nexen

PRECISION MOTION CONTROL

Application & Selection Guide

The most advanced technology in linear and rotary motion control.

ROLLER PINION TECHNOLOGY

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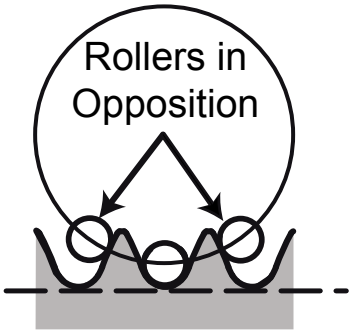
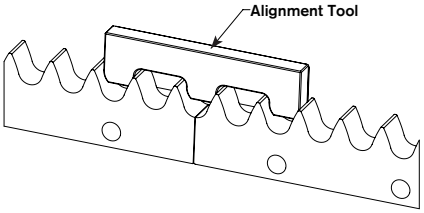
A New Standard For Precision

The Nexen Roller Pinion System (RPS) revolutionizes linear and rotary motion control possibilities. Giving a fresh face to traditional rack and pinion systems, the RPS overcomes the troublesome limitations of conventional drive systems and offers unmatched performance. Across industries as varied as laser cutting and mining, users will benefit from the accuracy and 99% efficiency of this new technology.

The incredible performance of the RPS starts with a pinion consisting of bearing-supported rollers that engage a unique tooth profile. Two or more rollers engage the teeth in opposition at all times to eliminate backlash. The pinion rollers glide easily along a tangent path and roll smoothly down the tooth face for quiet, low-friction operation.



Constant Positional Accuracy Regardless of the Distance Traveled



Every aspect of the RPS system is designed for reliable, easy operation. With customizations available to meet the specific needs of any application and multiple material finishes, the RPS system can go anywhere. Even installation is worry-free with a simple alignment tool to ensure positional accuracy over multiple sections of rack.

Dependable Performance. Every Time.
The Nexen RPS System Always Delivers.

Indexer

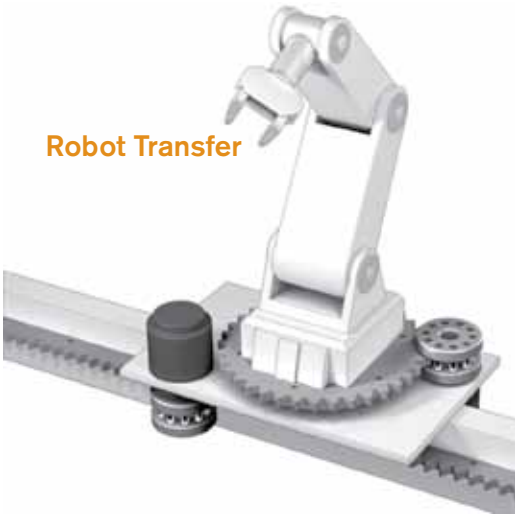
Gantry Router

Machine Tools • Plasma & Laser Cutting • Woodworking • Food Processing • Multi-head On A Common Axis • Gantries

THE NEXEN ADVANTAGE

Overcoming Common Problems Found in Traditional Drive Systems

INDUSTRY PROBLEMS	Ball Screws	Traditional Rack/Gear & Pinion Systems	Belt Drives	Chain Drives	Linear Motors Direct Rotary Stages Direct Drive Motors	nexen ROLLER PINION SYSTEMS
Low Accuracy			⬢	⬢		High Positional Accuracy
Backlash / Vibrations	⬢	⬢	⬢	⬢		Near-Zero Backlash
High Cost	⬢	⬢			⬢	Economical, Efficient Components
Dirty Operation	⬢	⬢	⬢	⬢		No Dust Emissions
High Maintenance	⬢	⬢		⬢	⬢	Little to No Maintenance
Low Load Capacity			⬢		⬢	High Load Capacity
Noisy	⬢	⬢	⬢	⬢		Quiet: pinion rollers glide smoothly along teeth
Low Speed	⬢	⬢				High Speeds (up to 11 m/sec)
Magnetic Field					⬢	No magnetic field
High Wear/ Low Life	⬢	⬢	⬢	⬢		Long Life (up to 36 million meters)
Limited System Length/Size	⬢		⬢	⬢		Custom Rack Sizes & Modular Components

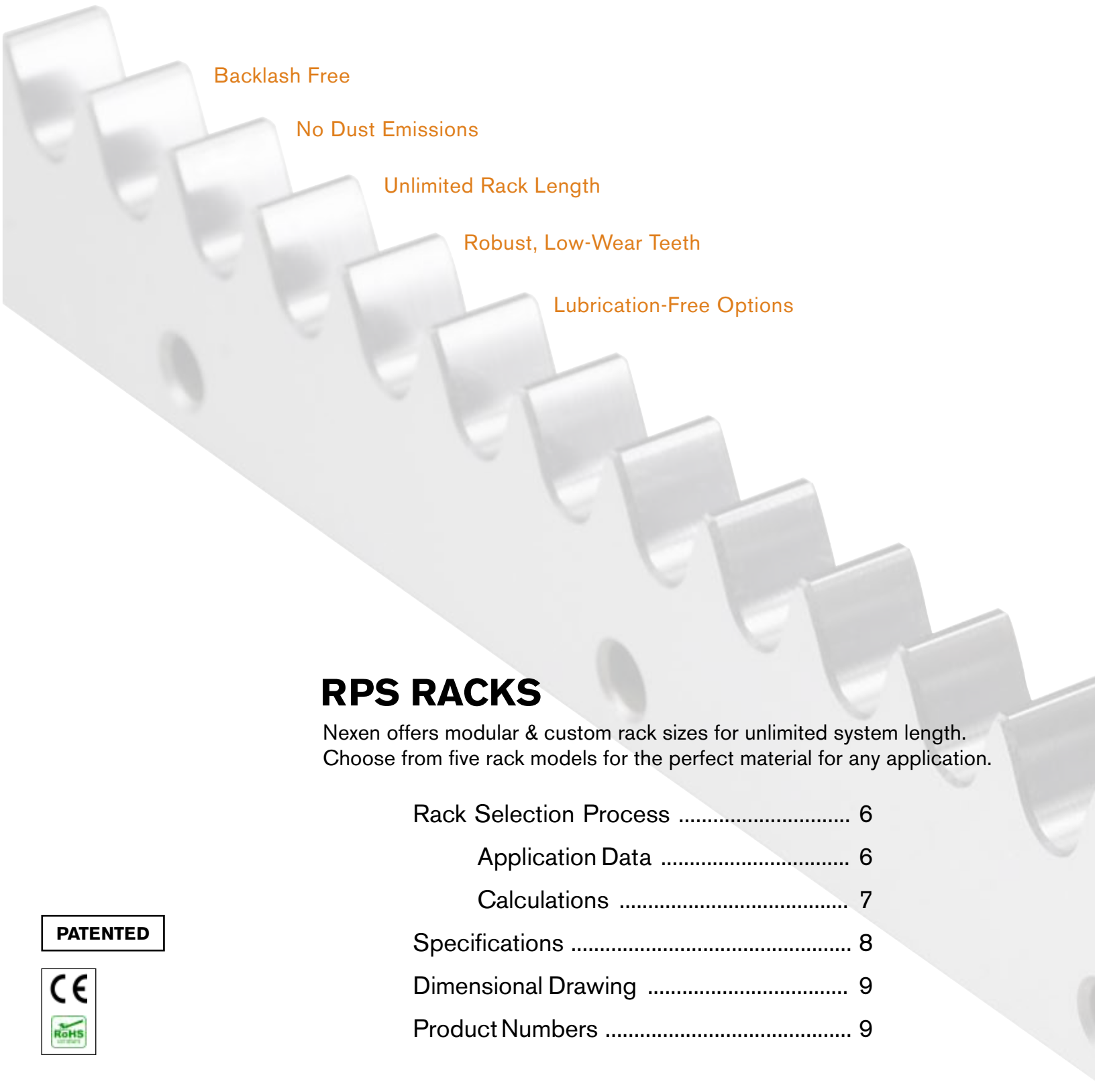


Robot Transfer

Rotopod

EVEN In The Most Challenging **APPLICATIONS**

Medical Imaging • Measurement Systems • Clean Rooms • Material Handling • Vacuum Environments • Welding



Backlash Free

No Dust Emissions

Unlimited Rack Length

Robust, Low-Wear Teeth

Lubrication-Free Options

RPS RACKS

Nexen offers modular & custom rack sizes for unlimited system length.
Choose from five rack models for the perfect material for any application.

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PATENTED

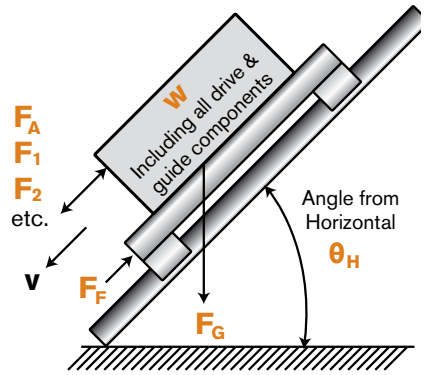
CE

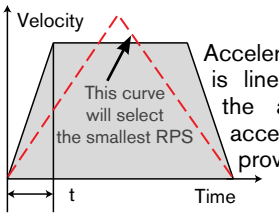
RoHS

Linear Drive Selection Process

Nexen offers a large range of rack sizes and materials, so you can find the perfect components for your application. Take advantage of the following guide designed to make selecting the right components for your system simple. If you don't find what you need, contact us about a custom design.

Figure 1
Refer to this drawing when recording values for Force, Weight & Angle From Horizontal.





Acceleration based on time is linear and may not reflect the actual curve. A known acceleration from the servo drive provider is preferred.

Weight to be Driven should include all drive and guide components and structures being moved and should reflect the maximum weight each individual pinion must bear at any given time. Take into account any movable or asymmetric loads that may shift between multiple pinions during operation.

STEP 1: GATHER APPLICATION DATA

Before you begin calculations, there are nine key measurements that you will need from your application. Collect the data and record it in the chart below. With this data available you can proceed on to the calculations on the following page.

Measurements Required for RPS Selection	Customer Data (record your values below)	*Sample Data*
Angle from Horizontal (θ_H) Refer to Figure 1.	°	*60°*
Maximum Velocity (V_{max})	m/s	*0.5 m/s*
Travel Distance (**L**)	m	*5.4 m*
Cycles Per Day (N_{day}) Assumes going the full Travel Distance & returning home each time		*1000*
Acceleration Time (t_A) or Known Acceleration	seconds m/s^2	*0.5 s*
Weight to be Driven (**W**)	kg	*150.0 kg*
Other Forces (F_1), (F_2) etc.	N	*0 N*
Shock Factor (**K**) Circle the value that best reflects the smoothness of your application.	Shockless Operation 1.0 Normal Operation 1.2 Operation with Impact 1.5 Operation with High Impact 2.5	*1.2*
Frictional Coefficient (**μ**) Circle the value that best reflects your application.	Profile Guide Rail 0.005 Ball Bearing Guide Rail 0.02 Polymer Bushing Guide 0.1 Bronze Bushing Guide 0.2	*0.01*

Other Key Application Information

Application Description:

Environmental Conditions:

Positional Accuracy Requirements:

STEP 2: CALCULATING RPS REQUIREMENTS

Rack selection is based on the load capacity required by your application. Using the information gathered on the preceding page, perform the following calculations to determine the Total Force of the Load. Use the space provided to record your calculations. (The sample calculations assume a single pinion driving an axis. Use the Sample Data from the chart on the preceding page.)

LOAD MASS: $M = W$
Use the total Weight to be Driven as your Load Mass value.

Sample: *$M = 150.0$ kg*

LOAD MASS	
$M =$	kg

LOAD ACCELERATION: $A = V_{max} \div t_A$
A known acceleration from a servo drive provider is preferred if available.

$A =$ m/s ÷ s

Sample: ***A*** *$= 0.5$ m/s ÷ 0.5 s $= 1.0$ m/s²*

LOAD ACCELERATION	
$A =$	m/s²

FORCE DUE TO LOAD ACCELERATION: $F_A = M \cdot A$

$F_A =$ kg • m/s²

Sample: $F_A = 150$ kg • 1.0 m/s² $= 150.0$ N

FORCE DUE TO LOAD ACCELERATION	
$F_A =$	N

FORCE DUE TO GRAVITY:
$F_G = M \cdot g \cdot \sin(\theta_H)$

$F_G =$ kg • 9.81 m/s² • sin( )

Sample: $F_G = 150$ kg • 9.81 m/s² • $\sin(60°) = 1274.4$ N

FORCE DUE TO GRAVITY	
$F_G =$	N

FORCE DUE TO FRICTION:
$F_F = M \cdot \mu \cdot g \cdot \cos(\theta_H)$

$F_F =$ kg • • 9.81 m/s² • cos( )

Sample: $F_F = 150$ kg • 0.01 • 9.81 m/s² • $\cos(60°) = 7.4$ N

FORCE DUE TO FRICTION	
$F_F =$	N

SUM OF FORCES:
$F_S = F_A + F_G + F_F + F_1 + F_2 + \ldots$etc

$F_S =$ N + N + N + N + N

Sample: $F_S = 150.0$ N + 1274.4 N + 7.4 N $= 1431.8$ N

SUM OF FORCES	
$F_S =$	N

TOTAL FORCE WITH SHOCK FACTOR:
$F_T = F_S \cdot K$

$F_T =$ N •

Sample: $F_T = 1431.8$ N • 1.2 $= 1718.2$ N

TOTAL FORCE WITH SHOCK FACTOR	
$F_T =$	N

STEP 3: SELECTING A RACK MODEL

Use Table 1 (RPS Rack Model Comparison Table) to review the five different rack materials and determine the rack model best suited for your application.

RACK MODEL

STEP 4: SELECTING RACK SIZE

Locate your chosen rack model in Table 2 and determine the rack size with enough thrust capacity to handle the Total Force with Shock Factor calculated above for your application.

RACK SIZE

STEP 4: VERIFY YOUR SYSTEM SPECIFICATIONS

Double check your selection against the Common Rack Specifications (Table 3) to be sure that the rack you have selected will meet all of your application requirements.

RACK PRODUCT NUMBER

Rack Models, Sizes, and Specifications

Table 1 Rack Model Comparison

See the Definitions Section at the end of this catalog for more information on these attributes.

Attributes \ RPS Model		Premium	Standard	Endurance	Universal Stainless	Universal
Positional Accuracy	± µm	30	50	80	50	50
Meshing Error Per Pitch	± µm	10	15	30	30	30
Repeatability	± µm	5	10	20	10	10
Backlash	< µm	3.2				
Corrosion Resistant Surface Treatment		Hard Chrome	None	Nitrided	None or Hard Chrome	None
Corrosion Resistance Rating		High	None	Medium	High/Very High	None
Lubrication Free Operation	<30m/min	Yes	No	Yes	No	No
Noise Level	dB	0-75 Speed Dependent				
Temperature Range	°C	-5 to 40				

Table 2 Maximum Rack Thrust Capacity (N)

See System Life & Calculations Section for Load Life Comparison

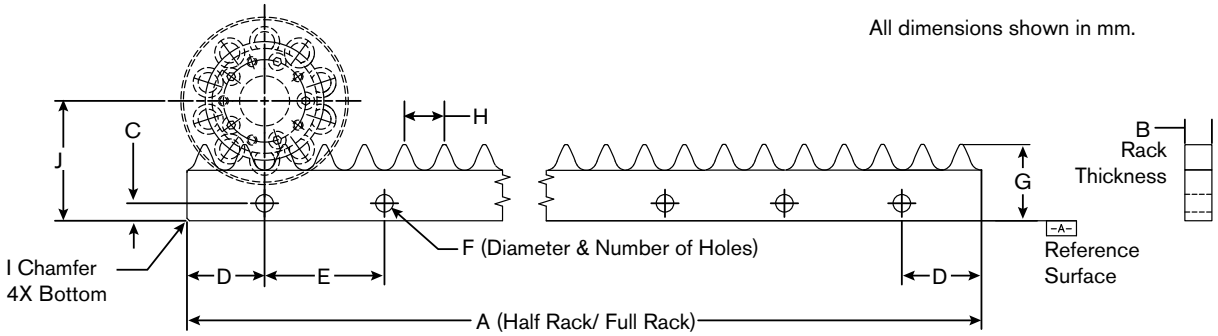
	Rack Model									
	Premium		Standard		Endurance		Universal (Stainless)		Universal	
RPS Size	Thrust Capacity (N)									
	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic	Static	Dynamic	Static
10	250	380	NA	NA	NA	NA	NA	NA	NA	NA
12	500	750	NA	NA	NA	NA	NA	NA	NA	NA
16	2400	2400	2400	2400	1500	2000	750	750	750	750
20	2900	3000	2900	3000	2250	3000	1125	1125	1125	1125
25	4000	4400	4000	4400	3300	4400	1650	1650	1650	1650
32	6300	7200	6300	7200	5400	7200	2700	2700	2700	2700
40	6000	12000	6000	12000	6000	12000	4500	4500	4500	4500
4014	14000	21000	14000	21000	14000	21000	10500	10500	10500	10500
50	19000	28500	NA	NA	NA	NA	NA	NA	NA	NA

Table 3 Common Rack Specifications

Attribute \ Rack Size		RPS10	RPS12	RPS16		RPS20		RPS25		RPS32		RPS40		RPS4014		RPS50	
Max Pressure Angle	°	26.4	26.4	27.9		26.4		26.4		26.0		26.0		26.0		26.0	
Avg Pressure Angle	°	21.9	21.9	23.4		21.9		21.9		22.7		21.3		20.9		21.3	
Module	mm	3.0	3.6	4.8		6.0		7.5		9.5		12.0		12.0		15.0	
Maximum Speed	m/s	4	8	4		5		8		11		6		6		6	
Rack Tooth Pitch	mm	10	12	16		20		25		32		40		40		50	
Rack Height	mm	27	27	30.5		42.0		48.0		57.0		72.6		69.0		71.5	
Rack Width	mm	5.7	5.7	11.5		15.5		18.5		24.5		31.5		42.0		42.0	
Rack Section Size		Half	Half	Half	Full	Half	Full	Half	Full	Half	Full	Half	Full	Half	Full	Half	Full
Rack Length	mm	480	480	512	992	500	1000	500	1000	512	992	520	1000	520	1000	500	1000
Number of Rack Teeth	kg	48	40	32	62	25	50	20	40	16	31	13	25	13	25	10	20
Rack Weight		0.5	0.6	1.1	2.1	2.1	4.1	2.7	5.4	4.2	8.2	6.9	13.2	8.8	17.0	8.1	16.2

Rack Dimensions

All dimensions shown in mm.



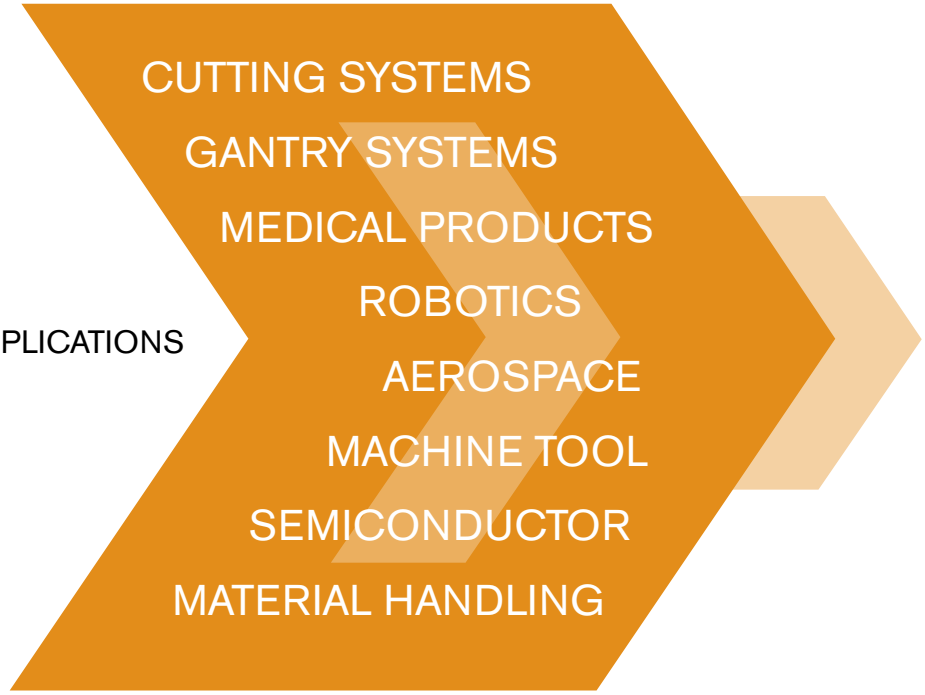
RPS Size	A		B	C	D	E	F			G	H	I	J
	Rack Length		Rack Thickness	Hole Height	Hole From End	Hole Spacing	Mounting Holes			Rack Height	Tooth Pitch	Rack Bottom Chamfer	Axis to Base
	Half	Full					Ø	# Half Rack	# Full Rack				
RPS10	480	NA	5.7	7	29.8	60	5.5	8	NA	27.0	10	1	37.5
RPS12	480	NA	5.7	7	29.8	60	5.5	8	NA	27.0	12	1	40
RPS16	512	992	11.5	7	16	96	7	6	11	30.5	16	1	48
RPS20	500	1000	15.5	10	50	100	9	5	10	42.0	20	1	64
RPS25	500	1000	18.5	12	50	100	11	5	10	48.0	25	1	75
RPS32	512	992	24.5	14	16	96	14	6	11	57.0	32	1	102
RPS40	520	1000	31.5	16	80	120	18	4	8	72.6	40	1	129
RPS4014	520	1000	42.0	16	60	80	18	6	12	69.0	40	2	140
RPS50	500	1000	42.0	15	31.25	62.5	18	8	16	71.5	50	2	145.5

See drawings or CAD models on Nexen's website for additional dimensions and tolerances.

Rack Product Numbers

RPS Size	Rack Length		Universal	Universal Uncoated Stainless	Universal Coated Stainless	Endurance	Standard	Premium	Corresponding Pinion (See Pinion Section)
10	Half	480 mm	N/A	Contact Nexen	Contact Nexen	N/A	N/A	966768	RPS10 B Series **Blue** Pinions
	Alignment Tool		966507						
12	Half	480 mm	N/A	Contact Nexen	Contact Nexen	N/A	N/A	966769	RPS 12 B Series **Blue** Pinions
	Alignment Tool		966508						
16	Half	512 mm	966801	966760	966742	Contact Nexen	966602	966652	RPS16 B Series **Blue** Pinions
	Full	992 mm	966800	966813	966741	966850	966601	966651	
	Alignment Tool		966503						
20	Half	500 mm	966803	Contact Nexen	Contact Nexen	Contact Nexen	966612	966662	RPS20 B Series **Blue** Pinions
	Full	1000 mm	966802	966625	966619	966851	966611	966661	
	Alignment Tool		966513						
25	Half	500 mm	966805	Contact Nexen	Contact Nexen	Contact Nexen	966622	966672	RPS25 B Series **Blue** Pinions
	Full	1000 mm	966804	966814	966755	966852	966621	966671	
	Alignment Tool		966523						
32	Half	512 mm	966807	Contact Nexen	Contact Nexen	Contact Nexen	966632	966682	RPS32 B Series **Blue** Pinions
	Full	992 mm	966806	966812	Contact Nexen	966853	966631	966681	
	Alignment Tool		966533						
40	Half	520 mm	966809	Contact Nexen	Contact Nexen	Contact Nexen	966642	966692	RPS40 B Series **Blue** Pinions
	Full	1000 mm	966808	966815	Contact Nexen	966854	966641	966691	
	Alignment Tool		966543						
4014	Half	520 mm	966811	Contact Nexen	Contact Nexen	Contact Nexen	966647	966695	RPS4014 B Series **Blue** Pinions
	Full	1000 mm	966810	966816	Contact Nexen	966855	966646	966694	
	Alignment Tool		966543						
50	Half	500 mm	N/A	Contact Nexen	Contact Nexen	N/A	N/A	966773	RPS 50 B Series **Blue** Pinions
	Alignment Tool		966775						
Rack Grease			853901						

INDUSTRIES & APPLICATIONS



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