

Maintenance Manual



Serial Numbers: 821-15-00100 & Up
Serial Numbers: 825-17-00001 & Up

Scheduled Maintenance
Messages and Codes
Symptom Tables



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Interactive Electronic Technical Manuals

The electronic version of this document is an Interactive Electronic Technical Manual (IETM). IETMs provide quick access to specific service and parts information and are available on iManuals or from your local authorized Raymond Sales and Service Center.

NOTE: IETMs require Adobe Reader 9.0 or higher.

[Blue](#) text in the Maintenance Manual is linked to a location within the manual. Clicking on blue text takes you to the linked location.



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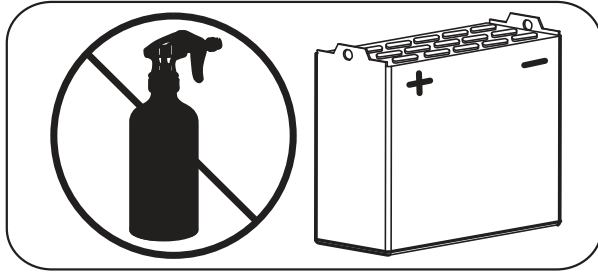


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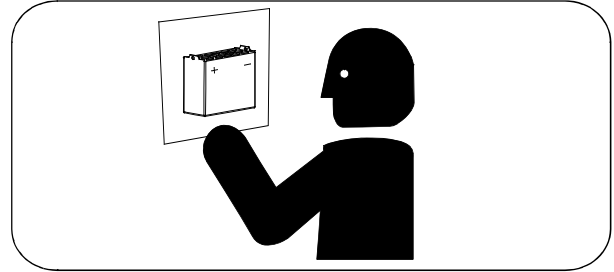


Lead Acid Battery Safety

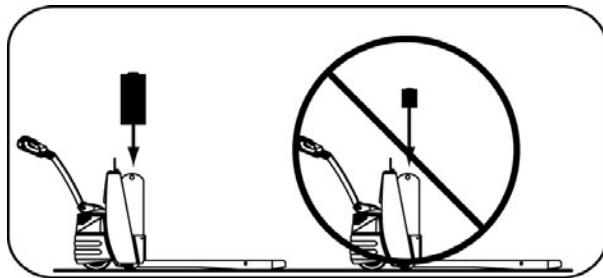
Do **not** permit cleaning solution, dirt, or any foreign matter to enter the cells.



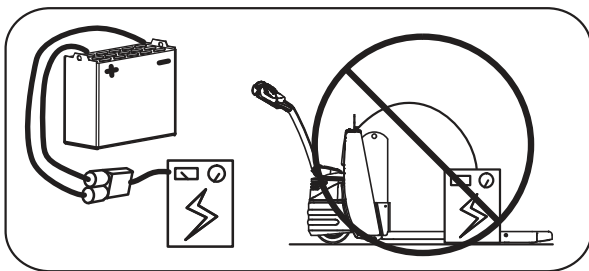
Obey the charging procedures in the Battery Instruction Manual and in the Battery Charger Instruction Manual.



Make sure you install the correct size and voltage battery. A smaller or lighter weight battery could seriously affect truck stability. An incorrect voltage battery could damage the truck's electrical system. See the truck's specification tag for more information.



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





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Truck Model Identification

Figure 3-1. Model 8210 Pallet Truck



Operator Display and Programming

Parameter	Name	Unit	Range	Step	Default	Description
31	iALERT (only with iWAREHOUSE option)		0 or 1	1	0	Requires the operator to login before truck operation is allowed. Enables caution and error codes to be sent to the iWAREHOUSE system. 0 = OFF 1 = ON NOTE: This parameter is Read Only except when using FlashWare.
32	iCONTROL (only with iWAREHOUSE option)		0 or 1	1	0	Requires the operator to login before truck operation is allowed. Enables remote setting of operator parameters. 0 = OFF 1 = ON NOTE: This parameter is Read Only except when using FlashWare.
33	Not used					
34	iBATTERY (only with iWAREHOUSE option)		0 to 2	1	0	Identifies the source of BSOC display information. 0 = OFF 1 = ON and displayed BSOC is from the TA 2 = ON and displayed BSOC is from the BSM NOTE: This parameter is Read Only except when using FlashWare.
35	Not used					
36	Not used					
37	Not used					
38	Not used					
39	Access Code		1 to 4	1	1	Defines whether truck has a Main ON/OFF switch or a keypad and what access level service personnel have to parameters. 1 = ON/OFF switch (no key pad) and driver parameters are open, 2 = ON/OFF switch (no key pad) and driver parameters are closed, 3 = keypad and driver parameters are open, 4 = keypad and driver parameters are closed. NOTE: When driver parameters are closed, a Service Key or FlashWare is required to access driver parameters.
40	Not used					

Faults Mode

In System Faults mode, currently active faults detected by the controller are displayed.

In Faults History mode, the controller's diagnostic history file is displayed. This field includes a list of all faults observed and recorded by the controller since the history was last cleared.

NOTE: Each fault is listed only once, regardless of the number of times it occurred.

1. If equipped with the optional keypad, press the red OFF (**O**) key. Place the Main ON/OFF Switch in the OFF position.
2. Remove the tractor covers.
3. Connect the PMT to the power amplifier. Wait for the PMT to “boot up” before proceeding to the next step.
4. Place the Main ON/OFF Switch in the ON position. If equipped with the optional keypad, enter your PIN-key code and then press the green ON (**|**) key.
5. To view the present status of the unit, use the Menu Navigation Key to select Faults -> System Faults
6. To access the log, use the Menu Navigation Key to select Faults -> Fault History.
7. Use the Up and Down arrows on the Menu Navigation Key to scroll through the list of multiple faults.

Clear

After you have diagnosed and corrected the problem, clear the diagnostic history file. This permits the power amplifier to accumulate a new file of faults. By checking the new history file at a later date, you can easily determine whether the problem was completely fixed.

1. To clear the fault history of the unit, use the Menu Navigation Key to select Faults -> Clear Fault History.
2. Press the increment arrow (+) for yes and the decrement arrow (-) to cancel and not clear the fault history.

“Test Mode Menu” on page 3-24 lists possible messages you may see displayed when the PMT is operating in either System Faults or Fault History mode.

Information Mode

The Information Menu provides access to product information describing the basic revision level of the PMT.

To view, use the Menu Navigation Key to select Information in the Main Menu. Remember to press the right arrow to select a Menu. Press the left arrow to exit.

Programmer Mode

Programmer mode permits you to perform a variety of tasks.

1. If equipped with the optional keypad, press the red OFF (**O**) key. Place the Main ON/OFF Switch in the OFF position.
2. Remove the tractor covers.
3. Connect the PMT to the power amplifier. Wait for the PMT to “boot up” before proceeding to the next step.
4. Place the Main ON/OFF Switch in the ON position. If equipped with the optional keypad, enter your PIN-key code and then press the green ON (**|**) key.
5. Use the Menu Navigation Key to select Programmer.
6. Press the right arrow on the Menu Navigation Key to enter the sub-menu.
7. Use the Up and Down arrows on the Menu Navigation Key to scroll through the sub-menu list of Programmer displays.
8. Use the right arrow to select and view a single variable.
9. Change the parameter value by pressing the Data Inc/Dec Key. The new value is set as soon as the Data Inc/Dec Key is released.

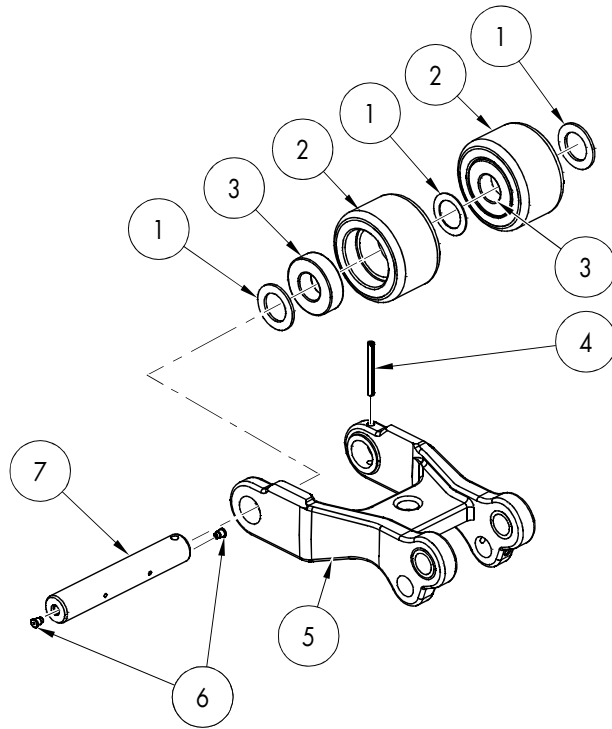
Grease Fittings

Figure 4-1. Load Wheel Axle (Single Wheel)



Dual load wheels have a grease fitting [6] in each end of the wheel axle [7].

Figure 4-2. Dual Load Wheel (item 6)

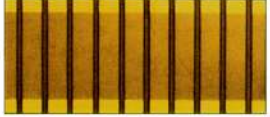

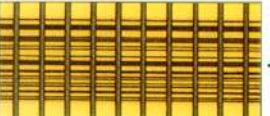
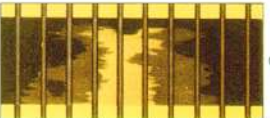
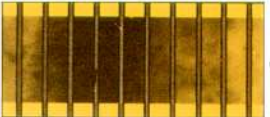


Service

Some conditions, identified in [Table 5-1](#), may be resolved by cleaning the commutator with a special polishing stone. Polishing the commutator should only be attempted for the specified conditions. Refer to [“Polishing the Commutator” on page 7-85](#) for instructions.

Some conditions can be resolved by recutting the commutator on a lathe. This requires special equipment and training and should only be attempted at a qualified DC motor repair facility.

Table 5-1. Commutator Surfaces

Condition	Probable Cause	Commutator Surface
Good Condition-Light Film	Uniform coloring indicates satisfactory operation of the machine and brushes. Acceptable film color may vary from light to dark due to film thickness.	
Satisfactory Condition-Light and Dark Pattern	This condition can appear in alternating bars as shown or every 3rd or 4th bar. This is caused by imbalances in the windings or other motor variances. It is not an indication of commutator problems. The motor should have no issues running, but the condition may indicate a need for more frequent inspections.	
Unsatisfactory Condition-Streaky Film With No Commutator Wear	Threading or streaked film on the commutator surface. May be accompanied by rattling or loud operation. This condition is frequently due to incorrect brush grade. Environmental conditions, such as freezer or low humidity, can be a contributing factor. This condition may be repaired with a polishing stone if caught soon enough. Refer to “Polishing the Commutator” on page 7-85 .	
Unsatisfactory Condition-Uneven Film	Patchy colors of varying densities and shape. This condition is generally due to unclean operating conditions and does not indicate damage to the commutator. Clean the commutator with a polishing stone and compressed air (see “Polishing the Commutator” on page 7-85). Consider more frequent scheduled maintenance intervals.	
Unsatisfactory Condition-Film With Dark Areas	Dark areas can be isolated or regular. This condition indicates a commutator is out-of-round. Continued use may result in failure and damage to other systems. The motor should be replaced or recut at a qualified repair facility.	

No Lift or Slow Lift, Lift Motor Does Run

Possible Cause	Action
Battery problems	Lead acid battery: Replace the battery with a fully-charged battery. Lithium-ion battery: Check charge status LEDs for charge level.
Mechanical binding in the lift mechanism	Repair the lift mechanism.
Low hydraulic pressure or relief valve setting	Check the hydraulic pressure setting and adjust if necessary. See “Hydraulic Pump Pressure Relief Valve Adjustment” on page 7-103.
Relief valve contaminated or bad. (Unable to get the correct hydraulic pressure)	With the main ON/OFF switch OFF and the battery disconnected, remove the pressure relief valve. Check for damage or contamination. Replace the valve or flush the system and replace the hydraulic fluid. See “Hydraulic Fluid” on page 7-95.
Bad lift pump motor or brushes	Check the lift pump motor brushes. If OK, replace the pump motor.
Contamination found in the pump	Flush the system and replace the hydraulic fluid.
Bad pump	If the lift motor is OK, remove the motor from the pump and rotate the pump by hand. Replace the pump if not OK.

No Lower, Lift and Travel OK

Possible Cause	Action
Bad lower solenoid valve...	With the main ON/OFF switch ON, cycle the lower switch. Does the lower solenoid valve energize? If YES, disconnect the battery, then slowly loosen, but DO NOT REMOVE, the hydraulic line at the hydraulic pump assembly. Permit the forks to slowly lower. Have rags and a drain pan ready to catch the fluid.
... if the forks do not lower, check for mechanical binding in the lift cylinder or the fork mechanism...	Replace the lift cylinder or repair the lift mechanism.
...if the forks lower, remove and inspect the solenoid valve...	Inspect for free movement and for signs of contamination. Clean the solenoid valve or flush the system, clean the filter, and replace the hydraulic fluid. See “Hydraulic Fluid” on page 7-95. If no contamination is found, repair or replace the solenoid valve or the pump assembly.
...check for a bad VM	With main ON/OFF switch ON, the PIN-key code entered, the green ON () key on the keypad pressed, and the lower button depressed, check for lower signal input at the CAN (see “Service Display” on page 3-17). If no signal is detected, replace the VM. NOTE: Check for mechanical problems in the handle head before replacing the VM.



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Section 6. Messages and Codes

Code Cold (C43)

Code Title	Traction Amplifier Cold Thermal Cutback
Operator Display	Cold TA Flash Code “2,1”
System Response	Travel performance may be limited.
Alarm Sounds	No
Reason	Low temperature (below -13°F (-25°C)) at the TA heatsink. Operation in extreme cold environment or incorrect TA mounting.
Tests to Run	<ol style="list-style-type: none"> 1. Verify the Traction Amp is cold. If it is, take action to bring the temperature back within normal operating range. 2. Check for correct traction amplifier mounting. 3. Bad traction amplifier. Check TA for error code.
How to Clear	Code is cleared when the traction amplifier heatsink temperature returns to within normal operating range.

Code Hot1 (C44)

Code Title	Motor Temperature Hot Cutback
Operator Display	‘Hot1’ TA Flash Code “2,8”
System Response	Travel performance may be limited.
Alarm Sounds	No
Reason	Traction motor temperature is above 248°F (120°C). Resistance of the temperature sensor should be 591 Ohms at room temperature.
Tests to Run	Use an accurate temperature measuring device to verify the temperature reading on the service display. See “Service Display” on page 3-17 .
How to Clear	Permit the motor to cool down. Replace the temperature sensor.

Error Codes

NOTE: Error Codes are 100 and above. Error codes are logged. No truck activity is allowed during error. Some codes can be cleared when the truck is cycled OFF/ON (unless otherwise noted).

Code E101

Code Title	Traction Amp Type Error
Operator Display	E101
System Response	No truck function active.
Alarm Sounds	No
Reason	Incorrect Traction Amplifier installed on the truck.
Tests to Run	Determine correct TA P/N. Verify TA and VM software versions.
How to Clear	Replace with the correct TA.

Code E106

Code Title	Main Contactor Driver Overcurrent Error
Operator Display	E106 TA Flash Code “3,1”
System Response	No truck function active
Reason	Short in main contactor coil. Resistance of coil should be 22 to 24.2 Ohms for standard contactor (76.5 to 93.5 Ohms for cold storage contactor).
Tests to Run	Examine main contactor for shorts to related wiring harness. See “No Travel, No Lift/Lower. TA Flash Code 3,1. Operator Display May Indicate Error Code E106” on page 5-23.
How to Clear	Examine for shorted component or related wiring. Repair or replace as needed.

Code E236

Code Title	Traction Amp OS Fault
Operator Display	E236
System Response	No truck function active
Reason	Internal TA fault
Tests to Run	None
How to Clear	Reload software via FlashWare. If unable to reload software, replace the TA.

Code E248

Code Title	Lift Contactor Tips Did Not Open
Operator Display	E248
System Response	Main contactor (MPC) opens
Reason	Welded contactor tips or shorted output driver from the TA.
Tests to Run	None
How to Clear	Cycle the truck OFF/ON. If still not clear, check the contactor or replace the TA.

Code E249

Code Title	Charger Voltage is Incorrect
Operator Display	E249
System Response	No truck function active
Reason	The voltage sense line from the on-board HF charger to the truck is either at 0 volts or more than 5 volts difference from what the TA is reading.
Tests to Run	None
How to Clear	Cycle the truck OFF/ON. If still not clear, check the charger and the charger cables.

Code C513

Code Title	LIB BMU Failure
Operator Display	C513
System Response	Truck performance is limited.
Alarm Sounds	No
Reason	Lithium-ion battery BMU potential failure.
Tests to Run	None
How to Clear	Cycle the truck OFF/ON. If still not clear, replace the BMU.

Code C514

Code Title	LIB Charger Failure
Operator Display	C514
System Response	Truck performance is limited.
Alarm Sounds	No
Reason	Lithium-ion battery charger potential failure.
Tests to Run	None
How to Clear	Cycle the truck OFF/ON. If still not clear, replace the Charger.

Code C515

Code Title	LIB Not Commissioned
Operator Display	C515
System Response	Truck performance is limited.
Alarm Sounds	No
Reason	Lithium-ion battery needs to be commissioned.
Tests to Run	None
How to Clear	Commission the lithium-ion battery.



Section 7. Component Procedures

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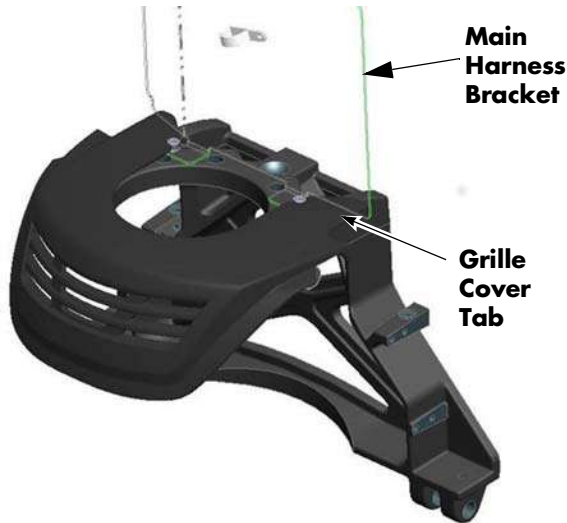
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Grille Cover Installation

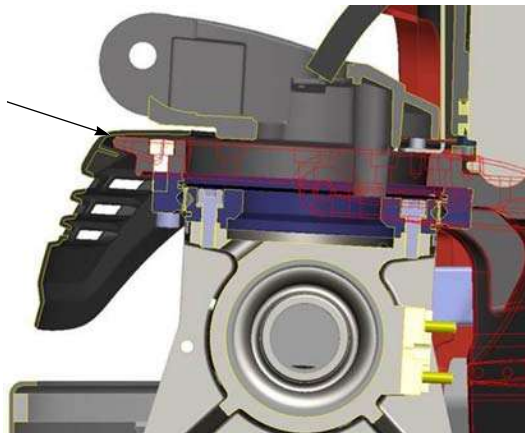
1. Place the grille cover flat on the top surface of the drive unit frame.
2. Slide the grille cover toward the forks of the trucks. The grille cover tabs will slide underneath the main harness bracket and around the heads of the main harness bracket mounting bolts. This locks the grille cover in position.

Figure 7-12.



3. Pull up on the back of the grille cover to make sure it is engaged with the casting.

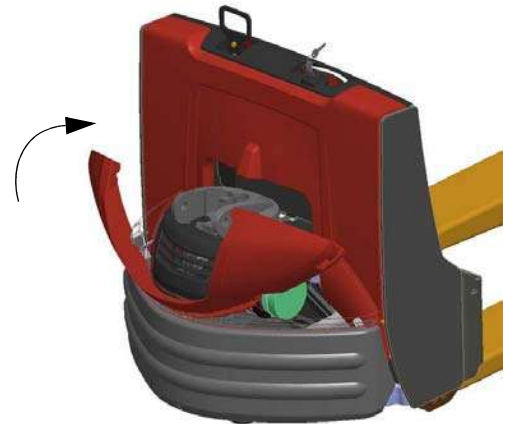
Figure 7-13. Grille Cover Engaged with Casting



Lower Cover Installation

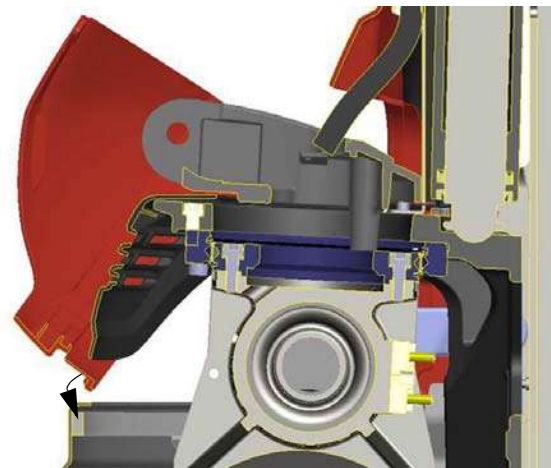
1. Place the steer tiller in the centered (straight ahead) position.
2. Place the center of the lower cover between the grille cover, drive unit, and bumper assembly.

Figure 7-14.



3. Seat the notch of the lower cover under the bumper beam.

Figure 7-15. Seat lower cover in bumper



Steering and Controls

Keypad

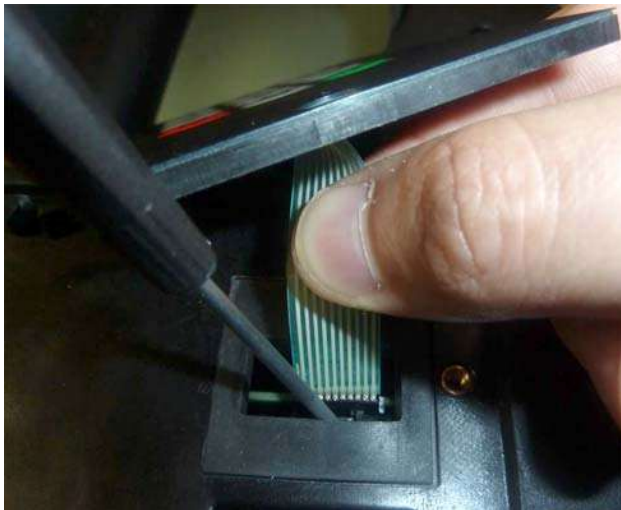
5. Use a fine tip flat head screwdriver to carefully press the connector's latch toward the circuit board (VM).

Figure 7-29.



6. With the connector's latch pressed, gently pull on the ribbon cable until the connector is released. Connector removal requires very little force when the latch is correctly pressed.

Figure 7-30.



Keypad Installation

1. Install the ribbon cable connector into the VM. The connector will only install in one orientation. You will hear the latch click when the connector is fully inserted.

Figure 7-31. Align Cable Connector with VM Connector

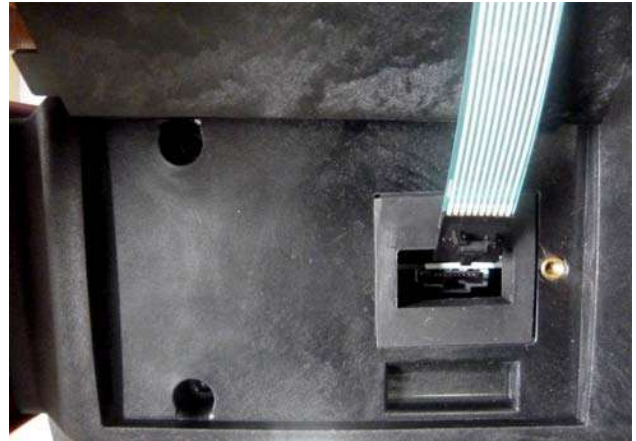
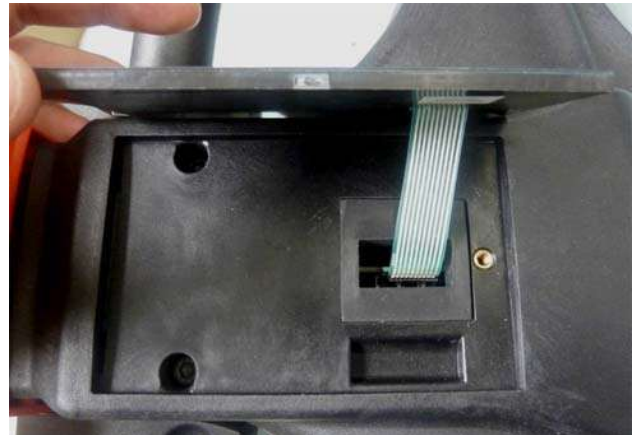


Figure 7-32. Connector Fully Installed



2. Insert the keypad mounting tabs into the control handle head.

Figure 7-33.

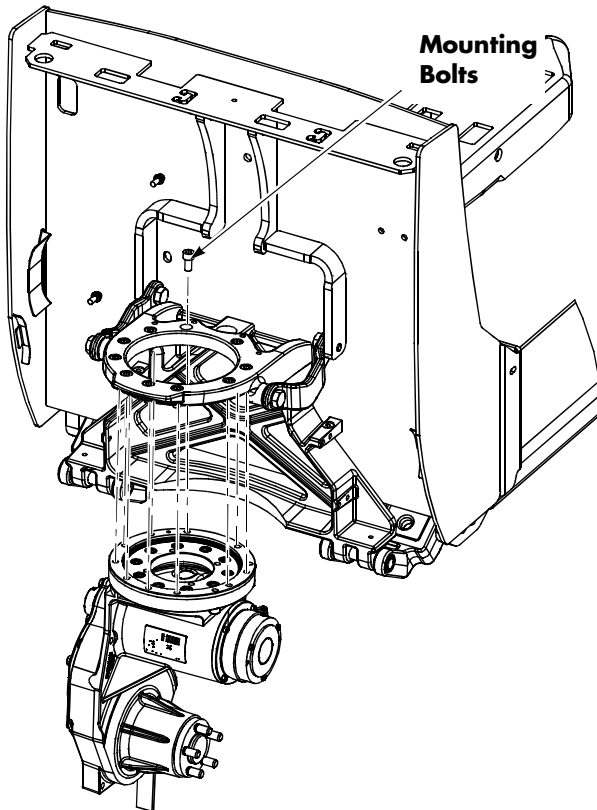


Drive and Brake

Drive Unit

- Secure the drive unit to prevent it from falling. Remove the ten bolts that secure the drive unit and bearing assembly to the frame.

Figure 7-42. Drive Unit Mounting Bolts



NOTE: Remove the ten Allen head bolts to remove only the transmission but not the steering bearing.

- Remove the drive unit and steer bearing assembly by lowering them through the pivot-frame mount.

Drive Unit Disassembly

NOTE: The drive unit capacity is 0.4 qt. (0.4 liters). Make sure to have a correct size waste container for collecting the removed gear case lubricant.

- Remove the drain plug [11]. Drain the gear case lubricant. After draining the gear case lubricant, thoroughly clean the outside with solvent or other non-corrosive cleaning fluid. Air dry all parts, and proceed with the disassembly of drive unit.

- Remove the screws [40] securing the speed sensor cover assembly [21] to the gear case cover. Move the speed sensor cover assembly to the side to prevent damage to the cable. Refer to [Figure 7-102 on page 7-86](#).
- Remove the nine hex head cap screws [3] securing the gear case cover [2]. Pull the gear case cover away from the drive unit to disengage it from the roll pin [26] in the housing.
- Remove the hex screw [19], washer [18], speed sensor pinion gear [17], and shaft seal [16] from the end of the armature. Refer to [Figure 7-102 on page 7-86](#).
- Remove the pinion nut [20, [Figure 7-102 on page 7-86](#)] that secures the top (pinion) gear [4].
- Remove the top (pinion) gear [4] attached to the traction motor armature shaft.
- Remove the traction motor if required. See [“Traction Motor” on page 7-86](#).
- Remove the traction motor bearing [10, [Figure 7-102 on page 7-86](#)], retaining ring [9], and seal [8] from the gear case if required.
- Remove the 2nd stage gear set [5] from the gear case.

NOTE: The 2nd stage axle [25] has an M8 tapped hole in the end. It can be removed with the gear [5] in place.

- Remove the retaining ring [27] from the drive axle [17] then remove the output gear [7].
- Press the drive axle [17] through the inner and outer gear case bearings [13].
- Remove the old bearings [13], spacer [19], and seal [16] from the gear case. Thoroughly clean the case.

Drive Unit Assembly

- Install the new bearings [12 and 18] in the gear case [1] and cover [2] for the 2nd stage gear set.
- Install the new bearings [13], spacer [19], and seal [16] in the gear case for the drive axle.

Installation (entire battery pack)

1. With a fully charged and tested battery on the lifting device, position the lifting device in accordance with the manufacturer's recommendations.

NOTE: Attach the lifting hook to the designated lifting area. Do **not** attach the lifting hook to the charger cord storage handle.

2. Position the battery in the compartment. Make sure the battery has no more than 1/2 in. (13 mm) of "free play" movement in the battery compartment in any direction.
3. Remove the lifting device from the area.
4. Install the mounting hardware through the battery retainer bracket.
5. Install the load backrest.
6. Reconnect the battery connector.

NOTE: When installing a battery pack, make sure the CAN bus is connected, if equipped.



7. Place the Main ON/OFF Switch in the ON position. If equipped with the optional keypad, enter your PIN-key code and then press the green ON (|) key.
8. Configure the truck parameters 21, 24, and 44 for the battery type installed.

Removal (single battery)

1. Park the truck on a level surface and make sure the parking brake is applied.
2. If equipped with the optional keypad, press the red OFF (O) key. Place the Main ON/OFF Switch in the OFF position.
3. Disconnect the battery connector found at the top of the console cover.
4. Unwind the AC power cord.
5. Remove the battery pack cover.
6. Disconnect the CAN connector, if equipped.
7. Release the latch and swing out the top battery tray.
8. Remove the battery retainer bracket.
9. The cables may now be disconnected from the battery terminals and the batteries may be serviced or replaced if necessary. See Figure 7-52.

NOTE: When replacing batteries, make sure all four batteries are the same type.

Installation (single battery)

1. Position the fully-charged and tested batteries in the battery pack.
2. Install the battery retention bracket.

Figure 7-51. Battery Retention Bracket Installed



3. Reconnect the battery cables to the battery terminals in accordance with the battery wiring hookup shown in Figure 7-52.

your PIN-key code and then press the green ON (|) key.

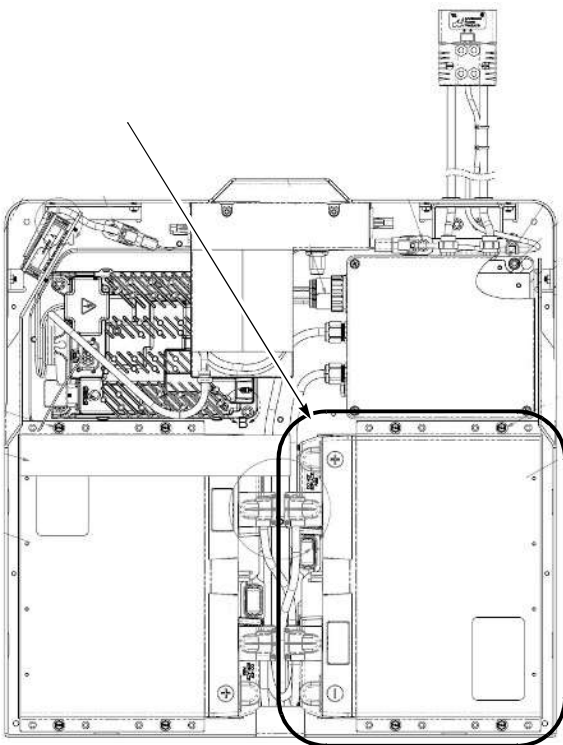
9. Test the operation of the truck.

Cell Module Assembly, Battery Monitoring Unit, and Cell Module Assembly Fuse

NOTE: When replacing any internal components of the Lithium-ion battery, make sure the software in the components (if applicable) is correct. Refer to FlashWare Help.

The Cell Module Assembly (CMA), Battery Monitoring Unit (BMU) and Cell Module Assembly Fuse should be installed or removed together. Do not separate these components. The installation and removal instructions in this section are for both the standard capacity lithium-ion battery as well as the high capacity lithium-ion battery. The Cell Module Assembly comes equipped with a Cell Module Assembly cover that should remain with the Cell Module Assembly, unless instructed otherwise.

Figure 7-63. CMA and BMU Location

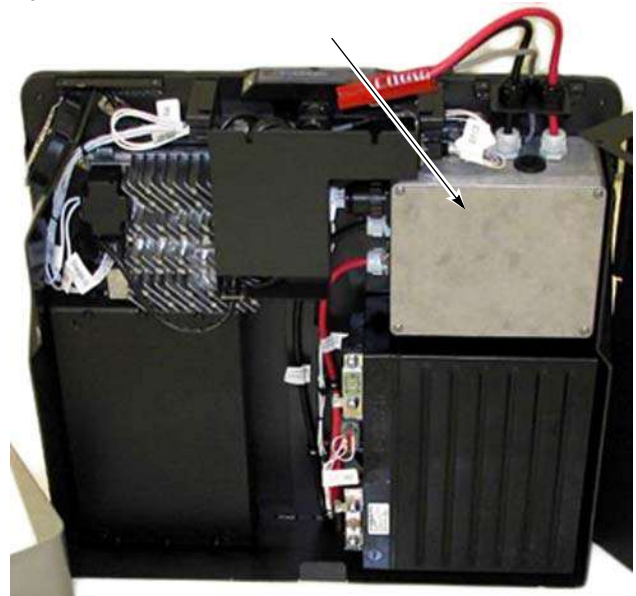


Cell Module Assembly, Battery Monitoring Unit, and Cell Module Assembly Fuse Removal

Perform the following steps to remove the Cell Module Assembly, Battery Monitoring Unit, and Cell Module Assembly Fuse (it is recommended to perform these steps with the back plate of the lithium-ion battery laying down on a level surface).

1. If equipped with the optional keypad, press the red OFF (O) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the lithium-ion battery from the truck. See “Battery Removal” on page 7-48.
3. Remove the top cover. See “Top Cover Removal” on page 7-49.
4. Remove the front cover. See “Front Cover Removal” on page 7-50.
5. Remove the Battery Management Controller (BMC) cover with a screwdriver.

Figure 7-64.



6. Disconnect the BMC F1 Fuse.

Cooling Fan

Cooling Fan Removal

Perform the following steps to remove the Cooling Fan.

1. If equipped with the optional keypad, press the red OFF (O) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the top cover. See “Top Cover Removal” on page 7-49.
3. Remove the front cover. See “Front Cover Removal” on page 7-50.
4. Unplug the cooling fan from the connector.
5. Unscrew the four cooling fan screws mounting the fan to the lithium-ion battery.

Figure 7-76. Fan Mounting Screws



6. Remove the cooling fan and all related hardware.

Cooling Fan Installation

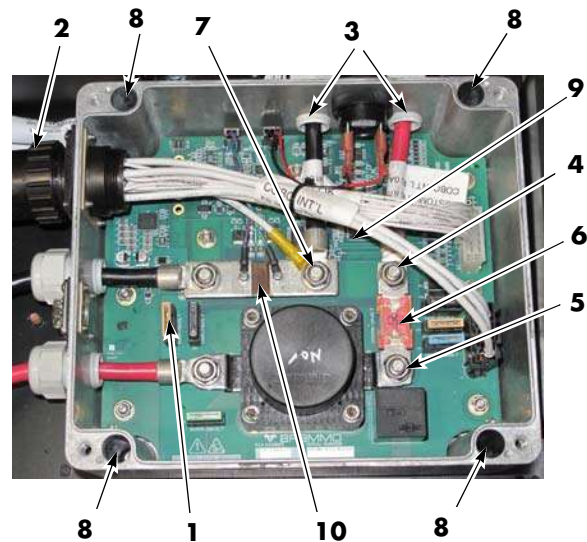
Perform the following steps to install the cooling fan.

1. Align the cooling fan to the four mounting screw holes on the lithium-ion battery.
2. Guide the four screws into the fan and into the lithium-ion battery,
3. Place the four cooling fan spacers on the screws once the screws are guided all the way through.

4. Screw the four cooling fan mounting screws.
5. Install fasteners. Torque fasteners to 0.9 ft. lb. (1.2 Nm).
6. Connect the cooling fan to the cooling fan connector inside the lithium-ion battery.
7. Install the front cover. See “Front Cover Installation” on page 7-50.
8. Install the top cover. See “Top Cover Installation” on page 7-49.
9. Reconnect the battery connector. Place the Main ON/OFF Switch in the ON position. If equipped with the optional keypad, enter your PIN-key code and then press the green ON (|) key.
10. Test the operation of the truck.

SBX Cable Assembly

Figure 7-77. BMC Component Locations



SBX Cable Assembly Removal

Perform the following steps to remove the SBX Cable Assembly. Refer to Figure 7-77.

1. If equipped with the optional keypad, press the red OFF (O) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the top cover. See “Top Cover Removal” on page 7-49.

Electrical Components

Wiring Harness

- the phase cables at the traction motor terminal block should be looped enough to allow full turning from left to right without contact with the lift linkage.

Figure 7-87.





Electrical Components

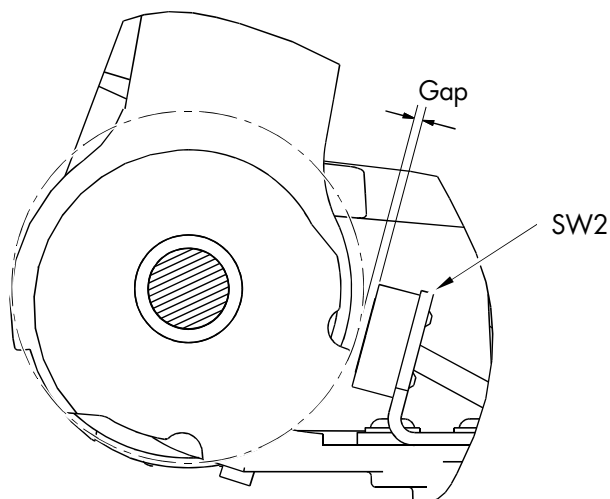
Switches (General)

12. Adjust the switch if necessary.
13. If equipped with the optional keypad, press the red OFF (**O**) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
14. Install the truck covers.
15. Reconnect the battery connector.

Arm Angle Proximity Switch Adjustment

1. If equipped with the optional keypad, press the red OFF (**O**) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the screws and control handle bumper stop to access the angle arm proximity switch.
3. Loosen the screws securing the proximity switch bracket to the tiller arm base. Slide the bracket toward or away from the cam surface of the raised tiller arm to adjust the gap. Correct gap between the switch sensing face and the raised tiller cam surface is 0.070 to 0.086 in. (2.0 ±0.20 mm). See [Figure 7-96](#).

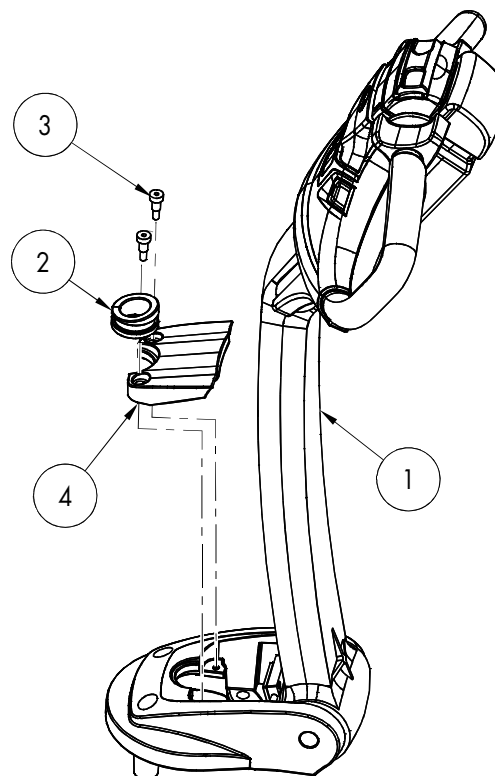
Figure 7-96. Arm Angle Proximity Switch Adjustment



4. Reconnect the battery connector. Place the Main ON/OFF Switch in the ON position. If equipped with the optional keypad, enter your PIN-key code and then press the green ON (**|**) key.

5. Test the operation of the truck.
6. Install the control handle bumper stop [4] and grommet [2] using socket head locking screws [3]. Torque screws to 13 ft. lb. (17.6 Nm). See [Figure 7-97](#).

Figure 7-97. Control Handle Bumper Stop Installation

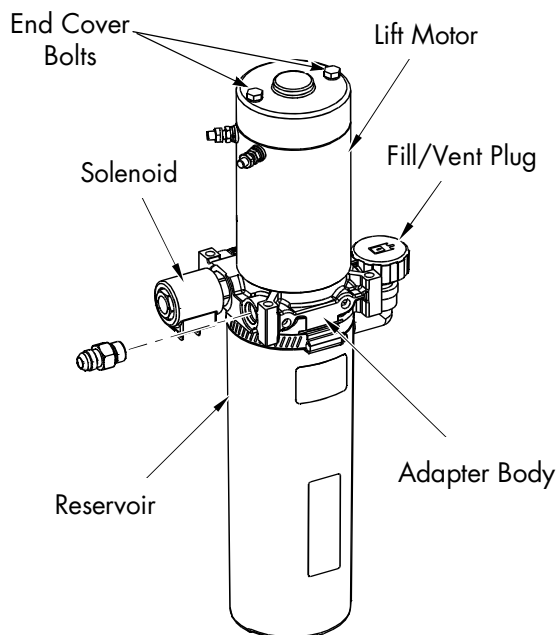


Lift Motor

Lift Motor Removal

1. If equipped with the optional keypad, press the red OFF (**O**) key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the tractor covers.
3. Remove the hydraulic unit from the truck. See [“Hydraulic Unit Removal” on page 7-98.](#)
4. Remove the two bolts from the end cover that attach the motor to the adapter body.

Figure 7-106. Motor End Cover Bolts



5. Separate the motor and the adapter body.

Lift Motor Installation

1. Stand the pump assembly on end, with the adapter body facing up.
2. Set aside the pump drive coupling for later reuse.

NOTE: The coupling is the mechanical connection between the pump shaft and the electric motor armature shaft. It may have been removed with the motor.

3. Insert the pump drive coupling on the end of the pump shaft. Fill the coupling cavity with anti-seize compound (P/N 990-638).
4. Rotate the pump or the motor shaft to align the motor shaft correctly with the coupling.
5. Install the new motor on the adapter body. Rotate the pump or the motor shaft if necessary to allow the motor to contact the adapter body.
6. Insert the screws into the motor end plate, through the motor and into the adapter body.
7. Make sure the motor is mating flush with the adapter body. Torque screws to 40 to 45 in. lb. (4.5 to 5.1 Nm) maximum.
8. Install the hydraulic unit. See [“Hydraulic Unit” on page 7-97.](#)

Lift Motor Brush Replacement

1. Remove the lift motor from the hydraulic assembly before inspecting the brushes.
2. Remove the two bolts from the motor end cover. Remove the end cover to access the brushes. See [Figure 7-106.](#)
3. Push each brush back into the holder to disengage the springs. Remove the nuts and washers from the side of the drive end head. Remove the brush assembly, then remove each brush and replace with a new one.

Filter Screen and Inlet Tube

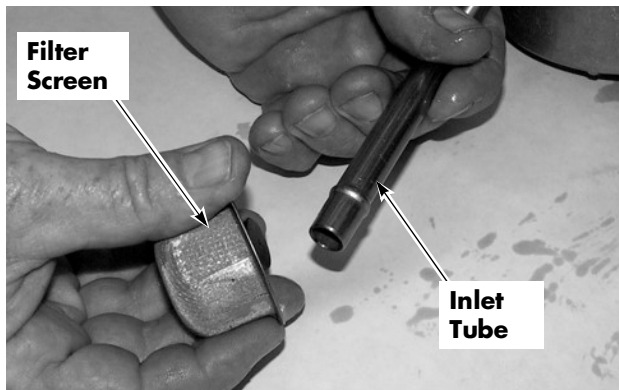
Filter Screen and Inlet Tube Removal

1. Remove the reservoir. See [“Reservoir Removal”](#) on page 7-100.
2. With the pump assembly inverted, remove the inlet tube fitting and sealing washer from the pump housing.

NOTE: Use a slight twisting motion when removing the inlet tube.

3. Clean the filter screen and magnet at the bottom of the inlet tube with a suitable solvent. See [Figure 7-111](#).
4. From the pump side, blow dry with clean, dry compressed air.

Figure 7-111. Cleaning Filter Screen



Filter Screen and Inlet Tube Installation

1. Inspect the filter screen, magnet, and inlet tube for damage. Replace if necessary.
2. Install the inlet tube, sealing washer, and fitting in the pump housing.
3. Install the hydraulic reservoir. See [“Reservoir Installation”](#) on page 7-100.



8210



8250



Mast

Pallet Forks and Load Wheels

Figure 7-121. Removing Spiral Pin



6. Drive the axle out of the wheel fork with a hammer and brass drift pin.
7. Push the wheel out.
8. If the bearings are to be reused, insert a brass drift pin into each end of the load wheel and knock the bearings out.
9. Install the bearings in the new load wheel with the shields facing out.
10. Place the new load wheel upright on a flat surface. Position the bearing over the load wheel. Put a flat metal plate over the bearing, and hammer the bearing in position with a plastic mallet. Make sure the bearing is fully seated in the load wheel.
11. Align the wheel with the holes in the wheel fork.
12. Drive the axle through the wheel fork and wheel. Align the "dimple" in the axle with the spiral pin hole.
13. Install the spiral pin.
14. Install the wheel fork pivot shaft.
15. Install the spiral pin in the wheel fork pivot shaft.
16. Remove the blocks under the pull rods and lower the forks to the floor.
17. Add grease if greaseable load wheel.

Load Wheels - Dual

Dual load wheels are available as an option.

Removal and Replacement

1. Jack the forks. See "Jacking Safety" on page 2-10.

Figure 7-122.



2. Drive out the spiral pin in the wheel fork pivot shaft.

Figure 7-123.



3. Place blocks under the pull rods, then drive out the wheel fork pivot shaft.

CAUTION

The pull rod and wheel fork will drop to the floor if not blocked prior to removing the pivot shaft.

Options

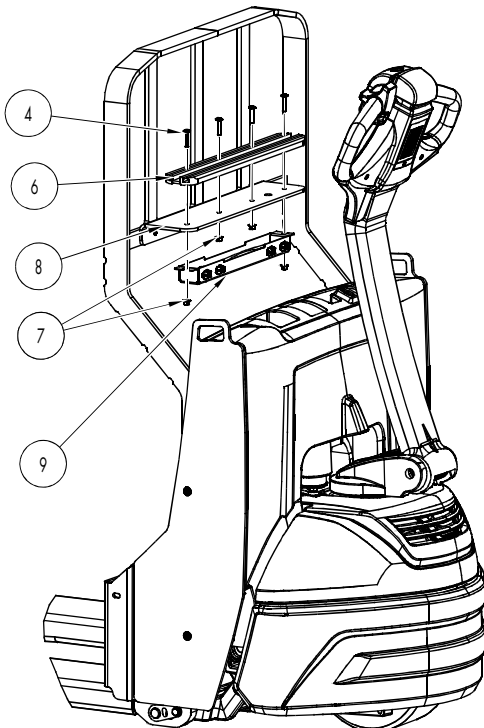
Accessory Bar, Load Backrest Mounted

Accessory Bar, Load Backrest Mounted

A load backrest mounted accessory bar is offered as optional equipment and may be added in the field to lift trucks originally manufactured without one. The accessory bar provides a mounting location and power for operator fans, auxiliary lights, or the iWAREHOUSE system operator display unit. Factory authorization must be granted before the addition of any equipment on the lift truck.

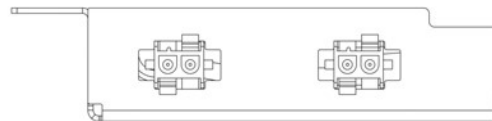
1. If equipped with the optional keypad, press the red OFF () key. Place the Main ON/OFF Switch in the OFF position. Disconnect the battery connector from the truck.
2. Remove the battery to access the tractor frame bulkhead.
3. Remove the lower, grille, and upper covers.
4. Install accessory bar frame [8] (refer to [Figure 7-135](#)) on the load backrest with button head screws [5] (refer to [Figure 7-137](#)). Torque screws to 27 to 29 ft. lb. (37 to 39 Nm).

Figure 7-135.



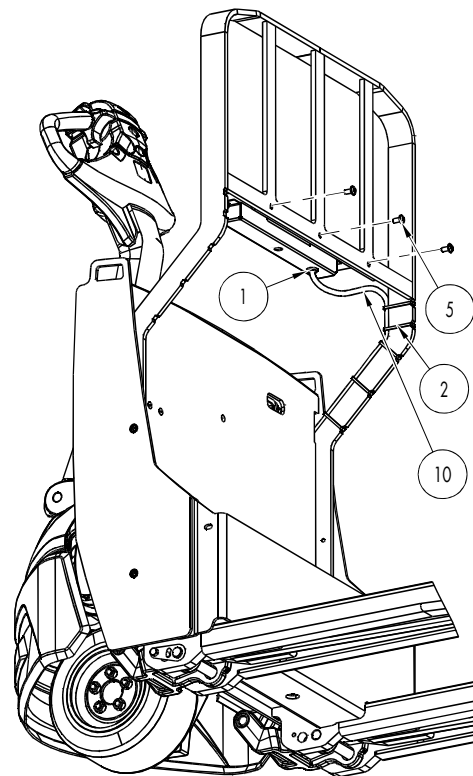
5. Route the accessory bar harness [10] through the left hole in the connector bracket [9]. Install the connectors in the connector bracket. Make sure the connectors are oriented with the flat surfaces facing towards the opening of the connector bracket (see [Figure 7-136](#)).

Figure 7-136. Connector Orientation



6. Install the accessory bar [6] and the connector bracket [9] to the accessory bar frame [8] using bolts [4] and nuts [7] as shown in [Figure 7-135](#). Torque the bolts [4] to 11 ft. lb. (15.1 Nm).
7. Route the accessory bar harness [10] down the load backrest and into the tractor frame as shown in [Figure 7-137](#). Secure using cable ties [2].

Figure 7-137. Wire Harness Routing



Deceleration (Neutral Braking)

Deceleration is the process where the truck's braking (regenerative) characteristic is determined by any reduction in the throttle, including neutral. This feature provides some plugging effect when the throttle is returned to the neutral position. This is a Driver parameter (Deceleration). The range is from 40 to 90% in increments of 5%. Default is 65%. A lower number gives less aggressive braking. See [“Programming Truck Parameters” on page 3-6](#).

Emergency Reverse

Emergency reverse function is activated when the brake is released, truck is ON, and the emergency reverse switch is pressed. After the switch is released, normal controller operation is not resumed until neutral (no direction) is selected and until the brake is cycled (brake applied, then brake released). However, repeatedly pressing the emergency reverse switch restarts the emergency reverse function each time.

Fault Codes

The VM provides fault information by displaying fault codes on the LED display built into the control handle head. See the [“List of Messages and Codes” on page 6-2](#) for a complete list of Caution and Error Codes. The TA provides fault information by flashing fault codes through two status LED indicators built into the TA cover.

High Pedal Disable (HPD)

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

Open Circuit

An open circuit is the lack of a continuous path between two or more electrical connections; usually greater than one megohm resistance.

Overvoltage Cutoff

Overvoltage Cutoff occurs when there is very high voltage (greater than 34V) at the traction amplifier TA B+ connection. Code C42 or E142 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 driver parameters. The default operator PIN-key code is number 1. See [“Setting Individual PIN-key Codes” 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 applied to the motor ON and OFF very quickly.

Regenerative Braking

Regenerative Braking occurs when current, generated by the motor during plugging, is permitted to flow back into the batteries. Regenerative braking results in less motor heating. Regenerative braking also provides some return of energy to the battery pack.



Section A. Appendix

Torque Chart - Hydraulic Fittings

Table A-9. Torque Chart - Hydraulic Fittings

SAE Dash Size	Thread Size	JIC (37° Flare Thread)		SAE Straight Thread O-Ring Steel Plugs			
				Hollow Hex Head Plug HP50N		Hex Head Plug P50N	
		ft. lbs.	Nm	ft. lbs.	Nm	ft. lbs.	Nm
-2	5/16-24	3 ±1	4 ±1	3 ±0.5	4 ±0.6	7.5 ±0.5	10 ±0.6
-3	3/8-24	6 ±1	8 ±1	5 ±0.5	7 ±0.6	14 ±1	19 ±1
-4	7/16-20	12 ±1	16 ±1	11 ±1	15 ±1	18 ±1	24 ±1
-5	1/2-20	15 ±1	20 ±1	15 ±1	20 ±1	22 ±1	30 ±1
-6	9/16-18	21 ±1	28 ±1	18 ±1	24 ±1	27 ±2	37 ±3
-8	3/4-16	45 ±2	61 ±3	46 ±2	62 ±3	48 ±2	65 ±3
-10	7/8-14	60 ±5	81 ±7	75 ±5	102 ±7	90 ±5	122 ±7
-12	1 1/16-12	85 ±5	115 ±7	85 ±5	115 ±7	110 ±5	149 ±7
-14	1 3/16-12	105 ±5	142 ±7	130 ±6	176 ±8	145 ±6	197 ±8
-16	1 5/16-12	120 ±5	163 ±7	135 ±6	183 ±8	160 ±6	217 ±8
-20	1 5/8-12	170 ±10	230 ±14	225 ±12	305 ±16	225 ±12	305 ±16
-24	1 7/8-12	200 ±15	271 ±20	250 ±12	339 ±16	250 ±12	339 ±16
-32	2 1/2-12	270 ±20	366 ±27	325 ±15	441 ±20	325 ±15	441 ±20



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