2 Product Description of Gear Units and Gearmotors

2.1 General information

Coating

Asynchronous servo gearmotors from SEW-EURODRIVE are painted as follows:

Type	Coating according to DIN 1843
Asynchronous gearmotor with R, F, K, S, W gear unit	RAL 7031 blue/gray
	RAL 9005 black

Special paints are available on request.

Weight specifications

Please note that all weights shown in the catalogs exclude the oil fill for the gear units and gearmotors. The weights vary according to gear unit type and gear unit size. The lubricant fill depends on the mounting position which means no universally applicable information can be given. For approximate lubricant fill volumes depending on the mounting position, refer to the gear unit catalog. For the exact weight, refer to the order confirmation.

Surface and corrosion protection

If required, all motors from SEW-EURODRIVE can be supplied with special surface protection for applications in extremely humid and chemically aggressive environments.

Air admission and accessibility

The motors/brakemotors must be mounted on the driven machine in such a way that both axially and radially there is enough space left for unimpeded air admission and for maintenance of the brake. Please also refer to the notes in the motor dimension sheets.

Brakemotors

On request, the motors can be supplied with an integrated mechanical brake. The SEW-EURODRIVE brake is an electromagnetic disk brake with a DC coil that releases electrically and brakes using spring force. Due to its operating principle, the brake is applied if the power fails. It meets the basic safety requirements. The brake can also be released mechanically if equipped with manual brake release. For this purpose, the brake is supplied with either a hand lever with automatic reset or an adjustable setscrew. The brake is controlled by a brake controller that is either installed in the motor wiring space or the control cabinet.

A characteristic feature of the brakes is their extremely short design. The brake bearing end shield is a part of both the motor and the brake. The integrated construction of the SEW-EURODRIVE brakemotor permits particularly compact and sturdy solutions.

Inverter operation

DRS/DRE/DRP motors can be combined with the proven SEW-EURODRIVE frequency inverter series MOVIDRIVE®, MOVITRAC®, MOVIFIT® and MOVIMOT®, and as of now also with MOVIPRO®.

The asynchronous DRL servomotors are operated with inverters of the MOVIDRIVE® series and multi-axis servo inverters of the MOVIAXIS® series.

International markets

On request, SEW-EURODRIVE supplies UL registered motors or CSA certified motors with connection conditions according to CSA and NEMA standard.

For the Japanese market, SEW-EURODRIVE offers motors conforming to JIS standard. Contact your sales representative to assist you in such cases.

2.2 Asynchronous servomotors of the DRL series

Asynchronous servomotors are the link between the classical asynchronous AC motors for supply system and inverter operation and the highly dynamic synchronous servomotors with permanent magnets.

DRL motors

Asynchronous servomotors of the DRL series are a drive package made up from the many options of the modular DR motor system.

In its basic variant, the drive package always contains

- Encoder, sine signals and electronic nameplate
- Thermal motor protection
- Dynamics package
- Various connection options
- Winding optimized with respect to speed

Depending on the application and requirements, the following elements can be added:

- Forced cooling fan
- Connection via plug connectors instead of terminals
- Temperature detection
- And many more

Alternatives can be selected instead of the elements of the basic variant, e.g. an absolute encoder instead of the sine encoder.

Dynamics

AC motors operated on the supply system usually have an overload capacity of 160% to 180% of the rated torque during startup.

If the motor is operated on an inverter of the same power, the inverter usually provides 150% current, and thus roughly 150% torque, for 60 seconds during startup. If a larger inverter is selected, the inverter can provide a higher current and theoretically a greater torque as well. In this case, the mechanical resistance of the motor against the overload, which might reach or exceed the permitted limit values, must be checked.

As a rule, the synchronous servomotors and the corresponding inverters are designed for a high short-time overload. 400% of the rated torque can generally be reached and are permitted.

The mechanical design of asynchronous servomotors of the DRL series is of such a high quality that dynamic overload values can be reached which exceed the classical values of an asynchronous motor operated on a supply system or inverter and almost match the values of a synchronous servomotor.

SEW-EURODRIVE offers the DRL motors in two dynamics packages:

Package	Overload capacity to nominal torque
Dynamics 1 (D1)	190% – 220%
Dynamics 2 (D2)	300% – 350%

The nameplate of the motor specifies the respective package.

Speeds

SEW-EURODRIVE offers the DRL servomotors with 4 rated speeds:

- 1200 rpm
- 1700 rpm
- 2100 rpm
- 3000 rpm

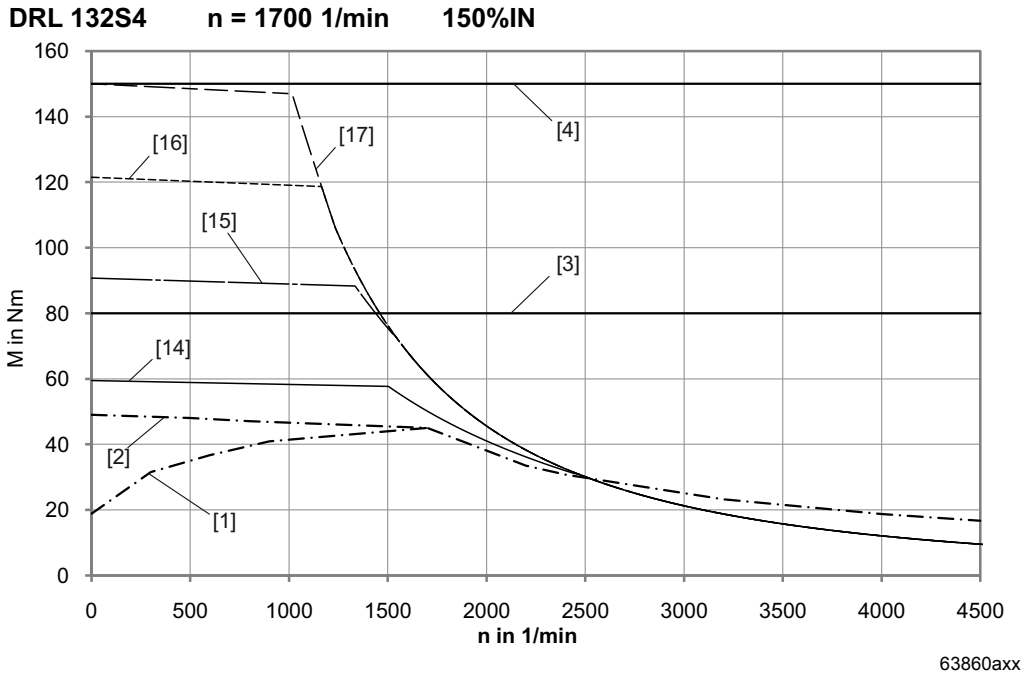
In inverter operation, field weakening begins at the rated speed.

Inverter combinations

The DRL motors are optimally adapted to operation on MOVIDRIVE® inverters and MOVIAXIS® multi-axis servo inverters.

Usually, the selection diagrams offer several inverter sizes. The size of the inverter which fits perfectly is based on the application data and project planning.

Sample selection diagram for the MOVIDRIVE® inverter (dynamic and thermal limit characteristic curve):



[1]	S1 characteristic curve	[14]	7.5 kW inverter output
[2]	S1 characteristic curve with forced cooling fan	[15]	11 kW inverter output
[3]	Maximum limit torque of dynamics package 1	[16]	15 kW inverter output
[4]	Maximum limit torque of dynamics package 2	[17]	22 kW inverter output

Startup

Startup of DRL motors on the MOVIDRIVE® inverter is particularly user-friendly with encoders that have an electronic nameplate.

The nameplate of the following encoders contains all drive-relevant data that is uploaded from the encoder to the inverter before startup.

- Incremental encoders ES7S, EG7S
- Absolute encoders AS7W, AG7W.

2.3 Corrosion and surface protection

General

SEW-EURODRIVE offers various optional protective measures for operation of motors and gearmotors under special ambient conditions.

The protective measures comprise two groups:

- Corrosion protection KS for motors
- Surface protection OS for motors and gear units

For motors, optimum protection is offered by a combination of KS corrosion protection and OS surface protection.

Special optional protective measures for the output shafts are also available.

KS corrosion protection

KS corrosion protection for motors comprises the following measures:

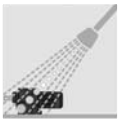
- All retaining screws that are loosened during operation are made of stainless steel.
- The nameplates are made of stainless steel.
- A top coating is applied to various motor parts.
- The flange contact surfaces and shaft ends are treated with a temporary anti-corrosion agent.
- Additional measures for brakemotors.

A sticker labeled "KORROSIONSSCHUTZ" (corrosion protection) indicates that special treatment has been applied.

	INFORMATION
	Motors with forced cooling fan are not available with KS corrosion protection.

OS surface protection

In addition to standard surface protection, motors and gear units are available with surface protection OS1 to OS4. The special procedure "Z" is also available. Special procedure "Z" means that large surface recesses are sprayed with a rubber filling prior to painting.

Surface protection[1]		Ambient conditions	Sample applications
Standard		Suitable for machines and systems in buildings and rooms indoors with neutral atmospheres. According to corrosivity category [2]: • C1 (negligible)	• Machines and systems in the automobile industry • Transport systems in logistics • Conveyor belts at airports
OS1		Suited for environments prone to condensation and atmospheres with low humidity or contamination, such as applications outdoors under roof or with protection. According to corrosivity category [2]: • C2 (low)	• Systems in saw mills • Hall gates • Agitators and mixers
OS2		Suitable for environments with high humidity or mean atmospheric contamination, such as applications outdoors subject to direct weathering. According to corrosivity category [2]: • C3 (moderate)	• Applications in amusement parks • Funiculars and chair-lifts • Applications in gravel plants • Systems in nuclear power plants
OS3		Suited for environments with high humidity and occasionally severe atmospheric and chemical contamination. Occasionally acidic or caustic wet cleaning. Also for applications in coastal areas with moderate salt load. According to corrosivity category [2]: • C4 (high)	• Sewage treatment plants • Port cranes • Mining applications
OS4		Suitable for environments with permanent humidity or severe atmospheric or chemical contamination. Regular acidic and caustic wet cleaning also with chemical cleaning agents. According to corrosivity category [2]: • C5-1 (very high)	• Drives in malting plants • Wet areas in the beverage industry • Conveyor belts in the food industry

1) Motors/brakemotors in degree of protection IP56 or IP66 are only available with OS2, OS3, or OS4 surface protection

2) To DIN EN ISO 12944-2 classification of ambient conditions

Special protection measures

Gearmotor output shafts can be treated with special optional protective measures for operation subject to severe environmental pollution or in particularly demanding applications.

Gear unit type	Measure	Protection principle	Suitable for
R, F, K, S, W	**FKM oil seal (Viton)**	High quality material	Drives subject to chemical contamination
R, F, K, S, W	**Surface coating of the contact surface of the oil seal**	Protective layer	Severe environmental impact and in conjunction with FKM oil seal (Viton)
R, F, K, S, W	**Stainless steel output shaft**	Surface protection with high-quality material	Particularly demanding applications in terms of surface protection

NOCO® fluid

As standard, SEW-EURODRIVE supplies NOCO® fluid corrosion protection and lubricant with every hollow shaft gear unit. Use NOCO® fluid when installing hollow shaft gear units. Using this fluid can help prevent contact corrosion and makes it easier to disassemble the drive at a later time.

NOCO® fluid is also suitable for protecting machined metal surfaces that do not have corrosion protection, such as parts of shaft ends or flanges. You can order larger quantities of NOCO® fluid from SEW-EURODRIVE.

NOCO® fluid is a food grade substance according to USDA-H1. You can tell that NOCO® fluid is a food grade oil by the USDA-H1 identification label on its packaging.

2.4 Extended storage

Type

You can also order gear units prepared for "extended storage." SEW-EURODRIVE recommends the "extended storage" type for storage periods longer than 9 months.

In this case, a VCI corrosion inhibitor (**v**olatile **c**orrosion **i**nhibitor) is added to the lubricant in these gear units. Please note that this VCI anti-corrosion agent is only effective in a temperature range of -25 °C to +50 °C. The flange contact surfaces and shaft ends are also treated with anti-corrosion agent. If not specified otherwise in your order, the gear unit will be supplied with OS1 surface protection. Instead of OS1, you can order OS2, OS3 or OS4.

Surface protection	Suitable for
OS1	Low environmental impact
OS2	Medium environmental impact
OS3	High environmental impact
OS4	Very high environmental impact

INFORMATION

The gear units must remain tightly sealed until taken into operation to prevent the VCI corrosion protection agent from evaporating.

At the factory, the gear units are filled with oil to the appropriate level depending on the specified mounting position (M1 to M6). Check the oil level before you start operating the gear unit for the first time.

Storage conditions

Observe the storage conditions specified in the following table for extended storage:

Climate zone	Packaging[1)]	Storage location[2)]	Storage duration
Temperate (Europe, USA, Canada, China and Russia, excluding tropical zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap.	Under roof, protected against rain and snow, no shock loads.	Up to 3 years with regular checks of the packaging and moisture indicator (relative humidity < 50%).
	Open	Under roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 60°C, < 50% relative humidity). No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks.	2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.
Tropical (Asia, Africa, Central and South America, Australia, New Zealand excluding temperate zones)	Packed in containers, with desiccant and moisture indicator sealed in the plastic wrap. Protected against insect damage and mildew by chemical treatment.	With roof, protected against rain and shocks.	Up to 3 years with regular checks of the packaging and moisture indicator (relative humidity < 50%).
	Open	Under roof, enclosed at constant temperature and atmospheric humidity (5 °C < ϑ < 50°C, < 50% relative humidity). No sudden temperature fluctuations. Controlled ventilation with filter (free from dust and dirt). Protected against aggressive vapors and shocks. Protected against insect damage.	2 years or more with regular inspections. Check for cleanliness and mechanical damage during inspection. Check corrosion protection.

1) Packaging must be carried out by an experienced company using the packaging materials that have been explicitly specified for the particular application.

2) SEW-EURODRIVE recommends to store the gear units according to the mounting position.

2.5 General product description

Ambient temperature

Gear units and gearmotors from SEW-EURODRIVE can be operated in a wide ambient temperature range. The following standard temperature ranges are permitted for filling the gear units according to the lubricant table:

Gear unit	Filled with	Permitted standard temperature range
Helical, parallel shaft helical and helical-bevel gear units	CLP(CC) VG220	-10 °C to +40 °C
Helical-worm gear units	CLP(CC) VG680	0 °C to +40 °C
SPIROPLAN® gear units	CLP(SEW-PG) VG460	-10 °C to +40 °C

The rated data of the gear units and gearmotors specified in the catalog/price catalog refer to an ambient temperature of +25 °C.

Gear units and gearmotors from SEW-EURODRIVE can be operated outside the standard temperature range if project planning is adapted to ambient temperatures from as low as up to -40 °C in the intensive cooling range until up to +60 °C. Project planning must take special operating conditions into account and adapt the drive to the ambient conditions by selecting suitable lubricants and seals. This kind of project planning is generally recommended for increased ambient temperatures as of size 97 and for helical-worm gear units with small gear ratios. SEW-EURODRIVE will gladly perform this project planning for you.

If the drive is to be operated on a frequency inverter, you must also consider the project planning notes of the inverter and take into account the thermal effects of inverter operation.

Installation altitude

Due to the low air density at high installation altitudes, heat dissipation on the surface of motors and gear units decreases. The rated data listed in the catalog/price catalog applies to an installation altitude of maximum 1000 m above sea level. Installation altitudes of more than 100 m asl must be taken into account for project planning of gear units and gearmotors.

Power and torque

The power and torque ratings listed in the catalogs refer to mounting position M1 and similar mounting positions in which the input stage is not completely submerged in oil. In addition, the gearmotors are assumed to be standard versions with standard lubrication and under normal ambient conditions.

Please note that the motor power shown in the selection tables for gearmotors is subject to selection. However, the output torque and the desired output speed are essential for the application and need to be checked.

Speeds

The quoted output speeds of the gearmotors are recommended values. You can calculate the rated output speed based on the rated motor speed and the gear unit ratio. Please note that the actual output speed depends on the motor load and the supply system conditions.

Noise

The noise levels of all SEW-EURODRIVE gear units, motors and gearmotors are well within the maximum permitted noise levels set forth in the VDI guideline 2159 for gear units and IEC/EN 60034 for motors.

Weights

Please note that all weights shown in the catalogs exclude the oil fill for the gear units and gearmotors. The weights vary according to gear unit type and gear unit size. The lubricant fill depends on the mounting position which means no universally applicable information can be given. Please refer to "Lubricants" in the "Design and Operating Notes" section for recommended lubricant fill quantities depending on the mounting position. For the exact weight, refer to the order confirmation.

Multi-stage gearmotors

You can achieve particularly low output speeds by using multi-stage gear units or multi-stage gearmotors. Such a setup requires a helical gear unit or gearmotor on the input end as a second gear unit.

It may be necessary to limit the motor power to match the maximum permitted output torque of the gear unit.

Reduced backlash design

Helical, parallel shaft helical and helical-bevel gear units with reduced backlash are available from gear unit size 37. The circumferential backlash of these gear units is considerably less than that of the standard versions so that positioning tasks can be solved with great precision. The circumferential backlash is specified in angular minutes ['] in the technical data. The circumferential backlash for the output shaft is specified without load (max. 1% of the rated output torque); the gear unit input end is blocked. For further information, refer to section "Reduced backlash gear units" on page 91.

RM gear units, RM gearmotors

RM gear units and RM gearmotors are a special type of helical gear units with an extended output bearing hub. They were designed especially for agitating applications and allow for high overhung and axial loads and bending moments. The other data are the same as for standard helical gear units and standard helical gearmotors.

SPIROPLAN® right-angle gear units/gearmotors

SPIROPLAN® right-angle gearmotors are robust, single- and two-stage right-angle gearmotors with SPIROPLAN® gearing. The difference to the helical-worm gear units is the material combination of the steel-on-steel gearing, the special tooth meshing relationships and the aluminum housing. As a result, SPIROPLAN® right-angle gearmotors are wear-free, very quiet and light.

The particularly short design and the aluminum housing make for very compact and lightweight drive solutions.

The wear-free gearing and the life-long lubrication facilitate long periods of maintenance-free operation. The fact that the oil filling is independent of the mounting position, except for SPIROPLAN® W..37 and W..47 in mounting position M4, makes any position possible for SPIROPLAN® right-angle gearmotors without having to alter the oil quantity. Identical hole spacing in the foot and face, as well as the equal shaft height to both, provides you with diverse mounting options.

Two different flange diameters are available. On request, SPIROPLAN® right-angle gearmotors can be equipped with a torque arm.

Input components

The following components on the input side are available for the gear units from SEW-EURODRIVE:

- **Input covers with input shaft extension, optionally with**
  - Centering shoulder
  - Backstop
  - Motor mounting platform
- **Adapter**
  - For mounting IEC or NEMA motors with the option of a backstop
  - For mounting servomotors with a square flange
  - With torque limiting safety couplings and speed or slip monitor
  - With hydraulic centrifugal coupling, also with disk brake or backstop

Swing base

A swing base is a drive unit consisting of helical-bevel gear unit, hydraulic centrifugal coupling and electric motor. The complete arrangement is mounted to a rigid mounting rail.

Motor swings are available with the following optional accessories:

- Torque arm
- Mechanical thermal monitoring unit
- Contactless thermal monitoring unit

2.6 Explosion protection according to ATEX

The following chapter provides a short explanation of the various zones, categories, and protection types. You find more detailed information on this topic in the "Explosion-Proof AC Motors" and "Explosion-Proof Drives" catalogs.

Explosion-proof DRL motors are currently being prepared.

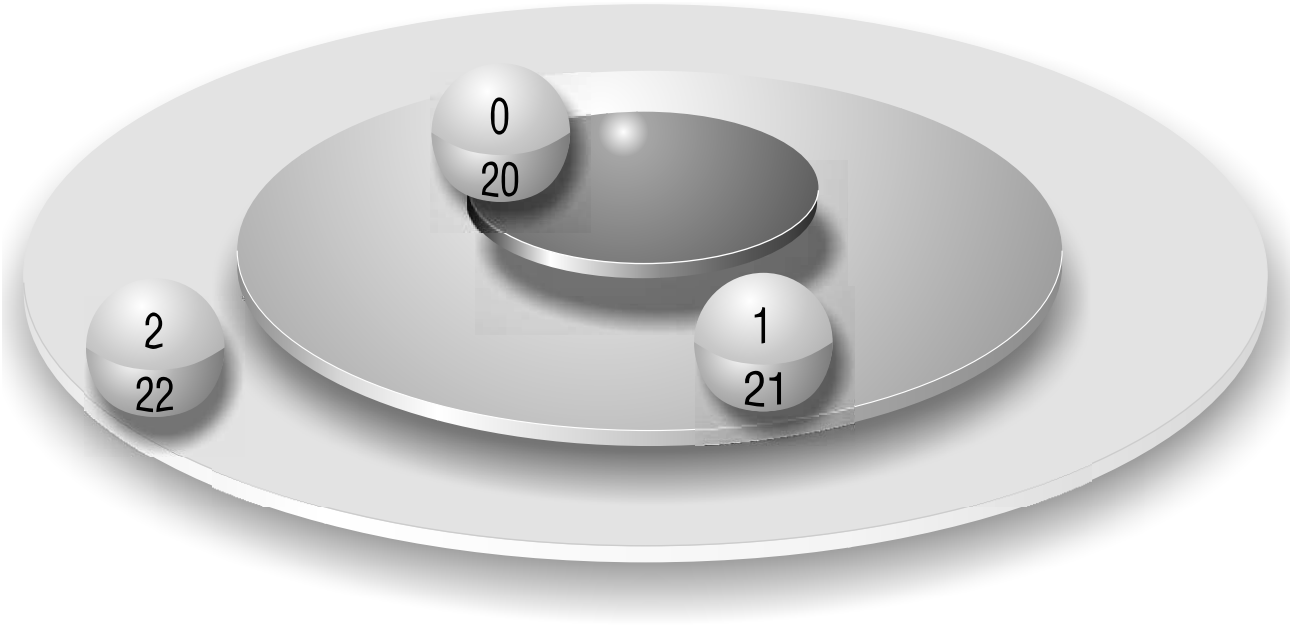
2.6.1 Regulations

Zones in a potentially explosive atmospheres

According to EU Directive 99/92/EC, the operator of the equipment must divide potentially explosive atmospheres into zones.

Zone		Probability of a potentially explosive atmosphere occuring	SEW-relevant
Gas	Dust		
0[1)]	20[1)]	Continuous, long-term, frequent, predominant in time	
1	21	Occasional, in normal operation	x
2	22	Seldom, short-term	x

1) Not relevant for electric drives



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Dividing explosion-proof equipment into categories

According to EU Directive 94/9/EC, explosion-proof equipment is divided into categories. The category specifies the protection level of the equipment, describes the operating conditions and makes it easier to assign permitted equipment to a zone. In addition to the degree of protection (normal, high, very high), the directive distinguishes between explosive G (gas) and D (dust) atmospheres.

Category	Protection level	Guaranteed protection	Operating conditions	SEW-relevant
M1	Very high	With two independent preventive measures; two faults are allowed to occur independently of one another	Equipment continues to operate in the presence of a potentially explosive atmosphere	
1	Very high	With two independent preventive measures; two faults are allowed to occur independently of one another	Equipment continues to operate in the presence of a potentially explosive atmosphere	
M2	High	Suitable for normal operation and harsh operating conditions	Equipment is switched off in the presence of a potentially explosive atmosphere	
2	High	One preventive measure; suitable for normal operation with the likeliness of frequent malfunctions, one fault is allowed to occur	Equipment continues to operate in the presence of a potentially explosive atmosphere	x
3	Standard	Suitable for standard operation	Equipment continues to operate in the presence of a potentially explosive atmosphere	x

Overview of explosion-proof equipment

The following table describes the division of explosion-proof equipment into equipment groups I and II:

	Equipment group I Mines, firedamp		Equipment group II Other areas with potentially explosive atmospheres due to gas or dust					
Category	M1	M2	1		2		3	
Ex atmosphere[1)]			G	D	G	D	G	D
Zone			0	20	1	21	2	22
Protection type **Motor** **Gear unit[2)]**					d, e, i, p ... (c, k ...)	t or tD (c, k ...)	 (c, k ...)	t or tD (c, k ...)

1) G = Gas atmosphere, D = Dust atmosphere

2) Standardization of protection types for gear units has not yet been completed.

INFORMATION

All gear units and motors offered by SEW-EURODRIVE for potentially explosive atmospheres are equipment group II units. SEW-EURODRIVE does not supply any drives for use in equipment group I (mining).

Potentially explosive atmospheres

Potentially explosive atmospheres are divided into gas and dust. The atmosphere is indicated by the letters G (Gas) and D (Dust) in the designation of the variant.

Protection types

Unit type	Protection type	Standard	Description	SEW-relevant
Motors (electrical units)	d	EN 60079-0 and -1	Flameproof enclosure	x
	e	EN 60079-0 and -7	Increased safety	x
	i	EN 60079-0 and -11	Intrinsic safety	
	n/nA	EN 60079-0 and -15	Non-sparking	x
	m	EN 60079-0 and -18	Casting compound enclosure	
	p	EN 60079-0 and -2	Excess pressure enclosure	
	t	EN 60079-0 and -31	Dust explosion protection	x
Gear units (mechanical units)	b	EN 13463-1 and -6	Protection by monitoring sources of ignition	
	c	EN 13463-1 and -5	Constructional safety	x
	d	EN 13463-1 and -3	Flameproof enclosure	
	fr	EN 13463-1 and -2	Restricted breathing	
	k	EN 13463-1 and -8	Liquid immersion	x

Validity of the Declaration of Conformity

The declaration of conformity is a statement that a device complies with Directive 94/9/EC. The validity of this statement of conformance is bindingly linked to compliance with the operating instructions supplied with the explosion-proof unit (in particular maintenance and servicing measures and permitted ambient conditions, e.g. ambient temperature, unit heating from other customer's equipment). This is necessary for adequate risk minimization. The validity of the declaration of conformity becomes void if the specifications for designated use made in the operating isntructions no longer apply.

The validity of the statement of conformance exclusively refers to the gear unit and motor types listed in the catalog or in the order confirmation. For customer-specific types, it is essential that you contact SEW-EURODRIVE.

2.6.2 Categories and protection types

Category 1 – Particularly high safety

SEW-EURODRIVE does not provide category 1 gear units and electric motors. Consequently, drives from SEW-EURODRIVE cannot be used in zones 0 and 20 where potentially explosive atmospheres are to be expected on a continuous and long-term basis.

Category 2 – High safety

Units in category 2 are safe in terms of the expected unit malfunctions and are predominantly intended for use in zones 1 and 21. Of course, these units can also be used in zones 2 and 22.

Category 3 – Normal safety

Category 3 equipment is only intended for zones 2 and 22 where there is a low probability of potentially explosive atmospheres occurring.