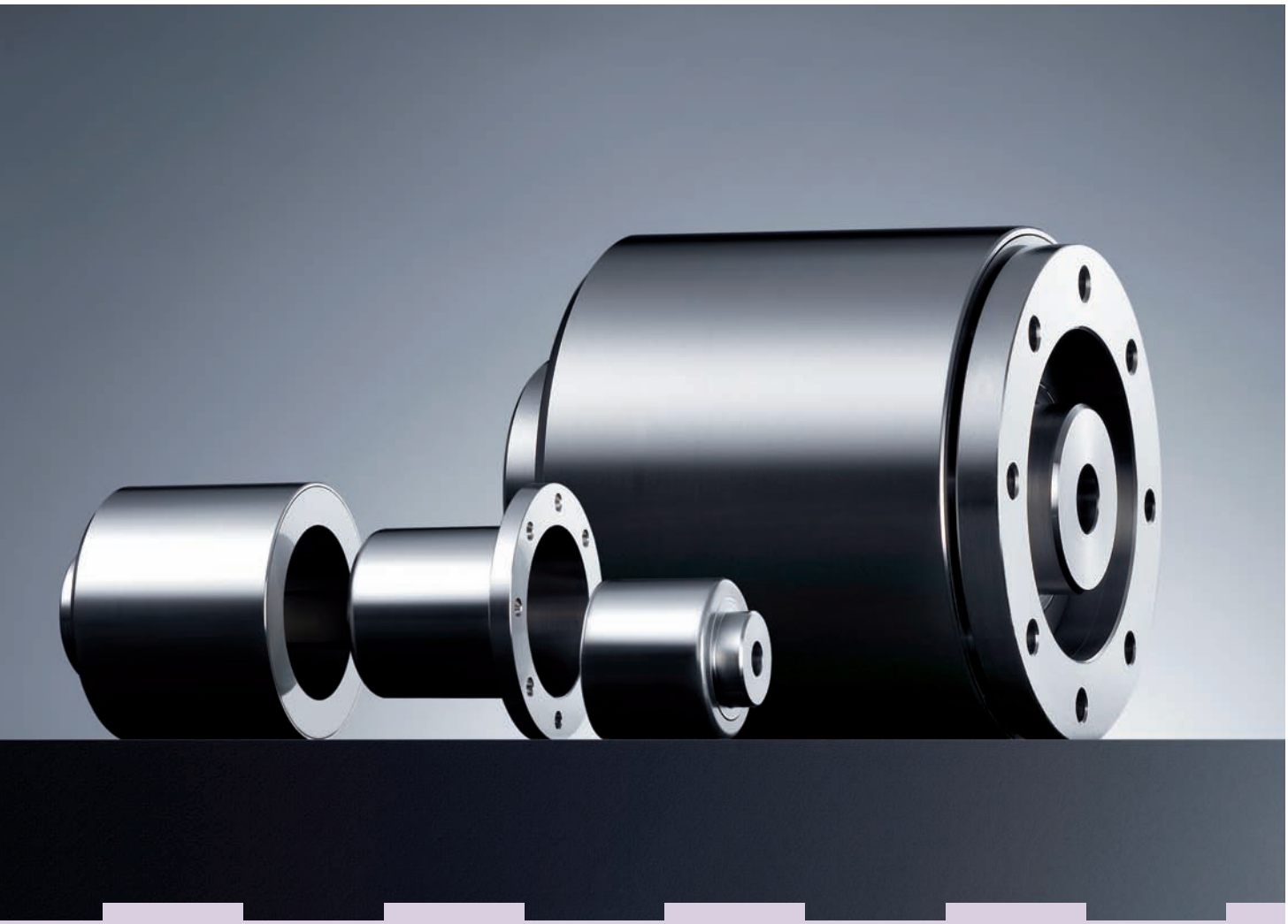
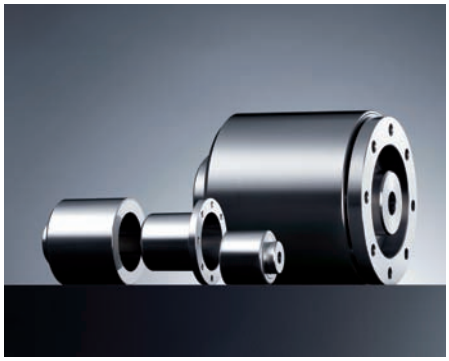


MINEX®-S

Permanent magnetic couplings

Made for Motion KTR

Table of contents



Coupling description

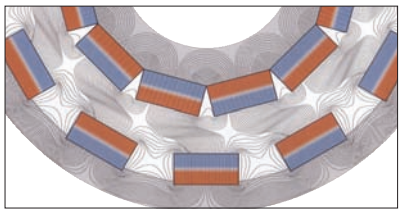
General description

MINEX®-S synchronous permanent magnetic couplings are designed to transmit torque between drive and driven components without mechanical contact. Incorporating a containment shroud provides encapsulation of the driven shaft providing separation of pumped media from the environment by the use of stationary seals which eliminates the need for rotating shaft seals.

Function/Design

Internal rotor External rotor

MINEX®-S synchronous magnetic couplings are constructed of samarium-cobalt or neodymium-iron-boron rare earth permanent magnets arranged concentrically on the rotor to maximize transmittable torque without slipping. The inner rotor is fully machined stainless material for the both mounting and welded magnet cover. Depending on the coupling series, the outer rotor is either a one-piece or modular design incorporating a flange for a variety of mounting options. Together the rotors transmit torque via magnetic fields that pass through the containment shroud. The torque capacity and heat generation is defined by the material properties of the containment shroud.



Run of flux lines

The containment shroud material selection is a key element when selecting the correct coupling for an application. Since the coupling is dependent on a magnetic field to transmit torque, the mechanical properties of the shroud may add heat to the process as a result of the friction of the magnetic field passing through the shroud. In order to minimize the resistance, several shroud materials and thickness are available in order to optimize the pressure ratings of the shroud, resistance and chemical compatibility.

Magnetic couplings with a variety of standard mounting options utilize inner rotors able to accommodate shafts up to 3.563 inches and a maximum nominal torque of 8,851 lb-in while still accommodating blind assembly. As defined by the magnet material, MINEX®-S couplings accommodate higher temperature ranges. Together these features reduce the maintenance required during the life-cycle of the coupling.

Torque transmission

The coupling consists of external and internal magnetic rotors and a containment shroud used to encapsulate the driven shaft. The external rotor, typically mounted on the driven side, contains alternating poles of high quality rare earth permanent magnets concentrically mounted over the inner rotor The inner rotor contains opposing magnets which are precision ground to ensure a minimal air gap and encapsulated within a cover impervious to fluids. A containment shroud provides a non-rotating seal of the internal rotor and driven shaft while positioned within the bore of the outer rotor.

In their non-dynamic states the north and south poles of the rotors are opposite to each other and the magnetic field is completely symmetrical. Once the rotors are spun, the magnetic field lines are moved and the torque is transmitted through the air gap. During synchronous operation the torsional angle between the inner and outer rotors must remain below the maximum value. If the maximum coupling torque is exceeded, the maximum torsion angle will also be exceeded, interrupting torque transmission. Thus the MINEX®-S offers an overload protection function for the drive train. After removing the cause of the overload (e.g. damage to the bearing, blocking of the internal rotor) both rotors can be synchronized again and operation is resumed.

Sealing function

Containment shroud

The main component of the MINEX®-S is the containment shroud installed on the drive-side power unit, encapsulating the internal rotor while positioned within the bore of the external rotor. Due to torque transmission via the magnetic field mechanical vibrations are isolated while providing a static seal of the process fluids.

The sealing, achieved with a flat seal or an o-ring, eliminates the need for a dynamic seals which require specific shaft locations and surface finishes. Since the containment shroud is a stationary component within a rotating magnetic field, the resistance of the magnetic field passing thought the shroud while rotating results in magnetic strength or losses of eddy current. In order to minimize this effect, the containment shroud and internal rotor are generally made from stainless steel 1.4571 or Hastelloy providing a good balance between containment pressure and eddy current losses. In the event eddy current losses must be excluded, alternative materials like PEEK® or ceramics may be chosen.

Technical description

Explosion-protection use

MINEX®-S couplings are designed for power transmission drives that are used in hazardous areas. As a component of the device class II the couplings are assessed and confirmed for the use in explosive areas of category 2G according to the EU standards 94/9/EC (ATEX 95).

Please see our website www.ktr.com for copies of certification and operating/installation instructions.

Technical Data

Size	Stat. tear torque $T_{Kmax.}$ @ 68 °F [lb-in]	External rotor					Internal rotor					Containment shroud			
		Standard material		operating-temperature $t_{max.}$ [°F]	Weight unbored [lb]	Mass moment of inertia @ min. bore Ø [lb-in-sec²]	Standard material		Operating-temperature $t_{max.}$ [°F]	Weight pilot bored [lb]	Mass moment of inertia with min. bore Ø [lb-in-sec²]	Standard material 2)		Max. pressure resistance $P_N/P_{max.}$ 1) [psi]	Max. speed [rpm]
		Hub	Magnets				Hub	Magnets				Flange	Can		
SA 22/4	1.3	Structural steel S355J2G3	NdFeB	150	0.28	0.000266	1.4462	NdFeB	300	0.09	0.00002	Stainless steel 1.4571	Stainless steel 1.4571	881 / 1,322	3,600 rpm using metal stationary cans as per KTR standard
SA 34/10	8.9				0.56	0.001039				0.21	0.00011			234 / 352	
SA 46/6	26.6		Samarium-cobalt (Sm_2Co_{17}) or neodymium-iron-boron (NdFeB)	300°F (NdFeB) 570°F (Sm_2Co_{17})	1.36	0.004059	Stainless steel 1.4571	Samarium-cobalt (Sm_2Co_{17})	570	0.70	0.00111	Stainless steel 1.4571			
SA 60/8	62				3.86	0.020171				1.24	0.00196			587 / 881	
SB 60/8	124				5.91	0.033271				2.06	0.00336				
SA 75/10	89				3.00	0.027960				2.07	0.00477		Stainless steel 1.4571 or Hastelloy	234 / 352 with 1.4571	
SB 75/10	212				4.62	0.042741				3.29	0.00787				
SC 75/10	354				6.37	0.058895				4.17	0.01090			367 / 550 with Hastelloy	
SA 110/16	221				4.06	0.065108				5.62	0.02889				
SB 110/16	531				6.22	0.107194				8.23	0.04628				
SC 110/16	841				8.35	0.143723				10.68	0.06317				
SB 135/20	885				8.26	0.202493				12.50	0.10916				
SC 135/20	1,283				10.81	0.264415				16.23	0.14841			367 / 550	
SD 135/20	1,770				13.36	0.326336				20.94	0.19815				
SC 165/24	1,859		Samarium-cobalt (Sm_2Co_{17})	570	11.70	0.402543				25.14	0.33560		Hastelloy		
SD 165/24	2,478				14.46	0.497161				32.36	0.44815				
SE 165/24	3,275				17.23	0.591778				38.15	0.53863				
SD 200/30	3,806				21.80	1.038187				57.46	1.11447				
SE 200/30	4,868				22.85	1.082849				57.58	1.11881				
SD 250/38	5,930				24.10	1.792682				83.61	2.50302			234 / 352	
SE 250/38	7,258				28.73	2.135507				99.71	3.01306				
SF 250/38	8,851				33.36	2.478280				115.76	3.52195				

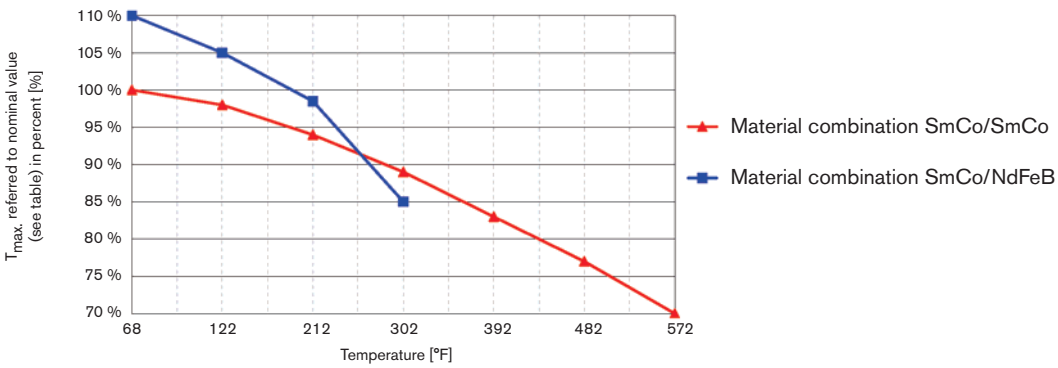
1) Higher containment pressures available when requested

2) Alternative materials of stationary cans like oxide ceramics (see page 158) or PEEK are available on request.

Description	Reference	Definition or explanation
Static tear torque of coupling	$T_{K\ max.}$	Max. transmittable torque, from which onwards the magnetic forces tear during the static test.

Description	Reference	Definition or explanation
Maximum operating temperature	$t_{max.}$	Max. allowable temperature causing a temporary attenuation of the magntic field. Exceeding irretrievable losses of magnetization.

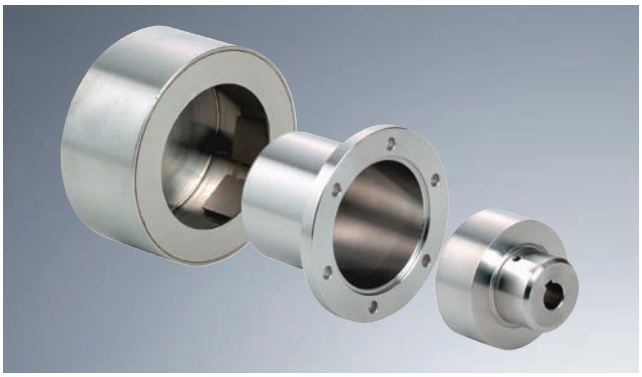
Torque reduction with temperature increase



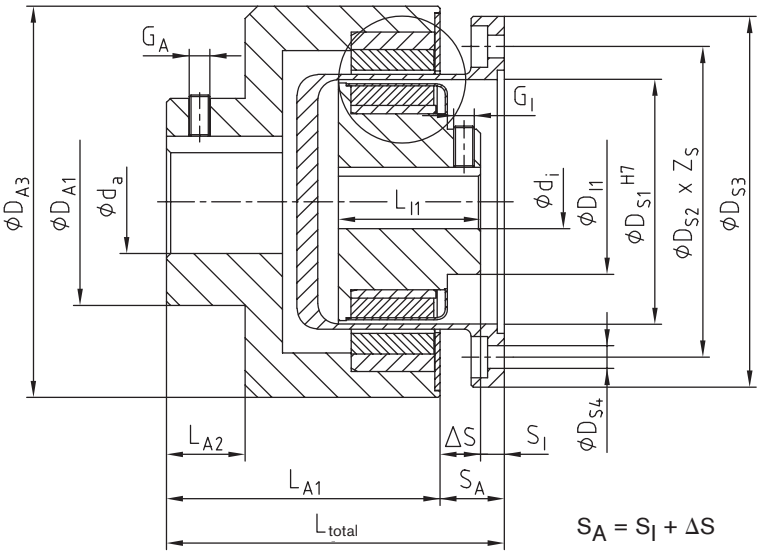
Temporary torque reduction with increased temperature for alternative material combinations [%]

Please note:
To reduce cost KTR recommends use of NdFeB magnets for the external rotor when operating temperatures are below 300 °F.

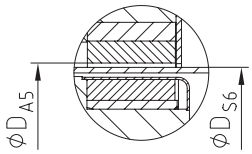
Sizes SA 22/4 to SB 60/8

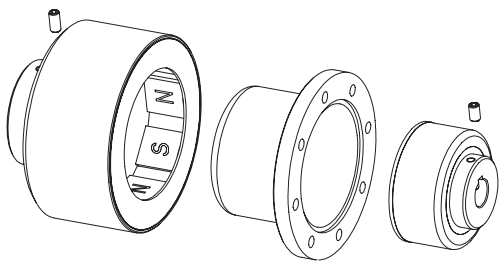


- Magnetic torque transmission
- Hermetically sealed when using shroud
- Samarium-cobalt or neodymium-iron-boron rare earth permanent magnets
- Ⓔx Approved according to EC Standard 94/9/EC
- Installation instructions available at www.ktr.com



$S_A = S_I + \Delta S$





External rotor | Containment shroud | Internal rotor

Technical Data – Internal rotor and containment shroud

Size	Stat. tear torque $T_{Kmax.}$@ 68 °F (lb-in)	Dimensions [in]											
		Internal rotor							Containment shroud				
		Bore [1] d_i		D_{I1}	L_{I1}	S_I		G_I	D_{S1}	D_{S2}	D_{S3}	D_{S4}	Z_S
		min.	max.			min.	max.						
SA 22/4	1.3	0.250	0.375	0.79	0.79	0.08	0.08	M3	0.85	1.50	1.81	0.18	8
SA 34/10	8.9	0.250	0.500	0.79	0.87	0.08	0.22	M3	1.34	1.81	2.17	0.18	4
SA 46/6	27	0.375	0.688	1.10	1.30	0.26	0.28	M4	1.81	–	3.07	–	–
SA 60/8	62	0.500	0.875	1.38	1.42	0.09	0.14	M5	2.32	2.95	3.52	0.22	8
SB 60/8	124				2.20	0	0.14						

Technical Data – External rotor and general

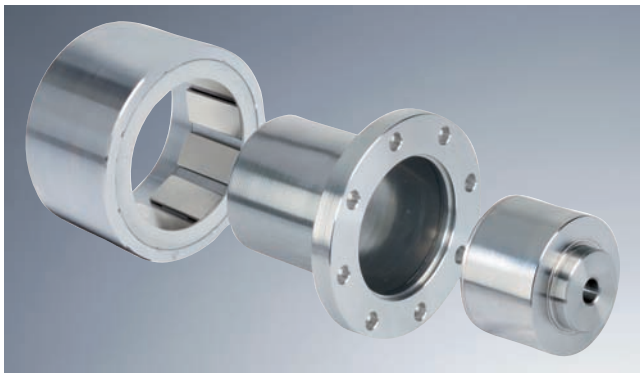
Size	Dimensions [in]											
	External rotor								General			
	Bore [1] d_a		D_{A1}	D_{A3}	L_{A1}	L_{A2}	ΔS	G_A	D_{S6}	D_{A5}	L_{total}	
	min.	max.									min.	max.
SA 22/4		0.438	0.71	1.50	1.38	0.33	0.20	M4	0.93	0.98	1.65	1.65
SA 34/10	0.250	0.563	0.87	2.09	1.52	0.41	0.22	M4	1.42	1.47	1.81	1.95
SA 46/6		0.750	1.18	2.74	2.09	0.63	0.35	M5	1.91	1.94	2.70	2.74
SA 60/8	0.375	1.125	1.97	3.72	2.60	0.75	0.47	M6	2.40	2.49	3.15	3.20
SB 60/8		1.500			3.66	0.59		M8	2.42	2.49	4.13	4.25

1) Inch bores machined to AGMA Class 1, Metric bores machined to H7

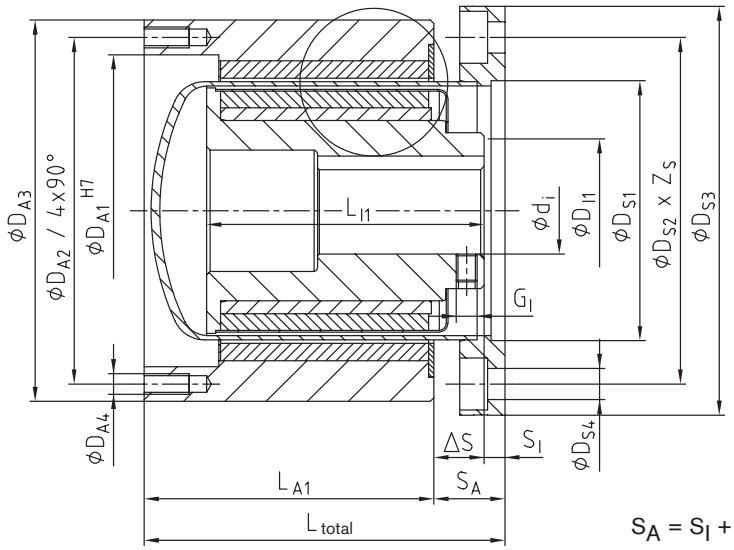
Order form:

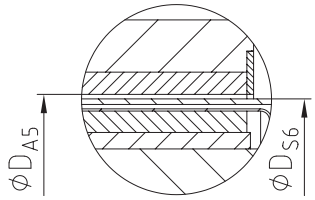
MINEX® SA 60/8	Design	d_i Ø 20	d_a Ø 24
Coupling size	NdFeB – $t_{max.}$ = 302 °F Sm_2Co_{17} – $t_{max.}$ = 572 °F	Bore	

Sizes SA 75/10 to SF 250/38

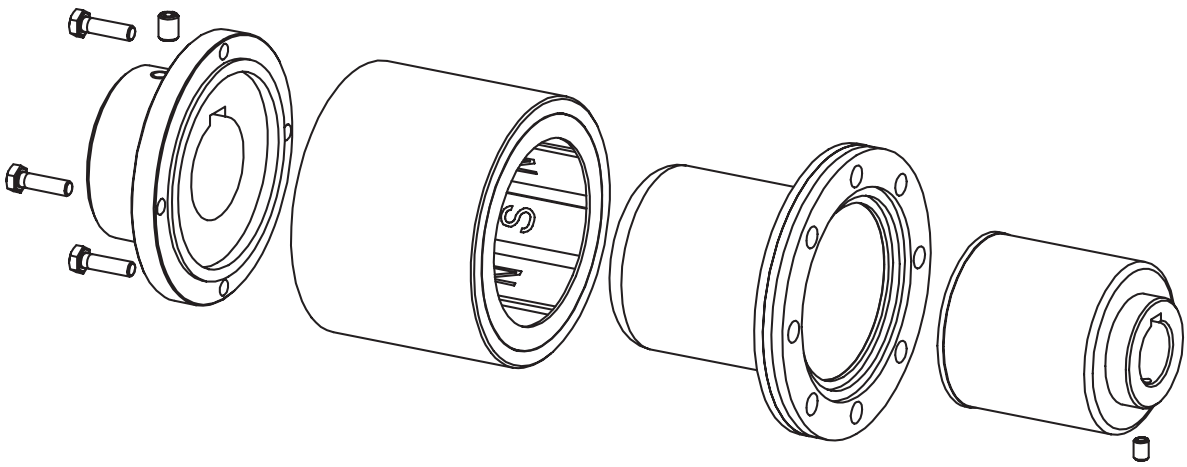


- Magnetic torque transmission
- Hermetically sealed when using shroud
- Samarium-cobalt or neodymium-iron-boron rare earth permanent magnets
- Ⓔx Approved to EC Standard 94/9/EC
- Installation instructions available at www.ktr.com





$S_A = S_I + \Delta S$



Optional flange hub | External rotor | Containment shroud | Internal rotor

Order form:

MINEX® SB 75/10	Design	d_i Ø 20	d_a Ø 24	Containment shroud type
Coupling size	NdFeB – $t_{max.}$ = 302 °F Sm_2Co_{17} – $t_{max.}$ = 572 °F	Bore		Stainless steel 1.4571 or Hastelloy

Technical data – Sizes SA 75/10 to SF 250/38

Technical Data – Internal rotor and containment shroud

Size	Stat. torque $T_{Kmax.}$ @ 68°F [lb-in]	Dimensions [in]											
		Internal rotor							Containment shroud				
		Bore [1] d_i		D_{I1}	L_{I1}	S_I		G_I	D_{S1}	D_{S2}	D_{S3}	D_{S4}	Z_S
		min.	max.			min.	max.						
SA 75/10	89				1.56		1.83						
SB 75/10	212	0.500	1.125	1.77	2.28		1.04	M6	2.95	3.94	4.65	0.35	8
SC 75/10	354				3.15		0.24						
SA 110/16	221				1.77		2.01						
SB 110/16	531	0.563	2.188	2.83	2.56	0.16	1.22	M8	4.33	5.24	6.02	0.35	
SC 110/16	841				3.35		0.43						
SB 135/20	885				2.56		1.83						
SC 135/20	1,283	0.813	2.813	3.54	3.35		1.04	M10	5.31	6.22	7.01	0.35	
SD 135/20	1,770				4.33		0.28						
SC 165/24	1,859				3.35		2.62						12
SD 165/24	2,478	1.000	3.563	4.33	4.33		1.61	M12	6.44	7.56	8.58	0.43	
SE 165/24	3,275				5.12	0.24	0.87						
SD 200/30	3,806			5.12	5.31		0.71	M16	7.87	9.92	10.94	0.43	
SE 200/30	4,868												
SD 250/38	5,930	1.500	3.563		4.53		0.28						
SE 250/38	7,258			6.50	5.31	–	1.02	M16	10.04	11.22	12.40	0.53	
SF 250/38	8,851				6.10		1.81						

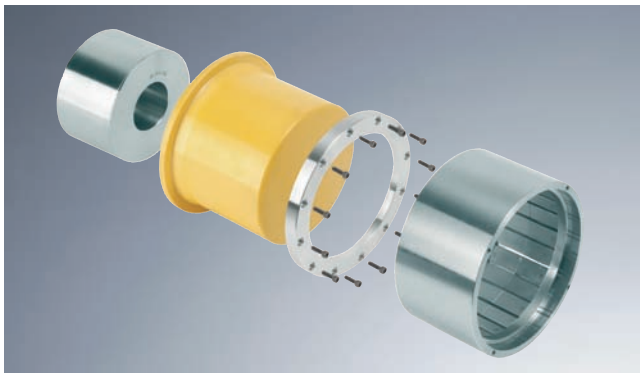
Technical Data – External rotor and general

Size	Dimensions [in]								
	External rotor						General		
	D_{A1}	D_{A2}	D_{A3}	D_{A4}	L_{A1}	ΔS	D_{S6}	D_{A5}	L_{total}
SA 75/10					1.61	0.49			
SB 75/10	3.54	3.54	3.54		2.40		2.94	3.00	4.02
SC 75/10					3.29	0.57			
SA 110/16					1.61				
SB 110/16	4.96	4.96	4.96		2.40	0.75	4.39	4.44	4.53
SC 110/16					3.19				
SB 135/20					2.76	0.73			
SC 135/20	5.91	5.91	5.91		3.54		5.37	5.44	5.47
SD 135/20				M6	4.33	0.87			
SC 165/24					3.54	0.73			
SD 165/24	7.09	7.09	7.09		4.33	0.83	6.57	6.63	6.69
SE 165/24					5.12				
SD 200/30	8.35	8.35	8.35		5.12	1.02	7.80	7.85	7.09
SE 200/30									
SD 250/38					4.33				
SE 250/38	10.51	10.51	10.51		5.12	1.02	9.96	10.04	7.20
SF 250/38					5.91				

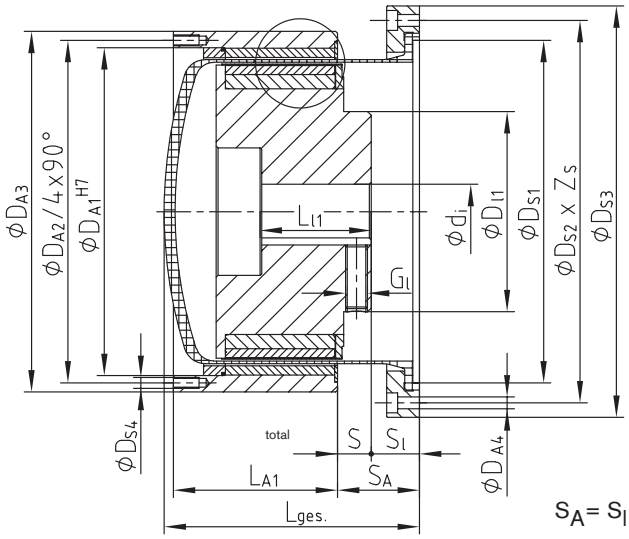
1) Inch bores machined to AGMA Class 1, Metric bores machined to H7

Consult KTR for additional sizes.

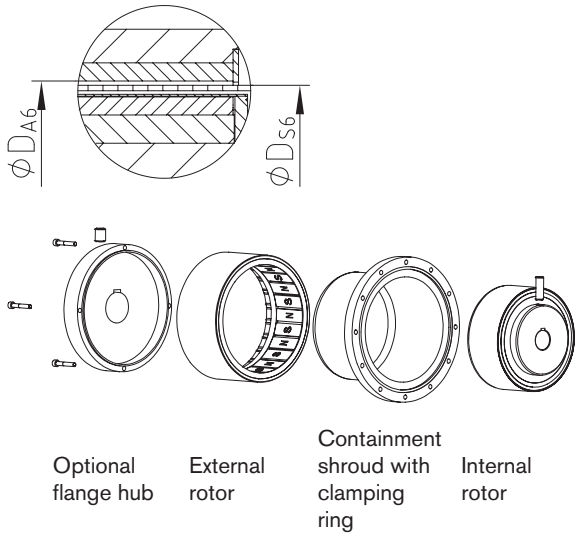
Sizes SB 135/20 to SE 200/30 with stationary ceramic shroud



- Same advantages as the standard MINEX®-S in addition
- Ceramic containment shroud
  - Reduced eddy current losses
  - Reduced heat generations
- Internal cooling typically not needed
- Increase service factor of 10 to 15 %
- Ⓔx Approved to EC Standard 94/9/EC
- Installation instructions available at www.ktr.com



$S_A = S_I + \Delta S$



Optional flange hub | External rotor | Containment shroud with clamping ring | Internal rotor

Technical Data – Internal rotor and containment shroud

Size	Stat. torque TKmax. @68 °F [lb-in]	Dimensions [in]											
		Internal rotor							Containment shroud				
		Bore 1) d_i		D_{I1}	L_{I1}	S_I		G_I	D_{S1}	D_{S2}	D_{S3}	D_{S4}	Z_S
		min.	max.			min.	max.						
SB 135/20	885				2.56		1.83						
SC 135/20	1,283	0.813	2.813	3.54	3.35	0.16	1.04	M10	5.71	6.81	7.36	0.22	12
SD 135/20	1,770				4.33		0.28						
SC 165/24	1,859				3.35	0.14	1.10						
SD 165/24	2,478	1.000	3.563	4.33	4.33	-	0.16	M12	7.40	8.27	8.90	0.26	12
SE 165/24	3,275				5.12	0.24	0.55						
SD 200/30	3,806	1.500	3.563	5.12	5.31	0.24	0.55	M16	9.53	10.71	11.57	0.35	12
SE 200/30	4,868												

Technical Data – External rotor and general

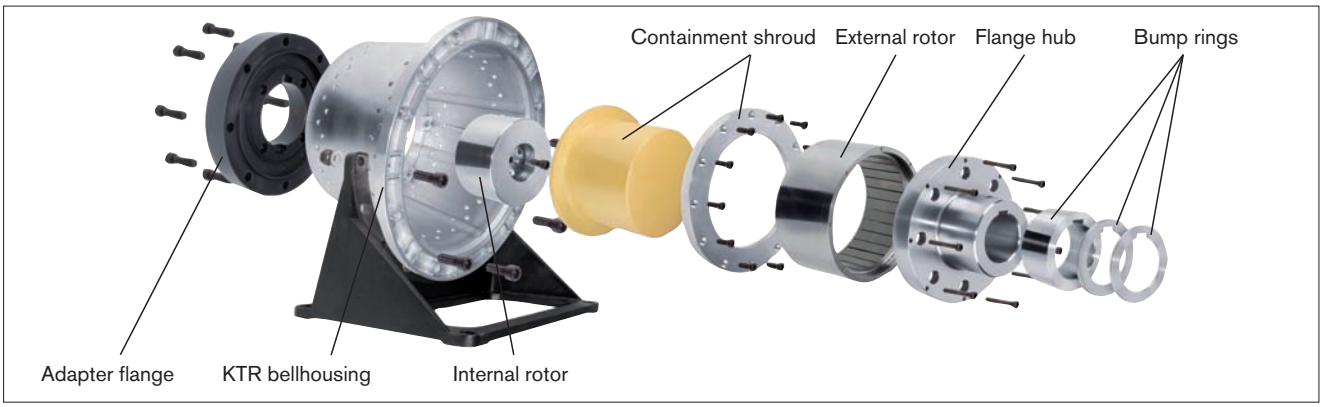
Size	Dimensions [in]								
	External rotor						General		
	D_{A1}	D_{A2}	D_{A3}	D_{A4}	L_{A1}	ΔS	D_{S6}	D_{A5}	L_{total}
SB 135/20					2.76	0.73			
SC 135/20	5.91	6.30	6.69	M6	3.54		5.37	5.44	5.47
SD 135/20					4.33	0.87			
SC 165/24					3.54	0.73			
SD 165/24	7.09	7.40	7.80	M6	4.33		6.57	6.63	6.69
SE 165/24					5.12	0.87			

1) Inch bores machined to AGMA Class 1, Metric bores machined to H7
Further sizes on request.

Order form:

MINEX® SB 135/20	Design	d_i Ø 20	Containment shroud type
Coupling size	NdFeB – $t_{max.}$ = 302 °F Sm_2Co_{17} – $t_{max.}$ = 572 °F	Bore	Oxide ceramics ZrO_2MgO

Mounting sets and customized assemblies



When requested, KTR can offer special customer-specific solutions in combination with hydraulic components from KTR, allowing for retrofitting existing systems with the MINEX®-S.

Redesigning sets for PUR foaming processes

During the supply and proportioning of polyol and isocyanate chemicals for PUR applications, premature reaction may occur when ambient air penetrates into the process, resulting in seal damage or improper mixing.

For reliable sealing, KTR offers standard setups for retrofitting of popular axial piston pumps:

REXROTH A2VK® and **ROTARY POWER C® series** offering the following benefits:

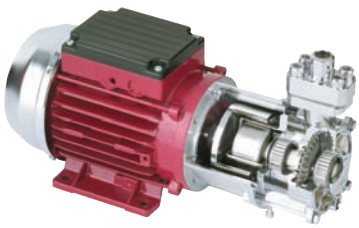
- Reduced maintenance
- Increased operational up-times
- Elimination of pump shaft seals
- Increased efficiency and process safety

The assemblies are available for all motor pump combinations in various materials.

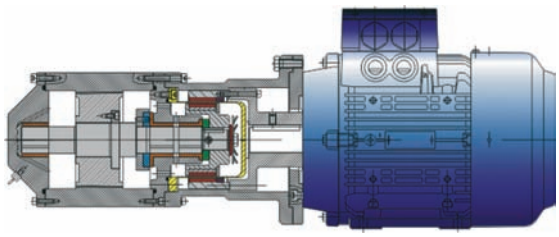
Axial piston pump REXROTH type A2VK®

Maintenance-free sealing of dosing pump for polyde and isocyanate in high-pressure reaction casting machines

Examples of application

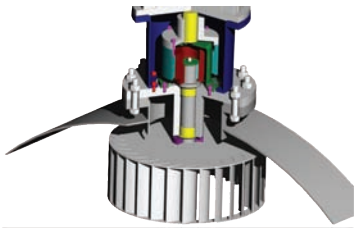


Use of the MINEX®-S in a small centrifugal pumps



MINEX®-S for sealing homogenizers for heavy oil processing in marine operation

Retrofit of a gear pump with MINEX® SA 75/10, bellhousing PK 200/30, base flange and damping rod



MINEX®-S for the separation of autoclaves (T.B.M./STERICHEM) in laboratories and clinics

Technical data for coupling selection/selection of components

Motor type	_____	Pump type	_____
Power	_____ hp	Speedl	_____ rpm
Pressure	_____ bar	Temperature	_____ °F
Viscosity of medium	_____ in^2/s	Max. perm. dimensions	_____ $ØDxL_{total}$