Explosion Protection

The ATEX standard and the
KTR programme for explosion-proof applications

Made for Motion KTR

www.ktr.com

Attention: “Explosive Atmosphere?”

Those who design drive systems for potentially explosive areas have to take into account many factors. In what way does ATEX 95 have an influence on the selection of shaft couplings, hydraulic components and clamping sets? What equipment category, for example, is a coupling part of for an actual application? What else do we need to know? – This leaflet will answer your questions.

The protection against the development of explosions and the resultant effect is one responsibility which affects everyone. As one of the leading manufacturers of shaft couplings, we have adhered with the requirements of the ATEX standard, at an early stage by having examined the products we manufacture with regard to their use in explosive areas. This is carried out by close liaison with an independent institute.

ATEX 95 has far-reaching consequences on the selection, installation, operation and maintenance of the equipment in explosive areas. In this context mechanical equipment and components are stringently inspected with a view to potential explosion hazards, couplings and other drive components.

We will support you.

We will not only advise you about the details of the ATEX standard, we will offer you products and solutions which will allow you to plan, design and build your machines and plants safely and in accordance with the ATEX standards.

KTR offers you an extensive range of couplings and drive components in accordance with ATEX. These products include the torsionally flexible jaw couplings ROTEX®, POLY-NORM®, REVOLEX® KX and POLY in various types, the backlash-free torsionally flexible ROTEX® GS, the curved-tooth gear coupling BoWex® and GEARex®, the steel lamina couplings RADEX®-N and RIGIFLEX®-N as well as the servo lamina coupling RADEX®-NC.

Our products POLY-NORM® and POLY as well as BoWex® M...C are available from stock in accordance with ATEX, having been manufactured with the necessary ATEX identification marks.

Apart from the couplings oil/air coolers and hydraulic components in accordance with ATEX are available.

On the following pages we will explain the specifications of ATEX 95, introduce the device groups and classification zones and will show the identification marks of the components corresponding to the standards which are used in areas potentially subject to gas or dust explosion. We will then identify the relevant KTR products for explosion-proof applications, along with their main characteristics and their identification marks for explosion protection.

The ATEX certificates for KTR couplings are shown on our website: **www.ktr.com**.

Explosion protection according to standard 94/9/EC (ATEX 95)

Specifications:

Appendix II of the European standard 94/9/EC, known as ATEX 95, requires adherence to general safety and health specifications on those machines operating in hazardous areas within the EU. These specifications have to be fulfilled during the development and production of the products by the manufacturer and be supported in the respective literature (e. g. operating and assembly instructions). This is a standard requirement with KTR products and literature.

We produce and supply a number of couplings that conform to the ATEX standard. However, a basic condition of their explosion-proof operation is the use of the products in accordance with the operating and mounting instructions.

Explosion hazard:

For an explosion to occur there are only a few mechanisms to be in place: a flammable material such as gas, mist, vapour or dust in an ignitable concentration, sufficient oxygen and an ignition source such as sparks or a hot surface.

Thus, explosion protection measures are always necessary if

- flammable materials exist
- the distribution of the air may produce an hazardous mixture
- the production of a dangerous and hazardous atmosphere is possible.

Typical ignition sources:

Rotating couplings may cause danger of ignition if it is subject to impact sparks, friction sparks or grinding sparks or if it is subject to rises in temperature or following electrostatic load. Dangers of ignition producing explosions are, as an example, electric or mechanical sparks and excessive rises in temperature.

Device groups and categories:

The devices used in hazardous areas are classified in groups I and II. Group I includes underground and surface mining and group II includes gas and dust explosion protection in every other application.

Device group	Category	Material group	Suitable zone
I (applies only for devices used in mining/above ground/underground companies)	**M1** (corresponds to very high safety)		
	M2 (corresponds to high safety)		
II (applies only for devices used in other ranges)	**1** (corresponds to very high safety)	**G** (gases)	0, 1, 2
		D (dusts)	20, 21, 22
	2 (corresponds to high safety)	**G** (gases)	1, 2
		D (dusts)	21, 22
	3 (corresponds to safety with normal operation)	**G** (gases)	2
		D (dusts)	22

= Potential use of KTR couplings

Zones:

The classification of hazardous areas in zones depends on the probability of how often and of how long a dangerous explosive atmosphere may occur. The zones are differentiated between flammable gases, mists, vapours and dusts.

Explosion range	Zone	Hazardous atmosphere
Gas (G)	0	Permanent, long-term or frequent use
	1	Occasional use
	2	No or rare and if so only short-term use
Dust (D)	20	Permanent, long-term or frequent cloud of dust in the air (except for dust deposit: no zone 20)
	21	Occasionally, dust deposits exist in general
	22	Not expected during normal operation, if so only for a short time

= Potential use of KTR couplings

Explosion groups:

The explosion groups are split according to how flammable a gas is. As an example, permissible size of insulating surfaces depends on the explosion groups, with increasing specifications from IIA to IIC:

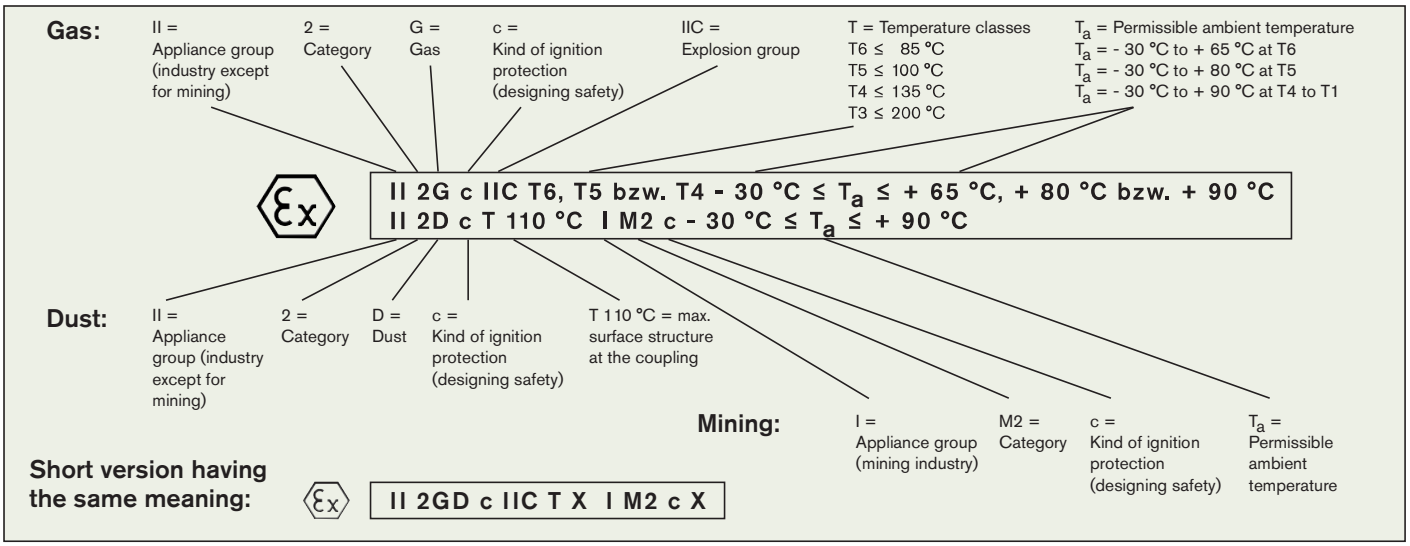
- IIA e. g. methane
- IIB e. g. ethylene, propane
- IIC e. g. hydrogen, acetylene, carbon bisulfide

Temperature classes:

The temperature class does not represent the operating temperature of the operating material, e. g. the coupling, but the maximum permissible surface temperature on the operating material. The maximum surface temperature has to fall below the corresponding ignition temperature. Gases and vapours are subdivided into temperature classes depending on the ignition temperature, with increasing specifications from T1 to T6:

- T1 ≤ 450 °C
- T2 ≤ 300 °C
- T3 ≤ 200 °C
- T4 ≤ 135 °C
- T5 ≤ 100 °C
- T6 ≤ 85 °C

Explanation of the identification marks one would find on a ROTEX® coupling:



For further details please have a look at http://europa.eu.int/comm/enterprise/atex/guide/index.htm

Coupling protection in hazardous areas

Covers:

For the use of couplings in areas subject to dust explosion and in mining companies the operator has to make sure that there is no dangerous dust accumulation between the cover and the coupling. The couplings must not be operated in a pile up of dust.

For covers with non-closed openings, light weight metals, such as aluminium, should not be used with the operation of the couplings as devices of device group II (if possible, stainless steel).

With the use of the couplings in mining companies (device group I, category M2) the cover must not consist of light metal. In addition, it has to resist higher mechanical loads than with the use as devices of device group II.

Opening			Cover	
			Top side	Lateral parts
Circular	Diameter	in mm	4	8
Rectangular	Lateral length	in mm	4	8
Straight or cranked slot, distance of lateral demarcation		in mm	Not permissible	8

The distance between the cover and the rotating parts has to be at least 5 mm. The cover has to be electroconductive.

Painting/coating:

If couplings with coatings (primary coating, painting, …) are used in explosion-proof areas, the specification on conductivity and thickness of the layer has to be respected. For insulating paintings up to 200 µm an electrostatic charge does not have to be expected. Multiple paintings with a thickness exceeding 200 µm are not allowed for the explosion group IIC.

Maintenance:

The respective maintenance intervals of the machines or components, respectively, have to be observed. During the operation of the machine amended running noise of the coupling or vibration that may arise have to be respected.

Design modifications:

Couplings with attachments which may produce heat, sparks and static load (e. g. combinations with brake drums or disks, overload systems such as torque limiters, fans, etc.) are not permitted for the use in explosion-proof areas. A separate inspection has to be performed.

Shaft-hub-connection:

If used in explosion-proof areas clamping ring hubs and clamping hubs without feather key have to be selected in a way that a service factor of at least s = 2 is ensured covering the peak torque of the machine including all operating parameters and the friction torque of the coupling. Clamping hubs without feather key are permissible for category 3 only. The responsibility for the shaft-hub-connection is subject to the customer. Please check the connection carefully.

Coupling selection:

Select the coupling with a sufficient service factor and choose suitable materials.

Screw connections:

Secure all screw connections by conglutinating and observe the tightening torque of the screws strictly.

ATEX certification:

KTR coupling components are marked with an ATEX certification as follows:

Example of ATEX marking

The customer is exclusively responsible for every remachining performed on unbored or pilot bored as well as finish machined coupling components and spare parts. KTR supplies unbored or pilot bored coupling components and spare parts only on special request of the customer. These parts are marked in addition with the symbol Ⓤ. Any claims for warranty resulting from insufficient remachining will not be taken over by KTR. Each kind of mechanical remachining on couplings which are intended for the use in hazardous locations requires testing and a special release by KTR.

KTR products for explosion-proof areas

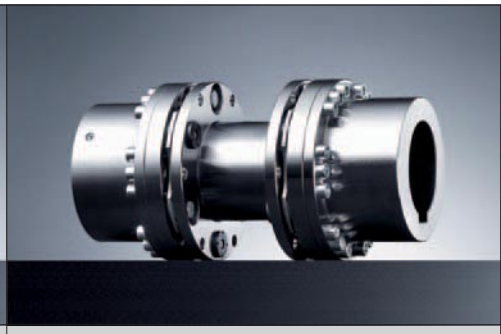
		
Product	**ROTEX®**	**POLY-NORM®**
Description	Fail-safe, torsionally flexible jaw coupling types standard, AFN, BFN, CF, CFN, DF and DFN, DKM and ZS-DKM	Short, fail-safe, torsionally flexible jaw coupling types AR, ADR, AZR, AR/AZR, AZVR
ATEX marking	On the collar of the hubs (or rolled up on the outside diameter of the hub) on a component (e. g. motor hub)	On the outside diameter D_H
- without details	Up to ROTEX® 19 and 28 AFN: only Ex designation, in addition complete marking in the order confirmation and packaging	
- brief (standard)	From ROTEX® 24 and 38 AFN: Ex **II 2GD c IIC T X** Ex **I M2 c X**	Ex **II 2GD c IIC T X** Ex **I M2 c X**
- complete	Ex II 2G c IIC T6, T5 bzw. T4 -30 °C ≤ T_a ≤ +65 °C, +80 °C bzw. +90 °C Ex II 2D c T 110 °C -30 °C ≤ T_a ≤ +90 °C Ex I M2 c -30 °C ≤ T_a ≤ +90 °C	Ex II 2G c IIC T6 bzw. T5 -30 °C ≤ T_a ≤ + 65 °C bzw. +80 °C Ex II 2D c T 100 °C -30 °C ≤ T_a ≤ +80 °C Ex I M2 c -30 °C ≤ T_a ≤ +80 °C
- others	Other components are marked with designation Ex only (except for elastomers).	

		
REVOLEX® KX	**POLY**	**BoWex®**
Short, fail-safe, torsionally flexible pin & bush coupling types KX and KX-D	Not fail-safe, torsionally flexible jaw coupling types PKN, PKZ, PKD, PKA	Not fail-safe curved-tooth gear coupling in the material combination nylon/steel for type M; for the design with external sleeve (colour: black) from electroconductive PA; with carbon fibre for type C (Ex), size M14 to M65[1]
On the outside diameter D_H or collar diameter of the pin & bush hubs	On the outside diameter D_H of the cams	On the nylon sleeve[2]
		Up to BoWex® M32-C on the external sleeve only Ex designation
Ex **II 2GD c IIC T X** Ex **I M2 c X**	Ex **II 2GD c IIC T X** Ex **I M2 c X**	From BoWex® M 38-C on the face: Ex **II 2GD c IIC T X** Ex **I M2 c X**
Ex II 2G c IIC T6 bzw. T5 -30 °C ≤ T_a ≤ +65 °C bzw. +80 °C Ex II 2D c T 100 °C -30 °C ≤ T_a ≤ +80 °C Ex I M2 c -30 °C ≤ T_a ≤ +80 °C	Ex II 2G c IIC T6 bzw. T5 -30 °C ≤ T_a ≤ +65 °C bzw. +80 °C Ex II 2D c T 100 °C -30 °C ≤ T_a ≤ +80 °C Ex I M2 c -30 °C ≤ T_a ≤ +80 °C	Ex II 2G c IIC T6, T5 bzw. T4 -30 °C ≤ T_a ≤ +65 °C, +80 °C bzw. +100 °C Ex II 2D c T 120 °C -30 °C ≤ T_a ≤ +100 °C Ex I M2 c -30 °C ≤ T_a ≤ +100 °C

[1] BoWex® type S ... St (plug-in couplings with steel core and steel hub) as well as type SSR (with circlip ring) - standard sleeve (material PA, light) or conductive sleeve (PA with carbon fibre, black) – on request

[2] For the BoWex® coupling the demand for explosion protection is only ensured with the use of the electroconductive PA sleeve type C. The coupling hubs from steel correspond to the standard design and can be combined with various sleeve materials which do not generally correspond to the ATEX requirements. For that reason the explosion protection marking is only shown on the respective outer sleeve made from PA.

KTR products for explosion-proof areas

		
Product	**GEARex®**	**RIGIFLEX®-N**
Description	Gear coupling from steel with grease lubrication types FA, FB and FAB	Backlash-free, torsionally stiff steel lamina coupling type A[(1)] (The coupling meets with the standards of API 610 and optionally API 671.)
ATEX marking	On the face of the hubs or the outside diameter of the sleeve, respectively	On the face of the hubs (or rolled up on the outside diameter of the hubs) on a component (e. g. engine flange hub)
- without details		
- brief (standard)	**Ⓔx II 2G c IIC T X** **Ⓔx II 2D c T X** **Ⓔx I M2 c X**	**Ⓔx II 2GD c IIC T X** **Ⓔx I M2 c X**
- complete	Ⓔx II 2G c IIC T6, T5 bzw. T4 -30 °C ≤ T_a ≤ +65 °C, +80 °C bzw. +90 °C Ⓔx II 2D c T 110 °C -30 °C ≤ T_a ≤ +90 °C Ⓔx I M2 c -30 °C ≤ T_a ≤ +90 °C	Ⓔx II 2G c IIC T6, T5, T4, T3 bzw. T2 -30 °C ≤ T_a ≤ +75 °C, +90 °C, +125 °C, +190 °C bzw. +250 °C Ⓔx II 2D c T 110 °C -30 °C ≤ T_a ≤ +100 °C Ⓔx I M2 c -30 °C ≤ T_a ≤ +140 °C
- others	Other components are marked with designation Ⓔx only (except for steel laminas).	

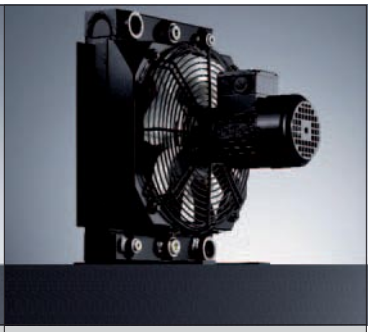
		
RADEX®-N	**ROTEX® GS / ROTEX® GS-P**	**RADEX®-NC**
Fail-safe, backlash-free, torsionally stiff steel lamina coupling types NN, NANA 1 to 5, NENA 1 and 2, NENE 1, NNZ, NNW and MK[1] with lamina sets from stainless spring steel.	Fail-safe, backlash-free under prestress, torsionally flexible jaw coupling types standard and DKM sizes 5 to 75	Fail-safe, backlash-free, torsionally stiff servo lamina coupling types EK and DK with hubs and spacers from highly stiff aluminium and lamina sets from stainless steel
On the face of the hubs (or rolled up on the outside diameter of the hubs) on a component (e. g. engine flange hub)	On the face of the hubs (or rolled up on the outside diameter of the hubs) on a component (e. g. engine flange hub)	On the face of the hubs on a component (e. g. motor hub)
Up to RADEX®-N 25: only Ex designation, in addition complete marking in the order confirmation and packaging	Up to ROTEX® GS 19: only Ex designation, in addition complete marking in the order confirmation and packaging	Up to RADEX®-NC 15: only Ex designation, in addition complete marking in the order confirmation and packaging
From RADEX®-N 35: Ex **II 2GD c IIC T X** Ex **I M2 c X**	From ROTEX® GS 24: Ex **II 2GD c IIC T X** Ex **I M2 c X** [2] Ex **II 3GD c IIC T X** [3]	From RADEX®-NC 20: Ex **II 2GD c IIC T X** Ex **I M2 c X** [2] Ex **II 3GD c IIC T X** [3]
Ex II 2G c IIC T6, T5, T4, T3 bzw. T2 -30 °C ≤ T_a ≤ +75 °C, +90 °C, +125 °C, +190 °C bzw. +280 °C Ex II 2D c T 110 °C -30 °C ≤ T_a ≤ +100 °C Ex I M2 c -30 °C ≤ T_a ≤ +140 °C	Ex II 2G c IIC T6, T5 bzw. T4 -30 °C ≤ T_a ≤ +65 °C, +80 °C bzw. +90 °C Ex II 2D c T 110 °C -30 °C ≤ T_a ≤ +90 °C Ex I M2 c -30 °C ≤ T_a ≤ +90 °C [2] Ex II 3G c IIC T6, T5 bzw. T4 [3] -30 °C ≤ T_a ≤ +65 °C, +80 °C bzw. +90 °C Ex II 3D c T 110 °C -30 °C ≤ T_a ≤ +90 °C [3]	Ex II 2G c IIC T6, T5, T4, T3 bzw. T2 -30 °C ≤ T_a ≤ +75 °C, +90 °C, +125 °C, +190 °C bzw. +200 °C Ex II 2D c T 110 °C -30 °C ≤ T_a ≤ +100 °C Ex I M2 c -30 °C ≤ T_a ≤ +140 °C [2] Ex II 3G c IIC T6, T5, T4, T3 bzw. T2 [3] -30 °C ≤ T_a ≤ +75 °C, +90 °C, +125 °C, +190 °C bzw. +200 °C Ex II 3D c T 110 °C -30 °C ≤ T_a ≤ +100 °C [3]

[1] For temperature classes T2 and T1 the max. permissible ambient and operating temperature is Ta = 280 °C. It is the max. permissible temperature for permanent operation at the same time. If necessary, all sizes of RADEX®-N can be designed in conformity with the standards of API 610 or API 671.

[2] Only permissible for coupling hubs from steel.

[3] Only permissible for clamping hubs without feather key.

KTR products for explosion-proof areas

			
Product	**MINEX®-S**	**BoWex-ELASTIC®**	**OAC Oil/air cooler** NEW
Description	Permanent-magnetic synchronous coupling for contactless torque transmission by magnetic forces between internal and external rotor; sizes 22 to 165[1]	Highly flexible flange couplings types HE and HEW	Oil/air cooler type OAC with electric or hydraulic drive motor
ATEX marking	At least on one component complete, on the other components by an Ex designation on the outside diatmeter of the hub or on the face	On the polyamide flange of the elastomer	As per type label on the surface of the cooler grid
- without details			
- brief (standard)	Ex **II 2G c IIC T X**	Ex **II 2GD c IIB T X**	Ex **II 2G c IIB+H_2 T X** Ex **II 3D c T X**
- complete		Ex II 2G c IIB T6, T5 bzw. T4 -30 °C ≤ T_a ≤ +50 °C, +65 °C bzw. +80 °C Ex II 2D c T 115 °C -30 °C ≤ T_a ≤ +80 °C	Ex II 2G c IIB+H_2 T X Motor: II 2G Ex e II T1-T3 Ex II 3D c T X Motor: II 2D Ex tD A21 IP65 T 125 °C
- others			

[1] For a safe operation of MINEX®-S in hazardous locations the temperature has to be permanently monitored during the operation. The temperature monitoring has to switch off the drive automatically before reaching the maximum permissible surface temperature. The heat produced on the MINEX®-S magnet coupling resulting from eddy current losses has to be dissipated permanently (e. g. by partial current of the pumping medium with pumps or sealing liquid).

Pointing to explosion protection for those driving components which are not part of the standard 94/9/EC

The standard 94/9/EC applies for machines and protection systems. Driving components are not part of this standard.

Definition of devices and components:

- Machines, operating machines, stationary or mobile equipment, controlling and equipment parts as well as warning and preventive systems serving to produce, transmit, store, measure, control or convert energy and process materials either individually or in combination, which have an individual potential ignition source and as a result may cause an explosion are described as “devices”.
- Components that are necessary for a safe operation of devices and protection systems with no independent function are described as “components”.

CLAMPEX® clamping sets:

Einsatz im explosionsgefährdeten Bereich
Use in explosion-proof areas
The power transmission of CLAMPEX® clamping sets is based on the principle of two conical rings twisted into each other. Due to a force generated on the rings axially (by means of several screws) a surface pressure is produced inside to the shaft and outside to the hub allowing for a frictionally engaged torque transmission. Taking into account all operating parameters (proper use) there is no potential source of ignition. That is why clamping sets are not subject to the standard 94/9/EC.
Based on the arrangement of CLAMPEX® clamping sets a fracture of the components does not have to be expected. Danger only arises if frictional heat is caused when a clamping connection slips (improper assembly/tightening torques).

Selection of clamping sets, clamping ring hubs, clamping hubs:

For the use in explosion-proof areas the types of clamping set, clamping ring hub (clamping hubs without feather key for category 3 only) and the size have to be selected in a way that a service factor of at least s = 2 exists covering the peak torque of the machine including all operating parameters and the rated torque of the clamping set.

Hydraulic components:

KTR bellhousings and foot flanges from aluminium, damping rings type D and DT from aluminium NBR and damping rods from steel NR are permitted as connection elements between pump and electric motor (bellhousing and tank). The share of magnesium in the aluminium falls below 7,5 %.

The user has to observe the following:

- All components have to be included in the equipotential bonding.
- Openings on top must not exceed 4 mm, laterally 8 mm.
- The distance to the rotating parts must be at least 5 mm. This has to be checked individually.
- The disassembly of the components is only permitted at standstill.
- The KTR mounting instructions for bellhousings (KTR standard 41010), damping rings (KTR standard 41030) and foot flanges (KTR standard 41011) have to be observed.

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