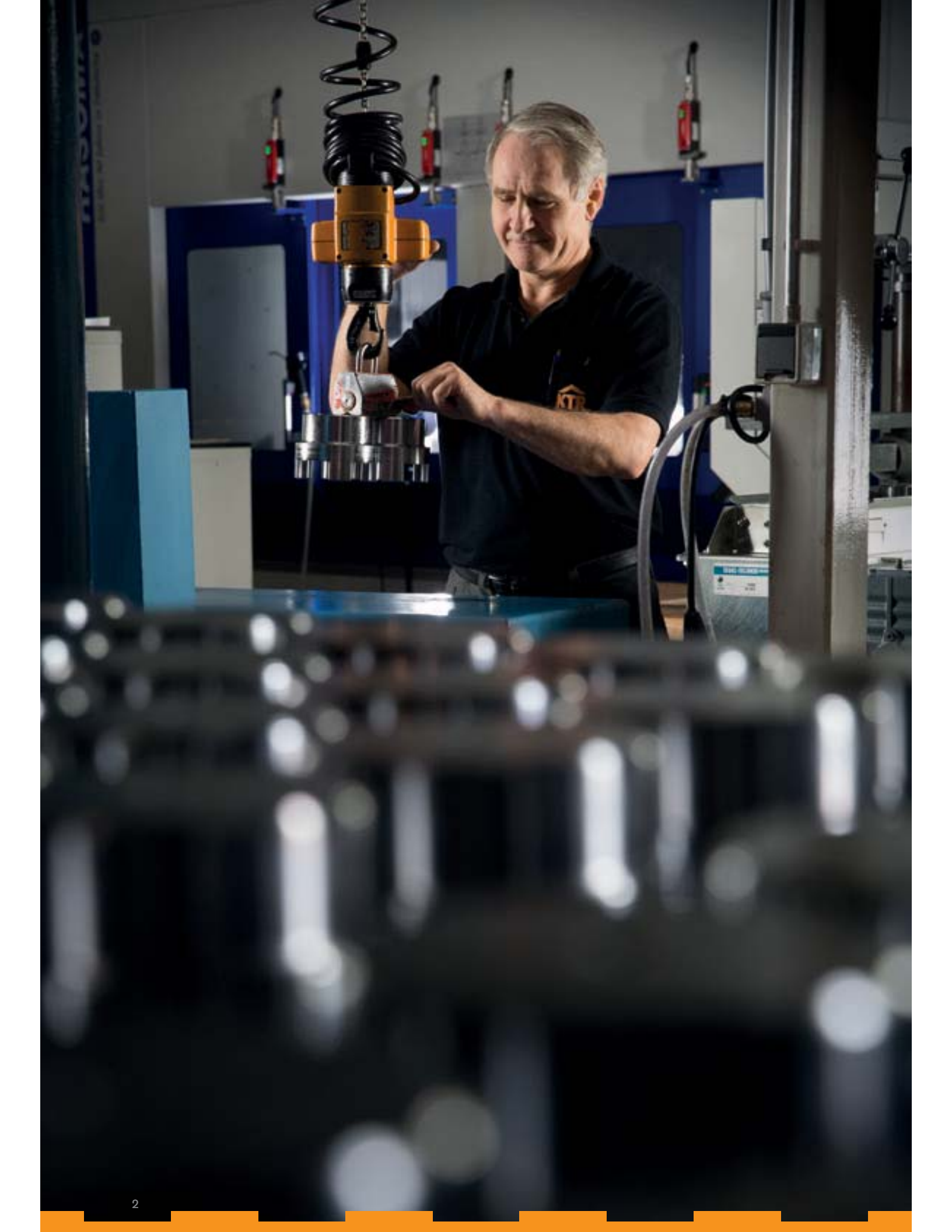


Made for Motion



Fluid couplings

Hydrodynamic power transmission according to the Föttinger principle



Those who value KTR as a manufacturer will love us as a partner.

It goes without saying that KTR supplies sophisticated products. It may be less obvious that we already supply quality when the product does not yet exist: that is to say as a competent consulting partner and/or sparring partner. On request KTR is there for the customers already during the design stage reverting to the know-how and experience gained from thousands of applications in the field. No matter which question our customers may have: We also advise on site and support you with designing.



We do not conceive ourselves as suppliers, but as solution providers.

Standstill in an industry dealing with motion? That is definitely a no-go for KTR. Although our product portfolio comprises more than 20,000 different couplings and other drive components including brakes and coolers, it only shows part of the options. Specifically with the development of individual solutions KTR makes full use of its strengths. On behalf of the customer KTR realizes more than 20,000 new developments and product variants some of which become industrial standard every year. Be assured: Together with our sales engineers and the sales team you will always find a tailor-made, cost-effective solution for your application.

Working on the future: the new Power Transmission Center

To make sure that today's drive technology will not be outdated already tomorrow, it must be continuously developed: This is done in the Power Transmission Center. It was opened in Rheine, the location of KTR's headquarters, in April 2015, combining the fields of innovation management, measuring technology, mechatronics and quality management.

An up-to-date R & D center along with a multifunctional assembly hall was built on a total surface of approx. 8,800 square metres. Drive components such as mechanical couplings, torque limiters and torque measuring shafts are developed, assembled and continuously tested here as well as hydraulic components like bellhousings, oil tanks and damping elements.

„We provide for strong connections. In particular with our customers.“

Martin Platt, Sales Manager

To ensure a smooth operation, the products are tested and further developed by KTR. For this purpose more than 25 hydraulic and electric test benches are available to the engineers in the PTC. And since nothing is harder than reality, KTR is testing its products under realistic conditions, i. e. conditions similar to operation. Anyway, KTR's products meet with special demands with external testing, too. One proof for that are the numerous certifications and standards our products were conferred in many different fields.

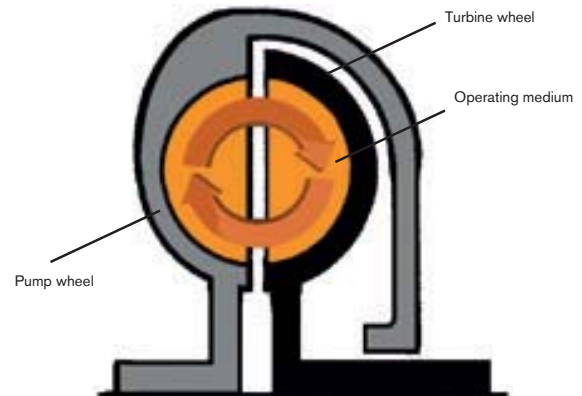
That is how we see ourselves: You can rely on KTR. We disapprove standstill – with us and our customers.

Fluid couplings

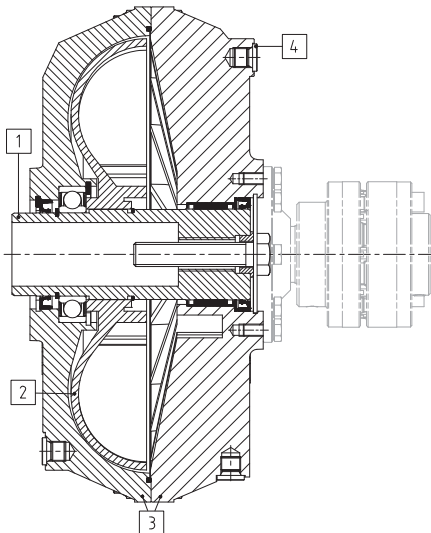
Structure and description of operation

Föttinger principle – the Föttinger coupling

Originally the operating principle of the fluid coupling is based on the hydrodynamic torque converter patented by Hermann Föttinger (1877 - 1945): The mass forces are transmitted via a flowing fluid (e. g. oil) while driving and driven side are mechanically separated from each other. With this operating principle the mechanically driven pump wheel (light grey) accelerates the fluid (orange) located in the operating area via radially arranged internal blades. The rotation energy of the rotating fluid absorbed by the turbine wheel blades (dark grey) accelerates the wheel while the resulting mechanical power is dissipated on the driven side.



General structure



The fluid coupling is composed of few components only. Its solid structure makes it extremely sturdy towards external environmental influences:

- 1 – Hollow shaft
- 2 – Impeller
- 3 – Two-part outer shell made of aluminium with impeller included
- 4 – Fusible safety plug

Gaskets, bearings, an oil filler screw and a retaining screw complete the coupling.

Optionally further accessories are available (e. g. delay chamber, safety systems, sight glass,...).

A (flexible) coupling (e.g. POLY-NORM® ADR) compensating for displacements are part of the scope of delivery, too.

Operating principle

Standstill	Start-up	Nominal operation
<p>There is oil (orange) in the working and delay chamber of the coupling</p>	<p>The motor accelerates the pump wheel (dark grey). In this way an oil circuit is generated in the working chamber of the coupling. The oil is sucked out of the delay chamber flowing into the working chamber. The rotation energy slowly accelerates the turbine wheel (light grey).</p>	<p>As soon as the machine has reached the rated torque, the coupling operates with nominal operation, i. e. it only transmits the torque required by the driven machine. A closed working circuit (orange) is formed. Depending on size and oil filling capacity, the slip with nominal operation is between 2 and 5 %.</p>

Fluid couplings

Product features

Applications and benefits	
<p>The fluid coupling is applied in sturdy environments where big masses need to be accelerated smoothly:</p> <ul style="list-style-type: none"> ● Conveyor belts ● Mills ● Shredders ● Crushers ● Agitators 	<p>Due to its structure and properties the coupling is characterized by the following benefits:</p> <ul style="list-style-type: none"> ● Soft start-up of the machine ● Released motor run-up, no oversizing of motors ● Preserving the power supply ● Preserving the system components ● Protecting the overall drive train ● Power transmission free from wear ● Damping vibrations in the drive train ● Easy torque control ● Tough characteristics towards external environmental influences

Types of drives (RM/MS)

Basically we distinguish between two types of drives in the range of fluid couplings: the inner wheel drive defined as a standard by KTR and the outer wheel drive.

Inner wheel drive (type ALFA K, KLM-S and BETA J)	Outer wheel drive (type ALFA K-RM, KLM-S-RM, K-CA and K-MS)
Example: ALFA K-S-ADR	Example: ALFA K-RM-S-ADR
<p>The fluid coupling with inner wheel drive is driven via the hollow shaft and the internal impeller. The outer shell of the coupling is linked with the driven side.</p> <p>Further details available from page 14</p>	<p>The fluid coupling with outer wheel drive is driven via the outer shell of the coupling. The hollow shaft with integrated impeller is linked with the driven side.</p> <p>Basically we distinguish between the following three types with outer wheel drives:</p> <ul style="list-style-type: none"> ● Type ALFA K-RM: By implementing respective modifications all sizes of type K(LM-S) are available as type K(LM-S)-RM with outer wheel drive, too. The outer dimensions are identical. Further details available on page 15 ● Type ALFA K-CA: This is a special design which is able to limit the starting factor to 1. Subject to its design this type is suitable for the outer wheel drive only. Further details available on page 18 ● Type ALFA K-MS: This is a special design with a coupling flange fitted on the outer shell of the coupling. This type was specifically designed for the outer wheel drive. ● Further details available on page 16

The two different types of drives provide for sophisticated benefits:

<ul style="list-style-type: none"> ● Standardisation of hollow shaft bores ● Smaller mass moment of inertia with start-up of the motor ● Slower start-up with the use of a delay chamber ● No axial extension of the coupling with the use of a brake disk or drum ● Preservation of the flexible coupling ● Low-cost variant 	<ul style="list-style-type: none"> ● Good heat dissipation, particularly during the starting period ● Easy filling/adjustment of oil ● Temperature monitoring system (ET + FTP) releasing with a respective temperature in every case ● Special feature of type ALFA K-MS: ● Weight of the complete fluid coupling bears on the motor shaft ● Combined with a fan on the driven side, the coupling has only few influence on the fan
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Technical details

Balancing

The outer shell of the fluid coupling and the impellers are statically balanced in accordance with DIN ISO 1940 at G6.3 with 1800 rpm. Balancing for higher speeds and/or with oil filling and minutes is available upon consultation with us. The connection coupling supplied as well (e. g. POLY-NORM® ADR) is not balanced as a standard.

Tightness test

Every fluid coupling is subject to tightness testing before supply. Testing is performed with 4 bar

Temperature range

The fluid coupling operates in an optimum range with ambient temperatures between – 20 °C to + 40 °C. For higher or lower temperatures please consult with KTR/Engineered Business.

Operating medium oil

Only thin-fluid mineral oil may be used as operating medium. For a selection of permissible oils and oil filling capacities please refer to page 23. Oil filling has to be performed by the customer. Filling by KTR is available on request.

ATEX

On request of the customer, an ATEX certificate following directive 94/9/CEE can be issued for the customer (e. g. Ex II 2 GD ... T4/120°C).

Mounting position

The fluid couplings are horizontally mounted in the machines as a standard. If vertical mounting is required, this can be done with the respective modifications. Please consult with KTR/Engineered Business.

Painting and preservation


The couplings are provided with a short-term corrosion protection. If a long-term corrosion protection is necessary, please communicate in your order. Painting by KTR is not provided as a standard. The housing of the fluid coupling is made of aluminium diecast. Connection couplings and steel components can be painted, if necessary.

Shaft ends in accordance with DIN 748-2 and bore tolerances

d [mm]	6 - 7	8 - 9	10 - 11	12 - 14	16 - 19	20 - 24	25 - 28	30 - 32	33 - 38	40 - 50	55	60 - 75	80 - 95	100 - 120
Tolerance fields	k6									m6				
l [mm]	16	20	23	30	40	50	60	80	80	110	110	140	170	210
Bore tolerances of fluid coupling / connection coupling														
ALFA K / K-RM / K-CA / BETA J	H7								G7					
ALFA K-MS / KLM-S	H7													
POLY-NORM AR / ADR / ROTEX 001	H7													
All finish bores are provided with feather keyways according to DIN 6885/1 as a standard														

Fusible safety plug with pin (FTP)


The fusible safety plug with pin (FTP) is available on request as additional protection. It prevents discharge of oil and serves for protecting the environment. It has to be selected one temperature class lower than the standard fusible safety plug. The fusible line (orange) integrated in the screw prevents the spring from ejecting the pin. Once the melting temperature (e. g. 120 °C) is reached, the fusible link melts and the pin protrudes by 5 to 6 mm. The machine can be switched off in combination with the mechanical switch ET. Discharge of oil is prevented. The FTP has to be replaced by a new FTP with the same temperature class after releasing. The following fusible safety plugs with pin are available:

	Coupling size	Thread size	Temperature classes [°C]			
			96 (blue)	120 (white)	145 (red)	180 (green)
	10 - 40P	¼"	○	○	●	○
	50 - 85P	½"	○	○	●	○
	90P - 95P	¾"	○	○	●	○

Fusible safety plug with pin (FTP)

The fusible safety plug with pin (FTP) is available on request as additional protection. It prevents discharge of oil and serves for protecting the environment. It has to be selected one temperature class lower than the standard fusible safety plug. The fusible line (orange) integrated in the screw prevents the spring from ejecting the pin. Once the melting temperature (e. g. 120 °C) is reached, the fusible link melts and the pin protrudes by 5 to 6 mm. The machine can be switched off in combination with the mechanical switch ET. Discharge of oil is prevented. The FTP has to be replaced by a new FTP with the same temperature class after releasing.

The following fusible safety plugs with pin are available:

	Coupling size	Thread size	Temperature classes [°C]		
			96 (blue)	120 (white)	145 (red)
	10 - 40P	¼"	○	○	○
	50 - 85P	½"	○	○	○
	90P - 95P	¾"	○	○	○

Further details about FTP with ET are available on page 7/8. ● ~ Standard | ○ ~ on request | - not available

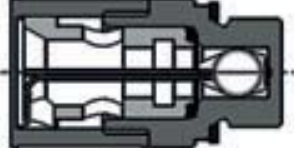
Fluid couplings

Technical details

Safety plug with temperature sensor (PM)

The safety plug with temperature sensor (PM) is available on request as additional protection. It prevents discharge of oil and serves for protecting the environment. It has to be selected one temperature class lower than the standard fusible safety plug. The temperature sensor operates as an impulse transmitter. As long as it is locked, i. e. as long as the temperature (e. g. 120 °C) is not exceeded, it permanently sends an alarm that is monitored by the electronic evaluating unit (T09). If the temperature exceeds the requested release temperature, the switch opens and sending of impulses is interrupted. The evaluation unit indicates an error and the unit is switched off. Discharge of oil is prevented. After elimination of the failure and a cooling phase, the coupling is ready for use again without replacing the fusible safety plug.

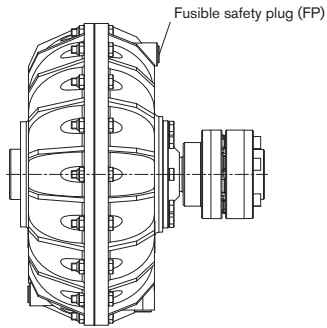
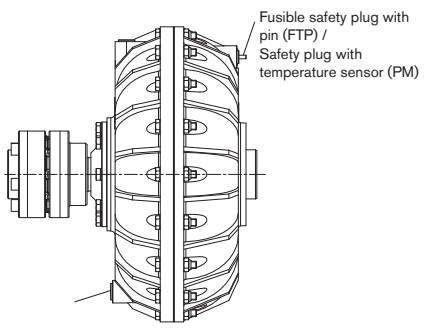
The following safety plugs with temperature sensor are available:

	Coupling size	Thread size	Temperature class [°C]			
			100 (blue)	120 (white)	145 (red)	160 (yellow)
	10 - 40P	1/4"	–	–	–	–
	50 - 85P	1/2"	○	○	○	○
	90P - 95P	3/4"	○	○	○	○

Further details about PM with T09 are available on page 8/9. ● ~ Standard | ○ ~ on request | - not available

Standard position of fusible safety plugs

The positions of the fusible safety plugs are defined as a standard. If a different position is preferred for reason of space or accessibility, this can be realized. In this case please consult with KTR/Engineered Business

Fusible safety plug (FP)	Fusible safety plug with pin (FTP) / Safety plug with temperature sensor (PM)
 <p>Fusible safety plug (FP)</p>	 <p>Fusible safety plug with pin (FTP) / Safety plug with temperature sensor (PM)</p> <p>Fusible safety plug (FP)</p>

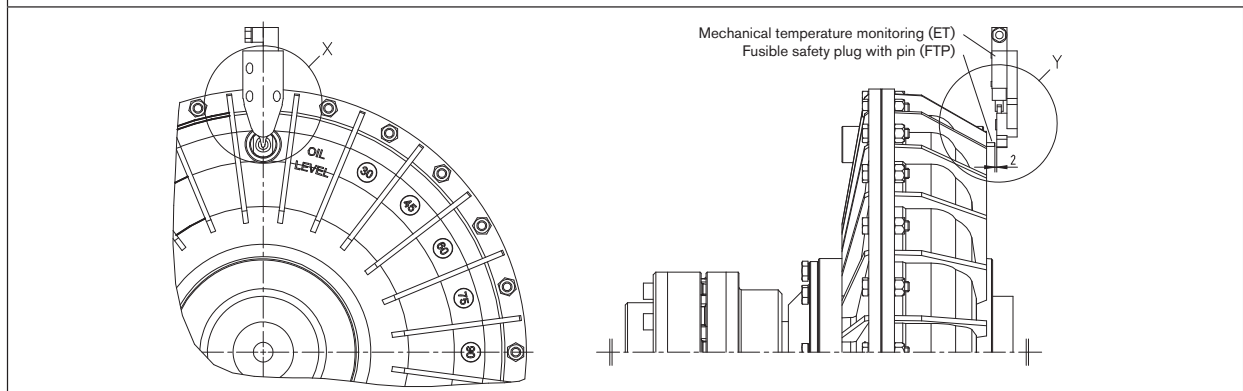
Temperature and speed monitoring systems

In order to prevent discharge of oil on the coupling, the following monitoring systems are available:

- Mechanical temperature monitoring (ET)
- Electronic temperature monitoring (T09)
- Electronic speed monitoring (SCD)






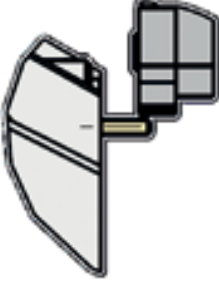
Mechanical temperature monitoring (ET)

The mechanical temperature monitoring is to be used in combination with the fusible safety plug with pin (FTP). In order to assure releasing of the unit with each failure, we recommend using this system with the type of drive „outer wheel drive“. If the driven side locks, it is assured in every case that the pin screwed in the outer shell activates the fixed switch with releasing. The switch has to be fitted with a distance of 2 mm towards the front surface of the pin not released.



Fluid couplings

Technical details

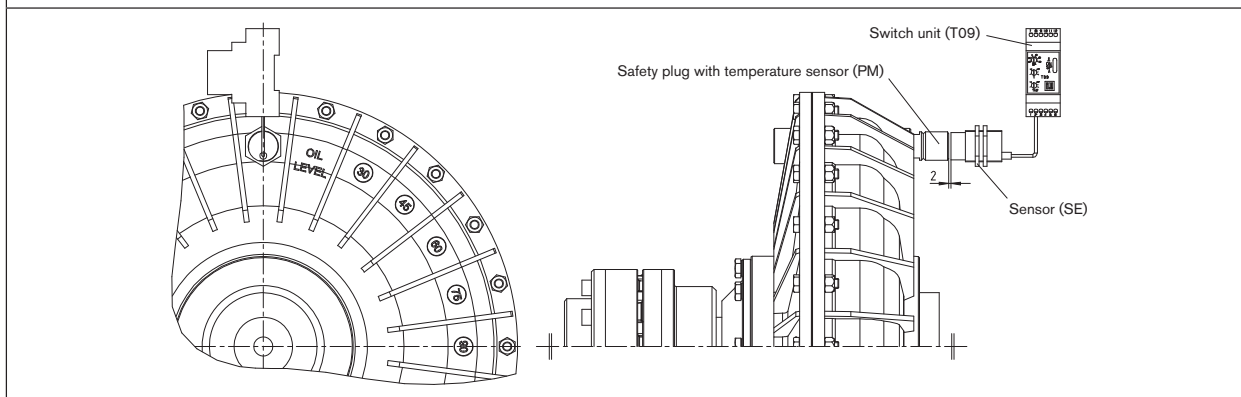
			
<p>Oil temperature < release temperature of FTP: Switch and pin not activated</p>		<p>Oil temperature > release temperature of FTP: Switch and pin activated</p>	
			
Detail X	Detail Y	Detail X	Detail Y

Operation

When the oil temperature exceeds the release temperature of the fusible safety plug with pin (FTP), the latter is released. The pin ejects activating the switch with the next revolution. The drive stops without any discharge of oil of the coupling. Having eliminated the failure, the FTP has to be replaced.

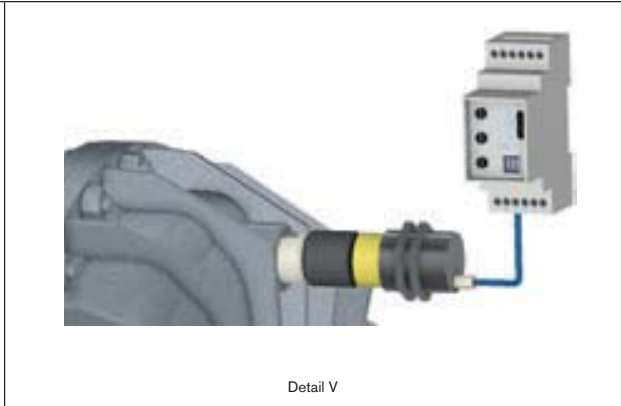
Electronic temperature monitoring (T09)

The electronic temperature monitoring system is to be used in combination with a temperature sensor (PM) and a sensor (SE). As with mechanical monitoring (ET), the type of drive „outer wheel drive“ is recommended here for the aforementioned reasons. The sensor has to be fitted with a distance of 2 mm towards the front surface of the temperature sensor/impulse transmitter (PM).



Fluid couplings

Technical details

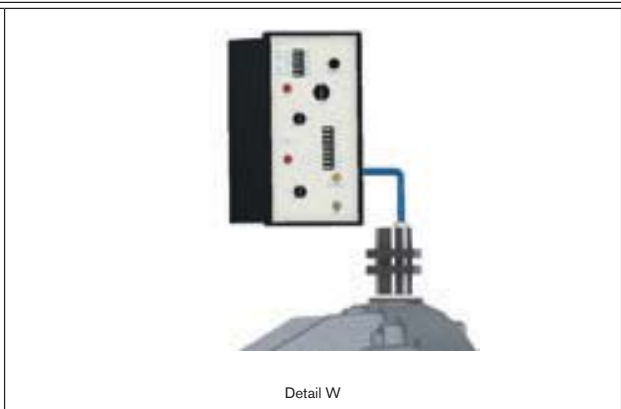
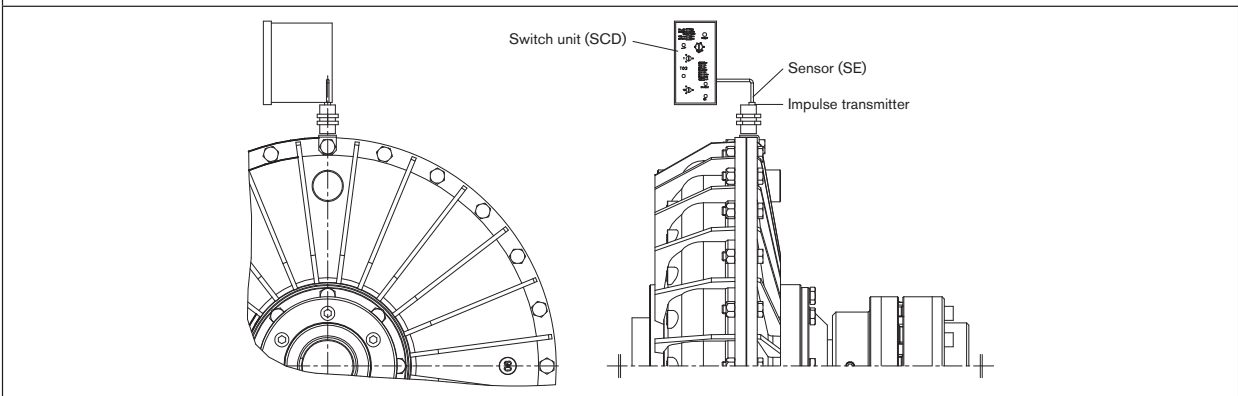


Operation

The temperature sensor (PM) operates as an impulse transmitter in the coupling. A sensor (SE) records the data transmitted inductively transferring the impulses on to the shift unit. When the release temperature of the sensor is exceeded, the latter is opened. Transmission of impulses to the sensor is interrupted. The information is transmitted to the switch unit. The unit switches off or an acoustic signal sounds with no oil dissipation of the coupling. Having eliminated the failure, the coupling including the overall monitoring system can be started up again. In addition to temperature monitoring this unit allows monitoring of the speed. The signal given by the impulse transmitter is recorded per revolution by the sensor. The evaluation unit compares the actual speed to the target speed set. If the difference specified is exceeded, the machine switches off. Speed monitoring is available with the type of drive „inner wheel drive“ only

Electronic speed monitoring (SCD)

Electronic speed monitoring can be mounted as additional monitoring system. The system can be used with the type of drive „inner wheel drive“ only. The sensor has to be fitted with a distance of 2 mm towards the surface of the impulse transmitter.



Operation

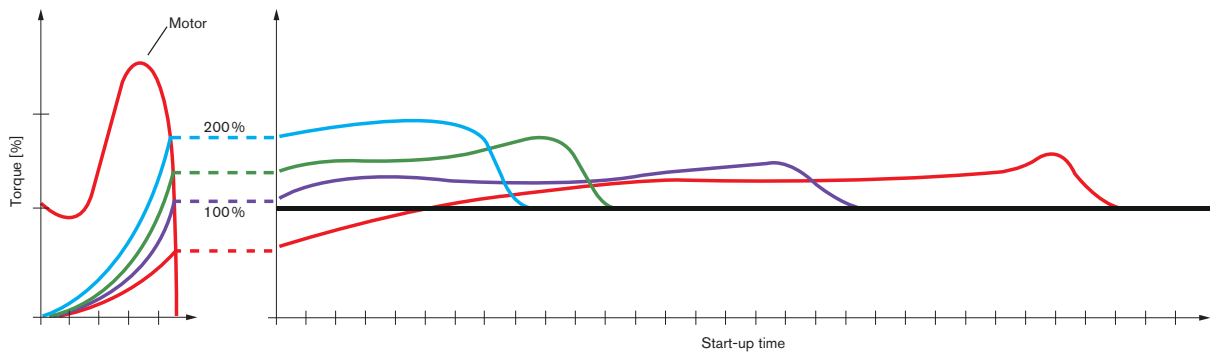
Two impulse transmitters (sheet metals) are mounted to the outer shell of the coupling offset by 180°. The sensor mounted in a distance of 2 mm records the transmitter sheet metals during operation. An evaluation unit compares the actual speed calculated to the target speed set. If the difference between driving and driven speed is too big, the machine switches off. This allows recognizing excessive heating and discharge of oil early and prevent accordingly. Having eliminated the failure, the machine can be started up again with no further maintenance operations. A delay time of a maximum of 120 s can be set during the start-up phase preventing releasing during start-up. False alarm (triggered by very short torque fluctuations) can be absorbed by setting an additional delay.

Fluid couplings

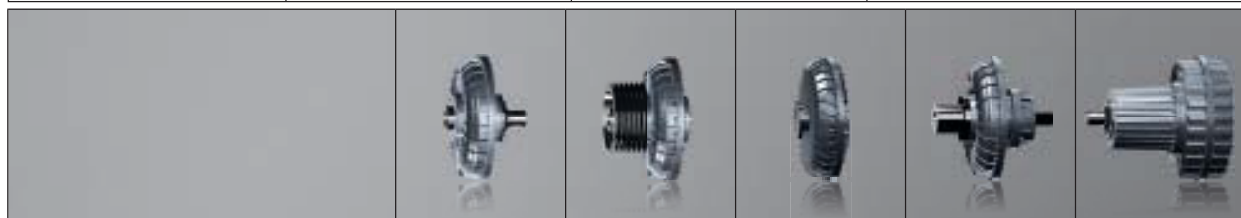
Technical details

Start-up factors

The start-up torque of the motor can be reduced via a fluid coupling. The standard coupling (type K) limits the torque to 1.8 to 2.0 times the rated torque of the motor. Fitting so-called delay chambers allows reduction of the start-up torque. The result is a smoother start-up with a longer start-up phase. The oil in the chamber reaches the working chamber only slowly. This results in a delayed start-up and a low start-up torque. The following diagramme shows the start-up curves of the fluid coupling along with the different delay chambers:



Torque of motor/coupling	Coupling torque via start-up time			
Without delay chamber	With small delay chamber	With large delay chamber	With large delay chamber and extra chamber	



Product type / Properties	ALFA K-S	BETA J	ALFA KLM-S	ALFA K-MS	ALFA K-CA-S
Antriebsart					
Inner wheel drive	●	●	●	-	-
Outer wheel drive	○	-	○	●	●
Fusible safety plug (FP)					
96 °C (blue)	○	○	○	○	○
120 °C (white)	○	○	○	○	○
145 °C (red)	●	●	●	●	●
180 °C (green)	○	○	○	○	○
Max. performance data					
Max. motor power [kW]*	430	430	430	430	510
Max. speed [rpm]	6000	6000	6000	6000	2600
Start-up factors					
1.8 – 2.0 (without delay chamber)	●	●	●	●	-
1.5 – 1.8 (with small delay chamber (+SCF))	○	○	○	○	-
1.2 – 1.5 (with large delay chamber (+DCF))	○	○	○	○	-
1.0 – 1.2 (with large delay chamber and extra chamber)	-	-	-	-	●
Coupling combinations					
with POLY-NORM® AR / ADR	●	-	●	●	●
with ROTEX® Bauart 001	○	-	○	○	○
with RADEX® -N NENE spec.	○	-	○	-	-
Type examination tests					
ATEX	○	○	○	○	○
Mounting position					
Horizontal	●	●	●	●	●
Vertical	○	○	○	○	○

● ≈ standard | ○ ≈ on request | - ≈ not available | * ≈ coupling with higher performance on request

Fluid couplings

Coupling types

Coupling combinations					
	ALFA				BETA
					
Accessories / type	K / K-RM	K-MS	KLM-S / KLM-S-RM	K-CA	J
 SCF* (small delay chamber)	○	○	○	-	○
 DCF* (large delay chamber)	○	○	○	-	○
 S (adapter flange)	●	-	-	●	-
 POLY-NORM* AR**	●	●	-	●	-
 POLY-NORM* ADR**	○	○	-	○	-
 ROTEX* 001**	○	○	-	○	-
 RADEX* NENE spec.	-	-	●	-	-
 Belt pulley	-	-	-	-	●
Example of designation					
	ALFA [60] K-S-[SCF]-[RM]-AR	ALFA [60] K-MS-[SCF]-ADR	ALFA [60] KLM-S-[DCF]-NENE	ALFA [65S] K-CA-S-AR	BETA [60] J

● ≈ standard | ○ ≈ on request | - ≈ not available | * ≈ coupling with higher performance on request

*only SCF ODER DCF available

**To connect the fluid coupling type ALFA K / K-RM respectively K-CA with POLY-NORM* A(DR) or ROTEX* 001, an adapter shaft (S) is always necessary

[60] Example for designation of size

[SCF] Example for delay chamber

[RM] Specification for outer wheel drive (only available with ALFA K respectively ALFA KLM-S)

Fluid couplings

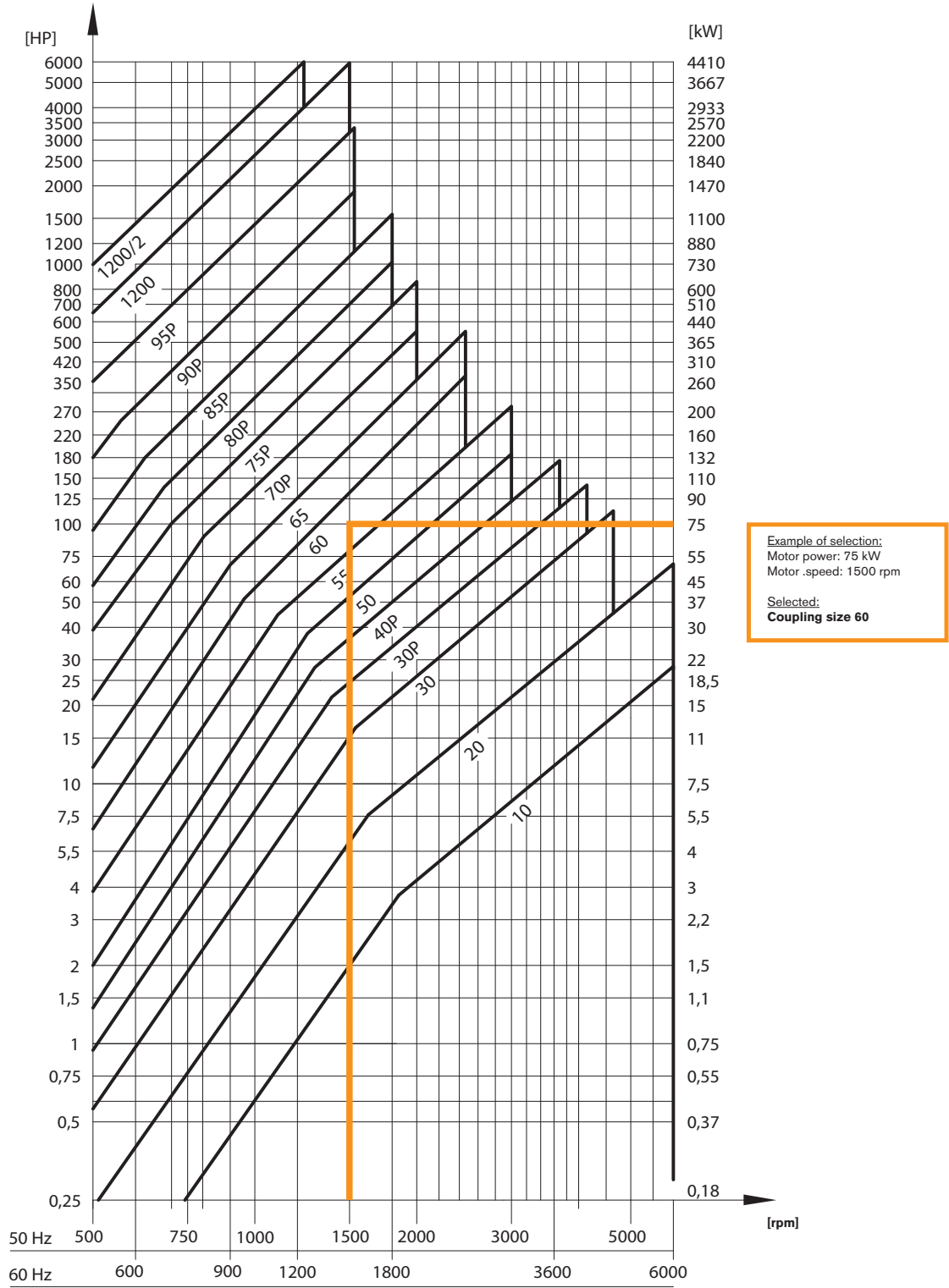
IEC standard motor – Assignment via selection table



Fluid couplings for IEC standard motors																			
Motor		Motor speed 50 Hz												Motor speed 60 Hz					
		8-poles			6-poles			4-poles			2-poles			6-poles			4-poles		
		750 rpm			1000 rpm			1500 rpm			3000 rpm			1200 rpm			1800 rpm		
Type	Ø	kW	HP	Coupling	kW	HP	Coupling	kW	HP	Coupling	kW	HP	Coupling	kW	HP	Coupling	kW	HP	Coupling
71	14				0,25	0,33	10	0,25	0,33		0,37	0,5		0,25	0,33		0,25	0,35	
								0,37	0,5		0,55	0,75		0,37	0,5	10	0,55	0,75	
80	19				0,55	0,75		0,75	1	10	1,1	1,5		1,1	1,5	10	0,55	0,75	1
90S					0,75	1	20	1,1	1,5		1,5	2		1,5	2		0,75	1	1,5
90L	24	0,55	0,75	20	1,1	1,5		1,5	2		2,2	3		1,1	1,5		1,5	2	
100L		1,1	1,5	30	1,5	2		2,2	3		3	4		1,5	2	20	2,2	3	
	28						30	3	4	20							3	4	
112M		1,5			2,2	3		4	5,5		4	5,5		2,2	3		4	5,5	20
132		2,2	2	30P	3	4		5,5	7,5		5,5	7,5		3	4	30	5,5	7,5	
	38						30P												
132M		3	4	40P	4	5,5		7,5	10		7,5	10	20	4	5,5		5,5	7,5	7,5
					5,5	7,5													10
160M	42	4	5,5	50	7,5	10	40P	11	15	30P	11	15		7,5	10	30P	11	15	30
											15	20							
160L		7,5	10	55	11	15	50	15	20		18,5	25		11	15		15	20	
180M								18,5	25	40P	22	30	30	15	20	40P	18,5	25	30P
180L	48	11	15		15	20		22	30								22	30	
200L	55	15	20	60	18,5	25		30	40	50	30	40		18,5	25				
					22	30								22	30	50			40P
225S	60	18,5	25					37	50								37	50	
225M	55	22	30	65	30	40	60	45	60	55	45	60	30P	30	40	55	45	60	50
	60																		
250M		30	40		37	50		55	75		55	75	40P	37	50		55	75	55
	65						65												
280S	75	37	50		45	60		75	100		75	100		45	60	60	75	100	
				70P						60									
280M	65	45	60		55	75		90	125		90	125	50	55	75		90	125	
	75																		
315S	65	55	75				70P				110	150							60
	80				75	100		110	150	65	132	180		75	100	65	110	150	
				75P									55						
315M	65	75	100		90	125		132	180					90	125		132	180	65
					110	150	75P	160	220	70P				110	150	70P	160	220	
	80			80P	132	180		200	270					132	180		200	270	
																			70P
355S					160	220	80P	250	340					16	220		250	340	
	100	132	180							75P						75P			
				85P															
355M	80	160	220		200	270	85P	315	430					200	270		315	430	75P
	100	200	270	90P	250	340								250	340	80P			

Fluid couplings

IEC standard motor – Assignment via selection diagramme



- Selection of coupling via input power and speed
- Curves show the maximum capacity of the respective couplings
- For the selection please consult with KTR/Engineered Business, if necessary (see questionnaire on page 24/25)