

RPG-B, Rotary Drive System With Bearing






FORM NO. L-21274-A-0113

In accordance with Nexen's established policy of constant product improvement, the specifications contained in this manual are subject to change without notice. Technical data listed in this manual are based on the latest information available at the time of printing and are also subject to change without notice.

Technical Support: 800-843-7445
(651) 484-5900

www.nexengroup.com

	<p style="text-align: center;"> DANGER</p> <p>Read this manual carefully before installation and operation. Follow Nexen's instructions and integrate this unit into your system with care. This unit should be installed, operated and maintained by qualified personnel ONLY. Improper installation can damage your system, cause injury or death. Comply with all applicable codes.</p>	
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This document is the original, non-translated, version.

Conformity Declaration: In accordance with Appendix II B of CE Machinery Directive (2006/42/EC):

A Declaration of Incorporation of Partly Completed Machinery evaluation for the applicable EU directives was carried out for this product in accordance with the Machinery Directive. The declaration of incorporation is set out in writing in a separate document and can be requested if required.

This machinery is incomplete and must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the applicable provisions of the Directive.

Nexen Group, Inc.
560 Oak Grove Parkway
Vadnais Heights, Minnesota 55127

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SIT S.A. | Tfn. 943 457200 | atencioncliente@sitsa.es | www.sitsa.es

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GENERAL SAFETY PRECAUTIONS



⚠️ WARNING

Use appropriate guarding for rotating components. Failure to guard could result in serious bodily injury.



⚠️ DANGER

This product has moving parts that can crush or cut appendages. Provide adequate spacing or guarding from any operating product.



⚠️ WARNING

Failure to properly support the load before disengaging the RPG system could cause serious harm to operators or equipment.



⚠️ WARNING

Ensure proper guarding of the product is used. Nexen recommends the machine builder design guarding in compliance with OSHA 29 CFR 1910 "Occupational Safety and Health Hazards".



⚠️ CAUTION

Use lifting aids and proper lifting techniques when installing, removing, or placing this product in service.



⚠️ CAUTION

Watch for sharp features when interacting with this product. The parts have complex shapes and machined edges.



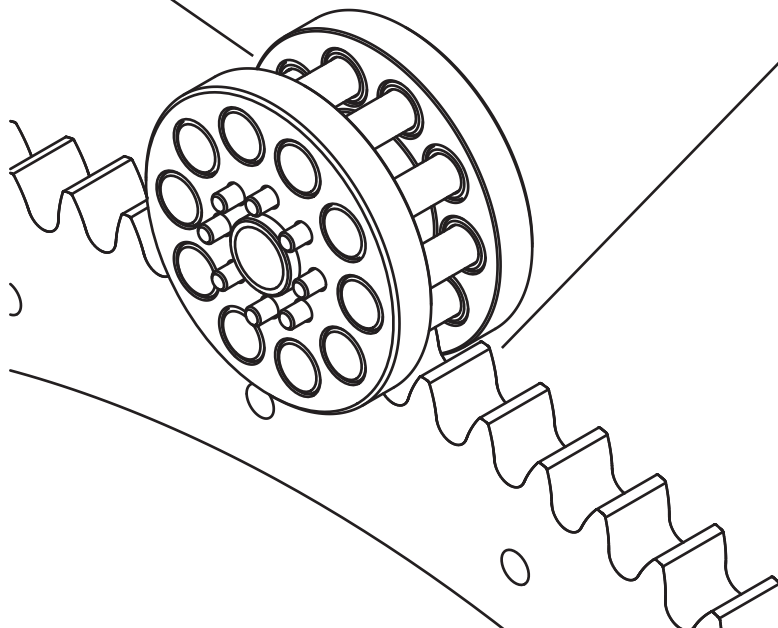
⚠️ WARNING

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⚠️ DANGER

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SYSTEM DESIGN OVERVIEW

GENERAL SYSTEM REQUIREMENTS

- Unlike traditional gear systems, the Roller Pinion Gear (RPG) rotary drive system has zero mechanical clearance and requires a system preload for proper operation. This preload must remain relatively constant around the entire gear to obtain optimal system performance and life. See Figures 1 and 2 for more details.
- Make sure that the machine design is rigid enough to avoid deflection that could affect the RPG system preload.
- The allowed ring gear concentricity variance tolerances shown in Figure 2 are greater than the system preload. This is not an error. The RPG system has been designed to operate correctly under these conditions.
- The RPG System generates a reaction force that tries to separate the pinion from the gear teeth. Make sure this is accounted for in the machine design. See product data for pressure angle specifications.
- The RPG System requires a mechanism to achieve proper pinion preload. It is recommended that the pinion be moved into the gear not vice versa. The recommended method is to mount the servo drive system on a sliding bracket that has an adjustment to push it into the gear. Another possible preloading method utilizes a bracket with an eccentric mounting slot pattern. Nexen offers a preloading mechanism that is easy to integrate into your application as shown in Figure 11. Spring loaded preloading mechanisms should not be used since the spring force required to counteract the separation forces are much higher than the allowed preloading force and would cause a reduction in pinion needle bearing life, and increase system noise. See Figure 11 for more details.
- The RPG System requires periodic lubrication and should use the grease offered on Nexen's website as an accessory to the RPG products or equivalent lubrication as described in the Lubrication section on page 16. For more information or applications with special lubrication needs consult Nexen.
- Do not use the RPG System in environments with temperature outside of -5 to 40° C (23 to 104° F), or with wide temperature swings since this can affect the preload and meshing of the system. If you have an application with any of these characteristics consult Nexen.

MOUNTING REQUIREMENTS

- Install the RPG-B system at the temperature at which it will be used.
- The ring gear teeth are hardened on the tooth faces only.
- Make sure the machine design is rigid enough to avoid deflection that could affect the ring drive system.

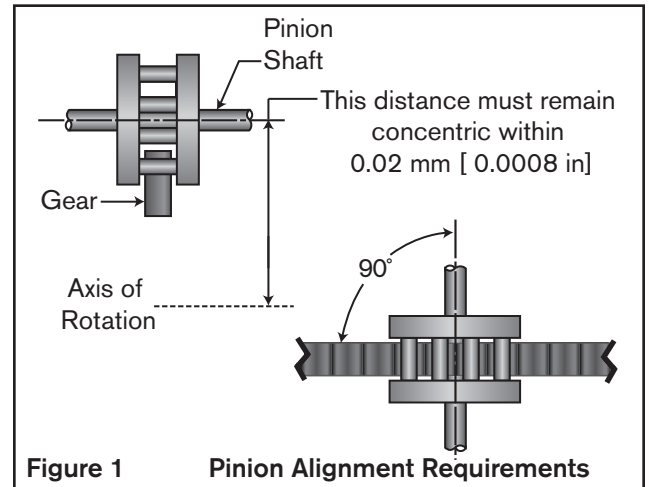
PINION REQUIREMENTS

- Verify the shaft variance and diameter tolerances meet Nexen specifications before mounting the pinion. See Figure 3.
- The shaft on which the pinion is mounted on must pass all of the way through the pinion and bushing for proper support.
- If using a flange mount pinion, verify that the dimensions and tolerances of the gearhead flange meet the specifications of the ISO 9409 Standard.
- Mount the pinion as close to a support bearing as possible to minimize shaft deflection.
- The pinion roller bearings are sealed. It is still recommended, however, that the pinion be shielded from liquids, dust, and debris.
- Multiple pinions can drive a gear without an additional service factor but the load sharing by each pinion must be equal. This is best accomplished with discrete drives linked electronically; mechanically linking pinions is not recommended. Contact Nexen for more information.
- The RPG system can be operated such that the pinion revolves around the ring gear as long as the pinion preload remains within specifications as it revolves.

PROPER SYSTEM ALIGNMENT

Unlike traditional gear systems, the RPG System operates with no mechanical clearance and requires a preload. For optimal performance the preload must remain as constant as possible as the ring gear travels past the pinion, or conversely, the pinion orbits around the stationary ring gear. To achieve this the ring gear and pinion concentricity and axial variance and pinion axis concentricity and parallelism to the axis of rotation must be well maintained. The following guidelines will ensure this is achieved.

1. See Figures 1 and 2.
2. The Pinion axis of rotation must be concentric (± 0.02 mm [± 0.0008 in]) to the axis of rotation of the ring gear and the angle between the Pinion Shaft axis and the plane the ring gear is in must be exactly 90° (Refer to Figure 1).
3. The Pinion Shaft must be supported adequately to ensure full contact of roller pins along the face of ring gear teeth.
4. Once the RPG-B system is properly installed and preloaded verify the meshing tooth pattern is correct as outlined in the System Alignment Verification section on Page 11.

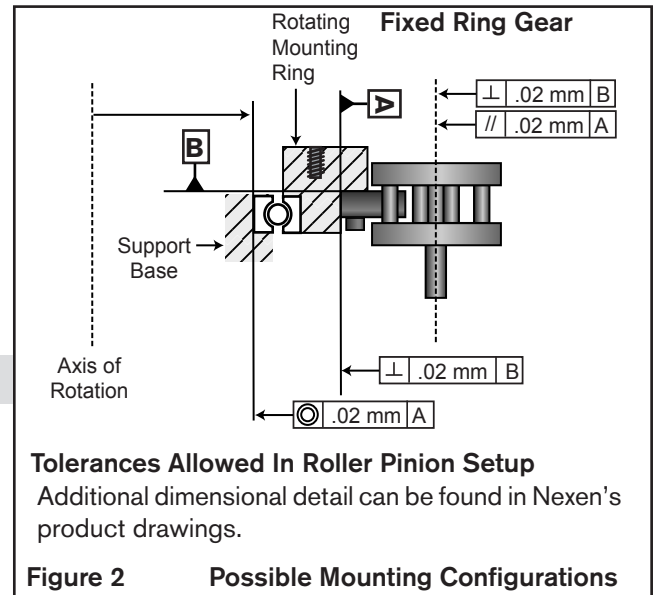


MOUNTING SURFACE DETAILS

The surface used to mount the RPG-B should be machined to a flatness of .050mm as shown to ensure proper alignment. See Figure 1.

All provided provisions for fasteners should be utilized.

Make sure there is proper clearance around the gearbox as seen in Figure 1.



INSTALLATION

SYSTEM MOUNTING

- Clean and check all mounting surfaces before assembly. Contamination from dirt or machining burrs can affect system performance.
- Position the system on the mounting surface. There are threaded holes available in the bearing to use as lift points, typically M12 x 1.75.
- To center the system, Nexen recommends using the OD of the teeth as a reference dimension for alignment.
- Once the system is in location, install the provided mounting bolts. Tighten the bolts in a star pattern to ensure even distribution of load.

DIAL PLATE MOUNTING (OUTPUT)

- The dial plate is designed to be piloted by a series of dowel pins installed in the plate and that straddle the male pilot on the ring drive. Drawings are available for each specific size, which will aid in understanding the method of piloting the dial plate.
- The dial plates should be mounted using all available holes. Again, tighten in a star pattern to ensure even load distribution. It is the responsibility of the customer to ensure the bolt grade and quantity is sufficient for the application.

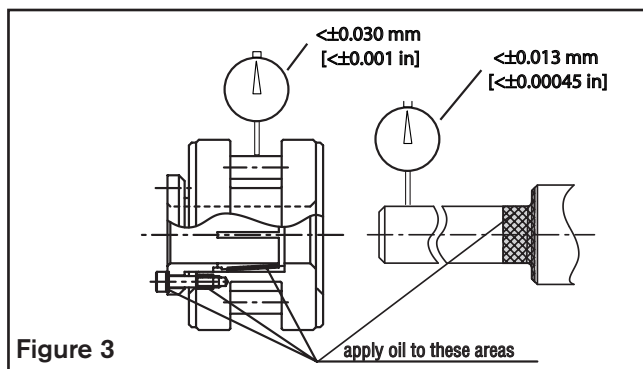
ROLLER PINION INSTALLATION

Note: There are two pinion mounting styles, shaft or flange mount. Refer to the following section that applies to your situation. In either case it is critical to minimize radial variance. It will effect pinion preload and positional accuracy throughout the run.

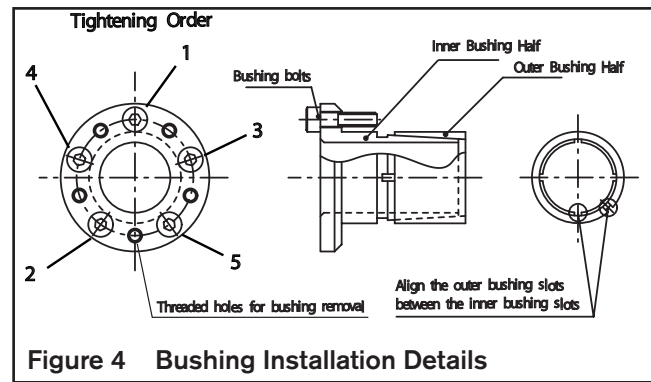
Shaft Mounted Pinion Installation

NOTES:

- Refer to product drawings for shaft details.
 - Refer to General Design Guidelines and Figures 1 and 2 for Roller Pinion mounting requirements.
 - The pinion should be mounted as close to a shaft supporting bearing as possible to minimize shaft deflection and obtain optimal performance.
 - The shaft the pinion is mounted on must extend all of the way through the pinion and bushing for proper pinion support and maximum torque transmission.
1. Clean the shaft the pinion will be mounted on and verify that variance is less than ± 0.013 mm [± 0.0005 in] as shown in Figure 3.
 2. Inspect the shaft, pinion bore and the inner and outer bushing halves to ensure they are clean and have no defects.
 3. Put oil that does not contain any pressure additives on the shaft, the tapered part of the bushing and the bushing bolts as shown in Figure 3. Do not lubricate the bore of the pinion bushing or shaft where the bushing contacts it or the torque transmission capacity of the bushing will be reduced.



4. Insert the outer bushing half into the roller pinion bore until it bottoms in the roller pinion body.



5. Insert the inner bushing half into the outer bushing half (previously inserted into the pinion) while ensuring that the inner and outer bushing half slots are not aligned as shown in Figure 4. For RPG32 and below you will also have to simultaneously ensure the bushing bolt through holes align with the pinion bolt holes. On RPG40 and larger the bushing bolts thread into the other half of the bushing, not the pinion body, so misalignment is not possible. The threaded holes are for bushing removal.



NOTE: Ensure that the slots in the two components that make up the bushing are not aligned as shown in Figure 4.

6. Insert the shaft into the pinion and bushing bore.
7. Insert the bushing fasteners into the through holes. Only use the provided bushing fasteners.
8. Locate the pinion on the shaft and lightly tighten the fasteners to take clearance out of all of the bushing parts but still allow the pinion to be moved axially on the shaft. Position the pinion and bushing assembly on the shaft so that the gap between the gear face and pinion roller bearing shoulders is even on both sides. As the bushing fasteners are tightened the pinion will be drawn slightly in the bushing direction so it is recommended that the pinion and bushing assembly be offset axially away from the bushing side 3 - 5 mm [0.1 - 0.2 in] initially so when the bushing fasteners are fully torqued the pinion ends up centered on the gear.
9. Equally tighten the bushing fasteners with 25% of the recommended tightening torque listed in Table 1. Start tightening at the top fastener and alternate back and forth across the face in a star pattern as shown in Figure 4. Repeat this procedure with 50% and then full torque. An additional 1 or 2 repetitions at full torque are recommended to ensure all fasteners have reached their target torque values. Progressive tightening of non-adjacent bushing fasteners is important to prevent any misalignment of components while installing the bushing.

10. Once the fasteners are fully torqued verify the pinion is centered on the gear. If not, measure the positional error and then remove the pinion as described in the Disengaging The Roller Pinion section on page 12. Repeat the pinion installation procedure and offset the pinion by the recorded error plus the previous off set value. When the pinion is fully torqued and properly centered then verify pinion concentric variation at the center of the pinion rollers as shown in Figure 9. Variation on this surface must be less than ± 0.030 mm [± 0.0010 in].

Table 1 Pinion Bushing Bolt Information

Model	Bolt Type	Tightening Torque
RPS16	M4	3.5 Nm [30.98 in-lb]
RPS20	M5	7.0 Nm [61.96 in-lb]
RPS25	M6	12.0 Nm [106.21 in-lb]
RPS32	M6	12.0 Nm [106.21 in-lb]
RPS40	M6	12.0 Nm [106.21 in-lb]
RPS4014	M8	38.0 Nm [336.26 in-lb]

	 CAUTION
	<p>Preload must be applied before putting your system into operation. Refer to APPLYING PRELOAD to properly set preload for your RPS system.</p>

Flange Mount Pinion Installation (ISO 9409)

1. Clean the gearhead mounting face and pilot bore, inspecting for contaminates, burrs, or surface defects that would interfere with full contact between the pinion and flange.
2. Using a test indicator, check the rotational flatness of the face as shown in Figure 5. Position the contact point of the indicator where the pinion will contact it. Rotate slowly for a minimum of one complete revolution and note the total amount of variance.



Figure 5

3. Position the contact point of the indicator at bottom dead center of the pilot bore as shown in Figure 6. Rotate slowly for a minimum of one complete turn and note the amount of total variance in one rotation.

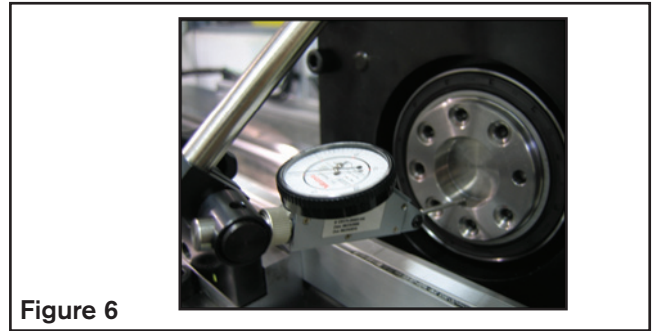


Figure 6

4. If either of the following conditions are true, the gearhead itself may contribute to excessive pinion preload variation, a reduction in pinion life and/or accuracy. The user should consider having the gearhead re-worked or replaced.
 - a. The measured total variance of the mounting face is greater than 0.013 mm [0.0005 in].
 - b. The measured total variance of the pilot bore wall is greater than 0.005 mm [0.0002 in].

Note: In some cases an adapter will be required to mount the pinion on the reducer. If so, proceed with Step 5, if not, skip to Step 13.

5. Clean the adapter flange and pilot where it will contact the gearhead flange inspecting for contaminates, burrs, or surface defects that would interfere with full contact between the adapter and gearhead flange. See Figure 7.

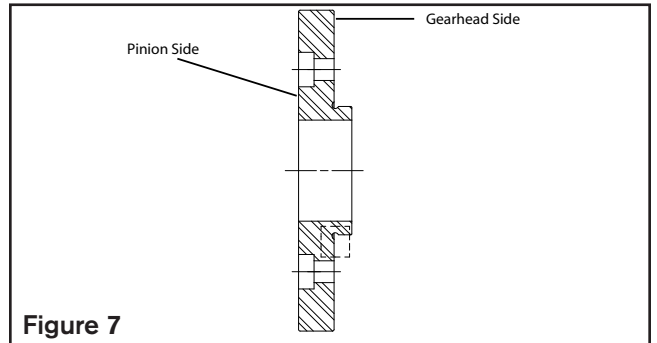


Figure 7

6. Apply a serviceable thread locking compound to the adapter mounting screws then assemble the adapter to the gearhead, leaving the mounting screws snug but do not tighten at this time.
7. Position a test indicator at bottom dead center of the pilot bore wall as shown in Figure 8 and zero the indicator. Rotate the assembly slowly by using the gearhead input shaft a minimum of one complete revolution while noting the amount of total indicator variance and mark the angular location in which the lowest reading occurs throughout the rotation.



Figure 8

8. If the measured total indicator variance of the adapter pilot bore is greater than 0.008 mm [0.0003 in], tap gently on the O.D. of the adapter using a soft hammer at the angular location in which the lowest reading occurred. Doing this will shift the center of the adapter closer to the center of rotation.
9. Repeat steps 7 and 8 until the total measured amount of indicator variance is 0.008 mm [0.0003 in] or less.
10. Tighten the mounting screws to 50% of the specified torque specified in Table 2 in a star pattern that allows for an even distribution of axial clamping force. Then repeat the tightening pattern with 100% of the recommended torque.

Table 2

Adapter Fasteners	Tightening Torque Nm [in-lb]
ISO 16/20 (M5x0.8)	6.5 [58.08]
ISO 16/25 (M6x1.0)	11.5 [78]
ISO 20/25 (M6x1.0)	11.5 [78]
ISO 20/32 (M6x1.0)	11.5 [78]
ISO 32/40 (M8x1.25)	26 [156]
ISO 40/4014 (M10x1.5)	46 [273]

11. Re-torque the mounting screws once more to the full-specified torque value in Table 2 to ensure full torque has been reached on all fasteners. Tighten in the same order as above.
12. Repeat inspection Step 7 and verify the variance listed in Step 8 is achieved after fully torquing the adapter. If variance is out of specifications the adapter should be removed inspecting for contaminates, burrs, or surface defects that would interfere with full contact between the adapter and gearhead flange. In some cases indexing the adapter relative to the gearhead flange can be helpful. Then repeat the adapter installation procedure starting with Step 5.

13. Clean the pinion flange and pilot where it will contact the adapter (if used) or gearhead flange inspecting for contaminates, burrs, or surface defects that would interfere with full contact between the pinion and adapter (if used) or gearhead flange.

14. Apply a serviceable thread locking compound to the pinion mounting screws and assemble the pinion to the adapter (if used) or gearhead, leaving the mounting screws snug but do not tighten at this time.

15. Position a test indicator on the center of the pinion rollers as shown in Figure 9 and zero the indicator. Rotate pinion a minimum of one complete revolution by turning the gearhead input shaft while noting the amount of total indicator variance and mark the angular location on the pinion shoulder in which the highest reading occurs throughout the rotation. When the pinion is properly centered the concentric variation at the center of the pinion rollers must be less than ± 0.030 mm [± 0.0010 in].



Figure 9

If the measured total indicator variance of the pinion rollers is greater than ± 0.030 mm [± 0.0010 in], tap gently on the O.D. of the pinion using a soft hammer at the angular location in which the highest reading occurred. Doing this will shift the pinion center closer to the center of rotation.

16. Tighten the mounting screws to 50% of the specified torque specified in Table 3 below in a star pattern that allows for an even distribution of axial clamping force. Then repeat the tightening pattern with 100% of the recommended torque in Table 3.

Table 3

Pinion Fasteners	Tightening Torque Nm [in-lb]
RPS 16 (M3x0.5-APEX)	1.5 [13]
RPS 16 (M4x0.7)	5.3 [47]
RPS 20 (M5x0.8)	10 [88]
RPS 25 (M6x1.0)	17.5 [155]
RPS 32 (M6x1.0)	17.5 [155]
RPS 40 (M8x1.25)	40 [354]
RPS 4014 (M10x1.5)	70 [620]

17. Re-torque the mounting screws once more to the full-specified torque value in Table 3 to ensure full torque has been reached on all fasteners. Tighten in the same order as above.

18. Repeat variance inspection Step 15 and verify the variance listed is achieved after fully torquing the pinion. If variance is out of specifications the pinion should be removed inspecting for contaminates, burrs, or surface defects that would interfere with full contact between the adapter (if used) and gearhead flange. Indexing the pinion relative to the adapter (if used) or gearhead may help in some cases. Repeat the pinion installation procedure starting with Step 13.

APPLYING PRELOAD

If you would prefer to not design your own pinion preloading mechanism, Nexen offers a high precision push bolt preloading system that bolts between the machine frame and servo reducer to simplify machine design and achieve optimal results. See figure 10.

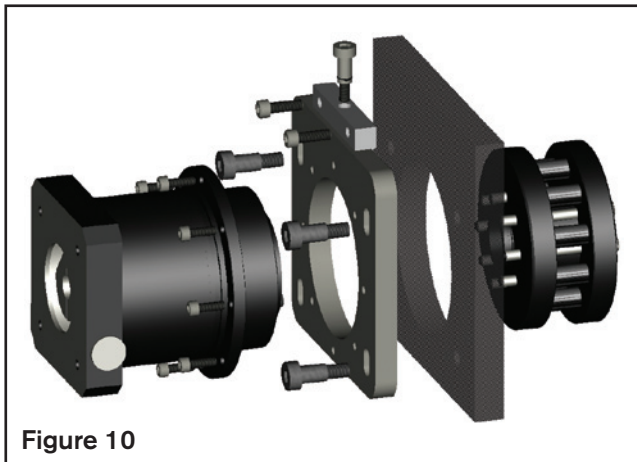


Figure 10

Nexen Precision Pinion Preloader product numbers and more information can be found at www.nexengroup.com on any of the RPG pinion pages under accessories in the left hand column.

To ensure optimal meshing of the roller pins with the gear teeth, the shaft must be preloaded to 0.010 - 0.015 mm [0.0004 - 0.0006 in] beyond first contact with teeth.

NOTE: Do not apply excessive preload. Preloading beyond 0.015 mm [0.0006 in] will decrease product life, increase noise, and cause vibration. When the RPG system is properly preloaded, there will be no tangential play between the gear teeth and the pinion rollers if the pinion is not allowed to turn and the rotating assembly forced back and forth in the direction of rotation.

Refer to Figure 11 for suggested preload methods.

Preloading Procedure

Note: Be careful engaging the pinion and servo assembly to the gear to avoid damaging the gear teeth or pinion rollers.

1. With a dial indicator mounted on the pinion frame, measure off the tooth peaks. Move the axis taking frequent measurements to locate the high spot in the run. This is where the pinion preloading should be done to prevent excessive preload from occurring elsewhere in the run.
2. Apply serviceable thread locking compound to the pinion preloader slider bolts and install the servo and preload mechanism. Ensure the preload related bolts are just loose enough to allow the pinion to be pulled away from the gear teeth. For the Nexen Preloader System, this is approximately 0.2 - 0.3 Nm [2 - 3 in-lbs].

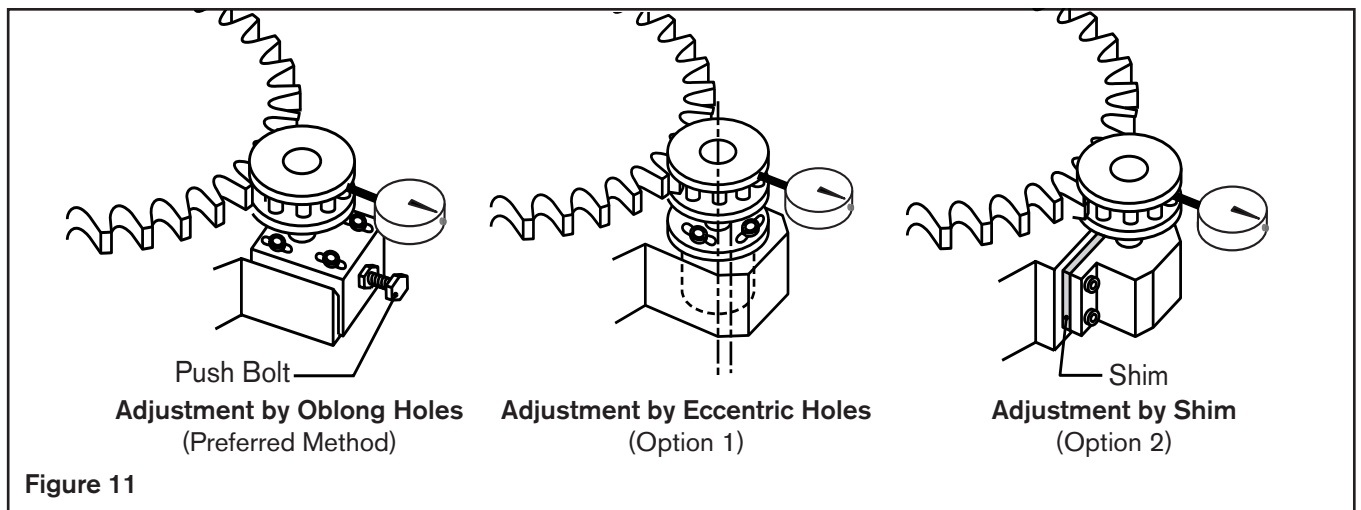


Figure 11

3. Verify that the pinion rotational axis is as parallel as possible to the gears rotational axis, and the gear is centered between the pinion bearing flanges as shown in Figure 1.
4. Rotate the preload adjustment screw clockwise to separate the pinion from the gear. This will ensure that clearance is initially present. Then seat the pinion into contact by turning the preload adjustment screw counterclockwise until a slight resistance is felt and then back the screw off 1/8 of a turn. This step is critical to prepare for preload settings.
5. Place a magnetic base dial indicator on the same part of the machine as the motor and reducer, and locate its probe on the OD of the pinion flange such that it measures in the direction of preload travel.
6. Apply the preload of 0.010 - 0.015 mm [0.0004 - 0.0006 in] with the preload application screw(s) and then tighten the preload lockdown bolts to their recommended torques. See Table 4 for Nexen Preloader System torque values. Typically the preload will change slightly when the preloader lockdown bolts are tightened. If tightening the preload bolts causes the amount of preload to fall outside of specifications, record how much it changed when tightening the preloader lock down bolts then loosen the preloading system and repeat the preloading procedure but adjust the initial preload (more or less) by the recorded preload deviation. This procedure will ensure that when the preloader lockdown bolts are tightened the amount of preload should fall within specifications.
7. With the pinion preloaded to specifications manually rotate the gear by hand (if possible) checking for smoothness and uniformity of resistance. If manually applied motion is not possible, use the servo motor to rotate the gear, with just enough torque output to move it while looking and listening for resistance to motion.

Table 4

	Screw	Tightening Torque Nm [in-lb]
Preloader Screw		
All Models	-	1.7 [15] Max
Shoulder Screws (Mtg. Plate)		
RPS-PRE-064	M8x1.25	40 [350]
RPS-PRE-090	M8x1.25	40 [350]
RPS-PRE-110	M8x1.25	40 [350]
RPS-PRE-140	M8x1.25	40 [350]
RPS-PRE-200	M12x1.75	120 [1060]
Gearhead Screws (Mtg. Plate)		
RPS-PRE-064	M4x0.7	5.3 [47]
RPS-PRE-090	M5x0.8	10 [88]
RPS-PRE-110	M5x0.8	10 [88]
RPS-PRE-140	M6x1.0	17.5 [155]
RPS-PRE-200	M8x1.25	40 [354]
Preloader Mtg. Screws (2x)		
All Models	M6x1.0	17.5 [155]

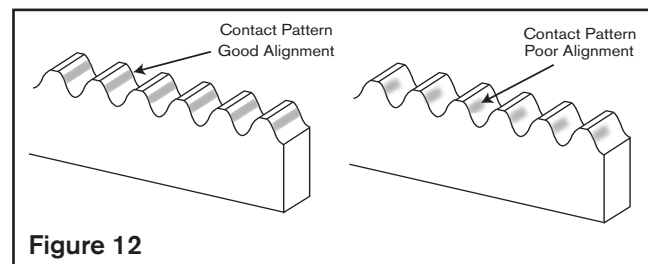
SYSTEM ALIGNMENT VERIFICATION

Proper roller to tooth meshing can be verified by two methods depending on which you find easier to interpret:

Option 1: Apply a slow drying machinists dye to the pinion rollers and move the RPG system back and forth over a short distance (about 1/2 meter). It is important the dye remain wet so it transfers to the gear teeth and is not depleted. Analyze the dye pattern transferred to the teeth. If the meshing geometry is good the dye will be spread evenly all the way across the tooth face over the middle 2/3 - 3/4 of the teeth with none at the top and bottom. If this section is properly aligned clean off dye residue and repeat as necessary to verify the RPG alignment over the entire rotation as shown in Figure 12.

Option 2: Apply a small amount of high contrast grease to each gear tooth face over 1/2 meter of circumference. Operate the RPG system back and forth over this 1/2 meter of travel. If the meshing geometry is good the grease will be completely wiped away all the way across


the tooth face over the middle 2/3 - 3/4 of the teeth with some remaining at the top and bottom. If this section is properly aligned clean off grease with a solvent and repeat as necessary to verify the RPG alignment over the entire rotation as shown in Figure 12.



If the dye or grease contact pattern indicates a meshing problem, diagnose the problem, correct it, and then repeat the Applying Preload and System Alignment Verification procedures.

DISENGAGING THE ROLLER PINION

1. De-couple the load from the RPG system.


	⚠ WARNING
	Failure to properly support the load before disengaging the RPG system could cause serious harm to operators or equipment.


2. Disconnect the power source, ensuring that no torque is applied to the roller pinion.
3. Remove pinion preload by loosening the preload mechanism sliding bolts slightly and then turning the preload application screw(s) to remove the pinion preload. You should be able to slightly separate the pinion from the gear teeth now.


4. Progressively loosen non-adjacent bushing fasteners in the same order they were tightened until all are removed from the bushing (Refer to Figure 4).
5. Insert the bushing fasteners into the threaded holes in the bushing flange and alternately tighten them as illustrated in Figure 4 to release the locking action of the bushing.
6. Lift the servo/reducer/preload mechanism assembly from the gear or slide the servomotor/reducer out of the pinion bore.

NOTE: Inspect all bushing fasteners and replace any that show excessive wear. Contact Nexen for replacements.


OPERATION

	⚠ DANGER
	This product has moving parts that can crush or cut appendages. Provide adequate spacing or guarding from any operating product.

	⚠ WARNING
	Never exceed maximum operating speeds listed for your product.

	⚠ WARNING
	Use appropriate guarding for rotating components. Failure to guard could result in serious bodily injury.

- Max speed of RPS25 Pinion = 1960 rpm.

	⚠ WARNING
	Ensure proper guarding of the product is used. Nexen recommends the machine builder design guarding in compliance with OSHA 29 CFR 1910 "Occupational Safety and Health Hazards".

LUBRICATION

The pinion needle bearings are sealed and lubricated for life and cannot be serviced.

Nexen recommends lubricating the gear teeth every 2 million pinion revolutions or 6 months, but it may need to be lubricated more frequently based on the application conditions, and observable tooth or roller wear.

When lubricating the RPG system inspect the pinion rollers and gear teeth for any abnormal wear patterns and ensure the pinion rollers are not seized or have excessive play. Wear on the edges of the gear teeth (not uniform across the tooth face) or rings on the rollers indicate an alignment problem which should be corrected to obtain maximum system performance and life.

The rollers in new pinions, especially larger sizes, can seem difficult to turn due to seal drag. This improves as the pinion breaks in.

THK AFA grease is recommended for gear tooth lubrication. Nexen offers this grease under product

number 853901. Greases for special applications such as food grade, vacuum, or others are allowed if they use a synthetic base, a polyurea thickener, and meet the following Kinematic Viscosity Levels: CST@40C = 25; CST@100C = 5. Contact Nexen for recommendations on alternative greases.

The RPG system can be lubricated in two ways:

1. Apply grease to the pinion rollers and roll the pinion back and forth 5 times over one meter circumference of gear teeth, repeating the process until the entire gear is lubricated.
2. Using a swab apply a very small dab of grease on the middle of each tooth face and rotate the ring gear 5 times.

Wipe excess grease from the sides of the gear and pinion body to prevent grease being thrown off during operation and for general cleanliness.

WARRANTY

Warranties

Nexen warrants that the Products will (a) be free from any defects in material or workmanship for a period of 12 months from the date of shipment, and (b) will meet and perform in accordance with the specifications in any engineering drawing specifically for the Product that is in Nexen's current product catalogue, or that is accessible at the Nexen website, or that is attached to this Quotation and that specifically refers to this Quotation by its number, subject in all cases to any limitations and exclusions set out in the drawing. NEXEN MAKES NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND ALL IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. This warranty applies only if: (a) the Product has been installed, used and maintained in accordance with any applicable Nexen installation or maintenance manual for the Product; (b) the alleged defect is not attributable to normal wear and tear; (c) the Product has not been altered, misused or used for purposes other than those for which it was intended; and (d) Buyer has given written notice of the alleged defect to Nexen, and delivered the allegedly defective Product to Nexen, within one year of the date of shipment.

Exclusive Remedy

The exclusive remedy for the Buyer for any breach of any warranties provided in connection with this agreement will be, at the election of Nexen: (a) repair or replacement with new, serviceably used, or reconditioned parts or products; or (b) issuance of credit in the amount of the purchase price paid to Nexen by the Buyer for the Products.

Agent's Authority

Buyer agrees that no agent, employee or representative of Nexen has authority to bind Nexen to any affirmation, representation, or warranty concerning the Products other than those warranties expressly set forth herein.

Limitation on Nexen's Liability

TO THE EXTENT PERMITTED BY LAW NEXEN SHALL HAVE NO LIABILITY TO BUYER OR ANY OTHER PERSON FOR INCIDENTAL DAMAGES, SPECIAL DAMAGES, CONSEQUENTIAL DAMAGES OR OTHER DAMAGES OF ANY KIND OR NATURE WHATSOEVER, WHETHER ARISING OUT OF BREACH OF WARRANTY OR OTHER BREACH OF CONTRACT, NEGLIGENCE OR OTHER TORT, OR OTHERWISE, EVEN IF NEXEN SHALL HAVE BEEN ADVISED OF THE POSSIBILITY OR LIKELIHOOD OF SUCH POTENTIAL LOSS OR DAMAGE. For all of the purposes hereof, the term "consequential damages" shall include lost profits, penalties, delay damages, liquidated damages or other damages and liabilities which Buyer shall be obligated to pay or which Buyer may incur based upon, related to or arising out of its contracts with its customers or other third parties. In no event shall Nexen be liable for any amount of damages in excess of amounts paid by Buyer for Products or services as to which a breach of contract has been determined to exist. The parties expressly agree that the price for the Products and the services was determined in consideration of the limitation on damages set forth herein and such limitation has been specifically bargained for and constitutes an agreed allocation of risk which shall survive the determination of any court of competent jurisdiction that any remedy herein fails of its essential purpose.

Inspection

Buyer shall inspect all shipments of Products upon arrival and shall notify Nexen in writing, of any shortages or other failures to conform to these terms and conditions which are reasonably discoverable upon arrival without opening any carton or box in which the Products are contained. Such notice shall be sent within 14 days following arrival. All notifications shall be accompanied by packing slips, inspection reports and other documents necessary to support Buyer's claims. In addition to the foregoing obligations, in the event that Buyer receives Products that Buyer did not order, Buyer shall return the erroneously shipped Products to Nexen within thirty (30) days of the date of the invoice for such Products; Nexen will pay reasonable freight charges for the timely return of the erroneously shipped Products, and issue a credit to Buyer for the returned Products at the price Buyer paid for them, including any shipping expenses that Nexen charged Buyer. All shortages, overages and nonconformities not reported to Nexen as required by this section will be deemed waived.

Limitation on Actions

No action, regardless of form, arising out of any transaction to which these terms and conditions are applicable may be brought by the Buyer more than one year after the cause of action has accrued.

nexen[®]

Nexen Group, Inc.
560 Oak Grove Parkway
Vadnais Heights, MN 55127

800.843.7445
Fax: 651.286.1099
www.nexengroup.com

ISO 9001 Certified

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