



### Mounting Guidelines of Rack & Pinions

Racks can be mounted in any position. In environments where debris (sawdust, etc.) is present, the rack should be mounted with the teeth facing down or covered to minimize contamination. Racks are typically mounted on their side faces due to the mounting hole locations; mounting holes can be drilled in the back face if necessary. It is recommended that a small right-angle "ledge" be provided on the mounting surface to locate the rack on two faces. This makes it easier to accurately mount several pieces of rack in succession.

The mounting and alignment of rack & pinion drives is critical to the performance and lifetime of the axis. The following instructions are meant to be general guidelines on how to achieve an accurate mounting of a rack & pinion drive.

1. Mount and align the linear slides (rails) to the axis base. Measure the location of the rail in relation to the rack mounting surface with a dial indicator. A shoulder should be provided on the mounting surface to locate the back of the rack. The rack mounting surface tolerance will affect the contact pattern of the drive; the rack shoulder tolerance will affect the backlash of the drive. The more accurate these surfaces are, the better the axis will perform.
2. Attach the first rack segment to the rack mounting surface. The mounting holes in the rack require hex-socket cap screws, which should be tightened to 7 lb.ft. for the M6 and 15 lb.ft. for the M8. Measure the location of the rail in relation to the pitchline of the rack segment with a dial indicator. To locate the pitchline of the rack, a pin is placed in-between the rack teeth and an over-pin tolerance is measured:

<b>Size Pin Size</b>	<b>Module 2.0</b> Ø 0.138"	<b>Module 3.0</b> Ø 0.197"	<b>Module 4.0</b> Ø 0.276"
<b>Size Pin Size</b>	<b>Module 5.0</b> Ø 0.354"	<b>Module 6.0</b> Ø 0.394"	<b>Module 8.0</b> Ø 0.551"

If the tolerances are found to be high, the rack should be shimmed accordingly and the rack mounting surface and shoulder should be checked again.

3. Attach the next rack segment to the rack mounting surface. A companion rack should be used to properly space the gap in-between helical rack segments; a 0.25 meter piece of rack should be used in-between straight rack segments (see diagram). Again measure the location from the rail in relation to the rack segment. Continue mounting the rack segments for the entire travel length using the same procedure.
4. Mount the pinion to the rail carriage. Make sure the pinion engages the total face width of the rack. Check of the alignment of the rack & pinion by marking or "bluing" the pinion teeth with a high spot paste (Dykem) and slowly running the axis in both directions. This will show the tooth contact pattern between the rack & pinion; a contact pattern across the majority of the tooth flank on both the rack and pinion is desired. If the contact pattern is shifted to one side of the tooth flanks, some form of misalignment is present.
5. Measure the linear backlash between the rack & pinion along the entire axis travel length. The minimum backlash using a hardened & ground pinion should be as follows:

Rack Quality	Minimum Backlash
<b>Induction Hardened</b>	0.1 mm (0.004")
<b>Quenched &amp; Tempered</b>	0.05 mm (0.002")
<b>Hardened &amp; Ground</b>	0.02 mm (0.0008")

If the backlash is found to be less in any location along the travel length, the pinion should be pulled away from the rack (increasing the center distance). If it is found to be more, the pinion location could be left as is or moved closer to the rack (decreasing the center distance) if needed for the desired accuracy of the axis.

6. Run the axis through the entire rack travel length to check for any problems, such as binding or excessive noise. If either is found, the alignment of the axis must be checked again. Finally, drill dowel pin holes into the rack mounting surface using the starter holes in racks. Place dowel pins in the holes (two for each rack segment).

### Guide bushing for round racks

The guide bushings are practically maintenance free and thus suitable for normal, low-stress service. It may be necessary to provide a lubricant reservoir, by mounting two collar bushings with a gap in-between them. If high loads and/or axial movement are expected, please consult us. The bore in the housing should be manufactured to H7 tolerance. After pressing in (with pin tolerance m5), a tolerance range of H7 can be expected inside the bushing.

### Safety instructions

The following preventive measures are necessary: Ensure there is no contact with rotating elements (output shaft, gears, rack, etc) and the gearbox mounting screws are tight. Avoid contact with lubricants, refer to safety data sheets.

