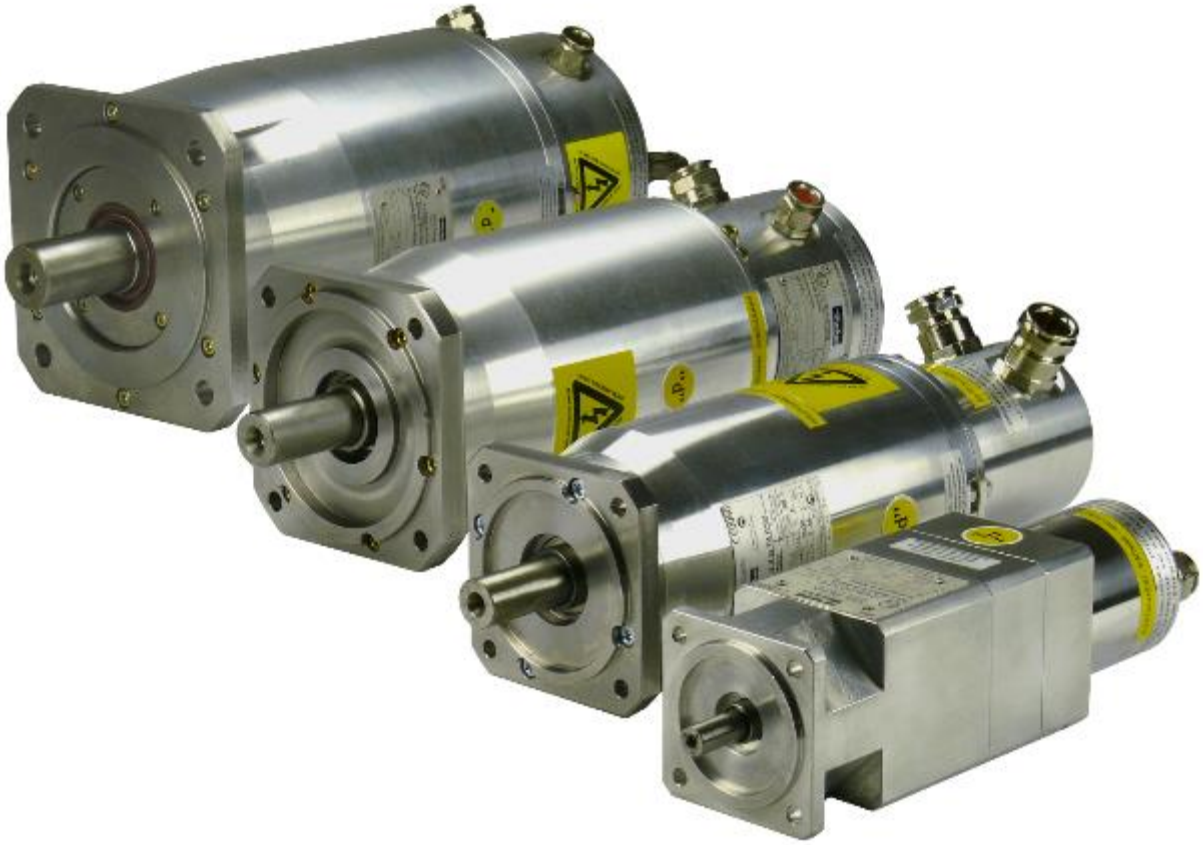
# Servomotors

# EX Series

## Technical Manual

## PVD 3665 – EX KCS



# 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 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 60034-1:2010/AC:2010 : Rotating electrical machines - Part 1 : Rating and performance.**
**IEC 60034-5:2000 / 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 : 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 Certification : INERIS 03ATEX0060X
EX4 EC Certification : INERIS 04ATEX0097X
Quality system notification ; **INERIS** body EC 0080.
EX6 EC Certification : INERIS 04ATEX0032X

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

Further information :

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

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

EX3 C.E. Marking in : June 04th 2003
EX4 C.E. Marking in : January 24th 2005
EX6 C.E. Marking in : March 09th 2004

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

Longvic, June 29th 2016

In the name of Parker
A. ANDRIOT
**Quality Manager**

*Ref : DCEEX-002rev0*

# 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 EX8** with the following marking :

**II 2 G Ex d IIB T4 IP64**
or
**II 2 GD Ex d IIB T4 IP65 Ex tD A21 IP65 T135°C**

satisfy the arrangements of the directives :

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

and meet standards or normative document according to :

**EN 60034-1:2010/AC:2010 : Rotating electrical machines - Part 1 : Rating and performance.**
**EN 60034-5:2001/A1:2007 : Rotating electrical machines - Part 5 : Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification.**
**EN 60079-0:2006 : Electrical apparatus for explosive gas atmospheres - General requirements.**
**EN 60079-1:2004 : Electrical apparatus for explosive gas atmospheres - Flameproof enclosures "d".**
**EN 61241-0:2006 : Electrical apparatus for use in the presence of combustible dust - General requirements.**
**EN 61241-1:2004 + corrigendum 2006 : Electrical apparatus for use in the presence of combustible dust - Protection by enclosures "tD".**

**The product is not impacted by the modifications made on the latest standards harmonized**, therefore it stays conform to the essential requirements regarding the healthy and the safety to the directive 2014/34/EU.

EX8 EC Certification : INERIS 05ATEX0061X
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.**

Further information :

**SERVOMOTORS shall be mounted on a mechanical support providing good heat conduction and not exceeding 40° 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 supplied with the product.

EX8 C.E. Marking in : May 30th 2005

Longvic, June 29th 2016

*Ref : DCEEX-001rev1*

In the name of Parker
A. ANDRIOT
**Quality 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<br>ESTABLISHMENT LONGVIC<br>4 Bld EIFFEL<br>21600 LONGVIC FRANCE |
| **This is to certify that representative samples of** | MOTORS, SPECIALTY FOR USE IN HAZARDOUS LOCATIONS<br>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.<br><br>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.<br>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

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# 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<br>ESTABLISHMENT LONGVIC<br>4 Bld EIFFEL<br>21600 LONGVIC FRANCE |
| **This is to certify that representative samples of** | COMPONENT - INCOMPLETE ROTATING MACHINES AND ROTATING MACHINE PARTS<br>COMPONENT - SERVO AND STEPPER MOTORS<br>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<br>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

# 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**<br>DANGER: The installation, commission and operation must be performed by qualified personnel, in conjunction with this documentation.<br>The qualified personnel must know the safety (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations.<br>They must be authorized to install, commission and operate in accordance with established practices and standards. |
|  | **Electrical hazard**<br>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.<br>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.<br>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.<br>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.<br>Check the drive recommendations.<br>The motor must be permanently connected to an appropriate safety earth. To prevent any accidental contact with live components, it is necessary to check that cables are not damaged, stripped or not in contact with a rotating part of the machine. The work place must be clean, dry.<br>General recommendations :<br>- Check the wiring circuit<br>- Lock the electrical cabinets<br>- Use standardized equipment |

| | |
|---|---|
|  | **Mechanical hazard**<br>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**<br>Always bear in mind that some parts of the surface of the motor can reach a temperature of 135°C. |
|  | **Generality**<br>The installation and operation must be made with the *Commissioning and use manual* given with the motor.<br>Commissioning and use manual of the EX motor series :<br>- EX8 Atex : PVD 3571 |
|  | **Atex servomotors**<br>This motor can be used in hazardous areas. May particular attention to the notes marked with  . |
|  | European directive 99/92/EC makes explicit the responsibility of employers to protect employees who may be exposed to risk of ATEX environments (Explosive Atmosphere). The employer must assess the risk and classify potentially dangerous areas. Equipment and materials must also be suited for use in dangerous areas in accordance with ATEX directives 94/9/EC and 2014/34/EU. |

### 1.2.3. Safe Torque Off function

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

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

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

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

## 1.2.4. Operating category and marking of EX servomotors

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

**II 2 G Ex db IIB T4 Gb IP64**

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

| | |
|---|---|
| | Suitable for ATEX/IECEX servomotors |

### 1.2.4.2. EX3-EX4-EX6 ATEX/IECEx 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<br>Very high level of protection | **D** Combustible dust | ATEX protection | ta<br>Protection by enclosure | **III** Dust | A<br>Combustible flying | T1 450 °C | Ma<br>Very high level of protection | **IP65** |
| | M2<br>High level of protection | | | **tb** / tc<br>Protection by enclosure | | | T2 300 °C | Mb<br>High level of protection | |
| **II** Surface | 1<br>Very high level of protection | | | pb / pc<br>Pressurized enclosure | | B<br>Non conductive dust | T3 200 °C | Da<br>Very high level of protection | |
| | 2<br>High level of protection | | | ia / ib / ic<br>Intrinsic safety | | | **T4** 135 °C | Db<br>High level of protection | |
| | **3**<br>Normal level of protection | | | ma / mb / mc<br>Encapsulation | | **C**<br>Conductive dust | T5 100 °C | **Dc**<br>Normal level of protection | |
| | | | | | | | T6 85 °C | | |

| | |
|---|---|
| | Suitable for ATEX/IECEX servomotors |

### 1.2.4.3. EX8 ATEX

| | |
|---|---|
| Gazous atmosphere | **II 2 G Ex d IIB T4 IP64**<br>- **II** Outside industries<br>- **2** Intermittent presence of gas<br>- **d** Explosionproof<br>- **II B** Ethylene or propane<br>- **T4** 135°C for the Max. temperature on the motor surface<br>- **IP64 or IP65** Protection index |
| Dust atmosphere | **II 2 D Ex tD A21 T135°C IP65**<br>- **tD** Protection by enclosure<br>- **A21** Protection with seal<br>- **T135°C** 135°C for the Max. temperature on the motor surface<br>- **IP65** Protection index |

## 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:<br><br>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.<br><br>In case of an using in dusty explosive atmospheres, the user must perform regular cleaning operations on the motor to avoid dust deposits. |

### 1.2.5.1. UL

**Class1 group C&D Code T4A**

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

## 2.3. Applications

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

## 2.4. General Technical Data for ATEX motors

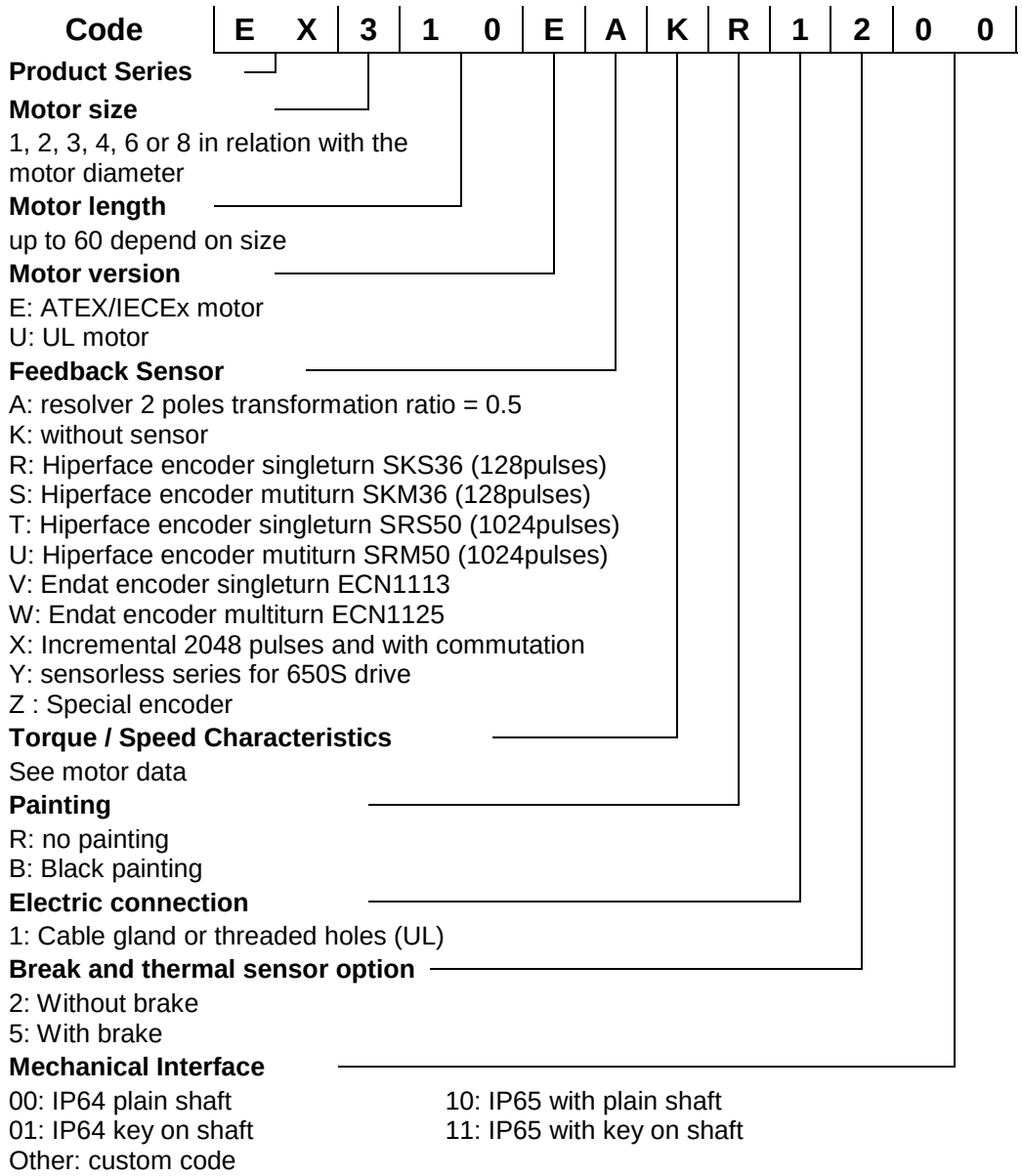
| | EX3, EX4, EX6 | EX8 |
|---|---|---|
| **Motor type** | Permanent-magnet synchronous motor | |
| **Magnets material** | Neodymium Iron Boron | |
| **Number of poles** | 10 | |
| **Type of construction** | IMB5 – IMV1 – IMV3 (EN60034-7) | |
| **Degree of protection** | • Gazeous atmosphere : IP64, IP65<br>• 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)<br>No allowed for higher altitude | |
| **Ambiant temperature** | -20°C to +40°C<br>-20°C to +60°C with performances derating | |
| **Storage temperature** | -20°C to +60°C | |
| **Connection** | Electronic plate with cable glands | |
| **Marking** | CE | |
| **Paint** | Without | |
| **Sensor** | • Resolver as a standard<br>• Sick encoder - Hiperface:<br>SKS36 and SKM36<br>SRS50 and SRM50 (Not available for EX3)<br>• Heidenhain encoder – Endat:<br>ECN1113 and EQN1125 (Not available for EX3 and EX4)<br>• Sensorless<br>• 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 in standard<br>• Sick encoder - Hiperface:<br>SKS36 and SKM36<br>SRS50 and SRM50 (Not available for EX3)<br>• Heidenhain encoder – Endat:<br>ECN1113 and EQN1125<br>• 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 $\Delta t_i$ *[s]*.

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

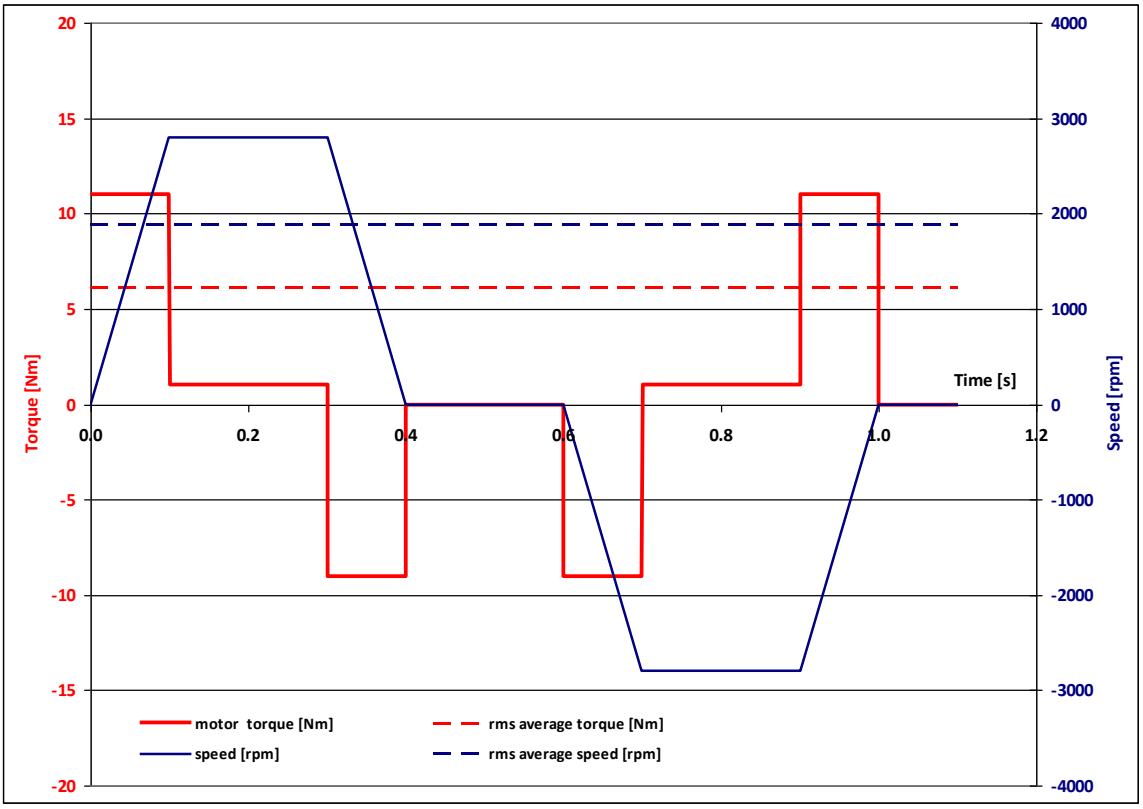
$$M_{rms} = \sqrt{\frac{1}{T} * \sum_{i=1}^{n} M_i^2 \Delta t_i}$$

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 $M_i$.

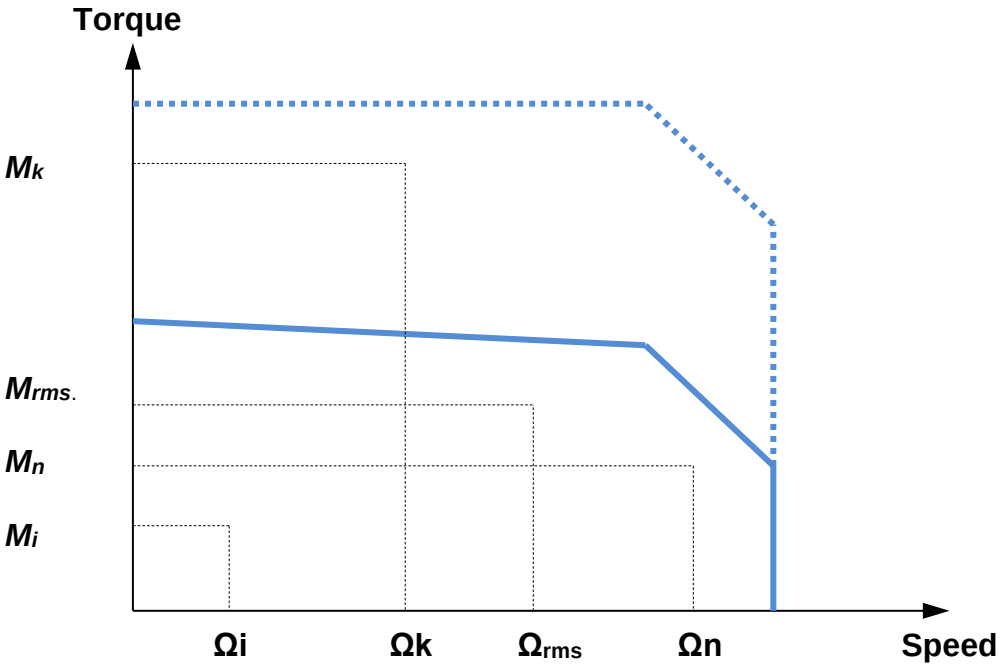
**Selection of the motor :**

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.

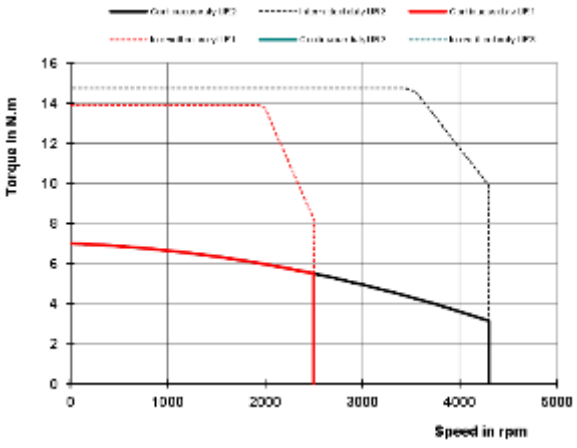
**Selection of the motor:**

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 | 1140 | 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"**.

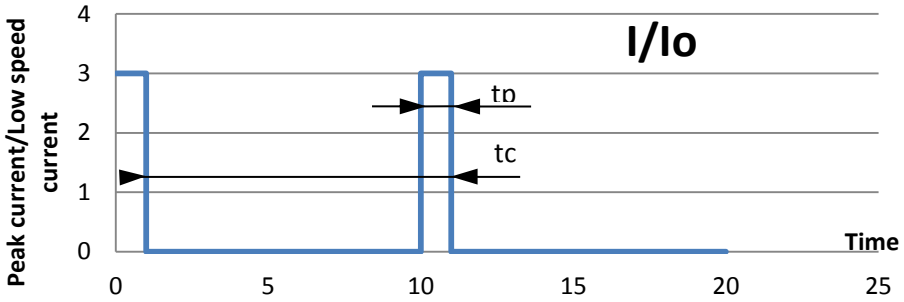
### 3.1.6. Current limitation at stall conditions (i.e. speed < 3 rpm)

**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.

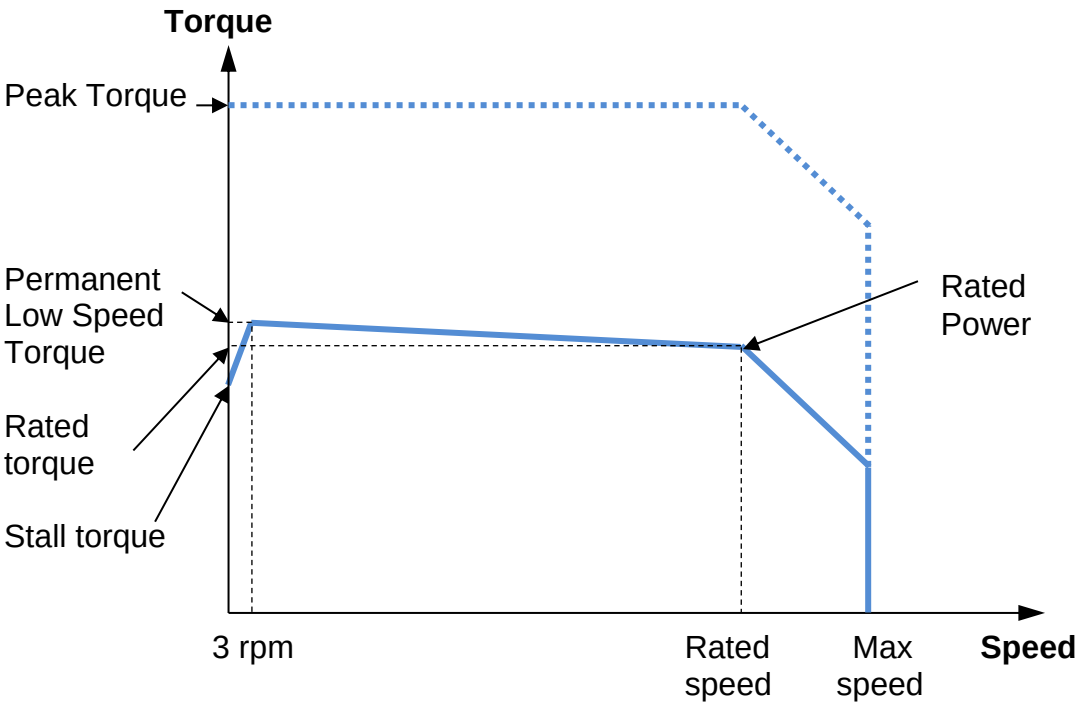
1) The peak currents and peak torques given in the data sheet must never be exceeded
2) The thermal equivalent torque must be respected (§3.1.3)
3) If 1) and 2) are respected (it can limit the peak current value or duration), the peak current duration (tp) must be limited, in addition, accordingly to 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 type | Drive | Nmax (rpm) | Mo (Nm) | Io (Arms) | Mn (Nm) | In (Arms) | Nn (rpm) | Mmax (Nm) | Imax (Arms) | Inertia (kgm²) | Kt N.m/Arms | KE ph-ph (Vrms) | Pn (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX310EAP | DRIVE 1.5/6 Arms 400 Vac | 2300 | 1,75 | 1,24 | 1,66 | 1,19 | 2300 | 4,38 | 3,27 | 0,000079 | 1,42 | 88,9 | 0,4 |
| EX310EAK | DRIVE 2.5/10 Arms 230 Vac | 4000 | 1,75 | 2,16 | 1,54 | 1,96 | 4000 | 4,38 | 5,71 | 0,000079 | 0,81 | 50,9 | 0,644 |
| EX420EAP | DRIVE 2.5/12 Arms 400 Vac | 2300 | 3,5 | 2,46 | 3,18 | 2,26 | 2300 | 8,75 | 6,55 | 0,00029 | 1,42 | 89 | 0,767 |
| EX420EAJ | DRIVE 5/20 Arms 230 Vac | 4000 | 3,5 | 4,26 | 2,67 | 3,33 | 4000 | 8,75 | 11,3 | 0,00029 | 0,821 | 51,4 | 1,12 |
| EX430EAJ | DRIVE 5/20 Arms 230 Vac | 3200 | 4,8 | 4,57 | 3,79 | 3,68 | 3200 | 12 | 12 | 0,000426 | 1,05 | 65,6 | 1,27 |
| EX430EAF | DRIVE 6/20 Arms 230 Vac | 4000 | 4,8 | 5,79 | 3,28 | 4,07 | 4000 | 12 | 15,2 | 0,000426 | 0,828 | 51,8 | 1,37 |
| EX620EAO | DRIVE 6/23 Arms 400 Vac | 2500 | 7 | 5,51 | 5,49 | 4,47 | 2500 | 17,5 | 13,9 | 0,00098 | 1,27 | 81,7 | 1,44 |
| EX630EAI | DRIVE 10/36 Arms 230 Vac | 3000 | 10,4 | 9,28 | 7,24 | 6,75 | 3000 | 26 | 23,3 | 0,00147 | 1,12 | 68,2 | 2,27 |

## 3.2.2. ATEX/IECEx 400V

| Motor type | Drive | Nmax (rpm) | Mo (Nm) | Io (Arms) | Mn (Nm) | In (Arms) | Nn (rpm) | Mmax (Nm) | Imax (Arms) | Inertia (kgm²) | Kt N.m/Arms | KE ph-ph (Vrms) | Pn (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX310EAP | DRIVE 1.5/6 Arms 400 Vac | 4000 | 1,75 | 1,24 | 1,54 | 1,12 | 4000 | 4,38 | 3,27 | 0,000079 | 1,42 | 88,9 | 0,644 |
| EX420EAP | DRIVE 2.5/12 Arms 400 Vac | 4000 | 3,5 | 2,46 | 2,67 | 1,92 | 4000 | 8,75 | 6,55 | 0,00029 | 1,42 | 89 | 1,12 |
| EX420EAV | DRIVE 1.5/6 Arms 400 Vac | 2000 | 3,5 | 1,24 | 3,25 | 1,16 | 2000 | 8,75 | 3,29 | 0,00029 | 2,83 | 177 | 0,681 |
| EX430EAP | DRIVE 2.5/12 Arms 400 Vac | 3000 | 4,8 | 2,46 | 3,9 | 2,03 | 3000 | 12 | 6,45 | 0,000426 | 1,95 | 122 | 1,23 |
| EX430EAL | DRIVE 3.5/12 Arms 400 Vac | 4000 | 4,8 | 3,3 | 3,28 | 2,32 | 4000 | 12 | 8,65 | 0,000426 | 1,45 | 90,9 | 1,37 |
| EX620EAO | DRIVE 6/23 Arms 400 Vac | 4300 | 7 | 5,51 | 3,13 | 2,75 | 4300 | 17,5 | 13,9 | 0,00098 | 1,27 | 81,7 | 1,41 |
| EX630EAY | DRIVE 6/23 Arms 400 Vac | 2900 | 10,4 | 5,11 | 7,42 | 3,8 | 2900 | 26 | 12,8 | 0,00147 | 2,03 | 124 | 2,25 |
| EX630EAN | DRIVE 7/23 Arms 400 Vac | 4000 | 10,4 | 6,92 | 5,2 | 3,76 | 4000 | 26 | 17,4 | 0,00147 | 1,5 | 91,6 | 2,18 |

## 3.2.3. UL 230V

| Motor type | Drive | Nmax (rpm) | Mo (Nm) | Io (Arms) | Mn (Nm) | In (Arms) | Nn (rpm) | Mmax (Nm) | Imax (Arms) | Inertia (kgm²) | Kt N.m/Arms | KE ph-ph (Vrms) | Pn (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX310UAU | DRIVE 2.5/7 Arms 400 Vac | 4200 | 1,6 | 2,46 | 1,41 | 2,24 | 4200 | 3,98 | 6,34 | 0,000079 | 0,652 | 41 | 0,62 |
| EX420UAI | DRIVE 4.5/11 Arms 400 Vac | 4000 | 3,2 | 4,15 | 2,45 | 3,25 | 4000 | 7,95 | 10,8 | 0,00029 | 0,772 | 48,3 | 1,03 |
| EX430UAG | DRIVE 5/12 Arms 400 Vac | 3200 | 4,4 | 4,88 | 3,48 | 3,94 | 3200 | 9,95 | 11,3 | 0,000426 | 0,902 | 56,4 | 1,17 |
| EX620UAM | DRIVE 6/17 Arms 400 Vac | 2750 | 6,4 | 6,02 | 4,76 | 4,67 | 2750 | 16 | 14,8 | 0,00098 | 1,06 | 68,8 | 1,37 |
| EX630UAK | DRIVE 8/20 Arms 400 Vac | 2700 | 9,5 | 7,92 | 7,12 | 6,16 | 2700 | 23,7 | 19,4 | 0,00147 | 1,2 | 73,6 | 2,01 |
| EX820UAQ | DRIVE 10/23 Arms 400 Vac | 2300 | 12,9 | 9,1 | 10,1 | 7,21 | 2300 | 29,7 | 22,8 | 0,0032 | 1,42 | 87,2 | 2,43 |
| EX840UAL | DRIVE 13/35 Arms 400 Vac | 1650 | 22,6 | 12 | 16,8 | 9 | 1650 | 56,5 | 32,3 | 0,0062 | 1,89 | 118 | 2,9 |
| EX860UAJ | DRIVE 15/45 Arms 400 Vac | 1500 | 31,4 | 13,9 | 22,3 | 10 | 1500 | 78,5 | 37,1 | 0,0092 | 2,26 | 140 | 3,5 |

## 3.2.4. UL 400V

| Motor type | Drive | Nmax (rpm) | Mo (Nm) | Io (Arms) | Mn (Nm) | In (Arms) | Nn (rpm) | Mmax (Nm) | Imax (Arms) | Inertia (kgm²) | Kt N.m/Arms | KE ph-ph (Vrms) | Pn (kW) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX310UAU | DRIVE 2.5/7 Arms 400 Vac | 7600 | 1,6 | 2,46 | 1,03 | 1,74 | 7600 | 3,98 | 6,34 | 0,000079 | 0,652 | 41 | 0,822 |
| EX420UAI | DRIVE 4.5/11 Arms 400 Vac | 7000 | 3,2 | 4,15 | 1,1 | 1,58 | 7000 | 7,95 | 10,8 | 0,00029 | 0,772 | 48,3 | 0,805 |
| EX430UAG | DRIVE 5/12 Arms 400 Vac | 5700 | 4,4 | 4,88 | 1,72 | 2,07 | 5700 | 9,95 | 11,3 | 0,000426 | 0,902 | 56,4 | 1,02 |
| EX620UAM | DRIVE 6/17 Arms 400 Vac | 4300 | 6,4 | 6,02 | 2,82 | 2,97 | 4300 | 16 | 14,8 | 0,00098 | 1,06 | 68,8 | 1,27 |
| EX630UAK | DRIVE 8/20 Arms 400 Vac | 4200 | 9,5 | 7,92 | 4,38 | 4,02 | 4200 | 23,7 | 19,4 | 0,00147 | 1,2 | 73,6 | 1,92 |
| EX820UAQ | DRIVE 10/23 Arms 400 Vac | 3600 | 12,9 | 9,1 | 6,96 | 5,08 | 3600 | 29,7 | 22,8 | 0,0032 | 1,42 | 87,2 | 2,62 |
| EX840UAL | DRIVE 13/35 Arms 400 Vac | 2900 | 22,6 | 12 | 6,84 | 3,9 | 2900 | 56,5 | 32,3 | 0,0062 | 1,89 | 118 | 2,08 |
| EX860UAJ | DRIVE 15/45 Arms 400 Vac | 2500 | 31,4 | 13,9 | 8,31 | 4,01 | 2500 | 78,5 | 37,1 | 0,0092 | 2,26 | 140 | 2,18 |

### 3.2.5. Further Data

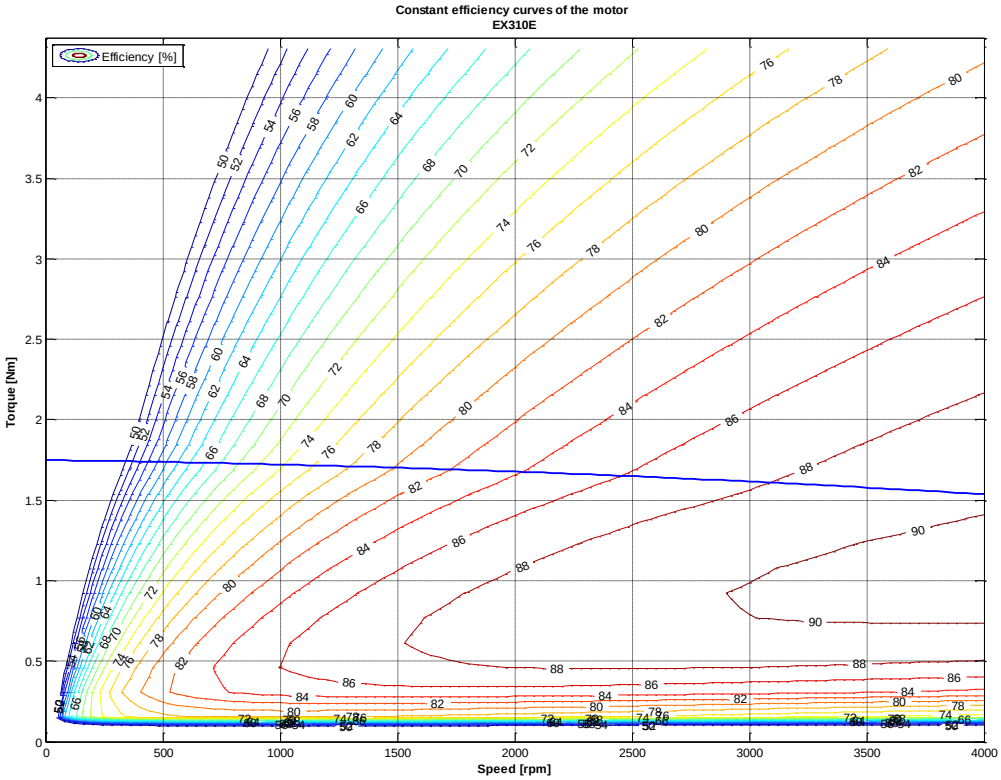
### 3.2.6. Efficiency curves

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

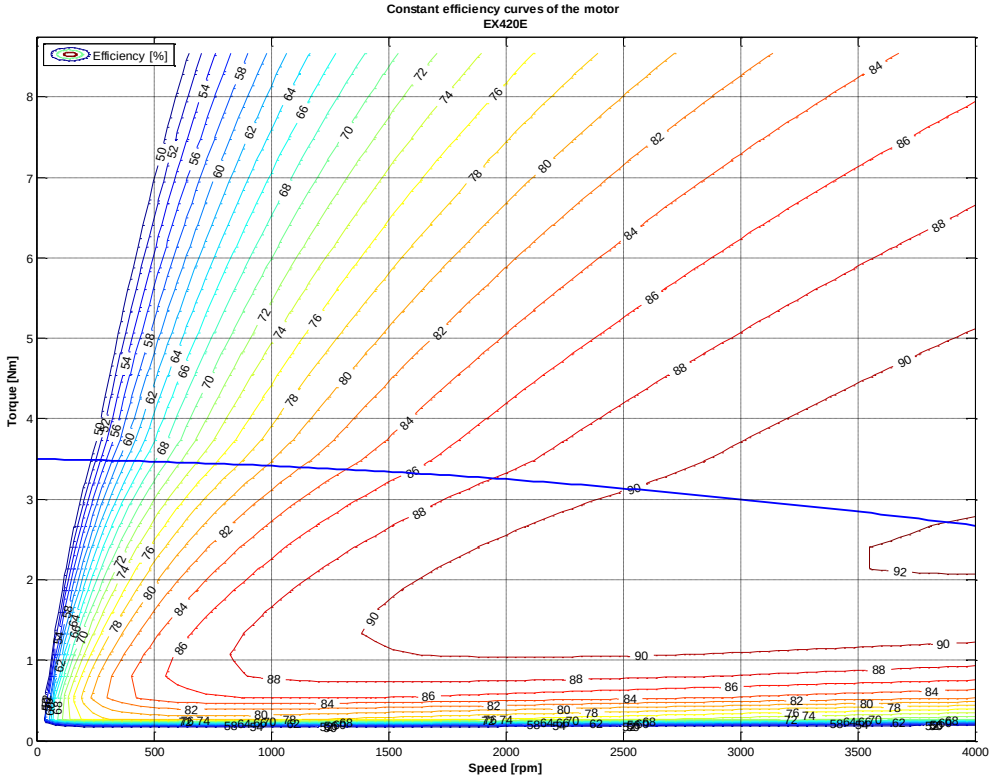
| | |
|---|---|
|  | Caution: The efficiency curves are given for an optimal motor control (no voltage saturation and optimal phase between current and EMF) |

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

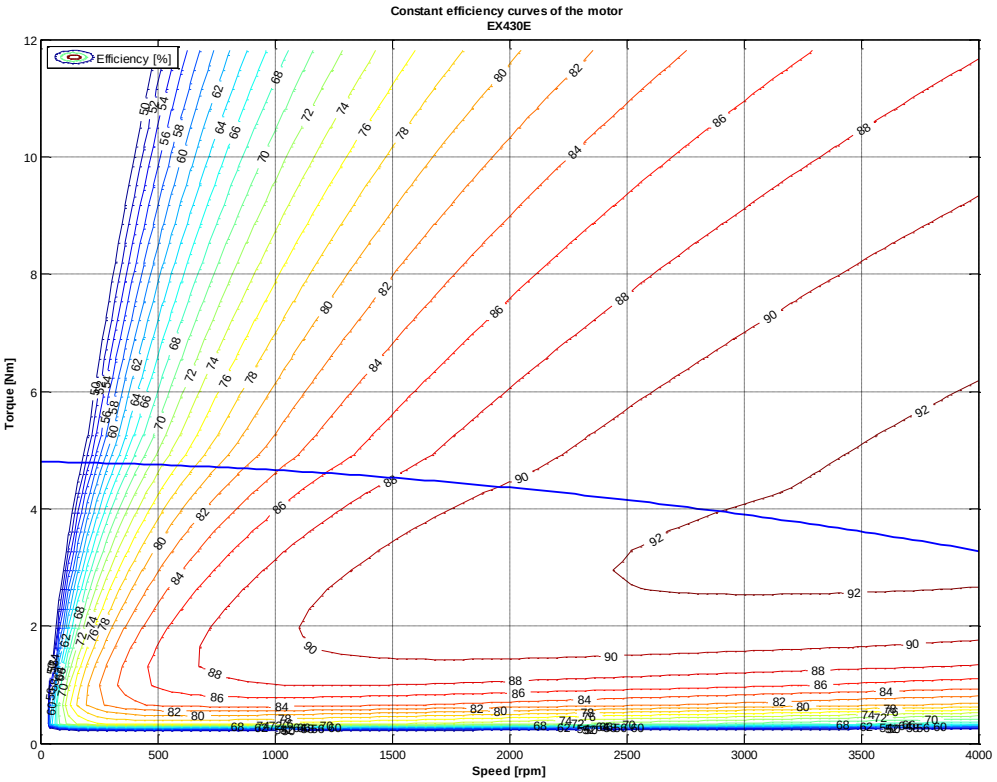
### 3.2.6.1. Series EX310E (EX310EAP)



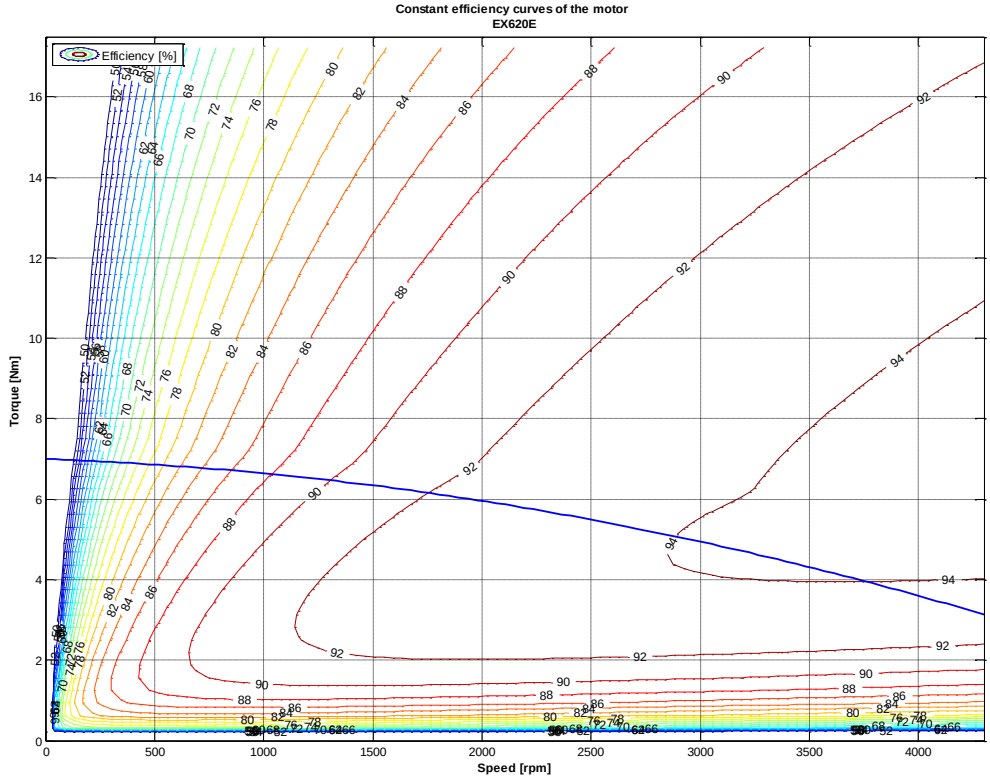
### 3.2.6.2. Series EX420E (EX420EAP)



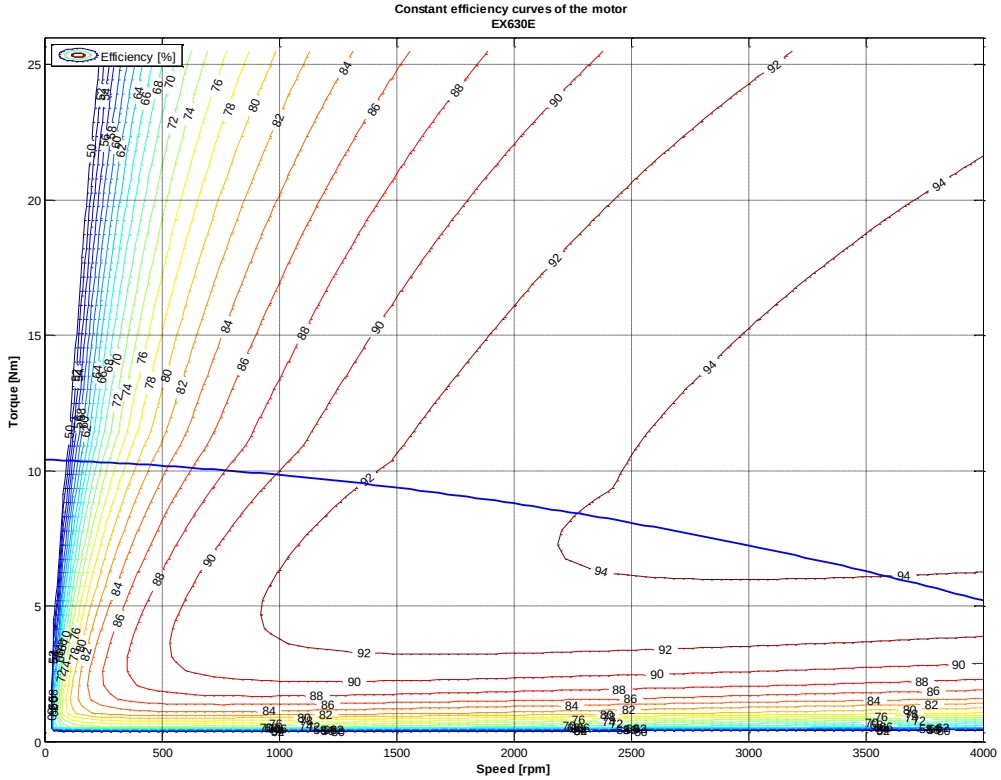

### 3.2.6.3. Series EX430E (EX430EAL)



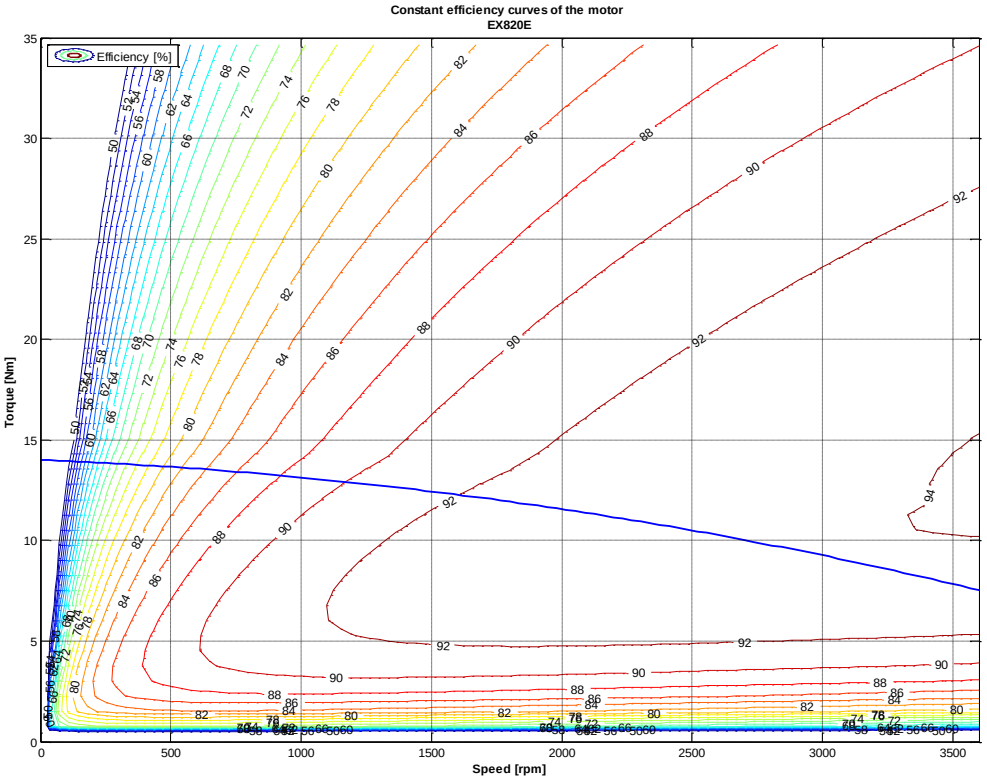
### 3.2.6.4. Series EX620E (EX620EAO)



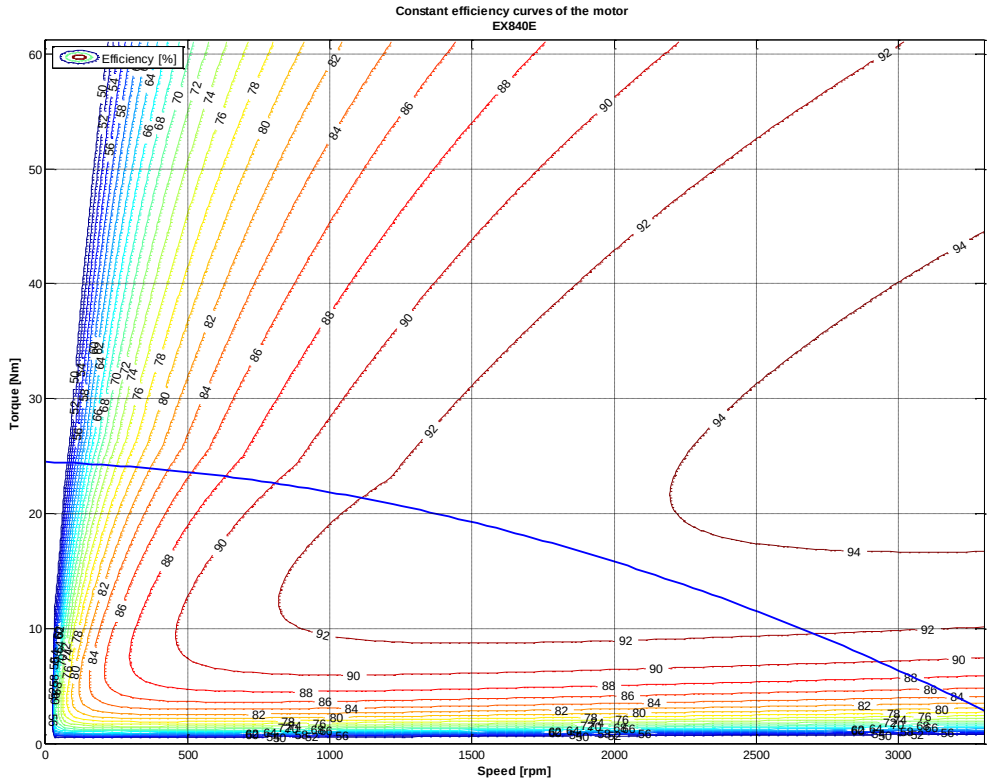

### 3.2.6.5. Series EX630E (EX630EAN)



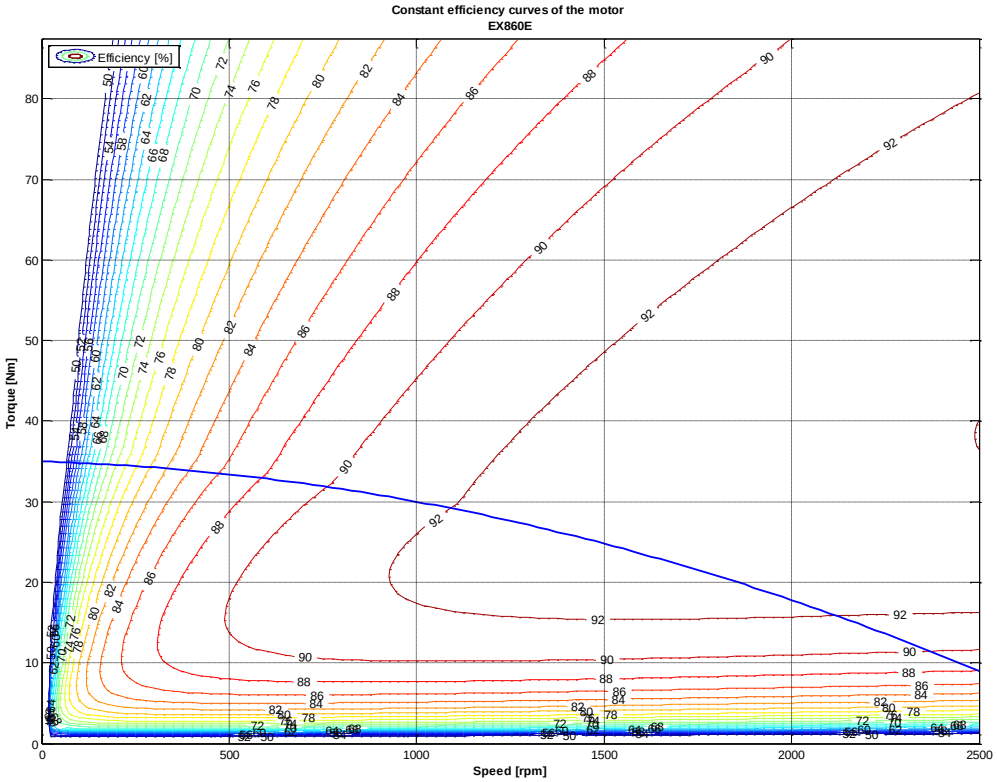
### 3.2.6.6. Series EX820E (EX820EAR)



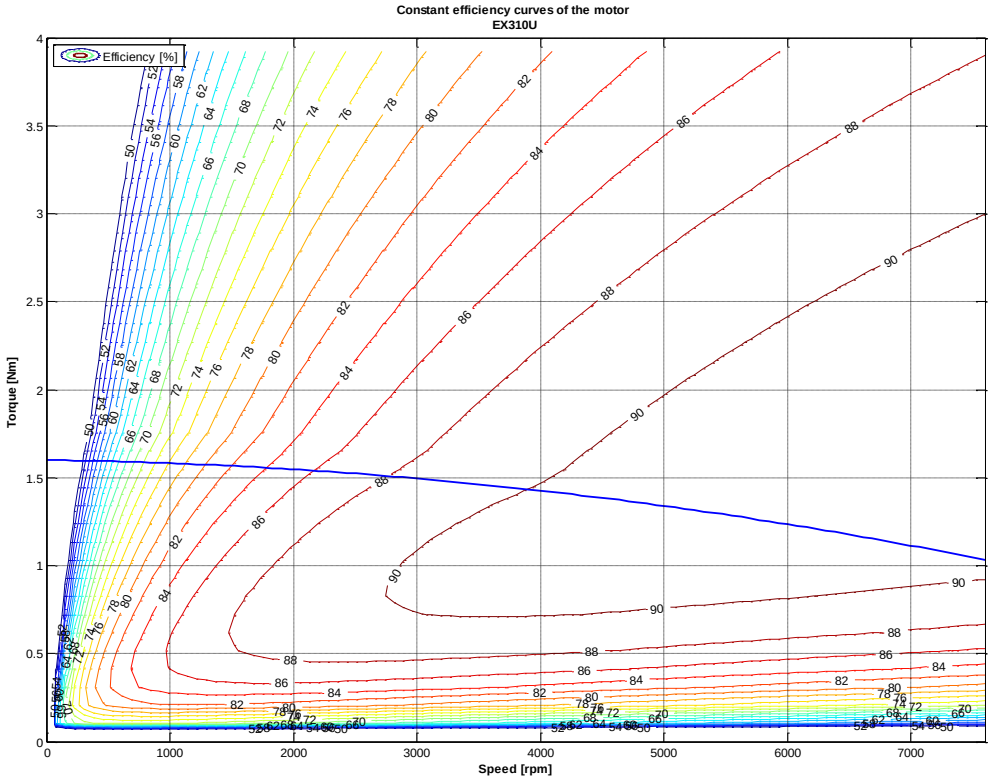

### 3.2.6.7. Series EX840E (EX840EAK)



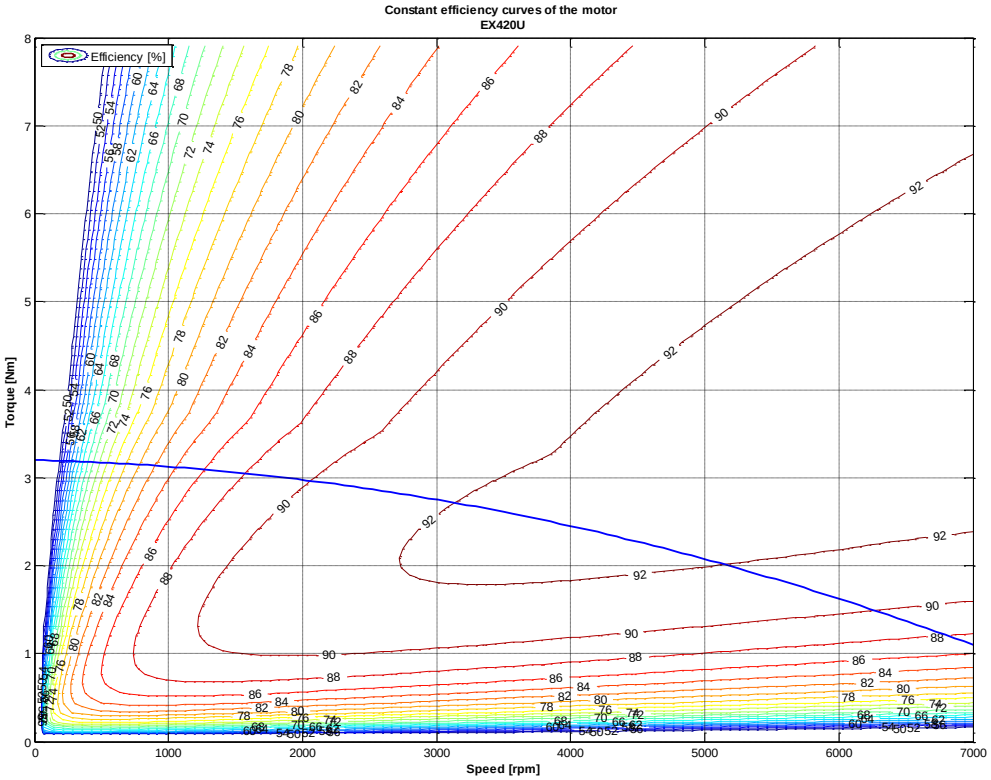
## 3.2.6.8. Series EX860E (EX860EAJ)



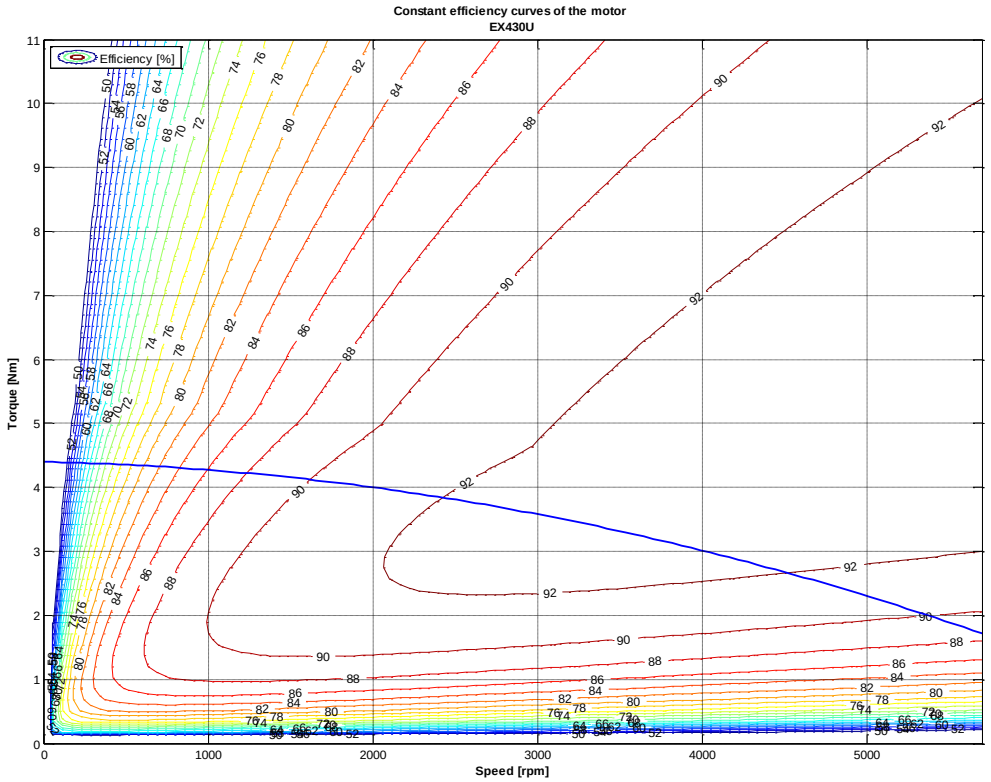
## 3.2.6.9. Series EX310U (EX310UAU)



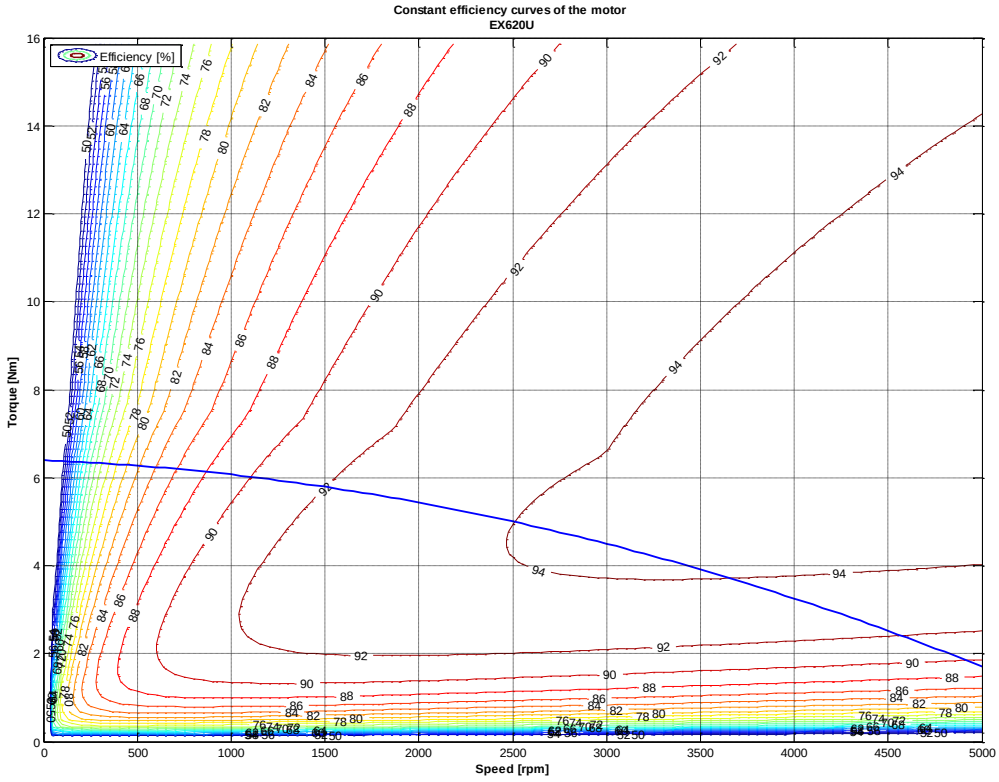
## 3.2.6.10. Series EX420U (EX420UAI)



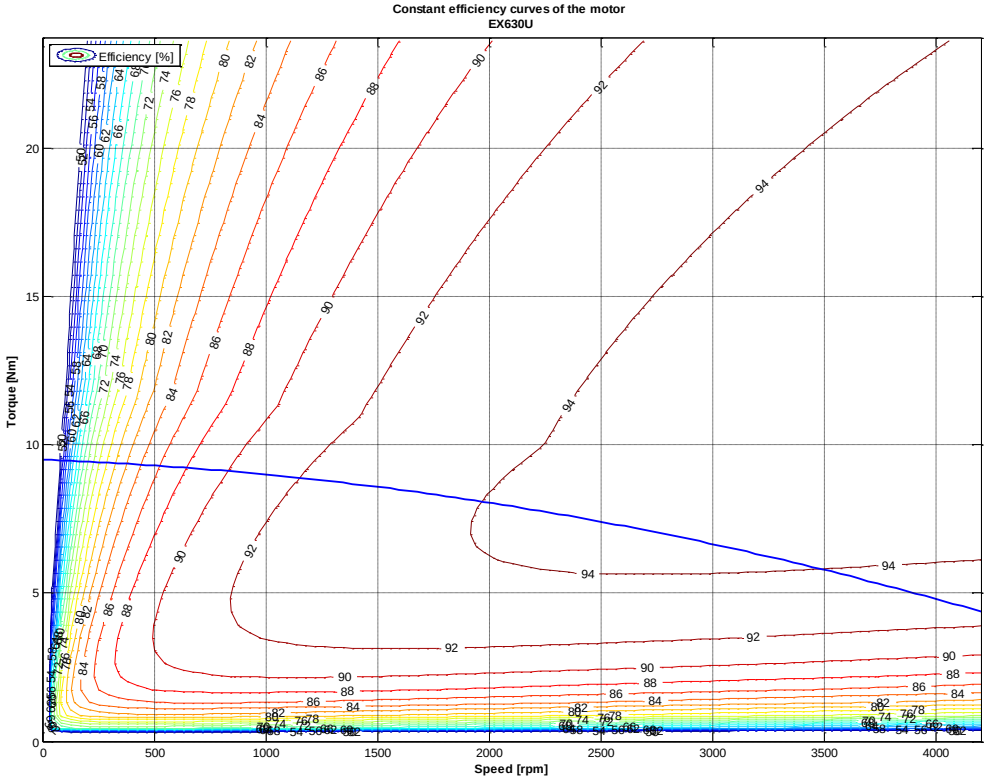

## 3.2.6.11. Series EX430U (EX430UAG)



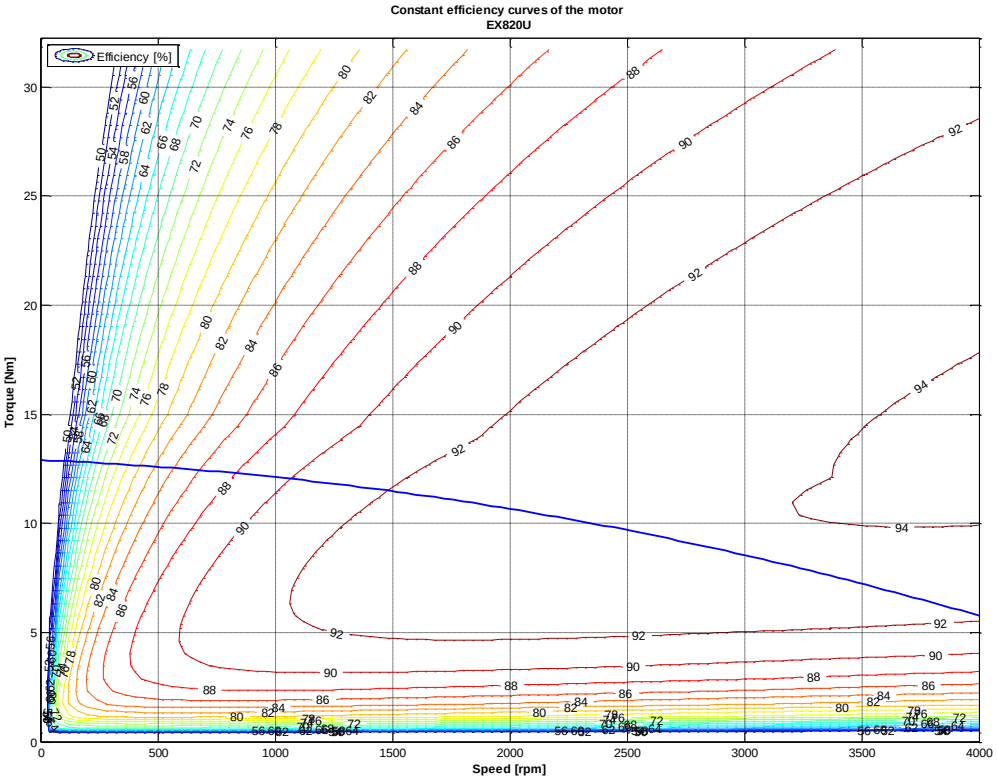
## 3.2.6.12. Series EX620U (EX620UAM)



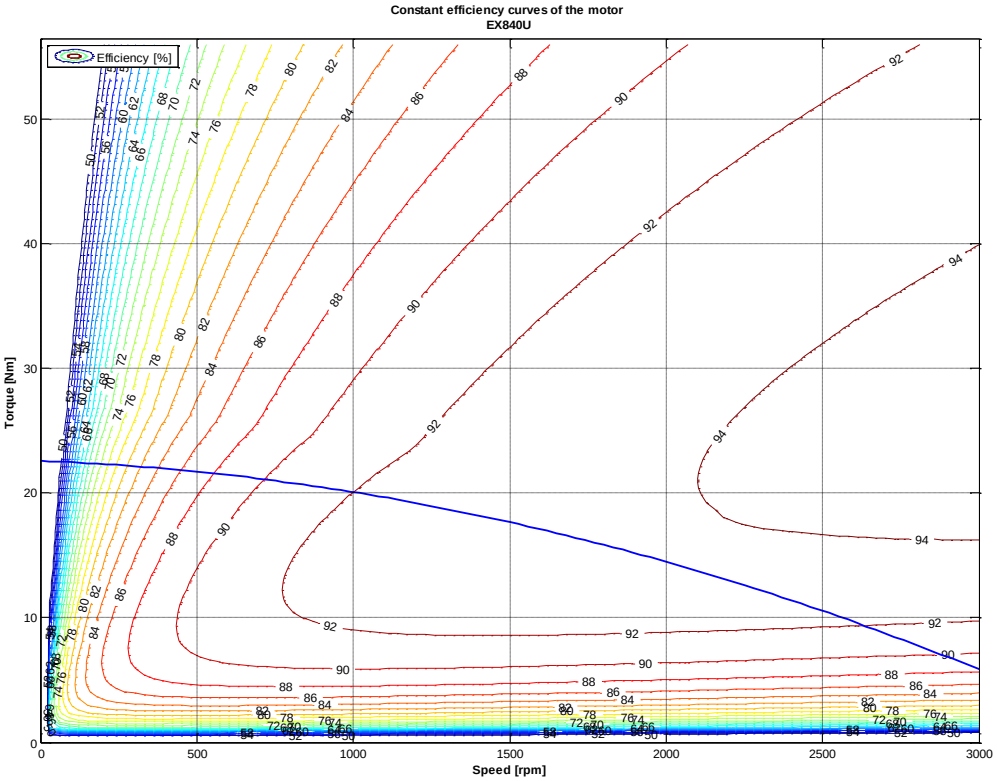

## 3.2.6.13. Series EX630U (EX630UAK)



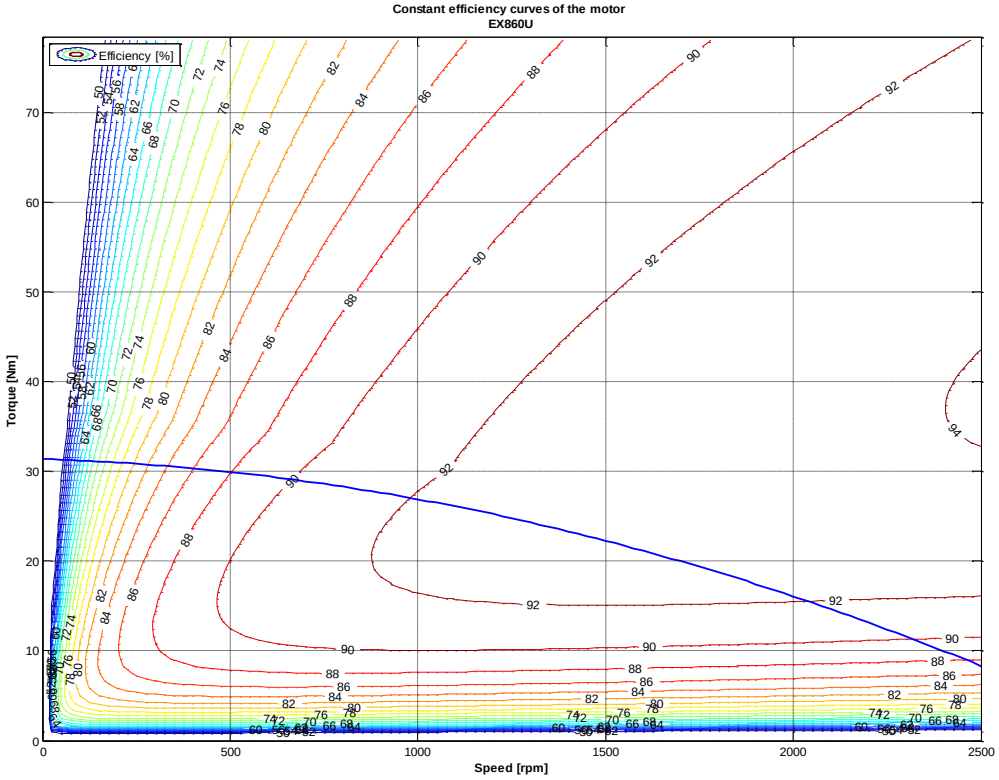
## 3.2.6.14. Series EX820U (EX820UAQ)




## 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 [$V_{rms/rad/s}$]
→ $\sigma_{mech}$=0.5*1.63*$98.10^{-5}$ /(0.7802²) = **1.3 ms**

**Remarks:**

For a DC motor, the mechanical time constant $\sigma_{mech}$ 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 $\sigma_{elec}$ is much smaller than the mechanical time constant $\sigma_{mech}$ (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:

$$N_{n2} = N_n * \frac{\frac{U_{n2}}{U_n} - 1 + \eta}{\eta}$$

$$N_{n2} = 3000 * \frac{\frac{360}{400} - 1 + 0.92}{0.92} = 2674 rpm$$

**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.<br>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).

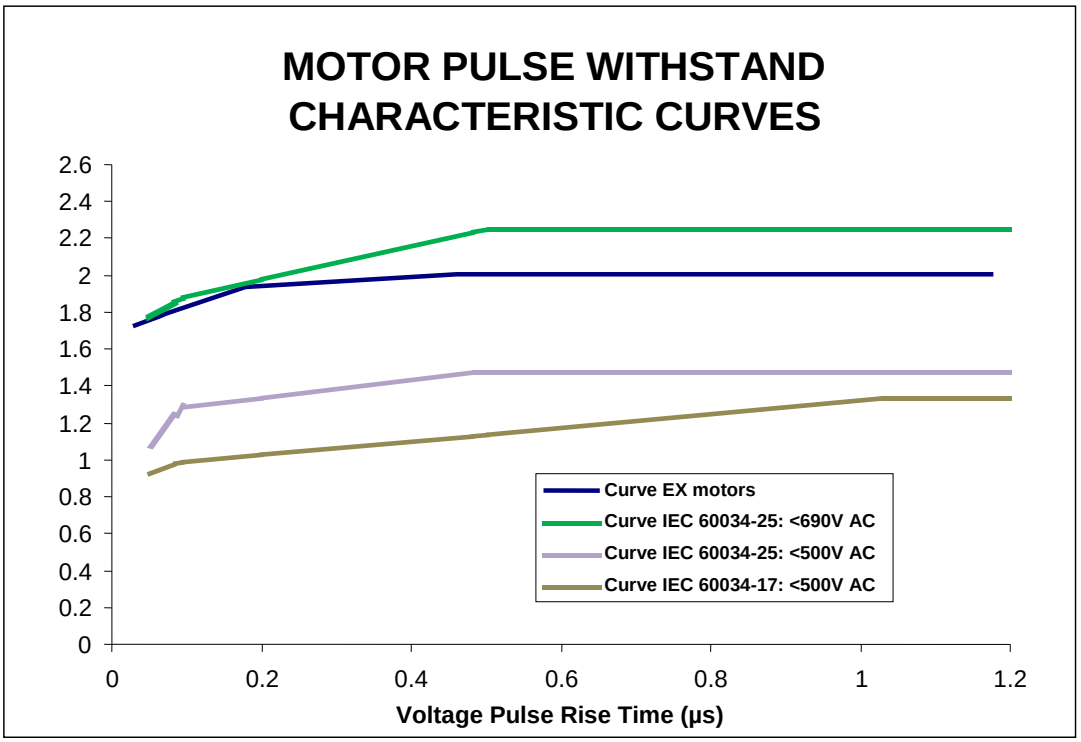



Figure 1: Minimum Voltage withstands characteristics for motors insulations according to IEC standards. At the top are the typical capabilities for the EX motors.

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 |

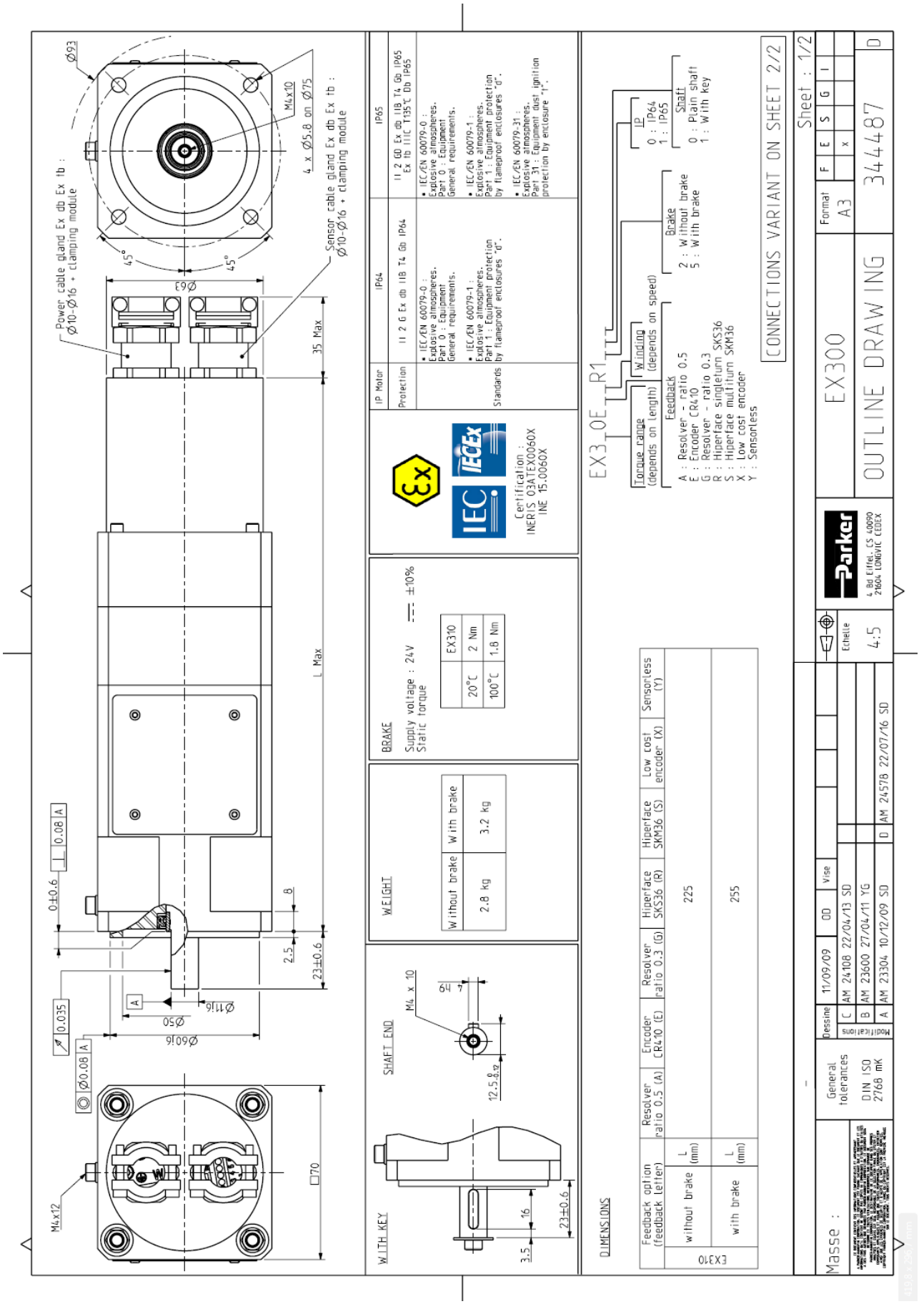
**EX8 UL :**

| 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 |

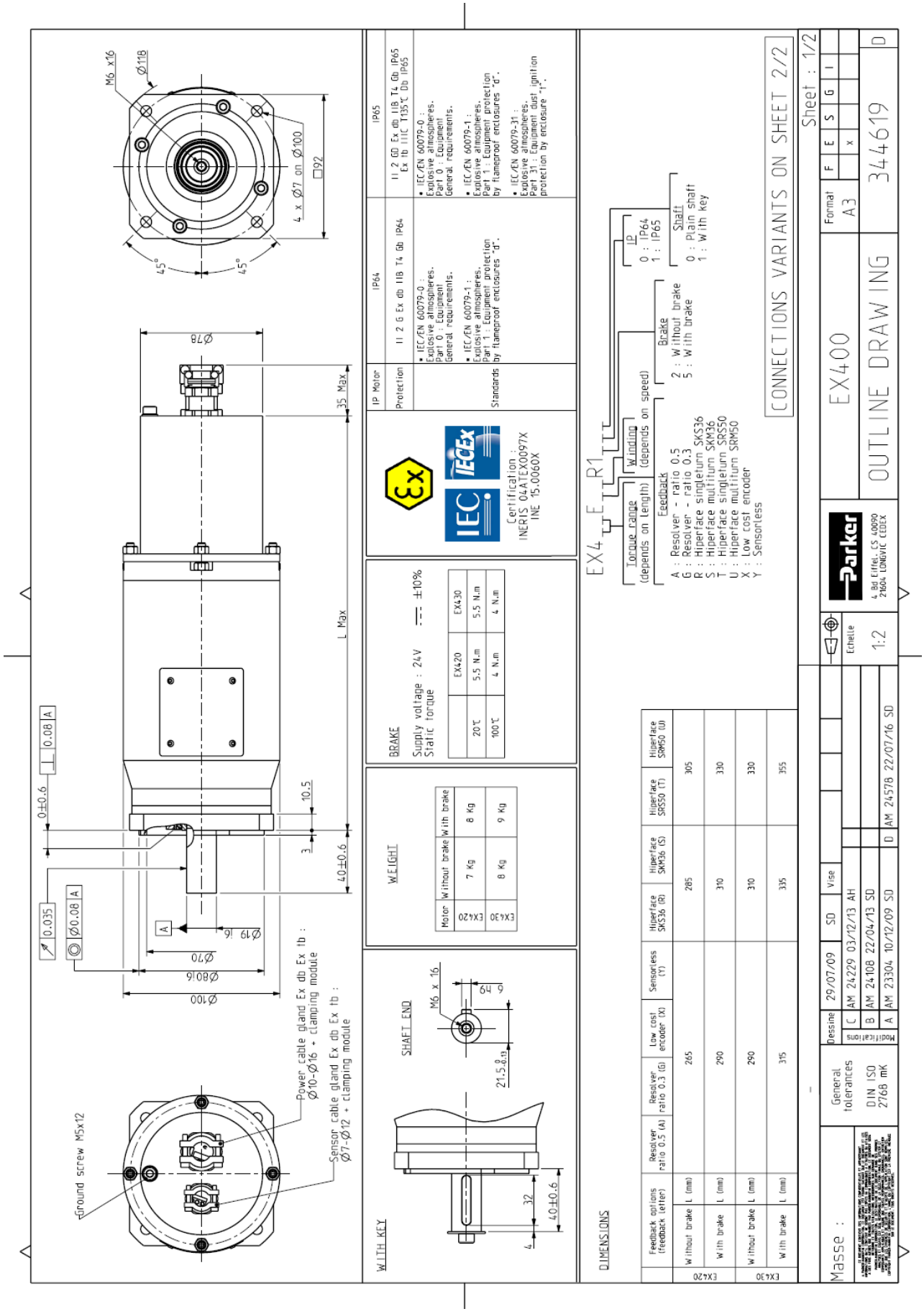
Warning : EX motors must be connected in accordance with the diagrams given in chapter §4.3.3

## 3.3. Dimension drawings

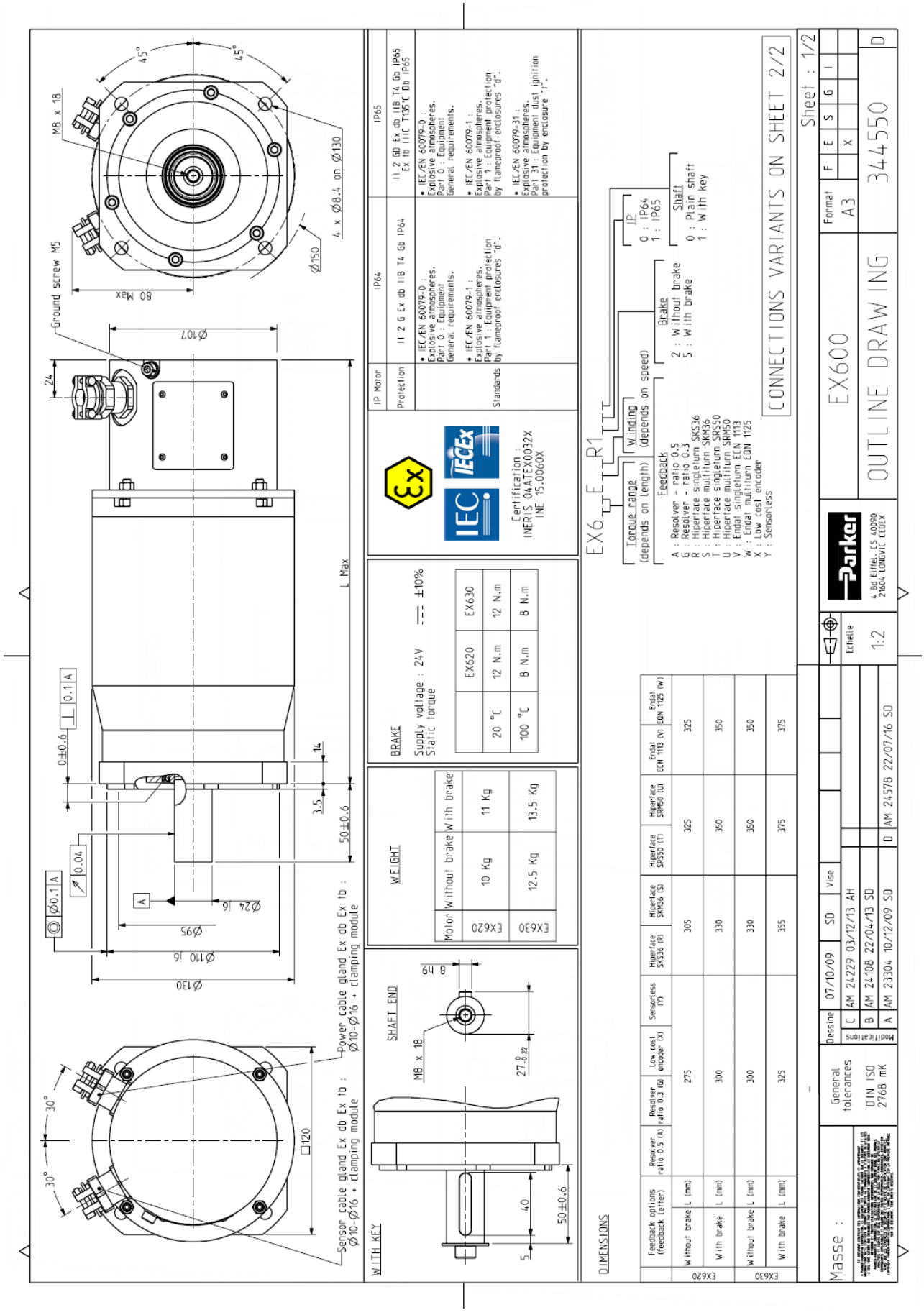
### 3.3.1. EX310E



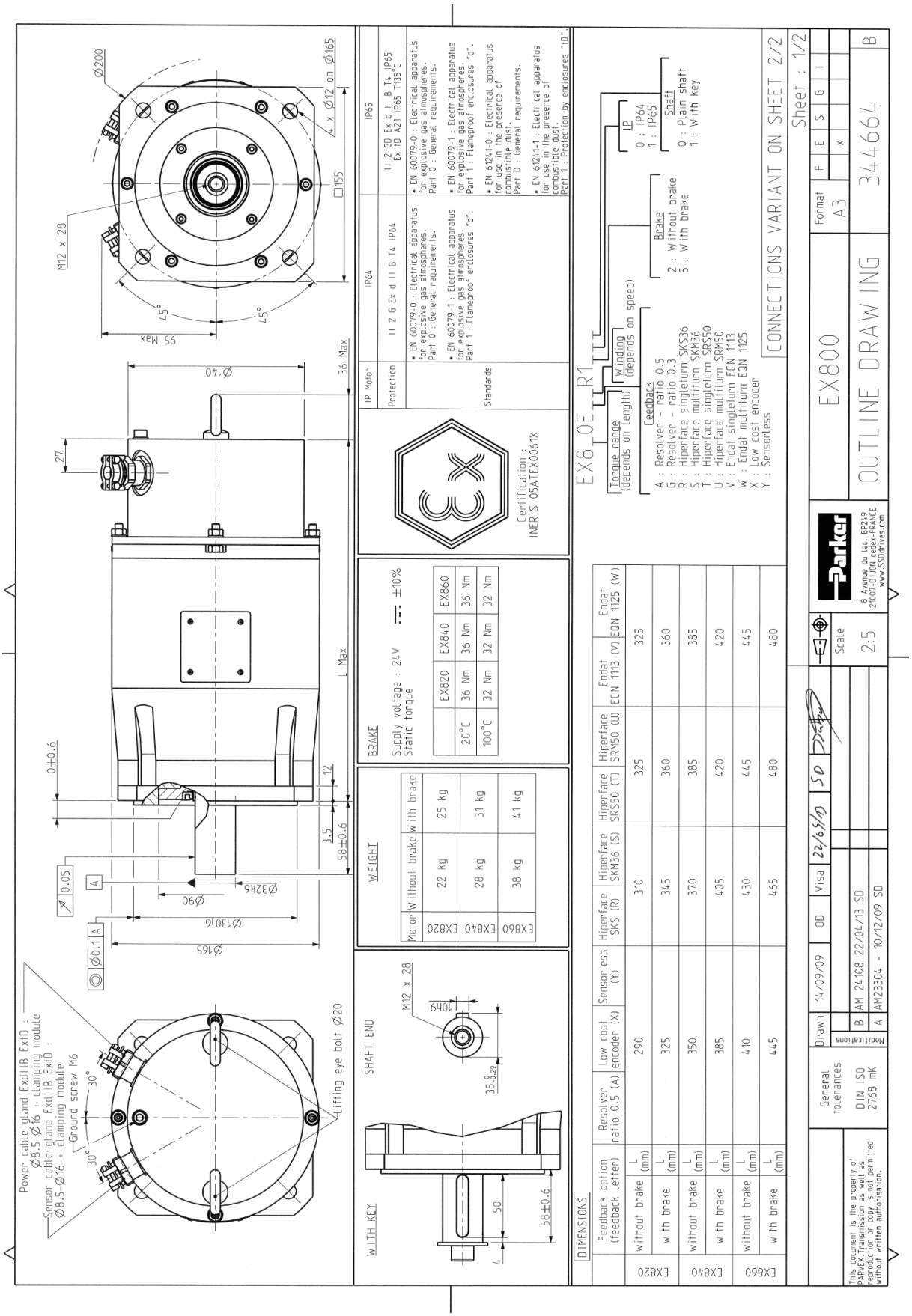
## 3.3.2. EX420E EX430E



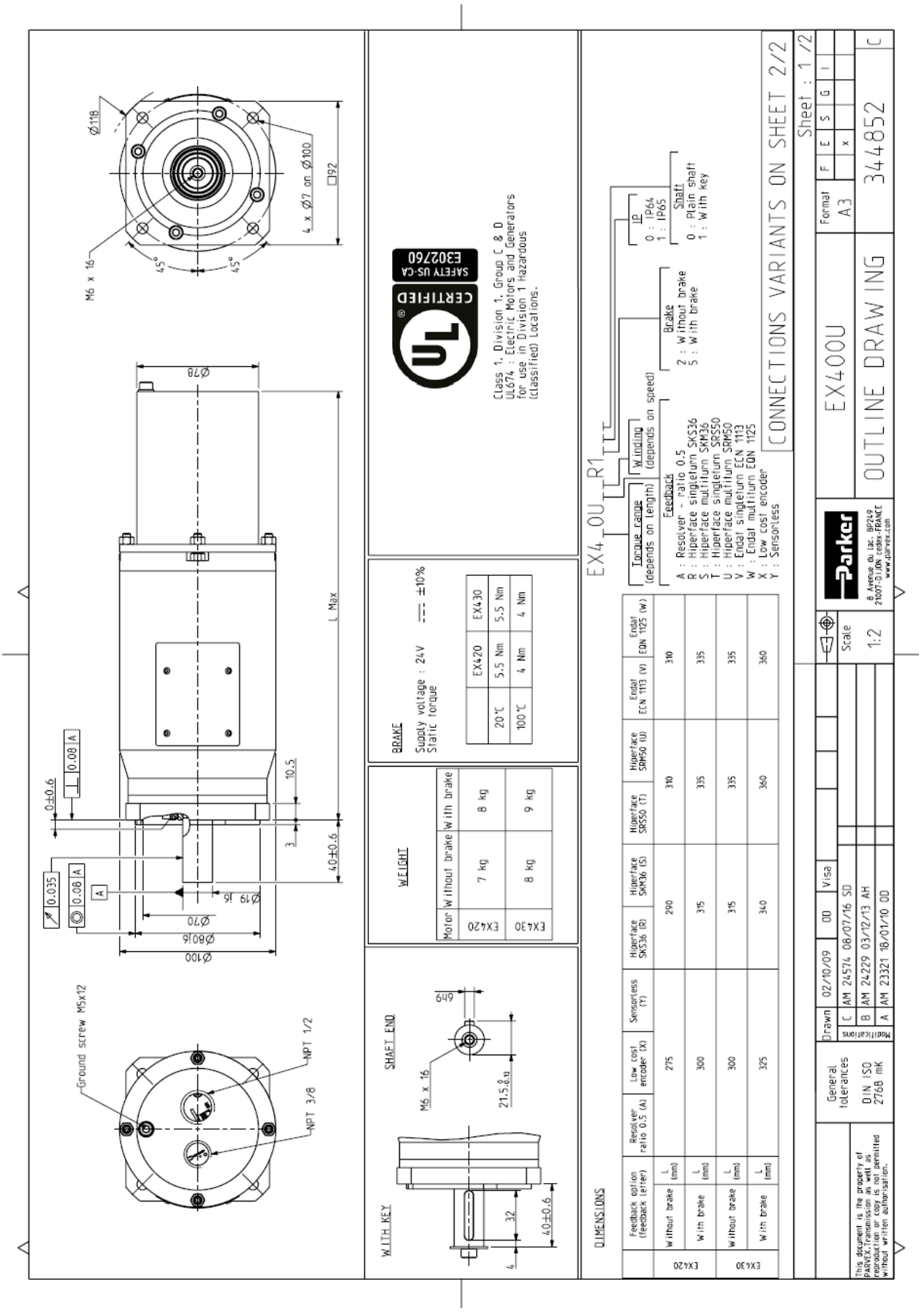
## 3.3.3. EX620E EX630E



## 3.3.4. EX820E EX840E EX860E



## 3.3.5. EX310U

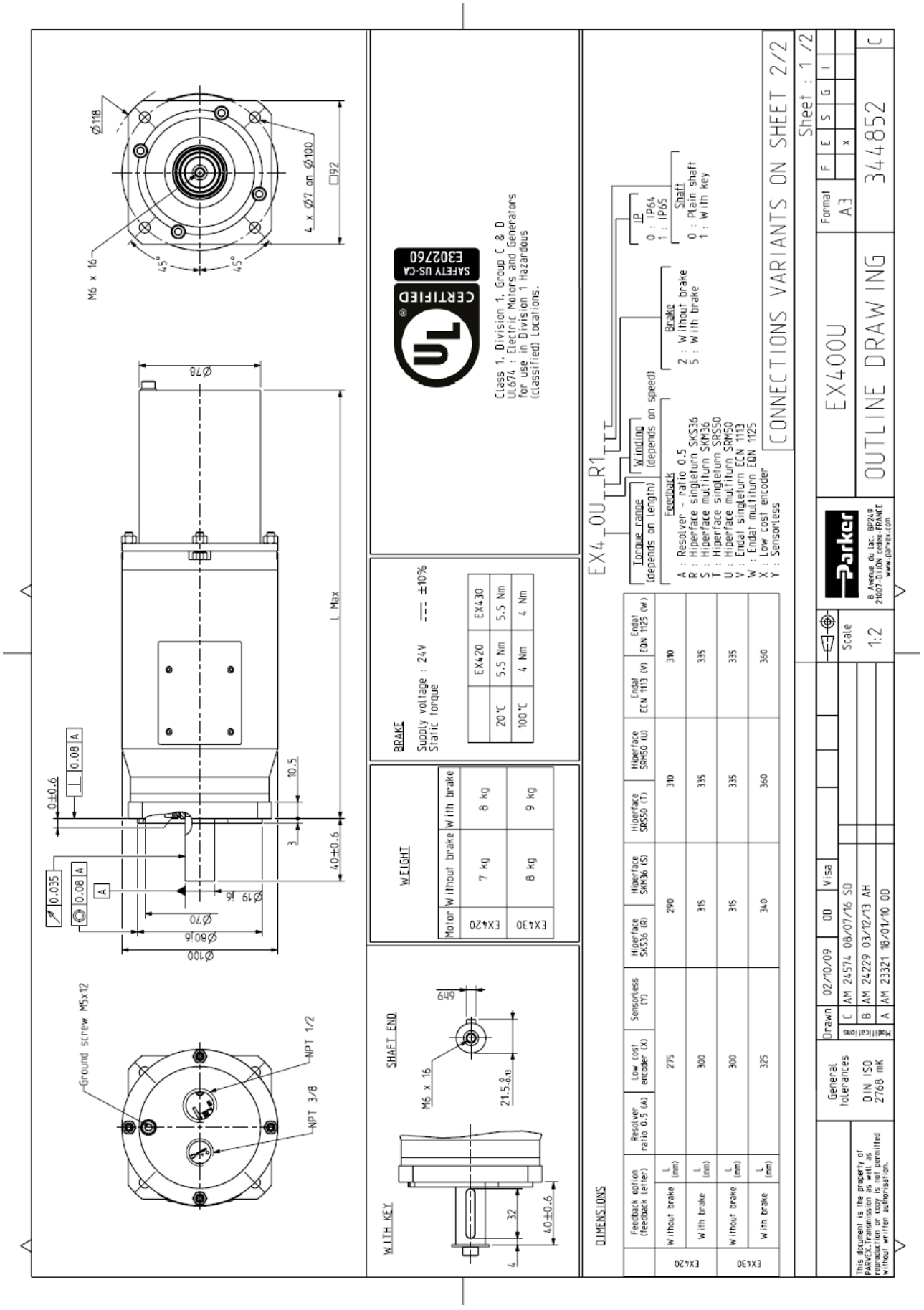



| Motor | Without brake | With brake |
|---|---|---|
| EX420 | 7 kg | 8 kg |
| EX430 | 8 kg | 9 kg |

| | EX420 | EX430 |
|---|---|---|
| 20°C | 5.5 Nm | 5.5 Nm |
| 100°C | 4 Nm | 4 Nm |

| | Feedback option (feedback letter) | | Resolver ratio 0.5 (A) | Low cost encoder (X) | Sensorless (Y) | Hiperface SKS36 (R) | Hiperface SKM36 (S) | Hiperface SRS50 (T) | Hiperface SRM50 (U) | Endat ECN 1113 (V) | Endat EQN 1125 (W) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EX420 | without brake | L (mm) | 275 | | | 290 | | 310 | | | 310 |
| | with brake | L (mm) | 300 | | | 315 | | 335 | | | 335 |
| EX430 | without brake | L (mm) | 300 | | | 315 | | 335 | | | 335 |
| | with brake | L (mm) | 325 | | | 340 | | 360 | | | 360 |

## 3.3.6. EX420U EX430U

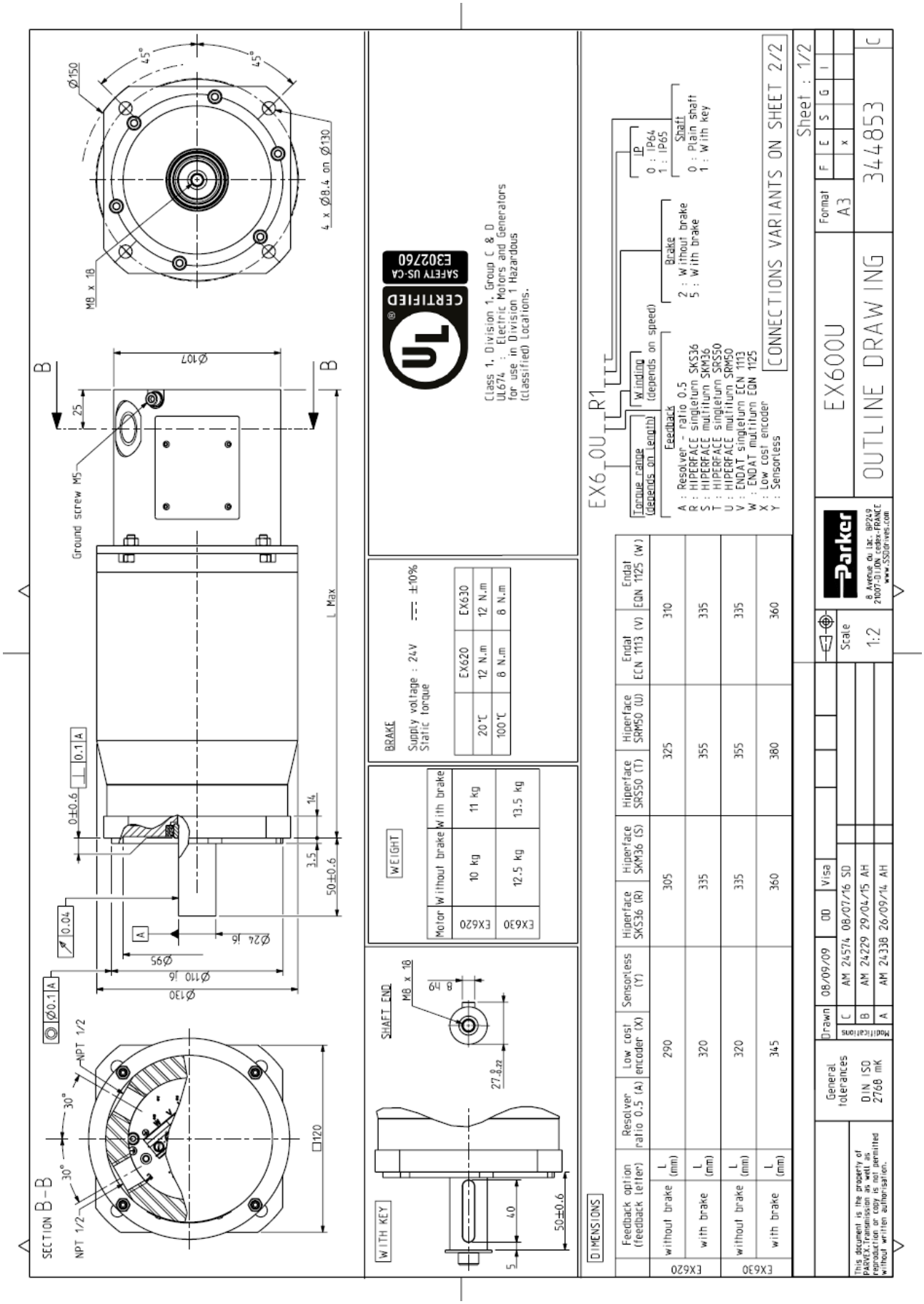



| Motor | Without brake | With brake |
|---|---|---|
| EX420 | 7 kg | 8 kg |
| EX430 | 8 kg | 9 kg |

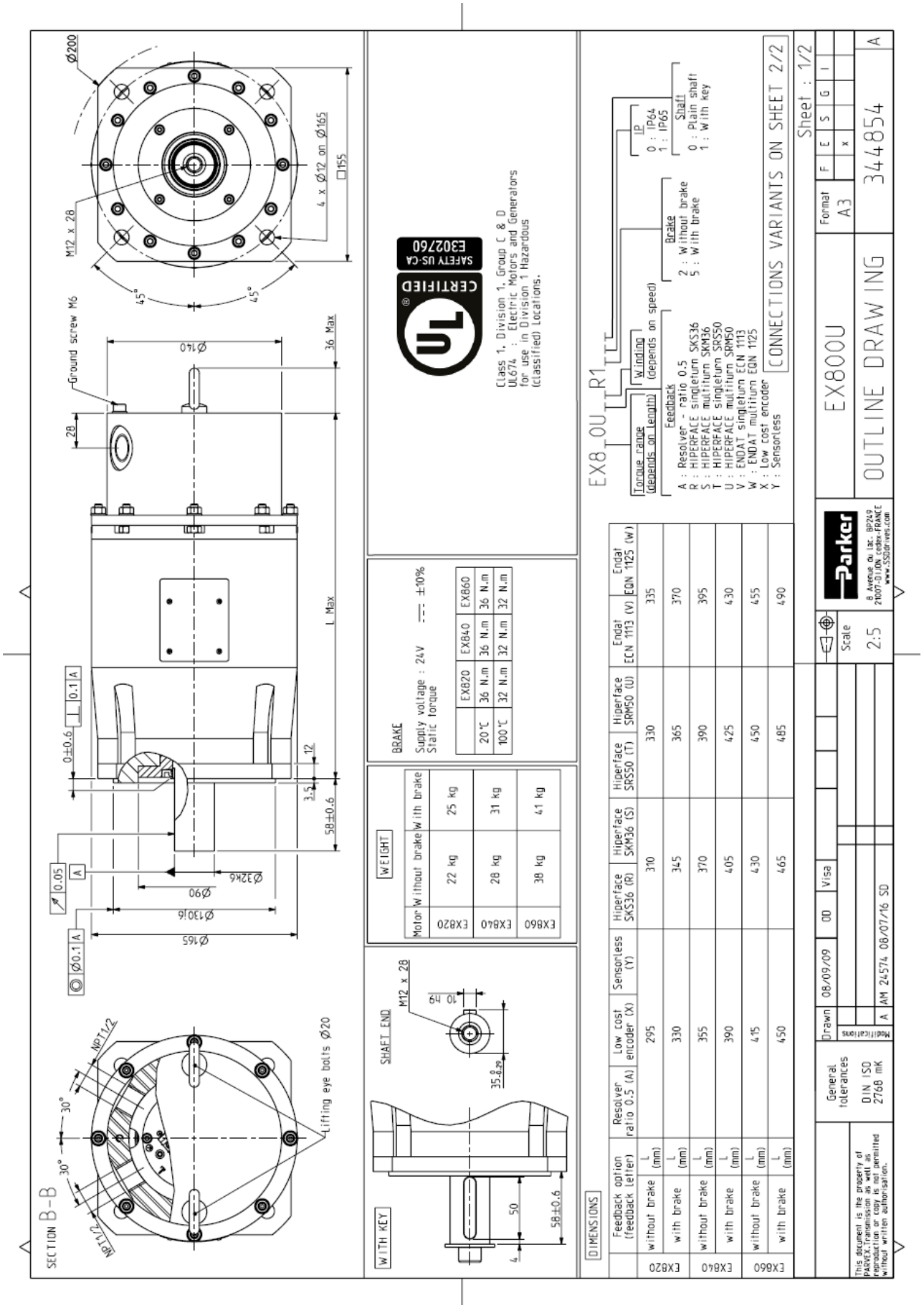
| | | Resolver ratio 0.5 (A) | Low cost encoder (X) | Sensorless (Y) | Hiperface SKS36 (R) | Hiperface SKM36 (S) | Hiperface SRS50 (T) | Hiperface SRM50 (U) | Endat ECN 1113 (V) | Endat EQN 1125 (W) |
|---|---|---|---|---|---|---|---|---|---|---|
| EX420 | Without brake | L (mm) | 275 | | 290 | | 310 | | | 310 |
| | With brake | L (mm) | 300 | | 315 | 335 | | | | 335 |
| EX430 | Without brake | L (mm) | 300 | | 315 | | 335 | | | 335 |
| | With brake | L (mm) | 325 | | 340 | 360 | | | | 360 |

| | 20°C | 100°C |
|---|---|---|
| EX420 | 5.5 Nm | 4 Nm |
| EX430 | 5.5 Nm | 4 Nm |

## 3.3.7. EX620U EX630U



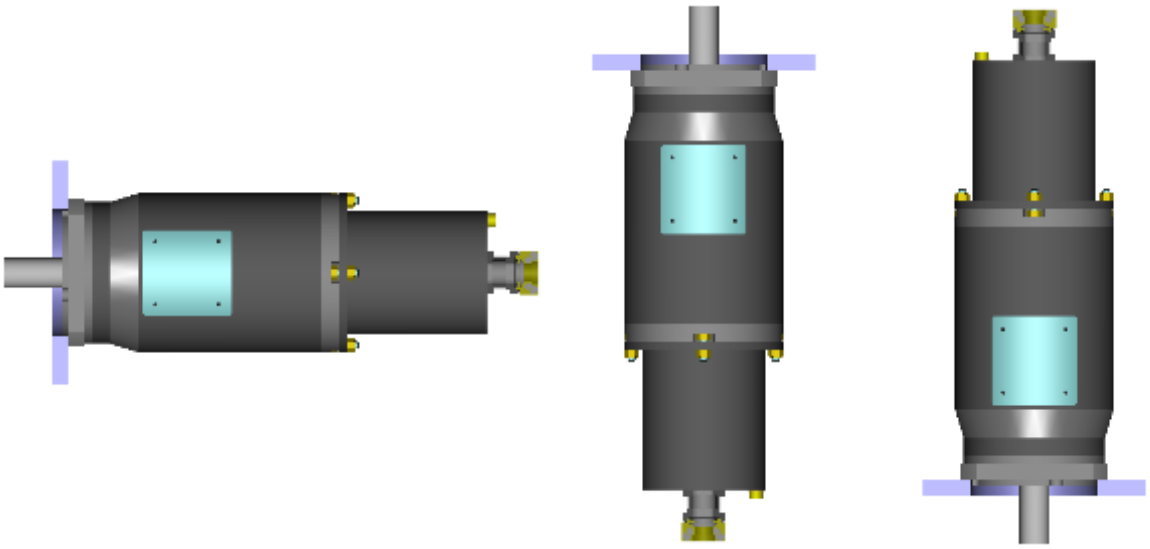
## 3.3.8. EX820U EX840U EX860U



## 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.<br>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.<br>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 |

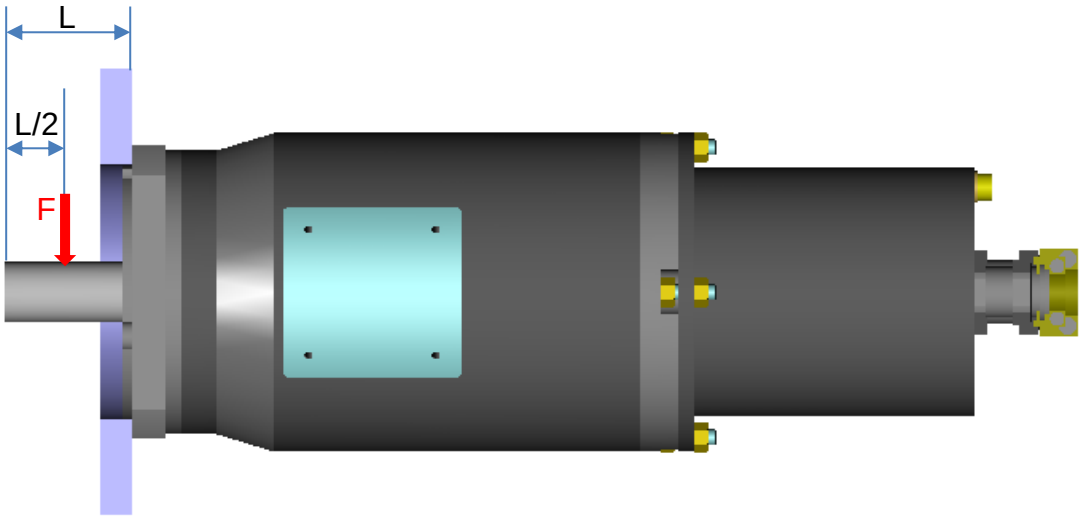
## 3.5. Shaft Loads

### 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 :**<br>The values written in the table are given for a load placed on the middle of the shaft like the picture below. |




| | |
|---|---|
| | **Warning :**<br>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.<br>The ATEX airgap requirements depend on the volume of the motor and can lead to lower radial loads for bigger motors. |

| | |
|---|---|
| | **Warning :**<br>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.<br>• if the air is not able to circulate freely around the motor,<br>• if the motor is mounted on a surface that dissipates not well the heating (surface with little dimensions for instance),<br>• if the motor is thermally isolated,<br>• if the motor is mounted on a warm surface (mounted on a gearbox for instance),<br>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 $\sqrt{2} \times 0.8\ Io \cong \mathbf{1,13 \times I_o}$. |

| | |
|---|---|
|  | 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.<br><br>Warning : the cables used in the :<br>• EX3 can reach a temperature of 80°C,<br>• EX4 can reach a temperature of 93°C,<br>• EX6 can reach a temperature of 95°C,<br>• EX8 can reach a temperature of 95°C<br><br>Warning : for a safe use, the EX3 servomotors has to be used with cable which withstand a maximum temperature of 80°C.<br><br>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.<br>• the first one is connected to ground screw on the PCB inside the motor,<br>• the other one is connected to the external motor housing<br>The connecting of these two grounding devices is mandatory in order to comply with ATEX standard IEC/EN 60079-0.<br>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 |

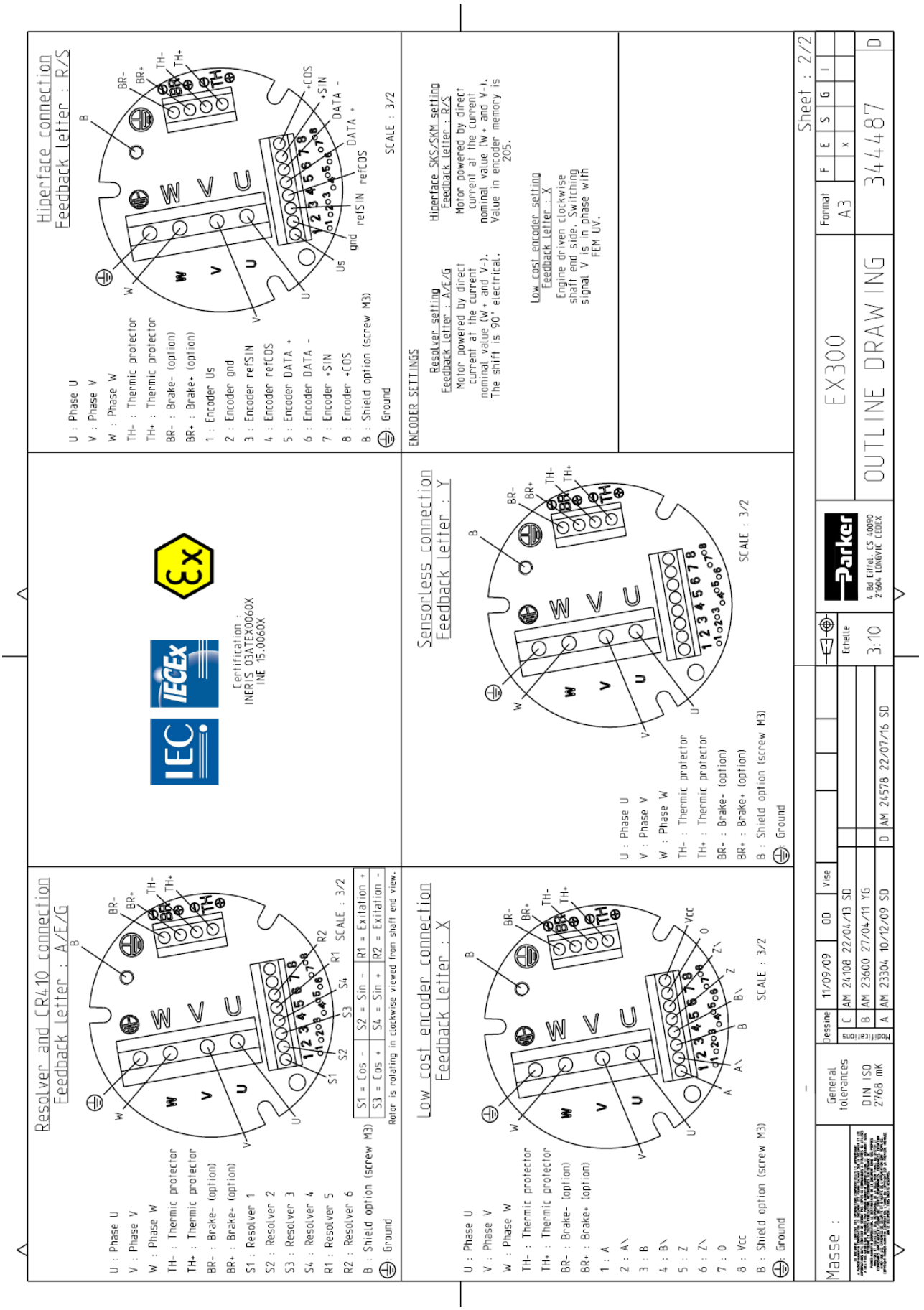
### 3.8.4. Motor cable length

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.

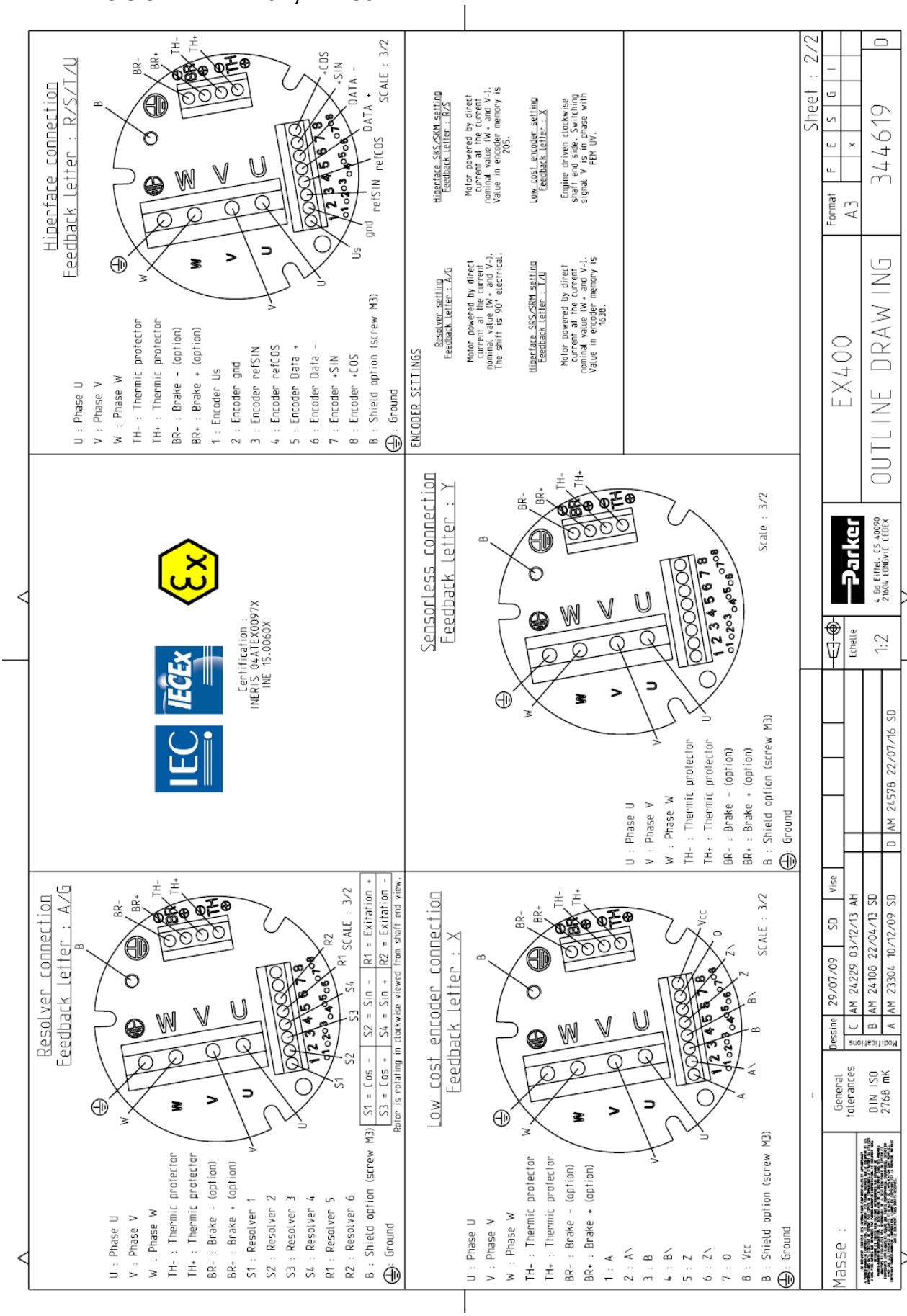
| | |
|---|---|
|  | Caution: It might be necessary to fit a filter at the servo-drive output if the length of the cable exceeds 25 m. Consult us. |
|  | The length of the cable must be of 3 meters min. |

## 3.8.5. Mains supply connection diagrams

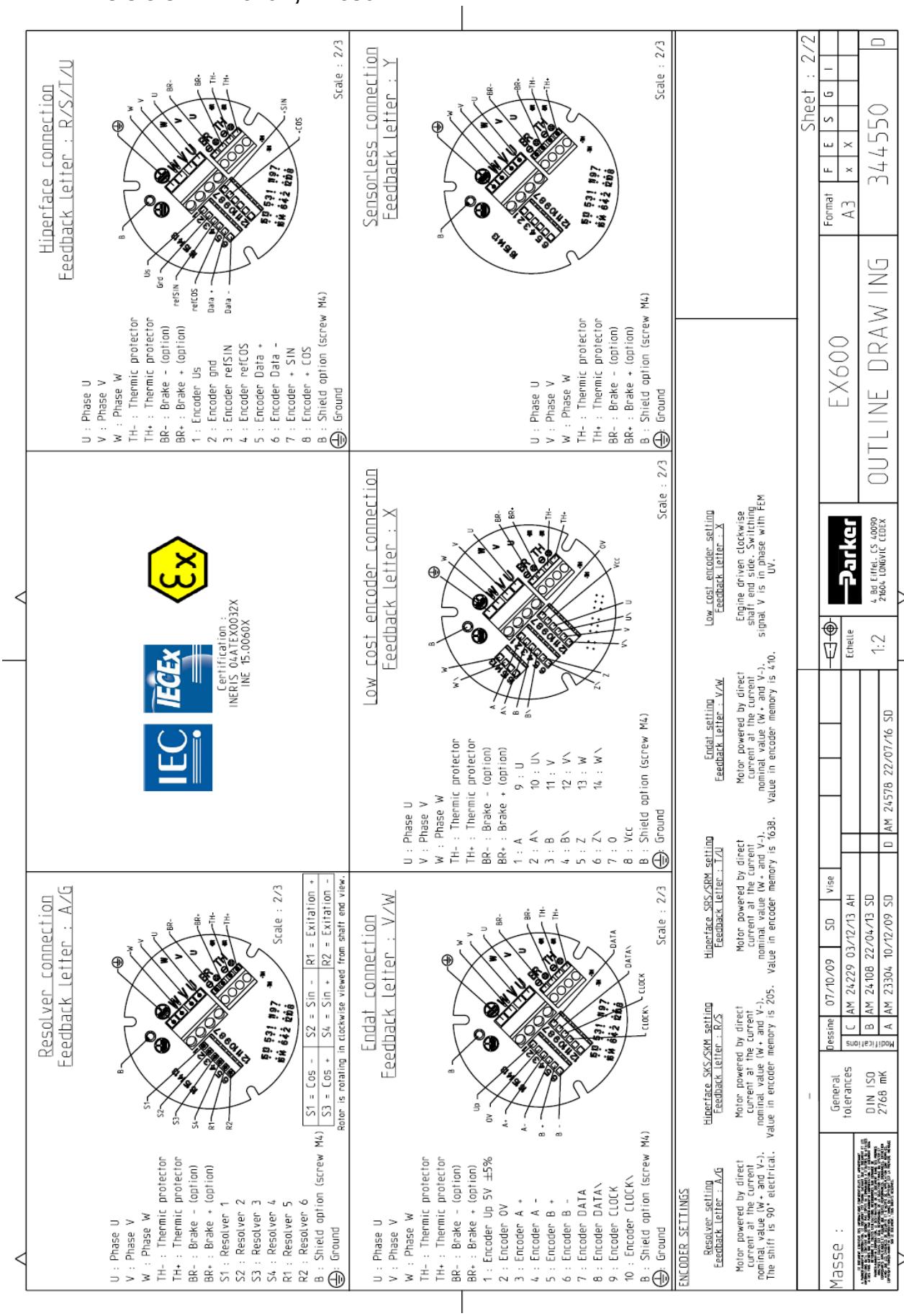
### 3.8.5.1. EX310E



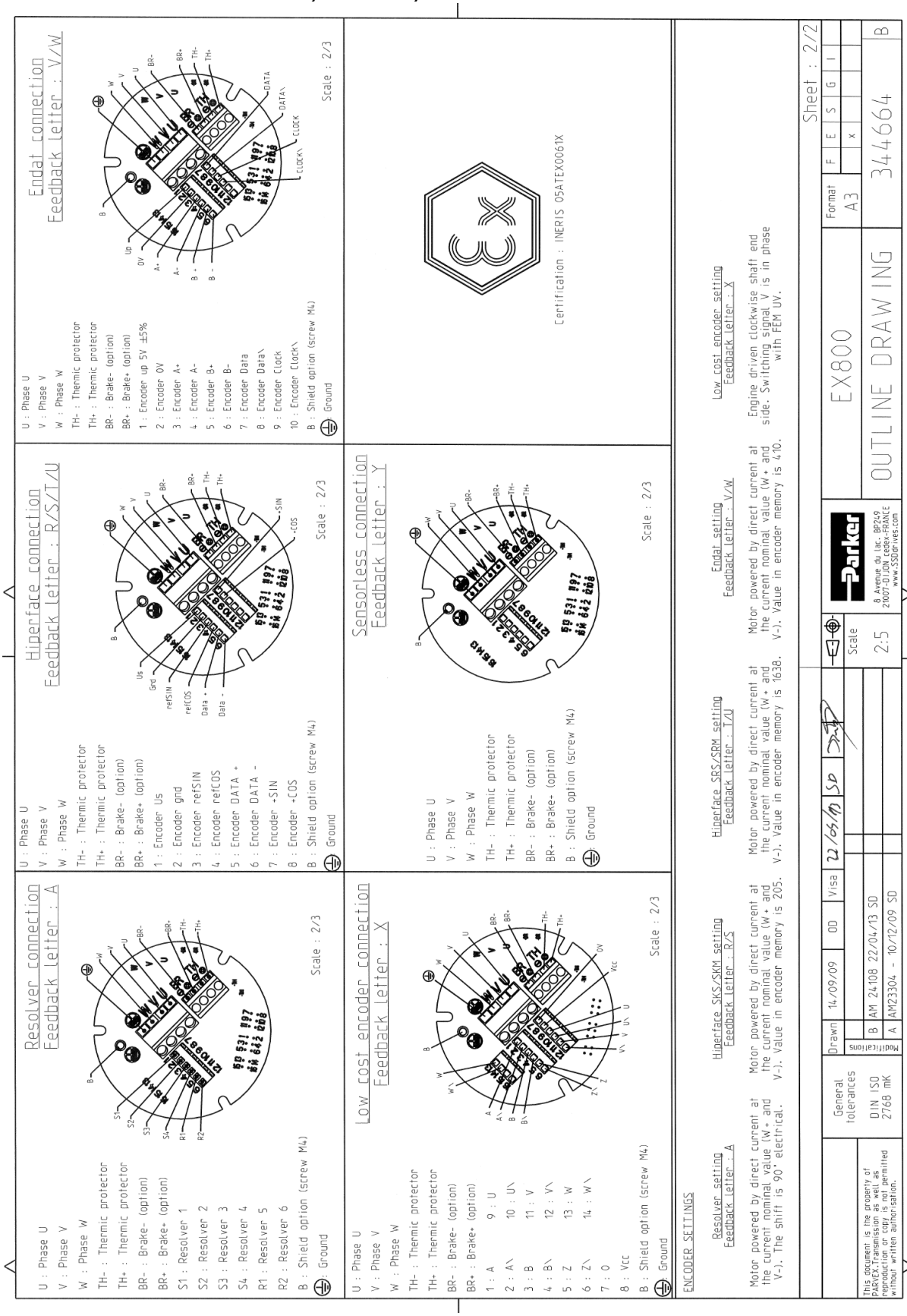
### 3.8.5.2. EX420E, EX430E



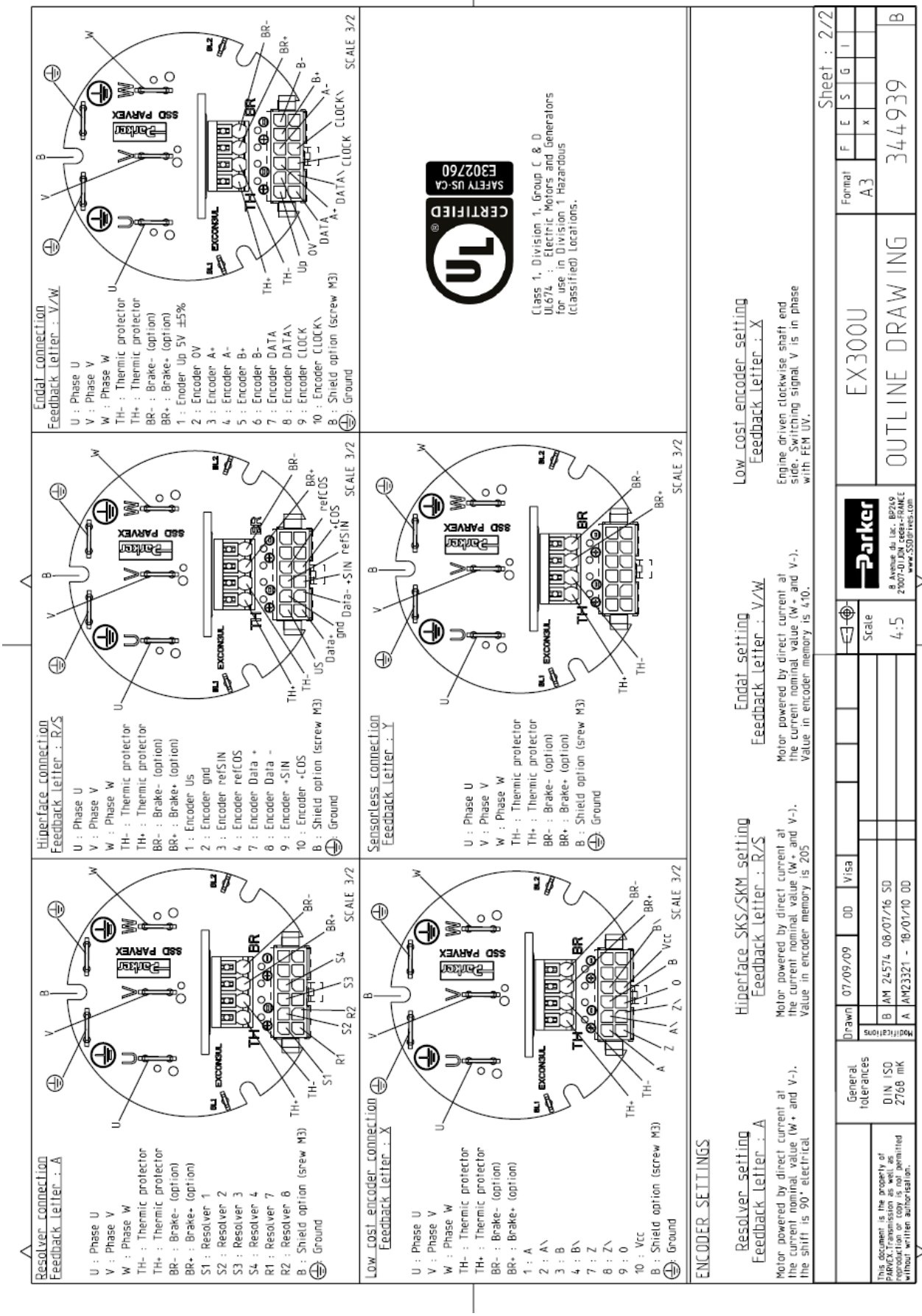
### 3.8.5.3. EX620E, EX630E



## 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 (srew 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 (srew 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 : Encoder 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 (srew 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.
EX300U
OUTLINE DRAWING
Format A3
Sheet : 2/2
344939
B
Drawn 07/09/09 OD Visa
Modifications
B AM 24574 08/07/16 SD
A AM23321 - 18/01/10 OD
General tolerances
DIN ISO 2768 mK
Scale 4:5
Parker
8 Avenue du Lac BP249
21007-DIJON cedex-FRANCE
www.SSDdrives.com
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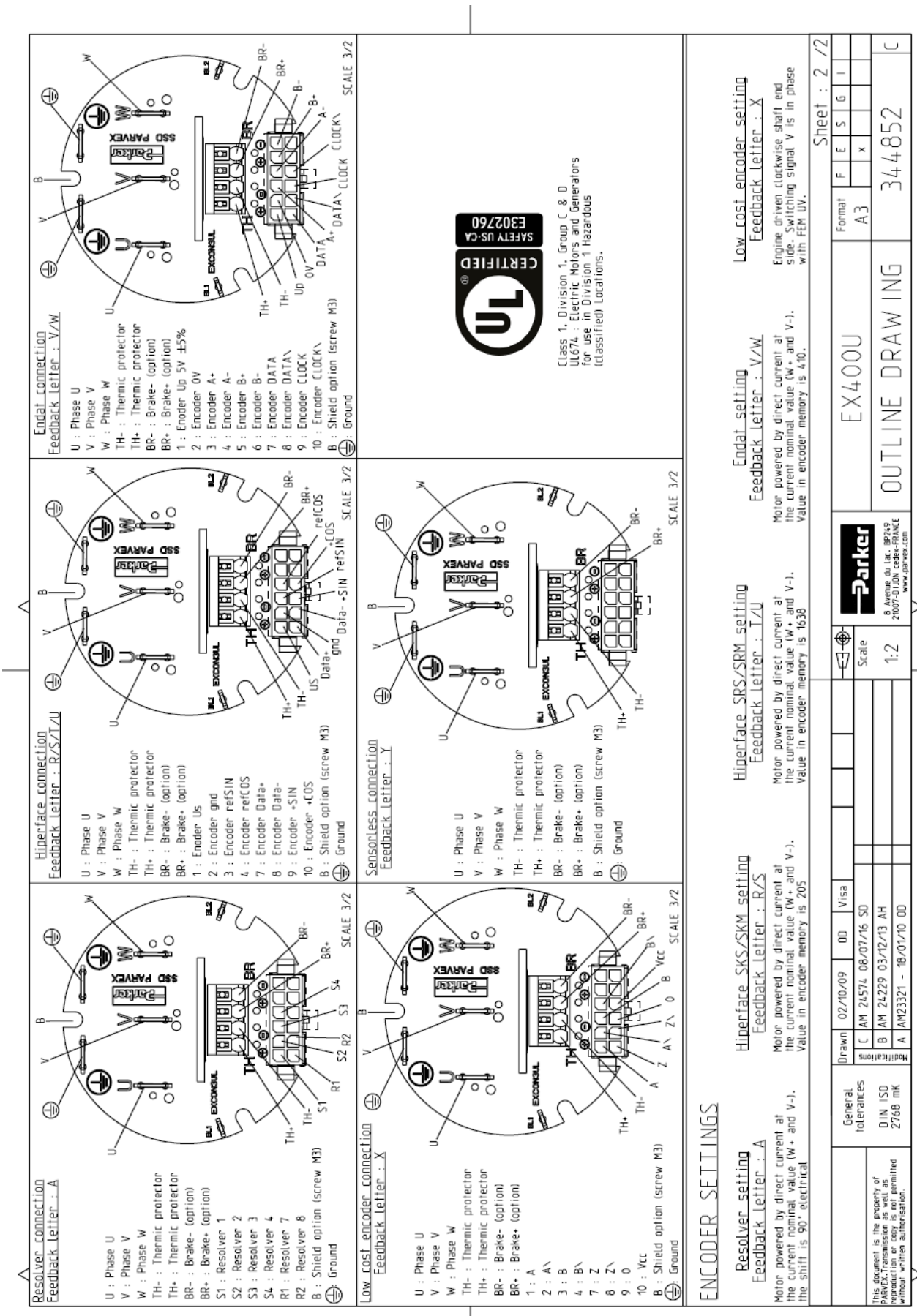
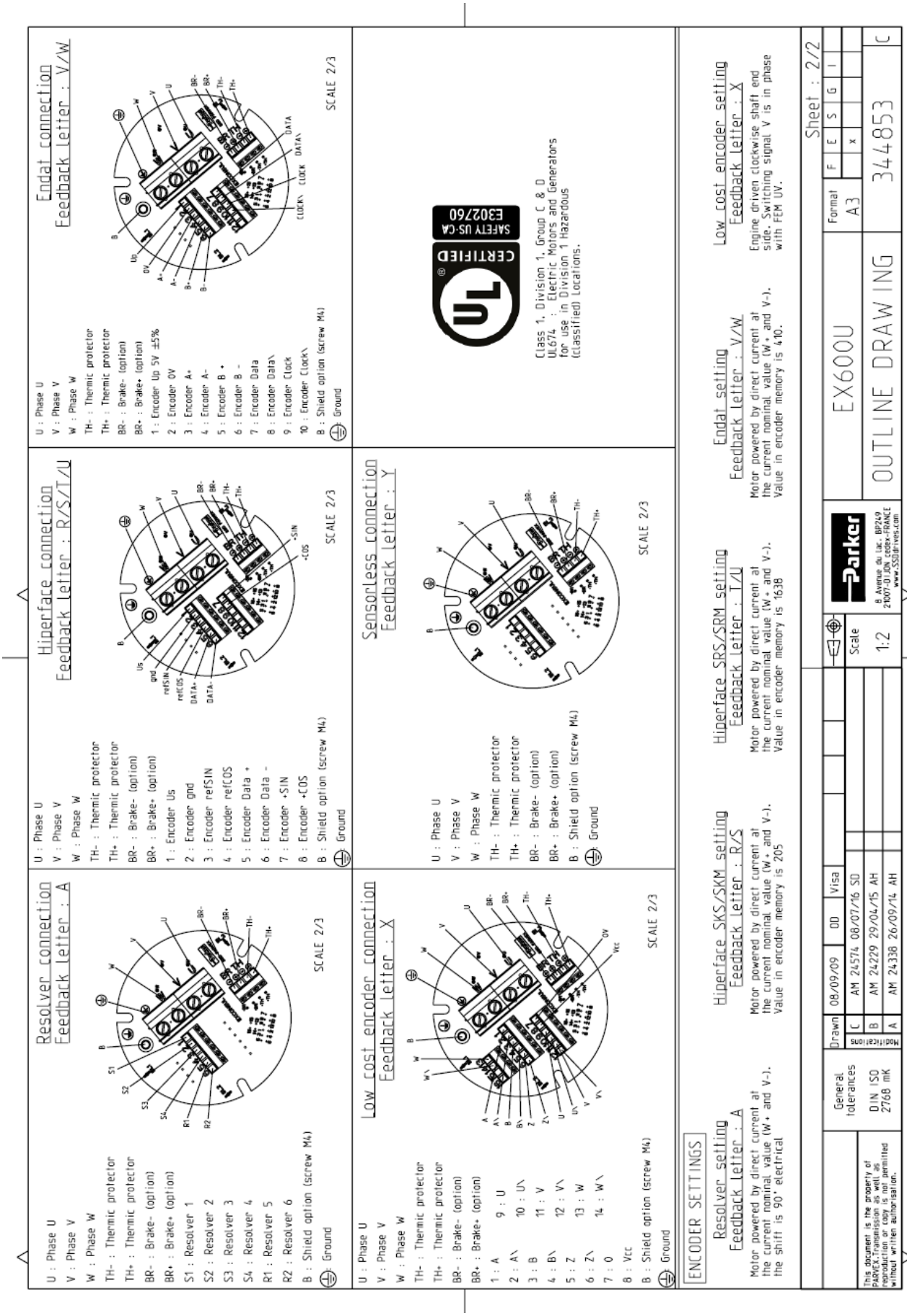
reproduction is not permitted
without written authorisation.

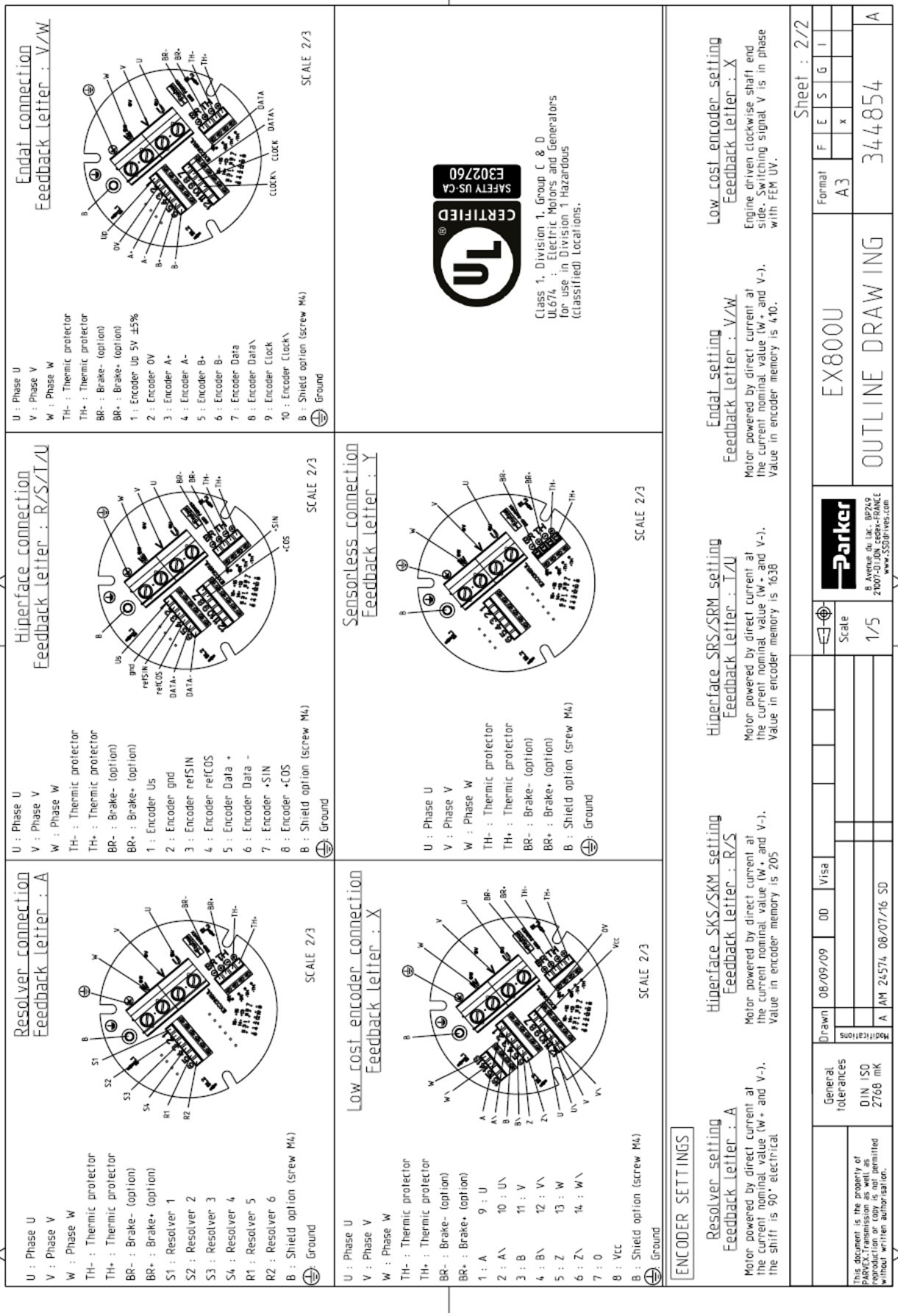
### 3.8.5.6. EX420U, EX430U



### 3.8.5.7. EX620U, EX630U

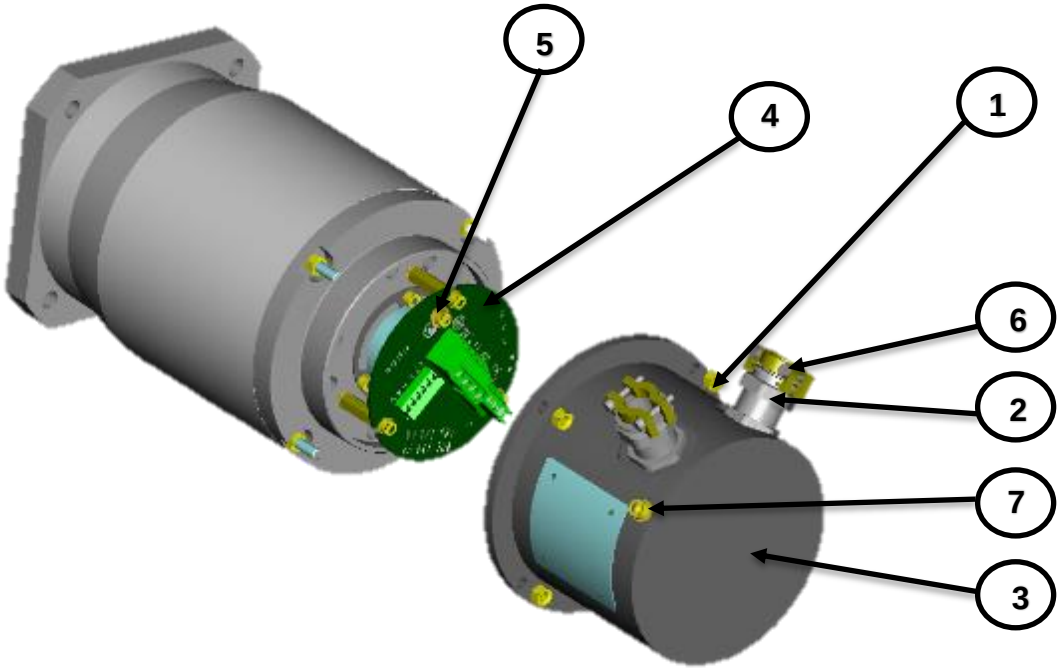


### 3.8.5.8. EX820U, EX840U, EX860U



## 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 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 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 |

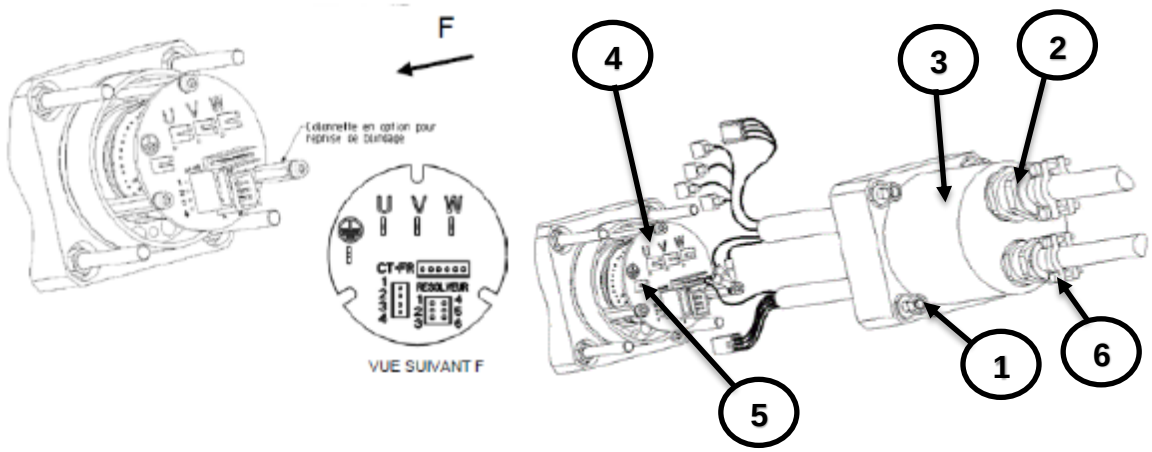
3. Tighten the screws of the connection modules Ref 6 at the torque value of 0,5 N.m.
4. Place the rear cover Ref 3 and take care to don't hurt the toric seal placed on the rear flange.
5. Tighten the 4 nuts Ref 1 at the torque value of :

| Motor size | Torque (N.m) |
|---|---|
| EX3-EX4-EX6 M5 nuts | 5,6 |
| EX8 M6 nuts | 8,5 |

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 :**

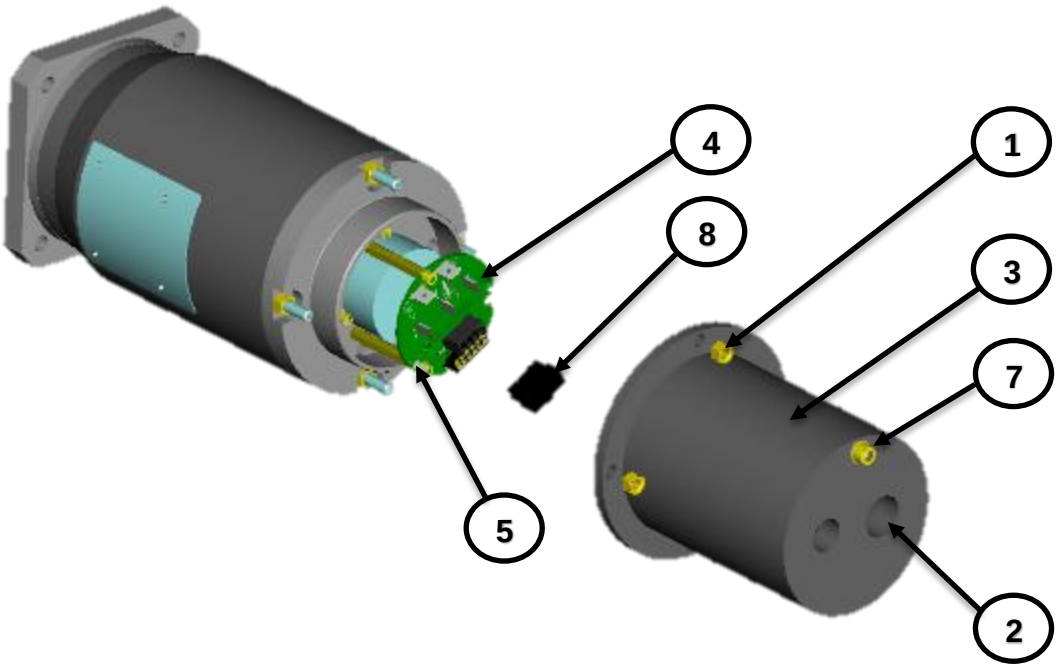
1. Slowly take up any slack in the cables and close the cover Ref 3.
2. Tighten the cable gland caps Ref 2 at the torque value of :

| 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.

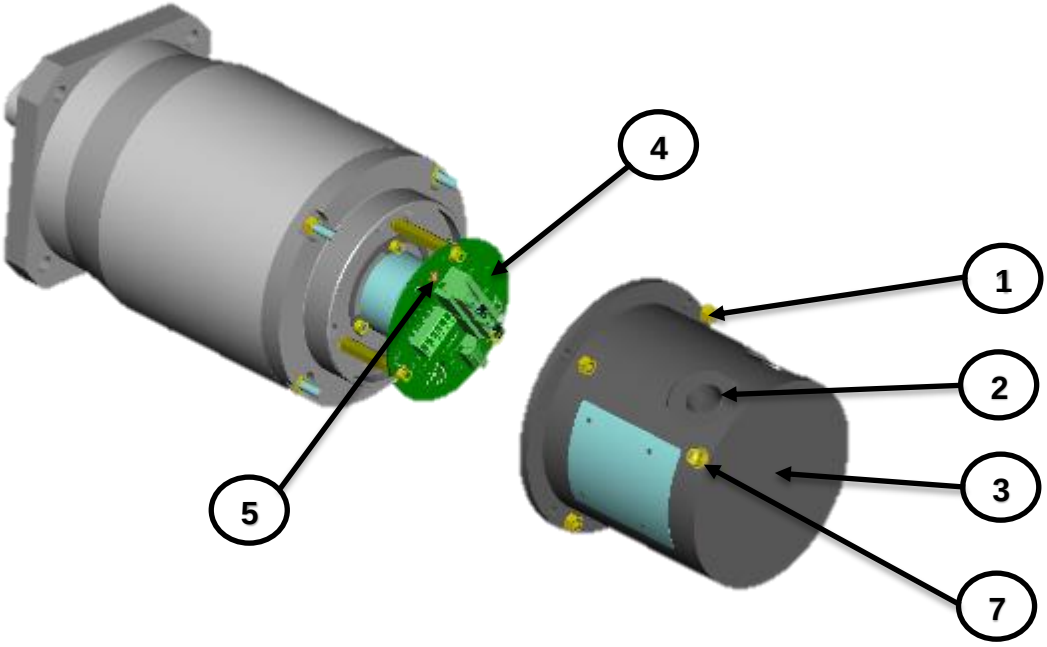
**Step 4 – Fitting of the rear cover :**

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<br>Current consumption (without load) | 7VDC to 12VDC<br>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<br>Current consumption (without load) | 7VDC to 12VDC<br>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<br>Current consumption (without load) | 7VDC to 12VDC<br>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<br>Current consumption (without load) | 7VDC to 12VDC<br>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<br>Current consumption (without load) | | 3.6VDC to 14VDC<br>85mA @ 5VDC |
| Cutoff frequency – 3 dB | | ≥ 190kHz typical |
| Operating temperature range | | -40°C to +115 °C |

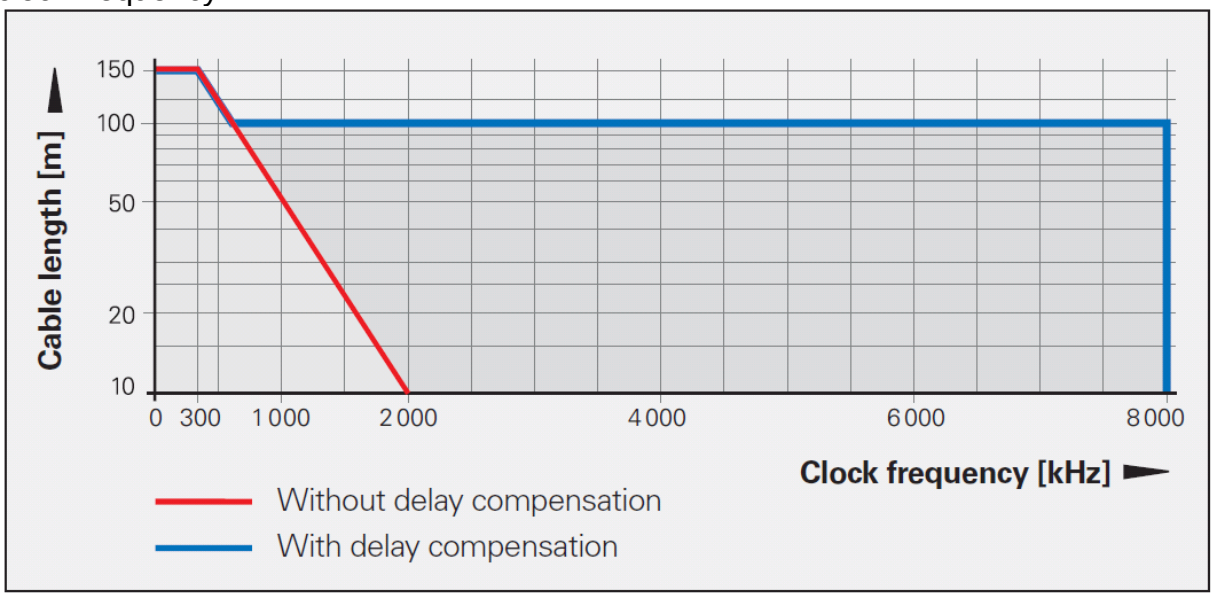
### 3.9.9. Endat encoder multiturn ECN1125 – code W

| | 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<br>Current consumption (without load) | | 3.6VDC to 14VDC<br>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

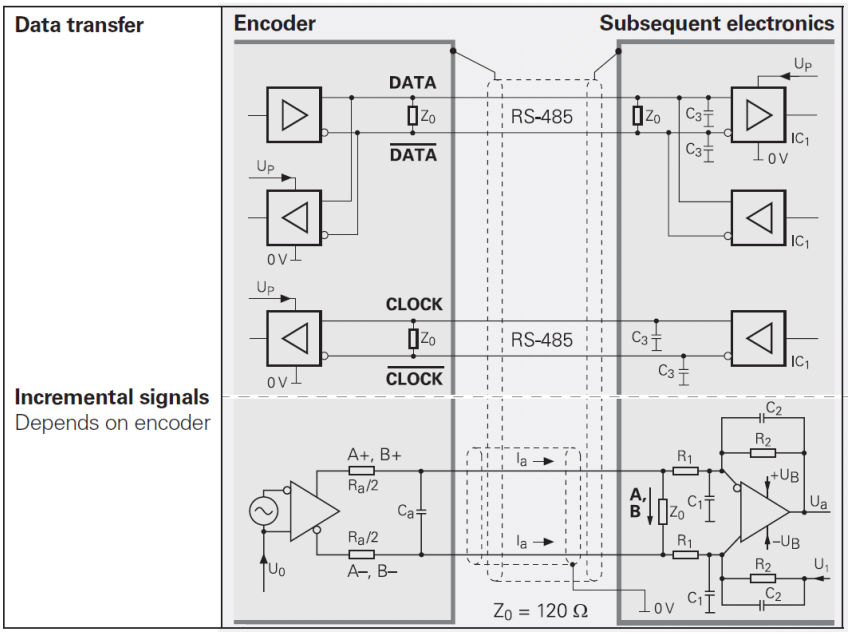
## From Heidenhain

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'<br>commutation signals ± 6' |
| Operating speed | 5 000 rpm |
| Power Supply<br>Current consumption (without load) | 5VDC ± 10%<br>100mA |
| Max pulse frequency | 300 kHz |
| Operating temperature range | 0°C to +120 °C |

## 3.10. Cables

You can connect EY 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.<br><br>Warning : the cables used in the :<br>• EX3 can reach a temperature of 80°C,<br>• EX4 can reach a temperature of 91°C,<br>• EX6 can reach a temperature of 95°C,<br>• EX8 can reach a temperature of 95°C<br><br>Warning : for a safe use, the EX3 servomotors has to be used with cable which withstand a maximum temperature of 80°C.<br><br>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 :**

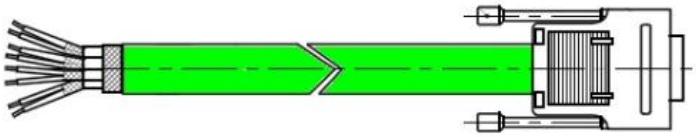
| | **EX6 certified for an ambient temperature of -20 to +40°C** | **EX6 certified for an ambient temperature of -20 to +60°C** |
|---|---|---|
| **Ambient temperature for Parker standard cable using (Max 100°C)** | -20 to +40°C | -20 to +60°C |
| **Ambient temperature for an using of cables withstanding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

**Size EX8 :**

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

### 3.10.2. Resolver cable connection for AC890

Cable reference :
**CS4UA1D1R0xxx**



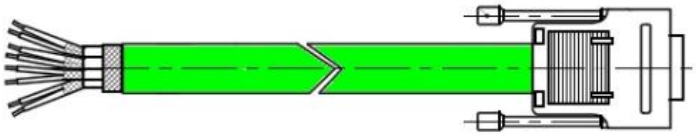
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

**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**



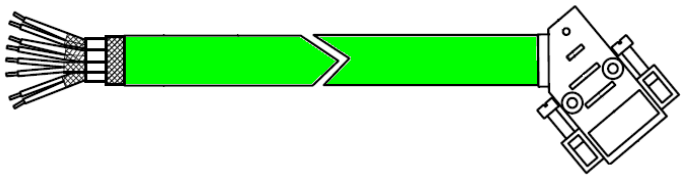
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **AC 80552**
SUB-D cover reference **220029P0043**
Pins reference **220029P0021**

**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**



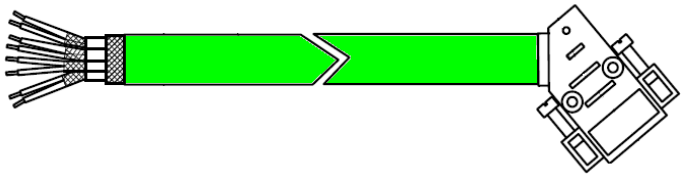
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

**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**



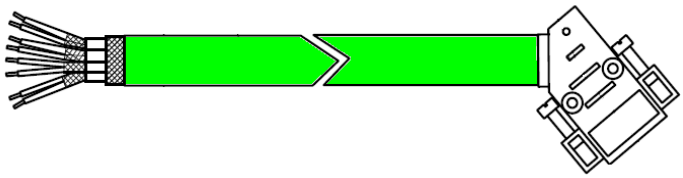
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

**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**



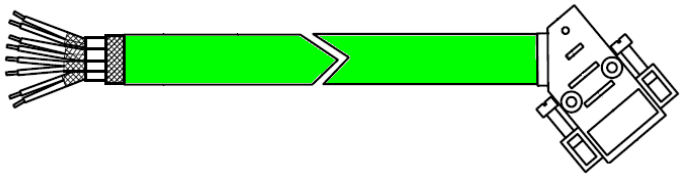
Feedback cable **6537P0059**
Male 15 pins SUB-D connector reference **220029P0040**
SUB-D cover reference **220029P0039**

**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**



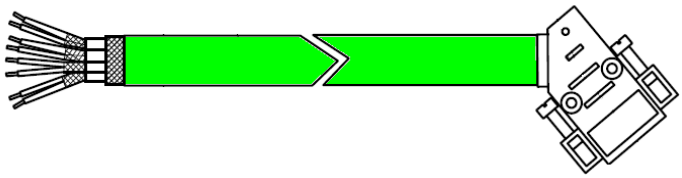
Feedback cable **6537P0059**
Male 9 pins SUB-D connector reference **220029P0020**
SUB-D cover reference **220029P0039**
Pins reference **220029P0021**

**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**

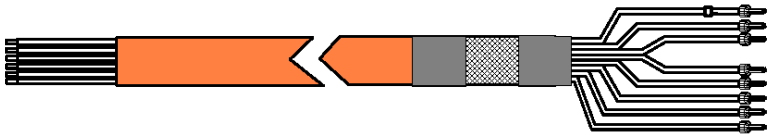
**Cable arrangement :**

| 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**



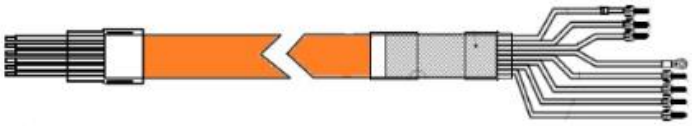
**Cable arrangement :**

| 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**



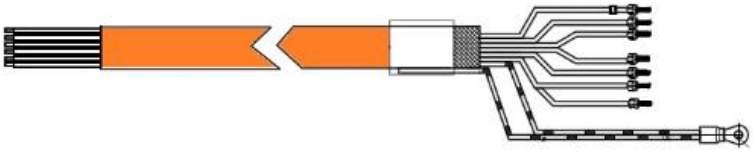
**Cable arrangement :**

| 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

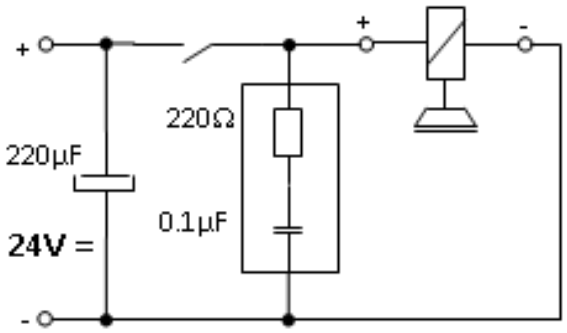
For other drive, you can assembly cable and plug by soldering with part number on the tab below:

| Ampacity | Cable reference (C2 / 100°C) |
|---|---|
| Current ≤ 12Amps @40°C<br>Current ≤ 9Amps @60°C | 6537P0057 |
| Current ≤ 24Amps @40°C<br>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.

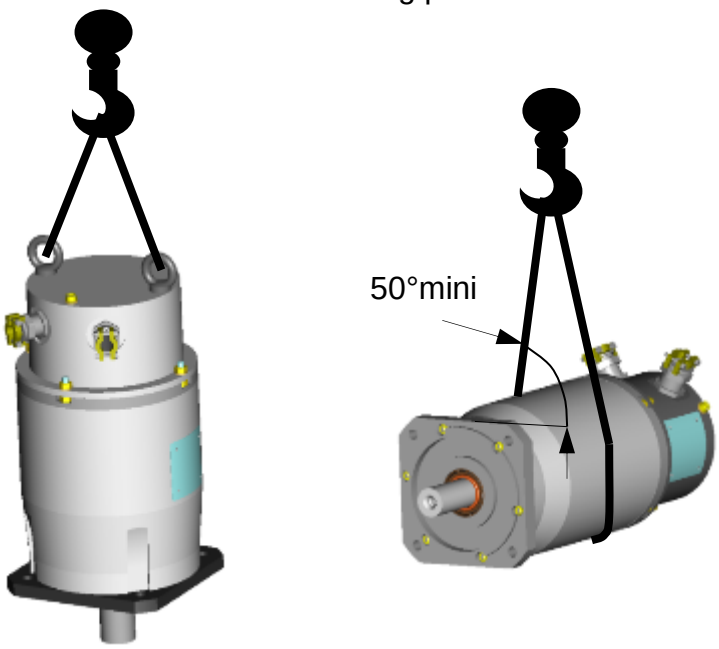
| | |
|---|---|
|  | Warning: In case of damaged material during the transport, the recipient must **immediately** make reservations to the carrier through a registered mail within 24 h.. |

### 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 |

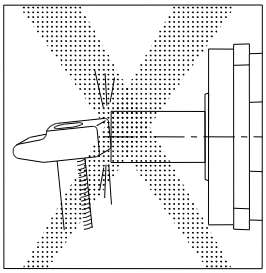
| | |
|---|---|
|  | Warning: After 15 days, check all tightening torques on all screw and nuts. |

### 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.

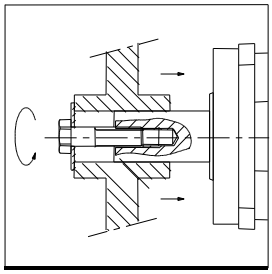
| | |
|---|---|
|  | Caution: Do not step on the motor or the cable glands. |
|  | Caution: Always bear in mind that some parts of the surface of the motor can reach a temperature of 135°C |

### 4.2.4. Mechanical assembly



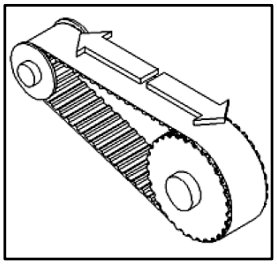
The operation life of servomotor bearings depends largely on the care and attention given to this operation.

- 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.<br>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. |

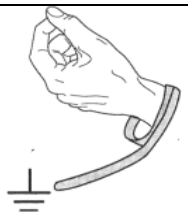
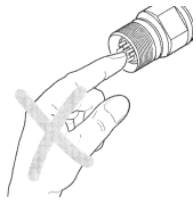
### 4.3.1. Cable connection

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

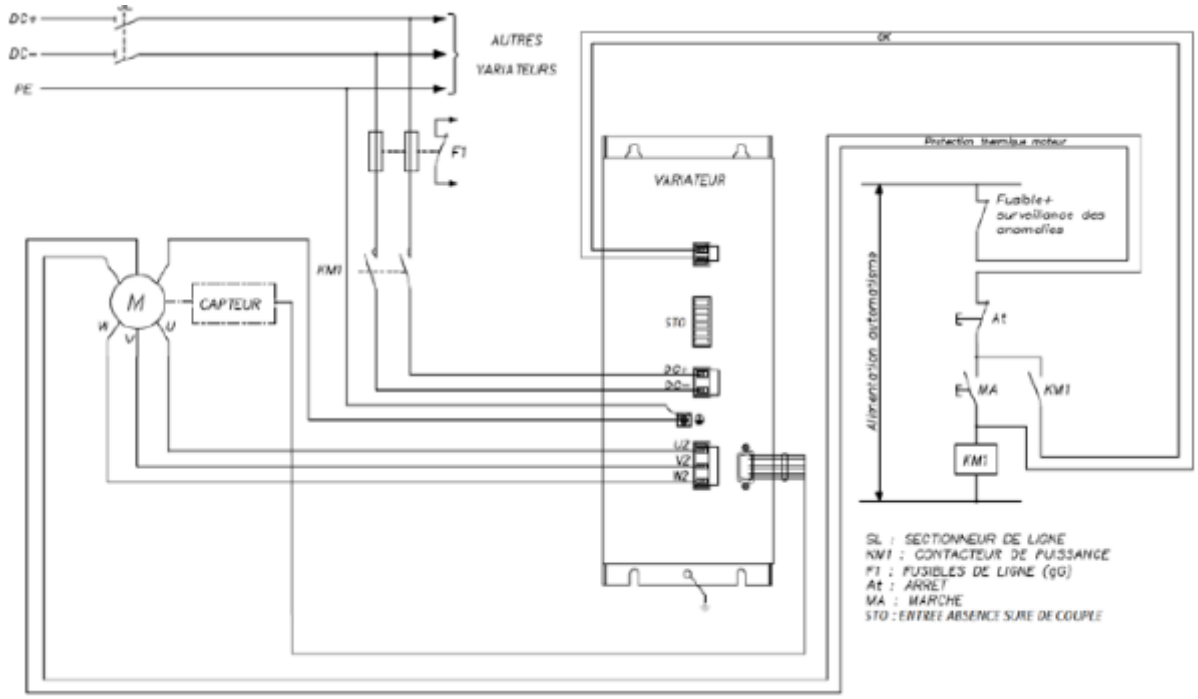
| | |
|---|---|
|  | Danger: before any intervention the drive must be stopped in accordance with the procedure. |

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

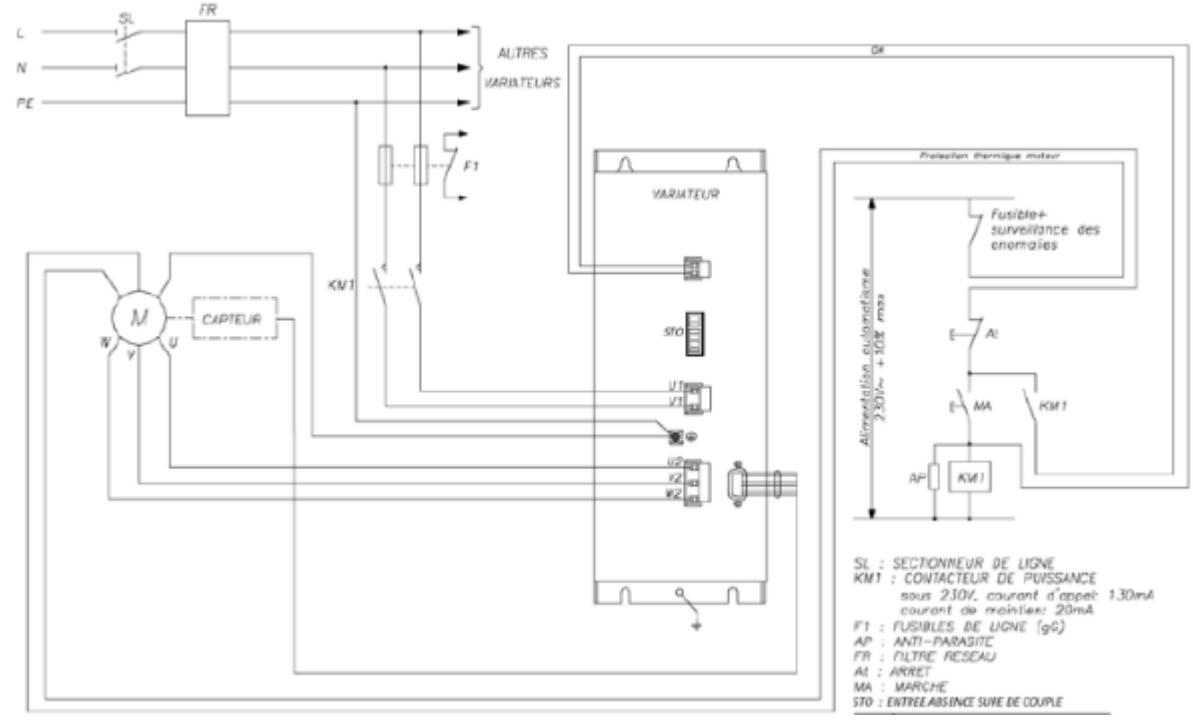
| | |
|---|---|
|  | Warning: Always wear an antistatic wrist strap during encoder handling. |
|  | Warning: Do not touch encoder contacts (risk of damage due to electrostatic discharges ESD. |

## 4.3.3. Connection diagrams

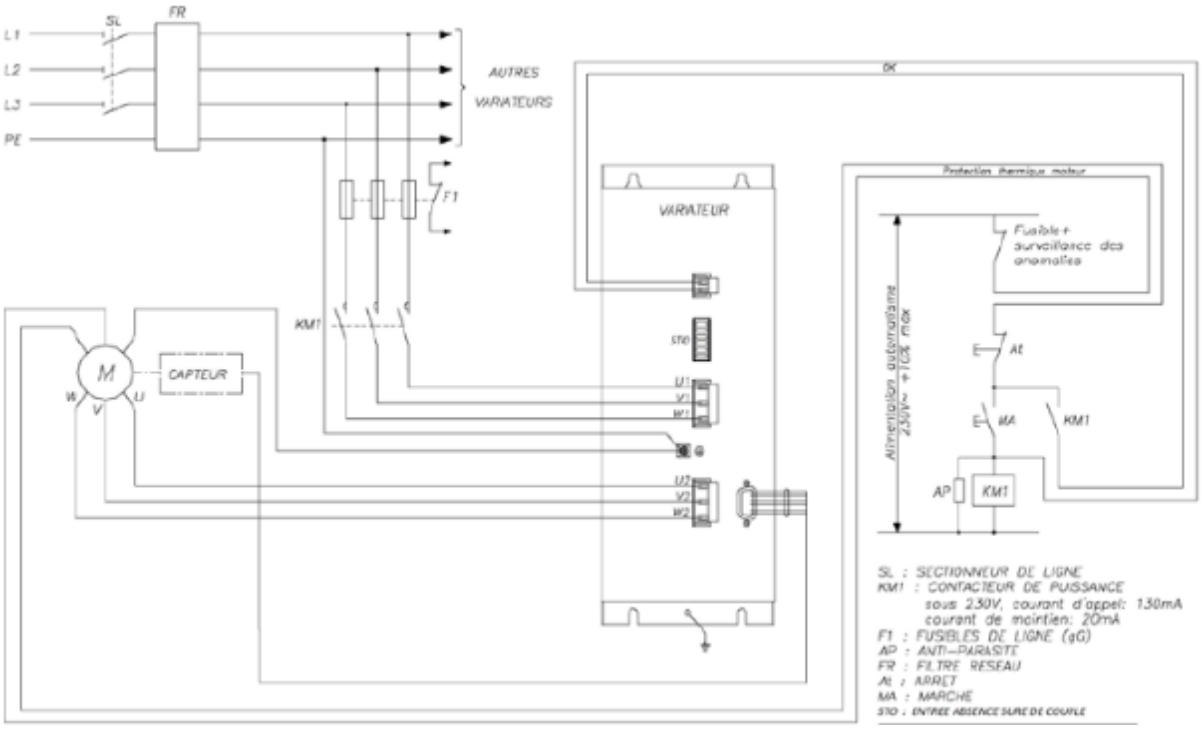
### 4.3.3.1. EX3-EX4 DC supply




### 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.

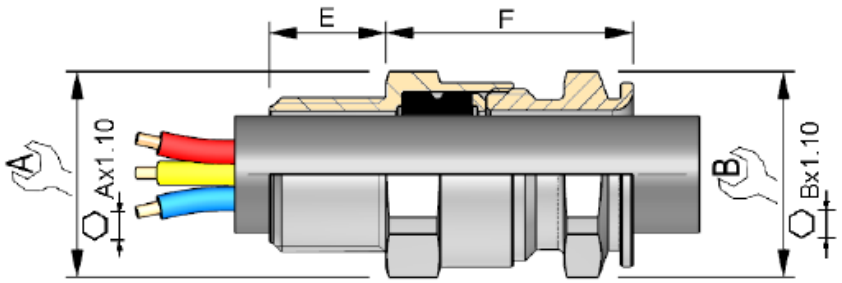
## 4.3.4. Cable glands informations (Only ATEX/IECEx)

### 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<br>Thread sizes M10 to M110 inclusive<br>UL thread size M20 to M110 inclusive |
| Cable type | Unarmored cable and Marine Shipboard cable.<br>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<br>Alternative material | Nickel Plated Brass<br>Stainless-steel, Bronze or Aluminum. |
| Service Temperature | From -30 to +80°C with Neoprene sealing ring<br>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<br>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:<br>* IP66 without added gasket.<br>* IP68 tested 30m/7days with Capri qualified Fiber-Gasket.<br>- On equipment with blank hole (not for "d" use), fixed with Capri qualified locknut, all the threads must be engaged:<br>* IP66 depending to the flatness and the roughness of the contact surface of the enclosure:<br>. Without added gasket for Ra 0.4 µm maxi.<br>. With Capri qualified Fiber-Gasket for Ra 1.6 µm maxi.<br>* IP68 tested 30m/7days with Capri qualified Fiber-Gasket for Ra 1.6 µm maxi roughness of the contact surface.<br>- 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<br>Standards<br>Marking code<br>Zones & Use | **INERIS:** INERIS12ATEX0032X<br>EN 60079-0:2009, EN 60079-1:2007, EN 60079-7:2007, EN 60079-15:2010, EN 60079-31:2009.<br>Ⓔx II2GD / Ex db IIC/ Ex eb IIC / Ex tb IIIC IP66<br>Ⓔx II3G Ex nRc IIC<br>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".<br>Zones 21 & 22 ; Groups IIIA, IIIB and IIIC ; for use "tb", "tc", "ia", "ib", "ma", "mb", "mc" & "p". |
| IECEx<br>Standards<br>Marking code | **INERIS:** IECEx INE 12.0025X<br>IEC 60079-0:2011, IEC 60079-1:2007, IEC 60079-7:2006, IEC 60079-15:2010, IEC 60079-31:2008<br>Ex db IIC / Ex eb IIC / Ex nRc IIC / Ex tb IIIC IP66 |
| Other Ex Certificates | **CEPEL** (Inmetro): CEPEL 05.0558X<br>**GOST-R:** РОСС FR.ГЕ05В03126 N°0422515<br>**NEPSI:** GYJ13.1082X |
| Shipping Certificates | **ABS** Manufacturing & Design Assessment P1836754-X & 10-HS 577243-PDA<br>**DNV** Type Approval certificate N° E-10892<br>**Lloyds** Type Approval certificate N° 11/00072 |
| c(UL)us | **cULus:** E310130<br>UL 514B, UL 2225 and C22.2 No 1 with respect to the US National Electrical Code (NEC) and Canadian Electrical Code (CEC).<br>Class I, Zone 2, AEx e II, Ex e II Hazardous Areas for use with unarmored ITC, MV, PLTC & TC cable.<br>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<br>UL 514B, UL 2225 and C22.2 No 1 with respect to the US National Electrical Code (NEC) and Canadian Electrical Code (CEC).<br>Class I, Zone 2, AEx e II, Ex e II Hazardous Areas for use with unarmored marine shipboard cable.<br>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 :**

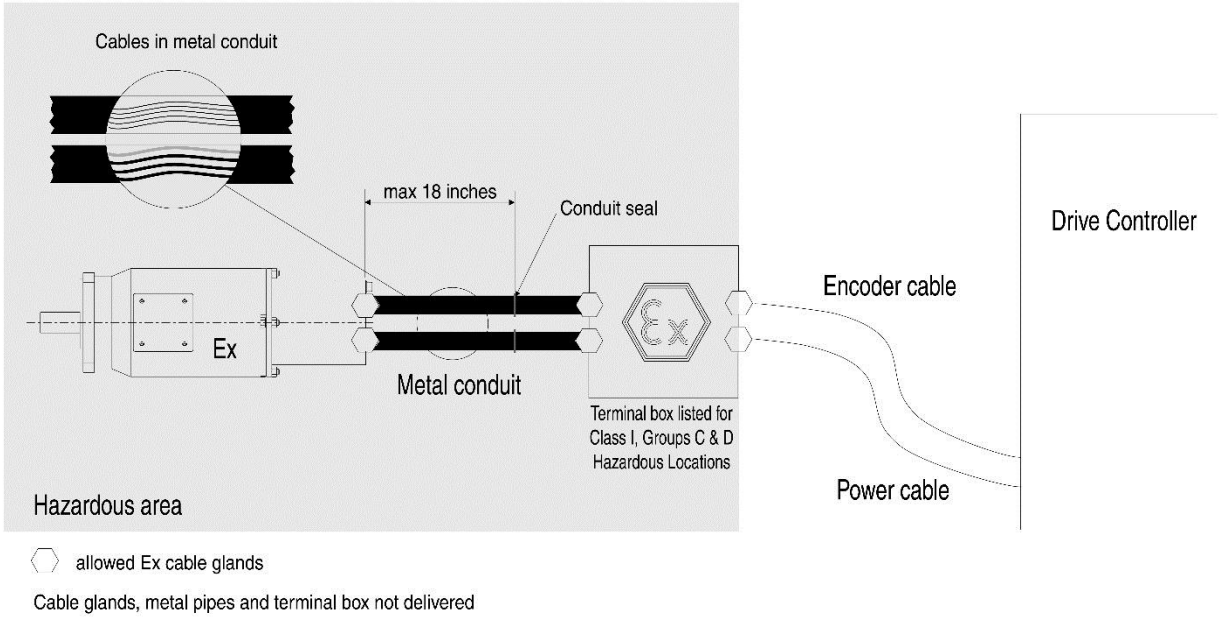
Torque value for the cap = 20 N.m

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.<br>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**<br>DANGER: The installation, commission and maintenance operations must be performed by qualified personnel, in conjunction with this documentation.<br><br>The qualified personnel must know the safety (C18510 authorization, standard VDE 0105 or IEC 0364) and local regulations.<br><br>They must be authorized to install, commission and operate in accordance with established practices and standards.<br><br>Please contact PARKER for technical assistance. |

| | |
|---|---|
|  | Danger: before any intervention the motor must be disconnected from te power supply.<br>Due to the permanent magnets, a voltage is generated at the terminals when the motor shaft is turned |

**Special requirements for ATEX servomotors**

| | |
|---|---|
|  | If a screw assembly of the enclosure need to be replaced, the new screw will must be quality 8.8 or higher. For the EX8 in UL version the screw must be quality 14.9 or higher. |

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

| Operation | Periodicity |
|---|---|
| Clean the motor | Every year |
| Motor inspection (vibration changes, temperature changes, tightening torques on all scews) | Every year |
| 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.

### 4.4.1. ATEX flameproof joints informations ATEX/IECEx

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

**Size EX3 :**

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

**Size EX4 :**

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

**Size EX6 :**

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

**Taille EX8 :**

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

## 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.<br>• 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.<br>• Check the power supply to the brake (+ 24 V ± 10 %) and its polarity.<br>• Check on any thermal protection, its connection and how it is set in the drive.<br>• Check on the servomotor insulation (if in doubt, carry out hot and cold measurements).<br><br>The minimum insulation resistance value measured under a max. 50V DC is 50 MΩ:<br>• Between the phase and the casing<br>• Between the thermal protection and the casing<br>• Between the brake coil and the casing<br>• 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.<br>• Check you are well and truly in speed regulation (and not in torque regulation).<br>• Check the encoder setting<br>• 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.<br>• Check the stability of the secondary voltages.<br>• 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.<br>• Check if the mounting surface is enough or if this surface is not a heat source – see §3.6 cooling.<br>• Friction in the machine may be too high :<br>- Test the motor current with and without a load.<br>- Check the motor does not have thermal insulation.<br>- 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 :<br>• Unsatisfactory mechanical balancing<br>• There is friction from the brake: mechanical jamming.<br>• Defective coupling<br>• Loosening of several pieces<br>• Poor adjustment of servo drive or position loop : check rotation in open loop |