

RAYMOND

Maintenance Manual

**Models 8300, 8400, and 8500 Pallet Trucks
and Model 8600 Tow Tractor**



Models:
8300, 8400, 8500, and 8600

Serial Numbers:
59,749 to 83,000

Publication: 1034066E
Replaces
Publication: 1034066D

Revised: 18 Dec 2009
Revised: 15 May 2009

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Page Revision Record

Page Revision Record

This page is a record of the revision of all pages in this manual. Whenever a page is revised, this section is updated and included in the revision.

Pages are revised due to technical and non-technical changes identified as follows:

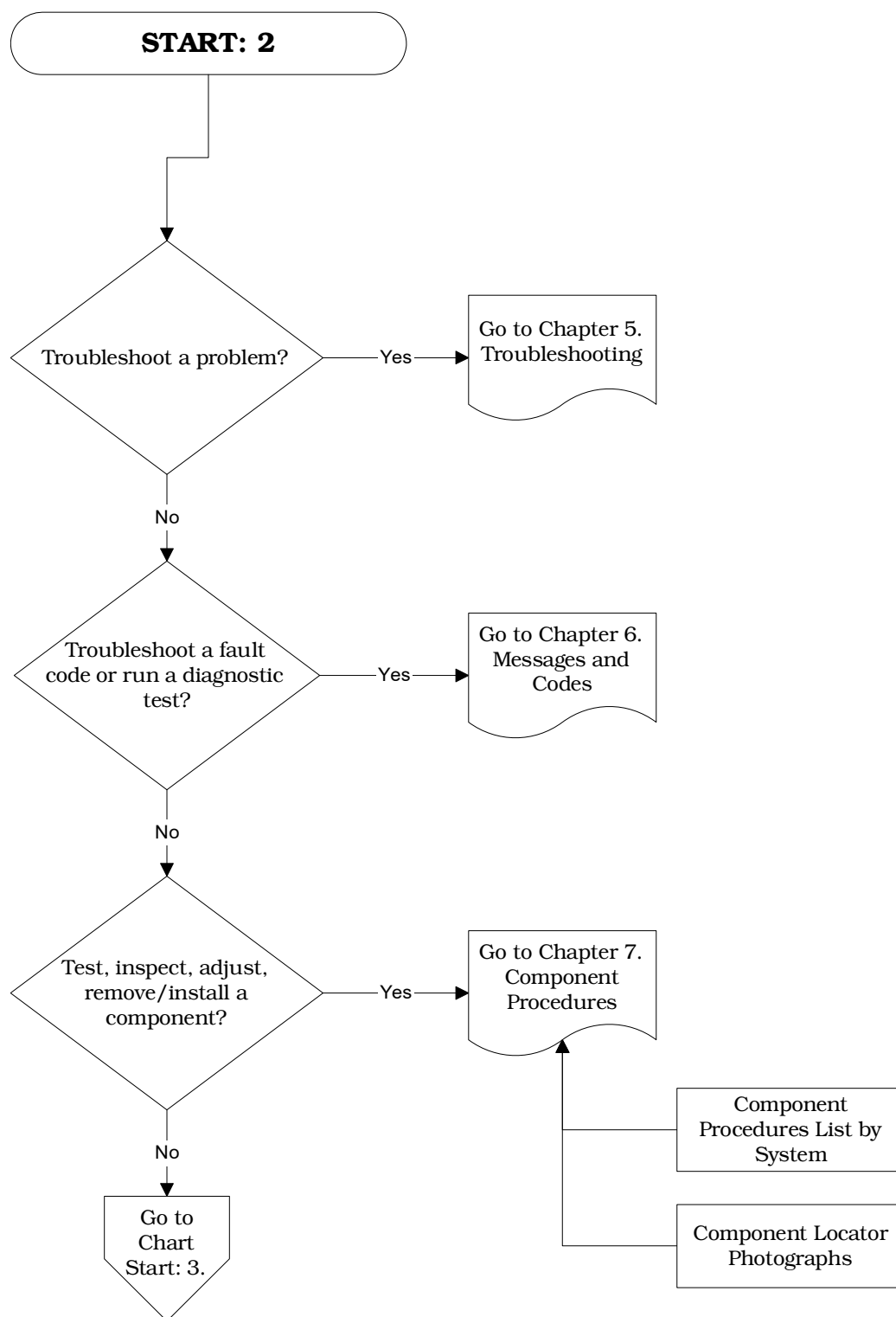
- Technical changes – These changes are identified by a vertical line (change bar) in the left margin next to the change. Pages affected by technical changes are identified with “Revised: Month Year” in the footer. These pages may also be available on the Raymond iNet.
- Non-technical changes – These changes consist of typographical and grammatical corrections, paragraph renumbering, repagination, and so on. Non-technical changes are not identified with a change bar, however, affected pages are identified with “Revised: Month Year” in the footer.

Document Revision History

- 1034066A, Original Issue Date,
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- 1034066B, Revision B,
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- 1034066D, Revision D
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- 1034066E, Revision E
Revised: 18 Dec 2009

List of Revised Pages

Revision E standardized placement of content into eight chapters instead of six. Chapters were added for Messages and Codes and Theory of Operation, removing this content from the Troubleshooting chapter. Operator Display and Programming content was moved from the Troubleshooting chapter to the Systems Overview chapter. These changes align content of this manual with other Raymond manuals to aid users in locating information from one class truck to another.

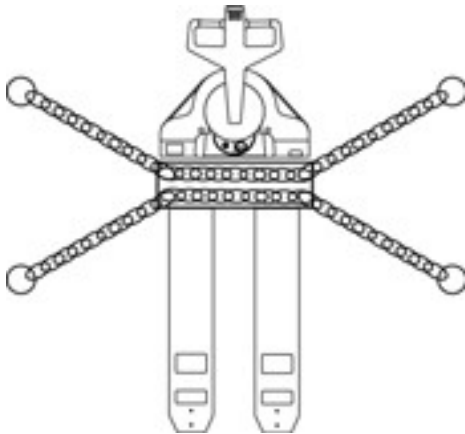


Tie-Down for Transport

To transport your *Raymond* pallet truck in an over-the-road vehicle or rail car, perform these steps:

1. Lower the forks and put the truck in the center of the transport vehicle.
2. Using suitable lifting device, remove the battery. See [“Battery” on page 7-46](#).
3. Position the adjustable chain over and thru the battery compartment.
4. Position an additional adjustable chain over and thru the battery compartment.
5. Position the chain ends of one chain toward the front of the vehicle bed and the chain ends of the other chain to the back of the vehicle bed and draw taut. See [Figure 2-1](#).

Figure 2-1. Tie-Down for Transport



NOTE: This secures the truck to the vehicle bed and prevents tip-over and forward or backward movement.

6. Secure the battery according to the battery manufacturer's instructions. If equipped, remove the battery cover or storage tray from the top of the battery and store separately.

Operator Display and Programming

- When the handle is released at a chosen history number (1-50), the display first shows the caution or error code and then the activity hour (Hour meter B) the fault occurred.
 - For example, if you only have one fault registered in the memory, the second empty position is shown like this: Fault: E - - - and time: - - - -.
3. Turn the truck OFF to end displaying the error code history.

Changing Truck Parameters (P)



Modifying specific truck parameters changes the driving characteristics of the truck.

NOTE: Parameters 1 thru 7 are individual operator (driver) parameters. Parameters 10 thru 40 are service parameters. Individual operator parameters (1 thru 7) may or may not be accessed, depending on the value of service parameter 39. See [Table 3-2, "Service Parameters,"](#) on page 3-9.

Programming Operator Parameters

To program the trucks operator parameters follow directions below:

1. Enter special truck mode. See ["Special Truck Mode"](#) on page 3-6.

2. Release the horn button when the "P" is displayed. The parameter control indicator is illuminated. See [Figure 3-8](#).
3. Use the directional/speed control to scroll to the desired truck parameter you want to change or view. See [Table 3-1](#). Release the directional/speed control to neutral when the desired parameter number and value is displayed.

NOTE: All parameters can be viewed; however, not all parameters can be changed. Individual operator parameters (1 thru 7) may or may not be accessed, depending on the value of service parameter 39.

4. Press the horn button once. The parameter control indicator on the display starts flashing.
5. Change the parameter value by rotating the directional/speed control up or down. Release the directional/speed control to neutral when the desired parameter number is shown.
6. Press the horn button again to confirm the change. The parameter control indicator on the display stops flashing and remains illuminated.
7. Turn the truck OFF to end programming.

The truck parameter change is complete. The next time the truck is started, the new parameter is in effect.

Table 3-1. Truck (Operator) Parameters

Parameter	Name	Model	Range (Step)	Default	Description
01	Max Speed, Walking Speed Mode	8300, 8400, 8500, and 8600	0 to 42% (2%)	42%	Maximum requested speed in walking speed mode (coast engaged mode on models 8400 and 8500). This parameter controls the scaling of the throttle request.
02	Max Speed, Rabbit Mode	8400, 8500, and 8600	0 to 100% (2%)	100%	Maximum requested speed when in Rabbit mode. This parameter controls the scaling of the throttle request.
03	Acceleration Rate for Riding Speed Mode	8400, 8500, and 8600	1 to 5 (1)	2 (3 - 10.5 in. Dia. Tire)	Selects from a table for acceleration rate. 1= fastest, 5 = gentlest.

Configuration and Truck Setup Options

The Truck Setup screen feature allows you to:

- View and change options (parameters)
- View and change the serial number, model number, software model number, and hour meters of the truck (with a passkey). See [Figure 3-12](#).

Figure 3-12. Typical Truck Setup Screen

Truck Setup

CAN USB Adapter connected Model: B400
 Serial Number: 10000 Software Model Number: 9000
 Date of Manufacture: 12/12/2009

Access: 3. Keypad, Open

Parameter	1	2	3	4	5	6	7	8	9	10
10. PIN-key code (Optional Keypad)	1	0	0	0	0	0	0	0	0	0
1. Max Speed, Working Mode	42	42	42	42	42	42	42	42	42	42
2. Max Speed, Rabbit Mode	100	100	100	100	100	100	100	100	100	100
3. Acceleration Rate, Riding Mode	3	3	3	3	3	3	3	3	3	3
4. Neutral Brake (Deceleration)	5	5	5	5	5	5	5	5	5	5
5. Truck Off Delay (Optional Keypad)	0	0	0	0	0	0	0	0	0	0
6. Max Speed, Riding Mode	66	66	66	66	66	66	66	66	66	66
7. Acceleration Rate, Working Mode	3	3	3	3	3	3	3	3	3	3

Truck Parameters

Parameter	Value
12. Throttle Map	50
13. Brake Rate	3
16. Travel Alarm Type	0
18. Port Inlet Speed	0
19. Port Exit Speed	0
23. Lift Cut-off	23
24. Battery Reset Level	75
26. Sequencing Delay	200
28. Battery Rate	0
29. Fork Height vs Travel Speed	0
30. Port Inlet	0
31. Alarm	0
32. Control	0
35. 3-Position Key Switch	0
37. Sub Model Type	1

Meters

Select Meter to be displayed on trucks' display:
 Activity Time

Meter	Hours
Key On	311
Activity Time	13
Travel	5
Coast	0

Buttons: Software, Reset Defaults, Diagnostics, Error Log, RE_READ Truck Settings, SEND Changes to Truck, SAVE Settings to File, Erase Vehicle Manager, Exit

Changing Truck Parameters:

Options and hour meters displayed in red require authorization codes. When these options are selected, a pop up window appears requesting the authorization code. Contact your local Raymond dealer for the correct forms and procedure for obtaining the authorization codes. Authorization codes are available that allow you to change the Serial Number, Hour Meters, and Date of Manufacture.

The Truck Parameters area lists the truck options.

1. Scroll to the parameter that you would like to change and click the value field.
2. Enter the corresponding number that matches how you want the truck set. See [Figure 3-13](#).

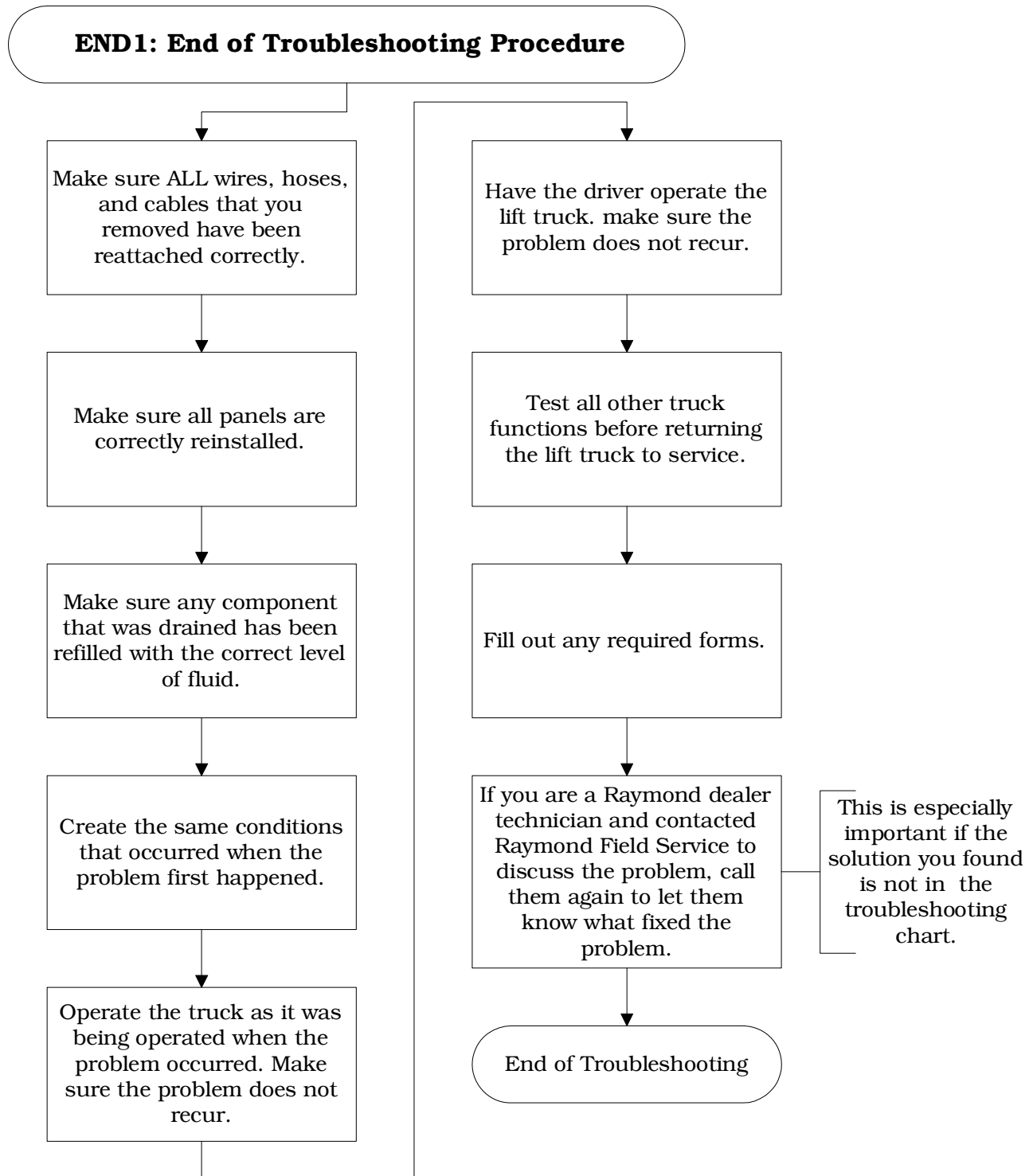
Every 180 Days or 500 Deadman Hours

Perform the following maintenance tasks every 180 days or 500 HD, whichever comes first.	
Component	Task
Frame and Tractor Checks	General visual inspection of structural members for cracks, including but not limited to the fork frame and tractor.
Hardware	Check bolt torque of major components (motors, brake, drive unit). Tighten any loose hardware. Replace any broken or missing hardware. See "Component Specific Service/Torque Chart" on page A-4.
Horn	Check that the horn operates when you press the horn button.
Hydraulic Hoses	Inspect all hydraulic hoses for leaks, nicks, cut, chafing, and bulges. Replace damaged hoses as soon as possible. Inspect all fittings for leaks. Repair any leaks immediately.
Hydraulic Reservoir	Check fluid level. See "Hydraulic Fluid" on page 7-83.
Lubrication	Lubricate all grease points and control handle pivot points. Lowest SM interval for truck. See "Grease Fittings (All Models)" on page 4-8.
Motors	AC - Check the cable lugs to make sure they are tight to the terminal studs. Torque the outside nut to the values listed. Replace any cable that shows signs of excessive heat. Check sensor wires for sound connection and condition. Blow out the inside of the motor with compressed air. DC - Check condition of brushes, springs, and holders. Check that the brush length exceeds the minimum length. Hydraulic Pump motor: 1/2 in. (13 mm). Inspect the commutator. See "Inspection" on page 5-12. Blow out the inside of the motor with compressed air. See "Lift Motor" on page 7-79.
Pallet Entry Wheels/Sliders	Check and replace damaged wheels/sliders as necessary. See "Pallet Entry Sliders" on page 7-107.
Traction Amplifiers	Torque power cable terminal nuts to 100 in. lb. (11.3 Nm).
Shorts to Frame	Check for electrical shorts to frame. See "Shorts to Frame Test" on page 5-8. Wipe down the inside of the compartment.
Static Straps	Make sure static straps are not worn or broken. Clean debris from straps.
Switches	Check all switches for correct operation and adjust as needed.
Warning Decals	Replace any unreadable or damaged decals.
Load Wheels and Drive Tires	Examine for bond failure, chunking, and excessive or uneven wear. Inspect load wheel bearings for binding or excessive play.



END1: End of Troubleshooting Procedure

Figure 5-3. END1: End of Troubleshooting Procedure



Grounded Motor Test

In a grounded motor, an electrical circuit exists between the current-carrying conductors and the motor housing. This can be caused either by direct contact or thru conductive foreign material.

The ground may be caused by:

- Insulation breakdown
- Brush leads touching the motor housing
- Build-up of carbon dust or other materials

To test a motor for grounds:

1. Isolate the motor from the truck circuit by removing the power cables. Use two wrenches to avoid twisting the terminal studs.
2. Attach one lead of a megohm meter or a digital ohmmeter to a motor terminal and the other lead to an unpainted surface of the motor housing. Set the ohmmeter to the highest scale.
3. If the ohmmeter reads resistance of less than 100,000 ohms, the motor is grounded. Clean, repair, or replace the motor as necessary.

Short-Circuited Armature

A short circuit in the armature causes heating that could result in burning of:

- Armature coil
- Brush wires
- Commutator segments

Visual inspection may reveal this condition.

Positive determination of a short-circuited armature requires special equipment at a motor rebuilding facility.

Short-Circuited Winding

A short-circuited winding is one where the insulation on the field or armature has broken down at two or more points. The breakdown creates a low resistance path, permitting current to flow from one turn of the coil to another adjacent coil turn, without actually flowing thru the coil wire. The result is a decrease in total resistance of the motor winding and an increase in the current flow. The severity of the short circuit depends on its location.

A shorted motor may be indicated by:

- Slow or sluggish operation
- Running faster than normal
- Overheating
- Blowing a power fuse
- On DC motors, severe burning or discoloring on one or two commutator segments every 90° of rotation

These symptoms can be caused by problems other than the motor itself:

- Brake too tight or dragging
- Wheel bearings too tight
- Faulty transmission
- Binding in an attached pump

Testing a motor for short-circuited windings requires special equipment at a motor rebuilding facility.

Symptom Tables: Travel (Forward/Reverse) System

Table 5-19. No Rabbit Speed, Travel/Lift/Lower OK. No Fault Codes

Possible Cause	Action
NOTE: Rabbit speed only works in the tractor-first (forward) direction. End rider models are equipped with “latched” rabbit speed buttons. Press and release the button to enable rabbit speed. Rabbit speed is disabled by applying brake or returning the throttle to neutral.	NOTE: Rabbit speed (actual) is dependant on: 1. +12V present at JP1-9 (Rabbit Input 3) of TA 2. CAN Hi input Comm I/O signal at JP1-23 3. Traction motor armature current
Traction Amplifier programming changed	Jack and block truck. Verify programming. If changed, reset programming. See “Changing Truck Parameters (P)” on page 3-7 . Verify inputs of B+ at TA and VM.
Bad control handle switches or grab rail switches	For control handle switches, enter the digital input test for rabbit switches and verify operation. For the grab rail switch, measure voltage at JP1-14 wrt B-. With the switch closed, voltage should be between 10.5 and 13 volts. With switch open, voltage should be 0 volts. If okay, replace the TA.

Table 5-20. No Truck Functions Active. TA Flash Code 1,8, (Excessive Battery Voltage). Operator Display May Indicate E222

Possible Cause	Action
Battery Problem	Verify the correct, (24V) fully-charged, battery is installed in truck.
Is battery charger plugged into truck?	Disconnect battery charger immediately.
Bad Traction Amplifier	Verify battery voltage at key switch input. Measure voltage at JP1-1 wire with JP1 disconnected. If 24V, replace TA.

Traction Amplifier Flash Codes

TA Flash Code	Error Code	Description	Action
5,1	E150 or blank	Initial CAN Message Not Recieved	See "Troubleshooting the CAN Bus" on page 5-6.
6,1	E150 or blank	CAN Timeout Error	See "Troubleshooting the CAN Bus" on page 5-6.
6,3	E150 or blank	Ead SDO CAN Message	See "Troubleshooting the CAN Bus" on page 5-6.
6,5	E150 or blank	Ead Communication Spec	See "Troubleshooting the CAN Bus" on page 5-6.
6,8	E232	VCL Runtime	See "Code E232" on page 6-26.
6,9	E230	External Supply Out-of-Range	See "Code E230" on page 6-25.
7,1		CAN Timeout, No Truck Functions Active	See Table 5-32 on page 5-29.
7,2	E150 or blank	FDO CAN Message Timeout	See "Troubleshooting the CAN Bus" on page 5-6.
7,3	C72	Traction Motor Stalled	See "Code C72" on page 6-18.

Caution Codes

Table 6-59. Code C50

Code Title	Lift Switch Active on Power Up
Operator Display	C50
System Response	Traction performance limited. LOS (Limited Operating Strategy) Outputs available Main, Horn, and Lower
Alarm Sounds	No
Reason	Grab Rail/Load Backrest Lift switch (SW15) active on power up, or pin 12 on TA shorted to B+. TA inputs to JP1-12 are ON
Tests to Run	Examine VM, Traction Amplifier, and related wiring
How to Clear	Clear input (held switch, stuck switch, or shorted lead). Cycle key switch OFF/ON.

Table 6-60. Code C51

Code Title	Lower Switch Active on Power Up
Operator Display	C51
System Response	Traction performance limited. LOS (Limited Operating Strategy)
Alarm Sounds	No
Reason	Grab Rail/Load Backrest Lower switch active on power up or pin 11 on TA shorted to B+. TA inputs to JP1-11 are ON
Tests to Run	Examine VM, Traction Amplifier, and related wiring
How to Clear	Clear input (held switch, stuck switch, or shorted lead). Cycle key switch OFF/ON.

Table 6-61. Code C52

Code Title	Grab Rail/Load Backrest Lift/Lower Switches Active at Same Time
Operator Display	C52
System Response	Traction performance limited. LOS (Limited Operating Strategy)
Alarm Sounds	No
Reason	Grab Rail/Load Backrest Lift and Lower switches active on power up, or pin 11 and 12 on TA shorted to B+. TA inputs to JP1-11 or JP1-12 are ON
Tests to Run	Examine VM, Traction Amplifier, and related wiring
How to Clear	Clear inputs (held switches, stuck switches, or shorted leads). Cycle key switch OFF/ON.

Error Codes

Table 6-89. Code E225

Code Title	Precharge Fault
Operator Display	E225 TA Flash Code “1,4”
System Response	No truck function active
Alarm Sounds	No
Reason	TA precharge circuit failed
Tests to Run	None
How to Clear	Try cycling key switch OFF/ON. If that does not solve the problem, replace TA.

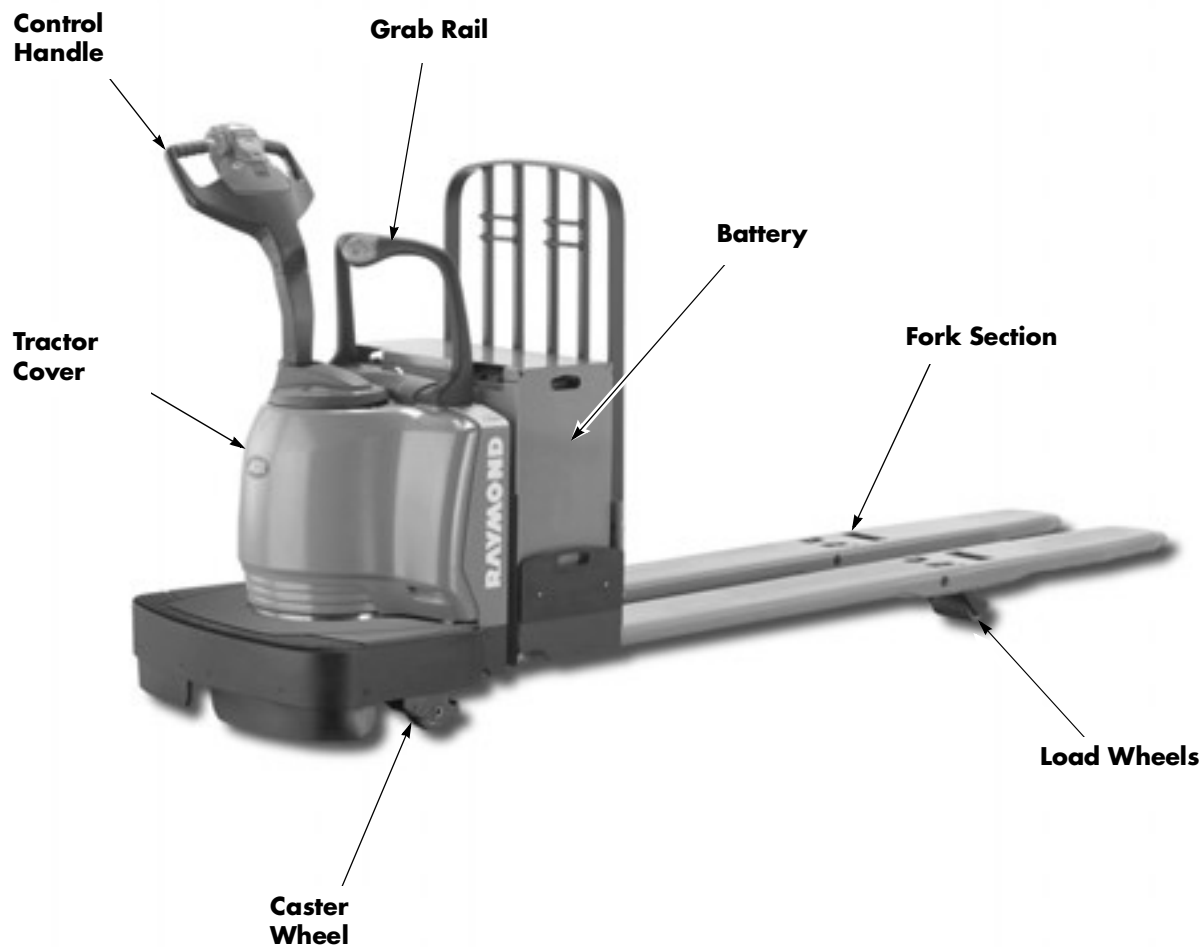
Table 6-90. Code E228

Code Title	Parameter Change Fault
Operator Display	E228 TA Flash Code “4,9”
System Response	No truck function active
Alarm Sounds	No
Reason	TA parameters have changed. Critical TA parameter changed while operating
Tests to Run	None
How to Clear	Cycle key switch OFF/ON.

Table 6-91. Code E230

Code Title	External Supply Out-Of-Range
Operator Display	E230 TA Flash Code “6,9”
System Response	No truck function active
Alarm Sounds	No
Reason	External supply current out-of-range (+12V, +5V). Devices connected to these outputs on the TA are drawing too much current (> 250 mA)
Tests to Run	If not cleared by cycling key switch OFF/ON, try to determine what device caused the problem
How to Clear	Cycle key switch OFF/ON.

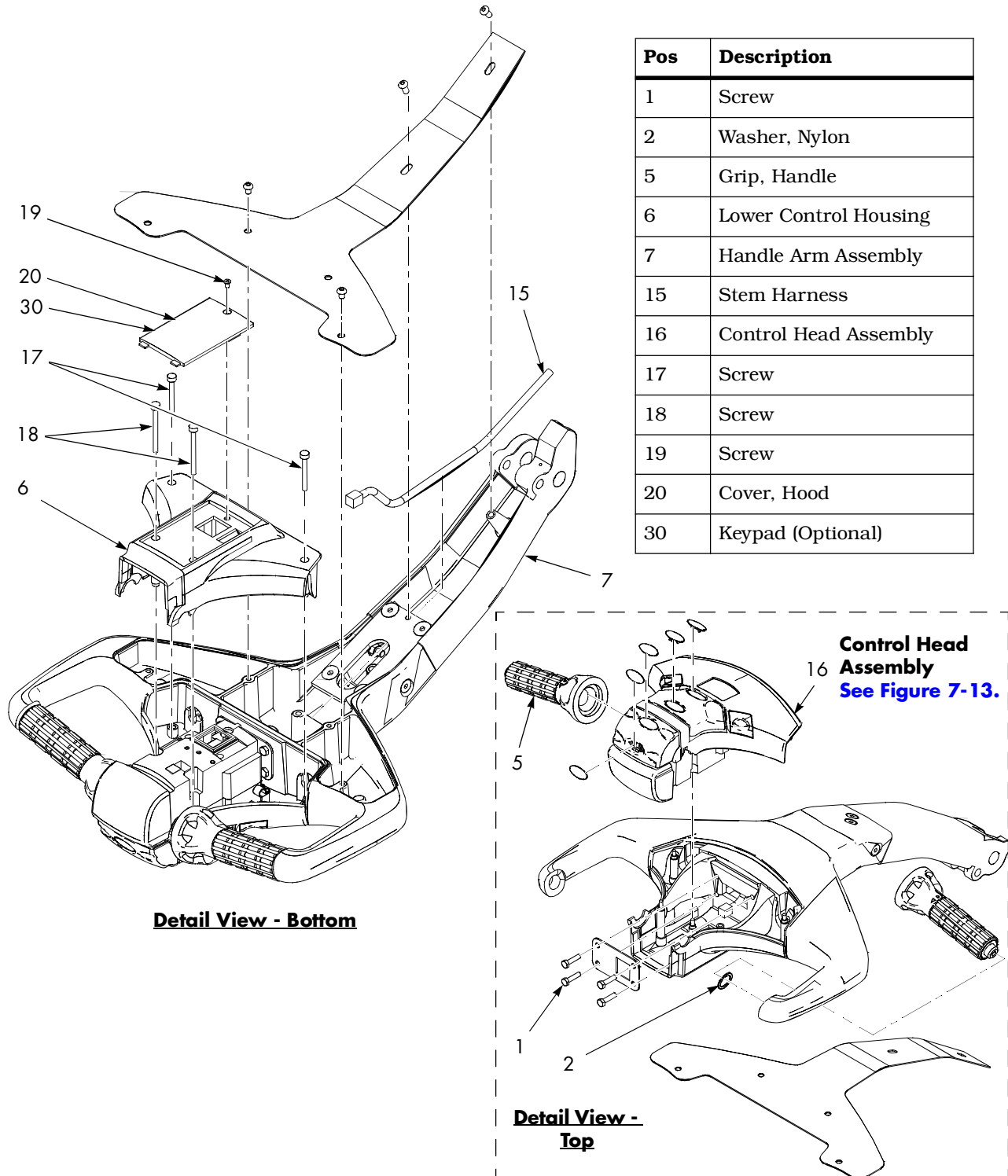
Figure 7-3. Model 8400 (Long-John Forks Shown)





Control Handle

Figure 7-12. Handle and Control Head Assembly



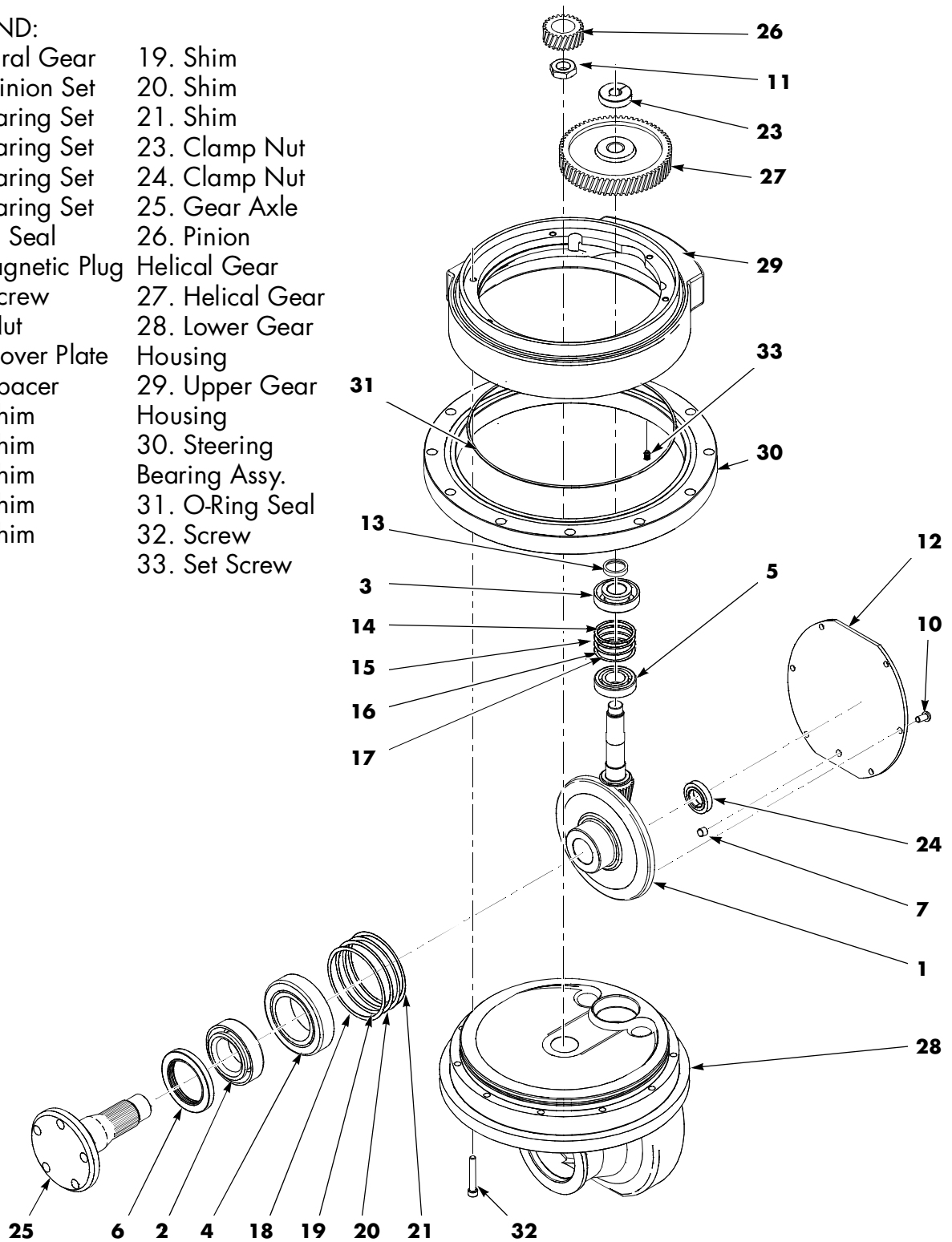
Drive and Brake

Drive Unit

Figure 7-27. Lower Drive Unit, Cross-Sectional View

LEGEND:

- | | |
|-------------------------------|----------------------------|
| 1. Spiral Gear and Pinion Set | 19. Shim |
| 2. Bearing Set | 20. Shim |
| 3. Bearing Set | 21. Shim |
| 4. Bearing Set | 23. Clamp Nut |
| 5. Bearing Set | 24. Clamp Nut |
| 6. Oil Seal | 25. Gear Axle |
| 7. Magnetic Plug | 26. Pinion |
| 10. Screw | 27. Helical Gear |
| 11. Nut | 28. Lower Gear Housing |
| 12. Cover Plate | 29. Upper Gear Housing |
| 13. Spacer | 30. Steering Bearing Assy. |
| 14. Shim | 31. O-Ring Seal |
| 15. Shim | 32. Screw |
| 16. Shim | 33. Set Screw |
| 17. Shim | |
| 18. Shim | |



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Drive and Brake

Casters (Torsion)

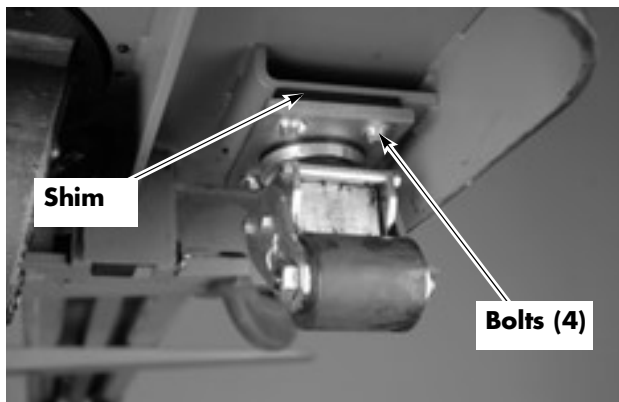
Figure 7-41. Caster Assembly, Assembled



Caster Installation

1. Fasten the caster assembly to the frame with the four bolts and washers. Do *not* tighten the bolts yet. See Figure 7-42.
2. Insert the height adjusting shims between the caster assembly and frame. See Figure 7-42. Adjust caster height so that each is flush with the drive tire (or 1/8 in. (3.175 mm) above drive tire).

Figure 7-42. Securing Caster To Tractor



3. Do *not* adjust casters higher than 1/8 in. (3.175 mm) above drive tire or caster may not track correctly. The two casters must contact the floor at all times when testing the truck.
4. Securely tighten the four mounting bolts.
5. Lubricate thru the grease fittings.
6. Remove the block and jack.

7. Check truck stability in a forks-trailing direction only and with a full-size battery.

Adjustable Caster Adjustment

1. Set the brake, turn the key switch OFF, remove the key (if equipped), and disconnect the battery connector.
2. Install the caster assembly as shown in Figure 7-43. The caster is off-set on the mounting plate. If installed incorrectly, the caster wheel hits the frame and does not rotate the full 360 degrees.

Figure 7-43. Adjustable Caster Adjustment



3. The caster has a coarse and fine adjustment. Adjust the coarse adjustment to place the caster wheel against the floor. Use shims only if needed.
4. Use the caster fine adjustment screw to make sure the caster just contacts the floor (after taking out any existing play). Loosen the jam nut. Turn the bolt OUT to lower the caster, turn the bolt IN to raise the caster. Tighten the jam nut when adjustment is complete.
5. Reconnect the battery connector and turn the key switch ON.

Electrical Components

Battery

Battery Installation

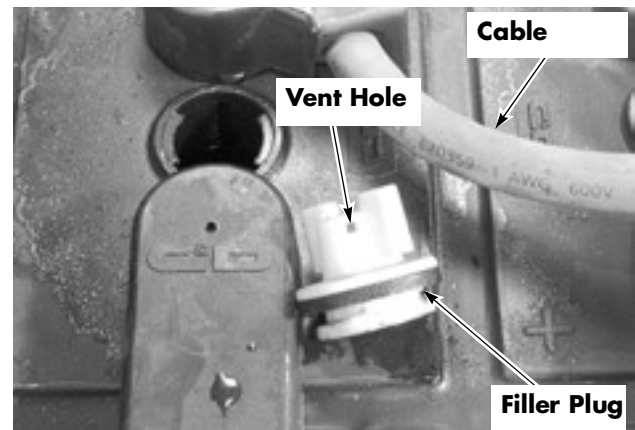
1. With a fully charged and tested battery on the hoist, position the battery above the battery compartment.
2. Lower the battery and position it in the compartment. Make sure the battery has no more than 0.50 in. (13 mm) of “free play” movement in the battery compartment.
3. Move the hoist from the area.
4. Reconnect the battery connector, turn the truck ON, and test the operation of the truck.

Battery Exterior Cleaning

1. Read, understand, and follow procedures, recommendations and specifications in the battery and battery charger manufacturer’s manuals.



2. Wear personal protective equipment. See “Battery Safety” on page 2-6.
3. Turn the truck OFF and disconnect the battery connector. Remove the battery from the lift truck.
4. Inspect the battery cables to make sure they are not frayed or loose. Inspect the battery connector to make sure there is no foreign material inside the connector. Make sure the filler plugs are tight and the vent holes in the filler plugs are open.

Figure 7-64. Battery Filler Plugs and Vent Holes

5. Keep the top of the battery clean and dry. Corrosion, dust, and moisture provide a conducting path to short-circuit cells or create grounds.

⚠ CAUTION

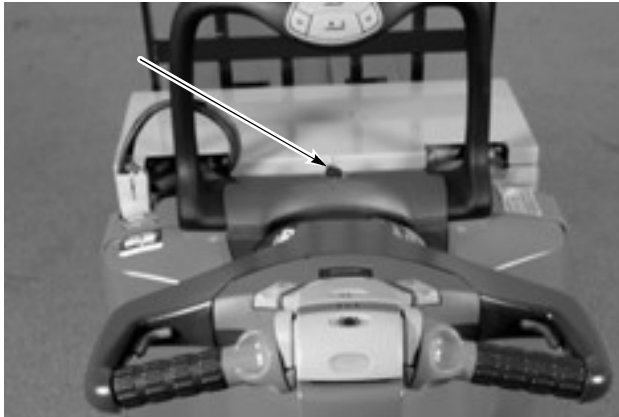
Do not use soda solution to clean the top of the battery while it is installed in the truck. Water can seep into the electrical compartments and cause serious damage.

6. Tighten the battery filler plugs.
7. Wash dirty batteries (or any that have had electrolyte spilled on them) with a solution of 1 lb. (0.45 kg) of baking soda added to 1/2 gal. (1.9 liters) of hot water.
8. Use a brush with flexible bristles to clean the entire top of the battery with the soda solution. Wait until all foaming stops, indicating that the battery exterior is neutralized.
9. Rinse the battery with clean water.
10. Dry the battery completely before re-installing it.
11. Reinstall the battery in the truck, using a suitable battery moving device. Reconnect the battery connector.
12. Apply a thin coat of petroleum jelly to the battery posts and cable terminals.

Key Switch (SW1)

Raymond pallet trucks are equipped with a two-position (OFF/ON) key switch, a two-position (OFF/ON) “keyless” key switch, or a three-position (OFF/Turtle/ON) key switch that energizes all truck operations.

Figure 7-72. Key Switch Location



Installation

1. Connect the wires to the terminals.
2. Install the new key switch. Install a toothed washer on the stem of the key switch, between the plastic console and the locking nut, for “keyless” key switches. Tighten the locking nut.
3. Reconnect the battery connector and check operation.
4. Turn the truck OFF and disconnect the battery connector.
5. Install the tractor cover.
6. Reconnect the battery connector.

Inspection

1. With the battery plugged in and the key switch ON, battery voltage B+ must be present on the two terminals of the switch.
2. Test the key switch with an ohmmeter **after** disconnecting the battery and removing the wires from the switch terminals.

In the key switch OFF position, the ohmmeter must read greater than one megohm, and in the ON position, the ohmmeter must read less than one ohm. If not, replace the switch.

Removal

1. Turn the truck OFF and disconnect the battery connector.
2. Remove the tractor cover.
3. Remove the mounting nut from the stem of the key switch.
4. Remove the key switch.
5. Disconnect wires from the bottom of the key switch.

Electrical Components

CoastPRO™ Solenoid

Coast Solenoid Switch/Spring

Removal

1. Remove the **CoastPRO** solenoid.
2. Remove the two machine screws that secure the spring guard and the switch to the solenoid.
3. Remove the machine screw securing the Z spring to the tab above the switch.

Installation

1. Install the Z spring on the tab above the switch.
2. Install the spring guard and switch to the solenoid.
3. Re-install the **CoastPRO** solenoid.

CoastPRO Canister

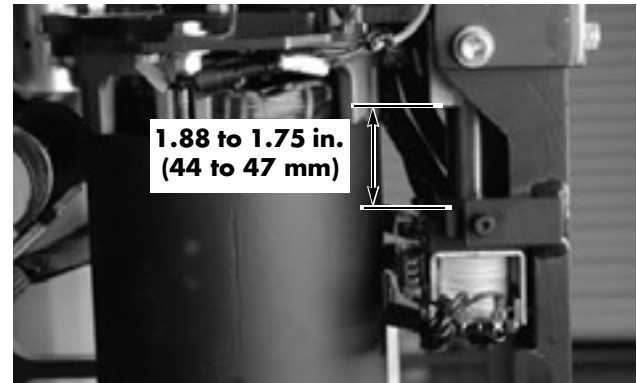
Removal

1. Remove the **CoastPRO** solenoid.
2. While holding the canister, remove the top jam nut on the handle mounting rod at the coast link.
3. Remove the canister from the handle mounting frame.

Installation

1. Position the canister into the handle mounting frame and the rod thru the coast link.
2. Install the top jam nut on the handle mounting rod.
3. Install the **CoastPRO** solenoid.
4. With the handle in the fully upright position, adjust the canister until the space between the canister and the mounting block is 1.88 to 1.75 in. (44 to 47 mm).

Figure 7-89. Canister Spacing



5. Move the handle between the fully upright and fully lowered position. The canister must slide up and down unobstructed. If the canister hits the brake arm pivot shaft or the mounting block, re-adjust to eliminate the obstruction.
6. Tighten the jam nut.

Repair

1. Remove the **CoastPRO** canister. See [“CoastPRO Canister” on page 7-67](#).
2. Position the special compression tool (P/N 950-183) in the canister. See [Figure 7-90](#).

Figure 7-90. Special Compression Tool



3. Secure the canister in a hydraulic press and compress the spring. See [Figure 7-91](#).

CAUTION

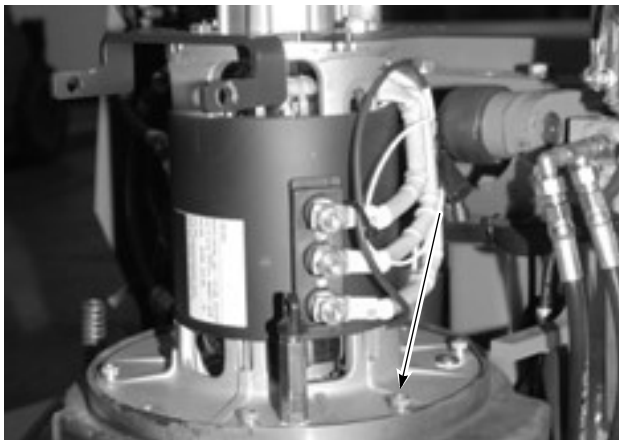
Note the position of cable ties holding harnesses and cables. When reassembling, attach new cable ties in the same locations.

CAUTION

Because of the weight of the traction motor and the attached components, we recommended that you use a hoist to lift the motor from the truck.

14. Remove the six socket head cap screws that secure the traction motor to the drive unit housing. [See Figure 7-110.](#)

Figure 7-110. Traction Motor Removal



NOTE: Traction motor weighs approximately 60 lbs. (27 kg).

15. Remove the traction motor with a suitable lifting device.

NOTE: If required, the seal between the motor and drive unit can be broken by inserting a M8 x 1.25 bolt in the threaded hole on the mounting plate flange.

16. To prevent contamination, install a temporary cover over the drive unit opening.
17. Remove the pinion gear lock nut and pinion gear on the armature shaft. [See Figure 7-111.](#)

Figure 7-111. Drive Unit Pinion Gear



18. Inspect the pinion gear for damage. Replace the gear if it is damaged.

Installation

1. Clean the ID of the gear with mineral spirits. Make sure to remove all contamination and rust preventative coating. Clean the gear ID with P/N 990-666.
2. Remove the key from the motor shaft and discard it.
3. Using mineral sprits and a wire brush, clean the motor shaft, keyway, and shaft threads. Make sure that all contamination is removed, especially from the keyway.
4. Clean the motor shaft, keyway, and threads with P/N 990-666.
5. Install a new key in the motor shaft.
6. Assemble the pinion gear onto the motor shaft with the taper in the correct orientation.
7. Apply thread-locking primer (P/N 990-666) to the motor shaft threads. Allow 1 minute curing time. Apply thread-locking compound (P/N 990-536) to the threads. Make sure that the locking compound covers 3 to 4 threads completely around the circumference.
8. Install the pinion gear and lock nut on the armature shaft. Torque to 45 ft. lb. (61 Nm).
9. Using a gasket scraper, remove any gasket material from the mating surfaces of the

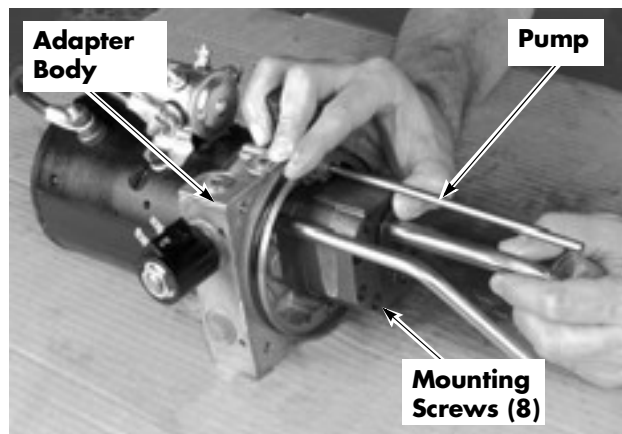
Hydraulic Components

Hydraulic Pump

Hydraulic Pump

Removal

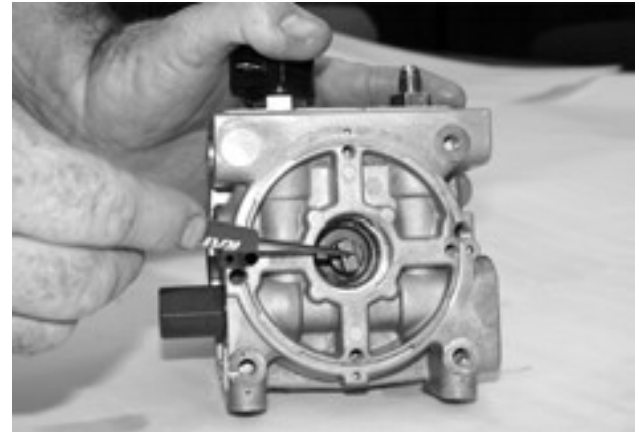
1. Remove the hydraulic reservoir. See [“Hydraulic Reservoir” on page 7-85.](#)
2. With the pump assembly inverted, push the spring clip toward the pump housing. See [Figure 7-123.](#)
3. Grasp the suction tube with the filter screen and pull out of the pump housing. See [Figure 7-123.](#)
4. Remove the eight screws that secure the pump to the adapter body.
5. Separate the pump from the adapter body. See [Figure 7-125.](#)

Figure 7-125. Pump and Adapter Body

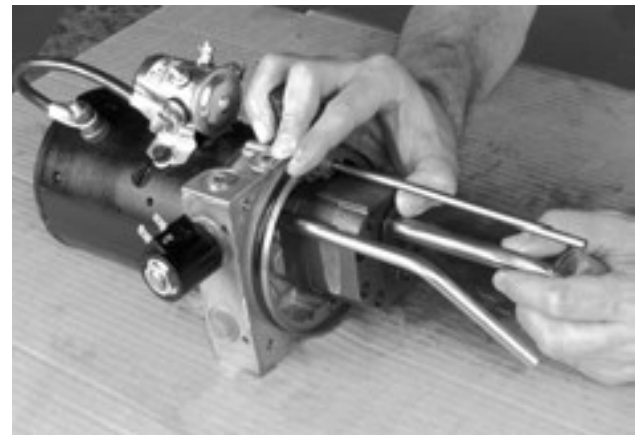
6. Set aside the pump drive coupling to be reused.

Installation

1. Stand the motor assembly on end, with the adapter body facing up.
2. Lubricate the three O-rings and position them between the pump and adapter body.
3. Insert the pump shaft coupling on the end of the motor armature shaft. See [Figure 7-126.](#)

Figure 7-126. Pump Drive Coupling

4. Put the pump on the adapter body while lining up the shaft with the coupling. See [Figure 7-127.](#) Rotate if necessary.

Figure 7-127. Installing Pump In Adapter

5. Secure the pump to the adapter body with eight screws. Torque to 10 to 12 ft. lb. (13.5 to 16.3 Nm).
6. Install the reservoir. See [“Hydraulic Reservoir” on page 7-85.](#)

Mast

Hydraulic Ram

Mast

Pallet Entry Sliders

Replacement



Use extreme care when the truck is jacked up. Keep hands and feet clear from the vehicle while jacking the truck. After the truck is jacked, put solid blocks beneath it to hold it. Do not rely on the jack alone to hold the truck.

6000 lb. Models (Single Pallet)

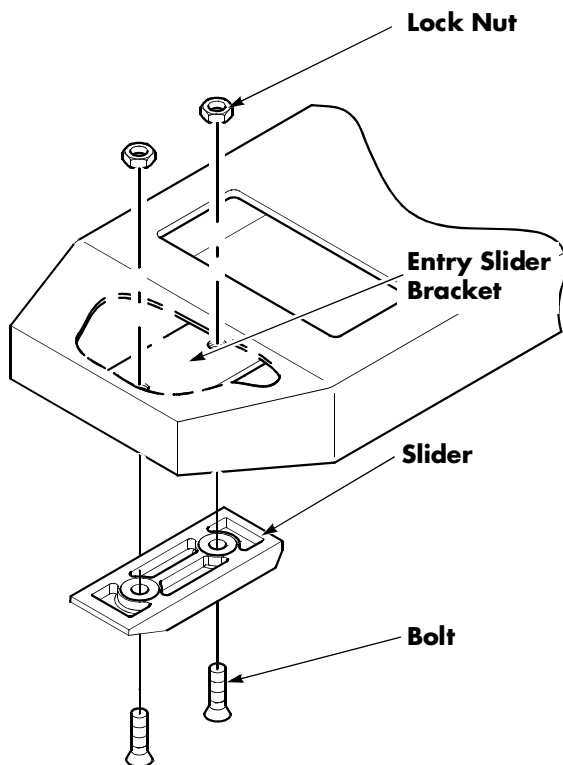
1. Raise the forks and block them in the raised position. See "Jacking Safety" on page 2-8.
2. Remove the two lock nuts and bolts from the bottom of the entry slider bracket. See Figure 7-162.

3. Replace the slider.
4. Insert the two 1/4-20 bolts thru the entry slider bracket and slider. Secure each bolt with a lock nut. See Figure 7-162.

Long-John Models (Multiple Pallet)

1. Raise the forks and block them in the raised position. See "Jacking Safety" on page 2-8.
2. Remove the three 1/4-20, Grade 8, Allen head screws from each of the two front entry sliders and the two 1/4-20, Grade 8, Allen head screws from each of the two rear entry sliders as required.
3. Replace the sliders as required.
4. Install the 1/4-20 Allen head screws thru the entry slider. Secure each screw with thread-locking compound (P/N 1013829).
5. Verify that the clearance from the floor to each slider is 1/8 in. (3.18 mm).

Figure 7-162. Replacing Pallet Entry Slider
(6000 lb. Standard Model Shown)



High Pedal Disable (HPD)

The HPD feature prevents the truck from starting while the throttle is applied. The system is programmed to give the HPD warning if there is a throttle request before a truck ON or brake release signal input.

Open Circuit

A lack of a continuous path between two or more electrical connections. Usually greater than one megohm resistance.

Overtemperature (Traction Amplifier)

Overtemperature of the Traction Amplifier (TA) is 185°F (85°C) and above. At overtemperature, the drive current limit is linearly decreased from full set current down to zero. [“Code Hot2 \(C45\)”](#) is displayed and the truck must be restarted.

NOTE: Plugging strength is not decreased at any overtemperature level.

Overvoltage Cutoff

Occurs when there is very high voltage (greater than 32V) at the TA B+ connection. [“Code Hi \(C42\)”](#) or [“Code E222”](#) may be displayed and the truck must be restarted.

PIN-Key Code

Trucks produced with an optional handle-mounted keypad are protected from unauthorized operation by Personal Identification Number (PIN) keypad entry codes. Up to 10 operators can be assigned their own individual PIN-key code (of one to four digits) for access to the truck. Each operator can also set individual operator parameters. The default operator PIN-key code is number 1. [See “Setting Individual PIN-Key Codes \(Keypad Only\)” on page 3-8.](#)

Pulse Width Modulation

Pulse Width Modulation (PWM), also called “chopping,” controls the speed of the motor by switching the battery voltage to vary the frequency of the input to the AC motor.

Ramp Shape

The ramp shape is the relationship between the directional/speed control rotation and truck response (PWM output). It is adjustable (throttle map parameter) so you can provide the correct feel for each truck.

The ramp shape number refers to the PWM output at half throttle, as a percentage of its full range.

The throttle map adjustment is called “ramp shape.” [See “Throttle Map” on page 8-5.](#)

Regenerative Braking

Regenerative braking occurs when current, generated by the motor during braking, is permitted to flow back into the battery. Regenerative braking results in less motor heating. Regenerative braking also provides some return of energy to the battery, for longer vehicle operating periods.

The Brake Rate defines the time it takes the TA to increase from 0% to 100% neutral braking current when regenerative braking is requested. The brake rate is a truck (Service) parameter (13 - Performance Settings) and is programmable from 1 to 5 with the default set at 3. [See “Service Parameters” on page 3-9.](#)

Sequencing Delay

Sequencing delay permits the brake (deadman) switch to be momentarily opened within a set time (sequence delay), thus preventing inadvertent activation of high pedal disable (HPD) or static return to off (SRO). [See “Static Return to Off \(SRO\)” on page 8-4.](#) This feature is useful in applications where the brake (deadman) switch may bounce or be

Pinout Matrix

Item	Model	Connection	Functional Description	Theory of Operation	Normal Level	Signal Source	Signal User
26	8300, 8400, 8500, 8600	JP1-20	Spare Digital Output	Spare		Spare	Spare
27	8300, 8400, 8500, 8600	JP1-30	Spare	Spare Analog Output.		Spare	
28	8300, 8400, 8500, 8600	JP1-26	5VDC Supply	Supplies regulated 5VDC to the Traction Motor Encoder when key switch is closed.	4.95VDC	TA	Traction Motor Encoder
29	8300, 8400, 8500, 8600	JP1-31	T Vel Phase A	This is generated whenever there is movement of the bearing encoder in the traction motor. It is a Square wave that is either High (>4VDC) or Low (<0.5VDC). The frequency varies directly with the speed of the traction motor. Identical formation to T Vel Phase B, except for the phasing between the two. The TA uses the Quadrature phase relationship between Phases A and B to determine travel direction and speed.	At Rest: Either 4.08VDC or 0.03VDC During motion: approx 2.05VDC	Traction Motor Encoder	TA
30	8300, 8400, 8500, 8600	JP1-32	T Vel Phase B	This is generated whenever there is movement of the bearing encoder in the traction motor. It is a Square wave that is either High (>4VDC) or Low (<0.5VDC). The frequency varies directly with the speed of the traction motor. Identical formation to T Vel Phase A, except for the phasing between the two. The TA uses the Quadrature phase relationship between Phases A and B to determine travel direction and speed.	At Rest: Either 4.08VDC or 0.03VDC During motion: approx 2.05VDC	Traction Motor Encoder	TA
31	8300, 8400, 8500, 8600	JP1-8	Traction motor Temp input	Monitored by TA to adjust motor performance with temperature.	75°F (24°C) Approx. 1.25VDC	Traction Motor Temp Sensor	TA
32	8300, 8400, 8500, 8600	W on TA	Traction Motor W	One of three phases from the TA to the Traction Motor. This AC voltage is produced by the TA and is dependent on B+ at the (+) terminal and B- of the TA. This AC voltage is measured between any two phases and varies from 0VAC at rest to about 12VAC on full acceleration. Stall condition produces about 7VAC.	VAC between phases. Stationary: 0VAC Full travel: 12VAC Stall: Approx. 7VAC	TA	Traction Motor

Thread Adhesives, Sealants, and Lubricants

Thread Adhesives, Sealants, and Lubricants

Table A-1. Thread Adhesives, Sealants, and Lubricants

Application	Raymond P/N	Loctite* Number/Color
Thread-locking 1/4 in. and below	990-403	222/Purple
Thread-locking 1/4 to 3/4 in.	990-536	242/Blue
Thread-locking 1/4 to 3/4 in. contamination tolerant	990-462	243/Blue
Thread-locking 1 in. and under	990-544	271/Red
Thread-locking 1 in. and under, contamination tolerant	990-463	603/Green
Thread-locking 1 in. and over	990-571	277/Red
Thread-locking compound, 250 ml	990-669/01	
Thread-locking compound, 10 ml	990-669/02	
Thread-locking compound, solid	1056414	/Red
Thread-locking Cleaner	990-538	707
Thread-locking Primer	990-533	T7471
	990-666	7649 (19269)
Primerless Thread-locking 1 1/2 in. and below	1013829	2440
Gasket Sealant	990-411	
Hydraulic Sealant	990-552	569
RTV Silicone Sealant	990-659	5900/Black
		Other Manufacturer designation
Molybdenum Anti-Seize Compound (Molykote)	990-638	/Silver
Corrosion Inhibitor Coating	990-644	
Cold Storage silicone sealing compound	990-445	
Alcohol-based cleaner	990-600/FOF	
NOTE: *Loctite is a registered trademark of the Loctite Corporation. Brand endorsement is not implied here, but listed only as a commonly identified product.		

Standard/Metric Conversions

Standard/Metric Conversions

Table A-10. Standard/Metric Conversions

To Convert...	Multiply...
Inches to Millimeters	Inches x 25.4
Millimeters to Inches	Millimeters x 0.039
Inches to Centimeters	Inches x 2.54
Centimeters to Inches	Centimeters x 0.394
Feet to Meters	Feet x 0.305
Meters to Feet	Meters x 3.281
Yards to Meters	Yards x 0.914
Meters to Yards	Meters x 1.094
Miles to Kilometers	Miles x 1.609
Kilometers to Miles	Kilometers x 0.621
Square Inches to Square Centimeters	Square Inches x 6.452
Square Centimeters to Square Inches	Square Centimeters x 0.155
Square Feet to Square Meters	Square Feet x 0.093
Square Meters to Square Feet	Square Meters x 10.753
Square Yards to Square Meters	Square Yards x 0.836
Square Meters to Square Yards	Square Meters x 1.196
Pints to Liters	Pints x 0.473
Liters to Pints	Liters x 2.113
Quarts to Liters	Quarts x 0.946
Liters to Quarts	Liters x 1.057
Gallons to Liters	Gallons x 3.785
Liters to Gallons	Liters x 0.26
Ounces to Grams	Ounces x 28.35
Grams to Ounces	Ounces x 0.035
Ounces to Kilograms	Ounces x 0.028



1034066E

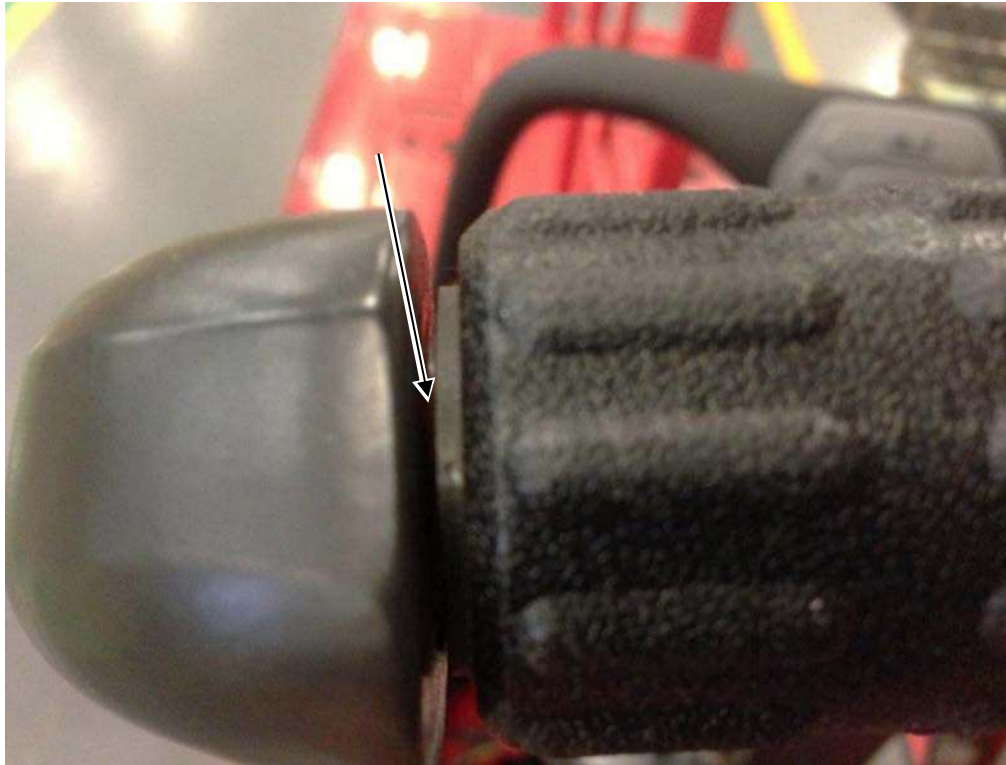


Figure 2: Handle with Shim

When a shim is present in the handle, make sure to check the gap between the shim and handle, not just the grip and the handle. The shim has a much smaller O.D. than the twist grip.



Figure 3: Handle without Shim

RAYMOND SERVICE INFORMATION

The Raymond Corporation
Corporate Headquarters
P O Box 130
Greene, New York 13778-0130



RSI PLT-11-006
February 9, 2012

Model
8400

SUBJECT:	Gluing of Cushioned Floor Mats
GENERAL INFORMATION:	PLT-09-R005 gave a glue part number of 990-569/102 (3M1357) as the recommended glue to install the floor mats with.
SERVICE INFORMATION:	An alternate recommended glue, P/N 990-569/03, is now available.
PARTS AVAILABILITY:	Now available through the Parts Distribution Center.
FILING INSTRUCTIONS:	File this notice in Maintenance Manual 1034066E next to page 7-11 and 1034066E next to page 7-11.

RAYMOND PRODUCT IMPROVEMENT NOTICE

The Raymond Corporation
Corporate Headquarters
P O Box 130
Greene, New York 13778-0130



RPIN PLT-10-R009
November 30, 2010

Models
8300/8400/8500/8600
S/N 83,000 and Below

SUBJECT:	AC Motor Service Procedures
DESCRIPTION:	The AC motor service procedures were not included in the Maintenance Manual when released for trucks serial number 83,000 and below.
REMEDY:	Insert the attached procedures in Maintenance Manual 1034066E.
PROCEDURE:	See page 2.
PARTS AVAILABILITY:	N/A
FILING INSTRUCTIONS:	File this notice in Maintenance Manual 1034066E next to page 7-78.

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