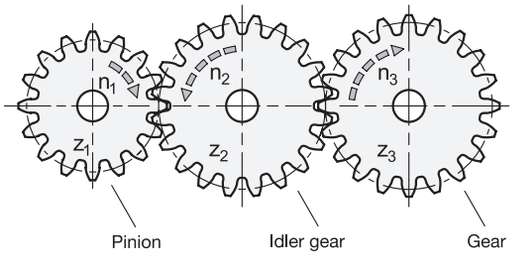
Gears

Gears transfer a rotary motion from a driving shaft to a driven shaft via a positive locking. Depending on the ratio of the number of teeth of the gears used, the speed and the torque may be retained, decreased or increased. This is called the gear ratio, where the driven gear is put into relation with the driving gear. The reverse relationship applies to the resulting speeds. See the equations below. Due to the positive locking between the gear pairs, the rotational movement is transmitted precisely and without slippage.

A pairing of two or more combined gears is called a gear train or gearbox. The smallest gear is often referred to as the pinion, while the largest is simply called a gear. The driving and the driven gears always rotate in opposite directions. If this is not desired, a third gear must be positioned between them as an idler gear. Gear trains require only small center distances, which can be influenced by the number of teeth selected.



Gear ratio i =	
Speed ratio	$i = \frac{n_1}{n_2}$
Tooth count ratio	$i = \frac{z_2}{z_1}$

The tooth shape, size and geometry can be described based on a trapezoidal reference profile, which corresponds in principle to the profile of a rack. The tooth or trapezoid height is standardized with a module value, which is specified in millimeters. The angle of the symmetrical trapezoid sides is referred to as the pressure angle.

The reference profile is mapped onto the individual tooth by rolling over an involute curve along the contact surface. It is only possible to pair gears with the same module and pressure angle.

Racks

A rack can be considered a segment of a gear with an infinitely large diameter. The teeth of the rack then correspond precisely to the reference profile and have no bent tooth flanks. A combination of a rack and a spur gear allows rotational movements to be converted into linear movements or vice versa. The gear that engages with the rack is called a pinion. Rack drives are used in automation applications with high repeatable precision and frequent changes of direction and load.

Rack drives in which the rack remains stationary while the pinion moves along the rack are frequently used in conveyor systems. The reverse case, in which the pinion rotates around a fixed axis while the rack moves, is often used in extrusion systems as well as lifting and forward feed applications.

The most important mechanical value for the toothed racks is the maximum force that can be exerted on an individual tooth.