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MULTI CROSS FORTE

Highly flexible coupling with progressive torsional stiffness

The MULTI CROSS FORTE is a highly flexible coupling with progressive torsional stiffness. The special characteristic of all MULTI CROSS FORTE couplings is the use of transmission elements, which are alike within the same type series, but their number vary according to the size of the coupling. Therefore it is possible that only three sizes of coupling elements are necessary to cover the complete MULTI CROSS FORTE coupling program with a torque range from 160 Nm to 54000 Nm. The result is a really simple and therefore cost-saving spare parts inventory.

Because of the use of the form-fit bolted elements they can – even with the biggest MULTI CROSS FORTE couplings – easily be assembled or disassembled. The principle of element bolting offers a universal combination to connect parts directly with other mechanical parts with the same connection dimensions.

The most important attributes and advantages of the highly flexible MULTI CROSS FORTE coupling are:

- Very high torsional flexibility with a progressive torsional characteristic line
- High compensation capability of axial, radial and angular misalignment
- Backlash-free torque transmission even for reverse rotation
- High torsional vibration and shock load absorbing capability
- Good removal of heat which may be generated by the damping effect of the coupling
- Easy alignment of the coupling
- Positive fit between transmission element and hub flange to prevent relative movement
- Cost-saving spare parts inventory by use of the same element size within one series type

Technical data

Size of coupling			T_{KN} [Nm]	T_{Kmax} [Nm]	$T_{KW\ (10\ Hz)}$ [1)] [Nm]	Dynamic torsional stiffness $C_{T\ dyn}$ [Nm/rad] 0.25 T_{KN}	0.5 T_{KN}	0.75 T_{KN}	1.0 T_{KN}	Static angular deflection at T_{KN} φ [°]	Relative damping ψ [-]	Maximum speed [rpm]
Type series 5	MCF	53	160	480	53	290	500	650	1100	40°	1.2	4500
	MCF	54	250	750	83	380	670	875	1500	40°	1.2	4500
	MCF	55	500	1500	165	720	1270	1650	2800	30°	1.2	3800
	MCF	56	630	1890	210	900	1600	2100	3600	28°	1.2	3700
	MCF	58	1100	3300	365	1650	2900	3750	6400	22°	1.2	3000
	MCF	510	1600	4800	500	2360	4160	5410	9300	20°	1.2	2800
Type series 6	MCF	65	2500	7500	900	6600	9000	11500	13700	35°	1.2	2300
	MCF	66	4000	12000	1400	11000	14500	18400	22000	27°	1.2	1900
	MCF	68	6300	18900	2200	17000	23400	29700	35500	22°	1.2	1700
	MCF	69	7600	22800	2600	20100	27600	35000	42000	21°	1.2	1600
	MCF	610	10000	30000	3400	26800	36700	46600	55700	18°	1.2	1500
Type series 7	MCF	75	14000	42000	4700	35000	58000	75700	119000	24°	1.2	1350
	MCF	76	20000	60000	7000	50000	83000	108000	170000	21°	1.2	1200
	MCF	78	35000	105000	12000	86700	144000	187000	294000	16°	1.2	1000
	MCF	710	54000	162000	18000	134000	223000	290000	457000	13°	1.2	900

1) Continuous alternating fatigue $\pm T_{KW}$ at f = 10 Hz, for other frequencies f_x apply $T_{KW} \cdot \sqrt{\frac{10}{f_x}}$

Selection of the proper coupling size

The coupling size has to be selected in such a way, that the acceptable coupling load is not exceeded in any operating mode. The coupling size of drives without periodic alternating torque can be selected according to the drive torque, taking into account the respective service factors. Otherwise the selection has to be checked by means of a torsional vibration analysis.

1. Calculation of the nominal **drive torque T_{AN}**:

$$T_{AN}\,[Nm] = 9550 \cdot \frac{P[kW]}{n[rpm]}$$

2. The **nominal torque capacity T_{KN}** has to be at least equal to the drive torque T_{AN} taking into account the safety factors.

$$T_{KN} \geq T_{AN} \cdot S_m \cdot S_t \cdot S_z$$

3. The **maximum torque capacity T_{Kmax}** of the coupling has to be at least equal to the highest torque T_{max} taking into account the temperature factor S_t and the start-up factor S_z

$$T_{Kmax} \geq T_{max} \cdot S_z \cdot S_t$$

4. The **continuous fatigue torque T_{KW}** of the coupling has to be at least equal to the highest fatigue torque T_w, as it occurs within the operating range, subject to frequency and temperature.

$$T_{KW(10Hz)} \geq T_W \cdot S_t \cdot S_f$$

The **frequency factor S_f** allows for the frequency dependence of the permissible continuous fatigue torque $T_{KW\ (10Hz)}$ at the operating frequency f.

$$S_f = \sqrt{\frac{f_X}{10}}$$

Service factors

Load factor S_m

Prime mover	Load factor of the driven machine			
	G	M	S	E
Electric motors, turbines, hydraulics motors	1.25	1.6	2.0	2.8
Combustion engine ≥ 4–cylinder	1.5	2.0	2.5	3.5
G = even load M = medium load			S = heavy load E = extreme load	

Temperature factor S_t

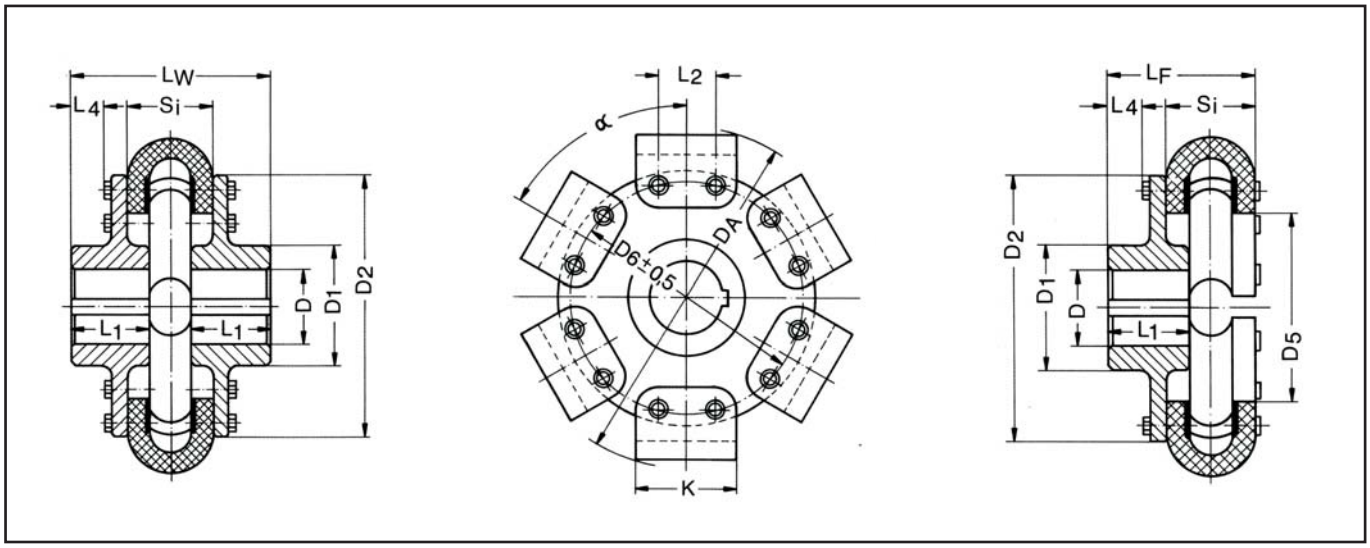
Ambient temperature	-40 °C +30 °C	+40 °C	+60 °C	+80 °C	> +80 °C
S_t	1.0	1.1	1.4	1.8	upon request

Start-up factor S_z

Starts per hour	30	60	120	240	> 240
S_z	1.0	1.1	1.2	1.3	upon request

Dimensions table

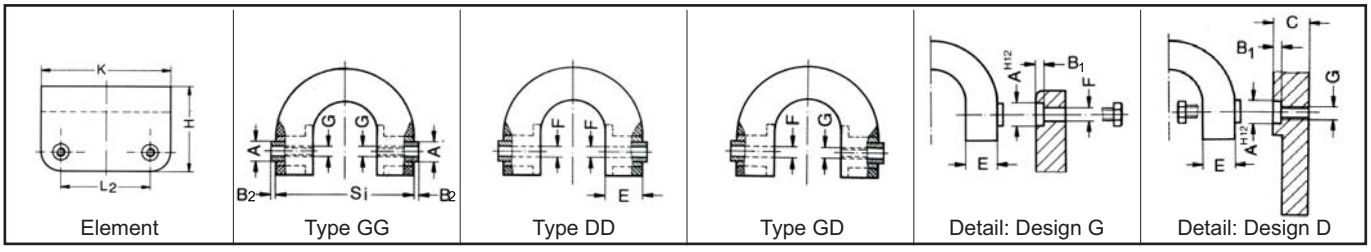
MULTI CROSS FORTE shaft coupling MCF...W **MULTI CROSS FORTE flange coupling MCF...F**



Coupling size	D_a	D min.	D max.	D_1	D_2	D_5	D_6	α°	L_1	L_4	L_W	L_F	S_i	MCF...W total weight[1] [kg]	MCF...W J[1] total [kgm²]	MCF...F total weight[1] [kg]	MCF...F J[1] total [kgm²]
MCF 53	190	unbored, precentered	50	80	120	62	100	120	50	21	155	115	75	4.1	0.0085	2.5	0.0055
MCF 54	190		50	80	120	62	100	90	50	21	155	115	75	4.4	0.009	2.8	0.0064
MCF 55	230		65	105	163	108	143	72	72	23	159	117	75	9.9	0.032	5.7	0.021
MCF 56	238		70	112	172	114	150	60	80	31	175	125	75	11.8	0.043	6.8	0.028
MCF 58	290		75	120	224	168	203	45	90	41	195	135	75	17.8	0.101	10.1	0.065
MCF 510	320		80	130	254	200	234	36	100	53	219	147	75	24.2	0.17	13.6	0.108
MCF 65	390		90	144	270	164	240	72	110	38	246	181	116	35.5	0.31	21.5	0.21
MCF 66	462		100	160	352	249	322	60	122	50	270	193	116	53.8	0.76	31.4	0.50
MCF 68	540	60	120	192	420	319	390	45	145	72	316	216	116	85.6	1.63	48.8	1.05
MCF 69	558	60	120	192	442	340	410	40	165	85	356	236	116	97.3	2.01	55.4	1.30
MCF 610	638	75	140	224	520	422	490	36	165	93	356	236	116	130.4	3.67	72.7	2.32
MCF 75	675	85	155	248	454	280	404	72	180	55	386	293	200	169.6	4.28	107	3.11
MCF 76	750	100	175	280	530	358	480	60	195	70	416	308	200	228	7.58	141	5.45
MCF 78	892	110	190	304	675	507	625	45	222	97	470	335	200	332	17.42	202	12.42
MCF 710	1040	120	215	344	825	660	775	36	245	120	516	358	200	479	35.83	285	24.97

[1] values taken at max. bores

Connection dimensions for attaching the rubber elements



Element | Type GG | Type DD | Type GD | Detail: Design G | Detail: Design D

Type series	A	B_1	B_2	C min.	E	F	G	H	K	L2	M_A [Nm]	Connection bolt for C min. Design G	Design D	
5	11	5 + 0.5	3	17	18	6.6	M 6	56	69	39 ± 0.2	10	M 6 x 30	M 6 x 35	DIN 933
6	18	6 + 0.5	4	24	31	11	M10	97	140	78 ± 0.2	49	M 10 x 35	M 10 x 55	DIN 933
7	33	7 + 0.5	5	33	57	22	M20	173	230	126 ± 0.2	410	M 20 x 60	M 20 x 90	DIN 933

According to the way of the attachment of the elements or the design of the coupling the following element designs have to be distinguished:

Type GG with thread to connect bolts from the outside (for shaft couplings)
Type GD with clearance hole and thread one side (for flange couplings)
Type DD with clearance hole to bolt from inside (for double flange couplings)

Materials of the MULTI CROSS FORTE couplings in standard design

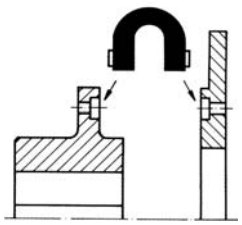
Coupling hub size 53 - 66 grey cast iron grade GG25
size 68 - 710 steel (min. yield strength 360 MPa)

Rubber element natural / synthetic rubber NR-SBR, 60-65 °Shore A with cord reinforcements, permissible ambient temperature up to 80 °C

Mounting instruction and alignment tolerances for MULTI CROSS FORTE shaft and flange couplings

To ensure a proper function of the coupling, the following assembly directions have to be followed:

When the hub or the flange is fitted, the counterbores of the mounting holes for the rubber elements must be on the correct side. (pict. 1)

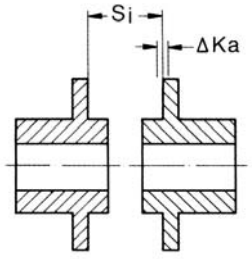


(pict. 1)

It is advisable to align the coupling parts as precisely as possible, even as the MULTI CROSS FORTE coupling permits a relative large shaft misalignment, so that there are more reserves for operational displacements.

After assembly of the coupling, the following measures should be checked with suitable instruments (straight edge, vernier caliper, depth gauge, precision dial etc.) – if possible at four locations, shifted by 90°.

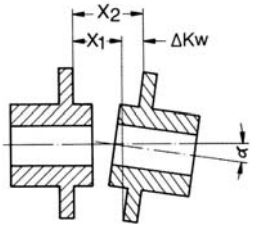
For a speed range of approx. 600 – 1500 rpm, the measured misalignments should not exceed the recommended max. alignment tolerances.



axial alignment

Recommended maximum alignment tolerances

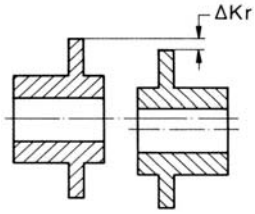
MCF size		53	54	55	56	58	510	65	66	68	69	610	75	76	78	710
Si±ΔKa	[mm]	75±2						116±3					200±5			
ΔKr	[mm]	0.6						1.0					1.5			
ΔKw	[mm]	1.5						2.0					3.0			
α	[°]	0.75	0.6	0.5	0.5	0.4	0.35	0.5	0.4	0.3	0.3	0.25	0.4	0.35	0.3	0.25



angular alignment

Larger shaft misalignments which may occur momentarily are permissible. For equipment with changing shaft misalignments during operation the coupling should be installed with an offset of the permissible misalignment in the opposite direction of the occuring misalignment. If the machine is flexibly supported, a possible baging of the support should be considered during the alignment.

The speed and torque of the system induce an axial force in the coupling which must be absorbed by suitable bearings of the shafts. Information is available upon request.



radial alignment

Assembly of the rubber elements

The assembly of the rubber elements follows the alignment of the coupling halves. Here each element has to be pushed in sequence from the outside so far between the hub flanges, until the guide jackets snap - conclusively to the form - into the counter bores of the hub flanges. After that the bolts must be tightened accordingly to the specified torques.

Safety precautions

It is the customer's and user's responsibility to observe the national and international safety rules and laws. Check all bolted connections for proper fit preferably after the test run.

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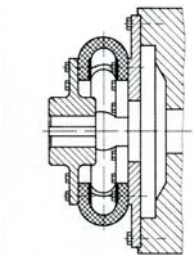
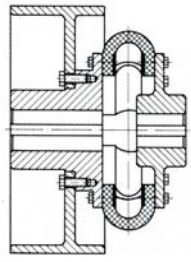
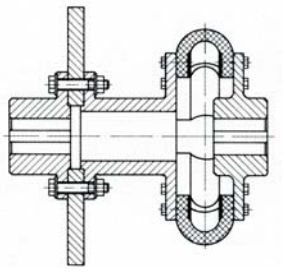
Examples of other design types



flange coupling
MCF...F2



brake drum coupling
MCF...BT



brake disk coupling
MCF...BS

Edition September 2006

This MULTI CROSS FORTE edition supercedes all previous catalogues of this coupling type. All dimensions in millimetres. We reserve the right to change dimensions and / or design details without prior notice.