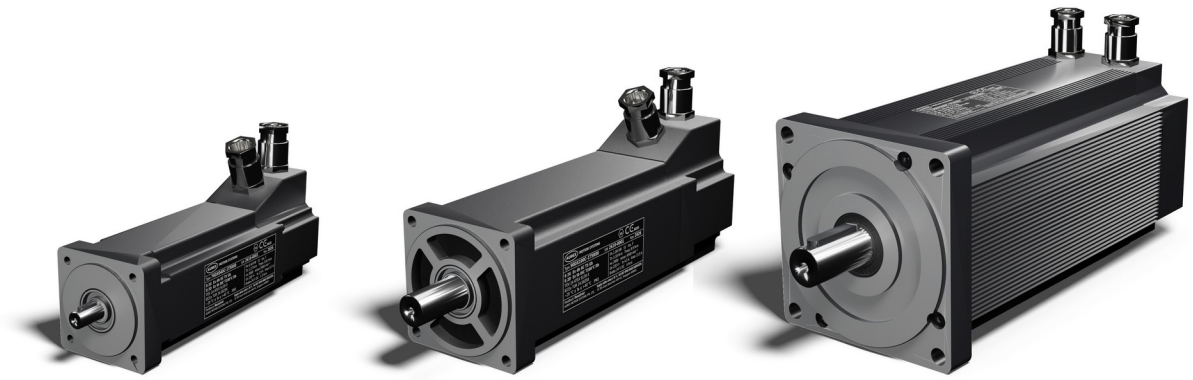
AUREX

AUREX MOTION SYSTEMS PTE. LTD.

Singapore · UEN 202619088E



TECHNICAL MANUAL

DX Series

Explosion-Proof AC Servo Motors

II 2 G Ex db IIC T5 / T4 Gb

II 2 D Ex tb IIIC T100 °C / T130 °C Db

IP65 Ta −20 °C … +40 °C

CE 0035 · Ex · IECEx™

Frame sizes DX70 · DX90 · DX130

Document number	**BA-DX-EN-V7.0**
Edition	**2026-11**
Language	**English — original instructions**

Read this manual before installing, operating or servicing the motor. Keep it with the equipment for its entire service life.

EU Declaration of Conformity

Document No. DOC-DX-EN-001 rev 1. Copy; the signed original is supplied with each motor.

1 Product
Explosion-proof brushless AC servomotors, DX series. Types: 70DX040C, 90DX100C, 130DX150C, 130DX260C, 130DX380C. Serial number: as marked on the nameplate of each motor.

2 Manufacturer
AUREX MOTION SYSTEMS PTE. LTD., 55 Toh Guan Road East, Uni-Tech Centre #03-01, Segment W100, Singapore 608601

3 Responsibility
This declaration of conformity is issued under the sole responsibility of the manufacturer.

4 Object of the declaration
Equipment group II, category 2G and 2D. Marking: 70DX040C, 90DX100C: II 2 G Ex db IIC T5 Gb / II 2 D Ex tb IIIC T100 °C Db. 130DX150C, 130DX260C, 130DX380C: II 2 G Ex db IIC T4 Gb / II 2 D Ex tb IIIC T130 °C Db. IP65, −20 °C ≤ Ta ≤ +40 °C.

5 Union harmonisation legislation
The object of the declaration described above is in conformity with Directive 2014/34/EU (equipment and protective systems intended for use in potentially explosive atmospheres).

6 Harmonised standards
EN IEC 60079-0:2018; EN 60079-1:2014; EN 60079-31:2014; EN IEC 60079-31:2024.

7 Notified body
TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln, Germany, notified body number 0035, performed the EU-type examination (Annex III, Module B) and issued EU-type examination certificate TÜV 24 ATEX 9139 X, Issue 01, 2026-11-02; and assessed the product quality assurance (Annex VII, Module E), quality assurance notification 01 220 2509006.

8 Additional information
IECEx certificate of conformity IECEx TUR 24.0029X, Issue No. 1, 2026-11-02. The “X” after the certificate numbers indicates special conditions for safe use, given in the certificates and in Section 4.4 of the technical manual BA-DX-EN-V7.0 (edition 2026-11), which shall be observed. The motors are components to be incorporated into machinery and shall not be put into service until the machinery complies with the applicable Union legislation on machinery (Directive 2006/42/EC or, from 20 January 2027, Regulation (EU) 2023/1230). Directive 2014/35/EU does not apply (Annex II). Compliance of the complete power drive system with Directive 2014/30/EU is the responsibility of the installer (EN IEC 61800-3); where a HIPERFACE encoder is fitted (code E), the encoder is CE marked by its manufacturer.

Signed for and on behalf of: AUREX MOTION SYSTEMS PTE. LTD.

Place: Singapore

Date: ____ November 2026

Name: Robin

Function: Director

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Document information

Table 0-1 Document identification

Item	Data
Document designation	Technical manual — original instructions within the meaning of Directive 2014/34/EU, Annex II, 1.0.6
Document number	BA-DX-EN-V7.0
Edition	2026-11
Supersedes	BA-DX-EN-V6.0, edition 2025-01 Rev. A
Applies to	70DX040C, 90DX100C, 130DX150C, 130DX260C, 130DX380C with feedback code R (resolver) or E (SICK SKM36, HIPERFACE). Project-specific feedback devices (code Q): see 12.5.
Manufacturer	AUREX MOTION SYSTEMS PTE. LTD., Singapore (UEN 202619088E)
Manufacturer’s address	55 Toh Guan Road East, Uni-Tech Centre #03-01, Segment W100, Singapore 608601
Registered office	2 Venture Drive, #19-18 Vision Exchange, Singapore 608526
Notified body (ATEX)	TÜV Rheinland Industrie Service GmbH, notified body number 0035
EU-type examination certificate	TÜV 24 ATEX 9139 X, Issue 01 (2026-11-02), issued by TÜV Rheinland Industrie Service GmbH, notified body 0035.
IECEx certificate of conformity	IECEx TUR 24.0029X, Issue No. 1 (2026-11-02), issued by TÜV Rheinland Industrie Service GmbH under the IECEx scheme.
ATEX quality assurance notification	01 220 2509006
IECEx quality assessment report	DE/TUR/QAR25.0002/02

0.1 Validity

(1) This document forms part of the product. It shall be kept legible and available at the place of installation for the entire service life of the motor and shall be passed on to any subsequent owner or user.

(2) This document applies only to motors in the condition in which they were delivered by the manufacturer, including the options stated in the order confirmation.

(3) Where this document differs from the data on the nameplate or in the certificates, the nameplate and the certificates take precedence.

(4) Any modification, repair or addition that has not been approved in writing by the manufacturer invalidates the explosion protection and the conformity of the product.

0.2 Original instructions and translations

(1) The English edition of this document is the original instructions within the meaning of Directive 2014/34/EU, Annex II, clause 1.0.6. Editions in other languages are translations of the English original and are identified as such.

(2) Where the motor is placed on the market in a Member State whose official language is not English, the person placing it on the market shall ensure that instructions in that language are supplied with the motor.

0.3 Copyright

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1 About this manual

This manual contains the information required to select, install, connect, commission, operate, inspect and service DX series explosion-proof AC servo motors. It covers both the engineering data needed before purchase and the instructions needed on site.

1.1 Intended audience

1.1.1 Chapters 3, 12 and 13 are addressed to the design engineer who selects the motor and specifies the machine interface.

1.1.2 Chapters 5 to 11 are addressed to qualified personnel as defined in 2.3, who install, connect, commission, operate and service the motor.

1.1.3 Chapters 2, 4 and 14 are binding on everyone who handles the motor.

1.2 Related documents

The following documents are required in addition to this manual. If one of them is missing or unclear, contact the manufacturer before putting the motor into service.

- the EU-type examination certificate and the IECEx certificate of conformity, including the special conditions for safe use;
- the EU declaration of conformity supplied with the motor;
- the dimension drawing of the motor type ordered;
- the manual and the parameter list of the servo drive with which the motor is operated;
- the hazardous area classification document of the installation.

1.3 Contact

AUREX MOTION SYSTEMS PTE. LTD.

55 Toh Guan Road East, Uni-Tech Centre #03-01, Segment W100, Singapore 608601

UEN 202619088E E-mail info@aurexmotion.com Website www.aurexmotion.com

2 Safety

2.1 Structure of the safety messages

Every safety message in this manual is built from the same four elements. Read all four before carrying out the action described.

Table 2-1 Elements of a safety message

No.	Element	Purpose
1	Signal word and hazard symbol	States the severity of the hazard.
2	Type and source of the hazard	States what the hazard is and where it comes from.
3	Consequence of disregard	States what happens if the message is not observed.
4	Measures to avoid the hazard	Lists the actions that shall be taken.

Table 2-2 Signal words

Signal word	Meaning	Severity
DANGER	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.	Immediate
WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.	Potential
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.	Potential
NOTICE	Indicates practices not related to personal injury which may result in damage to the equipment or loss of function.	Property

2.2 Wording conventions

2.2.1 "Shall" states a requirement binding on the user. "Should" states a recommendation. "May" states a permission. "Can" states a possibility or a capability.

2.2.2 Actions to be carried out in a fixed order are given as numbered steps. Actions that may be carried out in any order are given as dashed items.

2.2.3 Dimensions are in millimetres, tightening torques in newton metres and temperatures in degrees Celsius unless stated otherwise.

2.3 Qualified personnel

2.3.1 All work described in this manual shall be carried out only by qualified personnel: persons authorised by the operator who, on the basis of their training, experience and knowledge of the applicable standards and regulations, are able to assess the work assigned to them and to recognise the hazards it involves.

2.3.2 Work in hazardous areas and work affecting the explosion protection of the motor shall additionally be carried out only by persons with the competence described in EN IEC 60079-14 and IEC 60079-17.

2.3.3 Work on the electrical equipment shall be carried out only by electrically skilled persons.

2.4 Before you start

2.4.1 Read the documentation

Read this manual and the documents listed in 1.2 before any work on the motor. The motor is a component of a machine; the safety concept of that machine also applies.

2.4.2 Carry out a risk assessment

The machine manufacturer and the operator shall carry out a risk assessment for the complete machine and shall take account of the hazards arising from the motor: stored kinetic energy in the rotating mass, residual voltage at the motor terminals while the shaft is turning, a suspended load held only by the holding brake, and the hot motor surface.

2.4.3 Observe the technical data

The motor may be operated only within the data on the nameplate and in Chapter 12. Operation outside those data can raise the surface temperature above the certified temperature class.

2.4.4 Secure the key

A motor supplied with a key and without a transmission element fitted shall not be run: at speed the key is thrown out. Remove the key or secure it before turning the shaft.



WARNING

A key thrown from a rotating shaft.

Impact injury, and a mechanical spark capable of igniting an explosive atmosphere.

- Never run the motor with a loose key in the keyway.
- Remove the key, or fit and secure the transmission element, before the shaft is turned by power.
- Include this check in the commissioning record.

2.5 Intended use

2.5.1 DX series motors are permanent-magnet AC servo motors with a flameproof enclosure, intended to be operated from a servo drive installed outside the hazardous area, as a component within a machine or installation.

2.5.2 They may be used only within the zones, equipment group, gas and dust groups, temperature class and ambient temperature range covered by the Ex marking on the nameplate.

2.5.3 The motor is not a safety component within the meaning of Directive 2006/42/EC and does not on its own provide any functional safety function.

2.6 Prohibited use

The following are reasonably foreseeable misuses and are not permitted:

- operation of the motor directly from the mains supply;
- operation with a drive that has not been parameterised to the data of the motor concerned;
- operation as a generator, or in a regenerative application, without the written agreement of the manufacturer;
- opening the enclosure while an explosive atmosphere may be present;
- opening the enclosure to change the feedback device, the holding brake or the bearings outside the manufacturer’s works;
- use of the holding brake as a service brake to decelerate a moving load;
- use of the motor as a step or a handhold, or as a fixing point for other equipment.

2.7 Residual risks

Table 2-3 Residual risks

Risk	Cause	Protective measure
 Hot surface	Normal operation; overload; blocked heat dissipation	Observe Ta and rated data; keep the free space of 6.4.3; allow to cool before touching
 Voltage at the motor terminals with the drive switched off	The motor acts as a generator while the shaft turns	Isolate and lock out; stop the shaft and secure it before opening the terminal box
Unexpected movement of a suspended load	Holding brake released or worn	Support the load mechanically before any work
Electrostatic charge on the enclosure	Dry air, strong airflow over the coated surface	Observe the special condition of use in 4.4; clean only with a damp cloth
Magnetic field of the rotor	Permanent magnets	Persons with active implants shall keep clear of a dismantled rotor

3 Product description

3.1 Overview

DX series motors are square-flange permanent-magnet AC servo motors for motion control in hazardous areas. The stator, the rotor, the feedback device and, where fitted, the holding brake are enclosed in a flameproof aluminium housing; the motor is connected through two Ex d cable entries.

All frame sizes have four pole pairs, are rated for continuous duty S1 and are cooled by natural convection and radiation from the housing surface. No fan is fitted and none may be added.

Table 3-1 Product range

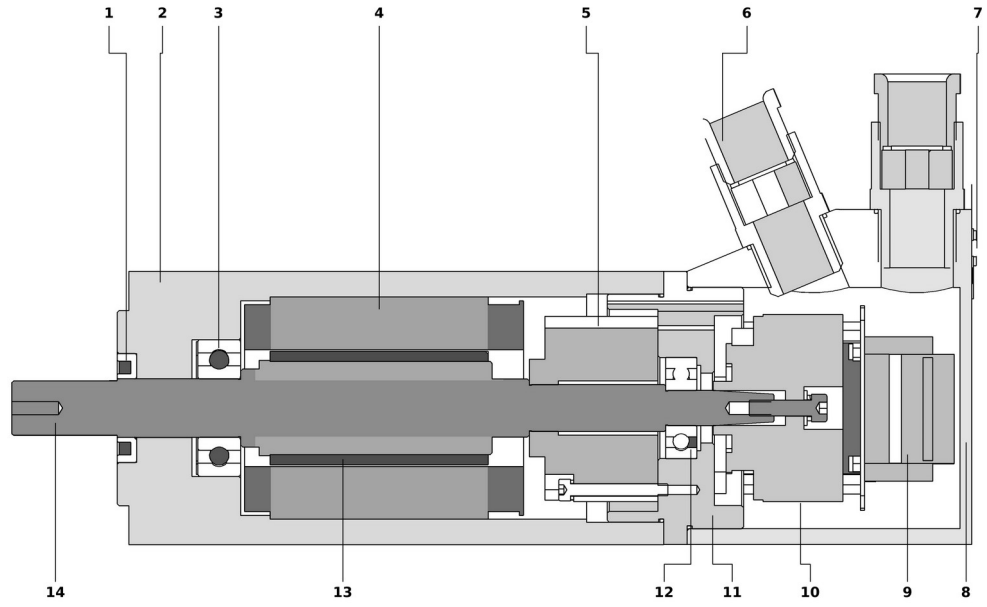
Type	Frame	Pn (kW)	Tn (N·m)	nn (rpm)	Un (VAC)
70DX040C	DX70	0.40	1.27	3000	220
90DX100C	DX90	1.00	3.18	3000	220
130DX150C	DX130	1.50	6	2500	220
130DX260C	DX130	2.60	10	2500	380
130DX380C	DX130	3.80	15	2500	380

3.2 Construction

Figure 3-1 shows the construction. The terminal compartment is at the non-drive end and is closed by the rear cover.

Table 3-2 Principal components

Component	DX70	DX90	DX130
Housing, end shield, rear cover	Aluminium alloy; rear cover cast aluminium	Aluminium alloy; rear cover cast aluminium	Aluminium alloy; rear cover cast aluminium
Bearing, drive end	6202-2Z	6004-2Z	6305-2Z
Bearing, non-drive end	629-2Z	6201-2Z	6205-2Z
Bearing preload	Wave washer D35 (27 × 34 × 0.5), 65Mn	Wave washer	Wave washer D52 (41 × 51 × 0.5), 65Mn
Shaft seal	TC 15 × 28 × 5, NBR	on request	TC 25 × 40 × 7, NBR
Static seals	O-ring Ø56 × 1 and Ø60 × 1, NBR	O-ring Ø75 × 1 (2 off), NBR	O-ring Ø120 × 1.9 (2 off), NBR
Thermal protector	PTC triple sensor to DIN VDE V 0898-1-401, 140 °C	PTC triple sensor to DIN VDE V 0898-1-401, 140 °C	PTC triple sensor to DIN VDE V 0898-1-401, 140 °C
Feedback device	Resolver or absolute encoder to the type code (7.4)	Resolver or absolute encoder to the type code (7.4)	Resolver or absolute encoder to the type code (7.4)
Holding brake (option)	Spring-applied, 24 V DC (Table 7-6)	Spring-applied, 24 V DC (Table 7-6)	Spring-applied, 24 V DC (Table 7-6)
Cable entries	2 × M20 × 1.5 with Ex d cable glands (7.5)	2 × M20 × 1.5 with Ex d cable glands (7.5)	2 × M20 × 1.5 with Ex d cable glands (7.5)



1 Shaft seal
2 Housing with mounting flange
3 Drive-end bearing
4 Stator with winding
5 Holding brake (option)
6 Cable entries with Ex d cable glands
7 External earth terminal
8 Rear cover / terminal compartment
9 Terminal blocks
10 Feedback device
11 Rear end shield
12 Non-drive-end bearing
13 Rotor with permanent magnets
14 Shaft

Shown: 70DX040C. Other frame sizes are of the same construction; the cable entries are arranged differently.

Figure 3-1 Construction of the DX series (example 70DX040C)

NOTICE *The components listed in Table 3-2 that are inside the flameproof enclosure form part of the certified equipment. They shall be replaced only by the identical part obtained from the manufacturer.*

3.3 Nameplate

Each motor carries a nameplate on the side of the housing: black anodised aluminium, 90 mm × 38 mm, laser-marked (Figure 3-2). The nameplate is the authoritative source for the Ex marking, the rated data and the certificate numbers of the individual motor. Do not remove, cover or paint over the nameplate.

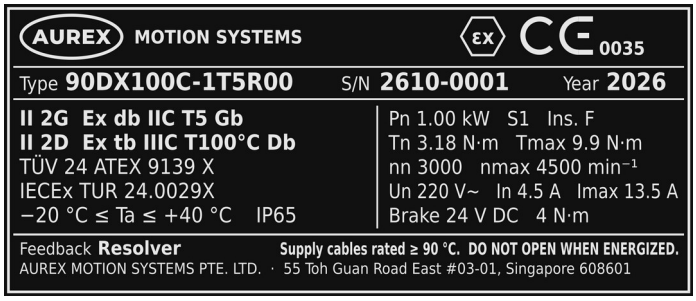


Figure 3-2 Nameplate (example 90DX100C, enlarged; actual size 90 mm × 38 mm)

Table 3-3 Nameplate fields

Field	Example	Description
Manufacturer	AUREX MOTION SYSTEMS PTE. LTD.	Name and address of the manufacturer
Type	90DX100C	Basic type designation, see 13.1
Serial number	S/N 2610-0001	Unique number for traceability
Year of manufacture	2026	Year in which the motor was manufactured
Pn / Tn / nn	1.0 kW / 3.18 N·m / 3000 min⁻¹	Rated power, torque and speed
Un / In	220 V~ / 4.5 A	Rated voltage and current
Duty / insulation / IP	S1 / F / IP65	Duty type, insulation class, degree of protection
Ex marking	II 2 G Ex db IIC T5 Gb / II 2 D Ex tb IIIC T100 °C Db	See Chapter 4
Ta	−20 °C ≤ Ta ≤ +40 °C	Permitted ambient temperature range
Certificates	ATEX / IECEx certificate numbers	ATEX and IECEx certificate numbers
CE mark and notified body number	CE 0035	Number of the notified body for the product quality assurance
Tmax / nmax / Imax	9.9 N·m / 4500 min⁻¹ / 13.5 A	Maximum torque, maximum speed, maximum current
Holding brake	24 V DC / 4 N·m	Brake supply and holding torque; "—" where no brake is fitted
Feedback	Resolver	Feedback device fitted, see 7.4
Warnings	Supply cables rated ≥ 90 °C. DO NOT OPEN WHEN ENERGIZED.	Cable rating (DX130: ≥ 110 °C, see 7.5.7) and opening warning

3.4 Scope of supply

Unless otherwise agreed in the order confirmation, the delivery comprises:

- the motor with the frame size, shaft, flange, feedback device and, where ordered, the holding brake stated in the order;
- the key, fitted in the keyway of the shaft;
- the nameplate and the safety labels;
- this manual and the EU declaration of conformity;
- transport packaging suitable for normal transport conditions.

Two certified Ex d cable glands are fitted as standard (7.5). Pre-assembled cables, couplings and spare parts kits are supplied only when ordered separately.

3.5 Applications

Positioning and speed control of machinery in chemical and petrochemical plant, pharmaceutical production, paint and coating plant, energy and process installations, and in any other installation in which an explosive gas or dust atmosphere may be present (Zone 1 and Zone 2 for gas, Zone 21 and Zone 22 for dust).

4 Marking and explosion protection

4.1 Certification

Table 4-1 Certificates

Item	Reference
EU-type examination certificate	TÜV 24 ATEX 9139 X, Issue 01 (2026-11-02), issued by TÜV Rheinland Industrie Service GmbH, notified body 0035.
IECEx certificate of conformity	IECEx TUR 24.0029X, Issue No. 1 (2026-11-02), issued by TÜV Rheinland Industrie Service GmbH under the IECEx scheme.
ATEX quality assurance notification	01 220 2509006
IECEx quality assessment report	DE/TUR/QAR25.0002/02
Quality management system (ISO 9001:2015)	Certificate 46626Q01714R053, issued by Shenzhen Zhongxin Certification Testing Co., Ltd; valid 2026-08-24 to 2029-08-23; scope: production of explosion-proof motors and ordinary motors
Notified body	TÜV Rheinland Industrie Service GmbH, notified body number 0035

4.2 Ex marking

The Ex marking defines the equipment group, the category and EPL, the type of protection, the gas and dust group and the temperature class for which the motor is certified. The marking of the individual motor is that on its nameplate.



The motor bears the specific marking of explosion protection shown above (Directive 2014/34/EU, Article 16), followed by the equipment group and category, the EPL and the type of protection.

Table 4-2 Marking by frame size

Frame	Gas	Dust
DX70	II 2 G Ex db IIC T5 Gb	II 2 D Ex tb IIIC T100 °C Db
DX90	II 2 G Ex db IIC T5 Gb	II 2 D Ex tb IIIC T100 °C Db
DX130	II 2 G Ex db IIC T4 Gb	II 2 D Ex tb IIIC T130 °C Db
All	IP65	−20 °C ≤ Ta ≤ +40 °C

Table 4-3 Meaning of the marking elements

Element	Value	Meaning
Equipment group	II	Equipment group II — surface industry, not mining
Category, gas	2 G	Category 2 for gas: Zone 1 and Zone 2, EPL Gb
Category, dust	2 D	Category 2 for dust: Zone 21 and Zone 22, EPL Db
Type of protection, gas	Ex db	Flameproof enclosure "db", EN 60079-1
Type of protection, dust	Ex tb	Protection by enclosure "tb", EN IEC 60079-31
Gas group	IIC	The most severe gas group — includes hydrogen and acetylene
Dust group	IIIC	Conductive dust
Temperature class	T5 / T4	Maximum surface temperature ≤ 100 °C / ≤ 135 °C
Dust surface temperature	T100 °C / T130 °C	Maximum surface temperature for dust protection
EPL	Gb / Db	High level of protection for gas / for dust

4.3 Selecting the motor for the hazardous area

The installer and the operator shall verify that the zone, the gas or dust group, the temperature class and the ambient temperature of the installation are covered by the marking on the nameplate.

Table 4-4 Zones in which the motor may be used

Atmosphere	Zone	Required category	DX series
Gas	Zone 0	1 G	not permitted
Gas	Zone 1	2 G	permitted
Gas	Zone 2	3 G	permitted
Dust	Zone 20	1 D	not permitted
Dust	Zone 21	2 D	permitted
Dust	Zone 22	3 D	permitted

The temperature class of the motor shall be equal to or more severe than the temperature class required by the gas present. T5 covers T1 to T5; T4 covers T1 to T4. For dust, the maximum surface temperature of the motor shall be lower than two thirds of the minimum ignition temperature of the dust cloud, and lower than the minimum ignition temperature of a 5 mm dust layer reduced by 75 K.

4.4 Special conditions for safe use ("X")

The certificates carry the suffix "X". The following special conditions are binding and apply in addition to every other instruction in this manual. Items (1) to (5) reproduce the five conditions of clause (17) of the EU-type examination certificate, in the same order.

(1) Operation with a converter in a safe area. The motor shall be operated only together with a converter (servo drive) installed in a non-hazardous area. The converter shall be parameterised in accordance with this manual and the documentation of the drive manufacturer.

(2) Flameproof joints. For the dimensions and tolerances of the flameproof joints, and before any intervention affecting them, the user shall contact the manufacturer. Flameproof joints shall not be machined, dressed, ground, polished, painted or repaired by the user.

(3) Protection of the shaft seal against light. The shaft seal shall be protected from direct daylight and from the light of luminaires. Where necessary, a shroud or a cover shall be fitted.

(4) Electrostatic charging in dust atmospheres. In explosive dust atmospheres the external surfaces of the motor can acquire an ignition-capable electrostatic charge. The motor shall not be installed where the conditions

favour hazardous electrostatic charging, for example very dry air or a strong airflow over a large coated surface. The motor shall be cleaned only with a damp cloth; dry cloths and solvent-based cleaners shall not be used.

(5) Cable entries. The motor shall be fitted only with Ex certified cable glands or blanking plugs, selected and installed in accordance with EN 60079-14. Their type of protection and thread size shall match the motor entries. See 7.5.

In addition, the certificate specifies the permitted ambient temperature range as −20 °C ≤ Ta ≤ +40 °C and the degree of protection as IP65. Operation outside this ambient temperature range is not permitted.



WARNING

Ignition of an explosive atmosphere by a hot motor surface.

Death or serious injury.

- Operate the motor only within the rated data on the nameplate and in Chapter 12.
- Keep the ambient temperature within the range Ta on the nameplate.
- Do not allow dust layers thicker than 5 mm to build up on the motor.
- Keep the free space required by 6.4.3 clear, and keep external heat sources away from the motor.

5 Transport, storage and handling

5.1 Receipt and inspection

1. Compare the delivery with the shipping documents and the order confirmation.
2. Check the packaging for visible damage. Where damage is found, notify the carrier and the supplier before unpacking further.
3. Unpack the motor and examine it for mechanical damage, corrosion and missing parts. Examine in particular the flange face, the spigot, the shaft end, the cable entries and the enclosure joints.
4. Verify that the type designation, the Ex marking and the rated data on the nameplate match the intended application.
5. Record any damage or discrepancy and report it before installation.

5.2 Transport and lifting

5.2.1 Only qualified personnel familiar with the handling of electrical machines may transport the motor.

5.2.2 Before lifting, check the mass of the motor (Table 12-1). Use lifting equipment of adequate capacity and in good condition.

5.2.3 DX series motors are not fitted with lifting eyes. Support the motor under the housing; do not sling from the shaft, the cable entries, the rear cover or the cables.

5.2.4 Avoid shock loads and collisions. An impact on the flange face or on an enclosure joint can impair the explosion protection.

5.3 Storage

5.3.1 Store the motor indoors, dry, clean and free from vibration, at −20 °C to +40 °C, relative humidity 20 % to 80 % without condensation.

5.3.2 Protect the motor against condensation, aggressive atmospheres, dust and mechanical damage. Keep the original packaging where possible.

5.3.3 Leave the transport plugs in the cable entries until the cables are connected.

5.4 Storage for longer than six months

– Protect the shaft end and other bare metal surfaces with a suitable corrosion preventive.

– Turn the shaft by hand through several revolutions every three months to redistribute the bearing grease. Where a holding brake is fitted, release it electrically first.
– Before commissioning, measure the insulation resistance in accordance with 7.10 and check the function of the holding brake.

NOTICE *Standard grease-filled bearings have a limited shelf life. After storage longer than three years the bearings should be replaced by the manufacturer before the motor is put into service.*

5.5 Handling before installation

1. Remove transport locks, covers and temporary protection.
2. Make sure the motor is clean and free from foreign objects around the shaft, on the flange face and in the cable entries.
3. Check that the shaft turns freely by hand without abnormal noise. Motors with a holding brake shall be checked with the brake released electrically.
4. Confirm that all enclosure fasteners are present and tight.

6 Mechanical installation

This chapter covers the mechanical installation. The electrical connection is described in Chapter 7. The mounting dimensions are given in 12.3.

6.1 Prerequisites

6.1.1 Personnel and documents

– Mechanical installation shall be carried out only by qualified personnel in accordance with 2.3.
– This manual, the dimension drawing of the motor type, the certificates with the special conditions of use, and the hazardous area classification document shall be available at the place of installation.

6.1.2 Installation rules

The installation shall comply with EN IEC 60079-14 and with the national and local installation rules in force at the site. Where the requirements differ, the more stringent requirement applies.

6.2 Checks before installation

Carry out the following checks and record the result. Do not install the motor if any check fails.

(1) The Ex marking on the nameplate covers the zone, the equipment group, the gas and dust group, the temperature class and the ambient temperature of the place of installation (Chapter 4).

(2) The motor type, the rated data and the feedback device match the drive and the parameter set intended for it.

(3) The motor shows no transport damage, in particular none on the flange face, the spigot, the shaft end, the cable entries or the enclosure joints.

(4) The shaft turns freely by hand without abnormal noise.

(5) All cable entries are closed, and all enclosure fasteners are present and tight.



WARNING

Loss of explosion protection through a damaged flameproof joint.
Death or serious injury.
- Do not install a motor on which a flameproof joint is scored, dented, corroded or painted.
- Do not dress, file, grind or polish a flameproof joint.
- Return the motor to the manufacturer.

6.3 Mounting interface

6.3.1 DX series motors are flange-mounted machines. The standard mounting arrangement is IM B5 to IEC 60034-7; IM V1 and IM V3 are also permitted.

6.3.2 The mounting flange and the shaft end conform to IEC 60072-1: flange number 75 (DX70), 100 (DX90) and 165 (DX130), with through holes. The flange of each frame size is given in Table 6-1; the dimensions are given in 12.3.

Table 6-1 Mounting flange by frame size

Frame	IEC flange No.	Spigot N	PCD M	Holes S
DX70	75	Ø60 j6	Ø75	4 × Ø5.5
DX90	100	Ø80 j6	Ø100	4 × Ø7.0
DX130	165	Ø130 j6	Ø165	4 × Ø11

6.3.3 The mating face on the machine shall meet the following requirements:

- a spigot recess to tolerance class H7 over the spigot diameter N;
- flatness of the mating face ≤ 0.05 mm over the spigot diameter;
- perpendicularity of the spigot recess axis to the mating face ≤ 0.05 mm;
- depth of the spigot recess not less than the spigot length T given in 12.3;
- the face free of paint, burrs, weld spatter, swarf and other foreign matter.

6.3.4 The spigot locates the motor; the fixing bolts clamp only. The clearance between the bolts and the fixing holes shall not be used to correct a misaligned spigot recess.

6.4 Mounting position and clearances

6.4.1 The motor may be installed in any orientation unless the nameplate or the order documents state otherwise.

6.4.2 The mounting structure shall be flat, rigid, and free from resonance at the operating speeds of the machine.

6.4.3 The motor is surface-cooled by natural convection and radiation. A free space of at least 50 mm shall be kept around the housing, and the air path through that space shall not be obstructed.

6.4.4 The motor shall not be installed where radiated or conducted heat from an adjacent component raises its surface temperature.

6.4.5 Where the cable entries point upwards, route the cables so that a drip loop is formed below the entry, so that condensate and liquid cannot run into the gland.

6.4.6 Leave sufficient access to the cable entries, the external earthing terminal and the enclosure fasteners for the periodic inspection required by IEC 60079-17.



WARNING

Ignition of an explosive atmosphere by an accumulated dust layer.

Death or serious injury.

- In Zone 21 and Zone 22, install the motor so that dust cannot accumulate on it.
- Include the removal of dust layers in the maintenance schedule of the installation.
- Clean the motor only with a damp cloth. Do not use a dry cloth and do not use solvent-based cleaners (special condition of use, 4.4).

6.5 Fixing the motor

6.5.1 Use four fixing bolts of the size and property class given in Table 6-2. Bolts of a lower property class shall not be used.

6.5.2 Fit plain washers to ISO 7089, hardness class 200 HV or higher, under the bolt heads.

1. Offer the motor up squarely and engage the spigot fully in the recess.
2. Start all four bolts by hand before tightening any of them.
3. Tighten in diagonally opposite pairs, first pass to about half the torque of Table 6-2.

4. Second pass to the full torque of Table 6-2.
5. Secure the bolts against loosening, for example with a chemical thread-locking compound or self-locking nuts. Spring washers alone are not sufficient where the machine vibrates.

Table 6-2 Fixing bolts and tightening torques

Frame	Hole Ø	Bolt	Min. engagement	Torque, class 8.8	Torque, A4-70
DX70	5.5 mm	M5	1.0 × d	6.0 N·m	4.3 N·m
DX90	7.0 mm	M6	1.0 × d	10 N·m	7.3 N·m
DX130	11 mm	M10	1.0 × d	48 N·m	34 N·m



WARNING

Fixing bolts confused with enclosure fasteners.

Loss of explosion protection.

- The torques in Table 6-2 apply only to the four bolts that fix the motor to the machine.
- The fasteners of the flameproof enclosure are of a defined property class and have their own torques (Table 9-2). They shall not be replaced by commercial fasteners.

6.6 Fitting the transmission element

The transmission element is the coupling hub, pulley, pinion or other component fitted to the motor shaft.

6.6.1 Use a flexible coupling unless the machine design requires otherwise. A rigid coupling transmits shaft misalignment into the motor bearings.

6.6.2 The motor is supplied with the key fitted and is balanced with a half key to ISO 21940-11. The transmission element shall be balanced on the same basis.

6.6.3 Draw the transmission element onto the shaft using the tapped hole in the shaft end and a suitable drawing-on device. The tapped hole size is given in Table 12-5.

6.6.4 The transmission element may be warmed to not more than 80 °C before fitting. Do not heat the motor shaft.

6.6.5 Remove the transmission element only with a puller that bears on the hub, never on the shaft end or on the motor flange.

6.6.6 Where the transmission element is clamped on a plain bore (clamping hub, shrink disc), the key may be removed. The motor is then no longer balanced to the stated grade, because the half key is missing: check the vibration of the machine at the maximum operating speed. The open keyway reduces the torque that a clamping hub can transmit: select the hub for the maximum torque Tmax of Table 12-1, applying the hub manufacturer's reduction for a shaft with keyway. The clamping element shall not bear on the shaft seal.

6.6.7 A plain shaft without keyway is not part of the standard range.



WARNING

Axial blows applied to the shaft end during fitting.

Damage to the bearings and to the shaft flameproof joint; premature failure and possible loss of explosion protection.

- Never drive a transmission element onto the shaft with a hammer or a press.
- Use only the tapped hole in the shaft end and a drawing-on device.
- Do not exceed the permissible axial force given in 12.6.

6.7 Alignment

6.7.1 Align the motor and the driven machine within the tolerance stated by the coupling manufacturer and, in any case, within Table 6-3.

Table 6-3 Maximum permissible misalignment at the coupling

Type of misalignment	Recommended	Maximum
Radial (parallel) offset	≤ 0.05 mm	≤ 0.10 mm
Angular offset	≤ 0.05°	≤ 0.10°
Axial offset	per coupling data sheet	per coupling data sheet

6.7.2 Check the alignment again after the fixing bolts have been tightened to the full torque, and again after the machine has first reached its normal operating temperature.

6.7.3 Radial and axial shaft forces shall not exceed the limits in 12.4. Belt and chain drives shall be assessed for the resulting radial force before they are used.

6.8 Earthing and equipotential bonding

6.8.1 An external earthing terminal (M4) is provided on the motor housing. It shall be connected to the equipotential bonding system of the installation in accordance with EN IEC 60079-14, in addition to the protective earth conductor in the motor cable.

6.8.2 The earthing terminal is provided by the manufacturer with a bare, corrosion-protected contact area. Do not remove the coating of the housing elsewhere.

6.8.3 Use a cable lug to DIN 46234 or equivalent and a serrated lock washer, and protect the completed joint against corrosion.

6.8.4 The equipotential bonding conductor shall be at least 4 mm² copper.

NOTICE *Where an adapter plate, a spacer or any other coated or non-conductive part is fitted between the motor flange and the machine, the bonding path through the flange is interrupted. In that case take the bonding conductor directly from the motor housing to the machine structure.*

6.9 Final mechanical checks

Complete the following checks before the electrical connection is made in accordance with Chapter 7.

(1) All four fixing bolts tightened to the torque of Table 6-2 and secured against loosening.

(2) Motor flange in full contact with the machine face; no gap visible.

(3) Transmission element fitted, aligned within Table 6-3 and secured; key fitted and secured, or removed.

(4) Shaft turns freely by hand; motors with a holding brake checked with the brake released.

(5) All rotating parts guarded in accordance with the safety concept of the machine.

(6) External earthing terminal connected and the joint protected against corrosion.

(7) All enclosure fasteners present and tightened to Table 9-2.

(8) The free space required by 6.4.3 is clear.

7 Electrical connection

The electrical installation shall be carried out only by electrically skilled persons and in accordance with EN IEC 60079-14 and the national wiring rules.



DANGER

Live parts and residual voltage inside the terminal compartment.

Death or serious injury by electric shock, and ignition of an explosive atmosphere.

- Isolate the drive, lock out and verify that the circuit is dead before opening the enclosure.
- Wait for the DC link of the drive to discharge — observe the waiting time given by the drive manufacturer.
- The motor generates a voltage at its terminals whenever the shaft turns. Stop the shaft and secure it against being turned.
- Never open the enclosure while an explosive atmosphere may be present.

7.1 General requirements

7.1.1 The motor shall be supplied only from a servo drive installed outside the hazardous area, parameterised to the data of the motor type concerned (special condition of use, 4.4).

7.1.2 Verify before connection that the nameplate data match the drive: rated voltage, rated current, number of pole pairs, voltage constant and feedback type.

7.1.3 The insulation of the cables shall be rated for the voltage class of the installation. Their temperature rating shall meet 7.5.7: at least 90 °C for DX70 and DX90, at least 110 °C for DX130.

7.1.4 Power cables and feedback cables shall be run in separate glands. Do not run signal and power conductors through the same entry.

7.1.5 The converter (servo drive) is not part of the scope of supply of the motor. Selecting a converter suitable for the motor data of Chapter 12 and for the installation, and parameterising it, are the responsibility of the user. No converter make or type is approved, recommended or excluded by this manual.

7.1.6 An output filter (dv/dt filter or sine filter) or a motor choke shall be fitted where the motor cable is longer than 20 m, or where the drive manufacturer requires it, so that the limits of 7.1.7 are kept at the motor terminals.

7.1.7 The converter shall be operated within the following limits, which form part of the special condition of use of 4.4: PWM switching frequency 4 kHz to 16 kHz (8 kHz recommended); peak line-to-line voltage at the motor terminals ≤ 1 300 V; rate of voltage rise at the motor terminals ≤ 5 kV/µs; output frequency not above that corresponding to nmax (Table 12-1).

7.1.8 Set the current limit of the drive to not more than Imax and the motor overload protection (I^2t) to the rated current In, with the thermal time constant of Table 12-1. Tmax and Imax may be applied for not longer than 3 s at a time; the rms current over the duty cycle shall not exceed In (12.1.3).

7.1.9 Set the maximum speed of the drive to not more than nmax. Set the direction of rotation only with the direction parameter of the drive. Never interchange U, V and W to change the direction of rotation.

7.2 Terminal compartment — opening and reclosing

The electrical connections are made on the terminal block inside the terminal compartment at the non-drive end of the motor. The compartment is closed by a bolted cover whose joint with the housing is a certified flameproof joint of the Ex db enclosure. The explosion protection of the motor therefore depends on the condition of this joint and on all original cover bolts being refitted to the correct torque.

Table 7-1 Terminals inside the terminal compartment

Terminal	Group	Function	See
U, V, W	Power	Three motor phases, from the drive output	7.3
PE	Power	Internal protective earth terminal	6.8
R1, R2	Feedback	Resolver excitation (type code R)	7.4
S1, S3	Feedback	Resolver sine output	7.4
S2, S4	Feedback	Resolver cosine output	7.4
B+, B−	Brake	Holding brake coil, 24 V DC (option B only)	7.6
TH1, TH2	Thermal	PTC thermistor chain	7.7



DANGER

Opening the terminal compartment while the motor is energized, while the shaft can turn, or while an explosive atmosphere may be present.

Ignition of the surrounding explosive atmosphere, and death or serious injury by electric shock.

- Isolate the drive, lock out and tag out, and verify that the circuit is dead.
- Wait for the DC link of the drive to discharge — observe the waiting time given by the drive manufacturer.
- Secure the shaft against rotation by the driven machine. A turning shaft makes the motor a generator and its terminals live even with the drive isolated.
- Confirm with a gas detector that no explosive atmosphere is present, or work under a permit that establishes this.

7.2.1 Opening the terminal compartment in the field is permitted for electrical connection, inspection and re-connection. Any other opening of the enclosure, in particular of the drive-end or the stator housing, is a repair and shall be carried out in accordance with Chapter 10.

7.2.2 Remove all cover bolts and lift the cover straight off. Do not lever the cover off with a screwdriver or a chisel at the joint, and do not strike the joint face.

7.2.3 While the cover is off, protect both joint faces from mechanical damage, and keep them free of dirt, swarf, paint and moisture. Lay the cover down with its joint face upwards.

7.2.4 The flameproof joint faces shall not be machined, filed, scraped, ground or painted, and no gasket, sealing compound, tape or adhesive other than that specified by the manufacturer shall be fitted between them. Any such action destroys the flameproof property of the joint.

7.2.5 Before reclosing, wipe both joint faces with a clean lint-free cloth and, where necessary, a non-corrosive solvent. Inspect them for scores, dents, burrs, corrosion and foreign matter. Then apply a thin film of the anti-rust oil 204-1 (displacement type) used in manufacture to the joint faces. Never fill the joint gap with grease or oil.

7.2.6 Refit every bolt that was removed. A missing bolt invalidates the explosion protection of the motor. Tighten the bolts crosswise in at least two passes to the torque given in Table 9-2.

7.2.7 Cover bolts shall be replaced only by bolts of the same thread size, the same length and at least the same property class as those supplied (see Table 9-2). Commercial bolts of unknown or lower property class shall not be used.

7.2.8 If a joint face is damaged so that it no longer complies with EN 60079-1, the motor shall not be returned to service. Withdraw it from service and proceed in accordance with Chapter 10.

7.2.9 Record every opening and reclosing of the terminal compartment, with the date and the person responsible, in the maintenance record of the installation.

7.3 Power connection

Table 7-2 Power terminals and conductors

Terminal	Conductor colour	Function	Drive terminal
U	Brown	Motor phase U	U
V	Black	Motor phase V	V
W	Grey	Motor phase W	W
PE	Green-and-yellow	Protective earth	PE

7.3.1 Connect U, V and W to the drive terminals of the same name. Do not interchange phases to change the direction of rotation (7.1.9). A wrong phase sequence causes the motor to run away.

7.3.2 Viewed from the shaft end, counter-clockwise rotation is the positive direction of rotation.

7.3.3 Tighten the terminal screws to the torque in Table 9-2 and keep the specified creepage and clearance distances inside the terminal compartment.

7.4 Feedback connection

The feedback device is located inside the flameproof enclosure and forms part of the certified equipment. The feedback type is identified by position ⑦ of the type code (13.1) and is stated on the nameplate. It cannot be changed in the field.

The resolver (code R) is the standard feedback device on all frame sizes. Tables 7-3 and 7-4 apply to it. The HIPERFACE encoder option (code E) is covered by Table 7-5.

This manual covers feedback codes R and E; project-specific feedback devices (code Q) are described in 12.5. The resolver is the standard configuration: it contains no electronic components, tolerates high internal temperatures and suits most applications. The HIPERFACE encoder (code E) is selected where the drive requires the HIPERFACE protocol or a battery-free multiturn absolute position is needed.

7.4.1 Resolver (code R)

Table 7-3 Resolver terminals and lead colours

Terminal	Lead colour	Signal	Pair	Remark
R1	Red / white	Excitation +	Pair 1	From the resolver excitation output of the drive
R2	Black / white	Excitation −	Pair 1	
S1	Red	Sine +	Pair 2	Differential
S3	Black	Sine −	Pair 2	
S2	Yellow	Cosine +	Pair 3	Differential
S4	Blue	Cosine −	Pair 3	
TH1 / TH2	White / blue	PTC thermistor chain	Pair 4	See 7.7
Shield	—	Overall screen	—	Bond at the drive end

Table 7-4 Resolver data to be set in the drive

Quantity	DX70 / DX90	DX130
Resolver type	Brushless resolver, size 15	Brushless resolver, size 21
Construction	Brushless, size 15, 1X (single speed)	Brushless, size 21, 1X (single speed)
Excitation voltage	10 V rms	7 V rms
Excitation frequency	4.5 kHz	10 kHz
Transformation ratio	0.5 ± 10 %	0.5 ± 5 %
Phase shift	+8°	−5°
Electrical error	± 10′	± 10′
Null voltage	≤ 20 mV rms	≤ 25 mV rms
Input impedance ZRO	90 + j180 Ω	110 + j140 Ω
Output impedance ZSS	210 + j300 Ω	130 + j240 Ω
Permissible temperature	−55 … +155 °C	−55 … +155 °C
Maximum speed	10 000 min^{-1}	10 000 min^{-1}

7.4.1.1 Two resolver types are used across the series and their excitation data are not interchangeable: DX70 and DX90 require 10 V rms at 4.5 kHz, DX130 requires 7 V rms at 10 kHz. Set the values of Table 7-4 for the motor actually connected. Excitation parameterised for 4.5 kHz will not operate a 10 kHz resolver correctly, and the reverse.

7.4.1.2 The resolver is single speed (1X), while the motor has four pole pairs. The number of pole pairs shall be entered in the drive so that the commutation angle is derived correctly; otherwise the motor will run away on the first enable.

7.4.1.3 Compensate the phase shift given in Table 7-4 in the drive where the drive provides that setting. The sign differs between the two resolver types.

7.4.2 HIPERFACE absolute encoder (code E)

Table 7-5 HIPERFACE multiturn encoder — data and terminals

Quantity	Value
Type	SICK SKM36 — HIPERFACE mechanical multiturn absolute encoder (sub-code E 01)
Interface	HIPERFACE — the drive shall support this protocol
Resolution	128 sine/cosine periods per revolution; 4096 steps per revolution; 4096 revolutions absolute
System accuracy	± 120″
Supply	7 … 12 V DC (8 V recommended), 60 mA
Permissible temperature	−20 … +110 °C
Maximum speed	9000 min⁻¹ (reliable absolute position); in service limited by nmax of the motor
Signals at the terminal block	US (8 V), GND, REFSIN, +SIN, REFCOS, +COS, DATA +, DATA −, shield

7.4.2.1 The encoder supply is 8 V DC nominal, not 5 V. A drive that supplies only 5 V to the feedback device cannot be used with this option.

7.4.2.2 No battery is required. The multiturn count is mechanical and is retained without power. Do not connect a backup battery to this device.



WARNING

Use of the HIPERFACE encoder option on a frame size whose internal temperature exceeds the encoder rating.

Loss of position feedback during operation, uncontrolled shaft movement, and premature failure of a device that is inside the flameproof enclosure and cannot be replaced in the field.

- The SICK SKM36 encoder is rated −20 … +110 °C. The internal service temperature of the motor at Ta = 40 °C is approximately 75 °C on DX70, 91 °C on DX90 and 106 °C on DX130 (type test A1624032.001). Do not exceed Ta = +40 °C or the rated data of Chapter 12.

7.4.3 Common requirements

7.4.3.1 Use shielded twisted-pair cable, with the pairs allocated as shown in the relevant table. Bond the shield at the drive end, or as specified by the drive manufacturer.

7.4.3.2 Keep the feedback cable separate from the power cable over its whole length. Where they must cross, cross them at right angles.

7.4.3.3 Before the first enable, verify that the drive is parameterised for the feedback type stated on the nameplate. An incorrect feedback setting causes the motor to run away.

7.5 Cable entries

7.5.1 The motor has two threaded cable entries. Only Ex db / Ex tb certified cable glands and stopping plugs of the matching thread size shall be used.

7.5.2 The motor is supplied with two Ex d cable glands M20 × 1.5 fitted, one for the power cable and one for the feedback cable. The glands are certified to TÜV 20 ATEX 8609 X and IECEx TUR 20.0079X (II 2G Ex db IIC Gb, II 1D Ex ta IIIC Da, IP66/IP68, service temperature −60 °C to +130 °C).

7.5.3 The male thread shall be screwed directly into the motor entry without an adapter. The minimum number of engaged threads shall comply with EN 60079-1.

7.5.4 Every unused entry shall be closed with a certified metallic stopping plug of the same thread size. Stainless steel or nickel-plated brass only.

7.5.5 After installation the entries shall maintain at least the degree of protection of the motor, IP65.

7.5.6 Clamping range of the glands supplied: power cable 7.5 mm to 12 mm, feedback cable 3 mm to 8 mm outer diameter. A cable outside the range neither seals nor is held. Fit and tighten the glands, body and cap nut, as stated in the gland manufacturer's instructions supplied with the motor. The flameproof property of the threaded entry is given by the thread engagement (7.5.3), not by the tightening torque; the torque provides the IP seal and prevents loosening.

7.5.7 Temperature at the cable entry. In the type test, referred to Ta = 40 °C, the temperature at the cable entry and at the branching point of the conductors was 71.7 °C and 82.6 °C on DX70, 84.2 °C and 83.5 °C on DX90, and 103.7 °C and 100.9 °C on DX130. The cables, and any replacement glands and stopping plugs, shall therefore be rated for at least 90 °C on DX70 and DX90 and at least 110 °C on DX130.

7.6 Holding brake

Motors ordered with a holding brake (position ⑤ of the type code) have a spring-applied, electrically released brake inside the flameproof enclosure.

Table 7-6 Holding brake data

Item	DX70	DX90	DX130
Supply voltage	24 V DC ± 10 %	24 V DC ± 10 %	24 V DC ± 10 %
Holding torque	1.3 N·m	4 N·m	16 N·m
Rated power	11 W	14 W	16 W
Excitation current	0.45 A	0.62 A	0.69 A
Coil resistance (± 7 %)	55.33 Ω	38.6 Ω	34.7 Ω
Pull-in time (brake released), max.	60 ms	60 ms	85 ms
Drop-out time (brake engaged), max.	20 ms	40 ms	30 ms
Backlash, max.	1.5°	1.5°	0.5°
Conductor BRK1	Black	Black	Black
Conductor BRK2	White	White	White

7.6.1 The brake is a holding brake only. It shall not be used to decelerate the motor or a moving load: stop the motor with the drive before the brake engages. Engagement at speed, for example on loss of supply, wears the brake and is not a rated function.

7.6.2 Provide free-wheeling protection where the brake is switched by a relay or a transistor output, and switch on the DC side only where the drive manufacturer permits it.

7.6.3 Check that the brake releases before the motor is first run under power.



WARNING

A suspended load held only by the holding brake.

Death or serious injury if the load falls.

- Support the load mechanically before any work on the motor, the coupling or the drive.
- Do not rely on the holding brake as a safety function; it is not a safety component.
- Check the holding torque of the brake at the intervals in Table 9-1.

7.7 Thermal protection

Every motor is fitted with a PTC thermistor triple sensor embedded in the stator winding, one thermistor pellet per phase, the three pellets connected in series and brought out to the terminal compartment. The thermistor chain is inside the flameproof enclosure and forms part of the certified equipment.

Table 7-7 Thermal protector data

Item	Value
Type	PTC thermistor triple sensor to DIN VDE V 0898-1-401, 140 °C
Rated response temperature T	140 °C ± 5 K
Rated resistance R	≤ 300 Ω (at V ≤ 2.5 V, 25 °C)
Resistance at T − 5 K	≤ 1 650 Ω
Resistance at T + 5 K	≥ 3 990 Ω
Resistance at T + 15 K	≥ 12 kΩ
Measuring voltage	≤ 2.5 V DC; 7.5 V DC maximum
Maximum operating voltage	30 V DC
Insulation test voltage	2.5 kV AC
Thermal threshold time	< 3 s
Standards	DIN VDE V 0898-1-401; UL 1434 (file E69802)
Leads	Silver-plated, PTFE-insulated AWG 26 litz wire, 500 … 520 mm
Lead colour	White / blue (colour code for T = 140 °C to DIN VDE V 0898-1-401)
Terminals	TH1 / TH2

7.7.1 Connect TH1 and TH2 to a tripping unit to IEC 60947-8 or DIN VDE V 0898-1-401, or to a PTC motor temperature input of the servo drive, so that the motor is switched off when the thermistor responds.

7.7.2 The tripping unit shall be installed outside the hazardous area. Its measuring voltage across the thermistor chain shall not exceed 2.5 V DC in normal operation, and shall not exceed 7.5 V DC under any condition.

7.7.3 Do not measure the thermistor chain with an ohmmeter that applies more than 2.5 V, and do not test it with an insulation tester. Both damage the thermistors.

7.7.4 The thermistor chain shall not be bypassed, and the trip shall not be set to auto-reset without an assessment of the machine safety concept.



WARNING

Treating the thermal protector as the means of maintaining the temperature class.

Where the cooling path is obstructed, the surface can approach its certified limit while the winding temperature is still normal. The thermistor does not respond, and an explosive atmosphere can be ignited.

- The thermistor responds at 140 °C in the winding. It protects the insulation system (class F, 155 °C). It does not measure the temperature of the motor surface.
- The temperature class is established by type test and is kept by operating the motor within the rated data and within Ta, by keeping the free space of 6.4.3 clear, and by not allowing a dust layer to build up.
- In a short overload the thermistor does help: the thermal time constant of the winding is a few minutes while that of the housing is 20 to 35 minutes, so the winding reaches 140 °C before the surface has time to heat. In obstructed cooling it does not help, because the whole thermal path degrades together.
- The thermal protector does not replace any requirement of Chapter 4, 6 or 8.

7.8 Cable selection

- flame-retardant and oil-resistant type;
- temperature rating as required by 7.5.7;
- conductor cross-section sized to the national wiring rules for the rated current in Table 12-1;
- outer diameter within the clamping range of the cable gland (7.5.6);
- mechanically protected, or armoured, where the installation requires it.

7.9 Checks before energizing

(1) All terminal screws tightened to the torque in Table 9-2.

(2) Enclosure and terminal compartment closed, all fasteners present and tightened.

(3) Cable glands tightened; all unused entries closed with certified stopping plugs.

(4) Protective earth and equipotential bonding connected.

(5) No tools or foreign objects left inside the terminal compartment.

(6) Feedback, brake and thermal protector wiring matches the drive terminal assignment.

(7) Ambient temperature within the range Ta on the nameplate.

(8) Insulation resistance measured and accepted in accordance with 7.10.

7.10 Insulation resistance test

Measure the insulation resistance before first commissioning, after storage longer than six months, and whenever moisture ingress is suspected. Carry out the test only in a non-hazardous area.

1. Isolate the motor completely from the drive and from the supply.
2. Disconnect the feedback device, the holding brake and the thermal protector so that no test voltage reaches electronic components.
3. Use a DC insulation tester at 500 V DC. Measure U–PE, V–PE and W–PE. Do not turn the shaft during the test.
4. Evaluate the result: a new, dry motor should read ≥ 100 MΩ at 25 °C. The measured value shall not be below 10 MΩ, or below the limit of the plant standard, whichever is the more stringent.
5. Where the value is too low, dry the motor by warm air within the permitted temperature limits of the insulation and the bearings, cool it to ambient and repeat the test.
6. Discharge the windings through a suitable resistor after each test and confirm that no voltage remains before reconnecting.

If the insulation resistance remains too low after drying, contact the manufacturer.

8 Commissioning and operation

8.1 Conditions for safe operation

The motor shall not be started until all of the following are satisfied.

(1) The mechanical installation is complete in accordance with 6.9.

(2) The electrical connection is complete in accordance with 7.9.

(3) The drive is parameterised to the data of the motor type: pole pairs, voltage constant, rated and peak current, current limit and feedback type.

(4) The load does not exceed the rated torque of the motor in continuous duty.

(5) The ambient temperature is within Ta and the free space of 6.4.3 is clear.

8.2 Start-up procedure

1. Confirm that all couplings and guards are fitted and that the key is fitted and secured or removed.
2. Energize the drive and check that the feedback signal is read correctly and that no fault is indicated.

3. Release the holding brake, where fitted, and confirm that it releases.
4. Give a low-speed jog command and verify the direction of rotation. Correct a wrong direction only with the direction parameter of the drive; never by interchanging U, V and W or by reversing the feedback.
5. Increase speed and load gradually to the rated values while monitoring current, vibration and noise.
6. Run the machine until the motor surface temperature has stabilised, and record the temperature and the ambient temperature.
7. Record the commissioning data and file it with the installation documentation.

NOTICE *Record the surface temperature and the ambient temperature measured at the end of commissioning as a reference for later inspections (Chapter 9). The measurement does not replace the type test and does not extend the certified operating limits.*

8.3 Operation in hazardous areas

8.3.1 The enclosure and the terminal compartment shall remain closed during operation.

8.3.2 The motor shall not be operated with a missing fastener, a damaged seal or a loose cable gland.

8.3.3 Rated power, current, speed and temperature class shall not be exceeded.

8.3.4 Where the motor is used above 1000 m, the rated data shall be derated in accordance with 12.7.

8.4 Monitoring during operation

Table 8-1 Quantities to be monitored

Quantity	Normal	Action if abnormal
Motor current	≤ rated current in continuous duty	Check the load and the drive current limit
Surface temperature	Within the certified temperature class	Stop the motor; check the load, ventilation and dust layer
Vibration	≤ vibration grade of 12.2	Check alignment, balance and bearing condition
Noise	Steady, no change of character	Stop and investigate — usually a bearing
Feedback signal	No error, no loss of position	Check the cable, the shield and the bonding
Ambient temperature	Within Ta	Operation above Ta is not permitted; stop the motor and improve the cooling of the installation location

If any abnormal condition occurs, stop the motor and investigate before restarting.

8.5 Shutdown

1. Remove the drive command and let the motor decelerate under control.
2. Apply the holding brake only after the shaft has come to rest.
3. Isolate the supply for a long shutdown, and protect the motor against condensation and dust.

8.6 Troubleshooting

Table 8-2 Faults, causes and remedies

Fault	Possible cause	Remedy
Motor does not start	Holding brake not released; drive disabled; wrong feedback offset	Check the brake supply; check the drive enable; re-run the feedback alignment
Motor runs in the wrong direction	Direction parameter of the drive; or phases not connected U–V–W to the drive terminals of the same name	Set the direction parameter of the drive. If phases were interchanged, restore U–V–W and re-run the commutation alignment. Never correct the direction by interchanging phases or reversing the feedback.
Motor runs away on enable	Feedback offset wrong; feedback and phase order do not match	Stop immediately; re-run the commutation alignment
Overheating at normal load	Blocked heat dissipation; dust layer; ambient above Ta; switching frequency too low	Clear the free space; clean; check Ta; check the drive setting
Increasing vibration or noise	Misalignment; unbalanced transmission element; bearing wear	Re-align; re-balance; have the bearings examined by the manufacturer
Position loss	Feedback cable shield not bonded; cable run with the power cable	Bond the shield at the drive; separate the cable runs
Brake does not hold	Brake worn; supply voltage still applied; load exceeds the holding torque	Support the load; check the supply; have the brake replaced by the manufacturer

NOTICE *Fault-finding that requires the enclosure to be opened shall be carried out only in a non-hazardous area, and only by the manufacturer where an Ex component is involved.*

9 Inspection and maintenance

DX series motors are low-maintenance when operated within their rated data. Periodic inspection is nevertheless required, both to keep the machine reliable and to keep the explosion protection valid. The scope and the intervals of the Ex inspection are governed by IEC 60079-17.

9.1 Inspection schedule

Table 9-1 Periodic inspection

Interval	Item	Criterion
3 months	Paint, corrosion, external damage; dust layer on the housing	No damage; dust layer < 5 mm
3 months	Tightness of the fixing bolts, the enclosure fasteners, the cable glands and the earthing connection	Tight to Table 6-2 / Table 9-2
6 months	Bearing running condition — noise, vibration, temperature	No change from the commissioning record
6 months	Cable sheath, cable support, drip loop	Undamaged, supported, drip loop present
6 months	Legibility of the nameplate and the safety labels	Legible
12 months	Holding brake — release and holding torque	Releases fully; holds the rated torque of Table 7-6
12 months	Insulation resistance (7.10)	≥ 10 MΩ at 500 V DC
12 months	Alignment at the coupling	Within Table 6-3

Where abnormal vibration, overheating or noise occurs, inspect immediately and do not wait for the next scheduled interval.

9.2 Cleaning

9.2.1 Clean the motor with a damp cloth only. Dry cloths and solvent-based cleaners are not permitted (special condition of use, 4.4).

9.2.2 Do not use high-pressure water or steam.

9.2.3 Do not use abrasives or tools on a flameproof joint.

9.2.4 After cleaning, verify that all covers, seals and glands are in place and tight.

9.3 Flameproof joints and enclosure integrity

The flameproof joints are the surfaces through which the explosion protection works. They are defined in the certificate documentation and are not user-serviceable.

Table 9-2 Enclosure fasteners and tightening torques

Item	DX70	DX90	DX130
Main enclosure screws	7 × M3 × 30, steel class 8.8	4 × M4 × 35 and 3 × M4 × 30, steel class 8.8	8 × M6 × 25 and 3 × M4 × 35, steel class 8.8
Rear cover screws	8 × M3 × 8, A2-70	8 × M3 × 8, A2-70	2 × M3 × 8, A2-70
External earth screw	1 × M4 × 8, A2-70	1 × M4 × 8, A2-70	1 × M4 × 8, A2-70
Tightening torque, steel class 8.8	M3: 1.1 N·m	M4: 2.5 N·m	M6: 8.5 N·m; M4: 2.5 N·m
Tightening torque, stainless A2-70	M3: 0.8 N·m; M4: 1.8 N·m	M3: 0.8 N·m; M4: 1.8 N·m	M3: 0.8 N·m; M4: 1.8 N·m
Conditions	± 10 %; thread lightly oiled; engagement in the aluminium ≥ 1.5 × d	± 10 %; thread lightly oiled; engagement in the aluminium ≥ 1.5 × d	± 10 %; thread lightly oiled; engagement in the aluminium ≥ 1.5 × d
Terminal screws	0.22 … 0.25 N·m	0.22 … 0.25 N·m	Feedback: 0.22 … 0.25 N·m; power: as marked on the terminal block

Do not:

- machine, file, grind, polish or rework a flameproof joint;
- apply paint or sealant to a flameproof joint, or any corrosion inhibitor other than that specified in 7.2.5;
- replace an enclosure fastener with a commercial fastener of unknown property class;
- open the enclosure while an explosive atmosphere may be present.

Do:

- keep the joints clean and undamaged;
- protect the joints with a thin film of non-hardening corrosion preventive when the enclosure has been opened by the manufacturer;
- replace a damaged seal immediately with the original part;
- contact the manufacturer for the joint dimensions and tolerances before any intervention.

9.4 Bearings

The bearings are lifetime-greased and are not relubricated in service. The bearing types are given in Table 3-2.

Increasing vibration, unusual noise or a rise in bearing temperature indicates that the bearings need attention. Bearing replacement affects the flameproof joints and shall be carried out only by the manufacturer.

9.5 Spare parts

Only original parts obtained from the manufacturer may be used. Parts inside the flameproof enclosure form part of the certified equipment; using a substitute invalidates the certification.

Table 9-3 Replacement parts

Part	DX70	DX90	DX130
Bearing, drive end	6202-2Z	6004-2Z	6305-2Z
Bearing, non-drive end	629-2Z	6201-2Z	6205-2Z
Shaft seal	TC 15 × 28 × 5	on request	TC 25 × 40 × 7
O-rings	Ø56 × 1; Ø60 × 1	Ø75 × 1 (2 off)	Ø120 × 1.9 (2 off)
Wave washer	D35 (27 × 34 × 0.5)	on request	D52 (41 × 51 × 0.5)
Cable gland	Ex d cable gland M20 × 1.5 (7.5)	Ex d cable gland M20 × 1.5 (7.5)	Ex d cable gland M20 × 1.5 (7.5)
Feedback device	manufacturer only	manufacturer only	manufacturer only
Holding brake	manufacturer only	manufacturer only	manufacturer only

9.6 Checks after maintenance

(1) All covers and the terminal compartment closed and tightened to Table 9-2.

(2) Cable glands sealed and the cables strain-relieved.

(3) Protective earth and equipotential bonding intact and tested.

(4) Shaft turns freely without abnormal noise.

(5) No tools or foreign objects left inside the motor.

(6) The work recorded in the maintenance log of the installation.

10 Service and repair

Repair of Ex equipment is governed by IEC 60079-19. Unauthorised repair or modification invalidates the explosion protection and the certification.

10.1 Work permitted on site

- cleaning the external surface in accordance with 9.2;
- opening the terminal compartment cover for connection work in accordance with 7.2, in a gas-free condition;
- checking the tightness of fasteners, cable glands and the earthing connection;
- checking and re-making the external cable connections outside the enclosure;
- functional check of the holding brake;
- insulation resistance test in accordance with 7.10, in a non-hazardous area;
- replacing a cable gland or a stopping plug with a certified part of the same type and thread size.

10.2 Work not permitted on site

- opening the enclosure in Zone 1, 2, 21 or 22;
- dismantling the rotor, the stator or the terminal assembly;
- separating a flameproof joint;
- replacing bearings, shaft seals, the feedback device or the holding brake;
- any machining, grinding, polishing or rework of an Ex surface;
- fitting a non-certified cable gland or stopping plug;

– altering the nameplate, the marking or the internal wiring.

10.3 Authorised repair

Repairs that require the flameproof enclosure to be opened, other than the terminal compartment cover of 7.2, are carried out only at the manufacturer's works: return the motor to the manufacturer. There are no authorised third-party repair workshops. Every such repair follows IEC 60079-19 and restores the product to the certified design.

After an Ex-related repair the manufacturer supplies with the motor:

– a repair report in accordance with IEC 60079-19;
– traceability records for every replaced component;
– a functional and, where required, a routine test report;
– confirmation of the marking, and the repair label where one is required.

Without this documentation the explosion protection of the repaired motor cannot be regarded as valid.

11 Decommissioning and disposal

11.1 Removal from service

1. Isolate the drive from the supply, lock out and verify that the circuit is dead. Observe the discharge time of the drive.
2. Support the load mechanically where the holding brake carries a suspended load.
3. Make sure the shaft has come to rest and secure it against being turned.
4. Confirm that no explosive atmosphere is present at the place of work.
5. Mark and disconnect the cables, then close the terminal compartment and fit stopping plugs in the open entries.
6. Remove the transmission element with a puller acting on the hub.
7. Release the fixing bolts and lift the motor as described in 5.2.

11.2 Storage after removal

– Store dry and dust-free as described in 5.3.
– Block the shaft for transport.
– For storage longer than six months, observe 5.4.

11.3 Disposal

At the end of its service life the motor shall be disposed of in accordance with the local environmental regulations. Separate the materials as follows:

– aluminium — housing, end shield, rear cover;
– steel — shaft, fasteners, bearings;
– copper and insulation — stator winding;
– rare-earth permanent magnets — rotor; these shall be handled separately and should be recycled;
– electronic components — feedback device;
– elastomers — shaft seal and O-rings.



CAUTION

Strong magnetic field of the dismantled rotor.
Injury by attraction of ferrous objects; malfunction of active medical implants; erasure of magnetic data carriers.
- Persons with active implants shall keep clear of a dismantled rotor.
- Keep the rotor away from ferrous tools and from data carriers.

12 Technical data

The data in this chapter apply to the motor types listed, in the condition in which they are delivered. Where a value differs from the nameplate, the nameplate takes precedence.

12.1 Rated data

Table 12-1 Rated data

Quantity	70DX040C	90DX100C	130DX150C	130DX260C	130DX380C
Rated power Pn (kW)	0.40	1.00	1.50	2.60	3.80
Rated torque Tn (N·m)	1.27	3.18	6	10	15
Max. torque Tmax (N·m)	3.81	9.9	18	25	30
Rated speed nn (min^{-1})	3000	3000	2500	2500	2500
Max. speed nmax (min^{-1})	5000	4500	2800	2800	2800
Continuous torque at nmax (N·m)	1.27	2.45	6	9.6	14.5
Rated voltage Un (V AC)	220	220	220	380	380
Rated current In (Arms)	2.9	4.5	6.0	5.9	7.4
Max. current Imax (Arms)	8.7	13.5	18	17.8	22.5
Voltage constant Ke (Vrms/krpm)	29.6	46	65	115	125
Torque constant Kt (N·m/A)	0.438	0.78	1.67	1.69	2.03
Continuous stall torque T0 (N·m)	1.27	3.18	6	10	15
Continuous stall current I0 (Arms)	2.9	4.5	6.0	5.9	7.4
Pole pairs p	4	4	4	4	4
Line inductance L (mH)	14.5	3.76	3.87	6.2	5.5
Line resistance R (Ω)	2.35	1.56	1.21	1.986	1.41
Electrical time constant τe (ms)	6.17	2.41	3.20	3.12	3.90
Rotor inertia, without brake J ($\times 10^{-4}$ kg·m²)	0.487	1.81	12.6	19.4	27.7
Rotor inertia, with brake J ($\times 10^{-4}$ kg·m²)	0.52	2.10	13.8	20.6	28.9
Mechanical time constant (ms)	0.3	0.3	0.3	0.3	0.3
Thermal time constant (min)	20	26	25	30	35
Mass (kg)	2.4	4.4	12	14	15
Overall length incl. shaft extension (mm)	240.2	298.5	289.5	319.5	341.5
Temperature class, gas	T5	T5	T4	T4	T4
Max. surface temp., dust	T100 °C	T100 °C	T130 °C	T130 °C	T130 °C

All values are for operation with a compatible servo drive, at rated voltage, at an ambient temperature of 40 °C, at an altitude up to 1000 m, with the motor flange mounted on a metal machine frame and the free space of 6.4 kept around

the housing. Pn, Tn, Tmax, nn, nmax, Un, In, Imax, Kt, the rotor inertia (without brake; with brake for DX70 and DX90) and the mass are the values of the certificate annex; Pn is the nominal power of the type designation (Tn × nn gives 0.40 / 1.00 / 1.57 / 2.62 / 3.93 kW). All other values are manufacturer data.

12.1.1 Above rated speed the continuous torque decreases, because iron and friction losses rise with speed while the surface temperature limit of the temperature class remains the same. Between the rated speed nn and the maximum speed nmax, the permissible continuous torque is obtained by linear interpolation between Tn and the value given for nmax in Table 12-1. Continuous operation above this torque is not permitted. For DX70 and 130DX150C the thermal margin of the type test is sufficient to keep Tn up to nmax.

12.1.2 Figures 12-1 to 12-5 show the torque–speed characteristics at rated voltage Un and an ambient temperature of 40 °C. The continuous duty range S1 is bounded by Tn up to the rated speed nn and falls linearly to the value at nmax (12.1.1). The intermittent range is bounded by Tmax and, at high speed, by the output voltage available from the drive at Un. The curves are typical and calculated; magnetic saturation is not included. Operation in the intermittent range is permitted only within the rms limit of 12.1.3.

12.1.3 Cyclic duty. For a duty cycle, the root-mean-square torque Trms = √(Σ Ti²·ti / Σ ti), taken over the whole cycle including standstill periods, shall not exceed the continuous torque at the mean speed of the cycle (Table 12-1 and 12.1.1). The cycle time shall be short compared with the thermal time constant in Table 12-1. The peak torque shall not exceed Tmax.

12.1.4 Standstill. At standstill or at very low speed the current flows permanently through the same phases. The torque held continuously at standstill shall not exceed the continuous stall torque T0. To hold a load at standstill for long periods, use the holding brake.

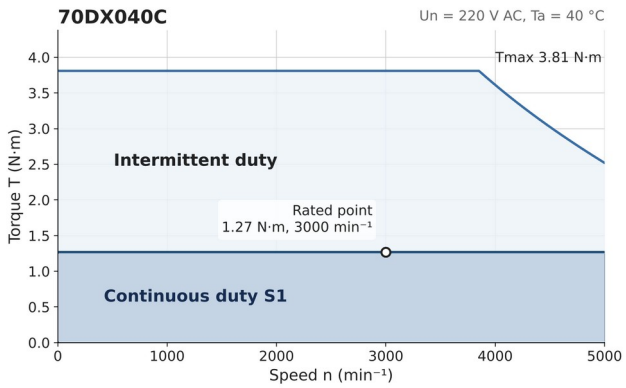


Figure 12-1 Torque–speed characteristic of 70DX040C

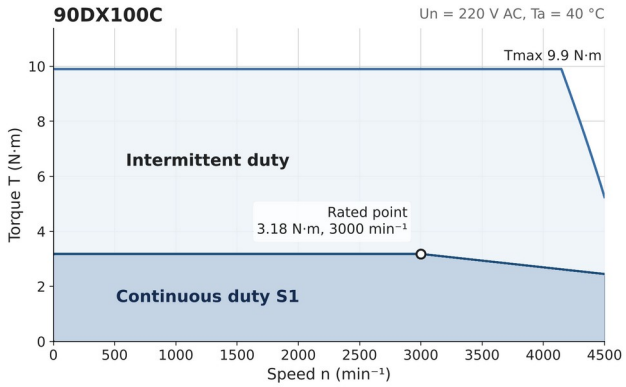


Figure 12-2 Torque–speed characteristic of 90DX100C

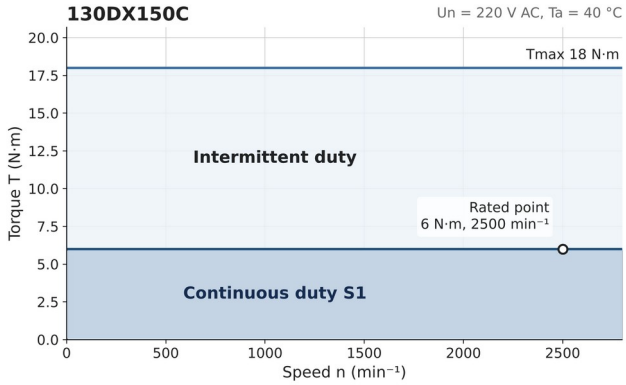


Figure 12-3 Torque–speed characteristic of 130DX150C

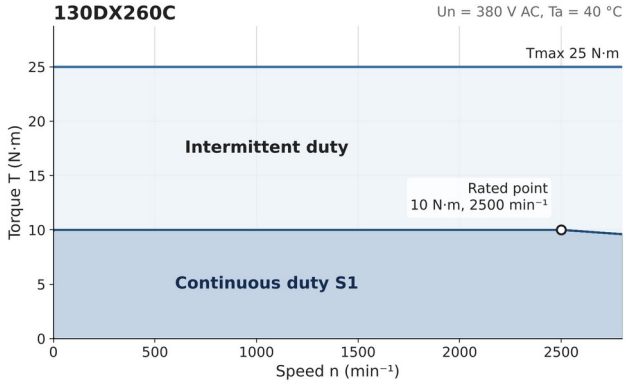


Figure 12-4 Torque–speed characteristic of 130DX260C

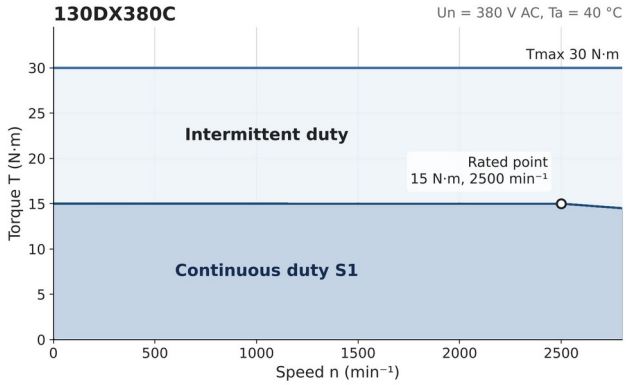


Figure 12-5 Torque–speed characteristic of 130DX380C

12.2 General characteristics

Table 12-2 General characteristics

Item	Value
Duty type	Continuous duty S1 to IEC 60034-1
Excitation	Permanent magnet
Mounting arrangement	IM B5 to IEC 60034-7; IM V1 and IM V3 permitted
Cooling	IC 410 — surface cooled, natural convection and radiation, no fan
Insulation system	Class F (155 °C)
Degree of protection	IP65 to IEC 60034-5
Direction of rotation	Counter-clockwise viewed from the shaft end is positive
Balance quality	Half key, ISO 21940-11 grade G2.5
Vibration grade	Grade A to IEC 60034-14
Vibration resistance	≤ 49 m/s²
Shock resistance	≤ 490 m/s²
Ambient temperature, operation	−20 °C ≤ Ta ≤ +40 °C
Ambient temperature, storage	−20 °C … +40 °C
Relative humidity	20 % … 80 %, no condensation
Altitude	≤ 1000 m without derating; 1000 m to 2000 m see 12.7; above 2000 m not permitted
Test voltage	220 V winding: 1500 V AC, 1 min; 380 V winding: 1800 V AC, 1 min
Insulation resistance, new	≥ 100 MΩ at 500 V DC, 25 °C

12.3 Mounting dimensions

The mounting flange and the shaft end conform to IEC 60072-1: flange numbers 75, 100 and 165, with through holes. The symbols are those of IEC 60072-1.

Table 12-3 Symbols

Symbol	Designation
N	Spigot (register) diameter of the mounting flange
T	Spigot length, measured from the flange face
M	Pitch circle diameter of the fixing holes
S	Diameter of the fixing holes
D	Diameter of the shaft extension
E	Length of the shaft extension
F	Width of the key
GA	Dimension over the shaft and the fitted key

Table 12-4 Mounting flange and shaft extension

Symbol	Dimension	DX70	DX90	DX130
—	Housing / flange, square across flats (mm)	70 / 70	85 / 85	130 / 136
—	IEC 60072-1 flange number (through holes)	75	100	165
N	Spigot diameter (mm)	Ø60 j6	Ø80 j6	Ø130 j6
T	Spigot length (mm)	2.5	3.0	3.5
M	Pitch circle diameter (mm)	Ø75	Ø100	Ø165
S	Fixing hole diameter (mm)	Ø5.5	Ø7	Ø11
—	Number and position of fixing holes	4 × 90°, 45° offset	4 × 90°, 45° offset	4 × 90°, 45° offset
D	Shaft extension diameter (mm)	Ø11 j6	Ø19 j6	Ø24 j6
E	Shaft extension, flange face to shaft end (mm)	23 ± 0.5	40 ± 0.6	50 ± 0.6
—	Mounting arrangement	IM B5	IM B5	IM B5

Table 12-5 Keyway and shaft-end tapped hole

Symbol	Dimension	DX70	DX90	DX130
F × h	Key, width × height (mm)	4 × 4, form A	6 × 6, form A	8 × 7, form A
—	Key length (mm)	16	32	40
—	Distance, shaft end to keyway (mm)	3.5	4	5
GA	Dimension over shaft and key (mm)	12.5	21.5	27
—	Tapped hole in shaft end	M4 × 10	M6 × 16	M8 × 19

NOTE *The motor is supplied with the key fitted and is balanced with a half key to ISO 21940-11 (6.6).*

12.3.1 Figures 12-6 to 12-8 show the outline dimensions. Figure 12-8 applies to all three DX130 types, which differ only in the body length L given in the table on the figure. The height of the cable glands depends on the cable diameter.

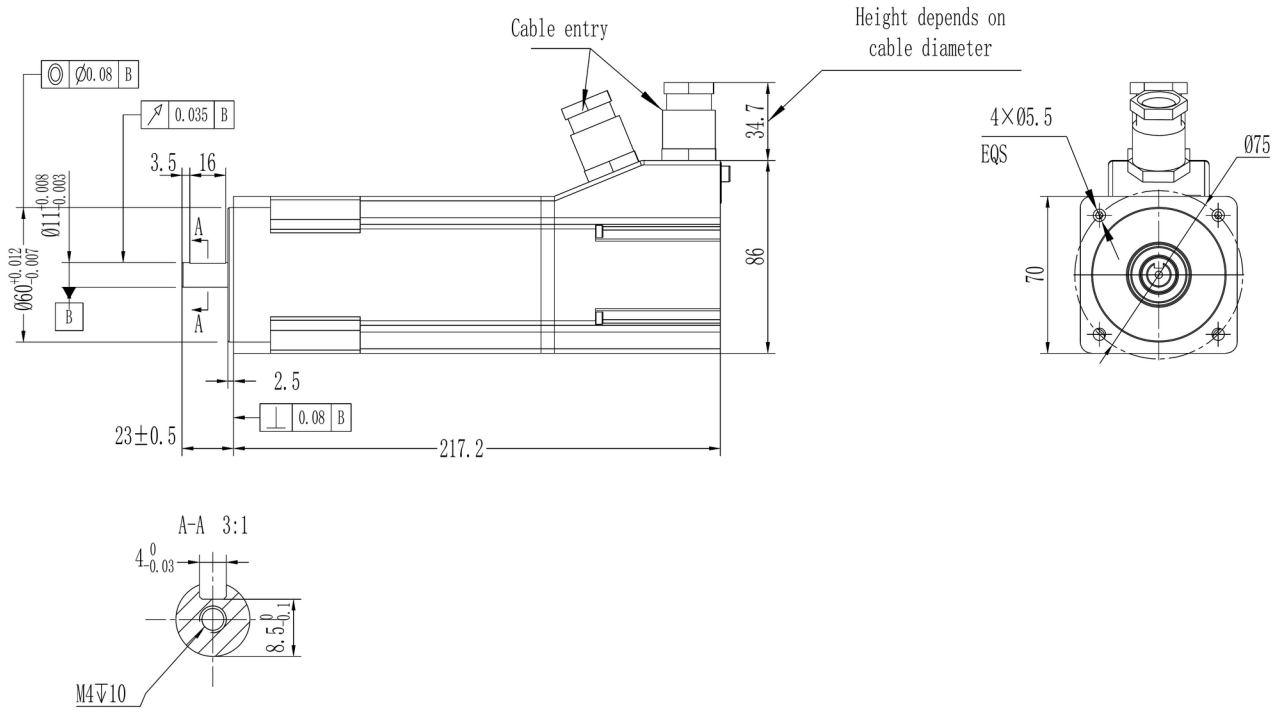


Figure 12-6 Outline drawing of 70DX040C (dimensions in mm)

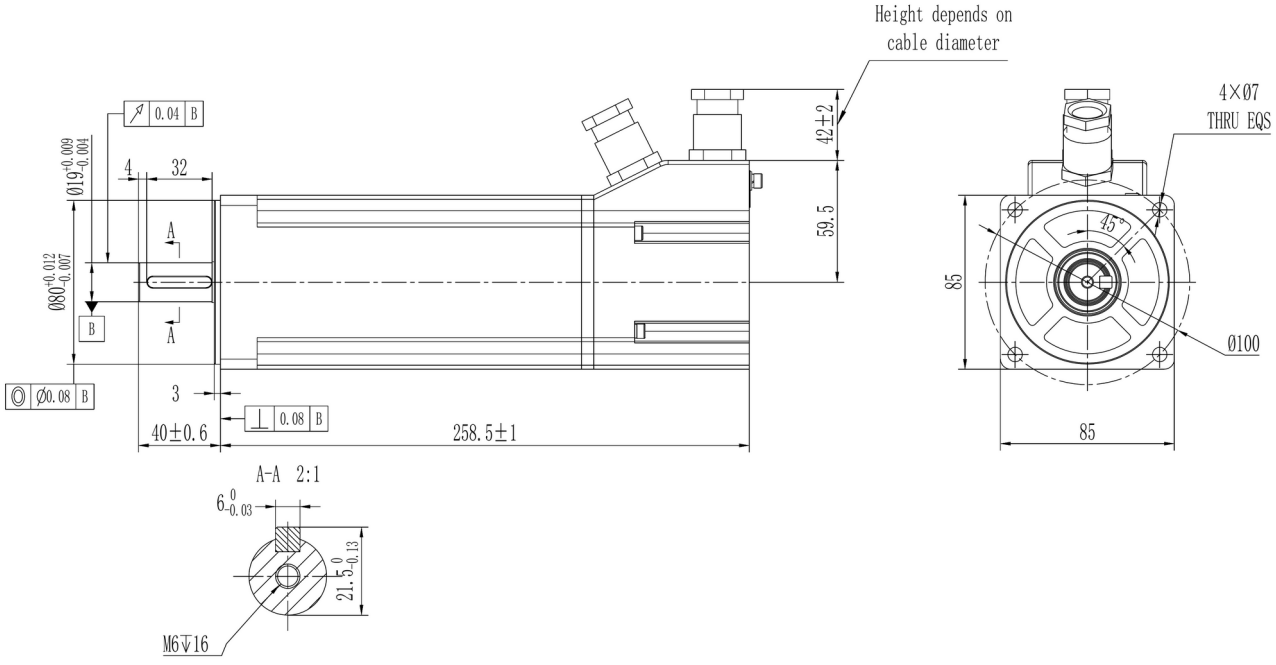
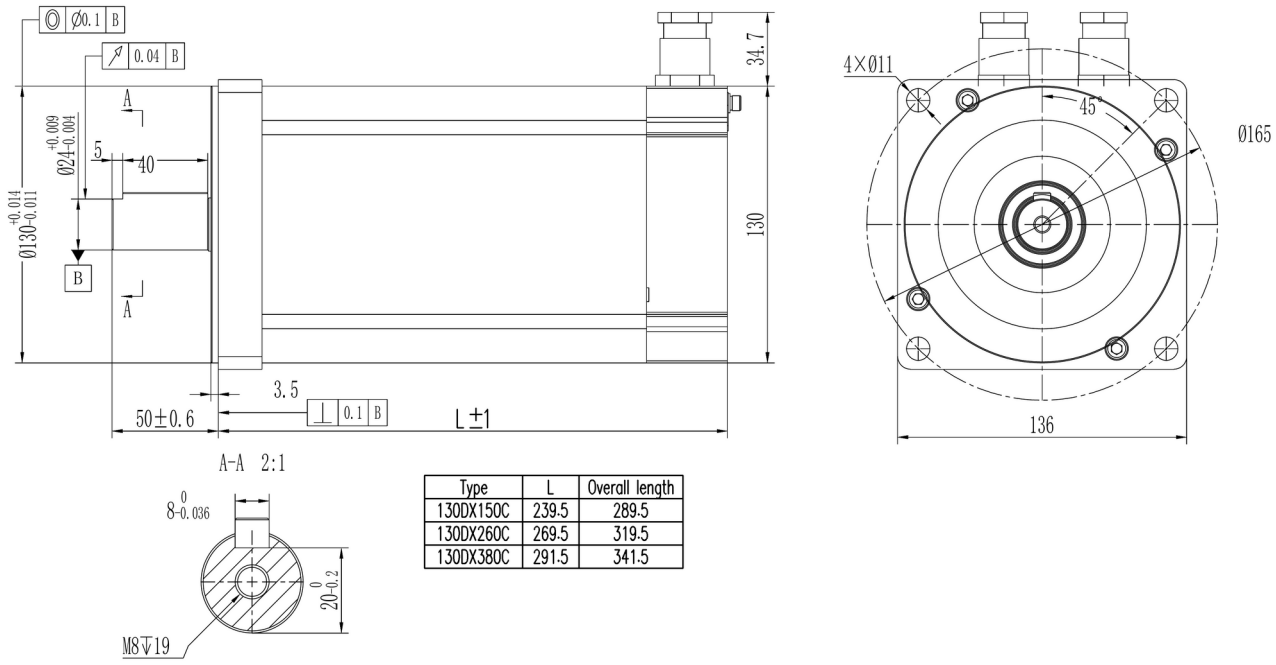


Figure 12-7 Outline drawing of 90DX100C (dimensions in mm)



Type	L	Overall length
130DX150C	239.5	289.5
130DX260C	269.5	319.5
130DX380C	291.5	341.5

Figure 12-8 Outline drawing of 130DX150C, 130DX260C and 130DX380C (dimensions in mm)



WARNING

A motor that fits mechanically but is not electrically equivalent to the motor it replaces.

Uncontrolled machine movement; damage to the drive; loss of the certified temperature class.

- A common mounting interface does not make the motor a drop-in replacement.
- Before commissioning, parameterise the drive to the pole pairs, the voltage constant, the current limits and the feedback type of the DX motor.
- The feedback device is inside the flameproof enclosure and forms part of the certified equipment; it shall not be exchanged for a different type.

12.4 Shaft loads

Table 12-6 Permissible shaft loads

Item	DX70	DX90	DX130
Maximum radial force at the shaft extension (N)	245	392	490
Maximum axial force (N)	98	147	160
Point of application of the radial force	Shaft end, E = 23 mm	Shaft end, E = 40 mm	Shaft end, E = 50 mm
Nominal bearing life L10h to ISO 281 at rated speed with the maximum radial force (h)	60 000	24 000	140 000
Axial force during fitting of the transmission element (N)	≤ 98	≤ 147	≤ 160

12.4.1 The permissible radial force applies at the end of the shaft extension, at the distance E from the flange face (Table 12-4). A force applied nearer to the flange gives a longer bearing life, but the permissible force is not increased.

12.4.2 The radial and the axial force shall not be applied at their maximum values at the same time.

12.4.3 The bearing life in Table 12-6 is the nominal life to ISO 281 at 90 % reliability. It does not include the service life of the bearing grease. The bearings are shielded and lubricated for life; at high bearing temperature the grease life can be shorter than L10h.

12.4.4 Where the motor runs continuously at or near its rated torque, return it for bearing replacement (10.3) after 20 000 operating hours, or earlier if bearing noise, vibration or temperature increases (9.4).

12.4.5 Fit the transmission element with a puller using the tapped hole in the shaft end (6.6). The axial force during fitting shall not exceed the value in Table 12-6.

12.5 Feedback devices

Table 12-7 Feedback options

Code	Device	Interface	Availability
R	Brushless resolver, 1X	Analogue; excitation differs by frame size, see Table 7-4	Standard on all frame sizes
E	SICK SKM36 — HIPERFACE mechanical multiturn absolute, 4096 revolutions, no battery	HIPERFACE, 8 V DC supply	Option on all frame sizes (sub-code E 01)
Q	Other feedback device	project-specific	

NOTICE *The feedback device is located inside the flameproof enclosure and is part of the certified equipment. Changing the feedback type is a change to the certification, not an option that can be fitted in the field.*

12.6 Holding brake

See Table 7-6 for the brake data and 7.6 for the connection and the conditions of use.

12.7 Derating

12.7.1 Altitude

Above 1000 m the cooling air is thinner and the permissible continuous torque falls; multiply the rated torque by the factor in Table 12-8. The motor shall not be installed above 2000 m: its explosion protection is assessed for atmospheric pressures of 80 kPa to 110 kPa (IEC 60079-0). Installation above 2000 m requires a separate assessment by the manufacturer and the notified body.

Table 12-8 Altitude derating factor

Altitude	≤ 1000 m	2000 m	3000 m	4000 m
Factor	1.00	0.93	not permitted	not permitted

12.7.2 Ambient temperature

The rated data apply at 40 °C ambient. The motor shall not be operated above 40 °C. Below 40 °C no increase of the rated data is permitted, because the temperature class is assessed at the upper limit of Ta.

13 Type designation and ordering

13.1 Type code

The full type code is made up of the basic type designation and four additional positions, in the order used by the EU-type examination certificate:

90 DX 100 C – 0 T5 R 00

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Table 13-1 Type code positions

Pos.	Element	Values	Example
①	Frame size	70 = 70 mm square, 90 = 85 mm square, 130 = 130 mm square	90
②	Series	DX = explosion-proof servo motor series	DX
③	Rated power code	Three digits ≈ Pn (kW) × 100: 040, 100, 150, 260, 380	100
④	Motor length / design letter	Depends on motor length and inertia	C
⑤	Holding brake	0 = without brake; 1 = with brake	0
⑥	Temperature class	T5 (DX70, DX90) or T4 (DX130)	T5
⑦	Feedback device	R = resolver (standard); E = mechanical multiturn absolute encoder; Q = other	R
⑧	Custom number	Two digits. 00 = standard configuration; E 01 = SICK SKM36, HIPERFACE; other numbers are assigned by the manufacturer	00

13.2 Ordering information

Specify at least the following when ordering:

- the complete type code, for example 90DX100C-0T5R00;
- quantity;
- the mounting interface required, where both interfaces are offered;
- the supply voltage, the drive make and type;
- cable glands, pre-assembled cables and their lengths, where required;
- the zone, the gas or dust group and the temperature class of the installation;
- any special ambient condition — low temperature, high vibration, aggressive atmosphere, altitude above 1000 m.

Where the requested configuration differs from a certified standard type, the manufacturer will confirm whether an additional assessment or a certificate variation is required before the order is accepted.

14 Conformity

14.1 Applied directives

Table 14-1 Directives

Directive	Scope	Application to the DX series
2014/34/EU (ATEX)	Equipment for use in potentially explosive atmospheres	Applied — flameproof "db" and dust protection by enclosure "tb"
2014/35/EU (LVD)	Low voltage	Not applicable — Annex II of the directive excludes electrical equipment for use in an explosive atmosphere; electrical safety is covered by 2014/34/EU
2006/42/EC	Machinery	Not applied for CE marking. The motor is a component to be incorporated into machinery and shall not be put into service until the machine into which it is incorporated complies with the directive. From 20 January 2027 Regulation (EU) 2023/1230 applies in place of Directive 2006/42/EC.
2014/30/EU (EMC)	Electromagnetic compatibility	Not applied — the motor is a passive component of a power drive system, see 14.1.1

14.1.1 Electromagnetic compatibility. The motor is a component intended for incorporation into a power drive system and is not operated on its own. Apart from the feedback device it contains no active electronic circuits; with the resolver (code R) it is inherently benign in terms of electromagnetic compatibility. The HIPERFACE encoder fitted with code E carries its own CE marking under 2014/30/EU from its manufacturer. Compliance of the complete power drive system with 2014/30/EU is the responsibility of the installer, following EN IEC 61800-3, the instructions of the drive manufacturer and the cabling rules of 7.1 and 7.4.3.

14.2 Applied standards

The editions listed are those applied in the EU-type examination and the IECEx certification. Presumption of conformity under 2014/34/EU follows from the harmonised editions listed in the Official Journal of the European Union.

Table 14-2 Standards applied in the certification

Area	Standard	Title
Explosion protection	EN IEC 60079-0:2018	Explosive atmospheres — Part 0: Equipment — General requirements
Explosion protection	EN 60079-1:2014	Part 1: Equipment protection by flameproof enclosures "d"
Explosion protection	EN IEC 60079-31:2024	Part 31: Equipment dust ignition protection by enclosure "t"
IECEx	IEC 60079-0:2017	General requirements
IECEx	IEC 60079-1:2014	Flameproof enclosures "d"
IECEx	IEC 60079-31:2022	Dust ignition protection by enclosure "t"
Rotating machines	IEC 60034-1	Rating and performance
Rotating machines	IEC 60034-5	Degrees of protection (IP code)
Rotating machines	IEC 60034-7	Classification of types of construction and mounting arrangements (IM code)
Rotating machines	IEC 60034-14	Mechanical vibration — measurement, evaluation and limits
Mechanical	IEC 60072-1	Dimensions and output series for rotating electrical machines
Installation	EN IEC 60079-14	Electrical installations design, selection and erection
Inspection	IEC 60079-17	Electrical installations inspection and maintenance
Repair	IEC 60079-19	Equipment repair, overhaul and reclamation

14.3 Conformity assessment

- EU-type examination (Module B) by the notified body;
- product quality assurance (Annex VII, Module E), covered by the ATEX quality assurance notification;
- IECEx testing and certification, covered by the IECEx quality assessment report.

14.4 CE marking

The motor bears the CE marking together with the identification number of the notified body responsible for the product quality assurance, and the Ex marking given in 4.2. The EU declaration of conformity is supplied with each motor.

CE 0035 Ex

14.5 Limits of validity

(1) The CE marking and the Ex marking apply only when the motor is used in accordance with this manual.

(2) Any modification of the motor, the cable entries or the mechanical parts that has not been approved by the manufacturer invalidates the certification.

(3) Operation outside the certified ambient temperature range is not permitted; it would require a variation of the certificate.

A Terms and abbreviations

Table A-1 Terms and abbreviations

Abbreviation	Term	Meaning
ATEX	Atmosphères Explosibles	Directive 2014/34/EU
IECEx	IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres	International certification scheme
Ex db	Flameproof enclosure	Type of protection to EN 60079-1
Ex tb	Protection by enclosure	Type of protection to EN IEC 60079-31
EPL	Equipment protection level	Gb, Db — high level of protection
QAN	Quality assurance notification	ATEX product quality approval
QAR	Quality assessment report	IECEx production quality approval
DoC	Declaration of conformity	EU declaration issued by the manufacturer
Ta	Ambient temperature	Permitted range on the nameplate
Pn / Tn / nn	Rated power / torque / speed	See Table 12-1
Un / In	Rated voltage / current	See Table 12-1
Ke	Voltage constant	Vrms per 1000 min^{-1}
IM	Mounting arrangement	IEC 60034-7 code
IC	Cooling method	IEC 60034-6 code
IP	Ingress protection	IEC 60034-5 code
DE / NDE	Drive end / non-drive end	Bearing positions
S1	Continuous duty	IEC 60034-1 duty type
IEC flange No.	Flange designation to IEC 60072-1	Number = pitch circle diameter M in mm

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