Spur Gear and Gear Rack Basics

There is a wide range of parameters that influence the selection of gears. Strength of the gear tooth and service factors are most important to consider. This is also known as the bending strength of the tooth as allowed by the stress at the tooth root under load from the mating gear. Surface durability is another, which can be described as the allowable tangential force transmitted safely at the pitch circle. Proper lubrication of the gears will also enhance the life of the working gears and extend service life. Selecting the proper lubricant and ensuring adequate re-lubrication are also important considerations.

Surface speed of the mating gears is another factor to consider. Unlike enclosed gears that are typically flooded in a lubricant, open gears are more subject to contamination and less lubricant. Other factors that influence selection include operating temperature, moisture, gear alignment, duty cycle and application shock loads.

As speeds increase, whether on mating circular gears for rotational motion or for gear racks and pinion gears that create linear motion, higher speeds may require ground gears for more precise and quiet movement. Minimizing the backlash, which is the space between the non-contact side of mating gear teeth, may require gears sets with a precision fit.

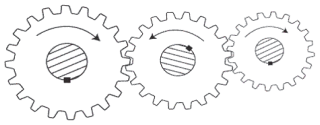
Experience also plays an important role, especially when evaluating design improvements. Consider existing applications and results concerning life and tooth wear can be a good guide to improve similar applications. Gear life is generally extended with hardened teeth, when contamination has been minimized and when proper lubrication has been maintained. Therefore, no one selection criteria can yield the ideal size, so considering all the possible application conditions will yield the best product choice. The following selection criteria will discuss typical gear tooth physical parameters and terms. These are industry standard terms, and are intended to form a basis for gear selection. Gears transmit torque and can maintain a rotational or linear speed. Hence, they are very popular and an inexpensive choice for power transmission or for controlling linear motion.

Hub Type

Plate Type

The gears in this catalog are 20° pressure angle and are metric by design. They are available with and without hubs and can fit onto the shaft by a variety of ways. The formulas and selection criteria will be the same regardless of whether these are inch or metric parameters. Metric gears are necessary for proper part replacement on European equipment and suggested for use on machinery destined for global end use markets where metric replacements may be found easier.

Typical applications include Machine Tools, Heavy Machinery, Packaging Equipment, Lifts, Positioning Equipment, Robotics, Linear Control Equipment and more.



So whether controlling rotational motion, or converting rotational to linear motion, or even clockwise to counter clockwise movement, spur gears offer an economical means for controlling, converting and managing motion efficiently and effectively.

Gear Terms

Addendum: The height of the tooth measured above the pitch circle.

Backlash: The play (distance) between mating teeth at the pitch circle.

Center Distance: The distance between centers of mating gears.

Circular Pitch: Arc length of the pitch circle between the centers of other corresponding points of adjacent teeth. Circular Pitch = 3.14159 / Diametral Pitch.

Clearance: The radial distance or separation between the top of one tooth and the bottom of the mating tooth space.

Crown: The face of each gear tooth having a slight outward bulge and thinner on each end. This feature helps accommodate slight misalignments of gear teeth or shafts on which they are mounted.

Dedendum: The depth of the tooth measured below the pitch circle.

Diametral Pitch: The ratio of the number of teeth to the number of inches of pitch diameter. Diametral Pitch = 3.14159 / Circular Pitch.

External Gears: Gears with teeth cut on the outside.

Face Width: The axial tooth length.

Tooth Flank: The surface between the pitch circle and the bottom of the tooth space.

Flank: The working, or contacting, side of the gear tooth.

Gear Center: The center of the pitch circle of the gear.

Gear Ratio: The ratio of the number of teeth in mating gear sets. Usually it is the number of teeth in the driven gear divided by the number of teeth in driving gear.

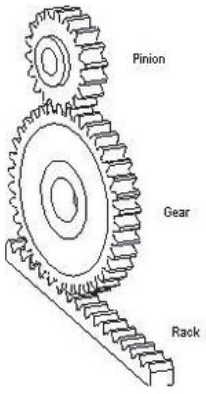
Line of Centers: Connects the centers of the pitch circles of two mating gears

Outside Diameter: (External gears) The distance from the top of one tooth to the top of a tooth opposite measured through the axis of the gear. Outside Diameter = Number of Teeth + 2 / Diametral Pitch.

Pitch: The distance between similar, equally spaced tooth surfaces along a given line or curve.

Pitch Circle: Circle where mating gear contact occurs. Pitch circles are tangent in mating gears.

Pitch Diameter: The diameter of the pitch circle. Pitch Diameter = Number of Teeth / Diametral Pitch.



Point of Contact: Any point at which two tooth profiles touch each other.

Pressure Angle: The angle between a tangent to the tooth profile and a line perpendicular to the pitch surface. Standard gears are either 14-1/2ø or 20ø degree.

Root Diameter: The distance from the bottom of one tooth to the bottom of a tooth opposite measured through the axis of the gear.

Tooth Thickness: The thickness of a tooth at the pitch circle.

Tooth Surface Area: The contact sides or faces of a gear tooth, or the area including the tooth face and the tooth flank.

Shaft Angle: The angle between the axis of two non-parallel gear shafts. This is often referred to as misalignment.

Spur Gears: Gears with straight teeth are always parallel to the axis of rotation.