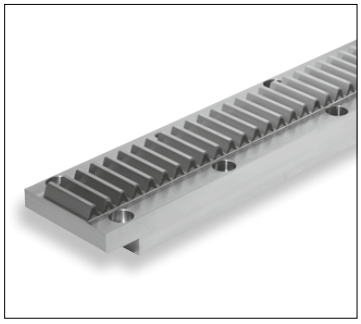
1.1 Overview

Range of versions



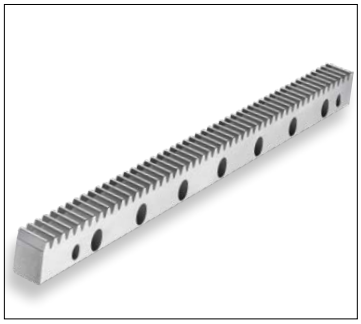
Gear racks

Gear rack drives main feature is their high level of efficiency. They are the best choice for high axial forces.
This drive rigidity is constant over the whole length.
They are also very cost effective for long strokes of more than 2 m.

With a rack and pinion system a slideway is driven by the pinion running on a a fixed gear rack.
There is a basic difference between straight and helical toothed gear racks.
Apart from typical dimensions, SCHNEEBERGER offers any cross sections with metric or module pitches. The max. one-piece length is 3000 mm. Joining with butt joints is possible for longer lengths.

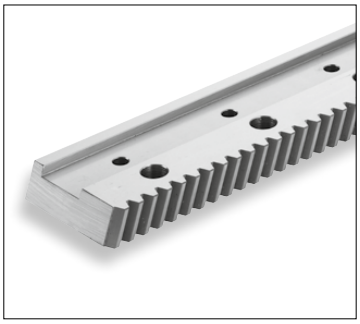
The tooth rack can be milled or ground depending on the customer's requirements.
A particular feature is that different materials and hardening processes can be used. Depending on the load to be applied you have a choice of soft, induction or case hardened or nitride hardened gear racks.

Skill and expertise are our strengths!



Standard gear racks

Straight and helical toothed gear racks are available in typical industrial dimensions from module 2 to module 12. Different materials, hardnesses and accuracy are available depending on the load to be applied.



Customised gear racks

You need a gear rack but standardised dimensions do not fit your system?
No problem.
You can have any gear racks up to module 20. The maximum one-piece length is 3000 mm.

The customer can choose from different materials and therefore configure the gear rack just as required.

Special is our standard.

1.2 Overview

Properties of the gear racks/ conversion

Modular tooth pitch (-M)

Tooth rack	Material condition	Material (-hardness-)	Modules	max. length for following qualities						
				Q4	Q5	Q6	Q7	Q8	Q9	Q11
helical (-S-)	soft	C45 (-W-)	2 … 16	1000	2000	3000	3000	3000		
	tempered	42CrMo4+QT (-V-)	2 … 16	1000	2000	3000	3000	3000		
	induction hardened	C45 (-I-), 42CrMo4+QT (-M-)	2 … 16	1000	2000	2000	2000			
			2 … 5							3000
	case hardened	16MnCr5 (-C-)	2 … 16	1000						
			2 … 16		2000	2000	2000			
	nitrided	42CrMo4+QT (-N-), 16MnCr5 (-O-)	2 … 16						2000	
	through hardened	X90CrMo V18 (-H-)	2 … 5	1000	1000	1000	1000			
straight (-G-)	soft	C45 (-W-)	2 … 16	1018	2035	3000	3000	3000		
	tempered	42CrMo4+QT (-V-)	2 … 16	1018	2035	3000	3000	3000		
	induction hardened	C45 (-I-), 42CrMo4+QT (-M-)	2 … 16	1018	2035	2035				
			2 … 4		2035	2035	2035			
	case hardened	16MnCr5 (-C-)	2 … 16	1018						
			2 … 16		2035	2035	2035			
	nitrided	42CrMo4+QT (-N-), 16MnCr5 (-O-)	2 … 16						2035	
	through hardened	X90CrMo V18 (-H-)	2 … 5	1018	1018	1018	1018			

Metric tooth pitch (-T)

Tooth rack	Material condition	Material (-hardness-)	Pitch (mm)	max. length for following qualities						
				Q4	Q5	Q6	Q7	Q8	Q9	Q11
straight (-G-)	soft	C45 (-W-)	5 … 20	1018	2035	3000	3000	3000		
	tempered	42CrMo4+QT (-V-)	5 … 20	1018	2035	3000	3000	3000		
	induction hardened	C45 (-I-), 42CrMo4+QT (-M-)	5 … 20	1018	1018	2035	2035			
			5 … 10							3000
	case hardened	16MnCr5 (-C-)	5 … 20	1018						
			5 … 20		2035	2035	2035			
	nitrided	42CrMo4+QT (-N-), 16MnCr5 (-O-)	5 … 20						2035	
	through hardened	X90CrMo V18 (-H-)	5 … 15		1018	1018	1018			

Cross reference of material designations

Germany		Japan	USA	China	Special properties
W.-Nr.	DIN	JIS	AIS/SAE	GB	
1.0503	C45	-	1045	45	
1.7131	16MnCr5	-	5115	18CrMn	can be welded
1.7225	42CrMo4+QT	SCM 440 (H)	4140	42CrMo	
1.4112	X90CrMo V18	SUS 440B	440B	9Cr18 oV	Stainless steel

Converting a module m into a pitch p (straight toothed) and Transverse pitch p_s for helical tooth racks

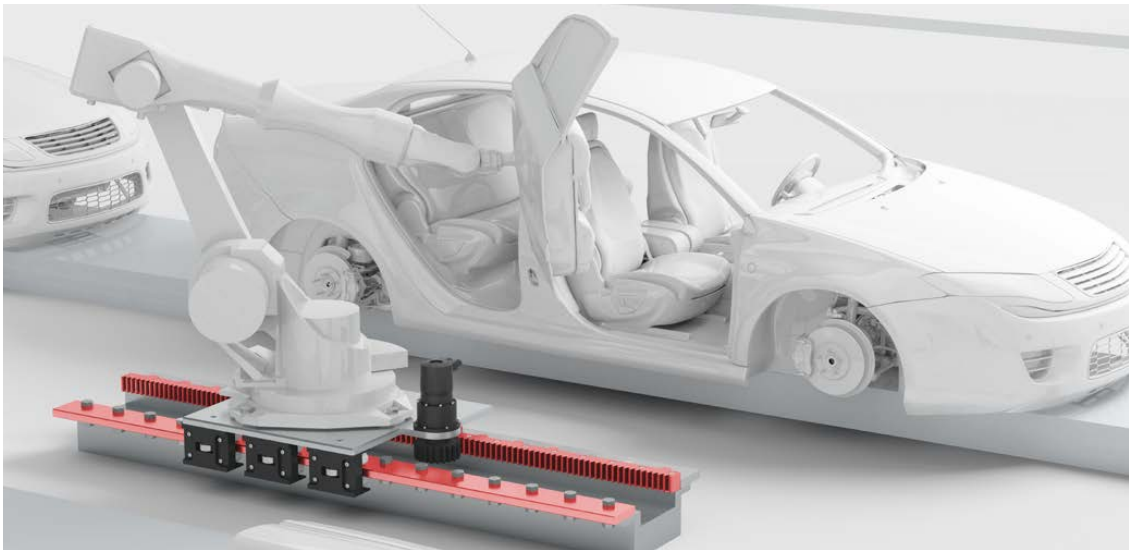
Module m	2	3	4	5	6	8	10	12	16	20
Pitch p (mm)	6,28	9,42	12,57	15,71	18,85	25,13	31,42	37,70	50.27	62.83
Transverse pitch p_s [1] (mm)	6,67	10,00	13,33	16,67	20,00	26,67	33,33	40,00	53.33	66.67

[1] where β=19.5283°

Converting pitch p (straight toothed) into a module m

Pitch p (mm)	5.00	7.50	10.00	12.50	15.00	20.00
Module m	1.59	2.39	3.18	3.98	4.77	6.37

p Pitch in mm
p_s Transverse pitch in mm
m Module
β Helix angle
$p=m*\pi$
$p=m*\pi/\cos\beta$



Traversing axis under robot, equipped with SCHNEEBERGER flat rails and racks

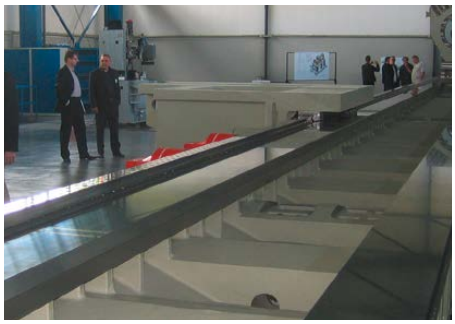
Hardness/ strength of tooth rack

Condition of teeth	Material	Tensile strength R_m N/mm²	Hardness HRc	Hardness HV1
soft	C45	~650		
tempered	42CrMo4+QT	max. 1000		
induction hardened	C45		55 … 60	
	42CrMo4+QT		$59^{\pm 3}$	
case hardened	16MnCr5		58^{+3}	
nitrided	42CrMo4+QT, 16MnCr5			550..700
through hardened	X90CrMoV18		$56^{\pm 2}$	

CUSTOMER-SPECIFIC BEARINGS AND GEAR RACKS

On to new shores.

SCHNEEBERGER involved in climate missions in Antarctica



Wherever large ships and, in particular, their drive systems, are built, our linear technologies are making a decisive contribution. Large multifunctional long bed lathes can be used to turn, mill, grind or even repair huge crankshafts or drive shafts, over a stroke of 40 meters and with minimal tolerance.
For these and similar applications, such as when manufacturing rotor heads or wind turbines for power engineering, we provide custom guideways and gear racks. That is how we help to make new sources of energy possible.
Our customized guideways and gear racks are used wherever standard guideways do not meet the specifications of the machine manufacturer either because the dimensions are incorrect or were not sufficiently precise.

In summary, we construct guideways that run perfectly smoothly, and guideways of particularly high rigidity or durability. There are no compromises with SCHNEEBERGER.

Thanks to our universal machinery and expert engineers, we are able to develop our products quickly and efficiently, even with complex customer specifications; initially in small batches as necessary for testing, and then in large-scale production, with high and constant quality and reliable and uninterrupted service.

Typical applications

Gear racks provides users with definite competitive advantages in the following industries:

- Machine tools
- Heavy machine construction
- Automation and robotics
- Material handling and material flow systems
- Machine and plant engineering
- Packaging machines
- Printing presses