

# RAFNA R-460 RAILGEAR ROTARY FRONT 2008-2016 FORD F-450/550 4x2/4x4 IMPROVED LEVER LOCKUP



# INSTALLATION / OPERATIONS / SERVICE MANUAL



# INSTALLATION SAFETY PRECAUTIONS

# If any installation problems are encountered, please call G&B Specialties for technical assistance before continuing with the installation process.



- Failure to heed to any of the following warnings could result in severe bodily injury and/or equipment damage.
- Read and understand this manual completely before attempting installation of the equipment.
- Installation instructions provided below only address the RAFNA railgear equipment. Applicable railway company procedures and policies must be adhered to.
- Before performing any work under the vehicle or railgear, ensure that the engine is turned off and the parking brake is set.
- Beware of all pinch points on the railgear and keep all parts of the body clear.
- Always disconnect the vehicle's battery when welding on the vehicle or railgear in order to protect the vehicle's electrical system.
- Ensure all removed components are given to the vehicle owner after the installation of the railgear. These components must be re-installed if the railgear is removed from the vehicle.
- Railway Company rules governing rail travel must be observed at all times.
- Never operate the vehicle if the Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR), or the wheel or tire load ratings are exceeded.



# INSTALLATION OF RAILGEAR KIT

#### FRAME MODIFICATION

The following procedure details the frame modification required prior to installation of the Rotating Front Railgear. The hardware required for this modification is listed in Table 1.

Part Number Description		Qty
R-14529D-A	Hole Template, Drivers Side	1
R-14529P-A	Hole Template, Passengers Side	1
R-11113	Tow Hook Spacer, 1"	2

#### Table 1: Front Railgear Kit Installation Parts

- 1. Remove the front bumper and front tow hooks if so equipped. Remove the coolant line retaining clips from the inside passenger frame rail. The coolant line retaining clip will need to be relocated in an appropriate place by the installer.
- 2. Remove the front air radiator. (Diesel Only)
- 3. Retain the front bumper and tow hooks for re-installation.
- 4. Drill the (3) existing holes in the top of each frame rail to 9/16" diameter.
- 5. On the out-board side of the driver's side frame rail, drill out the first existing hole to 11/16" diameter.
- 6. On the out-board side of the passenger's side frame rail, drill out the first existing hole to 11/16" diameter.
- 7. On the in-board side of the driver's side frame rail, drill out the first two existing holes to 11/16" diameter. Repeat for the in-board side of the passenger's side frame rail.
- 8. Attach the drivers side hole template to the out-board side of the driver's side frame rail and attach as shown with the supplied hardware.
- 9. Mark the frame as shown using the hole template as a guide. Remove the hole template from the frame. At the first marked point, drill an 11/16" diameter hole thru the outboard frame rail. At the second marked point, drill an 11/16" diameter thru both frame rails.
- 10. Attach the passengers side hole template to the out-board side of the passenger's side frame rail and attach as shown with the supplied hardware.
- 11. Mark the frame as shown using the hole template as a guide. Remove the hole template from the frame. At the first marked point, drill an 11/16" diameter hole thru the outboard frame rail. At the second marked point, drill an 11/16" diameter thru both frame rails.
- G&B Specialties Inc. 535 West 3<sup>rd</sup> Street, Berwick, PA, USA Tel: (570) 752-5901 Fax: (570) 752-6397 US Field Service: 570-441-6988; CAN Field Service 570-854-0482; www.rafna.com



- 12. Modify tow hook/bumper bracket by removing the tow hook loop from the bracket assembly as shown.
- 13. Drill the (3) existing holes to 9/16" diameter.
- 14. Re-install modified tow hook/bumper bracket using the supplied spacer and 1/2" hardware (included in the R-990KIT-277) as shown. Torque 1/2" bolts to 100 ft-lbs dry.

















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# MIO-R46RXF23130 Rev B







#### FRONT RAILGEAR INSTALLATION

The following procedure details the installation of the front railgear kit. The hardware required for this installation is listed in the table below.

Part Number	Description	Qty	
R-23131	R-460 Rotary Front Upper Assembly	1	
R-001	10" Steel Wheel Assembly	2	
R-20120D	Rail Sweep, Drivers Side	1	
R-20120P	Rail Sweep, Passengers Side	1	
K-R46RXF002LU	Railgear Axle Lock Kit	1	
R-990KIT-204C	Wheel Mounting Hardware	2	
R-11109	Frame Spacer	4	
R-20235	Bumper Spacer	4	
R-990KIT-277	Bumper Install Hardware Kit	1	

#### Front Railgear Kit Installation Parts (R-23130)

- 1. Be sure to modify the vehicle frame as outlined in the Frame Modification section of this manual before attempting to install the railgear unit.
- 2. Remove the Lock Cam from the upper cross frame assembly by removing the (3) 3/8" bolts securing the lock cam to the cam base.
- 3. Loosen, but do not remove the 3/8" bolts securing the front support beam assembly to the rail gear mounting brackets.
- 4. Loosen, but do not remove, the (8) 1/2" bolts securing the railgear bearing caps to the upper cross frame assembly.
- 5. Remove the shipping spacers and backer plates securing the outer support plates to the railgear mounting brackets. Retain the 5/8" hardware, these will be used to mount the front railgear unit. Use caution as the outer support plates will swing downward and free once the shipping spacers are removed.
- 6. Slide the railgear under the front frame horns and raise the unit into place. The railgear mounting brackets should sit flush with the bottom of the vehicle frame and flush to the inside of the vehicle frame.
- 7. The slots in the railgear mounting brackets should line up with the holes drilled in the frame during the frame modification.
- 8. Swing the outer support plates up into place and align the slots with the holes in the frame.
- 9. Ensure that the top surface of the outer support plate is level with the top surface of the railgear mounting bracket.
- 10. Secure the mounting brackets to the vehicle frame with the included 5/8" hardware, frame spacers and backer plates. Torque to 200 ft-lbs dry.
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- 11. Prep area for welding.
- 12. Field weld the railgear mounting brackets, both driver's side and passenger's side, to the railgear backer plates as shown.
- 13. Undercoat/paint any welded or unfinished areas.
- 14. Center the upper cross frame assembly to the railgear mounting brackets and tighten the (8) 1/2" bolts securing the railgear bearing caps to the upper cross frame assembly, do not torque at this time.
- 15. The railgear support beam needs to be centered between the railgear mounting brackets. If necessary, place shims between the support beam mounting plates and railgear mounting brackets as shown. An equal number of shims must be used on each side.
- 16. Tighten 3/8" support beam fasteners to 40 ft-lbs dry.

Proceed to install the railgear hydraulic system as per the Hydraulic Kit Installation manual before continuing with the following steps.

- 17. Follow the Railgear Lock System Installation and Adjustment Procedure detailed in the Railgear Lock System Kit Installation and Operation manual.
- 18. Follow the Railgear Alignment procedure detailed in the Service section of this manual.
- 19. Follow the Vehicle Axle Lockup Kit installation procedure detailed in the Axle Lockup Kit Installation and Operation manual.
- 20. Follow the Rail Sweep Adjustment procedure detailed in the Service section of this manual.
- 21. Torque all fasteners as detailed in the Service section of this manual.
- 22. Grease the railgear at all lubrication points as detailed in the Service section of this manual.
- 23. Modify and reinstall front bumper as required.

































# R-460 ROTARY FRONT RAILGEAR KIT OPERATION 2008-2016 FORD F-450/550 4x2/4x4 IMPROVED LEVER LOCKUP

# **OPERATION SAFETY PRECAUTIONS**

If any operating, services or parts problems are encountered, please call G&B Specialties, Inc. for technical assistance.



- Failure to heed to any of the following warnings could result in severe bodily injury and/or equipment damage.
- Read and understand this manual completely before attempting operation of the railgear equipped vehicle.
- Operating instructions provided below only address the RAFNA railgear equipment. Applicable railway company procedures and policies must be adhered to.
- Railway company rules governing rail travel must be observed at all times.
- Ensure that the position and function of all railgear controls are known before attempting operation.
- Ensure the railgear is locked in road position before starting road travel.
- Ensure all body parts and loose clothing are clear of any moving parts of the equipment.
- If misalignment of the railgear equipment is indicated, promptly perform the alignment procedure.
- Before performing any work under the vehicle or railgear, ensure the engine is turned off and the parking brake is set.
- Never operate the vehicle if the Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating Front or Rear (GAWR), or the wheel or tire load ratings are exceeded.
- Always disconnect the vehicle's battery when welding on the vehicle or railgear in order to protect the vehicle's electrical system.



# **OPERATION OF RAILGEAR KIT**

With the railgear kit installed on this vehicle, it may be operated as normal, however the vehicle has decreased ground clearance and angles of approach and departure due to the railgear. Caution must be used when operating the vehicle.

Never operate the vehicle if the Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating Front or Rear (GAWR), or the wheel or tire load ratings are exceeded.

#### Placing The Vehicle on Rail - To Lower The Railgear:

- 1. Engage the vehicle front axle lock. Follow the Axle Lockup Kit Operation procedure detailed in the Axle Lockup Kit Installation and Operation and Service manual.
- 2. Disengage the railgear mechanical locking pin. Do not force, if the lock pin cannot be disengaged, raise the railgear slightly.
- 3. Hold the lock pin in the disengaged position, ensure that the locking pin is in the fully disengaged position.
- 4. Lower the railgear and release the lock pin actuator once the railgear has rotated past the road locked position.
- 5. As the railgear is being deployed, it will start taking some of the vehicle's load. The railgears spring suspension should be observed compressing under this load.
- 6. Continue lowering the railgear until the hydraulic cylinders are fully extended. In this position, the railgear should be about 2°-3° over center and the vehicle front tires should be approximately 2"-3" above the rail and the lock pin is fully engaged.
- 7. Ensure that the vehicle front axle lock is fully engaged.

## Removing The Vehicle from Rail - To Raise The Railgear:

- 1. Disengage the railgear mechanical locking pin. Do not force, if the lock pin cannot be disengaged, lower the railgear slightly.
- 2. Hold the lock pin in the disengaged position, ensure that the locking pin is in the fully disengaged position.
- 3. Raise the railgear and release the lock pin actuator once the railgear has rotated past the rail locked position.
- 4. Raise the railgear fully. The railgear lock pin should engage automatically.
- 5. Disengage the vehicle front axle lock as per the Axle Lockup Kit Operation procedure detailed in the Axle Lockup Kit Installation and Operation and Service manual.



# SERVICE OF RAILGEAR KIT

The railgear kit must be serviced regularly to avoid damage to the equipment. Table 1 below provides the Recommended Service Schedule and the detailed service procedures follow.

Figure 1 provides the Non-Standard Fastener Torque Values. Table 2 provides Standard Fastener Torque Values for all other fasteners.

Grease fittings are provided at all railgear lubrication points as shown in Figure 2. The recommended lubricant for all lubrication points on this railgear is MYSTIK JT-6 LOW TEMP grease or equivalent. In cold weather areas/seasons, SHELL DARINA XL102 or equivalent may be used.

Service Required		Weekly	Monthly	3 Months	6 Months	12 Months
Visually inspect the railgear for damaged or worn parts	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Check for loose rail wheels and fasteners (re-torque if required)		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Ensure railgear lock pin is functioning correctly		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Ensure the vehicle is in good operating condition	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Inspect the rail wheel flanges for wear (use Rafna wear gauge)				~	$\checkmark$	
Inspect all hydraulic components for leaks or wear		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Check and adjust rail sweeps			$\checkmark$	$\checkmark$	$\checkmark$	
Grease railgear inner and outer guide tubes		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	
Grease railgear inner tube lower pivot point			$\checkmark$	$\checkmark$	$\checkmark$	
Grease railgear locking pin			$\checkmark$	<	~	
Check and adjust rail wheel bearing end-play			$\checkmark$	~	$\checkmark$	
Grease rail wheel bearings (every 3000 rail kms or 1900 rail				$\checkmark$	$\checkmark$	$\checkmark$
Check and adjust rail wheel load						$\checkmark$
Check and adjust rail wheel alignment						$\checkmark$
Check and repack rail wheel bearings						$\checkmark$

#### Table 1: Recommended Service Schedule

Note: For continuous service at ambient temperatures above 40°C (105°F), more frequent lubrication is required.



Fastener Size	Fastener Torque Value (ft-lbs) Dry
1" UNC Gr. 8 Fasteners	250
34" UNC Gr. 8 Fasteners	175
<sup>5</sup> / <sub>8</sub> " UNC Gr. 8 Fasteners	150
1/2" UNC Gr. 8 Fasteners	100
<sup>3</sup> / <sub>8</sub> " UNC Gr. 8 Fasteners	40
1/4" UNC Gr. 8 Fasteners	12

Table 2: Standard Fastener Torque Values



**Railgear Lubrication Points** 



# RAILGEAR OVER-CENTER ADJUSTMENT

The railgear is designed to rotate slightly past vertical into the rail position in order to provide a secondary safety feature in the event of a hydraulic and / or lock pin failure. This additional rotation past vertical is called the over-center angle and is adjustable via a threaded rod end on the end of the hydraulic cylinder. The location of the railgear in the road position is also a function of the over-center adjustment, however, DO NOT use the over-center adjustment to adjust the road position of the railgear. This will have adverse effects on the over-center safety feature.

The over-center angle is defined as the angle between the vertical edge of the outer guide tubes and the vertical. It can be measured with the vehicle on a level section of rail with the railgear in the rail position using an angle meter. The over-center angle must be between 2°-3° past vertical. If this is not the case, adjust as follows:

- 1. Unload the railgear hydraulic cylinder by raising the railgear just off rail.
- 2. Loosen the jam nut on the hydraulic cylinder rod end and adjust the rod end out to increase the over-center angle or in to decrease the over-center angle. Note that the cylinder rod can be turned instead of turning the rod end.
- 3. Re-deploy the railgear to the rail position and re-check the over-center angle. Re-adjust as necessary.
- 4. Tighten the jam nut on the hydraulic cylinder rod end.
- 5. Repeat process for other cylinder.
- 6. Both cylinders should be adjusted so that both cylinders have the same amount of stroke over center. This will help to eliminate any binding or twisting of the railgear when deployed to the rail position.
- 7. Following the over-center angle adjustment, the railgear may contact the vehicle if not enough clearance was left during installation. Check the railgear clearance to all vehicle components throughout the full range of railgear and railgear suspension movement. If there is interference with the vehicle bumper, it can be trimmed and reinforced as required.
- 8. With the railgear fully raised to the road position, ensure that the railgear lock pin properly engages the lock cam. It may be necessary to adjust and/or grind the lock cam slightly to ensure proper fit.





**Over Center Stop Installation** 



# RAIL WHEEL BEARING ADJUSTMENT

The rail wheel bearings require periodic adjustment in order to keep the endplay within specification. If the rail wheel bearings are not correctly adjusted, failure may occur and will not be covered under the railgear warranty. Check and adjust the bearing endplay with the railgear in the road position and with the rail wheels free to turn.

Use a magnetic base dial gauge to measure the endplay of each rail wheel bearing. The bearing endplay must be between 0.001" and 0.005". If this is not the case, adjust as follows:

- 1. Remove the rail wheel hubcap and gasket by removing the three 1/4" bolts and 1/4" lock washers. Remove and discard the cotter pin from the 3/4" slotted spindle nut.
- 2. Ensure the wheel-bearing cavity is full of grease.
- 3. While rotating the rail wheel forward, torque the spindle nut to 20 ft-lbs. Then loosen the spindle nut and re-torque it to 6 ft-lbs. Re-check and re-adjust the bearing endplay if required. If no torque wrench is available, tighten the spindle nut until the rail wheel is difficult to turn by hand. Then loosen the spindle nut and retighten it just until no loose can be felt in the bearings. Re-adjust the bearing endplay with a torque wrench as soon as possible.
- 4. Install a new 3/16" x 2" long cotter pin through the spindle nut. Tighten the spindle nut slightly if needed to insert the cotter pin.
- 5. Re-install the hubcap and gasket using the 1/4" bolts and new 1/4" split lock washers. Blue Loctite can be used on the bolts as an added safety measure. Tighten and torque the 1/4" fasteners to 12 ft-lbs dry. Do not over torque.

## RAIL SWEEP ADJUSTMENT

The distance between the rail sweep rubber and the rail is adjustable and should be maintained at approximately 1/8". To adjust the rail sweep rubber, with the railgear in the rail position, loosen the two 1/4" fasteners that secure the rail sweep rubber to the rail sweep bracket. Slide the rail sweep rubber up or down for the correct clearance. Tighten and torque the 1/4" fasteners to 12 ft-lbs dry. Do not over torque.



# RAILGEAR ALIGNMENT

The railgear must be correctly aligned to perform properly, safely, and avoid excessive wear and derailment. The rail wheels can be independently aligned for toe-in/toe-out and the railgear can be adjusted side to side (laterally) on the vehicle. A parallel line system and the following procedure should be used to perform the railgear alignment.

The rail wheel loads should be checked and adjusted, the vehicle should have had a fourwheel alignment (with the complete railgear package installed on the vehicle and any suspension modifications done) and the tires should be properly inflated prior to performing the railgear alignment.

The railgear alignment is done with the vehicle on a straight and level section of rail with the railgear in the rail position and the vehicle wheels pointing straight ahead. The individual rail wheel alignment should be done first, followed by the lateral alignment of the railgear.

Each rail wheel is aligned by loosening the four 1/2" fasteners that secure it to the railgear axle. The rail wheel is then turned into alignment. The four 1/2" fasteners should then be tightened and torqued to 100 ft-lbs dry. Do not over torque.

Lateral alignment is achieved by sliding the lower half of the railgear unit in the pivot bearings. It may be necessary to loosen the bearing caps slightly to ease the adjustment process. Once the railgear is in alignment, tighten the bearing caps to 40 ft-lbs dry. Do not over torque.

#### Ensure that the railgear over-center adjustment has been made before continuing

Once the alignment is complete, it will be necessary to install the rotation stops. The rotation stops also act as a type of shaft collar to keep the railgear from losing lateral alignment. Rotate the railgear down to the rail position, place the rotation stops on the upper axle as shown and weld in place.

Following the railgear alignment, the railgear may contact the vehicle if not enough clearance was left during installation. Check the railgear clearance to all vehicle components throughout the full range of railgear and railgear suspension movement. If there is interference with the vehicle bumper, it can be trimmed and reinforced as required. If there is interference with the vehicle exhaust system, it can be modified to fit, ensuring any exhaust system modifications conform to applicable laws and regulations. If there is interference with any other vehicle components, please call G&B Specialties, Inc. for technical assistance.



#### RAFNA RAILGEAR ALIGNMENT RACK DATA

GAS OR DIESEL VIN#		
VEHICLE MAKE:	VEHICLE MODEL.	VEHICLE YEAR
DOOR STICKER GVWR:	DOOR STICKER GAWR FRT:	DOOR STICKER GAWR RR
RAILGEAR S/N: FRT	RRVEHICLE UNIT #,S/N:	
RAILGEAR TYPE:	INSTALLER:	DATE:
SET UP PARALLEL STRING LINES A & B MUST BE EQUAL WITHIN 1/32' C & D MUST BE EQUAL WITHIN 1/32"	, Υ.	A
ADJUST STRING LINES AROUND VEH E, F, G, & H MUST BE EQUAL WITHIN I, J, K, & L MUST BE EQUAL WITHIN I (E, F, G, & H MAY NOT EQUAL I, J, K, ADJUST RAIL WHEEL ALIGNMENT M & O MUST BE EQUAL WITHIN 1/16' N & P MUST BE EQUAL WITHIN 1/16'' Q & S MUST BE EQUAL WITHIN 1/16'' R & T MUST BE EQUAL WITHIN 1/16''	HICLE 1/16" ./16" & L) 	
ADJUST RAILGEAR LATERAL ALIGN M & O MUST EQUAL N & P WITHIN 1/ Q & S MUST EQUAL R & T WITHIN 1/8 ENSURE THAT U & V ARE BETWEEN 53-7/16" AND 53-9/16"	MENT (8" 3" C C	
OVER-CENTER ANGLE (DEGREE) FRONT REAR		
RAIL WHEEL LOADS (LBS) LEFT FRONTRIGHT FRONT LEFT REARRIGHT REAR RAIL WHEEL FLANGE TO GROUND C LEFT FRONTRIGHT FRONT LEFT REARRIGHT REAR	LEARANCE	
MOUNTING HEIGHT FRONT:	MOUNTING HEIGHT REAR:	B
STOCK TURNING DIAMETER:	MODIFIED I UKNING DIAME	
OEM: VEHICLE WEIGHT:	FRONT GAWR:RE	EAR GAWR:
MODIFIED: VEHICLE WEIGHT:	FRONT GAWR:	REAR GAWR:

FAX COMPLETED FORM TO JAKE SANUTE AT FAX # 570-802-0491

MAY 31, 2018 REV "D"



#### **RAFNA RAILGEAR PORTABLE ALIGNMENT DATA**



MAY 31, 2018 REV B



# WHEEL WEAR STANDARDS AND RECOMMENDATIONS

At the present time, G&B produces 8", 10", 12", 14", and 16" steel wheels. Each size has a different flange and tread thickness, which dictates the allowable wear. Although the following numbers are recommended limits, risk of failure is increased when not followed. Rail gauge can be supplied by G&B Specialties for 8", 10", 12", 14", and 16" rail wheels. They are used as go/no go gauges. When placed on rail wheels they will indicate how much wear is still permissible or if the rail wheels need to be replaced.

The gauge for the R-460 model railgear can be ordered using the following part number; S-001200

• Rail wheel failure can result in equipment damage or failure, personal injury or death.

#### Flange Wear Limits:

The maximum flange wear is indicated on the rail wheel gauge. When the gauge is placed on the rail wheel, if a gap is seen between the gauge and the maximum flange wear line, the rail wheel needs to be replaced.

#### Tread Wear Limits:

For tread wear, use the following chart in conjunction with the appropriate rail wheel gauge.





















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