Reich
KUPPLUNGEN

# 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<br>M = medium load | | | S = heavy load<br>E = extreme load | |

### Temperature factor $S_t$

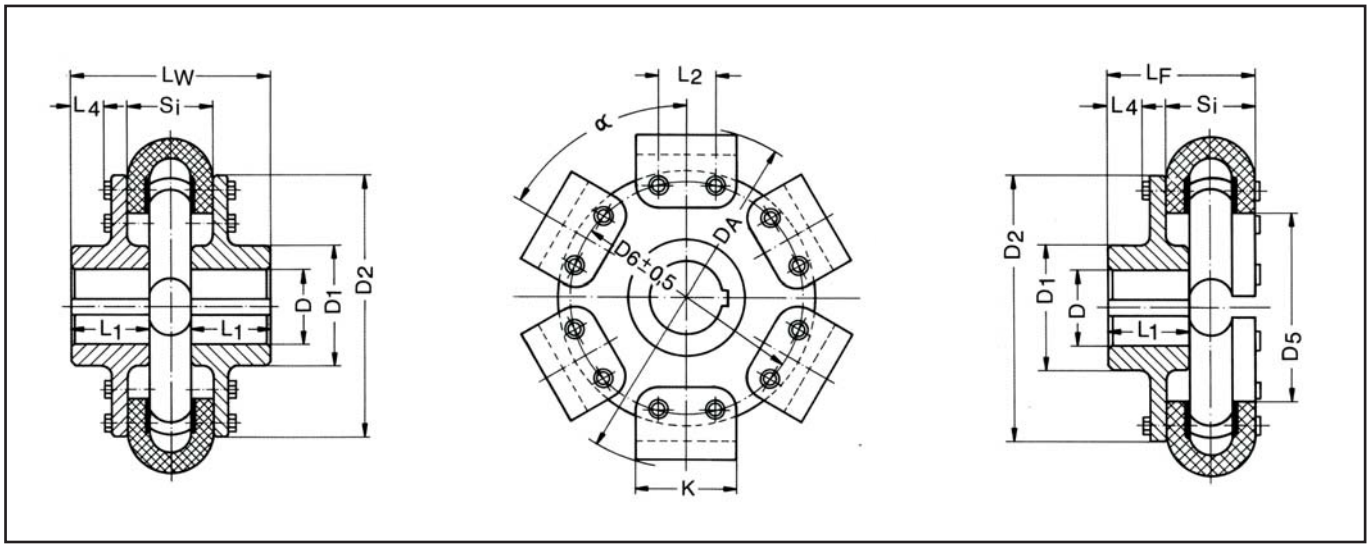
| Ambient temperature | -40 °C +30 °C | +40 °C | +60 °C | +80 °C | > +80 °C |
|---|---|---|---|---|---|
| $S_t$ | 1.0 | 1.1 | 1.4 | 1.8 | upon request |

### 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

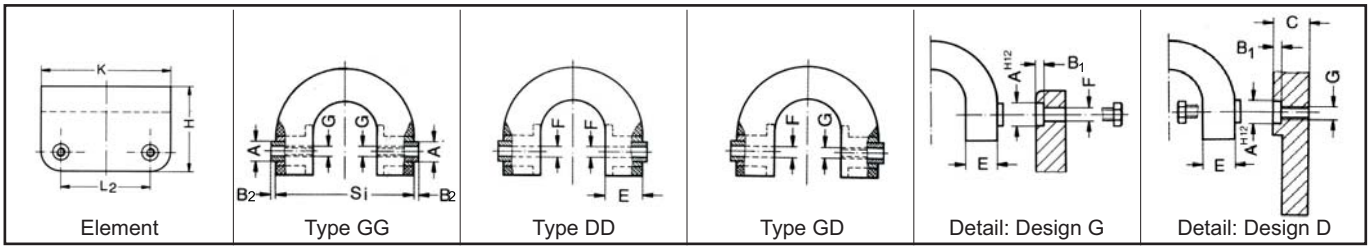
**MULTI CROSS FORTE shaft coupling MCF...W** **MULTI CROSS FORTE flange coupling MCF...F**




| 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

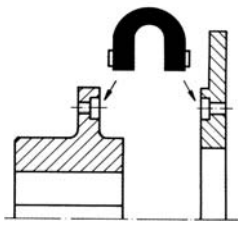
Coupling hub size 53 - 66 grey cast iron grade GG25
size 68 - 710 steel (min. yield strength 360 MPa)

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)

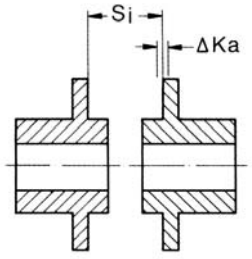


(pict. 1)

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°.

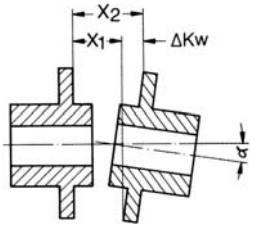
For a speed range of approx. 600 – 1500 rpm, the measured misalignments should not exceed the recommended max. alignment tolerances.




axial alignment

## Recommended maximum alignment tolerances

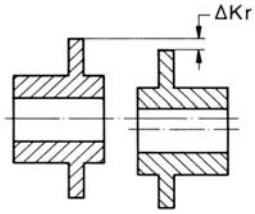
| MCF size | | 53 | 54 | 55 | 56 | 58 | 510 | 65 | 66 | 68 | 69 | 610 | 75 | 76 | 78 | 710 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Si±ΔKa | [mm] | 75±2 | | | | | | 116±3 | | | | | 200±5 | | | |
| ΔKr | [mm] | 0.6 | | | | | | 1.0 | | | | | 1.5 | | | |
| ΔKw | [mm] | 1.5 | | | | | | 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

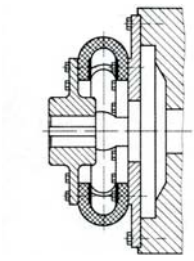
The assembly of the rubber elements follows the alignment of the coupling halves. Here each element has to be pushed in sequence from the outside so far between the hub flanges, until the guide jackets snap - conclusively to the form - into the counter bores of the hub flanges. After that the bolts must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

## Safety precautions

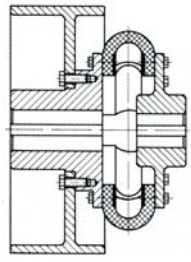
**It is the customer's and user's responsibility to observe the national and international safety rules and laws. Check all bolted connections for proper fit preferably after the test run.**


**Maschinenfabrik**
**Dipl.-Ing. Herwarth Reich GmbH**
P.O.Box 10 20 66
D-44720 Bochum
Vierhausstr. 53
D-44807 Bochum
Tel.: +49 2 34 9 59 16 0
Fax: +49 2 34 9 59 16 16
E-Mail: mail@reich-kupplungen.de
Internet: http://www.reich-kupplungen.de

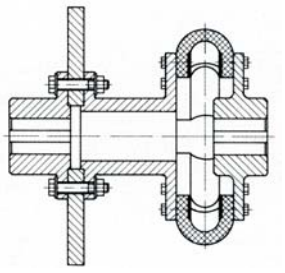

## Examples of other design types



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.*