

RAFNA INDUSTRIES LIMITED

19300 Clark-Graham, Baie d'Urfe, Quebec

Tel: (514) 457-4373 or 1-888-525-3660

Fax: (514) 457-3567

MODEL R-650

"CUSHION-RIDE" RAILGEAR INSTALLATION MANUAL

"VERTICAL & ROTATING FRONT - ROTATING REAR"

READ THIS MANUAL BEFORE INSTALLING RAILGEAR EQUIPMENT

Application Models : International 4900 Series
Ford F-800
GMC C-Series
GMC T-Series
Freightliner FL70
Sterling L7500

Note:

The appendix of this manual includes the latest changes to the installation of the railgear not included in the “body” of this manual.

Please refer to the appendix prior to installing the railgear.

The information in the appendix supersedes whatever is mentioned in the “body” of this manual.

THIS PAGE IS BLANK

TABLE OF CONTENTS

Initial Preparation	Section 1
<hr/>	
Safety Precautions	1-2
Installation Procedure Overview	1-3
Preparations For Railgear Installation	1-4
Railgear Installation	Section 2
<hr/>	
Vertical Front Railgear Installation	2-2
Rotating Front Railgear Installation	2-3
Rotating Rear Railgear Installation	2-6
Front Rail Wheel & Front Rail Sweep Installation	2-8
Rear Rail Wheel & Rear Rail Sweep Installation	2-9
Front Axle Lock-Up Installation	2-11
Auxiliary Installations	Section 3
<hr/>	
Steering Wheel Lock Installation	3-2
Hydraulic System Installations	3-7
Electrical System Installations	3-9
Optional Air Brake System Installation	3-11
Preparations For Operation	3-12
Check List	3-15
Alignment Chart	3-17
Appendix	
<hr/>	

THIS PAGE IS BLANK

INITIAL PREPARATION

SECTION 1: INITIAL PREPARATION

SAFETY PRECAUTIONS	1-2
INSTALLATION PROCEDURE OVERVIEW	1-3
PREPARATIONS FOR RAILGEAR INSTALLATION	1-4

1.0 SAFETY PRECAUTIONS



WARNING:

- **Installation instruction provided below only address the Rafna Industries railgear equipment. Applicable railway company procedures and policies must be adhered to.**
- **Always disconnect the vehicle's battery when welding on the vehicle or railgear in order to protect the vehicle's electrical system.**
- **Before performing any work under the vehicle or railgear, ensure 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.**
- **The following safety precautions should be taken before the vehicle is tested or operated:**
 - ✓ **Read the Operating, Service and Parts Manual**
 - ✓ **Visually inspect the railgear for damaged or worn parts**
 - ✓ **Perform the Alignment Procedure**
 - ✓ **Check for loose wheels and fasteners**
 - ✓ **Check for leaking hydraulic lines and cylinders**
 - ✓ **Check for proper brake operation**
 - ✓ **Check for proper lubrication**



Failure to heed to any of the above mentioned warnings could result in severe bodily injury and/or equipment damage.

IF ANY INSTALLATION PROBLEMS ARE ENCOUNTERED, PLEASE CALL RAFNA INDUSTRIES LTD. FOR TECHNICAL ASSISTANCE BEFORE CONTINUING WITH THE INSTALLATION PROCESS.

2.0 INSTALLATION PROCEDURE OVERVIEW

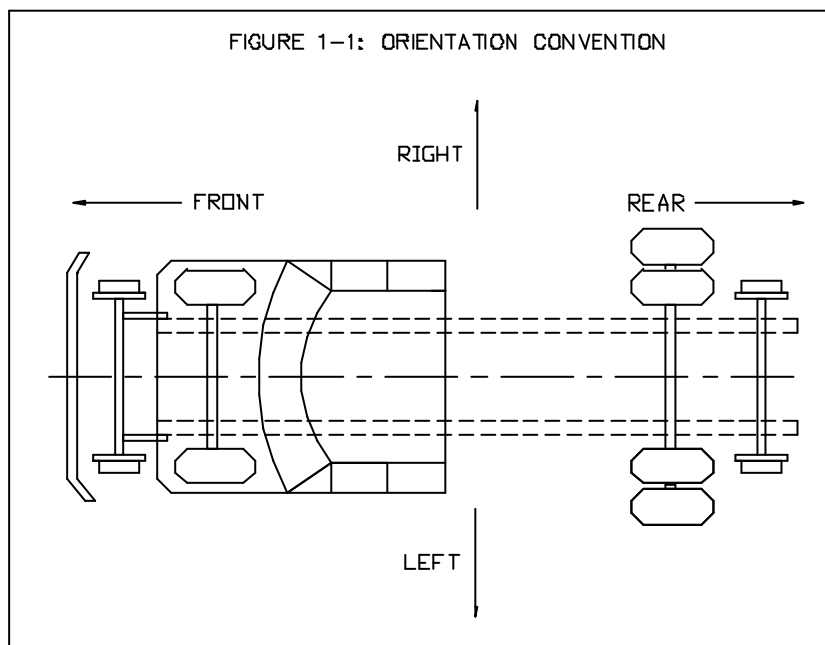
This manual covers the installation of the Rafna Industries R-650 vertical and rotating front railgear and rotating rear railgear on the following vehicles:

- International 4000 Series
- Ford F-800
- GMC C-Series
- GMC T-Series
- Freightliner FL70
- Sterling L7500

The Rafna Industries R-650 railgear is a hydraulically operated system applicable to vehicles of up to 39,000 lbs. G.V.W.R. Both front and rear units are hydraulically moved from rail to highway and highway to rail positions and are mounted to the vehicle frame. The hydraulic power is supplied through Rafna Industries' auxiliary electrical hydraulic pump or through the vehicles PTO hydraulic system. An optional air brake package on the front and/or rear rail wheels aid in on-rail braking.

The installation procedure consist of first installing the front railgear and then the rear railgear. The hydraulic, electrical, and optional brake installations follow and finally an adjustment of the equipment is performed.

This manual uses the orientation convention for the vehicle as shown in figure 1-1.



3.0 PREPARATIONS FOR RAILGEAR INSTALLATION

The following steps must be performed on all vehicles prior to installation of the railgear equipment:

1. Disconnect the negative battery terminal.
2. Remove the front bumper and all related mounting brackets. Retain fasteners for re-installation.

On models where a vertical front railgear is to be installed and the hood does not provide butterfly openings or a fixed grille:

1. Remove the front grille from the hood.
2. Modify the front grille so that it is fixed in front of the radiator and does not tilt with the hood.
3. This will enable the hood to be opened fully over the vertical front railgear.

SECTION 2: RAILGEAR INSTALLATION

VERTICAL FRONT RAILGEAR INSTALLATION	2-2
ROTATING FRONT RAILGEAR INSTALLATION	2-3
ROTATING REAR RAILGEAR INSTALLATION	2-6
FRONT RAIL WHEEL & FRONT RAIL SWEEP INSTALLATION	2-8
REAR RAIL WHEEL & REAR RAIL SWEEP INSTALLATION	2-9
FRONT AXLE LOCK-UP INSTALLATION	2-11

1.0 VERTICAL FRONT RAILGEAR INSTALLATION

The installation procedure for the vertical front railgear is identical for all vehicles covered by this manual, except where indicated. The hardware required for this installation is listed in table 2-1.

Table 2-1: Vertical Front Railgear Installation Hardware

Part Number	Description	Qty
R-6715C	Vertical Front Railgear Assembly	1
	5/8" UNC Gr. 8 Bolt x 3" Long	8
	5/8" Gr. 8 Washer	16
	5/8" UNC Gr. 8 Nylon Insert Lock Nut	8

The following procedure details the vertical front railgear installation:(refer to figure 2-1)

1. On vehicles not equipped with a frame extension, a front frame extension will have to be fabricated by the installer. The railgear is mounted as close as possible to the front grill and the frame extension is cut down, as it can not extend through the railgear.
2. Clamp the vertical front railgear (1) onto the outside of the front frame extensions (2). The inside dimension of the railgear mounting plates is fixed at 34 ". If the frame outside dimension is less than this value, fabricate and insert spacer plates between the frame and the railgear mounting plates as required. The spacer plates should be drilled to match the mounting plates and similar in size.
3. Position the railgear such that, with the cylinders (3) fully retracted and the vehicle on level ground, the rail wheel mounting tables are about 19" above the ground. Final adjustment of this height will be done later by loosening the outer guide tube clamps.
4. Using the railgear mounting flanges (4) as templates, drill the uppermost hole on each side through the frame. Bolt the railgear snugly with one 5/8" x 3" long fastener (5) per side.
5. Unclamp the railgear. It should now be able to pivot about the two 5/8" fasteners.
6. Pivot the railgear until it is 3-5° over center (top of railgear forward of bottom).
7. Clamp the railgear in this position and drill three other holes per side using the mounting flanges as templates. Note that the mounting flanges have six holes each to accommodate different frame heights yet only four holes are required for mounting.
8. Fasten the railgear in place with six additional 5/8" x 3" long fasteners and torque all 5/8" fasteners to 150 ft-lbs.
9. Re-install the original front bumper in front of the railgear. It may be necessary to make new brackets between the bumper and the frame.

2.0 ROTATING FRONT RAILGEAR INSTALLATION

The installation procedure for the rotating front railgear is identical for all vehicles covered by this manual, except where indicated. The hardware required for this installation is listed in table 2-2.

Table 2-2: Rotating Front Railgear Installation Hardware

Part Number	Description	Qty
R-6706	Rotating Front Railgear Assembly	1
	5/8" UNC Gr. 8 Bolt x 2.75" Long	8
	5/8" Gr. 8 Washer	16
	5/8" UNC Gr. 8 Nylon Insert Lock Nut	8

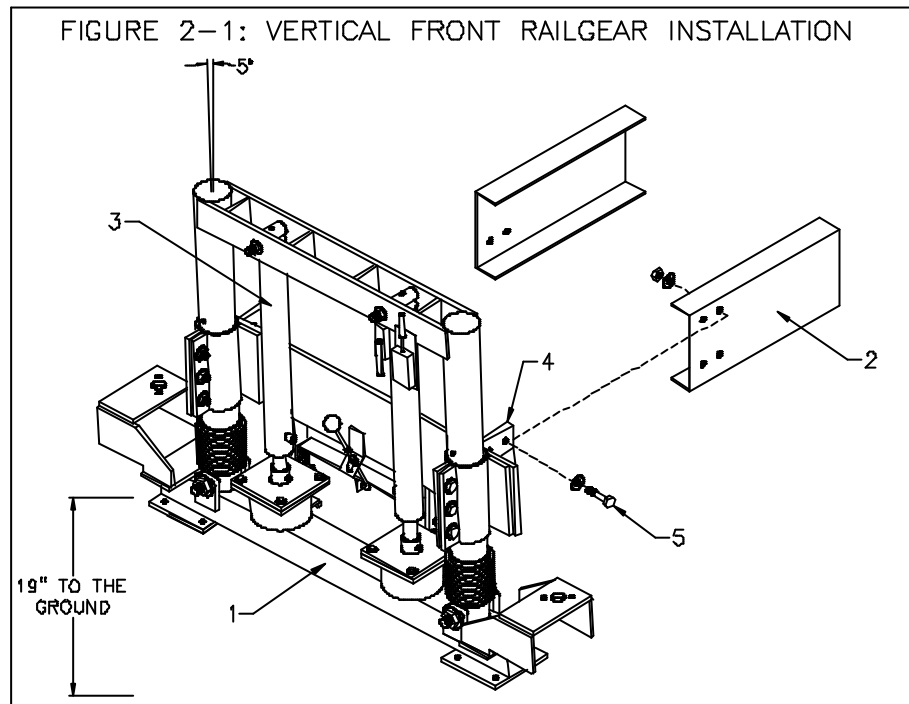
The following procedure details the rotating front railgear installation:(refer to figure 2-2)

1. For ease of shipment, the railgear is assembled by Rafna Industries. For installation it must be partially disassembled as follows: remove the cylinders, upper cylinder frame, and side mounting plates from the railgear. Retain all parts for re-assembly. Refer to the parts section of the Operating, Service, and Parts Manual for order of re-assembly.
2. Except for GMC T-Series, on vehicles not equipped with a frame extension, a frame extension will have to be fabricated by the installer.
3. **On GMC T-Series Models:** Position the mounting plates (1) against the **inside** of the front frame rails (2) such that the holes in the mounting plates align with the existing bolts. Note which bolts will be used, remove the mounting plates and remove the required bolts. The center of the bearing housing should be about 19.5" above the ground on an unloaded chassis. Re-install the mounting plates to align with the required bolt holes. Re-install the bolts and torque to 150 ft-lbs. Cut the front bumper to fit around the mounting plates and re-install it in its original position.
4. **On All Other Models:** Position the mounting plates (1) against the **outside** of the front frame extensions (2) as far rearward as possible (against the front spring hanger) with the center of the bearing housing about 19.5" above the ground on an unloaded chassis. Ensure that the hood can still open completely, that the mounting plates are level and that the bearing housings are in line with each other. Each mounting plate must be fastened in place with four 5/8" x 2.75" long fasteners. Use existing holes if possible, or drill four 11/16" diameter holes (3) through each mounting plate and the frame. Install and torque the 5/8" fasteners (4) to 150 ft-lbs.
5. Install the split bearings into the bearing housings and caps. Position the railgear lower assembly under the mounting plates with the small keystone on the underside of the axle facing rearward. Raise the railgear into the bearings and install the bearing caps.

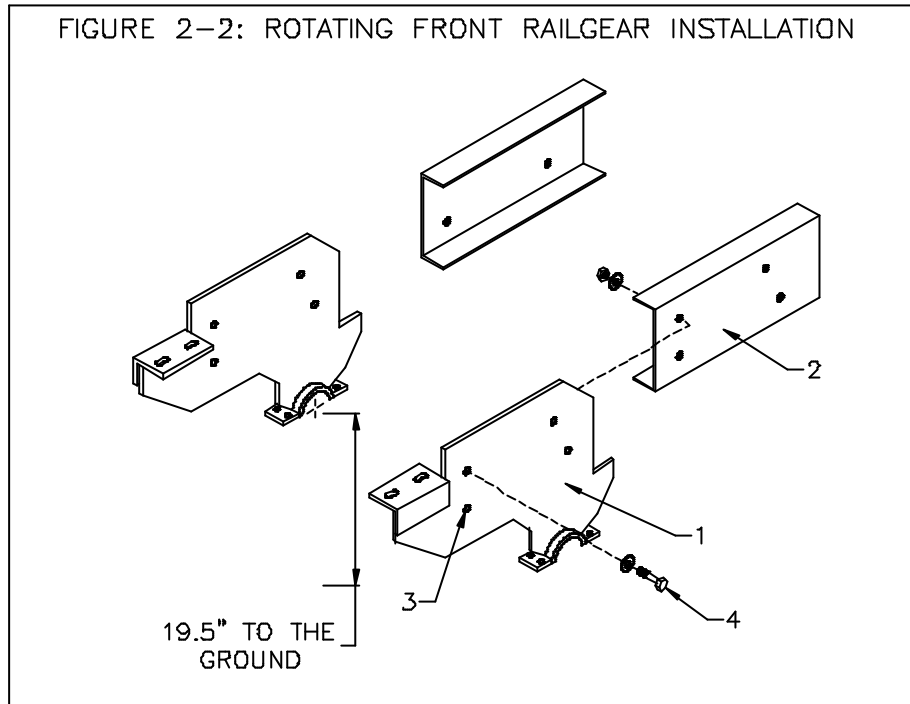
RAILGEAR INSTALLATION

2-4

6. Make sure that the split bearings are in place and snug the bolts on the bearing caps. Do not torque as this will be done following the railgear alignment.
7. Re-install the upper cylinder frame and hydraulic cylinders with the hydraulic fittings facing upwards. Torque all fasteners to specifications.
8. **On All Models Except GMC T-Series:** Re-install the original front bumper in front of the railgear. It may be necessary to make new brackets between the bumper and the frame.



RAILGEAR INSTALLATION



3.0 ROTATING REAR RAILGEAR INSTALLATION

The installation procedure for the rotating rear railgear is identical for all vehicles covered by this manual, except where indicated. The hardware required for this installation is listed in table 2-3.

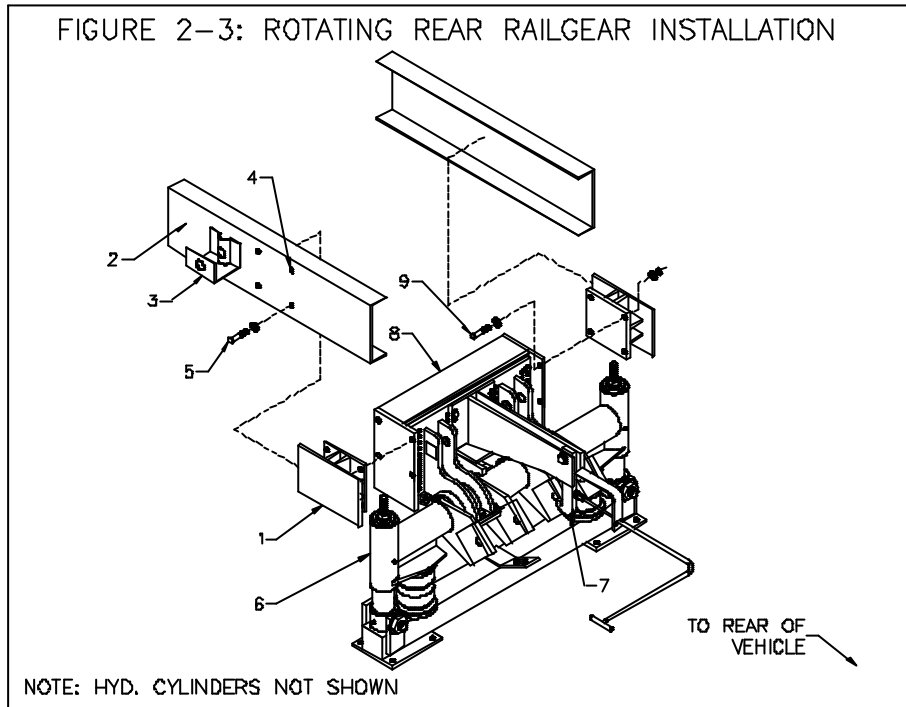
Table 2-3: Rotating Rear Railgear Installation Hardware

Part Number	Description	Qty
R-6873	Rotating Rear Railgear Assembly	1
R-6792	Mounting Bracket	2
	5/8" UNC Gr. 8 Bolt x 2.5" Long	16
	5/8" Washer	32
	5/8" UNC Nylon Insert Lock Nut	16

The following procedure details the rotating rear railgear installation:(refer to figure 2-3)

1. Position the mounting brackets (1) against the inside of the frame (2) just behind the rear spring hanger (3) and 1" above the bottom of the frame. If any cross-members are in the way, they may be removed or relocated as the railgear itself acts as a reinforced cross-member.
2. Clamp the mounting brackets to the frame such that they are level and in line with each other. Ensure that there is 26" between the inner faces of the two mounting brackets. If necessary fabricate shims and insert them between the frame and the mounting brackets to obtain the 26" measurement.
3. Drill four 11/16" diameter holes (4) through the frame and each mounting bracket. Use existing holes if possible. Bolt the mounting brackets to the frame using 5/8" fasteners (5).
4. Position the assembled railgear (6) below the mounting brackets with the lock-up hook (7) facing rearward. Jack the railgear up between the mounting brackets until the holes in the mounting plate assembly (8) align with the holes in the mounting brackets. Bolt the railgear in place with 5/8" fasteners (9).
5. Torque all 5/8" fasteners to 150 ft-lbs.
6. Locate and fabricate a bracket to hold the locking hook handle. Note that the lock hook handle should be located near to where the rear hydraulic operating valve will be situated.

RAILGEAR INSTALLATION



4.0 FRONT RAIL WHEEL & FRONT RAIL SWEEP INSTALLATION

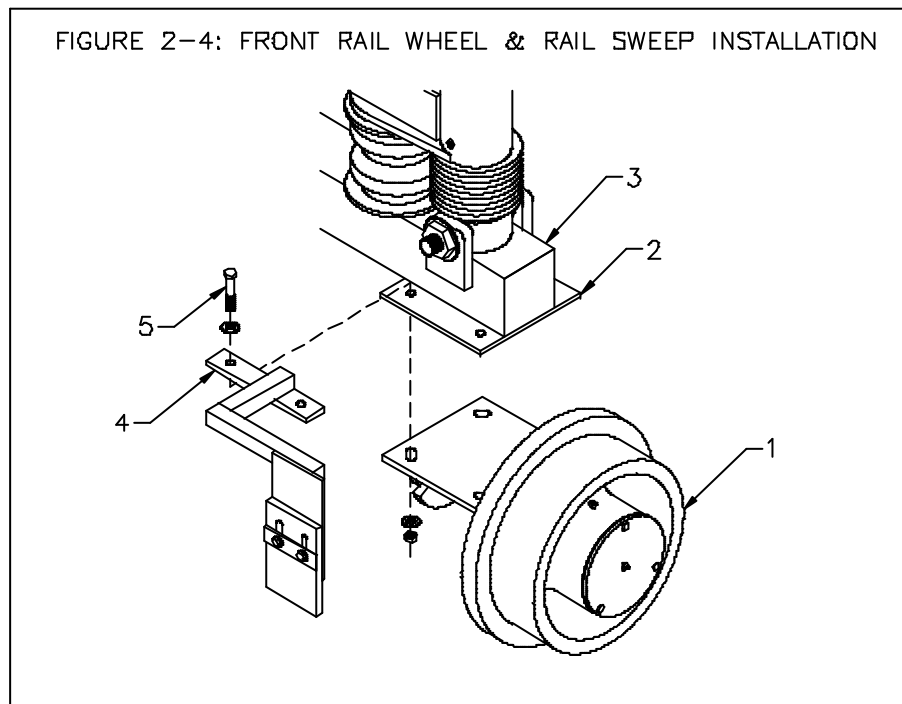
The installation procedure for the rail wheels and rail sweeps on the front railgear is identical for all vehicle models covered by this manual. The hardware required for this installation is listed in table 2-4.

Table 2-4: Rail Wheel and Rail Sweep Installation Hardware

Part Number	Description	Qty
R-5501	12" Wheel Assembly	2
R-5557R	Rail Sweep (Right Side)	1
R-5557L	Rail Sweep (Left Side)	1
	½" UNC Gr. 8 Bolt x 2 ¼" Long	8
	½" Washer	16
	½" UNC Nylon Insert Lock Nut	8

The following procedure details the wheel and sweeper installation: (refer to figure 2-4)

1. Place the rail wheels (1) below the mounting tables (2) on the railgear axle (3).
2. Place the rail sweeps (4) on top of the mounting tables in front of each front wheel.
3. Bolt the rail wheels and rail sweeps to the mounting tables with eight ½" bolts (5) each.
4. Tighten but do not torque the ½" bolts. These bolts will be torqued following the rail wheel alignment.



5.0 REAR RAIL WHEEL & REAR RAIL SWEEP INSTALLATION

The installation procedure for the rail wheels and rail sweeps on the rear railgear is identical for all vehicle models covered by this manual. The hardware required for this installation is listed in table 2-5.

Table 2-5: Rail Wheel and Rail Sweep Installation Hardware w/o brakes

Part Number	Description	Qty
R-6812	12" Wheel Assembly	2
R-8631R	Rail Sweep (Right Side)	1
R-8631L	Rail Sweep (Left Side)	1
	5/8" UNC Gr. 8 Bolt x 2 1/4" Long	8
	5/8" Washer	16
	5/8" UNC Nylon Insert Lock Nut	8

Table 2-5a: Rail Wheel and Rail Sweep Installation Hardware with brakes

Part Number	Description	Qty
R-6812	12" Wheel Assembly	2
R-8570R	Rail Sweep (Right Side)	1
R-8570L	Rail Sweep (Left Side)	1
	5/8" UNC Gr. 8 Bolt x 2 1/2" Long	8
	5/8" Washer	16
	5/8" UNC Nylon Insert Lock Nut	8

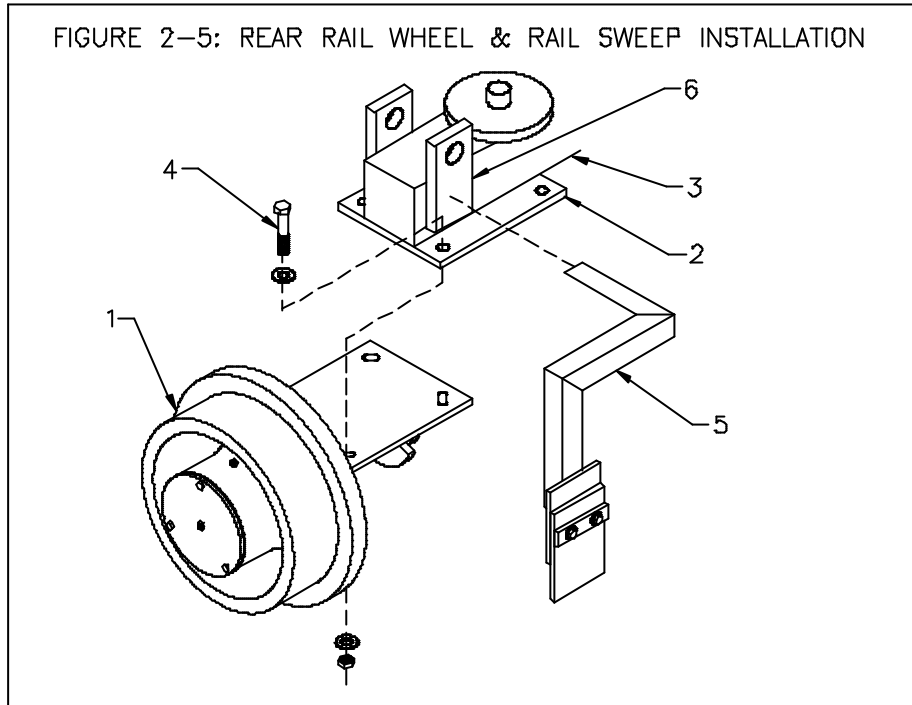
The following procedure details the wheel and sweeper installation: (refer to figure 2-5)

Note:

If the railgear is purchased with the optional brake package, install the rail sweeps after the brake package has been installed.

1. Place the rail wheels (1) below the mounting tables (2) on the railgear axle (3). If the brake package option has been purchased, install the brake housing above the mounting table (2).
2. Secure the rail wheels to the mounting tables with 5/8" fasteners (4). Do not torque the 5/8" fasteners as this will be done after the railgear alignment procedure.
3. Place the rail sweeps (5) to the rear of each rear wheel and butted up against the inner tube support lug (6) (or brake housing if so provided). Adjust the position of the rail sweep so that it is in line with the rail wheel and such that the rubber will be close to the rail yet still allow for adjustment as the rubber wears. Weld the rail sweep to the inner tube lug all around.

RAILGEAR INSTALLATION



6.0 FRONT AXLE LOCK-UP INSTALLATION

This section covers the installation of the front axle lock-up system for each applicable vehicle models.

6.1 INTER 4900, FORD F-800, FREIGHTLINER FL70, STERLING L7500 & GMC C-SERIES AXLE LOCK-UP INSTALLATION

The hardware required for this installation is listed in table 2-6.

Table 2-6: Front Axle Lock-Up Installation Hardware

Part Number	Description	Qty
R-6712	Axle Lock-Up Bracket	2
R-6711	Axle Lock-Up Hook Extension	2
R-5682	Axle Lock-Up Hydraulic Cylinder	1
R-6710	Axle Lock-Up Hook	2
R-5635	Plastic Washer	4
R-6610C	3/8" x 3/8" Square Bar x 2.5" Long	2
	3/8" UNC Gr. 8 Bolt x 2" Long	6
	3/8" Washer	12
	3/8" UNC Nylon Insert Lock Nut	6
	1/2" UNC Gr. 8 Bolt x 2 1/4" Long	4
	1/2" Washer	8
	1/2" UNC Nylon Insert Lock Nut	4
	3/4" UNC Gr. 8 Bolt x 2.5" Long	2
	3/4" UNC Gr. 8 Bolt x 3.5" Long	2
	3/4" Washer	8
	3/4" UNC Nylon Insert Lock Nut	4

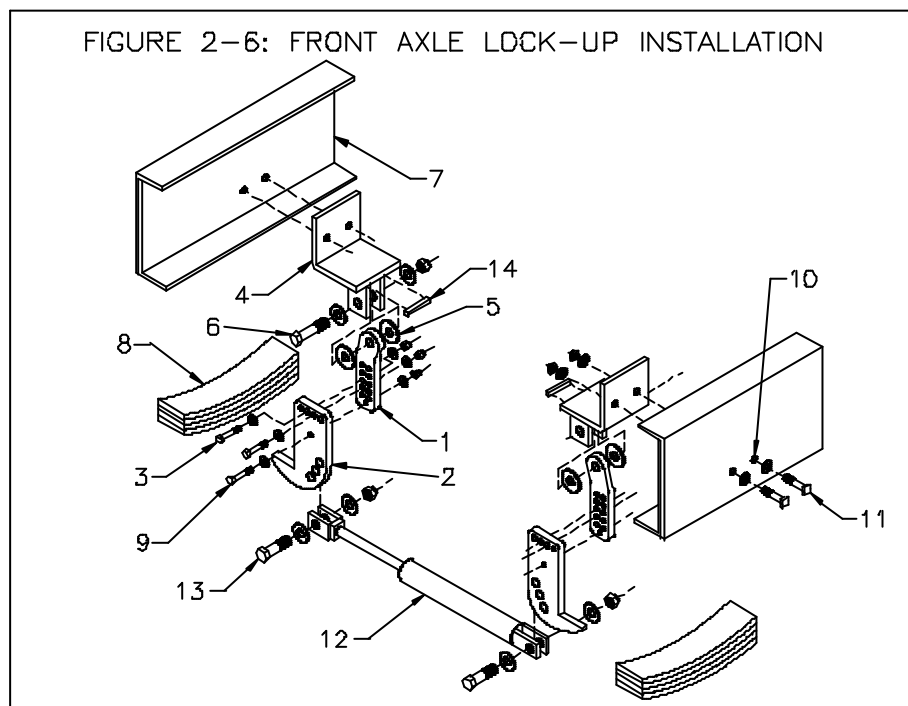
The following procedure details the front axle lock-up installation: (refer to figure 2-6)

1. Assemble the hook extensions (1) and the hooks (2) with two 3/8" fasteners (3) each and torque to 40 ft-lbs. A third 3/8" fastener is installed following verification of hook location.
2. Install the hook assemblies into the axle lock-up brackets (4) with a plastic washer (5) on each side using two 3/4" x 3.5" long fasteners (6). Do not torque, as the hooks must be free to swing.
3. Position the axle lock-up brackets and hooks on the inside of the frame (7) such that the hooks will hang down about 2.5" rearward of the front axle. Ensure that the hooks will be able to go under the springs (8) by about 1/2" with the truck body on and the truck unloaded. Ensure that they move unobstructed and that they do not hit any truck components (i.e., steering linkages, tie rods, etc.) with the truck wheels turned in

RAILGEAR INSTALLATION

2-12

- either direction as well as in the straight position. Adjust the hooks in the hook extensions as necessary then drill the hooks to accept the third 3/8" fastener (9).
4. Clamp the brackets in this position and drill two 17/32" diameter holes (10) through each bracket and frame rail. Fasten the brackets in place with two 1/2" fasteners (11) each. Torque to 100 ft-lbs.
 5. Install the axle lock-up cylinder (12) between the two hooks with the hydraulic fittings facing forward using two 3/4" x 2.5" long fasteners (13). Do not torque as the hooks must be free to move.
 6. Retract the hydraulic cylinder completely and ensure that the hooks do not interfere with the vehicle suspension or with any other vehicle components (i.e., steering linkages, tie rods, etc.) in this position or with the truck wheels turned in either direction.
 7. With the cylinder fully retracted, weld the 3/8" square bars (14) to the inside of the brackets to limit the hooks from swinging inwards.



6.2 GMC T-SERIES AXLE LOCK-UP INSTALLATION

The hardware required for this installation is listed in table 2-7.

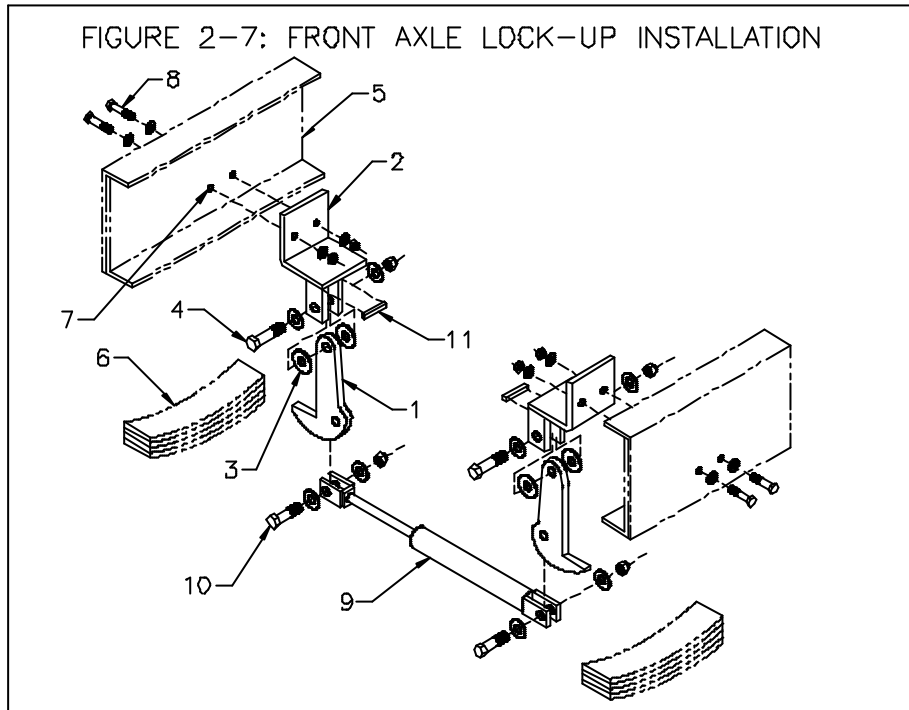
Table 2-7: Front Axle Lock-Up Installation Hardware

Part Number	Description	Qty
R-5635	7/8" Plastic Washer	4
R-5682	Hydraulic Cylinder	1
R-6735	Hook	2
R-6736	Hook Bracket	2
R-6610C	3/8" x 3/8" Square Bar x 2.5" Long	2
	1/2" UNC Gr. 8 Bolt x 2 1/4" Long	4
	1/2" Gr. 8 Washer	8
	1/2" UNC Nylon Insert Lock Nut	4
	3/4" UNC Gr. 8 Bolt x 2.5" Long	2
	3/4" UNC Gr. 8 Bolt x 3.5" Long	2
	3/4" Gr. 8 Washer	8
	3/4" UNC Nylon Insert Lock Nut	4

The following procedure details the front axle lock-up installation: (refer to figure 2-7)

1. Install the hooks (1) into the hook brackets (2) with a plastic washer (3) on each side using two 3/4" x 3.5" long fasteners (4). Do not torque as the hooks must be free to swing.
2. Position the hook brackets and hooks on the inside of the frame (5) such that the hooks will hang down rearward of the front axle. Ensure that the hooks will be able to go under the springs (6) by about 1/2" and that they will move unobstructed.
3. Clamp the brackets in this position and drill two 17/32" diameter holes (7) through each bracket and frame rail. Fasten the brackets in place with two 1/2" fasteners (8) each. Torque to 100 ft-lbs.
4. Install the hydraulic cylinder (9) between the two hooks using two 3/4" x 2.5" long fasteners (10). Do not torque as the hooks must be free to move.
5. Retract the hydraulic cylinder completely and ensure that the hooks do not interfere with the vehicle suspension in this position.
6. With the cylinder fully retracted, weld the 3/8" square bars (11) to the inside of the brackets to limit the hooks from swinging inwards.

RAILGEAR INSTALLATION



THIS PAGE IS BLANK

SECTION 3: AUXILIARY INSTALLATIONS

STEERING WHEEL LOCK INSTALLATION	3-2
HYDRAULIC SYSTEM INSTALLATION	3-7
ELECTRICAL SYSTEM INSTALLATION	3-9
OPTIONAL AIR BRAKE SYSTEM INSTALLATION	3-11
PREPARATIONS FOR OPERATION	3-12
CHECKLIST	3-15

1.0 STEERING WHEEL LOCK INSTALLATION

This section covers the installation of the steering wheel lock for each vehicle model.

1.1 INTER 4900, FREIGHTLINER & STERLING L7500 w/ TELESCOPING STEERING & GMC T-SERIES STEERING LOCK INSTALLATION

The hardware required for this installation is listed in table 3-1.

Table 3-1: Steering Wheel Lock Installation Hardware

Part Number	Description	Qty
R-050C	Steering Column Brace (Inter 4900 only)	1
R-050M	Steering Column Brace (GMC T-Series only)	1
R-5902	Steering Wheel Lock (F.L. w/ tele. steering only)	1
R-5903	Steering Column Brace (F.L. w/ tele. steering only)	1
R-8742A	Steering Wheel Lock (Sterling w/ tele. steering only)	1
R-8742B	Steering Column Brace (Sterling w/ tele. steering only)	1
R-6506	Steering Wheel Lock (Inter 4900 only)	1
R-6734	Steering Wheel Lock (GMC T-Series only)	1
R-2586B	Spring Pin (all except Freightliner & Sterling)	1
	#10 x 1/2" Long Self Tapping Screw	2

The following procedure details the steering wheel lock installation: (refer to figure 3-1)

1. Install the steering column brace (1) on the steering column so that the bracket is upwards. Tighten the hose clamp snug.
2. Insert the steering wheel lock (2) into the steering column brace and secure with the spring pin (3) (not require on Freightliner). Position the steering column brace so that the lock positively engages the steering wheel (4).
3. Tighten the hose clamp and use two #10 self-tapping screws to fasten the steering column brace in place.
4. Remove the spring pin (not on Freightliner) and steering wheel lock and store them in the glove box.

1.2 FORD F-800 STEERING WHEEL LOCK INSTALLATION

The hardware required for this installation is listed in table 3-2.

Table 3-2: Steering Wheel Lock Installation Hardware

Part Number	Description	Qty
R-050F	Steering Column Brace	1
R-6688A	Steering Wheel Lock	1
R-2586B	Spring Pin	1
	#10 x 1/2" Long Self Tapping Screw	2

The following procedure details the steering wheel lock installation: (refer to figure 3-2)

1. Install the steering column brace (1) on the steering column so that the bracket is to the side and clears the flasher lever. Tighten the hose clamp snug.
2. Insert the steering wheel lock (2) into the steering column brace and secure with the spring pin (3). Position the steering column brace so that the lock positively engages the steering wheel (4).
3. Tighten the hose clamp and use two #10 self-tapping screws to fasten the steering column brace in place.
4. Remove the spring pin and steering wheel lock and store them in the glove box.

1.3 GMC C-SERIES STEERING WHEEL LOCK INSTALLATION

The hardware required for this installation is listed in table 3-3.

Table 3-3: Steering Wheel Lock Installation Hardware

Part Number	Description	Qty
R-5661A	Steering Wheel Lock Pivot	1
R-5661B	Steering Wheel Lock Stopper	1
R-5665A	Steering Wheel Lock Latch	1
	3/16" x 1/2" Long Self Tapping Screw	3
	1/4" UNC Gr. 8 Bolt x 2" Long	1
	1/4" SAE Washer	2
	1/4" UNC Gr. 3 Nylon Insert Lock Nut	1

The following procedure details the steering wheel lock installation: (refer to figure 3-3)

1. Insert the steering wheel lock latch (1) into the steering wheel lock pivot (2) and secure with a 1/4" fastener (3).
2. Position the steering wheel lock assembly on the steering column so that the pivot point is on the top of the column. Tighten the hose clamp (4) snug.

3. Position the steering wheel lock stopper (5) on the horn cover. Flip the latch over so that it engages the stopper. Slide the pivot up or down the column if necessary. Use a self-tapping screw (6) near the pivot point to hold the steering lock pivot in place and two self-tapping screws (7) to secure the stopper to the horn cover. Be sure not to catch any wires when installing the self-tapping screws.
4. Tighten the hose clamp.

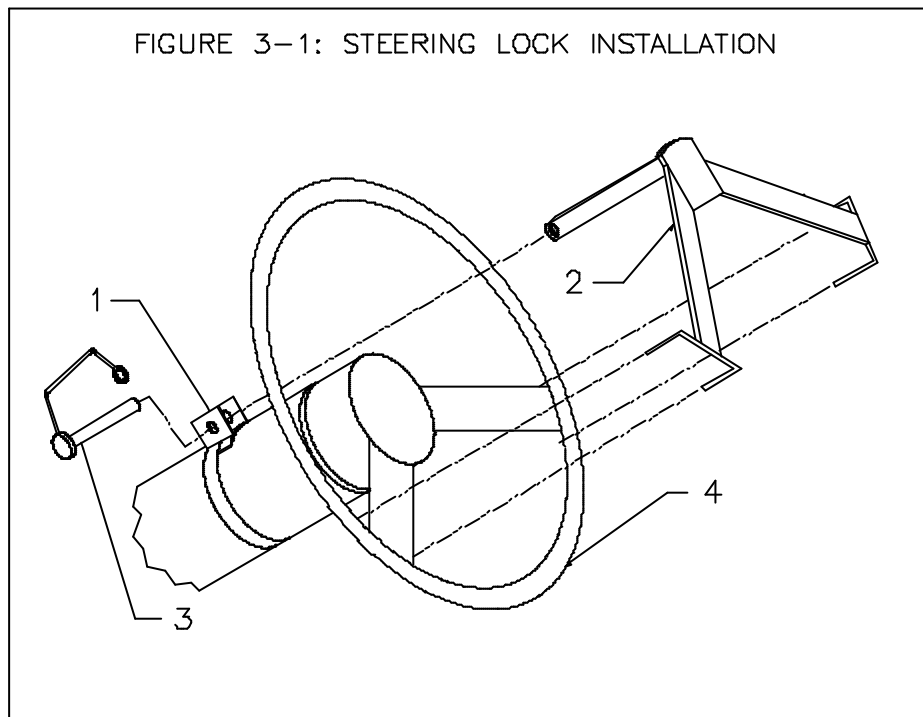
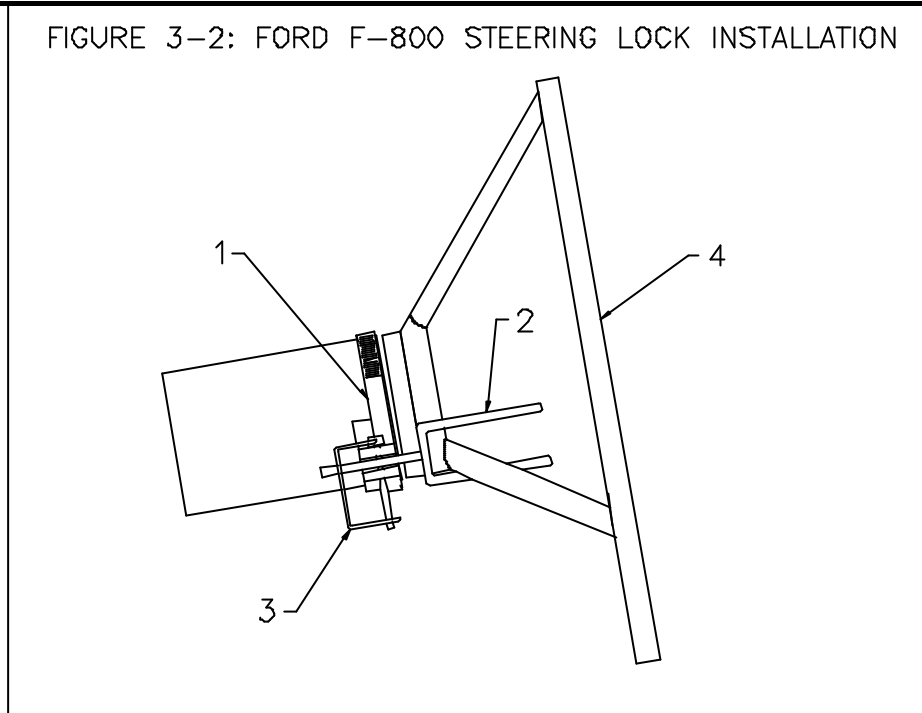


FIGURE 3-2: FORD F-800 STEERING LOCK INSTALLATION



1.4 FREIGHTLINER FL70 NON-TELESCOPING STEERING WHEEL LOCK INSTALLATION

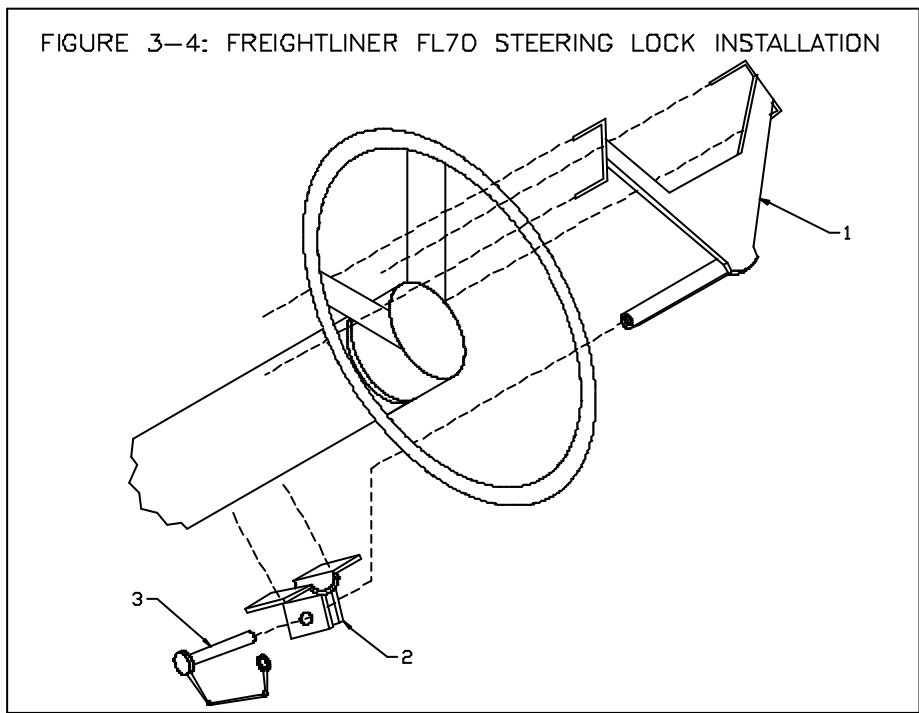
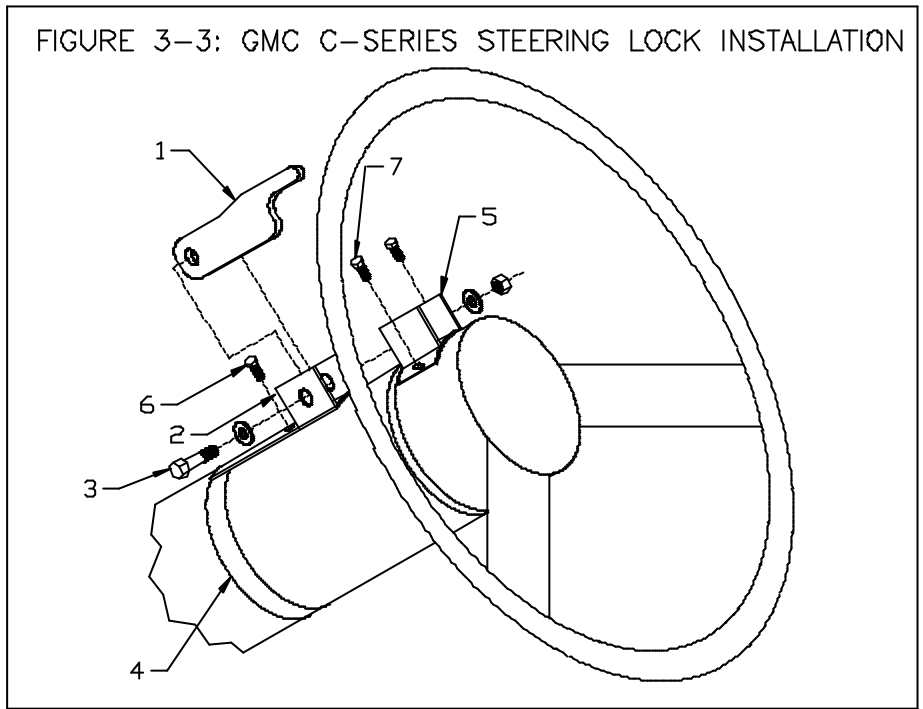
The hardware required for this installation is listed in table 3-4.

Table 3-4: Steering Wheel Lock Installation Hardware

Part Number	Description	Qty
R-5898	Steering Column Brace	1
R-5899	Steering Wheel Lock Bracket	1
R-2586B	Spring Pin	1

The following procedure details the steering wheel lock installation: (refer to figure 3-4)

1. Insert the steering wheel lock bracket (1) into the steering wheel webs with the long arm on the rear side of the steering column. Position the steering column brace (2) so that the holes in the brace align with the hole in the steering wheel lock bracket and insert the spring pin (3).
2. The two holes in the steering column brace should now align with existing steering column bolts. Remove these bolts, position the steering column brace over the factory holes and re-install the bolts.
3. Remove the spring pin and steering wheel lock bracket. Re-install the spring pin and store the steering lock bracket in a safe spot.



2.0 HYDRAULIC SYSTEM INSTALLATION

This section covers the installation of the hydraulic hoses, operating valves and optional electrical hydraulic pump. The installation procedure is identical for all models covered by this manual. This procedure may be modified by the installer in order to connect to an alternate hydraulic power source (PTO). The hardware required for this installation is listed in table 3-5.

Table 3-5: Hydraulic System Installation Hardware

Part Number	Description	Qty
R-053A	Optional Electrical Hydraulic Pump with Coil	1
R-559M	Operating Valve	2
R-559-39	Optional Operating Valve Handle (w/switch for use w/R-053A)	2
R-559-11	Operating Valve Handle (for use with PTO pumps)	2
	Hydraulic Hose	
	Hydraulic Fittings	

The following procedure details the hydraulic system installation:



IMPORTANT:

- **When routing hydraulic hoses, ensure that the hoses do not contact any sharp edges or hot surfaces.**
1. Install the optional 12 VDC electrical hydraulic pump:
 - a) Remove the coil from the pump motor and mount it near the battery. Re-install the coil mounting screws into the pump motor.
 - b) The hydraulic pump should be mounted in a convenient location on the vehicle.
 - c) Install an 849 FS 06-06 hydraulic fitting on the pressure port of the hydraulic pump and an 849 FS 06-04 hydraulic fitting on the tank port of the hydraulic pump.
 2. Install the operating valve handles on the operating valves.
 3. Install the front operating valve on the mounting plate provided on the front railgear with ¼" fasteners.
 4. Install the rear operating valve in a convenient location near the rear railgear locking cable handle.

AUXILLARY INSTALLATIONS

5. Connect the vertical front railgear hydraulics according to drawing MO-0018B page 14 (Vertical Front Hydraulics) in the Operating, Service and Parts Manual. (Note: Certain hoses and all fittings are installed on the railgear at Rafna Industries.)
6. Connect the rotating front railgear hydraulics according to drawing MO-0018B page 15 (Rotating Front Hydraulics) in the Operating, Service, and Parts Manual. (Note: Certain hoses and all fittings are installed on the railgear at Rafna Industries.)
7. Connect the rotating rear railgear hydraulics according to drawing MO-0018B page 16 (Rotating Rear Hydraulics) in the Operating, Service, and Parts Manual. (Note: Certain hoses and all fittings are installed on the railgear at Rafna Industries.)
8. Make to fit and route one hydraulic hose from the optional hydraulic pump pressure port (or PTO pump pressure line) to the inlet port on the front operating valve.

Note: Installer to insure that the pressure from the PTO pump to the railgear does not exceed 2,000 psi.

9. Make to fit and route one hydraulic hose from the front operating valve outlet port to the rear operating valve inlet port.
10. Make to fit and route one hydraulic hose from the rear operating valve outlet port to the optional hydraulic pump return port or the PTO pump return line.
11. Ensure all hydraulic hoses and fittings have been correctly installed, then tighten all fittings and tie-wrap all hoses securely so they do not rub.

3.0 OPTIONAL ELECTRICAL SYSTEM INSTALLATION

This section covers the installation of the 12 VDC electrical system for the optional electrical hydraulic pump. The hardware required for this installation is listed in table 3-6.

Table 3-6: Electrical System Installation Hardware

Part Number	Description	Qty
R-1567	Illuminated Rocker Switch	1
R-1577	5A In-Line Fuse	1
CO-124	Relay	1
Not Supplied	14 Gauge Stranded Copper Wire	As Req'd
Not Supplied	4 Gauge Copper Wire, Neoprene Jacketed (SAE J1127-type SRG)	As Req'd
Not Supplied	Cable Loom	As Req'd

The following procedure details the electrical system installation (refer to figure 3-5)



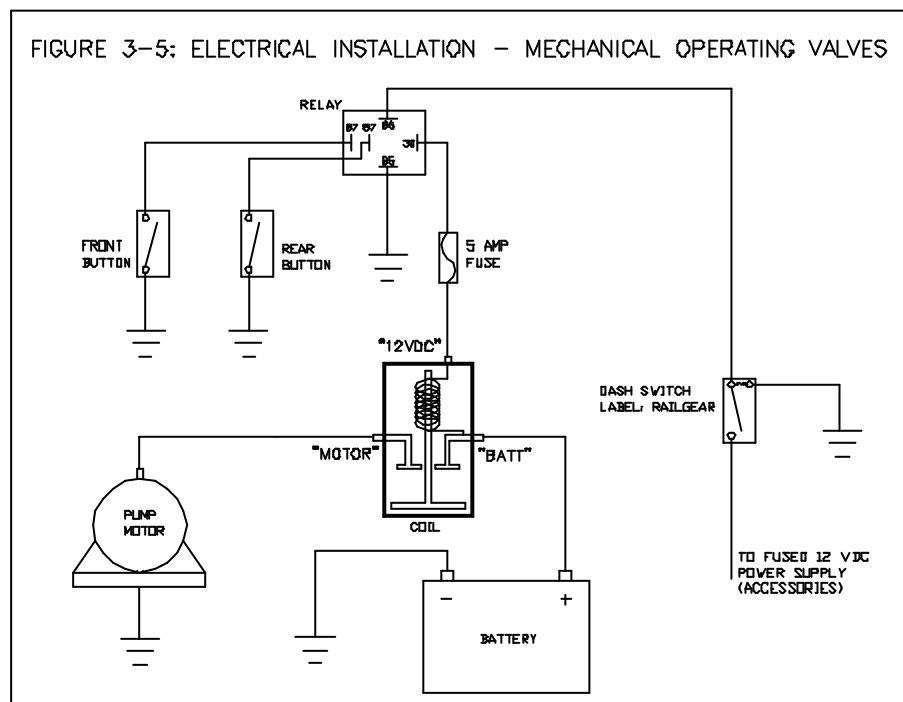
IMPORTANT:

- **When routing electrical wires, ensure that the wires do not contact any sharp edges or hot surfaces.**
 - **All wire connections are to be soldered and heat shrink sealed to prevent future corrosion related problems.**
 - **All wires must be covered with protective cable loom.**
 - **This procedure and equipment is for a 12 VDC electrical system.**
1. Install the illuminated rocker switch in a convenient location on the dashboard.
 2. Using suitable 4 gauge wire, cable loom, connectors, solder and heat shrink tubing:
 - a) Connect one wire from the positive terminal on the vehicle's battery to the "Batt" terminal on the hydraulic pump coil mounted under the hood.
 - b) Connect another wire from the "Motor" terminal on the coil to the terminal on the pump motor.
 - c) Apply a small amount of silicon sealant to the pump motor terminal to protect it from shorting out or rusting.
 3. Ensure that the pump motor base is properly grounded to the vehicle chassis.
 4. Install the relay under the hood close to the solenoid.

AUXILIARY INSTALLATIONS

5. Using suitable 14 gauge wire, cable loom, connectors, solder and heat shrink tubing:
 - a) Connect a wire from the "12 VDC" terminal on the hydraulic pump coil to the 5A inline fuse.
 - b) Connect a wire from the 5A inline fuse to the "30" terminal on the relay.
 - c) Connect a wire to each "87" terminal on the relay; route one along the driver's side of the frame to the rear operating valve and route one to the front operating valve.
 - d) At the front and rear operating valves, connect the above-mentioned wires to the pump start buttons. Note that the wire that comes out of the pump start buttons with a ring connector on the end should be grounded through one of the operating valve mounting bolts.
 - e) Connect a wire from the "85" terminal on the relay to a suitable ground.
 - f) Connect a wire from the "86" terminal on the relay through the firewall to the "Load" terminal on the dash switch.
 - g) Connect a wire from the "Supply" terminal on the dash switch to a fused 12 VDC power supply preferably on the vehicle accessories circuit.
 - h) Connect a wire from the "Ground" terminal on the dash switch to a suitable ground.

6. Ensure all wires are enclosed in cable loom, soldered and secured with tie-wraps.



4.0 OPTIONAL AIR BRAKE SYSTEM INSTALLATION

This section covers the installation of the air brake system on the front and rear railgear. The railgear air brake system must be incorporated into the vehicles air brake system.

1. Assemble the rail wheel brake system as shown in drawing M0018-8 of the Operating, Service and Parts Manual if not done at the factory.
2. Insert a tee fitting in the air brake line leading to the left front vehicle brake.
3. Connect an air brake hose from this fitting to the left railgear brake chamber. Ensure that there is enough slack in the hose to accommodate the movement of the railgear.
4. Do the same on the right front side of the vehicle.
5. Do the same on the right and left rear of the vehicle.



IMPORTANT:

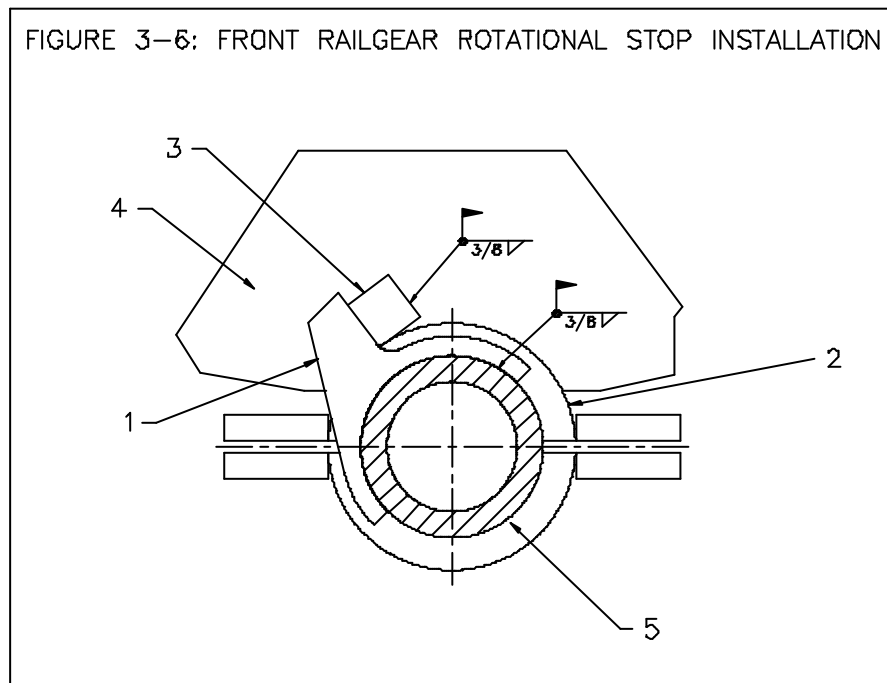
- **Use only DOT approved air brake components when tapping into the vehicle brake system.**
- **Tie-wrap all hoses to prevent wear on sharp edges.**

5.0 PREPARATIONS FOR OPERATION

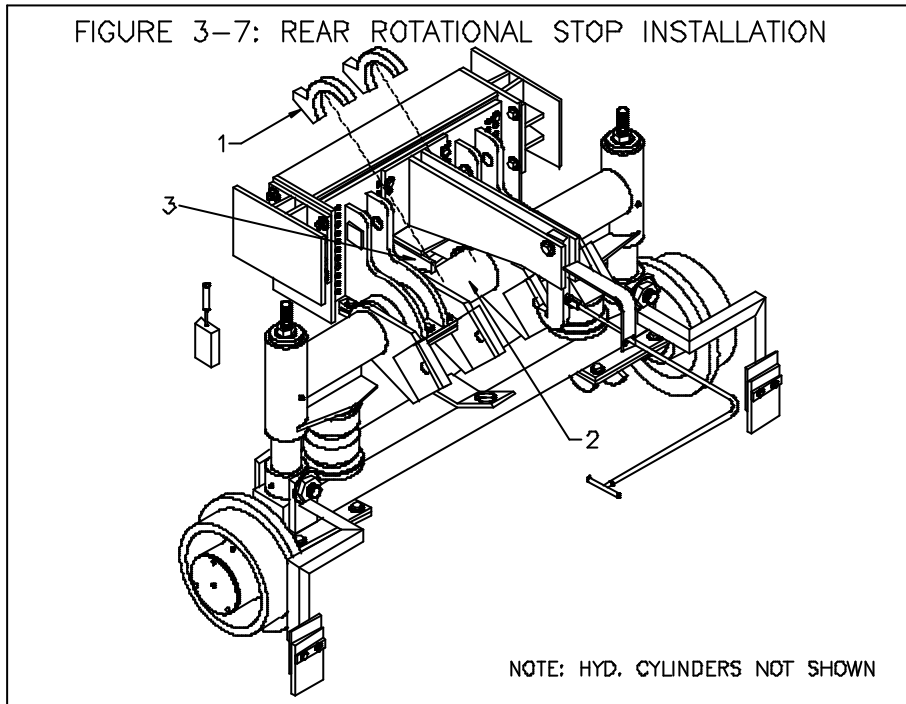
This section covers the preparation of the vehicle before having it put in service.

1. Fill the hydraulic system and bleed the air out:
 - a) Fill the hydraulic pump tank with ESSO Univis N-22 (or equivalent) hydraulic fluid.
 - b) Operate the front railgear up and down briefly to circulate the fluid and bleed the system of air. (refer to the Operating, Service and Parts Manual for operating instructions)
 - c) Refill the hydraulic pump tank and repeat step b) until all air is removed from the front hydraulic system. (the fluid level will be constant)
 - d) Operate the rear railgear up and down briefly to circulate the fluid and bleed the system of air. (refer to the Operating, Service and Parts Manual for operating instructions)
 - e) Refill the hydraulic pump tank and repeat step d) until all air is removed from the rear hydraulic system. (the fluid level will be constant)
2. Perform the Hydraulic Relief Valve Setting Adjustment Procedure detailed in the Operating, Service and Parts Manual.
3. Perform the Rear Railgear Pressure Adjustment Procedure detailed in the Operating, Service and Parts Manual. Be sure to torque the railgear to mounting plate assembly bolts to specifications.
4. Perform the Railgear and Rail Wheel Alignment Procedure detailed in the Operating, Service and Parts Manual. Be sure to torque the railgear mounting bolts, railgear bearing cap bolts, and rail wheel mounting bolts to specifications following the alignment procedure.
5. **On Vertical Front Railgear:** Adjust the height of the front railgear by loosening the six guide tube clamping bolts and moving the railgear up or down to get a minimum of 3" clearance between the vehicle tires and the head of the rail when on the tracks. Re-torque the bolts to specification. Adjust the railgear lock-up system such that the hooks engage completely with the railgear in the highway position.
6. **On Rotating Front Railgear:** Install the rotational stops as shown in figure 3-6. Rotate the railgear down until it is 3-5° over center. Position the rotational stops (1) snug against the bearing housings (2) and the stop blocks (3) against the mounting plates (4). The rotational stops should function as rotational limiters as well as side to side limiters by contacting the bearing housings. The rotational stops are welded to the cross frame (5) inward of the bearing housings and the stop blocks are welded to the mounting plates.

7. **On Rotating Rear Railgear:** Install the rotational stops as shown in figure 3-7. Rotate the railgear down until it is 3-5° over center. Position the rotational stops (1) on the cross frame (2) so that they contact the inner edge of the stopper block (3) on the mounting plate assembly. The rotational stops should function as rotational limiters as well as side to side limiters by contacting the stopper block. Weld the rotational stops to the cross frame all around.
8. Check for lubrication at all lubrication points detailed in the Operating, Service and Parts Manual.
9. Check for correct bolt torque values as detailed in the Operating, Service, and Parts Manual.
10. Adjust all rail sweeps have 1/8" clearance from the track by loosening the rubber sweep retaining bolts and adjusting as necessary. Be sure to tighten the rubber sweep retaining bolts following adjustment.
11. Complete the Installation Checklist in the following section to make sure nothing has been forgotten.
12. Read the entire Operating, Service, and Parts Manual before attempting operation of the railgear equipped vehicle.



AUXILLARY INSTALLATIONS



AUXILLARY INSTALLATIONS

RAFNA R-650 PREDELIVERY CHECK LIST			
Railgear Serial #:		Vehicle Year:	
Model:		Vehicle Make:	
Date Received:		Vehicle Model:	
Date Completed:		Vehicle V.I.N. :	
Installed By:		Inspection By:	
Check List Item		Approved/Value	Remarks
Hydraulic pump attached properly			
Hydraulic system bled of air			
Hydraulic pump relief set at 2000 PSI			Mechanical Valves
Operating valve relief set at 1800 PSI			Mechanical Valves
Split loom used on all exposed hyd. hoses			
Hyd. hoses clear of heat & sharp edges			
Hydraulic system free of leaks			
Hyd. pump & valve grounds checked			
Electrical connections soldered and sealed			
Split loom used on all exposed wires			
Wires clear of heat & sharp edges			
Axle lockup clears all possible obstructions -with wheel straight and turned			
Third bolt installed in axle lockup			
Stops welded to axle lockup housing to prevent sway.			
Rail sweeps installed			
Front railgear is 3-5° over center on track			
Front rotational stops installed			
Rear railgear is 3-5° over center on track			
Rear rotational stops installed			
Rear rail wheel pressures adjusted			Check tire air press
Rear left			7-10"
Rear right			7-10"
Railgear alignment completed			
Distance between front tire and rail head			3" Minimum
Distance between rail wheel flanges			53-7/16" to 53-1/2"
Front rail wheels			
Rear rail wheels			
Rail sweeps adjusted 1/8" above track			
Rail wheel bearings end-play adjusted			
Distance front rail wheel flange to ground			Min 9"
Distance rear rail wheel flange to ground			Min 9"
Front and rear lock systems engage easily			

AUXILLARY INSTALLATIONS

RAFNA R-650 PREDELIVERY CHECKLIST			
Railgear Serial #:		Vehicle Year:	
Model:		Vehicle Make:	
Date Received:		Vehicle Model:	
Date Completed:		Vehicle V.I.N. :	
Installed By:		Inspection By:	
Check List Item		Approved/Value	Remarks
Steering wheel lock system installed			
Bumpers installed level with body			
Steering lock decal installed on dash			
Railgear lubricated			
All bolts torqued as per specifications			See O.P.S. Manual
Vehicle track tested			
Operating, Service & Parts Manual in truck			

Appendix

MANUAL ADDENDUM

MA #: MI65-0-MA01

Date: June 4, 2002

Affected Manual / Railgear

Railgear Model: R-650/850

Manual #: MI-0019B & M-0022 & MI-0024B

Affected Page(s): Assorted

Addendum Information:

Preparations for Railgear Mounting:

This addendum adds the precaution for modifying the vehicle frame. In many cases, the frame is treated, and care must be taken when drilling or welding to the frame. Before drilling or welding to the frame, consult the appropriate body builder's book for the particular type of vehicle being fitted, and follow their recommendations.

MANUAL ADDENDUM

MA #: MI65-0-MA02

Date: June 4, 2002

Affected Manual / Railgear

Railgear Model: R-650/850
Manual #: MI-0019B & M-0022 & MI-0024B
Affected Page(s): Assorted

Addendum Information:

Rear railgear Mounting:

This addendum updates the installation manual for the option of having the railgear lock-up cable routed to the front of the railgear. In some cases, the vehicle type and purpose do not allow for a rear routed lock-up cable.

Rafna Industries will supply the variant, with the following parts modified: Lock-up Hook Assembly (R-6785A), and Locking Hook Support Assembly (R-6872A). The installation and operation are still the same.

When routing the cable, ensure a minimum bend radius of 3". Ensure the cable is clear of any moving parts.

MANUAL ADDENDUM

MA #: MI65-0-MA03

Date: November 20, 2002

Affected Manual / Railgear

Railgear Model: R-650
 Manual #: MI-0019B
 Affected Page(s): Assorted

Addendum Information:

This addendum details the installation of the optional R-053B hydraulic pump. It also details the installation of the hydraulics and electrical system related to the pump. This procedure includes the new "O"-Ring Boss (ORB) version operating valves and "O"-Ring Boss version hydraulic check valves. "O"-Ring Boss fitting must be used in this procedure.

3.5 R-053B Pump, Hydraulic and Electrical System Installation

Optional Hydraulic Pump Installation (refer to figures 3-5A, 3-5B, and 3-5C):

This procedure details the installation of the R-053B hydraulic pump. The hardware required for this installation is listed in table 3-5A:

Table 3-5A: R-053B Pump, Hydraulic and Electrical System Installation

Item	Description	Qty.
R-053B	Hydraulic Pump (w/ solenoid)	1
R-1567	Illuminated Rocker Switch	1
R-1577	5 Amp 'In-line' Fuse	1
CO-130G	'Railgear Pump' Decal	1
S-802020	Operating Valve	2
R-559-39	Operating Valve Handle	2
849FSO 06-06	3/8" JIC Male – 3/8" ORB Male 90° Fitting (for rear)	2
	Hydraulic Hose (Length and Terminated to Fit)	As Req'd
	Suitable 14 AWG Wire	As Req'd
	Suitable 4 AWG Wire	As Req'd
	Cable Loom	As Req'd

1. Remove the motor solenoid from the pump. Re-install the solenoid retaining screws into the pump to avoid water entering the pump motor. Install the solenoid in a suitable location under the hood near to the vehicle's battery with installer supplied hardware.
2. Install the relay near the solenoid under the hood.
3. Install the pump in a convenient location on the vehicle. Ensure the end of the tank is supported. Use installer supplied hardware to mount the pump. Follow the vehicle manufacturer's recommendation when modifying or attaching to the vehicle's frame.
4. For the front railgear, remove and discard the installed operating valve handle. Replace it with the supplied handle, which contains a pushbutton in the top. There are two wires exiting from the bottom of the handle. Connect the black wire (ring tongue) to a suitable ground location on the vehicle. The white wire will be lengthened as required to reach the relay.
5. For the rear railgear, fabricate a bracket to mount the rear operating valve in a suitable location, within reach of the rear lock-up cable handle. Mount the bracket to the vehicle, and mount the rear operating valve to the bracket with installer supplied hardware. Remove and discard the installed operating valve handle. Replace it with the supplied handle, which contains a pushbutton in the top. There are two wires exiting from the bottom of the handle. Connect the black wire (ring tongue) to a suitable ground location on the vehicle. The white wire will be lengthened as required to reach the relay.

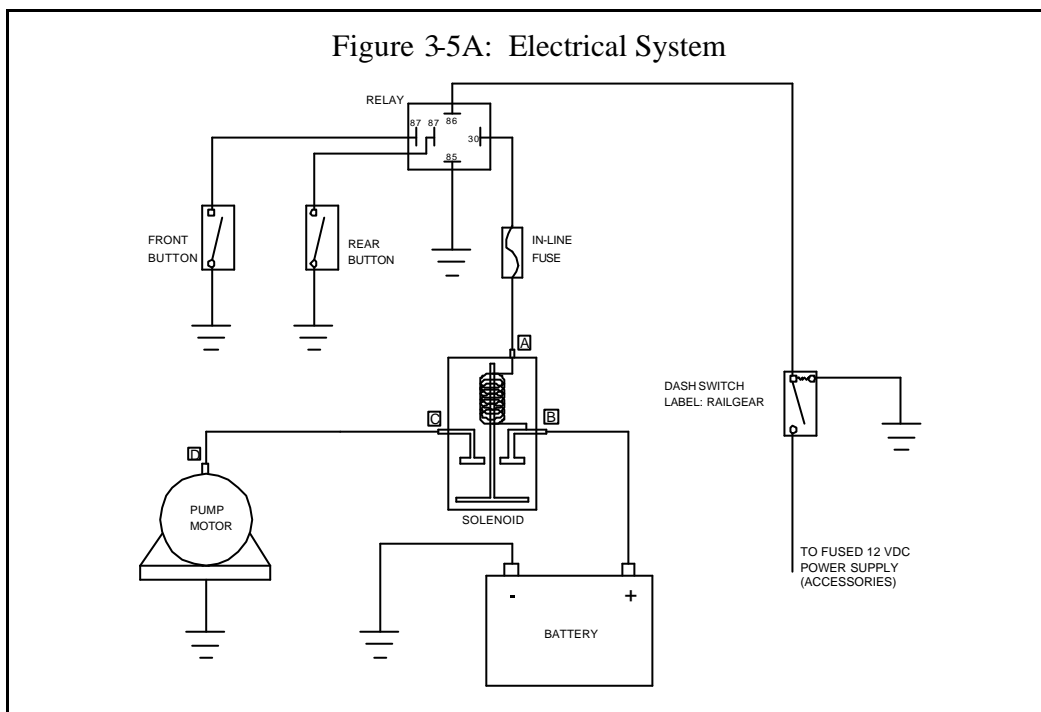
Electrical Installation:

1. Install the illuminated rocker switch in a convenient location on the dash. Affix the 'Railgear Pump' decal to the dash, above the switch.
2. Using suitable 14 gauge wire, cable loom, connectors, solder, and heat shrink tubing:
 - a) Lengthen the white wire from the front operating valve handle to terminal 87 on the relay. (Note: there are two terminal 87. Using either one is acceptable.)
 - b) Lengthen the white wire from the rear operating valve handle to the other terminal 87 on the relay.
 - c) Connect and terminate a length of wire to reach from the switching terminal (Terminal A) of the solenoid to the in-line fuse.
 - d) Connect and terminate another length of wire to reach from the in-line fuse to terminal 30 on the relay.
 - e) Connect another length of wire to reach from terminal 86 on the relay to the load terminal on the dash mounted illuminated rocker switch.
 - f) Connect a length of wire to reach from the supply terminal on the dash mounted illuminated rocker switch to a fused 12VDC power source inside the vehicle.

A Global Railway Industries Company

MI65-0-MA03

- g) Connect a wire from the ground terminal on the dash mounted illuminated rocker switch to a suitable ground location on the vehicle.
3. Using suitable 4 ga uge wire, cable loom, connectors, solder, and heat shrink tubing:
- Connect a length of wire to reach from the vehicle's battery to the power terminal (Terminal B) on the solenoid.
 - Connect a length of wire to reach from the load terminal (Terminal C) on the solenoid to the pump (Terminal D).
 - Ensure the pump motor is properly grounded to the vehicle chassis by connecting a wire from the pump motor base to a suitable ground location on the vehicle.

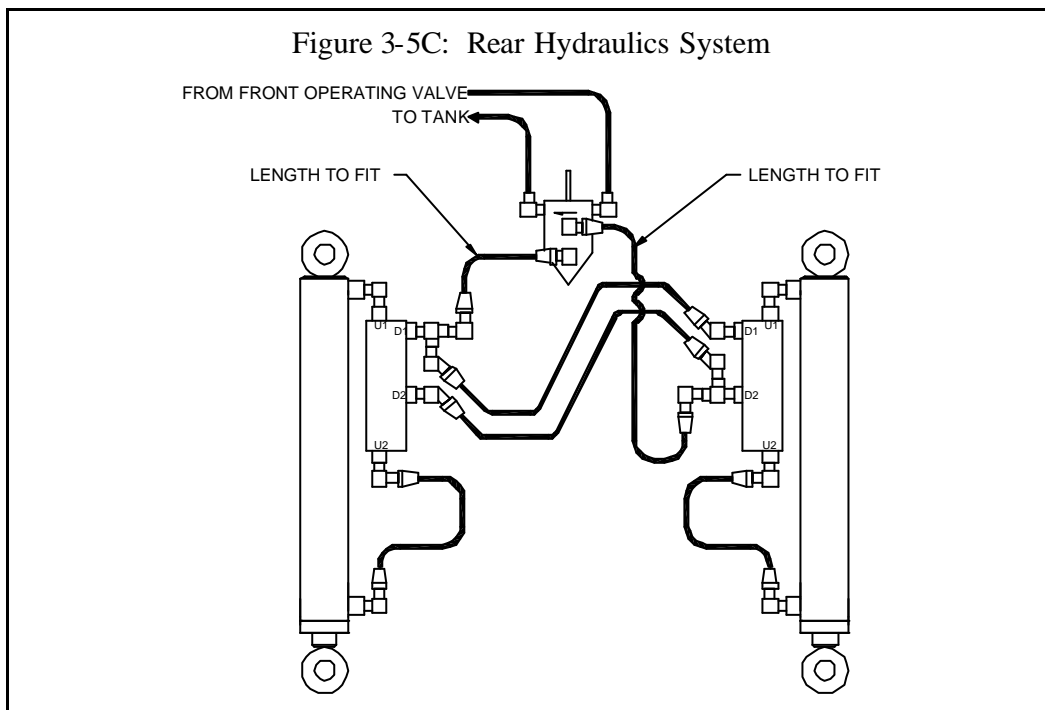
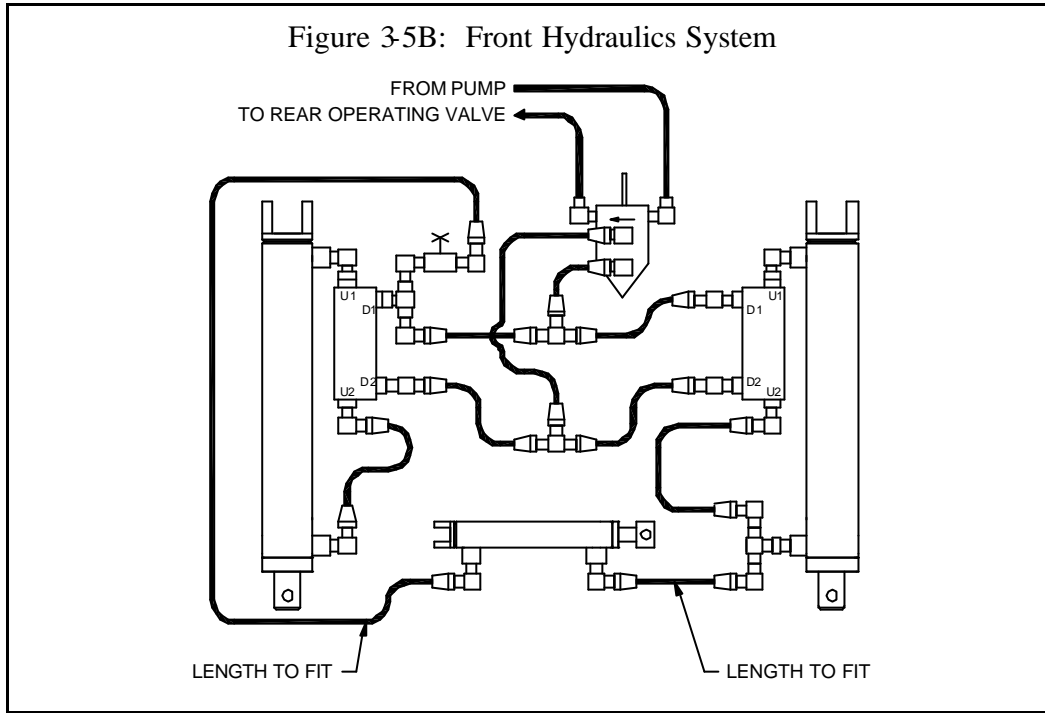


Hydraulic Installation:



- **When routing hydraulic hoses, ensure that the hoses do not contact any sharp edges or hot surfaces.**

1. Insert the installer supplied ½” JIC/ORB fittings into the ‘T’ and ‘P’ ports on the front and rear operating valves.
2. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘P’ port on the front operating valve to the pressure port on the pump.
3. Fabricate, terminate, and connect a hydraulic hose to reach from the free end of the ball valve on the front cylinder to the blind end of the front axle lock-up cylinder.
4. Fabricate, terminate, and connect a hydraulic hose to reach from the free end of rod end on the opposite front cylinder to the rod end of the front axle lock-up cylinder.
5. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘T’ port on the front operating valve to the ‘P’ port on the rear operating valve. Route this hose along the vehicle frame. Ensure the routing of this hose does not interfere with equipment mounted to the vehicle.
6. Fabricate, terminate, and connect a hydraulic hose to reach from the lower port on the rear operating valve to the free end of the D1 port on the rear cylinder check valve.
7. Fabricate, terminate, and connect another hydraulic hose to reach from the upper port on the rear operating valve to the free end of the D2 port on the other rear cylinder check valve.
8. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘T’ port on the rear operating valve to the tank port on the pump. Route this hose along with the previously installed hose. Ensure the routing of this hose does not interfere with equipment mounted to the vehicle.
9. Ensure that none of the installed hoses contact any sharp edges or hot surfaces. Secure all hoses in place with tie-wraps. Ensure there is enough slack in the hoses for the railgear and lock-up to function. Where necessary, fasten the hoses to the frame with ‘P’ clips. Hose clips, tie-wraps and related hardware are supplied by the installer



MANUAL ADDENDUM

MA #: MI0019-B-MA05

Date: June 20, 2003

AFFECTED MANUAL / RAILGEAR

Railgear Model: R-650 w/ Rotary Rear Railgear

Manual #: M-0019 Rev B

Affected Page(s): N/A

Addendum Information:

Some railgear equipped vehicles with Anti-Lock Braking Systems (ABS), where the front vehicle tires are raised off the rails in rail travel mode, may register an ABS fault code during rail travel and fail to reset or re-activate when returned to normal road travel mode. The ABS light may remain lit and the ABS may remain de-activated until the ABS is reset. This can cause a dangerous situation during braking.

To avoid this situation, Rafna Industries suggest using an ABS de-power kit (Rafna part number HR K-OXXXXXABS) which includes two 30 Amp relays (which may or may not be required, depending on the vehicle manufactures recommendations), a limit switch with an adjustable roller lever, a bracket, and a weld-on cam and necessary mounting fasteners. Due to variations in truck models, it is recommended that the installer contact the vehicle manufacturer's technical service center or body builder center to obtain detailed instructions on how to wire the Rafna components into the vehicles ABS system for safe rail and road travel. Manufacturers have this information available. The installer can contact Rafna's service department for manufacturer's contact names and numbers if needed. The installer is responsible for supplying any other necessary components such as wire, terminals, connections, etc. The switch connection should be sealed water tight.

The supplied kit is fully adjustable to fit most applications. The switch has normally open and normally closed terminals. The switch head can be removed and rotated around the switch in 90° increments. The switch lever can be adjusted in length and 360° about the switch shaft. The switch can be mounted on the bracket in many different positions. The bracket can be welded to or bolted to the vehicle frame in a vertical or horizontal position on either side of the vehicle frame. See figure 1 for some suggested installation arrangements.

A Global Railway Industries Company

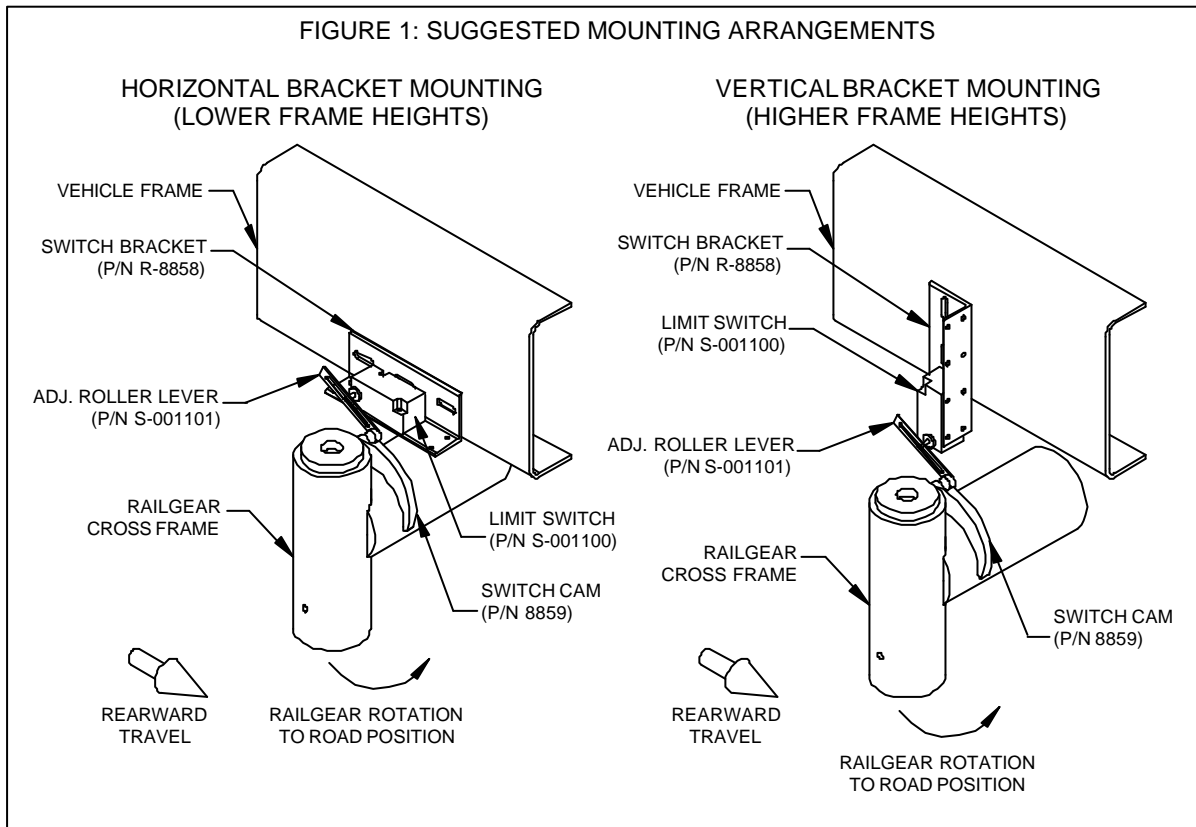
The cam must be stitch welded to the railgear cross frame so that, with the switch installed and adjusted, the switch is actuated when the railgear is deployed from the road position. Ensure the cam is positioned so the roller lever is in contact with the cam throughout the full rotation of the railgear.

The following table lists the supplied parts:

Table 1: ABS De-Power Kit Parts

Part Number	Description	QTY
S-001100	Limit Switch	1
S-001101	Adjustable Roller Lever	1
R-5690-2	30 Amp Relay	2
R-8858	Switch Bracket	1
R-8859	Switch Cam	1
	3/8" UNC Gr. 8 Bolt x 1.5" long	3
	3/8" SAE Washer	6
	3/8" UNC Gr. 3 Nylock Nut	3
	#10-32 UNF Screw x 2" Long	2
	#10 Washer	4
	#10-32 UNF Nylock Nut	2

The following figure shows some suggested mounting arrangements:



MANUAL ADDENDUM

MA #: MI65-0-MA06

Date: December 5, 2002

Affected Manual / Railgear

Railgear Model: R-650

Manual #: MI-0019B

Affected Page(s): Section 2 page 2-12

Addendum Information:

This addendum updates the front axle lock-up assembly and installation procedure in the R-650 installation manual. In some cases, the lock-up hooks will hang too low to properly engage the vehicle suspension. In this instance, shims should be added between the lock-up brackets and the lower flange of the vehicle frame. This will raise the lock-up brackets to allow for proper operation and adjustment of the lock-up hooks.

This procedure should replace the one currently in manual MI-0018B.

6.1 International Series 4900, Ford F-800, Freightliner FL 70 Series, Sterling L 7500 Series & GMC C-Series Front Axle Lock-up Installation

This procedure covers the installation of the front axle lock-up assembly on specific vehicles. The vehicle should be in the typical road position, and vehicle equipped with the permanently attached load and any normally carried non-attached load. The hardware required for this installation is listed in table 2-6.

Table 2-6: Front Axle Lock-up Installation Hardware

Part Number	Description	QTY
R-6708	Front Axle Lock-up	1
R-6610C	Stopper (3/8" x 3/8" x 2 1/2" Long Square Bar Stock)	2
	3/8" UNC Gr. 8 Bolt, 2" Long	2
	3/8" SAE Washer	4
	3/8" UNC Gr. 8 Nylon Insert Lock Nut	2
	1/2" UNC Gr. 8 Bolt, 2 1/4" Long	4
	1/2" Gr. 8 Washer	8
	1/2" UNC Gr. 8 Nylon Insert Lock Nut	4
Not Supplied	Shim Material	As Req'd

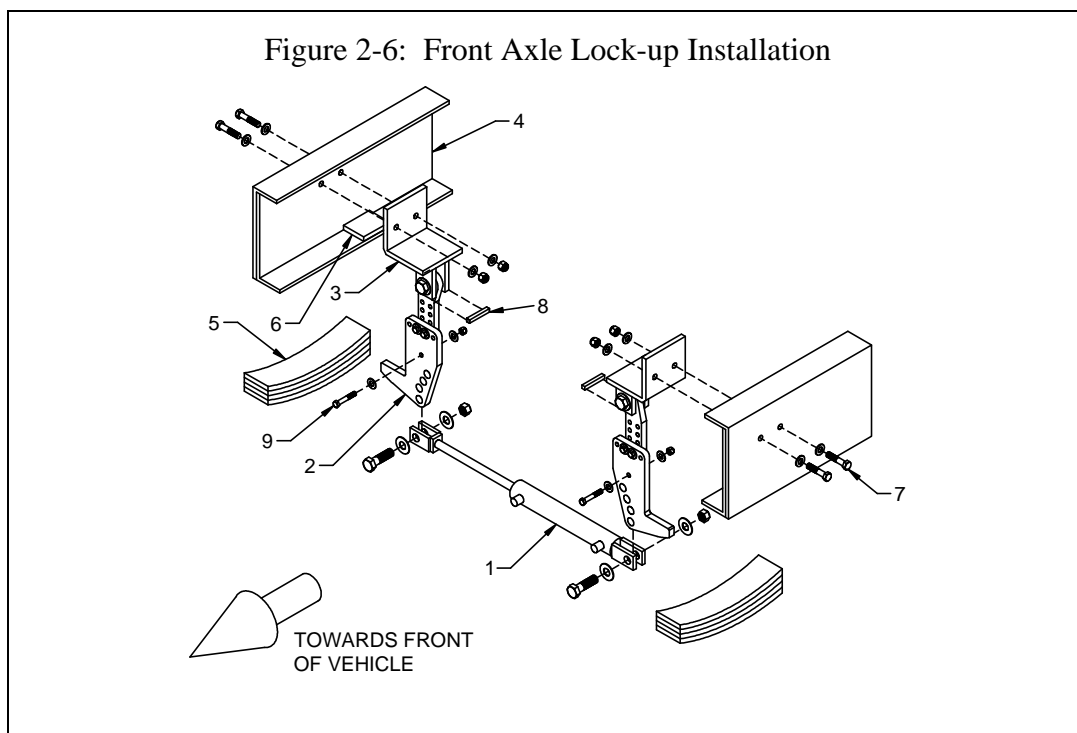
The following procedure details the front axle lock-up installation (refer to figure 2-6):



- **In many cases, the frame is treated, and care must be taken when drilling or welding to the frame. Before drilling or welding to the frame, consult the appropriate body builder's book for the particular type of vehicle being fitted, and follow their recommendations.**

1. The front axle lock-up is shipped assembled. To ease installation on the vehicle, it is recommended to be partially disassembled. Remove the hydraulic cylinder (item 1) from the lock-up hooks (Item 2). Identify the removed hardware for re-installation.
2. Position the front axle lock-up brackets (Item 3) and hooks on the inside of the frame (Item 4). The hooks should hang down about 2 ½" behind the vehicle's front axle. For Freightliner FL 70 Series trucks, and other trucks with limited space behind the front axle, the hooks should hang down about 2 ½" **ahead** of the vehicle's front axle. Ensure the hooks will engage and clear under the vehicle's springs (Item 5) by about ½". It may be necessary to adjust the hooks on the hook extensions to achieve this clearance. If the hooks are at the top-end of their adjustment, the axle lock-up brackets may be shimmed upwards. Use suitably sized shim material (Item 6) to raise the brackets on the vehicle frame. Raise both front axle lock-up brackets by the same amount. The hooks can also be moved in or out on the hook extensions to get a better fit.
3. Clamp the front axle lock-up brackets, with the shims, where applicable, in place. Ensure the front axle lock-up hooks swing freely, and do not interfere with any vehicle components (i.e. steering linkages, tie rods, etc.). Fully turn the front wheels in both directions to ensure there is no interference between the front axle lock-up and the vehicle.
4. Re-install the front axle lock-up hydraulic cylinder between the front axle lock-up hooks. The fittings on the cylinder should face forward. Use the previously removed hardware. Tighten, but do not torque these fasteners, as the hooks must be free to move. The cylinder should be mounted to the same hole in both hooks.
5. Retract the cylinder, and ensure the cylinder will not interfere with the vehicle components. Readjust the cylinder in the next set of holes in the front axle lock-up hooks if necessary.
6. With the brackets clamped in place, drill two $17/32$ " holes through each bracket and vehicle frame. Fasten the brackets in place with four ½" x 2 ¼" long bolts, eight ½" washers, and four ½" nuts (item 7). Torques these nuts to 100 ft-lbs.
7. If shims have been used to raise the front axle lock-up brackets on the vehicle frame, tack-weld the shims to the front axle lock-up brackets to secure them in place. **DO NOT** weld the shims to the vehicle frame.

8. With the front axle lock-up cylinder fully retracted, and the front axle hooks properly positioned, weld the two stoppers (Item 8) to the inside of the brackets to limit the inward swing of the hooks.
9. With the lock-up hook height properly adjusted; drill a $\frac{7}{16}$ " hole in the hook. Use the lowest hole on the hook extension as a guide. Secure in place with a $\frac{3}{8}$ " x 2" bolt, two $\frac{3}{8}$ " washer, and one $\frac{3}{8}$ " nut (Item 9). Repeat for the other hook. Torque these fasteners to 40 ft-lbs.



MANUAL ADDENDUM

MA #: MI65-0-MA07

Date: December 5, 2002

Affected Manual / Railgear

Railgear Model: R-650
 Manual #: MI-0019B
 Affected Page(s): Section 3, Part 2

Addendum Information:

This addendum updates the hydraulics installation procedure in the R-650 installation manual. Railgear are now being fitted with “O”-Ring Boss (ORB) operating valves and lock valves.

2.1 Hydraulic System Installation with “O”-Ring Boss (ORB) Operating Valves and ORB Check Valves

This procedure details the hydraulic system installation with “O”-Ring Boss (ORB) operating valves and check valves. The installation procedure is identical for all railgear and vehicle models covered by this manual. The hardware required for this installation is listed in table 3-5A.

Table 3-5A: Hydraulic System Installation Hardware

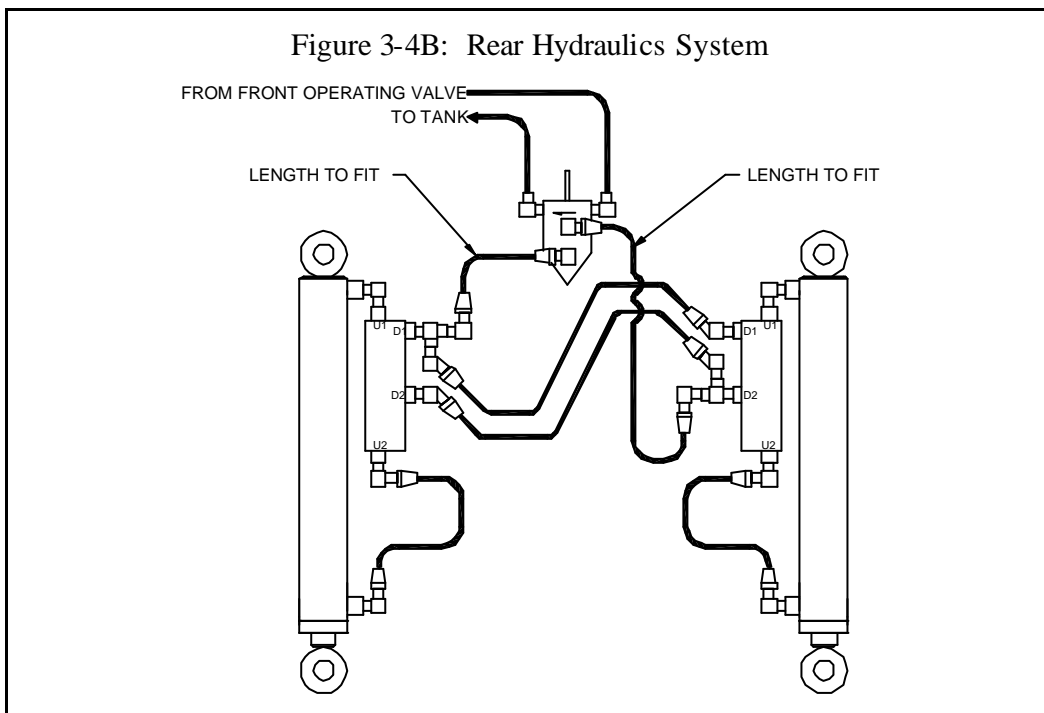
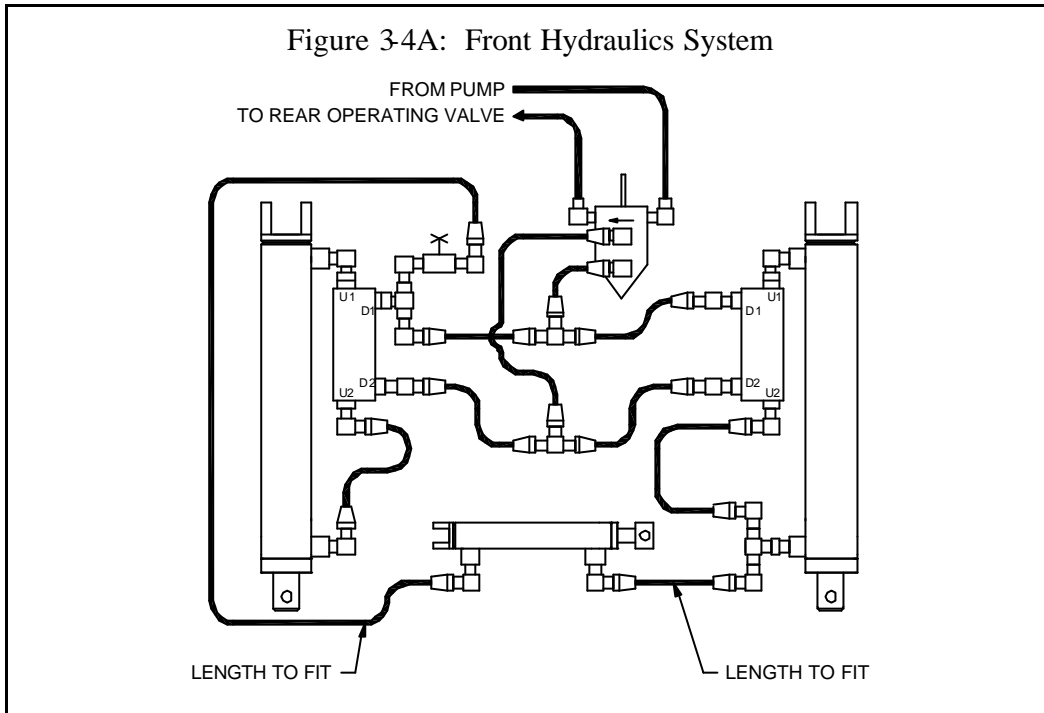
Part Number	Description	QTY
S-802020	ORB Operating Valve (Rear)	1
R-559-11	Operating Handle (Rear)	1
	Hydraulic Hose (length to fit)	As req'd
FSO XX-06	3/8” ORB Male fittings (Not Supplied, for Rear Valve)	2
FSO XX-08	1/2” ORB Male fitting (Not Supplied)	4

The PTO driven hydraulic pump should be capable of 3-5 GPM with 2000PSI at the railgear. Refer to figure 3-4A and figure 3-4B, or refer to the operating, parts and service addendum [MO 65-0-MA07] for a more detailed hydraulic schematic:



- When routing hydraulic hoses, ensure that the hoses do not contact any sharp edges or hot surfaces.

1. Insert installer supplied ½” ORB fittings into the ‘T’ and ‘P’ ports on the front and rear operating valves.
2. Insert installer supplied ¾” ORB fittings into the ports on the front face of the rear operating valve. Install the operating handle into the rear operating valve.
3. For the rear railgear, fabricate a bracket to mount the rear operating valve in a suitable location, within reach of the rear lock-up cable handle. Mount the bracket to the vehicle, and mount the rear operating valve to the bracket with installer supplied hardware.
4. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘P’ port on the front operating valve to the pressure port on the PTO driven hydraulic pump.
5. Fabricate, terminate, and connect a hydraulic hose to reach from the free end of the ball valve on the front cylinder to the blind end of the front axle lock-up cylinder.
6. Fabricate, terminate, and connect a hydraulic hose to reach from the free end of rod end on the opposite front cylinder to the rod end of the front axle lock-up cylinder.
7. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘T’ port on the front operating valve to the ‘P’ port on the rear operating valve. Route this hose along the vehicle frame. Ensure the routing of this hose does not interfere with equipment mounted to the vehicle.
8. Fabricate, terminate, and connect a hydraulic hose to reach from the lower port on the rear operating valve to the free end of the D1 port on the rear cylinder check valve.
9. Fabricate, terminate, and connect another hydraulic hose to reach from the upper port on the rear operating valve to the free end of the D2 port on the other rear cylinder check valve.
10. Fabricate, terminate, and connect a hydraulic hose to reach from the ‘T’ port on the rear operating valve to the tank port on the pump. Route this hose along with the previously installed hose. Ensure the routing of this hose does not interfere with equipment mounted to the vehicle.
11. Ensure that none of the installed hoses contact any sharp edges or hot surfaces. Secure all hoses in place with tie-wraps. Ensure there is enough slack in the hoses for the railgear and lock-up to function. Where necessary, fasten the hoses to the frame with ‘P’ clips. Hose clips, tie-wraps and related hardware are supplied by the installer



MANUAL ADDENDUM

MA #: MI65-0-MA08

Date: January 23, 2003

Affected Manual / Railgear

Railgear Model: R-650

Manual #: MI-0019B

Affected Page(s): Include in section 2, part 6

Addendum Information:

This addendum updates the R-650 installation manual to include the front axle lock-up assembly and installation procedure for “International Series 4200, 4300” vehicles, model year 2003, with tapered leaf front suspension. The hydraulics for the front axle lock-up are also detailed in this addendum.

This particular design ties into two engine mounts. Care must be taken when loosening these bolts, as to not shift the engine position. These fasteners are changed with Rafna supplied bolts. Instead of the hook engaging under the spring, a tab is bolted in place, and the hook engages the tab.

This addendum supersedes manual addendum MI65-0-MA04

6.3 INTERNATIONAL 4200 & 4300 SERIES TAPERED LEAF SUSPENSION FRONT AXLE LOCK-UP INSTALLATION

This section covers the installation of the front axle lock-up for International Series 4200 & 4300 vehicles with tapered leaf front suspension. The hardware required for this installation is listed in table 2-8.

Table 2-8: Front Axle Lock-Up Installation Hardware

Part Number	Description	Qty
R-6901P	Front Axle Lock-up Bracket (Right Side)	1
R-6901D	Front Axle Lock-up Bracket (Left Side)	1
R-6899	Spring Catch	2
R-6898	Hook Assembly	2
R-4665	Axle Lock up Cylinder	2
R-6900 Item 5	Square Washer (1-1/2" x 1-1/2" x 1/4" Flat Bar)	10
	1/2" UNC Gr. 8 Bolt x 2-1/2" Long	6
	1/2" UNC Gr. 8 Bolt x 2-3/4" Long	2
	1/2" UNC Gr. 8 Bolt x 3-1/4" Long	4
	1/2" UNC Gr. 8 Bolt x 4" Long	8
	1/2" Gr. 8 Washer	56
	1/2" UNC Nylon Insert Lock Nut	20
	M12 Gr. 10.9 Bolt x 120mm long	4
844FS 06-06	3/8" JIC Male - 3/8" JIC Male 'T' Fitting	2
854FS 06-06	3/8" JIC Male - 3/8" NPT Male 45° Fitting	4

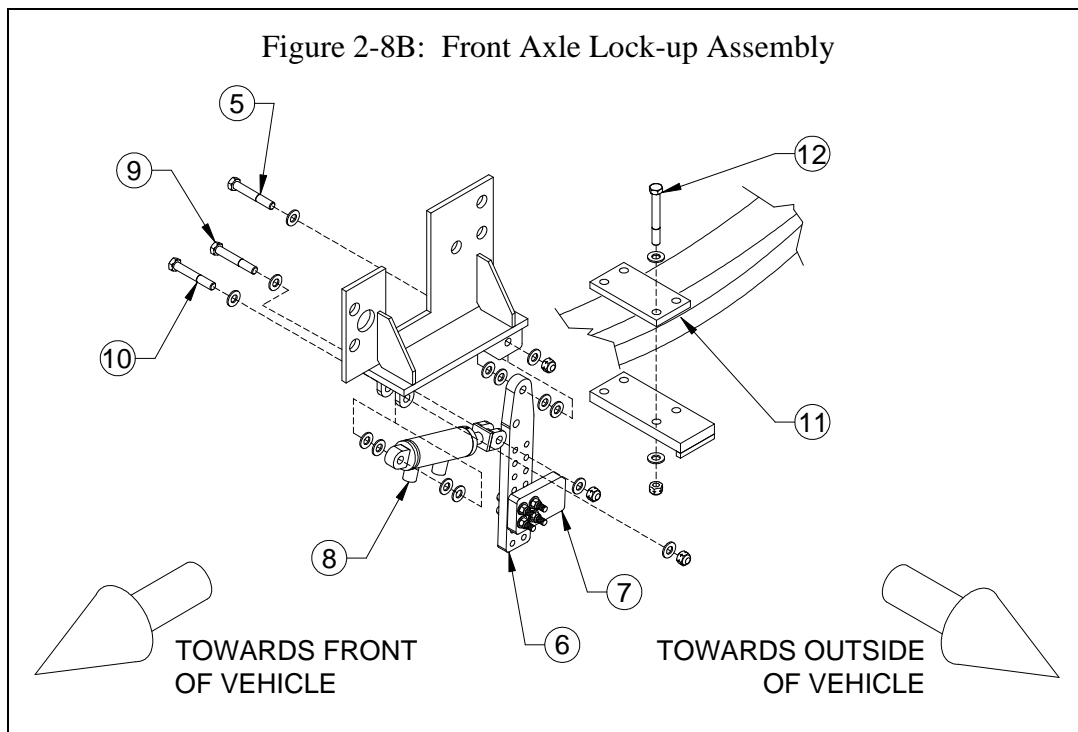
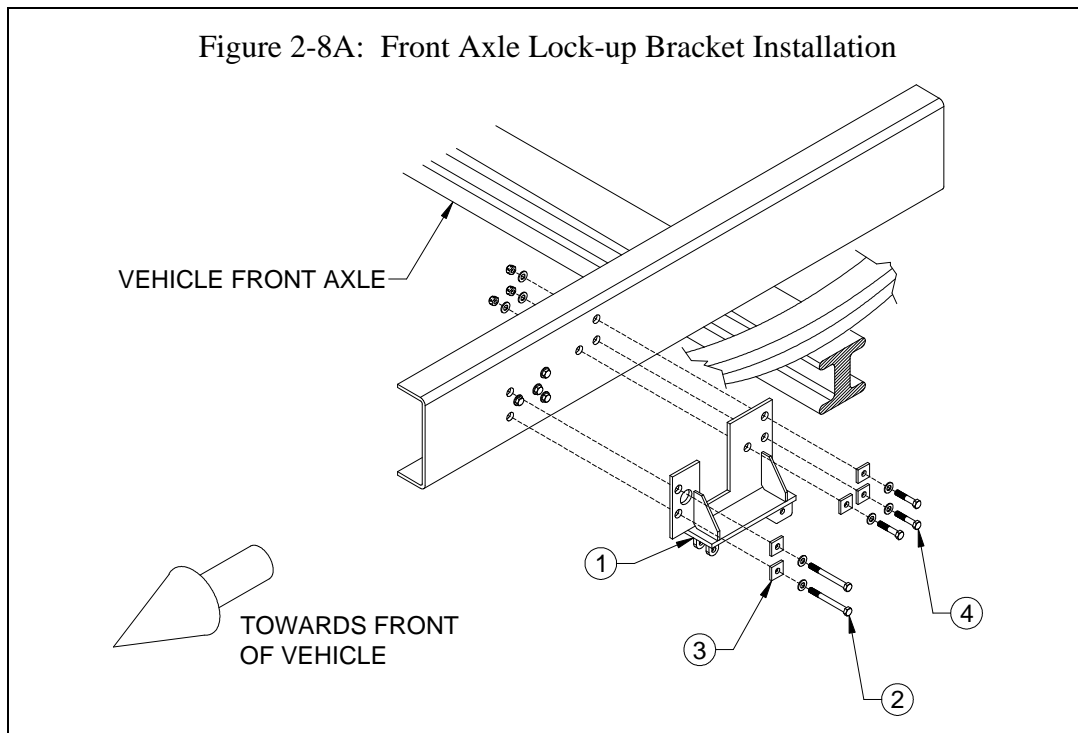
The following procedure details the front axle lock-up installation (refer to figures 2-8A, 2-8B and 2-8C):

The parts are shipped unassembled. It is recommended to perform this assembly on one side of the vehicle at a time.

1. On the left side of the vehicle, remove the three bolts securing the power steering fluid reservoir. Support the reservoir during until it is refastened to the vehicle. Move hose support bracket aside. These items will be repositioned to the same location after the truck axle lock-up bracket is installed.
2. Remove the wire clip fitted to the frame. A new position for this clip will have to be found.
3. Remove the two forward most bolts on the left side engine mount. Retain the special bracket that supports the metric nuts, and discard the metric bolts. These bolts will be replaced with longer metric bolts provided.

4. Place the lock-up bracket (Item 1) on the outside of the frame. The three holes in the rear portion should align with the holes used to secure the power steering fluid reservoir. The two forward most holes should align with the holes used to secure the engine mount. The large hole should fit over the bolt head.
5. The lock-up bracket should be tight against the underside, and the outside of the vehicle frame. Secure the bracket in place with two M12 x 120mm bolts (Item 2) and two square washers (Item 3) in the forward two holes. These longer bolts will thread into the engine mount, and secure it in place. Tighten but do not torque these bolts, as they will be torqued after final positioning and adjustments.
6. Install three ½” x 2-½” long bolts, six ½” washers, three ½” nuts (Item 4), and three square washers in the three rearward holes. Tighten but do not torque these bolts, as they will be torqued after final positioning and adjustments.
7. With one ½” x 3-¼” long bolt, six ½” washers, and one ½” nut (Item 5), fasten the lock-up hook assembly (Item 6) to the bracket. The hook (Item 7) should be on the outside of the hook assembly. Ensure there is clearance between the bolts on the hook assembly and the vehicle springs. The hook assembly can be adjusted laterally by repositioning the inside washers at the rearward bosses. Tighten but do not torque this bolt as the hook must swing freely.
8. Fasten the rod end of the cylinder to the hook assembly with one ½” x 2-¾” long bolt, two ½” washers, and one ½” nut (Item 9). Tighten but do not torque this bolt as the cylinder must be free to move.
9. Assemble the blind end of the cylinder between the two forward bosses on the lock-up bracket. The cylinder ports should point down. Use one ½” x 3-¼” long bolt, six ½” washers, and one ½” nut (Item 10) to secure it in place. The cylinder can be adjusted laterally by repositioning the four washers inside the forward bosses. Tighten but do not torque this bolt as the cylinder must be free to move.
10. Extend the cylinder. The lock-up hook assembly should hang down perpendicular to the ground. Adjust the lock-up hook up or down so the upper surface of the hook is ¾” to 1” below the lower surface of the vehicle’s suspension spring. If this is not the case, remove the four bolts securing the hook, and reposition the hook in the next appropriate set of holes, and re-install the bolts. Torque these bolts to 40 ft-lbs.
11. Bolt the spring catch (Item 11) in place. Sandwich the suspension spring between the upper and lower hook catch plates, rearward of the lock-up hook. The spring catch should be positioned forward of and as close to the shock absorber as possible. The lower plate is thicker, and longer. With the tab facing outwards, the lock-up hook should engage the tab. Use four ½” x 4” long bolts, eight ½” washes, and four ½” nuts (Item 12) to secure it in place.

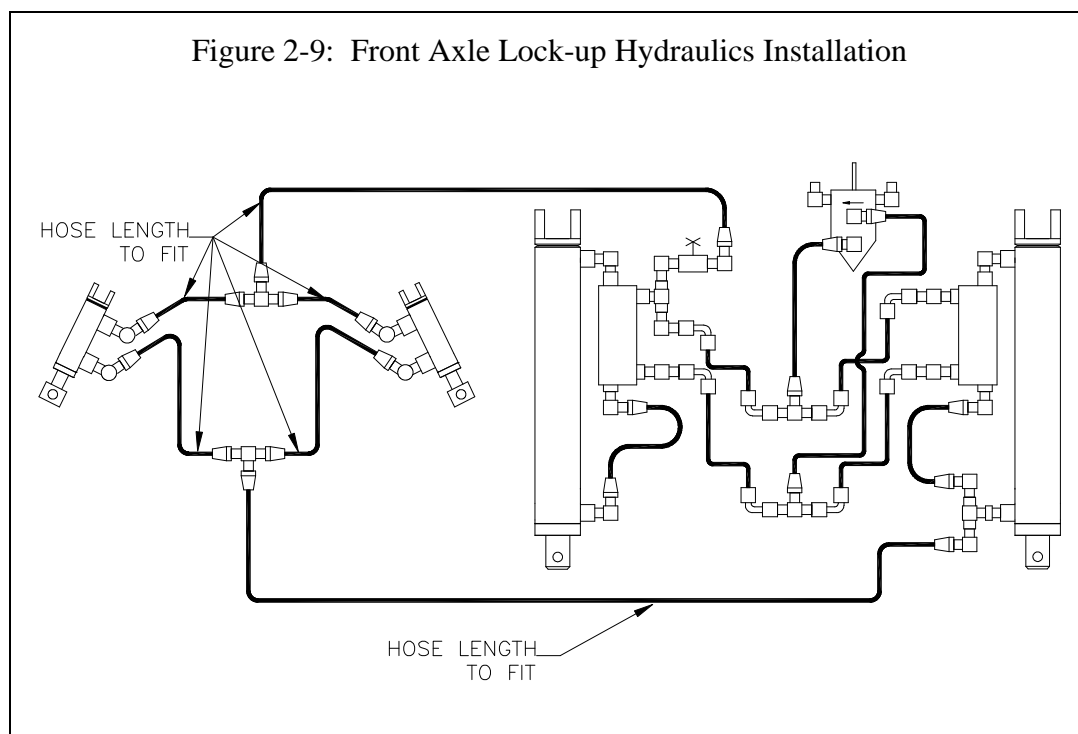
12. Repeat this procedure for the other side of the vehicle. Note: there is no power steering reservoir on the right side of the vehicle, however, there may be other optional accessories mounted in the area occupied by the bracket. Drill the bracket as required to mount the accessories. Longer bolts may be required, and should be supplied by the installer.





- When routing hydraulic hoses, ensure that the hoses do not contact any sharp edges or hot surfaces.

1. Install the 45° fittings to the hydraulic cylinders, facing forwards.
2. Fabricate, terminate and connect two hydraulic hoses to fit between the blind ends of both front axle lock-up cylinders and a supplied 'T' fitting. On the left side, ensure that the hose is routed such that it clears the steering linkages.
3. Fabricate, terminate and connect two hydraulic hoses to fit between the rod ends of both front axle lock-up cylinders and a supplied 'T' fitting. On the left side, ensure that the hose is routed such that it clears the steering linkages.
4. Fabricate, terminate and connect a hydraulic hose to reach from the 'T' fitting at the blind ends of the front axle lock-up cylinders to the free fitting on the ball valve on the front hydraulic cylinder.
5. Fabricate, terminate and connect another hydraulic hose to reach from the 'T' fitting at the rod ends of the front axle lock-up cylinders to the free fitting on the rod end of the opposite front hydraulic cylinder.
6. Secure these hoses in place with tie-wraps. Ensure there is enough slack in the hoses for the railgear and lock-up to function. Where necessary, fasten the hoses to the frame with 'P' clips. Hose clips, tie-wraps and related hardware are supplied by the installer.



MANUAL ADDENDUM

MA #: MI65-0-MA09

Date: March 7, 2003

AFFECTED MANUAL / RAILGEAR

Railgear Model: R-650

Manual #: MI-0019 Rev B

Affected Page(s): Section 3, sub-section 4 (page 3-11)

Addendum Information:

This addendum updates the Installation manual to include a safety clause in regards to optional rail wheel air brake installation.

This clause should be the first item in the 'Optional Air Brake System Installation' section of the manual. The clause should also be repeated in the 'Preparations for Operation' section of the manual.

For vehicles equipped with optimal pneumatic rail wheel brakes only:

It is the sole responsibility of the installer to ensure the vehicle and railgear pneumatic brake system comply with FMVSS-121* / CMVSS-121** regulations. The modification to the vehicle's brake system must also comply with any federal, state / provincial and local regulations. Failure to do so may impede the effectiveness of the vehicle's braking ability.

* Federal Motor Vehicle Safety Standards regulation #121

** Canadian Motor Vehicle Safety Standards regulation #121

MANUAL ADDENDUM

MA #: MI65-B-MA10

Date: June 09, 2003

Affected Manual / Railgear

Railgear Model: R-650

Manual #: MI-0019 rev. B

Affected Page(s): Pages 2-6 to 2-7

Addendum Information:

This addendum addresses the installation of the Rotating Rear Locking Hook Support Assembly Wedge.

This addendum supercedes the instructions in the Installation Manual.

3.0 ROTATING REAR RAILGEAR INSTALLATION

The installation procedure for the rotating rear railgear is identical for all vehicles covered by this manual, except where indicated. The hardware required for this installation is listed in table 2-3.

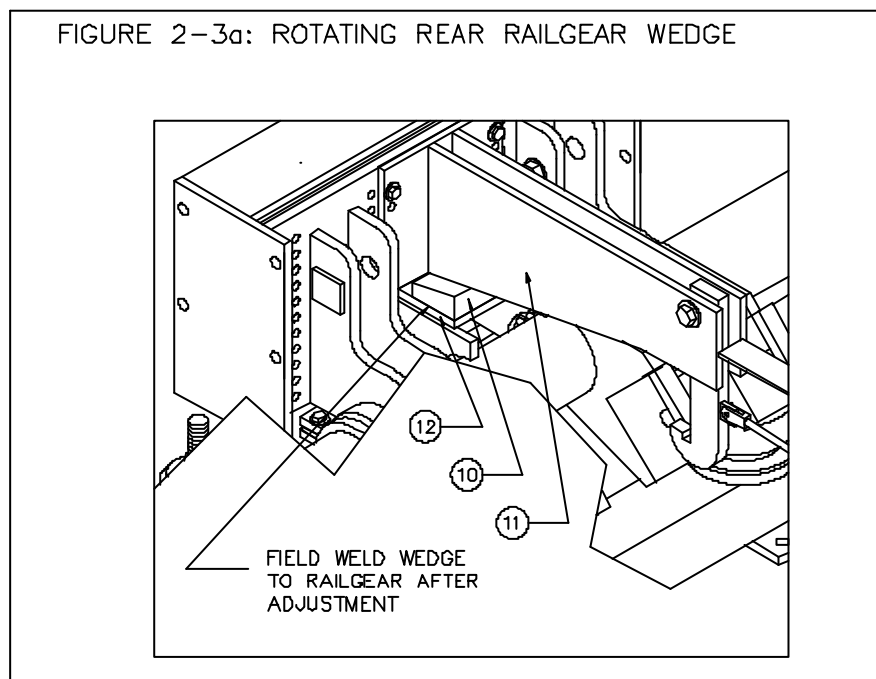
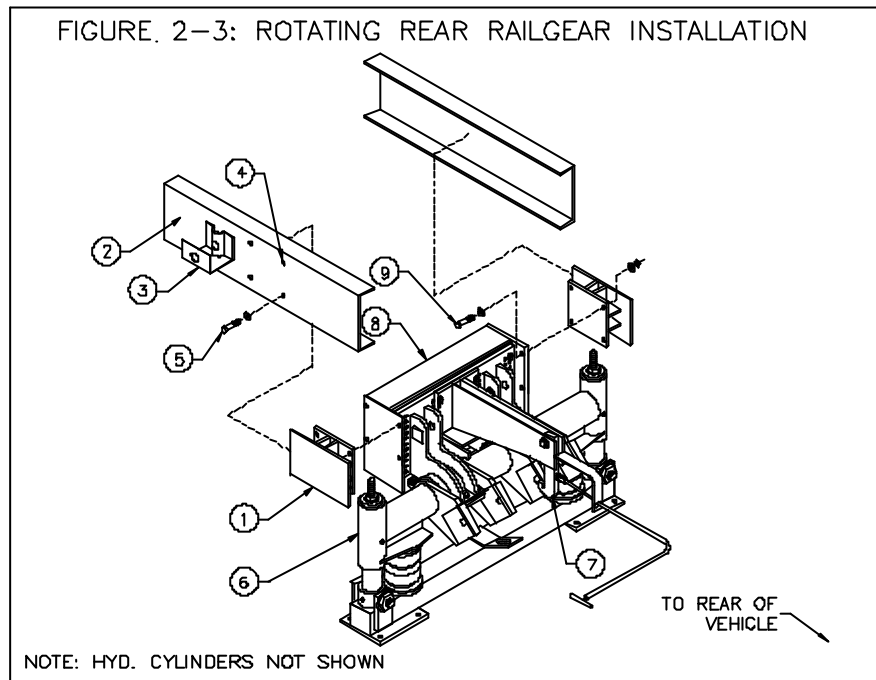
Table 2-3: Rotating Rear Railgear Installation Hardware

Part Number	Description	Qty
R-6873	Rotating Rear Railgear Assembly	1
R-6792	Mounting Bracket	2
R-6866	Locking Hook Support Assembly Wedge	1
	5/8" UNC Gr. 8 Bolt x 2.5" Long	16
	5/8" Washer	32
	5/8" UNC Nylon Insert Lock Nut	16

The following procedure details the rotating rear railgear installation:(refer to figure 2-3 and 2-3a):

1. Position the mounting brackets (Item 1) against the inside of the frame (Item 2) just behind the rear spring hanger (Item 3) and 1" above the bottom of the frame. If any cross-members are in the way, they may be removed or relocated as the railgear itself acts as a reinforced cross-member.
2. Clamp the mounting brackets to the frame such that they are level and in line with each other. Ensure that there is 26" between the inner faces of the two mounting brackets. If necessary fabricate shims and insert them between the frame and the mounting brackets to obtain the 26" measurement.
3. Drill four 11/16" diameter holes (Item 4) through the frame and each mounting bracket. Use existing holes if possible. Bolt the mounting brackets to the frame using 5/8" fasteners (Item 5).
4. Position the assembled railgear (Item 6) below the mounting brackets with the lock-up hook (Item 7) facing rearward. Jack the railgear up between the mounting brackets until the holes in the mounting plate assembly (Item 8) align with the holes in the mounting brackets. Bolt the railgear in place with 5/8" fasteners (Item 9).
5. Torque all 5/8" fasteners to 150 ft-lbs.
6. Locate and fabricate a bracket to hold the locking hook handle. Note that the lock hook handle should be located near to where the rear hydraulic operating valve will be situated.

7. The Locking Hook Support Assembly Wedge (Item 10) must be installed after the rear railgear has been installed and the rail wheel pressure adjusted. The wedge is forced in between the Locking Hook Support Assembly (Item 11) and the Adjustment Plate Assembly (Item 12), and is welded to the railgear as shown in Figure 2-3a.



MANUAL ADDENDUM

MA #: MI65-B-MA11

Date: Sept 12, 2003

Affected Manual / Railgear

Railgear Model: R-650

Manual #: MI-0019 rev. B

Affected Page(s): New Section

Addendum Information:

This addendum addresses the installation of the Manual Truck Axle Lock Up System.

MANUAL AXLE LOCK-UP INSTALLATION

The following procedure details the manual axle lock-up installation:

1. Install the Swing Arm Mounts on the vehicle frame:
 - a) Position the Frame Spacer Plate and the Swing Arm Mount against the outside of the vehicle frame as shown, just ahead of the front truck axle. There are three holes in the Frame Spacer Plate and the Swing Arm Mount. The two front holes should align with existing holes in the frame. The Swing Arm pivot hole in the Swing Arm Mount should be towards the rear of the vehicle. Clamp in place.
 - b) Position the Frame Stiffener Plate against the inside of the vehicle frame as shown, so that it aligns with the other parts. Clamp in place
 - c) Using the third (rear most) hole in the Swing Arm Mount as a guide, drill out the vehicle frame to match.
 - d) Use the specified fasteners to secure the parts to the vehicle frame through the existing and drilled holes. Torque all fasteners to specifications.
 - e) Repeat for the other side.

2. Install the Swing Arms on the Swing Arm Mounts:
 - a) Install the Swing Arm on the outside of the Swing Arm Mount as shown, with the specified fasteners. Do not torque the fasteners as the Swing Arm must be free to swing.
 - b) Install **two** springs between the Swing Arm and the Swing Arm Mount using the specified fasteners. Do not torque the fasteners as the springs must be free to articulate.
 - c) Repeat for the other side.

3. Install the Hook Plates on the Swing Arms:
 - a) There are two hole sets available to mount the Hook Plate on the Swing Arm. Position the Hook Plate on the inside of the Swing Arm as shown, with the Hook Plate pointing rearward. The hook portion of the Hook Plate should be approximately level with the top of the vehicle spring pack.
 - b) Using the appropriate hole set, secure the Hook Plate to the Swing Arm with the specified fasteners. Torque the fasteners to specifications.
 - c) Repeat for the other side. Both sides should be adjusted the same.

4. Install the Hook Reaction Pads and the Spring Clamp Bottom Plates:
 - a) Position the Hook Reaction Pad on top of the vehicle spring pack as shown, just ahead of the vehicle front axle. The piece of square bar welded to the Hook Reaction Pad should be to the outside and underside.
 - b) Position the Spring Clamp Bottom Plate under the vehicle spring pack as shown and loosely secure it to the Hook Reaction Pad with the specified fasteners.
 - c) With the Hook Plate held in a vertical position, slide the Hook Reaction Pad and Spring Clamp Bottom Plate on the spring pack so they just contact the Hook Plate. The hook portion of the Hook Plate should be under the Hook Reaction Pad with about ½” clearance. To adjust this clearance, the Hook Plate can be repositioned on the Swing Arm, the Hook Reaction Pad can be relocated below the spring pack and/or steel stock can be added to the hook portion.
 - d) Torque the Hook Reaction Pad fasteners to specification.
 - e) Repeat for the other side. Both sides should be adjusted the same.

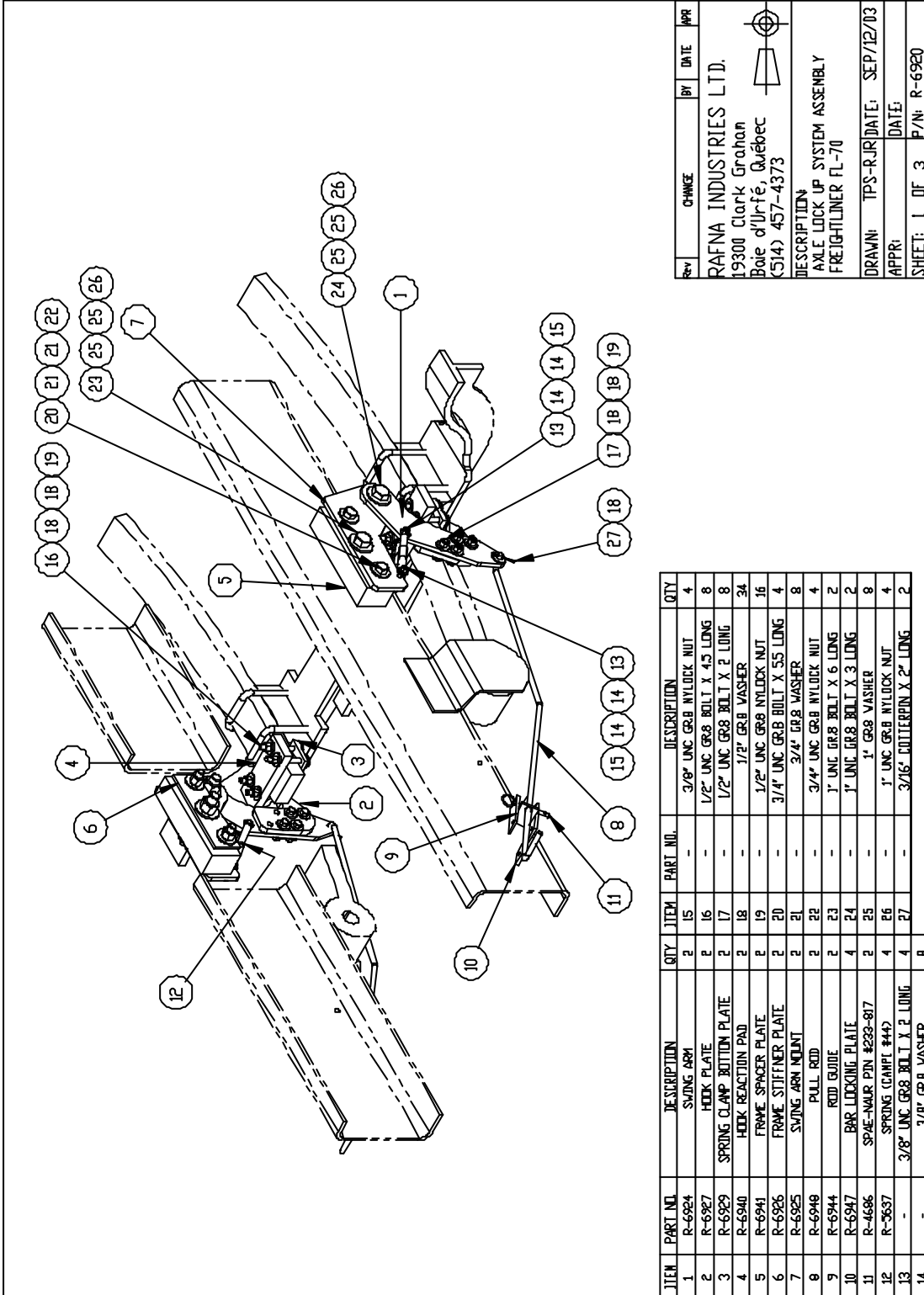
5. Install the Pull Rods on the Swing Arms:
 - a) Insert the hook end of the Pull Rod into the bottom hole on the Swing Arm as shown. The Pull Rod should be on the inside of the Swing Arm.
 - b) Secure the Pull Rod to the Swing Arm with the specified washer and cotter pin.
 - c) Repeat for the other side.

6. Install the Rod Guides on the Frame:
 - a) The Rod Guide is designed for a 34” wide vehicle frame extension. If the frame extension is wider or if there are railgear mounting plates or other equipment on the vehicle frame then each Rod Guide must be trimmed down by an equivalent amount. Once assembled, the Rod Guide should allow the Pull Rod to lay parallel to the vehicle frame.
 - b) Attach the Pin to the chain on the Rod Guide.
 - c) Insert the handle end of the Pull Rod into the Rod Guide.
 - d) Slide the Rod Guide down the Pull Rod and position the Rod Guide against the frame. With the Hook Plate engaged with the Hook Reaction Pad, the handle end of the Pull Rod should be at about 2-3” from the end of the Rod Guide. Clamp the Rod Guide to the frame. Ensure the Pull Rod will clear any obstructions by bending it to fit (apply heat to make it easier to bend).

- e) Push the Pull Rod until the Hook Plate engages the Hook Reaction Pad. Hold the pull Rod in this position.
 - f) Position a Bar Locking Plate against the Pull Rod so that the hole in the Bar Locking Plate aligns with the holes in the front side of the Rod Guide. Insert the Pin to hold it all in place. Weld the Bar Locking Plate to the Pull Rod.
 - g) Pull the Pull Rod until the Hook Plate disengages the Hook Reaction Pad and clears it by 1". Hold the Pull Rod in this position.
 - h) Position a Bar Locking Plate against the Pull Rod so that the hole in the Bar Locking Plate aligns with the holes in the rear side of the Rod Guide. Insert the Pin to hold it all in place. Weld the Bar Locking Plate to the Pull Rod.
 - i) Ensure that the Pin can be installed and holds the Pull Rod in the engaged and disengaged positions.
 - j) Repeat for the other side.
7. Ensure that the Axle Lock-Up clears all other components throughout its and their full range of motion.
 8. Paint any areas that were welded or heated.

Rafna Industries Limited

A Global Railway Industries Company



Rev	CHANGE	BY	DATE	APP
RAFNA INDUSTRIES LTD. 19300 Clark Graham Bois d'Ulfré, Québec (514) 457-4373				
DESCRIPTION: AXLE LOCK UP SYSTEM ASSEMBLY FREIGHTLINER FL-70				
DRAWN: TPS-RJR/DATE: SEP/12/03				
APPR: /DATE:				
SHEET: 1 OF 3 P/N: R-6920				

ITEM	PART NO.	DESCRIPTION	QTY	ITEM	PART NO.	DESCRIPTION	QTY
1	R-6924	SWING ARM	2	15	-	3/8" UNC GR8 NYLOCK NUT	4
2	R-6927	HOOK PLATE	2	16	-	1/2" UNC GR8 BOLT X 4.5 LONG	8
3	R-6929	SPRING CLAMP BOTTOM PLATE	2	17	-	1/2" UNC GR8 BOLT X 2 LONG	8
4	R-6940	HOOK REACTION PAD	2	18	-	1/2" GR8 WASHER	34
5	R-6941	FRAME SPACER PLATE	2	19	-	1/2" UNC GR8 NYLOCK NUT	16
6	R-6926	FRAME STIFFENER PLATE	2	20	-	3/4" UNC GR8 BOLT X 5.5 LONG	4
7	R-6925	SWING ARM MOUNT	2	21	-	3/4" GR8 WASHER	8
8	R-6948	PULL ROD	2	22	-	3/4" UNC GR8 NYLOCK NUT	4
9	R-6944	ROD GUIDE	2	23	-	1" UNC GR8 BOLT X 6 LONG	2
10	R-6947	BAR LOCKING PLATE	4	24	-	1" UNC GR8 BOLT X 3 LONG	2
11	R-4686	SPACER PIN #233-817	2	25	-	1" GR8 WASHER	8
12	R-3637	SPRING CLAMP #44	4	26	-	1" UNC GR8 NYLOCK NUT	4
13	-	3/8" UNC GR8 BOLT X 2 LONG	4	27	-	3/16" COLLIER PIN X 2" LONG	2
14	-	3/8" GR8 WASHER	8				