LINEAR MOTION CONTROL

Technical Data Sheet

Precision Roller Pinion System

RPS16, RPS20, RPS25, RPS32, RPS40

Nexen is proud to introduce an advanced technology that will revolutionize linear drive systems. Our Precision Roller Pinion System eliminates backlash and provides accurate positioning while operating at high speeds. The RPS line features a patented tooth design combined with a pinion consisting of bearing supported rollers to ensure precision and reduce maintenance. Offering better performance and longer life than traditional rack and pinion or ball screw systems, the Precision Roller Pinion System has models ideal for a variety of linear motion applications.



Precision Operation Maintains Accurate Positioning

The RPS line features an innovative rack and roller pinion combination that provides extremely accurate positioning. This design eliminates the cumulative error problems experienced with ball screw systems. The Roller Pinion System also offers backlash-free performance in both directions by maintaining opposing contact with two or more teeth at all times. This design eliminates the costly and complex split and dual pinion systems required by most traditional rack and pinion systems.

Patented Tooth Design Ensures Quiet Operation

The RPS line is designed with bearing supported rollers that move smoothly along the face of each tooth. This reduces noise levels often associated with other linear motion systems.

Segmented Rack Provides Easy Integration and Unlimited Travel

Nexen offers the rack in segmented lengths, making it easy to accommodate your application requirements. Supplied in meter and half meter increments, length can also be custom cut as required. The basic system is comprised of just two parts, a rack and roller, making it easy to adapt to any application.

Rugged Design Capable of High Speeds

The Roller Pinion System maintains accurate positioning at speeds as high as 250 m/min (13.7 ft/sec). Even at these speeds, the extremely-low friction design does not create heat or wear on components.

THE NEXEN ADVANTAGE

Nexen's Roller Pinion System (RPS) converts rotary motion into very precise, backlash-free linear motion. It does this with a revolutionary design concept that uses a pinion consisting of bearing supported rollers to engage a rack with an innovative tooth profile. As the pins and rack teeth interface, the rollers move smoothly along the tooth profile, driving the rack. This design allows zero tooth clearance while providing high accuracy, long life, low noise, and maintenance.

- High Precision
  - Repeatability
  - Accuracy
  - No Cumulative Error
- Zero Backlash
- 99% Efficient
- High Speed Operation
- Virtually No Wear
  - Long Life
  - Low Particle Emissions
- Low Maintenance
- Unlimited Length Possible
- Minimal Noise
- Easy System Integration

REPEATABILITY

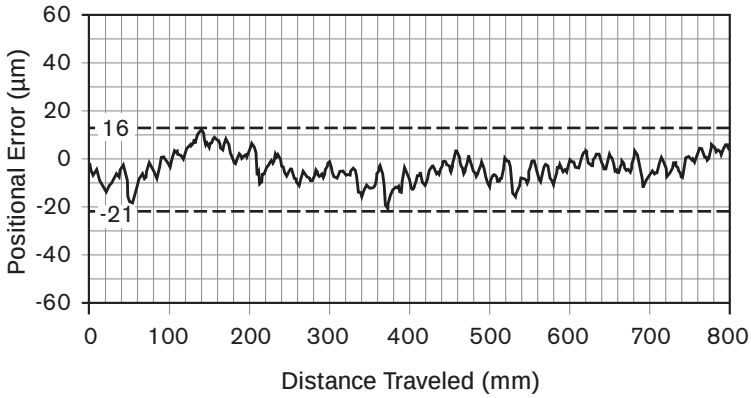
Precise to ±20 µm

BACKLASH COMPLIANCE

No more than 3.2 µm

PRECISION OPERATION ELIMINATES CUMULATIVE ERROR

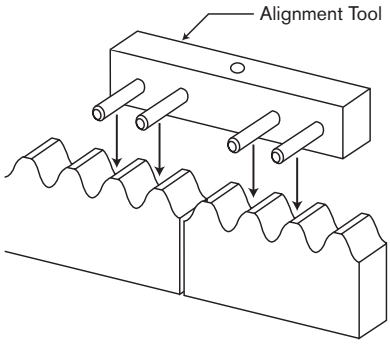
The variations shown below represent minor errors occurring throughout the pinion's travel. The small waves indicate meshing errors and larger wave patterns demonstrate pinion rotational error. As you can see, there is no cumulative error.



Regardless of the distance traveled, positional accuracy remains constant with the RPS System.

UNLIMITED RACK LENGTH POSSIBLE

Nexen's Precision Roller Pinion System offers versatility in distance with the ability to cut or join rack segments. Connect individual rack lengths to design an RPS System that meets your specific application requirements by using the Nexen Alignment Tool. A unique tool is available for each rack size.



SPECIFICATIONS

	RPS16	RPS20	RPS25	RPS32	RPS40
Maximum Allowable Force	1000 N [225 lbf]	1500 N [337 lbf]	2200 N [495 lbf]	3600 N [809 lbf]	6000 N [1349 lbf]
Maximum Torque	25 Nm [225 in-lb]	48 Nm [422 in-lb]	88 Nm [774 in-lb]	219 Nm [1946 in-lb]	458 Nm [4057 in-lb]
Linear Distance per One Rotation	160 mm [6.3 in]	200 mm [7.9 in]	250 mm [9.8 in]	384 mm [15.1 in]	480 mm [18.9 in]
Pinion Inertia	0.002 kg-m^2 [5.468 lb-in^2]	0.004 kg-m^2 [14.010 lb-in^2]	0.010 kg-m^2 [35.197 lb-in^2]	0.018 kg-m^2 [60.826 lb-in^2]	0.069 kg-m^2 [234.760 lb-in^2]
Meshing Pitch Circle Diameter	50.9 mm [2.00 in]	63.7 mm [2.51 in]	79.6 mm [3.13 in]	121.7 mm [4.79 in]	152.7 mm [6.01 in]
Bore Size	20 mm [0.79 in]	25 mm [0.98 in]	30 mm [1.18 in]	45 mm [1.77 in]	60 mm [2.36 in]
Module	4.75 mm [0.19 in]	6 mm [0.24 in]	7.55 mm [0.30 in]	9.5 mm [0.37 in]	12 mm [0.47 in]
Rack Mass per meter [in]	3.3 kg/m [0.19 lb/in]	5.2 kg/m [0.29 lb/in]	8.2 kg/m [0.46 lb/in]	12.9 kg/m [0.72 lb/in]	19.0 kg/m [1.06 lb/in]

PRODUCT NUMBERS

Model	Component		Product Number
RPS16	Roller Pinion	Bore: 20 mm [0.79 in]	966500
	Rack Length	992 mm [39.06 in]	966501
		512 mm [20.16 in]	966502
	Alignment Tool		966503
RPS20	Roller Pinion	Bore: 25 mm [0.98 in]	966510
	Rack Length	1000 mm [39.37 in]	966511
		500 mm [19.68 in]	966512
	Alignment Tool		966513
RPS25	Roller Pinion	Bore: 30 mm [1.18 in]	966520
	Rack Length	1000 mm [39.37 in]	966521
		500 mm [19.68 in]	966522
	Alignment Tool		966523
RPS32	Roller Pinion	Bore: 45 mm [1.77 in]	966530
	Rack Length	992 mm [39.06 in]	966531
		512 mm [20.16 in]	966532
	Alignment Tool		966533
RPS40	Roller Pinion	Bore: 60 mm [2.36 in]	966540
	Rack Length	1000 mm [39.37 in]	966541
		520 mm [20.47 in]	966542
	Alignment Tool		966543

PRECISION ROLLER PINION SELECTION PROCESS

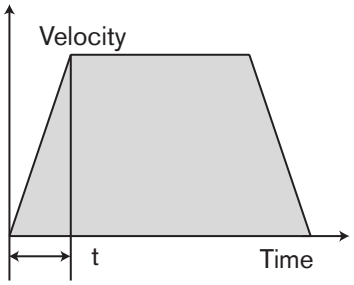
Proper RPS model size selection requires the application data listed below. These specifications are needed to determine: load mass, load acceleration, force due to acceleration, force due to gravity, force due to friction, and total force of the load. Sample calculations using both metric and imperial units are shown along with worksheet space to calculate your own application.

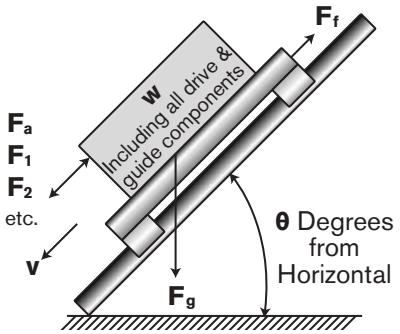
Friction Coefficient (μ)

Rolling Guide	0.005 ~ 0.02
Sliding Guide	0.1 ~ 0.2

Shock Factor* (K)

Normal Operation	1.2 ~ 1.5
Operation with Impact	1.5 ~ 2.5





Required Specifications for Proper RPS Selection	Customer Application Specifications		Metric Units (Examples shown on next page)	Imperial Units (Examples shown on next page)
Weight to be Driven** (**w**)	kg [lb]	Sample Data	226.8 kg	500 lb
Maximum Velocity*** (**v**)	m/s [ft/s]		0.91 m/s	3 ft/s
Acceleration Time (**t**)	seconds		0.5 s	0.5 s
Shock Factor (**K**) *see table above*			1.2	1.2
Other Forces**** ($\mathbf{F_1}$)	N [lb]		0 N	0 lbf
Gravitational Acceleration***** (**g**)	9.81 m/s² [32.2 ft/s²]		9.81 m/s²	32.2 ft/s²
Friction Coefficient (**μ**) *see table above*			0.01	0.01
Degrees from Horizontal (**θ°**)			60°	60°

* ***Shock Factor*** indicates the smoothness of operation.
** ***Weight to be Driven*** should include the servomotor, reducer, guide rail bearings, platform, etc., when applicable.
*** ***Maximum Velocity*** must be less than 4.17 m/s [13.7 ft/s].
**** ***Other Forces*** may include springs, counter balances, fluid dampening systems, wind resistance, etc.
***** ***Gravitational Acceleration*** is a constant value. Use 9.81 m/s² for metric applications and 32.2 ft/s² for imperial applications.

General Application Information

Application Type	
Shaft Diameter	
Environmental Conditions	
Distance of Travel	
Required Life	
Other Application Data	

SELECTING AN RPS MODEL

Use the value for ***Total Force of the Load***, to select the appropriate RPS model. Refer to ***Maximum Allowable Force*** in the SPECIFICATIONS Table (on page 3) to find the RPS model with the capacity required for your application.

Calculations	Metric Worksheet with Example	Imperial Worksheet with Example
Load Mass Metric: m = **w** Imperial: m = **w** ÷ **g**	m = kg	$m = \frac{lb}{ft/s^2} = Slug$
	226.8 kg	500lb ÷ 32.2ft/s² = 15.5 Slug
Load Acceleration A = **v** ÷ **t**	$A = \frac{m/s}{s} = m/s^2$	$A = \frac{ft/s}{s} = ft/s^2$
	0.91m/s ÷ 0.5s **=** 1.8 m/s²	3.0ft/s ÷ 0.5s **=** 6.0 ft/s²
Force Due to Acceleration F_a = **m•A**	F_a= kg • m/s² = N	F_a= Slug • ft/s² = lbf
	226.8kg • 1.8m/s² **=** 408.2 N	15.5Slug • 6.0ft/s² **=** 93.0 lbf
Force Due to Gravity F_g = **m•g•sin(θ)**	F_g= kg • m/s² • sin(θ°) = N	F_g= Slug • ft/s² • sin(θ°) = lbf
	226.8kg • 9.81m/s² • sin(60°) **=** 1926.8 N	15.5Slug • 32.2ft/s² • sin(60°) **=** 432.2 lbf
Force Due to Friction F_f = **m•μ•g•cos(θ)**	F_f= kg • **μ** • m/s² • cos(θ°) = N	F_f = Slug • **μ** • ft/s² • cos(θ°) = lbf
	226.8kg • 0.01 • 9.81m/s² • cos(60°) = 11.1 N	15.5Slug • 0.01 • 32.2ft/s² • cos(60°)= 2.5 lbf
Total Force of the Load F_t = **K**(**F_a**+**F_g**+**F_f**+**F_1**)	F_t= **K**(**F_a**+**F_g**+**F_f**+**F_1**) = N	F_t= **K**(**F_a**+**F_g**+**F_f**+**F_1**) = lbf
	1.2(408.2 + 1926.8 + 11.1 + 0) = **2815.3 N**	1.2(93.0 + 432.2 + 2.5 + 0) = **633.2 lbf**

The sample application requires an RPS32 which can accommodate a maximum total load force of 3600 N [809 lbf] (See SPECIFICATIONS Table).

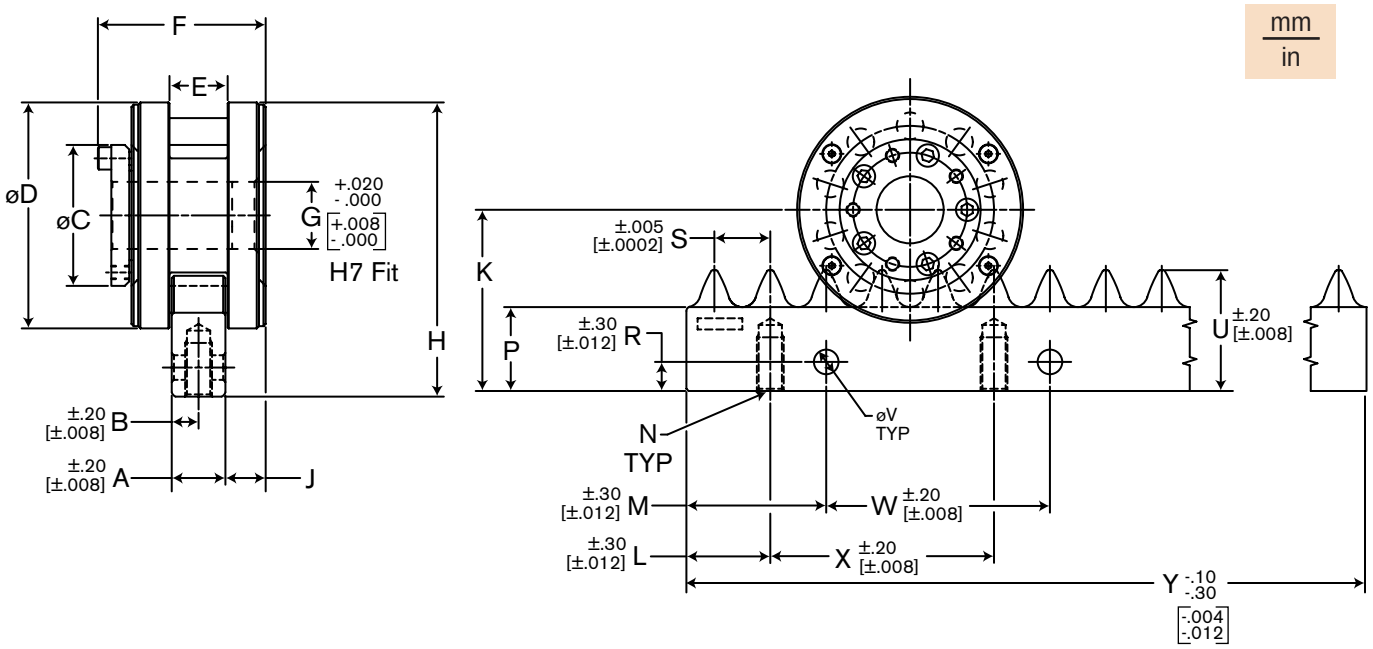
RPS32

SELECTING THE DRIVE MOTOR/REDUCER SIZE

Refer the calculations above and the SPECIFICATIONS Table to perform the following calculations:

Metric	Required Torque: **F_t** • Meshing Pitch Circle Diameter ÷ 2000	
		2815.3N • 121.7mm ÷ 2000 = 171.3 Nm
	RPM: 60000 • **v** ÷ Linear Distance Per One Rotation	
		60000 • 0.91m/s ÷ 384mm = 142.2 RPM
Imperial	Required Torque: **F_t** • Meshing Pitch Circle Diameter ÷ 2	
		633.2lbf • 4.79in ÷ 2 = 1516.5 in-lb
	RPM: 720 • **v** ÷ Linear Distance Per One Rotation	
		720 • 3ft/s ÷ 15.1in = 143.0 RPM

Roller Pinion System (Models RPS16, RPS20, RPS 25), Approximate Dimensions

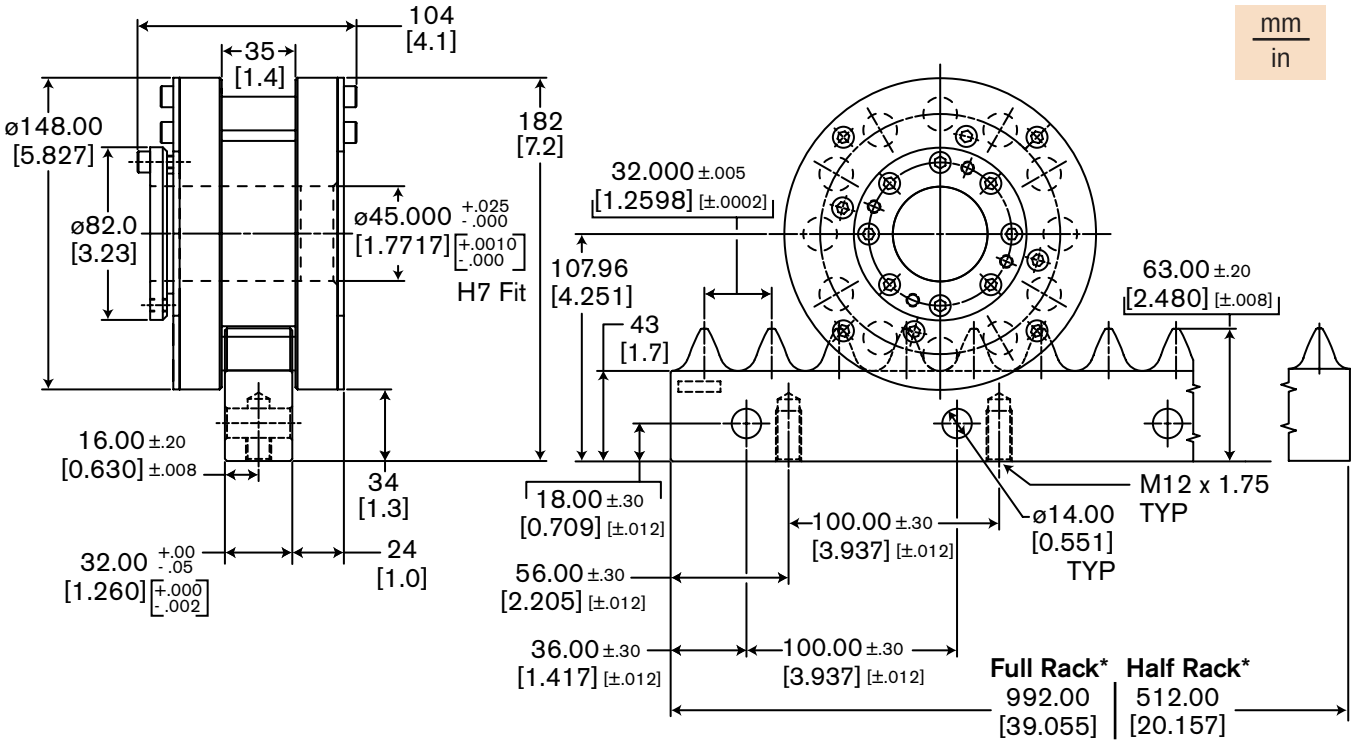


Model	A	B	øC	øD	E	F	øG	H	J
RPS16	16.00 [0.630]	8.0 [0.315]	42.0 [1.65]	67.00 [2.638]	18 [0.7]	58.5 [2.30]	20.000 [0.7874]	84 [3.3]	16 [0.6]
RPS20	20.00 [0.787]	10.00 [0.394]	50.0 [1.97]	84.0 [3.31]	22 [0.9]	65.0 [2.56]	25.000 [0.9843]	105 [4.1]	16 [0.6]
RPS25	24.00 [0.945]	12.00 [0.472]	63.0 [2.48]	101.00 [3.976]	26 [1.0]	75.0 [2.95]	30.000 [1.1811]	132 [5.2]	18 [0.7]

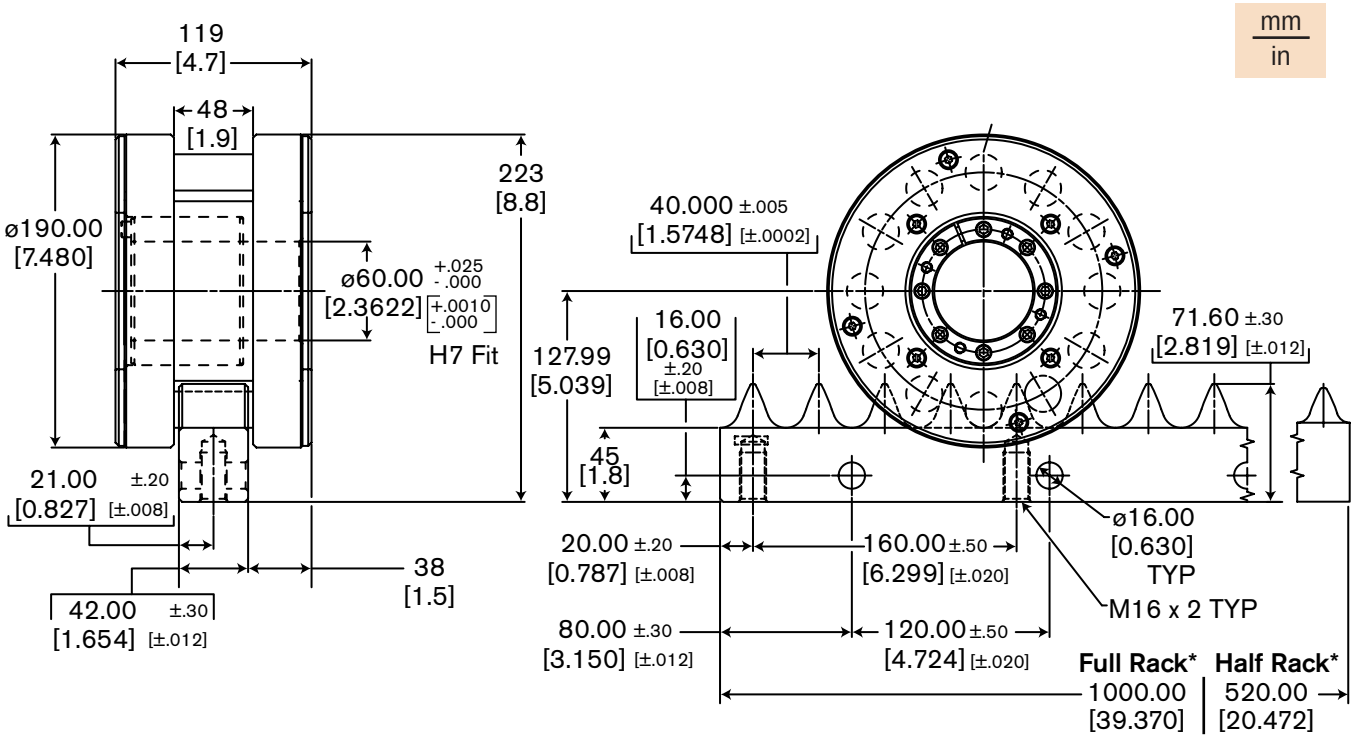
Model	K	L	M	N	P	R	S	U	V	W	X	Y1*	Y2*
RPS16	51.00 [2.008]	8.00 [0.315]	24.00 [0.945]	M8 x 1.25	23 [0.9]	8.00 [0.315]	16.000 [0.6299]	33.50 [1.319]	7.00 [0.276]	80.00 [3.150]	80.00 [3.150]	512.00 [20.157]	992.00 [39.055]
RPS20	63.00 [2.480]	10.00 [0.394]	30.00 [1.181]	M10 x 1.5	28 [1.1]	10.00 [0.394]	20.000 [0.7874]	41.00 [1.614]	9.00 [0.354]	80.00 [3.150]	80.00 [3.150]	500.00 [19.685]	1000.00 [39.370]
RPS25	81.00 [3.189]	37.50 [1.476]	62.50 [2.461]	M12 x 1.75	38 [1.5]	13.00 [0.512]	25.000 [0.9843]	54.00 [2.126]	11.00 [0.433]	100.00 [3.937]	100.00 [3.937]	500.00 [19.685]	1000.00 [39.370]

* Full rack and half rack lengths shown. Additional rack lengths are available. Please contact the factory for more information.

RPS32, Approximate Dimensions



RPS40, Approximate Dimensions



* Full rack and half rack lengths shown. Additional rack lengths are available. Please contact the factory for more information.

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