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TOYOTA

INDUSTRIAL EQUIPMENT

SERVICE MANUAL

Pallet Trucks

8HBW30
8HBE40
8HBC40

8HBE30
8HBC30
8TB50

00700-CL398-07, Issued: 9 August 2007

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Table of Contents

How To Use This Manual 1-1
Map of the Manual 1-2
Manual Design 1-3
Abbreviations & Symbols 1-4
START Page 1-7
Safety 2-1
Definitions 2-2
General Safety 2-3
Battery Safety 2-6
Jacking Safety 2-9
Tie-Down for Transport 2-10
Towing 2-11
Welding Safety 2-12
Static Safety 2-13
Systems Overview 3-1
Truck Model Identification 3-2
Vehicle Specifications 3-3
Maximum Speeds 3-4
General System Data 3-5
Special Tools 3-7
Theory of Operation 3-8
Planned Maintenance 4-1
Maintenance Guidelines 4-2
Initial 90 Day/250 Deadman Hours (HD) Maintenance 4-3
Every 180 Days or 500 Deadman Hours 4-4
Every 360 Days or 2000 Deadman Hours (HD) 4-6
Grease Fittings 4-7
Troubleshooting 5-1
How to Use This Section 5-2
Electrical Troubleshooting Guidelines 5-3
DC Electric Motor Tests 5-7
AC Electric Motor Tests 5-9
Hydraulic Troubleshooting Guidelines 5-10
Definitions 5-11
List of Electrical Symbols 5-15
Operator Display and Programming 5-17
Service Input/Output Displays 5-23
Traction Power Amplifier LED Diagnostics 5-26
Traction Power Amplifier Flash Codes 5-27
Troubleshooting Flowcharts 5-29
Caution and Error Codes 5-33
Symptom Tables: Lift/Lower System 5-55
Symptom Tables: Travel (Forward/Reverse) System 5-59
Symptom Tables: Wiring System 5-68
Pinout Matrix 5-69
Component Procedures 6-1
List of Component Procedures 6-2
Component Locator Photos 6-5
Tractor Cover 6-7

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Battery 6-8
Power Cables 6-11
Wiring Harness 6-12
Fuses 6-14
Switches (General) 6-15
Key Switch (SW1) 6-16
Brake (Deadman) Switch (SW2) 6-17
Lift-Limit Switch (SW8) 6-19
Grab Rail Switches 6-20
Hydraulic Solenoids 6-21
Jog Pick Solenoid 6-22
Horn 6-24
Traction Power Amplifier 6-25
AMP Harness/Traction Power Amplifier Connector 6-27
Contactors 6-30
Control Handle Assembly 6-33
Control Handle 6-36
Brake 6-41
Motors, General 6-45
Traction Motor 6-46
AC Motor Service 6-49
Drive Unit 6-51
Drive Wheel 6-60
Casters (Torsion) 6-63
Casters (Spring-Loaded) 6-65
Load Wheels 6-69
Pallet Entry Sliders 6-72
Fork Height Adjustment 6-73
Hydraulic Components 6-75
Hydraulic Fluid 6-76
Adjusting Hydraulic Pump Relief Valve Pressure 6-77
Hydraulic Ram 6-79
Hydraulic Unit 6-85
Lift Motor 6-89
Cold Storage Conditioning 6-91
Appendix A-1
Lubrication Equivalency Chart A-2
Torque Chart - Standard (Ferrous) A-3
Torque Chart - Standard (Brass) A-4
Torque Chart - Metric A-5
Torque Chart - Thread-Forming Screws A-6
Decimal Equivalent Chart A-7
Standard/Metric Conversions A-9
Electrical Schematics B-1
Index I-1

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Section 1. How To Use This Manual

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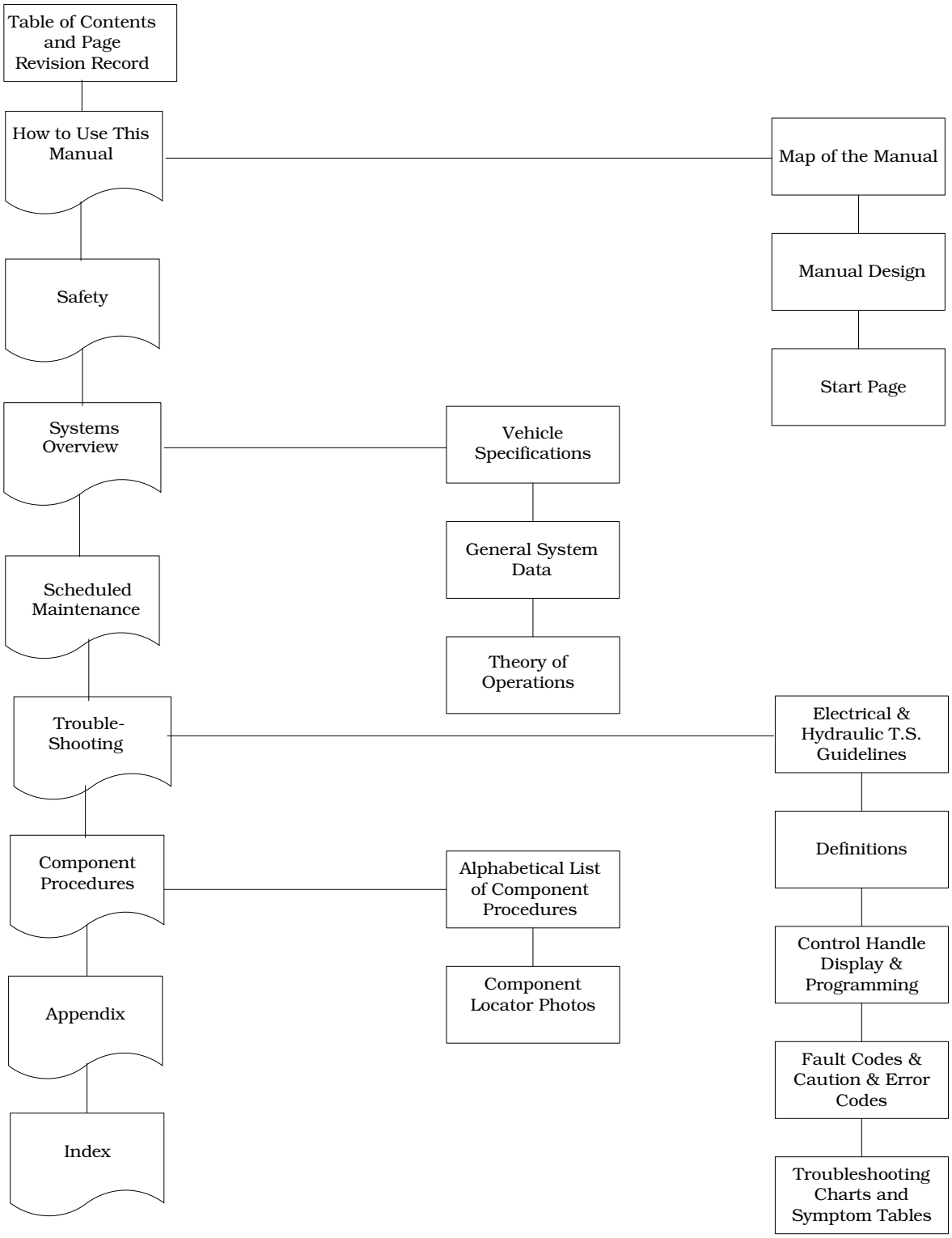
Map of the Manual



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Manual Design

The *Toyota* Pallet Truck Service Manual is designed with the following objectives in mind:

- Provide technical coverage for expected levels of user expertise
- Anticipate your needs and reduce your decisions regarding maintenance
- Reduce page flipping thru a "one-stop shopping" approach

The two-line running page header at the top of each page tells you:

- Name of the manual (*Toyota* Pallet Truck Service Manual)
- Current section title
  (for example, this page *How to Use This Manual*)
- Current topic
  (for example, this page *Manual Design*)

We suggest you get in the habit of turning to the **START** page first when you use this manual.

- The **START** page asks a few questions to guide you to the correct section.

How to Use This Manual explains the manual format and contains the START page.

Safety explains warning and caution notes, general safety rules and safety rules for batteries, static, jacking, and welding.

Systems Overview includes truck specifications and theory of operation information.

Planned Maintenance outlines the recommended schedule of preventive services to keep your truck working most efficiently.

Troubleshooting is a set of fault, caution, and error codes, charts and tables designed to take you from a symptom to a specific sequence of actions in order to isolate a failing component.

- The chart **"Traction Power Amplifier Flash Codes"** on page 5-27 will guide you thru the flash codes displayed on the LED's installed on the TA.
- The section **"Caution and Error Codes"** on page 5-33 defines the various codes displayed on the operator display.
- The chart **"TS1: START TROUBLESHOOTING"** on page 5-29 will guide you to the symptom chart you need.
- When you're familiar with the symptoms listed, you may simply look up the symptom from the **"Troubleshooting"** on page 5-29.
- As you work with a troubleshooting chart, code, or table, you may be instructed to test various electrical connector pins. The pinout matrix chart lists information on functions and normal voltages of terminals and harness connector pins. See **"Pinout Matrix"** on page 5-69.
- When you complete a troubleshooting procedure, perform the steps in the **"END1: End of Troubleshooting Procedure"** on page 5-31.

Component Procedures gives step-by-step procedures for testing, removal, installation, and adjustment of individual truck components. Components are listed in an order that considers:

- Frequency of attention
- Physical attachment (for example, remove the brake before the traction motor)
- Functional relation (for example, traction motor and drive unit components are grouped together)

To find a component procedure, you may use one of three methods:

- Look up the component name in the **"List of Component Procedures"** on page 6-2.
- Find the component in the **"Component Locator Photos"** on page 6-5.
- Look up component name in the "Index".

Appendix contains reference information such as torque values, lubricants, and schematics.

Index lists subjects alphabetically.

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Abbreviations & Symbols

These abbreviations, acronyms and symbols are used in this manual.

Term/Symbol	Definition
A	Ampere
AC	Alternating Current
amp	Ampere or amplifier
ANSI	American National Standards Institute
approx	approximately
aux	auxiliary
AWG	American Wire Gauge
BSOC	Battery State-of-Charge
CAN	Controller Area Network
CCW	counterclockwise
cm	centimeter
COP	Computer Operating Program
CV	checkvalve
CW	clockwise
DC	Direct Current
DGND	digital ground
EE	UL Electric Truck Type Certification Rating where electrical equipment is completely enclosed
ESD	Electrostatic Discharge
ETAC	Electronic Tiller Arm Control (*See* Vehicle Manager)
ft.	foot or feet
gal.	gallon or gallons
Gnd	ground
HD	hours on deadman
in.	inch or inches
kg	kilogram(s)
km/hr	kilometers per hour
kPa	kilo Pascal
lb.	pound or pounds
LED	Light Emitting Diode
L/H	Load Holding
L/L	Lift/Lower
mA	milliampere
mm	millimeter
mph	miles per hour
ms	millisecond(s)
N/A	Not Applicable or Not Available
N•m	newton meter
OD	Operator's Display
OSHA	Occupational Safety and Health Administration
oz.	ounce
pot	potentiometer
psi	pounds per square inch
PWM	Pulse Width Modulation
P/N	Part Number
RAM	Random Access Memory
RCFP	Relay Control Fuse Panel
ROM	Read Only Memory
RPM	Revolutions per Minute
R/R	Remove and Replace
SOL	Solenoid
spec	specification
SPI	Service Port Interface

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Term/Symbol	Definition
TPA	Traction Power Amplifier
temp	Temperature
TM	Traction Motor
TS	troubleshoot
UL	Underwriters Laboratories, Inc.
V	Volt or Volts
VAC	Volts Alternating Current
VDC	Volts Direct Current
VM	Vehicle Manager (ETAC)
wrt	with respect to
@	at
™	trademark
©	copyright
+	plus or positive
–	minus or negative
±	plus or minus
°	degrees
°F	degrees Fahrenheit
°C	degrees Celsius
<	less than
>	greater than
%	percent
=	equals

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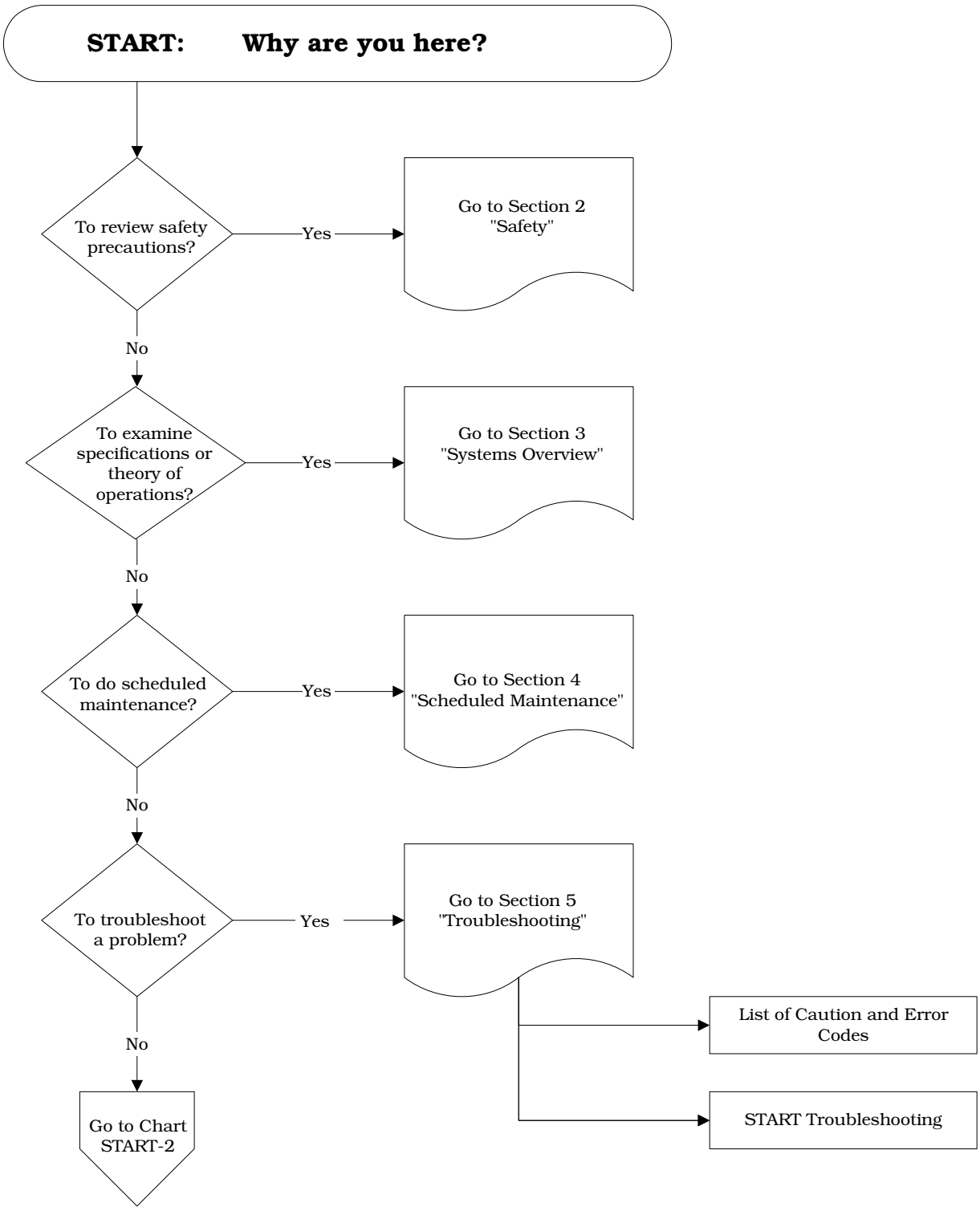
START Page



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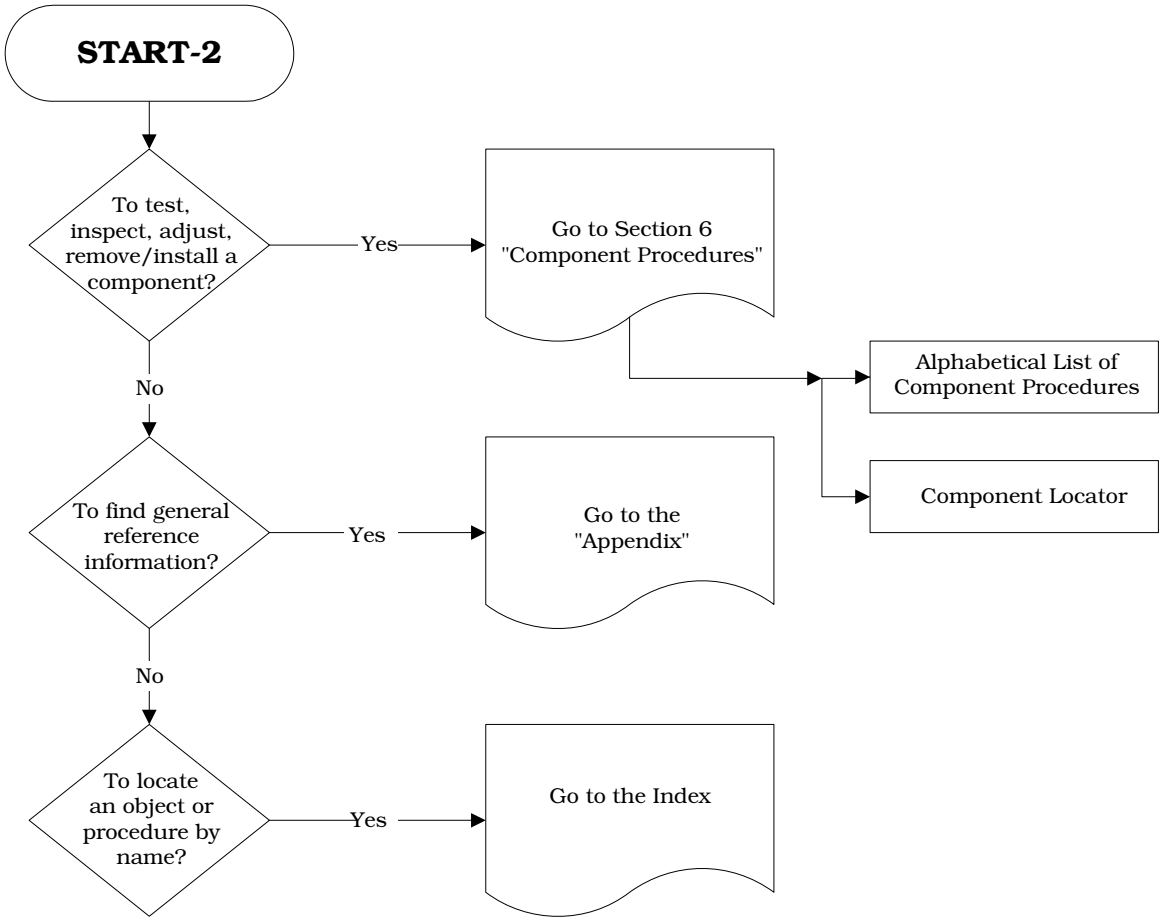

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Section 2. Safety

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Definitions

In this manual, you will see two kinds of safety reminders:

⚠ WARNING

A warning specifies a potentially hazardous situation that, if not prevented, could result in death or serious injury.

⚠ CAUTION

A caution specifies a potentially hazardous situation that, if not avoided, could result in minor or moderate injury or in damage to the lift truck or nearby objects. A caution can also alert against unsafe practices.

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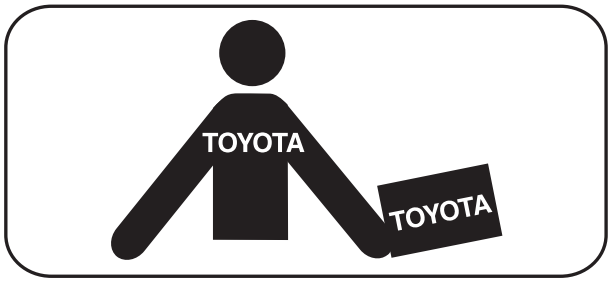
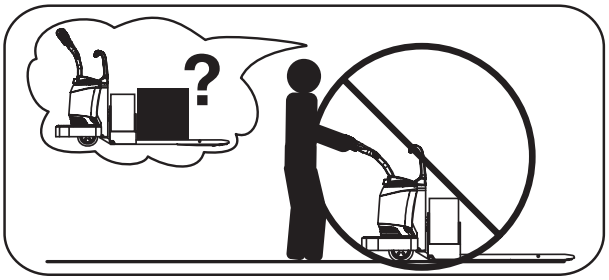
General Safety

Do *not* operate or work on this truck unless you are trained, qualified and authorized to do so, and have read the Owner/Operator Manual.



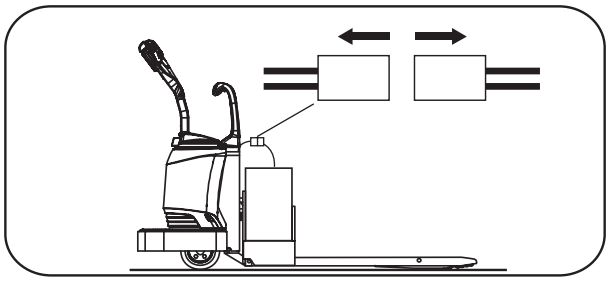
Know the truck's controls and what they do.



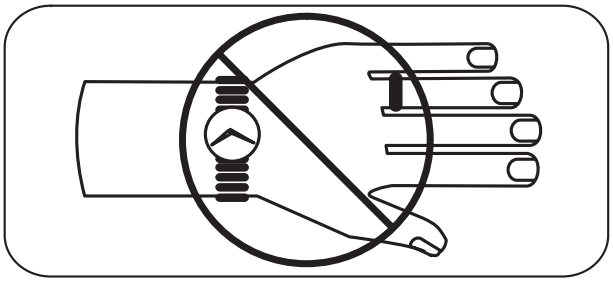
Do *not* operate this truck if it needs repair or if it is in any way unsafe.

Operate this truck only from the operator's position.

Before working on this truck, always turn the key switch to OFF and disconnect the truck's battery connector (unless this manual tells you otherwise).



Do *not* wear watches, rings, or jewelry when working on this truck.



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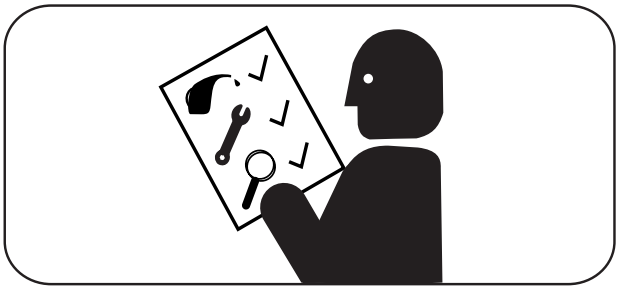
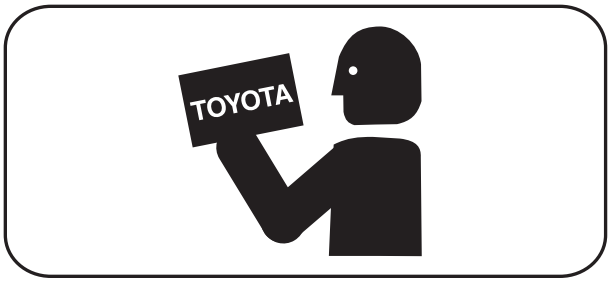
General Safety

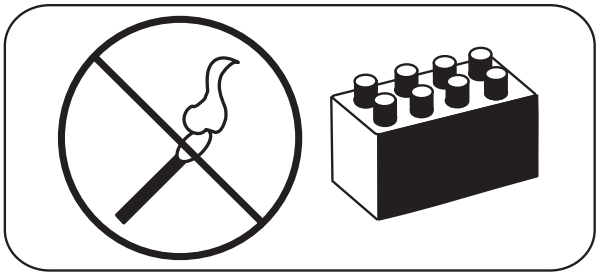
Obey the scheduled lubrication, maintenance, and inspection steps.



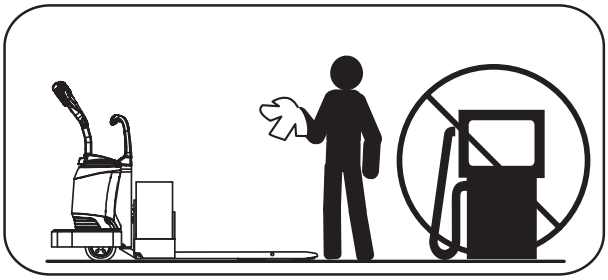
Obey exactly the safety and repair instructions in this manual. Do *not* take “shortcuts.”



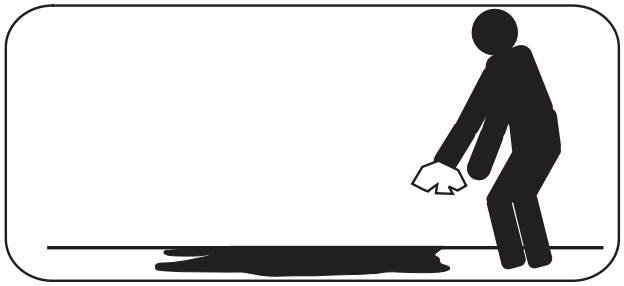
Do *not* use an open flame near the truck.



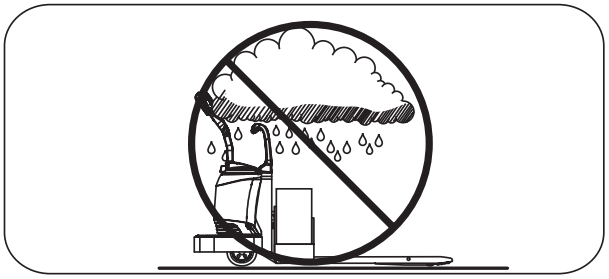
Do *not* use gasoline or other flammable liquids for cleaning parts.



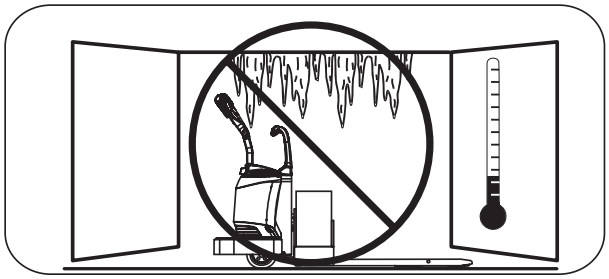
Clean up any hydraulic fluid, oil, or grease that has leaked or spilled on the floor.



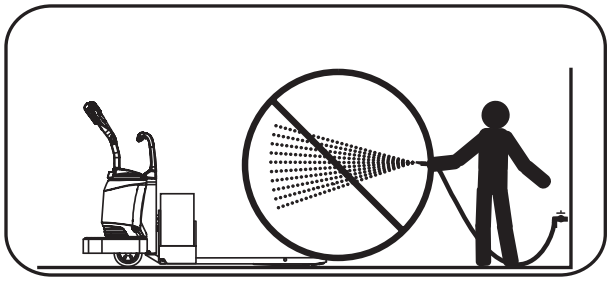
Always park this truck indoors.



Do *not* park this truck in a cold storage area overnight.



Do *not* wash this truck with a hose.



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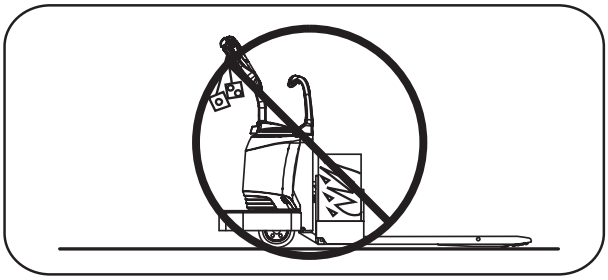
Do *not* add to or modify this truck until you contact your local authorized Toyota dealer to receive written manufacturer approval.



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Battery Safety

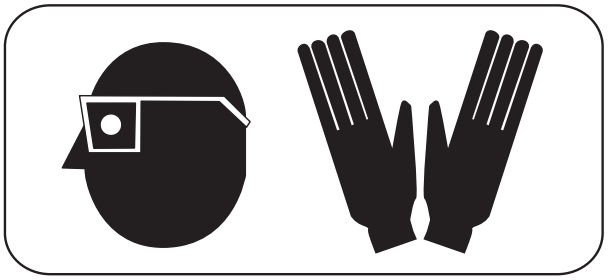
⚠ WARNING

As a battery is being charged, an explosive gas mixture forms within and around each cell. If the area is not correctly ventilated, this explosive gas can remain in or around the battery for several hours after charging. Ensure there are no open flames or sparks in the charging area. An open flame or spark can ignite this gas, resulting in serious damage or injury.

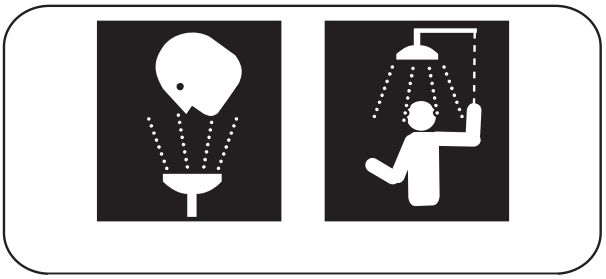
⚠ WARNING

Battery electrolyte is a solution of sulfuric acid and water. Battery acid causes burns. If any electrolyte comes in contact with your clothing or skin, flush the area immediately with cold water. If the solution gets on your face or in your eyes, flush the area with cold water and get medical help immediately.

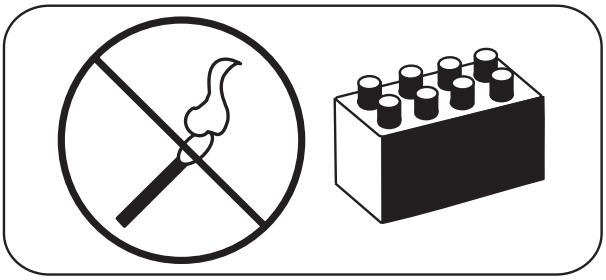
Wear personal protective equipment to protect eyes, face and skin when checking, handling or filling batteries. This equipment includes goggles or face shield, rubber gloves (with or without arm shields) and a rubber apron.



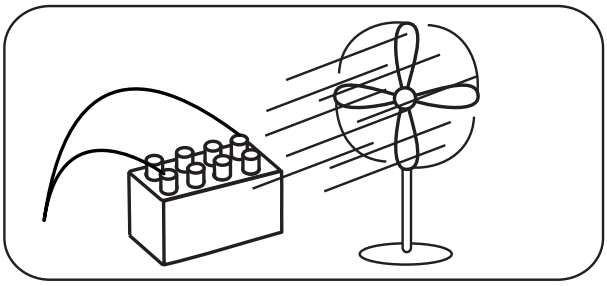
Make sure a shower and eyewash station are nearby in case there is an accident.



A battery gives off explosive gases. *Never* smoke, use an open flame, or use anything that gives off sparks near a battery.



Keep the charging area well-ventilated to avoid hydrogen gas concentration.



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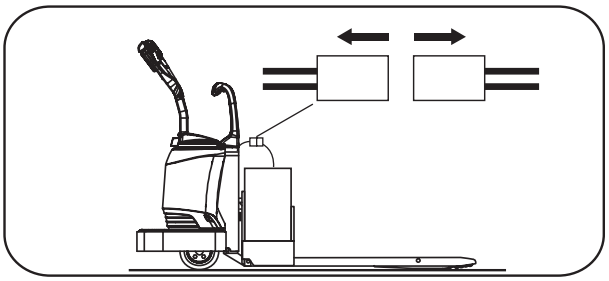
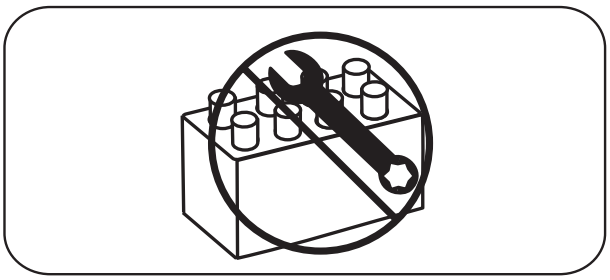
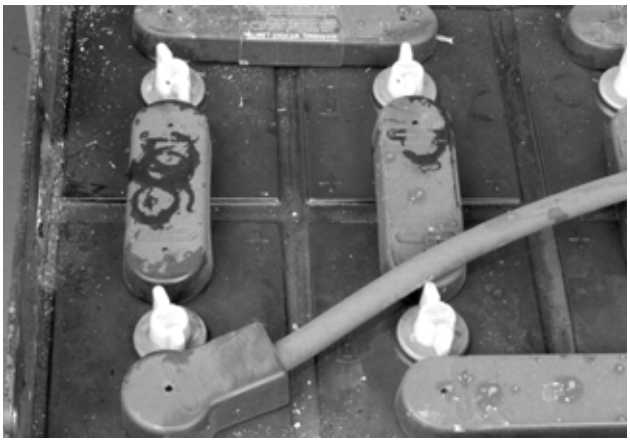
Always turn the key switch to OFF *before* disconnecting the battery from the truck at the battery connector. Do *not* break live circuits at the battery terminals. A spark often occurs at the point where a live circuit is broken.



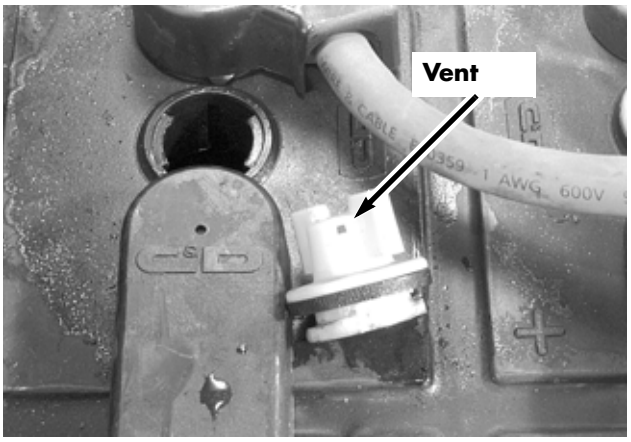
Do *not* lay tools or metal objects on top of the battery. A short circuit or explosion could result.



Keep batteries clean. Corrosion causes shorts to the frame and possibly sparks.



Keep plugs, terminals, cables and receptacles in good condition to avoid shorts and sparks.

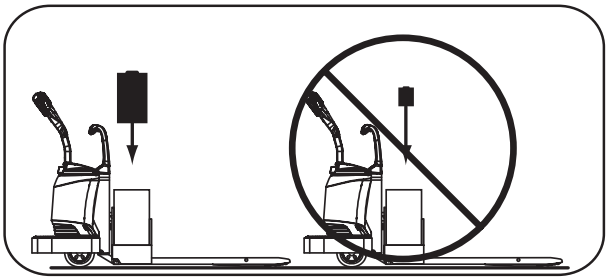


Keep filler plugs firmly in position at all times when not checking the electrolyte level, adding to the cells, or checking the specific gravity.

Make sure the vent holes in the filler plugs are open to let the gas escape from the cells.

Do *not* permit cleaning solution, dirt or any foreign matter to enter the cells.

Make sure you install the correct size battery. A smaller or lighter weight battery could seriously affect truck stability. See the truck's specification plate for more information.



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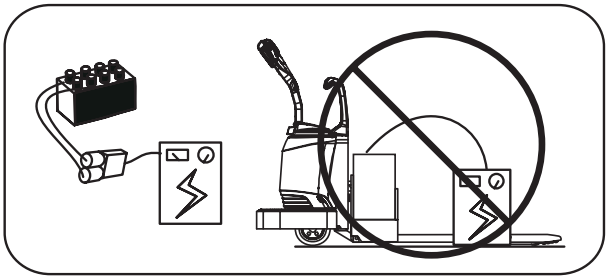
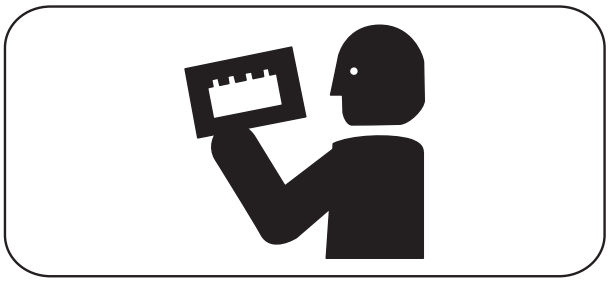
Battery Safety

Never plug a battery charger into the truck's battery connector. Plug the battery charger only into the battery connector from the battery.



Obey the charging procedures in the Battery Instruction Manual and in the Battery Charger Instruction Manual.



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Jacking Safety

You may need to jack the truck off the floor to perform maintenance procedures. When doing so, observe the correct safety precautions:

⚠ WARNING

Use extreme care whenever the truck is jacked up. Keep hands and feet clear from 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.

Tractor Section

1. Lower the forks completely. Remove any load.
2. Put all controls in neutral position.
3. Block the wheels to prevent movement of the vehicle.
4. Disconnect the battery connector.
5. Put the jack in the designated jacking points.
6. Jack one side of the truck so that the drive tire is no more than 1 in. (25.4 mm) off the floor.
7. Block that side of the truck in position.
8. Jack the other side of the truck level with the first side.
9. Block that side of the truck in position.

NOTE: After working on a vehicle, test all controls and functions to make sure operation is correct.

Fork Section

1. Using the lift button, lift the forks to maximum height.
2. Block each fork by placing a block behind the load wheels. The tractor section will remain on the floor.
3. Lower the forks on the blocks.
4. Turn the truck OFF and disconnect the battery connector.

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Tie-Down for Transport

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

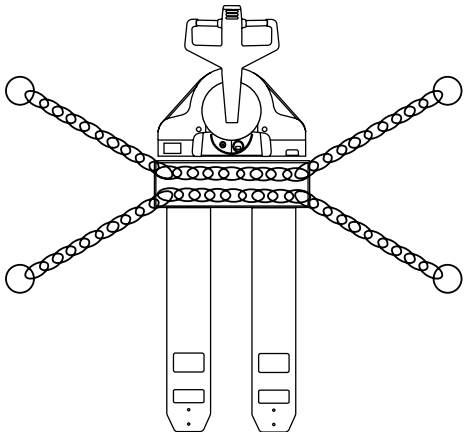

Figure 2-1. Tie-Down for Transport

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 6-8.
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.

NOTE: This will secure the truck to the vehicle bed and prevent 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.

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Towing

To safely tow a Toyota pallet truck:

1. Lower the forks and remove any load.
2. Turn the truck OFF and disconnect the battery connector.
3. Using a suitable towing vehicle, lift the tractor end of the pallet truck until the drive tire is no more than 1 in. (25.4 mm) off the floor.
4. Tow the truck slowly in the tractor-first direction.

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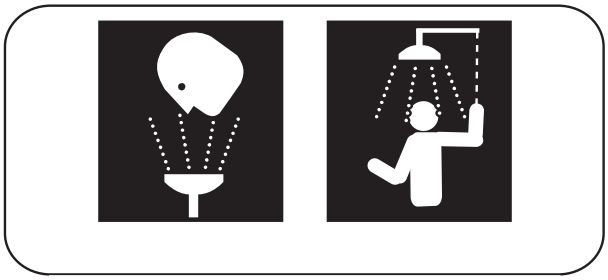
Welding Safety

⚠ WARNING

Flame cutting or welding on painted surfaces may produce potentially harmful fumes, smoke, and vapors. Remove any coating in the vicinity where the operation(s) will be performed prior to performing flame cutting or welding operations.

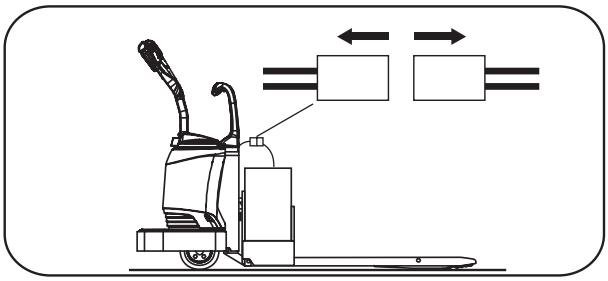
⚠ WARNING

Coating removal may be by mechanical methods, chemical methods or a combination of methods. Perform flame cutting and/or welding operations only in well ventilated areas using local exhaust if necessary.



Before working on this truck, make sure that:

- Fire protection equipment is nearby.
- You know where the nearest eyewash station is.You always turn the key switch to OFF and disconnect the battery connector before you attempt to inspect, service, or repair the lift truck. Discharge residual charge in the traction power amplifier by connecting a load across the TPA's B+ and B- (such as a contactor coil or by pressing the horn button).



- Check for shorts to frame as identified on Page 5-5. If any shorts are found, remove them before you proceed with the welding operation.
- Clean the area to be welded.
- Protect all truck components from heat, weld spatter, and debris.
- Attach the ground cable as close to the weld area as possible.
- Do *not* perform any welding operations near the electrical components.
- If welding must be done near the battery compartment, remove the battery from the truck.
- When you are finished welding, perform all ground tests and electrical inspections before the vehicle is operated.

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Static Safety

Electronic circuit boards and devices used on this truck can be damaged by the discharge of static electricity, called electrostatic discharge.

Static charges can accumulate from normal operation of the truck as well as movement or contact between non-conductive materials (plastic bags, synthetic clothing, synthetic soles on shoes, styrofoam coffee cups, and so forth).

Accumulated static can be discharged thru human skin to a circuit board or component by touching the parts. Static discharge is also possible thru the air when a charged object is put close to another surface at a different electrical potential. **Static discharge can occur without you seeing or feeling it.**

Whenever working on or near static-sensitive electronics, always use static discharge precautions.

1. Put a static discharge wrist strap around your wrist. Connect the ground lead to the wrist strap connector.
2. Connect the ground strap to an unpainted, grounded surface on the truck frame.
3. If you are removing or installing static-sensitive components, put them on a correctly grounded static mat.
4. To transport static-sensitive components, including failed components being returned, put the components in an anti-static bag or box (available from your Toyota dealer).

The wrist strap and associated accessories should be tested monthly to verify they are working correctly. The wrist strap contains a one megohm resistor in the strap cord that acts as a fuse for personal protection. If this resistor is open, the strap becomes ineffective.

Figure 2-2 shows the components of the anti-static field service kit, part number 00590-04849-71. The kit includes a wrist strap, ground cord and static-dissipative work surface (mat). Follow the instructions packaged with this kit.

Wrist straps are available in quantities of 25, as part number 00590-04848-71.

A wrist strap tester is available as part number 00590-04850-71.

Contact your authorized Toyota dealer for information.

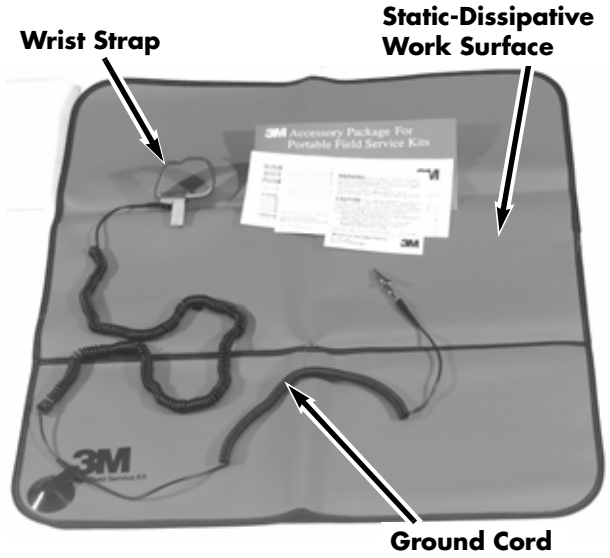

Figure 2-2. Anti-Static Kit (P/N 00590-04849-71) With Wrist Strap and Mat

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Section 3. Systems Overview

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Truck Model Identification

Model 8HBE30/40 End Rider

Model 8HBC30/40 Center Rider

Model 8HBW30 Low-Lift Walk-Behind

Model 8TB50 Tow Tractor

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Vehicle Specifications

Category	Model 8HBW30		Model 8HBE30/40	Model 8HBC30/40	Model 8TB50
Maximum Load Capacity	6,000 lb. (2,724 kg)		6,000 lb. (2,724 kg)*	6,000 lb. (2,724 kg)**	10,000 lb. (4540 kg)
Upright Height	60.1 in. (1527 mm)		60.1 in. (1527 mm)	54.1 in. (1374 mm)	54.1 in. (1374 mm)
Overall Length (Up to 60" forks)	up to 91.7 in. (2329 mm)		up to 102.4 in. (2601 mm)†	up to 114.3 in. (2903 mm)‡	53.11 in. (1349 mm)
Overall Width	32.5 in. (826 mm)		36 in. (910 mm)	32.5 in. (826 mm)	32.5 in. (826 mm)
Maximum Lift Height	9 in. (229 mm)		9 in. (229 mm)	9 in. (229 mm)	N/A
Battery Compartment Width	9.19 in. (230 mm)	13.44 in. (341 mm)	13.44 in. (341 mm)	13.44 in. (341 mm)	13.44 in. (341 mm)
Battery Voltage	24 volts		24 volts	24 volts	24 volts
Minimum Battery Weight	490 lb. (222 kg)	965 lb. (438 kg)	965 lb. (438 kg)	965 lb. (438 kg)	965 lb. (438 kg)
Maximum Battery Weight	1056 lb. (479 kg)	1500 lb. (681 kg)	1500 lb. (681 kg)	1500 lb. (681 kg)	1500 lb. (681 kg)
Truck Weight Without Battery	1058 lb.*** (480 kg)		1234 lb.*** (560 kg)	1320 lb.*** (599 kg)	1190 lb. (540 kg)

* Model 8HBE40 has 8,000 lb. (3,632 kg) capacity.
** Model 8HBC40 has 8,000 lb. (3,632 kg) capacity.
*** Trucks equipped with 48 in. x 27 in. forks.
† with 8,000 lb. (3,632 kg) trucks, overall length is up to 146 in. (3709 mm)
‡ with 8,000 lb. (3,632 kg) trucks, overall length is 156.3 in. (3970 mm)

⚠ WARNING

The total weight of the load must include the pallet, the container or the device holding the load, and the operator (on rider models).

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Maximum Speeds

Tractor First

Model	Coast Type	Jog Trigger	Jog Pick On	Jog Pick Off	Rabbit On
8HBW30	N/A	N/A	N/A	Walking Speed	N/A
8HBE30/40	No **Jog Pick**	N/A	N/A	Riding Speed	Rabbit Speed
8HBE30/40	**Jog Pick**	Walking Speed	Walking Speed	Riding Speed	Rabbit Speed
8HBE30/40	Speed Restricted	N/A	N/A	Walking Speed	Riding Speed
8HBC30/40	No **Jog Pick**	N/A	N/A	Walking Speed	Rabbit Speed
8HBC30/40	**Jog Pick** w/Jog Trigger, Fixed Handle, and Three-Position Switch	Walking Speed	Walking Speed	Walking Speed	Rabbit Speed
8TB50	No **Jog Pick**	N/A	N/A	Walking Speed	Rabbit Speed

Forks First

Model	Coast Type	Jog Trigger	Jog Pick On	Jog Pick Off	Rabbit On
8HBW30	No **Jog Pick**	N/A	N/A	Walking Speed	N/A
8HBE30/40	No **Jog Pick**	N/A	N/A	Riding Speed	Riding Speed
8HBE30/40	**Jog Pick**	N/A	Walking Speed	Riding Speed	Riding Speed
8HBE30/40	Speed Restricted	N/A	N/A	Walking Speed	Riding Speed
8HBC30/40	No **Jog Pick**	N/A	N/A	Walking Speed	Riding Speed
8HBC30/40	**Jog Pick** w/Jog Trigger, Fixed Handle, and Three-Position Switch	N/A	Walking Speed	Walking Speed	Riding Speed
8TB50	No **Jog Pick**	N/A	N/A	Walking Speed	Riding Speed

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General System Data

Figure 3-1. Model 8HBE30/40 (Long-John Forks Shown)

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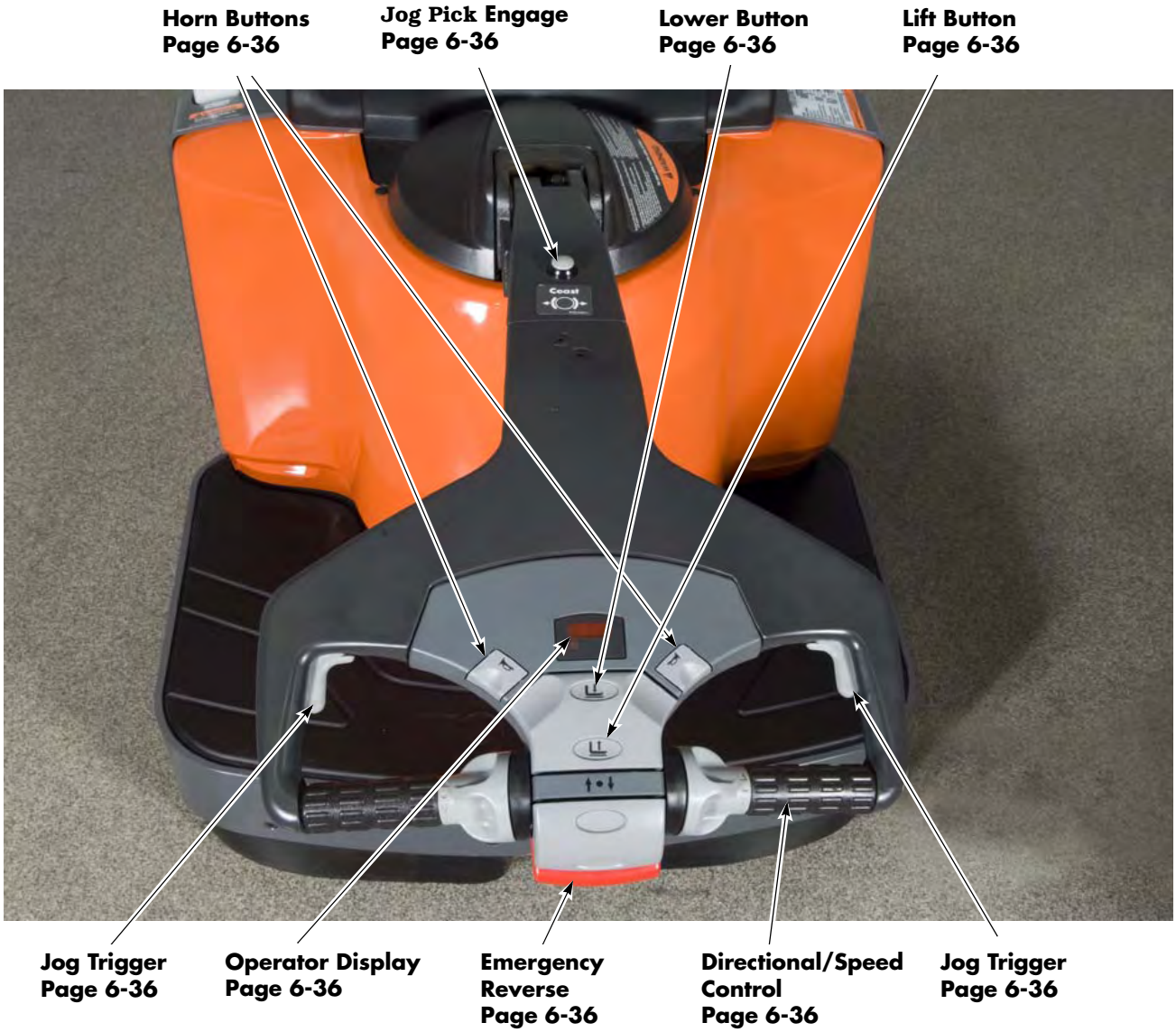

Figure 3-2. Model 8HBE30/40 Control Handle

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Special Tools

Service Key

Figure 3-3. Service Key

Use the optional Service Key (P/N 00590-42683-71) directly on the truck to troubleshoot and program the truck service parameter settings.

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Theory of Operation

Vehicle Manager (VM)

The programmable motor control functions are performed by the electronic circuitry housed within the control handle vehicle manager (VM). The basic functions of the VM include:

- Monitoring relative positioning of the directional/speed control to eighteen hall effect sensors for speed and direction control
- Monitoring the position of the emergency reverse button for emergency reversing of the truck direction
- Monitoring truck performance and providing input data and commands to the operator display
- Providing lift/lower input commands to the traction power amplifier (TA)
- Monitoring **Jog Pick** logic and speed control engage commands
- Monitoring jog switches S112 and S115 for jog control
- Monitoring horn switches S18A and S18B for horn operation
- Monitoring and setting truck performance parameters

Traction Power Amplifier (TPA)

The basic functions of the TPA include:

- Controls the traction motor direction by adjusting the traction motor field polarity according to the directional signal inputs from the VM
- Controls the traction motor speed and torque by monitoring the position change of the hall effect sensors. Variable motor speed is determined by voltage, frequency, and phase
- Controls the emergency reverse circuitry in the VM that provides the directional travel control commands to the TPA and traction motor
- Monitors the travel circuits for fault conditions and responds appropriately

Traction System

Battery Plugged In

When a fully-charged battery is plugged in, the truck has B+ and B- supplied to the following points:

- B+ to and thru FU1 to the normally-open M2 contactor
- B+ to and thru FU3 and to the open SW1
- B+ to and thru FU2 to the normally-open M1 contactor
- B- to the B- lug on the TPA, JP3-4 on the VM, and J5-2 on the service port interface

Key Switch ON and M1Energized

When the key switch is turned ON, the control handle must be in the correct position to close the brake (deadman) switch (SW2). See “Brake (Deadman) Switch” on page 5-11. B+, B-, 5V, and 12V are supplied to the following points:

- B+ thru SW1 to IGN 1, then to B+ Key on the TPA, JP3-1 on the VM, and J5-1 on the service port interface
- B+ thru SW18 at JP10-2, thru IGN 2 then thru JP10-1 to JP1-33 (High speed enabled) at the TPA
- B+ to the -X side of contactor M1, contactor M2, SOL 1, SOL 2, horn from TPA JP1-13, and grab rail J4-6
- Contactor M1 is activated thru a ground supplied to the -Y side of M1 thru TPA JP1-6
- B+ to the B+ lug on the TPA thru the activated contactor M1
- 5V is supplied to the Traction Motor Encoder JP6-1 from TPA JP1-26
- 12V is supplied to SW2, 8, 13, 14, 15, 16A, 16B thru the TPA JP1-25
- B- is supplied to TS2 thru TPA JP1-7

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- B- is supplied from TS2 to SW2, JP2-3, SW8, JP8-3, grab rail assembly JP4-5, Traction Motor Encoder JP6-4, and Traction Motor Temperature Sensor JP7-2

Travel Request, Tractor-First

The directional/speed control descriptions assume that the battery is fully charged and connected, and the key switch is ON. The control handle must be in the correct position to close brake (deadman) switch SW2. When SW2 is closed, main contactor (M1) is energized.

NOTE: When the control handle is released and the brake (deadman) switch opened, main contactor (M1) will remain energized for several seconds before de-energizing.

When the directional/speed controls are rotated in the forward direction (tractor-first) from neutral:

- A forward travel signal is detected in the hall effect sensors, converted into a travel request in the VM, and transmitted thru the CAN bus to the TPA
- The VM verifies that the emergency reverse button is not activated before supplying the travel command to the TPA
- The VM verifies that the arm angle is positioned correctly to activate SW2, indicating that the brake is released and contactor M1 is activated
- The TPA monitors the rabbit switch (if supplied) to permit full speed travel
- The TPA receives a forward travel command from the VM thru the CAN bus and determines the correct sequence to energize traction motor leads (U, V, W) to move the truck in the correct direction. The TPA also determines the required amount of AC voltage to be sent thru the motor leads based on the requested RPM and the required frequency
- The TPA also receives feedback from the Traction Motor Encoder and the Traction Motor Temperature Sensor to adjust the voltage to the motor

Travel Request, Forks-First

When the directional/speed controls are rotated in the reverse direction (forks-first) from neutral:

- Same as for tractor-first travel, except the travel signal requests motion in the opposite direction and the truck travels in the opposite direction

Emergency Reverse (Model 8HBW30 and 8HBE30/40)

If the emergency reverse button (belly button) hall effect switch is closed with the control handle lowered in travel mode (SW2 closed), the control system will activate an immediate, rapid acceleration in the reverse (forks-first) direction:

- The emergency reverse travel instruction is transmitted thru the CAN bus to the TPA
- Travel and speed inputs to the TPA are ignored
- The TPA provides maximum torque inputs to the TM immediately after the emergency reverse button is activated
- Travel in reverse (forks-first) direction will continue until the emergency reverse button is released

When the emergency reverse mode is activated, the TPA ceases to respond to the normal travel command from the directional/speed control. To reset the truck for normal travel, return the directional/speed control to its neutral position and cycle the brake ON/OFF.

NOTE: For Model 8HBE30/40 with Jog Pick option: the actuation of the emergency reverse switch will disengage the Jog Pick mechanism (if engaged) and return the brake to normal operating mode.

Strip Curtain Bypass (Model 8HBE30/40 only)

When the truck is traveling tractor-first, and the horn button on the grab rail is pressed, the

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emergency reverse sensor is disabled until the horn button is released.

Lift/Lower System

The lift/lower system consists of an electrically operated hydraulic pump and related components.

The hydraulic pump assembly has a positive displacement rotary gear pump with reservoir mounted to an adapter. A DC electric motor is mounted to the opposite side of the pump adapter. An adjustable relief valve, check valve, and a solenoid-operated release valve are installed within the adapter.

With the forks elevated, the normally-closed solenoid valve and the check valve prevent hydraulic fluid from returning to the reservoir.

Lift

When the battery is connected and the key switch is ON:

- When the control handle lift button is pressed, the lift switch closes and a lift request signal is transmitted thru the CAN bus thru VM JP3-2 & 3 to TPA JP1-23 & 35
- When the grab rail lift button (SW15) is pressed (if supplied), a 12V lift request signal is transmitted thru JP4-1 to TPA JP1-12
- A ground is supplied to contactor M2 from TPA JP1-5
- The lift pump contactor (M2) closes, applying B+ to the lift pump motor (MP) causing the lift pump to operate. Hydraulic fluid is drawn thru a filter, lift pump, and check valve
- As the pump rotates, oil is forced out the pressure port thru the lift hose to the lift cylinder. Oil can not return to the reservoir because of the closed pressure relief valve and the closed lowering solenoid valve
- Hydraulic pressure in the lift cylinder lifts the forks
- Lift-limit switch (SW8) transmits a lift-limit signal to the TPA that removes power to the lift motor when the forks reach a preset lift-limit

When the lift button is released:

- The pump contactor coil (M2) is de-energized. This stops the lift motor and pump. The forks are held in position by hydraulic fluid trapped in the cylinder by the check valve, the static position of the relief valve, and the closed lowering solenoid valve
- The relief valve opens if the hydraulic pressure exceeds the preset limit

Lower

When the battery is connected, the truck is ON, and the lower button is pressed:

- Lower signal instruction is transmitted thru the CAN bus from the VM JP3-2 and JP3-3 to TPA JP1-23 and JP1-35
- When the grab rail lower button (SW14) is pressed (if supplied), a 12V lower request signal is transmitted thru JP4-2 to TPA JP1-11
- A ground is supplied to SOL 1-Y from TPA JP1-3. The TPA then opens lowering solenoid valve (SOL 1)
- Hydraulic fluid in the lift cylinder returns to the hydraulic reservoir thru the lowering valve and the flow control valve. The lowering speed is regulated by the flow control valve
- The forks lower

Jog Pick Mode

Jog Pick mode is an operating mode where the brake is released at all times and speed is restricted to Walking Speed. **Jog Pick** mode is intended for order picking while walking beside the pallet truck. There are two possible **Jog Pick** modes:

- (optional on Model 8HBE30/40 only)

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- Manual **Jog Pick** operating mode on Model 8HBC30/40 with fixed-position handle and jog triggers

Model 8HBE30/40 only

To order pick, the Model 8HBE30/40 system uses an encapsulated spring at a predetermined preload and a solenoid-actuated ball retainer to keep the control handle in the operating range. This permits the truck to coast to a stop when the control handle is released instead of applying the brake. The operator can still apply the brake if it is needed.

Operator commands are signaled thru the **Jog Pick** engage actuator inputs to the VM. The VM controls **Jog Pick** logic and speed control.

When the truck is ON, the control handle is lowered into the operating range, and the **Jog Pick** engage actuator is pushed:

- The horn “clicks” two times
- The **Jog Pick** solenoid energizes
- Retaining balls are forced outward to hold the control handle in operating range
- **Jog Pick** switch engages, limiting speed to approximately Walking Speed
- Power switch engages, latching the **Jog Pick** solenoid circuit to the key switch. This permits **Jog Pick** to remain engaged when the **Jog Pick** engage actuator is released
- Operator display will read “JOG PIC”

When the rabbit button or the emergency reverse switch is pressed while is engaged:

- Power is cut to the **Jog Pick** solenoid
- Retaining balls are forced inward releasing **Jog Pick**
- **Jog Pick** switch disengages, returning the truck to normal operating speed (up to Rabbit Speed)
- Power is cut to the operator display

Manual Jog Pick

The **Jog Pick** system for Model 8HBC30/40 with a fixed-position control handle uses the standard manually-actuated brake lever design to keep the truck in the travel (brake-released) position during order picking operation. The **Jog Pick** system is activated by depressing either jog trigger. This sends a signal to the VM. This generates a speed reference input thru the CAN bus to the TPA. This creates a fixed output to the traction motor circuit and limits the fixed speed to Walking Speed.

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Section 4. Planned Maintenance

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Maintenance Guidelines

Following a regularly scheduled maintenance program:

- Promotes maximum truck performance
- Prolongs truck life
- Reduces costly down time
- Avoids unnecessary repairs

Scheduled maintenance includes:

- Lubrication
- Cleaning
- Inspection
- Service

Perform all of the scheduled checks and maintenance during the suggested intervals. The intervals given in this guide are based on normal operating conditions. When operating under abnormal or severe conditions, perform these services more often as required to keep the unit in good operating condition.

See “Lubrication Equivalency Chart” on page A-2. Refer to the manufacturer’s supplements for components not described in this manual.

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Initial 90 Day/250 Deadman Hours (HD) Maintenance

Perform the following maintenance tasks 90 days after the truck was put into service or at 250 HD, whichever comes first.	
Component	**Task**
Drive Unit	Break mounting bolts free and reapply thread-locking compound . Re-torque mounting cap screws to 30 ft. lb. (41 N•m). See “Drive Unit” on page 6-51. Change fluid. See “Hydraulic Fluid” on page 6-76.
Hydraulic Reservoir	Change hydraulic fluid. See “Hydraulic Fluid” on page 6-76.
Power Amplifiers	Torque power cable terminal nuts to 100 in. lb. (11.3 N•m).

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Every 180 Days or 500 Deadman Hours

Perform the following maintenance tasks every 180 days or 500 HD, whichever comes first.	
Component	**Task**
Battery	Check the weight stamped on the battery in the pallet truck against the minimum and maximum allowable weights on the spec tag for the pallet truck. Report any pallet trucks that are running with batteries below the minimum or over the maximum allowable weight. Check for voltage leaks to frame. Reference shorts to frame section in maintenance manual. If cleaning does not remove voltage to frame, install a new battery. Inspect all battery connectors and leads for damage and cuts in protective coatings. Make sure the battery gates are in position and not damaged. Make sure the battery has no more than 0.5 inch (13 mm) free play in any direction.
Brakes	In an open area, measure stopping distance. Traveling to 2 to 3 mph (3.2 to 4.8 km/hr) empty, apply the brake; the empty pallet truck should stop within 2 to 4 feet (0.6 to 1.2 m). During normal operation, with a rated load and traveling at top speed, the pallet truck should stop within approximately one and one-half truck lengths. Stopping distance depends on the load, floor, and tire condition. Examine for signs of oil on the pads or rotor. If oil is present, disassemble brake and clean the pads and rotor. *Failure to keep brakes adjusted causes premature pad and rotor wear and excessive motor heat.* See “Brake” on page 6-41.
Contactor	Inspect contactor tips for burnt or pitted surfaces. Failure to replace the tips may prevent the contactor from opening or closing causing unscheduled downtime. With the truck OFF and the battery disconnected, check the plunger for smooth operation with no binding. If binding occurs, the pallet truck may malfunction or exhibit intermittent fault codes. See “Contactors” on page 6-30. **NOTE:** For EE trucks, remove cover to inspect tips.
Control Handle Assembly	Make sure steering function is smooth and responsive, without binding or excess play. Verify lift/lower function is smooth and controllable. Verify travel function is smooth and responsive thru full range of acceleration and braking. Verify no codes on display. Verify function of all switches.
Brake (Deadman) Switch	Check the adjustment. See “Brake (Deadman) Switch (SW2)” on page 6-17.
Drive Unit	Inspect for leaks. Make sure O-ring is present on the dipstick. Examine for drive unit steering bearing wear. See “Drive Unit” on page 6-51.
Electrical Cables	Inspect all power cables for nicks or cuts. Give special attention to those cables that are not stationary, for example, cables to the traction motor. Replace any cable that is damaged or shows signs of excessive heat. Failure to do so may cause intermittent system shutdowns and/or electronic failures.
Forks	Check the fork height adjustment. See “Fork Height Adjustment” on page 6-73. Check the lift-limit switch for lift motor cut-out. Adjust if necessary. Check wear on pull rod bushings.
Frame and Tractor Checks	General visual inspection of structural members for cracks, including but not limited to the main frame and tractor.

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Perform the following maintenance tasks every 180 days or 500 HD, whichever comes first.	
Component	**Task**
Hardware	Check bolt torque of major components (motors, pumps, brake, drive unit, manifolds,). Tighten any loose hardware. Replace any broken or missing hardware. See “Appendix” on page A-1.
Horn	Check that the horn operates when you press the horn button. (Battery must be connected.) Check mounting bracket insulators.
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 6-76.
Lubrication	Lubricate all grease points. Lowest SM interval for truck. See “Grease Fittings” on page 4-7.
Motors	**AC** - Check the cable lugs to make sure they are tight to the terminal studs. Both the inside and outside nut should be torqued to the values listed. Replace any cable that shows signs of excessive heat. Check sensor wires for sound connection and condition. **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).
Pallet Entry Wheels/Sliders	Check and replace damaged wheels/sliders as necessary. See “Pallet Entry Sliders” on page 6-72.
Shorts to Frame	Check for electrical shorts to frame. See “Checking for Shorts from Components to Truck Frame” on page 5-6.
Switches	Check all switches for correct operation and adjust as needed.
Ventilation Slots	Make sure ventilation slots in the tractor frame are clear of obstructions and debris.
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. Check caster adjustment.

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Every 360 Days or 2000 Deadman Hours (HD)

Perform the following maintenance tasks every 360 days or 2000 HD, whichever comes first.	
Component	**Task**
Drive Unit	Change fluid. See “Drive Housing Lubrication” on page 6-58.
Hydraulic Reservoir	Change hydraulic fluid. See “Hydraulic Fluid” on page 6-76.
Pump Couplings	Separate pump and motor. Apply Molybdenum Anti-Seize Compound to the coupling. See “Hydraulic Pump” on page 6-87.

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Grease Fittings

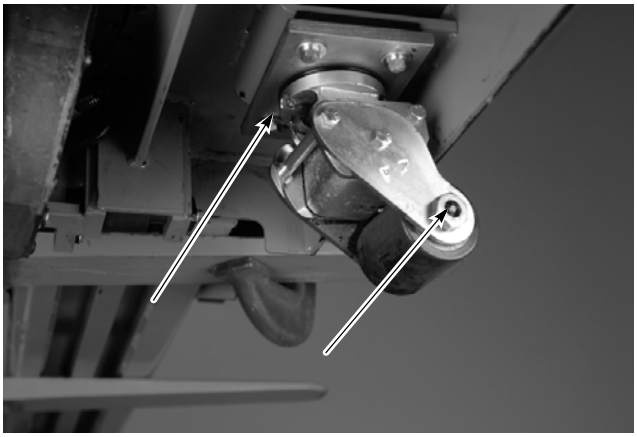

Figure 4-1. Caster Grease Fittings

Figure 4-2. Upper Bell Crank Grease Fittings (Between Tractor and Fork Section)

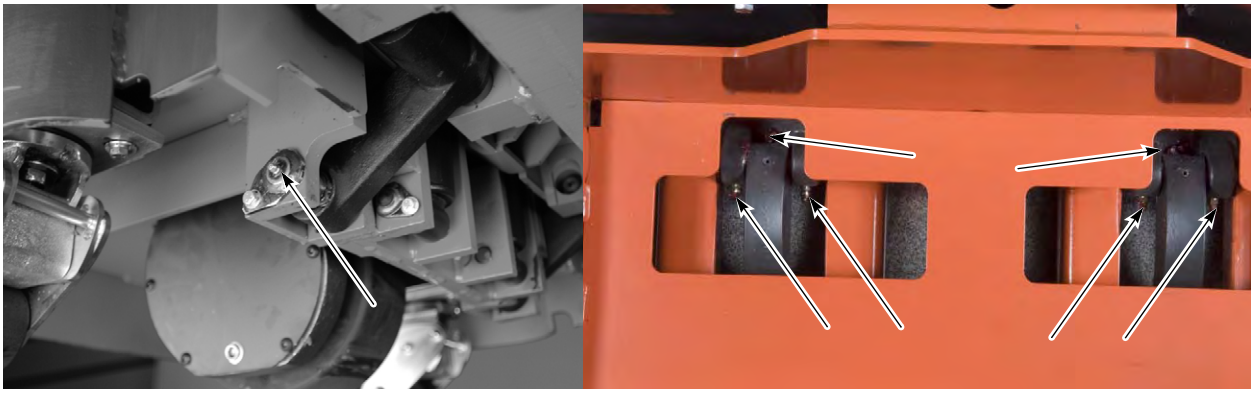

Figure 4-3. Lower Bell Crank Grease Fittings-left side shown (Between Tractor and Fork Section)

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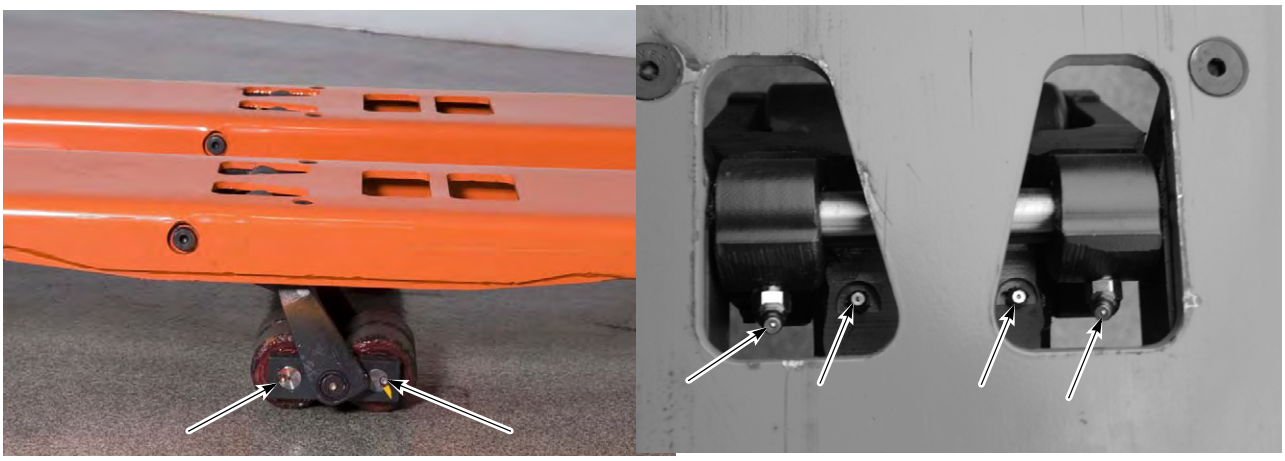

Figure 4-4. Load Wheel Grease Fittings and Fork Grease Fittings (Top View-8K trucks)

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Section 5. Troubleshooting

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How to Use This Section

This section uses a set of fault, caution, and error codes, charts, and tables that are designed to take you from a symptom to a specific sequence of actions in order to isolate a failing component.

- The chart **"Traction Power Amplifier Flash Codes"** on page 5-27 will guide you thru the flash codes displayed on the LED's installed on the TA.
- The section **"Caution and Error Codes"** on page 5-33 will define the various codes displayed on the operator display.
- Use the chart **"TS1: START TROUBLESHOOTING"** on page 5-29 to guide you to the individual symptom chart you need.
- When you're familiar with the symptoms listed, you may instead simply look up the symptom in the **"Troubleshooting"** on page 5-29**.**
- As you work with a troubleshooting chart, code, or table, you may be instructed to test various electrical connector pins. The pinout matrix chart lists information on functions and normal voltages of terminals and harness connector pins. See **"Pinout Matrix"** on page 5-69.

Every time you complete a troubleshooting procedure, follow the steps in the **"END1: End of Troubleshooting Procedure"** on page 5-31.

If the troubleshooting symptom charts, codes, or tables do *not* isolate the problem, or if the symptoms are not consistent or repeatable, go to **"GEN1: General Troubleshooting"** on page 5-30. This chart will help you approach the problem in a systematic and logical manner.

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Electrical Troubleshooting Guidelines

Many problems are caused by a faulty or dirty battery. Make sure the battery is clean. See "Battery" on page 6-8.

⚠ WARNING

Make sure you jack and block the pallet truck whenever a troubleshooting procedure requires turning the truck ON. This will avoid accidents caused by unexpected truck travel.

⚠ CAUTION

Unless otherwise directed, disconnect the battery connector when you examine electrical circuits or components with an ohmmeter. Electrical current can damage the ohmmeter.

Save time and trouble by looking for simple causes first.

Visually inspect all wiring and electrical components for:

- Loose connections or connectors
- Loose or broken terminals
- Damaged terminals, blocks, or strips
- Broken wiring and shorted conditions (especially those that are close to metal edges or surfaces)

Use a digital multimeter such as a Fluke meter for all measurements. Analog meters can give inaccurate readings and load down sensitive electronic circuits enough to cause failure. Ensure meter cables are connected to the correct meter jacks and that the correct function and scale are selected.

Whenever measuring resistance, turn the truck OFF and disconnect the battery connector. Battery current can damage an ohmmeter.

For troubleshooting DC electric motors, see "DC Electric Motor Tests" on page 5-7.

For troubleshooting AC electric motors, see "AC Electric Motor Tests" on page 5-9.

For information on fuses, see "Fuses" on page 6-14.

For information on pin, connector, and harness connections, see "List of Electrical Symbols" on page 5-15, "Wiring Harness" on page 6-12, and "AMP Harness/Traction Power Amplifier Connector" on page 6-27.

For information on functions and normal voltages of terminals and harness connector pins refer to the pinout matrix chart on page 5-69.

Troubleshooting the CAN Bus

The CAN bus consists of two wires interconnecting the VM, TPA, and service port interface. One wire is called CAN Hi and the other is called CAN Lo. All communications between the VM, TPA, and service port are performed over those two wires. Check these wires first if a communication problem arises or for any problem that could be related to the CAN Bus.

There is a 120 ohm terminating resistor in the VM and also one in the TPA. If the TPA has a jumper wire installed between JP1-21 and JP1-34, the resistor will terminate the bus wires at the TPA. There is no jumper wire for the VM.

To check the CAN Bus wires between the VM and TPA and to test the terminating resistors, disconnect either the VM or TPA from the CAN bus. If the resistor on the TPA and the wires from the VM to the TPA are checked, disconnect the wires going into the VM and measure the resistance from the CAN wires back to the VM. 120 ohm should be measured if the wires and resistor are good. If the resistor on the VM and

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Thank you very much for your reading.

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