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Torque rating of the Neugart gearboxes

The load ability of Neugart gearboxes is determined in accordance with the ISO-6336 (DIN 3990) gear calculation standards.

The most critical area of a gear is the gear tooth itself. The torque (circumferential force) must be transferred safely by the meshing pair of gear teeth.

The transferred torque creates:

1) a complex loading in the gear tooth root (bending an shear) ➔ gear strength
2) high "Hertz pressure" on the gear tooth flanks ➔ surface durability

The first, the "gear strength" can be described as the resistance against tooth breakage under load; the second is the resistance against surface damage on the gear face. The first one can cause instantaneities catastrophic gear failure, whereas the second long term deterioration.

The loading of the gear tooth is a classical case of a dynamic loading; the material it is subjected to fatigue failure.

Rated Torque

The rated torque of a Neugart planetary gear head corresponds to the torque which creates a tress level on the gear teeth allowing still for unlimited load cycles, based on the material S-N curve. At loads above the rated torque the gear tooth life becomes limited.

Neugart technical data sheets list following torque values

1)
Rated Torque T_{2N} - unlimited load cycles - applicable if a very long life is expected and the gearbox is running "virtually constantly" (very frequently)

2)
Allowable max. torque at up to 30000 output shaft rotations $T_{2\ max\ 30000}$ - applicable if the gearbox is running only limited time, or a short life expectation is acceptable Neugart defines this torque as: $T_{2\ max\ 30000} = 1.6 \times T_{2N}$

3)
Emergency stop (cut off) torque. This short duration torque can be sustained by the gearbox only about 1000 times during it's life. Torque of this magnitude should not be part of a routine load cycle it shall be a very seldom occurring high peak torque. Neugart defines this torque as: $T_{2\ EM.STOP} = 2 \times T_{2N}$

Max sustainable torque
A max sustainable static torque is not listed in the standard technical data, since the gearbox is designed for run not for a one time high loading.
However, the following shall document the still available torque reserves of the Neugart Planetary Gearboxes.

The material endurance stress value Neugart is using to determine the rated torque T_{2N} is 322 N/mm^2. (σ_{Flim}= 0.46 x 0.7 x10^3 = 322 N/mm^2 -- endurance limit of 16MnCr5 case hardening steel, for gear teeth subjected alternating bending stress)
The static strength for this material is listed in the material charts with up to, 1.4 x10^3 N/mm^2
The above allows the conclusion that the gearing can structurally sustain load torques well over 3 times the rated torque (based on the material data theoretically 1400 / 322 = 4.3 times rated torque), however only a very limited number of cycles.

Dr. Gerhard G. Antony