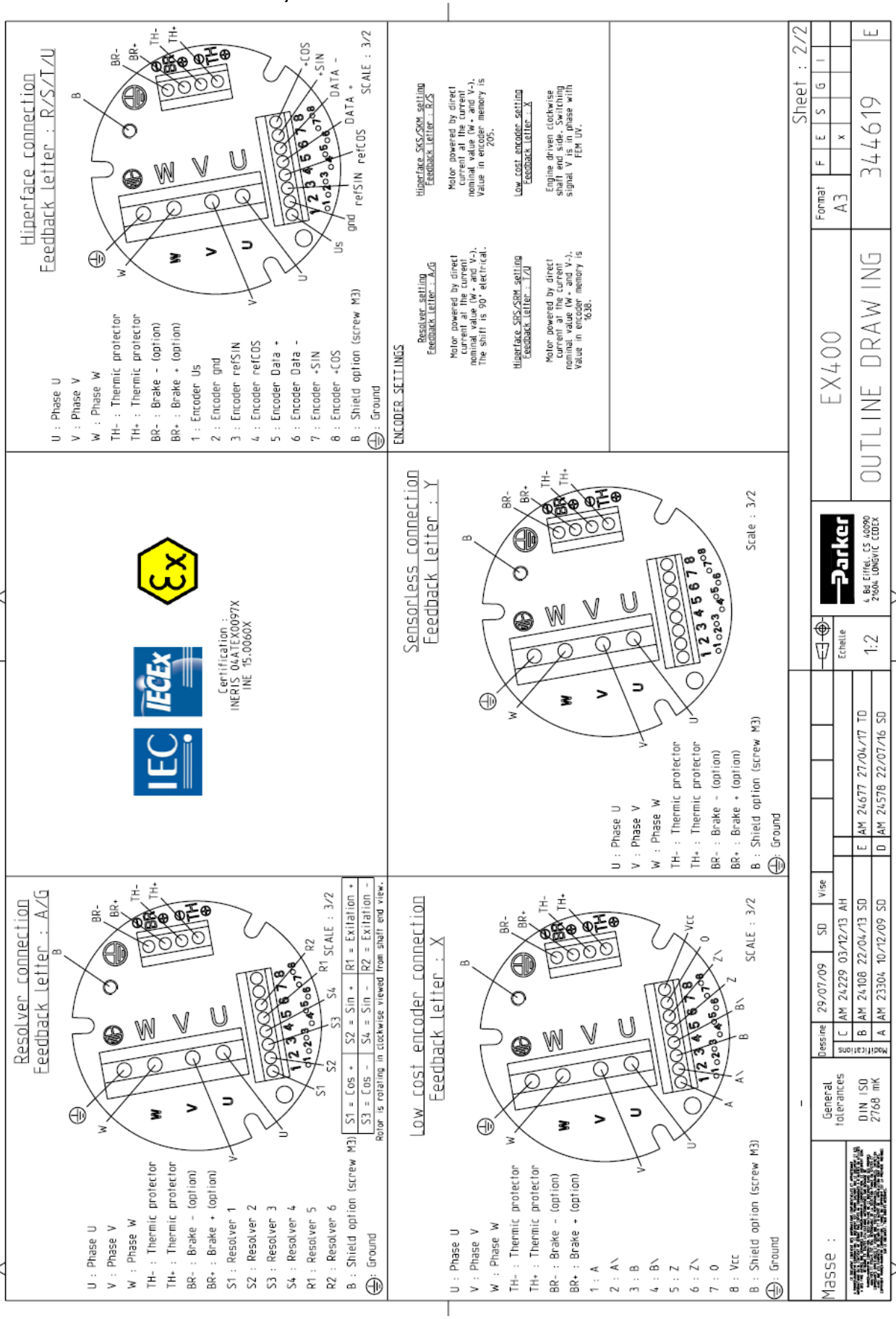
	Caution: It might be necessary to fit a filter at the servo-drive output if the length of the cable exceeds 25 m. Consult us.
	The length of the cable must be of 3 meters min.

3.8.5. Mains supply connection diagrams

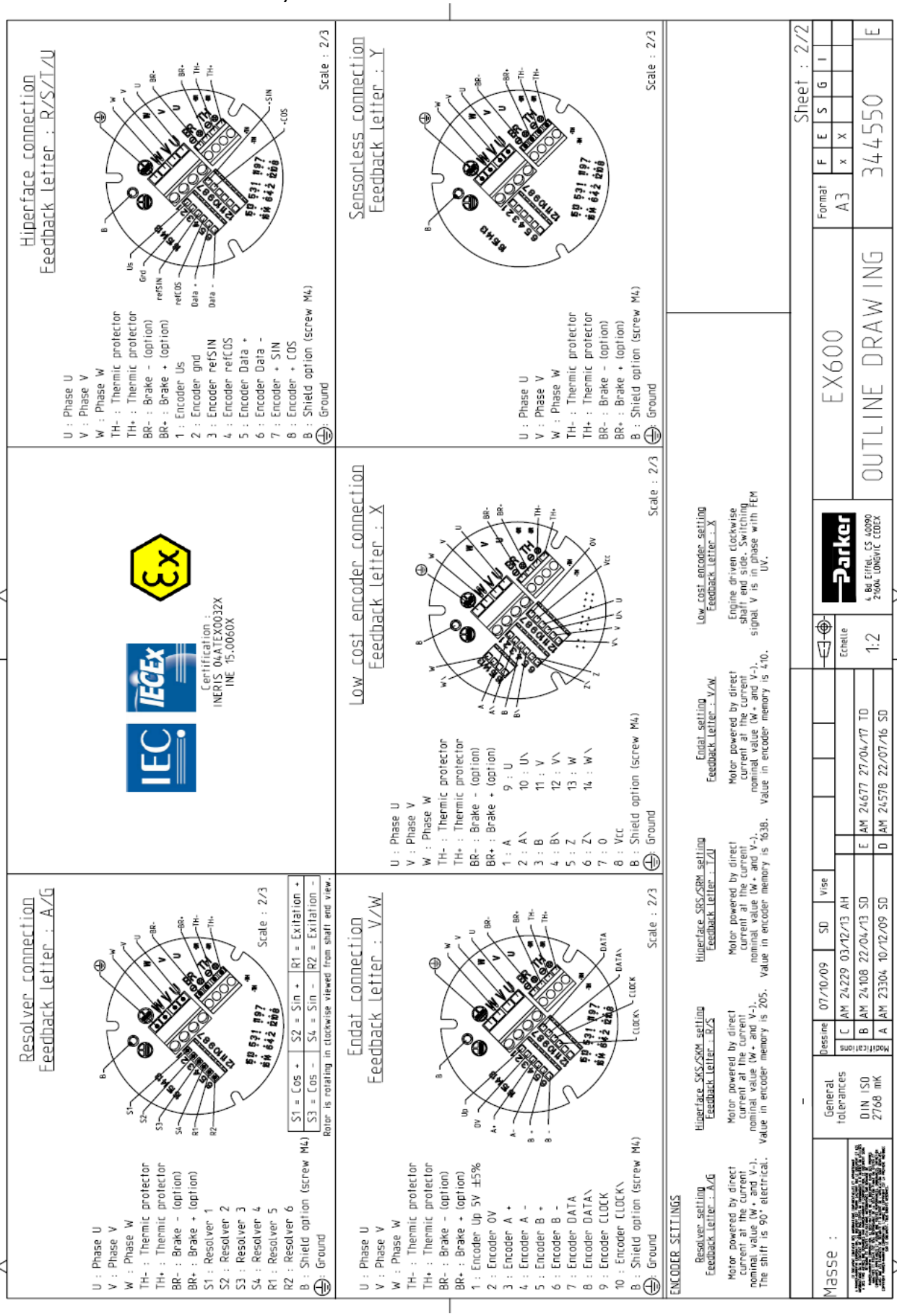
3.8.5.1. EX310E



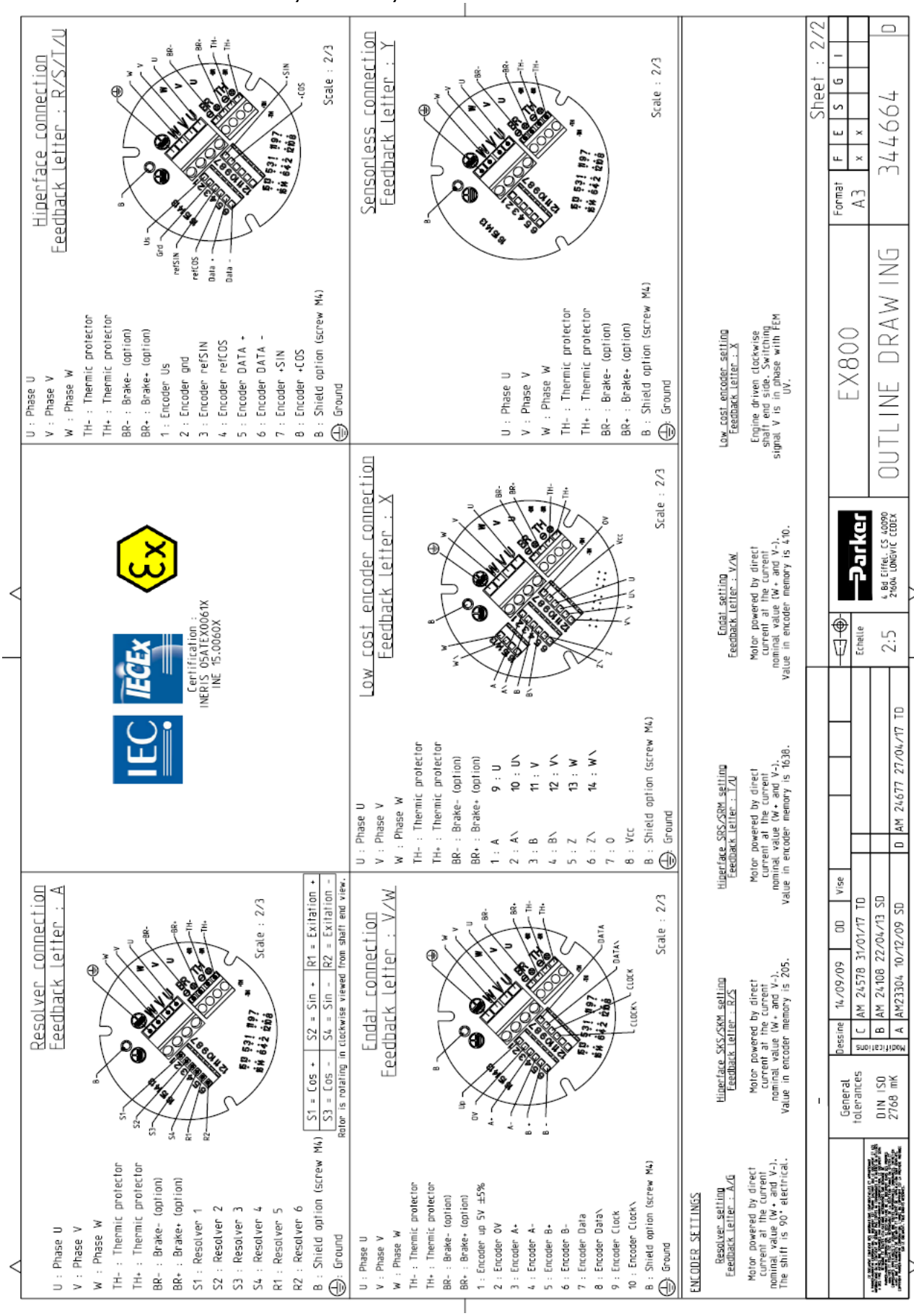
3.8.5.2. EX420E, EX430E



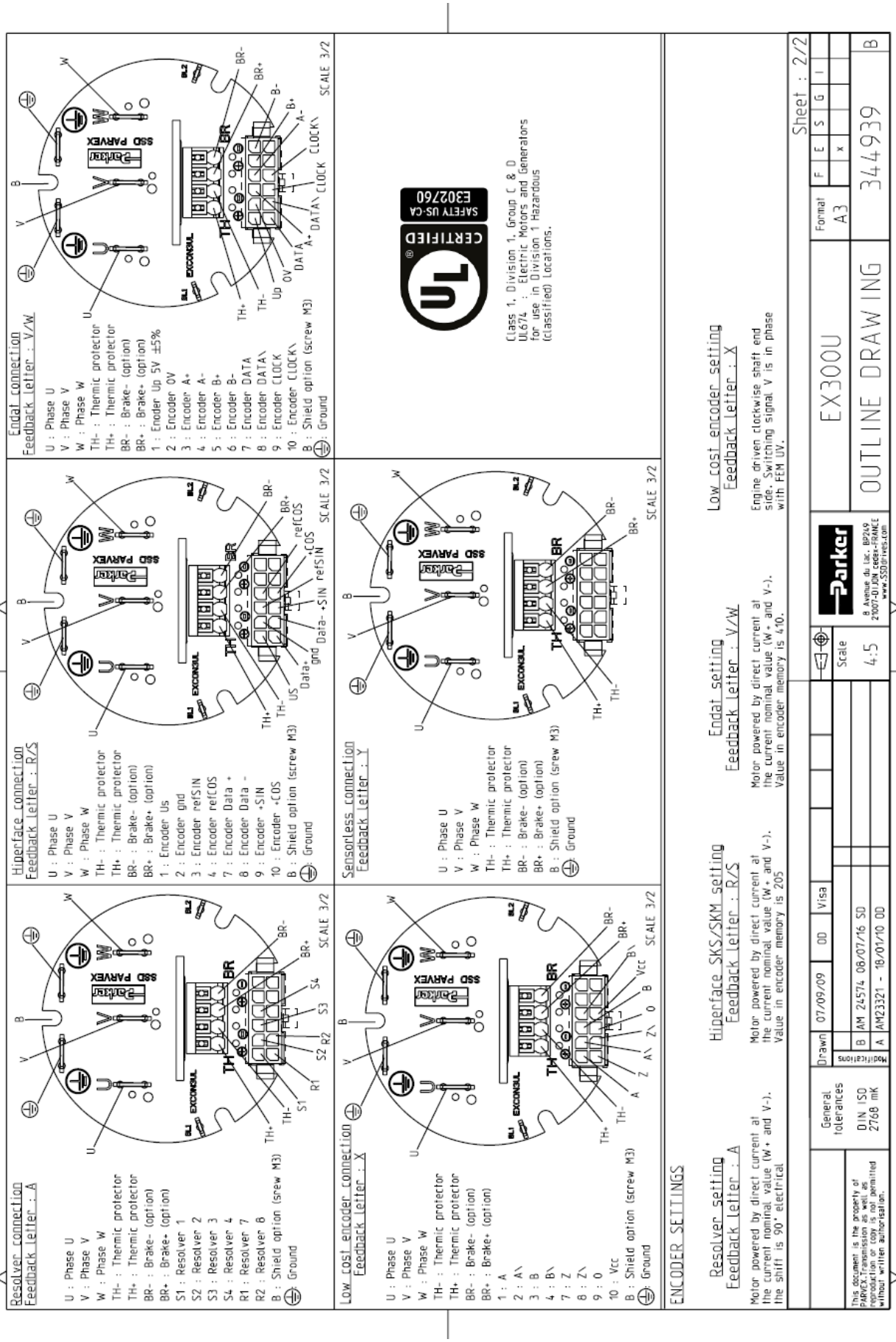
3.8.5.3. EX620E, EX630E



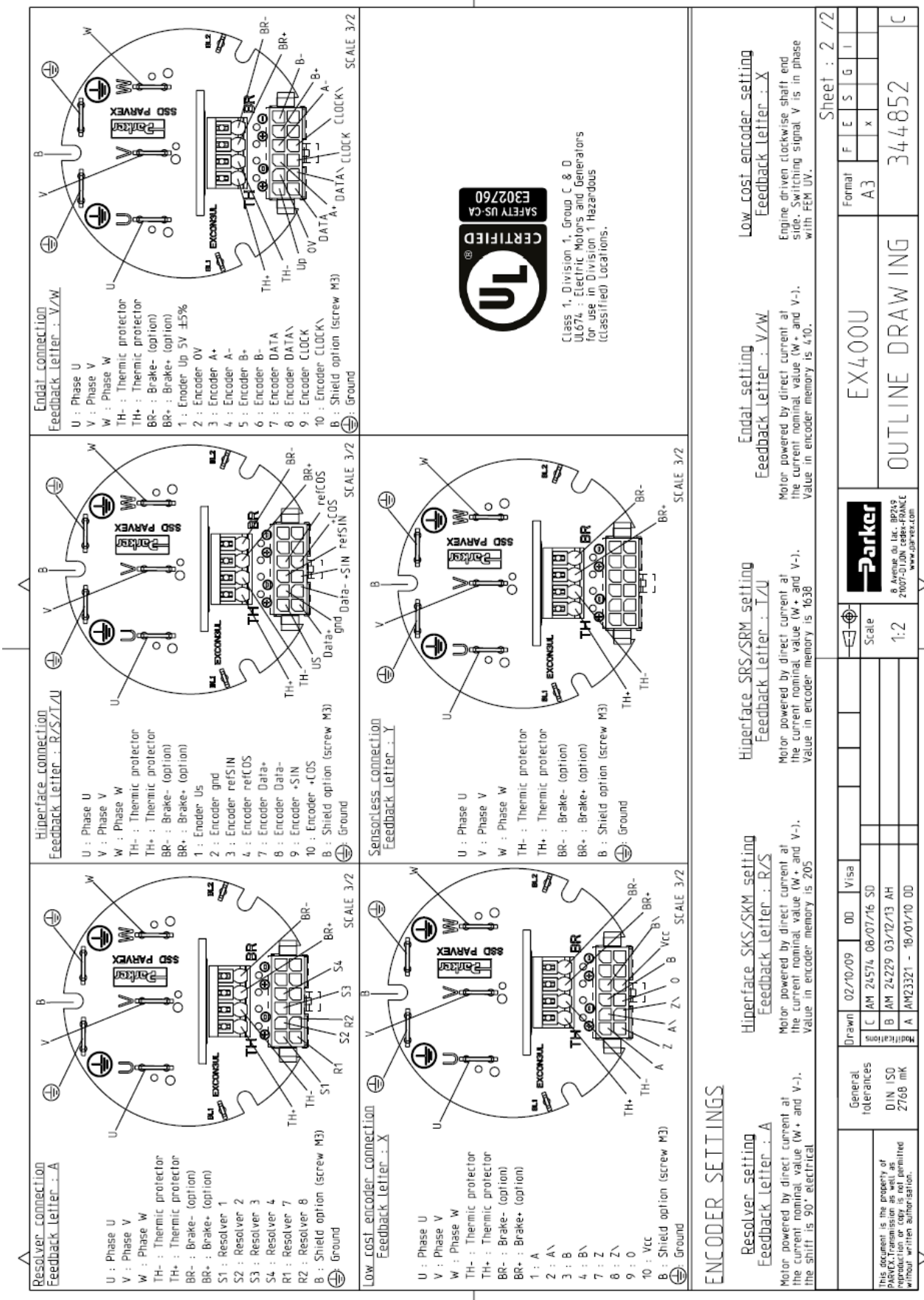
3.8.5.4. EX820E, EX840E, EX860E



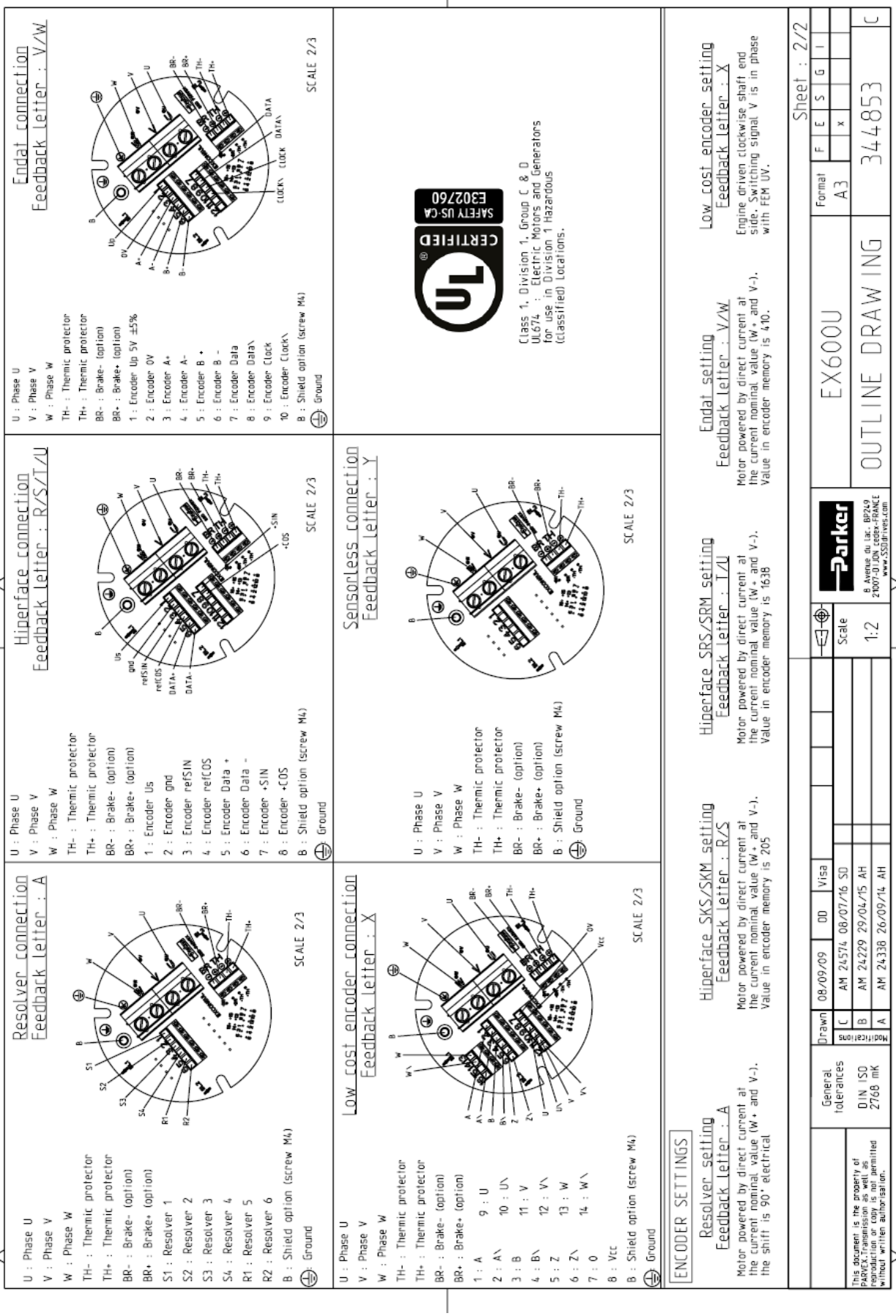
3.8.5.5. EX310U


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
SCALE 3/2
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
SCALE 3/2
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
SCALE 3/2
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
SCALE 3/2
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 (screw M3)
Ground
SCALE 3/2
CERTIFIED
SAFETY US-CA
E302760
Class 1, Division 1, Group C & D
UL674 : Electric Motors and Generators
for use in Division 1 Hazardous
(classified) Locations.
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.
Sheet : 2/2
Format A3
EX300U
OUTLINE DRAWING
344939
B
General tolerances
DIN ISO 2768 mK
Modifications
Drawn 07/09/09 OD Visa
B AM 24574 08/07/16 SD
A AM23321 - 18/01/10 OD
Scale 4:5
Parker
8 Avenue du Lac BP249
21007-DIJON cedex-FRANCE
www.SSDdrives.com
This document is the property of
PARKER transmission as well as
the information it contains. It cannot be copied
without written authorisation.

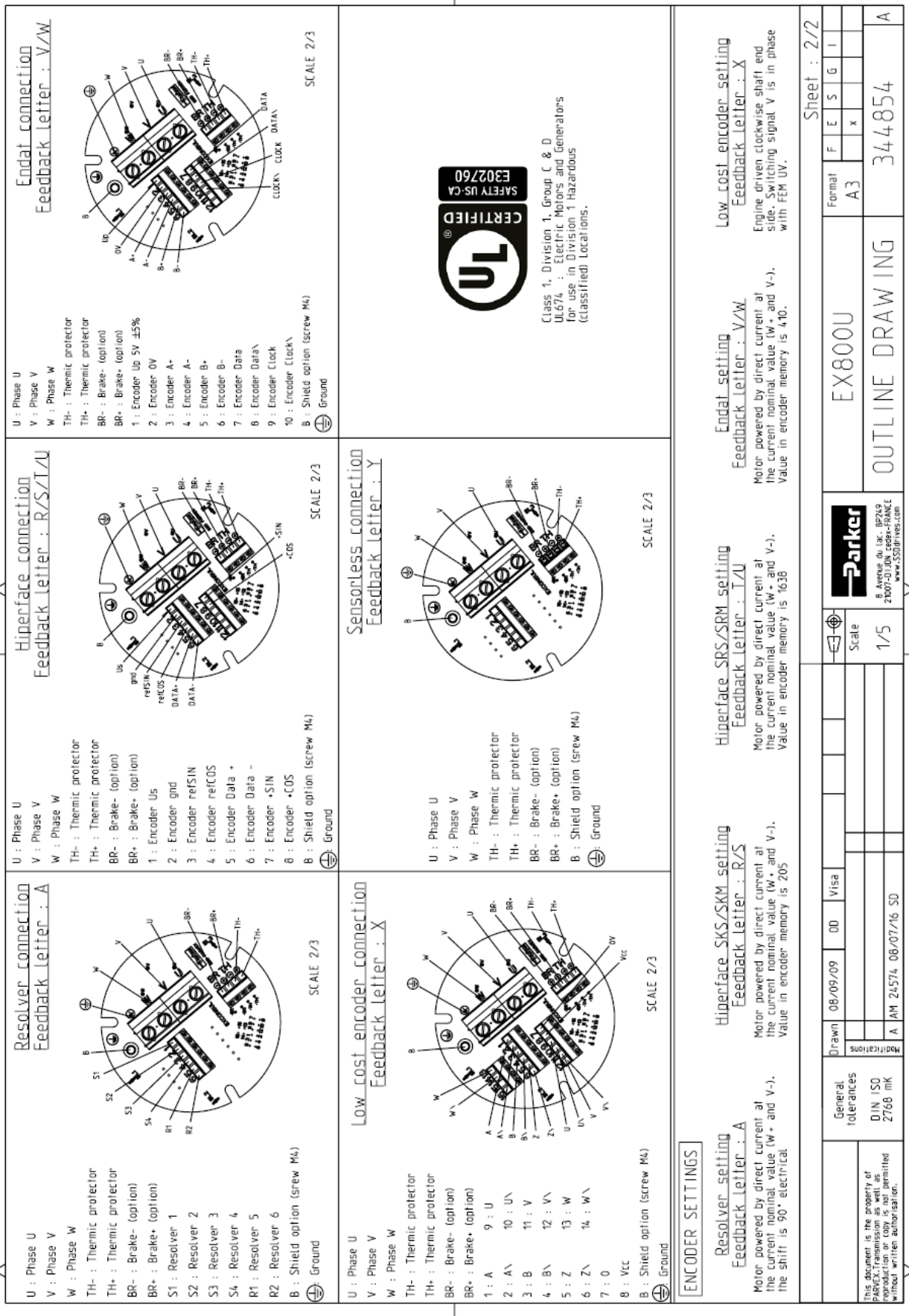
3.8.5.6. EX420U, EX430U



3.8.5.7. EX620U, EX630U

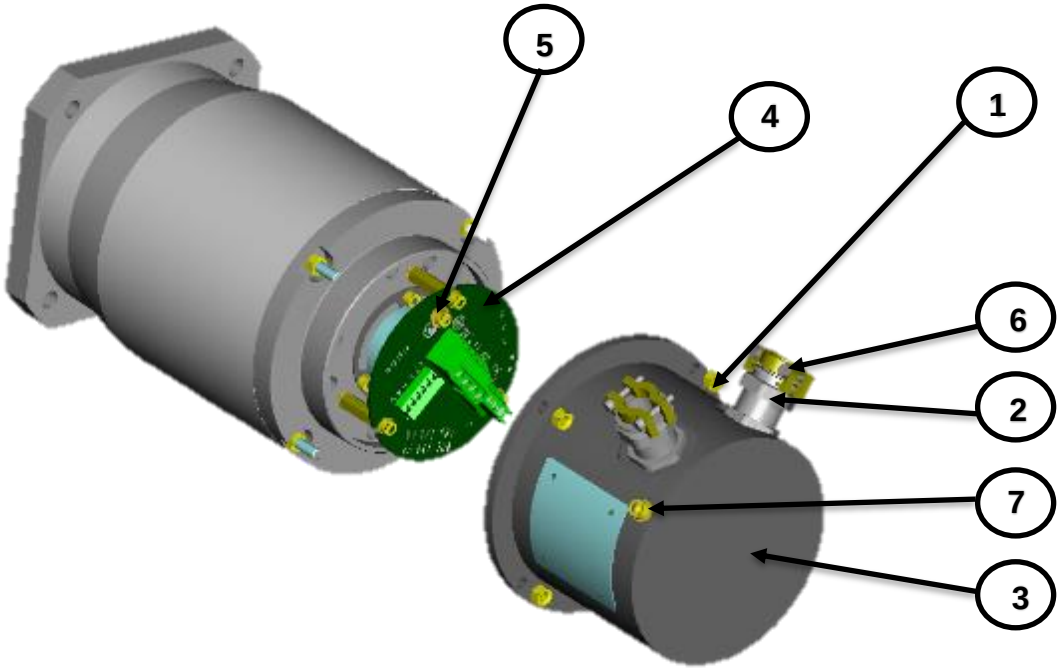


3.8.5.8. EX820U, EX840U, EX860U



3.8.6. ATEX/IECEx motor conenction

3.8.6.1. Connection of the power and the feedback cables with terminals



Step 1 – Remove the rear cover :

1. Unscrew the nuts for the EX3-EX4-EX6 and the screws for the EX8 Ref 1.
2. Unscrew the cable gland caps Ref 2.
3. Remove the cover Ref 3.

Step 2 – Connection of the feedback cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm.
3. Put the wires in the terminals on the PCB Ref 4 and tighten each screws at the torque value of 0,6 N.m.
4. Make the shielding connection with the connection of the terminal on the screw Ref 5 at the torque value of :

Motor size	Torque (N.m)
EX3-EX4 M3 screw	1,7
EX6-EX8 M4 screw	2,5

5. If the shielding connection is not necessary, cut the wire short the cable.

Step 3 – Connection of the power cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm.
3. Put the wires U, V, W, Ground, TH+ and TH- and also BR+ and BR- in a case of a motor with a brake in the terminal of the PCB Ref 4 and tighten each screws at the torque value of 0,6N.m.
4. Make the shielding connection with the connection of the terminal on the screw Ref 5 at the torque value of :

Motor size	Torque (N.m)
EX3-EX4 M3 screw	1,7
EX6-EX8 M4 screw	2,5

5. If the shielding connection is not necessary, cut the wire short the cable.

Step 4 – Fitting of the rear cover :

1. Slowly take up any slack in the cables and close the cover Ref 3.
2. Tighten the cable gland caps Ref 2 at the torque value of :

Cable gland size	Torque (N.m)
M16	12,5
M20	20

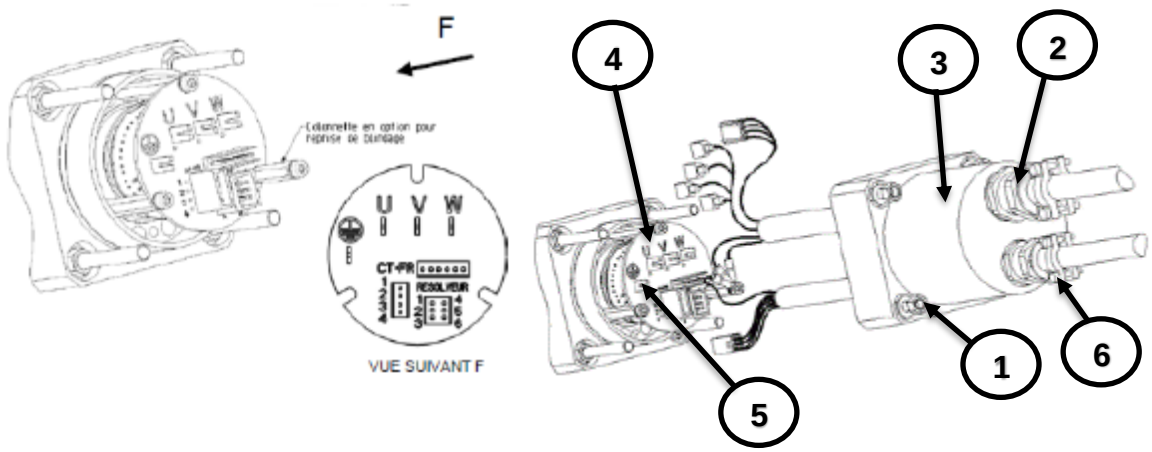
3. Tighten the screws of the connection modules Ref 6 at the torque value of 0,5 N.m.
4. Place the rear cover Ref 3 and take care to don't hurt the toric seal placed on the rear flange.
5. Tighten the nuts for the EX3-EX4-EX6 and the screws for the EX8 Ref 1 at the torque value of :

Motor size	Torque (N.m)
EX3-EX4-EX6 4 M5 nuts	5,6
EX8 16 screws M6	16

6. Connect the outside ground with the screw Ref 7 and tighten it at the torque value of :

Motor size	Torque (N.m)
EX3 M4 screw	2,5
EX4-EX6 M5 screw	5,6
EX8 M6 screw	8,5

3.8.6.2. Connection of the feedback and power cable with connector on EX3 :



Step 1 – Remove the rear cover :

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

Step 2 – Connection of the feedback cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm and crimp them in the connector.
3. Plug the connector in the terminal of the PCB Ref 4 .
4. Crimp the shielding wire in the connector and plug the connector in the terminal Ref 5.
5. If the shielding connection is not necessary, cut the wire short the cable.

Step 3 – Connection of the power cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm and crimp them in the connector.
3. Put the wires U, V, W, Ground, TH+ and TH- and also BR+ and BR- in a case of a motor with a brake equiped with their connectors on the terminal of the PCB Ref 4.
4. Crimp the shielding wire in the connector and place the connector in the terminal Ref 5.
5. If the shielding connection is not necessary, cut the wire short the cable.

Step 4 – Fitting of the rear cover :

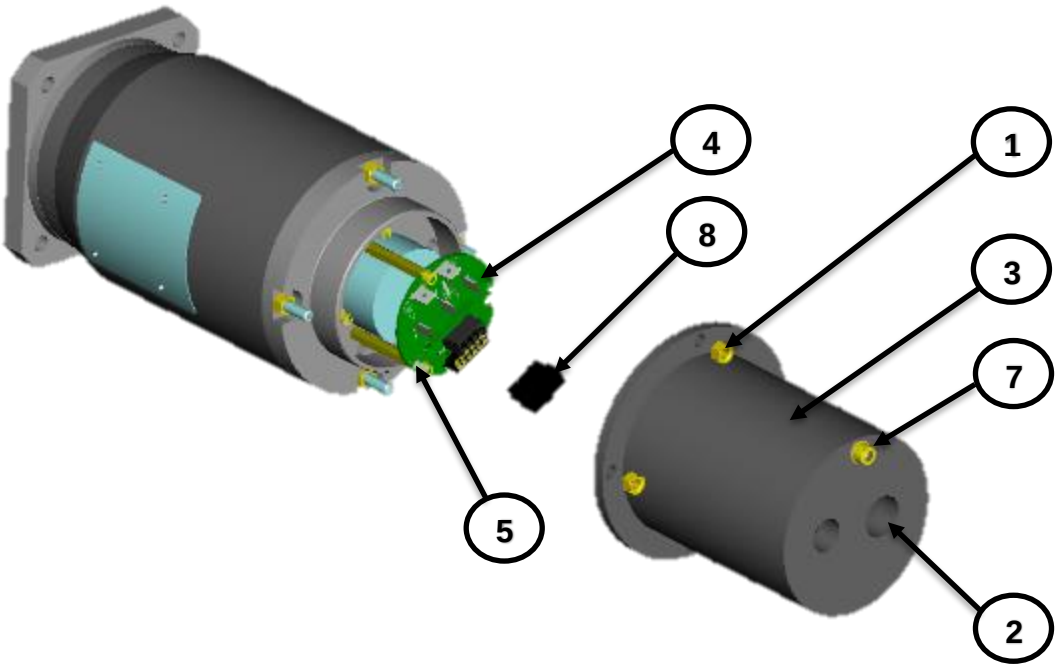
1. Slowly take up any slack in the cables and close the cover Ref 3.
2. Tighten the cable gland caps Ref 2 at the torque value of :

Cable gland size	Torque (N.m)
M16	12,5
M20	20

3. Tighten the screws of the connection modules Ref 6 at the torque value of 0,5 N.m.
4. Place the rear cover Ref 3 and take care to don't cut the toric seal placed on the rear flange.
5. Tighten the 4 nuts Ref 1 at the torque value of 5,6 N.m.
6. Connect the outside ground with the screw Ref 7 and tighten it at the torque value of 2,5 N.m.

3.8.7. EX3-EX4 UL connection

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



Step 1 – Remove the rear cover:

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

Step 2 – Connection of the feedback cable :

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

Step 3 – Connection of the power cable :

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

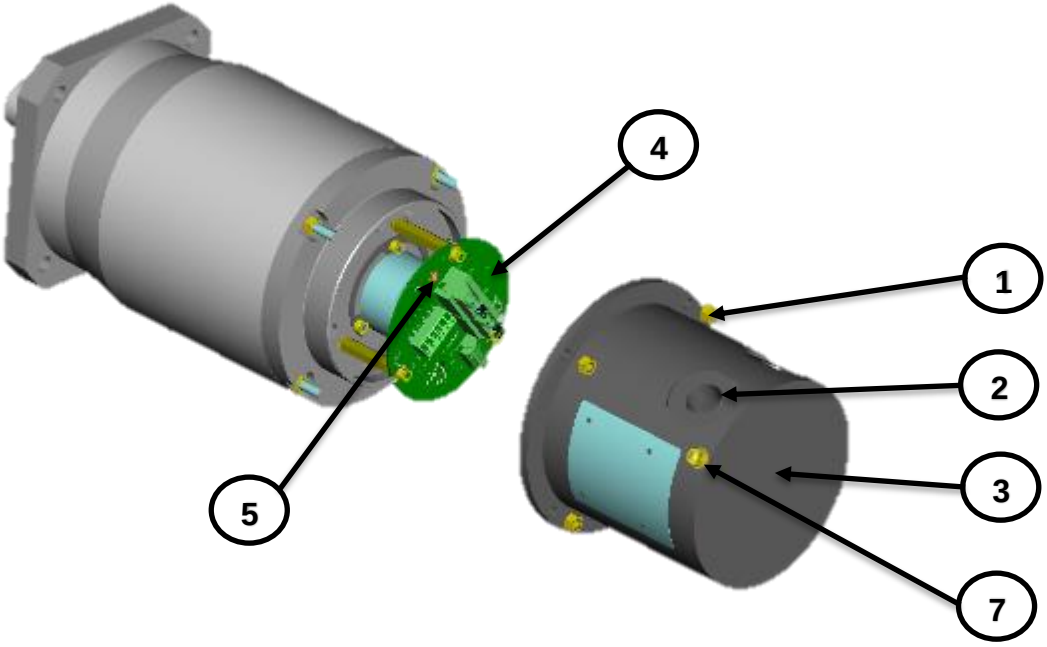
Step 4 – Fitting of the rear cover :

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

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

3.8.8. EX6-EX8 UL connection

3.8.8.1. Connection of the feedack and power cable with terminal:



Step 1 – Remove the rear cover :

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

Step 2 – Connection of the feedback cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm.
3. Put the wires in the terminals on the PCB Ref 4 and tighten each screws at the torque value of 0,6 N.m.
4. Make the shielding connection with the connection of the terminal on the screw M4 Ref 5 at the torque value of 2,5 N.m.
5. If the shielding connection is not necessary, cut the wire short the cable.

Step 3 – Connection of the power cable :

1. Insert the cable in the cable gland Ref 2.
2. Strip the wires on 3 mm.
3. Put the wires U, V, W, Ground, TH+ and TH- and also BR+ and BR- in a case of a motor with a brake in the terminal of the PCB Ref 4 and tighten each screws at the torque value of 0,6N.m.
4. Make the shielding connection with the connection of the terminal on the screw ref 5 at the torque value of 2,5 N.m.
5. If the shielding connection is not necessary, cut the wire short the cable.

Step 4 – Fitting of the rear cover :

7. Slowly take up any slack in the cables and close the cover Ref 3.
8. Tighten the cable gland caps or conduits stop Ref 2.
9. Place the rear cover Ref 3 and take care to don't hurt the toric seal placed on the rear flange.
10. Tighten the 4 nuts Ref 1 at the torque value of :

Motor size	Torque (N.m)
EX6 M5 nuts	5,6
EX8 M6 nuts	8,5

11. Connect the outside ground with the screw Ref 7 and tighent it at the torque value of :

Motor size	Torque (N.m)
EX6 M5 screw	5,6
EX8 M6 screw	8,5

3.9. Feedback system

3.9.1. Shaft rotation regarding the connection.

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

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

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

3.9.3. Sensorless – code K or Y.

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

3.9.4. 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)*
Operating 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

3.9.5. 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)*
Operating 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

3.9.6. 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)*
Operating 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

3.9.7. 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)*	
Operating 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	

3.9.8. Endat encoder singleturn ECN1113 – code V

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

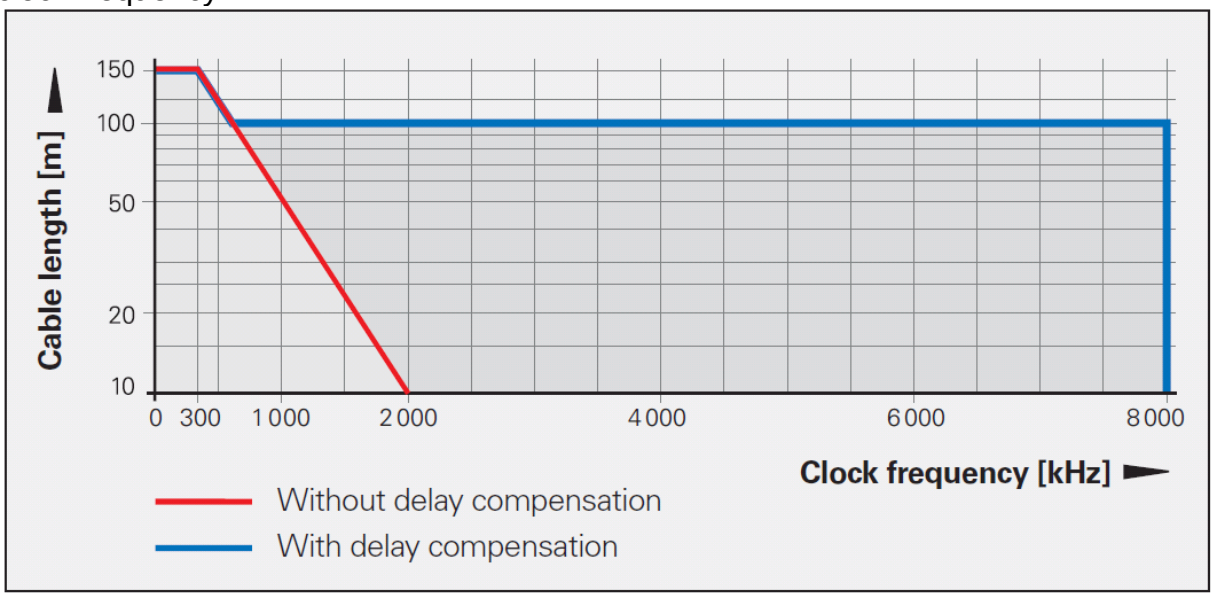
3.9.9. Endat encoder multiturn ECN1125 – code W

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

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

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

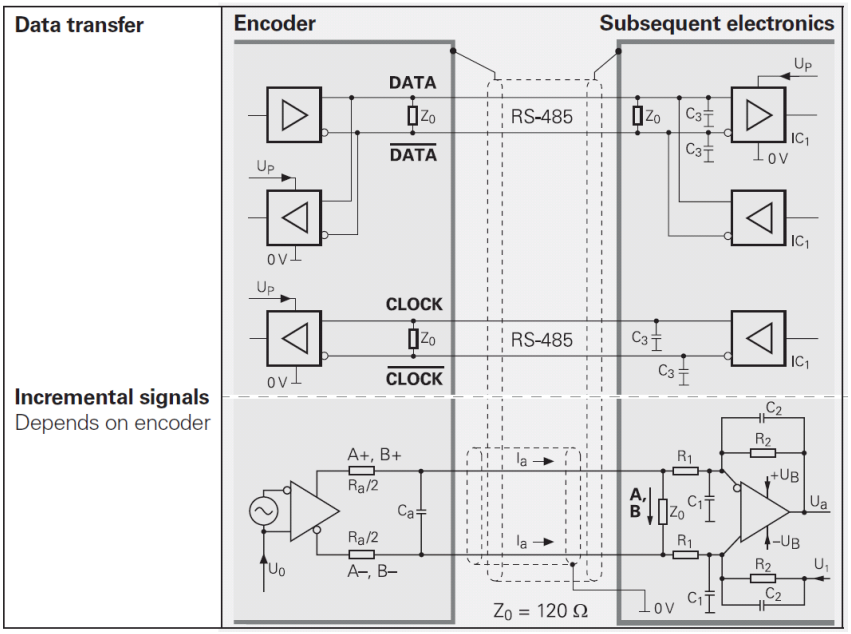
From Heidenhain

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



3.9.10. Incremental encoder - Commuted lines 10 poles – 2048pulses – code X (On request)

	EX3, EX4, EX6 & EX8
Model	F10 (Hengstler)
Type	Incremental encoder with 10 pole commutation signals
Parker part number	220167P0003
Line count	2048 pulses per revolution
Electrical interface	Line driver 26LS31
System accuracy	Incremental signals ± 2.5' commutation signals ± 6'
Operating speed	5 000 rpm
Power Supply Current consumption (without load)	5VDC ± 10% 100mA
Max pulse frequency	300 kHz
Operating temperature range	0°C to +120 °C

3.10. Cables

You can connect EX motors to PARKER servo drives : AC30, AC890, COMPAX3, PSD 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 with a minimal length of 3m.
Ex : for 20m cable, "xxx" = 020.

Special requirements for ATEX servomotors

	For the ATEX installations in ambient temperature of 40°C or 60°C, you have to use special cables C2 type auto-extinguish regarding the standard EN 50265-2-1. Warning : the cables used in the : • EX3 can reach a temperature of 80°C, • EX4 can reach a temperature of 91°C, • EX6 can reach a temperature of 95°C, • EX8 can reach a temperature of 94°C. Warning : for a safe use, the EX3 servomotors has to be used with cable which withstand a maximum temperature of 80°C. Warning : for a safe use, the EX4/EX6/EX8 servomotors has to be used with cable which withstand a maximum temperature of 100°C.

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

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

Size EX4 :

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

Size EX6 :

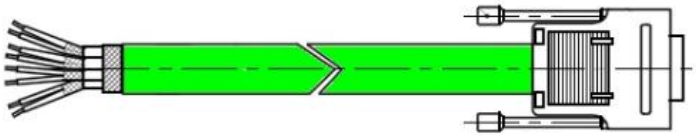
	EX6 certified for an ambient temperature of -20 to +40°C	**EX6 certified for an ambient temperature of -20 to +60°C**
Ambient temperature for Parker standard cable using (Max 100°C)	-20 to +40°C	-20 to +60°C
Ambient temperature for an using of cables withstanding a max temperature of 80°C.	-20 to +27°C	-20 to +45°C

Size EX8 :

	EX8 certified for an ambient temperature of -20 to +40°C	**EX8 certified for an ambient temperature of -20 to +60°C**
Ambient temperature for Parker standard cable using (Max 100°C)	-20 to +40°C	-20 to +60°C
Ambient temperature for an using of cables withstanding a max temperature of 80°C.	-20 to +32°C	-20 to +46°C

3.10.2. Resolver cable connection for AC890

Cable reference :
CS4UA1D1R0xxx



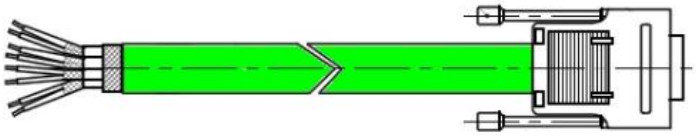
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

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

3.10.3. Endat cable connection for AC890

Cable reference :
CS4UV1D1R0xxx



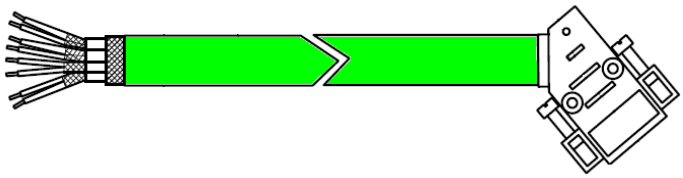
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

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

3.10.4. Resolver cable connection for COMPAX3

Cable reference :
CC3UA1D1R0xxx



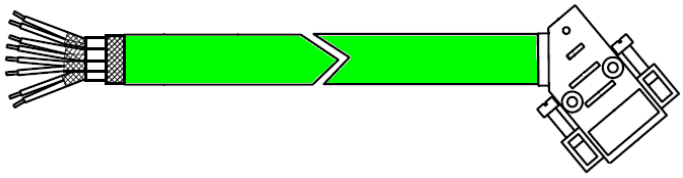
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

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

3.10.5. Hiperface encoder cable connection for COMPAX3

Cable reference :
CC3UR1D1R0xxx



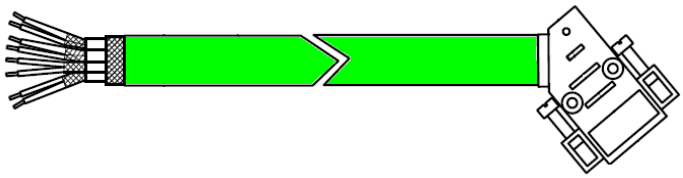
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

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

3.10.6. Resolver cable connection for SLVD

Cable reference :
CS5UA1D1R0xxx



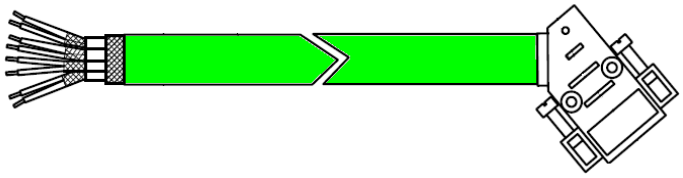
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

Cable arrangement :

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

3.10.7. Resolver cable connection for 637/638

Cable reference :
CS1UA1D1R0xxx



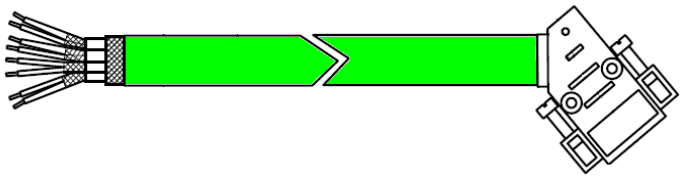
Feedback cable **6537P0059**
Male 9 pins SUB-D connector reference **220029P0020**
SUB-D cover reference **220029P0039**
Pins reference **220029P0021**

Cable arrangement :

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

3.10.8. Hiperface encoder cable connection for 637/638

Cable reference :
CS2UR1D1R0xxx



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

Cable arrangement :

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

3.10.9. Feedback cable reference

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

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

3.10.10. Power cable for AC890

Cable reference :

CS4UQ1D1R0xxx for current ≤ 12Amps Power cable **6537P0057**
CS4UQ2D1R0xxx for current ≤ 24Amps Power cable **6537P0058**

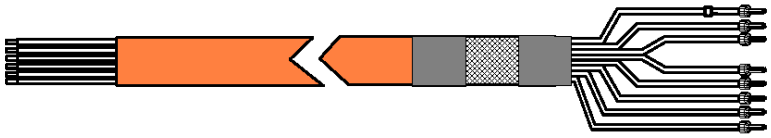
Cable arrangement :

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 -

3.10.11. Power cable for COMPAX3

Cable reference :

CC3UQ1D1R0xxx for current ≤ 12Amps Power cable **6537P0057**
CC3UQ2D1R0xxx for current ≤ 24Amps Power cable **6537P0058**



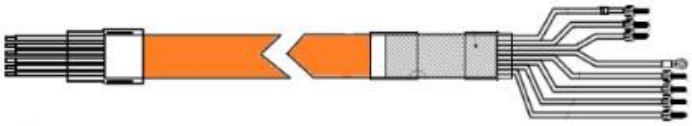
Cable arrangement :

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 -

3.10.12. Power cable for SLVD

Cable reference :

CS5UQ1D1R0xxx for current ≤ 12Amps Power cable **6537P0057**
CS5UQ2D1R0xxx for current ≤ 24Amps Power cable **6537P0058**



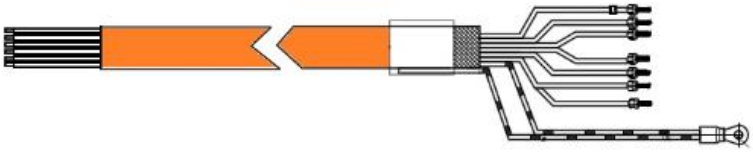
Cable arrangement :

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 -

3.10.13. Power cable for 637/638

Cable reference :

CS2UQ1D1R0xxx for current ≤ 12Amps Power cable **6537P0057**
CS2UQ2D1R0xxx for current ≤ 24Amps 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 -

3.10.14. Power cable reference

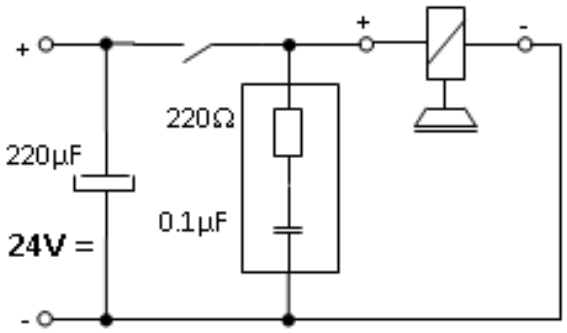
For other drive, you can assembly cable and plug by soldering with part number on the tab below:

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

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.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.

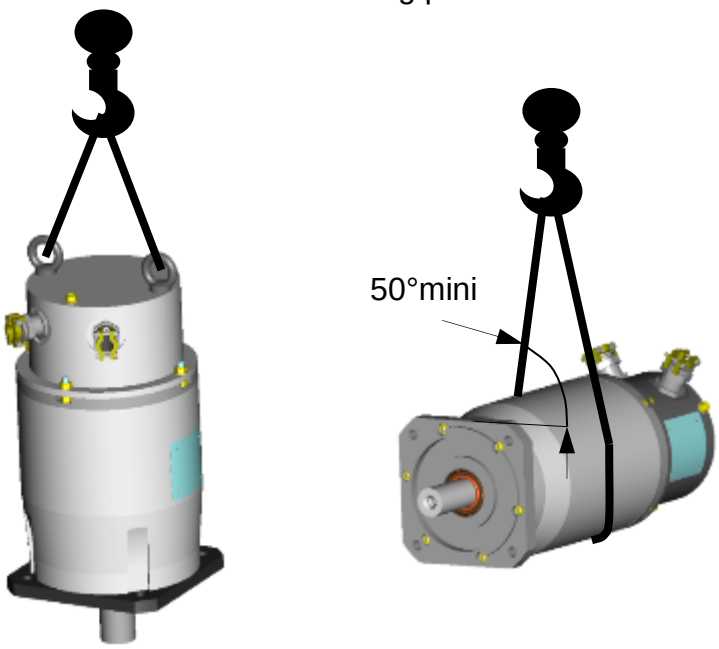
	Warning: In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h..

4.1.2. Handling

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

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

The drawings below show the correct handling procedure.



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

4.1.3. 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.

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

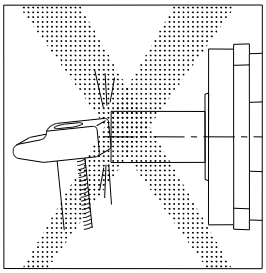
	Warning: After 15 days, check all tightening torques on all screw and nuts.

4.2.3. Preparation

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

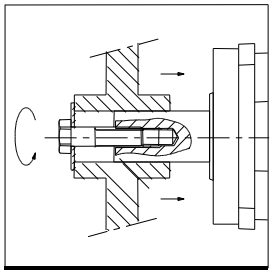
	Caution: Do not step on the motor or the cable glands.
	Caution: Always bear in mind that some parts of the surface of the motor can reach a temperature of 135°C

4.2.4. Mechanical assembly



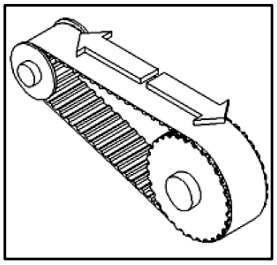
The operation life of servomotor bearings depends largely on the care and attention given to this operation.

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



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

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



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

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

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

	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.

	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.

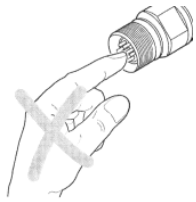
4.3.1. Cable connection

Please, read **§3.8 "Electrical connection"** to have information about cable connection
Many useful informations are already available in the drive documentations.

4.3.2. Encoder cable handling

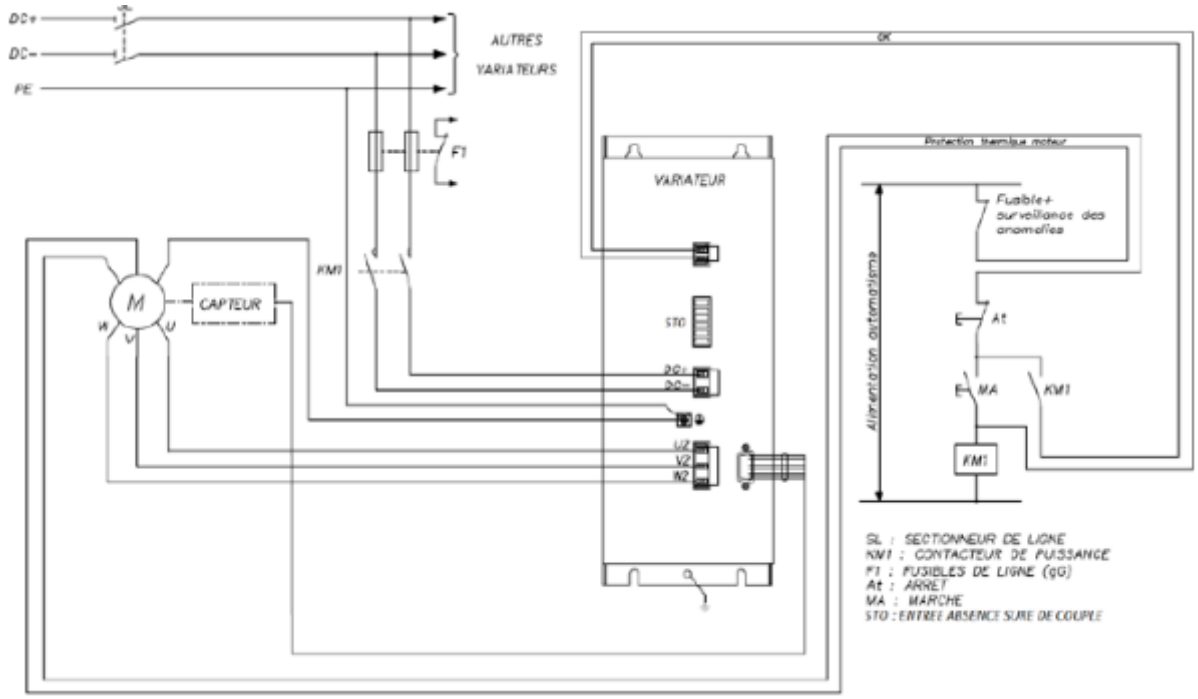
	Danger: before any intervention the drive must be stopped in accordance with the procedure.

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

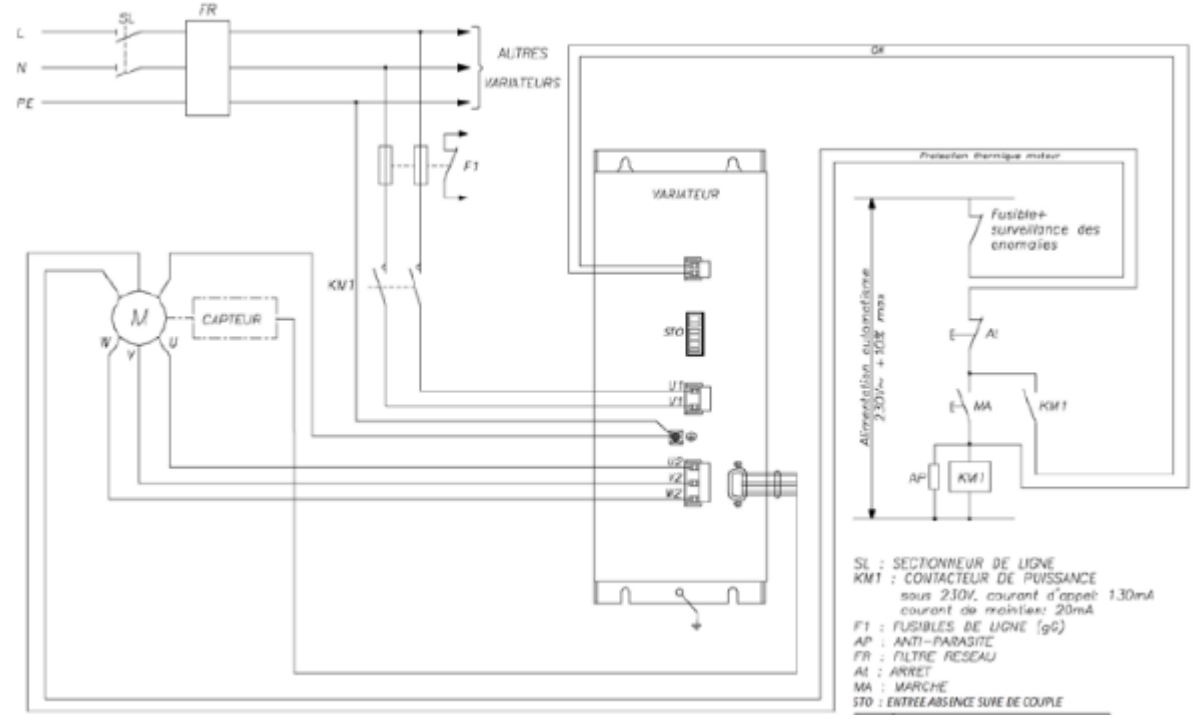
	Warning: Always wear an antistatic wrist strap during encoder handling.
	Warning: Do not touch encoder contacts (risk of damage due to electrostatic discharges ESD.

4.3.3. Connection diagrams

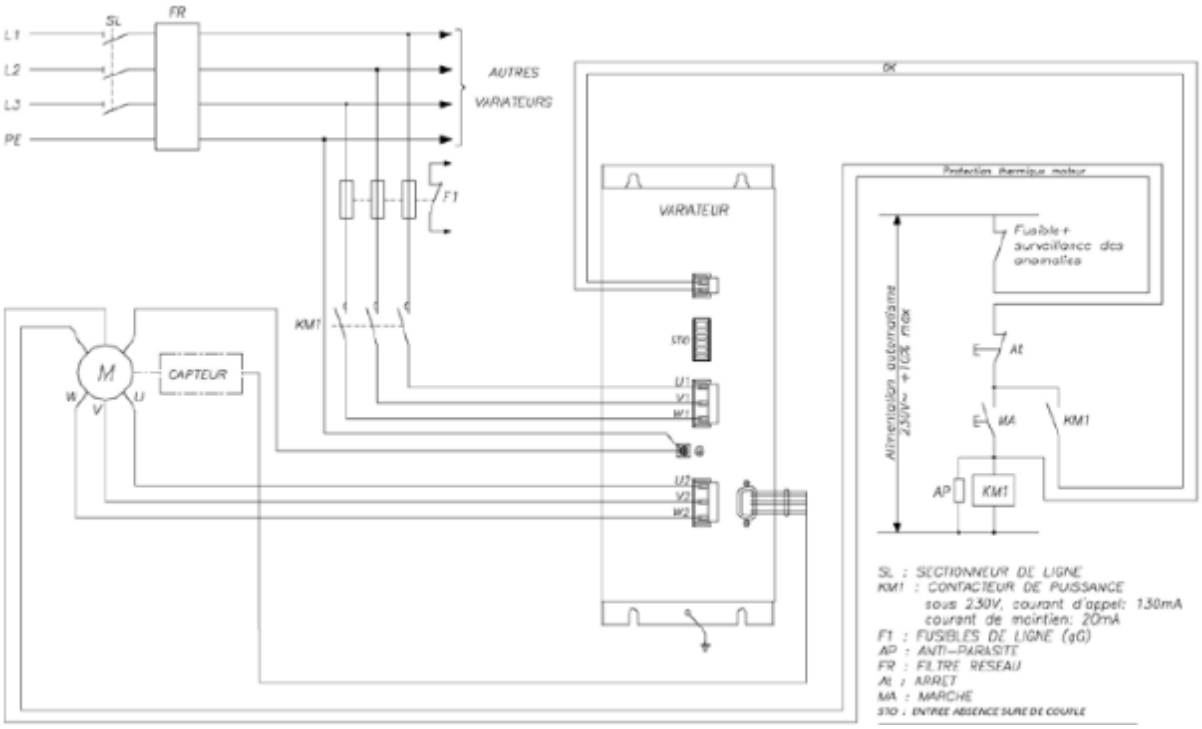
4.3.3.1. EX3-EX4 DC supply



4.3.3.2. EX single phase



4.3.3.3. EX three phase



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

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

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

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

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

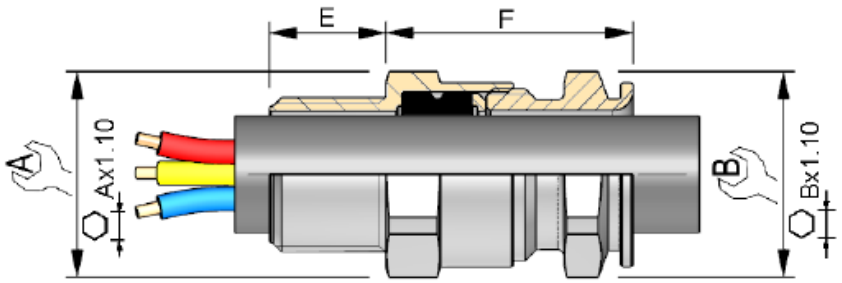
4.3.4. Cable glands informations (Only ATEX/IECEx)

4.3.4.1. Technical data

ADE - 1F2 ISO

COOPER

Type	**ADE-1F2** (not for Mining application)
Certified	**Ex: Ineris - Cepel - Gost-R - Nepsi - UL \\\\\ Shipping: ABS - DNV - Lloyds**
Size	n°3 to n°17 for cable external diameter from 2,75 to 104mm Thread sizes M10 to M110 inclusive UL thread size M20 to M110 inclusive
Cable type	Unarmored cable and Marine Shipboard cable. Instrumentation-Tray-Cable (ITC), Medium Voltage (MV), Power-Limited-Tray-Cable (PLTC) and Tray Cable (TC).
Clamping	By sealing ring (25%), the user shall provide additional clamping of the cable.
Standard material Alternative material	Nickel Plated Brass Stainless-steel, Bronze or Aluminum.
Service Temperature	From -30 to +80°C with Neoprene sealing ring From -60 to +140°C with Silicone sealing ring
Fixing to equipment	Metric according to ISO 965-1 & 965-3
Thread Lubricant / Sealer	STL2 (2oz) or STL8 (8oz) ; Temperature range -20°F to +200°F ≈ -30°C to +95°C HTL4 (4oz) ; Temperature range -70°F to +1800°F ≈ -60°C to +1000°C
IP rating:	- On equipment with threaded hole and contact surface roughness Ra 1.6 µm maxi: * IP66 without added gasket. * IP68 tested 30m/7days with Capri qualified Fiber-Gasket. - On equipment with blank hole (not for "d" use), fixed with Capri qualified locknut, all the threads must be engaged: * IP66 depending to the flatness and the roughness of the contact surface of the enclosure: . Without added gasket for Ra 0.4 µm maxi. . With Capri qualified Fiber-Gasket for Ra 1.6 µm maxi. * IP68 tested 30m/7days with Capri qualified Fiber-Gasket for Ra 1.6 µm maxi roughness of the contact surface. - The length of the threaded entry permit to meet the applicable thread engage, also with the add of gasket between the cable gland and the enclosure (gasket thickness 1,5 or 2mm).
Deluge Compliance	DTS-01:91
ATEX Standards Marking code Zones & Use	**INERIS:** INERIS12ATEX0032X EN 60079-0:2009, EN 60079-1:2007, EN 60079-7:2007, EN 60079-15:2010, EN 60079-31:2009. Ⓔx II2GD / Ex db IIC/ Ex eb IIC / Ex tb IIIC IP66 Ⓔx II3G Ex nRc IIC Zones 1 & 2 ; Groups IIA, IIB and IIC ; for use "d", "e", "ia", "ib", "ic", "ma", "mb", "mc", "nA", "nC", "nR, "o", "pv", "px", "py", "pz" & "q". Zones 21 & 22 ; Groups IIIA, IIIB and IIIC ; for use "tb", "tc", "ia", "ib", "ma", "mb", "mc" & "p".
IECEx Standards Marking code	**INERIS:** IECEx INE 12.0025X IEC 60079-0:2011, IEC 60079-1:2007, IEC 60079-7:2006, IEC 60079-15:2010, IEC 60079-31:2008 Ex db IIC / Ex eb IIC / Ex nRc IIC / Ex tb IIIC IP66
Other Ex Certificates	**CEPEL** (Inmetro): CEPEL 05.0558X **GOST-R:** РОСС FR.ГЕ05В03126 N°0422515 **NEPSI:** GYJ13.1082X
Shipping Certificates	**ABS** Manufacturing & Design Assessment P1836754-X & 10-HS 577243-PDA **DNV** Type Approval certificate N° E-10892 **Lloyds** Type Approval certificate N° 11/00072
c(UL)us	**cULus:** E310130 UL 514B, UL 2225 and C22.2 No 1 with respect to the US National Electrical Code (NEC) and Canadian Electrical Code (CEC). Class I, Zone 2, AEx e II, Ex e II Hazardous Areas for use with unarmored ITC, MV, PLTC & TC cable. Allow installation in all gas atmospheres Article 505 of the NEC and section 18 of CEC.
c(UL)us LISTED Marine for Zone	**cULus:** E314047 UL 514B, UL 2225 and C22.2 No 1 with respect to the US National Electrical Code (NEC) and Canadian Electrical Code (CEC). Class I, Zone 2, AEx e II, Ex e II Hazardous Areas for use with unarmored marine shipboard cable. Allow installation in all gas atmospheres Article 505 of the NEC and section 18 of CEC.



Reference CW614N /CR	Reference CW614N / SI	Reference 316 L / CR	Reference 316 L / SI	ISO mini	ADE N°	Ø Externe Cable External Ø	A	B	E	F maxi
CAP806404V1	CAP806405V1	CAP806409V1	CAP806406V1	12*	4	4,5-8	17	17	15	25
CAP806594V1	CAP806595V1	CAP806599V1	CAP806596V1	16*	4	4,5-8,5	19	17	15	25
CAP806504V1	CAP806505V1	CAP806509V1	CAP806506V1	16*	5	7-12	19	19	15	27,5
CAP806664V1	CAP806665V1	CAP806669V1	CAP806666V1	20	3	2,75-5,5	24	15	15	24
CAP806674V1	CAP806675V1	CAP806679V1	CAP806676V1	20	4	4,5-8,5	24	17	15	25
CAP806694V1	CAP806695V1	CAP806699V1	CAP806696V1	20	5	7-12	24	19	15	27,5
CAP806604V1	CAP806605V1	CAP806609V1	CAP806606V1	20	6	10- 16	24	24	15	32
CAP806774V1	CAP806775V1	CAP806779V1	CAP806776V1	25	5	7-12	30	19	15	27,5
CAP806794V1	CAP806795V1	CAP806799V1	CAP806796V1	25	6	10-16	30	24	15	32
CAP806704V1	CAP806705V1	CAP806709V1	CAP806706V1	25	7	13,5-20,5	30	30	15	36,5
CAP806804V1	CAP806805V1	CAP806809V1	CAP806806V1	32	8	18-27,5	41	41	15	46
CAP806904V1	CAP806905V1	CAP806909V1	CAP806906V1	40	9	23-34	48	48	15	50
CAP807004V1	CAP807005V1	CAP807009V1	CAP807006V1	50	10	29-41	55	55	16	52
CAP807084V1	CAP807085V1	CAP807089V1	CAP807086V1	50	11	35-45	64	64	16	56,5
CAP807204V1	CAP807205V1	CAP807209V1	CAP807206V1	63	12	42-56	72	72	17	60
CAP807304V1	CAP807305V1	CAP807309V1	CAP807306V1	75	13	50-65	85	85	18	67,5
CAP807594V1	CAP807595V1	CAP807599V1	CAP807596V1	90	14	58-74	95	95	22	69
CAP807504V1	CAP807505V1	CAP807509V1	CAP807506V1	90	15	66-83	110	110	22	80
CAP807604V1	CAP807605V1	CAP807609V1	CAP807606V1	110	16	75- 93	120	120	22	80
CAP807704V1	CAP807705V1	CAP807709V1	CAP807706V1	110	17	85-104	135	135	22	90

*Non UL

4.3.4.2. Torque value

M16 Cable glands ADE N°5 :

Torque value for the cap = 12,5 N.m

Torque value for the connection module = 0,5 N.m

M20 Cable gland ADE N°6 :

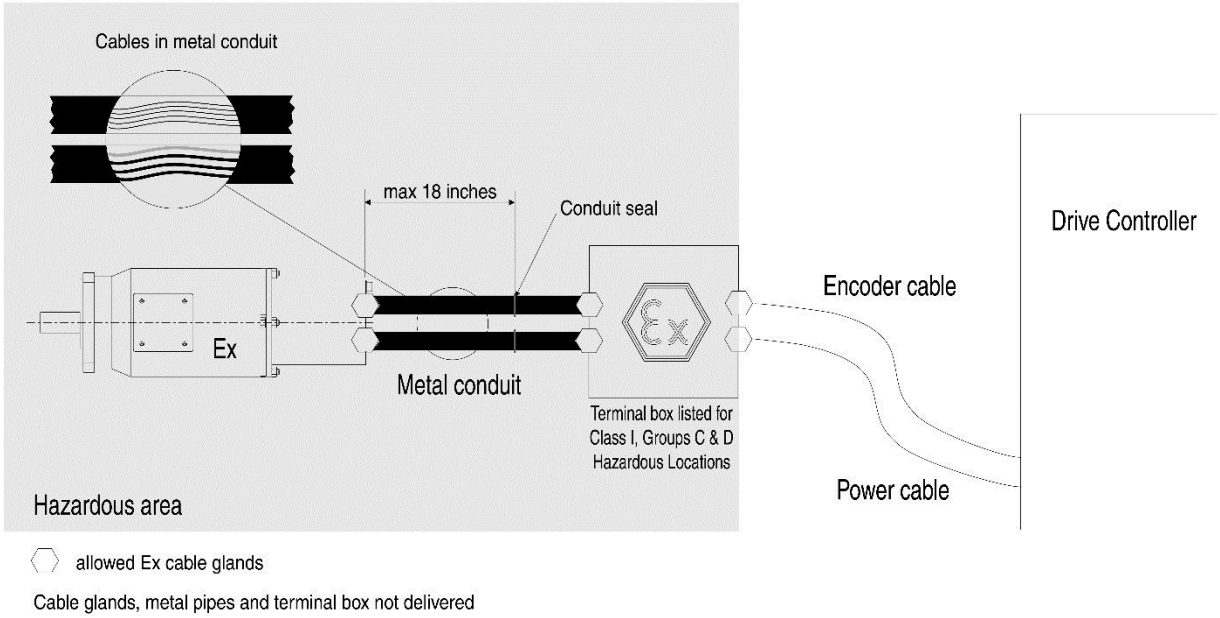
Torque value for the cap = 20 N.m

Torque value for the connection module = 0,5 N.m

4.3.5. UL Electrical commissioning

	The cables (Feedback or power cable) is a choice for end user and must be conform local state regulations.
	The end user will comply with local state regulations for his installation and he will make the UL certification for his installation
	The end user will determine which kind of connections and/ or conduits will be used.
	Warning : Installers use any wiring other than that shown in the diagrams in §4.3.3. “Connection diagrams” at their own risk; Parker cannot be held responsible for unauthorized wiring. Make sure that the characteristics of the contactors shown in these diagrams are strictly followed according to the drive current
	CAUTION : the drive associated with the motor must be outside the explosive area (hazardous area).
	Warning : the conduit seal must be required within 18 inches of the motor.

Connection of the UL motor:



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 EX3-EX4-EX6 or quality 12.9 or higher for EX8. 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
Cable inspection, no degradation (colour, flexibility, cracks…)	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.

4.4.3. ATEX flameproof joints informations ATEX/IECEx

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

Size EX3 :

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

Size EX4 :

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

Size EX6 :

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

Taille EX8 :

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

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 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 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