



Explosion Protection

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



Caution: explosive atmospheres!

There are many things that have to be taken into account when you are designing drive systems for potentially explosive atmospheres. How does the ATEX Directive influence your choice of couplings and cooling systems or hydraulic components and clamping sets? For example, can a selected component be used for the temperature class stipulated? And how should couplings be protected in potentially explosive atmospheres? This brochure provides the answers.

The ATEX Products Directive 2014/34/EU has far-reaching consequences for the selection, installation, operation and maintenance of equipment in potentially explosive atmospheres. In this context, mechanical equipment and components, among other things, are considered and evaluated with regard to potential risk of explosion.

As a leading manufacturer of drive components for the mechanical and plant engineering sectors, we examined the requirements of the ATEX Directive early on and had relevant series from our overall product range inspected by an independent institute with regard to their usability in potentially explosive atmospheres.



A safe bet: KTR's support for you

Not only do we provide you with information about the specifics of the ATEX Products Directive – we also provide products that allow you to safely plan, design and build your machines and plants.

KTR's comprehensive product range has been examined and evaluated as compliant with the ATEX Directive. It includes torsionally flexible pin and bush couplings, backlash-free servo couplings, gear, flange, steel lamina and magnetic couplings, and also oil/air coolers.

On the following pages we first of all set out the requirements of ATEX Directive 2014/34/EU, introduce the equipment categories and the zoning and show the standardised marking for components that are used in atmospheres potentially at risk of gas or dust explosions. We then present our products for potentially explosive atmospheres, with their key features and their explosion protection conformity marking.

In addition, we are happy to help you to conform with all other safety standards and advise you about all the required markings. The relevant type examination certificates and assembly instructions can be found at www.ktr.com.

Explosion protection according to standard 2014/34/EU.

Specifications:

Appendix II of the European products directive 2014/34/EU, 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 information material, e.g. operating and assembly instructions.

KTR manufactures and supplies a number of couplings and cooling systems 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:

Only a few mechanisms are required for an explosion to occur: 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:

Danger of ignition can arise due to sparks from impact, friction or grinding, from increases in temperature or as a result of electrostatic charge, and can lead to explosions. 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 groups	Category	Material group	Suitable zone
I (includes equipment intended for use in underground areas of mines and their surface installations)	M1 (corresponds to very high safety)		
	M2 (corresponds to high safety)		
II (includes equipment intended for use in other areas)	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 components

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	Should not be expected with normal operation, if so, only short-term

 = Potential use of KTR components

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:

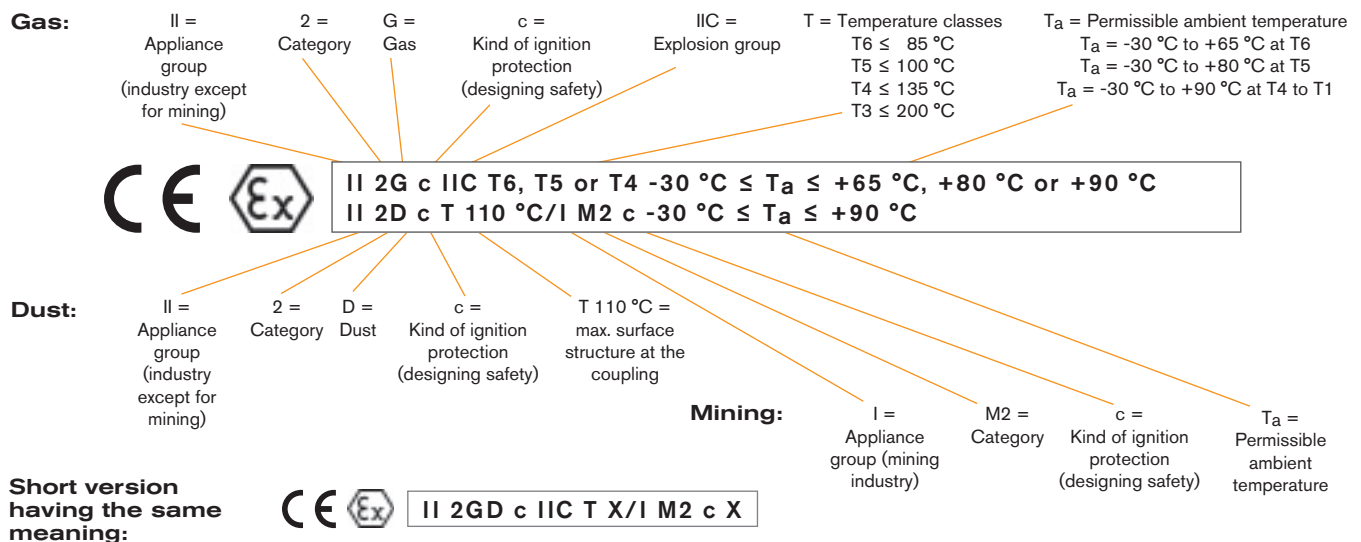
- IIA e.g. methane
- IIB e.g. ethylene, propane
- IIC e.g. hydrogen, acetylene, carbon bisulfide

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://ec.europa.eu/enterprise/sectors/mechanical/documents/guidance/atex/application/>

Component protection in hazardous areas.

Covers:

If the components are used in locations subjected to dust explosion and mining, the operator has to make sure that there is no accumulation of dust in a dangerous volume between the cover and the component. The component must not operate in an accumulation of dust.

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

With the use of the products 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 when used with devices of device group II.

The cover is required according to DIN EN ISO 12100 (safety of machines) and Guideline 2014/14/EU and must protect against:

- the access with the little finger
- the falling of solid foreign objects.

The cover may include openings for a necessary heat dissipation. These openings need to be specified according to DIN EN ISO 13857.

The cover must be electrically conductive and be included in the equipotential bonding.

Painting/coating:

If components with coatings (primary coating, painting, etc.) 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 anticipated. 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, must be observed. During the operation of the machine, any changes to running noise of the coupling, or vibration that may arise, must be respected.

Design modifications

Components 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 use in explosion-proof areas. A separate inspection must be performed.

Shaft-hub connection:

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

Component design:

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

Screw connections:


Secure all screw connections using a screw lock solution and closely adhere to the recommended tightening torque of the screws.

ATEX certification:

KTR parts bear an ATEX marking as follows:



Example of ATEX marking

The customer is solely responsible for all subsequent machining that is carried out on unbored, pilot-bored or finish-machined components and spare parts. KTR supplies unbored or pilot-bored components and spare parts only on the basis of a specific customer request. These parts are additionally marked with the symbol . Any warranty claims resulting from insufficient re-machining will not be accepted by KTR. Mechanical re-machining of components that are intended for use in potentially explosive atmospheres must be agreed with KTR.

KTR products for explosion-proof areas



Product	ROTEX®	ROTEX® SP (Non Sparking)	POLY-NORM®
Description	Fail-safe, torsionally flexible jaw coupling types standard, AFN, BFN, CF, CFN, DF, DFN, DKM, ZS-DKM, ZS-DKM-H, A-H and S-H	Fail-safe, torsionally flexible jaw coupling types EN, GN, GND, E4-DKM, ZS-DKM-C (maintenance free in potentially explosive areas)	Short, puncture-proof, torsionally flexible jaw coupling type AR, ADR, ADR-K, AVR, AZR, AR/AZR, AZVR and AR with taper bush.
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)	In the cam base of the coupling (injected into the face of the polyamide area)	On the outside diameter DH
- without details	Up to ROTEX® 19 and 28 AFN: only designation, in addition complete marking in the order confirmation and packaging		
- brief (standard)	From ROTEX® 24 and 38 AFN: II 2GD c IIC T X I M2 c X ⁽²⁾ Only for clamping hubs without feather key: II 3GD c IIC T X ⁽³⁾	II 2GD IIC T X	II 2GD c IIC T X I M2 c X
- complete	II 2G c IIC T6, T5 or T4 -30 °C ≤ T _a ≤ +65 °C, +80 °C or 0 °C II 2D c T 110 °C -30 °C ≤ T _a ≤ +90 °C I M2 c -30 °C ≤ T _a ≤ +90 °C	Bauarten EN, GN, GND und E4-DKM II 2G c IIC T6, T5, T4 or T3 -50 °C ≤ T _a ≤ +65 °C, +80 °C, +115 °C or +120 °C II 2D c T 140 °C -50 °C ≤ T _a ≤ +120 °C Bauart ZS-DKM-C II 2G c IIC T6, T5 or T4 -30 °C ≤ T _a ≤ +65 °C, +80 °C or +90 °C II 2D c T 110 °C -30 °C ≤ T _a ≤ +90 °C	II 2G c IIC T6 or T5 -30 °C ≤ T _a ≤ +65 °C or +80 °C II 2D c T 100 °C -30 °C ≤ T _a ≤ +80 °C I M2 c -30 °C ≤ T _a ≤ +80 °C
- others			

⁽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.



REVOLEX® KX

POLY

BoWex®

Short, fail-safe, torsionally flexible pin & bush coupling types KX and KX-D, KX-AB and KX-TB


Not fail-safe, torsionally flexible jaw coupling types PKN, PKZ, PKD and 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) and type GT

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
 designation



  II 2GD c IIC T X
I M2 c X

  II 2GD c IIC T X
I M2 c X

From BoWex® M 38-C on the face:
BoWex GT on the inside
  II 2GD c IIC T X
I M2 c X

  II 2G c IIC T6 or T5
 $-30\text{ °C} \leq T_a \leq +65\text{ °C}$ or $+80\text{ °C}$
 II 2D c T 100 °C $-30\text{ °C} \leq T_a \leq +80\text{ °C}$
 I M2 c $-30\text{ °C} \leq T_a \leq +80\text{ °C}$

  II 2G c IIC T6 or T5
 $-30\text{ °C} \leq T_a \leq +65\text{ °C}$ or $+80\text{ °C}$
 II 2D c T 100 °C $-30\text{ °C} \leq T_a \leq +80\text{ °C}$
 I M2 c $-30\text{ °C} \leq T_a \leq +80\text{ °C}$

  II 2G c IIC T6, T5 or T4
 $-30\text{ °C} \leq T_a \leq +65\text{ °C}$, $+80\text{ °C}$ or $+100\text{ °C}$
 II 2D c T 120 °C $-30\text{ °C} \leq T_a \leq +100\text{ °C}$
 I M2 c $-30\text{ °C} \leq T_a \leq +100\text{ °C}$

KTR products for explosion-proof areas



Product	GEARex®	COUNTEX®	RIGIFLEX®-N
Description	Gear coupling from steel with grease lubrication types FA, FB and FAB as well as DA, DB and DAB	Short, puncture-proof, backlash-free, torsionally stiff and double-cardanic shaft encoder coupling in sizes 6 to 14	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	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		Nur Only -designation. In addition, complete marking on the order confirmation and packaging.	
- brief (standard)	II 2G c IIC T X II 2D c T X I M2 c X	Only on the order confirmation and packaging. II 2 aD c II CTX II M2 c X ⁽²⁾ II 3 aD c II CTX ⁽⁴⁾	II 2GD c IIC T X I M2 c X
- complete	II 2G c IIC T6, T5 or T4 -30 °C ≤ Ta ≤ +65 °C, +80 °C or +90 °C II 2D c T 110 °C -30 °C ≤ Ta ≤ +90 °C M2 c -30 °C ≤ Ta ≤ +90 °C	II 2G c IIC T6, T5, T4 or T3 -40 °C ≤ Ta ≤ +55 °C, +70 °C, +105 °C, +160 °C II 2D c T 110 °C -40 °C ≤ Ta ≤ +160 °C I M2 c -40 °C ≤ Ta ≤ +115 °C ⁽²⁾	
- others	Other components are marked with designation only (except for steel lamina).		

⁽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.

⁽⁴⁾ Only permissible for hubs without feather key and without thread for setscrews.

⁽⁵⁾ For the safe operation of MINEX®-S in potentially explosive atmospheres the temperature during operation must be monitored constantly. The temperature monitoring must automatically switch off the drive before the respective maximum permissible surface temperature is reached. The heat produced by the MINEX®-S magnet coupling, resulting from eddy current losses, must be dissipated permanently (e.g. by partial current of the pumping medium with pumps or sealing liquid).



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 (hub designs 1.0, 1.1, 2.0, 2.1, 2.5, 2.6), clamping ring hubs, Compact, A-H and DKM sizes 5 to 90

Fail-safe, backlash-free, torsionally stiff servo lamina coupling types EK and DK with hubs and spacer from highly stiff aluminium (size 42 hubs and spacer from steel) and lamina sets from stainless spring 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 designation, in addition complete marking in the order confirmation and packaging

Up to ROTEX® GS 19:
only designation, in addition complete marking in the order confirmation and packaging

Up to RADEX®-NC 15:
only designation, in addition complete marking in the order confirmation and packaging

From RADEX®-N 35:
 II 2GD c IIC T X
I M2 c X

From ROTEX® GS 24:
 II 2GD c IIC T X
I M2 c X⁽²⁾
Only for clamping hubs without feather key:
 II 3GD c IIC T X⁽³⁾















From RADEX®-NC 20:
 II 2GD c IIC T X
I M2 c X⁽²⁾
Only for clamping hubs without feather key:
 II 3GD c IIC T X⁽³⁾

II 2G c IIC T6, T5, T4, T3 or T2
-30 °C ≤ Ta ≤ +75 °C, +90 °C, +125 °C,
+190 °C or +280 °C
II 2D c T 110 °C -30 °C ≤ Ta ≤ +100 °C
I M2 c -30 °C ≤ Ta ≤ +140 °C

II 2G c IIC T6, T5 or T4
-30 °C ≤ Ta ≤ +65 °C, +80 °C
or +90 °C
II 2D c T 110 °C -30 °C ≤ Ta ≤ +90 °C
I M2 c -30 °C ≤ Ta ≤ +90 °C⁽²⁾
II 3G c IIC T6, T5 or T4⁽³⁾
-30 °C ≤ Ta ≤ +65 °C, +80 °C
or +90 °C
II 3D c T 110 °C -30 °C ≤ Ta ≤ +90 °C⁽³⁾

II 2G c IIC T6, T5, T4, T3 or T2
-30 °C ≤ Ta ≤ +75 °C, +90 °C, +125 °C,
+190 °C or +200 °C
II 2D c T 110 °C -30 °C ≤ Ta ≤ +100 °C
I M2 c -30 °C ≤ Ta ≤ +140 °C⁽²⁾
II 3G c IIC T6, T5, T4, T3 or T2⁽³⁾
-30 °C ≤ Ta ≤ +75 °C, +90 °C, +125 °C,
+190 °C or +200 °C
II 3D c T 110 °C -30 °C ≤ Ta ≤ +100 °C⁽³⁾

KTR products for explosion-proof areas

				
Product	MINEX®-S	BoWex-ELASTIC®	OAC Oil/air cooler	OPC cooling-pump-unit
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, HEW and HEW Compact	Oil/air cooler type OAC with electric or hydraulic drive motor	Cooling-pump-unit type OPC with electric drive motor and hydraulic pump
ATEX marking	At least on one component complete, on the other components by an  designation on the outside diameter 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	As per type label on the top surface of the cooling grid
- without details				
- brief (standard)	containment shroud metallic  II 2G c IIC T X containment shroud ceramic  II 2G c IIC T X containment shroud carbon fibre reinforced  II 2G c IIC T X	 II 2GD c IIB T X	 II 2G c IIB+H2 T X II 3D c T X	 II 2G c IIB+H2 T X II 3D c T X
- complete		 II 2G c IIB T6, T5 or T4 -30 °C ≤ T _a ≤ +50 °C, +65 °C or +80 °C II 2D c T 115 °C -30 °C ≤ T _a ≤ +80 °C	 II 2G c IIB+H2 T X motor II 2G Ex e II T1-T3 II 3D c T X Motor: II 2D Ex tD A21 IP65 T 125 °C	 II 2G c IIB+H2 T X Pumpe: II 2G c IIB T4X Elektromotor: II 2G Ex de IIB T4-GB
- others				

⁽¹⁾ For a safe operation of MINEX®-S in hazardous locations, the temperature has to be constantly monitored during the operation. The temperature monitoring must automatically switch off the drive before reaching the maximum permissible surface temperature. The heat produced by the MINEX®-S magnet coupling, resulting from eddy current losses, must 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 2014/34/EU.

The ATEX Product Directive 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:

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 an axial force generated on the rings (by means of several screws) a surface pressure is produced inside on the shaft and outside on 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 2014/34/EU.

Based on the arrangement of CLAMPEX® clamping sets, a fracture of the components does not have to be anticipated. 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 use in explosion-proof areas, the type 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 allows a service factor of at least $s = 2$ to cover 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) as the percentage 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.
- For minimum distance “Sr” versus rotating parts please see the chapter “covers” (see page 6).
- The disassembly of the components is only permitted at standstill.
- The KTR mounting instructions for bellhousings (KTR standard 41010), damping rings (KTR standard 43010) and foot flanges (KTR standard 41110) have to be observed.
- For mining applications, cast-iron or steel bellhousings must be used.
- For maritime applications we also recommend cast-iron or steel bellhousings.



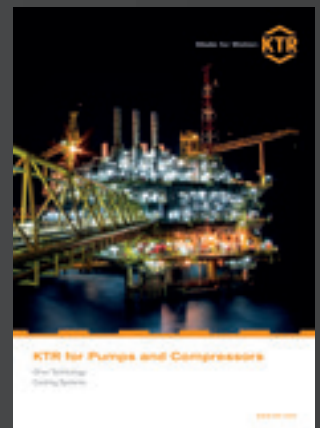
Overview of literature

The KTR product portfolio is as varied as its areas of use, whether you require the perfect power transmission system, effective brakes, space-saving cooling systems or precision hydraulics on land, water or high in the air. These catalogues and brochures offer an overview. Available at www.ktr.com

Product catalogues



Individual sector brochures



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