



4 Project Planning for Variable Speed Drives

4.1 Additional documentation

In addition to the information in this catalog, SEW-EURODRIVE offers extensive documentation covering the entire topic of electrical drive engineering. These are mainly the publications in the "Drive Engineering - Practical Implementation" series as well as the manuals and catalogs for electronically controlled drives.

You will find additional links to a wide selection of our documentation in many languages for download on the SEW-EURODRIVE homepage (<http://www.sew-eurodrive.com>). The list below includes other documents that are of interest in terms of project planning. You can order these publications from SEW-EURODRIVE.

Gearmotors catalog

The SEW "Gearmotors" catalog provides information in the form of

- Project planning notes
- Technical data
- Selection tables
- Dimension sheets

It provides detailed information for selecting SEW gearmotors, AC (brake) motors and their accessories, as well as about their functional principles.

Operating instructions

The SEW "VARIBLOC®/VARIMOT® Variable Speed Gear Units and Options" operating instructions contain extensive safety notes as well as information about

- Installation
- Assembly
- Removal
- Startup
- Inspection
- Maintenance
- Troubleshooting

for SEW variable speed gear units as well as components on the input side and options.

Drive engineering - practical implementation

The "Drive Engineering - Practical Implementation, Drive Planning" publication contains extensive information about the properties, differentiating characteristics and fields of application of SEW drives. This publication contains the most important drive calculation formulae as well as detailed examples of the most frequent applications making the publication an important tool for project planning and an essential complement to SEW product catalogs.

The following chapters also contain important information about rating variable speed gear units. On request, we gladly provide the SEW PRODRIVE program which can be used for drive project planning on a PC. In addition, SEW is happy to offer additional advice.



4.2 Drive selection data for standard variable speed gearmotors

Certain data is essential to specify the components for your drive precisely. These are:

Data for drive dimensioning			Your entry
n_{a1}	Minimum output speed	[1/min]	
n_{a2}	Maximum output speed	[1/min]	
P_{a1} at n_{a1}	Output power at minimum output speed	[kW]	
P_{a2} at n_{a2}	Output power at maximum output speed	[kW]	
M_{a1} at n_{a1}	Output torque at minimum output speed	[Nm]	
M_{a2} at n_{a2}	Output torque at maximum output speed	[Nm]	
F_{Ra}	Overhung load on the gear unit output (in drives with input shaft assembly)	[N]	
F_{Aa}	Axial load on the gear unit output (in drives with input shaft assembly)	[N]	
n_e	Input speed (in drives with input shaft assembly)	[1/min]	
P_m at n_e	Input power = motor power	[kW]	
M_e at n_e	Input torque	[Nm]	
M_{e max}	Maximum input torque	[Nm]	
F_{Re}	Overhung load on gear unit input	[N]	
F_{Ae}	Axial load on gear unit input	[N]	
J_{load}	Mass moment of inertia to be driven	[10 ⁻⁴ kgm ²]	
R, F, K, S M1 - M6	Required gear unit type and mounting position (→ Sec. Mounting Positions)	-	
IP..	Required enclosure	-	
ϑ_{amb}	Ambient temperature	[°C]	
H	Altitude	[m above sea level]	
S.., ..%cdf	Duty type and cyclic duration factor (cdf) or exact load cycle can be entered.	-	
Z	Starting frequency; alternatively, exact load cycle can be specified	[1/h]	
V_{brake}	Operating voltage of the brake	[V]	
V_{motor}	Operating voltage of the motor	[V]	
M_B	Required braking torque	[Nm]	
M_R	Slip torque (AR)	[Nm]	



4.3 Drive selection data for explosion-proof standard variable speed gearmotors

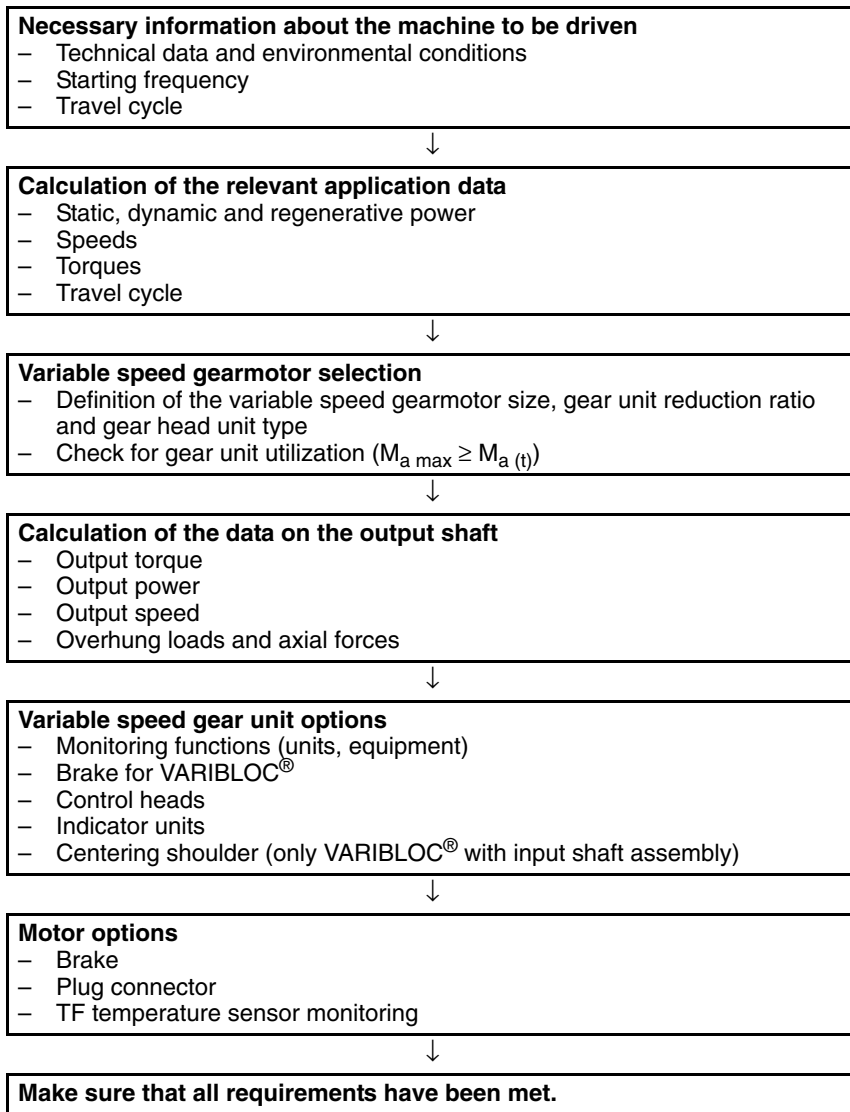
Certain data is essential to specify the components for your drive precisely. These are:

Data for drive dimensioning			Your entry	
Potentially explosive mixture of air and	–		Gas	
			Dust	
Ambient atmosphere at the location where the drive will be used, divided into zones	–	Gas	1	
			2	
Category II2D equipment must be used if the ambient atmosphere is electro-conductive dust with specific electrical resistance $\rho \leq 10^3 \Omega$!		Dust	21	
			22 (non-conductive)	
			22 (conductive)	
Maximum permitted surface temperature with dust/air mixtures	–	Dust	T 120 °C	
			T 140 °C	
Temperature class with gas/air mixtures	–	Gas	T1	
			T2	
			T3	
			T4	
In the case of zone 1, the protection type is prescribed by the customer as	–	Flameproof enclosure (d)		
		Increased safety (e)		
Only with flameproof enclosure: Specify the explosion group	–		IIA	
			IIB	
			IIC	
n_{amin}	Minimum output speed	[1/min]		
n_{amax}	Maximum output speed	[1/min]		
P_a at n_{amin}	Output power at minimum output speed	[kW]		
P_a at n_{amax}	Output power at maximum output speed	[kW]		
M_a at n_{amin}	Output torque at minimum output speed	[Nm]		
M_a at n_{amax}	Output torque at maximum output speed	[Nm]		
F_R	Overhung load on output shaft. Force application in center of shaft end is assumed. If not, please specify the exact application point giving the application angle and direction of rotation of the shaft for recalculation.	[N]		
F_A	Axial load (tension and compression) on output shaft	[N]		
J_{load}	Mass moment of inertia to be driven	[10 ⁻⁴ kgm ²]		
R, F, K, S, W M1 - M6	Required gear unit type and mounting position (→ Sec. Mounting Positions, Churning losses)	-		
IP..	Required enclosure	-		
ϑ_{amb}	Ambient temperature (with ambient temperatures < -20 °C and > 40 °C, please contact SEW-EURODRIVE)	[°C]		
H	Altitude	[m above sea level]		
S... ..%cdf	Duty type and cyclic duration factor (cdf) or exact load cycle can be entered.	-		
Z	Starting frequency; alternatively, exact load cycle can be specified	[1/h]		
f_{mains}	Supply frequency	[Hz]		
V_{mot} V_{brake}	Operating voltage of motor and brake	[V]		
M_B	Required braking torque	[Nm]		
For inverter operation: Required control mode and setting range				



4.4 Project planning process for standard variable speed gearmotors

The following flowchart displays a schematic view of the procedure for project planning a project incorporating a variable speed gear unit with a component on the input side.



In case of questions please contact SEW-EURODRIVE.



4.5 Project planning notes for standard variable speed gearmotors

The selection of variable speed gear units depends on various parameters. The most important project planning notes for VARIBLOC® and VARIMOT® are shown in below table.

Criterion	VARIBLOC® (variable speed belt drive gear unit)	VARIMOT® (variable speed friction disc gear unit)
Power ranges	0.25kW ... 45 kW	0.25kW ... 11 kW
Setting range	1:3, 1:4, 1:5, 1:6, 1:7, 1:8 depending on the number of poles of the driving motor and the input power.	1:4, 1:5 depending on the number of poles of the driving motor and the input power.
Adjustment at standstill	Adjustment at standstill is not permitted because the belt tension is only adjusted automatically when the drive is running.	Adjustment at standstill is possible, however this should not be done too frequently in operation.
Load type	Also suitable for variable loads (load shocks due to material feed, etc.), damping by the belt.	Only suitable for constant load (e.g. conveyor belts); load shocks can cause the friction ring to slip and lead to surface damage.
Adjustment options	Handwheel or chain sprocket, electrical or hydraulic remote control.	Handwheel, electrical remote control.
Indicator units	Analog or digital indicator units, analog display with special scale is possible.	Analog or digital indicator units, analog display with special scale is possible, setting indicator on the housing.
Wear	The wide V-belt must be replaced after approx. 6000 h under rated load. The service life is considerably longer at lower loadings. The service life of the wide V-belt is reduced by higher ambient temperatures and harsher environmental conditions.	Low wear, it is not possible to provide specific information about replacement intervals.

Belt life

The service factors f_B and f_T (→ Sec. "Service factors") can be used for determining the minimum life L_{nB} (h) of the wide V-belt according to the following relationship:

$$L_{nB} = \frac{6000}{f_B \times f_T}$$

Abrasive dust or aggressive ambient air shorten the service life. The service life is extended by having a reduced setting range and a low belt flexing frequency.

4.6 Efficiency of SEW gear units

The efficiency of gear units is mainly determined by the gearing and bearing friction. Keep in mind that the starting efficiency of a gear unit is always less than its efficiency at operating speed. This factor is especially pronounced in the case of helical-worm gear units.

R, F, K gear units

The efficiency of helical, parallel shaft and helical-bevel gear units varies with the number of gear stages, between 94 % (3-stage) and 98 % (1-stage).

S gear units

The gearing of helical-worm gear units produces a high proportion of sliding friction. As a result, these gear units may have higher gearing losses than R, F or K gear units and thus be less efficient.

The efficiency depends on the following factors:

- Gear ratio of the helical-worm gear stage



- Input speed
- Gear unit temperature

Helical-worm gear units are designed as helical worm gear units which makes them significantly more efficient than straightforward worm gear units. The efficiency may reach $\eta < 0.5$ if the worm gear stage has a very high ratio step.

Self-locking

Retrodriving torques on helical-worm gear units produce a reverse efficiency of $\eta' = 2 - 1/h$, which is significantly less favorable than the forward efficiency η . The helical-worm gear unit is self-locking if the forward efficiency $\eta \leq 0.5$. A few helical-worm gear units with the largest gear ratio are statically self-locking, although not dynamically self-braking. Please contact SEW-EURODRIVE if you wish to make technical use of the braking effect of self-locking characteristics.

Run-in phase

The tooth flanks of new helical-worm gear units are not yet completely smooth. That fact makes for a greater friction angle and less efficiency than during later operation. This effect becomes more apparent the greater the gear ratio. Subtract the following values from the listed efficiency during the running-in phase:

Worm	i range	η reduction
1 start	ca. 50 ... 280	ca. 12 %
2 start	ca. 20 ... 75	ca. 6 %
3 start	ca. 20 ... 90	ca. 3 %
4 start	-	-
5 start	ca. 6 ... 25	ca. 3 %
6 start	ca. 7 ... 25	ca. 2 %

The run-in phase usually lasts 24 hours. The helical-worm gear units achieve their listed rated efficiency values when:

- the gear unit has been run in completely,
- the gear unit has reached nominal operating temperature,
- the recommended lubricant has been filled in and
- the gear unit is working within the rated load range.

overhung load Determining overhung load

When determining the resulting overhung load, the type of transmission element mounted on the shaft end must be considered. The following transmission element factors f_Z also have to be considered for various transmission elements.

Transmission element	Transmission element factor f_Z	Comments
Gears	1.15	< 17 teeth
Chain sprockets	1.40	< 13 teeth
Chain sprockets	1.25	< 20 teeth
Narrow V-belt pulleys	1.75	Pre-tensioning influence
Flat belt pulleys	2.50	Pre-tensioning influence
Toothed belt pulleys	2.50	Pre-tensioning influence

The overhung load exerted on the gear shaft is then calculated as follows:

$$F_R = \frac{M_d \times 2000}{d_0} \times f_Z$$



- F_R = Overhung load in N
 M_d = Torque in Nm
 d_0 = Mean diameter of the mounted transmission element in mm
 f_Z = Transmission element factor

Permitted overhung load

The basis for determining the permitted overhung loads is the computation of the rated service life L_{H10} of the anti-friction bearings (according to ISO 281). For special operating conditions, the permitted overhung loads can be determined with regard to the modified service life L_{na} on request.

The permitted overhung loads F_{Ra} for the output shafts of foot-mounted gear units with a solid shaft are listed in the selection tables. Contact SEW-EURODRIVE in case of other versions.



The data refer to the radial force acting midway on the shaft end (with right-angle gear units on the A-side output). Worst case conditions have been assumed for the force application angle α and the direction of rotation.

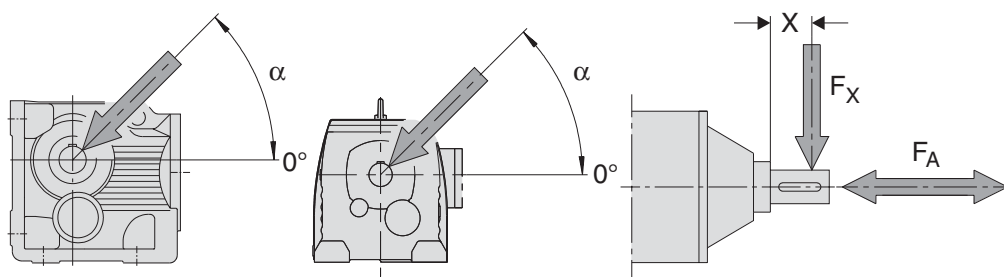
- Only 50 % of the F_{Ra} value specified in the selection tables is permitted in mounting position M1 with wall attachment on the front face for K and S gear units.
- Foot and flange-mounted helical gear units (R..F): A maximum of 50 % of the overhung load F_{Ra} specified in the selection tables in the case of torque transmission via the flange mounting.

Higher permitted overhung loads

Higher output shaft loads are permitted if heavy duty bearings are installed, especially with R, F and K gear units. Exactly considering the force application angle α and the direction of rotation also makes it possible to achieve a higher overhung load. Contact SEW in such cases.

Definition of force application

Force application is defined according to the following figure:



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Figure 1: Definition of force application

- F_X = Permitted overhung load at point x [N]
 F_A = Permitted axial force [N]



Permitted axial forces

If there is no overhung load, then an axial force F_A (tension or compression) **on the output end amounting to 50 %** of the overhung load given in the selection tables is permitted.

- for helical gear units except for R..137... to R..167...
- for parallel shaft and helical-bevel gear units with solid shaft except for F97...
- for helical-worm gear units with solid shaft



Contact SEW-EURODRIVE for all other types of gear units and in the event of significantly greater axial forces or combinations of overhung load and axial force.

Overhung load conversion on the output side for off-center force application

The permitted overhung loads given in the selection tables must be calculated using the following formulae in the event of force application not in the center of the shaft end. The smaller of the two values F_{xL} (according to bearing service life) and F_{xW} (according to shaft strength) is the permitted value for the overhung load at point x. Note that the calculations apply to $M_{a \max}$.

F_{xL} according to bearing service life

$$F_{xL} = F_{Ra} \cdot \frac{a}{b + x} \quad [\text{N}]$$

F_{xW} from the shaft strength

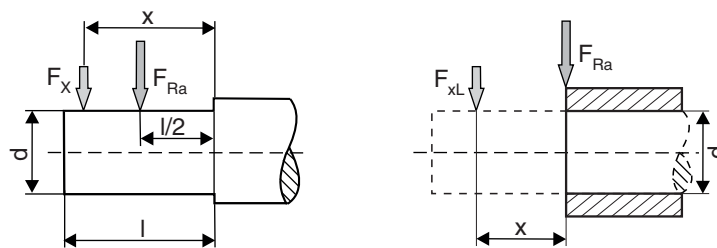
$$F_{xW} = \frac{c}{f + x} \quad [\text{N}]$$

F_{Ra} = Permitted overhung load ($x = l/2$) for foot-mounted gear units according to the selection tables in [N]

x = Distance from the shaft shoulder to the force application point in [mm]

a, b, f = Gear unit constants for overhung load conversion [mm]

c = Gear unit constant for overhung load conversion [Nmm]



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Figure 2: Overhung load F_x for off-center force application



*Gear unit
constants for
overhung load
conversion*

Gear unit type	a [mm]	b [mm]	c [Nmm]	f [mm]	d [mm]	l [mm]
R27	106.5	81.5	1.56×10^5	11.8	25	50
R37	118	93	1.24×10^5	0	25	50
R47	137	107	2.44×10^5	15	30	60
R57	147.5	112.5	3.77×10^5	18	35	70
R67	168.5	133.5	2.51×10^5	0	35	70
R77	173.7	133.7	3.97×10^5	0	40	80
R87	216.7	166.7	8.47×10^5	0	50	100
R97	255.5	195.5	1.19×10^6	0	60	120
R107	285.5	215.5	2.06×10^6	0	70	140
R137	343.5	258.5	6.14×10^6	30	90	170
R147	402	297	8.65×10^6	33	110	210
R167	450	345	1.26×10^7	0	120	210
RX57	43.5	23.5	1.51×10^5	34.2	20	40
RX67	52.5	27.5	2.42×10^5	39.7	25	50
RX77	60.5	30.5	1.95×10^5	0	30	60
RX87	73.5	33.5	7.69×10^5	48.9	40	80
RX97	86.5	36.5	1.43×10^6	53.9	50	100
RX107	102.5	42.5	2.47×10^6	62.3	60	120
F37	123.5	98.5	1.07×10^5	0	25	50
F47	153.5	123.5	1.78×10^5	0	30	60
F57	170.7	135.7	5.49×10^5	32	35	70
F67	181.3	141.3	4.12×10^5	0	40	80
F77	215.8	165.8	7.87×10^5	0	50	100
F87	263	203	1.19×10^6	0	60	120
F97	350	280	2.09×10^6	0	70	140
F107	373.5	288.5	4.23×10^6	0	90	170
F127	442.5	337.5	9.45×10^6	0	110	210
F157	512	407	1.05×10^7	0	120	210
K37	123.5	98.5	1.41×10^5	0	25	50
K47	153.5	123.5	1.78×10^5	0	30	60
K57	169.7	134.7	6.8×10^5	31	35	70
K67	181.3	141.3	4.12×10^5	0	40	80
K77	215.8	165.8	7.69×10^5	0	50	100
K87	252	192	1.64×10^6	0	60	120
K97	319	249	2.8×10^6	0	70	140
K107	373.5	288.5	5.53×10^6	0	90	170
K127	443.5	338.5	8.31×10^6	0	110	210
K157	509	404	1.18×10^7	0	120	210
S37	118.5	98.5	6.0×10^4	0	20	40
S47	130	105	1.33×10^5	0	25	50
S57	150	120	2.14×10^5	0	30	60
S67	184	149	3.04×10^5	0	35	70
S77	224	179	5.26×10^5	0	45	90
S87	281.5	221.5	1.68×10^6	0	60	120
S97	326.3	256.3	2.54×10^6	0	70	140

Values for types not listed are available on request.



4.7 Permitted overhung loads of reduction gear units

R27 - R67

Gear unit type	P _m [kW]	F _{Ra} [N]									
		≤ 20 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	180 [1/min]	250 [1/min]	350 [1/min]	500 [1/min]	700 [1/min]
R27	0.25	4440	3640	3220	2840	2530	2280	2050	1840	1640	1470
	0.37	4360	3600	3200	2830	2520	2270	2050	1840	1640	1470
	0.55	3730	3440	3090	2750	2470	2240	2020	1820	1620	1460
	0.75	795	3240	2960	2670	2410	2190	1990	1800	1610	1450
	1.1		2950	2810	2570	2340	2140	1950	1770	1590	1430
	1.5		775	2120	2400	2230	2060	1900	1730	1560	1410
R37	0.25	5960	5350	4710	4140	3680	3310	2970	2660	2370	2120
	0.37	5900	5310	4680	4120	3660	3300	2970	2660	2360	2120
	0.55	5570	5170	4590	4060	3620	3270	2940	2640	2350	2110
	0.75	4400	4990	4470	3980	3570	3230	2910	2620	2340	2100
	1.1		4790	4330	3890	3500	3180	2880	2600	2320	2090
	1.5		3150	4110	3740	3400	3110	2830	2560	2300	2070
R47	0.25	6140	5480	4820	4230	3760	3380	3030	2720	2420	2160
	0.37	6120	5460	4800	4220	3750	3370	3030	2710	2410	2160
	0.55	6020	5340	4720	4170	3710	3350	3010	2700	2400	2150
	0.75	5830	5190	4630	4100	3670	3310	2990	2680	2390	2150
	1.1	5490	5030	4520	4030	3620	3280	2960	2670	2380	2140
	1.5		4750	4330	3910	3530	3220	2920	2630	2360	2120
	2.2		4430	4120	3760	3430	3150	2870	2600	2330	2100
	3.0			3750	3520	3260	3020	2780	2530	2290	2070
R57	0.25	8010	6880	6040	5290	4690	4220	3780	3390	3010	
	0.37	8000	6860	6020	5280	4680	4210	3780	3380	3010	
	0.55	7940	6760	5950	5240	4650	4190	3760	3370	3000	2680
	0.75	7840	6640	5870	5180	4620	4160	3740	3360	2990	2680
	1.1	7670	6500	5780	5120	4570	4130	3720	3340	2980	2670
	1.5	7250	6270	5630	5020	4500	4080	3690	3320	2960	2660
	2.2	4050	6010	5450	4900	4420	4020	3640	3290	2940	2640
	3.0		5550	5150	4700	4280	3920	3570	3230	2900	2620
	4.0		3650	4800	4460	4120	3800	3490	3170	2860	2590
	5.5			2880	4160	3910	3650	3380	3090	2810	2550
R67	0.25	9920	9940	9470	8290	7350	6600	5920	5300	4710	
	0.37	9880	9930	9410	8250	7320	6580	5910	5290	4700	4200
	0.55	9810	9910	9340	8200	7290	6560	5890	5270	4690	4200
	0.75	9640	9880	9260	8150	7250	6530	5870	5260	4680	4190
	1.1	8900	9810	9120	8060	7180	6480	5840	5240	4660	4180
	1.5	7540	9650	8960	7950	7110	6430	5800	5210	4640	4160
	2.2		8900	8680	7760	6980	6340	5730	5160	4610	4140
	3.0		7560	8360	7550	6830	6230	5650	5110	4570	4110
	4.0			7940	7270	6640	6090	5550	5030	4520	4080
	5.5				6880	6370	5890	5410	4930	4450	4030



R77 - R97

Gear unit type	P _m [kW]	F _{Ra} [N]									
		≤ 20 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	180 [1/min]	250 [1/min]	350 [1/min]	500 [1/min]	700 [1/min]
R77	0.25	13000	13000								
	0.37	13000	13000	11500	10100	8920	8010	7190	6430		
	0.55	13000	13000	11400	10000	8890	7990	7170	6420		
	0.75	12800	12900	11400	9970	8860	7970	7160	6410		
	1.1	12400	12700	11200	9900	8800	7930	7130	6390	5680	5090
	1.5	11700	12500	11100	9810	8740	7890	7100	6370	5670	5080
	2.2	9800	12200	10900	9660	8640	7810	7040	6330	5640	5060
	3.0		11700	10600	9490	8520	7720	6980	6280	5610	5040
	4.0		10400	10300	9260	8360	7610	6900	6220	5570	5010
	5.5			9110	8940	8140	7450	6780	6140	5510	4970
	7.5				7390	7830	7220	6620	6030	5430	4910
	9.2				4960	7090	7050	6500	5940	5370	4860
	11.0					5150	6660	6350	5830	5300	4810
R87	0.25	20000									
	0.37	20000									
	0.55	20000									
	0.75	20000	18500	16200	14200	12600	11300	10100	9080	8070	
	1.1	20000	18400	16100	14100	12500	11300	10100	9060	8060	
	1.5	20000	18200	16000	14100	12500	11200	10100	9050	8050	
	2.2	20000	17900	15800	14000	12400	11200	10100	9020	8020	
	3.0	19300	17700	15700	13800	12300	11100	10000	8980	8000	
	4.0	17100	17300	15400	13700	12200	11000	9950	8640	7670	
	5.5		16700	15000	13400	12000	10900	9860	8880	7930	
	7.5		15900	14500	13100	11800	10700	9740	8790	7860	
	9.2		15300	14100	12800	11600	10600	9640	8720	7820	
	11.0			13700	12500	11400	10500	9530	8640	7760	
	15.0				11800	10900	10100	9290	8470	7640	
	18.5				11200	10500	9830	9080	8320	7530	
	22.0				10700	10100	9540	8880	8170	7430	
R97	0.25	28700									
	0.37	28700									
	0.55	28700									
	0.75	28600									
	1.1	28600									
	1.5	28500	23700	20800	18200	16200	14500	13000			
	2.2	28400	23500	20600	18100	16100	14500	13000	11600	10400	
	3.0	28100	23200	20500	18000	16000	14400	13000	11600	10300	9250
	4.0	27600	22900	20300	17900	15900	14300	12900	11600	10300	9230
	5.5	26100	22400	2000	17700	15800	14200	12800	11500	10300	9210
	7.5	21900	21800	19500	17400	15600	14100	12700	11500	10200	9170
	9.2		21300	19200	17200	15400	14000	12700	11400	10200	9140
	11.0		20700	18800	16900	15200	13900	12600	11300	10100	9110
	15.0		19500	18000	16300	14900	13600	12400	11200	10000	9030
	18.5			17200	15900	14500	13300	12200	11100	9940	8970
	22.0			16500	15400	14200	13100	12000	10900	9860	8910



R107 - R137

Gear unit type	P _m [kW]	F _{Ra} [N]									
		≤ 20 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	180 [1/min]	250 [1/min]	350 [1/min]	500 [1/min]	700 [1/min]
R107	0.37	37000									
	0.55	36900									
	0.75	36800									
	1.1	36600									
	1.5	36400	29100								
	2.2	36000	28900								
	3.0	35600	28700								
	4.0	35000	28400	25100	22000	19600	17600	15800	14200		
	5.5	34200	28000	24800	21900	19500	17500	15800	14100		
	7.5	33100	27500	24400	21600	19300	17400	15700	14100	12500	11200
	9.2	32300	27100	24100	21400	19200	17300	15600	14000	12500	11200
	11.0	30200	26600	23800	21200	19000	17200	15500	14000	12500	11200
	15.0		25500	23100	20700	18700	17000	15400	13900	12400	11100
	18.5		24600	22500	20300	18400	16800	15200	13800	12300	11100
	22.0		23700	21900	19900	18100	16600	15100	13600	12200	11000
	30.0			20400	18900	17400	16100	14700	13400	12100	10900
	37.0			19300	18200	16900	15700	14500	13200	11900	
	45.0				17200	16200	15200	14100	12900	11800	
R137	0.37	61400									
	0.55	61400									
	0.75	61400									
	1.1	61400									
	1.5	61400	61400								
	2.2	61300	61400								
	3.0	61300									
	4.0	61100									
	5.5	60900									
	7.5	60400									
	9.2	60000									
	11.0	59300	60900	61200	61300	61400	58900	53800	48900		
	15.0	57500	60500	61000	61200	61300	58200	53200	48500	43800	
	18.5	55300	59900	60800	61100	61300	57600	52800	48200	43600	
	22.0	52500	59300	60500	61000	61200	57000	52400	47900	43400	
	30.0		57400	59600	60600	59600	55500	51300	47100	42900	
	37.0		55500	58800	60300	58200	54400	50500	46500	42500	
	45.0		51600	57500	59000	56100	52900	49400	45800	41900	



R147 - R167

Gear unit type	P _m [kW]	F _{Ra} [N]									
		≤ 20 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	180 [1/min]	250 [1/min]	350 [1/min]	500 [1/min]	700 [1/min]
R147	0.37	74600									
	0.55	74600									
	0.75	74600									
	1.1	74600									
	1.5	74600									
	2.2	74500									
	3.0	74500	74600								
	4.0	74400	74600								
	5.5	74300	74500								
	7.5	74100	74500								
	9.2	73800	74400								
	11.0	73500	74300	74500	74500	74600	74600	74600	70800		
	15.0	72500	74100	74400	74500	74500	74600	74600	70500	63500	
	18.5	71300	73800	74200	74400	74500	74500	74600	70300	63400	
	22.0	69900	73500	74100	74400	74500	74500	74600	70000	63200	
	30.0	65300	72400	73600	74200	74400	74500	74500	69500	62800	
	37.0	60800	71400	73200	74000	74300	74400	74500	69000	62500	
	45.0		69700	72400	73600	74100	74400	74500	68500	62100	
R167	1.5	120000									
	2.2	120000									
	3.0	120000									
	4.0	120000									
	5.5	120000									
	7.5	120000									
	9.2	120000									
	11.0	120000									
	15.0	120000									
	18.5	120000									
	22.0	120000									
	30.0	120000	120000	120000	120000	120000	114600	104500			
	37.0	120000	120000	120000	120000	120000	113900				
	45.0	120000	120000	120000	120000	120000	113000				



RX57-RX107

Gear unit type	P _m [kW]	F _{Ra} [N]									
		100 [1/min]	150 [1/min]	200 [1/min]	300 [1/min]	450 [1/min]	600 [1/min]	800 [1/min]	1000 [1/min]	1200 [1/min]	1600 [1/min]
RX57	0.25	4000	4240	4320	4360	4120	3720	3350	3000	2680	2400
	0.37	3890	4200	4290	4340	4100	3700	3340	3000	2670	2390
	0.55		4000	4170	4270	4010	3640	3290	2960	2650	2380
	0.75		3720	4000	4170	3900	3560	3230	2920	2620	2360
	1.1			3800	4040	3770	3460	3160	2870	2580	2330
	1.5				3280	3560	3310	3050	2790	2530	2290
	2.2				645	2460	3130	2920	2700	2460	2250
	3.0						1130	2280	2540	2350	2170
RX67	0.25	5840	6030	6090	5710	5080	4580	4120	3690	3280	2940
	0.37	5770	5990	6060	5680	5060	4560	4110	3680	3280	2940
	0.55	5420	5850	5970	5570	4980	4510	4060	3650	3260	2920
	0.75	4920	5640	5850	5430	4880	4430	4010	3610	3230	2900
	1.1		5390	5700	5260	4770	4350	3950	3570	3200	2880
	1.5		4920	5410	4990	4580	4220	3860	3500	3150	2850
	2.2			3920	4680	4370	4060	3740	3420	3100	2810
	3.0				2180	3990	3790	3550	3280	3000	2740
RX77	0.37	10000	10000	9280	8150	7240	6520	5850	5240	4660	
	0.55	10000	10000	9130	8050	7170	6470	5820	5220	4640	4160
	0.75	10000	10000	8950	7930	7090	6400	5770	5190	4620	4140
	1.1	10000	9730	8740	7790	6990	6330	5720	5150	4600	41301
	1.5		9210	8390	7560	6830	6220	5640	5090	4560	4100
	2.2		7080	7980	7290	6640	6080	5540	5020	4510	4060
	3.0			4720	6820	6320	5850	5370	4900	4420	4000
	4.0				3650	5690	5580	5180	4760	4330	3930
	5.5					2620	4440	4930	4580	4200	2840
RX87	0.75	13000	12900	11400	10100	8960	8080	7270	6520	5800	
	1.1	13000	12600	11200	9940	8880	8020	7230	6490	5780	5180
	1.5	12500	12200	10900	9750	8750	7920	7160	6440	5750	5160
	2.2	11700	11700	10600	9520	8590	7810	7070	6380	5710	5130
	3.0	4360	10800	10000	9130	8310	7610	6930	6280	5640	5080
	4.0		7810	9330	8680	8000	7390	6770	6160	5550	5020
	5.5		295	6300	8090	7600	7090	6560	6010	5450	4940
	7.5				4820	7020	6680	6260	5800	5300	4840
	9.2					3040	5680	5840	5500	5090	4690
	11.0						3130	5410	5260	4930	4570
RX97	0.75	20000	16300	14400	12600	11200	10100	9080	8130	7240	6480
	1.1	19600	16100	14200	12500	11200	10100	9040	8110	7220	6460
	1.5	18900	15700	14000	12400	11000	9970	8980	8070	7190	6440
	2.2	18000	15300	13700	12200	10900	9870	8910	8020	7150	6420
	3.0	16500	14500	13200	11800	10700	9710	8790	7930	7090	6380
	4.0	4190	13700	12600	11500	10400	9520	8660	7830	7020	6330
	5.5		12500	11900	11000	10100	9270	8480	7700	6930	6260
	7.5		4930	10800	10300	9580	8910	8220	7520	6810	6170
	9.2			2880	8590	8890	8420	7860	7270	6630	6040
	11.0				4490	8360	8030	7590	7070	6490	5950
	15.0					5250	7590	7270	6840	6330	5830
	18.5						2950	6070	6350	5980	5580
	22.0							2780	5580	5680	5360

**RX107**

Gear unit type	P _m [kW]	F _{Ra} [N]									
		100 [1/min]	150 [1/min]	200 [1/min]	300 [1/min]	450 [1/min]	600 [1/min]	800 [1/min]	1000 [1/min]	1200 [1/min]	1600 [1/min]
RX107	4.0	15600	15800	14700	13400	12200	11200	10200	9250	8300	
	5.5	2140	14300	13700	12700	11800	10900	9960	9070	8180	
	7.5		7010	12200	11800	11100	10400	9620	8820	8010	7270
	9.2		3720	8470	11000	10600	10000	9350	8630	7870	7180
	11.0			2850	9470	9990	9590	9040	8420	7720	7070
	15.0				1230	7000	8650	8370	7930	7380	6830
	18.5					1990	6380	7780	7510	7090	6610
	22.0						2890	6560	7100	6800	6410

F37 - F67

Type	P _m [kW]	F _{Ra} [N]													
		≤ 10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]	900 [1/min]
F37	0.25	4710	5420	5490	5110	4520	4030	3710	3410	3160	2940	2770	2620	2410	2170
	0.37		5190	5410	4950	4410	3950	3650	3370	3120	2910	2750	2600	2390	2150
	0.55		4710	5200	4740	4270	3860	3570	3310	3080	2880	2720	2580	2370	2140
	0.75		3810	4840	4500	4110	3750	3490	3250	3030	2840	2690	2550	2350	2120
	1.1			4170	4100	3850	3570	3350	3140	2940	2770	2630	2500	2310	2100
	1.5				3640	3540	3350	3190	3010	2840	2690	2560	2440	2270	2070
F47	0.25	7940	8240	8270	7720	6790	6040	5540	5090	4710	4380	4120	3900		
	0.37	7250	8140	8240	7580	6700	5970	5490	5050	4680	4350	4100	3880		
	0.55	4710	7940	8160	7410	6580	5890	5420	5010	4640	4320	4080	3860	3550	3190
	0.75		7600	7990	7210	6450	5800	5350	4950	4600	4290	4050	3830	3530	3180
	1.1		6740	7500	6880	6230	5650	5240	4860	4530	4230	4000	3790	3500	3160
	1.5			6910	6490	5970	5470	5100	4760	4440	4170	3950	3750	3460	3130
F57	0.25	10200	10400	10500	10100	8850	7850	7190	6600	6100	5670	5340	5040		
	0.37	10100	10400	10400	10100	8830	7830	7180	6600	6090	5660	5330	5040		
	0.55	9700	10300	10400	9940	8750	7780	7130	6560	6070	5640	5320	5020	4610	
	0.75	9080	10100	10300	9780	8640	7710	7080	6520	6040	5620	5290	5000	4590	
	1.1	8220	9880	10200	9610	8530	7630	7020	6470	6000	5590	5270	4980	4580	
	1.5		9470	9950	9330	8340	7490	6920	6400	5940	5540	5230	4950	4550	4100
	2.2		8890	9670	8990	8110	7340	6800	6300	5860	5480	5180	4910	4520	4080
	3.0		4370	8970	8410	7730	7070	6590	6150	5740	5380	5100	4840	4470	
	4.0			7980	7740	7280	6760	6360	5960	5600	5270	5000	4760	4410	
	5.5				6880	6710	6360	6050	5730	5410	5120	4880	4650	4330	
F67	0.25	13000	13000	13000	13000	13000	13000	13000	12900	12000	11300	10700			
	0.37	13000	13000	13000	13000	13000	13000	13000	12900	12000	11200	10600			
	0.55	12800	13000	13000	13000	13000	13000	13000	12900	12000	11200	10600	10100	9340	
	0.75	12000	13000	13000	13000	13000	13000	13000	12800	12000	11200	10600	10100	9330	
	1.1	10200	13000	13000	13000	13000	13000	13000	12800	11900	11200	10600	10000	9300	8450
	1.5		12600	13000	13000	13000	13000	13000	12700	11800	11100	10500	10000	9280	8440
	2.2		11500	12800	13000	13000	13000	13000	12500	11700	11000	10500	9950	9230	8400
	3.0			12100	12900	13000	13000	13000	12400	11600	10900	10400	9880	9180	8360
	4.0			10800	12400	13000	13000	13000	12200	11400	10800	10300	9790	9110	8310
	5.5				11300	12600	13000	12600	11900	11200	10600	10100	9670	9010	8240



F77 - F97

Type	P _m [kW]	F _{Ra} [N]													
		≤ 10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]	900 [1/min]
F77	0.25	20000													
	0.37	20000	20000	20000	20000	20000	19600	18100	16700	15600	14600				
	0.55	19800	20000	20000	20000	20000	19500	18000	16700	15600	14600	13800			
	0.75	19600	20000	20000	20000	20000	19500	18000	16700	15500	14500	13800	13100		
	1.1	18900	19900	20000	20000	20000	19400	17900	16600	15500	14500	13700	13100	12100	
	1.5	17700	19800	20000	20000	20000	19300	17800	16600	15400	14500	13700	13000	12100	11000
	2.2	14500	19300	19800	20000	20000	19100	17700	16400	15300	14400	13700	13000	12000	10900
	3.0		18600	19600	19900	20000	18800	17500	16300	15200	14300	13600	12900	12000	10900
	4.0		17300	19100	19700	19900	18600	17300	16100	15100	14200	13500	12800	11900	10900
	5.5		14500	18100	19300	19800	18200	17000	15900	14900	14100	13400	12700	11800	10800
	7.5			16100	18500	19000	17600	16600	15600	14700	13800	13200	12600	11700	10700
	9.2			13900	17600	18400	17200	16200	15300	14500	13700	13100	12500	11600	10700
	11.0				16400	17600	16700	15900	15000	14200	13500	12900	12400	11500	10600
F87	0.25	30000													
	0.37	30000	28700												
	0.55	30000	28400												
	0.75	29700	28200	24300	21400	18700	16600	15200	14000	12900	12000				
	1.1	29200	27700	24000	21200	18600	16600	15200	14000	12900	12000	11300			
	1.5	28500	27200	23700	21000	18500	16400	15100	13900	12900	12000	11300	10700	9780	
	2.2	27200	26300	23100	20600	18200	16300	15000	13800	12800	11900	11200	10600	9750	
	3.0	25300	25300	22500	20200	17900	16100	14800	13700	12700	11800	11200	10600	9710	8740
	4.0	17500	23900	21700	19600	17600	15800	14600	13500	12600	11700	11100	10500	9660	8700
	5.5		22000	20500	18800	17000	15500	14300	13300	12400	11600	11000	10400	9580	8650
	7.5		19300	18800	17700	16300	14900	13900	13000	12200	11400	10800	10300	9480	8570
	9.2		17300	17500	16800	15700	14500	13600	12800	12000	11300	10700	10200	9400	8520
	11.0			16000	15800	15100	14100	13300	12500	11800	11100	10500	10000	9310	8450
	15.0			12800	13700	13600	13100	12500	11900	11300	10700	10200	9780	9110	8310
	18.5				11800	12300	12200	11900	11400	10900	10400	9960	9550	8930	8180
	22.0				9910	11100	11400	11200	10900	10500	10100	9700	9330	8760	8060
F97	0.25	38100													
	0.37	37900													
	0.55	37800													
	0.75	37500													
	1.1	37200													
	1.5	36700	37700	34600	30500	26800	23800	21800	20100	18500					
	2.2	35800	37400	34100	30100	26600	23600	21700	20000	18500	17200	16200			
	3.0	34600	37100	33500	29800	26300	23500	21600	19900	18400	17100	16100	15300	14000	12600
	4.0	32800	36600	32800	29200	26000	23200	21400	19700	18300	17000	16100	15200	14000	12600
	5.5	29800	35300	31700	28500	25500	22900	21100	19500	18100	16900	16000	15100	13900	12500
	7.5		32800	30100	27500	24800	22400	20800	19200	17900	16700	15800	15000	13800	12400
	9.2		30900	29000	26700	24300	22100	20500	19000	17700	16600	15700	14900	13700	12400
	11.0		28800	27600	25800	23700	21600	20200	18800	17500	16400	15600	14800	13600	12300
	15.0		24000	24600	23800	22300	20700	19500	18200	17100	16100	15300	14500	13500	12200
	18.5			22000	22100	21200	19900	18800	17800	16700	15800	15000	14300	13300	12100
	22.0			19500	20400	20000	19100	18200	17300	16400	15500	14800	14100	13100	12000



F107 - F157

Type	P _m [kW]	F _{Ra} [N]													
		≤10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]	900 [1/min]
F107	0.37	64900													
	0.55	64700	65000												
	0.75	64400	65000												
	1.1	64000	64800												
	1.1	64000	64800												
	1.5	63500	64600												
	2.2	62500	64300												
	3.0	61400	63900												
	4.0	59800	63300	56400	50400	45000	40500	37500	34800	32400					
	5.5	57400	62500	55600	49900	44600	40200	37300	34600	32300					
	7.5	53700	60700	54400	49100	44100	39900	37000	34400	32100	30100	28600	27200	25200	
	9.2	50600	59300	53500	48500	43700	39600	36800	34300	32000	30000	28500	27100	25100	
	11.0	46700	57700	52500	47800	43300	39300	36600	34100	31900	29900	28400	27000	25100	
	15.0		54100	50200	46300	42300	38600	36000	33700	31500	29700	28200	26900		
	18.5		50900	48300	45000	41400	38000	35600	33300	31300	29400	28000	26700		
	22.0		47900	46400	43700	40500	37400	35100	33000	31000	29200	27800	26500		
	30.0			41600	40600	38400	35900	34000	32100	30300	28700	27400			
	37.0			38200	38300	36900	34900	33200	31500	29800	28300				
	45.0			30800	35100	34800	33400	32100	30600	29100	27700				
F127	0.37	90000													
	0.55	90000													
	0.75	90000													
	1.1	90000	90000												
	1.5	90000	90000												
	2.2	90000	90000												
	3.0	90000	90000												
	4.0	90000	90000												
	5.5	90000	89400												
	7.5	90000	87900												
	9.2	90000	86700												
	11.0	90000	85300	76100	68500	61400	55500	51500	47800	44600	41900				
	15.0	90000	82200	74200	67300	60600	54900	51000	47500	44400	41600	39500	37600		
	18.5	85400	79500	72500	66100	59800	54400	50600	47200	44100	41400	39400	37400		
	22.0		77000	70900	65100	59100	53900	50200	46900	43900	41300	39200	37300		
	30.0		70500	66800	62400	57300	52700	49300	46100	43300	40800	38800	37000		
	37.0		65800	63900	60400	56000	51800	48600	45600	42900	40500	38500			
	45.0		59400	59900	57700	54200	50500	47700	44900	42300	40000	38200			
F157	1.5	120000	113100												
	2.2	120000	112700												
	3.0	120000	112200												
	4.0	120000	111600												
	5.5	120000	110700												
	7.5	120000	109500												
	9.2	120000	108500												
	11.0	119400	107400	94900	85000	75800	68300	63300	58700	54700					
	15.0	115200	105000	93400	83900	75200	67900	62900	58400	54500	51100	48400			
	18.5	110100	102900	92100	83100	74600	67400	62600	58200	54300	50900	48200			
	22.0	104000	100800	90800	82200	74000	67100	62300	58000	54100	50800	48100			
	30.0	59800	95700	87600	80100	72600	66100	61500	57400	53700	50400	47800			
	37.0		92000	85300	78500	71600	65400	61000	57000	53300	50100	47600			
	45.0		86900	82100	76400	70100	64400	60200	56400	52900	49800	47300			



K37 - K77

Type	P _m [kW]	F _{Ra} [N]												
		≤10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]
K37	0.25	6020	6160	5400	4800	4240	3790	3480	3210	2970	2760	2610	2460	2260
	0.37		5760	5160	4630	4130	3710	3420	3160	2930	2740	2580	2440	2250
	0.55		5270	4850	4430	4000	3620	3350	3110	2890	2700	2550	2420	2230
	0.75		4710	4500	4190	3840	3510	3270	3040	2840	2660	2520	2390	2210
	1.1			3920	3810	3580	3330	3130	2940	2760	2590	2460	2340	2170
K47	0.25	7960	8250	8280	7730	6800	6050	5550	5100	4720	4380	4130		
	0.37	7310	8150	8240	7580	6700	5980	5490	5060	4680	4360	4110	3880	
	0.55	5740	7960	8170	7400	6580	5890	5430	5010	4650	4330	4080	3860	3550
	0.75		7630	7960	7190	6440	5800	5350	4950	4600	4290	4050	3840	3530
	1.1		6820	7450	6850	6210	5640	5230	4860	4530	4230	4000	3800	3500
	1.5			6840	6440	5940	5450	5090	4750	4440	4160	3950	3750	3460
	2.2			5650	5740	5480	5130	4840	4560	4290	4040	3850	3660	3400
	3.0				4950	4940	4760	4560	4340	4120	3910	3730	3570	
K57	0.25	9800	10000	10100	10100	8900	7900	7240	6650	6150	5710			
	0.37	9710	10000	10100	10100	8880	7880	7230	6640	6140	5700			
	0.55	9320	9880	9990	9980	8790	7820	7180	610	6110	5680	5350	5060	
	0.75	8740	9710	9900	9810	8680	7740	7120	6560	6070	5650	5330	5040	
	1.1	7620	9500	9780	9620	8550	7660	7050	6510	6030	5620	5300	5010	
	1.5		9100	9570	9300	8340	7510	6940	6420	5960	5570	5260	4980	4580
	2.2		8550	9290	8930	8090	7340	6810	6320	5880	5500	5200	4930	4540
	3.0		6100	8740	8290	7660	7040	6580	6140	5750	5390	5110	4850	
	4.0			7660	7550	7170	6700	6320	5940	5590	5270	5010	4770	
	5.5				6590	6530	6260	5980	5680	5380	5100	4870	4650	
K67	0.25	13000	13000	13000	13000	13000	13000	13000	12900	12000				
	0.37	13000	13000	13000	13000	13000	13000	13000	12900	12000	11200			
	0.55	12800	13000	13000	13000	13000	13000	13000	12900	12000	11200	10600		
	0.75	12100	13000	13000	13000	13000	13000	13000	12800	11900	11200	10600		
	1.1	10300	13000	13000	13000	13000	13000	13000	12700	11900	11100	10600		
	1.5		12600	13000	13000	13000	13000	13000	12600	11800	11100	10500	10000	
	2.2		11600	12800	13000	13000	13000	13000	12500	11700	11000	10400	9930	
	3.0			12100	12900	13000	13000	13000	12300	11500	10900	10300	9850	
	4.0			10900	12400	13000	13000	12800	12100	11400	10700	10200	9750	
	5.5				11400	12600	13000	12400	11700	11100	10500	10000	9600	
K77	0.25	20000	20000											
	0.37	20000	20000	20000	20000	20000	19600	18100	16700	15600				
	0.55	19800	20000	20000	20000	20000	19500	18000	16700	15600	14600			
	0.75	19600	20000	20000	20000	20000	19400	18000	16700	15500	14500	13800		
	1.1	18900	20000	20000	20000	20000	19300	17900	16600	15500	14500	13700	13100	
	1.5	17800	19800	20000	20000	20000	19200	17800	16500	15400	14500	13700	13000	
	2.2	14700	19400	19800	20000	20000	19000	17600	16400	15300	14400	13600	13000	
	3.0		18700	19600	19900	20000	18800	17500	16300	15200	14300	13600	12900	
	4.0		17400	19100	19700	19900	18400	17200	16100	15100	14200	13500	12800	
	5.5		14700	18200	19300	19500	18000	16900	15800	14900	14000	13300	12700	
	7.5			16300	18500	18600	17400	16400	15400	14600	13800	13100	12500	
	9.2			14200	17700	17900	16900	16000	15100	14300	13600	13000	12400	
	11.0				16600	17100	16300	15600	14800	14100	13400	12800	12300	



K87 - K107

Type	P _m [kW]	F _{Ra} [N]												
		≤10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]
K87	0.25	29100	29100											
	0.37	29100	29100											
	0.55	29000	29100											
	0.75	29000	29100	29100	27100	24100	21600	20000	18500	17200				
	1.1	28900	29000	29100	26900	23900	21500	19900	18500	17200				
	1.5	28700	29000	29000	26600	23800	21400	19800	18400	17100	16100	15200	14500	
	2.2	28300	28900	29000	26200	23500	21200	19700	18300	17100	16000	15200	14400	
	3.0	27800	28800	28400	25700	23200	21000	19500	18200	17000	15900	15100	14400	
	4.0	26800	28700	27500	25100	22800	20700	19300	18000	16800	15800	15000	14300	
	5.5		28000	26200	24300	22200	20300	19000	1800	16600	15700	14900	14200	
	7.5		25100	24400	23000	21400	19800	18600	17400	16400	15500	14700	14000	
	9.2		22800	23000	22100	20800	19300	18200	17200	16200	15300	14600	13900	
	11.0			21400	21000	20000	18800	17800	16900	16000	15100	14400	13800	
	15.0			17800	18700	18500	17700	17000	16200	15400	14700	14100	13500	
	18.5				16600	17100	16800	16300	15700	15000	14300	13800	13300	
	22.0				14600	15700	15900	15600	15100	14600	14000	13500	13000	
K97	0.25	40000	40000											
	0.37	40000	40000											
	0.55	40000	40000											
	0.75	40000	40000											
	1.1	40000	40000											
	1.5	40000	40000	39800	35500	31600	28400							
	2.2	40000	40000	39200	35100	31400	28300	26200						
	3.0	40000	40000	38600	34700	31100	28100	26000	24200	22500	21100	20000		
	4.0	40000	40000	37800	34200	30700	27800	25800	24000	22400	21000	19900		
	5.5	40000	40000	36700	33400	30200	27500	25500	23800	22300	20900	19800		
	7.5		37700	35000	32300	29500	27000	25200	23500	22000	20700	19700		
	9.2		35700	33800	31500	28900	26600	24900	23300	21800	20600	19600		
	11.0		33400	32300	30500	28300	26100	24500	23000	21600	20400	19400		
	15.0		28300	29200	28400	26900	25200	23800	22400	21200	20000	19100		
	18.5			26400	26600	25700	24300	23100	21900	20800	19700	18900		
	22.0			23700	24800	24500	23500	22500	21500	20400	19400	18600		
K107	0.37	65000												
	0.55	65000	65000											
	0.75	65000	65000											
	1.1	65000	65000											
	1.5	65000	65000											
	2.2	65000	65000											
	3.0	65000	64500											
	4.0	65000	63400	56100	50200	44900	40400	37400	34700	32400				
	5.5	65000	61900	55200	49600	44500	40100	37200	34600	32200				
	7.5	65000	59800	53800	48700	43900	39700	36900	34300	32100	30100	28500		
	9.2	65000	58200	52800	48000	43400	39400	36700	34100	31900	30000	28400		
	11.0	60800	56300	51600	47300	42900	39100	36400	33900	31700	29800	28300		
	15.0		52200	49100	45500	41700	38300	35800	33500	31400	29500	28100		
	18.5		48500	46800	44000	40700	37600	35200	33000	31100	29300	27900		
	22.0		45000	44600	42600	39800	36900	34700	32600	30700	29000	27600		
	30.0			39100	38900	37300	35200	33400	31700	30000	28400			
	37.0			35200	36300	35600	34000	32500	30900	29400				
	45.0			29500	32700	33200	32300	31200	29900	28600				



K127 - K157

Type	P _m [kW]	F _{Ra} [N]												
		≤10 [1/min]	25 [1/min]	40 [1/min]	60 [1/min]	90 [1/min]	130 [1/min]	170 [1/min]	220 [1/min]	280 [1/min]	350 [1/min]	420 [1/min]	500 [1/min]	650 [1/min]
K127	0.37	82900												
	0.55	82900												
	0.75	82900												
	1.1	82800	82900											
	1.5	82800	82900											
	2.2	82800	82900											
	3.0	82700	82800											
	4.0	82600	82800											
	5.5	82500	82800											
	7.5	82100	82700											
	9.2	81800	82700											
	11.0	81400	82600	75300	67900	61000	55200	51200	47600					
	15.0	80100	80500	73100	66500	60100	54500	50700	47200	44100	41400			
	18.5	76000	77500	71200	65200	59200	53900	50300	46900	43900	41200			
	22.0	116600	74500	69300	64000	58400	53400	49800	46600	43600	41000			
	30.0		67100	64700	60900	56400	52000	48800	45700	42900	40500			
	37.0		61900	61400	58700	54900	51000	48000	45100	42500				
	45.0		54500	56800	55700	52900	49500	46900	44300	41800				
K157	1.5	116600												
	2.2	116600												
	3.0	116600	113600											
	4.0	116500	112900											
	5.5	116400	111900											
	7.5	116200	110600	97300										
	9.2	116000	109500	96600										
	11.0	115700	108300	95900										
	15.0	114900	103400	92800										
	18.5	114000	103400	92800										
	22.0	113000	101100	31400										
	30.0		95500	87900	80600	73200	66700	62100						
	37.0		91500	85400	78900	72100	65900	61500						
	45.0		85900	81900	76600	70500	64800	60700						



S37 - S77

Type	P _m [kW]	F _{Ra} [N]									
		≤10 [1/min]	30 [1/min]	50 [1/min]	70 [1/min]	100 [1/min]	1300 [1/min]	160 [1/min]	200 [1/min]	250 [1/min]	400 [1/min]
S37	0.25	3000	3000	3000	2990	2720	2530	2380	2230	2090	1810
	0.37	82900	3000	2930	2760	2560	2410	2290	2150	2030	1770
	0.55	82900		2540	2480	2350	2250	2150	2050	1950	1720
	0.75	82800	82900		2160	2130	2070	2010	1930	1850	1670
	1.1	82800	82900			1560	1780	1770	1740	1700	1570
S47	0.25	5570	5630	4900	4460	4010	3700	3470	3240	3020	2610
	0.37	5220	5230	4650	4270	3880	3610	3400	3180	2970	2580
	0.55	82600	4740	4350	4050	3720	3490	3300	3100	2910	2540
	0.75	82500	4180	4010	3800	3540	3340	3190	3020	2840	2490
	1.1	82100	82700	3450	3400	3260	3120	3000	2860	2730	2420
	1.5	81800	82700		2920	2920	2860	2780	2690	2580	2340
S57	0.25	8210	8290	7940	7160	6400	5890	5510	5130	4770	4100
	0.37	8010	8240	7730	7010	6300	5810	5450	5080	4730	4080
	0.55	7600	8130	7480	6820	6160	5710	5370	5020	4680	4040
	0.75	6900	7970	7200	6620	6020	5590	5270	4940	4620	4010
	1.1		7280	6730	6280	5770	5400	5120	4820	4530	3950
	1.5		6370	6180	5880	5490	5190	4940	4670	4410	3880
S67	0.25	10700	10600	9080	8170	7290	6700	6270	5830	5430	
	0.37	10600	10300	8900	8050	7200	6640	6220	5790	5390	4640
	0.55	10400	9990	8680	7890	7100	6550	6150	5740	5350	4610
	0.75	9990	9590	8440	7710	6970	6460	6070	5680	5300	4580
	1.1	9030	8940	8040	7420	6760	6300	5950	5580	5220	4530
	1.5		8170	7580	7080	6520	6110	5790	5460	5130	4470
	2.2	6850	6770	6500	6110	5790	5530	5240	4960	4370	
	3.0			5860	5840	5650	5430	5230	5000	4760	4250
	4.0			3530	4980	5040	4960	4850	4690	4510	4100
	5.5				2020	3700	4300	4310	4260	4160	3870
S77	0.37	16000	15400	13200	11800	10600	9700	9070	8440	7850	
	0.55	16000	15200	13000	11700	10500	9630	9020	8400	7820	6720
	0.75	16000	14900	12800	11600	10400	9560	8960	8350	7780	6990
	1.1	16000	14400	12500	11400	10200	9450	8870	8270	7720	6660
	2.2	13800	12800	11500	10700	9730	9070	8560	8030	7520	6530
	3.0	5660	11600	10800	10200	9370	8790	8330	7860	7380	6450
	4.0		9320	9940	9500	8910	8430	8040	7620	7200	6330
	5.5		3600	7790	8590	8270	7930	7630	7280	6930	6170
	7.5			2770	5430	7150	7220	7050	6820	6550	5940
	9.2				2650	5090	6250	6610	6460	6270	5750
	11.0					2790	4400	5310	6020	5940	5540



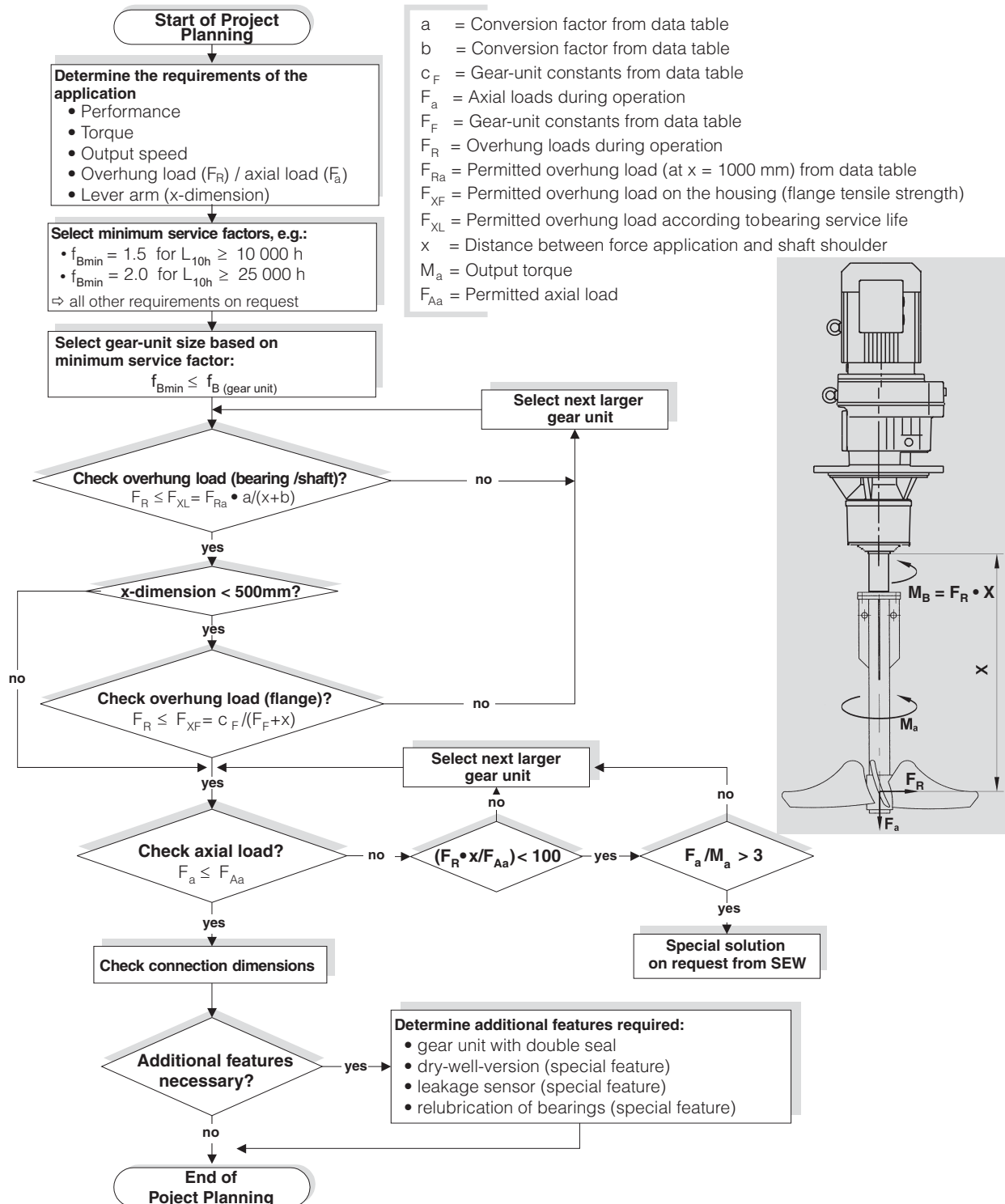
S87 - S97

Type	P _m [kW]	F _{Ra} [N]									
		≤10 [1/min]	30 [1/min]	50 [1/min]	70 [1/min]	100 [1/min]	1300 [1/min]	160 [1/min]	200 [1/min]	250 [1/min]	400 [1/min]
S87	0.75	30000	30000	30000	27700	25000	23200	21800	20500	19200	
	1.1	30000	30000	30000	27600	24900	23100	21700	20400	19100	16700
	1.5	29900	30000	29900	27300	24700	23000	21600	20300	19000	16600
	2.2	29600	30000	29400	26900	24500	22800	21500	20200	18900	16500
	3.0	29200	29900	28800	26500	24100	22500	21300	20000	18800	16500
	4.0	28600	29700	27900	25900	23700	22200	21000	19800	18600	16400
	5.5	21600	29100	26800	25000	23100	21700	20600	19500	18400	16200
	7.5		26400	25100	23800	22300	21100	20100	19100	18100	16000
	9.2		22200	23900	22900	21600	20600	19700	18800	17800	15800
	11.0		13700	22400	21900	20900	20000	19200	18400	17500	15700
	15.0			13700	19600	19300	18800	18200	17600	16800	15300
	18.5			3010	13300	17900	17700	17300	16800	16300	14900
	22.0				6070	14500	16600	16500	16200	15700	14500
S97	1.5	39900	40000	37700	34300	30900	28700				
	2.2	39800	40000	37200	33900	30700	28500	26900	25200	23600	
	3.0	39600	39900	36700	33600	30400	28300	26700	25100	23500	20600
	4.0	39200	39800	36000	33000	30100	28000	26500	24900	23400	20400
	5.5	38500	39000	35000	32300	29600	27700	26200	24700	23200	20400
	7.5	32800	36700	33600	31300	28900	27100	25800	24300	22900	20200
	9.2	21400	35000	32600	30600	28400	26700	25400	24100	22700	20100
	11.0		33000	31400	29700	27800	26200	25100	23800	22500	19900
	15.0		26100	28700	27800	26400	25200	24200	23100	22000	19600
	18.5		13500	26400	26200	25200	24300	23400	22500	21500	19300
	22.0			21400	24600	24100	23400	22700	21900	21000	19000

4.8 RM gear units

Project planning

You must take account of the higher overhung and axial loads when planning projects with RM helical gear units with extended bearing housing. Observe the following project planning procedure:





**Permitted
overhung loads
and axial forces**

The permitted overhung loads F_{Ra} and axial loads F_{Aa} are specified for various service factors f_B and nominal bearing service life L_{H10} .

$$f_{Bmin} = 1.5 / L_{H10} = 10\,000\ h$$

		n_a [1/min]							
		< 16	16-25	26-40	41-60	61-100	101-160	161-250	251-400
RM57	F_{Ra} [N]	400	400	400	400	400	405	410	415
	F_{Aa} [N]	18800	15000	11500	9700	7100	5650	4450	3800
RM67	F_{Ra} [N]	575	575	575	580	575	585	590	600
	F_{Aa} [N]	19000	18900	15300	11900	9210	7470	5870	5050
RM77	F_{Ra} [N]	1200	1200	1200	1200	1200	1210	1210	1220
	F_{Aa} [N]	22000	22000	19400	15100	11400	9220	7200	6710
RM87	F_{Ra} [N]	1970	1970	1970	1970	1980	1990	2000	2010
	F_{Aa} [N]	30000	30000	23600	18000	14300	11000	8940	8030
RM97	F_{Ra} [N]	2980	2980	2980	2990	3010	3050	3060	3080
	F_{Aa} [N]	40000	36100	27300	20300	15900	12600	9640	7810
RM107	F_{Ra} [N]	4230	4230	4230	4230	4230	4230	3580	3830
	F_{Aa} [N]	48000	41000	30300	23000	18000	13100	9550	9030
RM137	F_{Ra} [N]	8710	8710	8710	8710	7220	5060	3980	6750
	F_{Aa} [N]	70000	70000	70000	57600	46900	44000	35600	32400
RM147	F_{Ra} [N]	11100	11100	11100	11100	11100	10600	8640	10800
	F_{Aa} [N]	70000	70000	69700	58400	45600	38000	32800	30800
RM167	F_{Ra} [N]	14600	14600	14600	14600	14600	14700	-	-
	F_{Aa} [N]	70000	70000	70000	60300	45300	36900	-	-

$$f_{Bmin} = 2.0 / L_{H10} = 25,000\ h$$

		n_a [1/min]							
		< 16	16-25	26-40	41-60	61-100	101-160	161-250	251-400
RM57	F_{Ra} [N]	410	410	410	410	410	415	415	420
	F_{Aa} [N]	12100	9600	7350	6050	4300	3350	2600	2200
RM67	F_{Ra} [N]	590	590	590	595	590	595	600	605
	F_{Aa} [N]	15800	12000	9580	7330	5580	4460	3460	2930
RM77	F_{Ra} [N]	1210	1210	1210	1210	1210	1220	1220	1220
	F_{Aa} [N]	20000	15400	11900	9070	6670	5280	4010	3700
RM87	F_{Ra} [N]	2000	2000	2000	2000	2000	1720	1690	1710
	F_{Aa} [N]	24600	19200	14300	10600	8190	6100	5490	4860
RM97	F_{Ra} [N]	3040	3040	3040	3050	3070	3080	2540	2430
	F_{Aa} [N]	28400	22000	16200	11600	8850	6840	5830	4760
RM107	F_{Ra} [N]	4330	4330	4330	4330	4330	3350	2810	2990
	F_{Aa} [N]	32300	24800	17800	13000	9780	8170	5950	5620
RM137	F_{Ra} [N]	8850	8850	8850	8830	5660	4020	3200	5240
	F_{Aa} [N]	70000	59900	48000	37900	33800	31700	25600	23300
RM147	F_{Ra} [N]	11400	11400	11400	11400	11400	8320	6850	8440
	F_{Aa} [N]	70000	60600	45900	39900	33500	27900	24100	22600
RM167	F_{Ra} [N]	15100	15100	15100	15100	15100	13100	-	-
	F_{Aa} [N]	70000	63500	51600	37800	26800	23600	-	-



Conversion factors and gear unit constants

The following conversion factors and gear unit constants apply to calculating the permitted overhung load F_{XL} at point x $\frac{1}{4}$ 1000 mm for RM gear units:

Gear unit type	a	b	$c_F (f_B = 1.5)$	$c_F (f_B = 2.0)$	F_F
RM57	1047	47	1220600	1260400	277
RM67	1047	47	2047600	2100000	297.5
RM77	1050	50	2512800	2574700	340.5
RM87	1056.5	56.5	4917800	5029000	414
RM97	1061	61	10911600	11124100	481
RM107	1069	69	15367000	15652000	554.5
RM137	1088	88	25291700	25993600	650
RM147	1091	91	30038700	31173900	756
RM167	1089.5	89.5	42096100	43654300	869

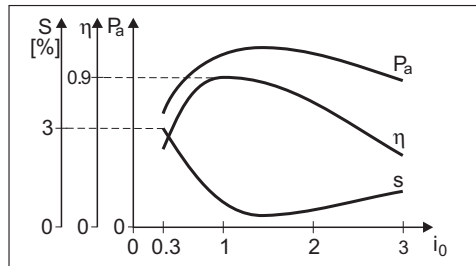
Additional weights of RM gear units

Type	Additional weight in addition to RF, related to the smallest RF flange Δm [kg]
RM57	12.0
RM67	15.8
RM77	25.0
RM87	29.7
RM97	51.3
RM107	88.0
RM137	111.1
RM147	167.4
RM167	195.4



4.9 Standard variable speed gearmotor selection

In order to establish the correct size of variable speed drive, it is necessary to know the power required, the speed setting range, the ambient temperature, the installation altitude and the operating mode. The following figure shows the output power P_a , the efficiency η and the slip s as a function of the gear ratio i .



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Key

P_a	Output power
η	Efficiency
s	Slip
i_0	Variable speed gear unit ratio

$$i_0 = \frac{n_{a0}}{n_{e0}}$$

n_{a0} = Output speed without load
 n_{e0} = Input speed without load

The figure above shows the profiles of P_a , s and η according to measurements on variable speed gear units with a load applied. The diagram shows there is a close correlation between efficiency and slip at the set ratio. There are no linear relationships here for mechanical reasons such as maximum friction between the belt (friction disc) and maximum circumferential velocity as well as speed-dependent friction factors. As a result, it is necessary to consider the specific application in order to enable a variable speed gear unit to be used optimally.

Dimensioning criteria

Mechanical variable speed gear units not only serve as speed converters but also as torque converters. As a result, their dimensions can be selected according to various criteria:

- Constant torque
- Constant power
- Constant torque and power (in partial speed ranges in each case)

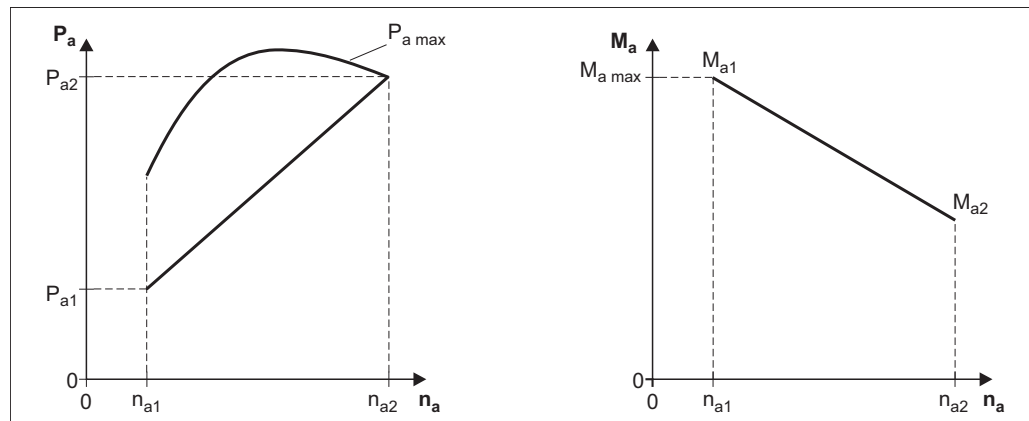


The "Drive Engineering - Practical Implementation, Drive Planning" publication contains extensive information about this topic.

Selection according to the selection tables

Selecting a variable speed gear unit according to the information in the selection tables means that its capabilities will be optimally exploited. The reduction gear unit must be configured so the maximum occurring output torques can be transmitted.

If you do not want to fully exploit the available setting range of the variable speed gear unit, it is a good idea to position the speed range to be used at the top end of the overall speed range since this gives better efficiency. The slip of the variable speed gear unit is at its lowest in the top speed range and the transmissible power is at its largest.



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Figure 3: Characteristic values of the variable speed gear unit (simplified representation)

Key

$P_{a \max}$	Maximum output power (based on experiment)
P_{a1}	Minimum output power at n_{a1}
P_{a2}	Maximum output power at n_{a2}
n_{a1}	Minimum output speed
n_{a2}	Maximum output speed
$M_{a \max}$	Maximum output torque of the variable speed gear unit
M_{a1}	Output torque at n_{a1}
M_{a2}	Output torque at n_{a2}

4.10 Service factors

It is essential to know exactly what the drive application is in order to select the correct size and type of drive. The operating conditions of the driven machine are represented by its duty cycle. Precise project planning work on the basis of the duty cycle demands extensive calculations to be performed. As a result, the effects of the driven machine on the gear unit and the variable speed gear unit are represented to an adequate degree of accuracy by the service factor f_B .

Service factor f_B for load type

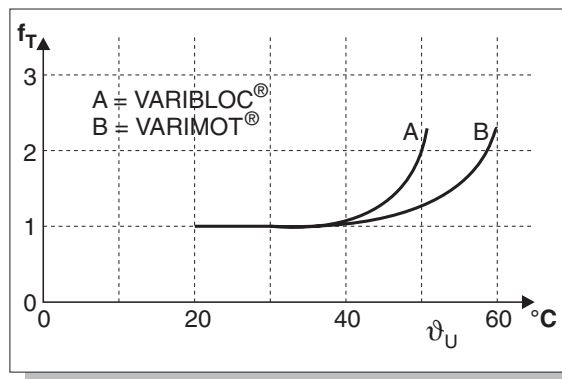
A service factor of 0.8 f_B can be expected for a daily operating time of 2 hours.

Load type	f_B	Notes on Repair Procedure	Examples
I	1.0	Uniform, smooth operation	Fans, light conveyor belts, filling machines
II	1.25	Non-uniform operation with medium shocks	Hoists, balancing machines, crane trolleys
III	1.5	Highly non-uniform operation with powerful shocks	Heavy mixers, roller tables, punching machinery, stone crushers



Factor f_T at elevated ambient temperature

The load on the variable speed gear unit must be reduced at elevated ambient temperature. The following diagram shows the required factor f_T at elevated ambient temperature J_{amb} .



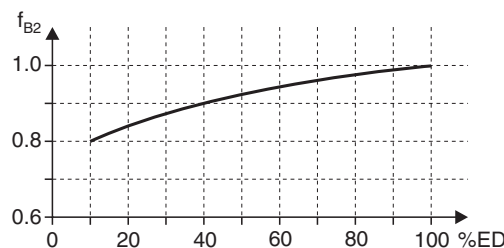
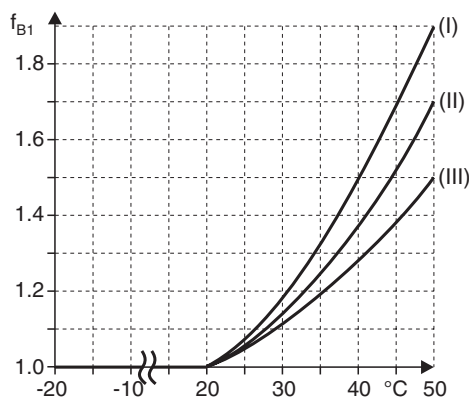
00637BXX

The variable speed gear unit must be selected for the factor $f = f_B \times f_T$ larger than the original calculation.

Special considerations for helical-worm gear units

With helical-worm gear units, it is necessary to take account of the service factor f_B and, in addition, the influence of ambient temperature above 20 °C in terms of the load type I, II and III (service factor f_{B1}) as well as the cyclic duration factor (service factor f_{B2}).

The additional service factors f_{B1} and f_{B2} can be determined by referring to the following diagrams. The load type is taken into consideration in f_{B1} in the same way as in f_B .



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The cyclic duration factor (cdf) is calculated using the following formula:

$$ED (\%) = \frac{\text{Time under load in min/h}}{60} \cdot 100$$

Contact SEW-EURODRIVE in case of temperatures below -20 °C ($\rightarrow f_{B1}$).

The total service factor for a variable speed gearmotor in conjunction with a helical-worm gear unit is calculated as follows:

$$f_{Btot} = f_B \cdot f_{B2} \cdot f_{B3}$$

In this case, the larger of the two factors f_T and f_{B1} is used for f_{B3} .



Starting frequency of variable speed gear units

Variable speed gearmotors are designed for continuous operation. Variable speed drives with a high starting frequency are preferably designed as electronically controlled AC or DC drives.

Note the following points for the special application of increased starting frequency:

VARIBLOC® and VARIMOT® variable speed gear units will operate reliably and can be expected to have a normal service life even given frequent load variations. The maximum permitted number of starts is higher than that of the particular motor. The additional mass moment of inertia J_Z to be accelerated by the motor is calculated using the following equation:

$$J_Z = J_1 + \frac{n_a^2}{n_n^2} \cdot (k \cdot J_1 \cdot i_G^2 + J_{\text{ext}})$$

Key

J_Z [kgm ²]	Mass moment of inertia to be accelerated
J_1 [kgm ²]	Mass moment of inertia of the driving variable pulley or drive disk
n_a [1/min]	Output speed in the range n_{a1} to n_{a2} (n_{a2} = most unfavorable speed setting)
n_n [1/min]	Rated speed of the motor
k	Coefficient according to table
i_G	Ratio of the reduction gear unit on the output end (if there is no reduction gear unit: $i_G = 1$)
J_{ext} [kgm ²]	External mass moment of inertia

Variable speed gear unit Type	J_1 [10 ⁻⁴ kgm ²]	k
VU/VZ01	12.52	1.1
VU/VZ11	29.78	1.1
VU/VZ21	39.72	1.22
VU/VZ31	209.65	1.1
VU/VZ41	456.48	1.6
VU51	917.94	1.56
VU6	2529	2.1
D/DF16	23	0.77
D/DF26	74	0.84
D/DF36	280	1.08
D/DF46	597	1.21



4.11 Protection and monitoring of standard variable speed gearmotors

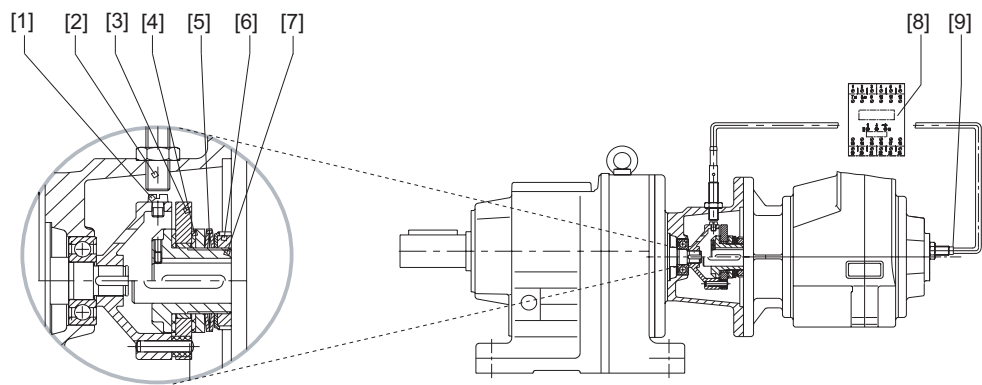


The WS option described in this section is not available for explosion-proof variable speed gearmotors.

Overload protection

The motor protection system, regardless of what type is installed, does not protect the gear units connected to the motor output. An adapter with a torque limiting coupling (AR) can be used with variable speed gear units to limit the mechanical torque and protect the gear stages connected on the output end.

Slip monitor /WS



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Figure 4: Adapter with torque limiting coupling and slip monitor /WS

- | | |
|------------------------|-----------------------|
| [1] Trigger cam | [6] Slotted round nut |
| [2] Encoder (adapter) | [7] Friction hub |
| [3] Driving disc | [8] Slip monitor /WS |
| [4] Friction ring pads | [9] Encoder IG |
| [5] Cup springs | |

Connection

The encoder is connected to the monitor using a 2 or 3-core cable (depending on the encoder type).

- Maximum cable length: 500 m with a line cross section of 1.5 mm²
- Standard incoming cable: 3-core / 2 m
- Route the signal lines separately (not in multicore cables) and shield them if necessary
- Enclosure: IP40 (terminals IP20)
- Operating voltage: 220 V_{AC} or 24 V_{DC}
- Maximum switching capability of the output relay: 6 A (250 V_{AC})



Terminal assignment WS

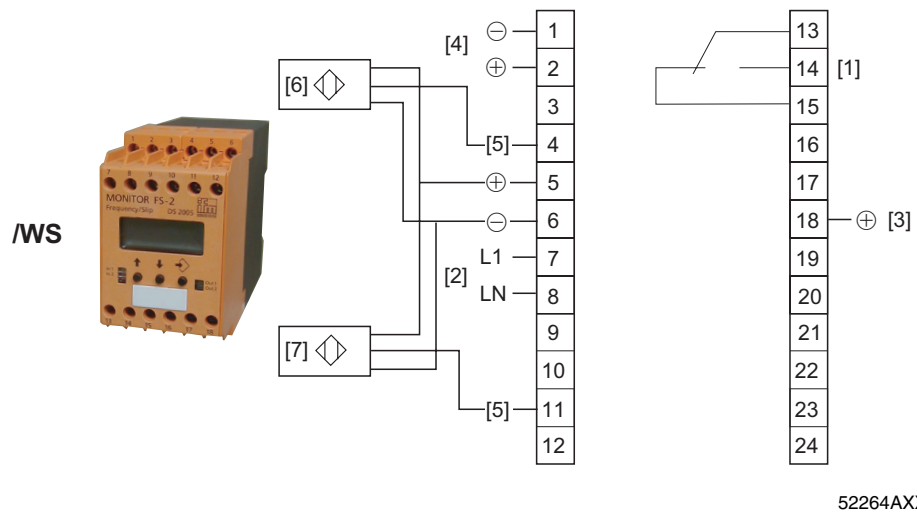


Figure 5: Terminal assignment/WS

- | | |
|--|-------------------|
| [1] Relay output | [6] Encoder 1 |
| [2] Supply voltage 230 V _{AC} (47 Hz ... 63 Hz) | [7] Encoder 2 |
| [3] External slip reset | [WS] slip monitor |
| [4] Supply voltage 24 V _{DC} | |
| [5] Signal | |

Dimensions WS

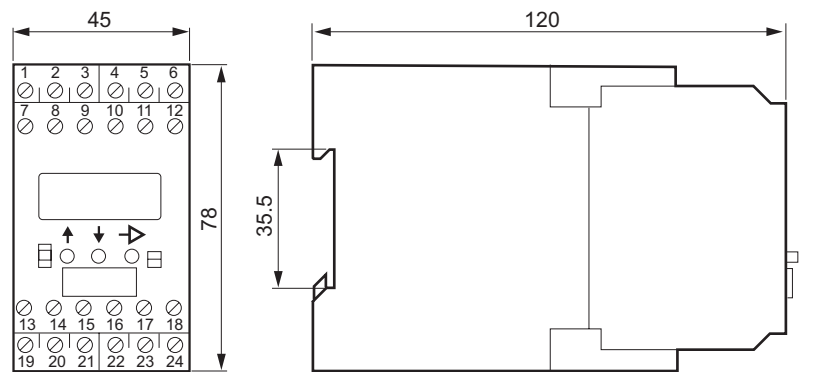
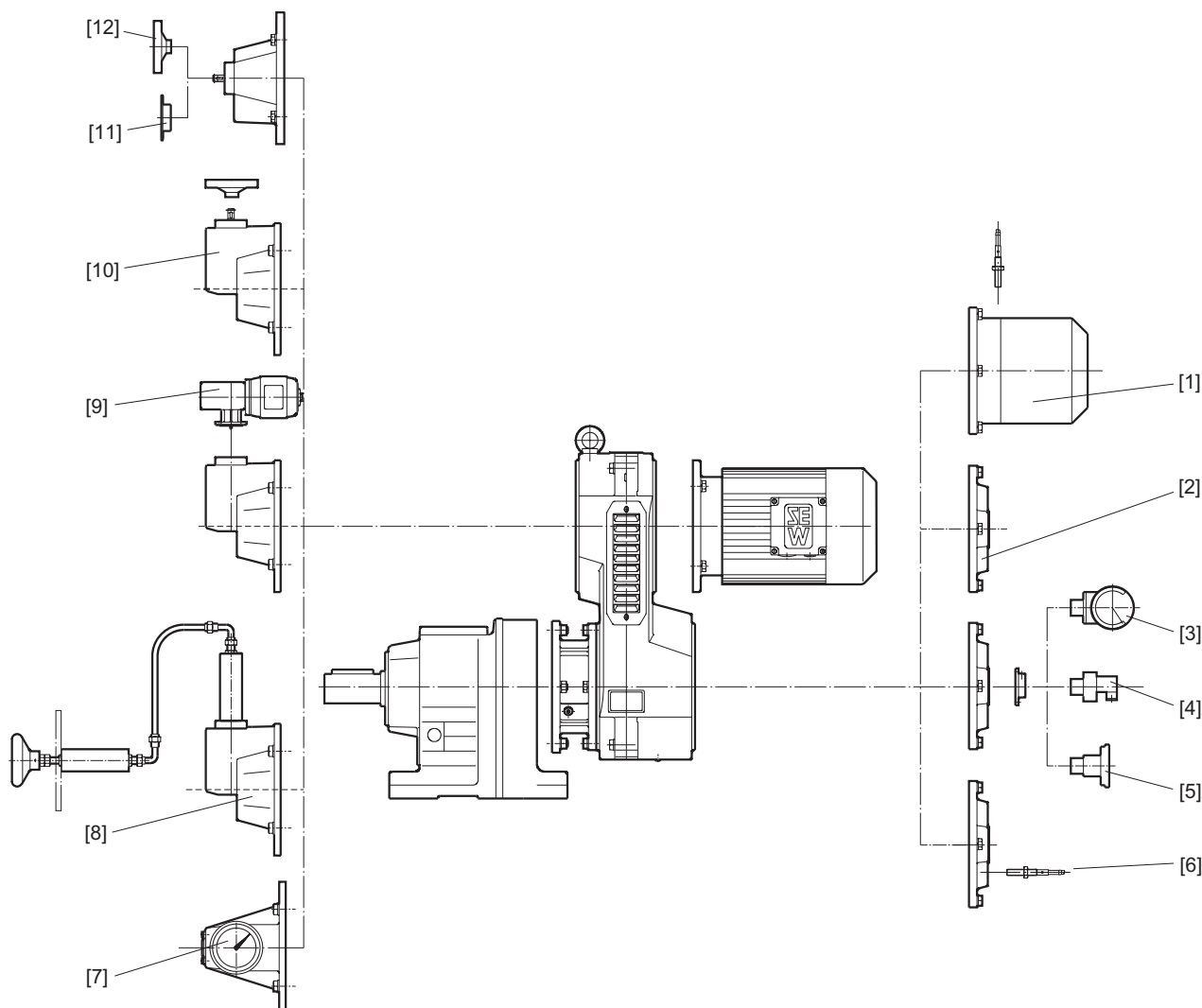


Figure 6: Dimensions /WS



4.12 VARIBLOC® options

Standard VARIBLOC®

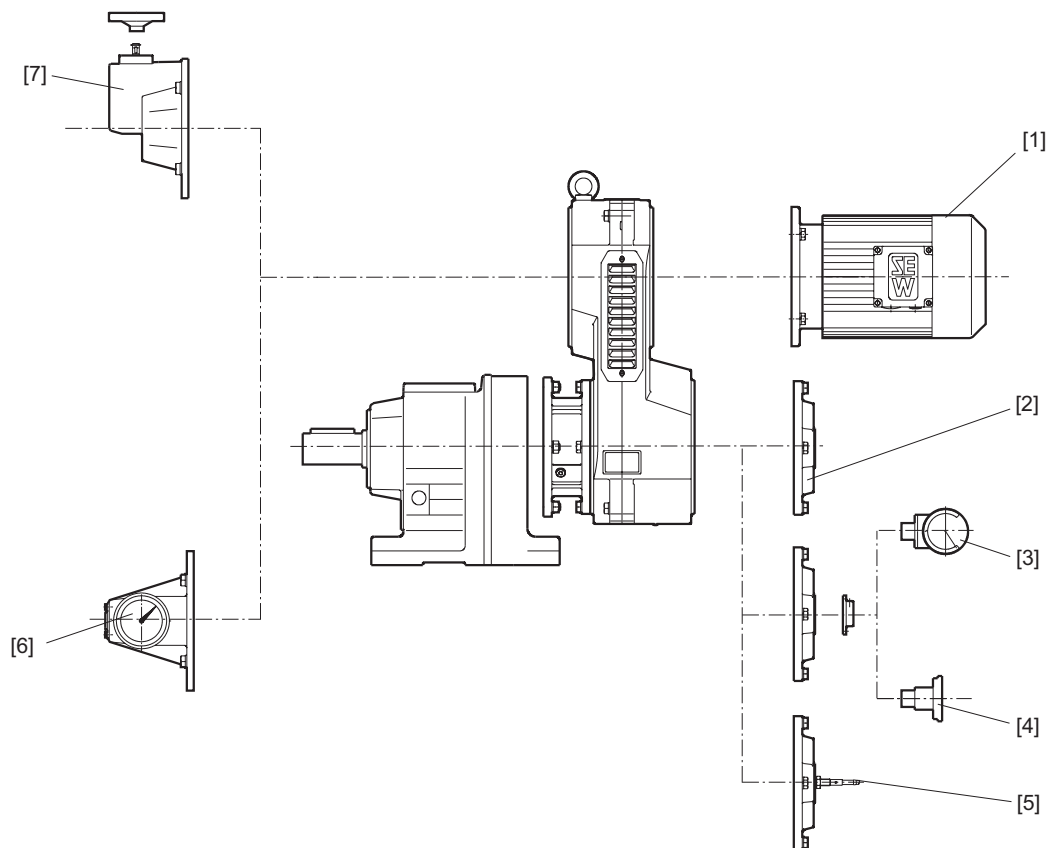


52300AXX

- [1] Brake BM(G) (with tachogenerator IG)
- [2] Bearing cover
- [3] Rightangled tachometer TW
- [4] AC tachogenerator GW
- [5] Axial tachogenerator TA
- [6] Tachogenerator IG
- [7] Control head with handwheel and setting indicator HS
- [8] Hydraulic setting unit HY
- [9] Electromechanical remote speed control EF
- [10] Control head with hand wheel H / with exposed shaft end NV
- [11] Front adjustment with chain sprocket
- [12] Front adjustment with handwheel (standard version)



**Explosion-proof
VARIBLOC®**



53769AXX

- [1] Driving motor
- [2] Bearing cover with M12x1 tapped hole (standard equipment)
- [3] Rightangle tachometer TW
- [4] Axial tachogenerator TA
- [5] Voltage encoder IGEX
- [6] Control head with handwheel and setting indicator HS
- [7] Control head with hand wheel H (standard type) / with exposed shaft end NV


**VARIBLOC®
with brake**


If VARIBLOC® is used with a brakemotor, the brake torque listed in the following table must not be exceeded for safety reasons!

If operating VARIBLOC® with mass acceleration factors of > 10, VARIBLOC® must be used with a brake.

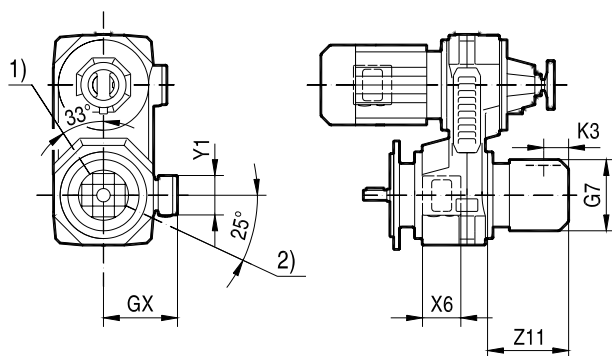
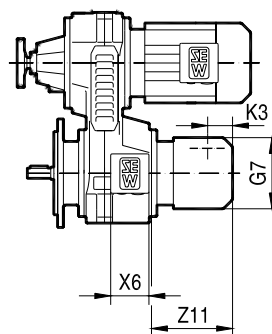
Type	Max. permitted braking torque of the motor [Nm]
VU/VZ01	5
VU/VZ11	10
VU/VZ21	20
VUVZ31	40
VUVZ41	75

If the VARIBLOC® variable speed gear unit cannot be combined with a brakemotor for reasons of safety, a safe solution can be achieved by mounting the BMG brake onto the output shaft of the variable speed gear unit.

VARIBLOC® with a brake is only available with manual brake release (BMG/HF or BMG/HR). The brake rectifier is installed in a special terminal box on the VARIBLOC® housing. Standard supply voltages are 230 V_{AC} und 400 V_{AC}.

Dimensions VU/VZ
with brake

12 006 001

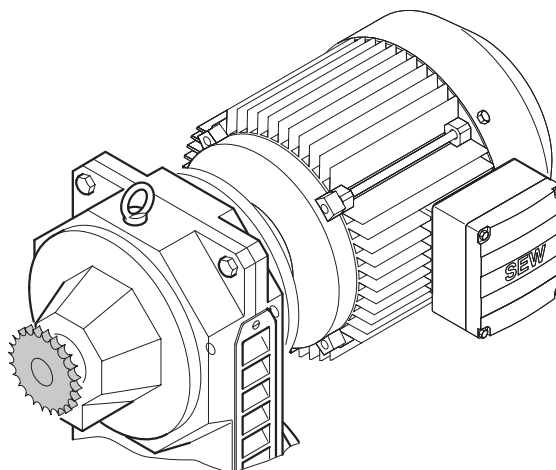
VU..

VZ..


- 1) Manual brake release HF or HR for brake
- 2) Connection hole for proximity-type speed measurement FL

	Brake type	M _{B max} [Nm]	GX [mm]	G7 [mm]	K3 [mm]	X6 [mm]	Y1 [mm]	Z11 [mm]
VU/VZ01 BMG/HF (HR)	BMG05	5	152	145	59	106	109	168
VU/VZ11 BMG/HF (HR)	BMG1	10	155	145	59	106	109	176
VU/VZ21 BMG/HF (HR)	BMG2	20	177	197	69	106	109	211
VU/VZ31 BMG/HF (HR)	BMG4	40	205	197	69	106	109	225
VU/VZ41 BMG/HF (HR)	BMG8	75	237	221	97	106	109	255



Front adjustment with chain sprocket

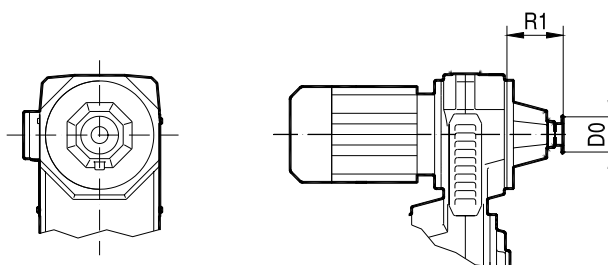


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CW direction of rotation on the chain sprocket means an increase in speed.

Dimensions

12 001 001

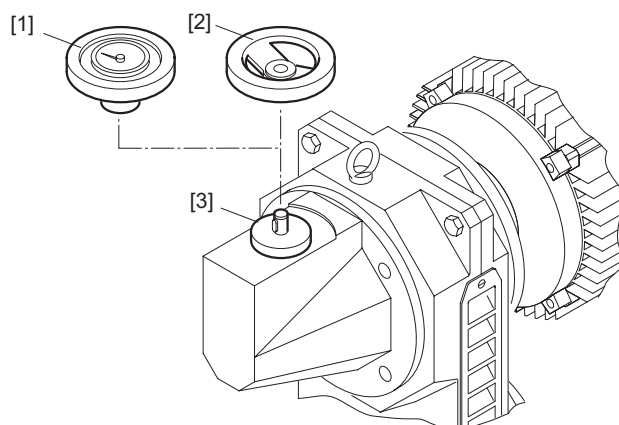


	R1	D0	1)	2) DIN 8187	3) 1:4	3) 1:6	3) 1:8	4) [Nm]
VU/VZ01 K	82	81.19	20	12.7x3.3	-	10	-	1.8
VU/VZ11 K	99	81.19	20	12.7x3.3	-	12	13	2.7
VU/VZ21 K	106	81.19	20	12.7x3.3	-	15	16	4.0
VU/VZ31 K	129	81.19	20	12.7x3.3	-	18	19	6.5
VU/VZ41 K	160	121.5	30	12.7x3.3	-	18	-	9.0
VU51 K	195	121.5	30	12.7x3.3	-	20	-	12.0
VU6 K	158	254.8	63	12.7x3.3	27	-	-	17.0

- 1) Number of teeth
- 2) Single row roller chain
- 3) Chain sprocket rotation for setting range
- 4) Torque needed for adjustment



**Exposed shaft
end NV,
Handwheel with
setting indicator
HS**



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- [1] Handwheel with setting indicator HS
- [2] Handwheel H
- [3] Exposed shaft end NV

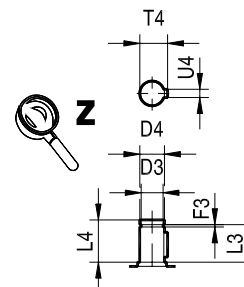
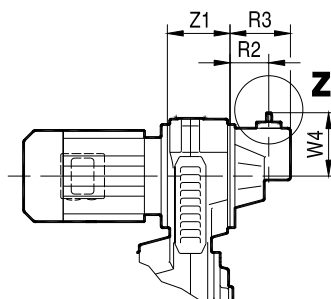
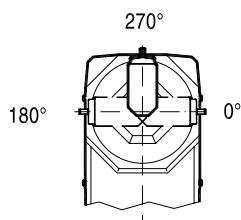
The control heads can be swiveled to the positions shown in the following dimensional diagram. Specify the required position in your order. CW direction of rotation on the handwheel H means an increase in speed. The handwheel with setting indicator HS only functions when the adjustment spindle is horizontal.



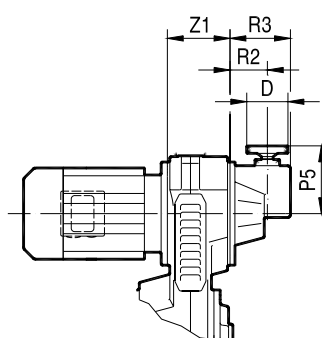
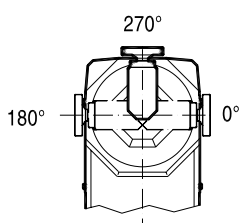
Dimensions NV, H,
HS

12 002 001

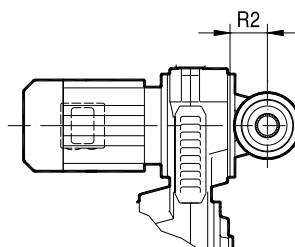
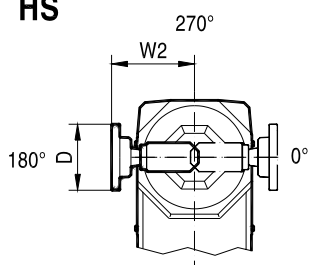
NV



H



HS



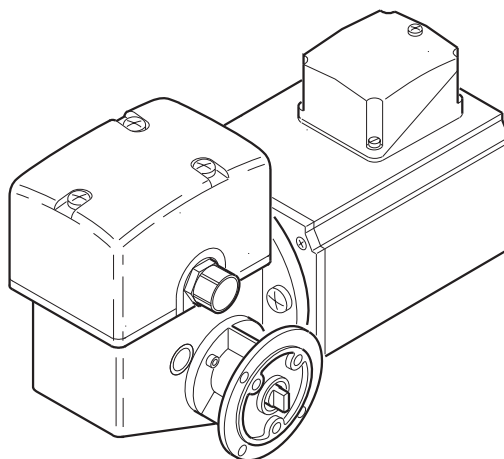
4

	D	D3	D4	F3	L3	L4	P5	R2	R3	T4	U4	W2	W4	2) 1:4	2) 1:6	2) 1:8	1) [Nm]
VU/VZ01 NV/H/HS	100	11.5	12	1.1	18.2	20.5	119	60	112.5	13.5	4	144	103	-	7	-	1.8
VU/VZ11 NV/H/HS	100	11.5	12	1.1	18.2	20.5	119	60	112.5	13.5	4	144	103	-	10	11	2.7
VU/VZ21 NV/H/HS	100	11.5	12	1.1	18.2	20.5	138.5	75	129.5	13.5	4	163.5	122.5	-	11	13	4.0
VU/VZ31 NV/H/HS	100	11.5	12	1.1	18.2	20.5	165	94	146.5	13.5	4	190	149	-	14	15	6.5
VU/VZ41 NV/H/HS	160	17	18	1.3	21.4	25	202	122	190	20.5	6	235	185	-	14	-	9.0
VU51 NV/H/HS	160	17	18	1.3	21.4	25	216	134	200	20.5	6	249	199	-	17	-	12.0
VU6 NV/H/HS	160	17	18	1.3	21.4	25	225	156	230	20.5	6	253	210	18	-	-	17.0

- 1) Torque needed for adjustment
2) Handwheel rotations for setting range



Electromechanical remote speed control EF/EFPA



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Electromechanical remote speed control consists of a servo motor which, in the EFPA type, is supplemented by an indicator unit. This indicator unit can be installed in a control cabinet. Speed changes resulting from load fluctuations are not shown on the display. The electromechanical remote speed control EF/EFPA is designed for maximum 40 % cdf and a starting frequency of < 20 cycles per hour. The minimum and maximum speeds are determined by setting the two limit switches. The control unit can be swiveled to the positions shown in the following dimension drawing (270° = standard position).



Electromechanical remote speed adjustment is not suitable for automatic control but only for occasional adjustment.

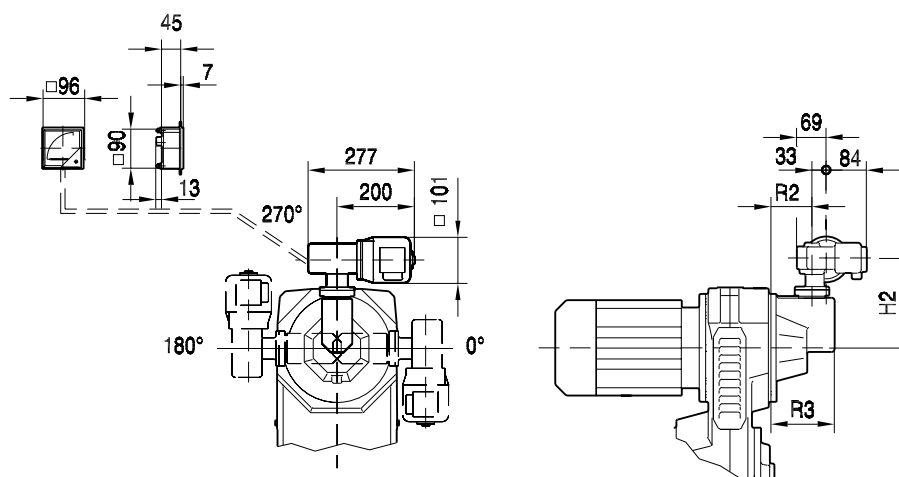
Technical data

VARIBLOC® type	Adjustment device	Variable motor							
		Type	P _m [W]	U [V _{AC}]	f [Hz]	I [A _{AC}]	n _a [1/min]	Enclos ure	Part number
VU/VZ01 - 41	EF/EFPA	DM90-60K + E13 with potentiometer	75	230/400	50	0.76/0.44	25	IP55	150 292 1
VU51									
VU6									



Dimensions EF/
EFPA

12 003 01 01



4

	H2	R2	R3	1) 1:4	1) 1:6	1) 1:8
VU/VZ01 EF/EFPA	159	60	112.5	-	17	-
VU/VZ11 EF/EFPA	159	60	112.5	-	22	24
VU/VZ21 EF/EFPA	178.5	75	129.5	-	26	31
VU/VZ31 EF/EFPA	205	94	146.5	-	36	39
VU/VZ41 EF/EFPA	236	122	190	-	34	-
VU51 EF/EFPA	250	134	200	-	41	-
VU6 EF/EFPA	260	156	230	46	-	-

1) Adjustment time in seconds for setting range

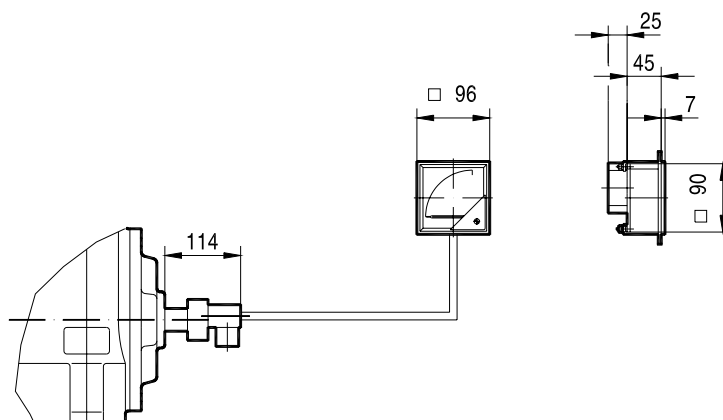
Analog remote speed indicators FA, FD

The analog remote speed indicators FA and FD comprise the AC tachogenerator GW mounted to the VARIBLOC® with 10 V / 1000 1/min and the indicator unit size 96. The indicator unit with the scale 0 % ...100 % (only FA) or with individual customer-specific scale (only FD) is matched to the mounted AC tachogenerator GW. FA and FD are used in VU/VZ01-41 and VU51.



Dimensions FA,
FD

12 014 001

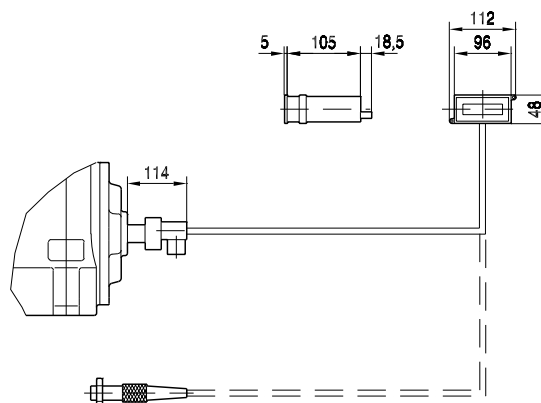


**Digital remote
speed indicator
DA**

The digital indicator unit DA with its 4-digit display (red 7-segment LEDs) is used for connecting to the AC tachogenerator GW in the VU/VZ01-41 and VU51 or to the encoder IG in the VU/VZ01-41BMG and VU6. The unit is suitable for use as a time-based counter for representing all measured quantities which have a measurement signal in the form of a frequency as pulses or as an AC voltage. The universal adjustment function for the calibration values makes it possible to assign the input frequency (speed of the output shaft of the variable speed gear unit) to the required display.

Dimensions DA

12 015 001





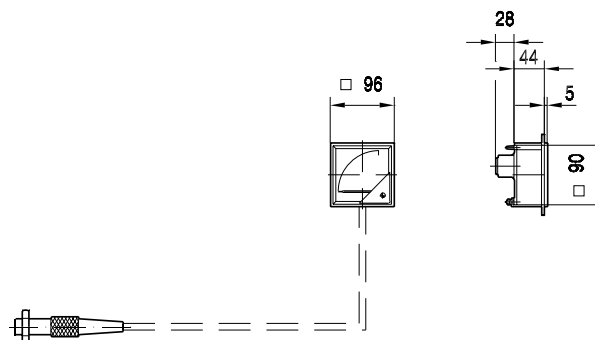
Remote speed indicators FL

VARIBLOC® VU6 and VU/VZ01 - 41BMG are exclusively equipped with a proximity-type encoder IG for speed measurement. This means the analog remote speed indicator FL can be used. FL is equipped for mains connection 220 V / 50 Hz and has a size 96 indicator unit (scale 0 % ... 100 %). Note that the maximum cable length is 100 m and the maximum cable resistance is 3 ohms.

Dimensions FL

12 016 001

4



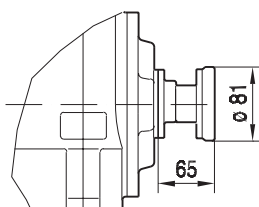
Axial tachogenerator TA, rightangled tachometer TW

Tachos TA or TW can be fitted as an alternative to the AC tachogenerator GW. They are equipped with scales for CW and CCW operation. The scale values are configured according to the customer's requirements.

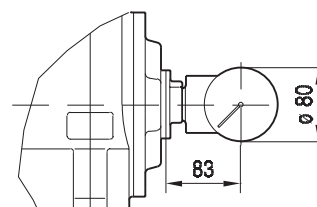
Dimensions TA, TW

12 017 001

TA



TW



***Special
VARIBLOC®
designs***

The VARIBLOC® drive can be especially accurately adapted to the available installation space by swiveling the variable speed gear unit to different 45° positions in relation to the reduction gear unit.

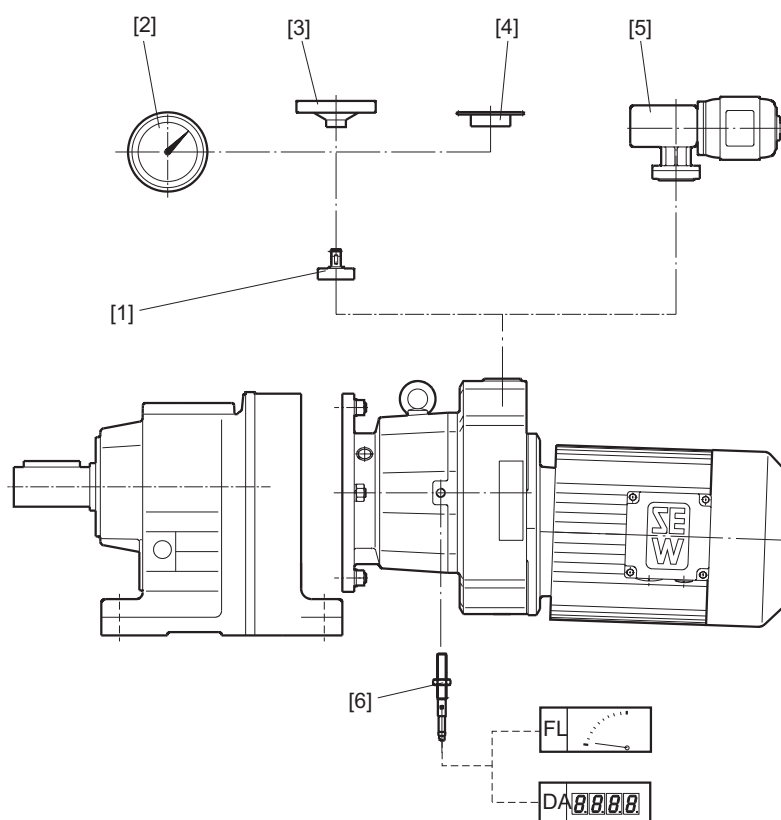
***Ventilation of
VARIBLOC®***

The basic version of VARIBLOC® variable speed gear units are ventilated to provide better heat dissipation. The drawn-in cooling air emerges through openings on the side. On request (option pricing) VARIBLOC® VU/VZ01...41 variable speed gear units can also be supplied as non-ventilated, completely enclosed versions (designation VU/VZ..U, → Selection tables, Sec. "VUF/VZF..").



4.13 VARIMOT® options

Standard VARIMOT®

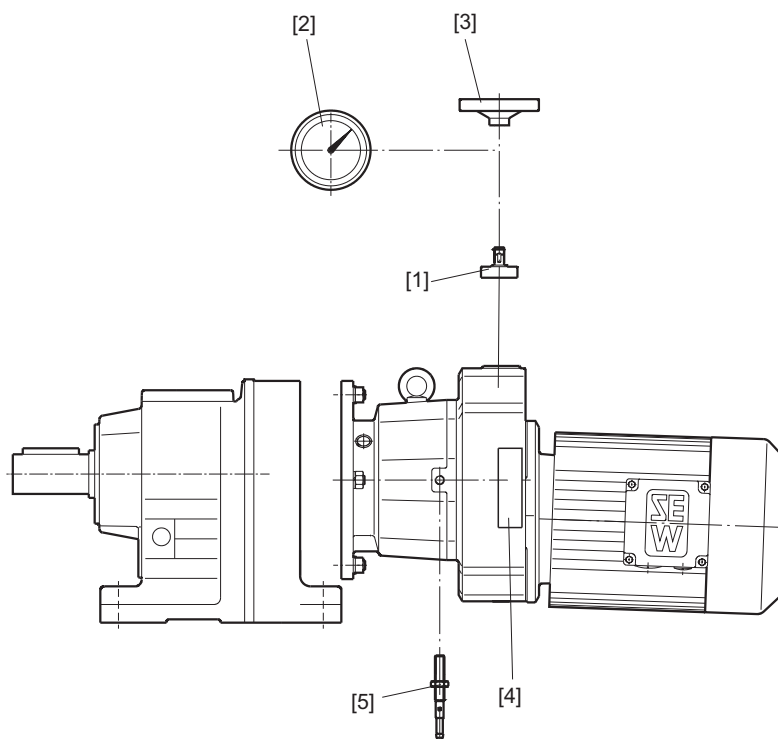


52302AXX

- [1] Control head with exposed shaft end NV
- [2] Control head with handwheel and setting indicator HS
- [3] Front adjustment with handwheel (standard version)
- [4] Control head with chain sprocket K
- [5] Electromechanical remote control EF and EFPA (with remote setting indicator)
- [6] Tachogenerator IG with analog/digital remote speed indicator FL/DA



**Explosion-proof
VARIMOT®**

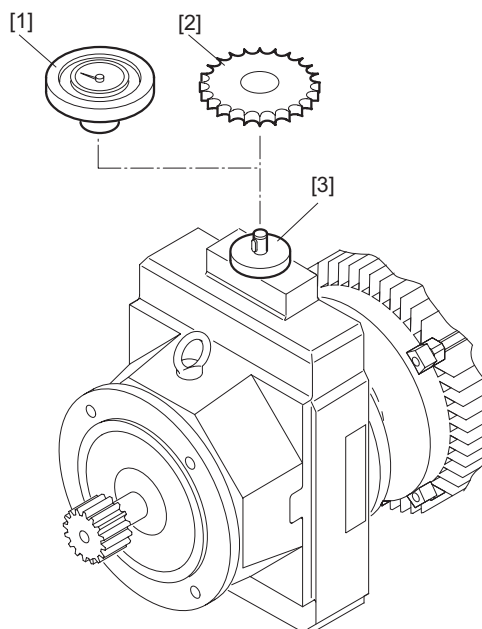


52019AXX

- [1] Control head with exposed shaft end NV
- [2] Control head with handwheel and setting indicator HS
- [3] Front adjustment with handwheel (standard version)
- [4] Display scale
- [5] Voltage encoder IGEX



**Adjustment with
chain sprocket K,
with exposed
shaft end NV or
with handwheel
with setting
indicator HS**



52304AXX

- [1] Handwheel with setting indicator HS
- [2] Chain sprocket K
- [3] Exposed shaft end NV

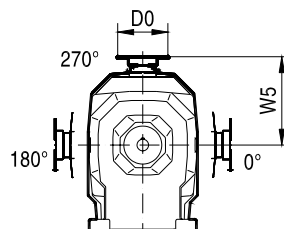
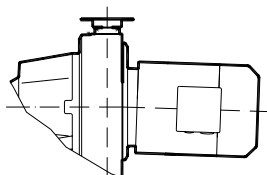
CCW direction of rotation on the adjustment spindle means an increase in speed. The handwheel with installed setting indicator HS only functions when the adjustment spindle is horizontal.



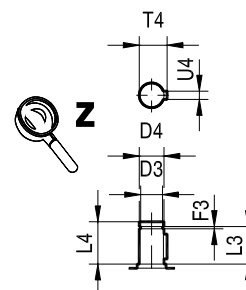
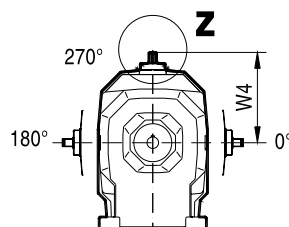
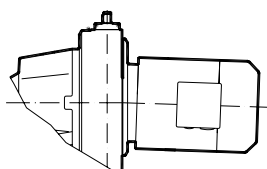
Dimensions K, NV,
HS

12 004 001

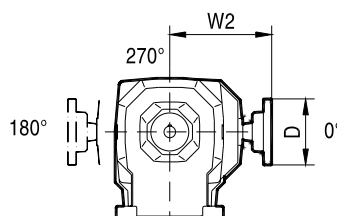
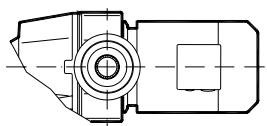
K



NV



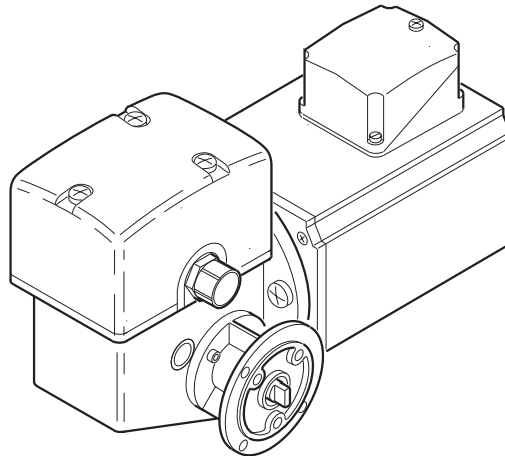
HS



	D	D0	D3	D4	F3	L3	L4	T4	U4	W2	W4	W5	1)	2) DIN 8187	3)	4) [Ncm]
D16 K/NV/HS	100	81.19	11.5	12	1.1	18.2	20.5	13.5	4	184	149.5	146	20	12.7x3.3	25.5	150
D26 K/NV/HS	100	81.19	11.5	12	1.1	18.2	20.5	13.5	4	217	179.5	179	20	12.7x3.3	34	250
D36 K/NV/HS	160	121.5	17	18	1.3	21.4	24	20.5	6	265	219	215	30	12.7x3.3	29	450
D46 K/NV/HS	160	121.5	17	18	1.3	21.4	24	20.5	6	295	246	240	30	12.7x3.3	31	800

- 1) Number of teeth
- 2) Single row roller chain
- 3) Spindle rotation for entire setting range
- 4) Torque needed for adjustment

Electromechanical remote speed control EF/EFPA



53862AXX

Electromechanical remote speed control consists of a servo motor which, in the EFPA type, is supplemented by an indicator unit. This indicator unit can be installed in a control cabinet. Speed changes resulting from load fluctuations are not shown on the display.

The electromechanical remote speed control EF/EFPA is designed for maximal 40 % cdf and a starting frequency of < 20 cycles per hour. The minimum and maximum speeds are determined by setting the two limit switches. The control unit can be swiveled to the positions shown (270° = normal position).

The setting indicator is located at either 0° or 180° when the control head is in its normal position. Specify the position of the control unit and, if required, the setting indicator and the voltage of the variable motor in your order.



Electromechanical remote speed adjustments are not suitable for automatic control but only for occasional adjustment.

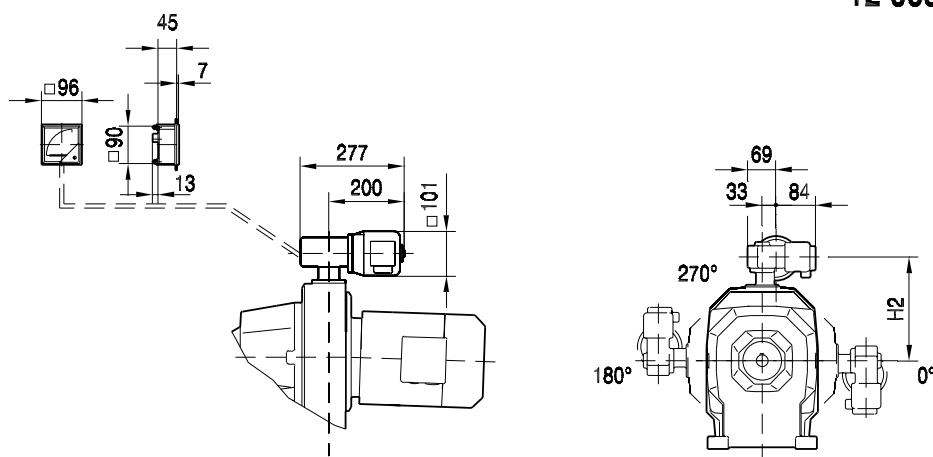
Technical data

VARIMOT® type	Adjustment device	Type	Variable motor					Enclosure	Part number
			P _m [W]	U [V _{AC}]	f [Hz]	I [A _{AC}]	n _a [1/min]		
D16...D46	EF/EFPA	DM90-60K + E13 with potentiometer	75	230/400	50	0.76/0.44	69	IP55	150 283 2



Dimensions EF/
EFPA

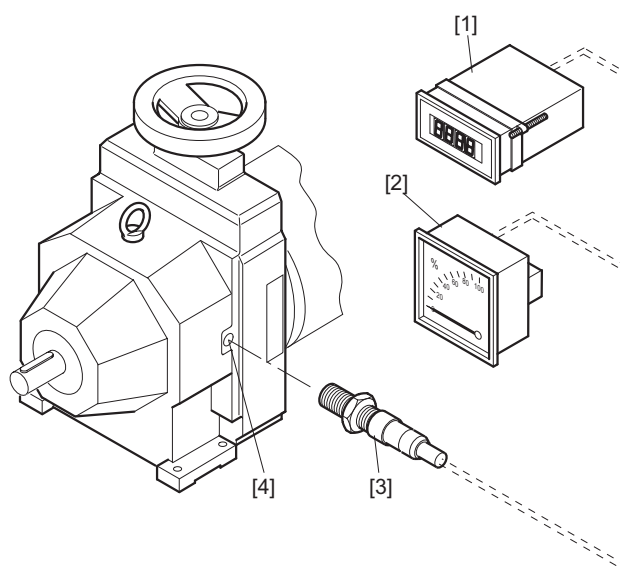
12 005 01 01



	H2	1)
D16 EF/EFPA	202	22
D26 EF/EFPA	232	29
D36 EF/EFPA	268	25
D46 EF/EFPA	293	27

1) Adjustment time in seconds

**Encoder IG,
remote speed
indicators FL and
DA**



52305AXX

- [1] Display DA
- [2] Remote speed indicator FL
- [3] Voltage encoder IG (3)



The analog remote speed indicator FL [2] and the digital indicator DA [1] operate in conjunction with a proximity-type tachogenerator IG [3] mounted on the left or right side of VARIMOT®.

The following types are possible:

1. IG:
 - The scope of delivery for this type only includes the tachogenerator IG [3] without indicator unit FL [2] or DA [1].
2. FL:
 - In this type, the tachogenerator IG [3] with analog remote speed indicator FL [2] is included in the scope of delivery.
3. DA:
 - In this type, the tachogenerator IG [3] with digital remote speed indicator DA [1] is included in the scope of delivery.
4. IGV:
 - In this type, the housing of the variable speed gear unit has a tapped hole M16x1 [4] for accommodating a tachogenerator.

Remote speed indicator FL

The analog remote speed indicator FL with encoder IG and a suitable switchboard measuring instrument size 96 with display scale 0 – 100 % can also be supplied with special scale notation. Note that the maximum cable length is 100 m and the maximum cable resistance is 3 ohms.

Digital remote speed indicator DA

The digital indicator unit DA with 4-digit display is used for connecting to the encoder IG on VARIMOT®. The unit is suitable for use as a time-based counter for representing all measured quantities which have a measurement signal in the form of a frequency as pulses or as an AC voltage.

*Dimensions DA,
FL*

12 018 001

