Wabtec Components LLC.
G&B Specialties, Inc.

MO-0018-B REV C

G&B SPECIALTIES, INC.

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MODEL R-650
"CUSHION-RIDE" RAILGEAR
OPERATING, SERVICE AND
PARTS MANUAL

"VERTICAL & ROTATING FRONT - ROTATING REAR"

READ THIS MANUAL BEFORE OPERATING
RAILGEAR EQUIPPED VEHICLE

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 operation of the railgear not included in the “body” of this manual.

Please refer to the appendix prior to operating the railgear.

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

TABLE OF CONTENTS

SECTION 1: GENERAL INFORMATION

1.0 SAFETY INFORMATION

WARNING:

- Read this manual completely before attempting operation of the railgear equipped vehicle.
- Before any maintenance or adjustments are performed under the vehicle or railgear, ensure the vehicle engine is turned off and the parking brake is set.
- Ensure that positions and functions of all railgear controls are known before attempting operation.
- 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.
- Do not operate the railgear equipped vehicle at speeds in excess of 40 km/h (25 MPH) on rail. Rail travel speed should always be in conformance with rail company regulations and should be reduce during inclement weather, passing through road crossings, switches, frogs, bridges and curves of more than 2 degrees. Curves of greater than 20 degrees should be negotiated with extreme caution. Operation of this vehicle at unsafe speeds could result in derailment.
- The railgear equipment is equipped with a safety lockout valve at each hydraulic cylinder to prevent the cylinders from retracting while on the rail. As a result of this feature, no mechanical locking system is required for the equipment in the rail position. However, when in the highway position, ensure that the railgear mechanical lockups on both the front and rear units are engaged positively before initiating highway travel.
- Note that braking distance while on track is greater then when on highway.
- The following safety precautions should be taken before vehicle is operated:

  - ✓ Visually inspect the railgear prior to use for damaged or worn parts
  - ✓ 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 these above-mentioned warnings could result in severe bodily injury and equipment damage.

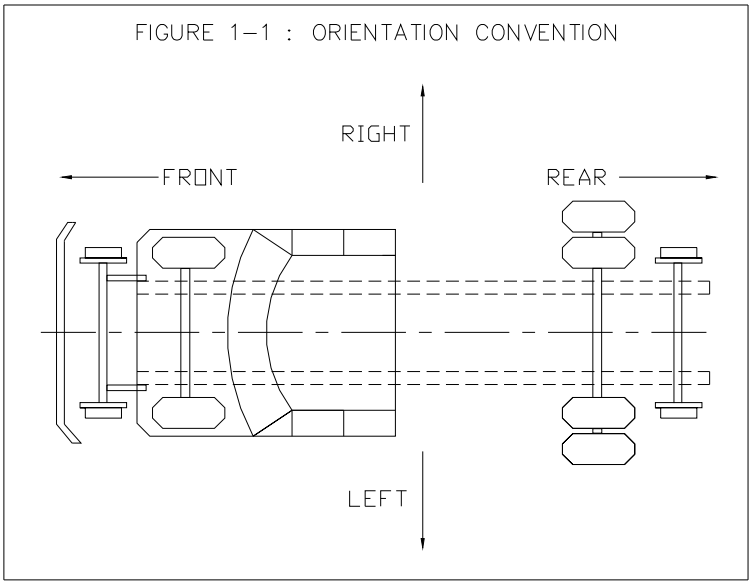
2.0 DESCRIPTION

This manual covers the operation, parts and service of the Rafna Industries R-650 vertical and rotating front railgear and rotating rear railgear as applicable to multiple vehicles. If necessary, any difference in operation, parts or service for specific vehicle and or railgear models is clearly detailed by separate instructions for each. Otherwise, the operation, parts and service instructions are the same for all models. Please refer to the appendix for the latest additions that have not been included in this manual.

The Rafna Industries R-650 railgear is a hydraulically operated road-to-rail conversion system applicable to vehicles of up to 39,000 lbs. G.V.W.R. The front unit is a frame mounted system that is hydraulically raised and lowered vertically or rotationally, depending on the model. The rear unit is also frame mounted and it is raised and lowered rotationally through hydraulics. The hydraulic power may be supplied either by the vehicle's own system (PTO) or an auxiliary electrical hydraulic pump. During highway travel, the front and rear railgear units are mechanically locked in position. During rail travel, hydraulic check valves on each cylinder lock the railgear in place and an additional hydraulic hook system holds the vehicle's front tires above the rail to avoid any contact with obstructions. A steering wheel lock system keeps the vehicle's front wheels straight during rail travel. The railgear's spring suspension system ensures constant wheel to rail contact and a comfortable ride. On-rail propulsion is provided by the vehicle's rear tires' contact with the rail. On-rail braking is accomplished through the vehicle's original braking system as well as optional air operated brake systems on each railgear unit.

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

FIGURE 1–1 : ORIENTATION CONVENTION



3.0 WARRANTY

G&B Specialties, Inc.,
Limited Warranty

G&B Specialties' warranty covers a period of TWELVE (12) months after the date of the railgear's entry into service. The warranty asserts that each new railgear sold will be free from defects in material and workmanship under normal use and service. G&B's obligation under this warranty is limited to repairing or replacing at its factory, or other locations as designated by the company. Any defective part or parts must be returned within 30 days of the date of failure or notice of defect for factory inspection or as designated by G&B Specialties, Inc.

Equipment or parts not manufactured by G&B Specialties, but which are furnished in connection with Rafna products are covered directly and solely by the warranty of the original equipment manufacturer supplying them.

The obligation of G&B Specialties under this warranty is limited to the replacement of parts that appear to be defective after review and inspection by our firm or designated representative. This warranty does not oblige G&B Specialties to bear the Customer's cost of labor or transportation charges concerning the return of defective parts. However, if found to be defective the outbound direct ground freight on the part will be prepaid to locations within continental United States and Canada by G&B Specialties, Inc. The warranty does not cover normal wear parts such as rail wheels, guide tubes, bearings, seals, rail sweeps or responsibility for customer's claims arising from abuse, misuse, neglect, or alteration of the railgear. All claims are subject to inspection of said parts by our firm.

This warranty is in lieu of other warranties, expressed or implied, including any implied warranties of merchantability or fitness for a particular purpose and any liability for special or consequential damages.

PRODUCT IMPROVEMENT LIABILITY DISCLAIMER

G&B Specialties, Inc., reserves the right to make any changes in or improvements on its products without incurring any liability or obligation whatever and without being required to make any corresponding changes or improvements in products previously manufactured or sold.

IMPORTANT NOTICE

This warranty will be considered void if G&B Specialties' Installation instructions or Service and Maintenance schedule is not followed according to the detailed instructions contained in both our Installation Manual and our Operation and Service Manual. **Rev. date: 21/09/01**

Warranty Policies And Procedures For Installers And Customers

Installers & Customer Warranty:

To prevent unnecessary delays or misunderstandings in handling Installers' or Customers' warranty claims, it is required that all warranty requests be authorized prior to any repairs, modifications or adjustments being started.

Warranty information and authorization can be obtained from G&B Specialties - Engineering Manager or Customer Service Manager who can be contacted at 570-752-5901.

G&B Specialties' warranty will not apply if the railgear or any of its components have been modified or replaced without the written consent of the company.

Additional Billing, Installers & Customers:

If, during installation, it is found that incorrect parts have been shipped. G&B will cover all costs involved in replacing these parts and return of incorrectly shipped parts.

All warranty claims concerning short / incorrect shipment of parts or accessories must be made within 30 days of delivery.

In order to maintain control over extra or additional billing due to incorrect shipments, only the Engineering Manager or Customer Service Manager can issue a Purchase Order authorizing replacement part, shipping or work to be performed by an outside source.

Warranty Claim information and requirements:

G&B Specialties will require the following information at time of claim as well as the a properly filled out **"Warranty Claim Form"** form reference "Warranty Form v#2 04/01"

Information Required:

1) Customer Purchase Order number.
2) Rafna railgear serial number.
3) Vehicle unit number.
4) Vehicle VIN number.
5) Purchaser of Rafna railgear.
6) Date of purchase.
7) Name of end user.
8) Company requesting warranty claim.
9) Ship to Address.
10) Bill to Address.

On approval of warranty claim, and where return of parts is requested by Rafna, the Installer or Customer will issue a Purchase Order to G&B Specialties, Inc. to cover the defective parts and out bound freight for part values exceeding $50.00 US and $75.00 CDN. G&B will in turn ship all required parts pre-paid ground direct to the Installer or Customer. On receipt of claimed warranty parts, G&B or their sub supplier will inspect defective parts and if deemed warranty, a credit will be issued to the Installer or Customer. If claimed warranty parts are not received within 30 days, a credit will not be issued.

Labor Warranty and /or additional labor charges:

Either the G&B Specialties Warranty or any of G&B's sub-suppliers does not cover labor or additional labor charges such as travel.

Faulty Railgear Installations:

If a warranty claim arises due to incorrect installation by an installer who has not followed the written instructions as outlined in our manual or as trained by either G&B Specialties Customer Service or Sales Department, warranty claims will not be honored.

Parts Warranty:

G&B Specialties manufactured parts will be warranted and replaced if found to be defective due to poor materials or workmanship for up to one year from date of the railgear's entry into service. Parts not manufactured by G&B Specialties, Inc., will be covered by the Original Equipment Manufactures warranty. Based on the OEM's investigation of the warranty claim against their manufactured component their decision will stand.

WARRANTY CLAIM FORM

This form must be completed prior to starting any warranty work Warranty # War01-_____

Customer		Date	
Tel/Fax		Railgear S/N	
Vehicle No.		Vehicle VIN	
End User		Date of Purchase	
P.O. Number			
Inv. Address		Ship to Address	
Inv. Address		Ship to Address	
Inv. Address		Ship to Address	
Inv. Address		Ship to Address	

Shipping instructions:

Standard Ground	Special Air

Standard 5 day +	Select 3 day	Expedition 2-3 day	Express 2 day

Shipper: Way Bill #

PART No.	QUANTITY	DESCRIPTION

PROBLEM DESCRIPTION

_____

_____

_____

_____

Required Documentation from the Customer (For issuing Credit)

Description of Rafna Parts (Ordered or Used)	Invoice #	Total Claimed $	US/CAD

G&B SPECIALITES approved by: _____ DATE: _____

CUSTOMER'S REPRESENTATIVE: _____ DATE: _____

For Internal Use only:

Engineering		Shipping		Outside Supplier	
Manufacturing		Service		Installation	

Warranty Form #2 04/01

Updated 06/21/01

4.0 SERIAL NUMBERS

Following receipt of this manual, the serial numbers, model numbers and date of manufacture for both the front and rear railgear units should be recorded below for future reference. This information is located on the identification plates (figure 1-2) mounted on the railgear main frames.

Front Railgear Unit:

Serial Number: _____

Model Number: _____

Date of Manufacture: _____

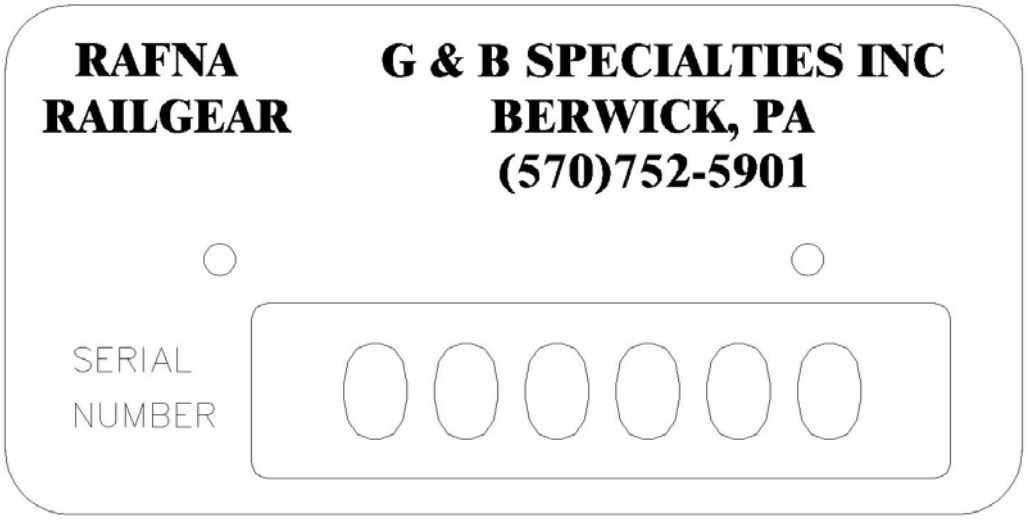
Rear Railgear Unit:

Serial Number: _____

Model Number: _____

Date of Manufacture: _____

Figure 1-2



5.0 SPECIFICATIONS

Item	Metric	SAE
Installed Weight…..……	735 Kg	1650 lbs.
Vehicle Load Rating……..	17,410 Kg	39,000 lbs.
Track Gauge……...	1435 mm	56 ½ in
Wheel Diameter……..	305 mm	12 in

SECTION 2: OPERATION

1.0 INSPECTIONS BEFORE OPERATION

Prior to each use of the railgear equipment, the following items should be inspected:

- ✓ Check for damaged or worn parts
- ✓ Check for loose wheels and/or fasteners
- ✓ Check for leaking or damaged hydraulic lines, fittings, and cylinders
- ✓ Check for leaking or damaged air lines and fittings
- ✓ Check for proper lubrication at specified intervals
- ✓ Check for proper brake operation

Also, the operator should ensure that the vehicle is in good operating condition by following the vehicle manufacturer's operating guide.

WARNING:

Following the accumulation of the first eight (8) hours of rail travel, an initial wheel bearing inspection and verification of sufficient wheel bearing grease should be performed. During this time period, the wheel bearings will have seated themselves and may require adjustment of endplay. If the endplay is not in accordance with specifications of 0.005", bearing failure could occur and would not be covered under the Rafna Industries Warranty. Refer to the Service section of this manual for wheel bearing adjustment procedures.

On newly applied railgear equipment, ensure that the railgear and guide wheel alignment procedure is performed before operation of the equipment. Note that excessively worn guide wheels, vehicle pulling to one side while on the rail, and vibrations through the vehicle while on the rail are indicators of misaligned railgear or guide wheels. If any of these situations are encountered, proceed to perform the alignment procedure as described in the Service section of this manual as soon as possible to avoid damage to the equipment and vehicle.

2.0 PLACING VEHICLE ON THE TRACK

WARNING:

- Operating instruction provided below only address the Rafna railgear equipment. Applicable railway company procedures and policies must be adhered to.
- At level rail crossings, ensure that no other vehicles are approaching and flag the crossing to ensure safety.
- Understand equipment operation before operating equipment.
- Hydraulic oil pressure from the hydraulic pump should not exceed 2000 PSI.

1. At a suitable location, drive the vehicle past the rail crossing and reverse onto and parallel to the rails while aligning the rear railgear unit guide wheels directly over the rails. At this point the front railgear unit guide wheels should be somewhat aligned over the rails.

2. Place the vehicle automatic transmission in "PARK" (manual transmission in "NEUTRAL") and apply the parking brake. Energize the hydraulic system by turning on the illuminated rocker switch mounted on the dashboard. The rocker switch light should come on at this point but the hydraulic pump should not run yet. The hydraulic pump is an intermittent duty pump which will only run while holding down the pump start button on the front or rear mechanical operating valves. Some vehicles may utilize a PTO driven hydraulic pump in which case the PTO must be engaged.

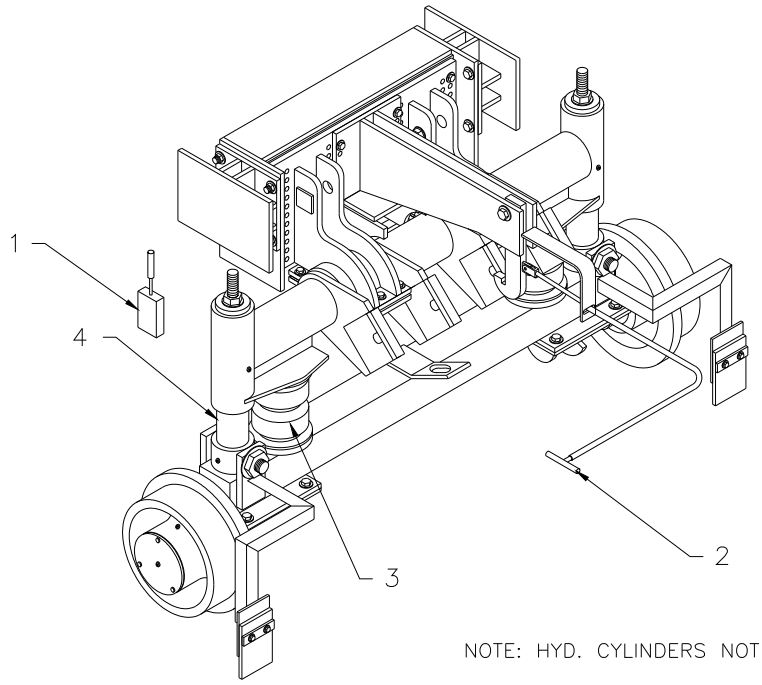
3. Note that in order to align the front railgear guide wheels directly over the rails, the rear railgear must be deployed first, then the vehicle is reversed until the front is aligned.

4. Lower the rear railgear unit: (refer to figure 2-1)

   a) Raise the railgear out of the mechanical locking system by pushing the pump start button and selecting the "UP" position on the rear operating valve (1).
   b) Release the mechanical locking hook by pulling the locking cable handle (2).
   c) While holding the hook in this position, lower the railgear by pushing the pump start button and selecting the "DOWN" position on the rear operating valve.
   d) Release the locking cable handle once the railgear has rotated below the locking hook.
   e) Note that while the railgear is taking some of the vehicle's load, the railgear suspension (3) should be observed compressing. If this is not the case, check for adequate lubrication. If the inner tubes (4) are not free to move, the spring suspension will not work correctly.

f) Continue lowering the railgear until the hydraulic cylinders are fully extended. In this position, the railgear should be about five degrees over center.
g) Release the pump start button and operating valve handle.
h) The hydraulic check valves automatically lock the railgear in this position.

FIGURE 2–1: ROTATING REAR RAILGEAR UNIT



5. Lower the front railgear unit: (refer to figure 2-2 for vertical front railgear and figure 2-3 for rotating front railgear)

a) With the rear railgear unit correctly deployed onto the rails, reverse the vehicle until the front railgear guide wheels are directly over the rails.
b) Place the vehicle's automatic transmission in "PARK" (manual transmission in "NEUTRAL"), apply the parking brake, and re-engage the hydraulic system if required.
c) Raise the railgear out of the mechanical locking system by pushing the pump start button and selecting the "UP" position on the front operating valve (1).
d) Release the mechanical locking hook from the locking position by moving the locking handle (2) rearward and down (vertical front railgear) or up (rotating front railgear). The locking handle is then locked in this position by moving it forward to catch on the handle collar.
e) Open the ball valve (3) to allow the axle locking hooks to engage under the vehicle's suspension.
f) Lower the railgear by pushing the pump start button and selecting the "DOWN" position on the front operating valve.

g) Note that while the railgear is taking the vehicle's load, the railgear suspension (4) should be observed compressing. If this is not the case, check for adequate lubrication. If the inner tubes (5) are not free to move, the spring suspension will not work correctly.
h) The axle lock-up hooks should engage the front axle springs and then the railgear moves vertically down into position on the rails until the hydraulic cylinders (6) are fully extended.
i) The hydraulic check valves automatically lock the railgear in this position.
j) Release the pump start button and the operating valve handle.
k) Close the ball valve to keep the vehicle axle locking hooks engaged.
l) Ensure that the railgear correctly contacts the rails, that the vehicle front tires are a minimum of 3" above the rails, and that the axle lock-up hooks are engaged before proceeding.

FIGURE 2–2: VERTICAL FRONT RAILGEAR UNIT

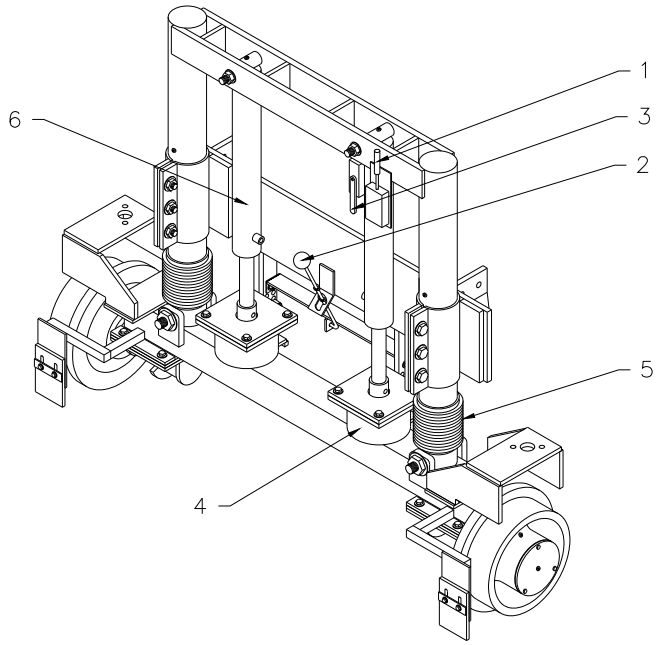
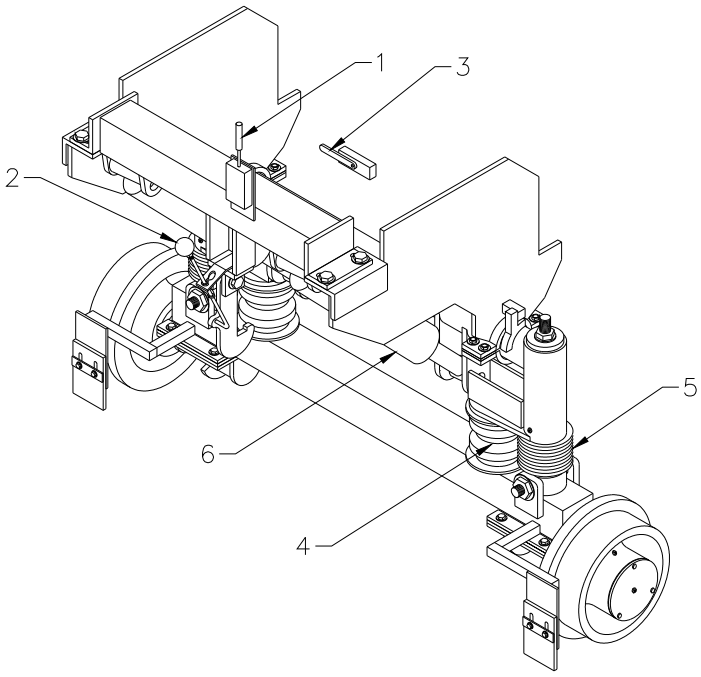


FIGURE 2–3: ROTATING FRONT RAILGEAR UNIT



6. De-energize the hydraulic pump (PTO or electrical).

7. Engage steering wheel lock system:

   On GMC C-Series Vehicles: (refer to figure 2-4)

   a) Turn the steering wheel (1) until the front tires are pointing straight ahead.
   b) Flip the steering lock latch (2) over to engage the steering wheel lock stopper (3).
   c) Ensure that the steering lock prevents the steering wheel from turning.

   On All Other Vehicles: (refer to figure 2-5 for International 4900 Series and GMC T-Series, figure 2-6 for Ford F-800, and figure 2-7 for Freightliner FL70 and Sterling L7500).

   a) Turn steering wheel (1) until front tires point straight ahead.
   b) Insert steering lock bracket (2) into steering column brace (3).
   c) Ensure that steering lock engages steering wheel webs.
   d) Insert locking spring pin (4) through the steering column brace and the steering lock bracket.

FIGURE 2–4: GMC C–SERIES STEERING LOCK

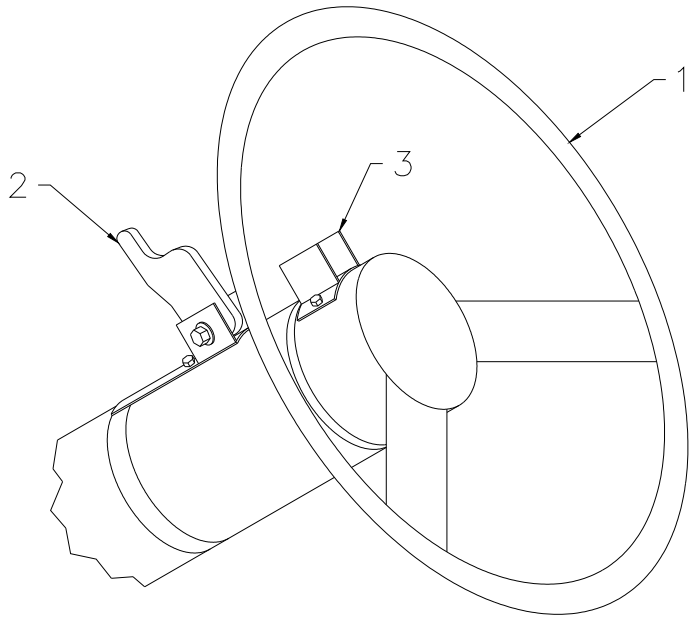


FIGURE 2–5: INTERNATIONAL & GMC T–SERIES STEERING LOCK

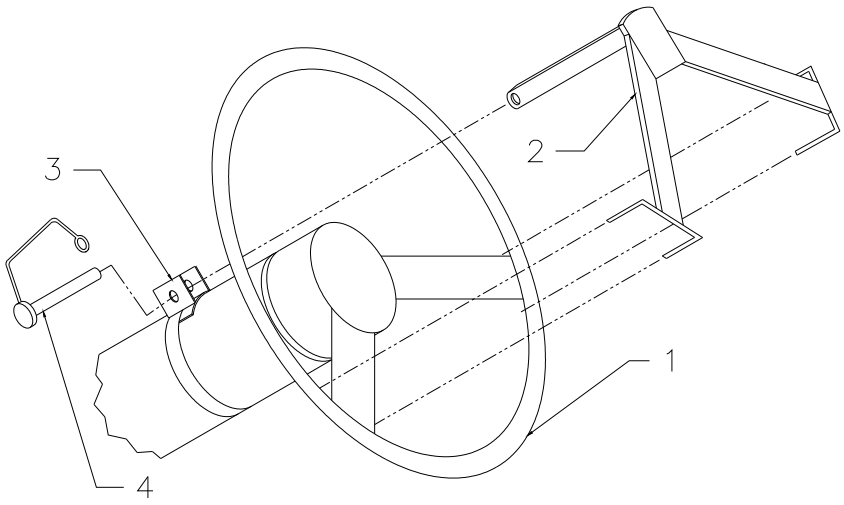


FIGURE 2–6: FORD F–800 STEERING LOCK

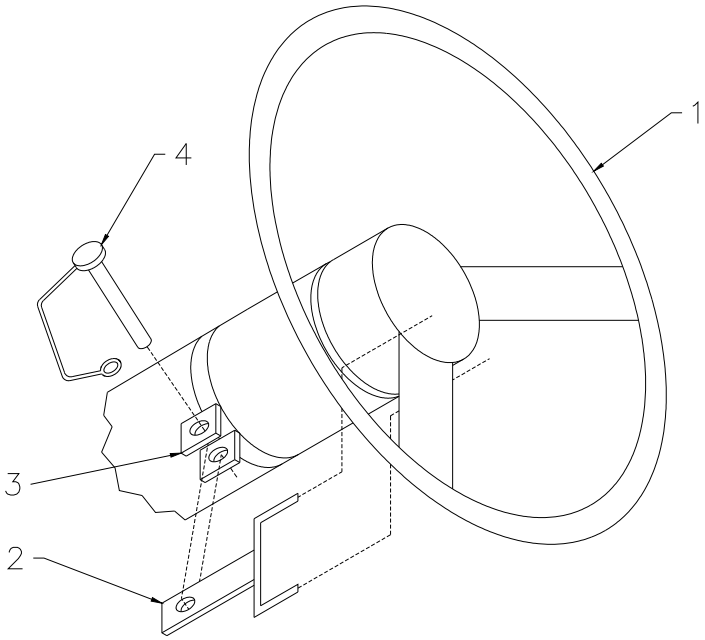
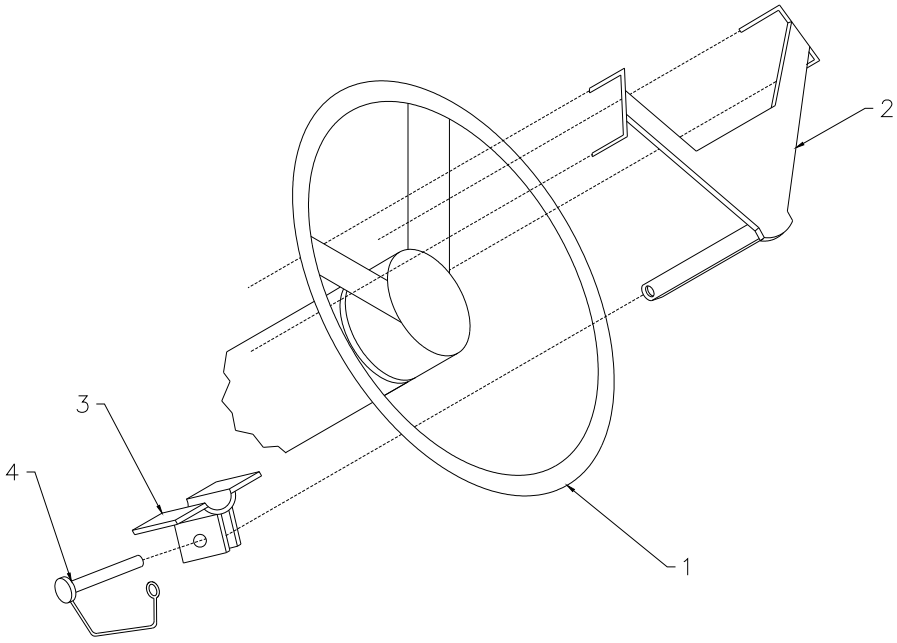


FIGURE 2–7: FREIGHTLINER FL70 STEERING LOCK



3.0 TRAVELING ON RAIL

Before proceeding to travel on the rail, ensure that the hydraulic pump has been disengaged (PTO or electrical) and that the steering wheel lock has been engaged with the front wheels pointing straight ahead.

WARNING:

- Do not operate the vehicle in excess of 40 km/h (25 MPH) on the track. Railroad rules governing on rail travel must be observed at all times.
- Do not operate vehicle on the track if clearance between the front vehicle tires and the rail is less than 3 inches.
- Do not operate vehicle on the track if load exceeds the maximum load rating of the railgear.
- Steering lock must be engaged at all times while on the track

The vehicle may now be driven as if on the highway, however speed must be reduced. Note also that braking distance is increased while on the track.

4.0 BRAKING ON RAIL

This railgear equipment provides for the transmission of vehicle's braking power through the vehicle's rear tires' contact with the rails, identical to as if on the highway. On rail braking is also assisted by the optional Rafna Industries air brake package which operates with the vehicle's original air brake system and applies braking force to the front and/or rear railgear wheels.

The optional railgear brakes activate simultaneously with the vehicle's standard brakes when pressure is applied to the vehicle brake pedal. The railgear brakes release as soon as pressure is removed from the brake pedal.

It is important to apply the brakes gradually in order to avoid locking up the vehicle tires and the railgear wheels. Note also that stopping distance while on the track is greater than when on the highway and braking ability will be adversely affected during inclement weather.

5.0 REMOVING VEHICLE FROM THE TRACK

WARNING:

- Operating instruction provided below only address the Rafna Industries railgear equipment. Applicable railway company procedures and policies must be adhered to.
- At level rail crossings, ensure that no other vehicles are approaching and flag the crossing to ensure safety.
- Understand equipment operation before operating equipment.
- Hydraulic oil pressure from hydraulic pump should not exceed 2000 psi.

1. Approach a level crossing or other suitable location, and prepare to remove the vehicle from the track by placing the automatic transmission in "PARK" (manual transmission in "NEUTRAL") and applying the parking brake.

2. Energize the hydraulic system by turning on the illuminated rocker switch mounted on the dashboard. The rocker switch light should come on at this point but the hydraulic pump should not run yet. The hydraulic pump is an intermittent duty pump which will only run while holding down the pump start button on the front or rear mechanical operating valves. Some vehicles may utilize a PTO driven hydraulic pump in which case the PTO must be engaged.

3. Note that the vehicle is removed from the track by first raising the front railgear unit and then raising the rear railgear unit. Finally, the steering wheel lock is removed.

4. Raise the front railgear unit: (refer to figure 2-2 for vertical front railgear and figure 2-3 for rotating front railgear)

   a) Raise the railgear unit by pushing the pump start button and selecting the "UP" position on the front operating valve (1) until the railgear wheels are just clear of the rails.
   b) Open the ball valve (3) to allow the axle locking cylinder and hooks to disengage from the vehicle suspension.
   c) Ensure that the railgear mechanical locking hook handle (2) is in the unlocked position and continue to raise the railgear unit by pushing the pump start button and selecting the "UP" position on the front operating valve until the unit is completely raised.
   d) Close the ball valve.

e) Move the railgear mechanical locking hook handle to the locked position and then lower the railgear unit onto the locking hooks by selecting the "DOWN" position on the front operating valve without pushing the pump start button.
f) Release the front operating valve.

5. Raise the rear railgear unit (refer to figure 2-1)

   a) Completely raise the railgear unit by pushing the pump start button and selecting the "UP" position on the rear operating valve (1).
   b) Ensure that the mechanical locking hook engages the railgear axle as the railgear rises.
   c) Lower the railgear onto the locking hook by selecting the "DOWN" position on the rear operating valve without pushing the pump start button and ensure that the hook is properly seated.

6. De-energize the hydraulic pump (PTO or electrical).

7. Disengage the steering wheel lock: (refer to figure 2-4 for International 4000 Series and GMC T-Series, and figure 2-5 for Ford F-800 and GMC C-Series)

   a) Remove the locking spring pin (4) from the steering column brace (3) and the steering lock bracket (2).
   b) Pull the steering lock bracket out of the steering column brace and store it securely.
   c) Re-insert the locking spring pin in the steering column brace for safe keeping.

WARNING:

- Before proceeding with highway travel, ensure both the front and rear railgear units are securely seated in their respective mechanical locking hooks.
- Ensure that the hydraulic pump has been de-energized.
- Ensure that the front axle lock-up system has disengaged from the vehicle suspension.
- Ensure that the steering lock has been disengaged.

8. Carefully drive the vehicle off the track and onto the highway.

SECTION 3: SERVICE

1.0 REAR RAILGEAR PRESSURE ADJUSTMENT

The rear railgear wheel pressure must be adjusted to ensure sufficient traction for acceleration and braking while maintaining railwheel guidance. The pressure adjustment procedure is detailed below.

WARNING:

- Before any maintenance or adjustments are performed under the vehicle or railgear, ensure the engine is turned off and the parking brake is set.
- Do not operate the vehicle on track apart for this adjustment procedure until the alignment of the railgear is complete.

1. Place the vehicle on a level section of track with the railgear deployed as described in this manual.

2. Put the vehicle in “Park” or “Neutral”, engage the parking brake, and turn off the engine.

3. Measure the contact patch length (traction) of the vehicle rear tires on the rail head. This measurement should be between 7” and 10” long. If this is not the case, proceed to adjust as noted below, otherwise, the rear railgear pressure is within specifications.

4. **Adjust the rear railgear pressure (refer to figure 3-1):** Remove the vehicle from the track. Support the railgear and remove the eight ¾” bolts (1) that secure the railgear (2) to the mounting plate assembly (3). To increase the contact patch length, move the railgear up one set of holes and to decrease the contact patch length, move the railgear down one set of holes. Fasten the railgear to the mounting plate assembly and torque the ¾” bolts to 175 ft-lbs.

5. Retest the vehicle contact patch length on track and adjust as required.

2.0 RAILGEAR ALIGNMENT

This railgear equipment must be correctly aligned in order to perform properly and avoid excessive wear on the equipment. The rear railgear pressure should be adjusted before alignment is attempted. The railgear wheels may be aligned independently and the railgear frames may be adjusted laterally. A parallel line system or other suitable tool and the following procedure should be used to perform the railgear alignment.

WARNING:

- This procedure should be done with the vehicle parked on level ground with the front tires pointing straight ahead in order to achieve correct alignment.

- Before any maintenance or adjustments are performed under the vehicle or railgear, ensure the engine is turned off and the parking brake is set.

1. Support the vehicle on blocks such that the railgear will just touch the ground when it is lowered to the highway position. Lower both railgear units to the rail position.

2. Ensure the vehicle front tires are pointing straight ahead and engage the steering lock.

3. Set two parallel chord lines on each side of the vehicle: (refer to figure 3-2)

   Arrange the parallel lines until the distances measured between the front-most and rear-most points of the front tire rims on each side are equal (dimensions A, B, C, D) and the front-most and rear most points of the rear tire rims on each side are equal (dimensions E, F, G, H). (Note A, B, C, D may not equal E, F, G, H)

4. Railgear wheel alignment:(refer to figure 3-2 and 3-3)

   a) Secure a straightedge to the back side of each railgear wheel flange.
   b) Measure the distance between the front-most and rear-most points of each straightedge and the parallel lines (dimensions I, J, K, L, M, N, O, P).
   c) With a tolerance of 1/16”, dimensions I and J should be equal, dimensions K and L should be equal, dimensions M and N should be equal, and dimensions O and P should be equal. If this is not the case, proceed to adjust the wheel alignment. Otherwise, proceed to step 6.
   d) Loosen the four bolts (1) securing each railgear wheel spindle housing (2) to the railgear axle (3) such that the wheels are free to rotate on the horizontal plane yet snug enough to stay in place.
   e) Adjust each wheel to the centered position (dimension I, J equal, K, L equal, M, N equal and O, P equal).
   f) Re-torque the bolts to specifications.
   g) Remove the straightedges.

FIGURE 3–1: REAR RAILGEAR ADJUSTMENT

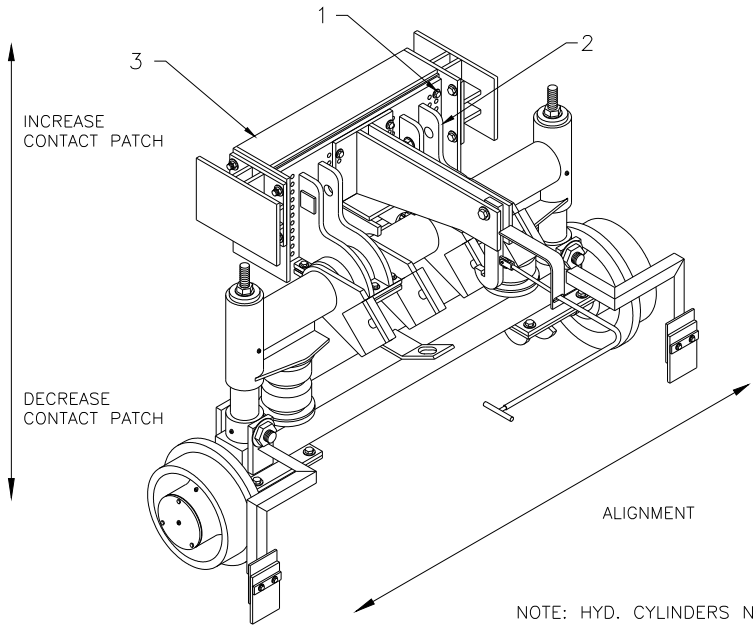
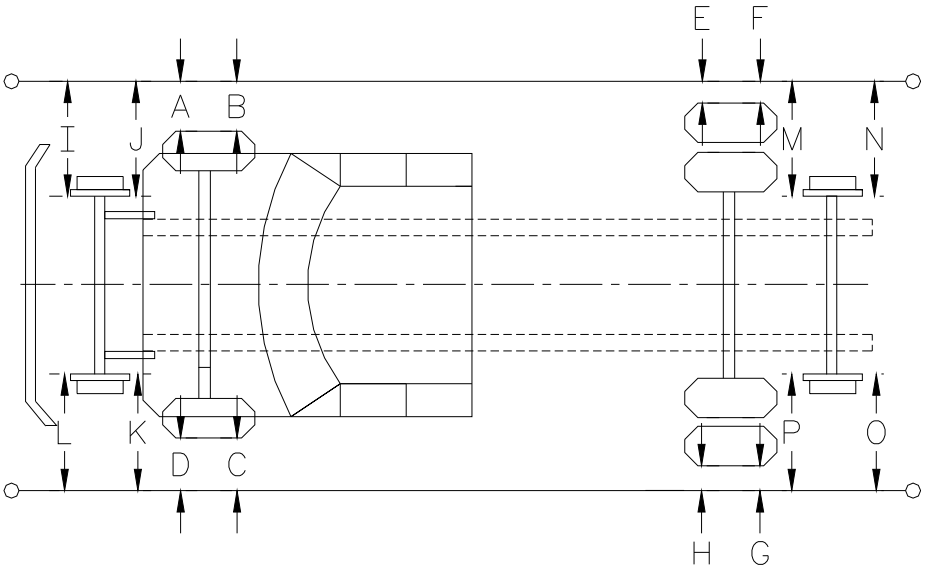


FIGURE 3–2: RAILGEAR ALIGNMENT MEASUREMENTS



5. Railgear frame alignment: (refer to figure 3-2)

   a) This adjustment allows for side-to-side alignment of the rotating railgear equipment and should only be required upon installation of the railgear and following damages to the equipment. Note the vertical front railgear is not adjustable for lateral alignment.
   b) To check the alignment of the rotating front railgear, check dimensions I, J, K, L. These measurements should be within 1/8".
   c) To check the alignment of the rotating rear railgear, check dimensions E, F, G, H. These measurements should be within 1/8".
   d) **Rotating front railgear alignment (refer to figure 3-4):** Remove the vehicle from the rails, cut off the rotational stops (1), loosen the bearing caps (2) and re-align the front cross frame (3). Re-weld the rotational stops securely to the rear cross frame snugly against the bearing housing. It is important to observe the position of these parts before removal and to ensure that the rotational stop comes into contact with the stop block (4) on the mounting bracket when the railgear is 2-3° over center.
   e) **Rotating rear railgear alignment (refer to figure 3-1):** Loosen the eight ¾" bolts (1) which secure the adjustment plate assembly (2) to the mounting plate assembly (3) and slide the railgear side to side. Once alignment is complete, re-torque the ¾" fasteners to 175 ft-lbs.

6. Remove the parallel line system.

7. Raise the railgear to the highway position and remove the vehicle from the blocks.

FIGURE 3–3: RAILGEAR WHEEL ALIGNMENT

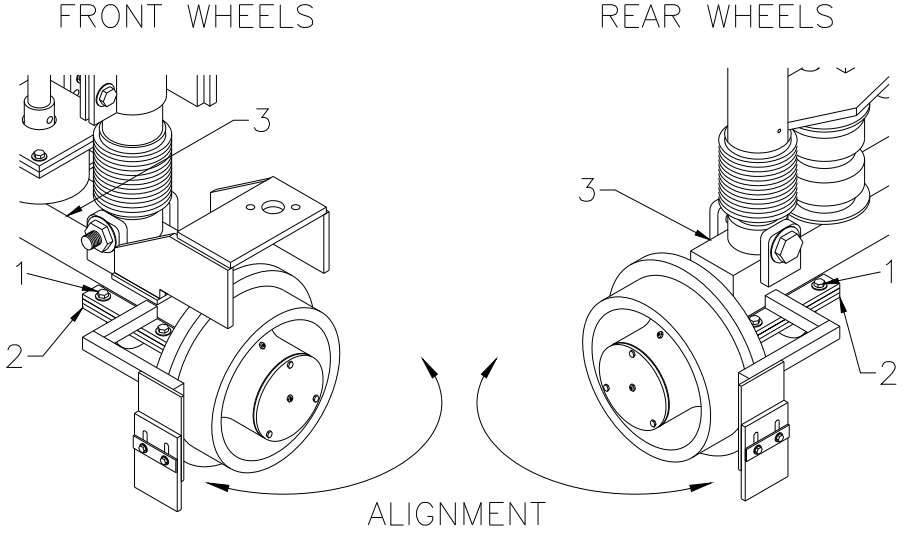
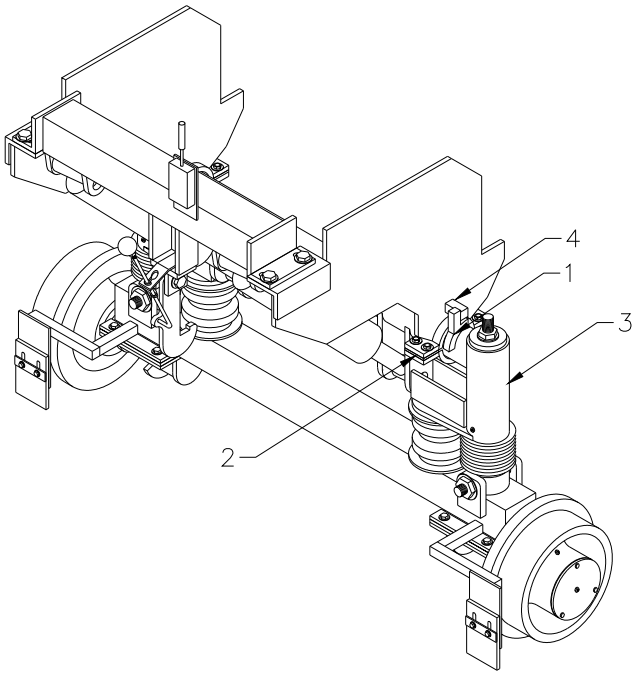


FIGURE 3–4: ROTATING FRONT RAILGEAR ALIGNMENT



3.0 WHEEL BEARING ADJUSTMENT

The front and rear railgear wheel bearings will need to be adjusted if the wheel endplay exceeds 0.005". If the bearings are not adjusted, bearing failure could occur and this would not be covered under the Rafna Industries Warranty.

Check wheel bearing end-play for each railgear wheel. Endplay should be within 0.001" to 0.005". If the endplay is not in conformance with this specification, adjust the wheel bearing as follows:

WARNING:

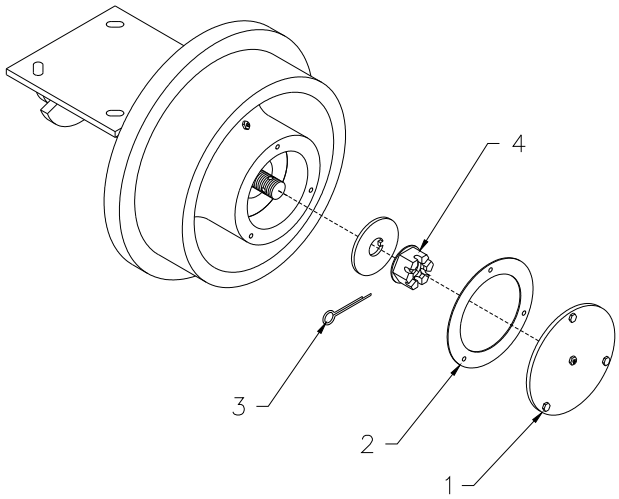
- Before any maintenance or adjustments are performed under the vehicle or railgear, ensure the engine is turned off and the parking brake is set.

1. Refer to figure 3-5.
2. Perform this procedure with the railgear in the highway position and with the railgear wheels free to turn.
3. Remove wheel hub cap (1) and gasket (2).
4. Remove spindle nut cotter pin (3).
5. While rotating the wheel forward, torque the spindle nut (4) to 20 ft-lbs.
6. Loosen the spindle nut slightly until it is "just loose".
7. Re-torque the spindle nut to 6 ft-lbs.
8. Install a new cotter pin through the spindle nut and spindle. If the cotter pin holes do not line up, tighten the spindle nut until the holes align. Do not tighten more than ½ flat of the nut.
9. Ensure there is sufficient grease in the wheel bearing cavity.
10. Re-install the gasket and hub cap.

If a torque wrench is not available, the following procedure may be substituted for steps 5 through 7 above:

5. Tighten the spindle nut until the wheel cannot be turned by hand.
6. Loosen the spindle nut until the wheel can be turned by hand and the cotter pin can be installed.
7. Re-adjust when torque wrench is available.

FIGURE 3–5: RAILGEAR WHEEL BEARING ADJUSTMENT



4.0 ROUTINE LUBRICATION

The front and rear railgear units must be routinely lubricated to ensure proper operation and avoid damage to the equipment. Grease fittings are provided at all lubrication points on the Rafna Industries railgear and are located in figures 3-6, 3-7 and 3-8. The recommended lubricant for this equipment is **MYSTIK JT-6 LOW TEMP grease** or equivalent (operating range –30°C to 135°C). Table 3-1 indicates the equipment requiring lubrication and their recommended frequencies.

Table 3-1: Routine Lubrication

Equipment	Lubrication Frequency
Railgear wheel bearings	3,000 rail km (1875 rail miles) or 3 months (for continuous service at temperatures above 90°C, more frequent lubrication is required)
Hydraulic cylinder pivot points	Every month
Inner tube pivot points	Every month
Inner tubes	Every month

FIGURE 3–6: VERTICAL FRONT RAILGEAR LUBRICATION

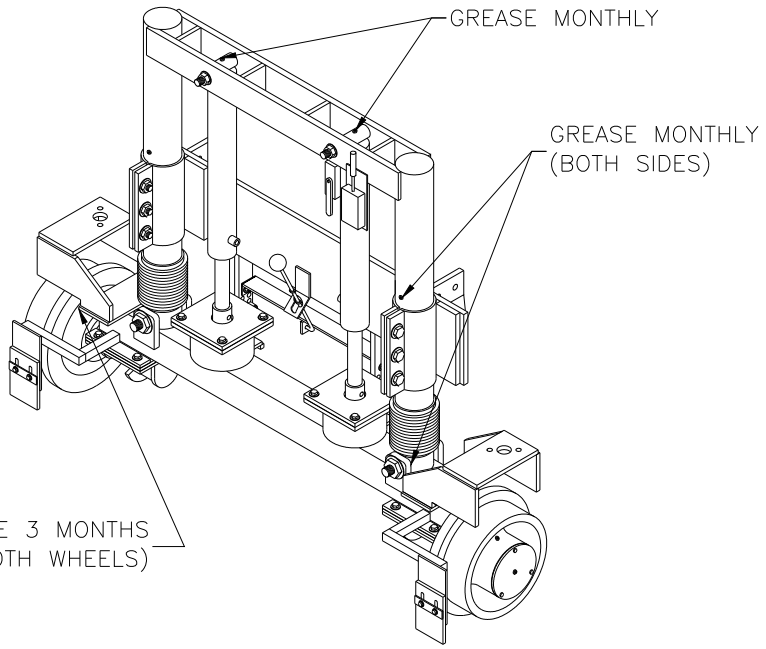


FIGURE 3–7: ROTATING FRONT RAILGEAR LUBRICATION

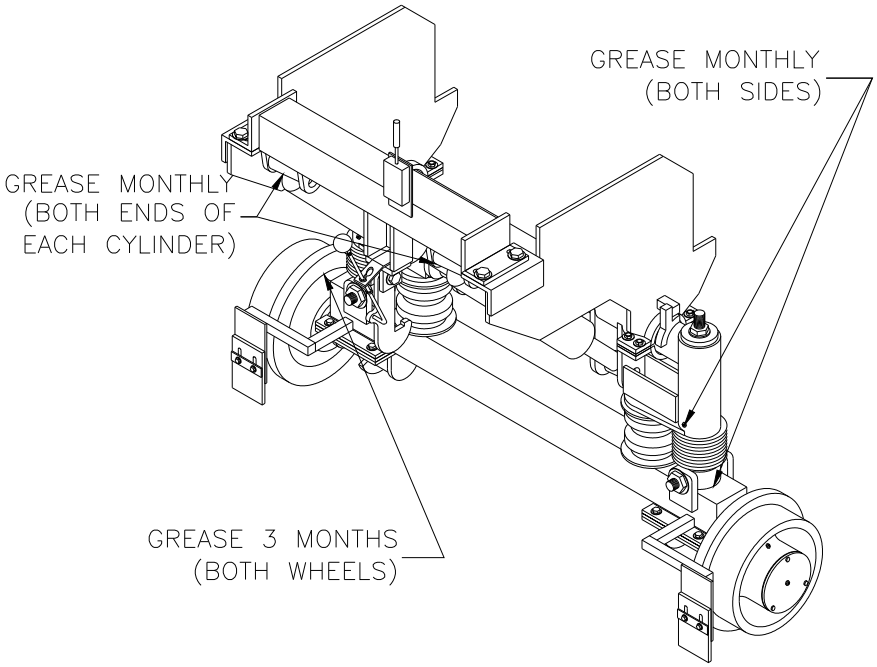
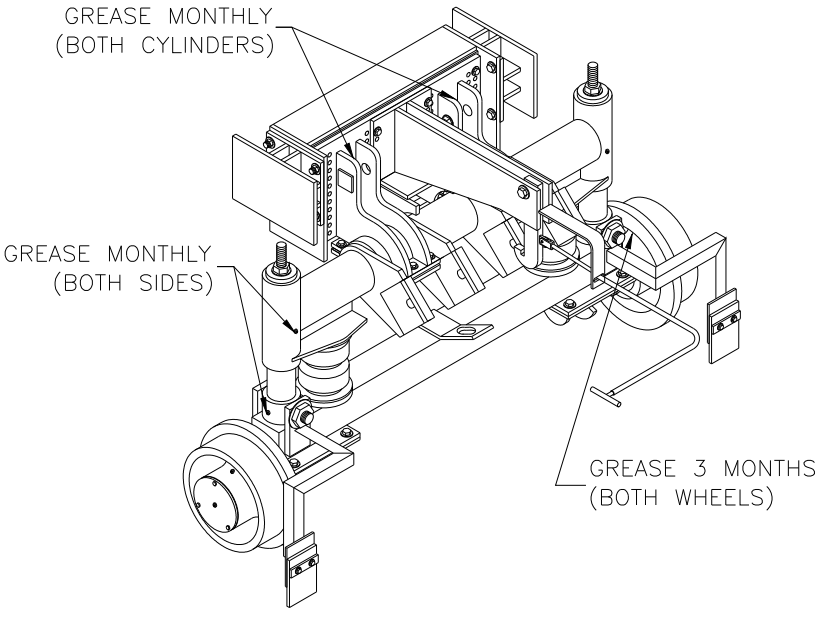


FIGURE 3–8: ROTATING REAR RAILGEAR LUBRICATION



5.0 ROUTINE INSPECTIONS

The front and rear railgear units must be routinely inspected to ensure proper operation and avoid damage to the equipment. Table 3-2 indicates the inspections required and their recommended frequency:

Table 3-2: Routine Inspections

Inspection Required	Frequency
Inspect complete railgear	Daily
Inspect railgear wheels for looseness	Weekly
Inspect railgear wheel flanges for wear	Weekly
Inspect all railgear fasteners for looseness	Weekly
Inspect all hydraulic fittings and hoses for leaks, wear	Weekly
Inspect railgear brake shoes for wear	Weekly
Inspect and repack railgear wheel bearings	Twice per year

WARNING:

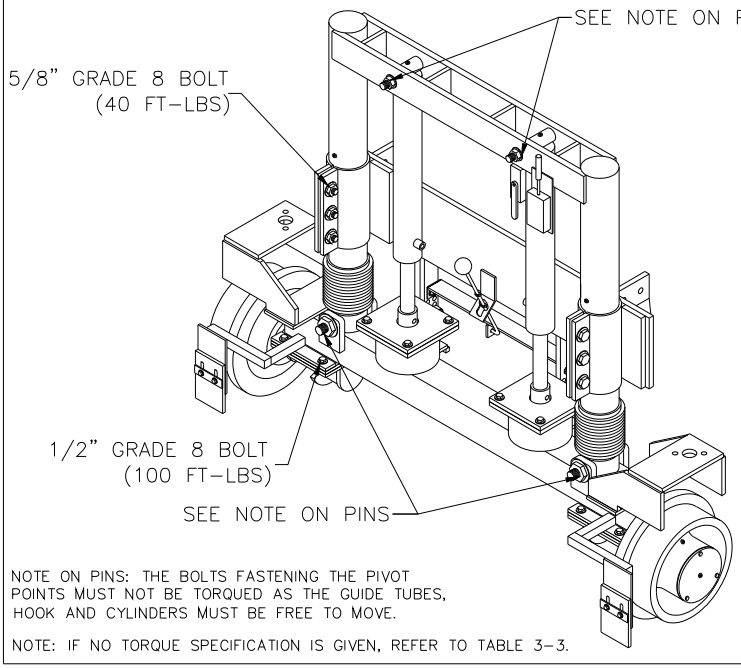
- If the vehicle should derail, a thorough inspection of the complete railgear assemblies for damaged parts, and a railgear alignment should be carried out before the units are put back in service.

Should any loose nuts and bolts be encountered on the railgear during the inspections or during maintenance of the railgear units, refer to figures 3-9, 3-10 and 3-11 and table 3-3 for bolt torque values.

Table 3-3: Bolt Torque Values

Bolt Detail	Bolt Torque Value (ft-lbs)
¾" UNC Gr. 8 Fasteners	175
⅝" UNC Gr. 8 Fasteners	150
½" UNC Gr. 8 Fasteners	100
⅜" UNC Gr. 8 Fasteners	40
¼" UNC Gr. 8 Fasteners	12

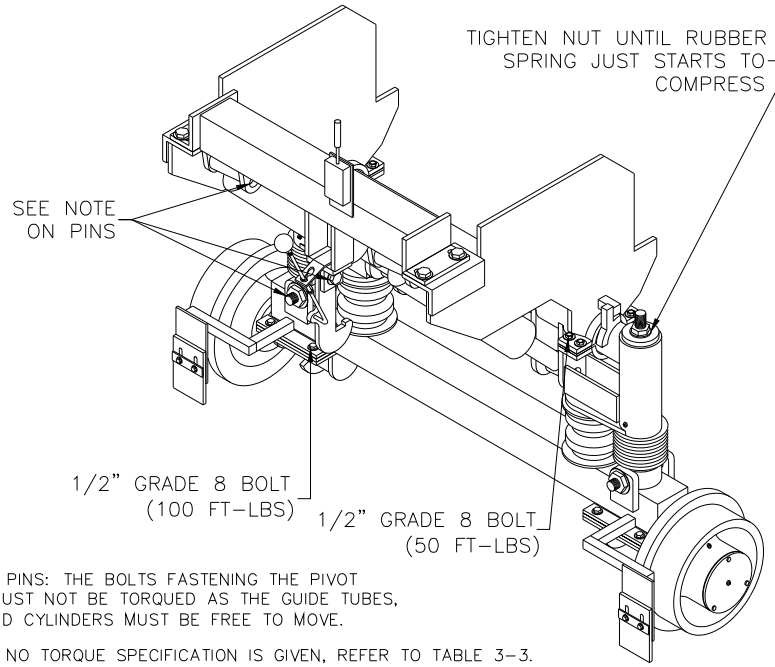
FIGURE 3–9: VERTICAL FRONT RAILGEAR BOLT TORQUES



NOTE ON PINS: THE BOLTS FASTENING THE PIVOT POINTS MUST NOT BE TORQUED AS THE GUIDE TUBES, HOOK AND CYLINDERS MUST BE FREE TO MOVE.

NOTE: IF NO TORQUE SPECIFICATION IS GIVEN, REFER TO TABLE 3–3.

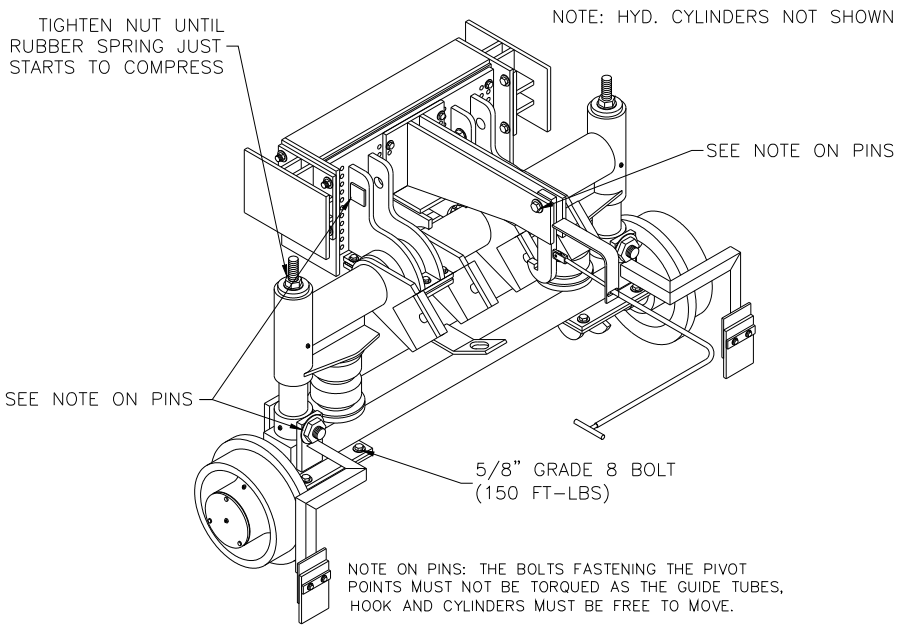
FIGURE 3–10: ROTATING FRONT RAILGEAR BOLT TORQUES



NOTE ON PINS: THE BOLTS FASTENING THE PIVOT POINTS MUST NOT BE TORQUED AS THE GUIDE TUBES, HOOK AND CYLINDERS MUST BE FREE TO MOVE.

NOTE: IF NO TORQUE SPECIFICATION IS GIVEN, REFER TO TABLE 3–3.

FIGURE 3–11: ROTATING REAR RAILGEAR BOLT TORQUES



NOTE ON PINS: THE BOLTS FASTENING THE PIVOT POINTS MUST NOT BE TORQUED AS THE GUIDE TUBES, HOOK AND CYLINDERS MUST BE FREE TO MOVE.

NOTE: IF NO TORQUE SPECIFICATION IS GIVEN, REFER TO TABLE 3–3.

6.0 HYDRAULIC SYSTEM RELIEF VALVE SETTING

The following procedure details how to adjust the three external pressure relief valve settings. One relief valve is located on the hydraulic pump, while the other two are located on each operating valve. If ever there appears to be inadequate hydraulic pressure to operate the railgear, an adjustment of the relief valve settings should be carried out. Refer to figure 3-12 throughout the procedure.

1. Locate the hydraulic hose (1) that supplies the front operating valve (2) from the hydraulic pump pressure port (3) and disconnect it at the pump.

2. Install a combination test gauge (4) (up to 3000 PSI) and shutoff valve (5) between the disconnected hydraulic hose and the pump pressure port. The pressure gauge will indicate the relief valve settings while the shutoff valve will enable a false load to be put on the hydraulic pump. Ensure that the test gauge is installed closer to the pump than the shutoff valve.

3. Energize the hydraulic system by turning on the dashboard mounted illuminated rocker switch.

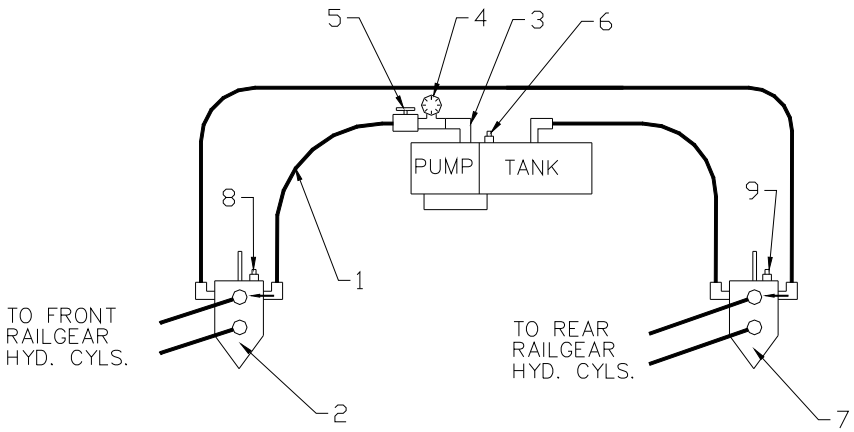
4. Depress the front operating valve pump start button. Do not select the “UP” or “DOWN” positions on the operating valve. The hydraulic pump should start.

5. Close the shutoff valve to enable the relief valve (6) on the pump to start releasing pressure. The pressure reading on the test gauge should indicate 2000 PSI. If this is not the reading, adjust the external relief valve on the pump accordingly.

6. Once the correct pressure on the pump relief valve is obtained, release the front operating valve pump start button and open the shutoff valve.

7. Proceed to adjust each operating valve (2 & 7) relief valve (8 & 9) setting as follows:
   a) Have an assistant watch the test gauge pressure reading while adjusting the rear relief valve setting.
   b) Ensure the shutoff valve has been completely opened.
   c) Depress the pump start button and select “UP” on the operating valve. Hold in this position until oil passes over the relief valve and a reading is taken on the test gauge.
   d) The pressure should be 1800 PSI. Adjust the relief valve setting accordingly.
   e) Proceed to adjust the second operating valve relief valve setting.

FIGURE 3–12: HYDRAULIC RELIEF VALVE PRESSURE ADJUSTMENT



7.0 ELECTRICAL SYSTEM TROUBLESHOOTING

Should the hydraulic pump fail to operate, all wiring should be checked for shorts, the fuse should be checked and the following tests should be performed. Refer to the electrical schematic in figure 3-13.

1. Pump motor coil shift test and voltage test (use a Volt-Meter in Volts-DC mode):
   a) Disconnect the wire from the coil "motor" terminal to the hydraulic pump motor.
   b) Ensure the coil "batt" terminal is connected to the positive terminal of the battery and the coil base is properly grounded. There should be 12V between the coil "batt" terminal and the coil base and 0V between the coil "motor" terminal and the coil base.
   c) Connect one end of a short "shunt" wire to the "12VDC" terminal of the coil and touch the other end to the coil base.
   d) The coil should shift in the housing producing a distinctive "click".
   e) With the "shunt" wire connected, the voltage between the coil "motor" terminal and the coil base should be 12V.
   f) If the coil does not "click" and/or the voltage in step e) is not 12V then the coil is inoperative and must be replaced.

2. Pump motor coil resistance test (use Ohm-Meter):
   a) Disconnect all wiring to the coil.
   b) Connect an Ohm-Meter to the coil "batt" terminal and to the coil "12VDC" terminal. The resistance should be about 20 Ohms.
   c) Connect an Ohm-Meter to the coil "motor" terminal and to the coil "12VDC" terminal. The resistance should be infinite (open). No resistance with this connection will indicate a shorted coil.
   d) If the coil resistances are not within specifications, the coil must be replaced.

3. Pump motor test:
   a) Disconnect the pump motor wire from the coil.
   b) Ensure the pump base is properly grounded.
   c) Connect one end of a large "shunt" wire to the pump motor positive terminal and touch the other end to the battery positive terminal.
   d) The pump motor should run upon touching the "shunt" wire.
   e) If the pump does not run, the pump motor is defective.

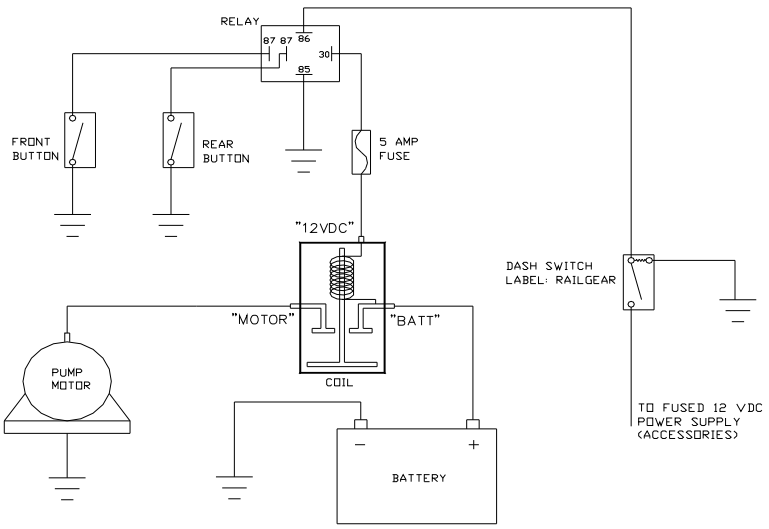
Should the pump motor start running immediately following turning on the dashboard mounted illuminated rocker switch, all wiring should be checked for shorts and the following should be performed.

1. Disconnect the wire from the under-hood relay to the rear operating valve pump start button. If the pump stops running then the rear pump start button is defective.

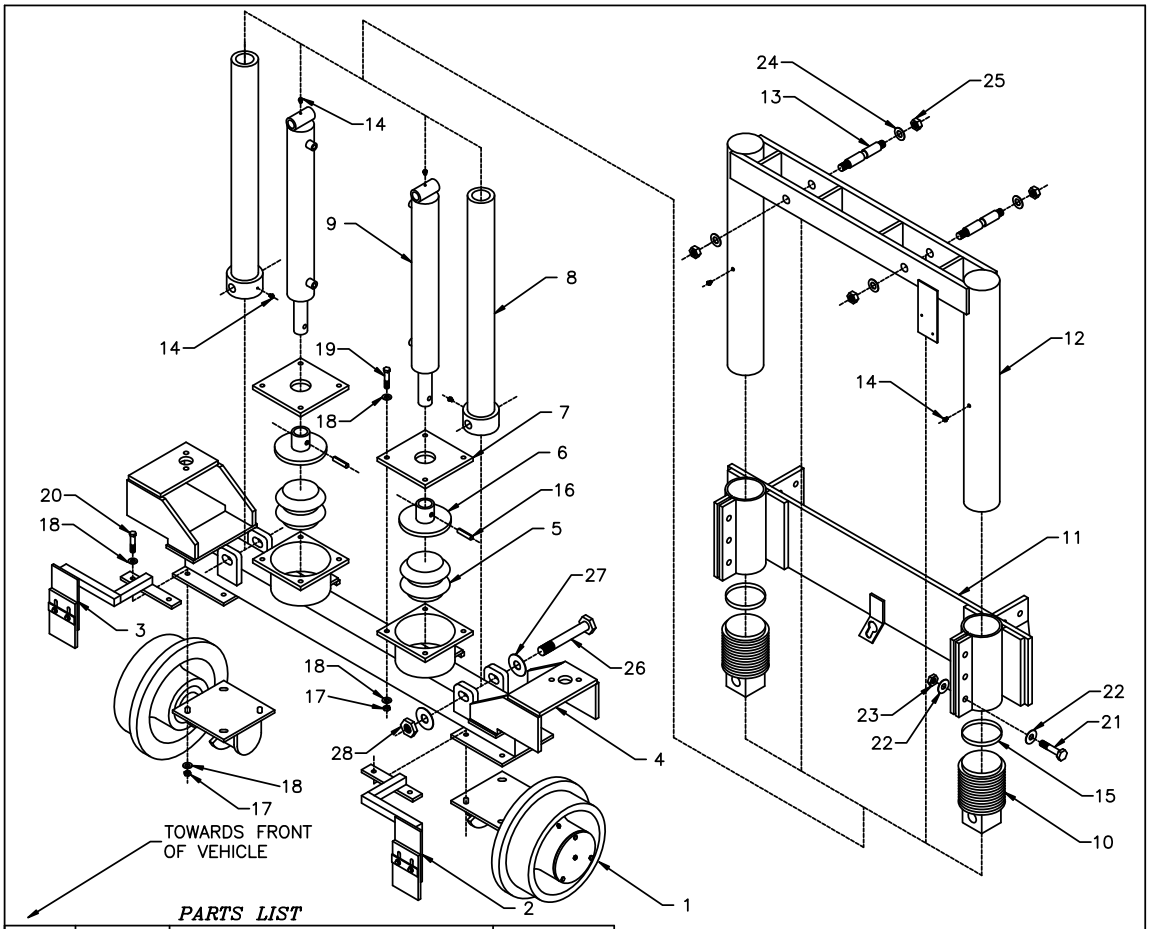
2. Disconnect the wire from the under-hood relay to the front operating valve pump start button. If the pump stops running, then the front pump start button is defective.

3. If the pump continues to run, there may be a short in the wiring or a defective main switch or coil. Perform the coil tests described above.

FIGURE 3–13: ELECTRICAL SYSTEM SCHEMATIC



SECTION 4: PARTS

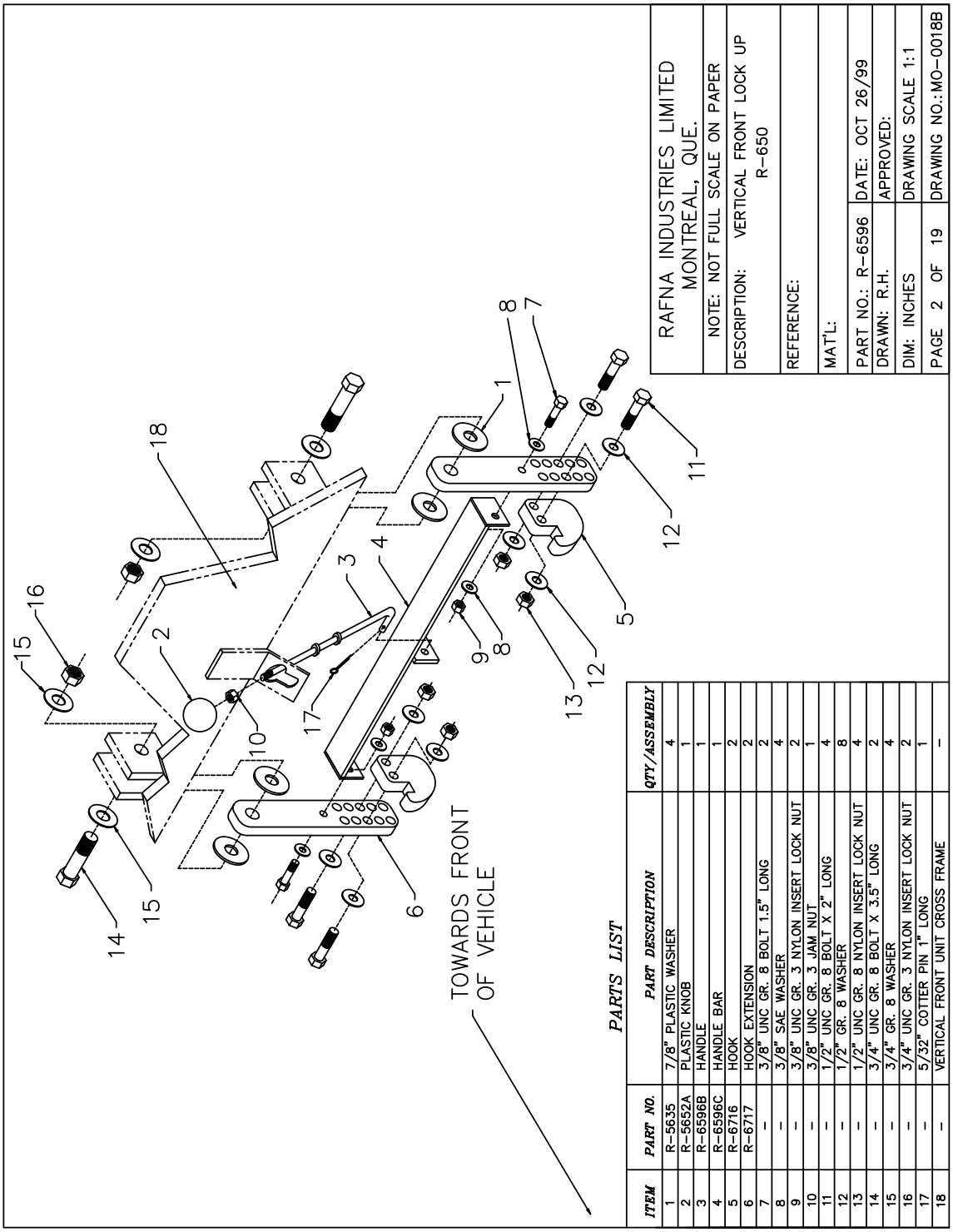


PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R-5501	12" WHEEL ASSEMBLY	2
2	R-5557L	LEFT SIDE RAIL SWEEP ASSEMBLY	1
3	R-5557R	RIGHT SIDE RAIL SWEEP ASSEMBLY	1
4	R-6526	FRONT AXLE ASSEMBLY(SHOWN W/ BRAKES)	1
5	R-5683	540/75 TIMBREN RUBBER SPRING	2
6	R-6599	HYDRAULIC CYLINDER PISTON ASSEMBLY	2
7	R-5741	AXLE SUSPENSION COVER PLATE	2
8	R-6593	FRONT INNER TUBE ASSEMBLY	2
9	R-6599B	HYDRAULIC CYLINDER (2.5" BORE X 17" ST)	2
10	R-6524	BELLOWS	2
11	R-6597	FRONT CROSS FRAME(USE W/O FRAME EXT)	1
	R-6713	FRONT CROSS FRAME (USE W/ FRAME EXT)	
12	R-6595	FRONT UPPER FRAME	1
13	R-5554	HYDRAULIC CYLINDER PIN	2
14	–	1/8" NPT GREASE FITTING	6
15	R-604	BELLOWS CLAMP	2
16	–	ø 1/2" X 2" SPRING PIN	2
17	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	16
18	–	1/2" GR. 8 WASHER	32
19	–	1/2" UNC GR. 8 BOLT X 2" LONG	8
20	–	1/2" UNC GR. 8 BOLT X 2.25" LONG	8
21	–	5/8" UNC GR. 8 BOLT X 3" LONG	6
22	–	5/8" GR. 8 WASHER	12
23	–	5/8" UNC GR. 8 NYLON INSERT LOCK NUT	6
24	–	3/4" GR. 8 WASHER	4
25	–	3/4" UNC GR. 3 THIN NYLON LOCK NUT	4
26	–	1" UNC GR. 8 BOLT X 7" LONG	2
27	–	1" GR. 8 WASHER	4
28	–	1" UNC GR. 3 NYLON INSERT LOCK NUT	2

NOTE : AIR BRAKE ASSEMBLY, FRONT LOCK UP ASSEMBLY, AXLE LOCK UP ASSEMBLY, HYDRAULICS AND IDENTICAL FASTNERS NOT SHOWN FOR CLARITY

RAFNA INDUSTRIES LIMITED MONTREAL, QUE.	
NOTE: NOT FULL SCALE ON PAPER	
DESCRIPTION: VERTICAL FRONT ASSEMBLY R-650	
REFERENCE:	
MAT'L:	
PART NO.: R-6715	DATE: OCT 26/99
DRAWN: R.H.	APPROVED:
DIM: INCHES	DRAWING SCALE 1:1
PAGE 1 OF 19	DRAWING NO.: MO-0018B



RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: VERTICAL FRONT LOCK UP R-650

REFERENCE:

MAT'L:

PART NO.: R-6596 | DATE: OCT 26/99

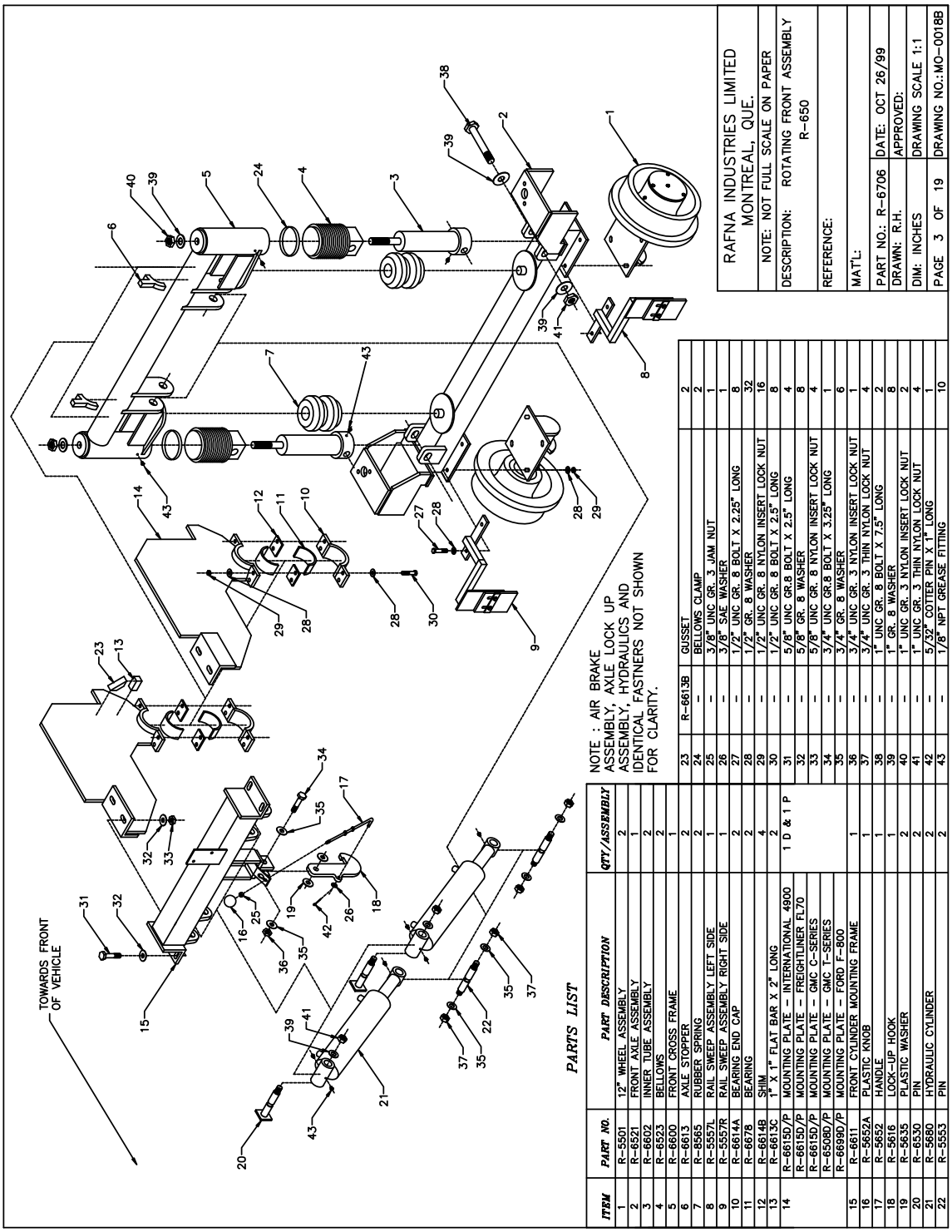
DRAWN: R.H. | APPROVED:

DIM: INCHES | DRAWING SCALE 1:1

PAGE 2 OF 19 | DRAWING NO.:MO-0018B

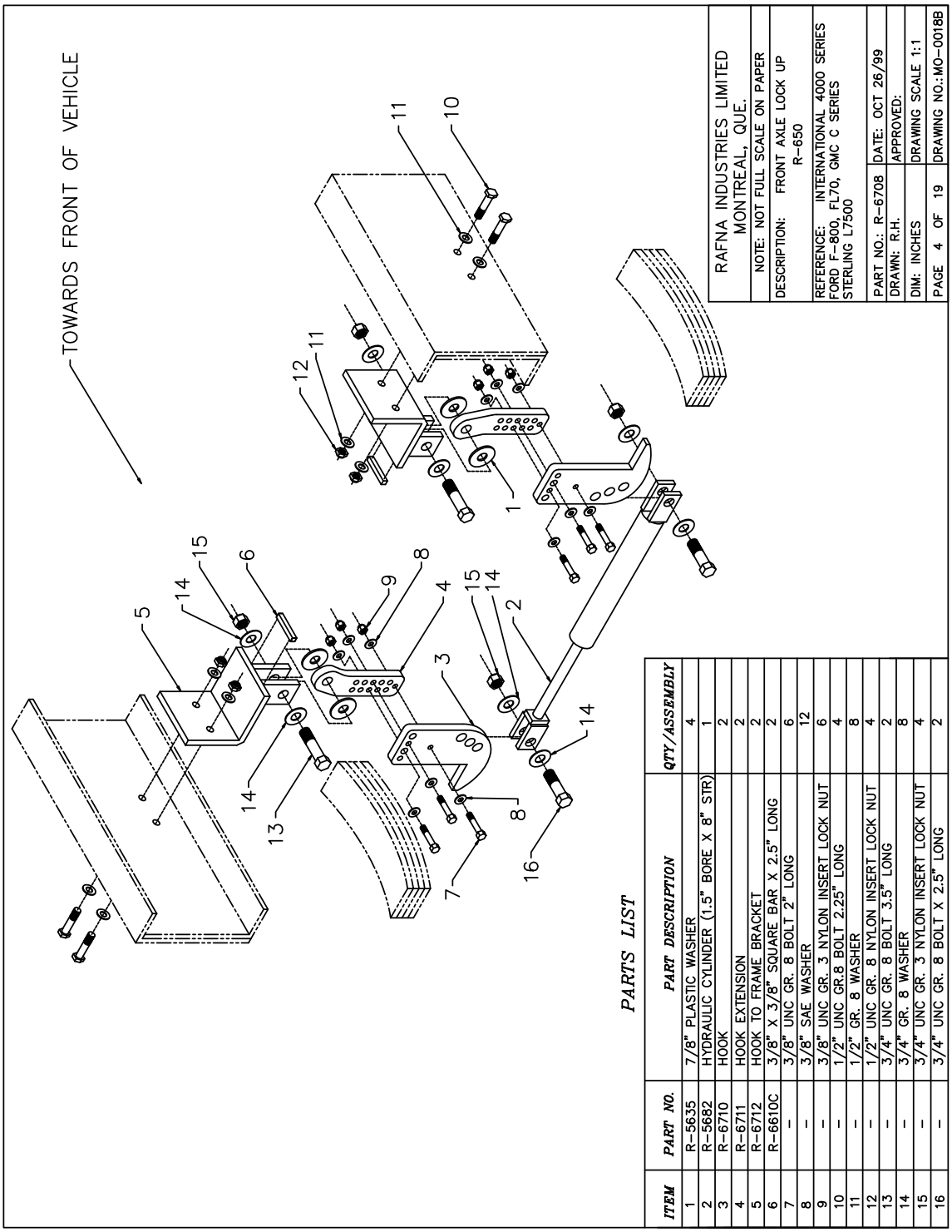
PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-5635	7/8" PLASTIC WASHER	4
2	R-5652A	PLASTIC KNOB	1
3	R-6596B	HANDLE	1
4	R-6596C	HANDLE BAR	1
5	R-6716	HOOK	2
6	R-6717	HOOK EXTENSION	2
7	–	3/8" UNC GR. 8 BOLT 1.5" LONG	2
8	–	3/8" SAE WASHER	4
9	–	3/8" UNC GR. 3 NYLON INSERT LOCK NUT	2
10	–	3/8" UNC GR. 3 JAM NUT	1
11	–	1/2" UNC GR. 8 BOLT X 2" LONG	4
12	–	1/2" GR. 8 WASHER	8
13	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	4
14	–	3/4" UNC GR. 8 BOLT X 3.5" LONG	2
15	–	3/4" GR. 8 WASHER	4
16	–	3/4" UNC GR. 3 NYLON INSERT LOCK NUT	2
17	–	5/32" COTTER PIN 1" LONG	1
18	–	VERTICAL FRONT UNIT CROSS FRAME	–



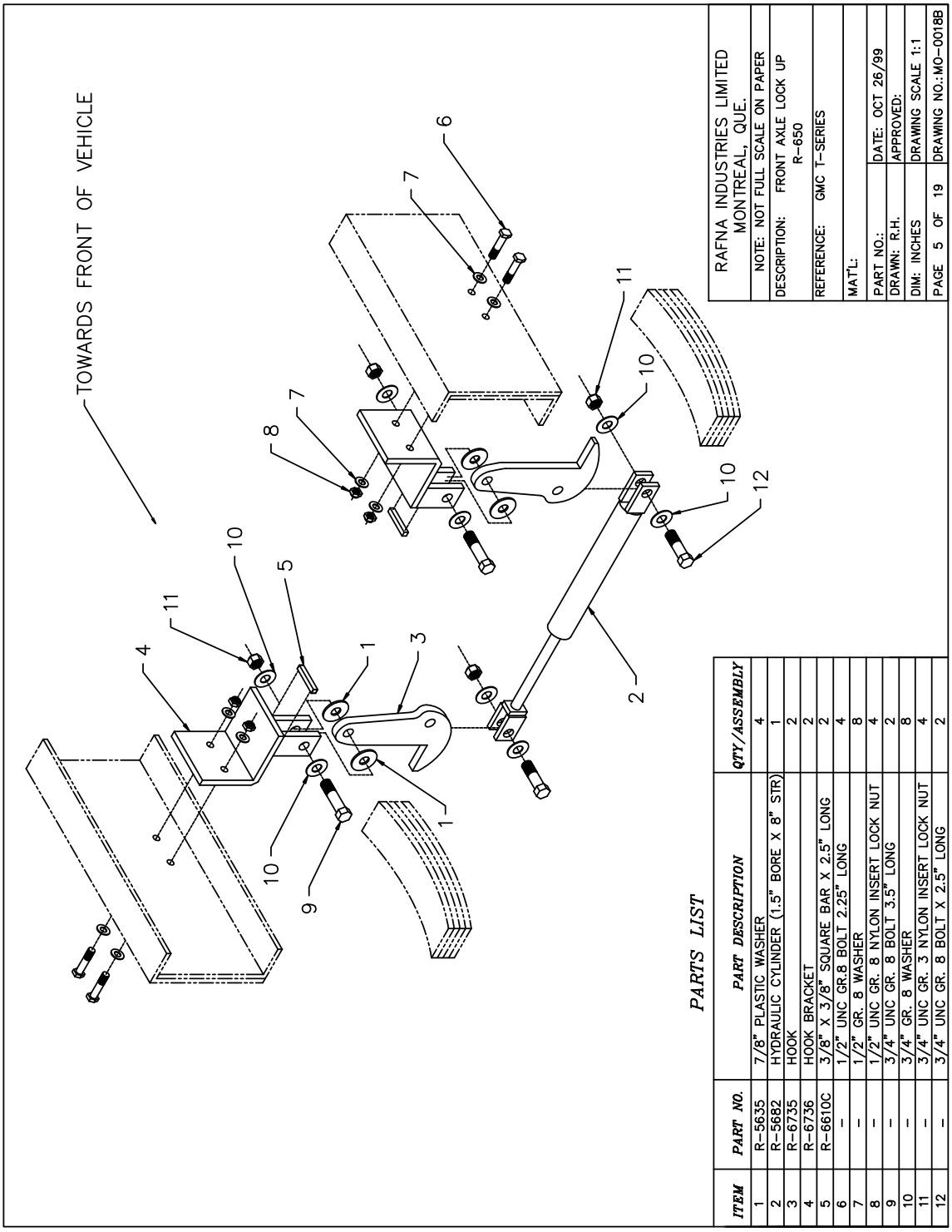
PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-5501	12" WHEEL ASSEMBLY	2
2	R-6521	FRONT AXLE ASSEMBLY	1
3	R-6602	INNER TUBE ASSEMBLY	2
4	R-6523	BELLOWS	2
5	R-6600	FRONT CROSS FRAME	1
6	R-6613	AXLE STOPPER	2
7	R-8565	RUBBER SPRING	2
8	R-5557L	RAIL SWEEP ASSEMBLY LEFT SIDE	1
9	R-5557R	RAIL SWEEP ASSEMBLY RIGHT SIDE	1
10	R-6614A	BEARING END CAP	2
11	R-6678	BEARING	2
12	R-6614B	SHIM	4
13	R-6613C	1" X 1" FLAT BAR X 2" LONG	2
14	R-6615D/P	MOUNTING PLATE - INTERNATIONAL 4900	1 D & 1 P
	R-6615D/P	MOUNTING PLATE - FREIGHTLINER FL70	
	R-6615D/P	MOUNTING PLATE - GMC C-SERIES	
	R-6508D/P	MOUNTING PLATE - GMC T-SERIES	
	R-6699D/P	MOUNTING PLATE - FORD F-800	
15	R-6611	FRONT CYLINDER MOUNTING FRAME	1
16	R-5652A	PLASTIC KNOB	1
17	R-5652	HANDLE	1
18	R-5616	LOCK-UP HOOK	1
19	R-5635	PLASTIC WASHER	2
20	R-6530	PIN	2
21	R-5680	HYDRAULIC CYLINDER	2
22	R-5553	PIN	2
23	R-6613B	GUSSET	2
24	-	BELLOWS CLAMP	2
25	-	3/8" UNC GR. 3 JAM NUT	1
26	-	3/8" SAE WASHER	1
27	-	1/2" UNC GR. 8 BOLT X 2.25" LONG	8
28	-	1/2" GR. 8 WASHER	32
29	-	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	16
30	-	1/2" UNC GR. 8 BOLT X 2.5" LONG	8
31	-	5/8" UNC GR.8 BOLT X 2.5" LONG	4
32	-	5/8" GR. 8 WASHER	8
33	-	5/8" UNC GR. 8 NYLON INSERT LOCK NUT	4
34	-	3/4" UNC GR.8 BOLT X 3.25" LONG	1
35	-	3/4" GR. 8 WASHER	6
36	-	3/4" UNC GR. 3 NYLON INSERT LOCK NUT	1
37	-	3/4" UNC GR. 3 THIN NYLON LOCK NUT	4
38	-	1" UNC GR. 8 BOLT X 7.5" LONG	2
39	-	1" GR. 8 WASHER	8
40	-	1" UNC GR. 3 NYLON INSERT LOCK NUT	2
41	-	1" UNC GR. 3 THIN NYLON LOCK NUT	4
42	-	5/32" COTTER PIN X 1" LONG	1
43	-	1/8" NPT GREASE FITTING	10



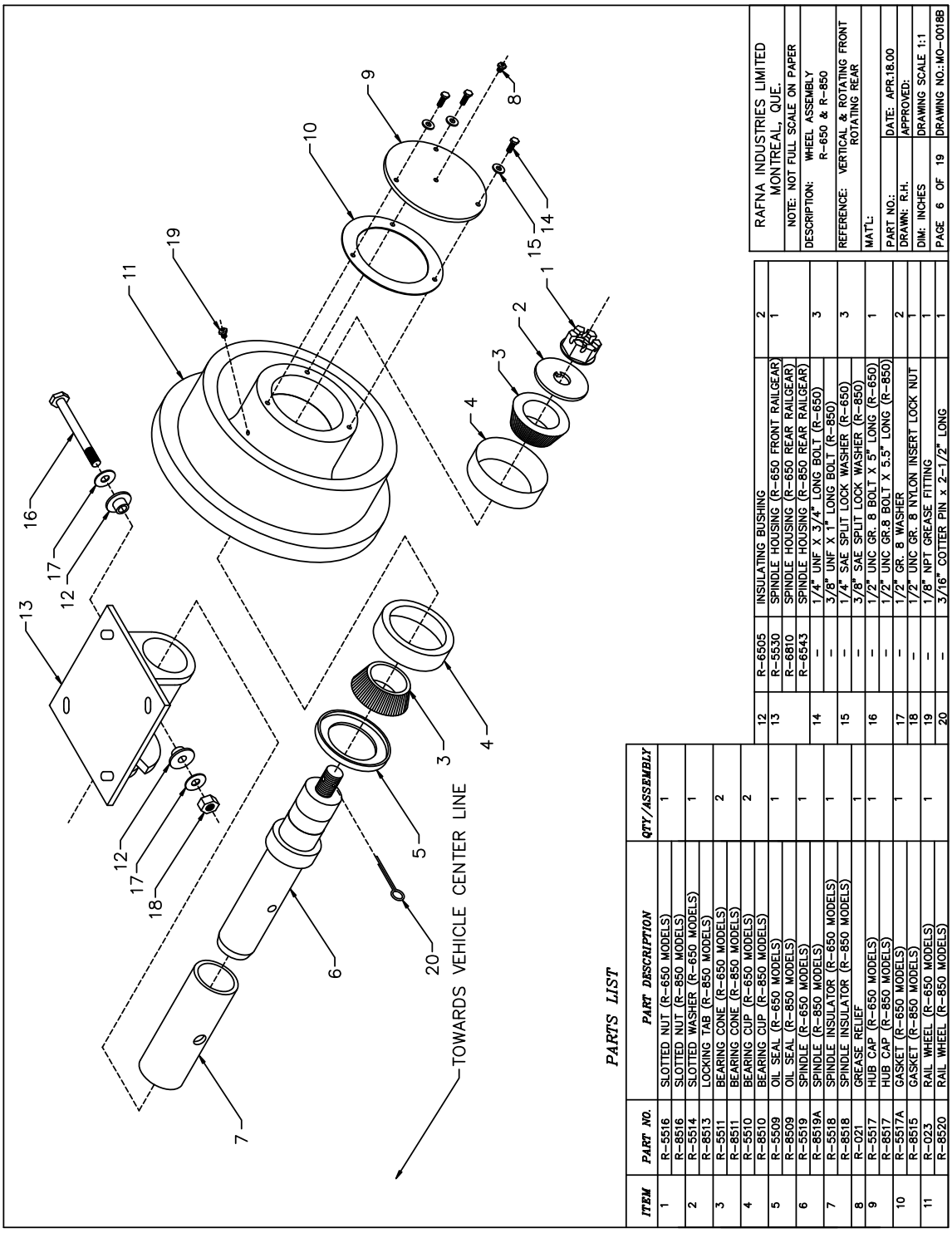
PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-5635	7/8" PLASTIC WASHER	4
2	R-5682	HYDRAULIC CYLINDER (1.5" BORE X 8" STR)	1
3	R-6710	HOOK	2
4	R-6711	HOOK EXTENSION	2
5	R-6712	HOOK TO FRAME BRACKET	2
6	R-6610C	3/8" X 3/8" SQUARE BAR X 2.5" LONG	2
7	–	3/8" UNC GR. 8 BOLT 2" LONG	6
8	–	3/8" SAE WASHER	12
9	–	3/8" UNC GR. 3 NYLON INSERT LOCK NUT	6
10	–	1/2" UNC GR.8 BOLT 2.25" LONG	4
11	–	1/2" GR. 8 WASHER	8
12	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	4
13	–	3/4" UNC GR. 8 BOLT 3.5" LONG	2
14	–	3/4" GR. 8 WASHER	8
15	–	3/4" UNC GR. 3 NYLON INSERT LOCK NUT	4
16	–	3/4" UNC GR. 8 BOLT X 2.5" LONG	2



PARTS LIST

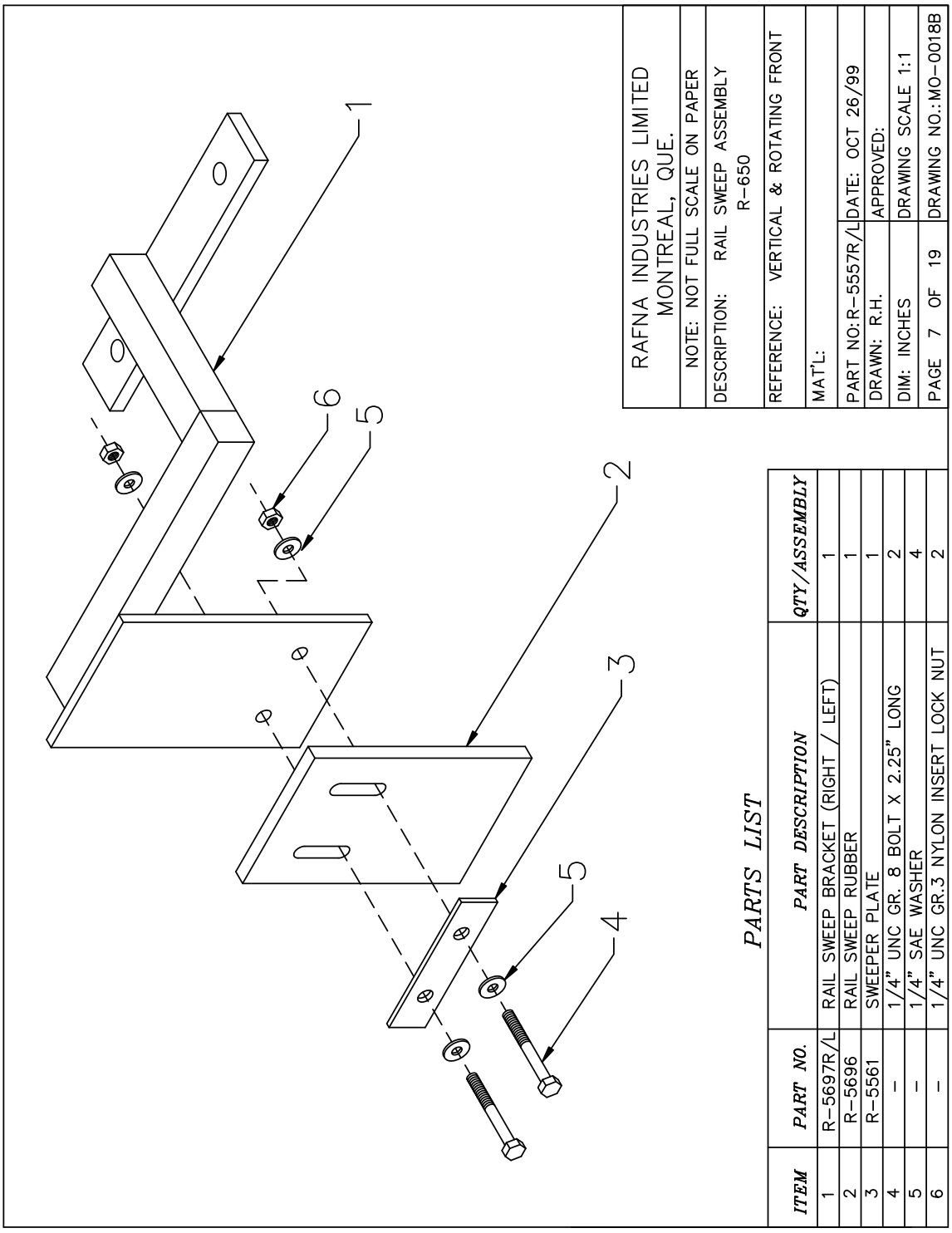
ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R-5635	7/8" PLASTIC WASHER	4
2	R-5682	HYDRAULIC CYLINDER (1.5" BORE X 8" STR)	1
3	R-6735	HOOK	2
4	R-6736	HOOK BRACKET	2
5	R-6610C	3/8" X 3/8" SQUARE BAR X 2.5" LONG	2
6	–	1/2" UNC GR.8 BOLT 2.25" LONG	4
7	–	1/2" GR. 8 WASHER	8
8	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	4
9	–	3/4" UNC GR. 8 BOLT 3.5" LONG	2
10	–	3/4" GR. 8 WASHER	8
11	–	3/4" UNC GR. 3 NYLON INSERT LOCK NUT	4
12	–	3/4" UNC GR. 8 BOLT X 2.5" LONG	2

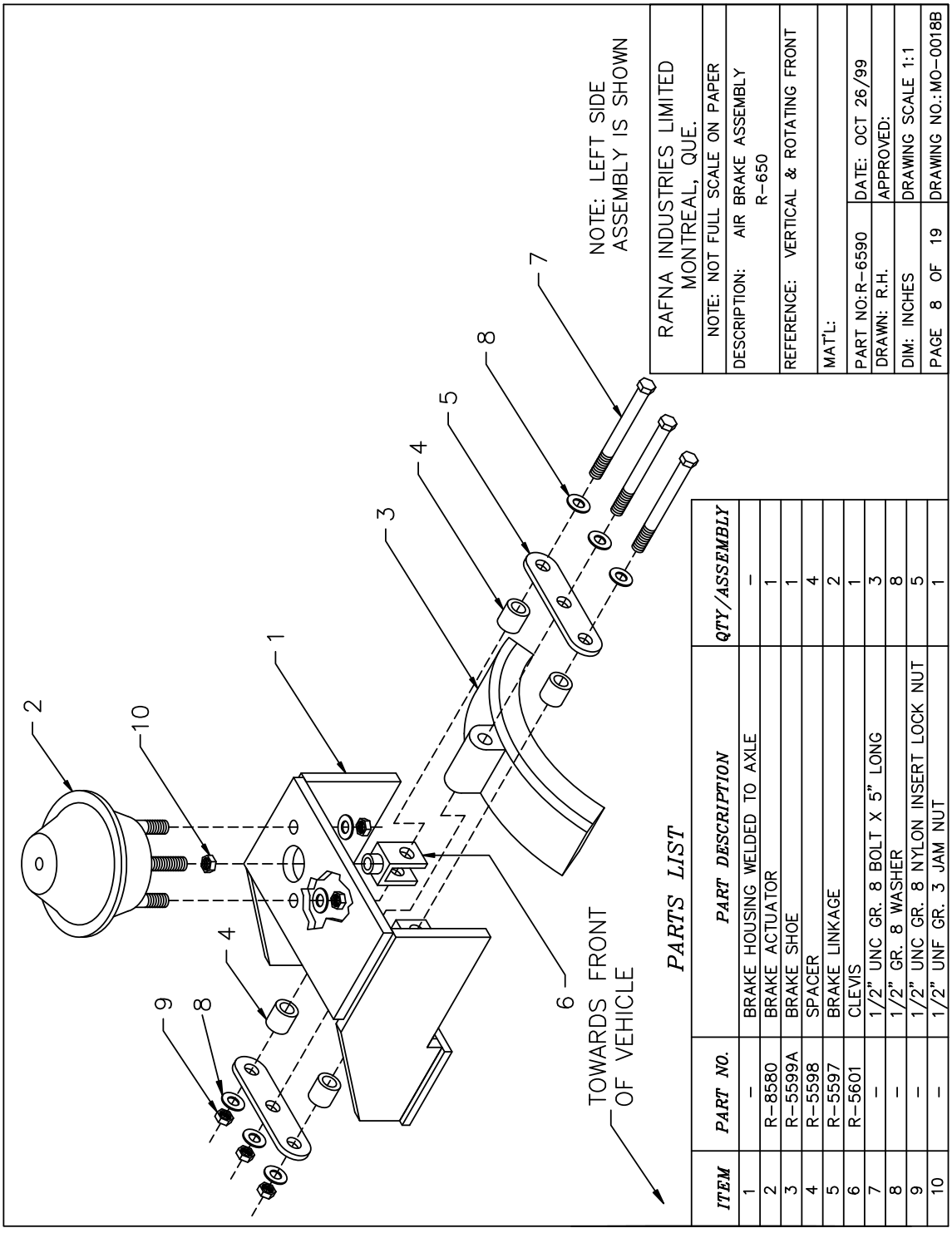


PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-5516	SLOTTED NUT (R-650 MODELS)	1
	R-8516	SLOTTED NUT (R-850 MODELS)	
2	R-5514	SLOTTED WASHER (R-650 MODELS)	1
	R-8513	LOCKING TAB (R-850 MODELS)	
3	R-5511	BEARING CONE (R-650 MODELS)	2
	R-8511	BEARING CONE (R-850 MODELS)	
4	R-5510	BEARING CUP (R-650 MODELS)	2
	R-8510	BEARING CUP (R-850 MODELS)	
5	R-5509	OIL SEAL (R-650 MODELS)	1
	R-8509	OIL SEAL (R-850 MODELS)	
6	R-5519	SPINDLE (R-650 MODELS)	1
	R-8519A	SPINDLE (R-850 MODELS)	
7	R-5518	SPINDLE INSULATOR (R-650 MODELS)	1
	R-8518	SPINDLE INSULATOR (R-850 MODELS)	
8	R-021	GREASE RELIEF	1
9	R-5517	HUB CAP (R-650 MODELS)	1
	R-8517	HUB CAP (R-850 MODELS)	
10	R-5517A	GASKET (R-650 MODELS)	1
	R-8515	GASKET (R-850 MODELS)	
11	R-023	RAIL WHEEL (R-650 MODELS)	1
	R-8520	RAIL WHEEL (R-850 MODELS)	
12	R-6505	INSULATING BUSHING	2
13	R-5530	SPINDLE HOUSING (R-650 FRONT RAILGEAR)	1
	R-6810	SPINDLE HOUSING (R-650 REAR RAILGEAR)	
	R-6543	SPINDLE HOUSING (R-850 REAR RAILGEAR)	
14	–	1/4" UNF X 3/4" LONG BOLT (R-650)	3
	–	3/8" UNF X 1" LONG BOLT (R-850)	
15	–	1/4" SAE SPLIT LOCK WASHER (R-650)	3
	–	3/8" SAE SPLIT LOCK WASHER (R-850)	
16	–	1/2" UNC GR. 8 BOLT X 5" LONG (R-650)	1
	–	1/2" UNC GR.8 BOLT X 5.5" LONG (R-850)	
17	–	1/2" GR. 8 WASHER	2
18	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	1
19	–	1/8" NPT GREASE FITTING	1
20	–	3/16" COTTER PIN x 2-1/2" LONG	1

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.
NOTE: NOT FULL SCALE ON PAPER
DESCRIPTION: WHEEL ASSEMBLY R-650 & R-850
REFERENCE: VERTICAL & ROTATING FRONT ROTATING REAR
MAT'L:
PART NO.: DATE: APR.18.00
DRAWN: R.H. APPROVED:
DIM: INCHES DRAWING SCALE 1:1
PAGE 6 OF 19 DRAWING NO.:MO-0018B


RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.
NOTE: NOT FULL SCALE ON PAPER
DESCRIPTION: RAIL SWEEP ASSEMBLY R-650
REFERENCE: VERTICAL & ROTATING FRONT
MAT'L:
PART NO:R-5557R/L
DATE: OCT 26/99
DRAWN: R.H.
APPROVED:
DIM: INCHES
DRAWING SCALE 1:1
PAGE 7 OF 19
DRAWING NO.:MO-0018B
PARTS LIST
ITEM | PART NO. | PART DESCRIPTION | QTY/ASSEMBLY
1 | R-5697R/L | RAIL SWEEP BRACKET (RIGHT / LEFT) | 1
2 | R-5696 | RAIL SWEEP RUBBER | 1
3 | R-5561 | SWEEPER PLATE | 1
4 | – | 1/4" UNC GR. 8 BOLT X 2.25" LONG | 2
5 | – | 1/4" SAE WASHER | 4
6 | – | 1/4" UNC GR.3 NYLON INSERT LOCK NUT | 2
1
2
3
4
5
6



RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: AIR BRAKE ASSEMBLY R-650

REFERENCE: VERTICAL & ROTATING FRONT

MAT'L:

PART NO:R-6590 | DATE: OCT 26/99

DRAWN: R.H. | APPROVED:

DIM: INCHES | DRAWING SCALE 1:1

PAGE 8 OF 19 | DRAWING NO.:MO-0018B

PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	–	BRAKE HOUSING WELDED TO AXLE	–
2	R-8580	BRAKE ACTUATOR	1
3	R-5599A	BRAKE SHOE	1
4	R-5598	SPACER	4
5	R-5597	BRAKE LINKAGE	2
6	R-5601	CLEVIS	1
7	–	1/2" UNC GR. 8 BOLT X 5" LONG	3
8	–	1/2" GR. 8 WASHER	8
9	–	1/2" UNC GR. 8 NYLON INSERT LOCK NUT	5
10	–	1/2" UNF GR. 3 JAM NUT	1

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: STEERING WHEEL LOCK
R-650

REFERENCE: FORD F-800

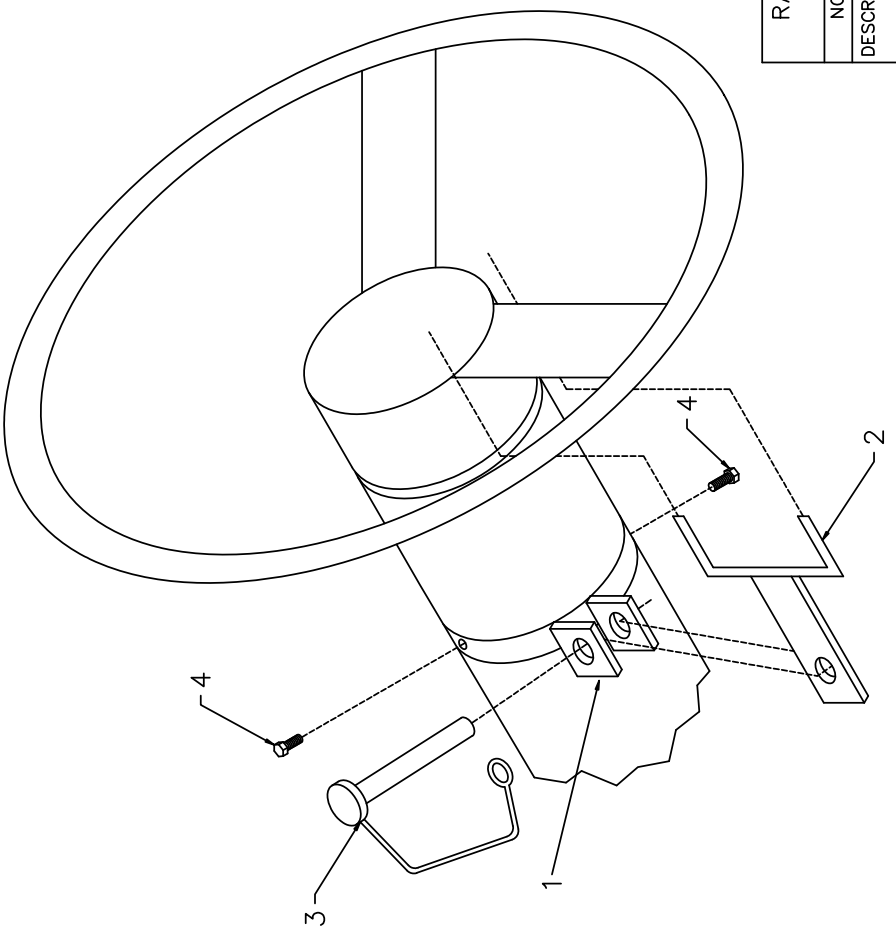
MAT'L:

PART NO.: DATE: OCT. 25/99

DRAWN: R.H. APPROVED:

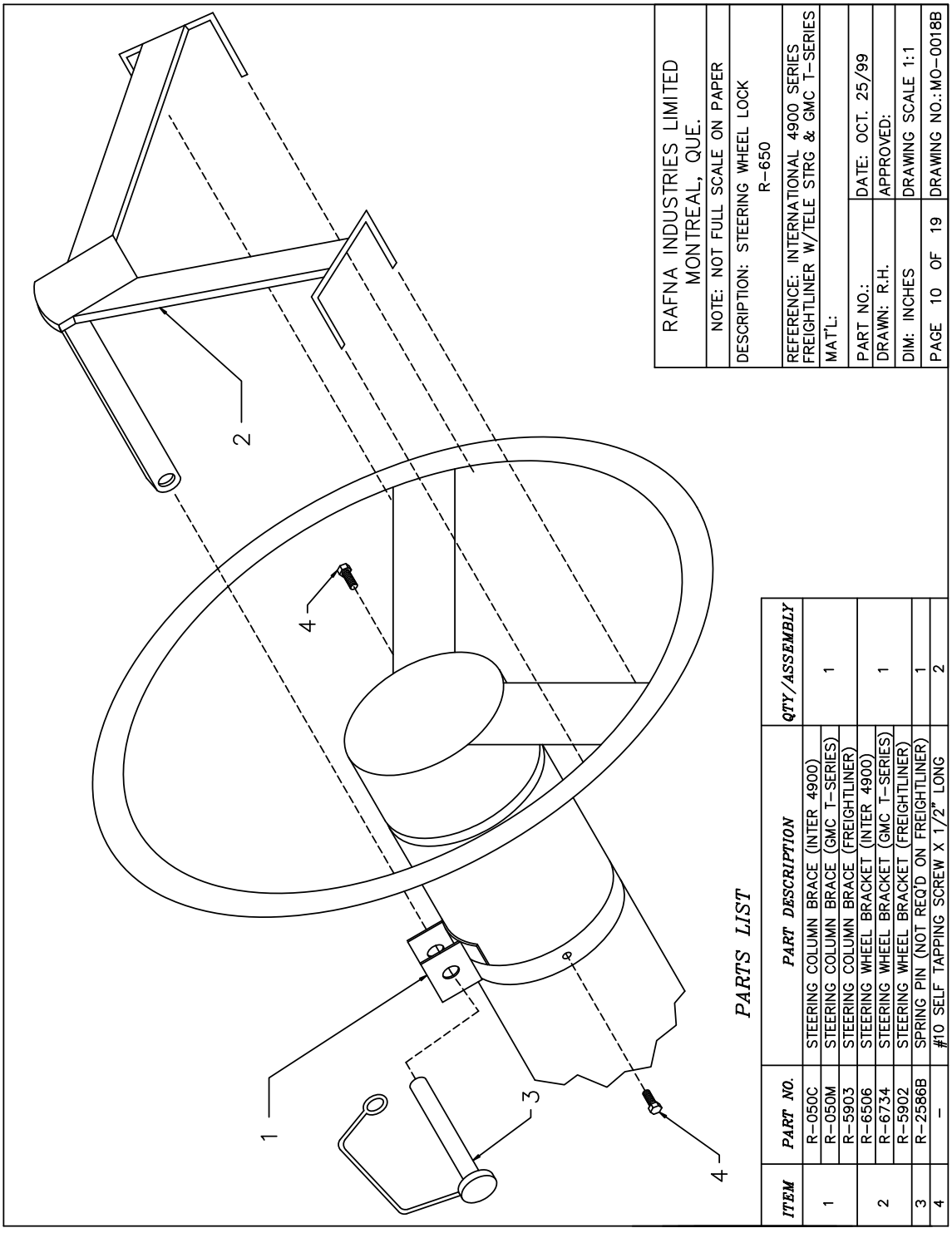
DIM: INCHES DRAWING SCALE 1:1

PAGE 9 OF 19 DRAWING NO.: M0018



PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R-050F	STEERING COLUMN BRACE	1
2	R-6688A	STEERING WHEEL BRACKET	1
3	R-2586B	SPRING PIN	1
4	–	#10 SELF TAPPING SCREW X 1/2" LONG	2



ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-050C	STEERING COLUMN BRACE (INTER 4900)	1
	R-050M	STEERING COLUMN BRACE (GMC T-SERIES)	
	R-5903	STEERING COLUMN BRACE (FREIGHTLINER)	
2	R-6506	STEERING WHEEL BRACKET (INTER 4900)	1
	R-6734	STEERING WHEEL BRACKET (GMC T-SERIES)	
	R-5902	STEERING WHEEL BRACKET (FREIGHTLINER)	
3	R-2586B	SPRING PIN (NOT REQ'D ON FREIGHTLINER)	1
4	–	#10 SELF TAPPING SCREW X 1/2" LONG	2

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: STEERING WHEEL LOCK
R-650

REFERENCE: GMC C-SERIES

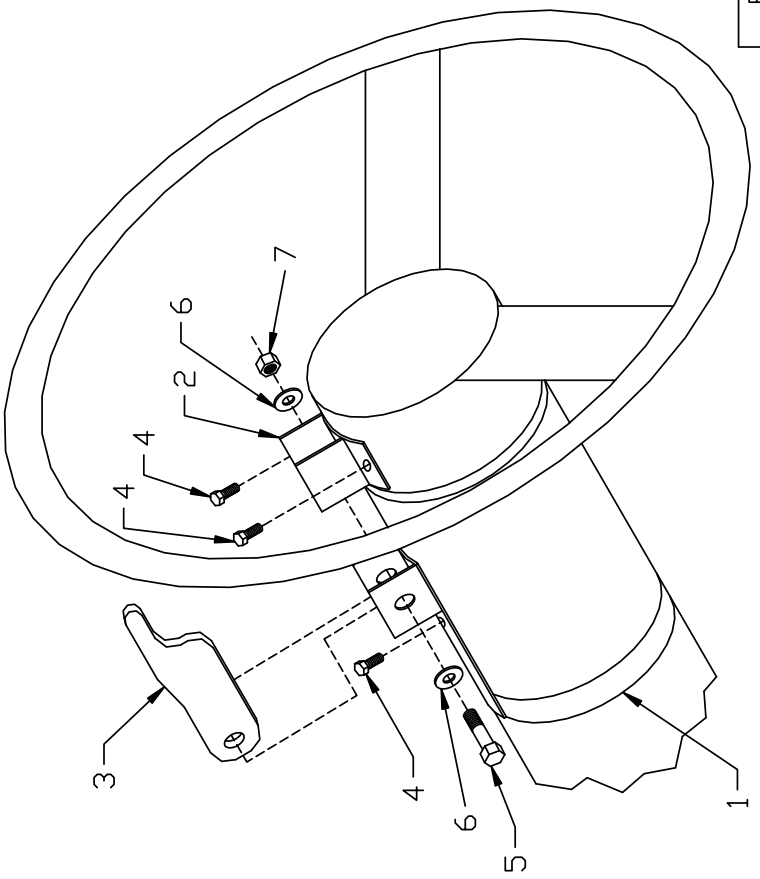
MAT'L:

PART NO.: DATE: OCT. 25/99

DRAWN: R.H. APPROVED:

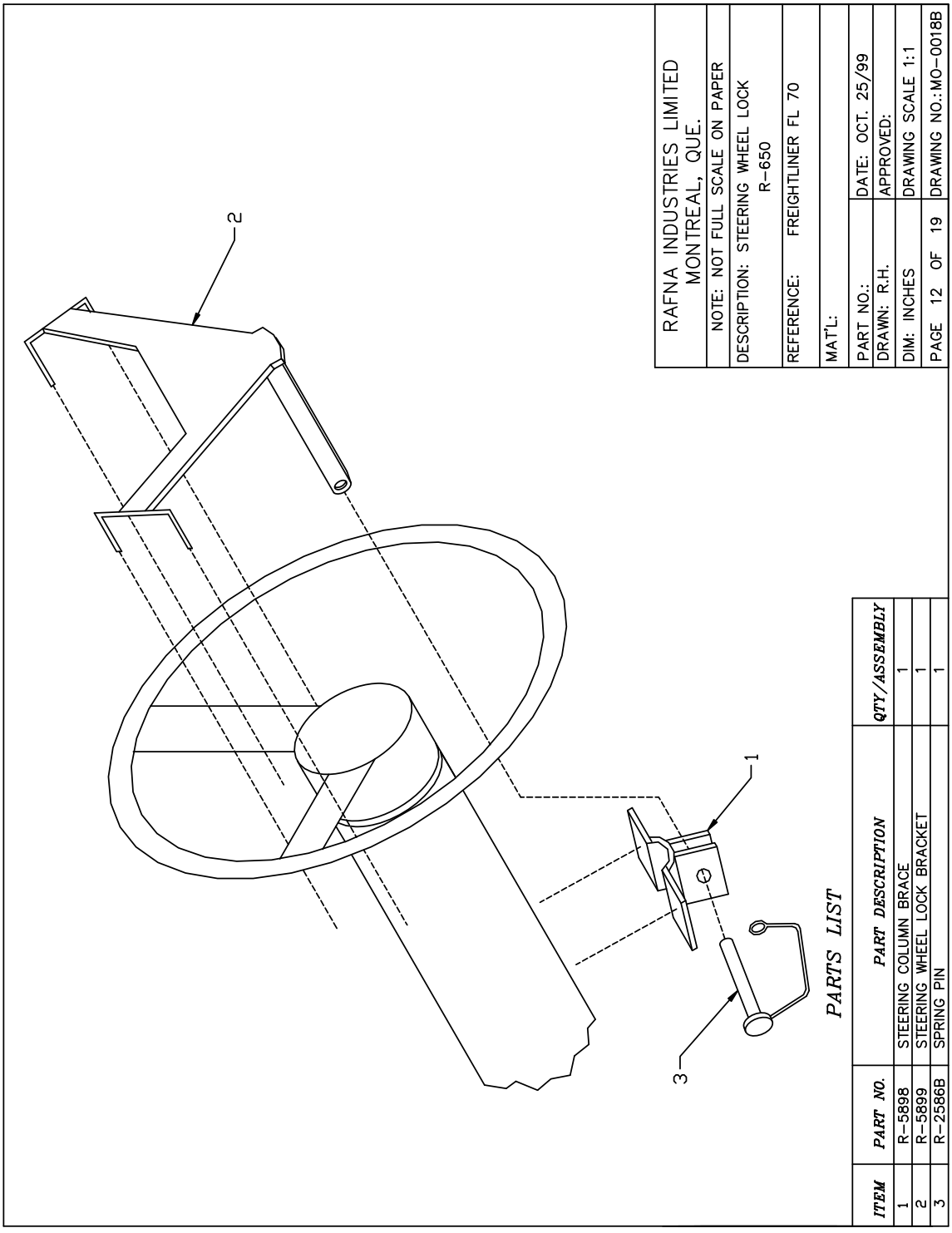
DIM: INCHES DRAWING SCALE 1:1

PAGE 11 OF 19 DRAWING NO.:MO-0018B

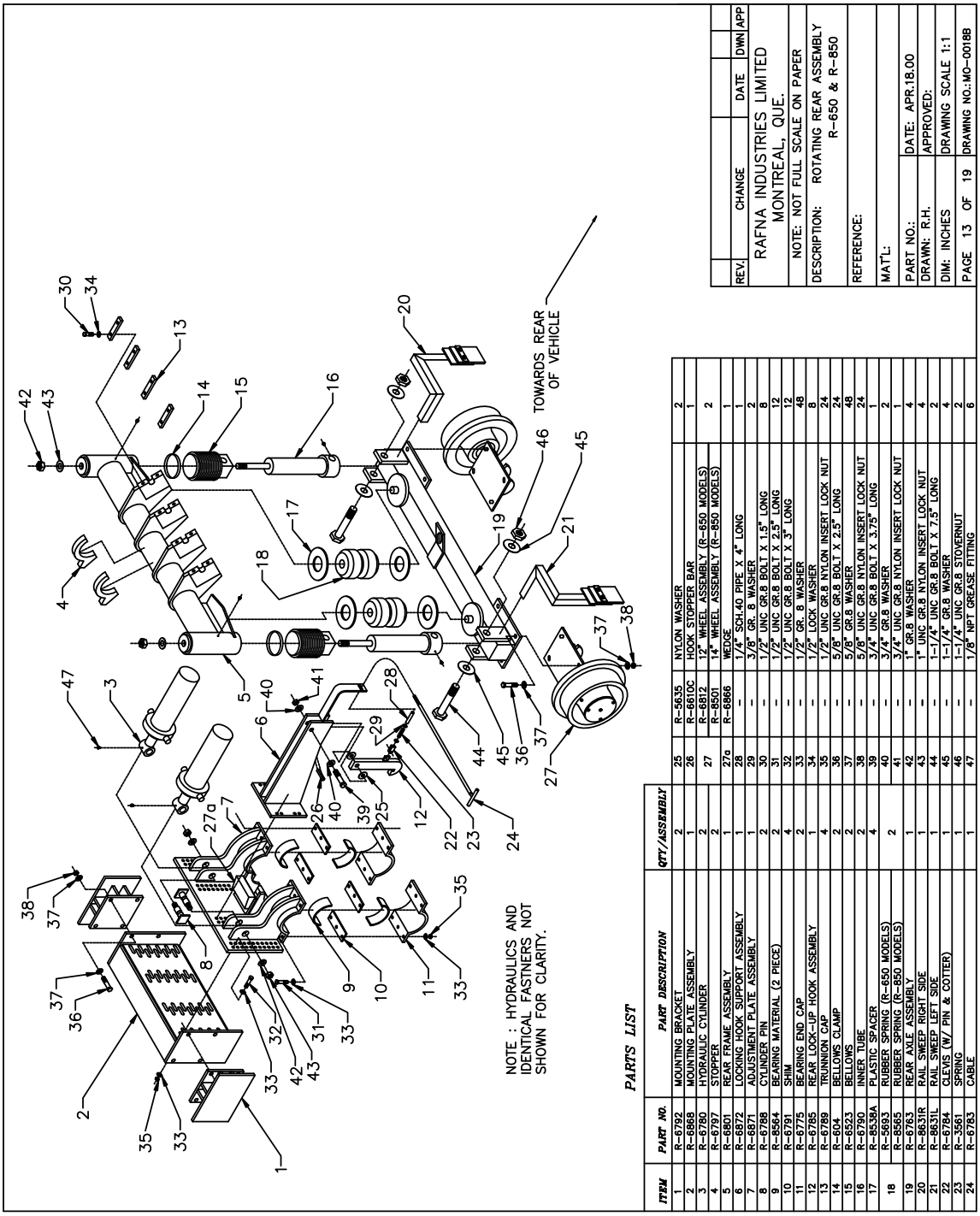


PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R-5661A	STEERING WHEEL LOCK PIVOT	1
2	R-5661B	STEERING WHEEL LOCK STOPPER	1
3	R-5665A	STEERING WHEEL LOCK LATCH	1
4	–	3/16" SELF TAPPING SCREW X 1/2" LONG	3
5	–	1/4" UNC GR. 8 BOLT X 2" LONG	1
6	–	1/4" SAE WASHER	2
7	–	1/4" UNC GR. 3 NYLON INSERT LOCK NUT	1



ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-5898	STEERING COLUMN BRACE	1
2	R-5899	STEERING WHEEL LOCK BRACKET	1
3	R-2586B	SPRING PIN	1



ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-6792	MOUNTING BRACKET	2
2	R-6868	MOUNTING PLATE ASSEMBLY	1
3	R-6780	HYDRAULIC CYLINDER	2
4	R-6797	STOPPER	2
5	R-6801	REAR FRAME ASSEMBLY	1
6	R-6872	LOCKING HOOK SUPPORT ASSEMBLY	1
7	R-6871	ADJUSTMENT PLATE ASSEMBLY	1
8	R-6788	CYLINDER PIN	2
9	R-8564	BEARING MATERIAL (2 PIECE)	2
10	R-6791	SHIM	4
11	R-6775	BEARING END CAP	2
12	R-6785	REAR LOCK-UP HOOK ASSEMBLY	1
13	R-6789	TRUNNION CAP	4
14	R-604	BELLOWS CLAMP	2
15	R-6523	BELLOWS	2
16	R-6790	INNER TUBE	2
17	R-8538A	PLASTIC SPACER	4
18	R-5693	RUBBER SPRING (R-650 MODELS)	2
	R-8565	RUBBER SPRING (R-850 MODELS)	
19	R-6763	REAR AXLE ASSEMBLY	1
20	R-8631R	RAIL SWEEP RIGHT SIDE	1
21	R-8631L	RAIL SWEEP LEFT SIDE	1
22	R-6784	CLEVIS (W/ PIN & COTTER)	1
23	R-3561	SPRING	1
24	R-6783	CABLE	1
25	R-5635	NYLON WASHER	2
26	R-6610C	HOOK STOPPER BAR	1
27	R-6812	12" WHEEL ASSEMBLY (R-650 MODELS)	2
	R-8501	14" WHEEL ASSEMBLY (R-850 MODELS)	
27a	R-6866	WEDGE	1
28	–	1/4" SCH.40 PIPE X 4" LONG	1
29	–	3/8" GR. 8 WASHER	2
30	–	1/2" UNC GR.8 BOLT X 1.5" LONG	8
31	–	1/2" UNC GR.8 BOLT X 2.5" LONG	12
32	–	1/2" UNC GR.8 BOLT X 3" LONG	12
33	–	1/2" GR. 8 WASHER	48
34	–	1/2" LOCK WASHER	8
35	–	1/2" UNC GR.8 NYLON INSERT LOCK NUT	24
36	–	5/8" UNC GR.8 BOLT X 2.5" LONG	24
37	–	5/8" GR.8 WASHER	48
38	–	5/8" UNC GR.8 NYLON INSERT LOCK NUT	24
39	–	3/4" UNC GR.8 BOLT X 3.75" LONG	1
40	–	3/4" GR.8 WASHER	2
41	–	3/4" UNC GR.8 NYLON INSERT LOCK NUT	1
42	–	1" GR.8 WASHER	4
43	–	1" UNC GR.8 NYLON INSERT LOCK NUT	4
44	–	1-1/4" UNC GR.8 BOLT X 7.5" LONG	2
45	–	1-1/4" GR.8 WASHER	4
46	–	1-1/4" UNC GR.8 STOVERNUT	2
47	–	1/8" NPT GREASE FITTING	6

PARTS LIST

REV.	CHANGE	DATE	DWN	APP

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: ROTATING REAR ASSEMBLY R-650 & R-850

REFERENCE:

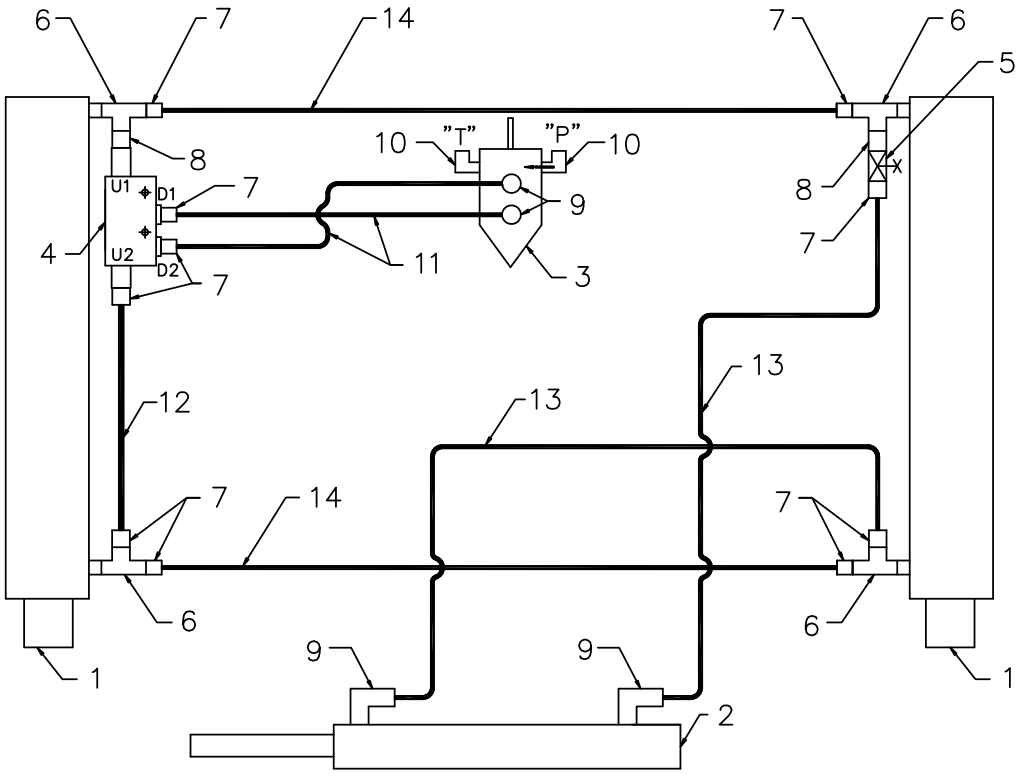
MAT'L:

PART NO.: DATE: APR.18.00

DRAWN: R.H. APPROVED:

DIM: INCHES DRAWING SCALE 1:1

PAGE 13 OF 19 DRAWING NO.:MO-0018B



PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R-6593	FRONT HYDRAULIC CYLINDER	2
2	R-5682	AXLE LOCK UP CYLINDER	1
3	R-559M	OPERATING VALVE	1
4	R-560	HYDRAULIC CHECK VALVE	1
5	R-8594	BALL VALVE	1
6	–	HYDRAULIC FITTING 25 VK-06	4
7	–	HYDRAULIC FITTING 848 FS-06-06	10
8	–	HYDRAULIC FITTING 24 SA-06	2
9	–	HYDRAULIC FITTING 849 FS-06-06	4
10	–	HYDRAULIC FITTING 849 FS-06-08	2
11	–	HOSE L=20.5" (HU-06-06NJ BOTH ENDS)	2
12	–	HOSE L=7.25" (HU-06-06NJ BOTH ENDS)	1
13	–	HOSE L=80" (HU-06-06NJ BOTH ENDS)	2
14	–	HOSE L=7.75" (HU-06-06NJ BOTH ENDS)	2

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

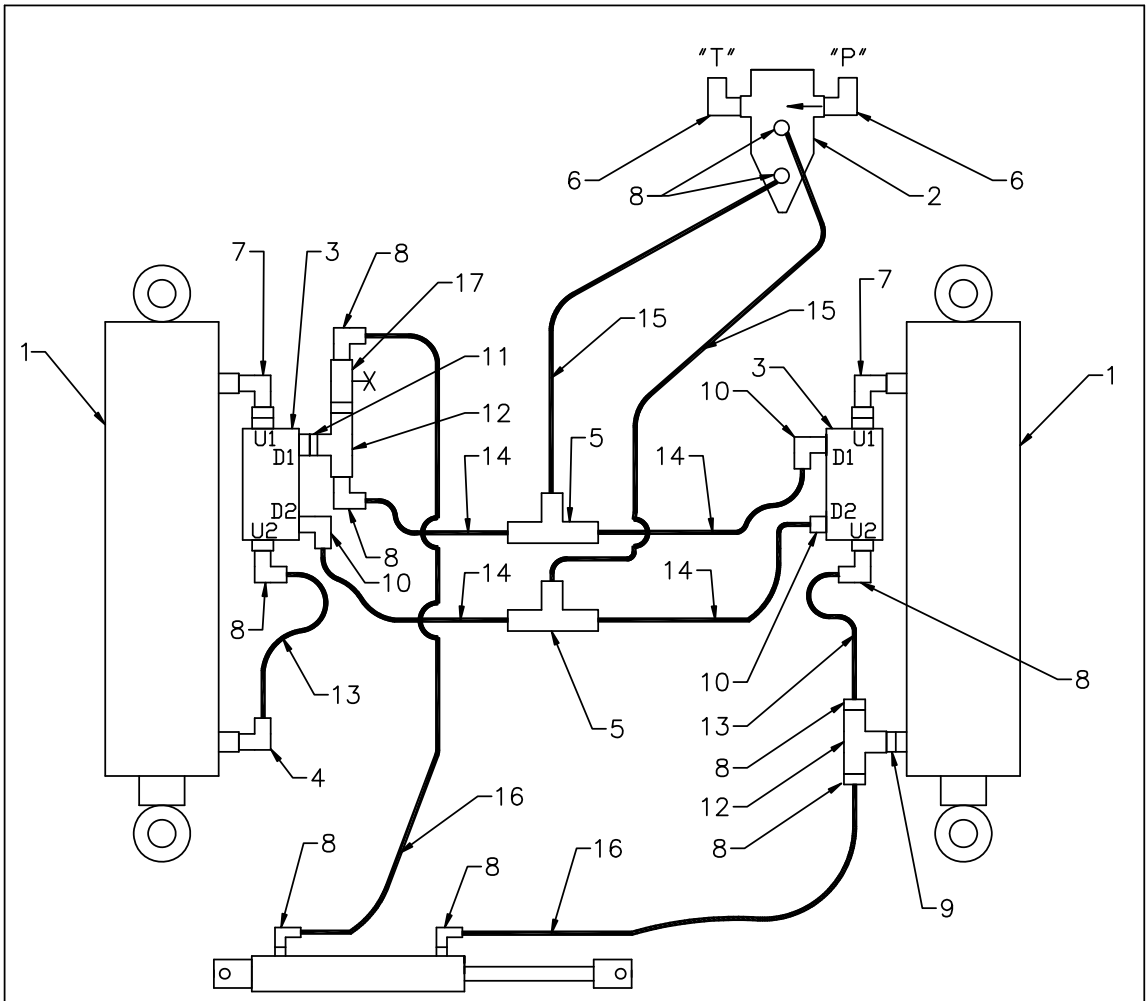
NOTE: NOT FULL SCALE ON PAPER

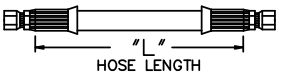
DESCRIPTION: VERTICAL FRONT HYDRAULICS R-650

REFERENCE:

MAT'L:

PART NO.:	DATE: OCT 26/99
DRAWN: R.H.	APPROVED:
DIM: INCHES	DRAWING SCALE 1:1
PAGE 14 OF 19	DRAWING NO.: MO-0018B

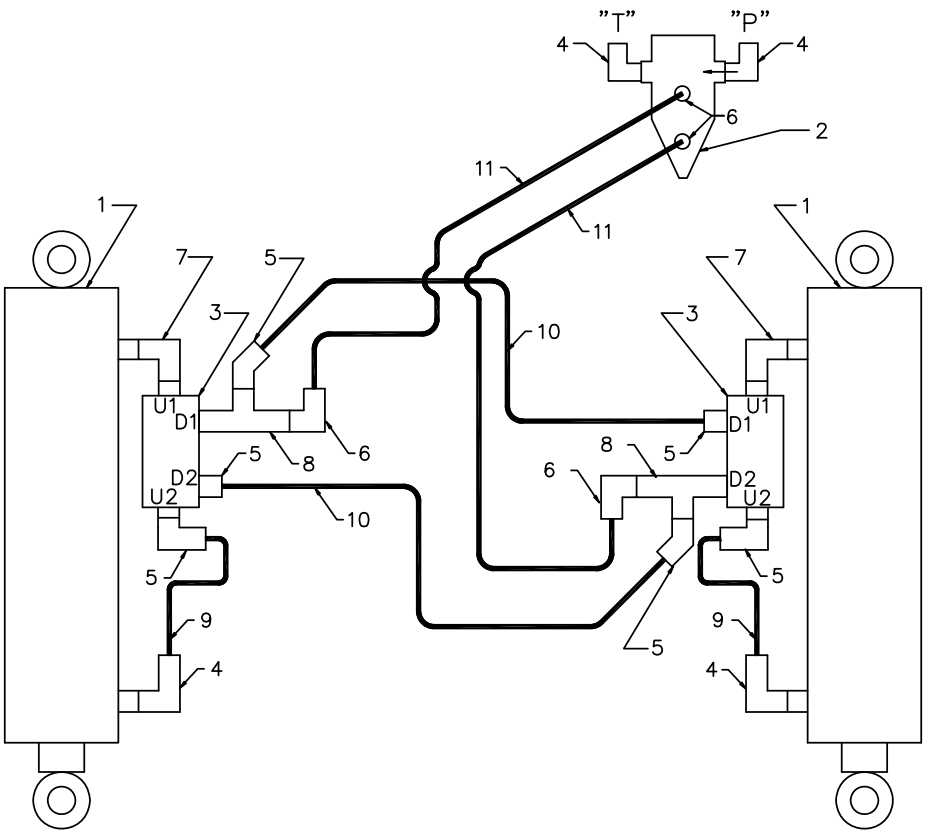


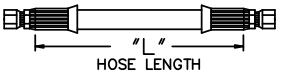


PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R–5680	HYDRAULIC CYLINDER	2
2	R–559M	OPERATING VALVE	1
3	R–560	HYDRAULIC CHECK VALVE	2
4	–	HYDRAULIC FITTING 849 FS–06–08	1
5	–	HYDRAULIC FITTING 844 FS–06–06	2
6	–	HYDRAULIC FITTING 849 FS–06–08	2
7	–	HYDRAULIC FITTING 25 UA–06–08	2
8	–	HYDRAULIC FITTING 849 FS–06–06	10
9	–	HYDRAULIC FITTING 24 SB–08–06	1
10	–	HYDRAULIC FITTING 848 FS–06–06	3
11	–	HYDRAULIC FITTING 24 SA–06–06	1
12	–	HYDRAULIC FITTING 25 VC 06	2
13	–	HYD. HOSE L=12.5" (HU–06–06NJ ENDS)	2
14	–	HYD HOSE L=10" (HU–06–06NJ90T ENDS)	4
15	–	HYD HOSE L=32" (HU–06–06NJ ENDS)	2
16	–	HYD HOSE L=80" (HU–06–06NJ ENDS)	2
17	R–8594	BALL VALVE	1

RAFNA INDUSTRIES LIMITED MONTREAL, QUE.	
NOTE: NOT FULL SCALE ON PAPER	
DESCRIPTION: ROTATING FRONT HYDRAULICS R–650	
REFERENCE:	
MAT'L:	
PART NO.:	DATE: OCT 26/99
DRAWN: R.H.	APPROVED:
DIM: INCHES	DRAWING SCALE 1:1
PAGE 15 OF 19	DRAWING NO.: MO–0018B





PARTS LIST

ITEM	*PART NO.*	*PART DESCRIPTION*	*QTY/ASSEMBLY*
1	R–6780	REAR HYDRAULIC CYLINDER	2
2	R–559M	OPERATING VALVE	1
3	R–560	HYDRAULIC CHECK VALVE	2
4	–	HYDRAULIC FITTING 849 FS–06–08	4
5	–	HYDRAULIC FITTING 854 FS–06–06	6
6	–	HYDRAULIC FITTING 849 FS–06–06	4
7	–	HYDRAULIC FITTING 25 UA–06–08	2
8	–	HYDRAULIC FITTING 25 VK–06	2
9	–	HYD. HOSE L=10" W/ HU–06–06NJ	2
10	–	HYD HOSE L=15" W/ HU–06–06NJ	2
11	–	HYD HOSE CUT TO FIT	2

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

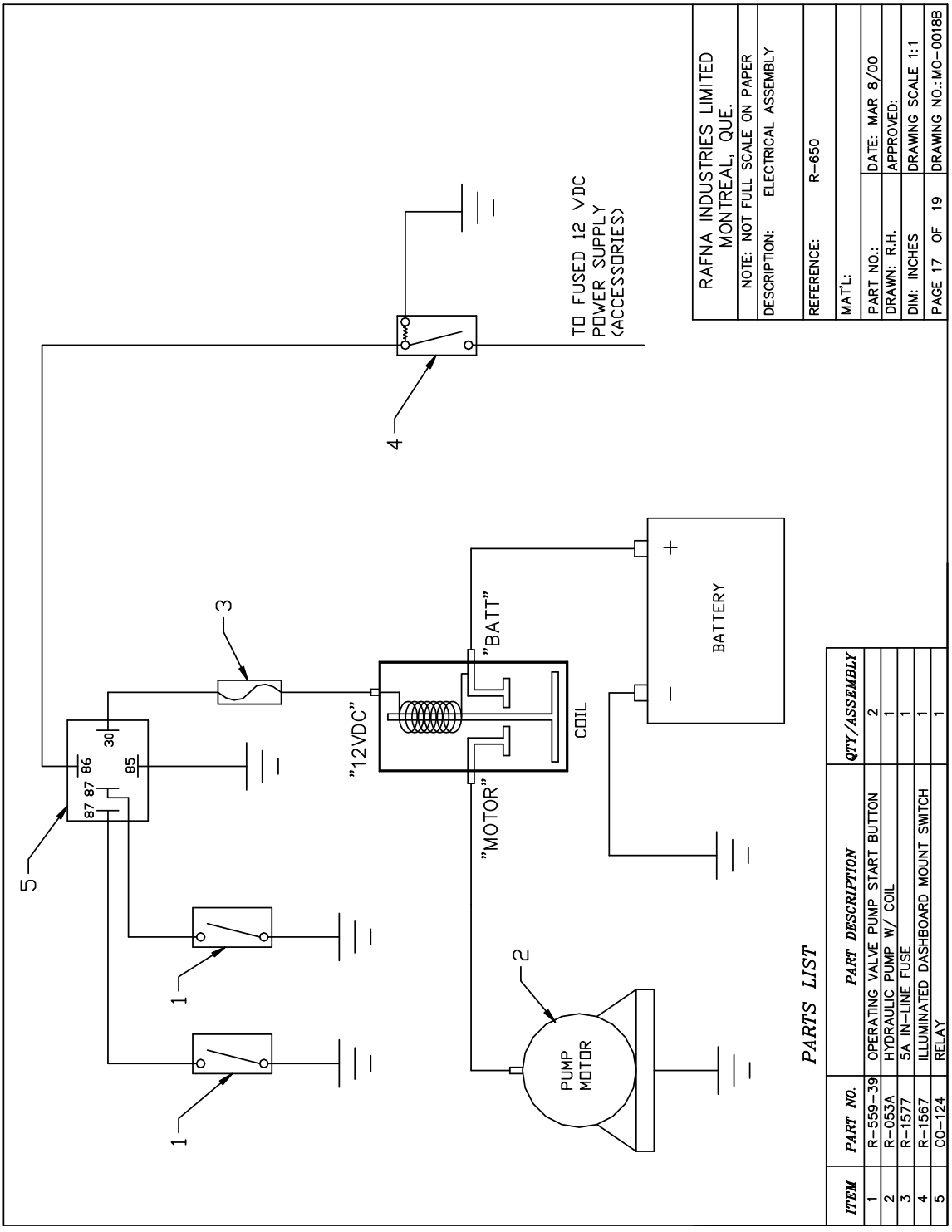
NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: ROTATING REAR HYDRAULICS R–650

REFERENCE:

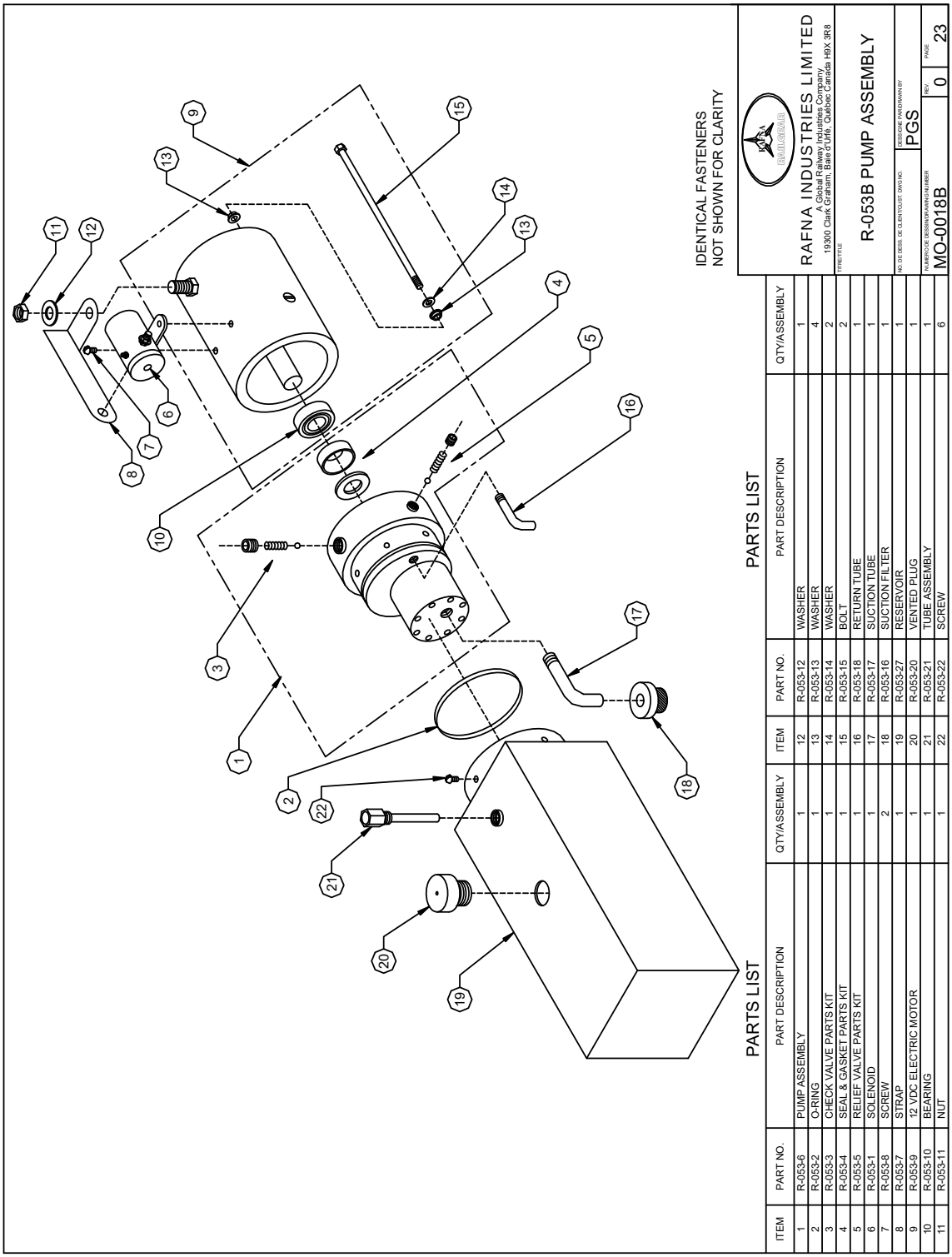
MAT'L:

PART NO.:	DATE: OCT 26/99
DRAWN: R.H.	APPROVED:
DIM: INCHES	DRAWING SCALE 1:1
PAGE 16 OF 19	DRAWING NO.: MO–0018B



PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-559-39	OPERATING VALVE PUMP START BUTTON	2
2	R-053A	HYDRAULIC PUMP W/ COIL	1
3	R-1577	5A IN-LINE FUSE	1
4	R-1567	ILLUMINATED DASHBOARD MOUNT SWITCH	1
5	CO-124	RELAY	1

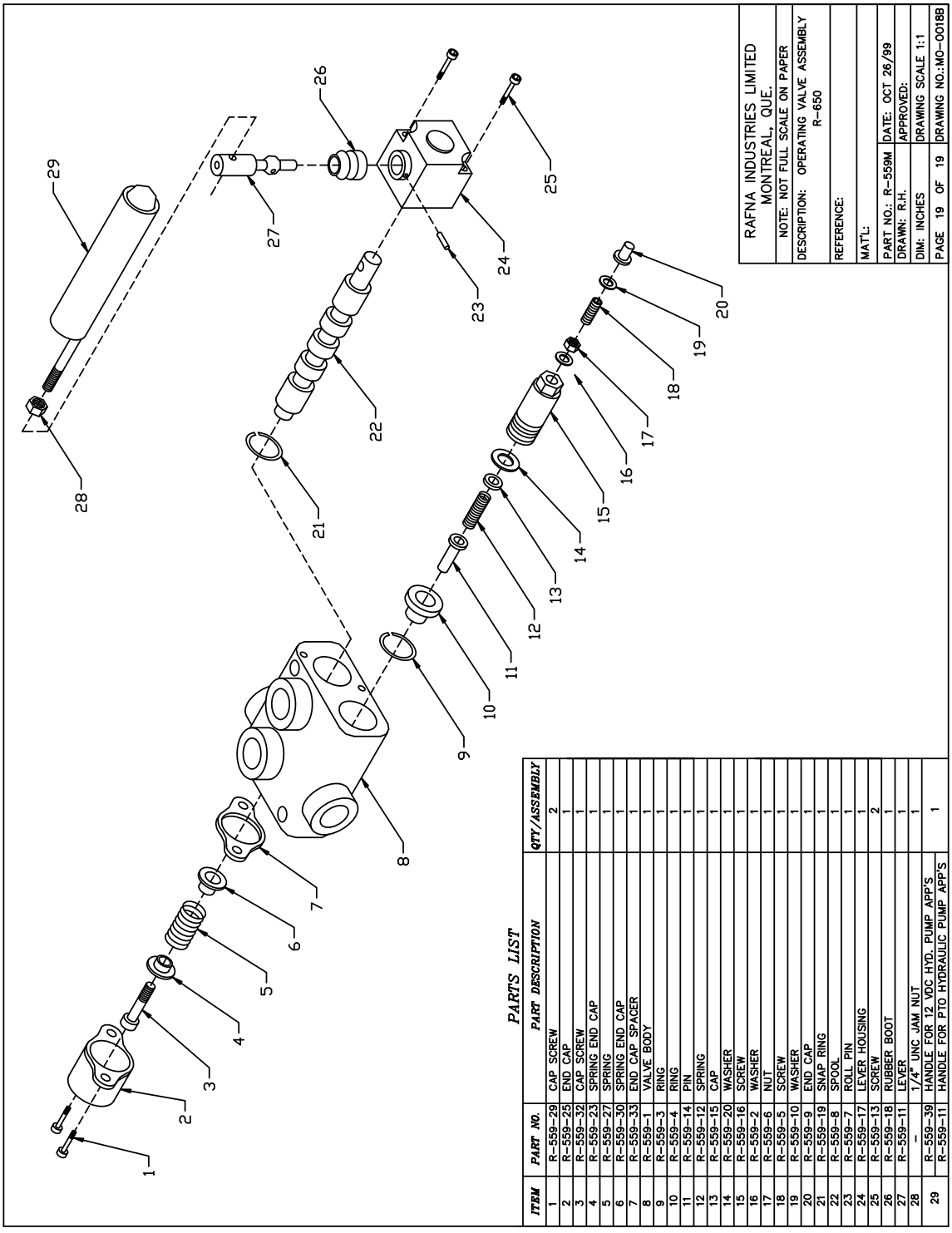


PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-053-6	PUMP ASSEMBLY	1
2	R-053-2	O-RING	1
3	R-053-3	CHECK VALVE PARTS KIT	1
4	R-053-4	SEAL & GASKET PARTS KIT	1
5	R-053-5	RELIEF VALVE PARTS KIT	1
6	R-053-1	SOLENOID	1
7	R-053-8	SCREW	2
8	R-053-7	STRAP	1
9	R-053-9	12 VDC ELECTRIC MOTOR	1
10	R-053-10	BEARING	1
11	R-053-11	NUT	1

PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
12	R-053-12	WASHER	1
13	R-053-13	WASHER	4
14	R-053-14	WASHER	2
15	R-053-15	BOLT	2
16	R-053-18	RETURN TUBE	1
17	R-053-17	SUCTION TUBE	1
18	R-053-16	SUCTION FILTER	1
19	R-053-27	RESERVOIR	1
20	R-053-20	VENTED PLUG	1
21	R-053-21	TUBE ASSEMBLY	1
22	R-053-22	SCREW	6



PARTS LIST

ITEM	PART NO.	PART DESCRIPTION	QTY/ASSEMBLY
1	R-559-29	CAP SCREW	2
2	R-559-25	END CAP	1
3	R-559-32	CAP SCREW	1
4	R-559-23	SPRING END CAP	1
5	R-559-27	SPRING	1
6	R-559-30	SPRING END CAP	1
7	R-559-33	END CAP SPACER	1
8	R-559-1	VALVE BODY	1
9	R-559-3	RING	1
10	R-559-4	RING	1
11	R-559-14	PIN	1
12	R-559-12	SPRING	1
13	R-559-15	CAP	1
14	R-559-20	WASHER	1
15	R-559-16	SCREW	1
16	R-559-2	WASHER	1
17	R-559-6	NUT	1
18	R-559-5	SCREW	1
19	R-559-10	WASHER	1
20	R-559-9	END CAP	1
21	R-559-19	SNAP RING	1
22	R-559-8	SPOOL	1
23	R-559-7	ROLL PIN	1
24	R-559-17	LEVER HOUSING	1
25	R-559-13	SCREW	2
26	R-559-18	RUBBER BOOT	1
27	R-559-11	LEVER	1
28		1/4" UNC JAM NUT	1
29	R-559-39	HANDLE FOR 12 VDC HYD. PUMP APP'S	1
	R-559-11	HANDLE FOR PTO HYDRAULIC PUMP APP'S	

RAFNA INDUSTRIES LIMITED
MONTREAL, QUE.

NOTE: NOT FULL SCALE ON PAPER

DESCRIPTION: OPERATING VALVE ASSEMBLY R-650

REFERENCE:

MATL:

PART NO.: R-559M | DATE: OCT 26/99
DRAWN: R.H. | APPROVED:
DIM: INCHES | DRAWING SCALE 1:1
PAGE 19 OF 19 | DRAWING NO.: MO-0018B

APPENDIX