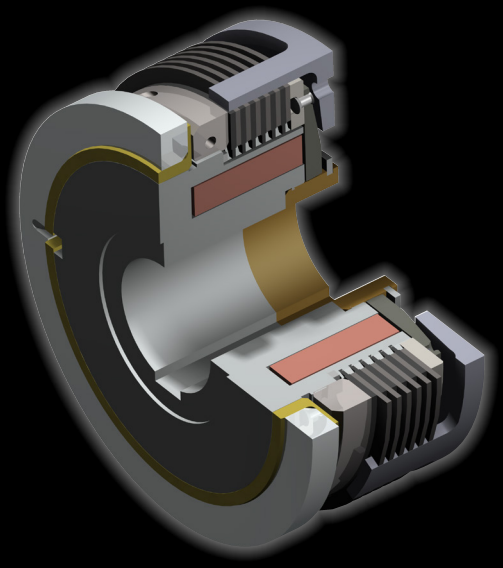
Mönninghoff

Electromagnetic multiple-disc brake Type 532



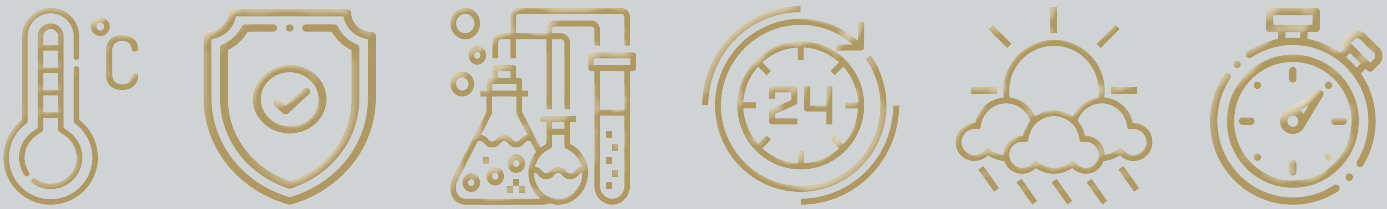
CHAIN & DRIVES®
COMPLETE BEARINGS & POWER TRANSMISSION
POWER > SPEED > TORQUE

Mönninghoff

Electromagnetic multiple-disc brake - Type 532

Characteristics and features

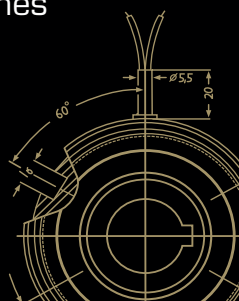
- suitable for torque transmission with increasing differential speed between the drive elements
- high torque transfer despite compact dimensions
- designs up to 3800 Nm possible
- high switching frequency due to optimized heat dissipation
- negligible wear due to special friction lining
- oil running 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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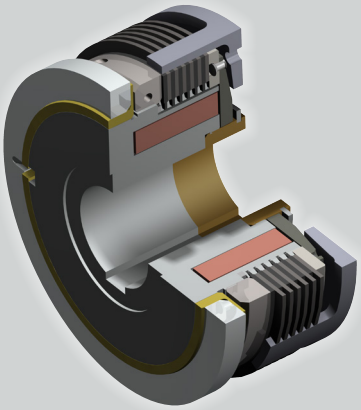
Electromagnetic multiple-disc brake - Type 532

Match code

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



532 . A . B . C

A brake size
B operating mode
C length of drive ring

Other individual characteristics:

- voltage
- bore size with keyway

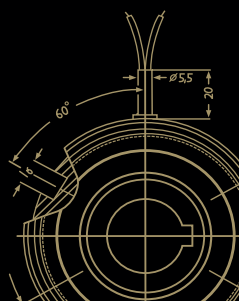
According to these characteristics, we design individual solutions concerning transmitted torque, engaging behavior or rotation speed.

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

Ordering example

Mönninghoff electromagnetic multiple-disc brake
Type 532.21.1.1

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



Electromagnetic multiple-disc brake - Type 532

Brake size

The selection of the correct size of a Mönninghoff electromagnetic multiple-disc brake 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 brake 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.

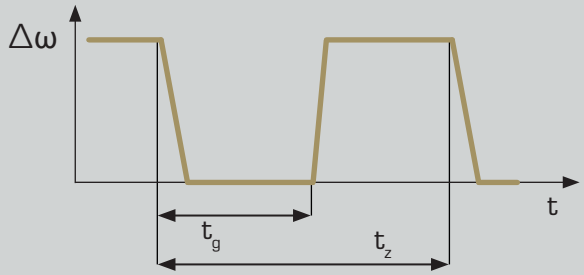
$$M_{erf} = 9550 \cdot \frac{P}{n} \cdot K \quad [Nm]$$

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 [kgm²]
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

Electromagnetic multiple-disc brake - Type 532

Determination of shift work

The energy that is lost in the brake 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.

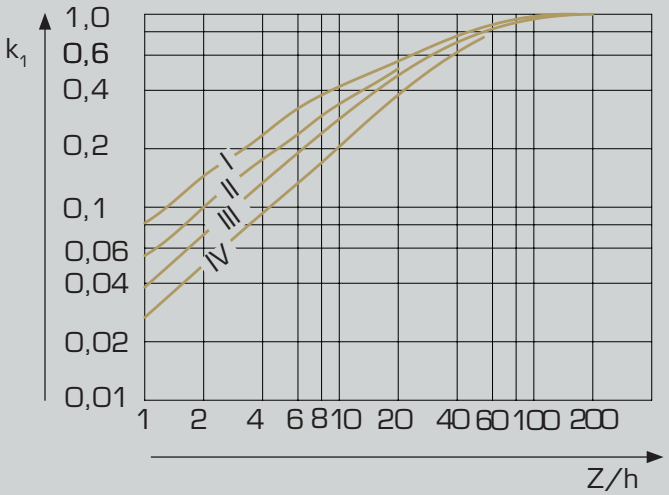


Course of a shift cycle

t_g = time during which the brake is closed

t_z = total cycle time

Δω = differential angular velocity



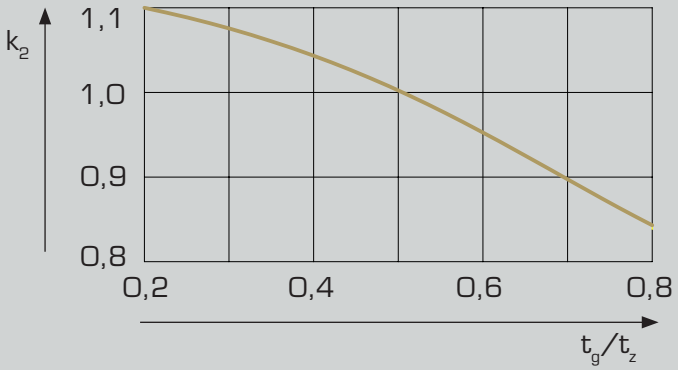
Correction factor k_1 as a function of the shift frequency per hour

I valid for 532.32 - 532.33

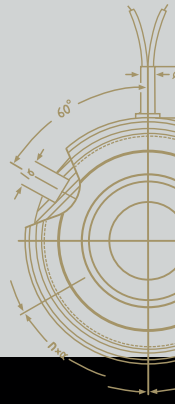
II valid for 532.24 - 532.28

III valid for 532.21 - 532.22

IV valid for 532.16



Correction factor k_2 as function t_g/t_z

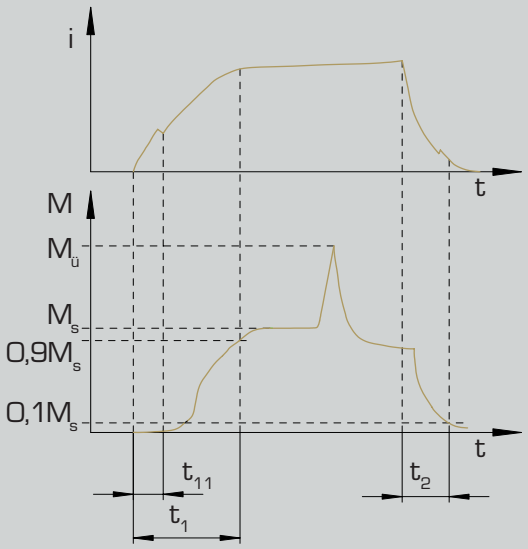


Size			16	21	22	24	26	28	31	32	33
Amount of heat Q	dry running: bad ventilation oil lubrication: oil spray	10^6 [Nm/h]	0,43	0,62	0,86	1,2	1,5	1,9	2,3	2,9	4,4
	dry running: good ventilation oil lubrication: oil pray		0,49	0,71	0,99	1,38	1,73	2,19	2,65	3,34	5,06

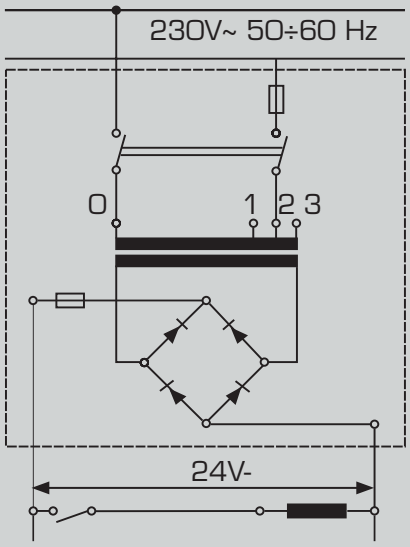
Electromagnetic multiple-disc brake - Type 532

Switching

Electromagnetic brakes 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	32	
shift speeds acc. to VDE 0580:2011-11	t_1 [msec]	120/170	140/200	200/280	310/400	400/480	480/550	600/750	800/1000	normal excitation for oil and dry lubrication
	t_2	30/35	30/40	35/50	40/60	40/60	50/80	50/80	60/100	

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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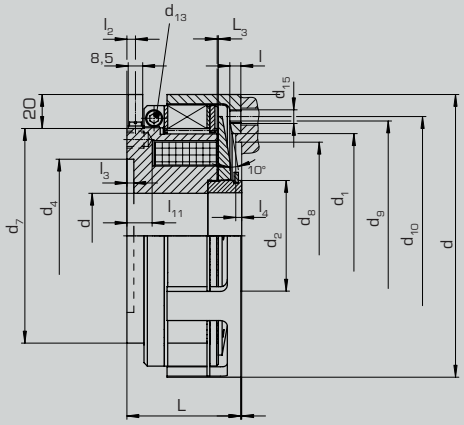
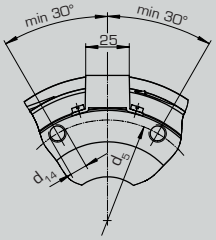
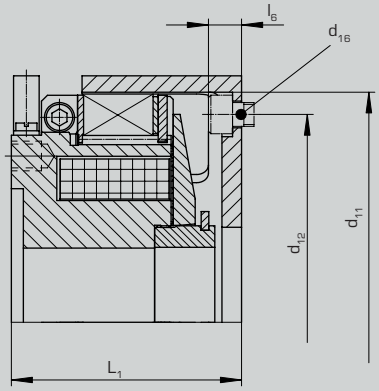
Electromagnetic multiple-disc brake - Type 532

Brake size





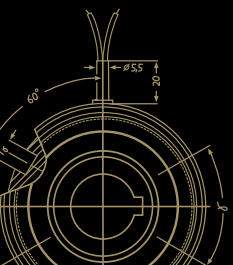


Type 532._._.1
with normal drive ring

Type 532._._.2
with long drive ring

Technical data

Size				16	21	22	24	26	28	31	32	33
torque	oil running	M_s dyn	[Nm]	60	100	200	400	600	800	1200	1600	3000
		M_0 stat		72	120	240	480	720	960	1450	1950	3600
	dry running	M_s dyn		80	135	270	540	800	1000	1600	2100	3800
		M_0 stat		105	175	350	700	1050	1300	2100	2700	4500
max. speed	oil running		[min^{-1}]	3000	2500	2500	1500	1500	1500	1000	1000	750
	dry running			2500	2000	2000	1500	1500	1000	1000	1000	1000
input power			[W]	35	43	63	93	100	122	125	140	120
inertia	outside		[10^{-3} kgm^2]	1,13	3,55	7,83	15,3	25,3	47,3	75	150	350
weight			[kg]	3,1	5,8	8,1	12,8	17,5	23,2	33	50	100
number of plates	inner plate			6	7	7	6	6	6	6	6	6
	outer plate			6	7	7	6	6	6	6	6	6
bore	keyway acc. to DIN 6885/1	d H7		20 - 36	25 - 42	30 - 52	35 - 62	40 - 68	50 - 80	50 - 85	50 - 90	50-120
dimensions		D	[mm]	115	140	166	195	214	240	264	295	375
		d_1H7		80	100	120	130	155	180	200	225	280
		d_2		45	52	65	72	80	95	100	105	152
		d_4 H7 max.		58	75	90	110	120	140	145	160	240
		d_5 max		76	95	115	135	150	170	186	205	264
		d_7		86	108	126	150	166	185	202	225	310
		d_8		76	96	115	125	148	170	190	215	270
		d_9		100	110	135	160	190	210	240	260	310
		d_{10}		100	120	140	170	190	215	240	265	330
		d_{11}		109	131	155	183	203	228	252	282	358
		d_{12}		95	115	140	160	180	205	230	255	320
		d_{13} DIN 6912		M5	M5	M6	M6	M6	M6	M6	M8	M8
		d_{14}		M6	M8	M10	M12	M12	M12	M12	M16	M20
		d_{15}		4 x M6	4 x M8	4 x M8	4 x M12	4 x M12	4 x M12	4 x M12	6 x M16	8 x M16
		d_{16}		M6	M8	M8	M12	M12	M12	M12	M16	M16
		L		53	63	67	73	81	90	101	110	130
		L_1		60,5	70	76,5	83	91	99	110	122	146
		L_3		0,4	0,7	0,8	0,9	1,0	1,0	1,1	1,2	1,2
		l		5	6	6,5	8	9	10	11	12	14
		l_2		5	5	5	5	5	5	5	6	8
		l_3		3	4	4	4	5	5	5	5	5
		l_4		2,5	3,5	3,5	4,5	4,5	5,5	5,5	6,5	6
		$l_{6\ max.}$		11	11	15	16	16	16	18	21	30
		$l_{11\ max}$		9	12	14	15	18	18	20	24	29



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Electromagnetic multiple-disc brake - Type 532

Operating mode

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

- Type 522._.1._ for dry running
- Type 522._.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).

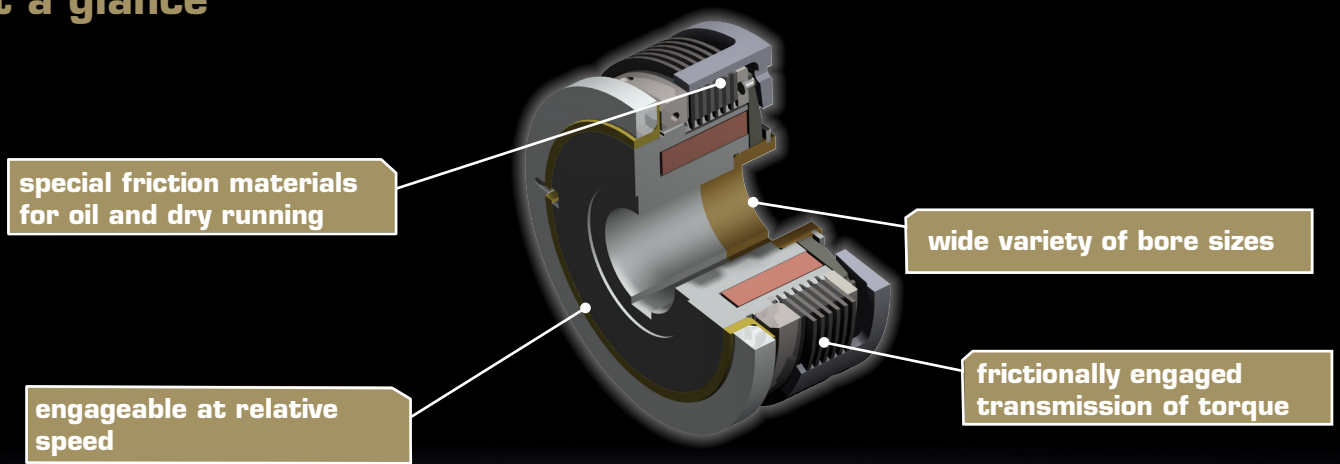
Voltage

- 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

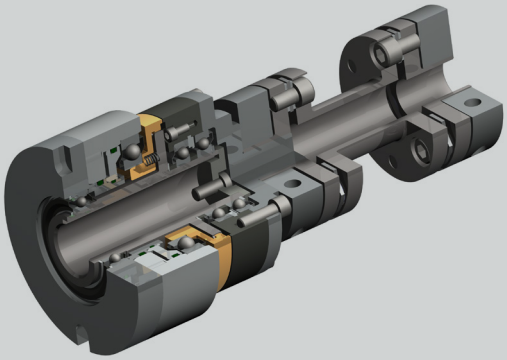
At a glance

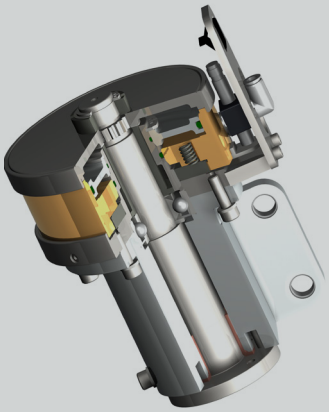


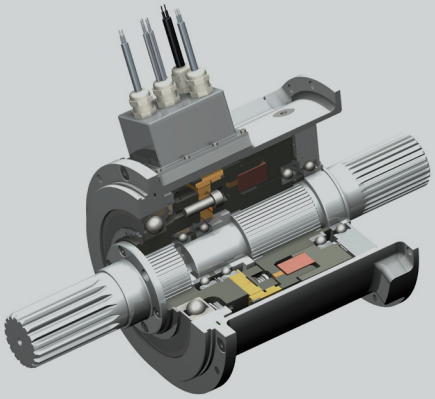
System solutions

You need more?

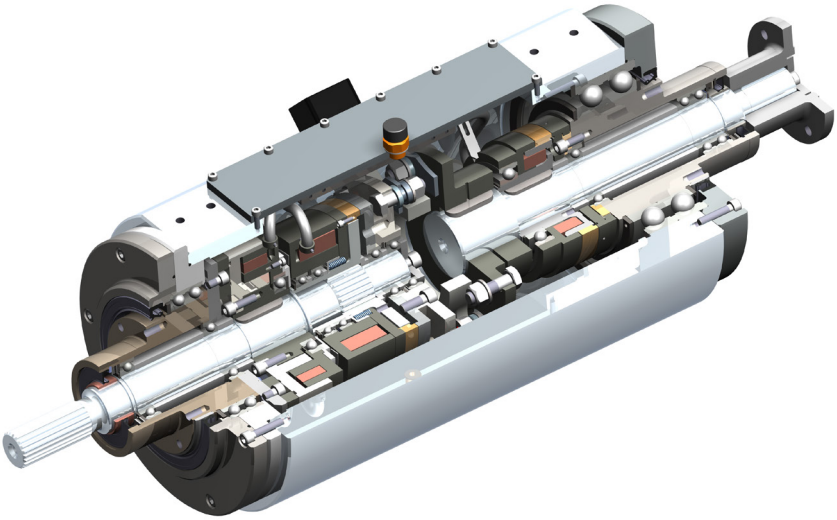
Mönninghoff brakes can be combined with a variety of many other power transmission elements. Such complex high-tech systems can solve any application-specific tasks and can fulfill any customer-specific wishes.



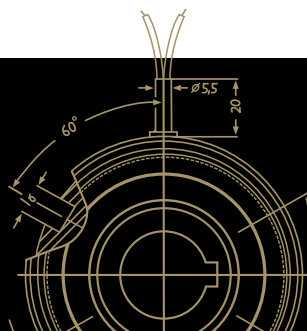




In many cases, a combination of different drive elements is needed to solve the applications particular problems and difficulties. Being not just supplier but technological partner to our customers, our extensive engineering is part of extraordinary and challenging power transmission projects.



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



Mönninghoff

Driven by excellence

Why Mönninghoff

- intensive dialog with our customers engineers
- decades of experience and competence
- deep understanding for all areas of mechanical engineering
- highly modern and flexible machine park
- enthusiasm for quality
- flexibility, inventiveness and communication skills of our employees
- commitment to Germany and Bochum as industrial location

Helps you find a customer-specific power transmission solution for extraordinary circumstances.

For the competent processing and smooth handling of your orders and delivery dates.

Feels committed to protect and preserve the high value of your machine and to secure its availability.

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