

Installation Instructions

Rack Installation and Mounting Instructions

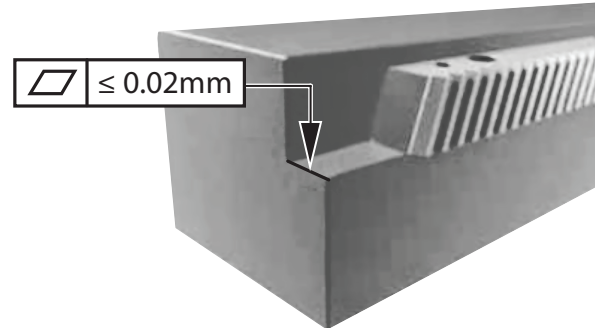
Inspection and Preparations

1. Inspect packaging to ensure the rack was not damaged in transit. Verify specifications of all necessary assembly tools.

2. Before assembly, verify the contact surface of installation is within tolerance:

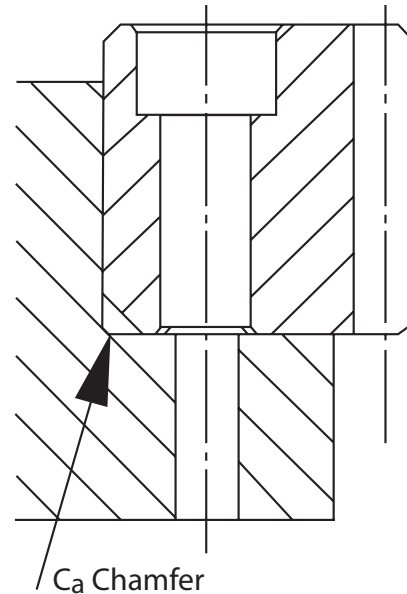
Flatness: $\leq 0.02\text{mm}$

Perpendicularity: $\leq 0.02\text{mm}$



3. In order to assure perfect mounting of the rack to the structure, a chamfer is included on the edges of the rack. Make sure the chamfer of the rack will fit the mounting surface.

Rack Chamfer (mm)	
Module Size	Ca
2	2.0 x 45°
3	2.0 x 45°
4	3.0 x 45°



4. Carefully clean the rack contact surface and check that it is free of chips. To stabilize the temperature, we advise leaving rack on the mounting surface for a minimum of 4 hours.



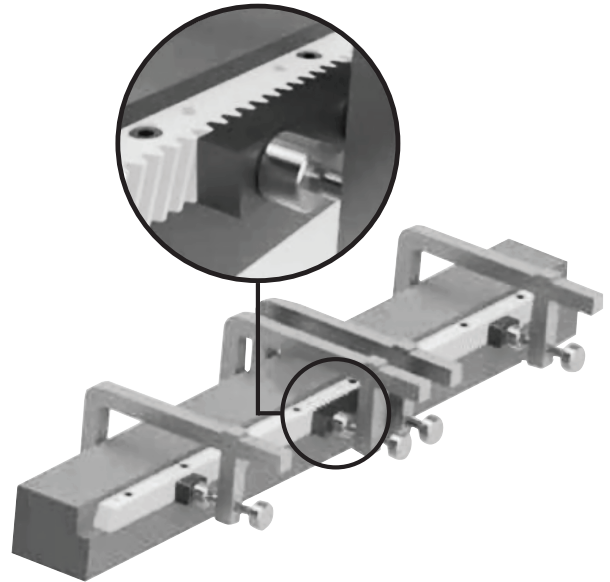
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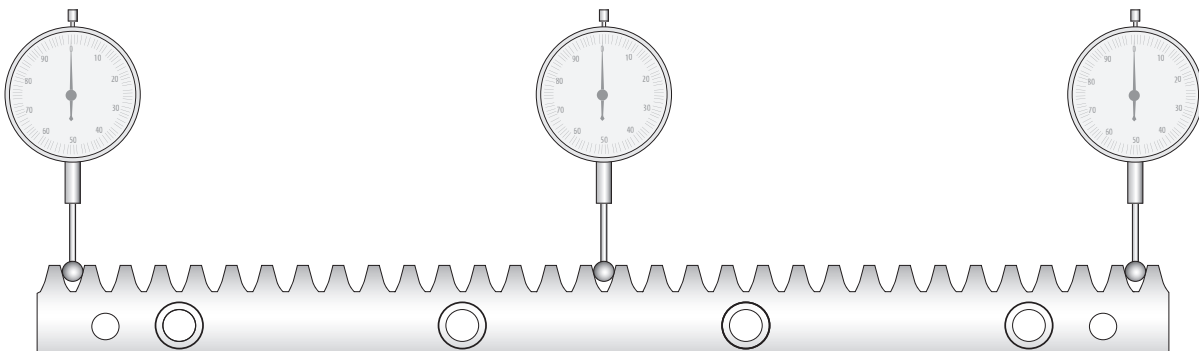
Rack Mounting and Positioning

- Position the first piece of rack at the center of the axis' length. Fix the socket head cap screws and tighten loosely, using 10% of the torque values in the table below. Using c-clamps and soft pads, fix the rack to the mounting surface.

Module Size	Cap Screw Size	Tightening Torque (Nm) by Strength Class	
		10.9	12.9
1, 1.5, 2	M6	14	16.4
3, 4	M8	34	40
5	M12	116	136
6	M16	291	341
8	M20	570	667
10	M30	1969	2305
12	M36	3435	4020



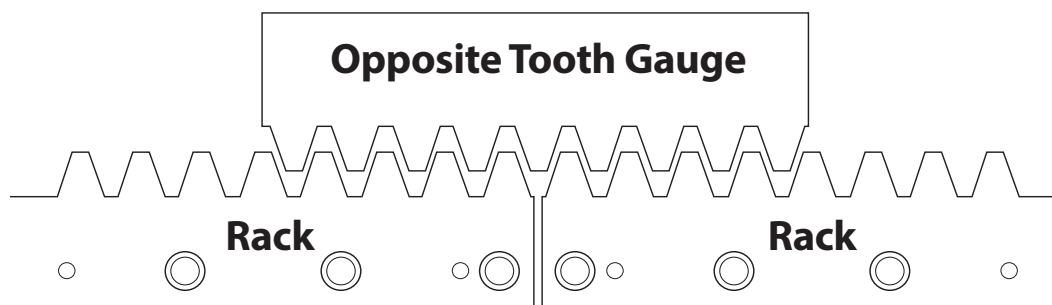
- Use dial indicator pins to measure the height of the rack teeth. Place calibrated pins on three adjacent grooves and check the deviation in several positions to ensure the values are the same across the rack length. Tighten the c-clamps as necessary.



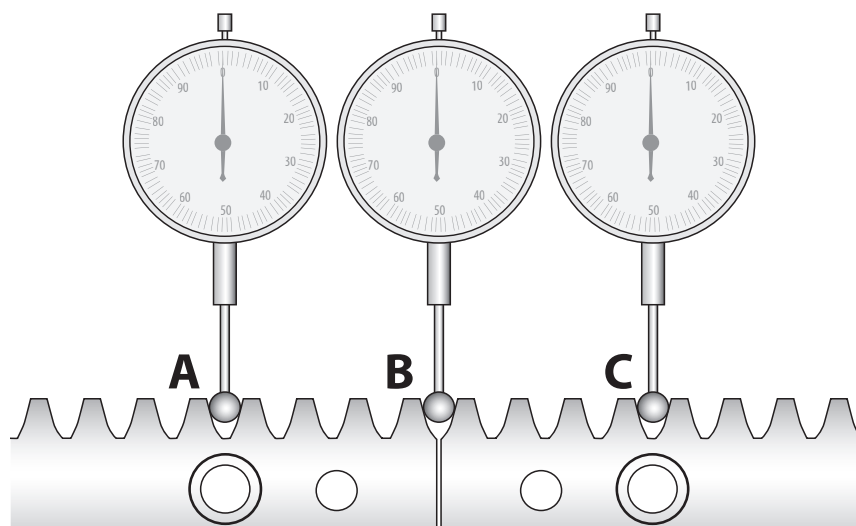
Module Size (Q6)	Height Tolerance (mm)	Inspection Pin Diameter (mm)
2	0.03	4.2
3	0.03	5
4	0.03	7

- Fully tighten the bolts to secure the rack, using values in the table above. Remove the c-clamps and pads.

8. In order to align multiple rack lengths, an opposite tooth gauge mounting template should be used to assure end-to-end assembly.

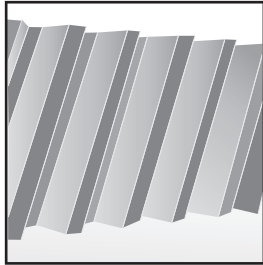


With the racks secured with c-clamps and soft pads, place the dial indicator pins on each rack and the tooth valley between the racks according to positions A, B, C below. These values should be within the tolerances in step 6; adjust the racks as needed. Measure each rack, secure the bolts and install the dowel pins as described in steps 5-8.

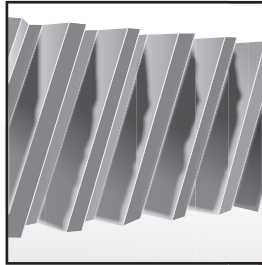


9. It is recommended to pin the sections of rack to the mounting surface. To accomplish this, pre-drill the pin hole locations in the mounting structure. After aligning the rack sections and installing the bolts, ream the pre-drilled holes in the rack and the mounting structure as assembled. Install a dowel pin through the rack into the mounting structure.

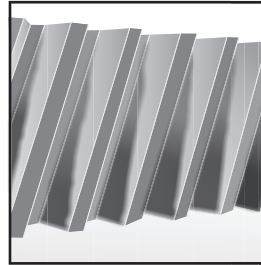
10. For best performance, the rack and pinion must be installed with proper tooth engagement. After mounting the pinion gear, check the parallelism between the rack and pinion with a marking compound. Contact should be even across the face of the tooth. Compare the results to the images below and adjust as necessary.



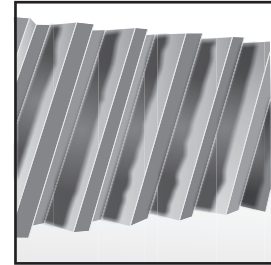
CORRECT
(contact even across tooth face)



INCORRECT
(poor perpendicularity)



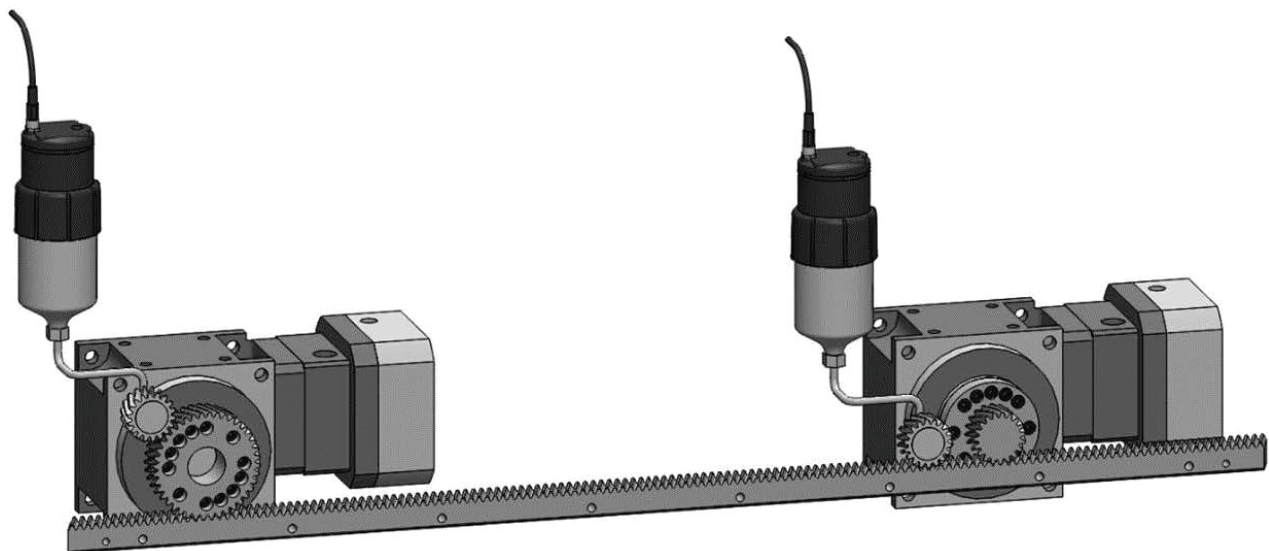
INCORRECT
(poor parallelism)



INCORRECT
(improper center height)

Lubrication

11. Rack and pinion systems require lubrication. A suitable lubricant and lubrication process must be selected. It is recommended to use a lubricant with EP additives. Lower speeds can use a grease and higher speeds above 5 m/s should use oil.
12. Lubrication systems using a felt pinion can be used to keep the rack and pinion lubricated. Lubrication can be applied to the pinion or the rack, as shown below:



13. Lubrication Supply Volume (mL/day) by Velocity and Module Size is below:

Velocity (m/s)		Supply Volume (mL/day)			
Over	Up to & Incl.	Mod 1.5	Mod 2	Mod 3	Mod 4
--	0.25	0.25	0.25	0.25	0.25
0.25	0.50				0.33
0.50	0.75			0.32	
0.75	1.00			0.42	
1.00	1.25		0.32	0.38	0.50
1.25	1.50		0.38	0.44	0.63
1.50	1.75	0.32	0.44	0.50	0.75
1.75	2.00	0.38	0.50	0.63	0.88
2.00	2.50	0.44	0.63	0.75	1.00
2.50	3.00	0.50	0.75	0.88	1.13
3.00	3.50	0.58	0.88	1.00	1.25
3.50	4.00	0.67	1.00	1.13	1.50
4.00	4.50	0.75	1.13	1.25	1.75
4.50	5.00	1.00	1.25	1.50	2.00

Safety Precautions

14. If any abnormal phenomenon occurs, stop operation immediately and take corrective measures. Examples are shown in the table below:

Function Failure	Possible Reason	Corrective Measure
Increased Noise	Transmission device defect	Inspect the gearbox or other transmission device
	Incorrect installation of rack and pinion	Refer to installation steps above
	Insufficient lubrication	Check lubrication system
Increased Temperature	Unsuitable design	Check design parameters
	Transmission device overheating	Check the transmission device. Apply cooling if necessary
	Ambient temperature is too high	Apply sufficient air conditioning
Lubricant Leakage	Too much lubricant applied	Remove excess lubricant and correct the lubrication rate and volume
	Leakage from system	Check lubrication canister and gearbox for leakage issues
Rubbing marks or crack on rack teeth	Insufficient lubrication	Adjust the lubrication rate and volume. Utilize an automated lubrication system
	Incorrect lubricant	Change to a suitable lubricant
	Environment	The operating environment should be clean and dry
Broken rack teeth	Overload	Check the design parameters
	Collision of system	Ensure there is no obstacle in range of operation and emergency stop procedure is set
	Pitting on tooth profile	Improve the lubrication for the system
	Insufficient lubrication	Check lubrication system
	Bad perpendicularity or parallelism	Check alignment of the pinion on the rack and the round-out of pinion on the gearbox
Increased backlash or position error	Misalignment of rack or transmission device	Check alignment of the pinion on the rack and the round-out of pinion on the gearbox



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