

Hover your mouse over certain areas of this PDF to see the cursor change to a “hand”. These areas can be selected to connect you directly to a specific website page. The interactive areas are primarily found in the headers of the selection charts.

RPS RACKS

Nexen offers modular & custom rack sizes for unlimited system length. Choose from six rack models for a perfect fit in any application.

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RPS System Configurations & Comparisons

Nexen features six different rack models and two pinion types, ensuring the perfect solution for any application. First compare the rack attributes to determine which rack model best meets your needs. Then compare the specifications of both the premium and value pinions to select the ideal RPS system configuration.

Rack Models Available

PREMIUM RACK	As the name premium suggests, this is Nexen's top of the line model featuring market leading accuracy and a hard chrome coating for corrosion resistance. A perfect choice for any precision motion need. • Very High Precision/Accuracy • Suitable for Dirty Environments • Lubrication Free • High Load Capacity • High Corrosion Resistance <i>Precision Assembly Equipment • Machine Tool/CNC Mills • High Precision Gantry • Robotics</i>
STANDARD RACK	The Standard Rack offers similar performance to the Premium model without the corrosion resistant coating. With slightly lower accuracy, the standard model still delivers dependable performance in many the same types of applications. A great, cost-saving choice when corrosion resistance is not required. • High Precision/Accuracy • High Load Capacity • No Corrosion Resistance • Lower Cost than Premium Rack <i>Precision Assembly Equipment • Machine Tool/CNC Mills • High Precision Gantry • Robotics</i>
ENDURANCE RACK	This is the work horse of the product line, combining both high load capacity and good corrosion resistance. • High Load Capacity • Medium Corrosion Resistance • Good Accuracy (not high precision) <i>General Assembly Equipment • Machine Tool • Gantry Systems</i>
UNIVERSAL RACK	With better accuracy than Endurance Racks, the Universal Rack is a great option for lower load applications when corrosion resistance is not required. • High Accuracy • Medium Load Capacity • No Corrosion Resistance <i>Material Handling Equipment • Gantry Systems • Packaging Equipment • General Motion Control</i>
UNIVERSAL STAINLESS RACK	Get all the features of the Universal Rack with the added benefits of corrosion resistant stainless steel. • High Accuracy • Medium Load Capacity • Wet or Dirty Environments • Very High Corrosion Resistance <i>Material Handling Equipment • Gantry Systems • Packaging Equipment • General Motion Control</i>
VERSA RACK	Made from thermoplastic, this rack can go places no other racks can go. It's wide range of applications make it a great fit for general motion control applications looking for the advantages of the RPS in a conventional accuracy version. • Extremely High Corrosion Resistance • Light Load Motion Control • High Durability • Basic Actuator (similar to cylinder/belt) <i>Equipment with Conventional Accuracy Requirements • Packaging • General Motion Control</i>

Pinion Models Available

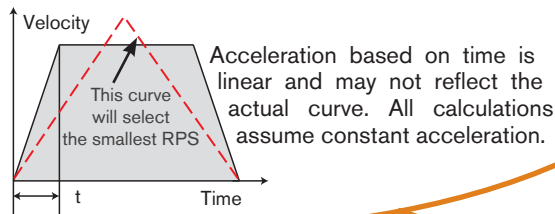
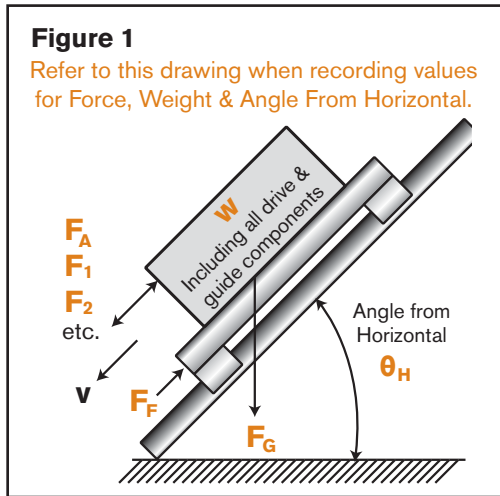
PREMIUM PINION	This long time standard at Nexen offers the best precision on the market. Use with any RPS rack for unbeatable performance. • Very High Precision/Accuracy • High Torque Capacity • Great Performance in Any Application
VALUE PINION	A great fit for unique applications, Nexen offers the Value pinion to fit applications looking for the general features of Nexen's RPS in a conventional accuracy version. • Lighter Load, General Accuracy Applications • Harsh Environments • Available in Sizes 16, 20 & 25

Linear Rack 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 Nexen Group.

Figure 1

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



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) (single direction move)	m	5.4 m
Cycles Per Day (N_{day}) (assumes single direction move)		1000
Acceleration Time (t_A) or Known Acceleration	seconds m/s ²	0.5 s
Weight to be Driven (W)	kgf	150.0 kgf
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:

☐ Typical Industrial

☐ High Humidity

☐ High Temperature

☐ High Dust

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. <i>Sample: $M = 150.0 \text{ kgf} = 150 \text{ kg}$</i>		LOAD MASS $M =$ kg
LOAD ACCELERATION: $A = V_{\max} \div t_A$ A known acceleration from a servo drive provider is preferred if available. <i>Sample: $A = 0.5 \text{ m/s} \div 0.5 \text{ s} = 1.0 \text{ m/s}^2$</i>		LOAD ACCELERATION $A =$ m/s $\div$ s $A =$ m/s²
FORCE DUE TO LOAD ACCELERATION: $F_A = M \cdot A$ <i>Sample: $F_A = 150 \text{ kg} \cdot 1.0 \text{ m/s}^2 = 150.0 \text{ N}$</i>		FORCE DUE TO LOAD ACCELERATION $F_A =$ kg $\cdot$ m/s² $F_A =$ N
FORCE DUE TO GRAVITY: $F_G = M \cdot g \cdot \sin(\theta_H)$ <i>Sample: $F_G = 150 \text{ kg} \cdot 9.81 \text{ m/s}^2 \cdot \sin(60^\circ) = 1274.4 \text{ N}$</i>		FORCE DUE TO GRAVITY $F_G =$ kg $\cdot$ 9.81 m/s² $\cdot$ sin() $F_G =$ N
FORCE DUE TO FRICTION: $F_F = M \cdot \mu \cdot g \cdot \cos(\theta_H)$ <i>Sample: $F_F = 150 \text{ kg} \cdot 0.01 \cdot 9.81 \text{ m/s}^2 \cdot \cos(60^\circ) = 7.4 \text{ N}$</i>		FORCE DUE TO FRICTION $F_F =$ kg $\cdot$ $\cdot$ 9.81 m/s² $\cdot$ cos() $F_F =$ N
SUM OF FORCES: $F_s = F_A + F_G + F_F + F_1 + F_2 + \dots \text{etc}$ <i>Sample: $F_s = 150.0 \text{ N} + 1274.4 \text{ N} + 7.4 \text{ N} = 1431.8 \text{ N}$</i>		SUM OF FORCES $F_s =$ N $+$ N $+$ N $+$ N $+$ N $F_s =$ N
TOTAL FORCE WITH SHOCK FACTOR: $F_T = F_s \cdot K$ <i>Sample: $F_T = 1431.8 \text{ N} \cdot 1.2 = 1718.2 \text{ N}$</i>		TOTAL FORCE WITH SHOCK FACTOR $F_T =$ N $\cdot$ $F_T =$ N

STEP 3: SELECTING A RACK MODEL

Use Table 4 in the RPS System section to review the six different rack models and determine the model best suited for your application.

STEP 4: SELECTING RACK SIZE

Locate your chosen rack model in Table 1 in the RPS System section and determine the rack size with enough thrust capacity to handle the Total Force with Shock Factor calculated above for your application.

STEP 5: EVALUATE LIFE AND VERIFY YOUR SYSTEM SPECIFICATIONS

With the rack model and size selections, evaluate expected life in the System Life section and review the Common Rack Specifications (Table 5 in the Rack Section) to be sure that the rack you have selected will meet all of your application requirements.

RACK MODEL	
RACK SIZE	
RACK PRODUCT NUMBER	

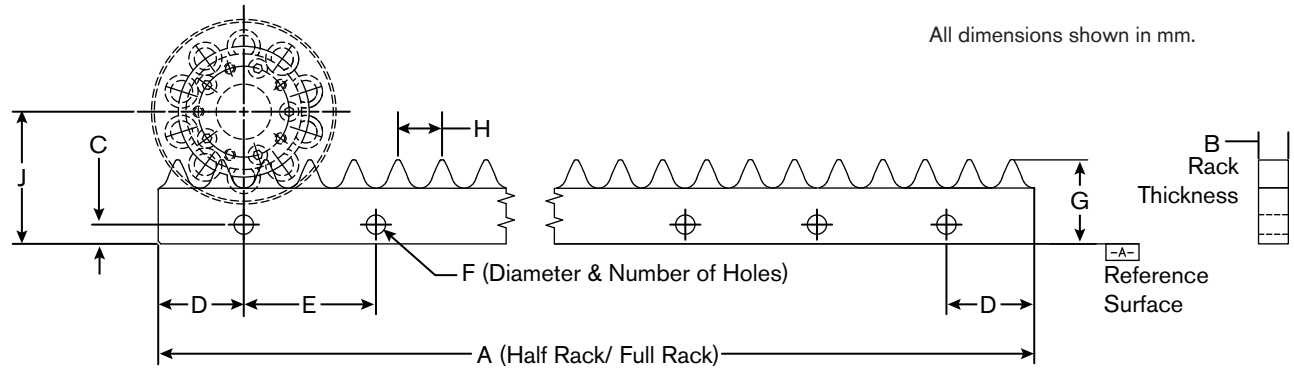
Rack Specifications

Table 5 Common Rack Specifications

Rack Size Attribute			RPS10	RPS12	RPS16		RPS20		RPS25		RPS32		RPS40		RPS4014	
Max Pressure Angle °			26.4	26.4	27.9		26.4		26.4		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	
Module mm			3.0	3.6	4.8		6.0		7.5		9.5		12.0		12.0	
Max Speed *	All Metal Racks	m/s	4	8	4		5		8		11		6		6	
	Versa Rack	m/s	NA	NA	2		2		2		NA		NA		NA	
Rack Tooth Pitch mm			10	12	16		20		25		32		40		40	
Rack Height mm			27	27	30.5		42.0		48.0		57.0		72.6		69.0	
Rack Width mm			5.7	5.7	11.5		15.5		18.5		24.5		31.5		42.0	
Rack Section Size			Half	Half	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
Number of Rack Teeth			48	40	32	62	25	50	20	40	16	31	13	25	13	25
Rack Weight	All Metal Racks	kg	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
	Versa Rack	kg	NA	NA	0.2	0.4	0.4	0.8	0.5	1.0	NA		NA		NA	

* The maximum rated speed of a RPS system is equal to the lowest rating of either the pinion or the rack.

Rack Dimensions



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

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

Rack Product Numbers

RPS Size	Rack Length		Premium	Standard	Endurance	Universal	Universal Uncoated Stainless	Universal Coated Stainless	Versa
10	Half	480 mm	966768	NA	NA	NA	Contact Nexen	Contact Nexen	NA
	Alignment Tool		966507						
12	Half	480 mm	966769	NA	NA	NA	Contact Nexen	Contact Nexen	NA
	Alignment Tool		966508						
16	Half	512 mm	966652	966602	Contact Nexen	966801	966760	966742	Contact Nexen
	Full	992 mm	966651	966601	966850	966800	966813	966741	966860
	Alignment Tool		966503						
20	Half	500 mm	966662	966612	Contact Nexen	966803	Contact Nexen	Contact Nexen	Contact Nexen
	Full	1000 mm	966661	966611	966851	966802	966625	966619	966861
	Alignment Tool		966513						
25	Half	500 mm	966672	966622	Contact Nexen	966805	Contact Nexen	Contact Nexen	Contact Nexen
	Full	1000 mm	966671	966621	966852	966804	966814	966755	966862
	Alignment Tool		966523						
32	Half	512 mm	966682	966632	Contact Nexen	966807	Contact Nexen	Contact Nexen	NA
	Full	992 mm	966681	966631	966853	966806	966812	Contact Nexen	NA
	Alignment Tool		966533						
40	Half	520 mm	966692	966642	Contact Nexen	966809	Contact Nexen	Contact Nexen	NA
	Full	1000 mm	966691	966641	966854	966808	966815	Contact Nexen	NA
	Alignment Tool		966543						
4014	Half	520 mm	966695	966647	Contact Nexen	966811	Contact Nexen	Contact Nexen	NA
	Full	1000 mm	966694	966646	966855	966810	966816	Contact Nexen	NA
	Alignment Tool		966543						
Rack Grease			853901						

Appendix: Definitions & Notes

ARCSECOND

ArcSecond is a unit of angular measurement equal to $1/3600$ of a degree.

BACKLASH

The innovative design of the RPS tooth allows for a zero-backlash drive system. Because zero backlash is impossible to measure, industry standard maintains that anything under 3.2 microns is considered zero.

CORROSION RESISTANCE

Nexen makes no corrosion resistance claims for specific applications but does offer various corrosion countermeasures that include stainless steel and various surface treatments or coatings. Nexen will convey all material and coating specifications, but it is up to the customer to determine application suitability based on this information and/or thorough sample testing.

EFFICIENCY

The RPS system uses needle bearings to support the rollers that engage the teeth. This eliminates the sliding friction found in many other motion control systems and gives it an efficiency greater than 99%. This high efficiency means little is lost to friction, heat, and wear, providing a long life of 60,000,000 pinion revolutions (up to 36 million meters of travel).

LIFE RATING

Pinions: Pinion life is based on L10 of the bearing components. Just like any bearing, environmental conditions will affect life. The product rating is assuming a clean environment with normal manufacturing facility temperatures.

Pinion performance tends to be constant over its life with a rapid deterioration at the end of life as the needle bearings supporting the rollers fail.

Racks & Gears: The rack and gears have their own specific life ratings depending on model, and in some cases RPS size, and is based on tooth contacts at allowed loads and speeds. The combined pinion and rack or gear that makes up a given RPS or RPG system will have the combined life of the lower-rated component and will be greatly effected by machine design, RPS or RPG installation, operating patterns, and receiving recommended lubrication intervals while operated in a clean, dry, 20° C environment.

Rack wear is relatively linear over its life. Application and environmental conditions and lubrication intervals will impact expected product life. Depending on the length of the rack or diameter of the gear and usage patterns, it is often possible to replace the pinion several times, restoring full system performance before the rack or gear would need replacement if the pinion is replaced before reaching the point where its failure starts damaging rack or gear teeth.

LUBRICATION FREE OPERATION

In some cases the RPS rack can be operated without lubrication on the rack teeth or pinion rollers. This is dependent on the specific rack model and the maximum speed being less than 30 m/min. The no-lubrication option generally applies to rack that has received a surface treatment and does not apply to bare steel models of rack or any gearing. See specifications for the specific rack model you are considering to know if this is possible.

Operating without tooth/roller lubrication will reduce tooth life but can be beneficial in food, pharmaceutical, clean room, and other applications where the grease could contaminate the environment, or applications with high levels environmental contaminants that would be attracted to the grease and accelerate the wear rate. Nexen can not calculate a life rating when running without lubrication due to the number of variables that impact life, but based on past experience, the reduction has been modest and far exceeds other mechanical drive alternatives.

Appendix: Definitions & Notes

MASS VS. WEIGHT

Mass is the quantity of matter contained in an object, while weight is the force by which the object is pulled to the earth due to gravity. Therefore, in this literature, mass is shown in kilograms (kg) and weight is shown in kilograms force (kgf).

NOISE RATING

The RPS system is nearly silent at low speeds and typically less than 75 dB at full speed. This is dependent on machine design, proper RPS installation, whether lubrication is used or not, and is difficult to isolate from other drive train and guiding system noise, so your results may vary.

OPERATING TEMPERATURE RANGE

This is the range that the RPS system will function in. Accuracy specifications are based on 20° C and thermal expansion/contraction will effect the accuracy of the RPS system. It is recommended the RPS system be installed at the highest temperature the system will be operated at and avoid wide temperature swings for maximum accuracy and performance.

For applications outside of this temperature range, or with wide temperature swings, contact Nexen for more information.

POSITIONAL ACCURACY

This is dependent on proper machine design and RPS product installation. Positional accuracy is measured at 20° C and subject to variations due to mounting surface irregularities, rigidity, installation accuracy, proper maintenance, and ambient temperature. To be conservative, the RPS rack transmitting accuracy has been rounded up to the next $\pm 10 \mu\text{m}$. Other rack positional accuracy specifications have been rounded up to the next $\pm 5 \mu\text{m}$. For RPG gearsets, the angular accuracy rating is increased (less accurate) by 5% and then rounded to the next whole number, except in the case of very large gears where rounding may be fractional. This allows customers to achieve Nexen accuracy ratings with reasonable effort. Higher performance can be obtained if machine design and tolerances are optimized.

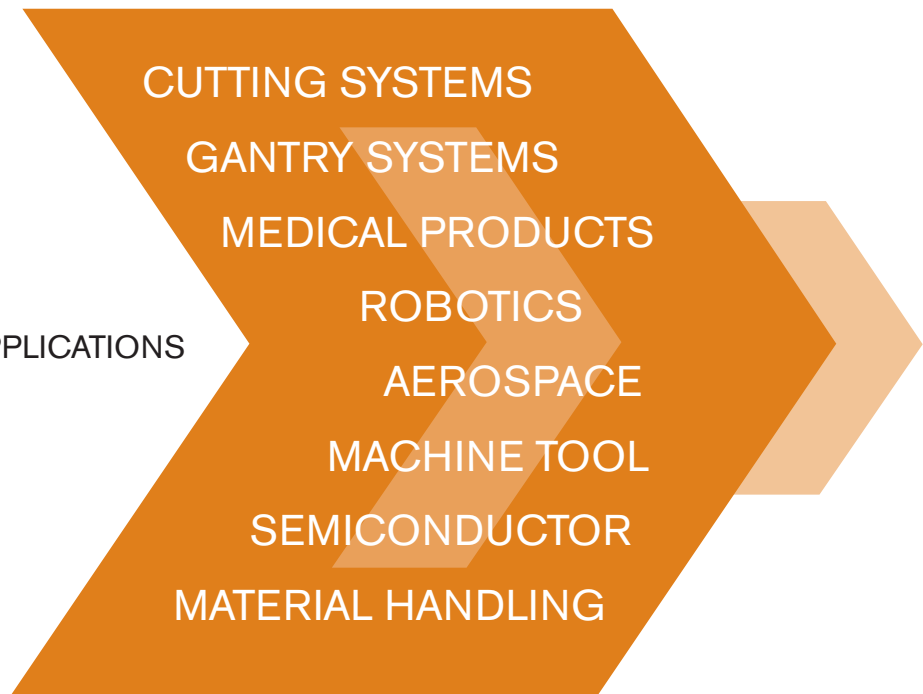
SERIES DIFFERENTIATION

The RPS and RPG pinions, racks and gears have been made in different series (thicknesses) depending on the specific product and should not be mixed when matching a pinion to a given rack or gear. All current pinions, racks and gears are B-series. Series A pinions (discontinued) are interchangeable with C-series pinions (discontinued) and have a wider body with longer rollers than the B-series pinions. The current rack and gear products only use B-series pinions, and the previous gears could use either depending on the RPG size. B-series pinions will not physically fit on a C-series gear, and a C-series pinion would be compromised if used on a B-series rack or gear due to a higher bending moment on the rollers, which would reduce their lives.

SHOCK FACTOR

Shock Factor is a value given to represent the smoothness of operation. Accommodating for Shock Factor when calculating system requirements ensures more accurate product selection.

INDUSTRIES & APPLICATIONS



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In accordance with Nexen's established policy of constant product improvement, the specifications contained in this document are subject to change without notice. Technical data listed in this document are based on the latest information available at the time of printing and are also subject to change without notice. For current information, please consult www.nexengroup.com or contact Nexen's Technical Support Group at the location to the right.

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