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Gear Motor Selection

Bauer has an experienced team of experts available for the dimensioning of EHB carriage drives.

If you give a precise description of the conditions of operation, using our questionnaire (see 14.2), a quote for the best drive for you can be processed as quickly as possible.

For frequently used applications where the drives are supplied from a frequency inverter, however, the selection tables below can be used for rough drive dimensioning.

Procedure for selecting BM-series geared motors

1) Establish the wheel load and running wheel diameter

$F_A = m_A \bullet g$

F_A	[N]	(Wheel load on running wheel)
m_A	[kg]	(Mass acting on the drive wheel)
g	[9,81 m/s²]	Acceleration due to gravity
F_{RN}	[N]	(Maximum permissible radial force at the centre, of the wheel, see table „**permissible radial forces“)**

Selection is baded on the following: $F_A < F_{RN}$

Running wheel diameter d is determined by the plant engineer (preferred diameters: 125 mm, 160 mm, 200 mm, 300 mm). Criteria are wheel load and carriage design, for example.

2) The travelling speed is a further important criterion in the selection tables.
Two setting ranges are available for selection: 1:10 and 1:20. The full range of rated torques up to these frequencies are available. At higher frequencies, the torque decreases as a result of the speed range under field control. As a rule, geared motors with the 1:10 setting range are somewhat quieter in operation and those with the 1:20 setting range have smaller, less expensive motor components. The 1:20 setting range facilitates lower positioning speeds.

$$n_2 = \frac{v}{d \cdot \pi}$$

v	[m/min]	(Travelling speed)
n_2	[1/min]	(Speed at the output shaft)
d	[m]	(Running wheel diameter)

3) Geared motor selection in accordance with the required acceleration torque M_{acc2} (specification: $M_{acc2} > M_{tot}$) and the permissible long-term rated torque M_{N2} (specification: $M_{N2} > M_r + M_h$).
The values for M_{acc2} and M_{N2} are contained in the selection tables. If acceleration torque M_{acc2} is not sufficient, the table usually provides higher values for torques M_{acc2} and M_{N2} at a higher permissible radial force F_{RN}.

Torque from rolling friction [Nm]:

$$M_w = F_w \cdot \frac{d}{2} = m \cdot f_w \cdot \frac{d}{2}$$

Lift on gradient: [Nm]:

$$M_h = m \cdot g \cdot \sin\alpha \cdot \frac{d}{2}$$

Acceleration torque [Nm]:

$$M_a = m \cdot a \cdot \frac{d}{2} = m \cdot \frac{v}{t_a} \cdot \frac{d}{2}$$

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Total torque required during acceleration [Nm]:

$\mathbf{M_{tot} = M_W + M_h + M_a}$

M_{acc2} = Torque [Nm] available at the output shaft during acceleration

M_{N2} = Torque [Nm] available at the output shaft during continuous operation.

d	[m]	(Running wheel diameter)
m	[kg]	(Moving mass)
f_W	[N/kg]	(Rolling resistance form rolling friction per 1000 kg , guide value approcimately ca. 200 N / 1000 kg = 0.2 N/kg)
F_W	[N]	(Rolling resistance from rolling friction)
v	[m/s]	(Maximum travelling speed)
t_a	[s]	(Run-up time)
a	[m/s²]	(Acceleration, standard values approximately 0,3 m/s²...1 m/s²)
α	[°]	(Angle of inclination)

4) Establishing the brake size in the brake selection table.

Choose a brake which can be fitted externally and then select the required braking torque.

Guide value for braking torque on the forizontal $M_{br1} = 0{,}9 \cdot M_{N1}$.

Total load and rotor at the moment of inertia at the rotor shaft [kgm²]

$\mathbf{J}_{tot1} = \mathbf{J}_{Last1} + \mathbf{Jr}_{ot}\ (+\mathbf{J}_{SL})$ (**J**$_{SL}$, with heavy cast-iron fan impeller)

Load at the moment of inertia at the rotor shaft [kgm²]

$$J_{Last1} = m \cdot \frac{\left(\frac{d}{2}\right)^2}{i^2} \text{ oder } J_{Last1} = 91{,}2 \cdot m \cdot \frac{v^2}{n_1^2}$$

Braking time [s]:

$$t_{br} = \frac{J_{tot1} \cdot n_1}{9{,}55 \cdot M_{br}}$$

n1	[1/min]	Rotor shaft speed
M_{br}	[Nm]	Brake torque of the mechanical brake

$$a_{br} = \frac{v}{t_{br}}$$

Rate of deceleration [m/s²]:

v	[m/s]	Travelling speed
a_{br}	[m/s²]	Rate of deceleration

The calculated rate of deceleration abr is a guide value which is exceeded somewhat in practice since the rolling resistance and level of efficiency are not taken into account.

d	[m]	(Running wheel diameter))
m	[kg]	(Moving mass)
i		Gear reduction ratio
v	[m/s]	Travelling speed
n_1	[1/min]	Rotor shaft speed
J_{rot}	[kgm²]	Moment of inertia of the rotor at the rotor shaft from the motor table
J_{SL}	[kgm²]	Moment of inertia of the heavy cast-iron fan from the motor table

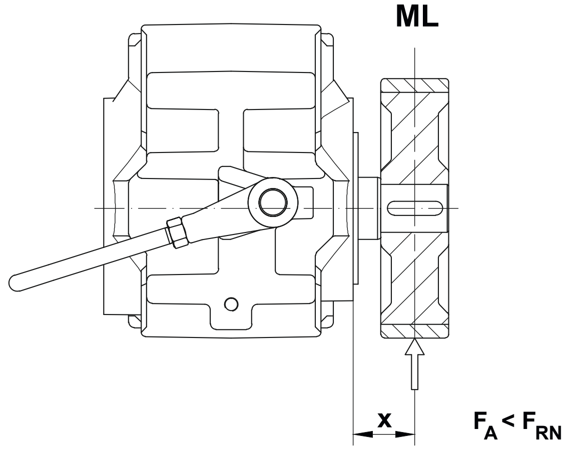
5) Compare the dimensional drawing of the geared motor with the carriage design, and determine the position of the terminal box.

6) Compare the electrical data of the motor (IN und Iacc) with the data of the inverter supplied.

Permissible radial forces

d_{Wheel} in mm	F_{RN} in N	Gear unit type	D_{Shaft} in mm
125	4400	BM09	20
125	6500	BM09X	25
125	8000	BM10	25
160	6500	BM09X	25
160	8000	BM10	25
200	8000	BM10	25
200	10000	BM10X	25
200	10000	BM20	30
200	12000	BM20X	30
200	12000	BM30(Z)	35
200	15000	BM30(Z)X	35
250	15000	BM30(Z)	35
250	20000	BM40(Z)	55
300	20000	BM40(Z)	55
300	25000	BM40(Z)X	55

Definition of force on wheel



Dimension x, see related drawing

Abbreviations in the selection tables:

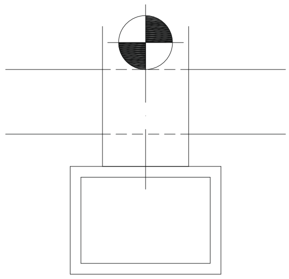
v	Travelling speed of the wheel diameter at a synchronous speed
i	Gear reduction ratio
M_{acc2}	Acceleration torque at the output shaft
M_{N2}	Permissible permanent load torque at the output shaft between 30 and 50 or 30 and 87 Hz in inverter duty
I_{acc}	Acceleration current (must be produced by the inverter)
I_L	Required current in inverter duty with $M_L = M_{N2}$
P	Rated output
n_2	Rated speed of the output shaft on a 50 Hz system
F_{RN}	Permissible radial force at the centre of the wheel (see dimension diagram)
d_{Wheel}	Running wheel diameter
d_{AW}	Output shaft diameter

Gear Motor Selection

Project planning advice

Carriage design

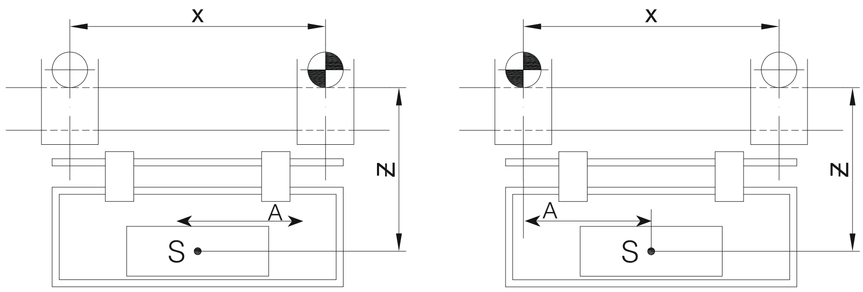
Prinzip „X/X“ = „/“ (Please enter principle used)
Prinzip „1/1“: One running wheel / one driven wheel



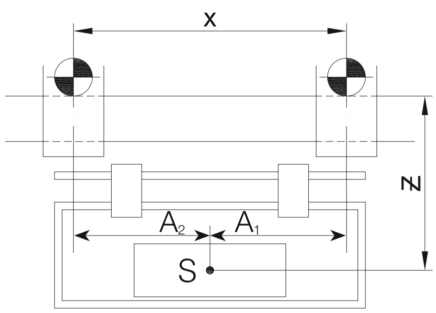
Legend:

S	Load centre of gravity
Z	Distance from rail to load centre of gravity
X	Distance between running wheels
Y	Distance between pivot joints
A, A1, A2	Distance from middle of running wheel to centre of gravity
	Driven wheel
	Non-driven wheel

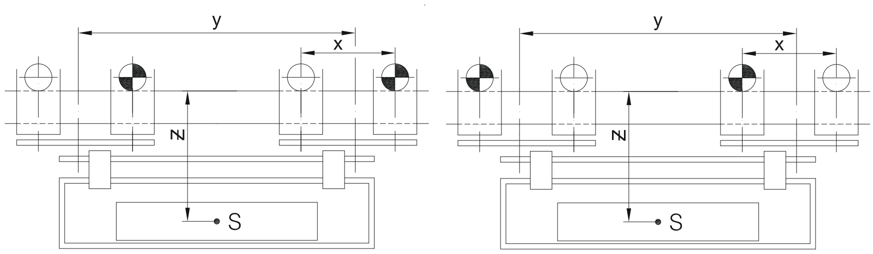
Prinzip „1/2“: Two running wheels / one driven wheel



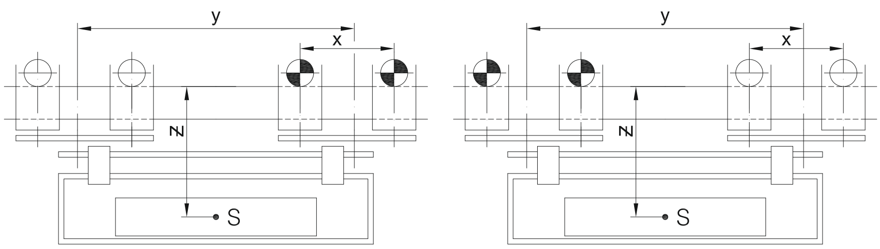
Prinzip „2/2“: Two running wheels / two driven wheels



Prinzip „1/4“: four running wheels/with one driven wheel per trolley



Prinzip „2/4“: four running wheels/two driven wheels per trolley



Note, „Principle 2/2“ and „Principle 2/4“ both involve carriages with two drives. Particular attention must be paid to cornering in such cases since different speeds will be present on the two drives when entering and exiting the corner; in practice this is resolved by the different motor slip on the two drives. This can cause considerable additional loading on the gear unit and motor, particularly where curves are tight and there are large distances between the drives wheels.

Please provide a sketch of your own principle here:

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A REGAL REXNORD BRAND

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Information
Company: ____________________
Contact person: ____________________
Phone: ____________________
Email: ____________________

Questionnaire for geared motor selection

Gearbox type

☐ BM
Electric overhead conveyors

Number of items:						
Country of operation:						
Trolley construction						
Trolley construction	☐ 1/2	☐ 2/2	☐ 1/4	☐ 2/4	☐ Sonder	
Dimensions	X	[mm]	Y	[mm]	Z	[mm]
	A	[mm]	A1	[mm]	A2	[mm]
Operating Conditions						
Installation height (above sea level)		[m]				
	min	[°C]	max	[°C]		
Mains voltage		[V]	Mains frequency			[Hz]
Regulations						
Further information						

Technical data - drive					
Trolley mass		[kg]	Suspension gear mass		[kg]
Gear motor mass		[kg]	Transport load mass		[kg]
Wheel load of the driving wheel		[N]			
Radial force on the main shaft		[N]	Distance from shaft collar of...		[mm]
Axial force on the main shaft		[N]	Bogie wheel diameter	d	[mm]
Bogie wheel material		[--]	Minimum curve radius		[m]
Angle of the sharpest curve		[°]	Total track length		[m]
Horizontal travel					
Travel velocity	max	[m/min]	Duty cycle		[%]
Number of start-ups per hour		[--]			
Travel velocity	min	[m/min]	Duty cycle		[%]
Number of start-ups per hour		[--]			
Travel through curves					
Travel velocity	max	[m/min]	Duty cycle		[%]
Number of start-ups per hour		[--]			
Travel velocity (curve)	min	[m/min]	Duty cycle		[%]
Number of start-ups per hour		[--]			
Desired acceleration		[m/s²]	Desired deceleration		[m/s²]
Permissible braking distance during operation		[mm]	Requisite stopping accuracy		[mm]
Permissible braking distance for emergency stop		[mm]	Number of start-ups per hour		[--]
Coupling	☐ manual coupling		☐ mechanical coupling		
Coupling and uncoupling possible while loaded	☐ YES	☐ NO			

▶

Technical data - ascent			
Ascent	[°]	Length of inclined track	[m]
Travel velocity	[m/min]	Duty cycle	[%]
Number of start-ups per hour	[--]	Desired acceleration	[m/s²]
Desired deceleration	[m/s²]	Permissible braking distance during operation	[mm]
Requisite stopping accuracy	[mm]	Permissible braking distance for emergency stop	[mm]
Number of start-ups per hour	[--]	Ascent assistance available ☐ YES ☐ NO	
Surface pressure	[N]		
Technical data - descent			
Descent	[°]	Length of declined track	[m]
Travel velocity	[m/min]	Duty cycle	[%]
Number of start-ups per hour	[--]	Desired acceleration	[--]
Desired deceleration	[m/s²]	Permissible braking distance during operation	[mm]
Requisite stopping accuracy	[mm]	Permissible braking distance during emergency stop	[mm]
Number of start-ups per hour	[--]	Ascent assistance available ☐ YES ☐ NO	
Surface pressure	[N]		
Further drive versions			
Mechanical brakes ☐ YES ☐ NO			
Manual release ☐ YES ☐ NO			
Brake supply voltage	[V]		
Brake rectifier ☐ on trolley control panel ☐ in terminal box			
Brake switching ☐ AC ☐ DC		Motor protection ☐ PTC ☐ thermostat	
Motor connection ☐ terminal box ☐ connector			
Main shaft			
Dimensions dlx	[mm]	Model ☐ with keyway ☐ without keyway	
Construction	[--]	Terminal box position	[--]
RAL tone paint (Bauer-Standard RAL 7031)	[--]		

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