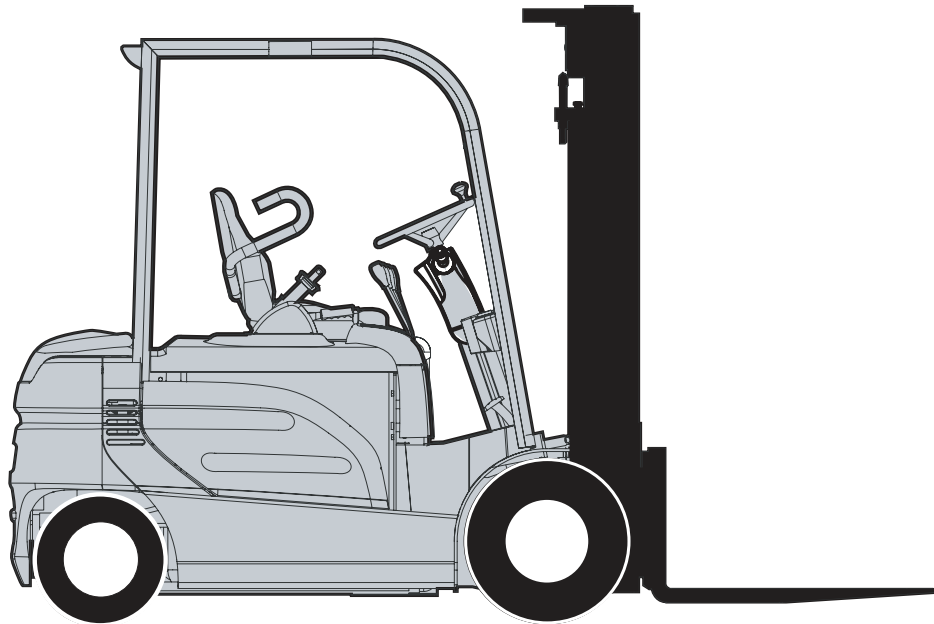


SM-765

GEX 20-30

Service Manual



Rated Capacity: 2000 - 3000kg

October 2007



**Technical
Publications**
Lexington, KY 40510
www.Clarkmhc.com

CLARK

Truck Models Covered by this Manual

This manual consists of “base” module that pertains to all GEX20-30 models and other modules that pertain only to specific models. Manuals shipped with the truck contain the base module and the modules specific to the purchased truck.

You may, however, purchase specific modules and expand your manual to fully cover multiple models. To do so, order the desired modules as you would any other Clark part.

Arrangement and Use of this Manual

Clark arranges parts and service procedures by standardized *Groups*. In this manual, Groups are similar to “chapters”. Groups are listed in the indexes on the next page.

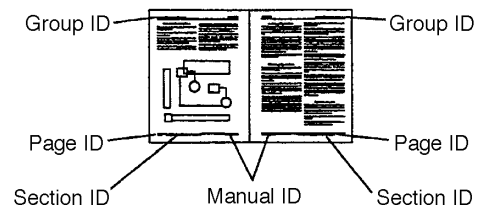
Each Group begins with a table of contents that shows the *Sections* contained within the Group. Lengthy Sections also begin with a table of contents.

Each Group and Section has an identifying name and number, or “ID”.

Each page also has a unique ID. The page ID consists of three numbers separated by hyphens. The three numbers represent the Group number, the Section number, and the page number. For example, “00-1-2” on the lower corner of the page indicates Group 00, Section 1, page 2.

The Group number sometimes has a letter or letters added to it in parentheses if one or more variations of the Group exist. For example, if the truck has a standard transaxle, Group 06 is expressed as “06(S)”; if the truck has a hydrostatic transmission, Group 06 is expressed as “06(H)”.

You can quickly locate a specific point in the manual by using the headers and footers that appear on every Section page. The following illustration points out these areas.



This manual is intended for the use of trained service personnel. Please read Group SA, “Safe Maintenance”, and the *Operator’s Manual* before working on or operating the truck.

NOTE :

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Jul. 2007

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NOTE :

CLARK

GROUP SA SAFE MAINTENANCE

**GROUP SA
SAFE MAINTENANCE**

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Towing	Section 3

NOTE :

Section 1

Safety

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Safety Signs and Messages

Safety signs and messages in this manual and on the lift truck provide instructions and identify specific areas where potential hazards exist and special precautions should be taken. Be sure you know and understand the meaning of these instructions, signs, and messages. Damage to the truck, death, or serious injury to you or other persons may result if these messages are not followed.

NOTE

This message is used when special information is required relating to procedures, equipment, tools, pressures, capacities, and other special data.

IMPORTANT

This message is used when special precautions should be taken to ensure a correct action or to avoid damage to, or malfunction of, the truck or a component.



CAUTION

This message is used as a reminder of safety hazards that can result in personal injury if proper precautions are not taken.



WARNING

This message is used when a hazard exists that can result in injury or death if proper precautions are not taken.



DANGER

This message is used when an extreme hazard exists that can result in injury or death or serious injury if proper precautions are not taken.

The above terms have been adopted by Clark Material Handling Company. The same terms may be used in different context in service literature supplied directly or indirectly by vendors or truck components.

Safe Maintenance Practices

The following instructions have been prepared from current industry and government safety standards applicable to industry truck operation and maintenance. These recommended procedures specify conditions, methods, and accepted practices that aid in the safe maintenance of industrial trucks. They are listed here for the reference and safety of all workers during maintenance operations. **Carefully read and understand these instructions and the specific maintenance procedures before attempting to do any repair work.**

When in doubt of any maintenance procedure, please contact your local Clark dealer.

1. Powered industrial trucks can become hazardous if maintenance is neglected. Therefore, suitable maintenance facilities, trained personnel, and procedures must be provided.
2. Maintenance and inspection of all powered industrial trucks shall be done in conformance with the manufacturer's recommendations.
3. A scheduled planned maintenance, lubrication, and inspection program shall be followed.
4. Only trained and authorized personnel shall be permitted to maintain, repair, adjust, and inspect industrial trucks. Work should be performed in accordance with the manufacturer's specifications.
5. Properly ventilate work area, vent exhaust fumes, and keep shop clean and floor dry.
6. Avoid fire hazards and have fire protection equipment present in the work area. Do not use an open flame to check for level or leakage of fuel, electrolyte, or coolant. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
7. Before starting work on truck:
 - a. Wear eye protection and remove all jewelry.
 - b. Raise drive wheels off of floor or disconnect power source. Use blocks or other positive truck positioning devices
 - c. Disconnect battery before working on the electrical system.
8. Before working on engine fuel system of gasoline or diesel-powered trucks, be sure the fuel shut-off valve is closed.
9. Operation of the truck to check performance must be conducted in an authorized, safe, clear area.

10. Before starting to drive truck:
 - a. Be in operating position.
 - b. Be sure parking brake is engaged.
 - c. Put direction control in neutral.
 - d. Start engine.
 - e. Check functioning of direction and speed controls, steering, brakes, warning devices, and any load handling attachments.
11. Before leaving truck
 - a. Stop truck.
 - b. Put directional control in neutral.
 - c. Apply the parking brake.
 - d. Turn key switch OFF.
 - e. Put blocks at the wheels if truck is on an incline.
12. Brakes, steering mechanisms, control mechanisms, warning devices, lights, governors, guards, safety devices, and frame members must be carefully and regularly inspected and maintained in a safe operating condition.
13. Special trucks or devices designed and approved for hazardous area operation must receive special attention to ensure that maintenance preserves the original, approved, safe-operating features.
14. Fuel systems must be checked for leaks and condition of parts. Extra special consideration must be given in the case of a leak in the fuel system. Action must be taken to prevent the use of the truck until the leak has been corrected.
15. The truck manufacturer's capacity, operation, and maintenance instruction plates, tags, or decals must be maintained in legible condition.
16. Batteries, motors, controllers, limit switches, protective devices, electrical conductors, and connections must be inspected and maintained in conformance with good practices. Special attention must be paid to the condition of electrical insulation.
17. To avoid injury to personnel or damage to the equipment, consult the manufacturer's procedures in replacing contacts on any battery connection.
18. Industrial trucks must be kept in a clean condition to minimize fire hazards and help in the detection of loose or defective parts.
19. Modifications and additions that affect capacity and safe truck operation must not be done without the manufacturer's prior written approval. Capacity, operation and maintenance instruction plates, tags, or decals must be changed accordingly. This is an OSHA requirement.
20. Care must be taken to assure that all replacement parts, including tires, are interchangeable with the original parts and of a quality at least equal to that provided in the original equipment. Parts, including tires, are to be installed per the manufacturer's procedures. Always use genuine CLARK or CLARK approved parts.
21. Use special care when removing heavy components from the truck, such as counterweight, seat deck, upright, etc. Be sure that lifting and handling equipment is of the correct capacity and in good condition. Also, this removal may upset stability of the truck. The frame must always be safely blocked for major component removal.

NOTE

Become familiar with additional operating and maintenance safety instructions contained in the following publications:

ASME B56.1 - Safety Standard for Low Lift and High Lift Trucks. Published by: American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016.

NFPA 505 - Powered Industrial Trucks. Including Type, Areas of Use, Maintenance and Operation. Available from: National Fire Protection Assoc., Inc., Batterymarch Park, Quincy, MA 02269.

General Industrial Standards, OSHA 2206: OSHA Safety and Health Standards (29 CFR 1910), Subpart N-Materials Handling and Storage, Section 1910.178 Powered Industrial Trucks. For sale by: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Group SA, Safe Maintenance

CLARK

General Shop Precautions

The following list contains general precautions that should be followed when working on a lift truck.

- Always wear safety glasses for eye protection.
- Remove rings, watches, loose jewelry and open clothing before working on a vehicle to avoid serious injury.
- Do not smoke while working on a vehicle.
- Put power key switch in the OFF position, unless otherwise required by the procedure.
- Set the parking brake. Place chocks to the front and rear surfaces of the tires to provide further restraint from inadvertent vehicle movement.
- Use safety stands or blocks whenever a procedure requires you to be under the vehicle.
- Service electric truck batteries in a well-ventilated area to avoid the danger of lighting explosive gases.
- Follow the Safety Instructions outlined in Group 12, Battery Handling.
- Always discharge the capacitors prior to working on or around electrical components.
- Avoid contact with battery acid. The battery contains corrosive acid which can cause injury. Follow the instructions outlined in Group 12 and those instructions received with your battery and charger.

Cautions

The following is a list of “CAUTIONS” connected with the operation and maintenance of trucks equipped with solid state control panels.



CAUTION

WELDING ON TRUCKS

1. Make sure the truck has no grounds.
2. Disconnect truck battery.
3. Protect electrical wiring and components from weld spatter with a shield.
4. Ventilate battery or remove battery from truck.

If the above is not followed, damage can result to wiring and electrical components on a solid state control truck.



CAUTION

DO NOT STEAM-CLEAN

Do not steam-clean a solid state controlled truck. Excessive moisture will interfere with proper operation of the solid state components.

Solid state controls should be cleaned at regular intervals. Blowing dirt off with an air (207 kPa [30 psi] max.) hose periodically will, for the most part, eliminate any serious cleaning problems. For a more thorough cleaning, water may be hosed over the control. A mild detergent may be applied, such as that used for washing dishes. The detergent should be rinsed off, and the controls must be thoroughly air-dried before putting truck into service.

Periodic cleaning should preclude the need for using a degreaser. However, if a degreaser is used, we recommend Clark #1801146 Degreaser, or the equivalent to MS-180 Freon TF Degreaser and Cleaner. Only approved solvents should be used to clean solid state control components.



CAUTION

CHECK POLARITY

Battery polarity must be correct or the truck will not operate.



CAUTION

USE TRUCK BATTERY ONLY

Do not use a motor generator unit such as “ready power” or a battery charger to move and/or check this truck as serious damage may occur.

IMPORTANT

SAFETY NOTICE

Read and understand all Safety Precautions and Warnings before performing repairs on lift trucks.

Appropriate service methods and proper repair procedures are essential to the safe, reliable operation of industrial trucks, as well as the personal safety of the individual doing the work. This Service Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure successful repair and reliable truck operation.



Group SA, Safe Maintenance

There are numerous variations in procedures, techniques, tools and parts used for servicing industrial trucks, as well as in the skill of the person doing the work.

This manual cannot possibly anticipate all such variations and provide advice or precautions as to each. Accordingly, anyone departing from the instructions provided in this manual, through procedures used or choice of tools, materials, and parts may jeopardize his or her personal safety and the safety of the vehicle user.

Improper or careless techniques cause accidents. Don't take chances with incorrect or damaged equipment. Read and understand the procedures for safe operation and maintenance outlined in this manual.

Drive and work safely. Follow the safety signs and their messages displayed in the work area, on the truck, and in this manual.

NOTE :

Section 2

Lifting, Jacking, and Blocking

Raising Drive Wheels	2
Chaning the Upright in Raised Position	3
Raised Rear of Truck	3
Raised Entire Truck	4
Shipping Tie-Down Instructions	5



WARNING

Lifting or jacking any large piece of equipment such as a fork truck presents obvious hazards. It must be done with great care and forethought. Consult the truck weight information in Group 40, Specifications, to ensure that your lifting equipment is of adequate capacity.

Group SA, Safe Maintenance

CLARK



CAUTION

To perform these service procedures, first:

- Park truck on a level surface.
- Put the upright in a vertical position and lower the carriage fully down.
- Return control handle to neutral and turn key switch OFF.



WARNING

Defective equipment can cause accidents:

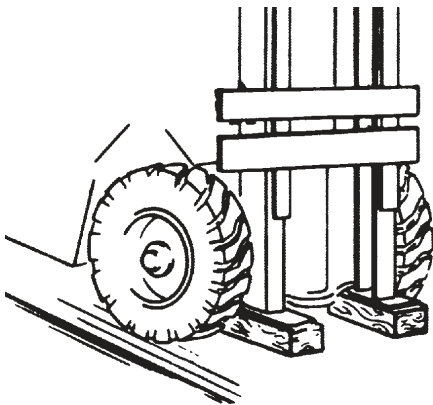
All tools and lifting equipment must be in good condition, meet the load capacity requirements and have OSHA labels when required. Tools with defects can fail, causing severe injury or death.

5. Block the truck under the frame behind the drive wheels with solid blocking.
6. Turn key switch OFF.
7. Check for safe clearance between drive wheels, block and floor.
8. Check the stability of the truck. Be sure that the blocks are located securely under the frame before operating the drive motor or working on truck.
9. Lower the drive wheels to the floor by reversing this procedure.
 - Turn key switch ON.
 - Tilt upright fully back.
 - Turn key switch OFF.
10. Remove the blocks from under the frame and upright rails.

Raising Drive Wheels

This procedure uses the upright as a lever to lift the drive wheels off the floor and prevent accidents due to inadvertent powering of the drive wheels.

1. Park the truck safely.
2. Turn key switch ON. **Tilt the upright fully back.**
3. Put a solid 100 x 100 mm (4 x 4 inch) hardwood block under the front section of each upright rail. Put a 3-6 mm (0.125-0.250 inch) steel plate on top of each block.
4. **Tilt the upright fully forward.** This will raise the drive wheels off the floor.

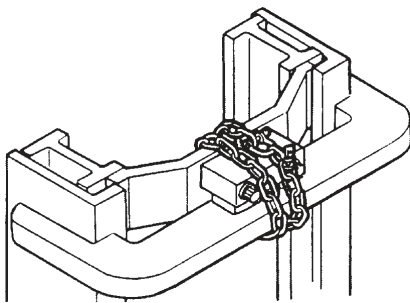


GENERIC ILLUSTRATION

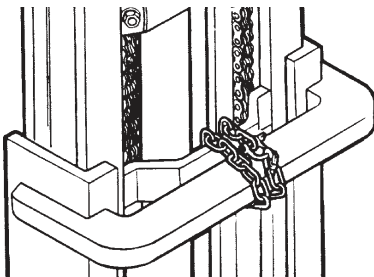
Chaining the Upright in Raised Position

This procedure is used to safely provide clearance for access from the front of truck to components on or near the drive axle.

1. Park truck safely.
2. Put blocks at front of and rear of drive wheels.
3. Raise upright carriage.
4. Chain the center inner rail tie bar to the top outer rail tie bar as shown.



Triple Stage Uprights: Chain the center intermediate rail tie bar and the lower inner rail tie bar to the top outer rail tie bar.



5. Reverse the procedure to remove the chains.



WARNING

Keep hands, tools, etc. out of upright.

Raising Rear of Truck

The truck may be raised at the rear by jacking and blocking under the center of the frame member at either the front or rear steer axle mounting, or under the center section of the steer axle.

Refer to truck data plate for truck weights.



WARNING

An incorrectly installed counterweight can move or fall unexpectedly. NEVER LIFT OR BLOCK A TRUCK USING THE COUNTERWEIGHT. Failure to follow procedures outlined in this manual can result in injury or death.

1. Park truck safely.
2. Put blocks at front and rear of drive wheels.



CAUTION

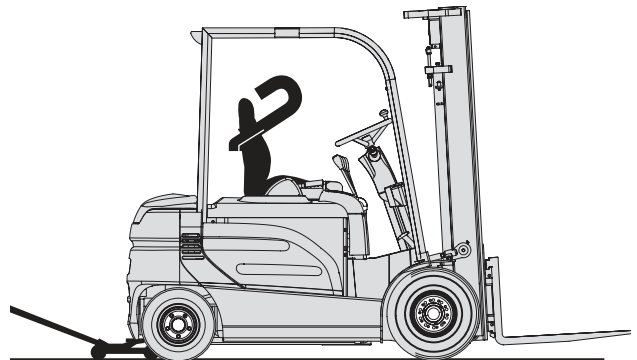
If possible, remove the battery from truck to reduce weight for added safety and ease of jacking.

3. Put a floor jack under the steer axle mounting frame member, centered between the two wheels.



WARNING

Never lift the truck by the counterweight.

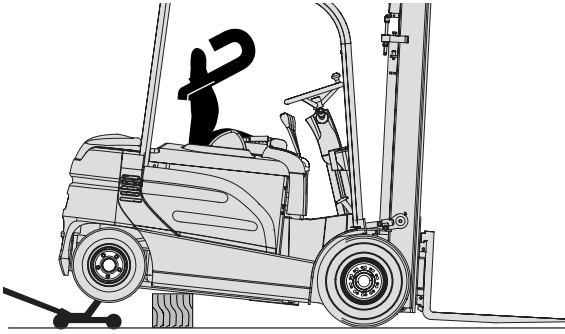


If there is insufficient clearance under frame for your jack, the truck may first be driven onto shims, such as 25x150x300 mm(1 x 6 x 12 in.) pieces of board, to increase the truck frame underclearance.

Group SA, Safe Maintenance

CLARK

4. Raise the truck only as high as necessary to perform the maintenance work.
5. Put blocks at both sides of the truck, fully under the frame main side structure. Put the blocks in front of but close to the counterweight and steer wheels for best truck stability.



Put an equal number of blocks under each side of the truck to provide a level working position.

6. Lower the truck onto the blocks and remove the jack.



CAUTION

Before performing any maintenance work, check the truck for stable condition on the blocking by determining that it will not rock on blocks.

7. When maintenance work is completed, lower the rear of truck to the floor by reversing the above procedure and lowering each side of the truck 50 mm (2 in.) at a time:
 - Put jack under frame and raise truck.
 - Carefully remove blocks and lower truck.
 - Remove jack and blocks from drive wheels.

Raising Entire Truck

Refer to truck data plate for truck weights.

1. Park truck safely. Lower upright fully.
2. If necessary, drive truck onto boards to increase underclearance.



WARNING

SIDE-TO-SIDE TIPOVER. When jacking side of truck, be sure upright is lowered fully. Do not raise one side of the truck more than about 50 mm (2 in.) higher than the other, to avoid tipping truck over laterally.

END-TO-END TIPOVER. If the upright and drive axle are removed while the truck is blocked up, the truck will tip backward due to the heavy counterweight. Upright and counterweight must both be removed before attempting to raise the truck for drive axle removal. The back of the truck must be supported by blocking under the steer axle to prevent movement.

If the counterweight is removed while the truck is up on blocks, the weight of the upright and drive axle will cause the truck to fall forward.

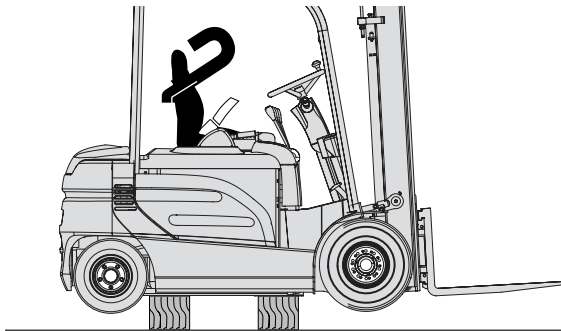
3. Put the jack under side frame, near the center of the truck.

IMPORTANT

Be sure to put the jack squarely and fully under the main side structure of the frame.

4. Carefully raise the truck one side at a time, only as high as necessary to do the maintenance work, and not more than 150 mm (6 in.) total.

5. Put blocks under the side frame, at each side of the jack. Spread the blocks close to the steer and drive wheels for maximum stability.
6. If using one jack, lower the truck onto the blocks and move the jack to the opposite side. Repeat the lifting procedure.
7. Put the same size blocks under each side of the truck so it will be leveled.



CAUTION

Before performing any maintenance work, check the truck for stable condition on the blocking.

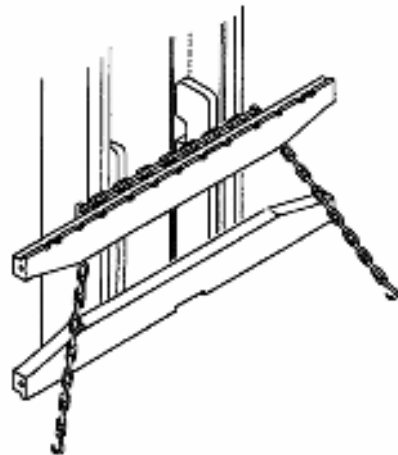
8. When maintenance work is completed, lower the entire truck to the floor by reversing this procedure. Lower the truck one side at a time, while carefully removing the blocks. Be sure no tools or equipment are under the truck or wheels.

NOTE

Depending on jack height, shims under the tires may be needed for clearance to allow removal of jack.

Shipping Tie-Down Instructions

1. Front of Truck
 - a. With Upright and Carriage Installed
 - Lower the carriage fully.
 - Put a tie-down (e.g., chain) between the carriage fork bars.



- b. Without Upright and Carriage Installed
 - Put a chain across the truck floor plate. Protect truck from chain damage by using covered chain or protective material under the chain at contact points.
2. Rear of Truck
 - Attach the tie-down to the toe-pin in bottom of counterweight.

NOTE :

Section 3

Towing

Group SA, Safe Maintenance

CLARK

If your truck is disabled but can be moved freely on its own wheels without further damage, use the following procedures to tow the truck safely to a repair area.



WARNING

For your safety and the care of your truck, use the proper equipment and carefully follow these recommendations for safe towing.

Do not tow a lift truck if there is a problem with the brakes or tires, or if the steering cannot be operated.

Do not tow up or down ramps or steep inclines.

Do not tow the disabled truck if traction or weather conditions are poor.

1. Apply the parking brake or block the drive wheels on the disabled truck while working around it.
2. When possible, raise the forks on the disabled truck 300 mm (12 in) from the floor or ground. Secure the carriage on the upright with a chain.
3. Use a truck for towing that is of equal or larger capacity than the disabled truck. Carry a partial load on the towing truck for improved traction

4. Check that the counterweight bolts on both trucks are in place and properly torqued to 340-380 Nom (250-280 ft-lb). These bolts are made of special, high-tensile steel and are not commercially available. When necessary, replace these bolt only with genuine Clark replacement parts.
5. Use an approved, solid metal tow bar with towing couplers that connect to the towing pins in the counterweights of each truck.

NOTE

DOT-approved towing equipment is available from your Clark dealer.

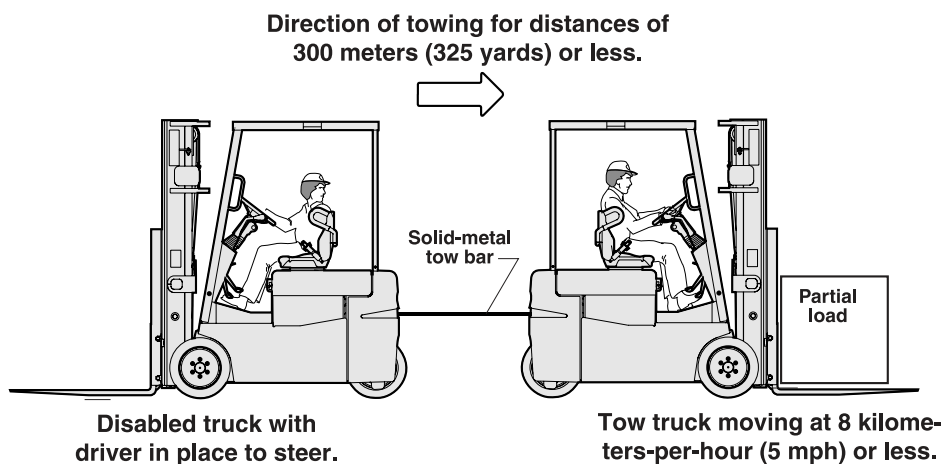
6. Release the parking brake on the towed vehicle. Place directional control lever in NEUTRAL.
7. Tow the disabled truck backward. An operator must be on the disabled truck.



CAUTION

The power steering will not operate on the disabled truck when the power steering motor is not running. The steering hand-wheel will be difficult to turn.

8. Tow the truck slowly. Careful towing is necessary to prevent injury to personnel or damage to the disabled truck. The truck should be towed at a speed of less than 8 kph (5 mph, or a moderate walking speed) with a driver in place and steering the disabled truck.



IMPORTANT

Do not lift the disabled truck or any wheels off the floor while the truck is being towed.

9. Park the disabled truck in authorized areas only. Fully lower the forks to the floor. Leave the directional control in neutral. Turn the key switch to OFF, and engage the parking brake. Remove the key. Disconnect the battery. When necessary, block the wheels to prevent the truck from rolling.



WARNING

Always engage the parking brake when parking a lift truck. The truck can roll and cause injury or death to personnel near it.

NOTE :

CLARK

GROUP PS PERIODIC SERVICE

GROUP PS PERIODIC SERVICE

Maintenance Schedule Section 1

Planned Maintenance Program Section 2

The PM Inspection Form Section 3

NOTE :

Section 1.
Maintenance Schedule

“Periodic Service” and “Planned Maintenance”	2
Determining Maintenance Intervals	2
GEX Service Chart/Lubrication Points	3
Recommended Periodic Service Schedule	4

“Periodic Service” and “Planned Maintenance”

The term “periodic service” includes all maintenance tasks that should be performed on a regularly scheduled basis.

The term “Planned Maintenance” indicates a formalized program of basic inspections, adjustments, and lubrications that the Clark service organization provides customers at a prescribed interval, usually 50-250 hours. The recommended basic “Planned Maintenance” procedure is given in Section 2 of this Group.

The current Section, “Maintenance Schedules,” specifies all maintenance tasks, including Planned Maintenance tasks, that should be performed periodically, and suggests intervals at which they should be performed.

Determining Maintenance Intervals

Time intervals on the charts on the next four pages and elsewhere in this manual relate to truck operating hours as recorded on the hourmeter, and are based on experience Clark has found to be convenient and suitable under normal operation. Standard operating condition classifications are:

Normal Operation: Eight-hour material handling, mostly in buildings or in clean, open air on clean, paved surfaces.

Severe Operation: Prolonged operating hours or constant usage.

Extreme Operation:

- In sandy or dusty locations, such as cement plants, lumber mills, and coal dust or stone crushing sites.
- High-temperature locations, such as steel mills and foundries.
- Sudden temperature changes, such as constant trips from buildings into the open air, or in refrigeration plants.

If the lift truck is used in severe or extreme operating conditions, the maintenance intervals should be shortened accordingly.

IMPORTANT

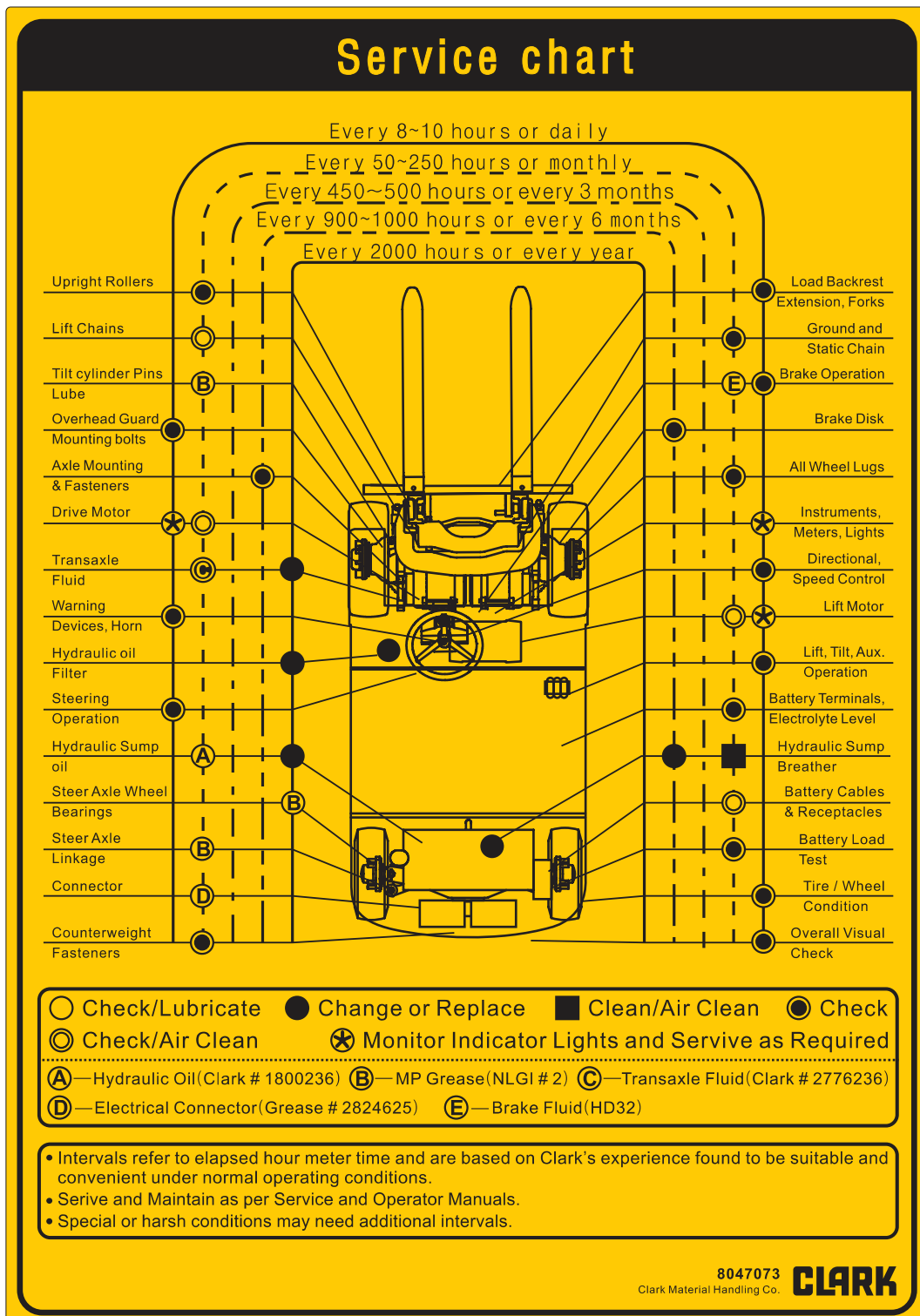
MAINTENANCE INTERVALS. If the lift truck is used in severe or extreme operating conditions, the maintenance intervals should be shortened accordingly. Put upright in vertical position and fully lower the forks or attachment.

Service Chart/Lubrication Points

A decal, similar to the illustration below, is located on the underside of the seat deck. This decal is a basic guide to periodic

maintenance intervals and tasks. A more detailed chart is supplied on the next page.

GEX Service Chart/Lubrication Points



Group PS, Periodic Service

CLARK

Recommended Periodic Service Schedule

This chart lists maintenance tasks that should be done periodically, the suggested time intervals, and the service manual Group in which the task is covered. Refer to Operator's Manual for Daily Checks.

TASKS	1st 50 Hours	Every 50-250 Hours	Every 450- 500 Hours (or 3 months)	Every 900- 1000 Hours (or 6 months)	Every 2000 Hours (or 1 year)
Group PS - Periodic Maintenance					
Perform Planned Maintenance inspections, lubrications, and adjustments		.			
Group 12 - Battery					
Battery electrolyte level - check/add		.			
Battery load voltage test		.			
Battery terminals/cables - clean/tighten		.			
Group 13 Wiring and Instruments					
Hourmeter - check		.			
Lamp check - at start-up		.			
Wiring harness - inspect		.		.	
Instruments/accessories					
Group 16 - Electric Motors					
Drive motor - check/air clean		.			
Lift pump motor - check/air clean		.			
Group 17 -Contactors					
Contactor tips - check/air clean					
Group 19 - Motor Controls					
Display - check display for error codes		.			
Controller - air clean		.			
Controller connectors - check and lubricate		.			
Group 20 - Drive Axle					
Air vent - inspect, clean or replace		.			
Axle mounting bolts - inspect/tighten				.	
Pressure checks					.
Fluid change - drain/fill					.
Fluid filter - replace	.				.
Fluid level/condition - check/sample	.	.			
Group 22 - Wheels And Tires					
Wheel mounting bolts - tighten	.	.			
Tire pressure/condition - check	.	.			
Group 23 - Brakes					
Operation - check		.			
Service brake - check wear					.
Brake lines - check	.	.			
Parking brake - check/adjust	.	.			



Group PS, Periodic Service

TASKS	1st 50 Hours	Every 50-250 Hours	Every 450- 500 Hours (or 3 months)	Every 900- 1000 Hours (or 6 months)	Every 2000 Hours (or 1 year)
Group 25/26 - Steer Axle and Lines					
Operation - check		.			
Power steering relief pressure - check					.
Steer axle mounting - inspect		.			
Steer wheel and trunnion bearings - check		.			
Steer wheel and trunnion bearings - lubricate/adjust					.
Steering cylinder seals - check leakage		.			
Steering linkage - lubricate		.			
Group 29/30 - Hydraulic Lift System					
Hydraulic fluid level/condition - check/sample		.			
Hydraulic fluid change - drain/fill					.
Hydraulic filler screen - clean					.
Hydraulic fluid filter - replace	.				.
Hydraulic tank breather - clean/replace	.	.			.
Control valve linkage - check/clean					
Hydraulic system relief pressure - test/adjust					.
Group 32 - Tilt Cylinders					
Tilt cylinder adjustment - check/adjust		.			
Tilt cylinder drift - test		.			
Tilt cylinder mounting - check/tighten		.			
Tilt cylinder rod ends - check/tighten/lubricate		.			
Tilt cylinder rod/seals - check for leaks		.			
Group 34 - Upright, Lift Cylinders, Carriage, Forks					
Operation - check		.			
Carriage and lift chain - lubricate		.			
Carriage chain condition - inspect/adjust		.			
Forks, latches, stop pin - inspect/check wear		.			
Lift chain condition - inspect/adjust		.			
Load backrest		.			
Upright cylinder/mounting - inspect/tighten		.			
Upright lift cylinder downdrift - test		.			
Upright rollers - check		.			
Upright trunnion bolts - tighten		.			

NOTE :

Section 2

Planned Maintenance

Use PM Report Form	2
How to Perform the PM Periodic Inspections and Maintenance	2
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Test Drive Truck with Load	6
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Group PS, Periodic Service

CLARK

Use PM Report Form

A planned maintenance program of regular, routine inspections and lubrication is important for long life and troublefree operation of your lift truck. Make and keep records of your inspections. Use these records to help establish the correct PM intervals for your application and to indicate maintenance required to prevent major problems from occurring during operation.

As an aid in performing and documenting your PM inspections, Clark has prepared an Electric Truck Planned Maintenance Report form. Copies of this form may be obtained from your authorized Clark dealer. We recommend that you use this form as a checklist, to make a record of **your inspection and** truck condition.

The periodic maintenance procedures outlined in this manual are intended to be used with the PM report form. They are arranged in groupings of maintenance work that are done in a logical and efficient sequence.

A check mark or entry is made on the PM Report Form when the PM is performed. Please note the special coding system for indicating the importance of needed repairs and/or adjustments.

When you have finished the PM inspections, be sure to give a copy of the report to the designated authority or the person responsible for lift truck maintenance.

Do not make repairs or adjustments unless authorized to do so.

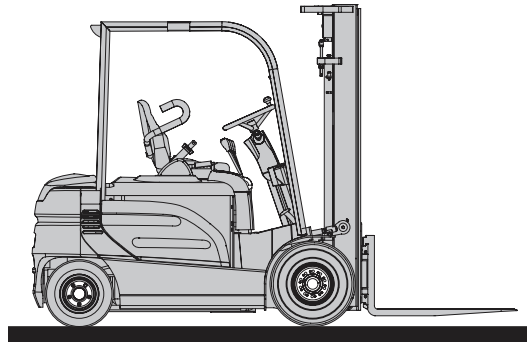
For safety:

- Remove all jewelry (watch, rings, bracelets, etc.) before working on the truck.
- Disconnect battery from truck receptacle before working on electrical components.
- Wear safety glasses. Wear a safety (hard) hat in industrial plants and in special work areas where protection is necessary or required.

How to Perform the PM Periodic Inspections and Maintenance

Visual Inspection

Perform a visual inspection of the lift truck and its components. Walk around the truck and take note of any obvious damage and maintenance problems. Check for loose fasteners and fittings.



Be sure all capacity, safety, and warning plates or decals are attached and legible.



CAUTION

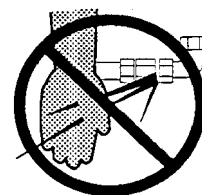
Do not operate a lift truck with damaged or missing decals and nameplates. Replace them immediately. They contain important information.

Inspect the truck for signs of external leakage of transmission fluid, etc. Check for hydraulic leaks and loose fittings. **DO NOT** use bare hands to check. Hydraulic Fluid may be hot or under pressure.



DANGER

HYDRAULIC FLUID PRESSURE: Do not use your hands to check for hydraulic leakage. Fluid under pressure can penetrate your skin and cause serious injury.



Be sure that the driver's overhead guard, load backrest extension, finger guards, and any other safety devices are in place, undamaged, and attached securely.



WARNING

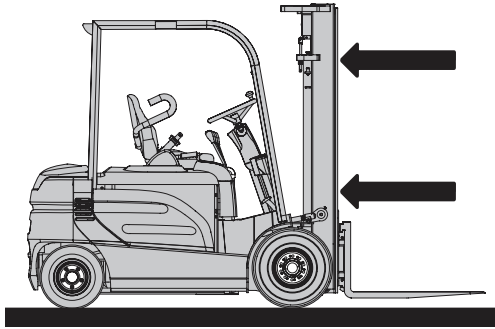
For trucks equipped with spark-enclosed (EE) construction, or with polyurethane

CLARK

Group PS, Periodic Service

tires, check the ground strap or chain for wear and secure attachment.

Check all of the critical components that handle or carry the load.



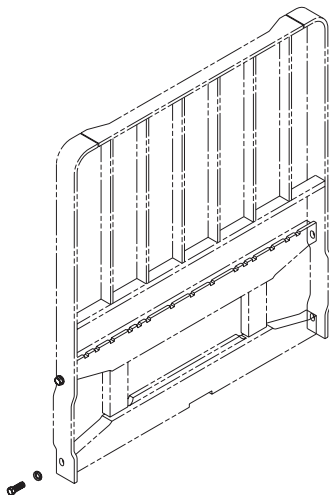
Check the overhead guard for damage. Be sure that it is properly positioned and all mounting fasteners are in place and tight.



CAUTION

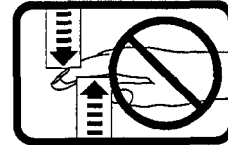
If load backrest has been removed, a bolt and washer must be in place on each end of the top fork bar to act as a fork stop.

Check the load backrest for damage. Inspect the welds on the carriage and load backrest for cracks. Be sure that the mounting fasteners are all in place and tight.



DANGER

Uprights can drop suddenly if not properly blocked. Look at the upright, but keep hands, tools, etc. out.



IMPORTANT

Uprights and lift chains require special attention and maintenance to maintain them in safe operating condition. Refer to Lift Chain Maintenance in Group 34 for additional information.

Check the upright assembly. Inspect the upright rails, carriage rollers, lift chains, lift and tilt cylinders. Look for obvious wear and damaged or missing parts. Check for leaks, damaged or loose parts or fittings. Check for leaks, damaged or loose rollers, and rail wear (metal flaking). Carefully check the lift chains for wear, rust and corrosion, cracked or broken links, stretching, etc. Check that the lift and carriage chains are correctly adjusted to have equal tension. Check that the lift chain anchor fasteners and locking means are in place and tight.

Be sure all safety guards and chain retainers are in place and not damaged. Inspect the carriage stops and cylinder retainer bolts. Check all welded connections.

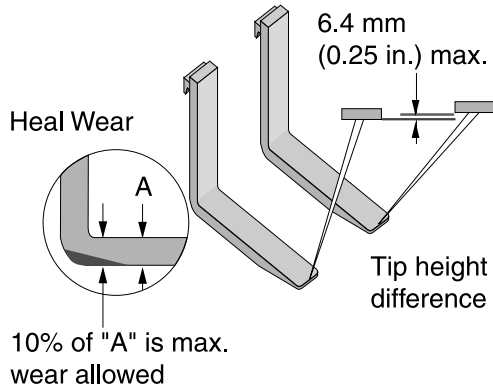
Inspect all lift line hydraulic connections for leaks. Check the lift cylinder rods for wear nicks, grooves, and scratches. Check the cylinder seals for leaks. Refer to Group 34 for details on uprights.

Group PS, Periodic Service

CLARK

Forks

Inspect the load forks for cracks, breaks, bending and wear. The fork top surfaces should be level and even with each other. The height difference between both fork tips should be no more than 6 mm (0.25 in.)



NOTE

Your Clark dealer has special tools for measuring fork wear.



WARNING

If the fork blade at the heel is worn down by more than 10%, the load capacity is reduced and the fork must be replaced. DO NOT attempt to fill with weld. See Group 34 for inspection procedure.

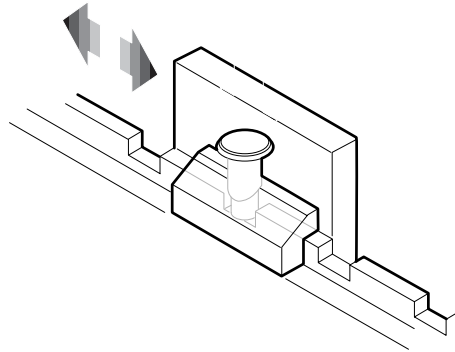
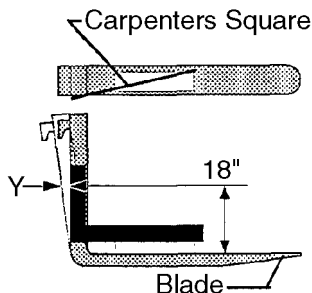
Check the amount of wear at the heel of the fork.



CAUTION

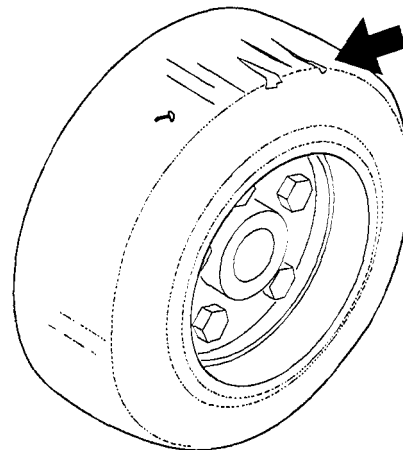
If the forks are obviously bent or damaged, have them inspected by a trained maintenance person before operating the truck.

Inspect the forks for twists and bends. To check, put a 2 x 4 x 24 in. long block on the blade of the fork with the 4 in. surface against the blade. Put a 24 in. carpenter's square on the top of the block and against the shank. Check the fork 18 in. above the blade to be sure it is not bent more than 14.5 mm (0.6 in.) at Y.

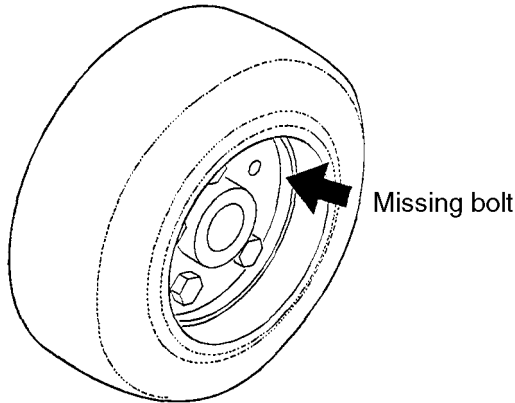


Inspect the fork latches. Be sure they are not damaged or broken, operate freely and lock correctly. Check the fork stop pins (or bolt and washer) for secure condition.

Wheels and Tires



Check the condition of the drive and steer wheels and tires. Remove objects embedded in the tread. Inspect the tires for excessive wear, break, "chunking out," and bond failure between the tire and rim.



Check all wheel mounting bolts to be sure none are loose or missing.



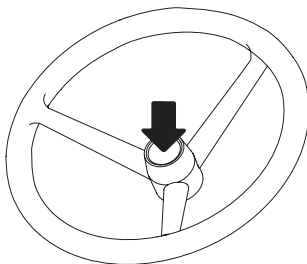
CAUTION

Personnel working on wheels and tires must be trained and qualified to do wheel and tire maintenance.

Replace missing bolts and tighten loose bolts to the correct torque before operating the truck.

Operational Checks

1. Check horn to be sure it operates.



IMPORTANT

Because the battery is such an important part of electric truck operation, it requires its own specialized maintenance program, which should include full-scale cleaning and inspection. Refer to Group 13 for specific instructions.

2. Using the Display



Seat Belt: At start up this symbol displays along with an audio alarm for 4 seconds. This display reminds you to fasten your seat belt.



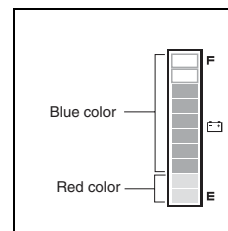
Parking Brake: The symbol is displayed and "-255" status code appears on the numeric display when parking brake is applied. Release parking brake to operate truck.



Service Status: The following 5 codes are usually operator fault codes, and can be corrected by as explained in "Section 5, Operating Procedures." If you see any other codes displayed, the truck needs to be serviced.

- -01 Seat Switch Open
- -061, -065, -140, -203, -207 Overheat of motor and controller (Restart after cooling down)
- -66 Low Battery (truck will go into lift lockout when the dash display shows less than 15%)
- -77 Maintenance Hours (preset hour meter reading indicating that it is time to have the truck serviced. Truck will reduce the top speed if desired)
- -79 Incorrect Start Up Sequence (SRO)
- -217, -245 Wrong set battery
- -255 Parking Brake Switch Open

Battery discharge indicator



It displays the battery discharge condition of forklift truck.

The one bar indicates 10% charging condition.

If the battery is charged more than 20% (8 bars or more), blue LED is displayed, but it is less than 20% (2 bars or less), red

LED is displayed. If it is less than 10% (1 bar), it will flicker and buzzer sound.

Group PS, Periodic Service**Slow-speed indicator (Turtle shaped)**

The traveling speed of truck is limited to set speed.

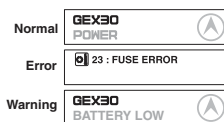
The upper mark is slow speed operating icon, and the figure shows the limited max. speed. (In upper example, the limited max. speed is 2km/h)

Hourmeter & Speed

- It displays the accumulated operating hour and traveling speed of truck.

- When the traveling speed is less than 0.5km/h, it displays the accumulated operating hour.

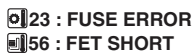
- When the traveling speed is more than 0.5km/h, it displays the traveling speed.

Message display

The model name, POWER selection, travel direction, warning and error message are displayed.

- In normal operating condition: Model name/POWER/Travel direction

- When several messages are simultaneously displayed, it will be displayed in the order of Error, Warning and Normal condition.



- If many error conditions are simultaneously occurred, the priority 2 Errors will be displayed. (The priority means Error number)

Travel direction icon

- It displays the traveling direction or angle of steering wheel..

- The direction icon rotates in 10 degrees. (Total 36 icon)

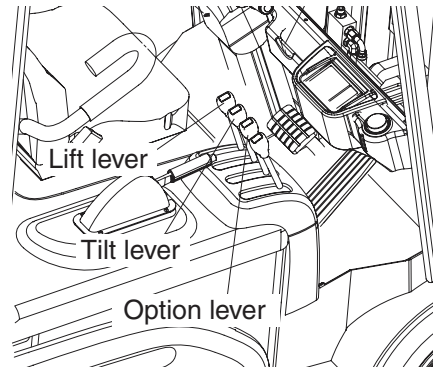
Error icon

- When error occurs this icon is displayed to distinguish the condition easily. When the error message is displayed, this icon is simultaneously displayed.

3. Check Function Control Levers

- Gently pull back on the lift control lever. The pump motor should turn on and the carriage should begin to elevate.

- Release the control lever. It should return to neutral without binding. The pump motor should turn off. The control lever should not bind when moving it to any position.
- Repeat procedures with tilt control lever. Forks should tilt evenly and smoothly.
- If lift truck is equipped with an attachment, test the auxiliary control lever for a correct function.
- Briefly operate the attachment.

**4. Check Drive Motor (Brake) Cut-Off Switch**

- Move the truck forward slowly. Slowly depress brake pedal. Drive motor should cut off before the brakes apply.
- If operation is not satisfactory, DO NOT operate the truck. Take truck out of service and report condition to designated authority.

5. Check Upright

- Note any excessive "slop" or "noise" in the upright. It may indicate roller damage, or that roller shimming, repair or adjustment may be required.

6. Check Tilt Cylinder (Refer to Group 32 to do the following)

- Perform drift test.
- Perform check and adjustment procedure.
- Check rod seal condition.
- Check mounting. Tighten as needed.
- Check rod end. Tighten as needed.

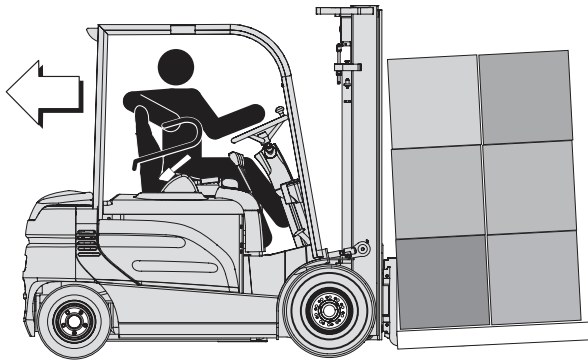
7. Check Truck Performance**WARNING**

Check all around to be sure that your intended path of travel is clear of obstructions and pedestrians.

CLARK

Group PS, Periodic Service

- Drive the truck forward in a straight line at a high rate of speed. Listen for unusual drive train noise. Stop truck.
- Check acceleration from a stop to top travel speed. Acceleration should be smooth without hesitation. Stop the truck. Repeat procedure in reverse.
- Report condition on PM report form.

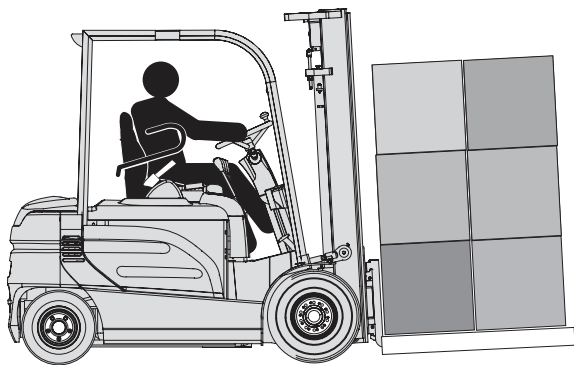


Test Drive Truck with Load

NOTE

Conduct these tests with a rated capacity load, if possible.

Test the truck for proper operation and drive train function by driving the truck in both the forward and reverse directions. Drive first in a straight line and slowly through a series of full right and left turns. Then repeat, driving in opposite direction.



Carry Load Low & Tilt Back

Test for correct function of the transistor control.

Check Controlled Plugging (Braking)

1. Operate the truck with parking brake set. It should not move. Release parking brake.

2. Operate the truck at a slow speed in a forward direction of travel. Reverse direction of travel. The truck should slow down to a smooth controlled stop, and accelerate normally in the opposite direction.

If plugging is as specified, then repeat the procedure at high speed. The truck should come to a smooth controlled stop in approximately 20 feet (6.10 m) with accelerator in maximum travel position.

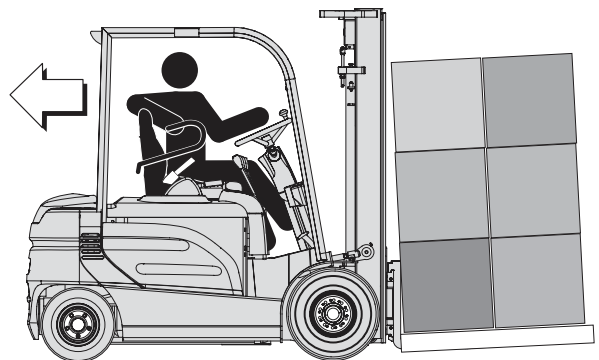
3. Repeat the procedure at high speed with the direction lever moved in reverse direction.

If plugging (braking) is not as specified, refer to the adjustment instructions in Group 19 of this manual. Report condition to designated authority.

Check Accelerator

1. After checking to see that you have a clear path ahead, drive the truck in a straight line at a high rate of speed in a forward direction of travel. Listen for unusual drive train noise. Stop truck.
2. Check acceleration from a stand still condition to top travel speed. Acceleration should be smooth without hesitation.
3. After checking to see that you have a clear path behind, drive the truck in reverse. Check acceleration from stand still condition through top travel speed. Acceleration should be smooth.

Check the accelerator pedal while conducting the speed range tests. It must move easily and smoothly throughout the acceleration stroke and return without binding. There should be no restriction to movement on either acceleration or deceleration.



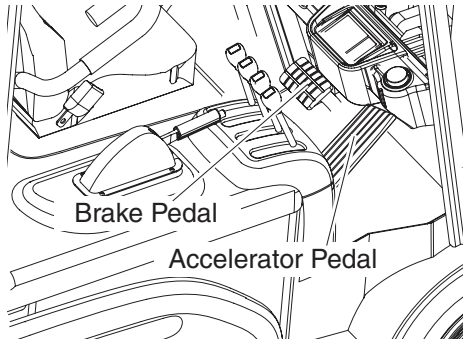
CAUTION

DO NOT operate lift truck if the brakes are not operating properly. Use Hydraulic oil RANDO HD32 or NUTO H32.

Group PS, Periodic Service

CLARK

Test the service brake (drive motor cut-off) switch. Drive the truck FORWARD (or in REVERSE) at creep speed. While holding the accelerator pedal steady in creep speed position, depress brake pedal. The braking action should interrupt power to the drive motor and stop the truck. Release the brake pedal. The drive motor should again start moving the truck.



Test brake operation by depressing and releasing the brake pedal several times while driving the truck. The brakes should bring the truck to a smooth stop without pulling, squealing, or shuddering. Have the brakes adjusted or repaired as necessary. Drive motor should cut off before brakes apply.

To check brake holding capability and adjustment, park the truck on a grade and depress brake pedal. The brake should hold a lift truck with rated load on a 15% grade.

Check Steering



CAUTION

DO NOT operate lift truck if steering system is not operating properly.

Check steering control operation. First, drive the truck in a straight line. The truck must drive in a straight line without drifting toward either side. Then drive slowly (creep speed) through a series of full right and left turns. Check steering response and smoothness of operation. Turning effort must be the same in either direction. You will hear the hydraulic pump operate over relief when in a full turn. If there is a steering problem, have it repaired.

NOTE

Conduct the following test with a rated capacity load.

Test for general drive train operation. Drive the truck at various speeds and operating conditions, in both FORWARD and REVERSE directions. Test shifting from NEUTRAL to FORWARD, then back to NEUTRAL.

Test shifting from NEUTRAL to REVERSE, then back to NEUTRAL. Check for positive control action when changing directions.

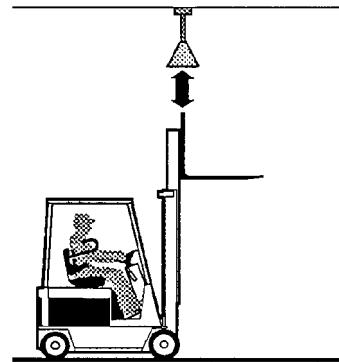
Listen for clunking, squealing, grinding, scraping, or other unusual noises. Check for vibration. Listen for wheel bearing or other specific running noise.

Lift Mechanism and Controls

NOTE

Conduct these tests with a rated capacity load.

Test the operation of the hydraulic system and upright.



CAUTION

Be sure there is adequate overhead clearance before raising the upright.

Cycle (raise to full height and then lower) the upright at both slow and fast speed, with the upright tilted slightly backward. Watch the upright assembly as it rises. All movements of the upright, fork carriage, and lift chains must be even and smooth, without binding or jerking motions. Watch for chain wobble or looseness. The chains should have equal tension and move smoothly, without noticeable wobble.

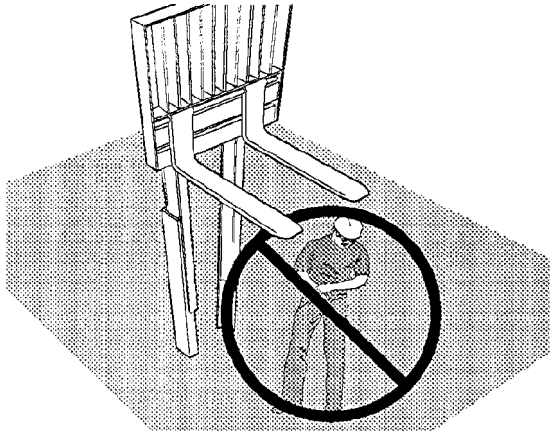
Check function of the control lever and main hydraulic valve. Listen for abnormal noises in the hydraulic valve, main hydraulic pump, and system components.

If the maximum fork height is not reached, either the fluid level in the hydraulic sump tank is low, or there is severe binding within the upright.



WARNING

FALLING FORKS. Do not walk or stand under raised forks. The forks can fall and cause injury or death.



Never Walk Under Raised Forks!

Check the upright rails, rollers, carriage, lift chains, and cylinders as they move. Watch for binding or excessive freeplay (looseness) between the carriage and the upright rails and rollers. Listen for abnormal noises. If there is excessive clearance between the rails and channels, the upright roller needs adjustment. If the rails or carriage bind or hesitate when lowering, the rollers are either damaged or roller adjustment is incorrect.

Check the upright for excessive downdrift. Stop the fork carriage in an intermediate position. Check that it holds its position without moving down. If you observe downward movement (drift) or have a report of a drift problem, the lift cylinder seals may be worn. With forks elevated, turn key switch off. Pull back on the lift lever. The forks should not lower. This tests the check valve.

Test the tilt function. Check for excessive tilt cylinder drift. Stop the upright at a position near vertical. Check that the upright holds its position without moving forward. If you observe forward movement (drift) or have a report of a tilt drift problem, the tilt cylinder seals may be worn.

Check fork height adjustment and carriage chain adjustment. Tilt the upright to the vertical position and fully lower the carriage. The forks should stop and be held approximately 13 mm (0.50 in.) above the floor. If the forks hit the floor, the carriage lift chains should be adjusted. Also check the rail chains.

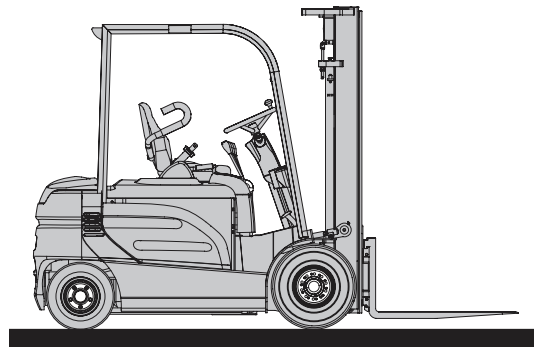
If truck is equipped with an attachment, briefly operate the attachment to check the controls for correct function.

Test for correct tilt cylinder rod adjustment. Raise the carriage to an intermediate position. Tilt the upright fully forward without a load on the forks. Check for upright racking (twisting) as the tilt cylinders reach the end of their stroke. Tilt the upright fully back. The upright should not rack (twist) when the tilt cylinders reach the end of their travel. If forward upright racking is found, adjustment of the tilt cylinder rod ends (yokes or spacers) is required. If backward racking is found, adding or removing shims is required. Refer to Group 32.



CAUTION

When you have completed the operational tests, park and leave truck according to standard shutdown procedures.



Standard Shutdown Procedures:

- Come to a complete stop.
- Park only in authorized locations.
- Lower the forks fully, tilt upright forward until fork tips touch floor.
- Allow travel control to return to neutral.
- Turn the key switch OFF.
- Apply the parking brake.
- Disconnect Battery

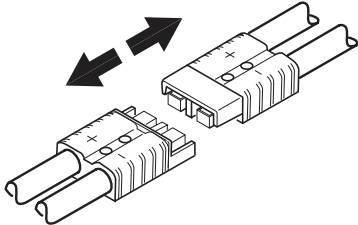
Make a record of all maintenance and operating problems you find.

Group PS, Periodic Service

CLARK

Battery Compartment Inspection

Turn key switch OFF. Disconnect battery from truck receptacle.



Inspect condition of the battery connector and truck battery receptacle. Check the spring-loaded terminals, connectors, and retaining tabs. Look for poor connections due to burning, bad crimps, or broken or loose retainers. Check the molded body for damage from overheating, burning, and chips or cracks. Replace receptacle terminals if pitted or corroded.

Inspect condition of the battery and cables. Check the battery cables for wear or other damage. Check for signs of interference or rubbing with other components. Be sure that the cable terminals are tight and clean. Clean off any deposits of corrosion found on the battery.

Never wash the battery when it is in the truck.

Check battery post terminals for corrosion and damage. Clean all corrosion from cable end and battery post. Check tightness of cable and post terminals.

If necessary, check the state-of-charge condition of the battery. Take a specific gravity test of the electrolyte with a hydrometer. Be sure to check a minimum of six battery cells.

Check the electrolyte level of the battery. Add distilled water, as required, to fill each cell to the correct level.

Check to be sure the vent hole in each battery cell cap is open. If cap vents are plugged with corrosion, remove the caps and wash in a solution of baking soda and water.

Refer to Group 12, Battery, for additional information.

Motor Transistor Controls Inspection

IMPORTANT

Do not clean electrical components with steam. Only approved solvents should be used to clean controls.

Turn key switch OFF. Disconnect battery from truck receptacle. Remove the control compartment cover from the counterweight.

Discharge the capacitor using a 10W~100W resistance connected from the +Batt(pos.) to the -Batt(neg.).

Inspect the transistor controls for clean condition. Check for oily dirt buildup on contactors. Inspect all control wiring terminals for any obvious damage. Look for cracks or worn areas in the wiring insulation. Check for loose connections at the control terminals. Air-clean as necessary. Treat the control panel plugs with Clark 1801145"Electric-Like" Spray or Clark 1803827-brush on cleaner.

Hydraulic Compartment Inspection

Remove the floorplate.

Check the condition of all hydraulic system components, hoses, piping, and connections. Check for wear, leakage, and damage.

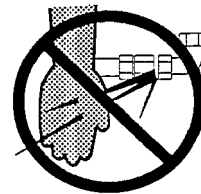
Remove the battery.

Inspect the drive motor, hydraulic pump motor power cables. Check drive motor mounting fasteners. Check hydraulic pump motor. Check pump motor mountings.



DANGER

HYDRAULIC FLUID PRESSURE: Do not use your hands to check for hydraulic leakage. Fluid under pressure can penetrate your skin and cause serious injury.



Brake Shoe and Drum Inspection

The brake linings, drum and adjustment setting can be inspected without removing the drum or hub. Refer to Group 23, Section 6 for inspection procedure.

CLEANING

Cleaning Summary

- | | |
|--------------------------------|-------------------------|
| * Battery Compartment. | * Hydraulic Compartment |
| * Drive Motor and Steer Motor. | * Pump Motor. |
| * Axle Mounting | * Control Compartment |
| | * Upright. |

IMPORTANT

Do not clean electrical components with steam. Only approved solvents should be used to clean Solid State components. Scheduled cleaning (as outlined) should preclude the need for using a degreaser. Not all degreasers are acceptable. If a degreaser is to be used, we recommend degreaser or the equivalent to MS-180 Freon TF degreaser and cleaner.



WARNING

When cleaning with compressed air:

- Wear eye protection and protective clothing when cleaning or drying with air pressure.
- Reduce air pressure to 30 PSI (207 kPa). Debris removed with air pressure can cause injury.

Normal Cleaning

Blowing dirt off with an air hose periodically will, for the most part, eliminate any serious cleaning problems. Should the need arise for a more thorough cleaning, water may be hosed over the control and if necessary a mild detergent applied such as that used in washing dishes in the home. This detergent should be rinsed off and the control dried with an air hose. The control must be thoroughly dry before putting the truck back into service.

IMPORTANT

Cleaning the components of the truck is a vital part of the P.M. process. Keeping the components clean will increase their service life and assure trouble free truck operation.

Air-Cleaning

Always maintain a lift truck in a clean condition. Do not allow dirt, dust, lint, or other contaminants to accumulate on the truck. Keep the truck free from leaking oil and grease. Wipe up all oil spills. Keep the controls and floor-board clean and dry. A clean truck makes it easier to see leaks and loose, missing or damaged parts, and will help prevent fires. A clean truck will run cooler.

The environment in which a lift truck operates will determine how often and to what extent cleaning is necessary. For example, trucks operating in manufacturing plants which have a high level of dirt or lint (e.g., cotton fibers, paper dust, etc.) in the air or on the floor, will require more frequent cleaning. If air pressure does not remove heavy deposits of grease, oil, etc., it may be necessary to use steam or liquid spray cleaner. DO NOT clean electrical components with steam.

NOTE

See special provision for blowing dust from pump and drive motors on page 14 of this section.



CAUTION

Battery must be disconnected and capacitors discharged before inserting air wand through access holes.



CAUTION

Wear suitable eye protection and protective clothing.

Lift trucks should be air-cleaned at every PM interval, and as often as required.

Air-cleaning should be done using an air hose with special adapter or extension having a control valve and nozzle to direct the air properly. Use clean, dry, low-pressure compressed air. Restrict air pressure to 207 kPa (30 psi).

Air-clean the following: upright assembly; drive axle; battery, cables, switches and wiring harness; transistor controls and wiring; drive and hydraulic pump motors; steering axle and steering cylinder.

Critical Fastener Torque Checks

Fasteners in highly loaded (critical) components can quickly fail if they loosen. Loose fasteners can cause damage or component failure. For safety, it is important that the correct torque be maintained on all fasteners of com-

ponents which directly support, handle or control the load, or protect the operator.

Check torque of critical items, including: overhead guard, drive axle mounting, drive and steering wheel mounting, counterweight mounting, load backrest extension, tilt cylinder mounting and yokes, upright mounting and components. Refer to Group 40 for torque specifications.

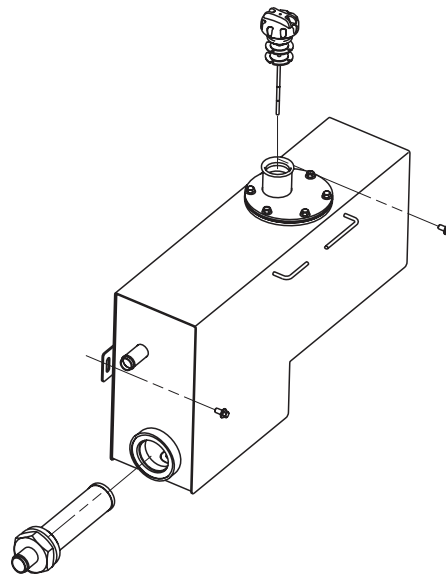
Lubrication, Fluids, and Filters

Hydraulic Sump

Check the hydraulic sump tank fluid level. Correct fluid level is important for proper hydraulic system operation. Low fluid level can cause pump damage. Overfilling can cause loss of fluid or lift system malfunction.

Hydraulic fluid expands as its temperature rises. Check the fluid level at operating temperature, after approximately 30 minutes of truck operation. To check the fluid level, park the truck on a level surface. Put the upright in a vertical position and lower the fork carriage fully down. Remove the floorplate and observe the fluid level marking on the sump tank. Refer to Group 29, Section 1 for more information on the sump tank. DO NOT overfill.

Check the condition of the hydraulic fluid for color, clarity, and contamination. Change (replace) the hydraulic fluid as necessary.



Hydraulic Fluid and Filter Change

Drain and replace the hydraulic sump fluid every 2000 operating hours, or sooner, as required. Replace the

hydraulic fluid filter at every fluid change. Replace the sump tank breather/fill cap every 2000 operating hours.

NOTE

Always use genuine Clark Parts.

Sump Tank Breather Maintenance

Remove the sump tank fill cap/breather and inspect for excessive contamination and damage. Clean and replace as recommended by the PM schedule, or as required by operating conditions.

Access to the Drive Axle

Access the Drive axle by removing the floorplate or through the upright.



WARNING

An upright or carriage can move unexpectedly. Chain or block the carriage and rails. Failure to follow this warning can result in serious injury or death.

Refer to Group SA, Section 2 for additional information on supporting the upright.

Block the wheels. Be sure to put blocking under the carriage and upright rails.

Drive Axle Fluid

Check the drive axle fluid level with the truck on a level surface and fluid at operating temperature.

Remove the fluid level inspection plug located on the left side of the drive axle housing. Fluid level should be at the bottom of the inspection hole. If fluid level is low, add enough fluid to bring fluid level up to bottom of the inspection hole. DO NOT overfill.

Add the recommended fluid only, as required.

Inspect the fill plug for damage. Replace as needed. Install and tighten the plug.

Drive Axle Fluid Change

NOTE

Check the PM interval (operating hours), or the condition of the fluid to determine if the drive axle fluid needs to be changed.

Drain and replace the drive axle fluid every 2000 operating hours. The fluid should be drained when it is at operating temperature. Put the truck in a level position. Block the wheels to prevent truck from moving.

Inspect and clean the drive axle breather (air vent) mounted on top of drive axle. Refer to Lubrication Chart and Group 40.

Truck Chassis Inspection and Lubrication

Lubrication and inspection of truck chassis components, including steer wheels and wheel bearings, will be easier if the rear of the truck is raised and blocked up under the frame. Refer to Group SA, Section 2, for additional information.

IMPORTANT

Do not raise truck by lifting under the counterweight.



WARNING

Be sure to put blocking under the frame to keep the truck safe.

Be sure to clean the grease fittings before lubricating. Remove excess grease from all points after lubricating.

Upright and Tilt Cylinder Lubrication

Clean the fittings and lubricate the tilt cylinder rod end bushings.

Clean the fittings and lubricate the upright trunnion bushings (one fitting on top of trunnion, each side).

Lift Chains

Lubricate the entire length of the rail lift and carriage chains with Clark Chain and Cable Lube.

Group PS, Periodic Service

CLARK

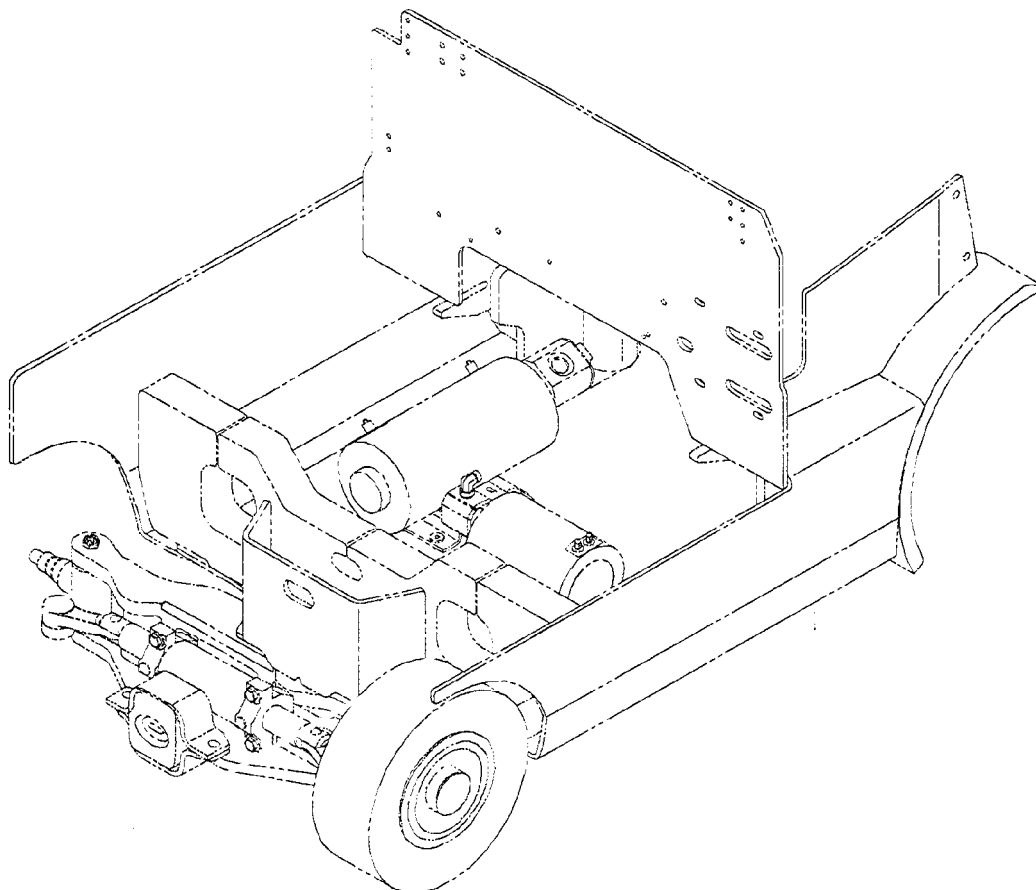
Air Cleaning of Motors



WARNING

Before inserting metal air cleaning wand, disconnect the battery and discharge the capaci-

tors by using a 10W~100W resistance connected from the +Batt(pos.) to the - Batt(neg.).



Section 3

The PM Inspection Form

- As an aid to service technicians performing and documenting PM inspections, Clark has prepared an Electric Truck Planned Maintenance Report form. (Sample appears on the next page.)
- Use this form as a checklist, and make a record of your inspection and truck condition. Note the special coding system for indicating the importance of needed repairs and/ or adjustments.

CLARK

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GROUP 12 BATTERY

GROUP 12 BATTERY

Battery Service Section 1

NOTE :

Section 1
Battery Service

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Battery Tests	6
Specific Gravity Test	6
Load Test	6

Group 12, Battery

CLARK

Battery Handling



CAUTION

Remove all jewelry (watch, rings, bracelets, etc.) before working on electrical systems. Severe burns can result from contact with electrical circuits.



WARNING

Battery service must be done by trained personnel. Battery acid can cause severe burns and injury. Do not smoke or have open flames around batteries.

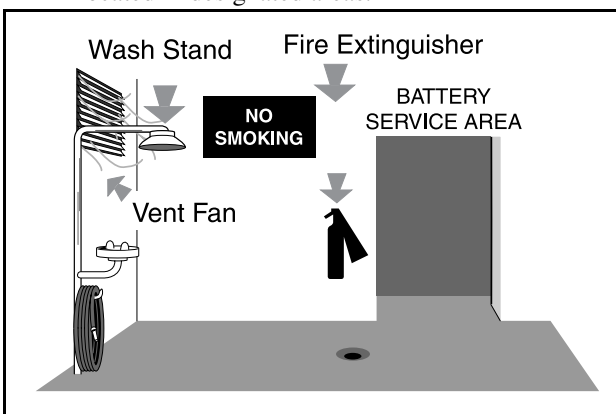


WARNING

Electric truck batteries are heavy and awkward to handle. On charge, they give off hydrogen and oxygen which, in certain concentrations, are explosive. Electric truck batteries are also costly, so before you remove, service, or install a truck battery, consult BATTERY MANUFACTURER for more recommendations and instructions on handling and charging batteries. Carefully read and follow recommendations and instructions.

Change or service batteries only in an area designated for this purpose. Refer to page 4 for additional information.

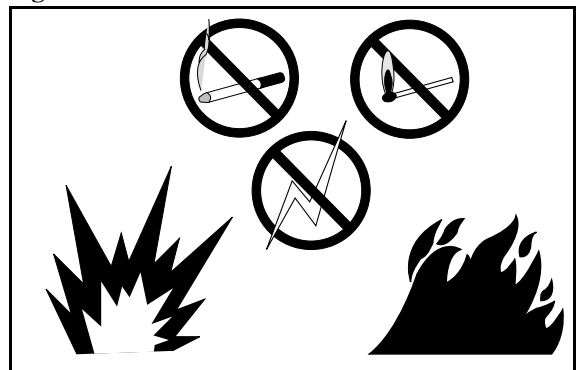
- Be sure this area has provisions to flush and neutralize acid spillage.
- Be certain the area has proper ventilation to ventilate fumes from charging batteries.
- Check to see that there is fire protection. Fire extinguishers should be properly maintained and located in designated areas.



DANGER

Explosive gas is always present around batteries, especially when they are being charged.

- No smoking allowed in the charging area.
- Battery electrolyte must never be checked with an open flame.
- Open flame, sparks, or electric arcs must never be allowed in the battery charging area.
- The battery contains corrosive sulfuric acid which can cause injury. If acid contacts your eyes or skin, flush immediately with water and get medical assistance.



Persons maintaining batteries must wear protective clothing such as:

- Face and head shields
- Long shirt sleeves
- Gauntlet gloves
- Rubber apron

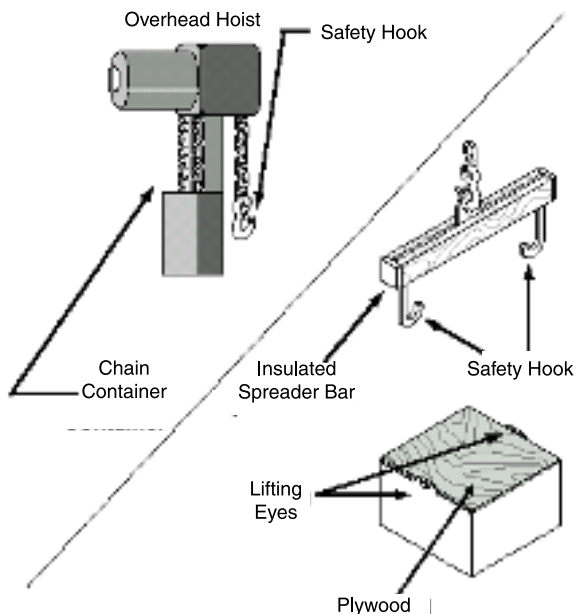


Be sure the battery service area is equipped with material handling equipment designed for the purpose of removing and replacing batteries, such as a conveyor or overhead hoist equipped with safety hooks.

IMPORTANT

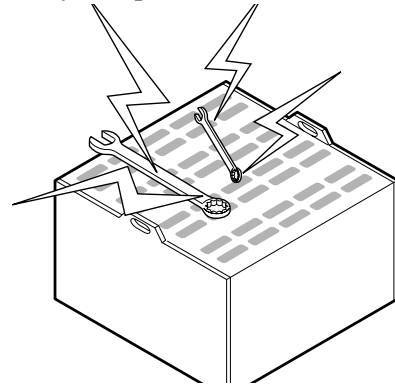
To prevent side forces from damaging the battery, the distance between the lifting hooks (of the spreader bar) must be adjusted to the same dimension as measured between the battery lifting eyes. Make sure the lifting hooks are the correct size to fit the lifting eyes of the battery.

- When using an overhead hoist, be sure to use an insulated spreader bar or similar lifting device.
- Be sure the hoist is equipped with a chain container to accumulate excess lifting chain. When this is not possible, be sure the battery is covered with a non-conductive material, such as plywood, as shown below.
- If the battery does not have a cover of its own, cover it with a non-conductive material such as plywood.



DANGER

Never lay tools or other metal objects on a battery. Metal objects contacting battery terminals will cause short circuits. The shorted circuits could ignite battery fumes and cause the battery to explode.



Battery Removal

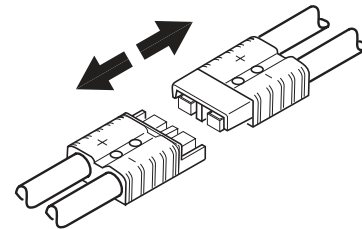
1. Move truck to the designated battery service area.



CAUTION

SAFE PARKING. Before working on truck:

- Park truck on a hard, level and solid surface, such as a concrete floor with no gaps or breaks.
 - Put upright in vertical position and fully lower the forks or attachment.
 - Put all controls in neutral. Turn key switch OFF and remove key.
 - Apply the park brake and block the wheels.
2. Turn key switch OFF and disconnect battery.



Group 12, Battery

CLARK

3. Lift and latch seat deck to access battery.
4. If the battery to be handled is uncovered, cover battery with a non-conductive material (plywood, heavy cardboard, etc.) prior to removal from truck.

IMPORTANT

Do not wash battery in truck.



CAUTION

An overhead hoist of sufficient lifting capacity (refer to “Weights” in Group 40) should be used to lift battery. The safety hooks of the insulated spreader bar should be attached to the lifting eyes provided in the battery casing.

5. Be sure battery is covered. Attach lifting device. Lift and remove battery.

Battery Maintenance

NOTE

To obtain maximum performance and battery life, follow the instructions supplied by your battery vendor.

Industrial batteries are used to supply the electrical power to operate an electric industrial truck. Their voltage depends on the number of individual cells they contain. There are approximately two volts for each cell in the commonly used lead-acid type battery. Batteries normally range from 6 volts to 72 volts. Their capacity varies depending on the application. Only use batteries that comply with factory specifications as to size and capacity.

Maximum Battery Life

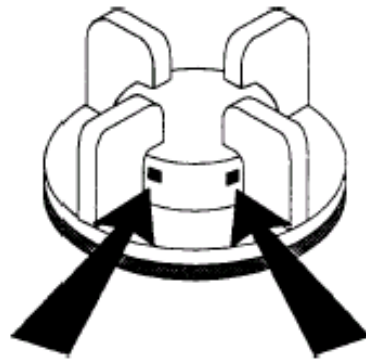
- Do not add acid to a battery. Only qualified battery representatives should determine if this is necessary.
- When lifting a battery, use a lifting device designed for this purpose.
- Check the electrolyte level after placing a battery on charge. The electrolyte level in a battery should be slightly below the lower lip of the filling hole vent. Do not overfill. Overfilling causes loss of electrolyte.
- Keep the battery clean, dry and in good condition.
- Keep metal objects and tools away from the top of the battery. Short circuits will cause battery dam-

age and could ignite battery fumes, causing the battery to explode.

- Maintain good battery cable connections.
- Check power cables and wiring for damage that can cause premature drainage of the battery.
- Do not overcharge a battery.
- Do not undercharge a battery.
- Follow the instructions provided by the supplier(s) of the battery and battery charging equipment.
- Maintain accurate battery records. If battery troubles occur, these records will help you and your battery representative determine the nature of the problem.

Battery Vents

- When Charging Batteries: The vent caps must be kept in place to avoid electrolyte spray. Care must be taken to assure that vent caps are functioning. The vents must be open to allow the battery to breathe. The battery cover must be removed/opened to dissipate heat and explosive gas.
- When Cleaning Batteries: The vent caps must be tightly in place.



Battery Cleaning

The easiest and most satisfactory method of cleaning a battery is to wash it with a low-pressure cold water spray. The battery top can also be washed with a baking soda solution and rinsed with clear water.

IMPORTANT

- Remove battery from truck before washing.
- Vent caps must be free of obstruction and in good condition.
- Battery top should be clean and free of cracks or breaks.
- Battery terminals must be clean and solidly mounted.
- Damaged batteries should be repaired or replaced. Consult your battery vendor.
- Check to be sure all vent caps are tight before washing the battery.
- Fill a bucket with cold water. Add a box of baking soda to the bucket. Stir the solution until dissolved. Keep this solution around the battery service area at all times.
- After washing battery, thoroughly rinse with clear cold water.

Battery Charging

Follow the instructions supplied by the battery charger vendor.

Battery Electrolyte

- Check with battery manufacturer's documentation before working on battery electrolyte.
- Always use a carboy tilter or siphon when handling battery electrolyte.
- When mixing electrolyte, always pour acid into water-NEVER pour water into acid. Pouring water into acid will cause a dangerous chemical action or splash.

Clean Battery Compartment

. Using baking soda and water solution, clean the walls and floor of the compartment. Rinse with clear water.

. Blow off the compartment walls and floor with an air hose. Allow to air-dry.



CAUTION

Wear eye protection and protective clothing when cleaning or drying with compressed air. Reduce air pressure to 207 kPa (30 psi). Debris removed with air pressure can cause injury.



Replacement Batteries



CAUTION

Use a battery properly sized to the dimensions of the battery compartment. Batteries too small can shift and cause damage to the truck or injury to the operator or bystanders. Only use batteries that comply with factory recommendations as to size and capacity.

Battery Installation

If the battery is uncovered, cover the battery with a non-conductive material (i.e., plywood, heavy cardboard, etc.) prior to installation.

- Using an overhead hoist and insulated spreader bar, lift battery into battery compartment.
- Install battery retainer, if applicable.
- Remove non-conductive material from battery.
- Connect battery to truck.

Group 12, Battery

CLARK

Keeping Battery Records

Records should be maintained to get the best service out of your battery and truck.

These records should contain:

- **Test Date.** Each test should be dated for future reference and comparison.
- **Specific Gravity and Temperature Readings.** Each battery cell should be checked and recorded before and after charging. The specific gravity reading of the electrolyte, calculated using a multiplier to account for the ambient temperature, should not be less than 1.260. If below 1.250, the battery should be recharged and tested.
- **Variation Between Each Cell Tested.** The variation in specific gravity reading between cells should not be greater than 15 points (0.015). If readings are greater, there are defective cells.

NOTE

The pilot cell should be changed occasionally to distribute any electrolyte loss over the battery when taking readings.

- **Load Voltage Tests** should be performed and recorded indicating the condition of a battery while it is performing work.
- **Actual Operating Hours of the Battery.** Record the actual time the battery is in use before putting it on charger.
- **Charging Time.** Keep an accurate record of the actual time the battery is on charger. After each charge, check to see if the battery is fully charged. Test the battery before placing it back into service. Record these results.
- **Visually Inspect** for loose terminal connections or posts, a cracked case, damaged cell covers (vent caps), or excessive corrosion. This data should be noted to help determine work environment and possible trouble areas.

Battery Tests

NOTE

Use both tests described here.

Specific Gravity Test

Test at least six cells across battery with a temperature corrected hydrometer (see chart). Battery is fully charged when the reading falls in the 1.280 to 1.300 range. If the difference between cells is more than .015, battery needs maintenance.

SPECIFIC GRAVITY TEST	
SPECIFIC GRAVITY	STATE OF CHARGE
1.260~1.300	100% CHARGED
1.230~1.250	75% CHARGED
1.200~1.220	50% CHARGED
1.170~1.190	25% CHARGED
1.140~1.160	VERY WEAK
1.110~1.130	DISCHARGED

The battery specific gravity is an indication of the battery's state of charge. You can determine the specific gravity of the electrolyte solution in a battery with an hydrometer. If the state of charge is low, the hydrometer will read low. If the state of charge is high, the hydrometer will read high.

For, example a reading from:

- 1.260 to 1.300 indicates a fully-charged battery.
- 1.200 to 1.220 indicates a battery is in a discharged condition and cannot give satisfactory service.

Load Test

Put the main hydraulic system into tilt by-pass while reading battery volts with a voltmeter.

Battery needs recharge or repair if voltage drops below 80% of the rated voltage of the battery.

Minimum acceptable readings:

- 80 volt battery: 64 volts

CLARK GROUP 13 WIRING, SWITCHES, AND INSTRUMENTS

GROUP 13 WIRING, SWITCHES, AND INSTRUMENTS

Schematic Electric Circuit Diagrams	Section 1
General Electrical Service Tips.....	Section 2
Wiring and Cables	Section 3
Switches and Sensors.....	Section 4
Instrument Panel	Section 5

NOTE :



Section 1

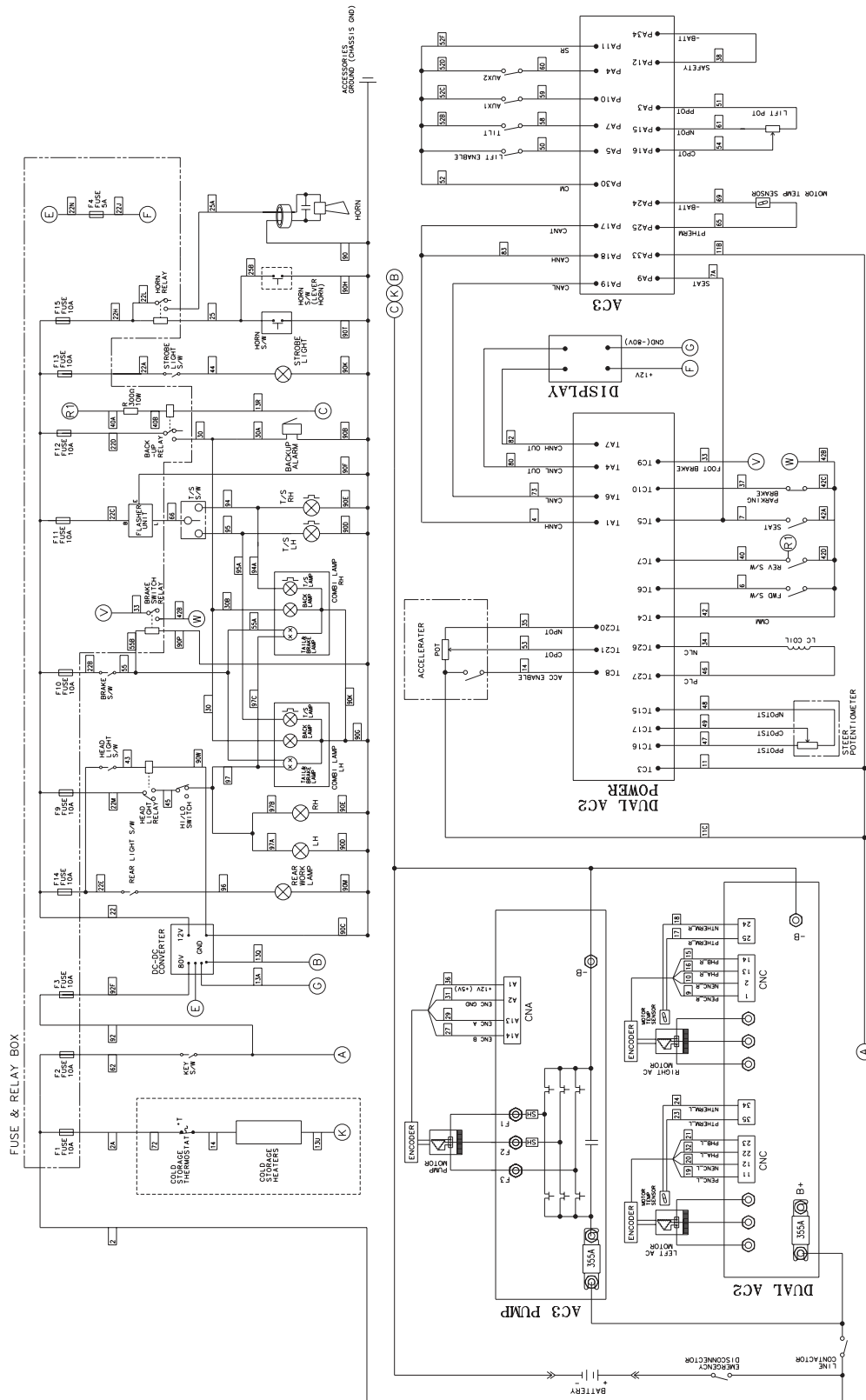
Schematic Electric Circuit Diagrams

Standard Truck	IN-28280
ELH Options Truck	IN-28294

Group 13, Wiring, Switches, and Instruments

CLARK

Standard Truck

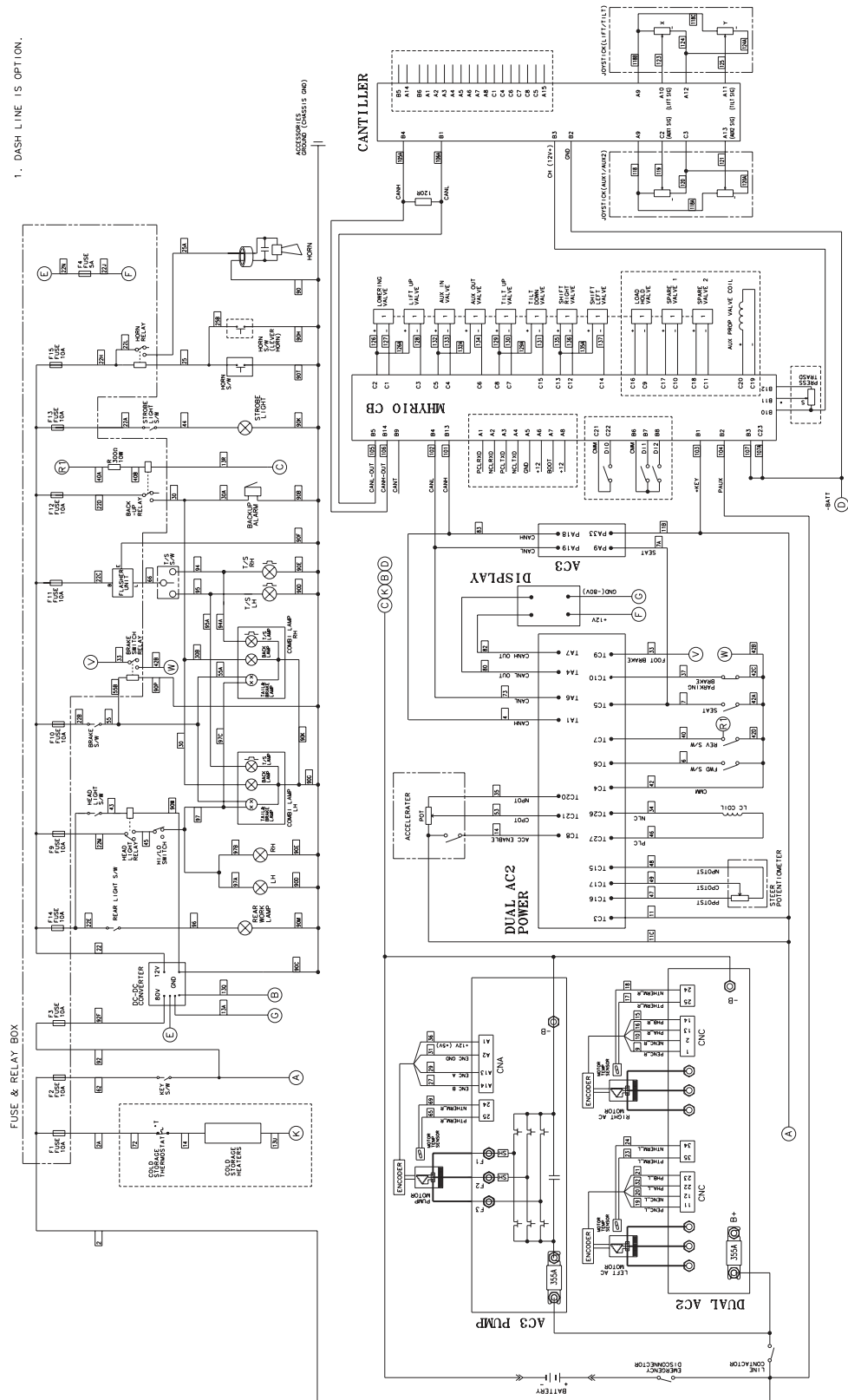


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Group 13, Wiring, Switches, and Instruments

ELH Options Truck

1. DASH LINE IS OPTION.



NOTE :

Section 2

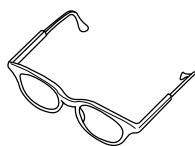
General Electrical Service Tips

General Electrical Service Tips



CAUTION

Always wear safety glasses.



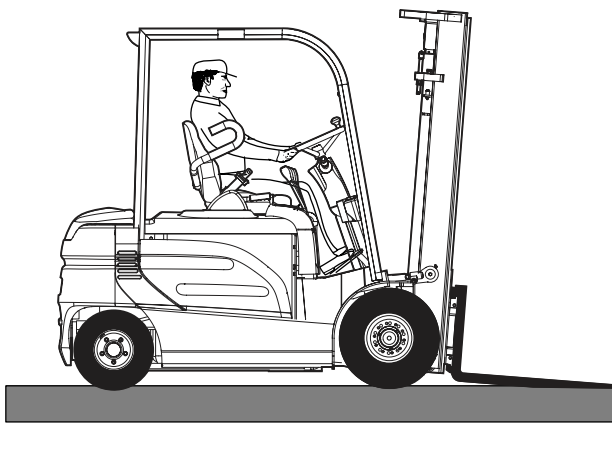
Remove all jewelry before working on truck.



1. Move truck to service area:

- . Park truck on a flat level surface.
- . Fully lower upright.
- . Tilt forks forward until fork tips touch the floor.

SERVICE AREA



2. Disable the truck:

- . Turn the key switch to OFF.
- . Remove key.

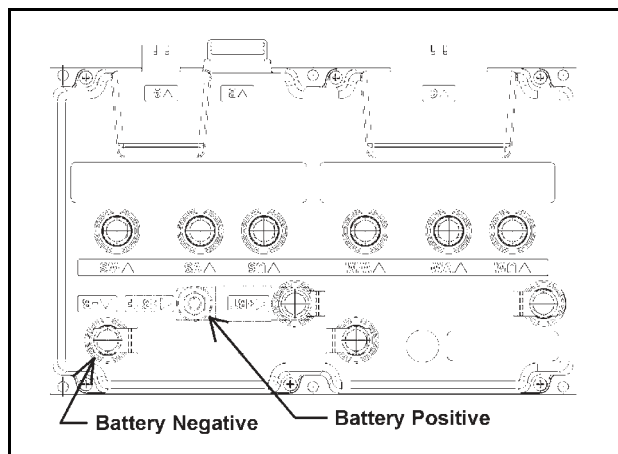
- . Make sure battery is disconnected.

3. Discharging Controller Capacitors

It is necessary to discharge the capacitors before you work on the controller.

NOTE

Make sure that the battery has first been disconnected at the battery receptacle.



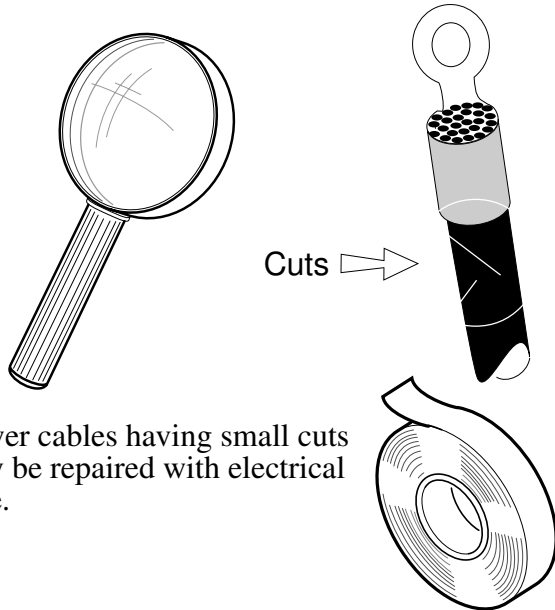
To discharge the capacitors connect a 200 ohm 10 watt resistor between the positive and negative input post of the controller for 10 seconds.

Group 13, Wiring, Switches, and Instruments

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Checking Power Cables

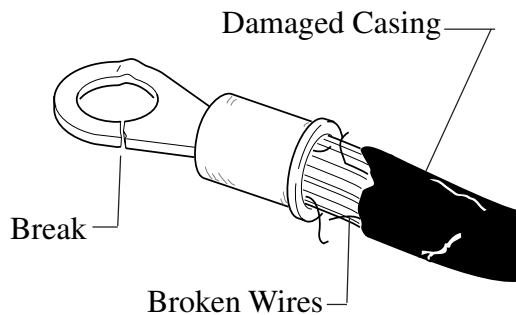
Every cable and wiring harness on this truck is manufactured to an exact specification. A shorter cable or harness will not fit. If either a harness or cable is routed improperly, it will not fit. Subsequently, electrical shorts and damaged components may result if the replacement part is the wrong one, or if it is routed incorrectly.



Power cables having small cuts may be repaired with electrical tape.

Repairable Damage

Cables having damage as shown in illustration below should be removed immediately and replaced with new. Be certain the replacement cable is the exact same length, size and has the proper connector. Make absolutely certain the cable end is properly crimped and its connection properly torqued upon installation

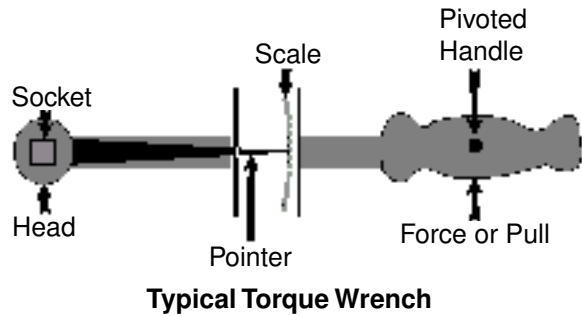


Cable Unfit for Further Service

Torquing Fasteners

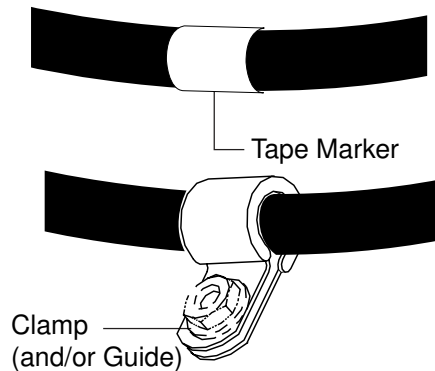
Improperly torqued fasteners can cause damage

Use an appropriate wrench and tighten all fasteners to the torque specified in the following inspection procedures.



Connecting and Mounting Components

Tape markers are used to correctly position each wire harness and electrical cable on the truck. When correctly installed, the tape marker will be hidden by the mounting clamp (guide). Be sure to follow the instructions, where noted in this manual, when installing a wire harness or electrical cables. If you do not, possible shorts and equipment damage may result.



Markers on Wire Harnesses and Power Cables

CLARK

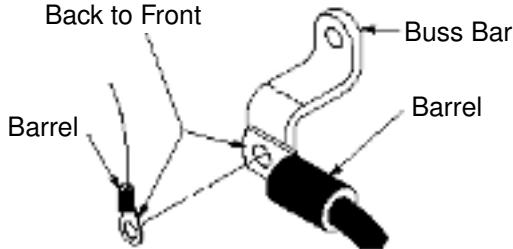
Group 13, Wiring, Switches, and Instruments

Multiple cable and wire connections must be connected as illustrated or electrical shorts and control damage may result.

Terminal Barrels
Must Face Opposite
Each Other



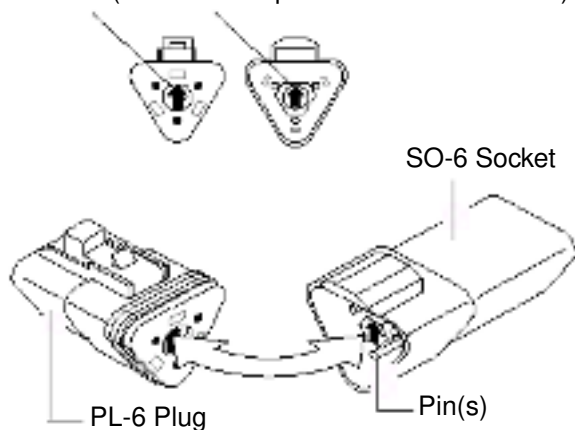
Assemble
Back to Front



Multiple Connections

Connector Plugs and Receptacles are permanently labeled with the proper PL (Plug) and SO (Socket/ Receptacle) number for easy identification. Match the plug number with the appropriate receptacle number before making a connection. If you do not, electrical shorts and possible damage to the equipment may result. i.e., Plug #PL-6 plugs into pin socket #SO-6, etc.

Pin Lock (Arrows must point in direction shown:)

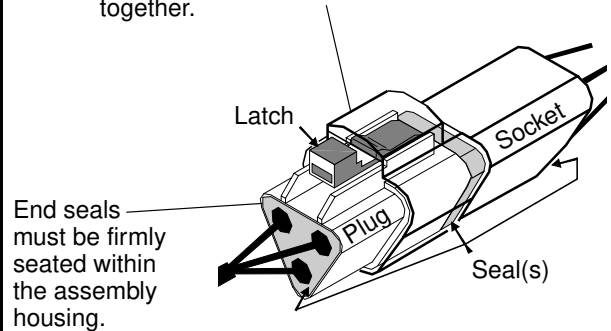


Example of Pin Lock Plug and Socket

There is a moisture-resistant seal at each wireend of the connector and between the plug and socket.

Check seals for damage that would make them unfit for further service (cuts, etc.). Make certain the end seals are seated flush with the end of the connector housing. Make certain the plug and socket latch tightly to each other.

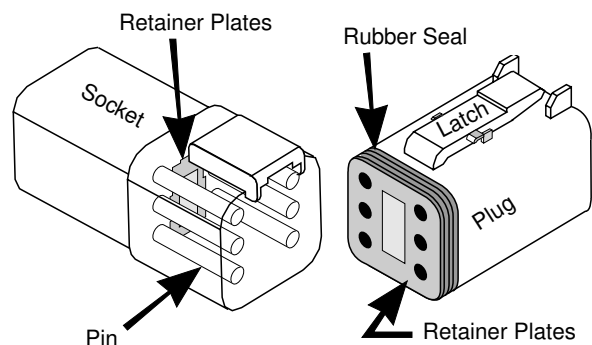
Firmly push plug into socket until latch "clicks" locking the two components together.



Seals and Latch

Retainer plates snap into place to secure the pins and their sockets.

Check the plates and seal for damage and secure mounting.



Retainer Plates

NOTE :

Section 3

Wiring and Cables

The following illustrations depict wiring and cable routing and connections for standard trucks and main accessory harness.

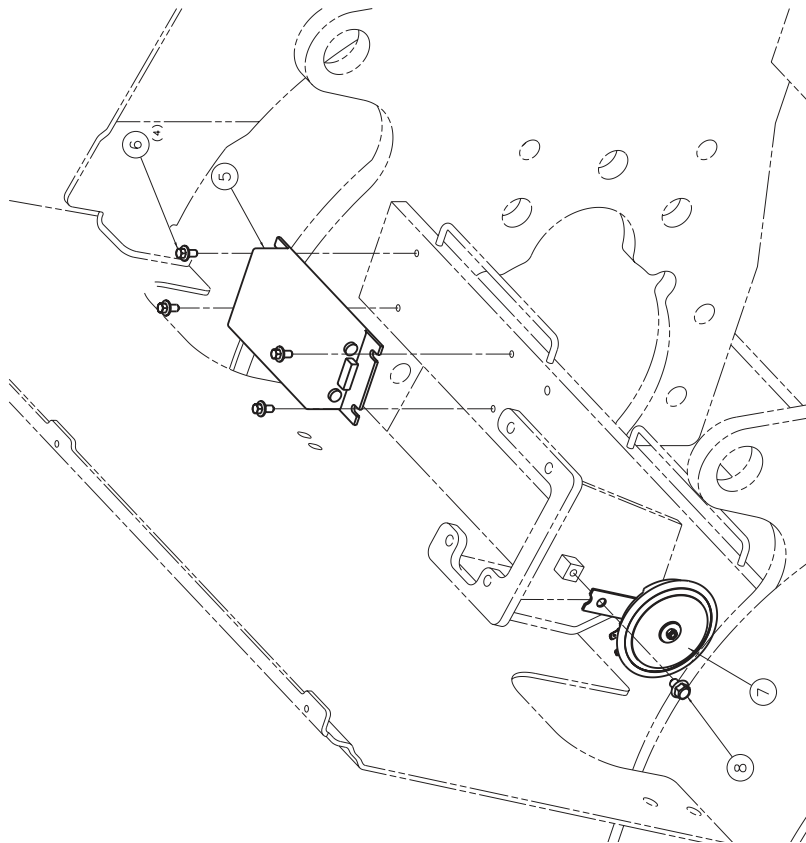
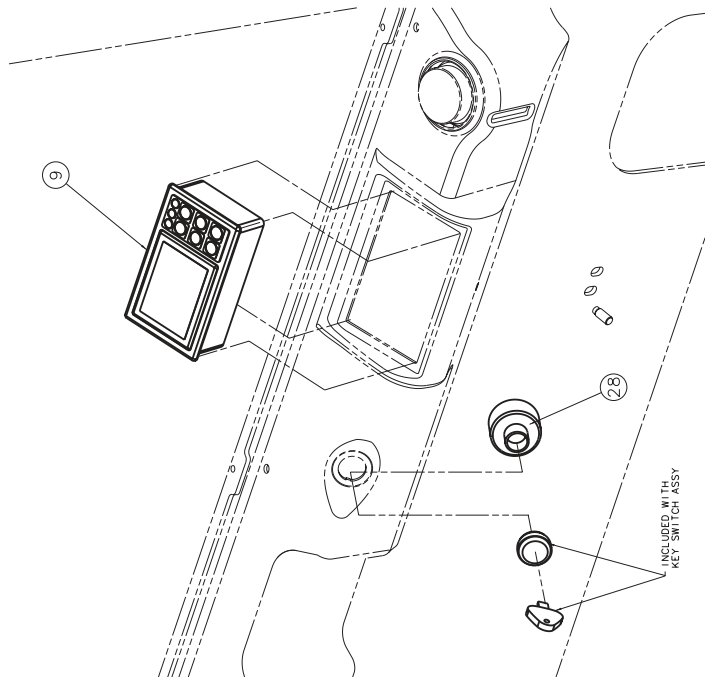
Electrical Components	SI-47116
Main Harness	SI-47202
Cables.....	SI-47193
Accessory Harness and Components.....	SI-47115

A technical drawing of a mechanical assembly. The drawing includes a large, irregularly shaped component on the left, a long horizontal bar on the right, and a vertical plate in the center. The components are labeled with numbers 1 through 5 in circles, with leader lines pointing to them. The labels are: 1 (top of the vertical plate), 2 (a small circular feature on the vertical plate), 3 (a small circular feature on the horizontal bar), 4 (a small circular feature on the horizontal bar), and 5 (a small circular feature on the horizontal bar). The drawing uses solid lines for visible edges and dashed lines for hidden edges.

SM 765, Nov '06

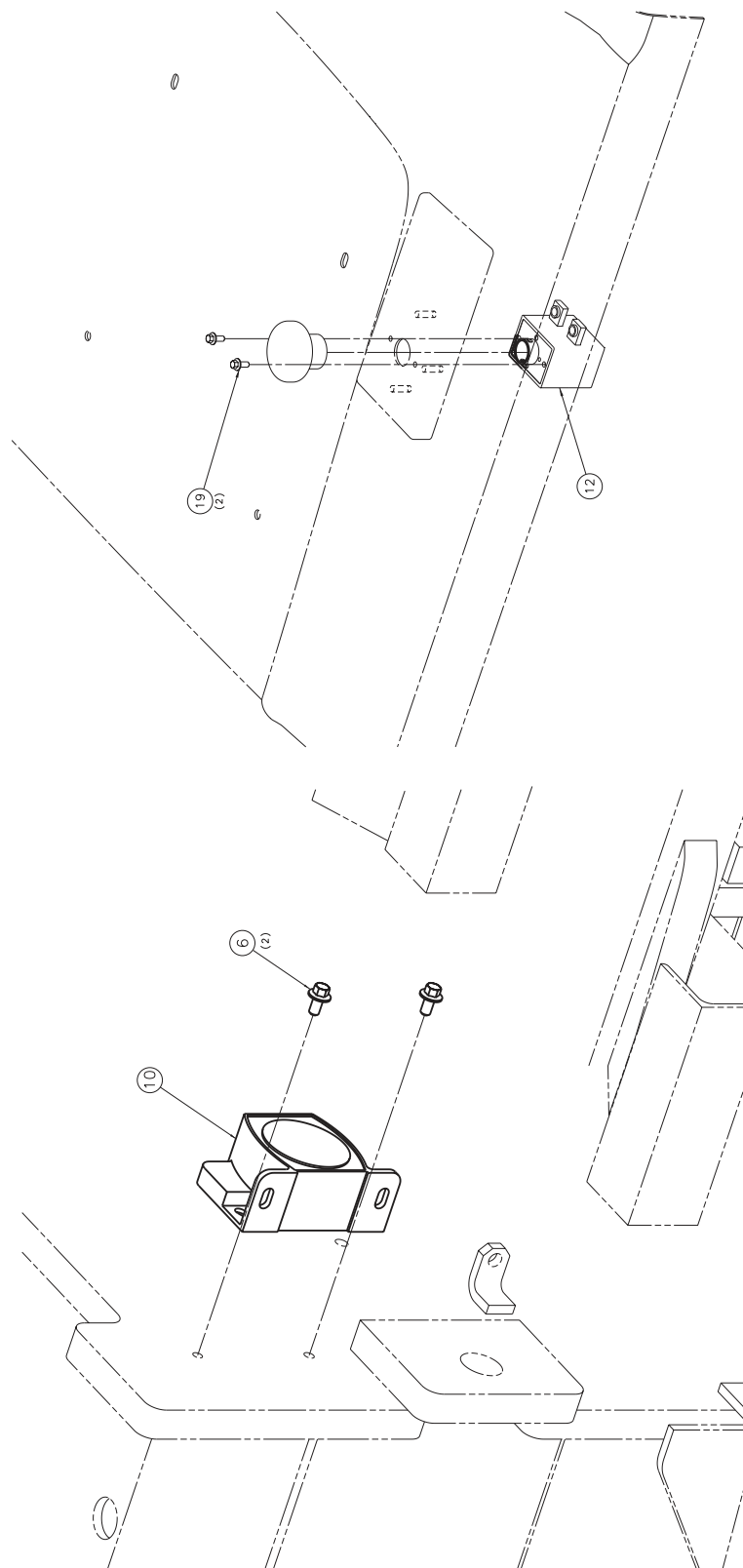
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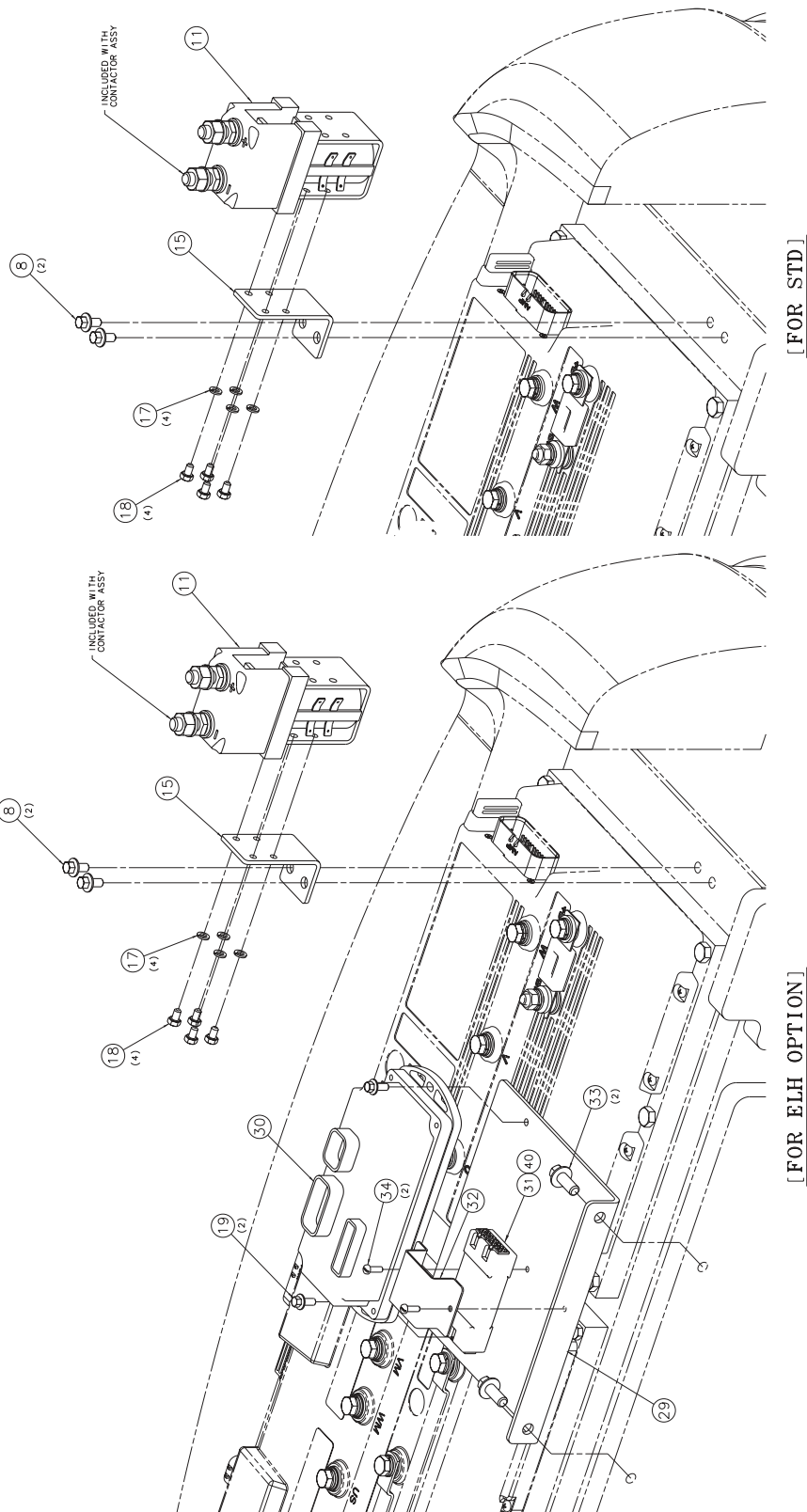
Group 13, Wiring, Switches, and Instruments



Group 13, Wiring, Switches, and Instruments

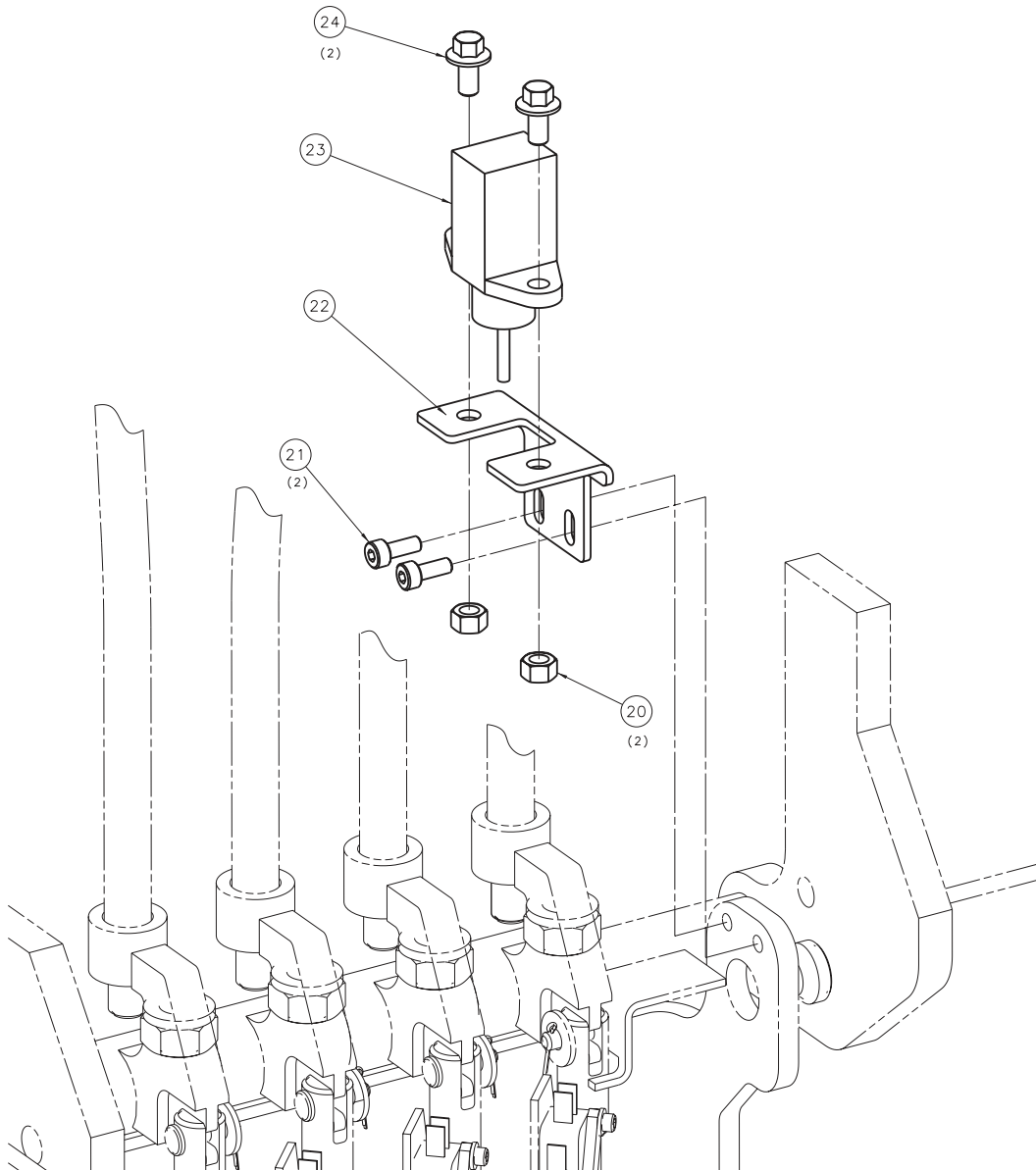
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Group 13, Wiring, Switches, and Instruments

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