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UNIVERSAL Worm Gear UnitsTechnical Explanations

Torque

During continuous operation at constant load, the maximum output torques M_{2max} represent the load limit. Correct configuration is carried out according to the chapter "Selecting a Gear Unit", taking into account operating factors.

The output limiting torque M_{2grenz} will tolerate static for a short time while running without incurring damage to the gear unit. The output limiting torque M_{2grenz} represents the upper limit of the permited load and should not exceed it during impact.

Maximum Output Torque M_{2max} at n_1=1400 min^{-1}					
Type	SK 1SI 31	SK 1SI 40	SK 1SI 50	SK 1SI 63	SK 1SI 75
M_{2max}	30 Nm	50 Nm	90 Nm	160 Nm	260 Nm
Output Limiting Torque M_{2grenz}					
Type	SK1SI 31	SK1SI 40	SK1SI 50	SK1SI 63	SK 1SI 75
$M_{2\ grenz}$	75 Nm	125 Nm	225 Nm	400 Nm	650 Nm

Speed

The gear unit is designed for a motor or input speed up to 1800 min-1. Greater speeds reduce operating life.

Please inquire if you require greater speeds.

Gear Ratios

All gear ratios, including the multi-gear unit, are finally detailed exactly. (e.g. i=10 is i=10.000000000…)

All helical worms of the UNIVERSAL worm gear unit are right hand pitch. This results in the direction of rotation.

Sequence of Ratios												
5	7.5	10	12.5	15	20	25	30	40	50	60	80	100
Gear ratios are uniform for all 5 worm gear unit sizes.												

Efficiency

The smooth tooth flanks and the standard lubrication in particular provide UNIVERSAL worm gear units the greatest efficiency. The efficiency increases with new worm gear units in the initial phase of normal use by the worm gears wearing in. The output torque and ratings in the selection lists take into account the efficiency η in the drive unit status when not in operation.

Efficiency Levels η with n_1=1400 min^{-1}													
i_{sch}	5	7.5	10	12.5	15	20	25	30	40	50	60	80	100
SK 1SI 31: η [%]	86	82	80	76	71	67	63	55	50	45	42	36	32
SK 1SI 40: η [%]	88	85	82	80	75	71	68	60	54	50	46	41	36
SK 1SI 50: η [%]	90	87	85	83	79	75	72	65	60	56	52	46	42
SK 1SI 63: η [%]	92	89	87	86	82	79	76	69	64	61	57	51	47
SK 1SI 75: η [%]	93	90	84	88	84	82	80	77	69	65	62	57	52

Because of the hydrodynamic lubrication in the gearing, the efficiency increases with the input speed of worm gear units. This results in an initial lower efficiency η_a while starting the motor from a stand still. The torque should be taken into account, when it must be moved under load, of which the following guideline values for initial efficiency η_a is dependent on the gear ratio i_{worm}:

Initial Efficiency Levels η_a													
i_{sch}	5	7.5	10	12.5	15	20	25	30	40	50	60	80	100
SK 1SI 31 to SK 1SI 75 : η_a [%]	72	67	62	59	53	47	43	36	31	27	25	20	17

Lubrication

The worm gear units are lubricated for life at the factory with a high-quality, synthetic long-life lubricant with a polyglycol base. Because of this, the gears are maintenance free.

Universal worm gear units of the size 63 and 75 have standard oil screw fittings. This allows for the valves to be bled at initial start up. The optional bleed valve module contains a quick guide on the mounting position dependent installation of the bleed valve fitting.
We would be happy to provide you more information.
Bleed valve module order number: 60693500

Special Lubricants: CLP PG 220 DIN 51502					
Type	SK 1SI 31	SK 1SI 40	SK 1SI 50	SK 1SI 63	SK 1SI 75
Quantity	30ml	55ml	95 ml	180 ml	360 ml

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Ambient Conditions

The UNIVERSAL worm gear unit series is suitable for installing in enclosed rooms and outdoors because of the corrosion resistance of the aluminium surfaces. Avoid allowing contact with aggressive mediums or corrosive substances (contaminated air, gases, acids, alkaline solution, salts, etc.). A colour coating is available in these cases at additional cost. Please ask us.

The NORD UNIVERSAL worm gear unit series is suitable for ambient temperatures of –25° to 40°C. Please note that at low temperatures, increased torque is required at start up because the lubrication has toughened.

Self-Locking

During self-locking also when the torque is so large on the output (worm gear), the idling gears cannot turn in either direction when the motor is shut off. When the motor is turned off, the drive inevitably comes to a stop with self-locking in operation and when the self-braking is specified.

With a mass acceleration factor of m_{af} > 1 (see the section Selecting a Gear Unit - page 12) self-locking can cause an abrupt locking or chatter vibration during a reverse load in motor-braking (see VDI 2158). A non-self-locking gear unit should be chosen in this situation.

Self-locking and self-braking with worm gear units is dependent on the gear ratio:

Self-locking with UNIVERSAL Worm Gear Units			
i_{sch} = 5 – 10	i_{sch} = 12.5 – 40	i_{sch} = 50 – 80	i_{sch} = 100
no self-locking	no reliable information on self-locking	self-locking while idling and during zero vibration	self-locking
no self-braking	no self-braking	no reliable information on self-braking	self-braking with SK 1SI 31 SK 1SI 40 SK 1SI 50 and n_1<1500min^{-1}

Lateral Forces and Axial Loads

The selection lists show the permissible F_R and F_{RF} lateral forces which can load the output shafts in addition to the M_2 torques. The transmission of force at the middle of the shaft ends of the insert shafts is used as the basis for calculating the values of the lateral forces. The values F_R apply to the insert shafts 60393000, 60493000, 60593000, 60693000, 60793000, 60393100, 60493100, 60593100, 60693100, 60793100. The values F_{RF} apply to the flange-mounted design long insert shafts 60393200, 60493200, 60593200, 60693200, 60793200. During a midway radical force acting on the hollow shaft, the permissible lateral force is 2xFR.

The calculation of permissible lateral forces is based on the worst possible direction of force and takes into account the gear unit bearing, the gear unit housing and the insert shaft.

The hollow output shaft is stored in unusually oversized ball bearings with UNIVERSAL worm gear units. Because of this, the UNIVERSAL worm gear units are suitable to attach on the output end for lateral forces and axial loads also.

Permitted Axial Load F_A [N]				
SK 1SI 31	SK 1SI 40	SK 1SI 50	SK 1SI 63	SK 1SI 75
1800 N	3200 N	4800 N	6300 N	8000 N

The permissible amount of lateral force working at the middle of the shaft ends on a drive shaft of the free drive shaft module – type W is 1200N (order no. 60494200) or 1500N (order no. 60794200).

Dimensions and Weight

The to-scale dimension sheets and CAD-sketches of the drive as a whole is available online at the NORD homepage www.nord.com. In addition, there is the CD-ROM "NordPAC" with which you can easily create dimension sheets and sketches. We will gladly fulfill your CD-ROM created request.

Notes on Dimension Sheets on Pages 54 to 68:

- kBre and g1Bre are brake motor dimensions
- Threaded holes on shaft ends: DIN 332, Page 2
- Keyways: DIN 332, Page 1
- Flange centering: H7 and j6
- Tolerances of flange hole diameter: DIN 42948

Weight of Worm Gear Unit Module				
SK 1SI 31	SK 1SI 40	SK 1SI 50	SK 1SI 63	SK 1SI 75
1.3 kg	2.4 kg	4.1 kg	7.6 kg	12 kg

Selecting a Gear Unit

The selection lists provides for the combination of UNIVERSAL worm gear units with 4-pole standard AC motors, the resulting gear output torque M_2, output speeds n_2 and operating factors f_B. The operating factor f_B mark the safety of the gears with the given drive power.

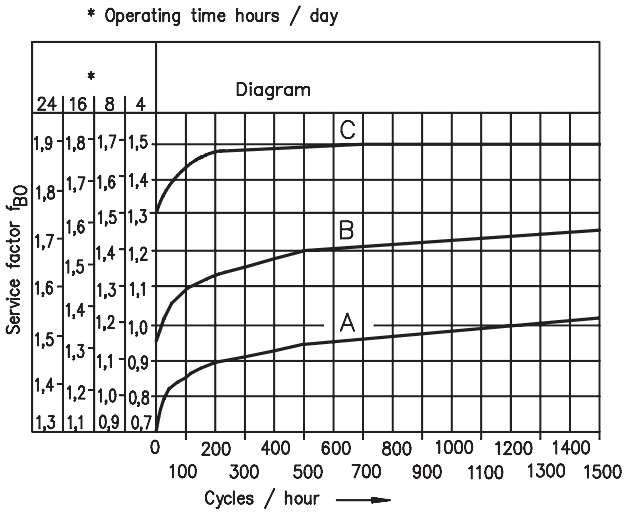
Each application has specific loads depending on factors such as jolts, frequent starts, intermittent operation and increased ambient temperatur, and therefore demands a specific minimal operating factor f_{Bmin} in order to guarantee reliable operation. You should note during gear unit selection with the aid of the selection list that the drive selected indicates the same or a greater operating factor f_B as the minimal operating factor f_{Bmin}.

The selection list "n_1 = 1400 / 900 / 500 / 250 min^{-1}" starting on page 50 is practical if a 4-pole standard AC motor is not attached. The selection list uses the operating factor f_B = 1.0 as a basis. Taking into account the minimal operating factor f_{Bmin}, the installed motor power may be at most P_{emax} / f_{Bmin}.

The required minimal operating factor f_{Bmin} for an application is calculated as follows:

$$f_{Bmin} = f_{B0} \cdot f_{B1} \cdot f_{B2}$$

The operating factor f_{B0} takes into account load type A, B or C, the frequency of activation and daily run time. The operating factor f_{B1} takes into account different ambient temperatures. The operating factor f_{B2} takes into account intermittent operation. The diagram below is used when determining the operating factors f_{B0}, f_{B1} and f_{B2}.



Examples of load types for gear units:

A Light screw conveyors, fans, assembly belts, light conveyor belts, small agitators, elevators, cleaning machines, filling machines, testing machines and belt conveyors.

B Decoilers, feed drives for wood processing machines, hoists, balancing machines, tapping units, mid-sized stirrers and mixers, winches, sliding doors, stall dunging machines, packaging machines, bending machines and gear pumps.

C Scissors, presses, punchers, nut bevelling machines, polishing and grinding drums, agitators and choppers.

Load types A, B, and C are defined as follows:

A: constant operation and $m_{af} \leq 0.25$
B: irregular operation and $m_{af} \leq 3$
C: highly irregular operation and $m_{af} \leq 10$

In which m_{af} is the mass acceleration factor:

$$m_{af} = \frac{J_{ex.red.}}{J_{mot.}}$$

$J_{ex.red.}$ = all external mass moments of inertia are reduced to the drive motor
$J_{mot.}$ = mass moments of interia of the motor

with $m_{af} > 10$ are offered upon inquiry.