Electromagnetic multiple-disc clutch Type 521

Lenze SELECTION

Drive elements are our world.

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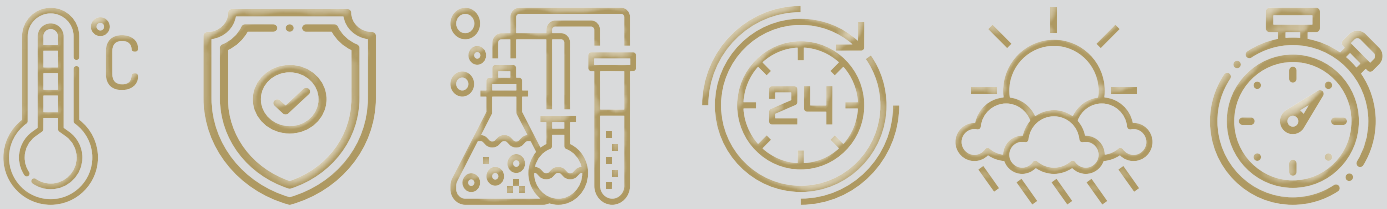
Characteristics and features

- suitable for torque transmission with increasing differential speed between the drive elements
- high torque transfer despite compact dimensions
- designs up to 2100 Nm possible
- high switching frequency due to optimized heat dissipation
- low maintenance due to slip-ring-free power supply and lifetime-lubricated bearings
- negligible wear due to special friction lining
- oil running or dry running
- suitable for applications in harsh environments
- reduced shift speeds due to adapted control



Mönninghoff power transmission represents an infinite variant diversity that is applied by all areas of modern mechanical engineering.

Our technologies are mostly designed to operate under extreme conditions. We offer high precision products for medical robotics, fail-proof security for aerospace technology or synchronization soultions for the packaging or printing industry.

We thus address customers who have the highest standards for their own machines or systems. To them, we can offer highly complex, application-specific solutions.

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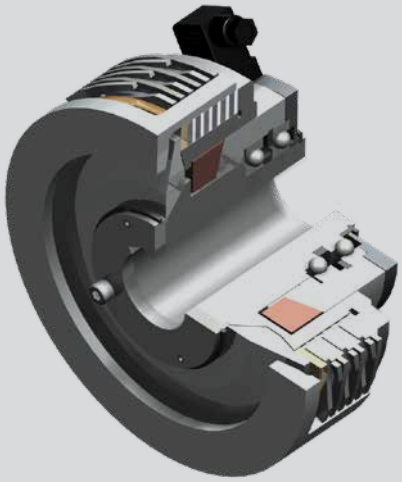
Match code

Mönninghoff multiple-disc clutches are indicated by the following match code:



521 . A . B . C

- **A** clutch size
- **B** operating mode
- **C** length of drive ring

Other individual characteristics:

- voltage
- bore size with keyway

According to these characteristics, we design individual solutions concerning transmitted torque, engaging behavior or rotation speed.

Our engineers can assist with finding an application-specific clutch at any time. Together, we can develop individual and innovative solutions for extreme operating conditions.

Ordering example

Mönninghoff electromagnetic multiple-disc clutch
Type 521.21.1.1

Operating mode	dry running
Voltage	24 Vdc
Bore size d	30 mm H7, keyway acc to. DIN 6885/1

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Clutch size

The selection of the correct size of a Mönninghoff electromagnetic multiple-disc clutch is determined by the requiered torque as well as the shift work.

- According to the required torque

$$M_S \geq M_{erf}$$

- According to the shift work

$$E_h \leq Q_h$$

The clutch must transfer load and acceleration torque (M_L; M_b). The required safety is obtained by using a corresponding safety factor (K).

$$M_{erf} = (M_b \pm M_L) \cdot K$$

$$M_b = \frac{I \cdot \Delta n}{9{,}55 \cdot t} \quad [Nm]$$

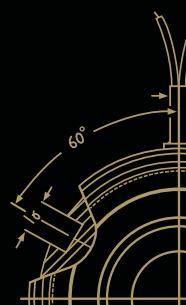
$$Q_h = Q \cdot k_1 \cdot k_2 \quad [Nm]$$

$$E_h = \frac{I \cdot (\Delta n)^2 \cdot Z}{182{,}4} \quad [Nm]$$

If the load and acceleration torque cannot be determined, the required torque can be derived from the driving power, taking the required safety into cosideration.

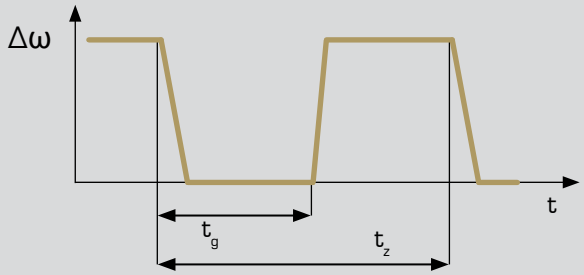
$$M_{erf} = 9550 \cdot \frac{P}{n} \cdot K \quad [Nm]$$

M_{erf}	= required torque	P	= driving power [kW]
M_b	= acceleration torque	K	= safety factor [1,2 to 4]
M_s	= shift torque	I	= moment of inertia [kgm^2]
M_L	= output load torque	Z	= number of shift operations per hour
n	= speed of rotations [min^{-1}]	Q	= amount of heat
Δn	= differential speed of rotations [min^{-1}]	E_h	= shift energy per hour [Nm]
k_1	= correction factor	t	= acceleration time [sec]
k_2	= correction factor		based on t_1



Determination of shift work

The energy that is lost in the clutch depends on the shift curve and the shift frequency. The correction factors for the permissible shift work per hour Q_h can be derived from the tables and graphs.

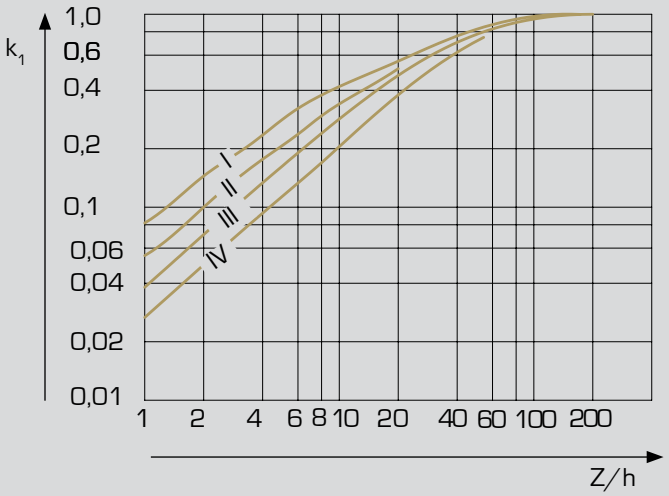


Course of a shift cycle

t_g = time during which the clutch is closed

t_z = total cycle time

Δω = differential angular velocity



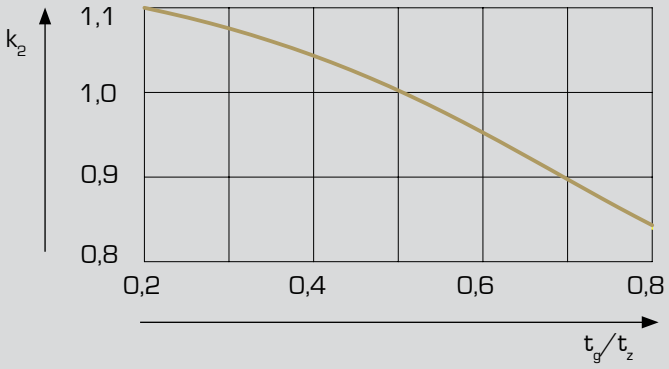
Correction factor k_1 as a function of the shift frequency per hour

I valid for 521.32 - 521.33

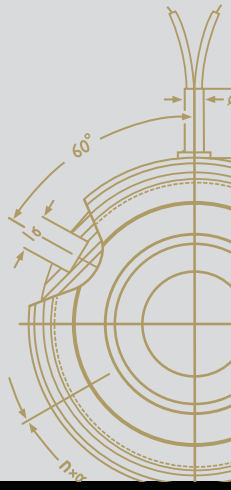
II valid for 521.24 - 521.28

III valid for 521.21 - 521.22

IV valid for 521.16



Correction factor k_2 as function t_g/t_z



Size			16	21	22	24	26	28	31	32	33
Amount of heat Q	dry running: bad ventilation oil lubrication: oil spray	10^6 [Nm/h]	0,43	0,62	0,86	1,2	1,5	1,9	2,3	2,9	4,4
	dry running: good ventilation oil lubrication: oil pray		0,49	0,71	0,99	1,38	1,73	2,19	2,65	3,34	5,06

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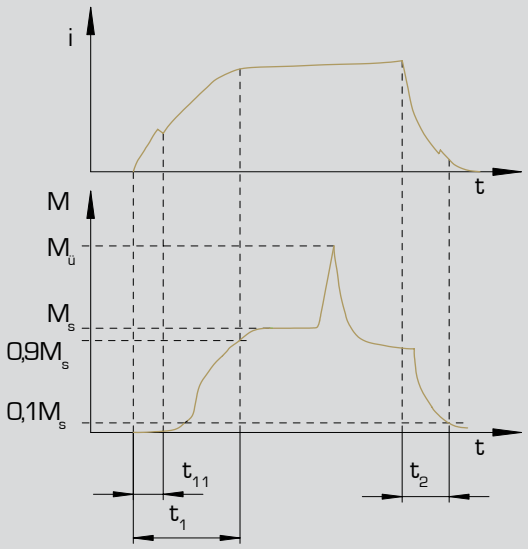
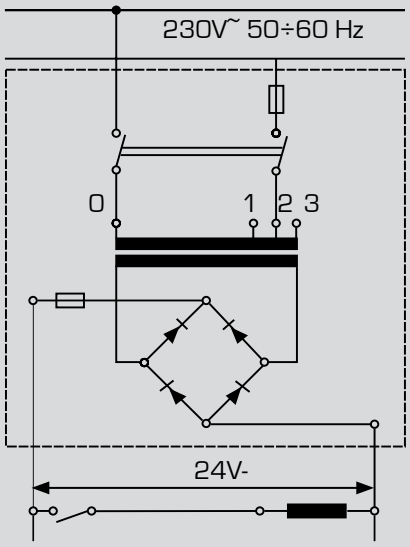
Switching

Electromagnetic clutches are inductances. Engagement and disengagement are subject to the laws of induction, i. e. the induction current increases according to an e-function.



Shift speeds



Shift diagram: normal shifting

- t_1 and t_2 can be electrically influenced by taking appropriate measures
- it is advisable to use direct current for shifting
- when determining the size, the engage time is considered to be approximately 30% of the total acceleration time, which normally results in additional safety

Technical data

Size			16	21	22	24	26	28	31	
shift speeds acc. to VDE 0580:2011-11	t_1	[msec]	130/180	150/210	220/300	340/420	420/500	500/600	650/800	normal excitation for oil and dry lubrication
	t_2		25/30	30/40	30/40	40/60	40/60	40/60	50/80	

i = induction current

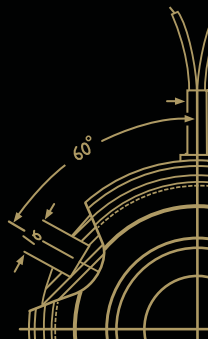
$M_Ü$ = torque to be transferred / static torque

M_S = torque to be shifted

t_1 = engage time

t_2 = disengage time

t_{11} = response delay



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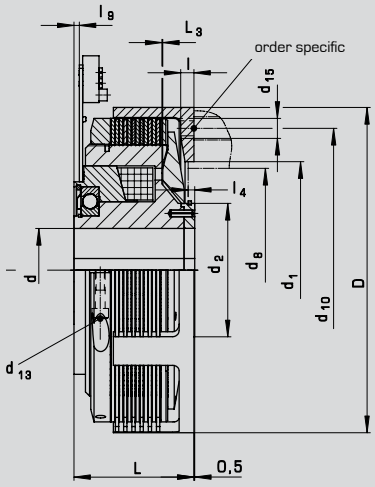
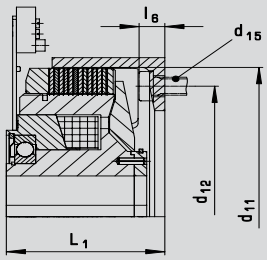
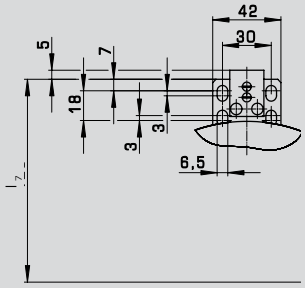
Clutch size



Typ 521._._.1
with normal drive ring



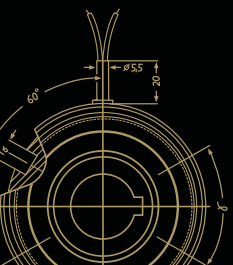
Typ 521._._.2
with long drive ring



spool holder

Technical data

Size				16	21	22	24	26	28	31	32
torque	oil running	M_s dyn	[Nm]	60	100	200	400	600	800	1200	1600
		M_0 stat		72	120	240	480	720	960	1450	1950
	dry running	M_s dyn		80	135	270	540	800	1000	1600	2100
		M_0 stat		105	175	350	700	1050	1300	2100	2700
max. speed	oil running		[min^{-1}]	3000	2500	2500	1500	1500	1500	1000	1000
	dry running			1500	1500	1500	1500	1000	1000	1000	1000
input power			[W]	33	43	61	85	99	111	112	144
inertia	inside		[10^{-3} kgm^2]	3,18	4,7	13,4	24,5	50,3	86,3	140	328
	outside			1,13	3,55	7,83	15,3	25,3	47,3	75	150
weight			[kg]	2,8	5,3	7,5	12	16,5	22	31,5	48
number of plates	inner plate			6	7	7	6	6	6	6	6
	outer plate			6	7	7	6	6	6	6	6
ballbearing DIN 625				16007	16009	16012	16013	16016	16017	16020	16021
bore	min.	Ød H7	[mm]	20	25	30	35	40	50	50	50
keyway acc. to DIN 6885/1	max.			25	35	48	50	65	68	80	85
dimensions		Ø D	[mm]	115	140	166	195	214	240	264	295
		Ø d_1H7		80	100	120	130	155	180	200	225
		Ø d_2		45	52	68	80	85	100	105	115
		Ø d_8		76	96	115	125	148	170	190	215
		Ø d_9		100	110	135	160	190	210	240	260
		Ø d_{10}		100	120	140	170	190	215	240	265
		Ø d_{11}		109	131	155	183	203	228	252	282
		Ø d_{12}		95	115	140	160	180	205	230	255
		Ø d_{13} DIN 6912		M5	M5	M6	M6	M6	M6	M6	M8
		Ø d_{15}		4xM6	4xM8	4xM8	4xM12	4xM12	4xM12	4xM12	6xM16
		Ø d_{16} DIN 6912		M6	M8	M8	M12	M12	M12	M12	M16
		L		53	63	67	73	81	90	101	110
		L_1		60,5	70	76,5	83	91	99	110	122
		L_3		0,3	0,4	0,5	0,5	0,6	0,7	0,7	0,8
		l		5	6	6,5	8	9	10	11	12
		l_4		2,5	3,5	3,5	4,5	4,5	5,5	5,5	6,5
		$l_{6\,max.}$		11	11	15	16	16	16	18	21
		l_7		82	97,5	108	123	132,5	144	158,5	168
		l_9		4	4	4	4	4	4	5	5



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Operating mode

Mönninghoff electromagnet multiple-disc clutches are avaible in two operating modes

- Type 521._.1._ for dry running
- Type 521._.2._ for oil running

To reduce the engage time, fast excitation can be achieved by applying up to three times the rated voltage. When oil is used and particularly if the oil is cooled internally, the rise time can be affected considerably and may double or triple (observe oil instructions).

Use oil with a viscosity up to 25 x 10^{-6} $m^2 \cdot s^{-1}$ by 50 °C (3°E / 50 °C).

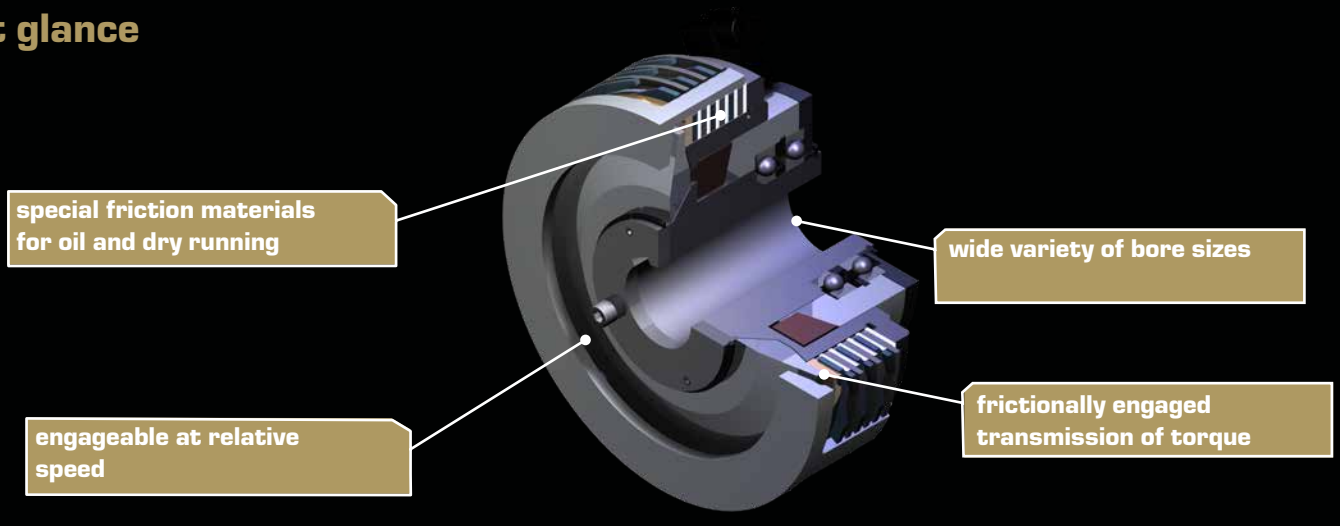
Voltage

- standard voltage is 24 Vdc dirrect current
- special voltages as a example 48 Vdc on request

Technical characteristics

- the positioning of the discs outside the magnetic field permits the use of special friction materials for both oil and dry lubrication
- the expanding springs of the outside discs open the disc stack when the coil is switched off. Consequently, friction and wear in neutral are negligible
- the adjustment of the air gap is easily accessible

At glance



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System solutions

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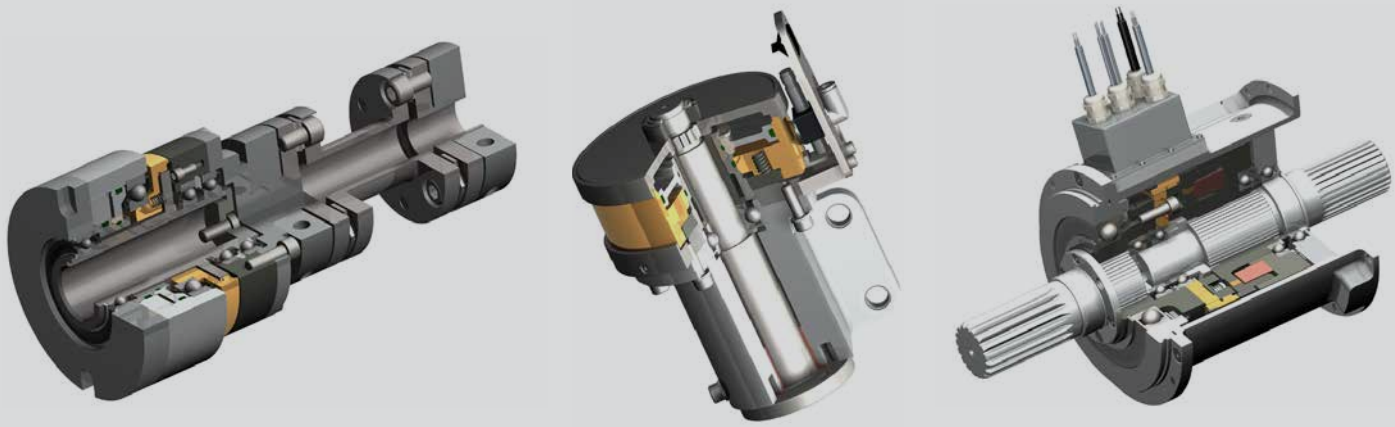
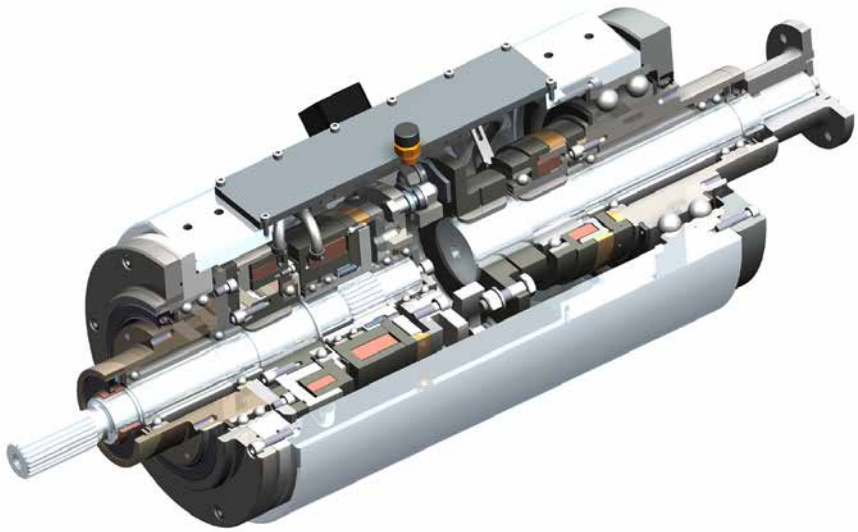
You need more?

Mönninghoff couplings can be combined with a variety of many other power transmission elements. Such complex high-tech systems can solve any application-specific tasks and can fulfill any customer-specific wishes.



In many cases, a combination of different drive elements is needed to solve the applications particular problems and difficulties. Being not just supplier but technological partner to our customers, our extensive engineering is part of extraordinary and challenging power transmission projects.



Our product is the know-how,
with hardware as an added bonus.