Curved Tooth Couplings
Standard Series
AX-BO® and RAFINEX®

Coupling Selection and Size Determination

Table 1, Service Factor

Machine	Service Faktor K_1 1)	Machine	Service Faktor K_1 1)	Machine	Service Faktor K_1 1)
Excavators		**Wood processing machines**		**Presses**	
Chain bucket excavators	2,0	Debarking drums	1,8	Folding presses	1,8
Travelling gears (caterpillar)	1,8	Planers	1,4	Briquetting presses	2,5
Travelling gears (rails)	1,6	Frame saws	1,4	Eccentric presses	2,0
Suction pumps	1,6	**Steel plants**		Forging presses	2,25
Bucket wheels	1,8	Blast furnace blowers	1,4	Brick moulding presses	2,5
Cutter heads	2,0	Converters	2,0	**Pumps**	
Slewing gears	1,4	Inclined blast furnace elevators	1,8	Centrifugal pumps (thin liquid)	1,25
Winches	1,6	Slag crushers	1,8	Centrifugal pumps (viscous liquid)	1,4
Mining, stones		**Cranes**		Reciprocating pumps (U 1 : 100)	1,8
Crushers	2,24	Luffing gears	1,25	Reciprocat. pumps (U 2: 100-200)	1,6
Rotary kilns	1,8	Traversing gears	1,6	Plunger pumps	2,0
Mine ventilators	2,0	Hoists	1,4	Sludgers	1,4
Vibrators	1,6	Slewing gear	1,4	ELMO-Vacuum pumps	1,5
Chemical plants		Winches	1,25	**Textile machines**	
Agitators (thin liquid)	1,25	**Metal working**		Winders	1,6
Agitators (viscous liquid)	1,6	Press brakes	1,6	Printing and drying machines	1,6
Centrifuges (light)	1,4	Sheet straighteners	1,8	Tanning vats	1,6
Centrifuges (heavy)	1,8	Hammers	1,8	Calenders	1,6
Conveyor plants		Shears	1,6	Opening machines	1,6
Conveyors	1,8	Forging presses	1,8	Weaving looms	1,6
Slatted conveyors	1,6	Stamping machines	1,8	**Compressors**	
Belt conveyors (bulk materials)	1,4	**Mills**		Reciprocat. compress. (U ≤ 1:100)	2,0
Slatted conveyors (piece goods)	1,6	Hammer mills	2,0	Reciprocating compressors	
Pocket belt conveyors	1,25	Ball mills	2,0	(U = 1 : 100 – 200)	1,6
Reels	1,8	Suspended roller mills	2,0	Turbo compressors	1,6
Bucket chain conveyors	1,4	Impact mills	2,0	**Rolling mills**	
Rotary conveyors	1,4	Rod mills	2,0	Sheet metal shears	1,8
Elevators	1,4	Roller mills	2,0	Sheet turning machines	1,6
Bucket type flour elevators	1,25	**Food machinery**		Ingot slab mills	2,0
Lifts	1,8	Fillers	1,25	Block conveyors	1,8
Apron conveyors	1,4	Kneading machines	1,4	Block pushers	2,0
Screw conveyors	1,4	Packaging machines	1,25	Tape and wire reels	1,4
Steel belt conveyors	1,4	Sugar cane crushers	1,6	Descalers	1,6
Redler conveyors	1,4	Sugar cane cutters	1,6	Sheet mills	1,8
Blowers, ventilators		Sugar cane mills	1,8	Plate mills	2,0
Rotary piston blowers	1,4	Sugar beet cutters	1,6	Cold rolling mills	2,0
Blowers (axial and radial)	1,25	Sugar beet washing plants	1,6	Track-type tractors	1,6
Cooling tower ventilators	1,4	**Paper machines**		Billet shears	1,8
Induced draught fans	1,4	Couch presses	1,8	Cooling beds	1,4
Turbo-blowers	1,25	M. G. cylinders	2,0	Transfer skids	1,4
Generators, converters		Beating engines	1,6	Roller tables (light)	1,4
Frequency converters	2,24	Pulp grinders	1,8	Roller tables (heavy)	1,8
Generators	1,4	Calenders	1,6	Roller levellers	1,6
Welding generators	2,24	Wet presses	1,8	Trimming shears	1,4
Rubber and plastics machinery		Opening machines	1,8	End shears	1,8
Extruders	1,6	Agitators	1,8	Looplifters	1,4
Calenders	1,6	Suction presses	1,6	Roller control gears	1,4
Kneader machines	1,8	Suction couch rolls	1,8		
Mixers	1,8	Drying cylinders	2,0		
Rolling plants	1,8				

1) Service factor K_1 for electric motor or turbine drives.
For hydraulic motor or internal combustion engine drives factor K_1 has to be multiplied by 1.1.

Size determination

Condition for continuous power

$$\frac{P_N}{n} \cdot K_1 \leq \frac{P_{KN}}{n} \text{ (kW} \cdot \text{min)}$$

Condition for continuous torque

$$\frac{P_N}{n} \cdot K_1 \cdot 9550 \leq \frac{P_{KN}}{n} \cdot 9550 \text{ (Nm)}$$

P_N = max. contin. power (kW)
n = Operating speed (rpm)
K_1 = Service factor in accordance with Table 1

$\frac{P_{KN}}{n}$ = Power factor in accordance with dim. table (kW · min)

Permissible additional loads:

max. starting load of coupling $= 1{,}5 \cdot P_{KN}$
max. short-circuit load of coupling $= 3 \cdot P_{KN}$

If higher angular or radial misalignments occur in operation, it may be necessary to reduce the max. permissible operating speed.

A further criterion when defining the coupling size is the max. permissible bore diameter. For this reason, the bore must be checked after output-related determination of the coupling. If this bore does not permit mounting of the existing shaft, then a correspondingly larger coupling must be selected.

Important note

The values specified in the dimension tables for the max. permissible bore only apply to key connections if the height of the keyway does not exceed the dimensions in accordance with DIN 6885. Please consult us if the keyway is higher.

The power transmission capacity of the shaft-hub connection has to be verified by the purchaser.

Lubricant Quantities, Radial Misalignment Weights and Mass Moments of Inertia

Lubricant quantities

Depending on design and size, an additional lubricant quantity must be taken into account for curved tooth couplings with spacer. The length L ist the primary determining factor here. The table thus contains the required additional quantities for all sizes of the construction series RAZ.
One value in each case refers to the whole spacer for the length $L = L_{min}$ and other to the partlengths of 10 mm each for $L > L_{min}$.
The values obtained from the table must be added to the coupling values. These are listed for every size in the dimension list No. 243172 on page 6.
On longer spacers, the ends are closed off by plates. In these cases, no additional lubricant filling must be taken into account for the spacers. The length L > 400 mm applies as a guide value for this measure.
If required, smaller spacers may also be closed off by plates. However, this has to be indicated in the order.

1) The dimension L_{min} refers to the shortest possible spacer in accordance with design 2 on page 6.

Coupling type RAZ	Minimum[1) spacer length L_{min}	Grease quantity	
		Spacer with $L = L_{min}$	per 10 mm tube length with $L > L_{min}$
Size	mm	kg	kg
32	25	0,0075	0,003
38	25	0,0013	0,005
48	28	0,017	0,006
60	37	0,026	0,007
75	45	0,086	0,019
95	50	0,16	0,032
125	60	0,21	0,035

Coupling type RAZ	Minimum[1) spacer length L_{min}	Mass moment of inertia		Weight	
		Spacer with $L = L_{min}$	per 10 mm tube length with $L > L_{min}$	Spacer with $L = L_{min}$	per 10 mm tube length with $L > L_{min}$
Size	mm	kgm^2	kgm^2	kg	kg
32	25	0,00047	0,000044	0,44	0,064
38	25	0,00072	0,000078	0,51	0,078
48	28	0,00235	0,00022	0,98	0,13
60	37	0,0066	0,00046	1,8	0,18
75	45	0,019	0,00099	3,5	0,26
95	50	0,048	0,0028	5,4	0,41
125	60	0,124	0,0096	9,0	0,64

Radial misalignment

The maximum permissible static radial misalignment depends on the permissible angular misalignment and on the distance between the tooth centers of both coupling halves. This distance is variable for couplings with spacer or intermediate shaft.
The dimension tables thus do not contain any values for the permissible misalignment.

The following formulae can be used for calculation of these data:

Coupling with spacer

C = Length of coupling half in accordance with type dimension list.

L = Distance between flange surfaces of the spacer.

Series RAZ

$$\Delta_{Kr} = 0{,}013 \cdot (C + L)$$

Couplings with intermediate shaft

L = Overall length of the intermediate shaft, including hub seats.

D = Length of coupling hub in accordance with type dimension list.

Series RAG

$$\Delta_{Kr} = 0{,}013 \cdot (L - 0{,}4 \cdot D)$$

Mass moment of inertia, Weights

The opposite table contains values for the mass moments of inertia and weights of the spacers.

One value in each case refers to the whole spacer for the length $L = L_{min}$ and the other to the partlengths of 10 mm each for $L>L_{min}$.

The overall values for spacers with $L>L_{min}$ can be calculated as follows:

W_{Lmin} = Values for spacer with $L = L_{min}$

W_{10} = Values for 10 mm tube length of spacer

$$W_{tot} = W_{L\,min} + \frac{W_{10} = (L - L_{min})}{10}$$

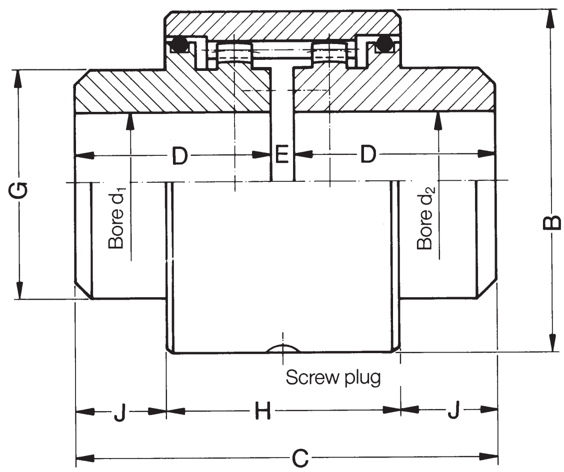
Values for mass moments of inertia or weights can be taken for W accordingly.

Curved Tooth Couplings®

Series AX-BO®

Dimension Table No. 243 170

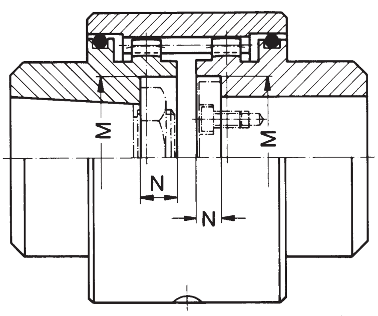
Basic design



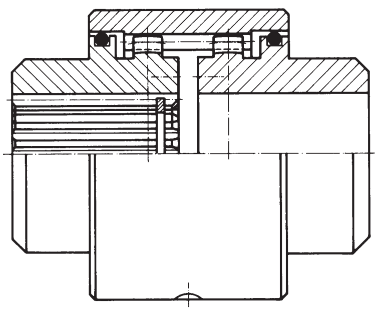
Coupling type RAX Size	Torsional spring rates C_T Nm/rad
24	0,38 · 10^6
32	0,66 · 10^6
38	1,26 · 10^6
48	2,91 · 10^6
60	6,43 · 10^6
75	12,80 · 10^6
95	26,24 · 10^6
125	53,10 · 10^6

The values for torsional spring rate C_T given in the table always apply to the complete coupling in its basic design. The hub bores with the maximum possible diameter (d_1; d_{2max}) were used as basis for calculation.

Other possible designs



Hub with conical bore and nut.
Hub with cylindrical bore and holding plate.



Hub with serrated bore.

Curved Tooth Couplings of series AX-BO® are intended for operation with grease. Mounting and dismounting of the machines has to be effected in axial direction.

1) Refers to a permissible angular misalignment of ΔK_w perm = 0,75° per coupling half.
2) Values of complete coupling for bores d_1; d_{2max}.

Sizes 24 to 125 available ex stock

Subject to alterations which are due to technical process.

Coupling type RAX Size	Norm. cont. duty P_{KN}/n kw · min	Speed $n_{max.}$ min⁻¹	Dimensions Bore d_1: d_2 pre mm	Bore min. mm	Bore max. mm	B mm	C mm	D mm	E mm	G mm	H mm	J mm	M max. mm	N mm	Max. static1) radial misalignment $\Delta K_{r\,max.}$ mm	Total grease quantity kg	Mass moment of inertia 2) kgm²	Weight 2) kg
24	0,011	12500	10	12	24	56	64	30	4	36	44	10	30	To be informed by customer	± 0,21	0,010	0,00025	0,65
32	0,022	10600	10	12	32	70	85	40	5	48	50	17,5	40		± 0,25	0,013	0,0010	1,3
38	0,033	9000	10	12	40	80	105	50	5	57	60	22,5	50		± 0,30	0,02	0,0020	1,8
48	0,08	7500	20	22	52	105	125	60	5	73	72	26,5	63		± 0,35	0,04	0,0065	4,4
60	0,16	6300	20	22	65	130	145	70	5	92	85	30	80		± 0,43	0,06	0,019	7,7
75	0,33	5300	26	28	80	160	166	80	6	115	108	29	100		± 0,55	0,11	0,055	15
95	0,66	4500	30	32	102	200	206	100	6	145	124	41	125		± 0,65	0,25	0,16	26
125	1,32	3750	30	32	130	250	248	120	8	184	150	49	160		± 0,84	0,40	0,45	51

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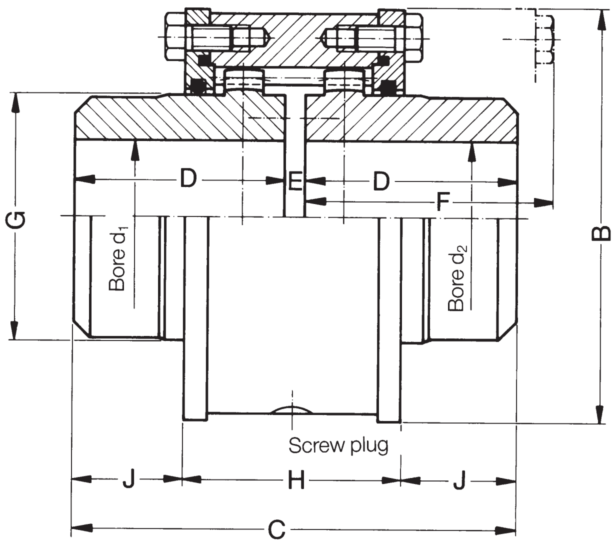
Curved Tooth Couplings

RAFINEX® series RAH

Dimension Table No. 243 171



Coupling type **RAH** Size	Torsional spring rates C_T Nm/rad
32	$0{,}88 \cdot 10^6$
38	$1{,}37 \cdot 10^6$
48	$3{,}17 \cdot 10^6$
60	$7{,}00 \cdot 10^6$
75	$13{,}81 \cdot 10^6$
95	$14{,}60 \cdot 10^6$
125	$59{,}58 \cdot 10^6$

The values for torsional spring rate C_T given in the table always apply to the complete coupling in its basic design. The hub bores with the maximum possible diameter (d_1; $d_{2\,max}$) were used as basis for calculation.

Curved Tooth Couplings of the RAFINEX® series RAH are intended for operation with grease.

Dismounting dimension F is required for vertical installation and removal of machines.

1) Refers to a permissible angular misalignment of ΔK_w perm = 0,75° per coupling half.

2) Values of complete coupling for bores d_1; $d_{2\,max}$.

Sizes 32 to 125 available ex stock

Subject to alterations which are due to technical process.

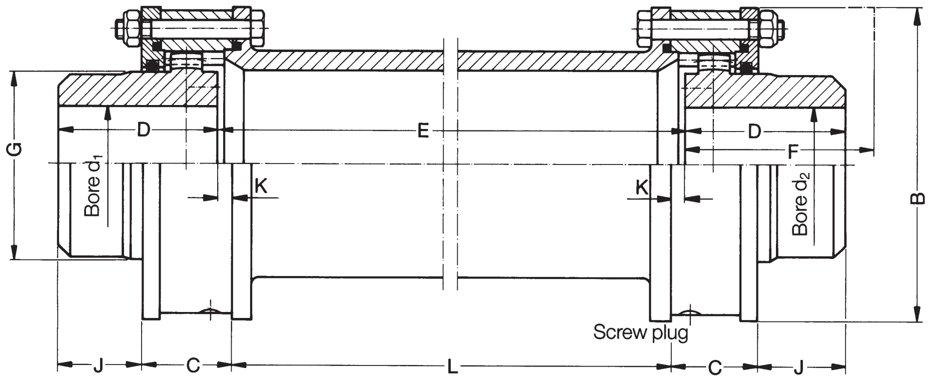
Coupling type **RAX** Size	Norm. cont. duty P_{KN}/n kw · min	Speed $n_{max.}$ min^{-1}	Dimensions: Bore d_1: d_2 pre mm	min. mm	max. mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	J mm	max. static radial misalignment $\Delta K_{r\,max.}$ [1)] mm	Total grease quantity kg	Mass moment of inertia [2)] kgm²	Weight [2)] kg
32	0,022	10600	10	12	32	84	85	40	5	50	48	39	23,0	± 0,25	0,01	0,0012	1,5
38	0,033	9000	10	12	40	94	105	50	5	60	57	48	28,5	± 0,30	0,02	0,0027	2,1
48	0,08	7500	20	22	52	122	125	60	5	70	73	58	33,5	± 0,35	0,04	0,008	4,6
60	0,16	6300	20	22	65	148	145	70	5	80	92	72	36,5	± 0,43	0,06	0,025	8,9
75	0,33	5300	26	28	80	180	166	80	6	90	115	91	37,5	± 0,55	0,1	0,072	17,5
95	0,66	4500	30	32	102	225	206	100	6	115	145	108	49	± 0,65	0,2	0,21	31
125	1,32	3750	30	32	130	280	248	120	8	140	184	136	56	± 0,84	0,4	0,63	59

Curved Tooth Couplings

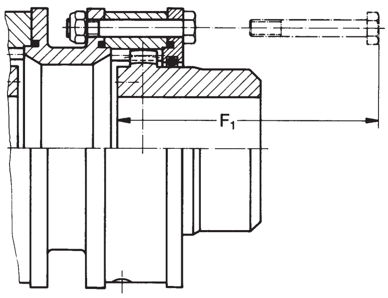
RAFINEX® series RAZ with spacer

Dimension Table No. 243 172

Design 1



Design 2



Dismounting dimensions F and F_1 are required for vertical installation and removal of machines.

The table on page 8 contains information on torsional spring rates of couplings with spacer.

Curved Tooth Couplings of the RAFINEX® series RAZ are intended for operation with grease.

Refer to tables on page 3 for data on additional lubricant quantities and on mass moments of inertia and spacer weights.

The max. permissible static radial misalignment depends on the permissible angular misalignment and on the length of the spacer. The permissible angular misalignment is ΔK_w perm. = 0,75° per coupling half for the RAZ series.

Use formula on page 3 for calculation of the max. permissible static radial misalignment $\Delta K_{r\,max}$.

1) Speed n_{max} depends on the length and weight of the spacer.

2) Values of complete coupling without spacer for bores d_1; $d_{2\,max}$.

Coupling type **RAZ** Size	Minimum length of spacer $L = L_{min}$ Design 1 mm	Design 2 mm
32	55	25
38	60	25
48	70	28
60	90	37
75	110	45
95	125	50
125	150	60

Sizes 32 to 125 without spacer available ex stock.

Subject to alterations which are due to technical process.

Coupling type **RAZ** Size	Norm. cont. duty P_{KN}/n kw · min	Speed[1)] $n_{max.}$ min^{-1}	Dimensions: pre mm	Bore d_1: d_2 min. mm	max. mm	B mm	C mm	D mm	F mm	F_1 mm	G mm	J mm	K mm	L mm	Total grease quantity kg	Mass [2)] moment of inertia kgm^2	Weight [2)] kg
32	0,022	10600	10	12	32	84	19,5	40	50	60	48	23,0	2,5	E- 5	0,01	0,0012	1,45
38	0,033	9000	10	12	40	94	24,5	50	60	70	57	28,5	3	E- 6	0,02	0,0027	2,2
48	0,08	7500	20	22	52	122	30	60	70	80	73	33,5	3,5	E- 7	0,04	0,0079	4,4
60	0,16	6300	20	22	65	148	38,5	70	80	105	92	36,5	5	E-10	0,06	0,025	8,5
75	0,33	5300	26	28	80	180	48	80	90	130	115	37,5	5,5	E-11	0,1	0,074	16,5
95	0,66	4500	30	32	102	225	58	100	115	145	145	49	7	E-14	0,2	0,22	31
125	1,32	3750	30	32	130	280	72	120	140	180	184	56	8	E-16	0,4	0,64	57

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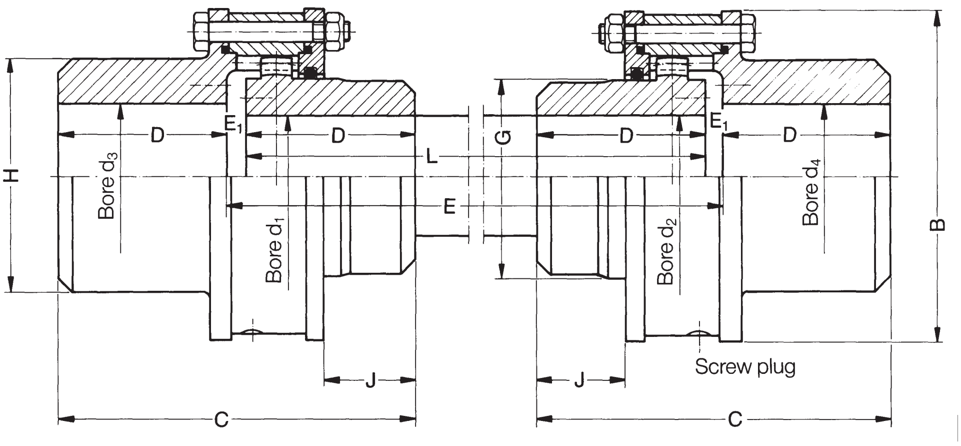
Curved Tooth Couplings

RAFINEX® series RAG with intermediate shaft

Dimension Table No. 243 173



Sizes 32 to 125 without intermediate shaft available ex stock.

Subject to alterations which are due to technical process.

Contrary to couplings with spacer, no minimum lengths are prescribed for intermediate shafts.

The table on page 8 contains information on torsional spring rates of couplings with intermediate shaft.

The max. permissible static radial misalignment depends on the permissible angular misalignment and on the length of the intermediate shaft. The permissible angular misalignment is ΔK_w perm. = 0,75° per coupling half for couplings of the RAG series.

Use formula on page 3 for calculation of max. permissible static radial misalignment $K_{r\,max}$.

Curved Tooth Couplings of the RAFINEX® series RAG are intended for operation with grease.

1) Speed n_{max} depends on length and weight of the intermediate shaft.

2) Values of complete coupling without intermediate shaft for bores d_1; $d_{2\,max}$ and d_3; $d_{4\,max}$.

Coupling type RAG size	Norm. cont. duty P_{KN}/n kw · min	Speed[1] $n_{max.}$ min^{-1}	Dimensions: Bore d_1; d_2 pre mm	d_1; d_2 min. mm	d_1; d_2 max. mm	d_3; d_4 pre mm	d_3; d_4 min. mm	d_3; d_4 max. mm	B mm	C mm	D mm	E_1 mm	G mm	H mm	J mm	Total grease quantity kg	Mass[2] moment of inertia kgm^2	Weight[2] kg
32	0,022	10600	10	12	32	10	12	38	84	85	40	5	48	57	23,0	0,01	0,0020	2,7
38	0,033	9000	10	12	40	10	12	45	94	105	50	5	57	68	28,5	0,02	0,0047	4,2
48	0,08	7500	20	22	52	20	22	60	122	125	60	5	73	88	33,5	0,04	0,015	8,0
60	0,16	6300	20	22	65	20	22	72	148	145	70	5	92	106	36,5	0,06	0,042	15
75	0,33	5300	26	28	80	26	28	92	180	166	80	6	115	135	37,5	0,1	0,123	28
95	0,66	4500	30	32	102	30	32	120	225	206	100	6	145	175	49	0,2	0,37	55
125	1,32	3750	30	32	130	30	32	145	280	248	120	8	184	210	56	0,4	1,03	99

Torsional Spring Rates of Spacers and Intermediate Shafts

Coupling type RAZ Size	Minimum [1)] spacer length L_{min} mm	Torsional spring rates C_{T1} Nm/rad	C_{TR} NM·mm/rad
32	25	0,68 · 10^6	44 · 10^6
38	25	1,09 · 10^6	78 · 10^6
48	28	2,56 · 10^6	221 · 10^6
60	37	5,27 · 10^6	466 · 10^6
75	45	10,32 · 10^6	1004 · 10^6
95	50	12,65 · 10^6	2814 · 10^6
125	60	44,66 · 10^6	6995 · 10^6

Coupling type RAG Size	Torsional spring rates C_T Nm/rad
32	0,11 · 10^6
38	0,16 · 10^6
48	0,36 · 10^6
60	0,76 · 10^6
75	1,65 · 10^6
95	3,05 · 10^6
125	8,21 · 10^6

Values for torsional spring rates C_T for RAH series given in the table on page 5 apply to the complete coupling in its basic design. The hub bore with the maximum possible diameter (d_1; $d_{2\,max}$) was used as a basis for calculation.

In case of couplings with spacer or intermediate shaft, these parts must be taken into account additionally.

Formula for calculation of the overall torsional spring rate for Curved Tooth Couplings, series RAZ, with spacer.

$$C_{T3} = \frac{1}{\frac{1}{C_{T1}} + \frac{L - L_{min}}{C_{TR}}} \text{ (Nm/rad)}$$

1) Dimension L_{min} refers to minimum spacer length in accordance with design 2 on page 6.

Information required for calculation of torsional spring rates of curved tooth couplings with spacer.

C_{T1} = Torsional spring rate of complete coupling, including spacer, for lengths $L = L_{min}$ and bore d_1; d_{2max}.

C_{TR} = Relative torsional spring rate (Value as per table).

C_{T3} = Torsional spring rate of complete coupling, including spacer, for length $L > L_{min}$ and bore d_1; d_{2max}.

Contrary to couplings with spacer, no minimum lengths are prescribed for intermediate shafts. Values in the table indicated under C_{T1} therefore only contain information about the coupling, but do take into account the parts of the intermediate shaft located inside the hub seats.

Diameter d_1; d_2 equivalent to nominal size of coupling.

Formula for the calculation of the overall torsional spring rate for Curved Tooth Couplings, series RAG, with intermediate shaft.

$$C_{T3} = \frac{1}{\frac{1}{C_{T1}} + \frac{1}{C_{T2}}} \text{ (Nm/rad)}$$

Information required for calculation of torsional spring rates of curved tooth couplings with intermediate shaft.

C_{T1} = Torsional spring rate of coupling for bore d_3; $d_{4\,max}$. This contains the values of the intermediate shaft with a diameter corresponding to d_1: $d_{2\,max}$, but only in the area of the hub length D. The data must be calculated additionally for the free part of the shaft.

C_{T2} = Torsional spring rate of the intermediate shaft.

C_{T3} = Torsional spring rate of the complete coupling.

Formula for calculation of the torsional sping rate C_{T2} for the part of the intermediate shaft located outside the hub seats:

$$C_{T2} = \frac{d^4 \cdot G}{(L - 2 \cdot D) \cdot 10185} \text{ (Nm/rad)}$$

G = shear modulus = 7,95 · 10^4 N/mm²

In the area of the hub length D, shaft diameters deviating from d_1; $d_{2\,max.}$ have only an insignificant influence on the overall torsional spring rate of the coupling.

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