



SH/SHR 5500 AC

Service & Parts Manual

Crown PF15849-006



New Bremen, Ohio 45869 USA

Phone 419/629-2311

crown.com

How to Order Service Parts

To obtain fast, efficient service when ordering repair parts for your Crown Material Handling Equipment, please follow this simple procedure:

1. Address all orders to your local Crown dealer.
2. Specify model and serial number of truck, which is shown on the serial number plate.
3. List the quantity needed.
4. List the part number and description, as shown in this Service Manual.
5. Show billing and shipping address.
6. Suggest fastest routing.

Your authorized Crown dealer stocks a large number of standard service parts. In addition, he has a factory - trained Service Department to serve you.

Our Local Crown Dealer Is

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

TELEPHONE _____

The information in this manual is the latest available at the time of printing for the unit with which it was shipped. Should there be any variation due to vendor changes or special options on your unit, contact your Crown Dealer or Crown at the above address.



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Notes:



SAFETY

Notes:

General Maintenance Instructions



WARNING

TO PREVENT SERIOUS RISK OF INJURY TO YOURSELF AND OTHERS OBSERVE THE FOLLOWING SAFETY INSTRUCTIONS

Power industrial trucks may become hazardous if adequate maintenance is neglected. Therefore, adequate maintenance facilities, trained personnel and procedures should be provided.

Maintenance and inspection shall be performed in conformance with the following practices:

1. A scheduled planned maintenance, lubrication, and inspection system should be followed.
2. Only qualified and authorized personnel shall be permitted to maintain, repair, adjust and inspect truck.
3. Before leaving the truck—
 - Stop truck.
 - Fully lower the load engaging means.
 - Place directional controls in neutral.
 - Apply the parking brake.
 - Turn off power (power disconnect).
 - Remove key.
 - Block the wheels if truck is on an incline.
4. Before working on truck—
 - Raise drive wheel free of floor or disconnect power sources.
 - Use chocks or other positive positioning devices.
 - Block load engaging means, inter masts, or chassis before working under them.
 - Operation to check performance of truck or attachments shall be conducted in an authorized safe clearance area.
5. Before starting to operate truck—
 - Be in operating position.
 - Apply brake.
 - Place directional control in neutral.
 - Before operating truck, check functions of lift systems, directional control, speed control, steering, warning devices, brakes and any attachments if any used.
6. Avoid fire hazards and have fire protection equipment present. Do not use an open flame to check level, or for leakage of electrolyte and fluids or oil. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.
7. Keep shop well ventilated, clean and dry.
8. Brakes, steering mechanisms, control mechanisms, lift overload devices, guards, and safety devices shall be inspected regularly and maintained in a safe operating condition.
 - All guards must be installed to factory configuration and condition before operating truck. Do not operate truck if any guards or fasteners are damaged, improperly installed or missing.
9. Capacity, operation and maintenance instruction plates or decals shall be maintained in legible condition.
10. All parts of lift mechanisms shall be inspected to maintain them in safe operating condition.
11. All hydraulic systems shall be regularly inspected and maintained in conformance with good practice. Cylinders, valves, and other similar parts shall be checked to assure that “drift” has not developed to the extent that it would create a hazard.
12. Batteries, motors, controllers, limit switches, protective devices, electrical conductors, and connections shall be maintained in conformance with good practice. Special attention shall be paid to the condition of electrical insulation.
13. Trucks shall be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.

14. Modifications and additions which affect capacity and safe truck operation shall not be performed by the customer or user without manufacturers prior written approval. Capacity, operation and maintenance plates or decals shall be changed accordingly.
 - Adding electrical devices (radio, terminal, lights, etc.) or changing existing components or wiring can affect truck operation and could cause an accident. Contact authorized Crown personnel before adding to or changing the electrical system in any way.
 - For EE rated trucks, adding electrical devices could cause a fire or explosion, as well as void the EE rating. Written approval must be obtained from Crown prior to adding electrical device(s). Prior to use, inspection of installed device(s) must be performed by an appropriate nationally recognized testing laboratory (i.e. Underwriters Laboratories Inc) or the Authority Having Jurisdiction (see NFPA 505).
15. Care shall be taken to assure that all replacement parts are interchangeable with the original parts and of equal quality to that provided in the original equipment.
16. Be sure that any equipment added to the truck (terminal, fan, clipboard, etc.) is positioned so that it does not block your vision or interfere with safe and efficient operation of the truck.

For further information pertaining to operating and maintenance procedures:

- All trucks except Series B and Tow Tractors, refer to current ASME B56.1.
- Series B trucks, refer to current ASME B56.10.
- Tow Tractors, refer to current ASME B56.9.

Control of Hazardous Energy

Lockout/Tagout

In the interest of safety and to ensure compliance with the OSHA Regulations, (Standards - 29 CFR), The control of hazardous energy (lockout/tagout) - 1910.147, Crown has developed guidelines for proper energy control when performing service and maintenance. Before performing any service or maintenance, review the appropriate sections in this service manual for additional procedures to be followed.

In addition, Crown recommends that all mechanics wear appropriate protective items, such as safety glasses, work gloves, and steel-toed shoes, whenever performing service or maintenance work on Crown equipment.

Battery

Safety Rules

- Wear protective clothing, such as, rubber apron, gloves, boots and full-face shield when performing any maintenance on batteries. Do not allow electrolyte to come in contact with eyes, skin, clothing or floor. If electrolyte comes in contact with eyes, flush immediately and thoroughly with clean water. Obtain medical attention immediately. Should electrolyte be spilled on skin, rinse promptly with clean water and wash with soap. A baking soda solution (one pound to one gallon of water) will neutralize acid spilled on clothing, floor or any other surface. Apply solution until bubbling stops and rinse with clean water.
- Keep vent plugs firmly in place at all times except when adding water or taking hydrometer readings.
- Do not bring any type of flame, spark, etc., near the battery. Gas formed while the battery is charging, is highly explosive. This gas remains in the cells long after charging has stopped.
- Do not lay metallic or conductive objects on battery. Arcing will result.
- Do not allow dirt, cleaning solution or other foreign material to enter cells. Impurities in electrolyte has a neutralizing effect reducing available charge.

- If battery repair is planned, follow the battery manufacturer's instructions concerning repair practices and procedures.

Battery Care



CAUTION

Only qualified and experienced personnel should perform maintenance and repair on batteries.

- Make certain the charger being used matches the voltage and amperage of the truck battery. This voltage is listed on the truck serial plate.
- Before disconnecting or connecting batteries to a charger, make sure the charger is "OFF". If an attempt is made to do this while the charger is "ON", serious injury to you, the battery and charger could result.
- Never use a match or lighter. Battery fumes are explosive.
- Make certain battery used meets weight, size and voltage requirements of truck (refer to serial plate). NEVER operate truck with an undersized battery.

Charging



CAUTION

Never smoke or bring flame near the battery. Gas formed during charging is highly explosive and can cause serious injury.

Consult the charger manufacturer's manual covering your charger for hints on operation and maintenance.

Battery Removal

CAUTION

When removing the battery, move truck to area intended for battery care. Floor must be level. Turn key-switch or toggle switch to "off" position and remove key. Disconnect battery and lockout or tagout truck as described in Battery - Lockout/Tagout in this section. Never move battery partially from truck without roller stand in place. Lower load engaging means completely. If battery is removed with load engaging means raised, use hoist attached to mast to provide tip over protection. Don't allow any metallic object to come in contact with the top of the battery cells. This may cause a short circuit when removing, transporting the battery. Use an insulator (such as plywood) to cover the top of the battery before and during removal.

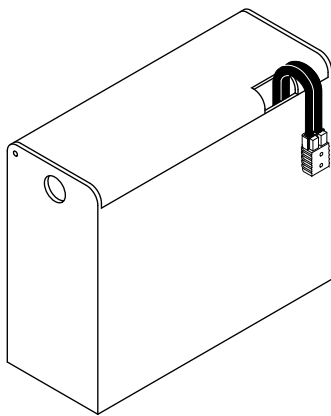


Figure 17318

Battery Installation

CAUTION

When installing the battery, move truck to area intended for battery care. Floor must be level. Turn key-switch or toggle switch to "off" position and remove key. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section. If battery was removed with load engaging means raised, use hoist attached to mast to provide tip over protection. Don't allow any metallic object to come in contact with the top of the battery cells. This may cause a short circuit when transporting or installing the battery. Use an insulator (such as plywood) to cover the top of the battery before and during installation.

CAUTION

Make certain same battery or battery of equal weight is loaded into truck for truck stability. See nameplate for minimum battery weight.

Lockout - Tagout

Always turn keyswitch to "off", remove key and apply tag to handle grip with cable tie warning others truck is being serviced.

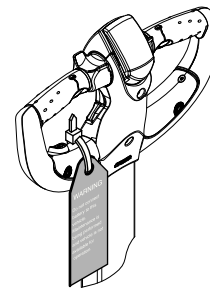


Figure 11349

When maintenance is to be performed and the battery will be left in the truck, remove the main power fuses and install a commercially available lockout device on the battery connector.

When maintenance is performed and the battery is removed from the truck, remove the main power fuses, install a lockout device on the trucks battery connector if possible, or if possible install a tag with a cable tie on the trucks battery connector so it cannot be removed easily warning that the truck is not available for operation.

Capacitance

Due to capacitance voltage present in the traction motor controller, lift motor controller (ACCESS 123) and Steer Motor (ACCESS 5), whenever performing maintenance which may permit contact with the bus bars and associated power cables, discharge the capacitors.

- Move truck to a secure non traffic maintenance area with a level floor.
- Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
- Disconnect battery and connect a 100 ohm resistor between the positive and negative terminals on controller.
- Turn keyswitch to "off", remove key.

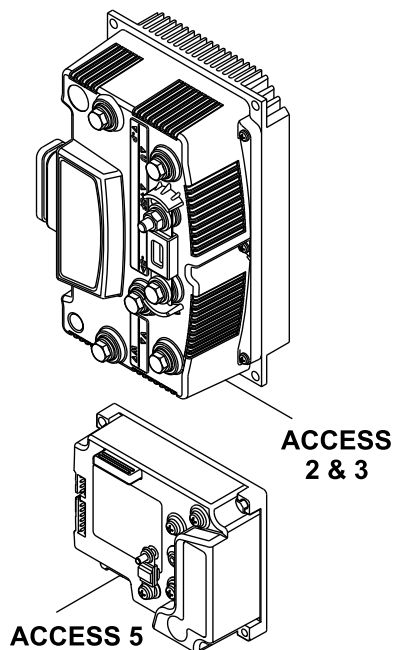


Figure 18865

Hydraulic



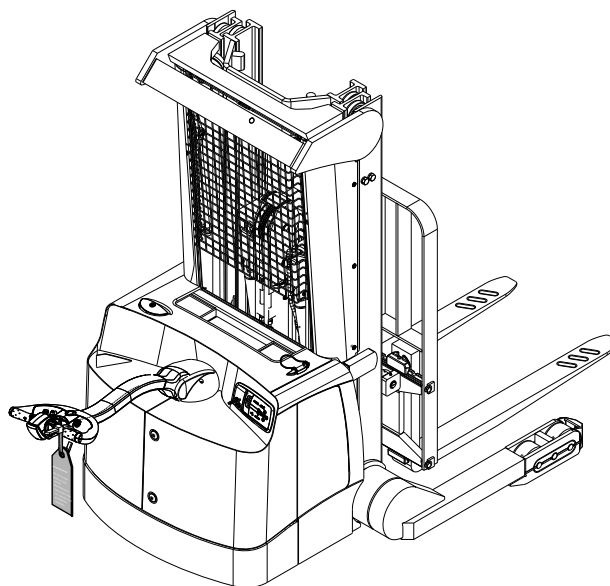
WARNING

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

When maintenance is to be performed on the hydraulic system, make certain the hydraulic system is not under pressure by:

1. Move truck to a secure non traffic maintenance area with a level floor.
2. Retract reach mechanism all the way or, if required for maintenance, block when extended as described in Reach Mechanism of this section.
3. Completely lower load engaging means (mast) or, if required for maintenance, block mast sections at appropriate height as described in Mast of this section.
4. Tilt forks tips all the way down. Do not continue to tilt after fork tips are down to keep pressure from building up at the tilt cylinder.
5. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
6. Operate hydraulic levers to remove any hydraulic pressure that may be present.



Retract Reach Mechanism Completely
Completely Lower Forks
Tilt Forks Tips Down
No Load on Forks

Figure 17312

Towing Truck

- Make sure towing vehicle works properly.
- No riders on the vehicle being towed.
- Make sure "tow-bar" is securely attached to towing truck and not at a loading notch, but close to center line of the truck.
- Tow at creep speed 0.8 - 3.2 Km/h (0.5 - 2.0 mph) maximum.
- Only raise vehicle being towed enough to clear drive tire of the ground and expansion joints.
- Slow down for turns.
- Follow all normal driving rules for the towing trucks.
- Keep pedestrians clear of both truck towing and being towed.
- Do not exceed capacity of the towing truck.
- Use a spotter if there are any visibility issues.
- Keep spotter clear of both vehicles.
- No towing on grades.
- Stay clear of open docks and dock boards.
- Rotate drive unit to right. This will expose drive tire to tow bar and not gear box. Do not lift truck by gear box.

SAFETY

Control of Hazardous Energy



Lifting and Blocking

- Move truck to a secure non traffic maintenance area with a level floor.
- No load on forks.
- Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.

NOTES:

- Hydraulic Jack - Capacity 3620 kg (8000 lb)
- Crown part number: 122599
- Collapsed height minimum: 60 mm (2.25 in)
- Raised height maximum: 400 mm (16 in)

WARNING

Truck stability decreases dramatically if truck skirt is raised more than 140 mm (5.5 in) or 15°. Attach sling and overhead lifting device to all cross members of the mast to prevent truck from tipping over when raising one side of the truck.

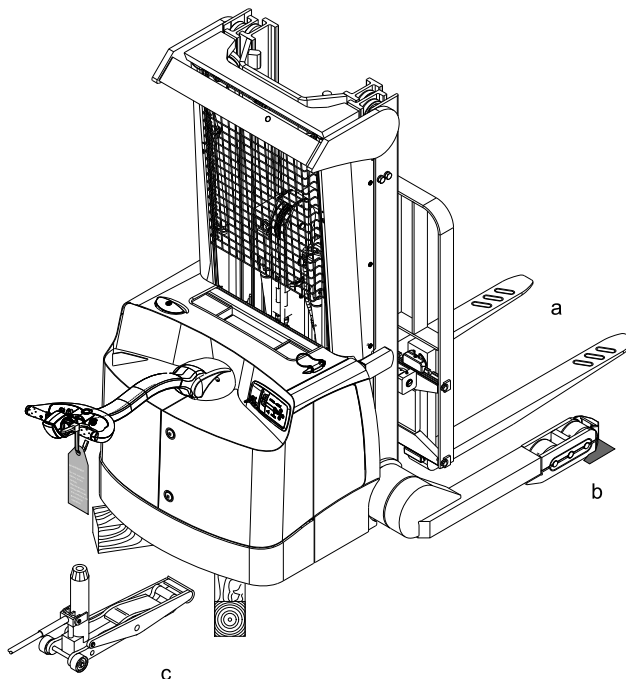


Figure 17313

- a Raise Forks 70 to 150 mm (3 to 6 in) from Floor
- b Wheel Chock Load Wheel on Both Outriggers
- c Use Hardwood Blocks to Set Height as Required Not to Exceed 400 mm (16 in)

NOTE

Position hardwood blocks as shown when lifting and blocking the truck.

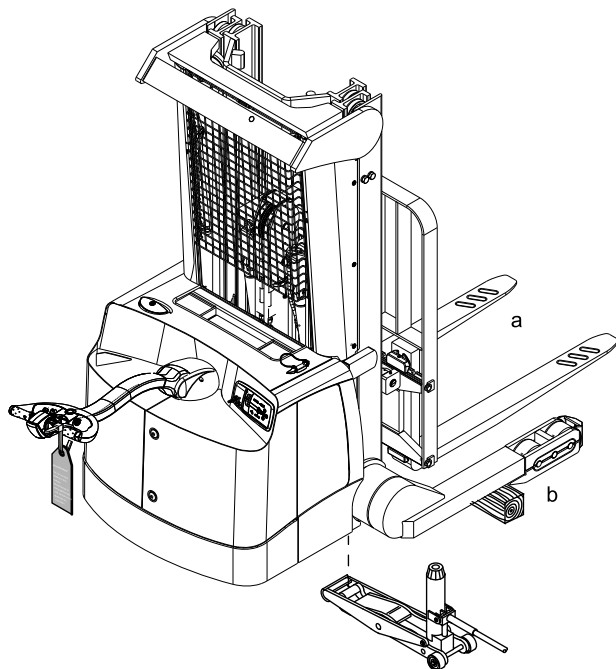


Figure 17314

- a Lower Forks Completely
- b Hardwood Block Behind Load Wheel

Mast**Blocking Masts**

Use 100 mm (4 in) by 100 mm (4 in), 50 mm (2 in) by 100 mm (4 in) or bigger hardwood blocks of appropriate length for supporting mast channels. Block both mast rails of each stage to maintain truck stability.

Remove any carriage mounted accessory (e.g. carton clamp, etc.) except sidershifters before blocking masts. These accessories add significant weight to the mast.

1. Move truck to a secure non traffic maintenance area with a level floor.
2. Chock wheels of truck. Refer to Lifting and Blocking in this section.
3. Connect battery.
4. Raise forks and position blocks under second stage mast as shown.
5. Using a clamp or ratchet tie down, secure blocks to mast channel as shown.
6. Lower mast and position appropriate length blocks under third stage mast as shown.
7. Using a clamp or ratchet tie down, secure blocks to mast channel or second stage block as shown.
8. Lower fork carriage until carriage rests on stops or place blocks under carriage and lower until weight rests on blocks.
9. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.

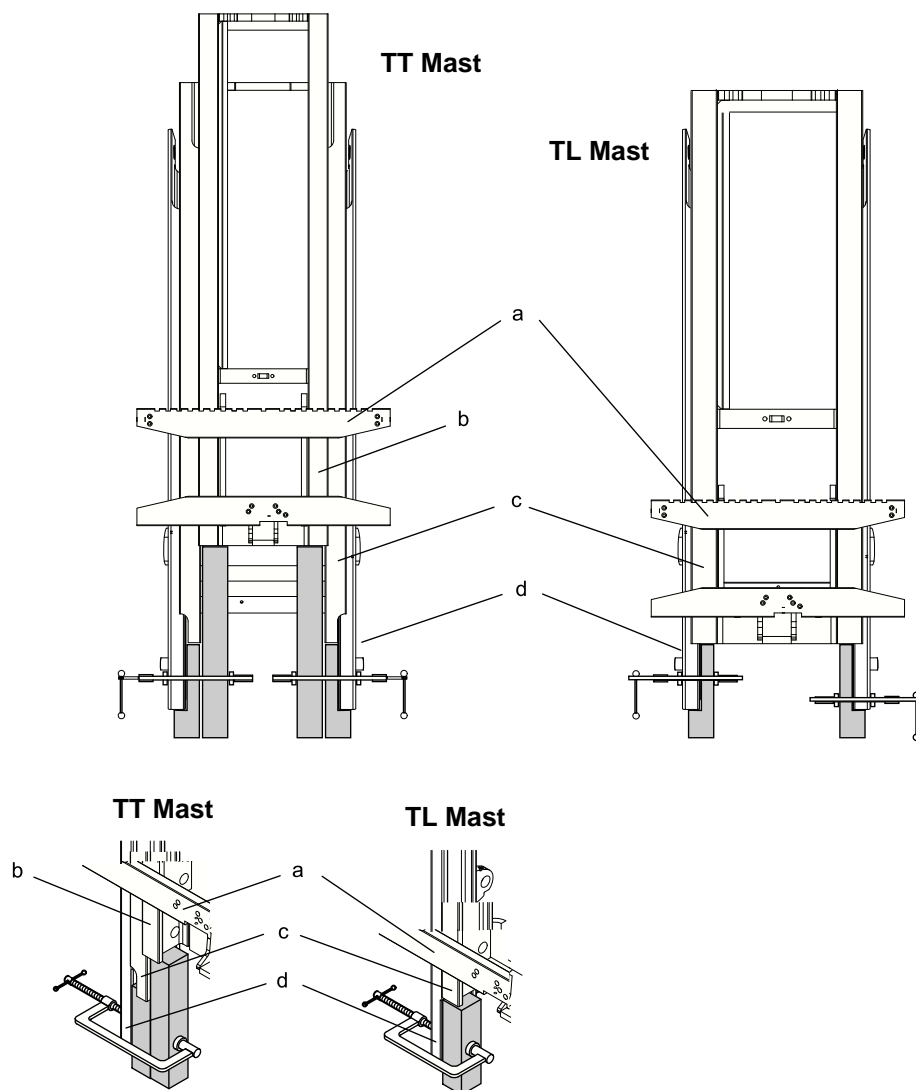


Figure 17315

- a Fork Carriage
- b Third Stage
- c Second Stage
- d First Stage (Mainframe)

Disconnecting Tilt Cylinder

 **WARNING**

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand. Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury. When maintenance is to be performed on the hydraulic system, to make sure the hydraulic system is not under pressure:

1. Move truck to a secure non traffic maintenance area with a level floor.
2. Retract reach mechanism all the way or, if required for maintenance, block when extended as described in Reach Mechanism of this section.
3. Completely lower load engaging means (mast and fork carriage) or, if required for maintenance, block mast sections at appropriate height as described in Mast of this section.
4. Tilt forks tips all the way down. Do not continue to tilt after fork tips are down to keep pressure from building up at the tilt cylinder.
5. Turn key switch to "off", remove key.
6. Disconnect battery. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
7. Open manual lower valve to relieve hydraulic pressure. Retract reach mechanism all the way. Tilt forks completely down. Lower mast completely including fork carriage.

Attach Lifting Device to All Top Cross Braces and Center to Maintain Balance

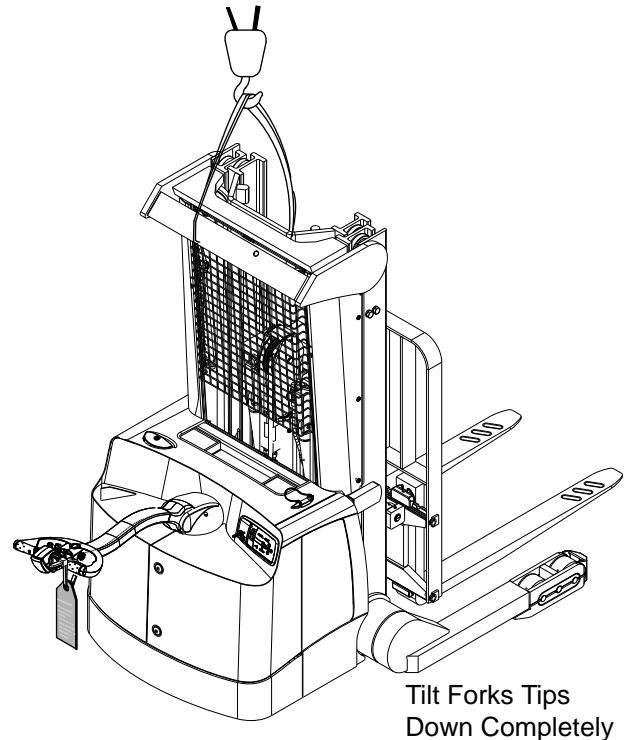


Figure 17316

Reach Mechanism

1. Move truck to a secure non traffic maintenance area with level floor.
2. Chock wheels of truck. Refer to Lifting and Blocking in this section.
3. Extend reach assembly.
4. Clamp a 50 mm x 100 mm (2 in x 4 in) hardwood block in either left or right channel of reach support assembly below roller.

NOTE

Using a standard 100 mm x 100 mm (4 in x 4 in) block can cause steel hydraulic tube to be damaged.

5. Relieve hydraulic pressure from reach circuit by retracting carriage until roller rests on block.
6. If mast is staged refer to Mast in this section for blocking instructions.
7. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.

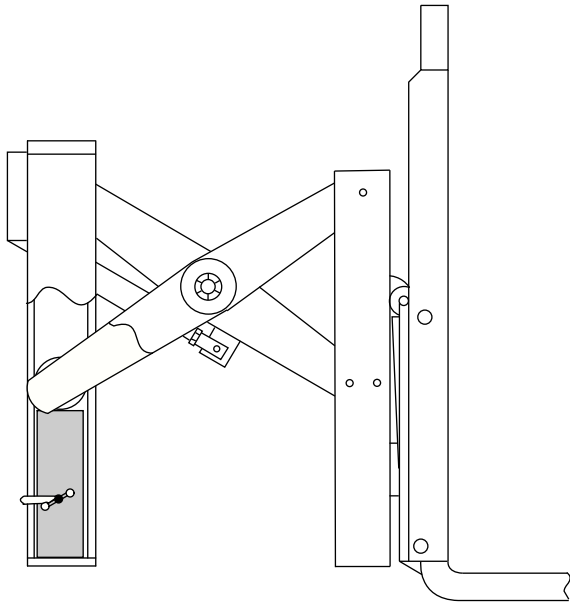


Figure 18962

Cleaning of Material Handling Equipment

Cleaning Methods

The preferred method of cleaning built up dirt and dust from electric material handling equipment is dry pressured air. For localized degreasing, use of an appropriate solvent is recommended.

If these methods are not effective and power washing is the only alternative, extreme care must be exercised. Electrical components including connectors, terminal boards and wiring can be permanently damaged from water and/or cleaning solvents. Mineral and chemical residue left on or in components (i.e., circuit boards, contactors, encoders, switches, potentiometers, etc.) after washing is a proponent of oxidation and corrosion.

Functional integrity of contaminated components may be questionable. Nuisance fault logging, intermittent

operation or immediate failure could be the resultant of power washing. For these reasons all electronic components including motors must be protected. Component removal is the best method to eliminate the risk of damage.

Power washing will also remove and/or destroy lubricants in or on the surface of shafts, unsealed bearings, hinges, exposed gears, bushings, chains, linkages, etc. These items must also be protected or properly lubricated after cleaning.

Consideration must also be given to metal surfaces. The cleaning process can strip away paint and protective coatings applied to components (i.e., hydraulic lines, terminal strips, linkages) for freezer/corrosion environment. Paint and/or protective coating must be re-applied to these areas to reduce the chance of oxidation and corrosion.

Before installing removed components, lubricating or returning the equipment to service it must be free of solvent residue and thoroughly dry.

Crown Cleaning Products Chart		
Cleaner Type	Part Number	Package Quantity
Degreaser & Cleaner	363105-001 363105-012	20 oz. Can (12) 20 oz. Cans
All Purpose Cleaner	363114-001 363114-012	20 oz. Can (12) 20 oz. Cans
Glass Cleaner	363101-001 363101-012	20 oz. Can (12) 20 oz. Cans
Waterless Hand Cleaner	363111-001 363111-012	15 oz. Tube (12) 15 oz. Tubes
Pumiced & Smooth Hand Cleaner	363112-001 363112-004	1 Gallon Jug (4) 1 Gallon Jugs
Wall Mounted Deluxe Soap Dispenser	363122	Used with 363112-001
Tough On Grease	063009-005	1 Gallon Jug

Notes:



INTRODUCTION

Notes:

Introduction

This manual is intended for the service technician who is seeking information about maintenance and service replacement parts. It contains a section on troubleshooting which will enable a qualified technician to locate and solve problems which may occur.

Operation Instructions

This manual does not contain operator instructions. Operator Instructions in tag or booklet form are sent with each truck. Additional copies can be ordered if required. These booklets are for you and your personnel to insure years of safe, trouble-free operation of your Crown Lift Truck.

Operator Training

Crown produces a complete series of operator training programs available through your local Crown dealer. A complete listing of these and other available programs can also be found under "Training" on www.crown.com.

Service Training

Complete Service Training is available for the lift truck technician covering all Crown Lift Trucks, module systems, wire guidance, hydraulic and electrical systems. To obtain more information concerning service training, contact your Crown Dealer or under "Training" on www.crown.com.

Replacement Parts

When ordering replacement parts from this manual, always specify, along with part number, model and serial number of the truck. This information will further enable us to give correct, fast and efficient service.

For current part number of service manuals, operator manuals, operator training programs, truck capacities and technical specifications, contact your local dealer or at www.crown.com.

This manual is arranged according to major sections which covers maintenance and replacement parts. The sectional descriptions are as follows:

Chart 1 - Service and Parts Pages			
Maintenance		Replacement Parts	
Section	Description	Section	Description
M1	Lubrication and Adjustment	1	Power Unit Parts
M2	Hydraulic	2	Hydraulic Parts
M3	Drive Unit	3	Drive Unit Parts
M4	Electrical	4	Electrical Parts
M5	Brake	5	Brake Parts
M6	Steering	6	Steering Parts
M7	Lifting Mechanism	7	Lifting Mechanism Parts
M8	Cylinders	8	Cylinder Parts
M10	Glossary	10	Labels and Decals

INTRODUCTION

Introduction

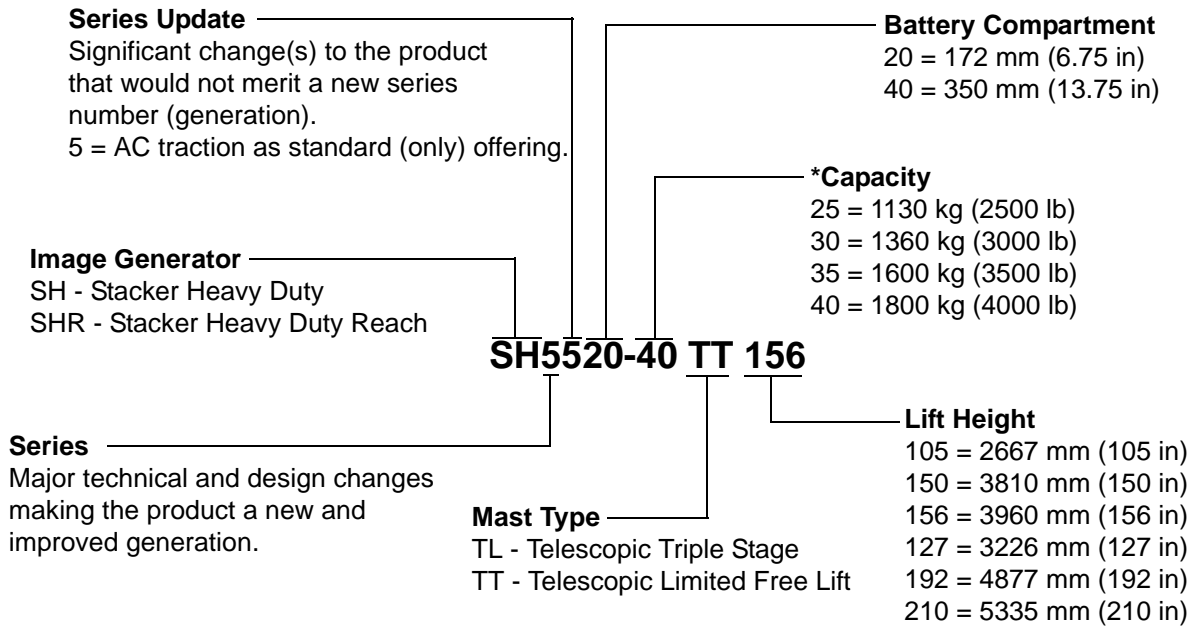


The data plate for the SH/SHR 5500 series truck is located on the lower right side of the mast rail above the outrigger and includes a model number and truck data number. From these two numbers, you can identify the truck model, series, series updates, determine relative size and performance, capacity and specific truck data. The following pages explain the model & truck data numbering system.

Units of measure, kg/mm (lb/in)		Max	Min
Battery Weight			
Truck Weight Less Battery $\pm 5\%$			Hour Rate
Battery Type	D.C. Voltage	Max. AMP Hr.	
Max. Grade with 305 (12) Max. Fork Height		%	
Load Tire Tread Width			
Model Number			Max. Tilt Back °
Serial Number			Fork Length
Truck Data Number			
This truck as released conforms to the mandatory requirements of ASME B56.1			
Crown Equipment Corporation New Bremen, Ohio 45869 USA			

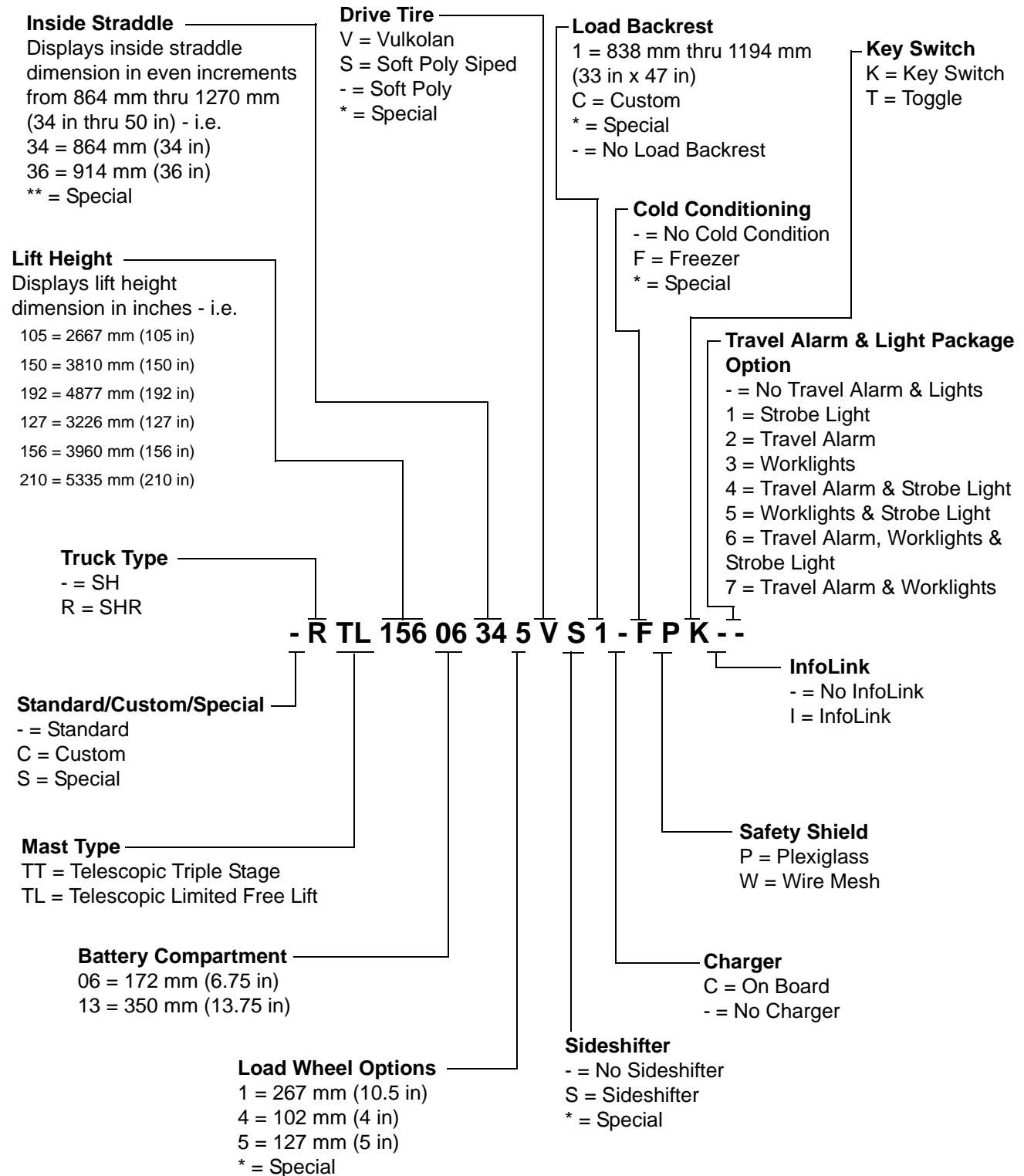
Figure 18855

MODEL NUMBER EXAMPLE



Truck data numbers provides you and your Crown dealer with a wealth of information to insure the selection of proper parts for your Crown truck. You may sim-

ply provide this number to your Crown dealer, or use the following breakdown if selecting your own part numbers or service information from this manual.



Notes:



LUBRICATION & ADJUSTMENT

Notes:



LUBRICATION & ADJUSTMENT

Lubrication and Adjustment

Lubrication and Adjustment

To obtain maximum life of any industrial equipment, a well planned maintenance program (PM), performed by qualified technical personnel should be followed. In conjunction with, and an integral part of, any planned maintenance program should be daily operator input. Operator involvement can greatly reduce truck down time, assist in determining planned maintenance (PM) schedules and ultimately save money. For these reasons, Crown recommends a checklist similar to the Operators Daily Checklist shown below.

Before performing maintenance to any unit, it should be taken to an area set aside for maintenance or a section where there is adequate space to perform required work. This is a must to insure the safety of others and to insure that proper maintenance is performed to the unit.

If desired, padded packs of this checklist (OF-3772) are available through your Crown dealer.

CROWN		Operators Daily Checklist						
Model _____ Serial No. _____		Week beginning _____ 20 _____						
<small>This check must be made by the truck operator daily at the start of the shift. Certain items listed are not included on some models. Check all items applicable to unit noted above.</small>		Shift No. _____						
Check <input checked="" type="checkbox"/> appropriate box <input type="checkbox"/> OK <input type="checkbox"/> Needs repair or adjustments (give details in comments section)		Truck No. _____						
		MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
VISUAL CHECKS	DAMAGE bent, dented or broken parts	OK	OK	OK	OK	OK	OK	OK
	LEAKS drive unit, brakes, hydraulics	OK	OK	OK	OK	OK	OK	OK
	TIRES & WHEELS drive wheels, load wheels, casters	OK	OK	OK	OK	OK	OK	OK
	FORKS in place, properly secured	OK	OK	OK	OK	OK	OK	OK
	CHAINS, CABLES & HOSES in place	OK	OK	OK	OK	OK	OK	OK
	HOUR METER operating	OK	OK	OK	OK	OK	OK	OK
	BATTERY water level, vent caps in place, cleanliness	OK	OK	OK	OK	OK	OK	OK
	BATTERY CONNECTOR cracked, burnt, tight fitting	OK	OK	OK	OK	OK	OK	OK
	GUARDS overhead, load backrest, battery retainer	OK	OK	OK	OK	OK	OK	OK
	SAFETY DEVICES flashing lights, indicator lights, safety shield, operator harness, warning labels, etc. in condition as equipped	OK	OK	OK	OK	OK	OK	OK
OPERATIONAL CHECKS	HORN sounds	OK	OK	OK	OK	OK	OK	OK
	STEERING no binding, no excessive play	OK	OK	OK	OK	OK	OK	OK
	TRAVEL CONTROLS all speed ranges, forward & reverse, no unusual noise	OK	OK	OK	OK	OK	OK	OK
	HYDRAULIC CONTROLS raise & lower, tilt forward & rearward, reach in & out, sideshift right & left, etc., no unusual noise	OK	OK	OK	OK	OK	OK	OK
	BRAKES stop truck within required distance, work smoothly, brake override functions	OK	OK	OK	OK	OK	OK	OK
	PARKING BRAKE reset, hand, foot	OK	OK	OK	OK	OK	OK	OK
	BATTERY CHARGE discharge meter in full green or 75% charge after raising forks	OK	OK	OK	OK	OK	OK	OK
	POWER DISCONNECT cuts off all electric power	OK	OK	OK	OK	OK	OK	OK
	ATTACHMENTS function properly, no unusual noise	OK	OK	OK	OK	OK	OK	OK
	LIMIT SWITCHES travel limit, lift limit, tilt limit, etc.	OK	OK	OK	OK	OK	OK	OK
HOUR METER READING								
OPERATOR'S INITIALS								
SUPERVISOR'S OK								

- If the truck is found to be in need of repair or in any way unsafe, or contributes to an unsafe condition, the matter shall be reported immediately to the designated authority, and the truck shall not be operated until it has been restored to safe operating condition.
 If during operation, the truck becomes unsafe in any way, the matter shall be reported immediately to the designated authority, and the truck shall not be operated until it has been restored to safe operating condition.
 Do not make repairs or adjustments unless specifically authorized to do so.

OF3772 Rev. 500 Printed in U.S.A.

Figure 14990

LUBRICATION & ADJUSTMENT

Lubrication and Adjustment



The following is a list of lubricants and maintenance products recommended when doing Planned Maintenance on Crown Lift Trucks.

Lubrication Identification Chart			
Type of Lubricant		Part Number	Package Quantity
A	Gear Lube 80W-90 (Typical)	363506-001 363506-012	1 Quart (12) 1 Quart Cans
AA	Automatic Transmission Fluid (Multi-Purpose)	363503-001 363503-012	1 Quart (12) 1 Quart
AAA	Universal Hydraulic & Transmission Fluid	363513-001 363513-012	1 Quart (12) 1 Quart
B	Grease (Multi-Purpose)	063002-034 063002-045	14.5 oz Cartridge (40) 14.5 oz Cartridges
BB ⁽¹⁾	Grease (Low Temperature)	063002-017 063002-046	14.5 oz Cartridge (40) 14.5 oz Cartridges
BBB	Food Grade Grease (Multi-Purpose)	363002-001 363002-030	14 oz Cartridge (30) 14 oz Cartridges
C	Oil (SAE 40)		
CC	Engine Oil (10W30)	363500-001 363500-012	1 Quart (12) 1 Quart
D	Hydraulic Oil	363504-101 363504-106	1 Gallon (6) 1 Gallon
DD ⁽¹⁾	Hydraulic Oil (Low Temp)	363505-101 363505-106	1 Gallon (6) 1 Gallon
DDD	Hydraulic Oil - DTE24	063001-021	1 Gallon
E	Channel Grease	063002-024 063002-022	14.5 oz Cartridge 35 lb Pail
F	Gear Grease	063002-024 063002-022	14.5 oz Cartridge 35 lb Pail
G	Chain & Cable Lube	363107-001 363107-012	15 oz Can (12) 15 oz Cans
	Premium Chain & Cable Lube	363115-001 363115-012	12 oz Can (12) 12 oz Cans
H	Final Finish - Rubber & Vinyl Dressing	363129-001 363129-012	11 oz Can (12) 11 oz Cans
I	Grease (Lift Pump Coupling)	063002-039 127801S	1 lb 1 oz
J	Brake Fluid - Dot 5	063004-002	12 oz
		063004-003	1 Gallon
⁽¹⁾ Trucks operated in below freezing temperatures must use Low Temp Hydraulic Oil & Grease.			

Lubrication Identification Chart			
Type of Lubricant		Part Number	Package Quantity
K	Grease (Wheel Bearing)	063002-034	14.5 oz Cartridge
		063002-045	(40) 14.5 oz Cartridges
L	Metal Assembly Spray	063002-021	11 oz Spray
M	Silicone Grease (Clear)	063002-020	5.3 oz Tube
N	Brake & Parts Cleaner	363102-001 363102-012	14 oz Can (12) 14 oz Cans
	Low VOC Brake & Parts Cleaner	363103-001 363103-012	14 oz Can (12) 14 oz Cans
	Non-Flammable Brake & Parts Cleaner	363116-001 363116-012	19 oz Can (12) 19 oz Cans
O	Penetrating Lubricant	363104-001	20 oz Can
		363104-012	(12) 20 oz Cans
P	Premium Formula Multi-Purpose Grease	363108-001	11 oz Can
		363108-012	(12) 11 oz Cans
Q	White Lithium Grease	363110-001	11 oz Can
		363110-012	(12) 11 oz Cans
R	Choke & Carburetor Cleaner	363109-001	15 oz Can
		363109-012	(12) 16 oz Cans
S	Contact Cleaner - Non-Flammable	363106-001 363106-012	10 oz Can (12) 10 oz Cans
	Contact Cleaner	363128-001 363128-012	11 oz Can (12) 11 oz Cans
T	Electrical Connector Oxidation & Corrosion Inhibitor	127189-001	30 cc
U	Battery Cleaner	363124-001	18 oz Can
		363124-012	(12) 18 oz Cans
V	Battery Protector	363125-001	15 oz Can
		363125-012	(12) 15 oz Cans
W	Food Grade Machine Lubricant	363127-001	12 oz Can
		363127-012	(12) 12 oz Cans
X	Food Grade Silicone Spray	363126-001	11 oz Can
		363126-012	(12) 11 oz Cans
Y	Coolant	363509-101 363509-106	1 Gallon (6) 1 Gallon
	Extended Life Coolant	363511-101 363511-106	1 Gallon (6) 1 Gallon

LUBRICATION & ADJUSTMENT

Lubrication and Adjustment



Alternate Lubricants & Fluids Chart

Type of Lubricant		Product Name	Manufacturer / Distributor
A	Gear Lube 80W-90 (Typical)	Crown	Crown
AA	Automatic Transmission Fluid (Multi-Purpose)	Crown	Crown
B	Grease (Multi-Purpose)	Mobilgrease XHP 222 Special Union Unoba EP No 2 Retinax A ⁽¹⁾ LM Grease Unirex EP-2	Mobil Union 76 Co. Shell Burmah Castrol Exxon
BB	Grease (Low Temp) ⁽²⁾	Lubriplate Alvania RA ⁽¹⁾ Helveum O ⁽¹⁾	Fiske Bros Refining Co. Shell Burmah Castrol
BBB	Food Grade Grease (Multi-Purpose)	Petro Canada Purity FG	Petro Canada
C	Oil (SAE 40)		
D	Hydraulic Oil	Crown	Crown
DD	Hydraulic Oil (Low Temp) ⁽²⁾	Crown	Crown
DDD	Hydraulic Oil - DTE24 ⁽³⁾	Mobil DTE 24	Mobil
E	Channel Grease	Factran #2	Standard Oil Co.
F	Gear, Channel & Shaft Grease	Molykote BR-2 Plus	Dow Corning
G	Chain & Cable Lube	Crown	Crown
	Premium Chain & Cable Lube	Crown	Crown
H	Final Finish - Rubber & Vinyl Dressing	Crown	Crown
I	Grease (Lift Pump Coupling)	Nyogel 774F-MS	NYE Lubricants
J	Brake Fluid - Dot 5	Q2-1141 Silicon Brake Fluid	Dow Corning
K	Grease (Wheel Bearing)	Mobilgrease XHP 222 Special Unirex EP-2 Lubriplate No. 1242 ⁽¹⁾	Mobil Exxon Fiske Bros. Refining Co.
L	Metal Assembly Spray	Dow Corning	Dow Corning
M	Silicon Grease (Clear)	Dow Corning 111 Compound	Dow Corning
N	Brake & Parts Cleaner	Crown	Crown
	Low VOC Brake & Parts Cleaner	Crown	Crown
	Non-Flammable Brake & Parts Cleaner	Crown	Crown

⁽¹⁾ Denotes allowable substitutes, contact factory if unavailable.

⁽²⁾ Trucks operated in below freezing temperatures must use Low Temp Hydraulic Oil & Grease.

⁽³⁾ Premium antiwear hydraulic oil used in blending with low temp oil.

Alternate Lubricants & Fluids Chart			
Type of Lubricant		Product Name	Manufacturer / Distributor
O	Penetrating Lubricant	Crown	Crown
P	Premium Formula Multi-Purpose Grease	Crown	Crown
Q	White Lithium Grease	Crown	Crown
R	Choke & Carburetor Cleaner	Crown	Crown
S	Contact Cleaner	Crown	Crown
T	Electrical Connector Oxidation & Corrosion Inhibitor	Nye Grease	NYE Lubricants
U	Battery Cleaner	Crown	Crown
V	Battery Protector	Crown	Crown
W	Food Grade Machinery Lubricant	Crown	Crown
X	Food Grade Silicone Spray	Crown	Crown
Y	Extended Life Coolant		

Notes:

Lubrication and Adjustment



WARNING

Wear appropriate items, such as safety glasses and steel-toed shoes whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points. In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

General

Before performing truck maintenance, it should be taken to an area set aside for maintenance or where there is adequate space to perform the required work. This is a must to insure the safety of others and to insure that proper maintenance is preformed to the unit.

NOTE

Be sure the battery connectors are disconnected.

For regular maintenance, access to components is accomplished by removing screws connecting door assemblies. Swinging doors open allows maintenance to be preformed on pump, motor, contactor panel, drive unit, hydraulic system and electrical components located in the power unit.

Some hydraulic components are located beneath power unit, below battery. To perform maintenance on any of these components, battery will have to be removed. To perform maintenance to certain areas of mast it may be necessary to remove safety shield. Maintenance to directional switches and raise/lower switches is accomplished by removing screws which secure cover plate to control pod in handle. Refer to appropriate sections for procedures.

Lubrication

To obtain maximum life of industrial equipment, a well planned maintenance program should be followed. The following information is intended to provide guidelines for proper lubrication intervals as called out in the lubrication chart, however, some operating conditions will require more frequent checks and lubrication than listed. For example, applications with much dust or

moisture will require modification of schedule to fit that particular application.

The use of high grade lubricants and fluids should be used. Sources of these lubricants may be from almost any oil company; those listed within the Lubricant Chart are typical and any lubricant with equal specifications may be used.

On trucks equipped to operate in below freezing temperatures, low temperature hydraulic oil and grease must be used.

LUBRICATION & ADJUSTMENT

Lubrication and Adjustment

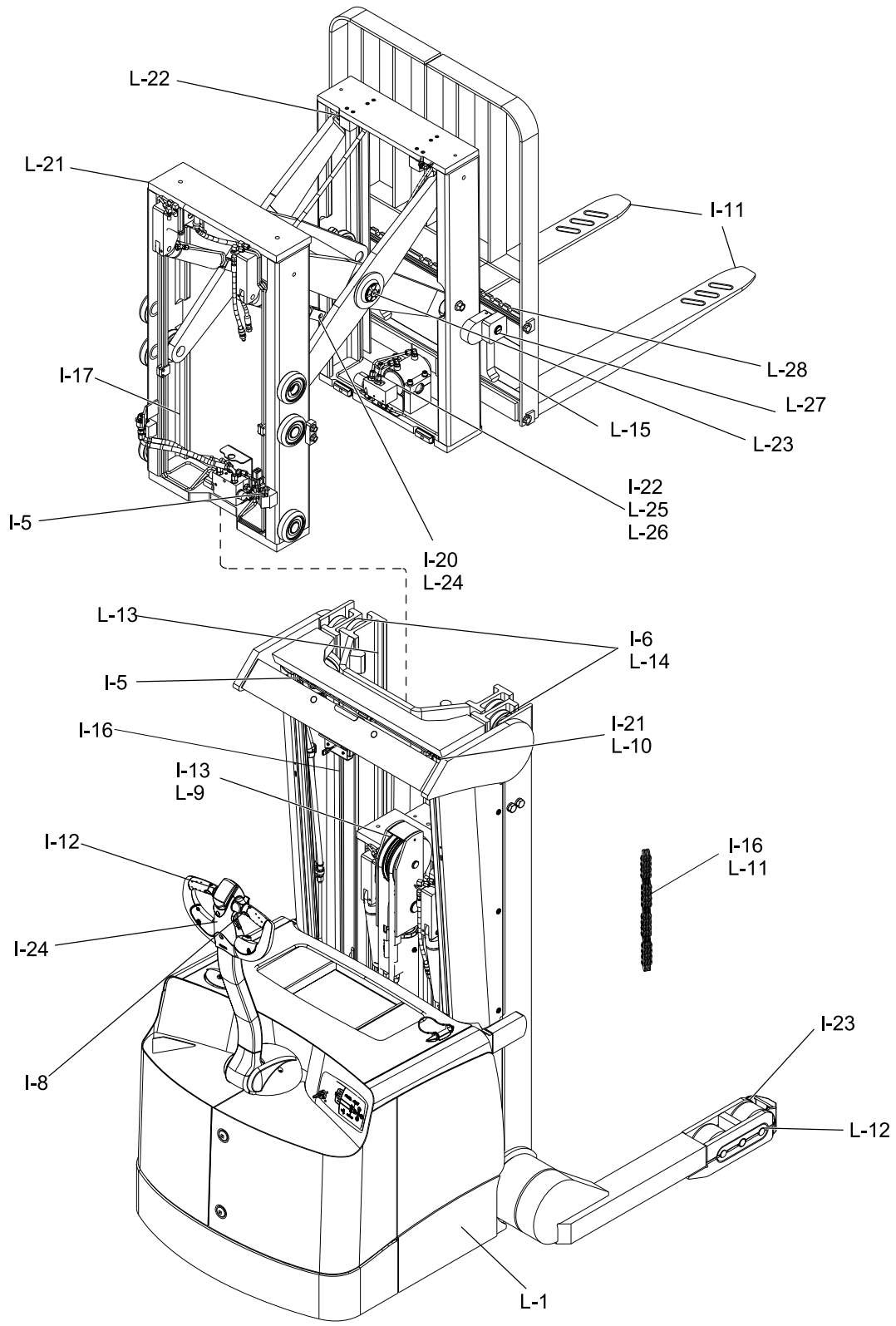


Figure 18647

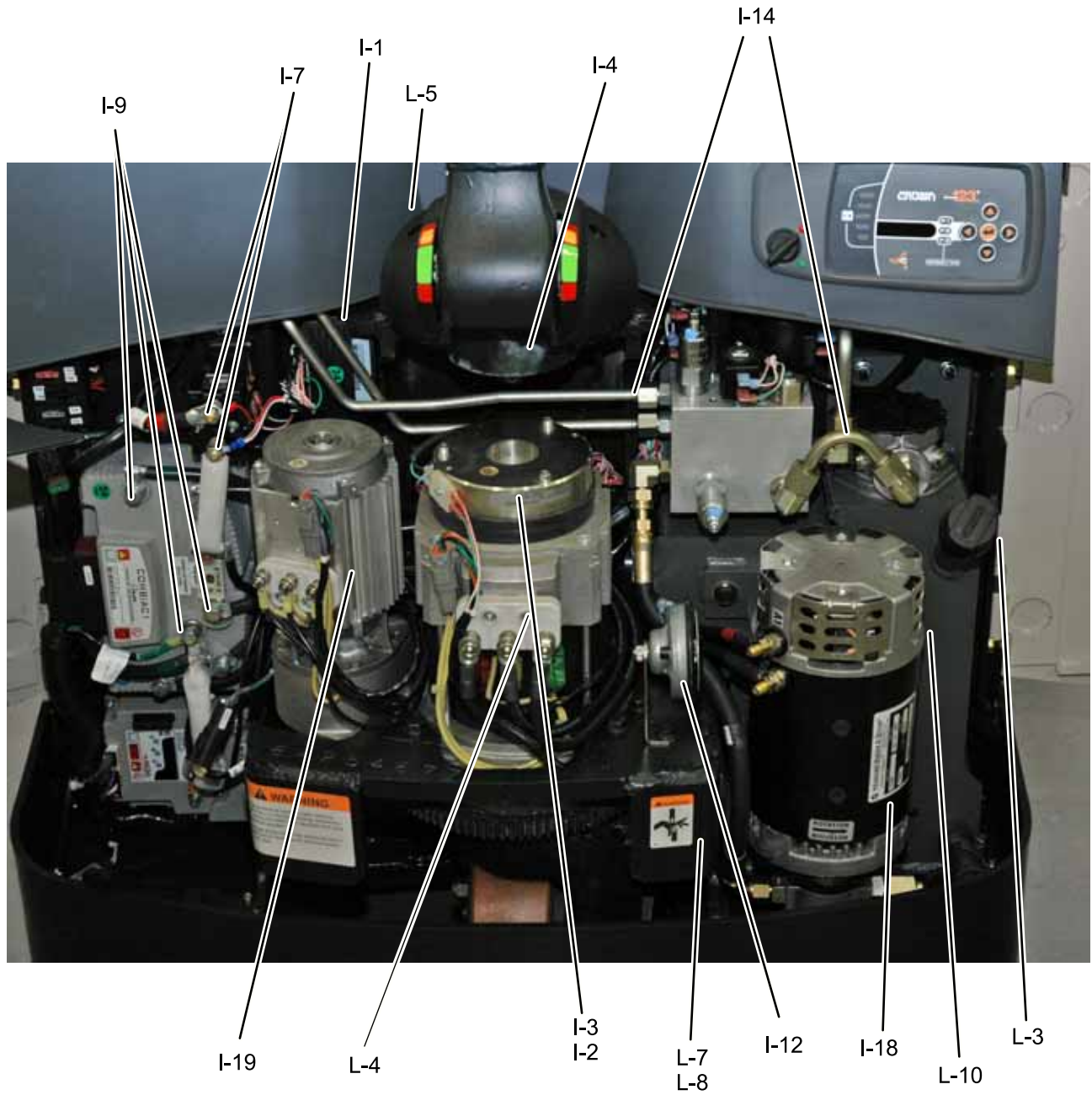


Figure 19052

LUBRICATION & ADJUSTMENT

Lubrication and Adjustment



Chart 1 - Lubrication Chart

Index	Component	Lube Type	Quantity	60 days 250 hr	90 days 500 hr	6 months 1000 hr	12 months 2000 hr
L-1	Battery Rollers	C	(1)	(2)			
L-2	Brake Lingage	C	(1)	(2)			
L-3	Door Hinges	C	(1)	(3)			
L-4	Drive Unit - Level	A	2 liter (0.5 gal)	(2)	(2)	(2)	(4)
L-5	Steering Unit - Pivot	B	(1)	(3)			
L-6	Drive Unit - Rollers	B	(1)	(2)			
L-7	Drive Unit - Shaft	B	(1)	(3)			
L-8	Drive Unit - Hub	B	(1)	(3)			
L-9	Yoke		(1)				
L-10	Hydraulic Reservoir	D	12 liter (3.2 gal)				
L-11	Lift Chains	F	(1)				
L-12	Load Wheel Axels	B	(1)		(2)	(2)	(4)
L-13	Mast Channels	E	(1)				
L-14	Mast Rollers	B	(1)				
L-15	Reach Assembly	B	(1)				
(1) - As Required							
(2) - Check							
(3) - Lubricate							
(4) - Change							
Refer to Lubrication Identification Chart in Lubrication and Adjustment for Lube Type explanation and capacity.							
Refer to Figure 18647 and 19052 for Lubrication locations.							

Chart 2- Lubrication Chart

Index	Component	Lube Type	Quantity	30 days 100 hr
L-21	Upper Inner Arm	B	(1)	(3)
L-22	Upper Outer Arm	B	(1)	(3)
L-23	Pivot Areas	B	(1)	(3)
L-24	Reach Cylinder	B	(1)	(3)
L-25	Tilt Cylinder Rod End	B	(1)	(3)
L-26	Tilt Cylinder Pivot End	B	(1)	(3)
L-27	Fork Carriage Pivots	B	(1)	(3)
L-28	Fork Slides	B	(1)	(3)
(1) - As Required				
(2) - Check				
(3) - Lubricate				
(4) - Change				
Refer to Lubrication Identification Chart in Lubrication and Adjustment for Lube Type explanation and capacity.				
Refer to Figure 18647 and 19052 for Lubrication locations.				

LUBRICATION & ADJUSTMENT

Lubrication and Adjustment



Chart 3- Inspection and Adjustment Chart

Index	Component	30 days 100 hr	60 days 250 hr	3 months 500 hr	12 months 2000 hr
I-1	Battery	(1)			
I-2	Brake Lining			(1)	
I-3	Brake Operation	(1)			
I-4	Brake Switch	(1)			
I-5	Chain Anchors and Retainers	(1)			
I-6	Column Rollers		(1)		
I-7	Contact Tips	(1)			
I-8	Control Switches	(1)			
I-9	Electrical Connections	(1)			
I-10	Emergency Disconnect	(1)			
I-11	Forks	(1)			
I-12	Horn	(1)			
I-13	Yoke	(1)			
I-14	Hydraulic Lines and Fittings	(1)			
I-15	Lift Chains			(1)	
I-16	Lift Cylinder	(1)			
I-17	Mast Limit Switch	(1)			
I-18	Lift Motor Bushings		(1)		
I-19	Traction Motor Bushings		(1)		
I-20	Reach Cylinder(s)	(1)			
I-21	Stop Blocks and Mast Latches (TT)		(1)		
I-22	Tilt Cylinder	(1)			
I-23	Tires, Load Wheels	(1)			
I-24	Travel Controls	(1)			

(1) - Inspect, Clean and/or Adjust. Refer to Figure 18647 and 19052 for component locations.

(2) - Change

Refer to appropriate section of service manual for additional information concerning inspection or adjustment.

Componentry

ACCESS 1

Display Control Module

Location: on power unit.

Purpose: displays pertinent truck information to operator or service technician (battery charge, hours of operation, etc.).

Data: information received from truck control modules and sensors. Power received through FU2 by activation of Key Switch (KYS).

Adjustment: none required.

Diagrams: DIA-8055-002 (C-3).

Parts Breakdown: 04.8-8055-001 (1).



ACCESS 1

Figure 18914

ACCESS 2/3 (COMBI AC1)

Traction Control Module/Hydraulic Control Module

Location: on control panel.

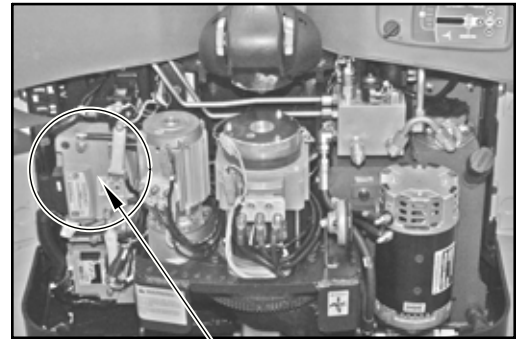
Purpose: controls traction motor speed via operator input from POT1 ACCEL and hydraulic pump motor speed via operator input from X10 Handle MAIN PCB.

Data: information received from truck control modules and sensors.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-4), DIA-8055-003 (B-1), DIA-8055-007 (A-2).

Parts Breakdown: 04.1-8055-001 (20).



ACCESS 2/3 (COMBI AC1)

Figure 18915

ACCESS 5 (EPS ACO)

Steering Control Module

Location: on control panel.

Purpose: controls steer motor.

Data: receives information from operator via POT1/ POT2 (STEER CMD) and provides speed and directional control to steering motor in relation to POT3 (STEER FEEDBACK) and ECR2.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-2), DIA-8055-003 (B-3), DIA-8055-007 (A-3).

Parts Breakdown: 04.1-8055-001 (23).



ACCESS 5 (EPS ACO)

Figure 18916-01

ACCESS 7 (HVC)

Hydraulic Accessory Controller

Location: in control panel (used only on SHR trucks).

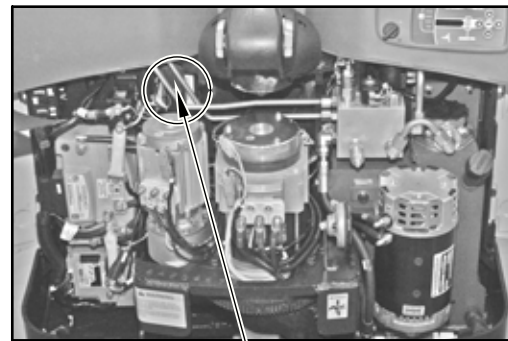
Purpose: controls tilt, reach and sideshift accessories as applicable to the truck.

Data: information received from operator via X10 Handle MAIN PCB and applicable switches.

Adjustment: none required.

Diagrams: DIA-8055-004 (B-1).

Parts Breakdown: 04.1-8055-001 (15).



ACCESS 7 (HVC)

Figure 18917

ACCESS 8

CAN Interface

Location: inside tiller arm assembly.

Purpose: transfers all input from X10 Handle MAIN PCB to proper controllers and functions.

Data: information received from operator input via switches and controls on X10 Handle.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-1), DIA-8055-005 (B-4)

Parts Breakdown: 04.5-4255-001 (3), 04.5-8055-001 (3).

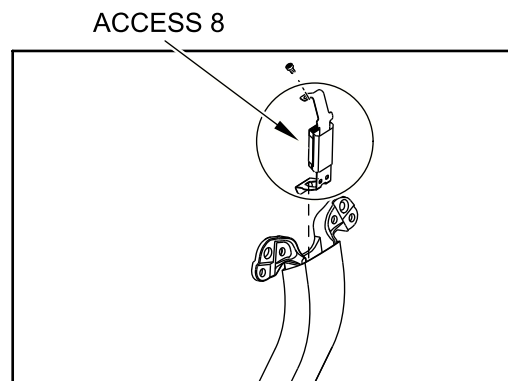


Figure 18918

ALM1 (Optional)

Travel Alarm

Location: lower left side of power unit.

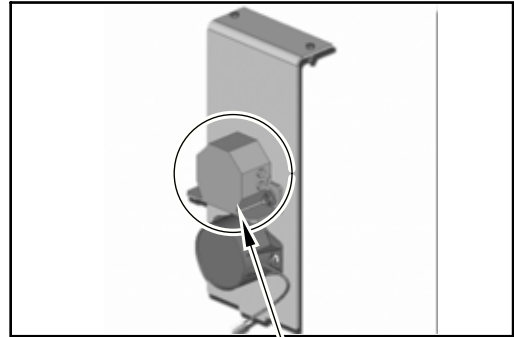
Purpose: audible warning to indicate truck movement.

Data: controlled by ACCESS 2.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-3), DIA-8055-003 (A-2).

Parts Breakdown: 04.0-8055-001 (7).



ALM

Figure 18919

BRK

Brake

Location: on top of traction motor.

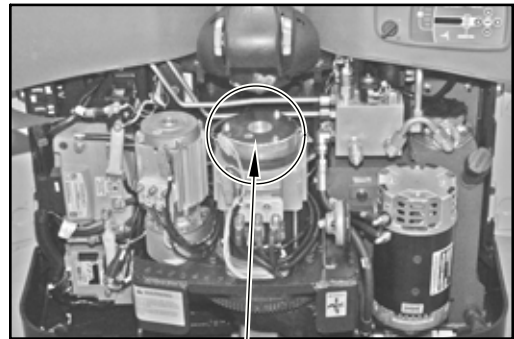
Purpose: provides braking force to traction motor to stop truck and prevent movement of parked truck.

Data: received from traction controller via input received from ORS and BRS switches on tiller knuckle.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-4), DIA-8055-004 (B-4).

Parts Breakdown: 05.3-8055-001.



BRK

Figure 18920

BRS

Brake Switch

Location: on tiller knuckle.

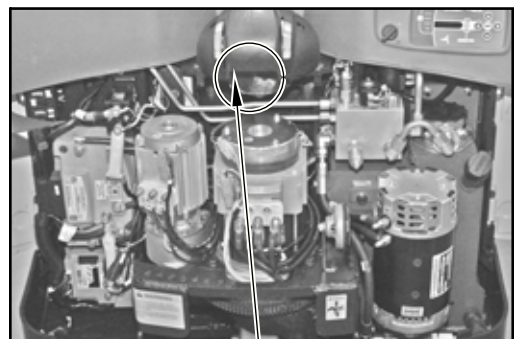
Purpose: indicates brake request from tiller position to traction controller.

Data: momentary contact switch wired normally open. Actuated by closing switch when control handle is moved to the "brake on" zone.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-3), DIA-8055-004 (B-3).

Parts Breakdown: 05.0-8055-001 (28).



BRS

Figure 18921-01

ECR1

Traction Motor Encoder

Location: inside traction motor.

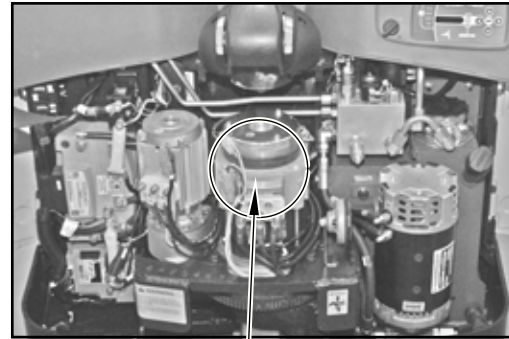
Purpose: indicates motor speed and direction.

Data: channels A & B feedback.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-4), DIA-8055-003 (A-1), DIA-8055-004 (C-2).

Parts Breakdown: 03.1-8055-001.



ECR1

Figure 18922

ECR3

Steer Encoder

Location: inside steer motor.

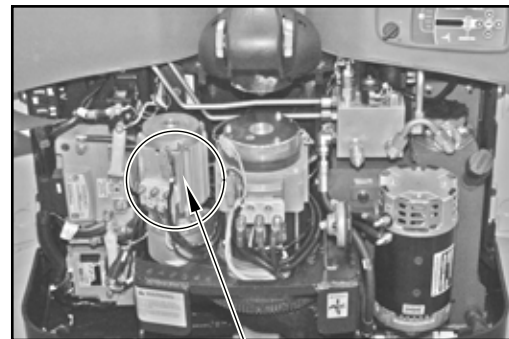
Purpose: works with POT3 to indicate steer motor speed and direction to controller.

Data: channels A & B feedback.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-2), DIA-8055-003 (A-4), DIA-8055-004 (C-2).

Parts Breakdown: 06.2-8055-001.



ECR3

Figure 18923

FN1

Controller Fan

Location: on control panel.

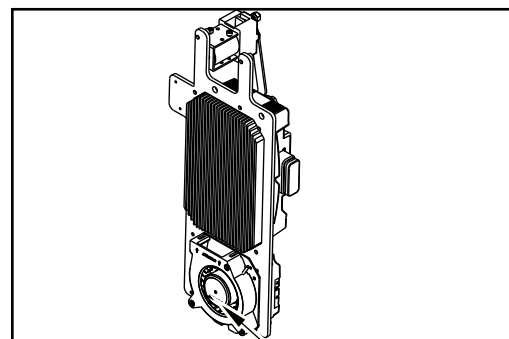
Purpose: provides cooling for controllers.

Data: 24 V DC.

Adjustments: none required.

Diagrams: DIA-8055-002 (B-3), DIA-8055-003 (A-2).

Parts Breakdown: 04.1-8055-001 (19).



FN1

Figure 18924

FN2

Operator Fan

Location: on mast guard.

Purpose: operator comfort.

Data: 24 V DC.

Adjustments: none required.

Diagrams: DIA-8055-006 (C-3).

Parts Breakdown: 10.0-8055-050 (16).



FN2

Figure 18925

FS

Forward Switch

Location: in control handle cap ACCEL POT1.

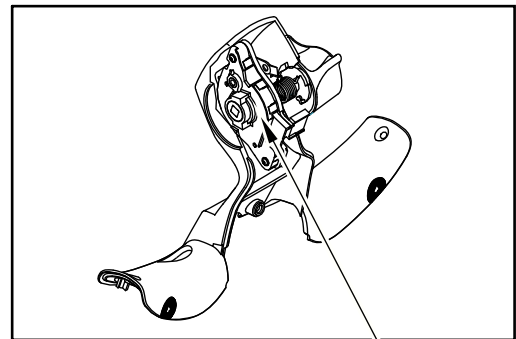
Purpose: provides input to traction controller for forward travel direction.

Data: momentary contact wired normally open.

Adjustments: none required.

Diagrams: DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (10),
04.5-8055-100 (10).



POT1 ACCEL (Includes FS & RS)

Figure 18997

FU1

Traction Motor Power Fuse

Location: on ACCESS 2 / ACCESS 3.

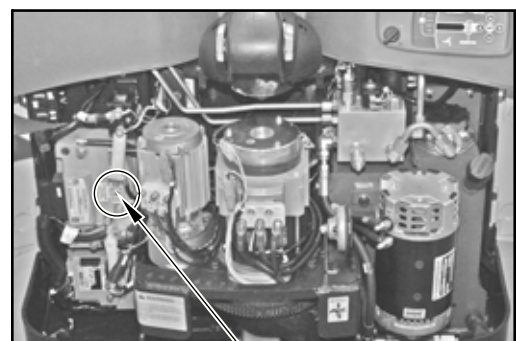
Purpose: protects ACCESS 2 and associated wiring from over current.

Data: 400 A.

Adjustments: none required.

Diagrams: DIA-8055-002 (B-4), DIA-8055-003 (B-3),
DIA-8055-007 (B-2).

Parts Breakdown: 04.1-8055-001 (20).



FU1

Figure 18926

FU2

Main Control Fuse

Location: on control panel bracket inside power unit.

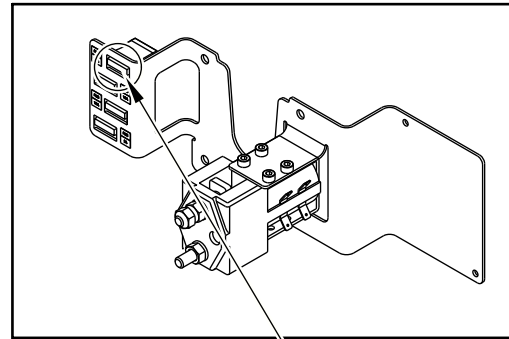
Purpose: protects control circuitry and associated wiring from over current.

Data: 10 A.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-4), DIA-8055-003 (B-3).

Parts Breakdown: 04.1-8055-001 (8).



FU2

Figure 18927

FU3

Hydraulic Motor Power Fuse

Location: on control panel bracket inside power unit.

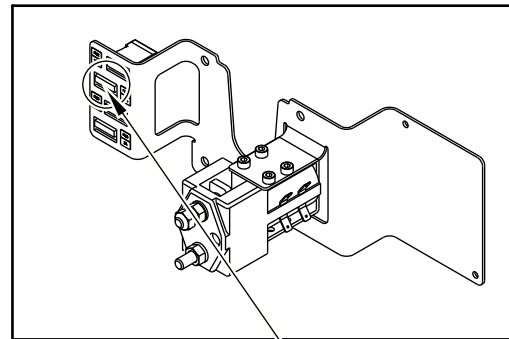
Purpose: protects ACCESS 3 and associated wiring from over current.

Data: 10 A.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-4), DIA-8055-003 (B-3).

Parts Breakdown: 04.1-8055-001 (8).



FU3

Figure 18928

FU4

Steering Pump Motor Power Fuse

Location: on ACCESS 5.

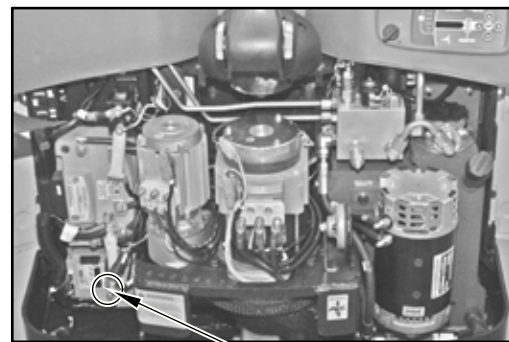
Purpose: protects steering pump motor and associated wiring from over current.

Data: 30 A.

Adjustments: none required.

Diagrams: DIA-8055-003 (B-3), DIA-8055-007 (A-3).

Parts Breakdown: 04.1-8055-001 (23).



FU4

Figure 18929

FU5

Work Assist Option Fuse

Location: on control panel bracket inside power unit.

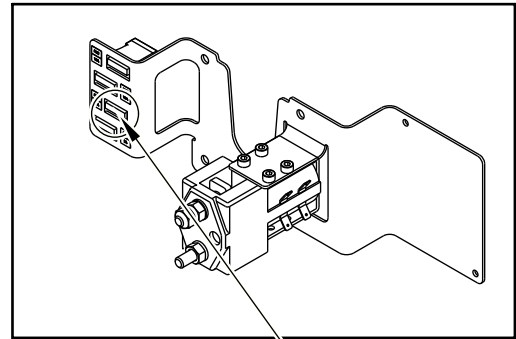
Purpose: protects optional work assist components (i.e. work lights, strobe lights, operator fan) and associated wiring from over current.

Data: 10 A.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-4), DIA-8055-003 (B-3).

Parts Breakdown: 04.1-8055-001 (8).



FU5

Figure 18930

FU6

Freezer/Corrosion Fuse

Location: on control panel bracket inside power unit.

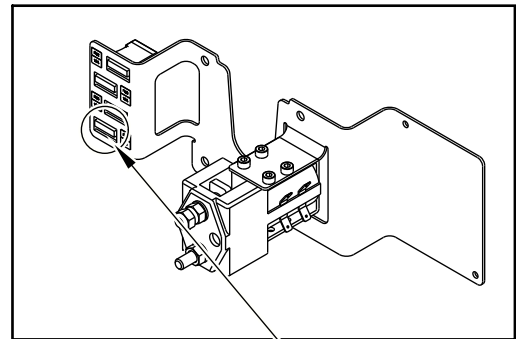
Purpose: protects freezer/corrosion components and associated wiring from over current.

Data: 2 A.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-4), DIA-8055-003 (B-3).

Parts Breakdown: 04.1-8055-001 (8).



FU5

Figure 18931

HN

Horn

Location: on power unit, mounted between traction motor and hydraulic motor.

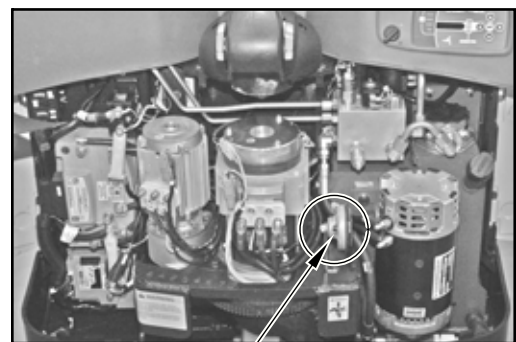
Purpose: audible alarm actuated by driver to warn of truck movement.

Data: information received from operator input via HNS1 or HNS2 on control handle.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-3), DIA-8055-003 (A-2).

Parts Breakdown: 04.0-8055-001 (4).



HN

Figure 19018

HNS1/HNS2

Horn Switch

Location: on control handle.

Purpose: allows operator to sound horn.

Data: wired normally open. Circuit closes and sounds horn when horn switch button on handgrip is depressed.

Adjustments: none required.

Diagrams: DIA-8055-002 (B-1), DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-001 (14, 16), 04.5-8055-001 (14, 16).

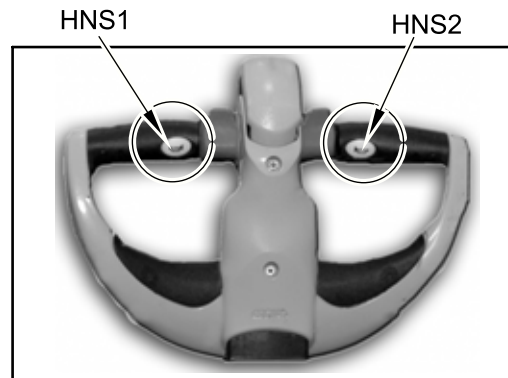


Figure 18989

HSS

High Speed Switch

Location: control handle cap.

Purpose: controls traction speed.

Data: information received from operator input via switches and controls on X10 Handle.

Adjustments: none required.

Diagrams: DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (30), 04.5-8055-100 (30).

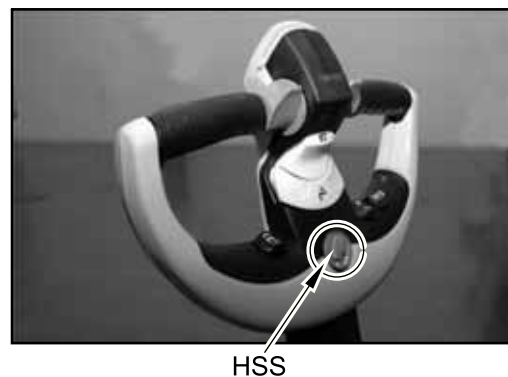


Figure 18938-01

K1

Accessory Relay

Location: on control panel bracket inside power unit.

Purpose: provides power to optional work assist components (i.e. work lights, strobe lights, operator fan).

Adjustments: none required.

Diagrams: DIA-8055-006 (B-3).

Parts Breakdown: 04.1-8055-001 (26).

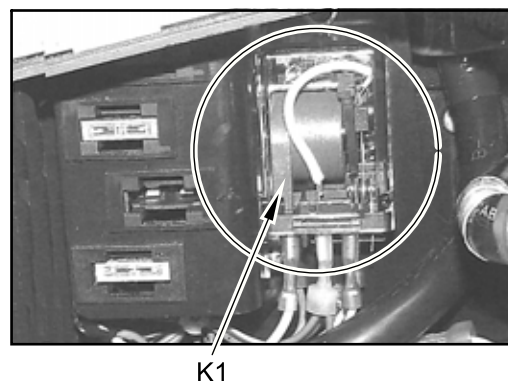


Figure 18990

KYS

Key Switch

Location: ACCESS 1 display panel.

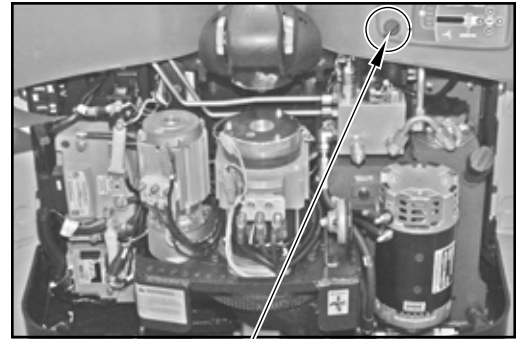
Purpose: allows operator to power truck up and shut truck down.

Data: key operated selector switch, energizes controller circuitry in ignition position.

Adjustments: none required.

Diagrams: DIA-8055-002 (A-4), DIA-8055-003 (A-3).

Parts Breakdown: 04.8-8055-001 (5).



KYS

Figure 18991

L (LINE)

Line Contactor

Location: on control panel.

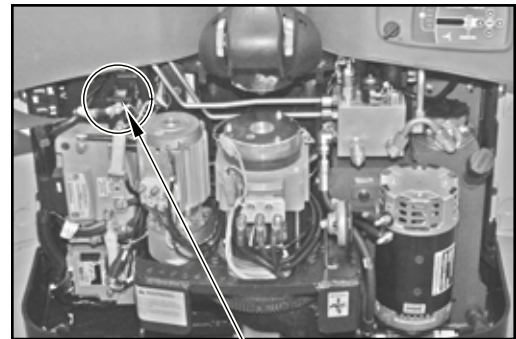
Purpose: provides power to ACCESS 2/ACCESS 3.

Data: 24 volts DC.

Adjustments: none required.

Diagrams: DIA-8055-002 (B-4), DIA-8055-003 (A-2), DIA-8055-007 (A-1).

Parts Breakdown: 04.1-8055-001 (14), 04.4-04.2-020.



LINE

Figure 18932

LGT1/LGT2

Work Lights

Location: on mast.

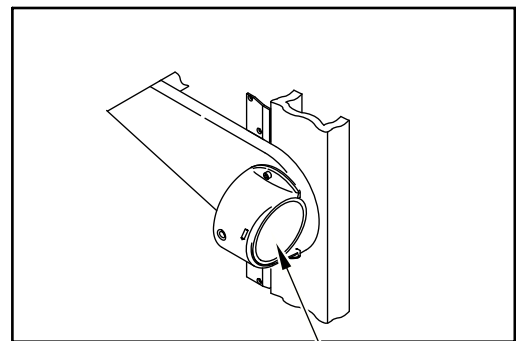
Purpose: provide work area light outside operator compartment.

Data: activated by light switch (LGTSW1) through accessory relay (K1).

Adjustments: none required.

Diagrams: DIA-8055-006 (C-2).

Parts Breakdown: 04.9-8055-050 (4).



LGT1/LGT2

Figure 18933

LGT3

Strobe Light

Location: on mast.

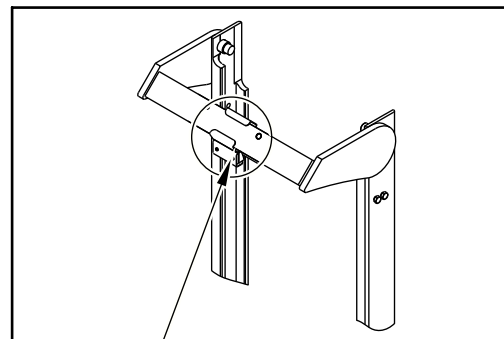
Purpose: visual warning of truck presence.

Data: activated by power supply (PS1) through accessory relay (K1).

Adjustments: none required.

Diagrams: DIA-8055-006 (C-2).

Parts Breakdown: 04.9-8055-001 (1).



LGT3

Figure 18988

LGTSW1

Light Switch

Location: on left side of control panel opposite ACCESS 1.

Purpose: operates optional work light.

Adjustments: none required.

Diagrams: DIA-8055-006 (B-2).



LGTSW1

Figure 19056

LMS1 (SH/SHR Trucks with TL Mast)

Height/Speed Cutback Switch

Location: on mast of TL trucks.

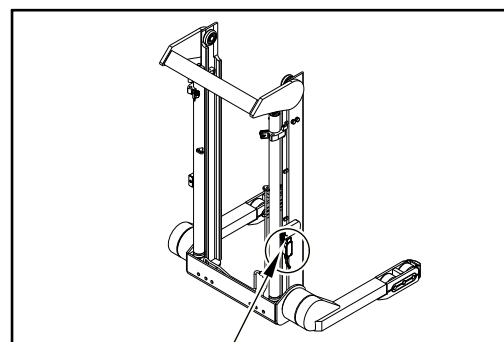
Purpose: reduces maximum travel speed when forks reach a pre-determined height and reduces flow through proportional valve (PV) to reduce lowering speed when forks reach a pre-determined position.

Data: momentary contact switch wired normally open, held closed when mast is in lower positions. Circuit opens when mast is extended to a pre-determined height.

Adjustments: operator adjustments can be made in performance menus to determine desired lift height and speed.

Diagrams: DIA-8055-002 (B-4), DIA-8055-004 (C-2).

Parts Breakdown: 07.1-8055-001 (31).



LMS1 (TL Trucks)

Figure 18992

LMS1 (SH Trucks with TT Mast)

Height/Speed Cutback Switch

Location: on fork carriage.

Purpose: reduces maximum travel speed when forks reach a pre-determined height.

Date: momentary contact switch wired normally open, held closed when mast is in lower positions. Circuit opens when mast is extended to a pre-determined height.

Adjustments: operator adjustments can be made in performance menus to determine desired lift height and speed.

Diagrams: DIA-8055-002 (B-4), DIA-8055-004 (C-2).

Parts Breakdown: location example 07.6-8055-050, part number 123316-012

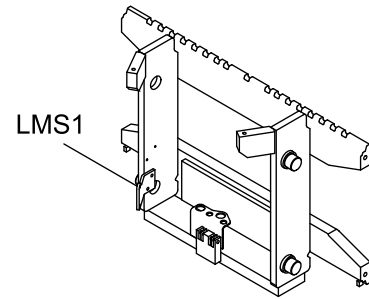


Figure 19635

LMS1 (SHR Trucks with TT Mast)

Height/Speed Cutback Switch

Location: on reach support of TT trucks.

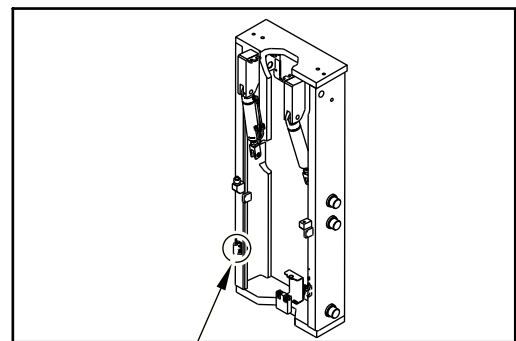
Purpose: reduces maximum travel speed when forks reach a pre-determined height and reduces flow through proportional valve (PV) to reduce lowering speed when forks reach a pre-determined position.

Data: momentary contact switch wired normally open, held closed when mast is in lower positions. Circuit opens when mast is extended to a pre-determined height.

Adjustments: operator adjustments can be made in performance menus to determine desired lift height and speed.

Diagrams: DIA-8055-002 (B-4), DIA-8055-004 (C-2).

Parts Breakdown: 09.0-8055-100 (31).



LMS1

Figure 18993

LMS2

Reach Retract Switch (used only on SHR Trucks)

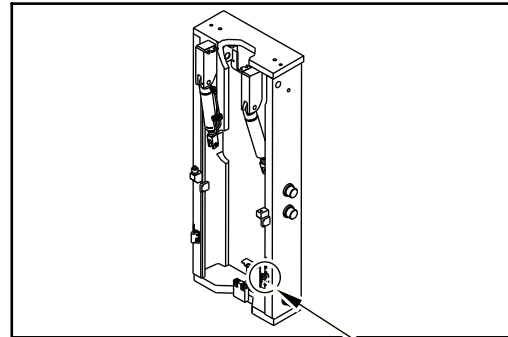
Location: on reach support.

Purpose: detects and controls retract of reach carriage.

Adjustments: operator adjustments can be made in performance menus to determine desired speed.

Diagrams: DIA-8055-002 (A-4), DIA-8055-004 (C-2).

Parts Breakdown: 09.0-8055-100 (7).



LMS2

Figure 18995

LOS1

Lower Switch (Low Speed)

Location: control handle.

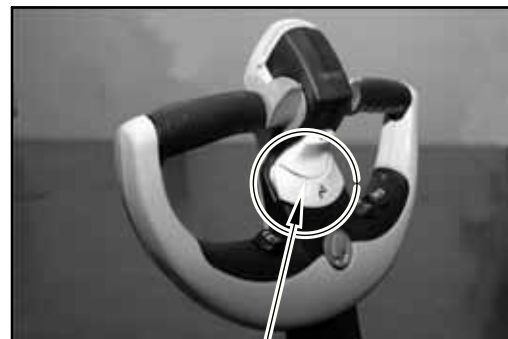
Purpose: signals lower hydraulic function request at low speed.

Data: wired normally closed, held open. When lower button is depressed, switch closes and activates function.

Adjustments: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (31),
04.5-8055-100 (31).



LOS1

Figure 18937

LOS2

Lower Switch (High Speed)

Location: control handle.

Purpose: signals lower hydraulic function request at high speed.

Data: wired normally closed, held open. When lower button is depressed, switch closes and activates function.

Adjustments: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-4255-100 (31),
04.5-8055-100 (31).



LOS2

Figure 19022

M1**Traction Motor**

Location: power unit.

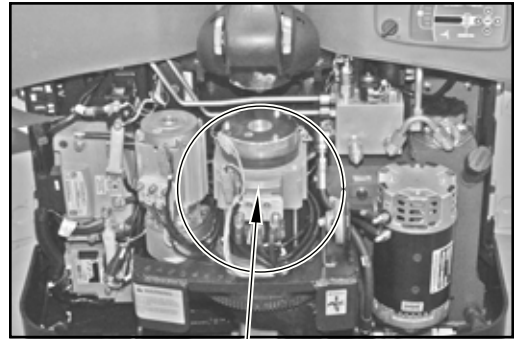
Purpose: provides driving force for traction.

Data: ACCESS 2 (TRACTION) provides speed control via operator input POT 1 ACCEL.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-4), DIA-8055-003 (C-2), DIA-8055-007 (B-2).

Parts Breakdown: 03.1-8055-001.



M1

Figure 18934

M2**Hydraulic Pump Motor**

Location: power unit.

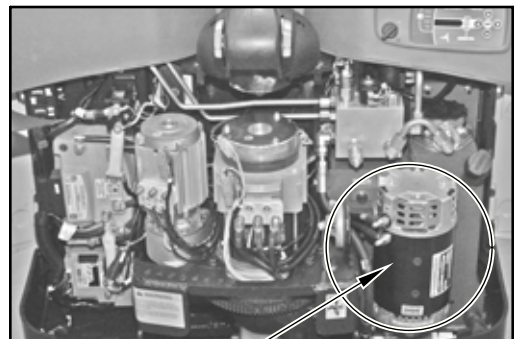
Purpose: provides driving force for hydraulic pump supplying hydraulic oil flow for lift and accessory functions.

Data: ACCESS 3 (HYDRAULIC) from operator input through the X10 Handle via CAN Interface.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-4), DIA-8055-003 (B-3), DIA-8055-007 (B-3).

Parts Breakdown: 02.0-4255-001, 02.0-8055-001.



M2

Figure 18935

M3**Steer Motor**

Location: power unit.

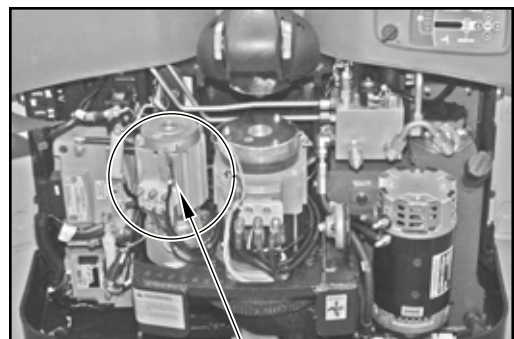
Purpose: provides driving force for steering and brake functions.

Data: ACCESS 5 (EPS ACO) receives information from operator via POT2 (STEER CMD) and provides speed and directional control to steering motor in relation to POT3 (STEER FEEDBACK) and ECR2.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-2), DIA-8055-003 (B-4), DIA-8055-007 (C-2).

Parts Breakdown: 06.2-8055-001.



M3

Figure 18936

Main PCB (X10 Handle)

Main Printed Circuit Board

Location: control handle cap.

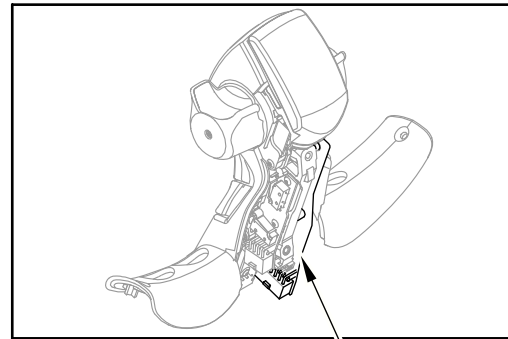
Purpose: provides wireless connections in control handle.

Data: not applicable.

Adjustment: none required.

Diagrams: N/A.

Parts Breakdown: 04.5-4255-100 (35),
04.5-8055-100 (35).



MAIN PCB

Figure 18996

ORS

Override Switch

Location: on tiller knuckle.

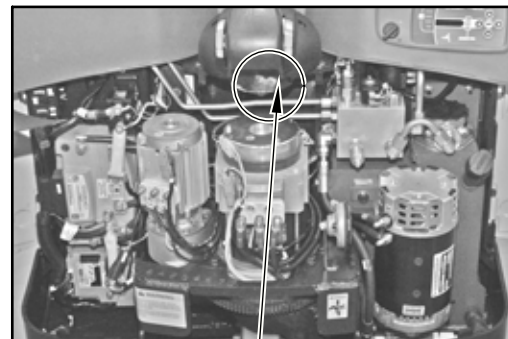
Purpose: signals slow travel range to traction controller.

Data: momentary contact wired normally open. Actuated when control handle is moved to the brake override zone.

Adjustment: none required.

Diagrams: DIA-8055-002 (C-3), DIA-8055-004 (B-3).

Parts Breakdown: 05.0-8055-001 (28).



ORS

Figure 18942-01

POT1 ACCEL

Traction Command

Location: control handle cap.

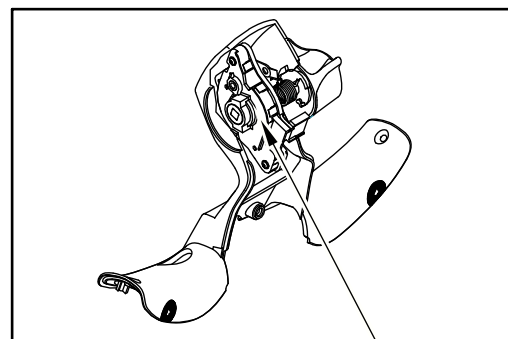
Purpose: translates information received from operator input via thumb wheels on handle to ACCESS 2 to determine speed and direction for traction motor.

Data: approximately 2.5k ohm at full throttle (forward or reverse) and 10 ohms in neutral.

Adjustment: none required.

Diagrams: DIA-8055-005 (C-2).

Parts Breakdown: 03.0-8055-001 (32).



POT1 ACCEL (Includes FS & RS)

Figure 18997

POT1/POT2

Steer Command

Location: in power unit attached to tiller mount.

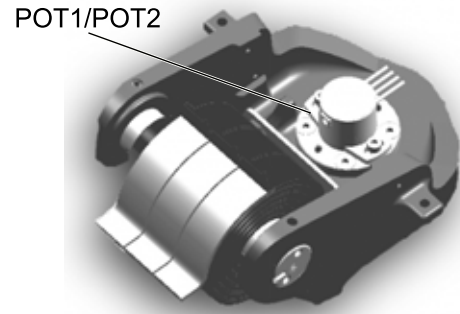
Purpose: dual potentiometer that provides input to traction ACCESS 2 AND ACCESS 3 combination.

Data: N/A.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-2), DIA-8055-004 (B-3).

Parts Breakdown: 05.0-8055-001 (19).



Bottom Side of Tiller Knuckle

Figure 19019

POT3

Steer Feedback Pot

Location: under steer motor flange.

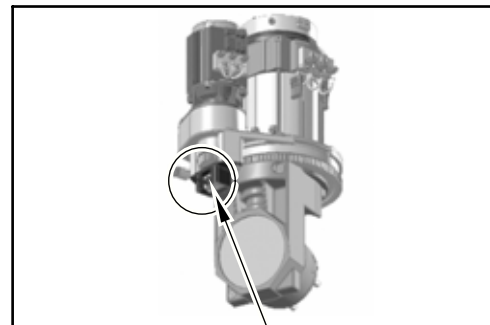
Purpose: works in conjunction with ECR3 to provide feedback to controller to indicate current tiller position.

Data: N/A.

Adjustment: none required.

Diagrams: DIA-8055-002 (A-2), DIA-8055-004 (B-3).

Parts Breakdown: 03.0-8055-001 (32).



POT3

Figure 19020

PS1

Strobe Light Power Supply

Location: on power unit, in front of ACCESS 5.

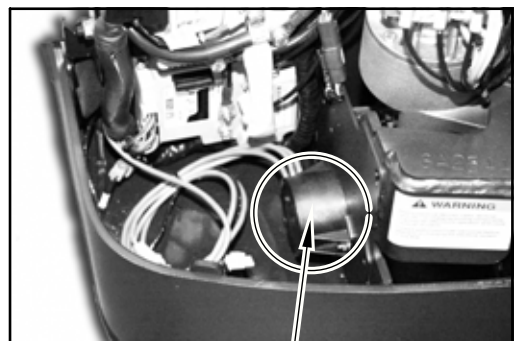
Purpose: powers strobe light.

Data: activated by accessory relay (K1) to supply power to strobe light (LGT3).

Adjustment: none required.

Diagrams: DIA-8055-006 (B-2).

Parts Breakdown: 04.9-8055-001 (12).



PS1

Figure 19011

PV

Proportional Valve

Location: manifold block with and without accessories.

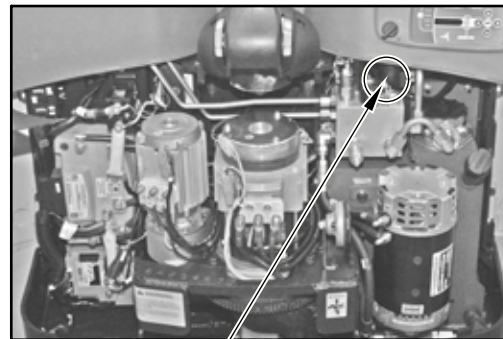
Purpose: controls hydraulic flow to permit lowering.

Data: N/A.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-3), DIA-8055-003 (A-1), DIA-8055-003 (C-2).

Parts Breakdown: 02.4-4255-001 (1), 02.4-8055-001 (1).



PV

Figure 19012

RAS

Raise Switch

Location: on hydraulic pc board in control handle cap.

Purpose: indicates raise hydraulic function request.

Data: wired normally closed, held open. When raise button is depressed, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (31), 04.5-8055-100 (31).



RAS

Figure 19013

RIS

Reach In Switch (on trucks with optional reach function)

Location: control handle cap.

Purpose: indicates reach in request.

Data: wired normally closed, held open. When reach in button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-8055-100 (63).



ROS/RIS

Figure 18940-01

ROS

Reach Out Switch (on trucks with optional reach function)

Location: control handle cap.

Purpose: indicates reach out request.

Data: wired normally closed, held open. When reach out button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-8055-100 (63).



ROS/RIS

Figure 18940-01

RS

Reverse Switch

Location: in control handle cap ACCEL POT1.

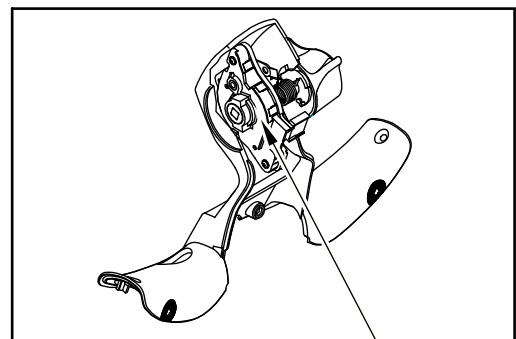
Purpose: provides input to traction controller for reverse travel direction.

Data: momentary contact wired normally open.

Adjustments: none required.

Diagrams: DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (10),
04.5-8055-100 (10).



POT1 ACCEL (Includes FS & RS)

Figure 18997

SAS

Safety Reverse Switch

Location: control handle cap.

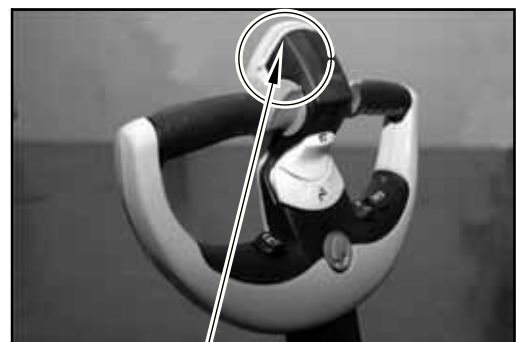
Purpose: moves truck in direction of forks when actuated.

Data: momentary contact switch wired normally open, held closed by button on end of control handle cap.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-1), DIA-8055-005 (C-3).

Parts Breakdown: 04.5-4255-100 (36),
04.5-8055-100 (36).



SAS

Figure 18939-01

SVA1/SVA2

Location: manifold block with accessories.

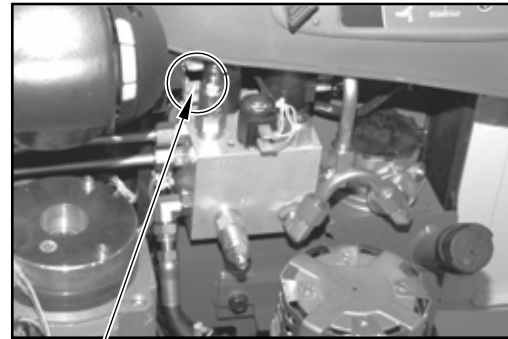
Purpose: selects direction of hydraulic flow for accessory functions.

Data: N/A.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-3), DIA-8055-003 (A-2), DIA-8055-003 (C-2).

Parts Breakdown: 02.4-8055-001 (2).



SVA1/SVA2

Figure 19025

SLS

Sideshift Left Switch (on trucks with optional sideshift function)

Location: control handle cap.

Purpose: indicates sideshift left request.

Data: wired normally closed, held open. When sideshift button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-4255-100 (53), 04.5-8055-100 (54).



SRS/SLS

Figure 19023

SRS

Sideshift Right Switch (on trucks with optional sideshift function)

Location: control handle cap.

Purpose: indicates sideshift right request.

Data: wired normally closed, held open. When sideshift button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-4255-100 (53), 04.5-8055-100 (54).



SRS/SLS

Figure 19023

SVCV

Solenoid Check Valve

Location: on manifold block with accessories.

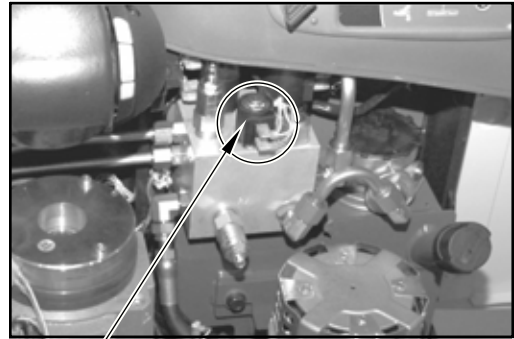
Purpose: prevents back flow of hydraulic fluid to allow proper lift.

Data: N/A.

Adjustment: none required.

Diagrams: DIA-8055-002 (B-3), DIA-8055-003 (A-1).

Parts Breakdown: 02.4-8055-001 (4).



SVCV

Figure 19014

SVR

Reach Solenoid

Location: carriage manifold mounted at base of reach support.

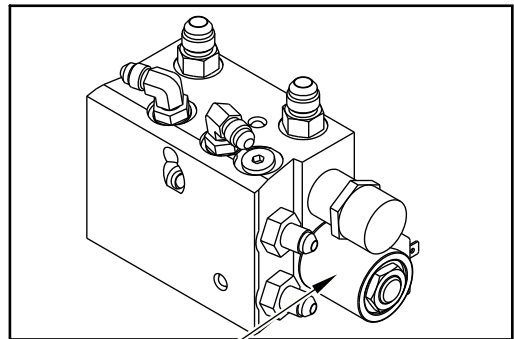
Purpose: provides hydraulic flow path for reach functions selected by operator via ROS or RIS.

Data: coil energized when reach function is selected via ROS or RIS.

Adjustment: none required.

Diagrams: DIA-8055-004 (C-1).

Parts Breakdown: 02.4-8055-050 (7).



SVR

Figure 19015

SVS

Sideshift Solenoid

Location: tilt/sideshifter manifold.

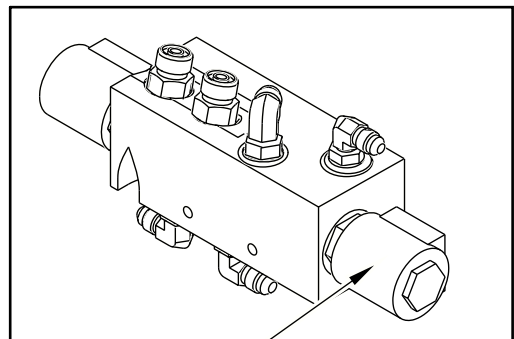
Purpose: provides hydraulic flow path for sideshift functions selected by operator via SLS or SRS.

Data: coil energized when reach function is selected via SLS or SRS.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-004 (C-1).

Parts Breakdown: 02.4-8055-100 (4).



SVS

Figure 19017

SVT

Tilt Solenoid

Location: tilt manifold.

Purpose: provides hydraulic flow path for tilt functions selected by operator via TBS or TDN.

Data: coil energized when reach function is selected via TBS or TDN.

Adjustment: none required.

Diagrams: DIA-8055-004 (C-1).

Parts Breakdown: 02.4-8055-100 (1), 02.4-8055-150 (4).

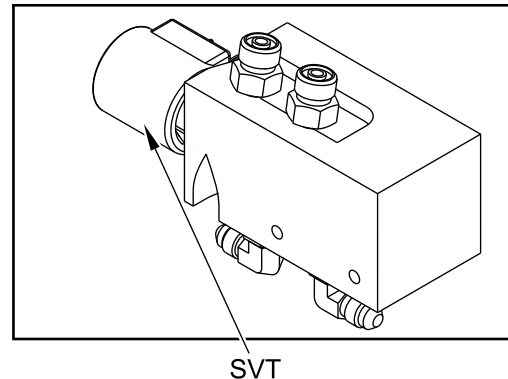


Figure 19016

TBS

Tilt Back Switch (on trucks with optional tilt function)

Location: control handle cap.

Purpose: indicates tilt back request.

Data: wired normally closed, held open. When tilt back button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-8055-100 (72).



TDN/TBS

Figure 19024

TDS

Tilt Down Switch (on trucks with optional tilt function)

Location: control handle cap.

Purpose: indicates tilt down request.

Data: wired normally closed, held open. When tilt down button is depressed in correct direction, switch closes and activates function.

Adjustment: adjustments can be made in performance menus to determine desired pump speed.

Diagrams: DIA-8055-005 (C-4).

Parts Breakdown: 04.5-8055-100 (72).



TDN/TBS

Figure 19024

Metric Torque Values

All Crown trucks are manufactured with class 8.8 or better screws and bolts. The information contained in this section will aid you when replacing any screws and bolts that are necessary when performing maintenance on your lift truck.

Grade




Grade Marking (on Head)	Specification	Material	Bolt and Screw Size (mm)
	Class 5.8	Low Carbon Steel	M5 through M36
	Class 8.8	Medium Carbon Steel Quenched and Tempered	M5 through M36
	Class 10.9	Medium Carbon Alloy Steel Quenched and Tempered	M5 through M36
<p>NOTE: Even though a bolt head is unmarked, Crown uses nothing less than class 8.8 in all of its bolted assemblies. Instances do occur when class 8.8 bolts are manufactured unmarked. When a fastener is replaced that is unmarked, replace the fastener with a class 8.8.</p>			

Figure 15048

LUBRICATION & ADJUSTMENT

Metric Torque Values



Torque Chart - Metric Hex Head Cap Screws and Nuts			
Thread Diameter & Pitch	Tightening Torque Nm (ft lb)		
	Class 8.8	Class 10.9	Class 12.9
M5 x 0.80	5 - 8 (4 - 6)	7 - 8 (5 - 6)	8 - 10 (6 - 7)
M6 x 1.00	8 - 10 (6 - 7)	12 - 14 (9 - 10)	15 - 16 (11 - 12)
M8 x 1.25	20 - 25 (15 - 18)	28 - 31 (21 - 23)	34 - 37 (25 - 27)
M10 x 1.50	39 - 43 (29 - 32)	56 - 61 (41 - 45)	68 - 75 (50 - 54)
M12 x 1.75	71 - 76 (52 - 56)	100 - 107 (73 - 79)	119 - 127 (88 - 94)
M14 x 2.00	113 - 122 (83 - 90)	159 - 171 (117 - 126)	190 - 205 (140 - 151)
M16 x 2.00	175 - 190 (129 - 140)	247 - 267 (182 - 197)	296 - 320 (218 - 236)
M20 x 2.50	340 - 357 (251 - 271)	479 - 518 (353 - 382)	574 - 621 (423 - 458)
M24 x 3.00	587 - 635 (433 - 468)	824 - 892 (608 - 658)	990 - 1071 (730 - 790)
M30 x 3.50	1175 - 1274 (867 - 940)	1654 - 1792 (1220 - 1322)	1985 - 2150 (1464 - 1586)

Note: Torque values called out in the maintenance section of this manual will take precedence over torque values found on this page.

Torque Chart - Metric Hex Socket Countersink Head Screws			
Thread Diameter & Pitch	Tightening Torque Nm (ft lb)		
	Class 8.8	Class 10.9	Class 12.9
M5 x 0.80	4 - 7 (3 - 5)	5 - 8 (4 - 6)	7 - 10 (5 - 7)
M6 x 1.00	7 - 10 (5 - 7)	9 - 12 (7 - 9)	11 - 14 (8 - 10)
M8 x 1.25	16 - 19 (12 - 14)	23 - 26 (17 - 19)	27 - 30 (20 - 22)
M10 x 1.50	31 - 34 (23 - 25)	45 - 49 (33 - 36)	54 - 58 (40 - 43)
M12 x 1.75	56 - 60 (41 - 44)	79 - 84 (58 - 62)	94 - 102 (69 - 75)
M14 x 2.00			
M16 x 2.00	124 - 146 (99 - 108)	190 - 206 (140 - 152)	228 - 247 (168 - 182)
M20 x 2.50	259 - 281 (191 - 207)	363 - 395 (268 - 291)	437 - 473 (322 - 349)
M24 x 3.00	416 - 451 (307 - 333)	586 - 635 (432 - 468)	702 - 762 (518 - 562)
M30 x 3.50			

Note: Torque values called out in the maintenance section of this manual will take precedence over torque values found on this page.

Torque Chart - Metric Socket Head Cap Screws			
Thread Diameter & Pitch	Tightening Torque Nm (ft lb)		
	Class 8.8	Class 10.9	Class 12.9
M5 x 0.80	5 - 8 (4 - 6)	7 - 9 (5 - 7)	8 - 11 (6 - 8)
M6 x 1.00	9 - 12 (7 - 9)	12 - 15 (9 - 11)	15 - 18 (11 - 13)
M8 x 1.25	22 - 24 (16 - 18)	30 - 33 (22 - 24)	35 - 38 (26 - 28)
M10 x 1.50	42 - 45 (31 - 33)	58 - 64 (43 - 47)	71 - 76 (52 - 56)
M12 x 1.75	72 - 77 (53 - 57)	102 - 110 (75 - 81)	122 - 132 (90 - 97)
M14 x 2.00	115 - 125 (85 - 92)	161 - 175 (119 - 129)	194 - 210 (143 - 155)
M16 x 2.00	179 - 194 (132 - 143)	251 - 273 (185 - 201)	301 - 327 (222 - 241)
M20 x 2.50	348 - 377 (257 - 278)	489 - 530 (361 - 391)	588 - 637 (434 - 470)
M24 x 3.00	601 - 651 (443 - 480)	846 - 915 (624 - 675)	1014 - 1098 (748 - 810)
M30 x 3.50	1196 - 1296 (882 - 956)	1681 - 1822 (1240 - 1344)	2017 - 2187 (1488 - 1613)

Note: Torque values called out in the maintenance section of this manual will take precedence over torque values found on this page.

Torque Chart - Metric Flanged Hex Head Cap Screws and Nuts			
Thread Diameter & Pitch	Tightening Torque Nm (ft lb)		
	Class 8.8	Class 10.9	Class 12.9
M5 x 0.80		8 - 11 (6 - 8)	9 - 12 (7 - 9)
M6 x 1.00		14 - 16 (10 - 12)	16 - 19 (12 - 14)
M8 x 1.25		31 - 34 (23 - 25)	38 - 41 (28 - 30)
M10 x 1.50		62 - 68 (46 - 50)	75 - 81 (55 - 60)
M12 x 1.75		108 - 117 (80 - 86)	130 - 141 (96 - 104)
M14 x 2.00		174 - 187 (128 - 138)	209 - 225 (154 - 166)
M16 x 2.00		273 - 294 (201 - 217)	327 - 354 (241 - 2610)
M20 x 2.50			

Note: Torque values called out in the maintenance section of this manual will take precedence over torque values found on this page.

Notes:

Torque Values

All Crown Trucks are manufactured with Grade 5 or better screws and bolts. The information contained in this section will aid you when replacing any screws and bolts that are necessary when performing maintenance on your lift truck.

Grade





Grade Marking (on Head)	Specification	Material	Bolt and Screw Size (Inches)
	SAE - Grade 2	Low Carbon Steel	1/4 thru 1-1/2
	SAE - Grade 5	Medium Carbon Steel, Quenched and Tempered	1/4 thru 1-1/2
 	SAE - Grade 8	Medium Carbon Alloy Steel, Quenched and Tempered	1/4 thru 1-1/2
<p>NOTE: Even though a bolt head is unmarked, Crown uses nothing less than Grade 5 in all of its bolted assemblies. Instances do occur when Grade 5 bolts are manufactured unmarked. When a fastener is replaced that is unmarked, replace the fastener with a Grade 5.</p>			

Figure 14916

LUBRICATION & ADJUSTMENT

Torque Values



Torque Chart						
Bolt Diameter	Grade 5			Grade 8		
	Dry Torque Requirement			Dry Torque Requirement		
in	ft lb	kgm	Nm	ft lb	kgm	Nm
1/4	9 ± 3	1.2 ± .4	12 ± 4	13 ± 4	1.8 ± .5	17.5 ± 5.5
5/16	18 ± 5	2.5 ± .7	24.5 ± 7	25 ± 5	3.5 ± .7	34 ± 7
3/8	32 ± 5	4.4 ± .7	43.5 ± 7	48 ± 10	6.6 ± 1.3	65 ± 13.5
7/16	50 ± 10	6.9 ± 1.4	67.5 ± 13.5	75 ± 10	10.4 ± 1.4	102 ± 13.5
1/2	75 ± 10	10.4 ± 1.4	101.5 ± 13.5	112 ± 15	15.5 ± 2.0	152 ± 20.5
9/16	110 ± 15	15.2 ± 2.0	149 ± 20.5	163 ± 20	22.5 ± 3.0	221 ± 27
5/8	150 ± 20	20.7 ± 2.8	203.5 ± 27	225 ± 30	31.1 ± 4.1	305 ± 41
3/4	265 ± 35	36.6 ± 4.8	359 ± 47.5	400 ± 50	55.2 ± 6.9	542 ± 68
7/8	420 ± 60	58.1 ± 8.3	569 ± 81	640 ± 80	88.3 ± 11.0	868 ± 108
1	640 ± 80	88.5 ± 11.1	868 ± 109	960 ± 115	132.5 ± 15.9	1300 ± 156
1 1/8	800 ± 100	110.6 ± 13.8	1085 ± 136			
1 1/4	1000 ± 120	138 ± 16.6	1356 ± 163			
1 3/8	1200 ± 150	166 ± 20.7	1630 ± 203			
1 1/2	1500 ± 200	207 ± 27.7	2034 ± 271			
Mounting bolt torque requirements involving hydraulic valves.						
5/16	13 ± 2	1.8 ± .3	17.5 ± 2.5			
3/8	24 ± 2	3.3 ± .3	32.5 ± 2.5			
7/16	39 ± 2	5.4 ± .3	53 ± 2.5			
NOTE: Torque values called out in the maintenance section of this manual will take precedence over torque values found on this page.						



HYDRAULIC

Notes:

Hydraulic System

The hydraulic system in your truck is powered by a gear type pump which supplies hydraulic pressure for lift, reach, tilt and any other auxiliary functions with which your truck may be equipped. Maximum pressure for lift, reach and etc. are limited by relief valves.

Following is a general description of the hydraulic system refer to Figure 17404-01, which is typical of current standard trucks. Your truck may vary - see appropriate hydraulic schematic in hydraulic schematic section of this manual.

Hydraulic oil is drawn from reservoir (item a), through suction line, by pump and motor (item d). Pressurized oil from pump enters control valve assembly (item e). The control valve assembly is a multiple spool, closed center, self centering electronically operated valve containing integral relief valves. Adjustable relief valve limits maximum load that can be lifted.

When control switch is in the raise position, the appropriate spool is shifted and oil is directed out of valve and through flow control valve unrestricted. Oil then enters lift cylinder (item f).

SHR 5500

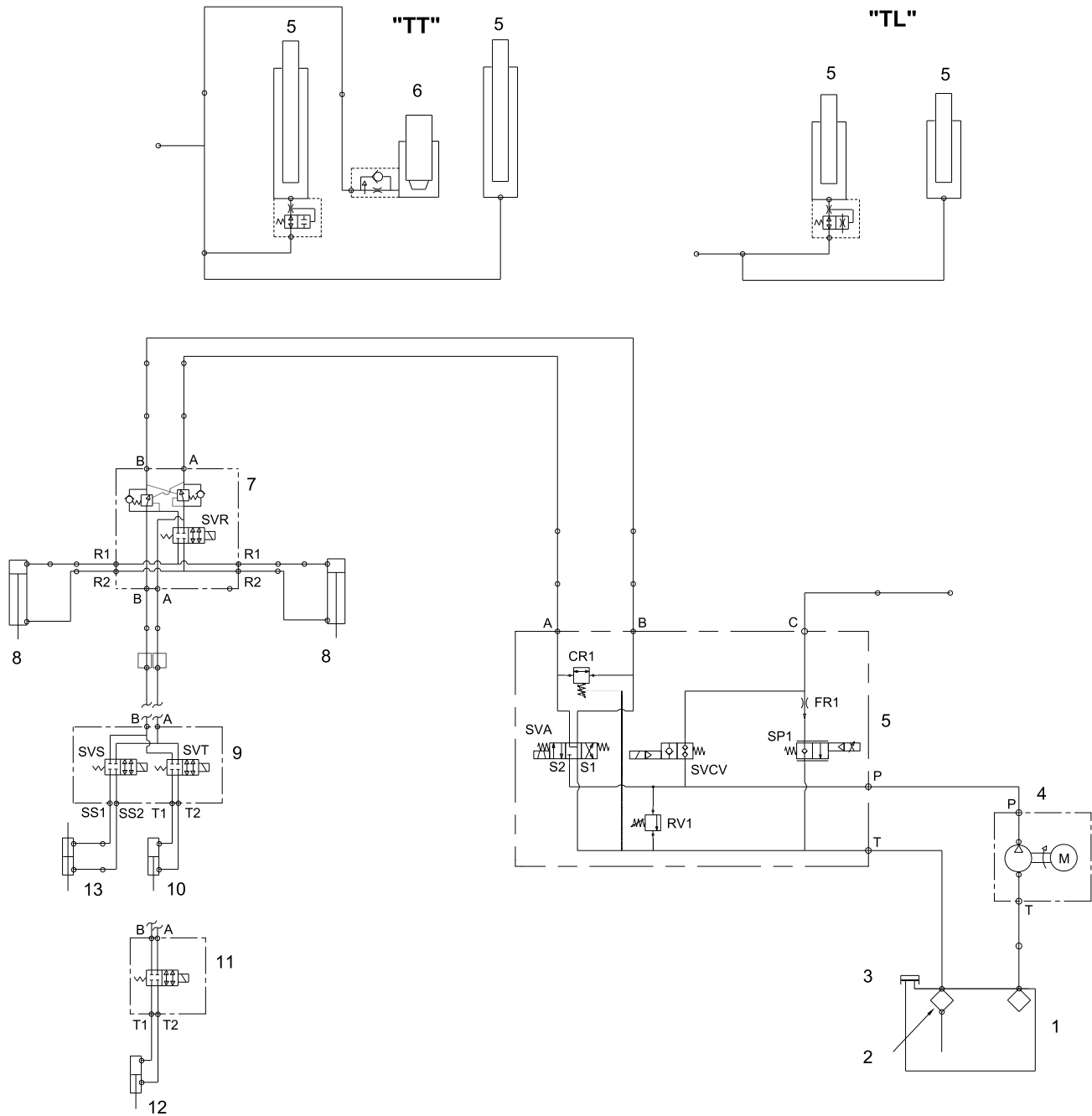


Figure 17404-01

- | | | | |
|---|-----------------|----|------------------------|
| 1 | Reservoir | 7 | Carriage Cylinder |
| 2 | Return Filter | 8 | Reach Manifold Block |
| 3 | Breather | 9 | Reach Cylinder |
| 4 | Motor/Pump Unit | 10 | Tilt/SS Manifold Block |
| 5 | Manifold Block | 11 | Tilt Cylinder |
| 6 | Lift Cylinder | 12 | Tilt Manifold Block |
| | | 13 | Side Shift Cylinder |

When the control switch is positioned for lowering, PWM controlled proportional valve SP1 is opened by Access 3, allowing oil in the cylinder to return to reservoir. Oil is directed back through flow control valve FR1, which restricts flow to lowering valve SP1 and meters oil to reservoir, controlling cylinders rate of descent.

To activate reach cylinders (item i), spool SVA (S1 or S2 depending on direction) is activated by Access 3, and SVR is activated by Access 3. Oil is directed through counterbalance valve (item h). Oil travels to the reach cylinders (item i) located on the reach support.

To activate tilt cylinder (item k), spool SVA (S1 or S2 depending on direction) is activated by Access 3, and SVR & SVT are activated by Access 3. Oil is directed through counterbalance valve (item h) and auxiliary valve (item l). Oil travels to the tilt cylinder (item k) located on the reach box.

Truck is equipped with X-10 handle containing all hydraulic control switches. When the raise or lower switch is pressed Access 7 relays instruction via CAN message to Access 3. Appropriate spools are activated to achieve requested function.

Reservoir

With all cylinders in retracted position and after all air has been bled from hydraulic system, oil in reservoir (2) should be mid way between the minimum and maximum level notches on the dipstick (1). Total capacity of the hydraulic system at this level should be 12 liters (3.2 gal). Refer to Figure 19297.

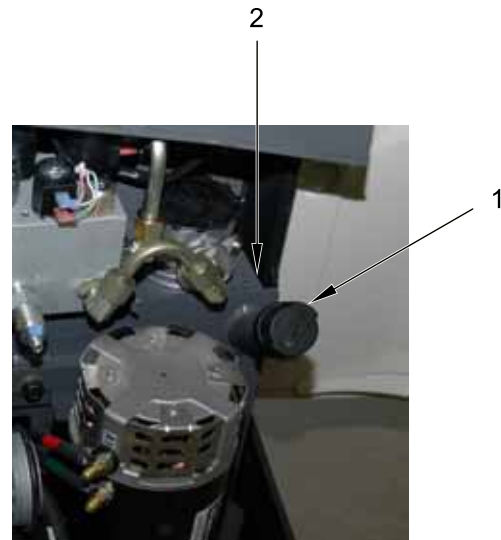


Figure 19297

Hydraulic Lines and Fittings

Blow air through all hoses and lines to remove loose particles before installing. Any rubber hose with wire braid inner construction and any steel tube lines which have been collapsed or kinked are permanently damaged and must be replaced even if the damage is not externally visible.

Flexible hose shall be replaced if it collapses in its normal operating position.

All hoses and lines are to be clear of any surface or edge which can cause damaging wear, cuts or on which they become caught.

All connections are to be leak free.

Beaded elbows in suction ports of all pumps must be positioned such that suction hose retains its full volume flow, and does not collapse.

NOTE

Should a leak develop in one of the hydraulic lines, oil reservoir can be unbolted and moved without disconnecting hydraulic hose line. Reservoir will slide out of the way and provide access to hydraulic components.

Hydraulic Oils

Use only a good grade of hydraulic oil such as those mentioned in "Lubrication" section of this manual. On trucks equipped to operate in below freezing temperatures, "low-temp" oil should be used.

NOTE

Do not use hydraulic brake fluid.

Drift Test

All drift tests should be conducted with a capacity load (refer to truck serial plate for the rated capacity). Material used for test load must be evenly stacked within limits of a four foot square pallet and must be secured to fork carriage with forks spread to their maximum width.

NOTE

Lift measurement is to be taken from tip of the fork to floor.



WARNING

Never stand or work under a suspended load.

Lift Drift Test

Elevate test load approximately 600 mm (24.0 in) and shut off truck. After five minutes, measure distance forks have drifted. Drifting in excess of 63.5 mm (2.5 in) is considered unacceptable. Five minute duration of this test is necessary due to centering time required for control valve spool.

Occasionally, a slight creep of fork assembly may occur due to internal leakage in the check or control valve. To seat these valves properly when this occurs, raise and lower forks to flush out any foreign material from valve seat. A thorough check for leaks in the system should be conducted if abnormal oil losses occur.

Tilt Test

The maximum allowable fork tilt drift on trucks equipped with a tilting carriage is 12.7 mm (0.5 in).

In five minutes. Measurement is taken at 600 mm (24.0 in) load center.

Occasionally, a slight creep of fork assembly may occur due to internal leakage in piston pack, but it can also be caused by leakage in check or control valve. To seat these valves properly when this occurs, raise and lower forks to flush out any foreign material from valve seat.

A thorough check for leaks in system should be conducted if abnormal oil losses occur. Hydraulic system is designed to eliminate mechanical damage even if fittings become loose.

Hydraulic Schematic Symbols


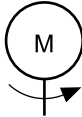


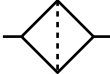
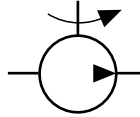

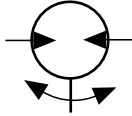


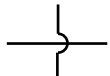

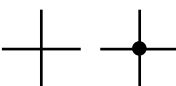

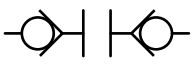


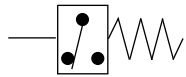
	VENTED RESERVOIR with lines above fluid level		ELECTRIC MOTOR unidirectional single speed
	VENTED RESERVOIR with lines below fluid level		ELECTRIC MOTOR unidirectional variable speed
	FILTER or STRAINER		HYDRAULIC PUMP fixed displacement unidirectional
	HYDRAULIC LINE with full flow (plumbing - may be tubing, hose, or flow passage in manifold)		HYDRAULIC MOTOR bi-directional
	PILOT or DRAIN LINE limited flow		GAUGE pressure
	LINES CROSSING		GAUGE temperature
	LINES CONNECTED		ACCUMULATOR gas charged diaphragm type
	QUICK DISCONNECT (disconnected)		PLUGGED PORT (test port)
	FLOW METER		

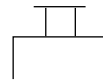
Figure 3559-03

HYDRAULIC

Hydraulic Schematic Symbols



PRESSURE SWITCH



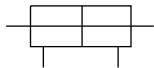
ACTUATOR MANUAL



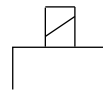
CYLINDER
double acting unequal area



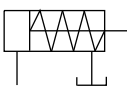
SPRING
(bias to normal
de-energized position)



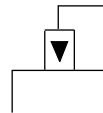
CYLINDER
double acting equal area
(steer) (double end)



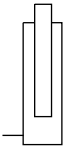
SOLENOID
single coil or winding



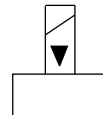
CYLINDER
single acting spring returned
(rod end vented)



HYDRAULIC PILOT
OPERATED



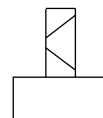
CYLINDER
single acting ram type



SOLENOID
pilot operated



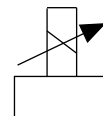
CYLINDER
single acting with cushion



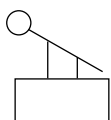
SOLENOID DUAL



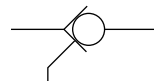
COMPONENT ENCLOSURE
manifold block



SOLENOID PROPORTIONAL

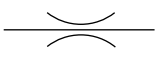


ACTUATOR MANUAL LEVER

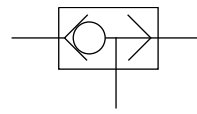


VALVE PILOT CHECK
(pilot to open)

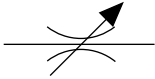
Figure 3560-03



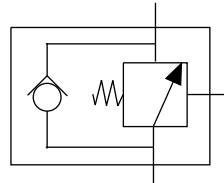
ORIFICE THROTTLE
 fixed



VALVE SHUTTLE



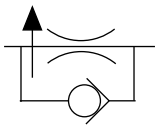
ORIFICE THROTTLE
 adjustable



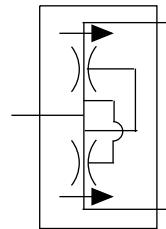
VALVE
 SINGLE COUNTERBALANCE
 in manifold



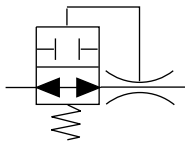
FLOW CONTROL
 PRESSURE COMPENSATED
 fixed



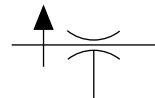
FLOW CONTROL
 PRESSURE COMPENSATED
 fixed with reverse flow bypass



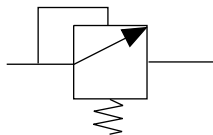
FLOW DIVIDER/COMBINER



FUSE VELOCITY



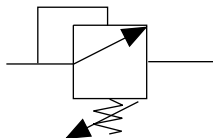
BYPASS FLOW CONTROL
 regulated flow
 pressure compensated



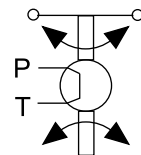
VALVE RELIEF
 fixed setting



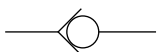
VALVE MANUAL SHUTOFF



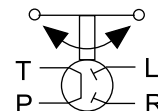
VALVE RELIEF
 adjustable



TORQUE GENERATOR

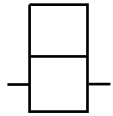


VALVE CHECK

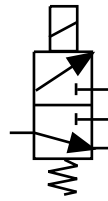


STEER UNIT
 hydrostatic

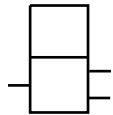
Figure 3561-03



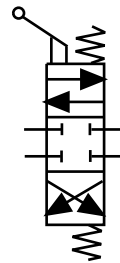
VALVE
2 way 2 position



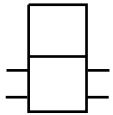
VALVE
3 way 2 position
spring bias, solenoid control



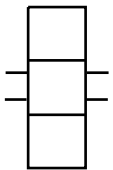
VALVE
3 way 2 position



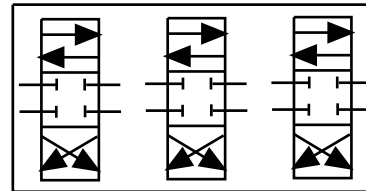
VALVE
4 way 3 position
dual spring centered,
manual lever control



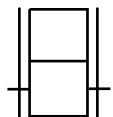
VALVE
4 way 2 position



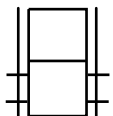
VALVE
4 way 3 position



NOTE: The type of valve depends on the number of spools found in the component enclosure (Triple spool valve shown)



VALVE
2 way infinite positions



VALVE
4 way infinite positions

Figure 3562-03

Hydraulic Pump

 **WARNING**

Avoid accidents by:

- Switching off truck.
- Disconnecting battery.
- Preventing the truck from being switched on, refer to Lockout/Tagout.
- Lift the truck and preventing it from rolling, refer to Lifting and Blocking.
- Refer to Safety for further instructions.

 **WARNING**

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand. Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury. When maintenance is to be performed on the hydraulic system, to make sure the hydraulic system is not under pressure.

Refer to Figure 16535 for the following procedures.

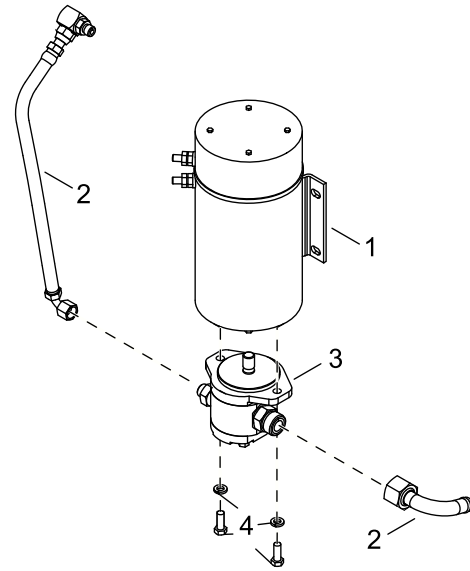


Figure 16535

Remove Hydraulic Pump

1. Lower the platform and forks.
2. Switch off truck and disconnect battery.
3. Prevent truck from being switched on again or rolling away; refer to Lockout/Tagout for procedures.
4. Relieve pressure from the hydraulic system.
5. Disconnect the hydraulic lines (2) from the pump (3).
6. Seal all open ports with plugs.
7. Remove the screws and flatwashers (4) from the pump (3).
8. Remove the pump from the hydraulic motor (1).

Assemble Hydraulic Pump

1. Clean all mating surfaces.
2. Install the pump (3) to the hydraulic motor using the screws and flatwashers (4), torque to 40 Nm (30.0 ft lb).
3. Remove plugs from all ports.

NOTE

Make sure not to allow any foreign material to enter the open ports.

4. Connect the hydraulic lines (2) to the pump (3) and bleed the hydraulic system.
5. Add hydraulic fluid to the maximum level in the reservoir; refer to Lubrication and Adjustment for recommended grade of fluid.
6. Check all hydraulic connection for leaks.
7. Make sure all filters, where applicable, are installed.
8. Remove all Lockout/Tagout devices.
9. Connect the battery.



WARNING

Never stand underneath a raised and unsecured fork carriage. The fork carriage can automatically lower and result in fatal injury. Use suitable hardwood blocks to prevent the raised fork carriage from lowering. Refer to Lifting and Blocking.

10. Slowly extend the lift cylinder until just before maximum height.
11. Slowly open the fork carriage bleed screw and collect the fluid.
12. Activate lifting until a steady stream of hydraulic liquid emerges from the bleed screw.
13. Tighten the bleed screw securely.
14. Clean all contaminated areas with cleaning solvent.
15. Retract and lower the fork carriage and lift cylinder.
16. Add hydraulic fluid to the maximum level in the reservoir.
17. Raise and lower the fork carriage rapidly for a minimum of 10 cycles, while checking the operation.
18. When the fork carriage is raised inspect for leaks.

Hydraulic Lift Pump Motor

Maintenance Instructions



WARNING

Health Risk. Observe the manufacturer's safety instructions when handling solvents and lubricants.



WARNING

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand. Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury. When maintenance is to be performed on the hydraulic system, to make sure the hydraulic system is not under pressure.

Refer to Figure 16534 for the following procedures.

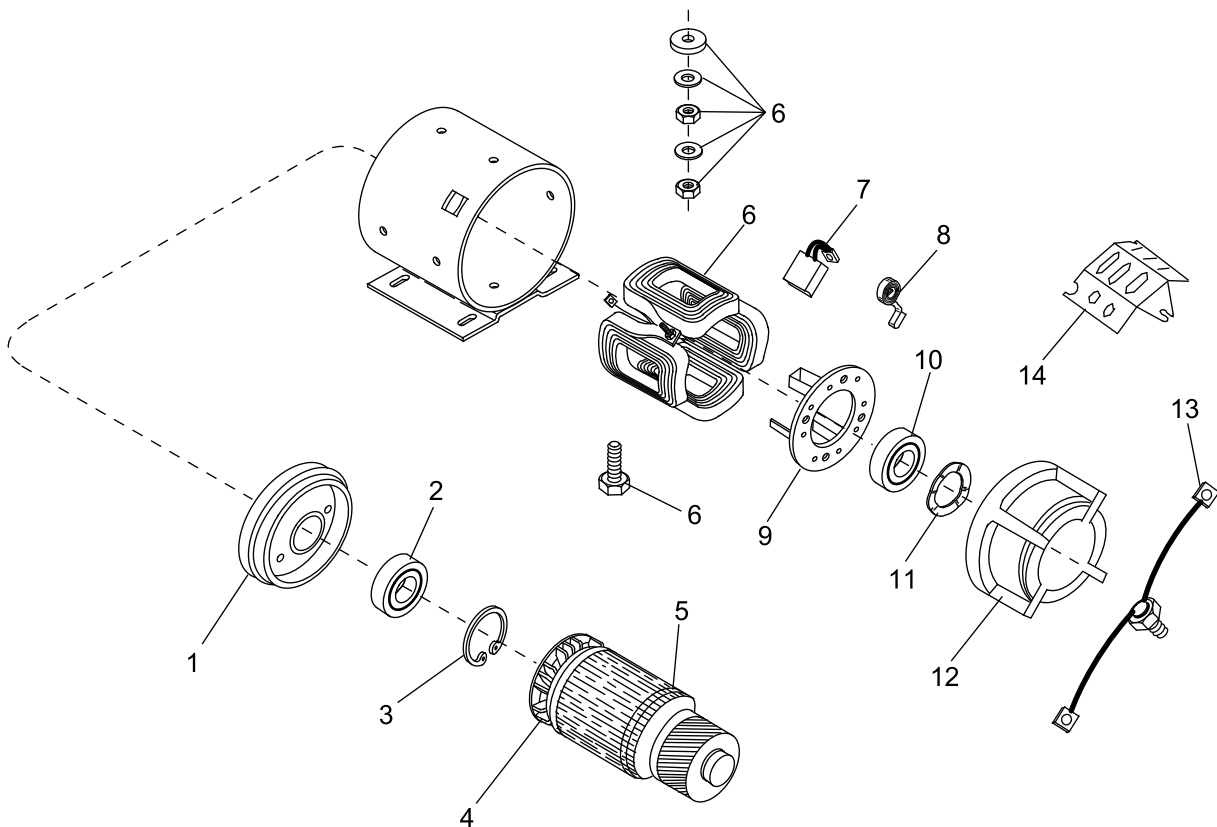


Figure 16534

1. Switch off the truck and disconnect the battery.
2. Prevent the truck from being switched on again and rolling away. Refer to Lockout/Tagout for safety procedure.
3. Remove the lift pump motor endhead commutator cap (12).

NOTE

If oil or grease is found in the endhead commutator cap (12), (usually a paste consisting of oil, oil vapor, dust and carbon particles), immediately remove the cause and clean the motor thoroughly. Oil or grease burns in the brush sparks and leaves behind a highly abrasive oil ash which can very quickly destroy the armature and the brushes.

4. Remove the wavy washer (11) and bearing (10), inspect for wear.
5. Apply dry compressed air to the motor.
6. Remove and check the carbon brushes (7), brush springs (8) and brush box (9), inspect for wear. If one or more brushes need to be replaced, replace all brushes at the same time. In addition to the brushes the pressure springs must also be replaced to ensure correct pressure. Clean the brush cover plate.

NOTE

If a brush (7) is too short the spring (8) will lie on the brush support and there will be no pressure. The brush will spark during operation, burning the armature with consequential damage. The length of the shortest brush will determine whether the brush set requires replacement. The brushes should be replaced even if they have not worn down to the minimum length. Their remaining useful life could be much shorter than the time until the next inspection. Loose brush connections are a clear sign of motor overload. In this case inspect the field coil for burning and repair or replace as necessary.

The brushes (7) must be able to move freely in the brush support (without spring tension) without tilting. Never modify the brushes if one or more can not move freely. In this case replace all of the brushes as they will probably have been thermally overloaded. Thermal overloading causes the brushes to swell up. Brushes which jam in the brush support (9) produce intense sparking and damage will occur.

Length of new carbon brush: 20 mm (0.8 in)

Wear limit is 10 mm (0.4 in)

7. Inspect the armature (5). Check the armature for unevenness, burning, grooves and cracking of the multi-plate edges. Turn the armature if necessary. A non-oily, evenly distributed layer on the brush surfaces is normal.

NOTE

New armatures have 40 mm (1.57 in) diameter. Wear limit is 38.3 mm (1.50 in) diameter.

Replace it if the wear limit has been reached.

Assemble Lift Pump Motor

1. Install the carbon brushes (7), brush springs (8) and brush box (9).

NOTE

Be sure all brushes (7) contact the armature (5) with the same pressure. When installing the brush be sure to place the spring gently on the brush. If the contact is too hard the brush will be damaged. New brushes must be run with a medium load in the first hours. Never fully charge the motor at first operation.

2. Install the bearing (10) and wavy washer (11).
3. Install the lift pump motor bearing endhead commutator cap (2).
4. Remove Lockout/Tagout and blocking devices, refer to Control of Hazardous Energy.
5. Connect battery.
6. Test truck.

Lift/Lower Control Valve

Relief Valve (RV) Operation

The lift and tilt circuit is protected from excessive oil pressure by RV. RV senses pressure at valve inlet. If pressure within system exceeds RV maximum preset level, RV will open and relieve pressure by directing oil to reservoir.

Relief Valve (RVA) Operation

The 1st and 2nd accessory circuit maximum operating pressure is limited by RVA. RVA senses pressure in the 1st and 2nd accessory at valve inlet. If pressure within either circuit exceeds RVA maximum preset level, it will open and relieve pressure by directing oil to reservoir. When the 1st and 2nd accessory are operating at different pressures, the higher of the two pressures is sensed by RVA.

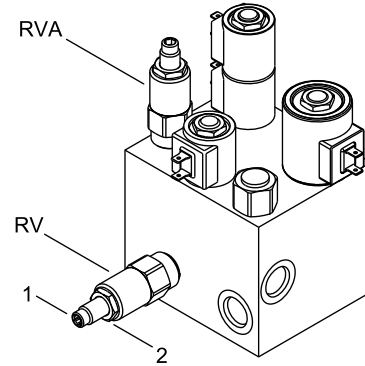


Figure 19143

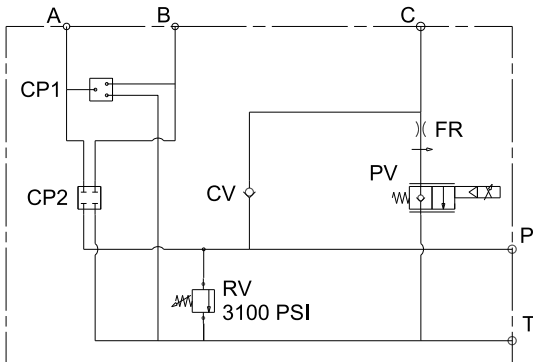
- 1 Adjusting Screw
- 2 Jam Nut

Adjustment

To adjust RV or RVA, refer to Figure 19143 and proceed as follows:

1. Connect a 0-35 MPa (0-5000 psi) pressure gauge to test port (Quick Disconnect).
2. A fully charged battery of correct voltage should be installed in truck before making relief valve adjustments.
3. Operate hydraulic system until oil temperature is between 37° and 54° C (100° and 130° F).
4. Loosen jam nut (2) so RV can be adjusted.
5. Raise fork carriage until it stops and hold the control lever in the RAISE position. Check the pressure gauge when the relief valve opens.
6. Refer to Chart 1 - Pressure Settings for correct pressure setting. Turn the adjustment screw (a) to change the setting.
7. Tighten jam nut (2) when adjustment is correct.
8. Lower platform 150 - 300 mm (6 - 12 in). Recheck relief valve setting and readjust if necessary.
9. Apply security sealant to threads of the adjustment screw (1) threads.
10. If adjustment is being made to RVA, follow the same procedure except activate accessory instead of raising fork carriage.

Circuit without Accessories



Circuit with Accessories

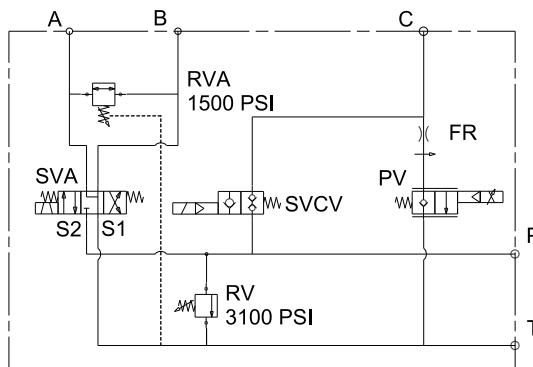


Figure 19130

Chart 1 - Pressure Settings		
Valve	Set Pressure (MPa)	Set Pressure (psi)
RV	21.37 MPa	3100 psi
RVA	10.34 MPa	1500 psi

Chart 2 - Troubleshooting		
Symptom	Probable Cause	Possible Solution
Oil leaks around manifold.	Defective o-rings in cartridge valve or port connector fittings.	Replace o-rings.
Platform will not raise (pump[s] runs).	Relief valve stuck in the open position. Solenoid valves or manual valve stuck in the open (free flow) position.	Replace relief valve. Actuate the valve(s) and try to dislodge the debris. Check to see that the valve (solenoid only) is not over-tightened. If neither of the above remedies work, replace valve.
No low speed raise; high speed raise works properly.	Check valve stuck in the open position.	Actuate lift button several times to try and dislodge debris. If that doesn't work, replace check valve.
Platform will not raise capacity load.	Relief valve not adjusted correctly.	Re-adjust relief valve in accordance with Chart 1 - Pressure Settings.
Platform drifts down in excess of drift test.	Defective o-rings on check valves, solenoid valves, manual valve or relief valve. Debris caught in check valve seats. Manual valve not closed properly.	Replace o-rings or back-up rings. Check valve capacity at o-ring sealing area for nicks or rough surfaces. Actuate the valve(s) and try to dislodge the debris. If that doesn't work, replace valve. Close manual valve or replace.
Platform will not lower.	Solenoid coil failure. Cylinder malfunction. Electrical malfunction.	Replace solenoid coil. Refer to Cylinders. Refer to Electrical.



DRIVE UNIT

Notes:

Drive Unit

Drive Unit Inspection

The unit is totally enclosed and oil filled to give maximum lubrication to the bearings and gears. Before attempting to replace the drive tire or remove the drive unit, perform a visual and physical inspection of the following:

- Inspect the drive unit for leaks.
- Inspect the fill-plug, drain-plug, breather-plug and level check-plugs for leaks.
- Check the drive unit for proper oil level.
- Physically check torque valves on the drive wheels.

Drive Unit Lubrication



WARNING

Observe the manufacturer's Safety instructions when handling solvents and lubricants.

NOTE

The oil should reach operating temperatures before changing. This will ensure that it will flow away quickly and any contamination is kept in suspension. Refer to Lubrication and Adjustment for oil change intervals and recommended oil grades. The drive unit has a capacity of approximately 2.0 l (0.5 gal) of oil. The refill plug can only be accessed if the truck is raised. Therefore a lifting device with sufficient capacity must be used to raise the truck.



WARNING

Wear appropriate items, such as safety glasses and steel-toe shoes whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points. In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

NOTE

Before working under a raised truck refer to Lifting and Blocking Procedures in Control of Hazardous Energy.

1. Power up the truck and turn the drive wheel so the refill plug (1) and the drain plug (2) on the drive unit are accessible, refer to Figure 18870.

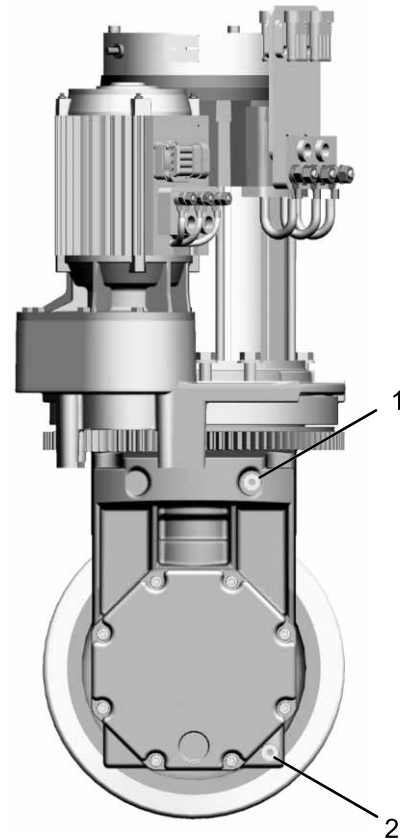


Figure 18870

2. Turn the truck off, disconnect the truck battery to prevent the truck from being switched on. Refer to Control of Hazardous Energy Lockout/Tagout.
3. Place a flat tray with a minimum capacity of 2.0 l (0.5 gal) underneath to collect the used oil.
4. Remove the oil drain plug (2) and collect the oil.
5. Dispose of the used oil in accordance with environmental and local regulations.
6. Clean the drain plug (2), screw it in securely.
7. Add 80W-90 gear oil to the recommended level. Capacity is approximately 2.0 l (0.5 gal). Refer to Lubrication and Adjustment.

DRIVE UNIT

Drive Unit



8. Clean the refill plug and screw it in securely.
9. Lower the truck onto blocking material.
10. Remove the lifting device from the truck.
11. Lubricate the steering gear teeth with recommended lubricant. Refer to Lubrication and Adjustment.
12. Test the truck.

10. Torque the lug nuts in a crossing sequence, refer to Figure 18871. This is a step torque procedure. Perform as follows:

- First torque value 27 - 41 Nm (20 - 30 ft lb) to seat nuts.
- Second torque value 81 - 95 Nm (60 - 70 ft lb).
- Final torque values 122 - 135 Nm (90 - 100 ft lb).

Drive Tire Replacement

When replacing the drive tire, make sure the composition and size are such that maneuverability, capacity and braking are maintained. The drive tire is a "press-on" type. Press the existing tire off the hub and press on the replacement tire. The outside of the hub must be pressed flush with the outside edge of the tire. It is recommended that both drive tires be replaced at the same time to maintain equal tire circumference.



WARNING

Refer to Control of Hazardous Energy Lockout/Tagout before attempting lifting and blocking procedures.

1. Move the truck to a non-traffic maintenance area with a level floor. Lower the forks and chock load wheels. Disconnect the battery.
2. Lift and block truck so drive tire just clears floor.
3. Remove the five lug nuts and drive tire from the unit.
4. Press existing tire off the hub.
5. Inspect hub for any damage and replace if necessary.
6. Remove any paint that may be present on tapered lug seats or on inner hub face that contacts the truck axle.
7. Make sure the replacement drive tire being installed is of the correct composition and size. The incorrect type of tire can affect maneuverability and braking requirements of the truck. Refer to Drive Unit parts for tire part number selection.
8. Press replacement tire onto the hub. The outside of the hub must be pressed flush with the outside edge of the tire.
9. Install the tire on the truck and finger tighten the lug nuts.

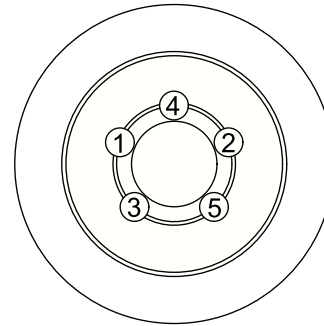


Figure 18871

11. Raise truck and remove blocking material from under truck and lower to the floor.
12. Connect the battery and verify truck operation.

Drive Unit Components

The drive unit consists of several components. A steering assembly with a steering gearbox and servo motor is incorporated via an intermediate flange. The drive unit components include the following, refer to Figure 19163:

- Brake (1)
- Steering motor (2)
- Steering assembly (3)
- Drive unit (4)
- Drive wheel (5)
- Traction motor (6)

If the drive unit is to remain in the truck, the following components can be removed and installed:

- Brake, refer to Brake Maintenance.
- Traction motor, refer to Drive Unit Maintenance.
- Steering assembly, refer to Steering Maintenance.
- Drive wheel, refer to Drive Unit Maintenance.
- Shaft seal of the shaft on which the drive wheel is attached, refer to Drive Unit Maintenance.

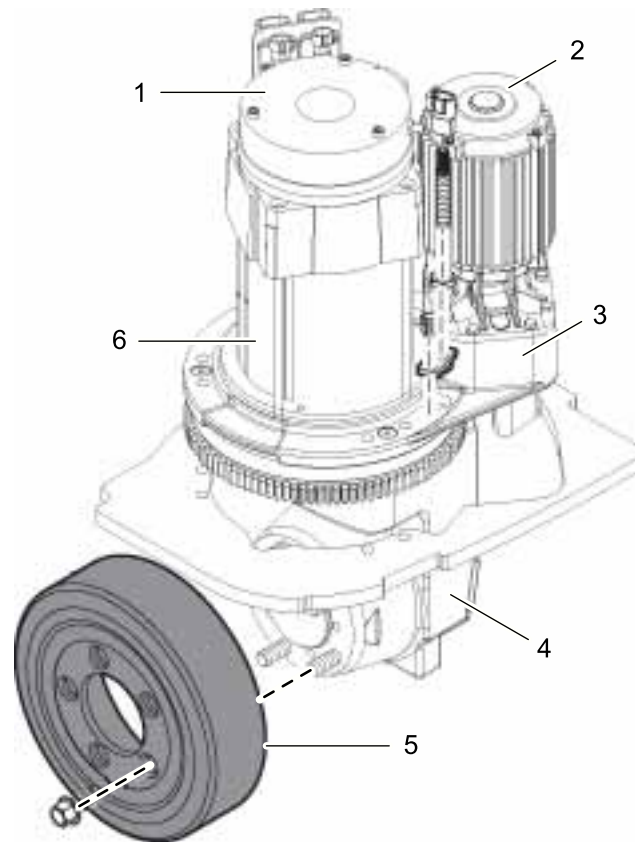


Figure 19163

Drive Unit Removal



WARNING

Wear appropriate items, such as safety glasses and steel-toe shoes whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove the battery from the truck, disconnect tilt cylinders from the mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing the above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

NOTE

Refer to Figures 19160 and 18870 for the following procedures.

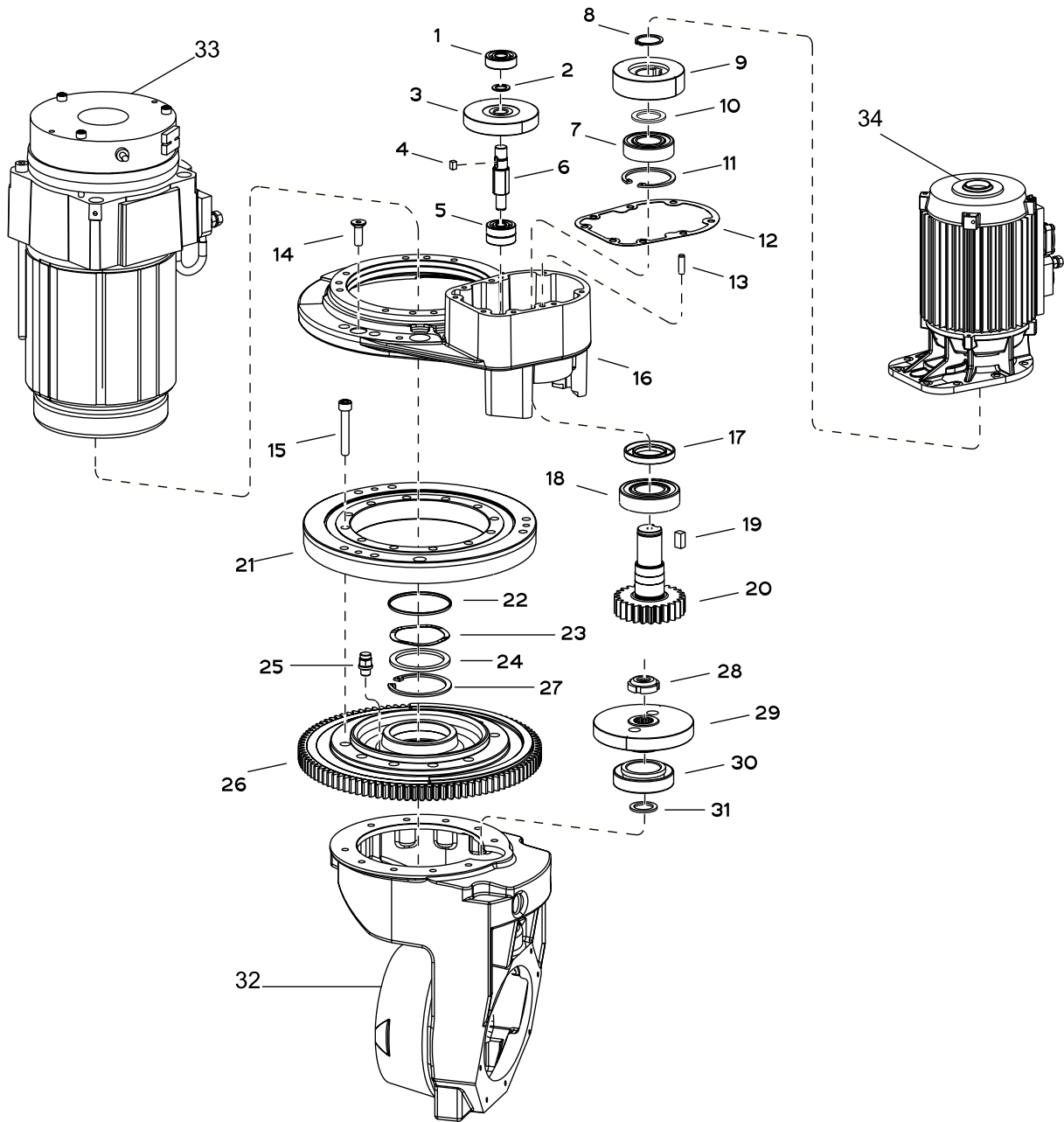


Figure 19160

1. Move the truck to a non-traffic maintenance area with a level floor. Lower forks, chock load wheels and disconnect the battery. Refer to Lockout/ Tagout for safety procedure.
2. Remove the drive tire. Refer to Drive Tire Replacement.
3. Disconnect all connections on the traction motor, steer motor and drive unit.
4. Remove the drive unit mounting screws.
5. Remove the drive unit assembly from under the power unit using a suitable lifting device. Move the drive unit to a clean workbench for further maintenance.
6. Remove the steer motor (34). Refer to Steer Motor Maintenance.
7. Remove the traction motor (33). Refer to Drive Unit Maintenance.

Drive Unit Installation

1. Install the traction motor (33). Refer to Drive Unit Maintenance.
2. Install the steer motor (34). Refer to Steer Motor Maintenance.
3. Move the drive unit to the power unit from the workbench using a suitable lifting device.
4. Use a lifting device and raise the truck. Refer to Control of Hazardous Energy.
5. Install the drive unit mounting screws, torque to 43 - 50 Nm (32 - 37 ft lb).
6. Connect all connections on the traction motor, steer motor and drive unit.
7. Install the drive tire. Refer to Drive Tire Replacement.

NOTE

Check for leaks and the oil level is correct.

8. Remove the Lockout/Tagout device and wheel chocks. Refer to Lockout/Tagout for safety procedure.
9. Raise the forks.
10. Verify drive unit and truck operation.

Drive Unit Disassembly

NOTE

For the following procedures, refer to Figure 19160.

1. Remove the screws (14) and remove the intermediate flange (16).
2. Remove the screws (15).
3. Remove the ring bearing (21).
4. Remove the bleeder valve (25).
5. Remove the O-ring (22), shim (23), supporting ring (24) and retaining ring (27).
6. Remove the drive unit gear cover (26).

Drive Shaft Removal

NOTE

For the following procedures, refer to Figures 18743, 19160, 19161 and 19162.

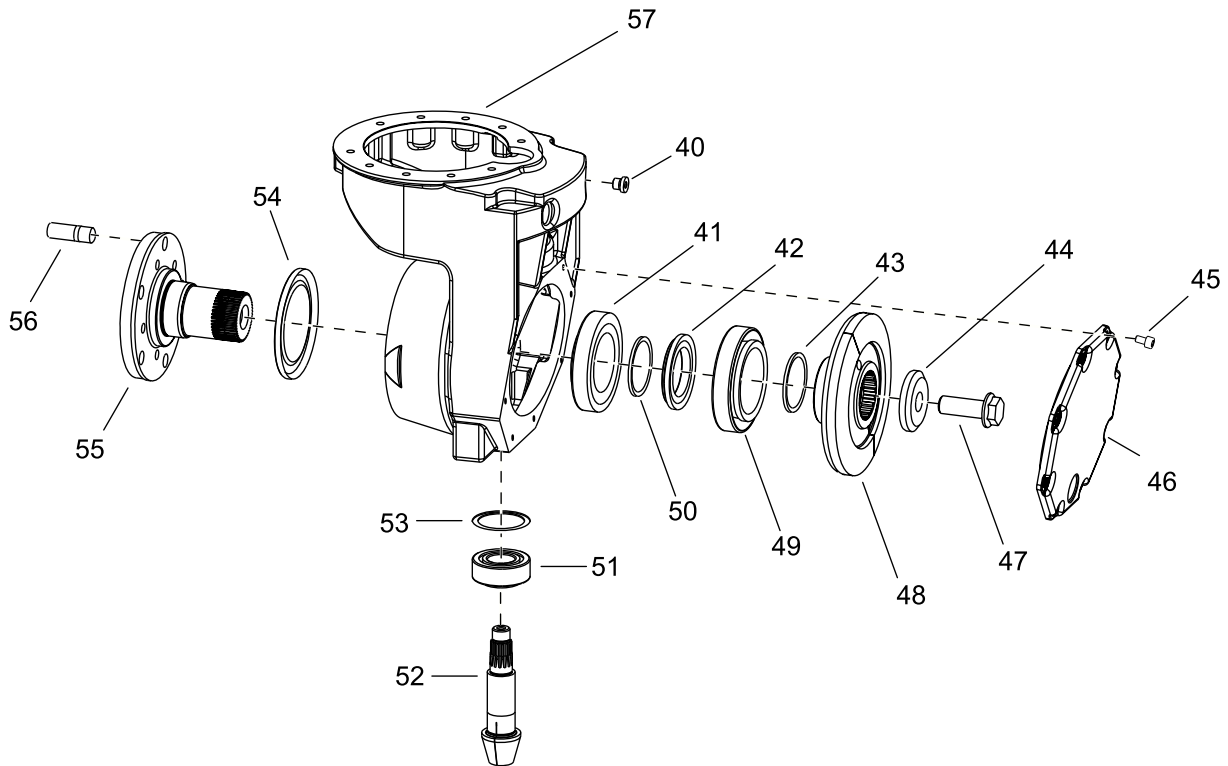


Figure 18743

NOTE

Drive Units with screw-on cover (46).

7. Remove the screws (45) and remove the cover (46).

NOTE

Drive Units with a press-on cover (46). The cover will be damaged and must be replaced.

8. Strike through the cover with a large screwdriver and hammer.
9. Pry off the cover with the screwdriver.
10. Using a mandrel (1) in the hole of the pinion prevent the gear unit from moving. Refer to Figure 19161.

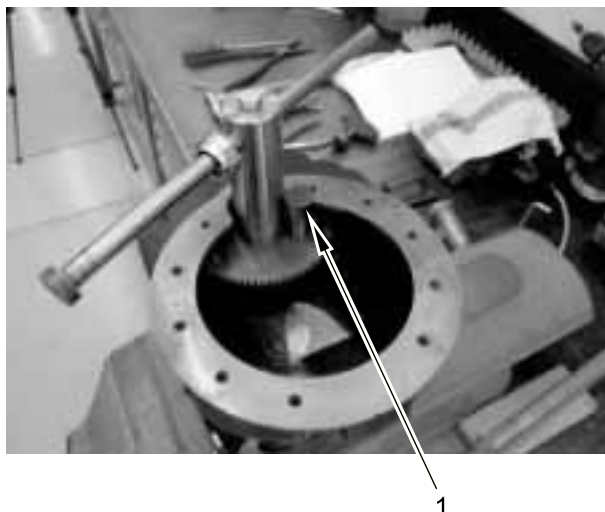


Figure 19161

DRIVE UNIT

Drive Unit



11. Loosen the screw (47) and remove it with the washer (44). Refer to Figure 18743.
12. Press off the shaft (55). Refer to Figure 18743.
13. Remove the shims (50) and bushing (42). Refer to Figure 18743.
14. Remove the bearing (41) and dispose it. Refer to Figure 18743.
15. Remove the shaft seal (54) from the shaft. Dispose the shaft seal.



Figure 19162

16. Remove the bevel gear (48), bearing (49) and washer (43) from the housing (57). Refer to Figure 18743. Refer to Figure 19162 for gear and bearing set.
17. Push the bearing (49) off the bevel gear (48) and remove the washers (43). This can be done through the two holes in the bevel gear.
18. Using a mandrel (1) in the hole of the pinion prevent the gear unit from moving. Refer to Figure 19161.
19. Remove the groove nut (28). Refer to Figure 19160.
20. Pull the bevel pinion shaft (52), roller bearing (51) and washers (31) as a unit out from under the gear unit. Refer to Figures 19160 and 18743.
21. Remove the washers (31). Refer to Figure 19610.
22. Remove the roller bearing (51) from the bevel pinion shaft (52). Refer to Figure 18743.
23. Press the pinion (29) and the roller bearing (30) from the housing. Refer to Figure 19610.
24. Pull the roller bearing (30) off of the pinion (29). Refer to Figure 19610.
25. Remove the outer rings of the roller bearings (30, 52, 49 and 41) off the housing (32 or 57). Refer to Figures 19160 and 18743.
26. Remove the washer (53) from the housing (57). Refer to Figure 18743.

Drive Unit Assembly

NOTE

Use only new bearings and seals.

NOTE

For the following procedures, refer to Figures 18743, 19160, 19161 and 19162.

1. Insert the washer (53) into the housing (57). Refer to Figure 18743.
2. Use a press to force the outer rings of the roller bearing (30, 52, 49 and 41) in the housing (32 or 57). Refer to Figures 19160 and 18743.
3. Press the roller bearing (30) onto the bevel pinion shaft (52). Refer to Figure 18743.
4. Install shim (31) onto a supporting ring.

NOTE

The thickness of the two shims combined = 2.2 mm (0.09 in).

5. Press the roller bearing (30) onto the pinion (29). Refer to Figure 19160.
6. Install the pinion (29) in the correct position in the housing (32). Refer to Figure 19160.
7. Install the bevel pinion shaft (52) into the pinion (29). Refer to Figures 19160 and 18743.

NOTE

The bevel pinion shaft and the pinion must now be installed in to the gear unit.

8. Using a mandrel (1) in the hole of the pinion prevent the gear unit from moving. Refer to Figure 19161.

9. Install the groove nut (28) onto the bevel pinion shaft and torque to 35 Nm (26 ft lb). Refer to Figure 19160.
10. Remove the mandrel.

NOTE

After installing bevel pinion shaft, check the friction torque. The friction torque should measure 0.1 - 0.2 Nm (1.0 - 2.0 in lb).

11. Using a mandrel (1) in the hole of the pinion prevent the gear unit from moving. Refer to Figure 19161.
 12. Remove the groove nut (28). Refer to Figure 19160.
 13. Pull the bevel pinion shaft (52), roller bearing (51) and washers (31) as a unit out from under the gear unit. Refer to Figures 19160 and 18743.
- To reduce friction torque:
 - Add a shim.

- To increase friction torque:
 - Remove a shim
14. Install the bevel pinion shaft (52) into the pinion (29). Refer to Figures 19160 and 18743.
 15. Using a mandrel (1) in the hole of the pinion prevent the gear unit from moving. Refer to Figure 19161.
 16. Install the groove nut (28) onto the bevel pinion shaft and torque to 35 Nm (26 ft lb). Refer to Figure 19160.
 17. Remove the mandrel.

NOTE

After installing bevel pinion shaft, check the friction torque again. The friction torque should measure 0.1 - 0.2 Nm (1.0 - 2.0 in lb).

18. Place the shim (43) onto the bevel gear (48). Refer to Figure 18743.

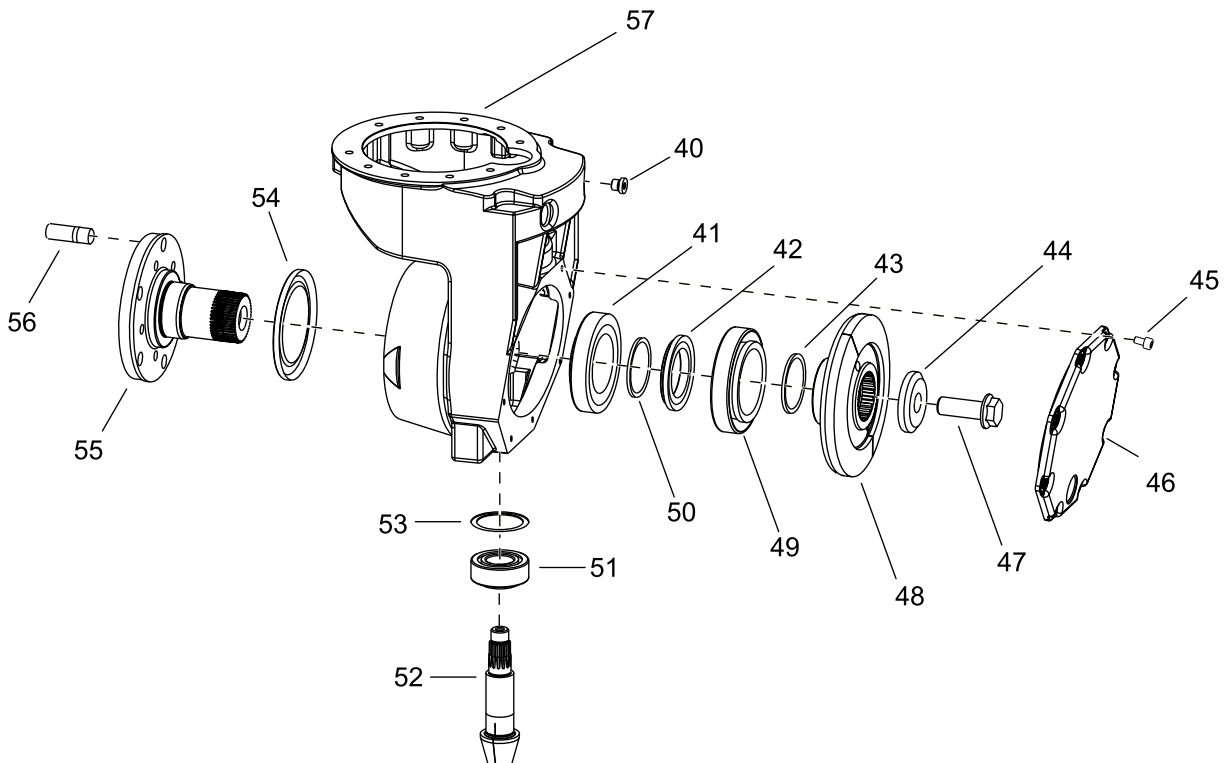


Figure 18743

NOTE

The thickness size of the shim is 1.0 mm (0.04 in).

19. Press the roller bearing (49) onto the bevel gear (48). Refer to Figure 18743.
20. Install the bevel gear in the correct position in the gear housing (57). Refer to Figure 18743.
21. Install the shaft and adjust the friction torque. Refer to shaft assembly.
22. Check the bevel gear teeth on the reference diameter of the pinion (29). Refer to Figure 19164.
 - Clearance tolerance: 0.2 - 0.5 mm (0.008 - 0.020 in)

NOTE

Adjust clearance if necessary.

23. Install the bevel gear (48), roller bearing (49) and washer (43) into the housing (57). Refer to Figure 18743.



Figure 19164

24. Press the bearing (49) onto the bevel gear (48). This can be done through the two holes in the bevel gear. Refer to Figure 18743. Remove the washers (43) adjust the thickness:
 - To reduce the clearance: Increase the number of shims (43).
 - To increase the clearance: Reduce the number of shims (43).
25. Install the washers (43) with the adjusted size.
26. Press on the roller bearing (49). Refer to Figure 18743.
27. Install the shaft and check the clearance again. Keep adjusting if necessary until the clearance is within the tolerance range of 0.2 - 0.5 mm (0.008 - 0.020 in).
28. Press the shaft seal (54) over the holes in the flange on the shaft in the correct position. Refer to Figure 18743.

NOTE

For gear units with screw-on cover (43):

- *Clean the contact surface of the housing (57) and cover (46) with a suitable solvent. Refer to Figure 18743.*
- *Apply sealing compound to the contact surfaces in accordance with the manufacturer's instructions.*
- *Attach the cover (46) with the screws (45). Torque to 10 Nm (7.5 ft lb).*

NOTE

Before adding oil, check the hardening times required for the sealing compound used.

For gear units with a press-on cover (46).

- Install a new cover (46) with the sealed side facing out.
 - Using a plastic hammer strike the cover evenly without damaging the cover (46).
29. Install the drive gear cover (26) into the correct position.
 30. Install the O-ring (22), shim (23), supporting ring (24) and retaining ring (27) into the correct position and fasten the screws (15). Torque to 25 Nm (18 ft lb). Refer to Figure 19160.
 31. Install the bleeder valve (25). Refer to Figure 19160.
 32. Install and tighten the drain plug.

33. Install the intermediate flange (16) and torque to 35 Nm (26 ft lb). Refer to Figure 19160.

NOTE

Before adding oil check the hardening times requiring for each sealing compound used.

34. Add oil. Refer to Lubrication and Adjustment for recommended oil.
35. Install the drive unit using a suitable lifting device. Refer to Drive Unit Maintenance.
36. Install traction motor. Refer to Drive Unit Maintenance.
37. Install steer motor. Refer to Steer Motor Maintenance.
38. Connect all connections for traction motor, steer motor and drive unit.
39. Remove Lockout/Tagout device.
40. Verify truck operation.

Notes:



ELECTRICAL

Notes:

Accelerator Calibration (VACC)

This function looks for and remembers the minimum and maximum POT1 ACCEL (FS/RS) wiper voltage over the full mechanical range of the potentiometer. It compensates for non-symmetry of the mechanical system between directions. This calibration is performed by turning the thumbwheel on the control handle which operates the POT1 ACCEL (FS/RS) potentiometer.

1. While truck is ON, locate C1 Prog FWD/REV Rocker menu under Calibration menu. Indicate you would like to calibrate system selecting "Sure? Y" and pressing enter.
2. Locate C1.1 Turn Max FWD and Max REW. under Calibration Menu.
3. Slowly rotate the thumbwheel to its full Forks First position and hold for one second.
4. Slowly rotate the thumbwheel in the opposite direction to its full Power Unit First position and hold for one second.
5. When complete, press enter.
6. To save calibration, select "Save? Y" and press enter.
7. To restart calibration, select "Save? N" and press enter. To recalibrate accelerator, repeat steps 1 through 6.

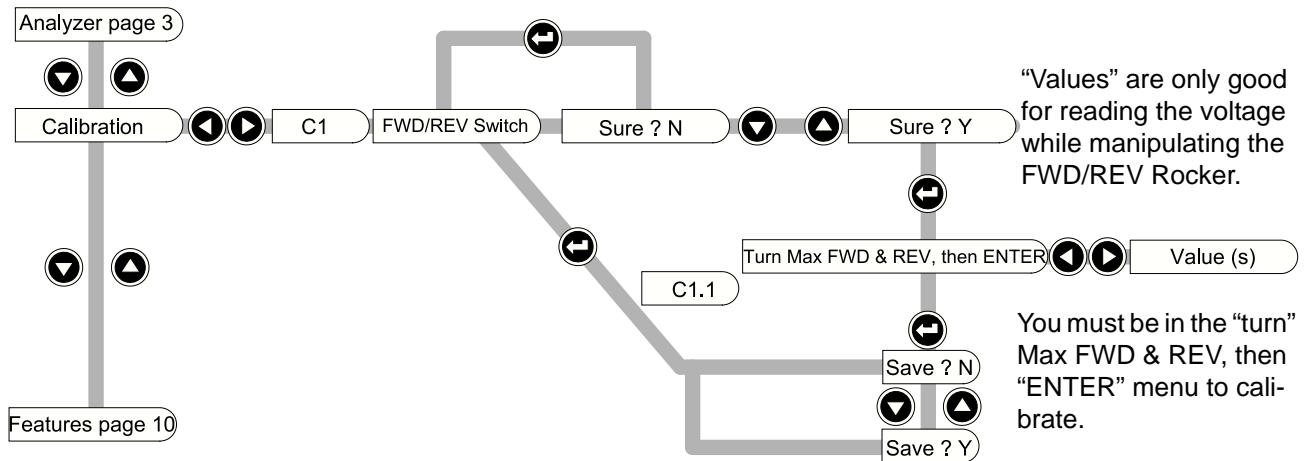


Figure 19576

Notes:

Wiring

Wiring Color Codes

The following information is an explanation of wiring color codes used.

Color

Wire colors will be limited to those in the chart. The color of the wire will be chosen based on the function of the circuit in which it is used.

Number

Each wire is assigned a three or four digit number. The first one or two digits will identify the color of the wire and the last two digits are the sequential numbering of the wires from 01 to 99.

Wire Numbering			
Abbreviation	Color	Number	Circuit Function
BLK	Black	0**	Digital Signal
BRN	Brown	1**	Analog Signal
RED	Red	2**	Battery Positive
ORG	Orange	3**	+12 volts (DC - DC converter)
YEL	Yellow	4**	Third DC - DC converter
GRE	Green	5**	Battery Negative
BLU	Blue	6**	Isolated Negative
VIO	Violet	7**	+5 volts (DC - DC converter)
GRAY	Gray	8**	Fourth DC - DC converter
WHT	White	9**	Miscellaneous
R/W	Red Stripe on White	29**	Battery Positive after a switch
G/W	Green Stripe on White	59**	Battery Negative after a switch or resistor
** - Sequential number from 01 to 99			

Power Cables

Power cables are designated using the initials PC which stands for power cable, #- is the AWG size of the cable and the dash number. This designation also represents the part number to be ordered. e.g. PC#1/0-10 is a power cable that is size 1/0 AWG and is part number 084572-010. Refer to the following chart for the base part number of all cable sizes used.

Power Cables	
Abbreviation	Part No.
PC#1	084571
PC#2	084570
PC#4	084569
PC#6	084568
PC#10	090963
PC#1/0	084572
PC#2/0	084573
PC#3/0	086749

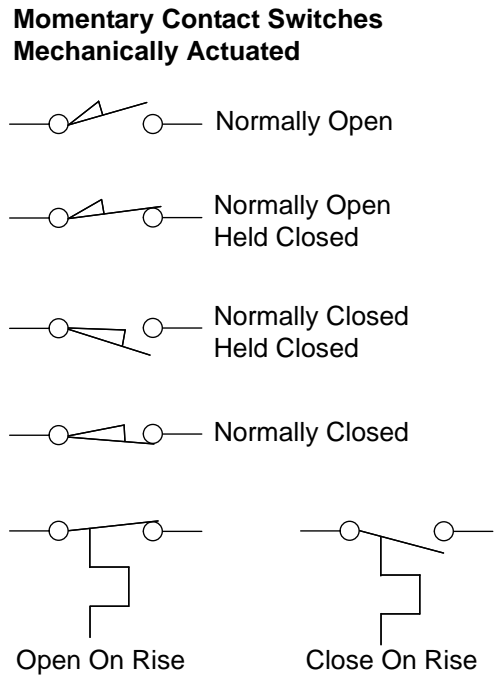
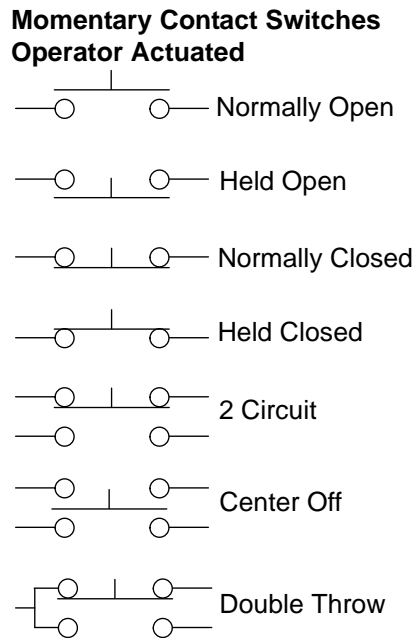
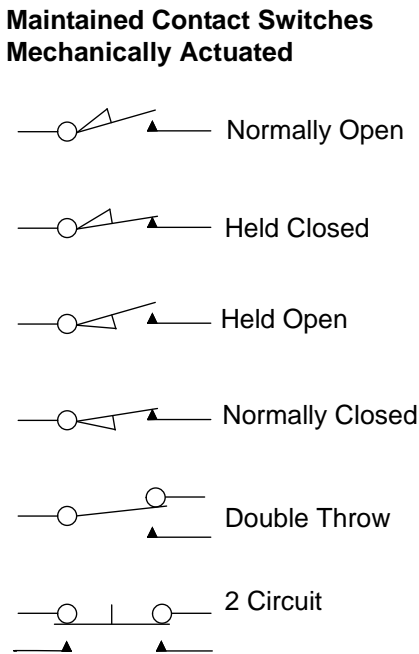
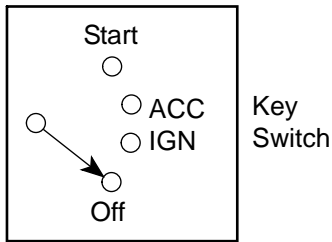
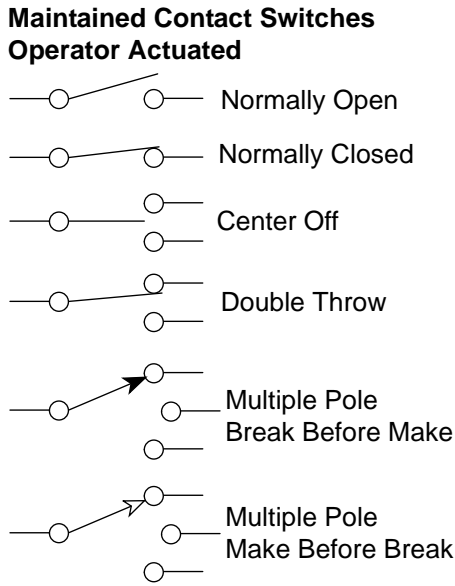


Figure 3804-01

Notes:

Access 123



Figure 18670

- a BDI
- b Message Display
- c Performance Level Indicators
- d Navigation Arrows - Up, Down, Left and Right
- e Enter/Return Button

Typical navigation button usage: up and down arrows will scroll through menu choices, right arrow will enter a menu, and left arrow will exit current menu. Enter/return button is used to select a function or choice.

User Level

The following pages describe user controlled display options. User may choose from the following options (provided a higher priority message is not active):

1. Message
2. Hour
3. Events
4. Service
5. Performance

The following messages will be displayed in order of priority (if enabled), regardless of user selection:

1. Steer Controller Hot
2. Steer Motor Hot
3. Slow or Stop Traction Control Hot
4. Slow or Stop Traction Motor Hot
5. Charge Battery - Battery Low
6. Charge Battery - Truck Stops 5:00
7. Charge Battery - Battery Down
8. Release Travel Control
9. Release Hydraulic Control
10. Release Control Handle
11. Release Reverse Button

If any message is more than 8 characters it will be scrolled across the display from right to left.

Display will continue to show last selected message even if truck is turned off and back on. To change message displayed, enter Message Mode and select one of the other choices.

Message Mode

NOTE

Message Mode is controlled by Features menu (F10). F10 allows one of the message choices (in which case you would not be able to scroll through any choices) or all.

To enter Message Mode, key up truck. With a message on display, press right arrow to enter this menu. Press up/down arrows to scroll through menu choices:

1. PIN
2. BDI
3. Hours

BDI - Message Mode

This menu allows operator to display battery percent of remaining charge. To select this message, key up truck. Press right arrow to enter Message Mode. Use up/down arrows to scroll to BDI. Press enter/return button. Display will exit Message Mode and show (BDI = XX%).

Hours - Message Mode

This menu allows operator to display accumulated truck hours. To select this message, key up truck. Press right arrow. Use up/down arrows, scroll to Hours. Press enter/return button. Display will exit Message Mode and show (H1=XX).

Hour

This menu allows user to view one of five different hour meter readings.

1. H1 (key on)
2. H2 (key on, plus delay)
3. H3 Traction - ACCESS 2
4. H4 Lift - ACCESS 3
5. H5 Steer - ACCESS 5

To enter this menu, key up truck. Press down arrow to display Hour. Press right arrow and H1 will be displayed. Use up/down arrows to view different hour meter readings. To stop message from scrolling, press right arrow at desired hour meter. To exit Hour menu, press left arrow until Hour is displayed.

Events

NOTE

Event codes cannot be cleared from User level menu.

This menu allows user to view stored event codes (up to 15). To enter this menu, key up truck. Press down arrow until Events is displayed. Press right arrow and Last will briefly be displayed. The last event code stored will then be displayed (EV=XXX). Use up/down arrows to scroll through stored event codes (Last to Last-15). Press left arrow button to return to main menu at Events.

Service

NOTE

Once maintenance Levels 2 or 3 are entered, truck must be turned off then back on to exit Service menu.

This menu enters maintenance levels 2 and 3. A password is required to enter maintenance levels. Contact your local Crown dealer to obtain this password.

To enter this menu, key up truck. Press down arrow until Service is displayed. Press right arrow and Level 2 will be displayed. Press down arrow to go to Level 3, if desired. From either level, press right arrow and four blank boxes will be displayed. Use up/down arrows to enter first digit of password. Press right arrow to move to next digit and continue until final digit is entered. Press enter/return button to accept password.

Performance

This menu allows operator to choose one of three performance modes to operate truck in. This is possible only if User Performance is enabled in Features menu (F6).

1. P1 (maximum achievable performance level)
2. P2 (reduced performance from maximum)
3. P3 (used where operational conditions require lowest truck performance)

To enter Performance menu, key up truck. Use up/down arrows to scroll to Performance. Press right arrow and P1, P2, or P3 will be displayed. Use up/down arrows to display a different performance level. Once desired level is displayed, press enter/return button to select. Press left arrow button to return to main menu at Performance.

Operator Menus

Note: Optional, user Pin Number to enable.
Go to F6.

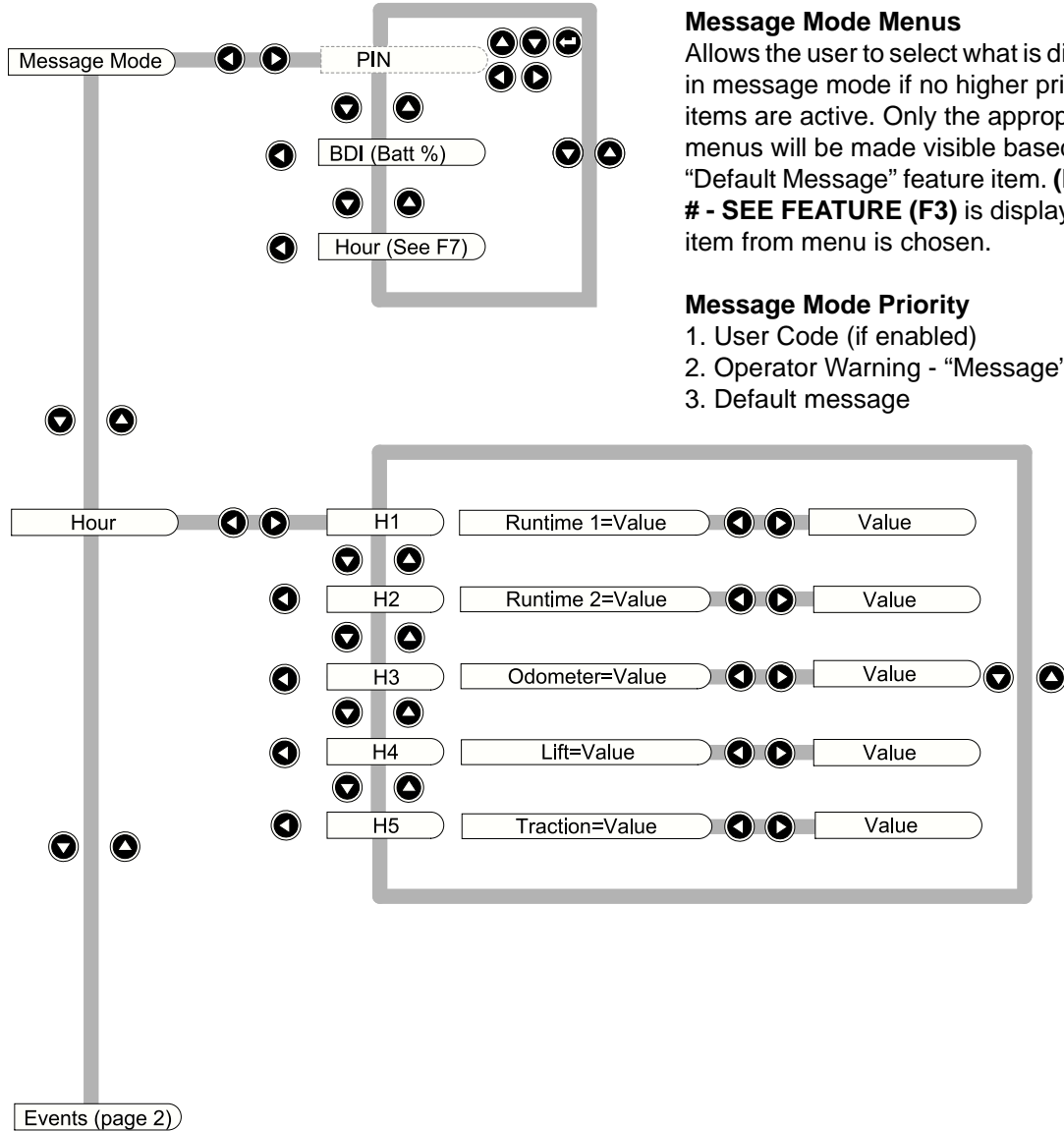
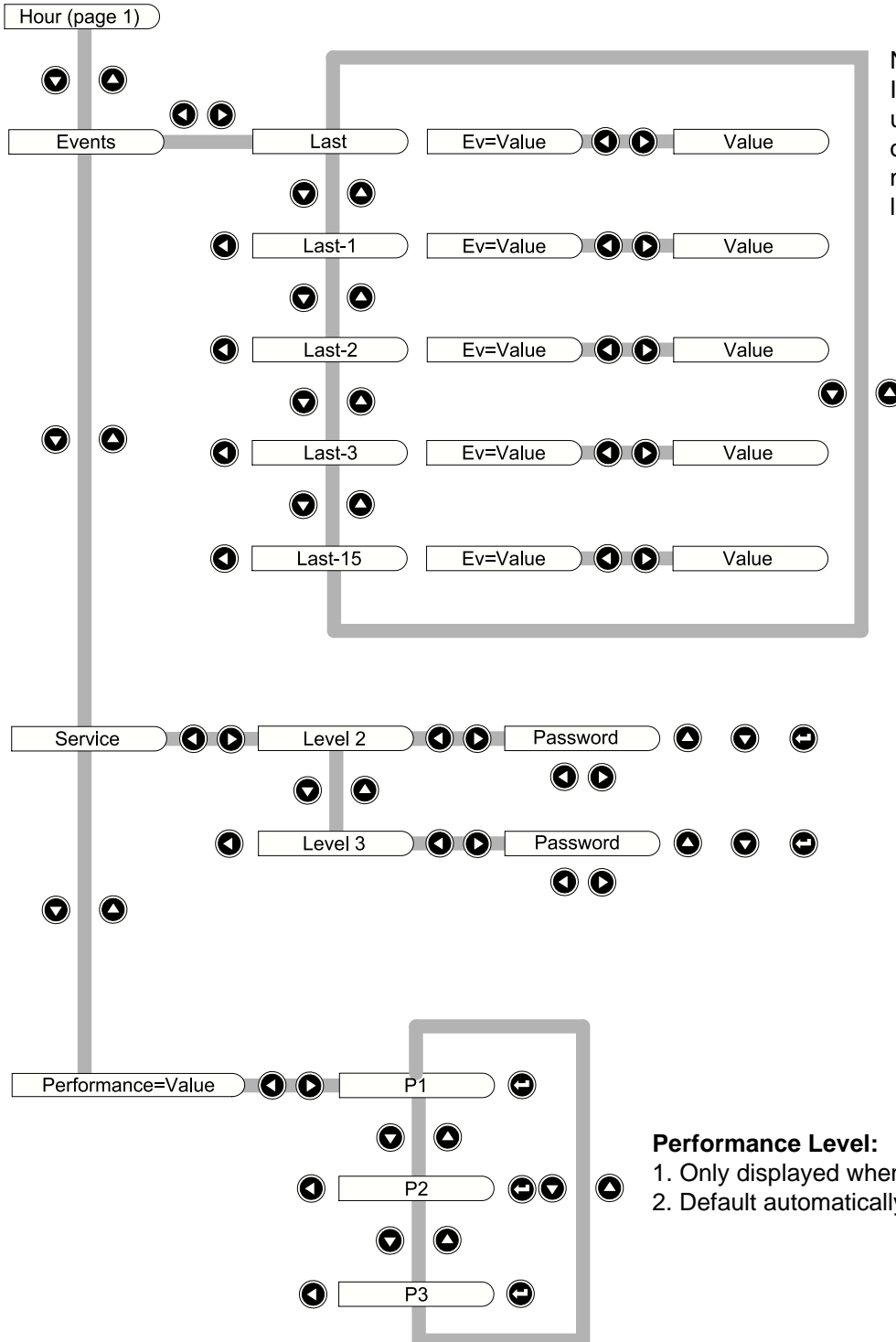


Figure 18651

Operator Menus



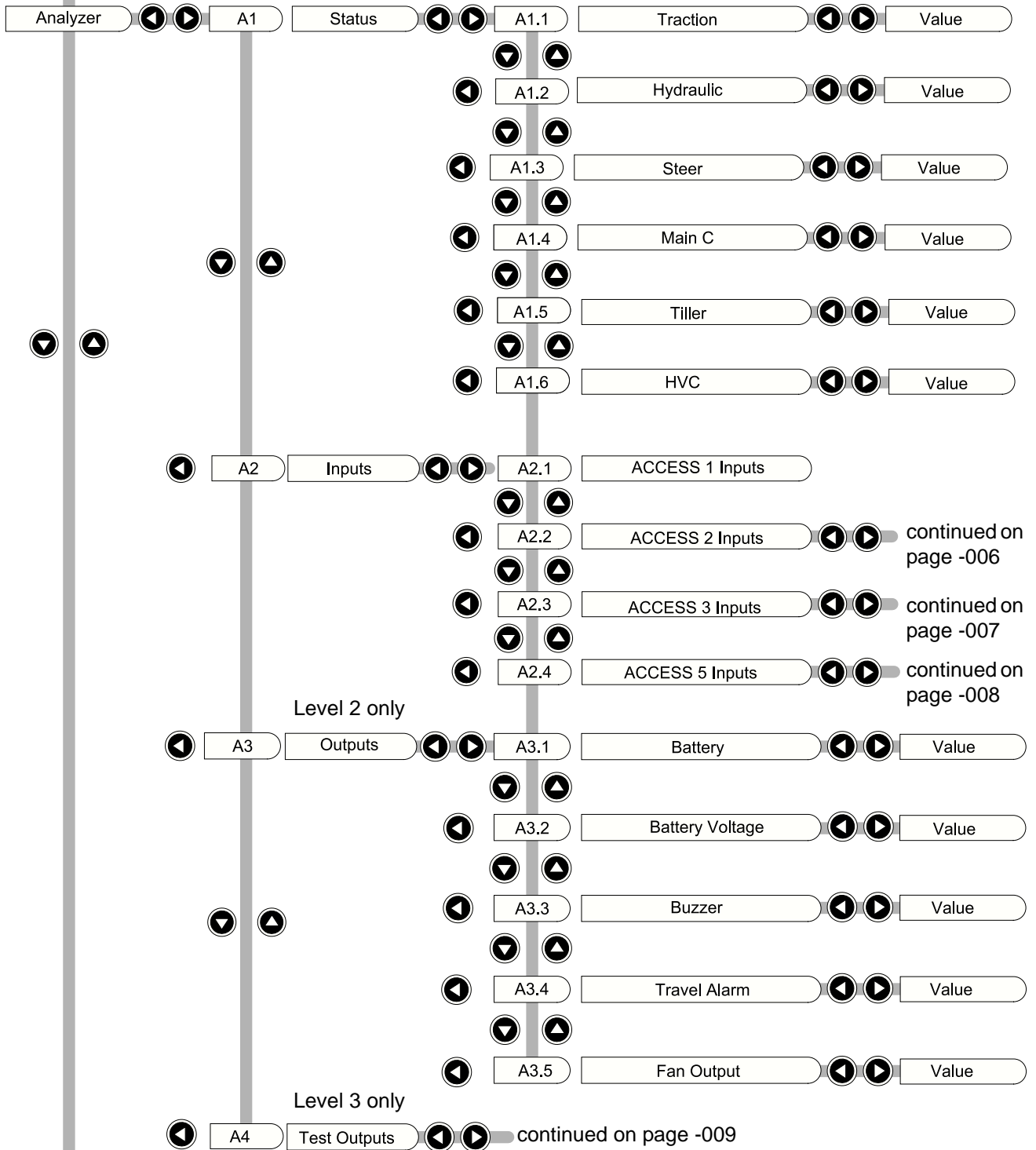
Notes:
If in Event Menu, list will not update if a new Event occurs. Must go out of menu, then back into see latest Event.

Performance Level:
1. Only displayed when F5 Enabled
2. Default automatically to P1

Figure 18652

continued from page -021

Analyzer Menus



continued on page -010

Figure 18653-01

ACCESS 2 Inputs

Service Menus

continued from
page -005

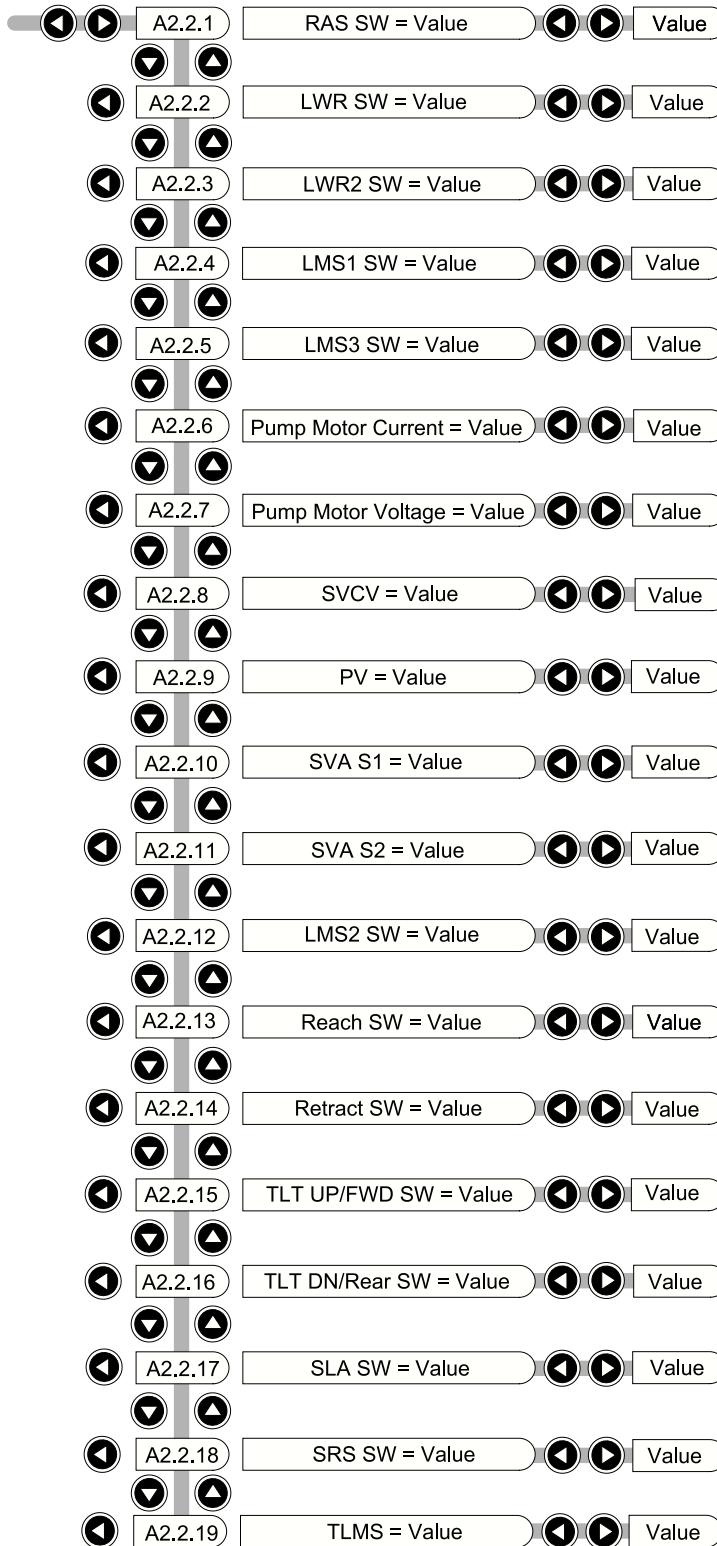


Figure 18654-01

ACCESS 3 Inputs

Service Menus

continued from
page -005

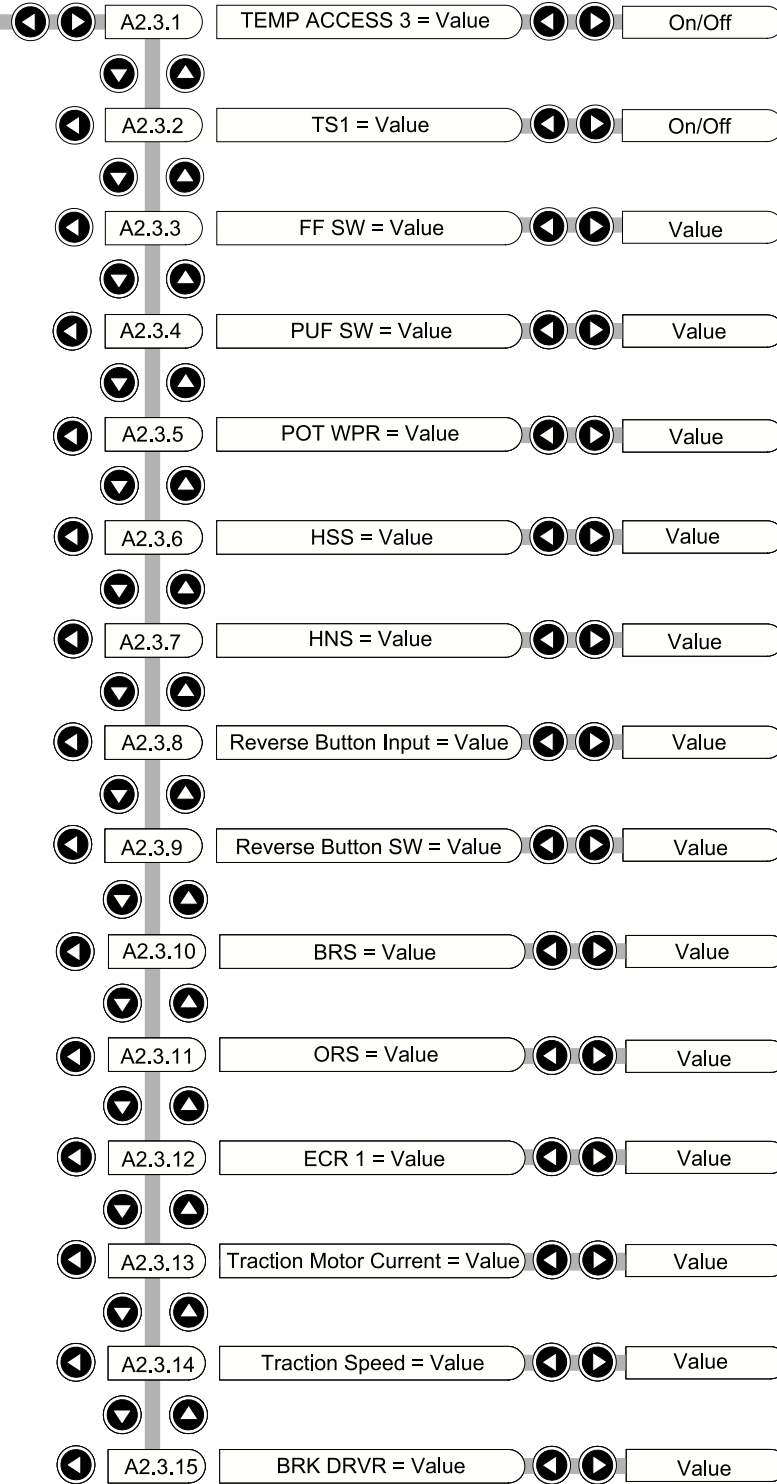


Figure 18655-01

Service Menus

ACCESS 5 Inputs

continued from
page -005

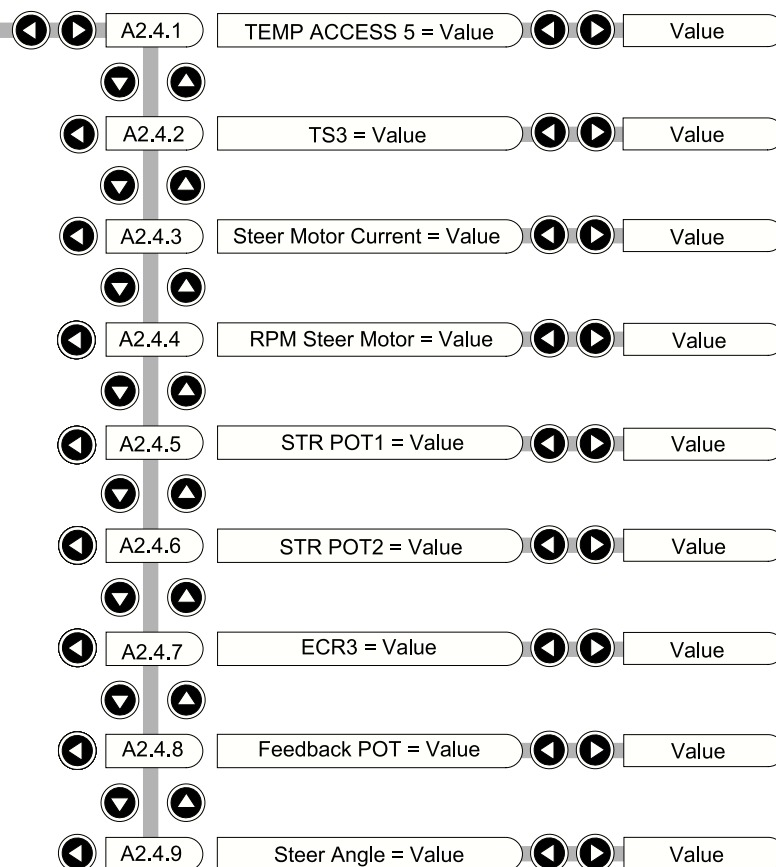


Figure 18656-01

Service Menus

Truck Automatically Enabled when leaving Menu: Exit "Test Mode" All Truck Functions Restored

Truck Automatically Disabled when entering Menu: Enter "Test Mode" No Truck Functions are available Only able to test Truck Functions via Display

Test Inputs

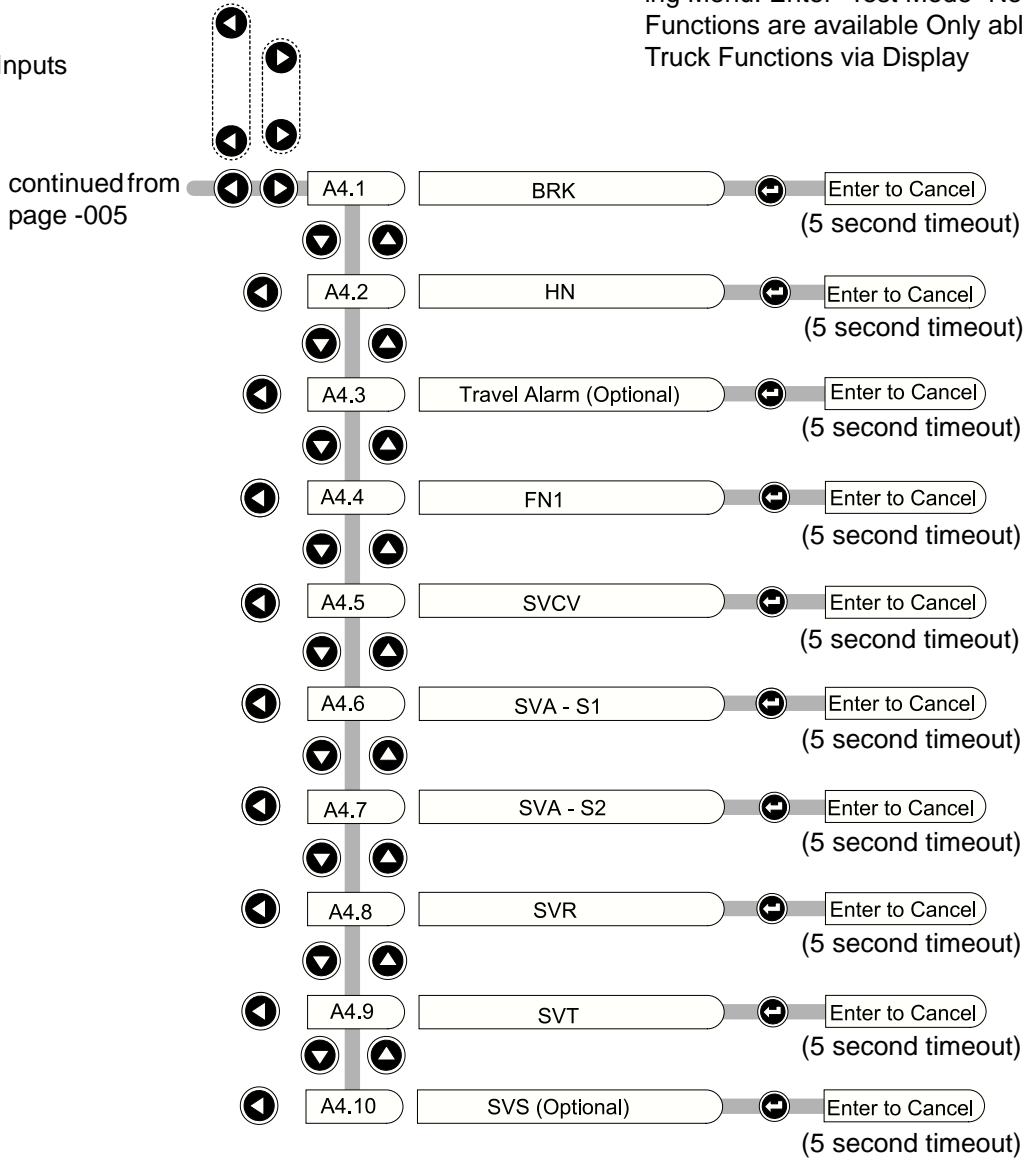


Figure 18657-01

Service Menus

continued from page -005

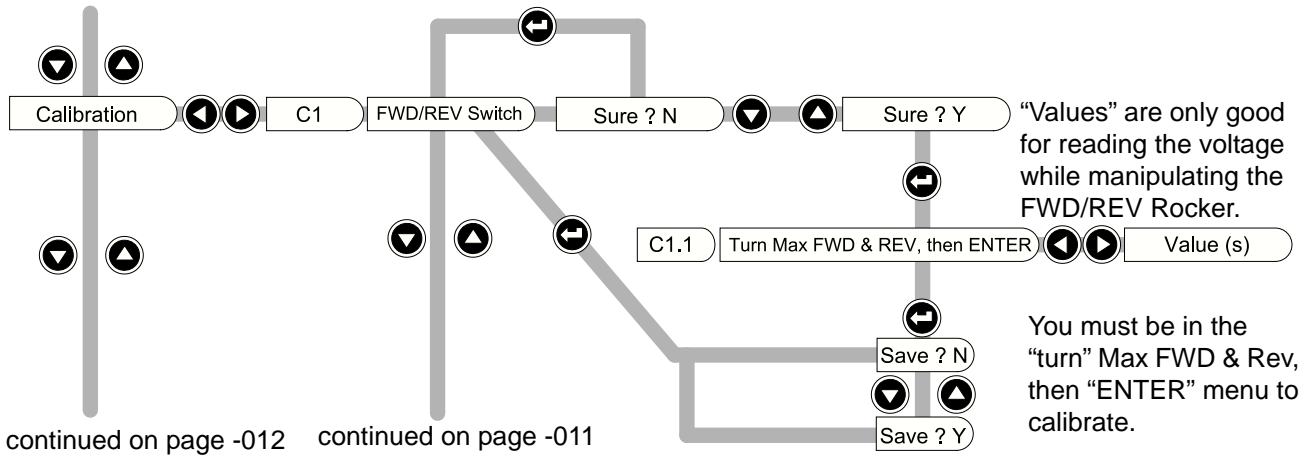


Figure 18658-01

continued from page -010

Service Menus

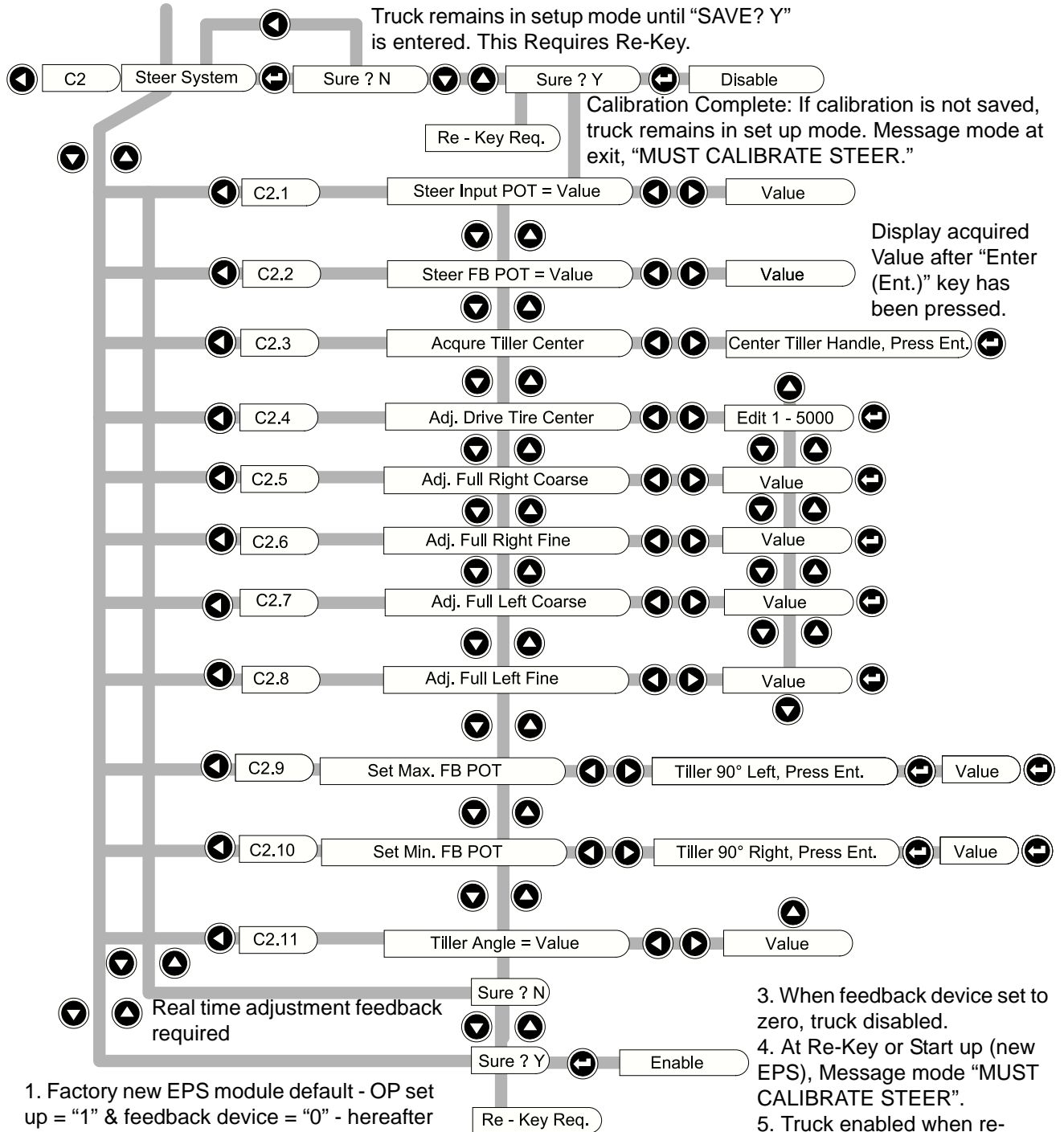


Figure 18659-01

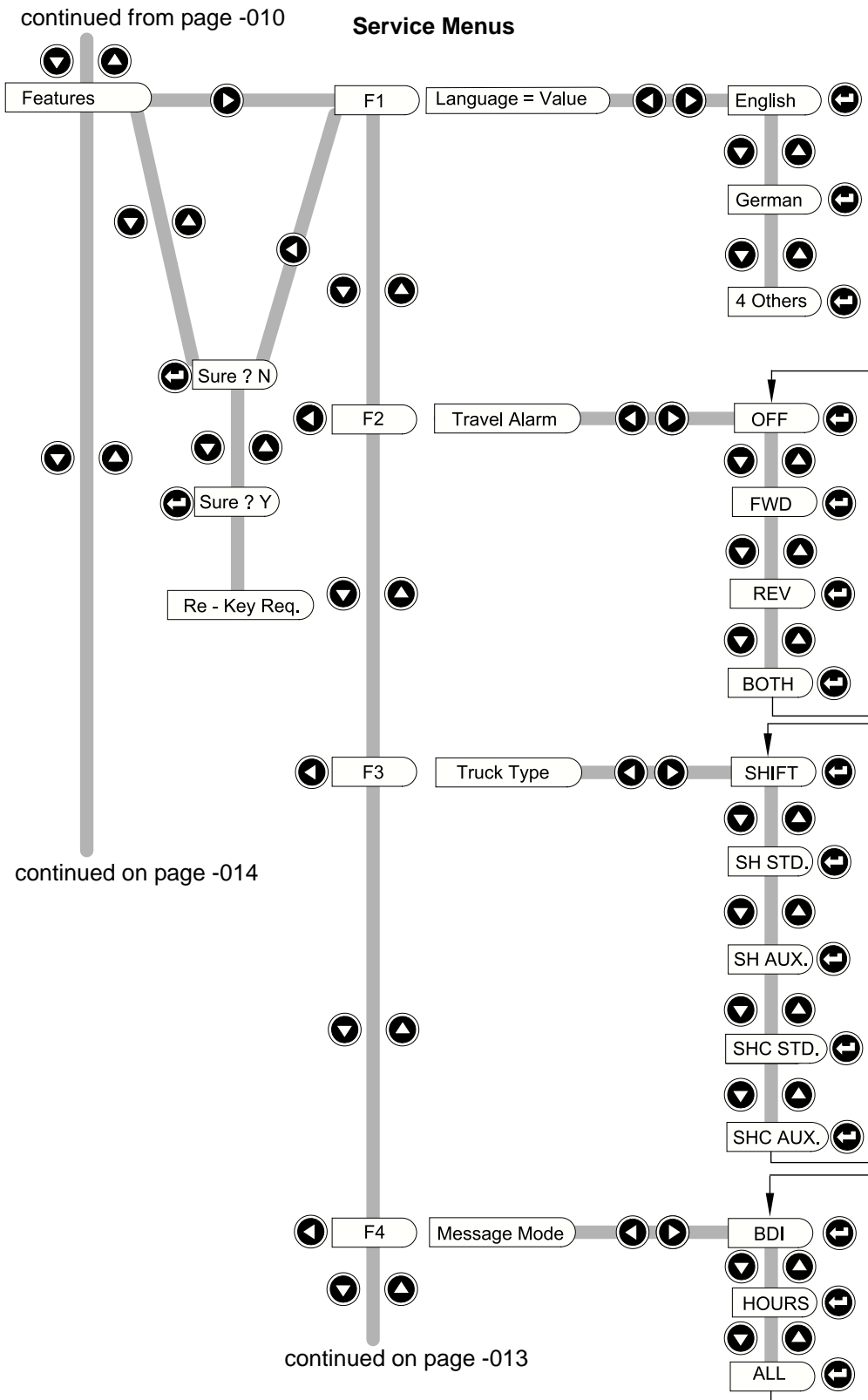


Figure 18660-01

Service Menus

continued from page -012

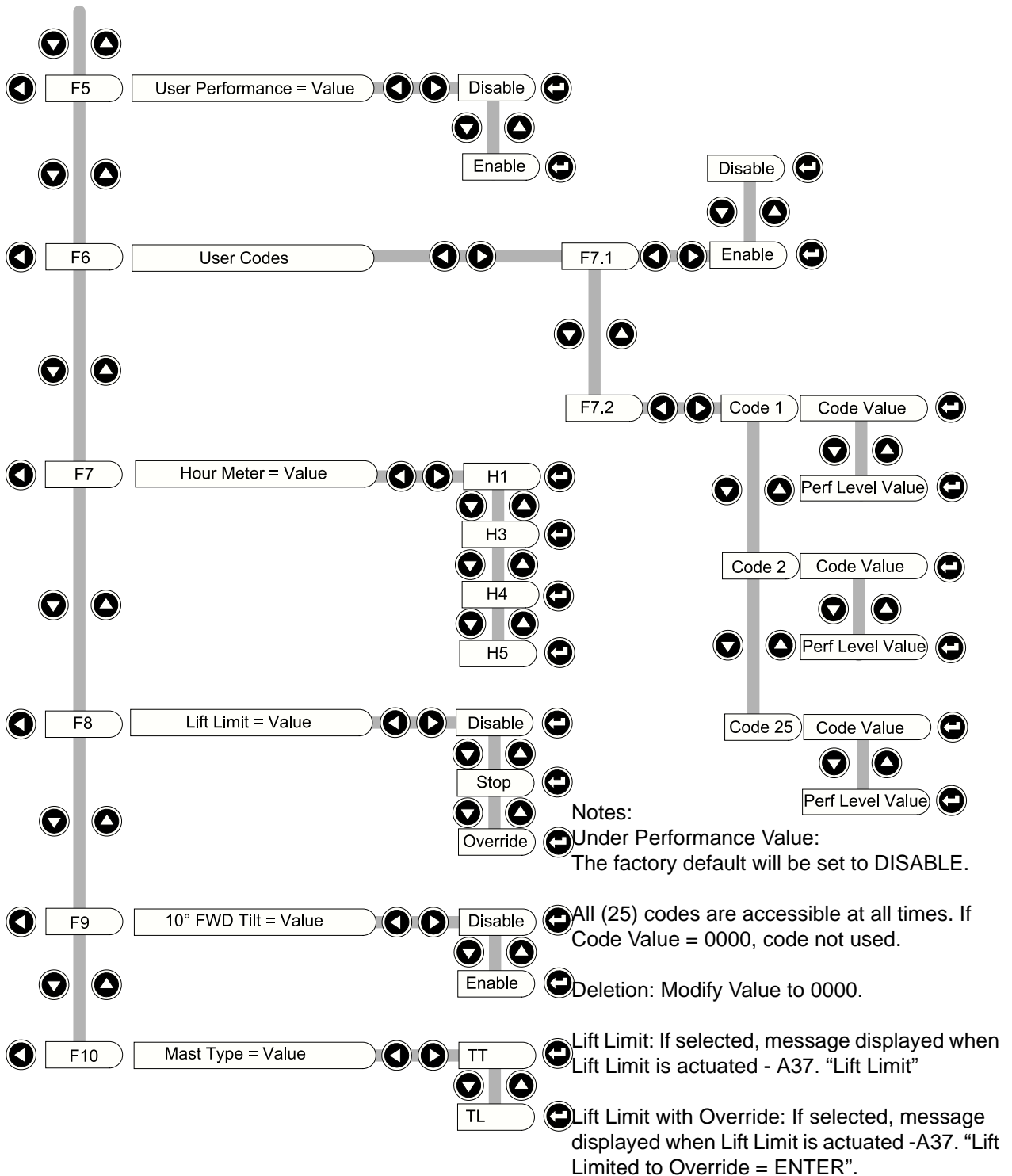
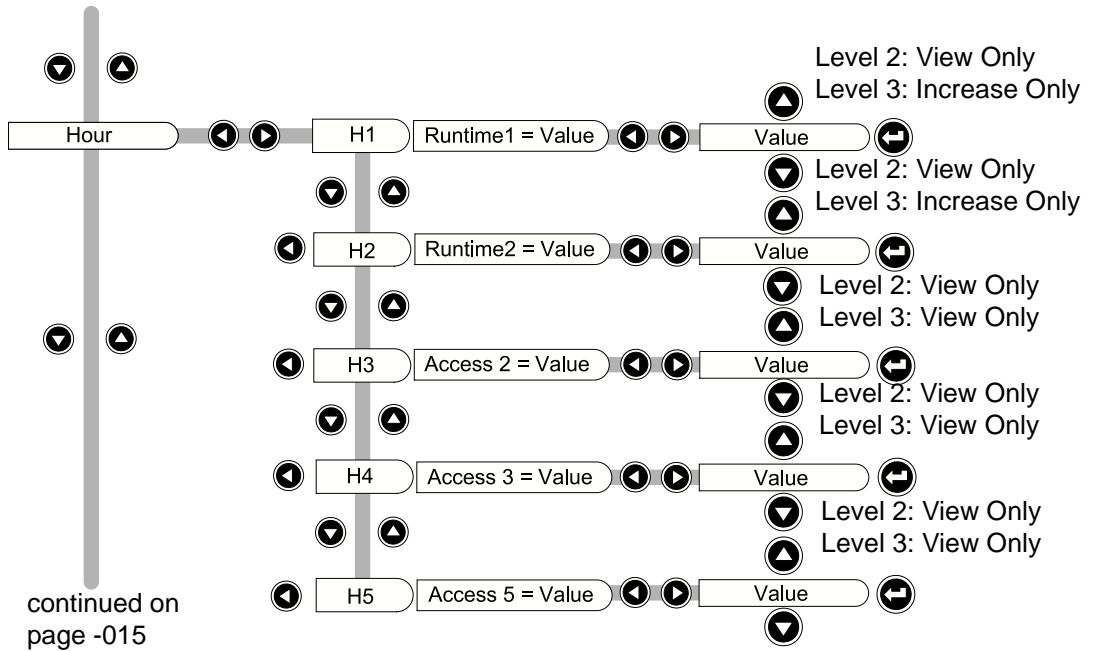


Figure 18662-01

Service Menus

continued from page -012

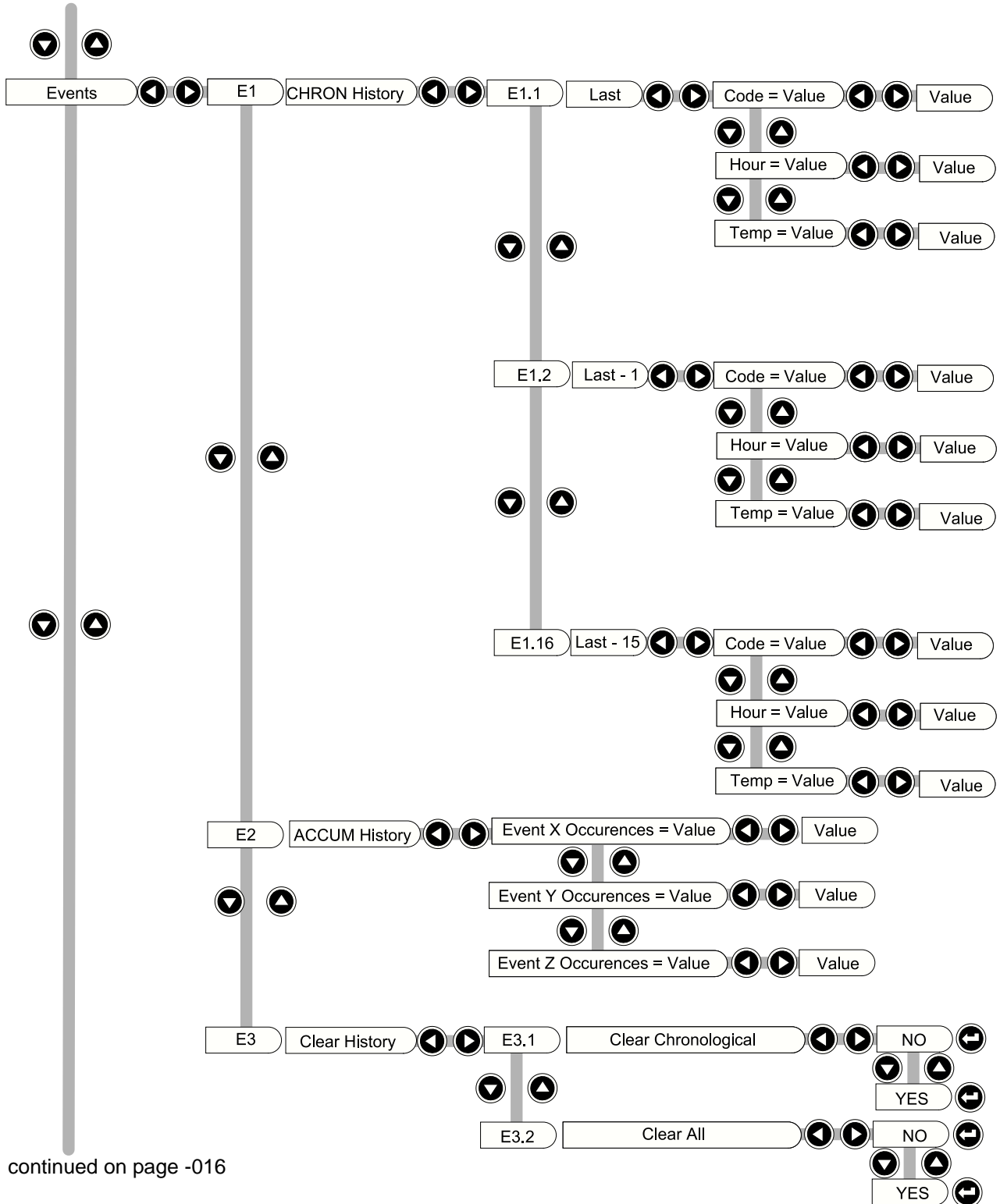


continued on page -015

Figure 18661-01

continued from page -014

Service Menus

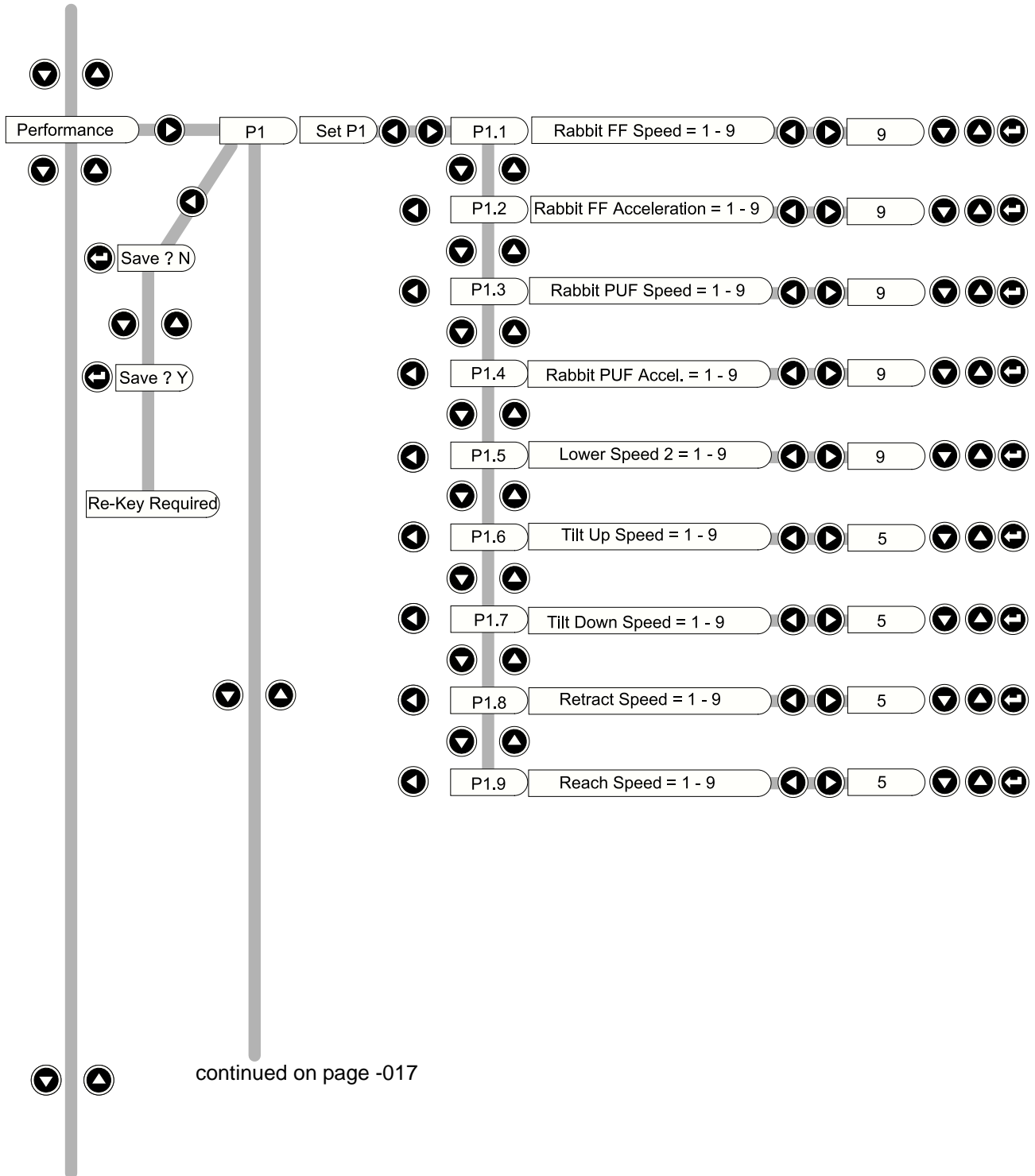


continued on page -016

Figure 18663-01

Service Menus

continued from page -015



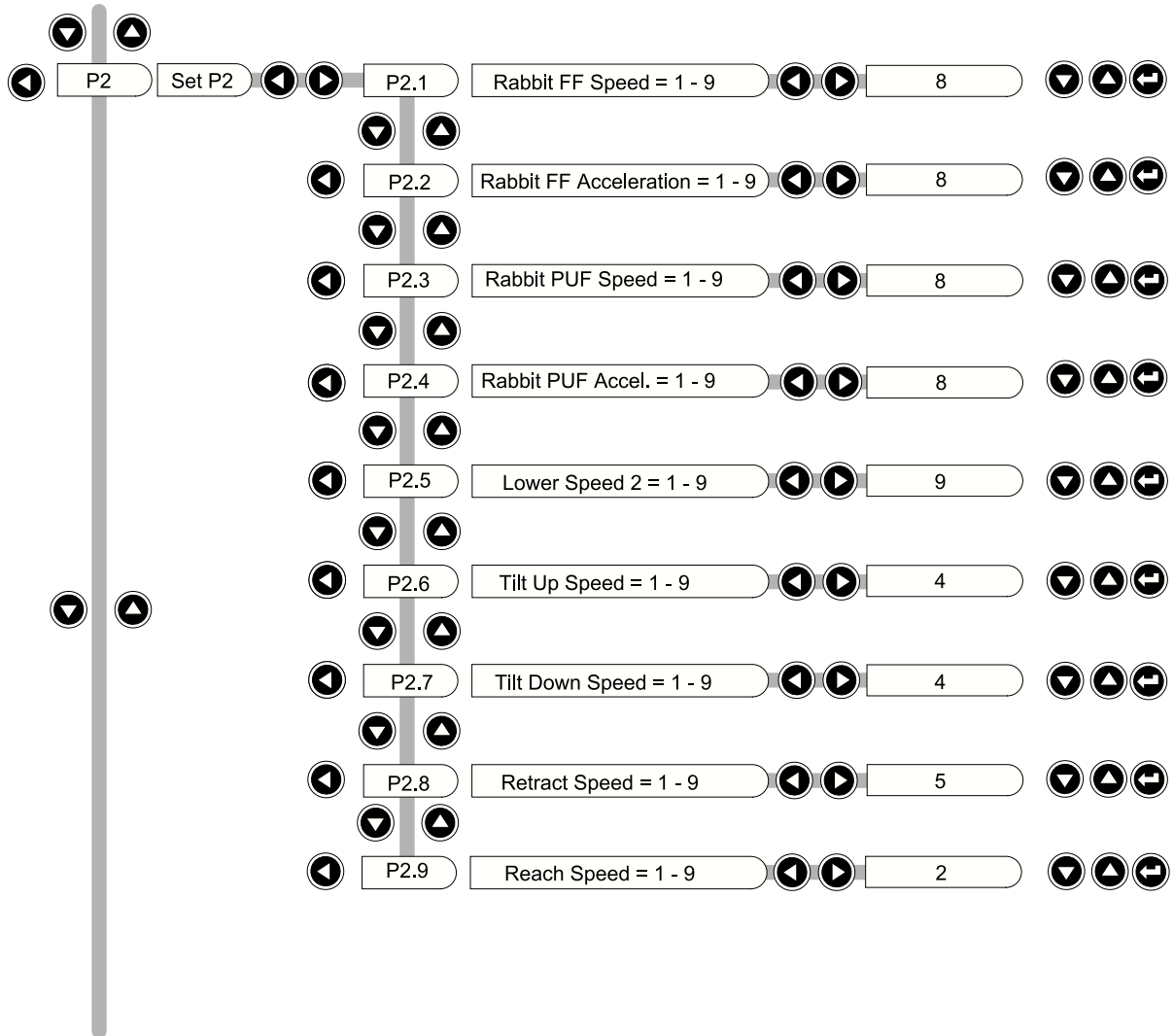
continued on page -017

continued on page -021

Figure 18664-01

Service Menus

continued from page -016

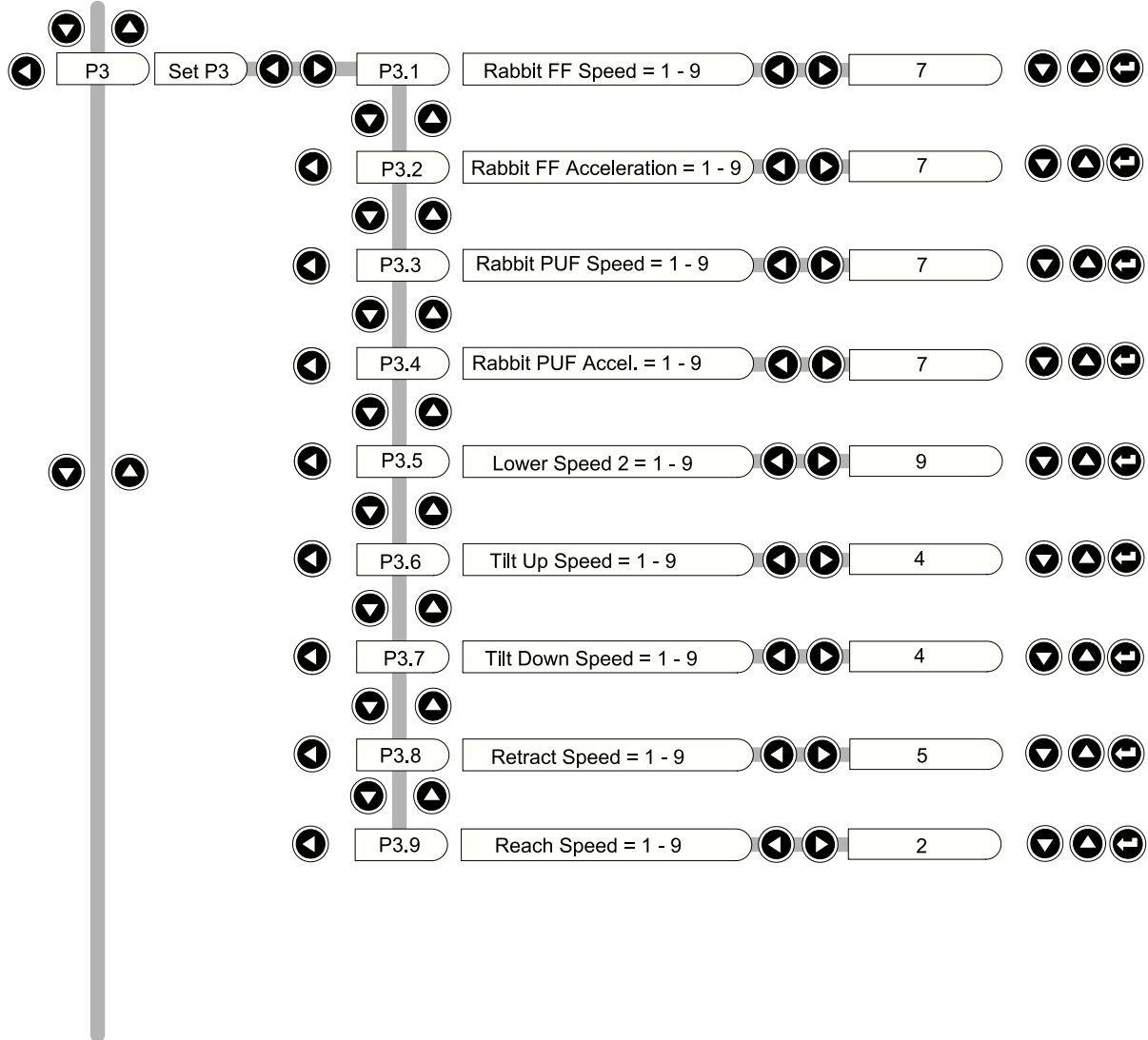


continued on page -018

Figure 18665-01

Service Menus

continued from page -017

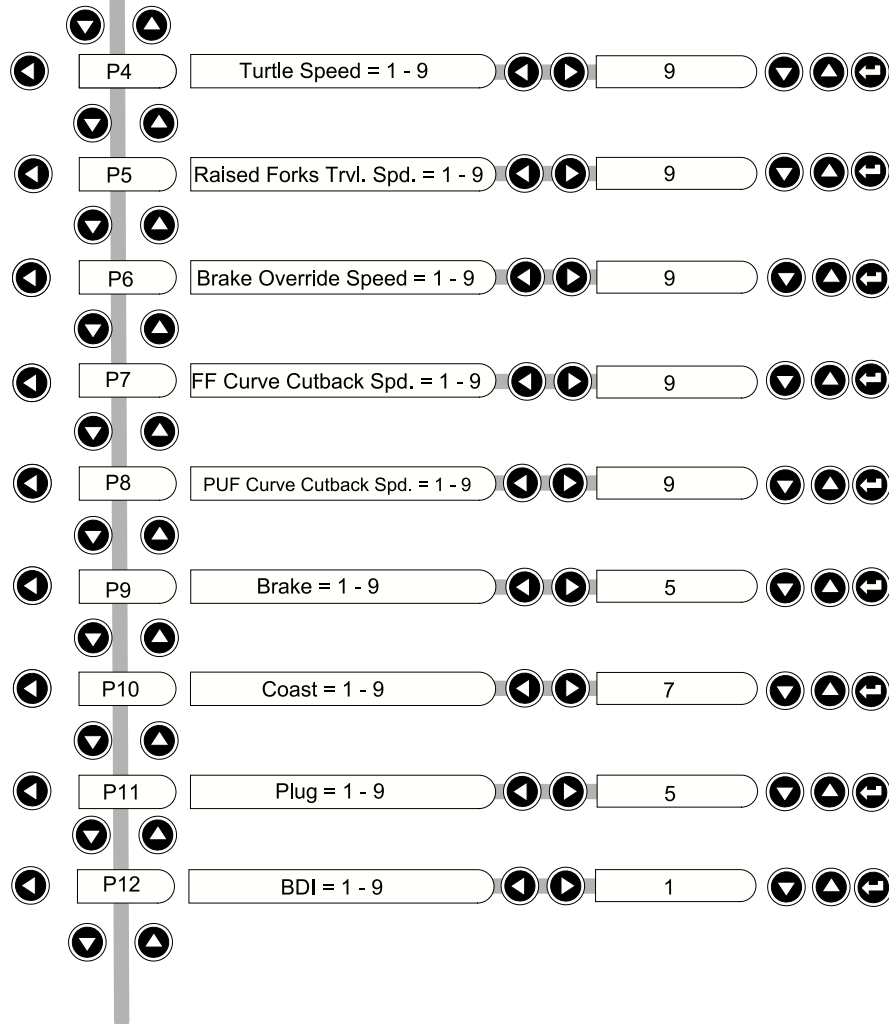


continued on page -019

Figure 18666-01

Service Menus

continued from page -018



continued on page -020

Figure 18667-01

Service Menus

continued from page -019

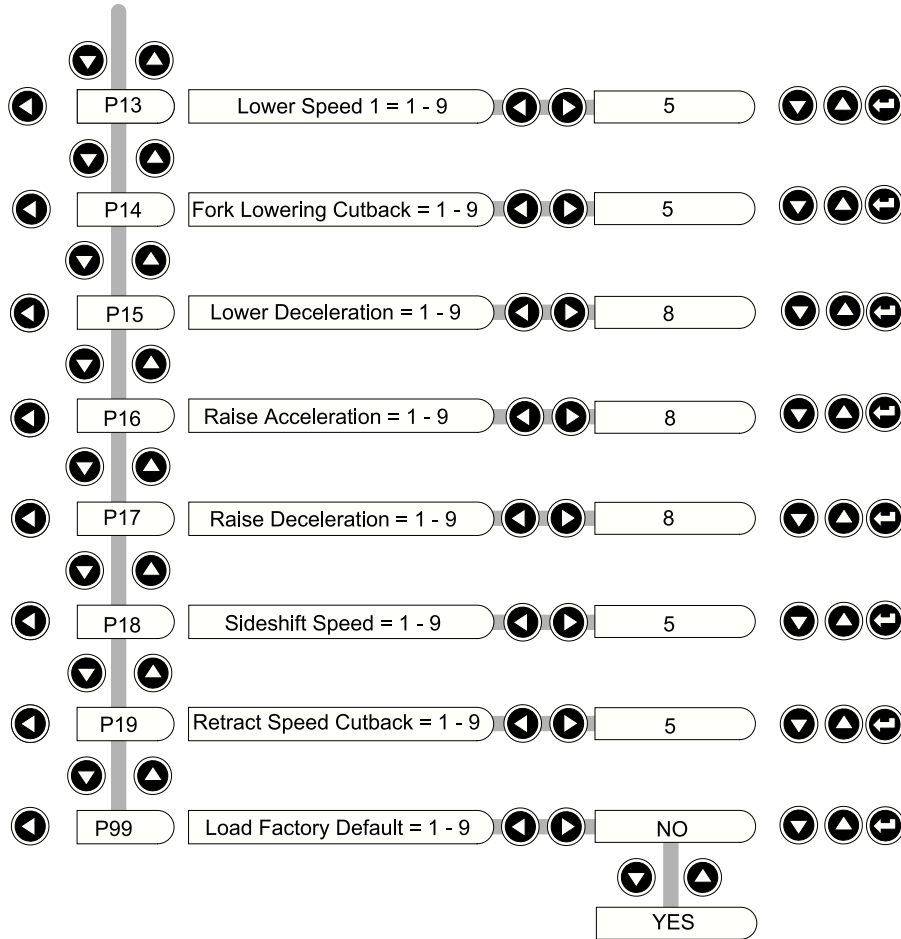
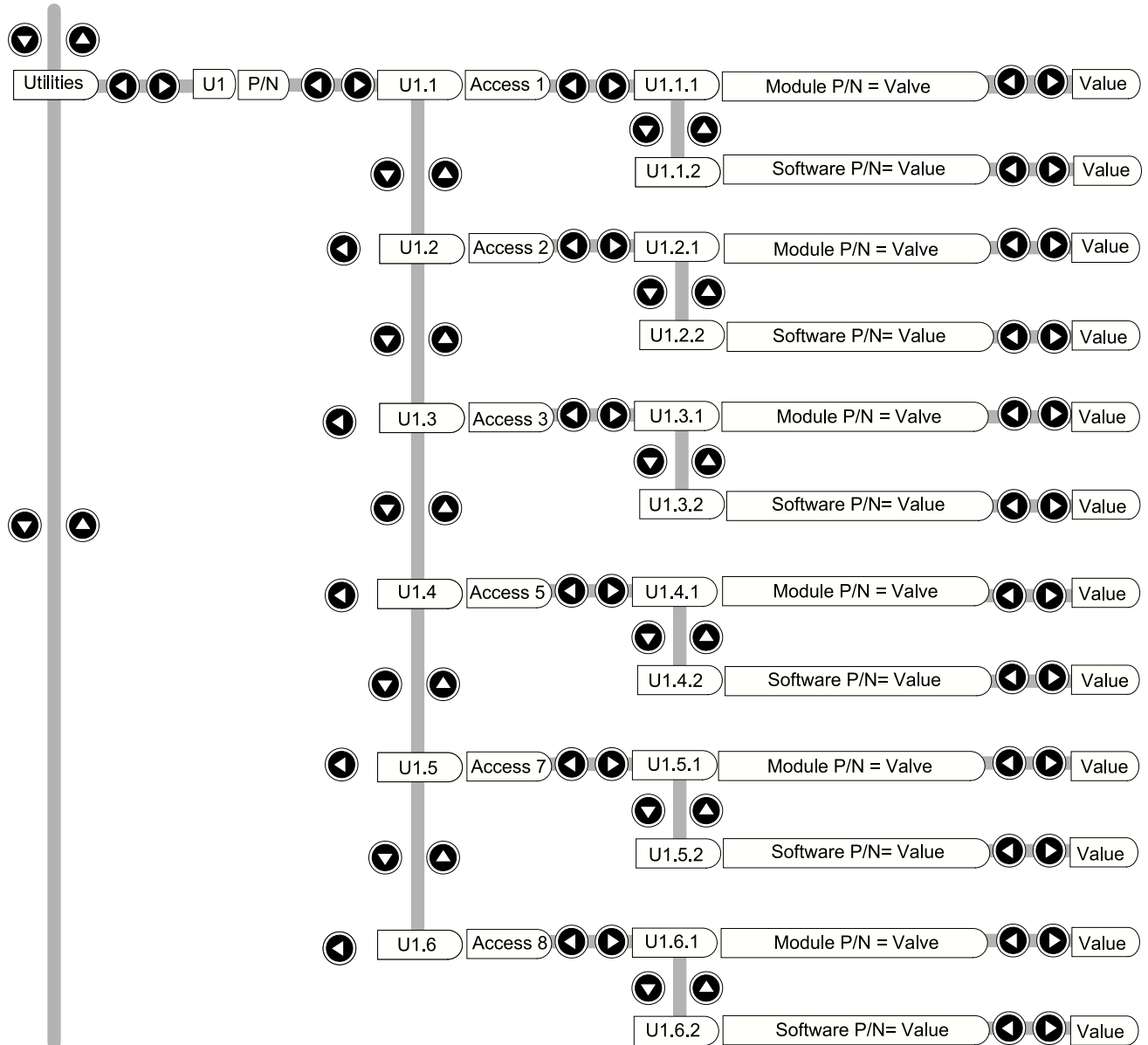


Figure 18668-01

Service Menus

continued from page -016



continued on page -005

Figure 18669-01

Notes:

Contactor

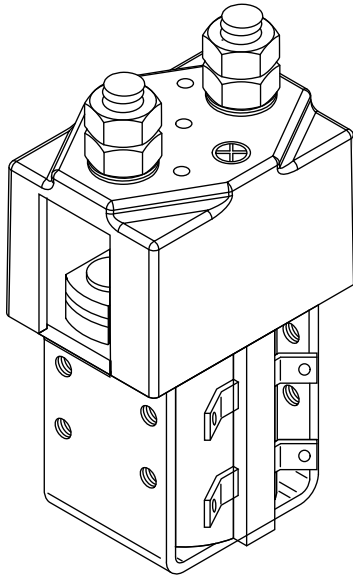


Figure 10554-01

The purpose of this information is to instruct the technician on proper care and maintenance to obtain satisfactory service from these devices. Crown has tested and applied these contactors according to the requirements of our vehicle. No modifications or changes should be made in the layout, physical arrangement or electrical connections without permission from Crown.

CAUTION

Before any inspection, adjustments, servicing, parts replacement or any other act is performed requiring physical contact with the electrical working components or wiring of these contactors, disconnect battery, raise drive wheels clear of floor and place blocks under truck frame.

Inspection

The following information is intended to assist during periods of normal maintenance and to provide checks for maintaining adjustments. As these devices are tested and adjusted at the factory, they should not normally require further adjustments. However, if factory adjustments are tampered with or otherwise changed, the checks contained in the following information may be made.

Contacts

- In normal operation, the contacts will become blackened, discolored, and roughened. This will not interfere with proper operation and cleaning is not necessary.
- The contacts should be replaced before the silver contact facing is completely eroded through to the backing material. The silver contact facing may transfer to either the moving or stationary contact and cause buildup on one contact. This can be expected under certain conditions and does not require contact dressing or filing.
- It is recommended that contacts always be replaced in mating pairs.

Coil

- Remove all electrical connections.
- Resistance reading of the coil should be between 15 - 19 ohms.
- If reading does not fall within the limits, replace coil.

Component Replacement

Refer to Figure 5674 and parts breakdown in Parts Section of manual when replacing components.

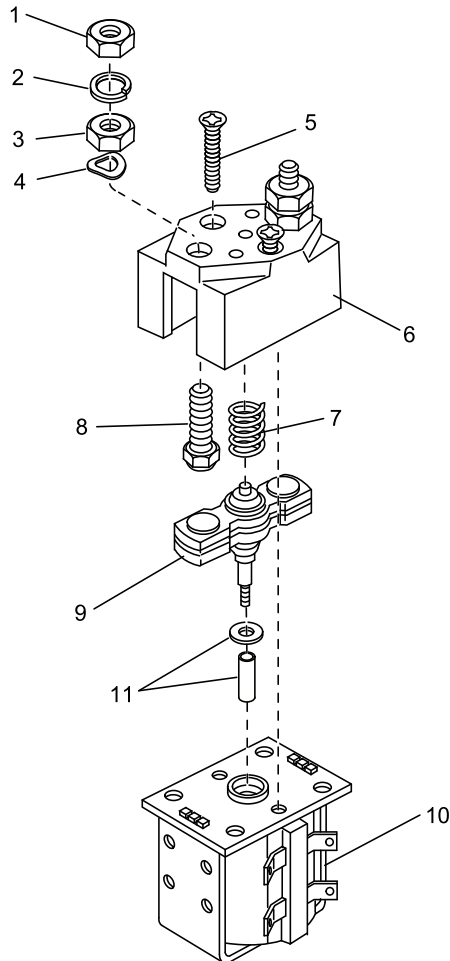


Figure 5674

Coil Replacement

1. Disconnect all electrical wiring.
2. Remove four mounting screws that secure contactor to mounting bracket and remove contactor from truck.
3. Remove two screws (5) and separate contact assembly from coil assembly.
4. Select replacement coil and transfer plunger (9) from existing coil to replacement coil.
5. Reassemble contact assembly to coil and secure with two screws (5).
6. Mount contactor on truck and reconnect all electrical wiring removed in step 1.

Contact Replacement

1. Remove electrical connections to contacts (coils do not have to be disconnected for this procedure).
2. Remove two screws (5) from top of contact and remove contact top cover (6).
3. Remove and replace contacts (contacts always should be replaced in pairs).
4. Place contact assembly on coils and install top cover and secure with two screws removed in step 1.
5. Connect electrical wiring removed in step 1.

Control Modules

General

Display, travel, lifting and steering are controlled by modules that communicate with each other via a common CAN interface.

- ACCESS 1 (Display)
- ACCESS 2 (Traction controller)
- ACCESS 3 (Lift controller)
- ACCESS 5 (Steer controller)
- ACCESS 8 (CAN interface #1 and #2)

Display Control Module (ACCESS 1)

Location is on the power unit (4), refer to Figure 18968. It is activated by the key switch. Function of display module (ACCESS 1) is to display pertinent truck information to the operator or service technician. This information is received from truck control modules and sensors. The information supplied is battery charge and operation hours, etc.



Figure 18968

Traction Control/Lift Control Module (ACCESS 2 and 3)

The traction control module (ACCESS 2) and the lift control module (ACCESS 3) are within the same housing (1), refer to Figure 18891. Location is on the control panel within the power unit. Function of traction control module and lift control module is to control traction motor speed via operator input from POT1 ACCEL and hydraulic pump motor speed via operator input from the X10 handle. Information is also received from various truck control modules and sensors.

Steering Control Module (ACCESS 5)

The Steering Control Module (ACCESS 5) is located on the control panel beneath ACCESS 2 and 3 within the power unit (4), refer to Figure 18891. Function of the steering control module is to control steer motor via information from the operator using POT2 (STEER CMD). This provides speed and directional control to the steering motor in relation to POT3 (STEER FEED-BACK) and ECR2.

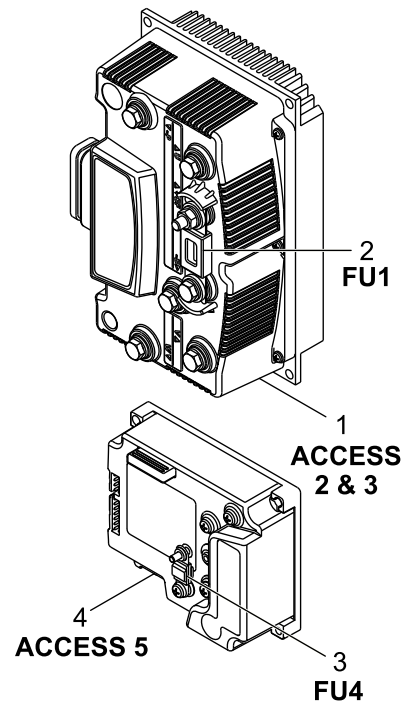
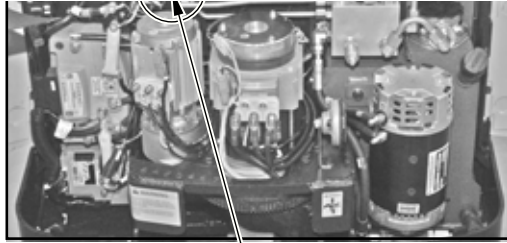


Figure 18891

Hydraulic Accessory Control (ACCESS 7), (SHR Trucks Only)

The hydraulic Accessory Control (ACCESS 7) is located on control panel. Function of the hydraulic accessory control is to control tilt, reach and sideshift accessories as applicable to the truck. The information is received from operator via X10 handle and applicable switches.



ACCESS 7 (HVC)

Figure 18917

CAN Interface (ACCESS 8)

The CAN Interface (ACCESS 8) is located inside the tiller arm assembly. Function of the CAN interface is to transfer all input from the X10 handle to the proper controllers and functions. The information received is from operator input via switches and controls on the X10 handle.

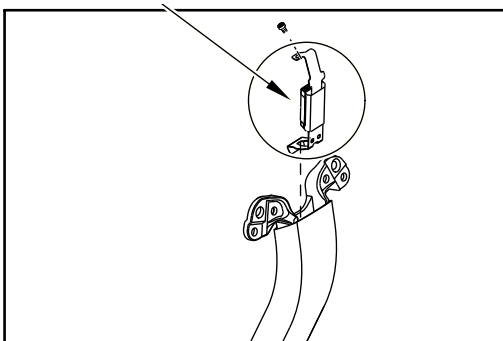


Figure 18918

Power Fuses

The power fuses (1 and 2) are mounted direct on controllers, refer to Figure 18891.

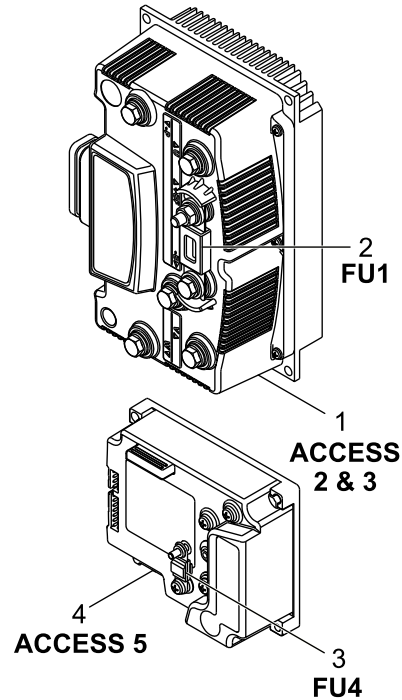


Figure 18891

Servicing Control Modules



WARNING

Fire risks from short circuits. Control modules operate at high currents. Please note:

- You must be trained to carry out this work.
- Use fatigue-free eye protection.
- Wear close-fitting clothing.
- Do not wear jewelry.
- Always use insulated tools.



WARNING

Risk of serious injury, avoid accidents by:

- *Switching the truck off.*
- *Disconnecting the battery.*
- *Preventing the truck from being switched on again, refer to Lockout/Tagout.*

Discharging Capacitors

The truck must be de-energized and secured, refer to Safety section. Once this has been completed:

- Short-circuit the positive and negative connections of the control module over a resistor (10 - 100 Ohm, min. 5 W) for a few sections.

The truck must be de-energized and secured. Refer to Control of Hazardous Energy section.

1. Discharge capacitors.
2. Dry clean outside control module.
3. Check nuts attaching power cables are tight.
4. Check logged events.

Replacing Control Modules

Remove

The truck must be de-energized and secured. Refer to Control of Hazardous Energy section.

1. Discharge capacitors.
2. Disconnect all wires (mark wires if necessary). Remove bus bars if present.
3. Remove control module mounting screws.
4. Remove control module.
5. Check tooth pattern left by back plate of control module on assembly plate. The full surface area of control module must be in contact with plate. If there are any large areas without direct contact to controller replace assembly plate to avoid thermal problems.



WARNING

When handling solvents lubricants observe manufacturers safe handling instructions. Refer to Lubrication and Adjustment sections for recommended types.

6. Remove heat conducting paste remains on assembly plate with lint-free cloth and a commercial silicon removing agent.

Assemble

Use a control module with correct software version. Refer to Electrical Parts.

1. Apply heat conducting paste part number (053051-008), thin and evenly to base plate of new control module.
2. Install control module to assembly plate.
3. If necessary clean power cable connections.
4. Connect all wires. Attach bus bar (if applicable).
5. Set control module parameters and carry out a function test:
 - Connect the battery and remove Lockout/Tagout items.
 - Adjust parameters, refer to ACCESS 1 2 3 for settings.
 - Perform functions test.

Notes:

Control Pod



WARNING

Before proceeding, refer to the Control of Hazardous Energy procedures.

NOTE

For many of the components, two different versions are available: standard and freezer. Be sure you install the correct component. The control handle cap contains the traction potentiometer assembly (POT, FS and RS), fast/slow switch (HSS), main PC board and hydraulic PC board. The control handle cap must be disassembled from control handle to replace any of these components.

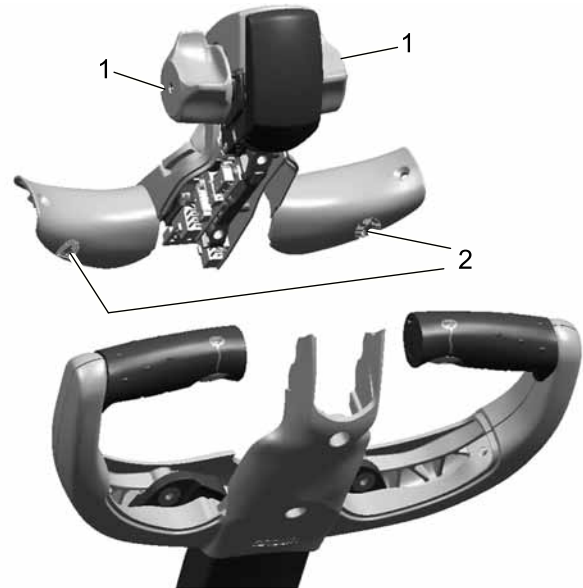


Figure 19032

Upper and Lower Shell

Removal

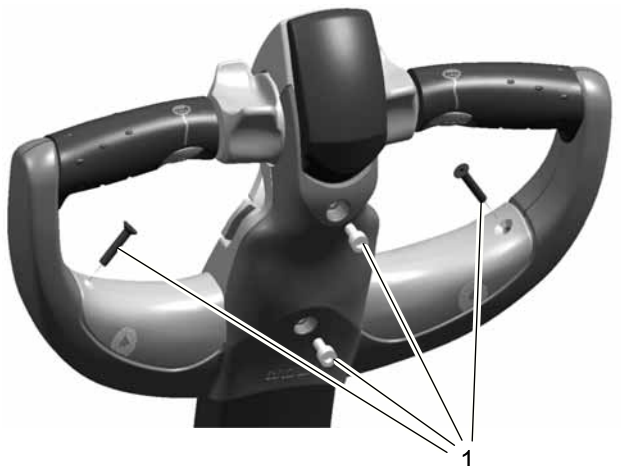


Figure 19031

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove the screws (1), refer to Figure 19031.
3. Press on control handle cap thumb markings (2) or gently pull on thumb wheels (1), refer to Figure 19032. The control handle cap will slide up and out of lower shell.

4. Disconnect control handle wire harness and horn switch harness connectors from control handle cap PC boards.

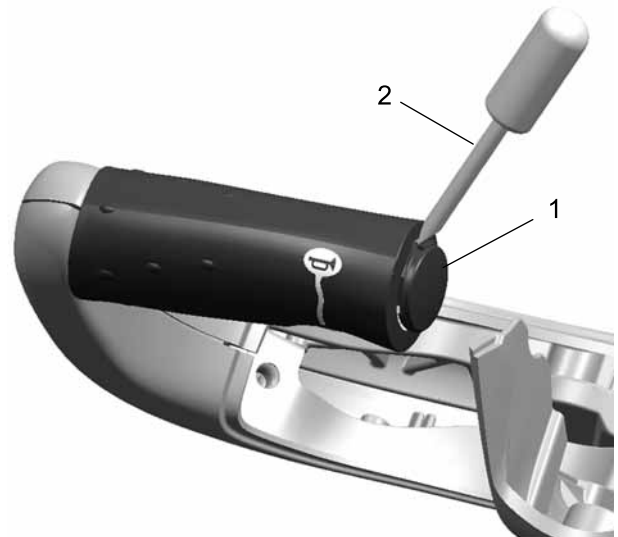


Figure 19047

5. Using a small flat-blade screwdriver (2), pry protective cap (1) from each handle, refer to Figure 19047.

6. While pressing horn button, pull horn switch assembly (2) out of handle, refer to Figure 19048.
7. Disconnect switch connector from harness.

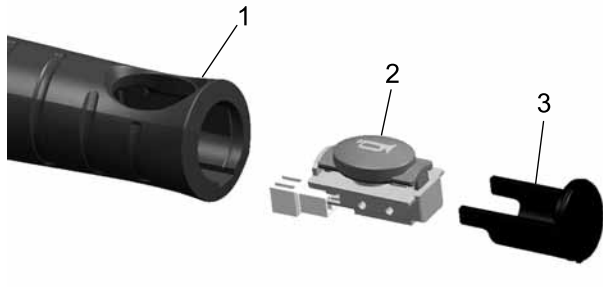


Figure 19048

Installation

1. Connect switch connector to harness.
2. While pressing horn button, push horn switch assembly (2) into handle refer to Figure 19048.
3. Using palm of hand push small protective cap (1) into each handle, refer to Figure 19047.
4. Connect control handle wire harness and horn switch harness connectors to the control handle cap PC boards.
5. Press on control handle cap thumb markings (2) or gently push on thumb wheels (1), refer to Figure 19032. The control handle cap will slide down and in of lower shell.
6. Install the screws (1), refer to Figure 19031.
7. Connect the battery, test all functions.

Fast/Slow Toggle Switch

Removal

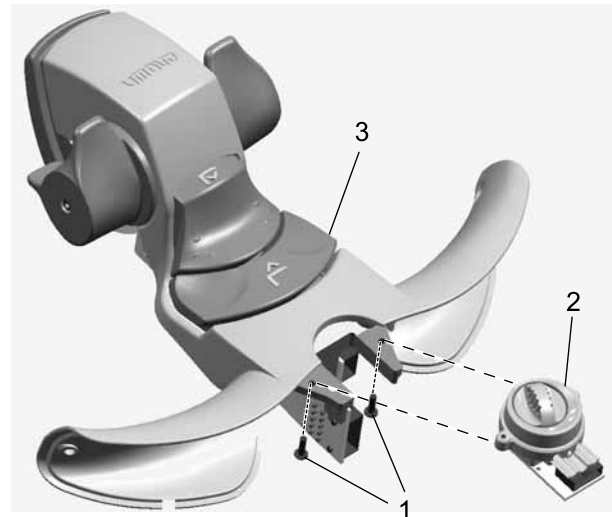


Figure 19033

NOTE

There are no parts in this switch module that can be repaired.

The entire module must be replaced.

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.
3. Remove the screws (1) and disassemble switch module (2) from control handle cap, refer to Figure 19033.
4. Press on control handle cap thumb markings (2) or gently pull on thumb wheels (1), refer to Figure 19032. The control handle cap will slide up and out of lower shell.
5. Disconnect control handle wire harness and horn switch harness connectors from control handle cap PC boards.

Installation

1. Connect control handle wire harness and horn switch harness connectors to control handle cap PC boards.
2. Press on control handle cap thumb markings (2) or gently push on thumb wheels (1), refer to Figure 19032. The control handle cap will slide down and in of lower shell.
3. Install the screws (1) and assemble switch module (2) to control handle cap, refer to Figure 19033.
4. Install control handle cap, refer to Control Handle Cap in this section.
5. Connect battery, test all functions.

Hydraulic PC Board

Removal

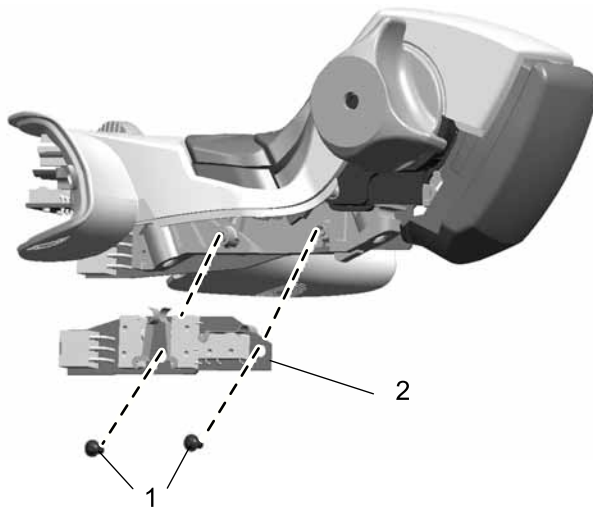


Figure 19034

NOTE

There are no parts on this board that can be repaired. It must be replaced in full.

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.
3. Disassemble the screws (1) from the smaller, hydraulic PC board (2), refer to Figure 19034, (the larger one is the main PC board). Remove hydraulic PC board.

Installation

1. Assemble the screws (1) to the smaller, hydraulic PC board (2), refer to Figure 19034, (the larger one is the main PC board). Install hydraulic PC board.
2. Install control handle cap, refer to Control Handle Cap in this section.
3. Connect battery, test all functions.

Main PC Board

Removal

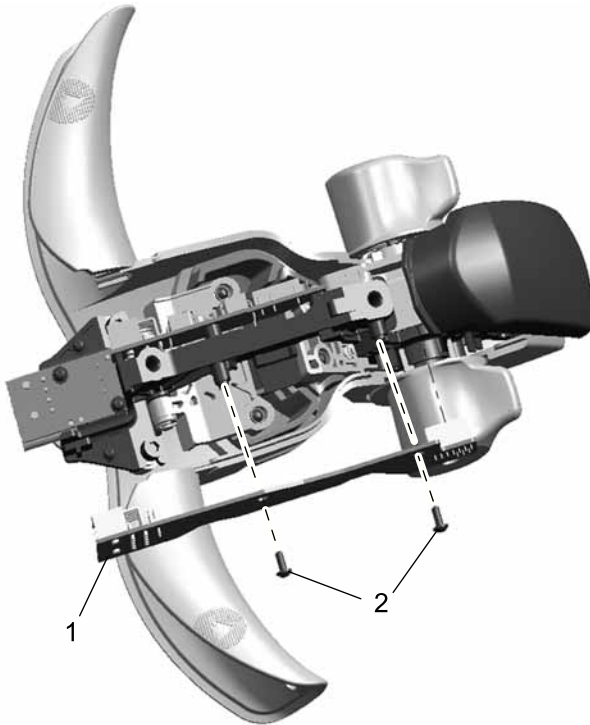


Figure 19035

NOTE

Because of the compact design, it may be somewhat difficult to access the connector on the main PC board through this process. If you experience difficulties replacing the board using above procedures, remove thumb wheels, lower cover and control handle cap cover (refer to Traction Potentiometer Assembly in this section).

There are no parts on this board that can be repaired. It must be replaced in full.

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.
3. Disconnect potentiometer connector from the main PC board.
4. Remove the screws (2) from the larger, main PC board (1), refer to Figure 19035, (the smaller one is the hydraulic PC board).

5. Disconnect safety reversing switch lead connector from main PC board and remove board.

Installation

1. Connect safety reversing switch lead connector to main PC board and install board.
2. Install the screws (2) to the larger, main PC board (1), refer to Figure 19035, (the smaller one is the hydraulic PC board).
3. Connect potentiometer connector to the main PC board.
4. Install control handle cap, refer to Control Handle Cap in this section.
5. Connect battery, test all functions.

Traction Potentiometer Assembly

Removal

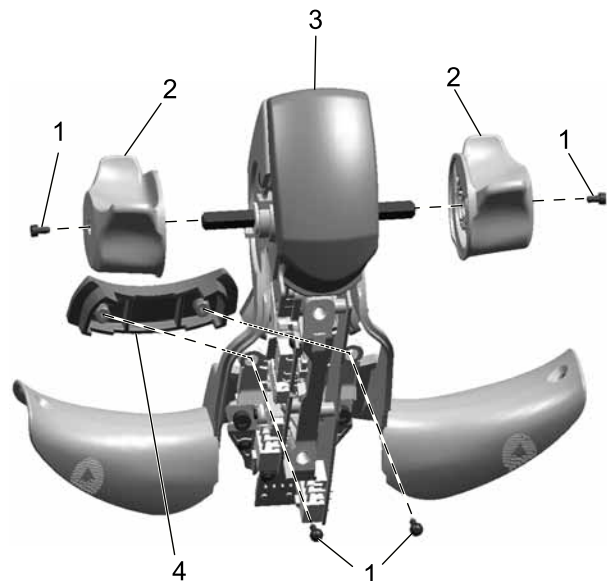


Figure 19036

There are no parts in the traction potentiometer assembly that can be repaired. It must be replaced in full.

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.

3. Remove the screws (1) from thumb wheels (2) and pull wheels from shaft, refer to Figure 19036. Be careful not to lose plastic bushings.
4. Remove the screws (5) that secure the lower switch cover (4), refer to Figure 19036.
5. Remove the cover (4), refer to Figure 19036.
8. Remove the screws (1) from securing the traction potentiometer (2), refer to Figure 19038.
9. Disconnect the traction potentiometer assembly connector from PC board and remove assembly from square shaft.

Installation

NOTE

The thumb wheels cannot be assembled incorrectly. They will only fit properly in one position.

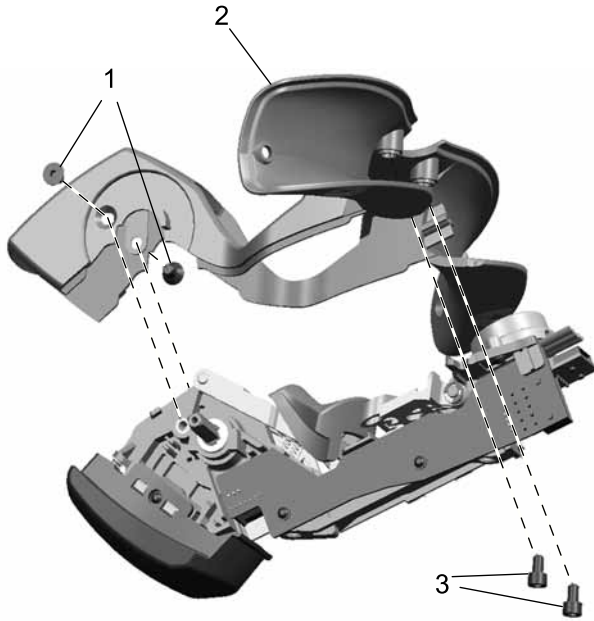


Figure 19037

1. Connect traction potentiometer assembly connector to the PC board and install assembly from square shaft.
2. Install the screws (1) securing the traction potentiometer (2), refer to Figure 19038.
3. Install the control handle cap cover (2), refer to Figure 19037.
4. Install the screws (1), refer to Figure 19037.
5. Install the cover (4), refer to Figure 19036.
6. Install the screws (5) that secure the lower switch cover (4), refer to Figure 19036.
7. Install the screws (1) to the thumb wheels (2) and pull the wheels from shaft, refer to Figure 19036.
8. Install the control handle cap, refer to Control Handle Cap in this section.
9. Connect battery, test all functions.

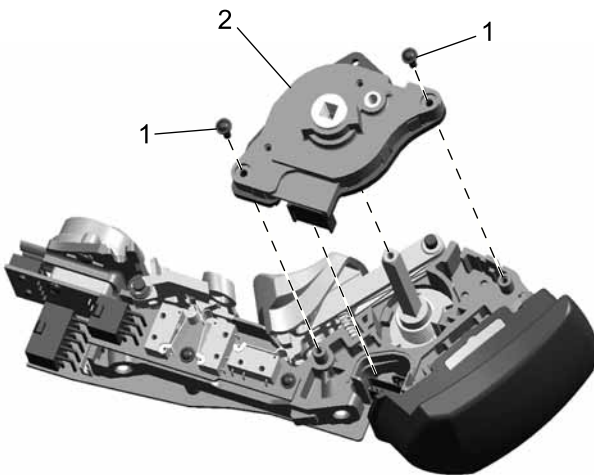


Figure 19038

Horn Switch

Removal

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.
3. Using a small flat blade screwdriver (2), pry protective cap (1) from each handle, refer to Figure 19047.

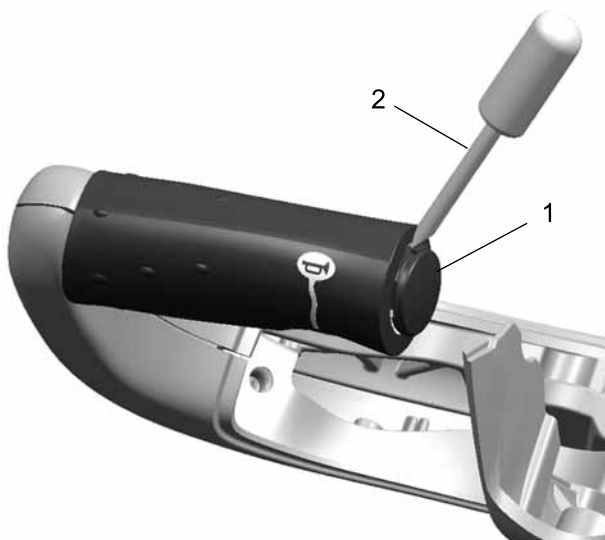


Figure 19047

4. While pressing horn button, pull horn switch assembly (2) out of handle. Disconnect the switch connector from harness, refer to Figure 19048.

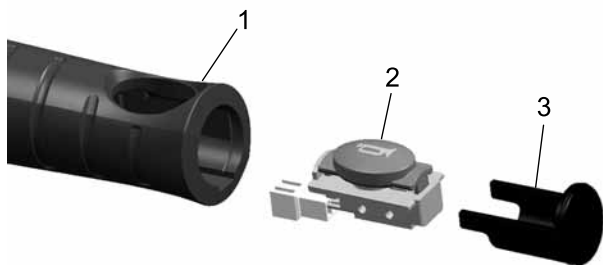


Figure 19048

Installation

NOTE

The horn switches for the left and right handles are different. If you assemble a switch on the wrong side, the horn symbol will be upside down.

1. While pressing horn button, push horn switch assembly (2) into handle. Connect the switch connector to the harness, refer to Figure 19048.
2. Using palm of hand, push protective cap (1) into each handle, refer to Figure 19047.
3. Install control handle cap, refer to Control Handle Cap in this section.
4. Connect the battery refer to Control of Hazardous Energy.
5. Connect battery, test all functions.

Handle

Removal

1. Disconnect the battery refer to Control of Hazardous Energy.
2. Remove control handle cap, refer to Control Handle Cap in this section.
3. Use a small flat blade screwdriver (2) and pry the protective cap (1) from each handle, refer to Figure 19047.
4. While pressing horn button, pull horn switch assembly (2) out of handle (1), refer to Figure 19047. Disconnect the switch connector from harness.

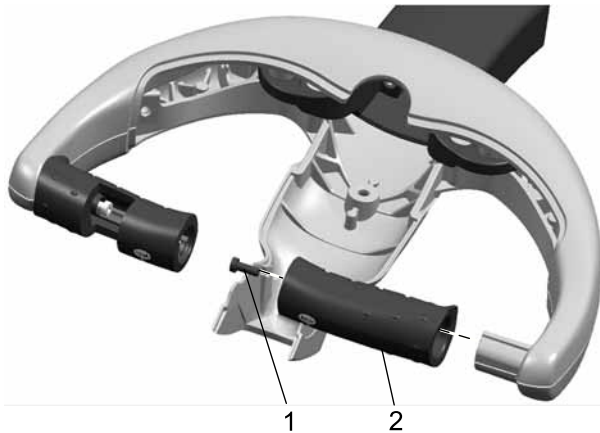


Figure 19049

5. Remove the internal screws (1) and pull handles (2) off shell, refer to Figure 19049.

Installation

NOTE

The horn switches for the left and right handles are different. If you assemble a switch on the wrong side, the horn symbol will be upside down.

1. Push handles (2) onto shell and install the internal screws (1), refer to Figure 19049.
2. While pressing horn button, push horn switch assembly (2) into the handle (1), refer to Figure 19047. Connect the switch connector to the harness.
3. Using palm of hand, push protective cap (1) into each handle, refer to Figure 19047
4. Install control handle cap, refer to Control Handle Cap in this section.
5. Connect the battery refer to Control of Hazardous Energy.
6. Connect battery, test all functions.

Notes:

Battery

Care and maintenance of battery is very important to obtain efficient truck operation and maximum battery life.



CAUTION

Gases produced by a battery can be explosive. Do not smoke, use an open flame, or create an arc or sparks in vicinity of battery. Ventilate an enclosed area well when charging.

Batteries contain sulfuric acid which may cause severe burns. Avoid contact with eyes, skin, or clothing. In case of contact, flush immediately and thoroughly with clean water. Obtain medical attention when eyes are affected. A baking soda solution .37 kg (1 lb) soda to 3.79 l (1 gal) water applied to spilled acid until bubbling stops, neutralizes acid for safe handling and disposal.

Voltage leakage from battery terminals to battery case can cause misleading trouble symptoms with truck electrical system. Since components of truck electrical system are insulated from truck frame, voltage leakage will not normally affect truck operation unless a short circuit or breakdown of circuit wire insulation to truck frame occurs.

A voltage check from battery connector terminal to battery case should indicate near 0 volts. Typically, however, sum of voltages at both terminals will equal battery volts. This voltage leakage will discharge battery. As battery cleanliness deteriorates, usable charge of battery decreases due to this self discharge.

Although a voltage leakage reading of 0 volts may not be possible, a cleaner battery will have more usable charge for truck operation and not affect operation of electronic devices on unit.

Safety Rules

1. Wear protective clothing, such as steel-toed shoes, rubber apron, gloves, boots, and goggles when performing any maintenance on batteries. Do not allow electrolyte to come in contact with eyes, skin, clothing, or floor. If electrolyte comes in contact with eyes, flush immediately and thoroughly with clean water. Obtain medical attention immediately. Should electrolyte be spilled on skin, rinse promptly with clean water and wash with soap. A baking soda solution .37 kg (1 lb) soda to 3.79 l (1 gal) water will neutralize acid spilled on clothing, floor or any other surface. Apply solution until bubbling stops and rinse with clean water.
2. Keep vent plugs firmly in place at all times except when adding water or taking hydrometer readings.
3. Do not bring any type of flame, spark, etc., near battery. Gas formed while battery is charging is highly explosive. This gas remains in cells long after charging has stopped.
4. Do not lay metallic or conductive objects on battery. Arcing will result.
5. Do not allow dirt, cleaning solution or other foreign material to enter cells. Impurities in electrolyte will have a neutralizing effect reducing available charge.
6. If battery repair is planned, follow battery manufacturer's instructions concerning repair practices and procedures. Battery electrolyte level should be checked before each charge of battery. Level should be maintained at 13 mm (0.5 in) above plates or just below lower lip of filler hole at all times. If low, add distilled water or approved local supply (consult battery manufacturer) at end of a charge cycle. Do not overfill. For maximum battery life, specific gravity readings should be taken daily on a pilot cell and recorded. A different pilot cell should be selected on a monthly basis with readings taken on all cells at semi-annual or annual intervals. Do not take specific gravity readings immediately after adding water. Water and electrolyte must be thoroughly mixed by charging before a reliable reading can be taken. Normal full charged specific gravity should be between 1.265 and 1.285.

Battery Care

Your Crown truck is powered by an electrical storage battery. Here are a few suggestions which will help you give battery proper care.

The battery on your truck is located in front of Power Unit.

1. Charge battery only in areas designated for that use.
2. Make certain charger being used matches voltage and amperage of truck battery. This voltage is listed on truck data plate and is located on lower portion of platform.
3. Before disconnecting or connecting batteries to charger, make sure charger is "OFF". If an attempt is made while charger is "ON", serious injury to you, battery, and charger could result.

4. Before charging, make sure battery cells contain correct amount of water. Charging batteries with a low water level might result in damage to cells. When checking water levels, never use a match or lighter. Battery fumes are explosive.
5. Before connecting battery cable to truck's receptacle, make sure key switch is off and all controls are in off position and brakes are applied. Battery cable must be fully connected before truck is used. If plug is not making good contact, heat will weld two parts of battery connector together, making it difficult to remove and necessary to replace.
6. Battery terminals should be checked and cleaned of corrosion regularly. Good battery terminal contact is essential not only for operation, but also for proper charging of battery.
7. Battery cover should be closed except when charging.
8. Charging requirements will vary depending on use of truck. Battery should be given an equalizing charge on a weekly basis. This charge should normally be an additional three hours at finish rate.
9. Refer to charger manufacturer's instruction for specific charging procedures.
10. Make certain battery used meets weight, type, amp hour, voltage, and size requirements of truck (refer to data plate). NEVER operate truck with an undersized battery or incorrect voltage battery. For battery weights and type, refer to Chart 1 for ANSI trucks and Chart 2 for international trucks.

Chart 1 - Battery ANSI Truck

Model	Battery Weight								Battery Type	Battery Rating		
	172 mm (6.75 in)				350 mm (13.75 in)					Voltage	Hour Rate	Capacity
	Minimum		Maximum		Minimum		Maximum					
	kg	lb	kg	lb	kg	lb	kg	lb				
SHR5520-25	230	510	320	710					E	24	6	300
SHR5520-30	230	510	320	710					E	24	6	300
SHR5540-35					440	975	635	1400	E	24	6	660
SH5520-40	230	510	320	710					E	24	6	300
SH5540-40					440	975	635	1400	E	24	6	660

Chart 2- Battery International Truck

Model	Battery Weight								Battery Type	Battery Rating		
	172 mm (6.75 in)				350 mm (13.75 in)					Voltage	Hour Rate	Capacity
	Minimum		Maximum		Minimum		Maximum					
	kg	lb	kg	lb	kg	lb	kg	lb				
SHR5520-11	230	510	320	710					E	24	6	300
SHR5520-13	230	510	320	710					E	24	6	300
SHR5540-16					440	975	635	1400	E	24	6	660
SH5520-18	230	510	320	710					E	24	6	300
SH5540-18					440	975	635	1400	E	24	6	660

Charging

Charging requirements will vary depending on use of truck. A battery with a specific gravity of 1.160 should be recharged. In some applications, more than one battery is required to provide ample power to unit during service period.

CAUTION

Never smoke or bring flame near battery. Gas formed during charging is highly explosive and can cause serious injury. Consult charger manufacturer's manual covering your charger for hints on operation and maintenance. Basic rules are as follows:

Placing battery on charge:

1. Park truck at charging station with forks lowered and key removed.
2. Make certain charger control is in off position.
3. Connect battery to charger and make certain connectors are mated completely.
4. Set timer for specified time. Set for Normal (Daily Charge, except one night a week when the Equalize [Weekend] Charge should be used).
5. Check charger ammeter to make certain it shows charge.

Removing battery from charge:

1. Make certain charger is turned off.
2. Unplug connector using both hands with a straight pulling motion.
3. Hang up charger cable to prevent damage to cable. (Broken connectors can cause poor connections and connector failures).
4. Make daily battery checks and add water as needed.
5. Connect battery to truck. Make certain connectors are mated completely.

Battery Removal

CAUTION

Don't allow any metallic object to come in contact with top of battery cells. This may cause a short circuit when removing, installing, or transporting battery. Use an insulator (such as plywood) to cover top of battery before and during removal and installation.

1. Turn key switch OFF. Refer to Figure 18910.

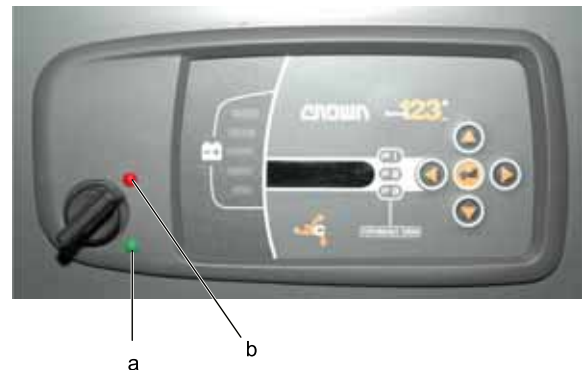


Figure 18910

- a "ON"
b "OFF"

2. Open Power Unit doors and disconnect battery.
3. Remove battery cover (one side only).
4. Position battery roller stand next to truck. Align stand with battery. Battery roller stand should be same height as truck's battery compartment rollers, and as long/longer than battery.
5. Roll battery onto stand. Using approved spreader bar, lift and move battery to charging area.

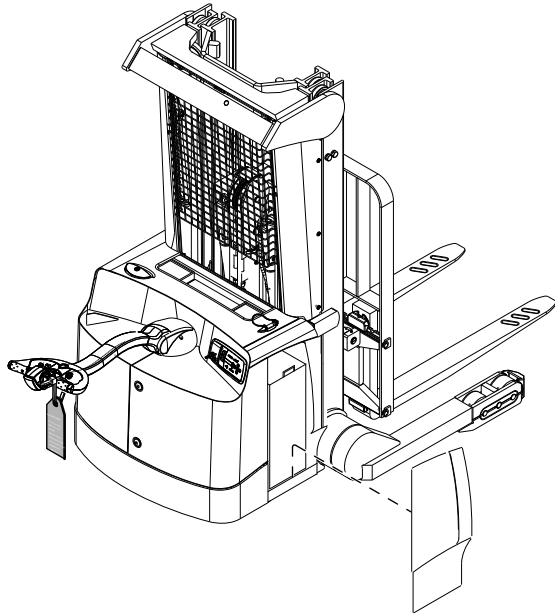


Figure 18913

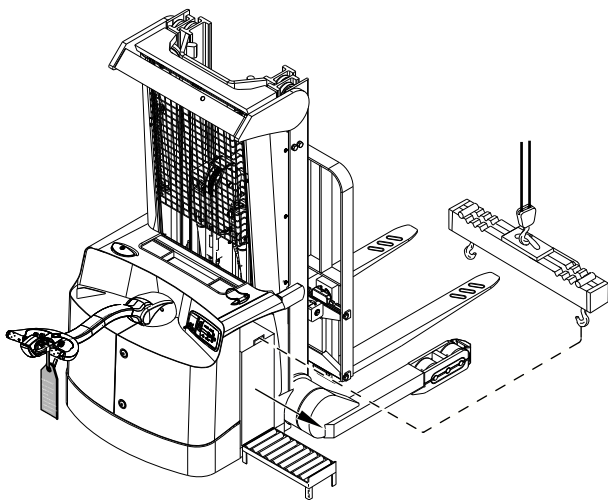


Figure 18911

Battery Installation

CAUTION

Don't allow any metallic object to come in contact with top of battery cells. This may cause a short circuit when removing, installing or transporting battery. Use an insulator (such as plywood) to cover top of battery before and during removal and installation. Make certain same battery or battery of equal weight is loaded into truck for truck stability. See data plate for minimum battery weight and type.

1. Check to ensure key switch is turned off.
2. Using approved spreader bar, move battery onto roller stand and push battery into battery compartment.

WARNING

Battery can slide out and hurt someone if side retainers are not properly installed. Be sure both retainers are in place and secure.

3. Remove roller stand and install battery cover. Make sure battery retainers are properly adjusted for battery installed.
4. Connect battery and close top cover.
5. Turn key switch ON and check truck operation.

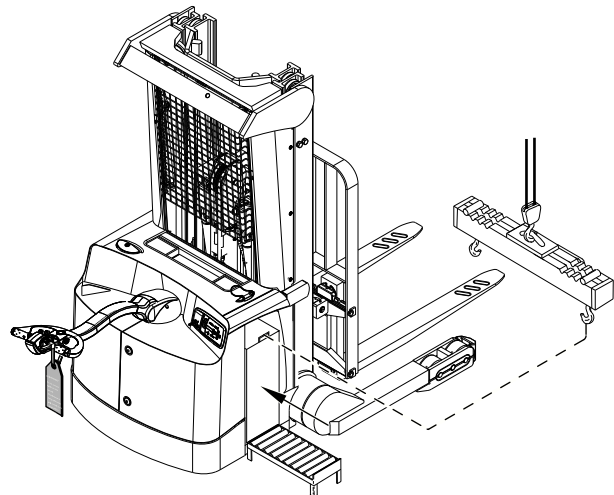


Figure 18912

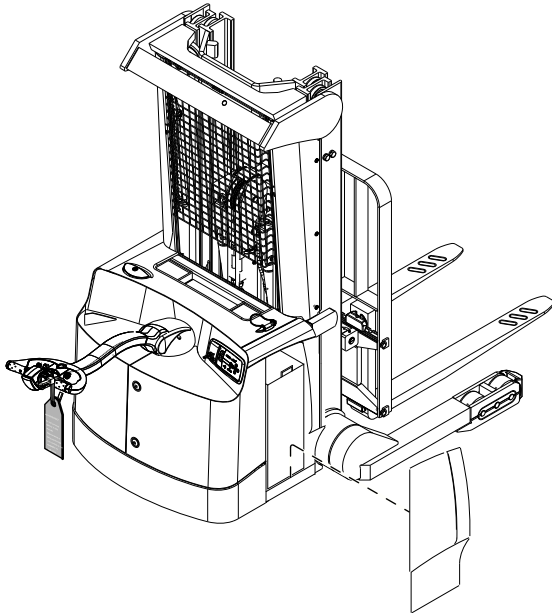


Figure 18913

Voltage readings of each cell taken at normal charger finish rate also indicate battery condition. New batteries will have cell voltages ranging from 2.055 volts to 2.065 volts. Older batteries may range from 2.045 volts to 2.055 volts. These readings still indicate a battery in good condition.

A variation of .20 volts may be normal if certain cells are exposed to higher temperatures during discharge. Voltage differences that cannot be attributed to battery age or operating conditions indicate a weak cell(s) and maintenance is required.

Battery Cleaning

Always keep vent plugs tightly in place when cleaning battery. When properly watered and charged, battery will remain clean and dry. Brush or blow off any dust or dirt which may accumulate on them. However, if electrolyte is spilled or overflows from a cell, it should be neutralized with a solution of baking soda and water .37 kg (1 lb) soda to 3.79 l (1 gal) of water. To do this, remove battery from truck and clean with solution of soda and water, brushing soda solution beneath connectors and removing grime from covers. Then rinse battery with cool water from a low pressure supply to remove soda and loosened dirt. If batteries stay wet consistently, they may be overcharged or overfilled. This condition should be investigated and corrected.

Troubleshooting



CAUTION

Only qualified and experienced personnel should perform maintenance and repair on batteries.

Records of battery specific gravity readings, charger used, truck used, etc. can be the most effective troubleshooting aid. Contact your dealer for charts designed specifically for this purpose.

Notes:

Motors

This truck is equipped with an AC motor that provides traction and a DC motor that powers the hydraulic

pump. The traction motor has an ECR1 sensor to monitor speed and position.

Chart 1 Motor Information			
Motor Function	Traction Motor - AC	Lift Pump Motor	Steer Motor
Part Number	821581	114330	821421
Motor Type	AC Induction	DC	AC Induction
Voltage	24	12/24	24
Rated Output KW (HP)	4.8 (6.5)	4.8 (6.5)	4.8 (6.5)
RPM	1690	2465	1600
Direction of Rotation	N/A	Clock Wise Drive End	N/A
Motor Diameter mm (in)	N/A	141.7 mm (5.58 in)	N/A
Number of Brushes	N/A	4	N/A
Internal Sensors	ECR1	N/A	ECR3

Check motors for shorts between terminals and motor frame by use of an ohmmeter on a high resistance scale such as R x 10,000. If a reading less than 50,000 ohms is observed, the source of trouble should be repaired before unit is placed into operation to prevent further damage.

The standard hydraulic pump motor is DC. The pump motor has ECR3 to monitor pump direction and speed. This is internal to the motor.

Pump Motor and Brush Inspection

1. Switch off the truck and disconnect the battery.
2. To prevent the truck from being switched on again and rolling away. Refer to Lockout/Tagout for safety procedure.
3. Remove the hydraulic unit mounting bolts and tilt unit just enough to access top of motor. Remove the head band and commutator end head.
4. Clean brush band and remove brush band head.
5. Clean dirt and carbon dust from winding and brush holder with low pressure air. Use a clean, dry cloth to clean the commutator.

NOTE

Do not use an emery cloth to clean the commutator.

NOTE

*Length of new carbon brush: 20 mm (0.8 in)
Wear limit is 10 mm (0.4 in)*

6. Brushes should be replaced when they reach their wear limit or if they will reach the wear limit before next scheduled inspection.
7. Check the brush spring to see they maintain tension against the commutator equally on all brushes.

Notes:

Event Codes

Access Module Listing:

ACCESS 1: Display Control Module (DCM)

ACCESS 2 and 3 combination (Combi): Hydraulic (HCM) and Traction (TCM)

ACCESS 5: Steering Control Module (SCM)

ACCESS 7: Accessory Control Module (ACM)

ACCESS 8: Operator Control Module (OCM)

Some Troubleshooting Basics

Statistically the majority of malfunctions occur in or at hardware components, contactors and motors. The next components to test are connectors, wiring and input devices such as switches, potentiometers and encoders. Inspect the motor control system last. Always begin your troubleshooting procedure at the driven device, then proceed to inputs devices and finally move on to the control attached to these devices.



WARNING

Never key "ON" truck with any control connectors disconnected. In addition, never remove or connect any control connectors while truck is keyed "ON".

When a Malfunction Occurs

Proceed to the display and access the Level 2: Field Service Mode as follows.

NOTE

Your monitoring system can be accessed at three levels of authorization:

Level 1: Operator Mode

Level 2: Field Service Mode (Full Truck Operation)

Level 3: Analyzer/Test Mode (No Truck Operation)

This section deals with the Level 2 and Level 3. For information on Level 1 see the Operator's Manual. Refer to Access 1 2 3 for display information.

No Event Code?

When the truck malfunctions and no event code is entered it usually means the malfunction is not electrical.

If the truck powers up, but a code is not entered, the malfunction is probably mechanical or hydraulic rather than electrical. Information regarding mechanical and hydraulic troubleshooting is located in the appropriate section in this Manual.

Messages

During truck operation, messages may occur which are intended to provide visual assistance to the operator of the truck. Once the reason for the message is corrected the message will be removed. Following is a list of these messages as viewed on the display with a description of message intent.

To Locate Malfunctioning Components

Component and wiring location maps are provided at strategic locations to help you quickly determine the physical location of items in question.

All components are clearly marked at the connection points.

Power Cable Connections

Due to capacitance voltage present on the motor control panel, whenever performing maintenance which may permit contact with the bus bars and associated power cables, discharge capacitor on the traction control panel by placing a minimum 100 ohm, two watt resistor (062033-030) between positive (+) and negative (-) of capacitor for three or more seconds.



ACCESS 1

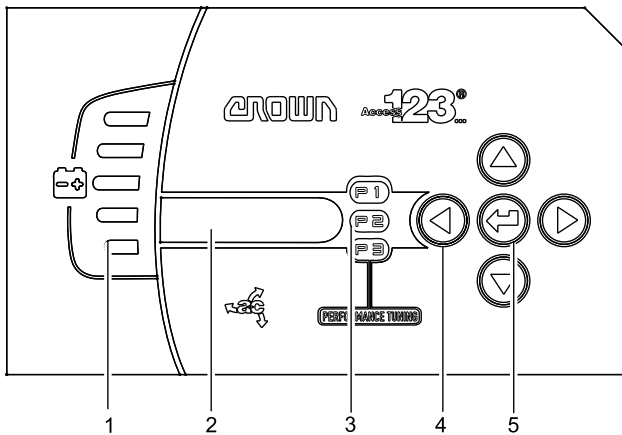


Figure 19121

- 1 Battery Discharge Indicator
- 2 Display Screen
- 3 Service Required Indicator
- 4 Navigation Keys - up, down, left and right arrows; used to scroll through menus
- 5 Enter or Return Key - used to navigate in and out of menus and accept inputs

ACCESS 1: Display Control Module (DCM)

ACCESS 2 and 3 combination (Combi): Hydraulic (HCM) and Traction (TCM)

ACCESS 5: Steering Control Module (SCM)

ACCESS 7: Accessory Control Module (ACM)

ACCESS 8: Operator Control Module (OCM)

Event Code 200

It is a self diagnosis test within the logic between microcontrollers. Possibly caused by a CAN bus malfunctioning, which stops communication.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

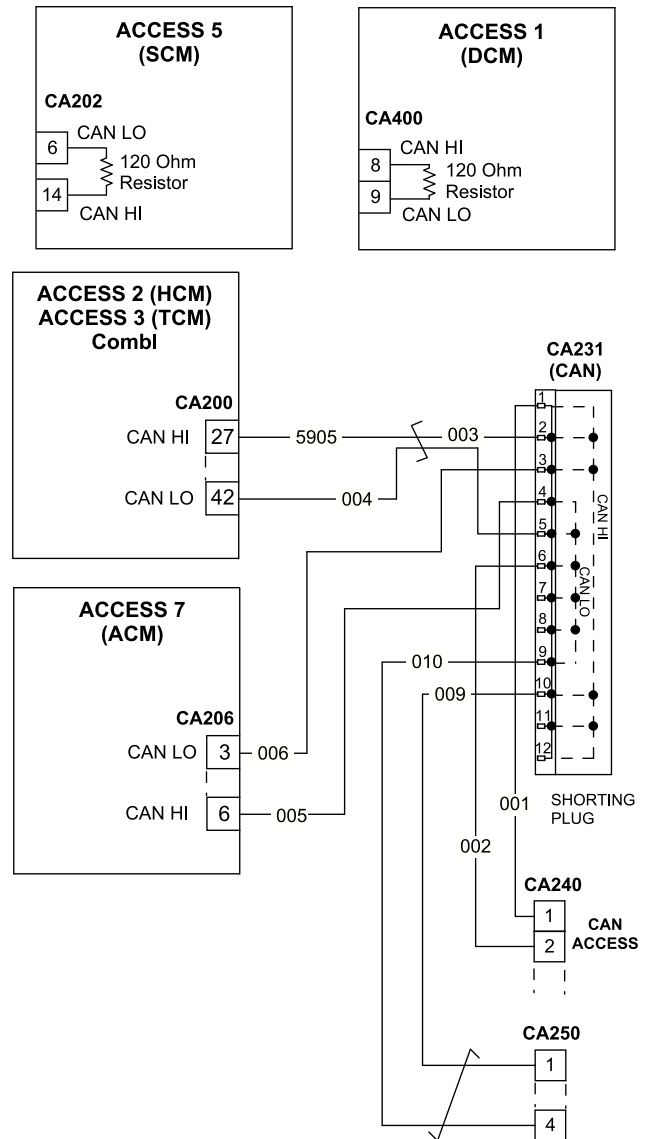


Figure 19098

Event Code 201

This code is due to a HW or SW defect of the non-volatile embedded memory supporting the parameters. Does not inhibit the machine operations, but the truck will work with the deissue values. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 202

Pump VMN Low

The pump motor output is lower than expected, considering the pulse width modulation (pwm) applied.

Step 1: Verify the line contactor is closing properly with good contact.

- If: Contacts do not close properly.
 - Then remove or repair the contactor.

Step 2: Verify the power cables for the AC motor are properly connected.

- If: Power cables are not correct.
 - Then repair or replace cables as necessary.

Step 3: Using Digital Volt-Ohm Meter (DVOM), verify power cables for shorts to truck frame. Disconnect battery connector and disconnect each of the three-phase power cables from the ACCESS 2 and 3 combination and motor. Verify resistance between each power cable and frame.

- If: Cables are shorted.
 - Then repair or replace cables as necessary.
- If: Cables are correct.
 - Then proceed to Step 4.

Step 4: With cables disconnected from motor, verify resistance of each motor terminal to truck frame.

- If: Any terminal is shorted (not open).
 - Then replace motor.

- If: Motor windings do not show a connection to frame on DVOM.
 - Then issue could be intermittent or higher resistance than DVOM can detect.

Step 5: Using DVOM, verify ACCESS 2 and 3 combination terminals. The resistance to truck frame. Keep power cables disconnected from ACCESS 2 and 3 combination. Verify resistance of each phase terminal to truck frame.

- If: Any terminal is shorted (not open).
 - Then replace ACCESS 2 and 3 combination.

Step 6: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 203

Pump VMN High

This test is carried out when the pump motor is turning (pulse width modulation (pwm) applied). The pump motor output is higher than expected, considering the pwm applied.

Step 1: Verify the power cables for the AC motor are properly connected.

- If: Power cables are not correct.
 - Then repair or replace cables as necessary.
- If: Cables are shorted.
 - Then repair or replace cables as necessary.

Step 2: Using Digital Volt-Ohm Meter (DVOM), verify power cables for shorts to truck frame. Disconnect battery connector and disconnect each of the three-phase power cables from the ACCESS and motor. One at a time, verify resistance between power cable and frame.

- If: Cables are shorted.
 - Then repair or replace cables as necessary.
- If: Cables are correct.
 - Then proceed to Step 3.

Step 3: With cables disconnected from motor, verify resistance of each motor terminal to truck frame.

- If: Any terminal is shorted (not open).
 - Then replace traction motor.
- If: Motor windings do not show a connection to frame on a DVOM.
 - Then issue could be intermittent or higher resistance than a DVOM can detect.

Step 4: Using DVOM, verify ACCESS 2 and 3 combination terminals. The resistance to truck frame. Keep power cables disconnected from ACCESS 2 and 3 combination. Verify resistance of each phase terminal to truck frame.

- If: Any terminal is shorted (not open).
 - Then replace ACCESS 2 and 3 combination.

Step 5: Clear code and re-key the truck.

- If: Event clears.

- Then return to operation.

- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 204

Pump 1=0 Ever

This test is carried out when the pump motor is running and verifies that the current feedback sensor is not constantly stuck to 0.

Step 1: Verify the motor connections and continuity.

- If: Motor connections are opened.
 - Then repair or replace cables as necessary.
- If: Connections are correct.
 - Then issue could exist in the current sensor or in the related circuit in the ACCESS 2 and 3 combination.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 205

Pump STBY 1 High

In standby condition (pump motor not driven), the feedback coming from the current sensor in the pump chopper gives a value too high. This event is not related to external components, so replace ACCESS 2 and 3 combination. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 206

High Temperature

Occurs when the temperature of the power section plate is higher than 75°C (167°F). Then the maximum current decreases proportionally with the temperature increases from 85° (185°F) up to 105°C (221°F). At 105°C (221°F), the current is limited to 0 A.

Event Code 207

High Current

Occurs if the circuit to limit current via hardware in the motor is either always active at key-ON or repeatedly active when the motor is turning. Not entered with ACCESS 2 codes.

Event Code 208

No CAN Message #2

It is a self diagnosis test within the logic between master and slave microcontrollers. Possibly caused by a CAN bus malfunctioning, which blinds master-slave communication. This condition may be caused by other issues. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which causes a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When the traction moves slowly and draws high current, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

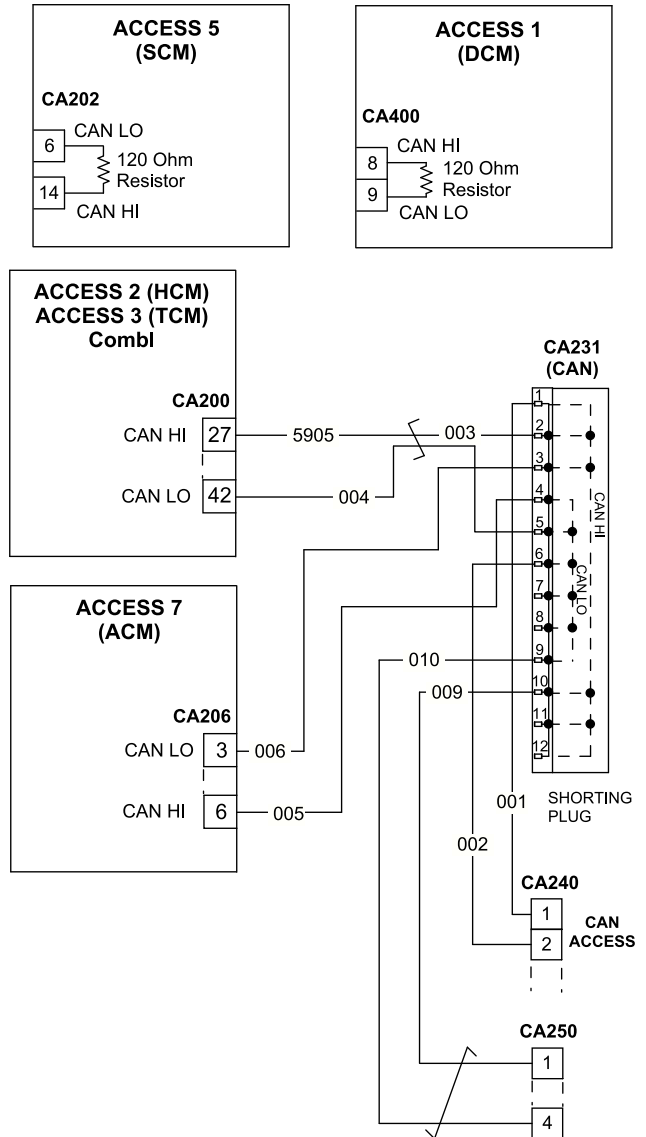


Figure 19098

Event Code 209

ACCESS 7 In Alarm

This code is not entered with ACCESS 2 codes.

Event Code 210

Wrong Zero

The outputs of the amplifiers (used to measure the motor currents and voltage) are verified to be near null. Occurs when current signals are $>2.85\text{ V}$ or $<2.15\text{ V}$. Voltage signals $>3\text{ V}$ or $<2\text{ V}$ initially. Not related to external components, so it may be necessary to replace the ACCESS 2 and 3 combination. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 211

Output Mismatch

ACCESS 2 has detected the ACCESS 3 driving the traction motor incorrectly. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 212

Safety Feed

ACCESS 2 has detected an issue in the feedback of the driver outputs. Not related to external components, so it may be necessary to replace the ACCESS 2 and 3 combination. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 213

Wrong Setpoint

ACCESS 2 has detected ACCESS 3 wrong traction function set point. Not related to external components, so it may be necessary to replace the ACCESS 2 and 3 combination. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 214

CAN In Mismatch

CAN messages, from the ACCESS 2 microcontroller, have detected an issue.

Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which will cause a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When the traction moves slowly and draws high current, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

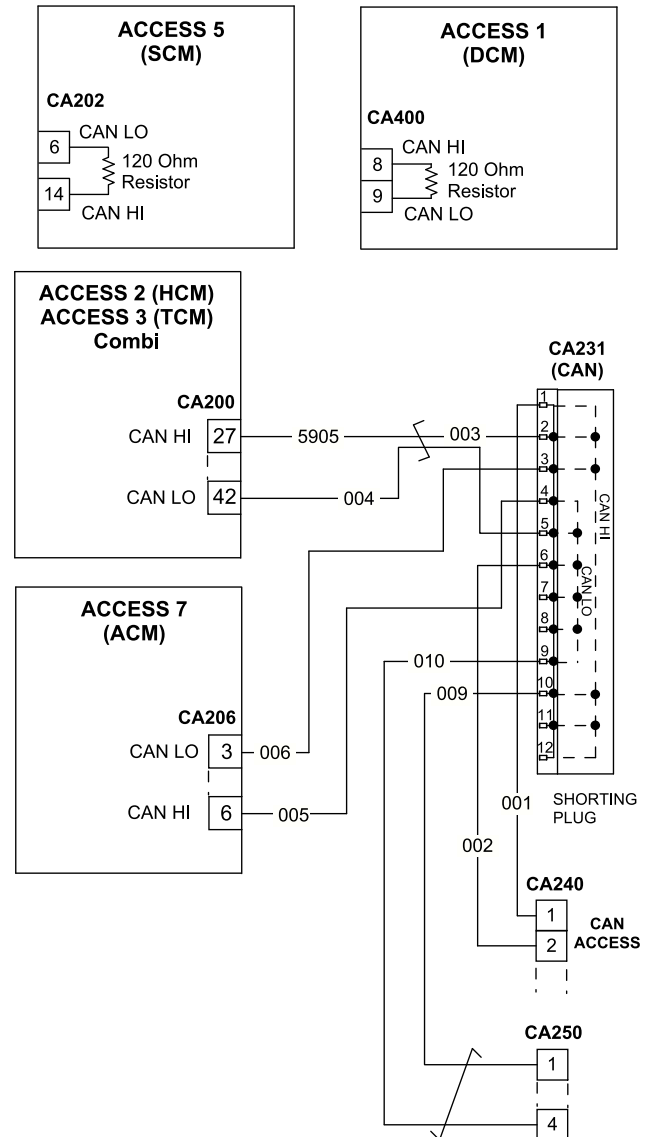


Figure 19098

Event Code 215

Input Mismatch

ACCESS 2 has detected a mismatch between its input (digital, analog and encoder) and ACCESS 3 inputs. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 216

HW Issue Valve

The slave has detected that the master microcontroller is not able to stop hydraulic valves functions. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 217

Hardware Issue

ACCESS 2 has detected that ACCESS 3 is not able to stop hydraulic functions. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination. One or more ON/OFF valve drivers opened (not able to close, so not able to drive the valve).

Event Code 218

Lift Lower

Lift and lower are pressed at the same time creating a sequence issue. Not entered as an alarm, but a warning. See No Event Code section.

Event Code 219

No CAN Tiller Message

No CAN messages from the tiller microcontroller.

Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which will cause a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When the traction moves slowly and draws high current, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

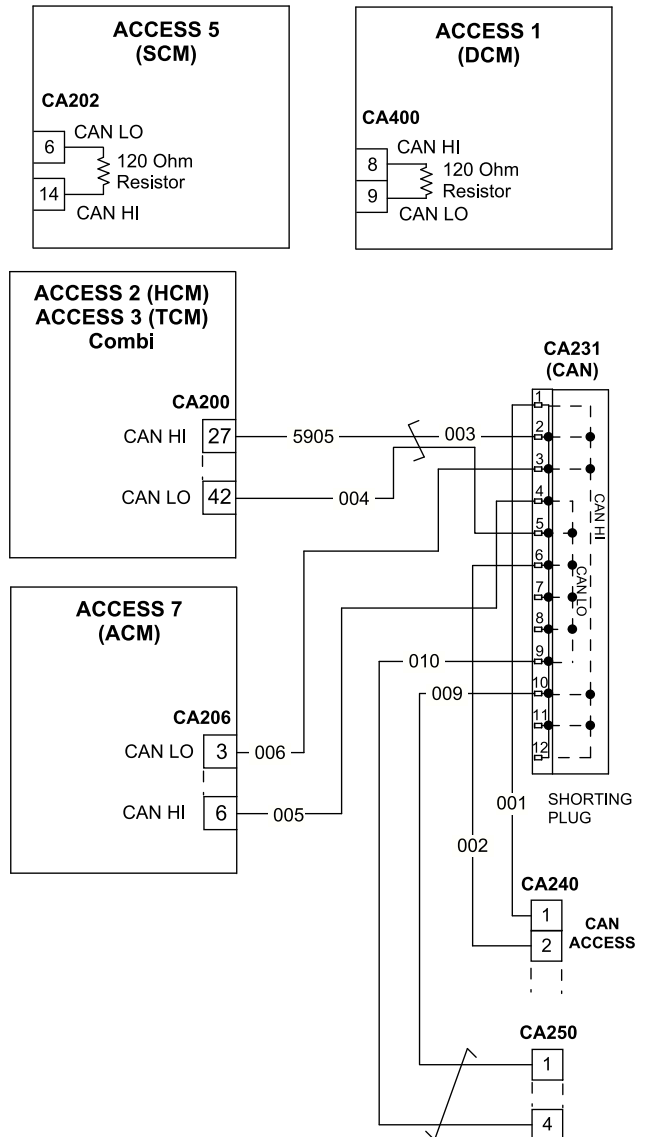


Figure 19098

Event Code 220

Current Sensor Low

The pump chopper current sensor feedback is too low (below 0.5 V). Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination. One or more ON/OFF valve drivers opened (not able to close, so not able to drive the valve).

Event Code 221

EEP VERIFIESUM

This issue caused internally, verify sum issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination. One or more ON/OFF valve drivers opened (not able to close, so not able to drive the valve).

Event Code 222

RAM Warning

This issue caused internally, verify sum issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 223

Waiting For Traction

This code is not entered.

Event Code 224

EVP Driver KO

EVP valve driver not able to drive the load (does not close), an internal issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 225

EVP Driver Shorted (PV)

PV (EVP) driver is shorted.

Step 1: Verify control wires from PV to PC200-3.

- If: Wiring not correct.
 - Then repair or replace wiring as necessary.
- If: Wiring correct.
 - Then proceed to Step 2.

Step 2: Remove wire 5901 at PV and re-key the truck.

- If: No event.
 - Then replace the PV solenoid.
- If: Event continues.
 - Then turn OFF truck. Verify for continuity between battery negative (B-) and wire 5901.
- If: Continuity exists.
 - Then remove CA200 connector and verify again at CA200-3 to B-.
- If: Continuity to B-.
 - Then repair or replace harness as necessary.
- If: No continuity.
 - Then driver in ACCESS 2 is not working properly. Replace ACCESS 2 and 3 combination.

Event Code 227

Analog Input

A/D input conversion is not correct, an internal issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

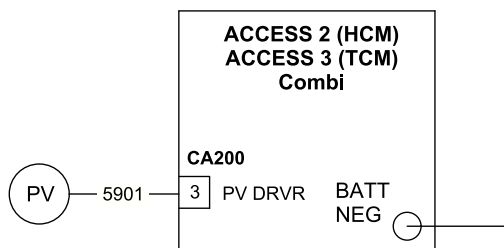


Figure 19095

Event Code 228

No CAN Message 02

No CAN messages from ACCESS 3.

Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which will cause a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When the traction moves slowly and draws high current address, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

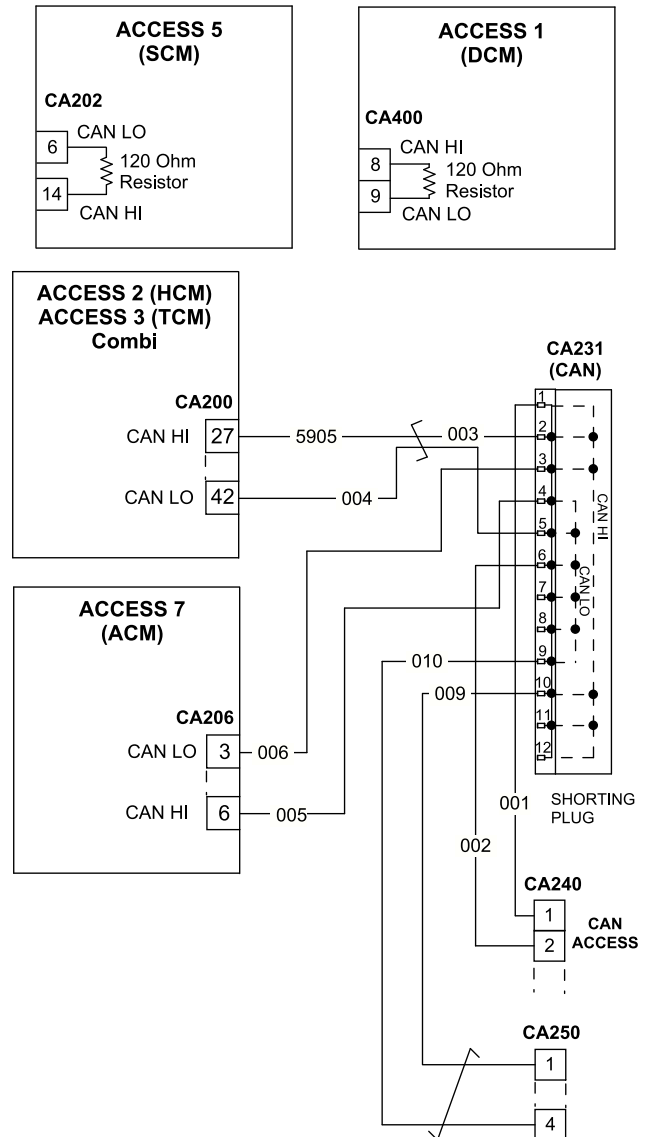


Figure 19098

Event Code 229

CONt Driver

One or more ON/OFF valve drivers is not able to drive the load (does not close), an internal issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 230

Driver Shorted (SVA1, SVA2, SVCV, FN1, HN, Travel Alarm)

One or more ON/OFF drivers are shorted.

Step 1: Verify FU3 has not opened or an open wire to the positive rail for the various drivers.

- If: Volt not present in FU3. A driver short is recognized.
 - Then replace FU3.
- If: Volt present in FU3. Wiring not open on positive rail.
 - Then proceed to Step 2.

Step 2: Turn truck OFF, verify short or a low impedance pull-down between the negative of the coil and battery negative.

- If: Wiring and coil resistance correct (less than 10 ohm).
 - Then driver circuit is damaged. Repair or replace ACCESS 2 and 3 combination as necessary.

Step 3: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 231

Coil Shorted (SVA1, SVA2, SVCV, FN1, HN, Travel Alarm)

Occurs when there is a short circuit exists in ON/OFF coil.

Step 1: Event occurs.

- If: Alarm is present when the ACCESS 2 and 3 combination drives the outputs.
 - Then the issue exists in the harness and coils.
- If: Alarm is present at start up.
 - Then hardware over current protection circuit is damaged. Disconnect the negative of all the loads.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 250

Self test with truck ON and in stand by mode.

Possibly caused by a CAN bus malfunctioning, which blinds ACCESS 2 and ACCESS 3 combination communication. Otherwise the issue is internal to the ACCESS.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

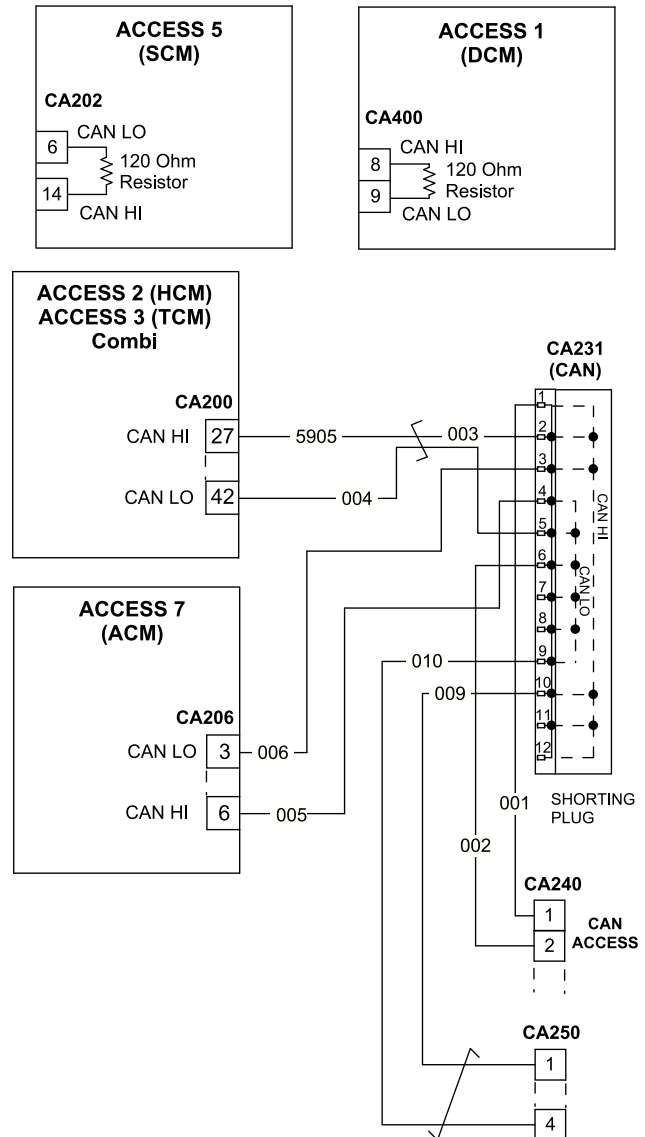


Figure 19098

Event Code 251

CAN Bus KO

CAN BUS communication has failed.

Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which will cause a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When the traction moves slowly and draws high current, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

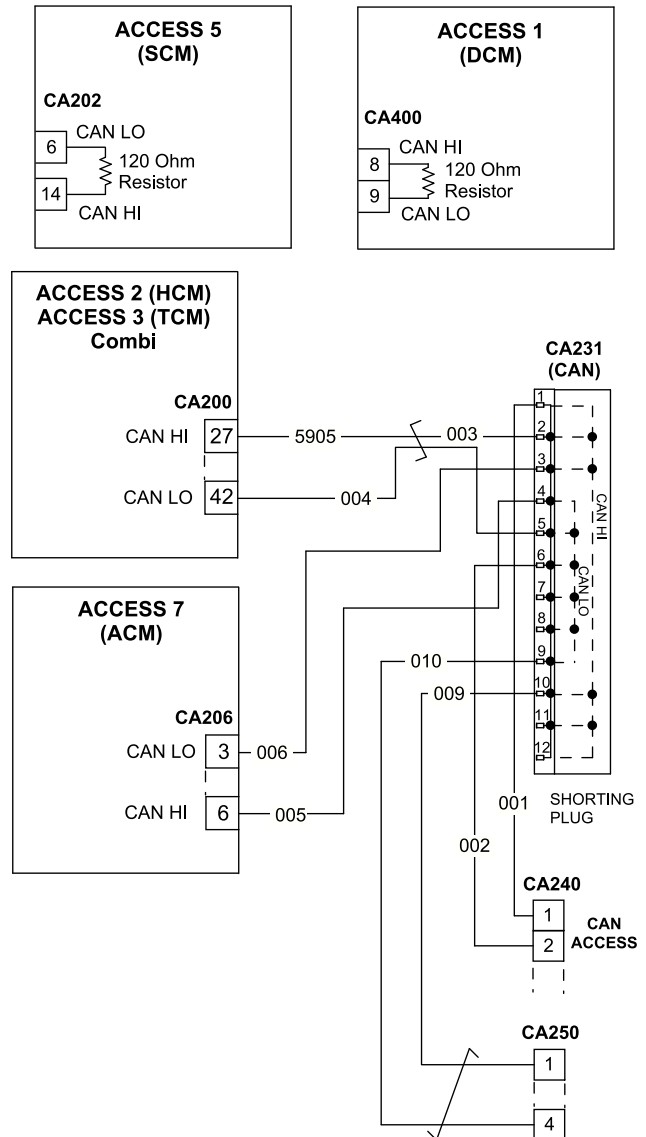


Figure 19098

Event Code 252

Coil Shorted (SVR, SVT, SVS)

Occurs when there is a short circuit of one of the coils connected to outputs of the ACCESS 7 (SVR, SVT, SVS) have shorted. After the overload condition has been removed, the alarm exits automatically by releasing and then enabling a travel demand. The typical root cause for this code is shorts in the harness or in the load coil.

Step 1: Verify wiring from PC206 through CA207 and CA601 to the coils.

- If: Wiring not correct.
 - Then correct harness.
- If: Wiring correct.
 - Then verify the resistance of the coil is greater than 10 ohm.
- If: Coil is less than 10 ohm.
 - Then replace the coil.
- If: Coil is correct.
 - Then proceed to Step 3.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 7.

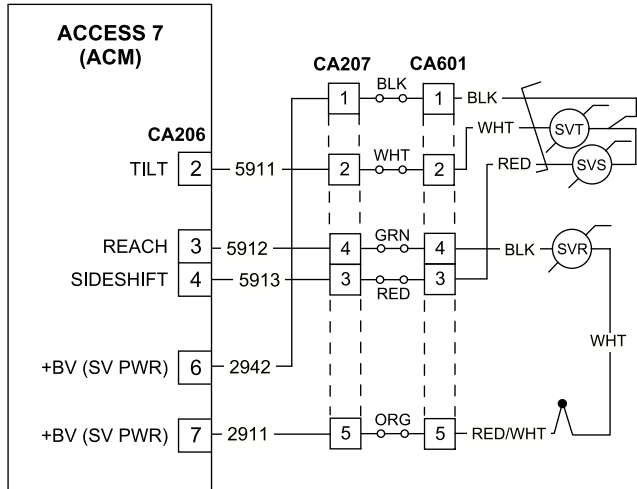


Figure 19097

Event Code 253

EV Driver KO

The valve driver is not able to drive the load. The device or driving circuit is damaged. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 7.

Event Code 254

Key Off

Occurs when an under voltage condition is detected in ACCESS 7.

Step 1: Verify power is ON and input wiring is correct to ACCESS 7.

- If: Wiring is correct and power is to the ACCESS 7.
 - Then proceed to Step 2.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 7.

Event Code 255

EVP Driver KO

This event occurs when the proportional valve drivers are open (do not close when commanded by ACCESS 7).

Event Code 256

Positive Not Correct

The positive for the valves is missing.

Step 1: Verify PC205-2 voltage is +BV, reference battery negative.

- If: Voltage is +BV.
 - Then verify pin connection to ACCESS 7.
- If: Voltage is not +BV.
 - Then verify FU3 is correct.
- If: FU3 is correct.
 - Then replace or repair harness as necessary.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 7.

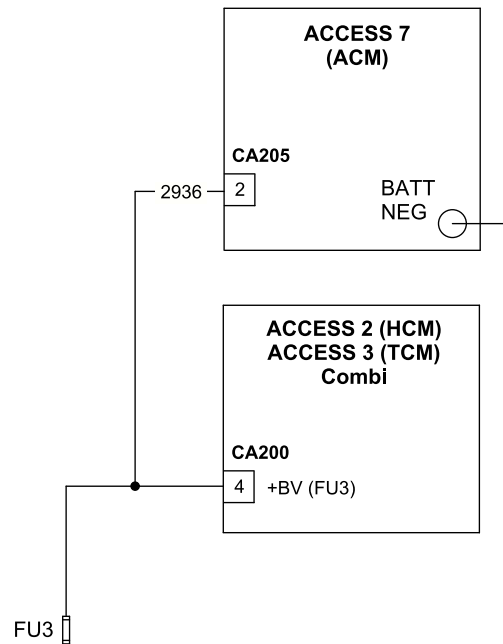


Figure 19096

Event Code 257

FF Valves

Occurs if the short circuit protection does not properly reset within the ACCESS 7. This issue is internal. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 7.

Event Code 258

EVP Driver Shorted

This is a driver for PC206-1.

Event Code 259

EV Driver Shorted

Occurs when there is a short circuit in of one of the drivers (SVR, SVT, SVS). This is likely an internal short. Remove the connector at CA206 and request SVR, SVT and SVS.

- If: Event clears.
 - Then verify the solenoids for shorts.
- If: Event continues.
 - Then replace ACCESS 7.

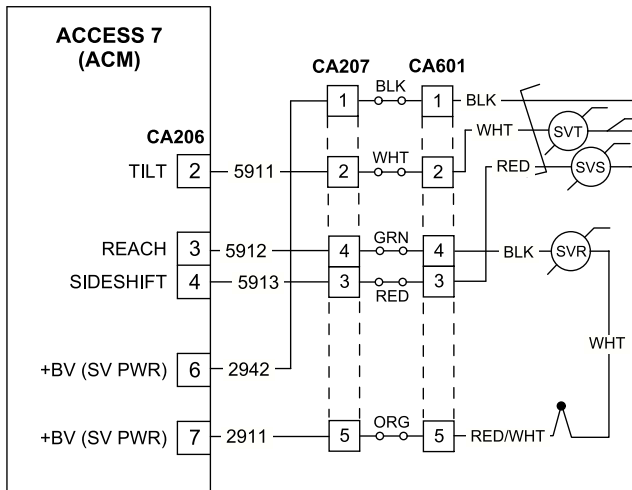


Figure 19097

Event Code 301

Self diagnosis test within the logic between microcontrollers. Possibly caused by a CAN bus malfunctioning, which blinds microcontroller communication. This event is an ACCESS 2 verify event, which can occur during key up initialization, during standby (line contactor open) or during vehicle operation.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

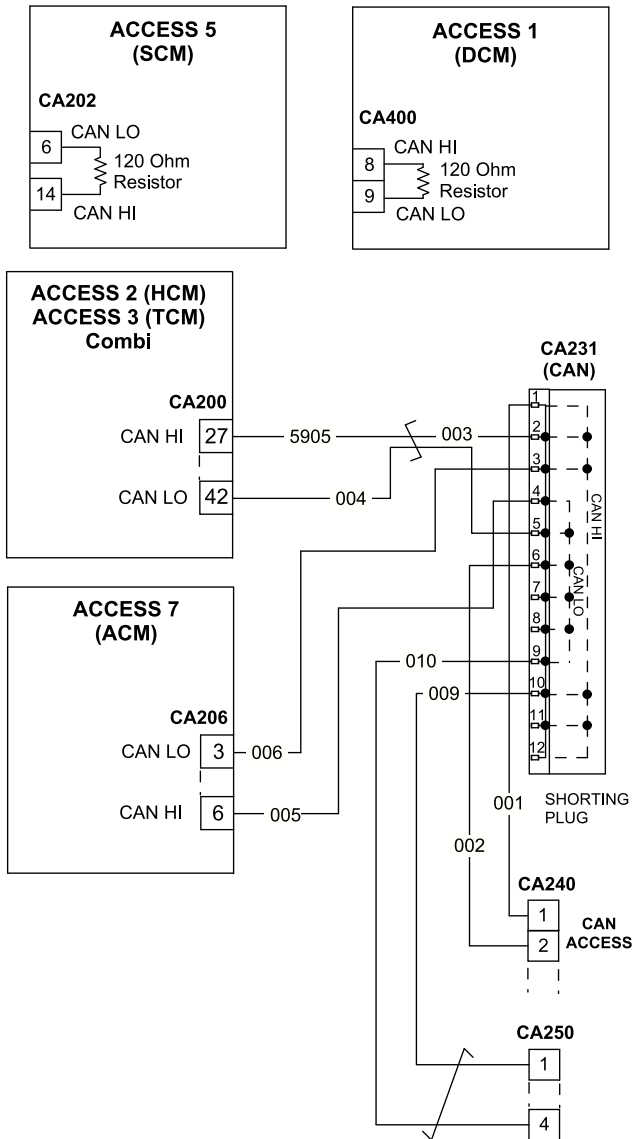


Figure 19098

Event Code 302

EEPROM KO

HW or SW defect of the non-volatile embedded memory supporting ACCESS parameters. Does not inhibit the machine operations, but the truck will work with the deissue values. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 303

Logic Failure #3

Hardware issue in the logic card circuit for high current (overload) protection. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 304

Logic Failure #2

Issue exists in the hardware section of the logic board, which manages the phase's voltage feedback. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 305

Logic Failure #1

Occurs during an overvoltage or undervoltage condition. Overvoltage threshold is 45 V. Undervoltage threshold is 9 V in the 24 V controller.

Step 1: Verify if issue is a startup code or occurs after startup in run time mode.

- If: Not startup code.
 - Then proceed to Step 4.
- If: Startup code.
 - Then proceed to Step 2.

Step 2: Temporarily remove (disable) any accessories that may be added on. Issue is likely an undervoltage caused by an initial current inrush at the key input signal pulling down the input voltage due to external loads, like DC/DC converters starting-up, relays or contactor switching, solenoids energizing or de-energizing.

- If: Event is a result of external loads.
 - Then consult the Crown pictorials for proper addition of accessories.

Step 3: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Step 4: When the issue appears during motor driving, an undervoltage or overvoltage condition exists. When an issue occurs during traction acceleration or driving hydraulic functions, it is likely an undervoltage condition. Verify battery charge condition, power cable connections.

- If: Issue exists in battery or power cable connections.
 - Then repair or replace as necessary.
- If: Issue does not exist in battery or power cable connections.
 - Then proceed to Step 5.

Step 5: When an issue occurs during release braking, it is likely an overvoltage condition. Verify the line contactor contact is fully seated and power cable connections are correct and tight. Proceed to Step 6.

Step 6: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 306

VMN Low

Verified at start-up and at runtime.

Start up test

Before switching the line contactor ON, the software verifies the power bridge: it turns ON alternating the high side power mosfets (metal oxide semiconductor field-effect transistors) and expects the phases voltage to increase toward the rail capacitor value. When the phases' voltage does not increase, this issue occurs.

Run time test

Motor running test. When the traction motor (M1) is running, power bridge is ON, the motor voltage feedback is tested if it is lower than commanded value issue status is entered.

Step 1: Verify the line contactor is closing properly with good contact.

- If: Contacts are not closing properly.
 - Then repair or remove the contactor as necessary.

Step 2: Verify the power cables for M1 are properly connected.

- If: Power cables are not correct.
 - Then repair or remove cables as necessary.

Step 3: Using Digital Volt-Ohm Meter (DVOM), verify power cables for shorts to truck frame. Disconnect battery connector and disconnect each of the three-phase power cables from the ACCESS and M1. One at a time, verify resistance between power cable and frame.

- If: Cables are shorted.
 - Then repair or replace cables as necessary.
- If: Cables correct.
 - Then proceed to Step 4.

Step 4: With cables disconnected from M1, verify resistance of each M1 terminal to truck frame.

- If: Any terminal is shorted.
 - Then replace M1.
- If: Motor windings do not show a connection to frame ON a DVOM.
 - Then issue could be intermittent or higher resistance than meter detects.

Step 5: Using DVOM, verify ACCESS 2 and 3 combination terminals. The resistance to truck frame. Keep power cables disconnected from ACCESS 2 and 3 combination. Verify resistance of each phase terminal to truck frame.

- If: Any terminal is shorted.
 - Then replace ACCESS 2 and 3 combination.

Step 6: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 307

VMN High

Verified at start-up and runtime.

Start up test

Before switching the line contactor ON, the software verifies the power bridge: it turns ON alternating the low side power mosfets (metal oxide semiconductor field-effect transistors) and expects the phases' voltage

to decrease down to battery negative. When the phases' voltage does not decrease, this issue occurs.

Run time test

Occurs during run time, so the line contactor is closed. The phases' voltage is expected to be lower than $\frac{1}{2}$ V battery or an issue occurs.

Step 1: Verify the power cables for the AC motor are properly connected.

- If: Cables not correct.
 - Then repair or replace cables as necessary.

Step 2: Using Digital Volt-Ohm Meter (DVOM), verify power cables for shorts to truck frame. Disconnect battery connector and disconnect each of the three-phase power cables from the ACCESS and motor. Verify resistance between each power cable and frame.

- If: Cables are shorted.
 - Then repair or replace cables as necessary.
- If: Cables correct.
 - Then proceed to Step 3.

Step 3: With cables disconnected from AC traction motor, verify resistance of each motor terminal to truck frame.

- If: Any terminal is shorted.
 - Then replace traction motor.
- If: Motor windings do not show a connection to frame ON a DVOM.
 - Then issue could be intermittent or higher resistance than meter CAN detect.

Step 4: Using DVOM, verify ACCESS 2 and 3 combination terminals. The resistance to truck frame. Keep power cables disconnected from ACCESS. Verify resistance of each phase terminal to truck frame.

- If: Any terminal is shorted.
 - Then replace ACCESS 2 and 3 combination.

Step 5: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 308

Contactor Closed

Before driving the line contactor coil, the ACCESS 2 and 3 combination verifies if the contactor is stuck. It drives the bridge for ten milliseconds, trying to discharge the capacitors' bank. When they do not discharge, this condition occurs.

Step 1: Verify the line contactor is not closed before key ON.

- If: Contacts are not correct (closed).
 - Then repair or replace contactor as necessary.
- If: Contacts are correct (open).
 - Then verify there is no short in the wiring to the low side driver wire 5904 to B-.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 309

Contactor Open

The main contactor coil has been driven by the ACCESS 2 and 3 combination, but the contactor does not close.

Step 1: Verify the wires to the line contactor coil are correct.

- If: Wires are not connected to the line contactor.
 - Then repair or replace harness as necessary.

Step 2: Verify if the line contactor closes freely.

- If: Contacts are not correct (closed).
 - Then repair or replace contactor as necessary.
- If: Contactor does not move freely.
 - Then repair or replace line contactor as necessary.

Step 3: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 310

STBY I High

The current transducer or the current feedback circuit is damaged in the ACCESS 2 and 3 combination. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 311

Capacitor Charge

When the key is switched ON, the inverter tries to charge the power capacitors through a power resistance and verify if the capacitors are charged within a timeout. If they do not charge, an alarm is signaled and the main contactor is not closed.

Verify there is not an external load in parallel with the pre-charge circuit (+BV line contactor to ACCESS 2 and 3 combination fuse). There should be no addition to the truck without accessory relay that will isolate the truck from such loads.

- If: Load (work lights, fan, etc.) exists without the addition of an accessory relay.
 - Then add the relay into the circuit per prints or remove the load.
- If: No unspecified loads are added to the truck.
 - Then replace ACCESS 2 and 3 combination.

Event Code 312

Power Failure #2

Not entered with ACCESS 3 codes.

Event Code 313

Power Failure #1

Not entered with ACCESS 3 codes.

Event Code 314

Driver Shorted

The driver of the main contactor coil is shorted.

Step 1: Verify if there is a short or a low impedance pull-down between PC200-17 and B-.

- If: Wiring and coil resistance is correct.
 - Then driver circuit is damaged in the ACCESS 2 and 3 combination.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

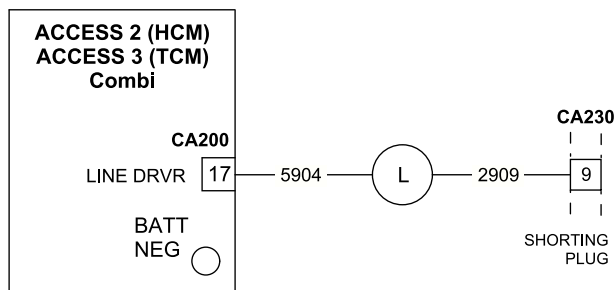


Figure 19099

Event Code 315

Contactor Driver

Line contactor driver is not able to drive the load. The device itself or its driving circuit is damaged. Not related to external components. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 316

Coil Shorted

Occurs when there is a short circuit of one of the coils connected to outputs of the ACCESS 2 and 3 combination (line contactor coil or electric brake coil). After the overload condition has been removed, the alarm exits automatically by releasing and then enabling a travel demand. The typical root cause is shorts in the harness or load coil.

Step 1: Verify wiring from PC200-17 to the coil.

- If: Wiring is not correct.
 - Then correct harness.
- If: Wiring is correct.
 - Then verify the resistance of the coil is greater than 10 ohm.
- If: Coil is less than 10 ohm.
 - Then replace the coil.
- If: Coil is correct and the wiring is correct.
 - Then proceed to Step 3.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 317

VACC Not Correct

The test is made at key-ON and 20 seconds after both directional travel commands have been turned OFF. Occurs when the accelerator reading (analyzer menu A2.3.5) is 10 V higher than program VACC when the accelerator is released.

Step 1: Repeat the calibration process for the accelerator (C1).

Step 2: When issue continues, verify reading (analyzer menu A2.3.5) that the potentiometer is functional and changes 0 to 9.3 to 10 V with rotation of the accelerator.

- If: Voltage changes.
 - Then replace ACCESS 2 and 3 combination.
- If: Voltage does not change.
 - Then determine if voltages for NPOT (negative potentiometer) or PPOT (positive potentiometer) are open or issue using a Digital Volt-Ohm Meter using battery negative as reference.

Step 3: Verify voltage at connector CA410-5 is 9.3 to 10 V and voltage at CA410-8 is near 0 V.

- If: Voltage correct.
 - Then proceed to Step 5.
- If: Voltage not correct.
 - Then open CAN tiller, disconnect CA402 and test at CA402-9 (9.3 to 10 V) and CA402-12 (0 V).
- If: Voltage correct.
 - Then verify wiring for potentiometer to CA410 from CA402.
- If: Voltage not correct.
 - Then replace the CAN tiller.
- If: Voltage correct.
 - Then verify the resistance of the potentiometer low signal. Disconnect CA411.

Step 4: Using a Digital Volt-Ohm Meter (DVOM), verify the resistance from PC411-1 wiper to PC411-3 POT Low. Resistance should be 10 ohm in neutral and near 2.5K when full throttle.

- If: Resistances are not correct.
 - Then replace the potentiometer.
- If: Resistances correct.
 - Then verify resistance of potentiometer high signal.

Step 5: Using a DVOM, verify resistance from PC411-1 wiper to PC411-4 POT High. Resistance should be near 2.5K ohm in neutral and near 10 ohm when full throttle.

- If: Resistances are correct.
 - Then replace the handle.

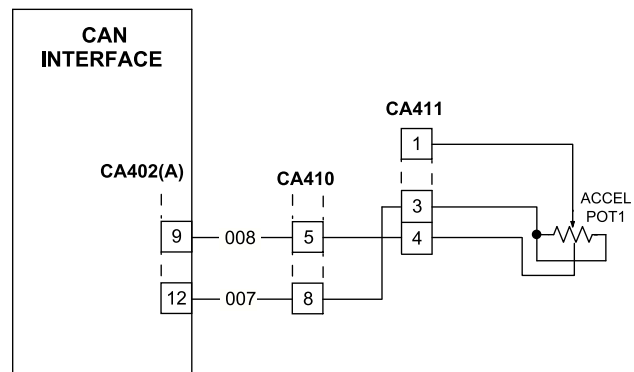


Figure 19100

Event Code 318

FORW+BACK

Occurs when both travel demands (forward and reverse) are active at the same time.

Step 1: Verify the wiring of the forward and reverse travel command (use the readings in the analyzer mode A2.3.3 and A2.3.4 to facilitate the troubleshooting).

- If: Inputs do not show a switch closure.
 - Then replace ACCESS 2 and 3 combination.

Step 2: When analyzer mode shows switches closed, then remove control handle, switch cap and disconnect CA410 from handle. Verify using analyzer mode that the FS and RS switches are open.

- If: Switches are not open.
 - Then proceed to Step 4.
- If: Switches are open.
 - Then disconnect PC411.

Step 3: Verify continuity at PC411-5, reference PC411-7. Verify PC411-6 reference PC411-7.

- If: Continuity exists with these switches while in neutral.
 - Then replace the switch/POT assembly.
- If: Continuity does not exist with these switches while in neutral.
 - Then replace the handle.

Step 4: Open the CAN tiller and disconnect PC402.

- If: Switches are open.
 - Then replace or repair harness PC402 to PC410 as necessary.
- If: Switches are not open (closed).
 - Then replace the CAN tiller.

Step 5: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

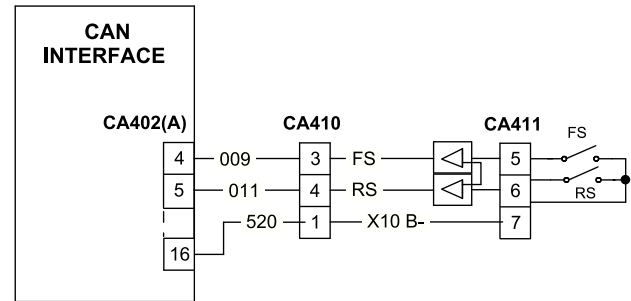


Figure 19101

Event Code 319

Encoder Issue

Occurs when the frequency supplied to the motor is higher than 40 Hz and the signal feedback from the encoder has a jump higher than 40 Hz in less than ten milliseconds.

Step 1: Verify encoder is functioning by reading analyzer mode A2.3.12.

- If: ECR1 value is not changing while doing a traction function.
 - Then verify voltage at ECR1 (PC209-1 (+) and PC209-2 (-)) is approximately 12 V.
- If: Voltage is not correct.
 - Then repeat the test at ACCESS 3 (PC200-9 (+) and PC200-10 (-)).
- If: Voltage is not 12 V at ACCESS 3.
 - Then replace ACCESS 3.
- If: Voltage is correct.
 - Then verify wiring and continuity from channel A at CA200-8 to CA209-4 and CA200-22 to CA209-3 channel B of the encoder. Verify the pins are properly seated in connector at CA209.
- If: Voltage is not correct.
 - Then repair or replace as necessary.
- If: Voltage is correct.
 - Then replace ACCESS 2 and 3 combination.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

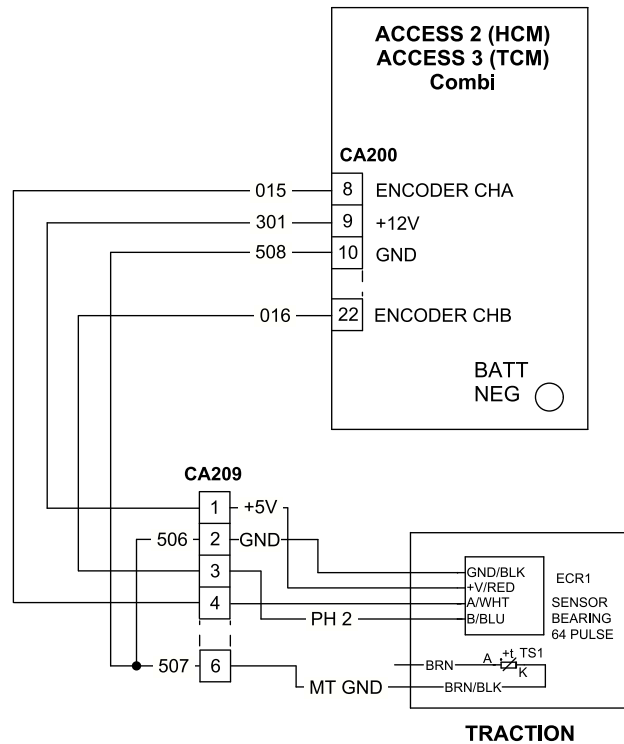


Figure 19102

Event Code 320

Pedal Wire KO

The software continuously verifies for the connection of the two supply ends of the potentiometer in the accelerator.

Step 1: Repeat the accelerator calibration process (C1).

Step 2: When event continues, verify reading in the analyzer menu A2.3.5 that the potentiometer is functional and changes 0 to 9.3 to 10 V with rotation of the accelerator.

- If: Voltage changes.
 - Then replace ACCESS 2 and 3 combination.
- If: Voltage does not change.
 - Then determine if voltages for NPOT (negative potentiometer) or PPOT (positive potentiometer) are open or issue using a voltmeter using battery negative as reference.

Step 3: Verify voltage at CA410-5 is 9.3 to 10 V and voltage at CA410-8 is near 0 V.

- If: Voltage is correct.
 - Then proceed to Step 4.
- If: Voltage is not correct.
 - Then open CAN tiller, disconnect CA402 and test at CA402-9 (9.3 to 10 V) and CA402-12 (0 V).
- If: Voltage is correct.
 - Then verify wiring for potentiometer to CA410 from CA402.
- If: Voltage is not correct.
 - Then replace the CAN tiller.

Step 4: Verify the resistance of the potentiometer low signal. Disconnect CA411. Using a Digital Volt-Ohm Meter (DVOM), verify the resistance from PC411-1 wiper to PC411-3 POT Low. Resistance should be 10 ohm in neutral and near 2.5K when full throttle.

- If: Resistances are not correct.
 - Then replace the potentiometer.
- If: Resistances are correct.

- Then verify resistance of potentiometer high signal.

Step 5: Using a DVOM, verify resistance from PC411-1 wiper to PC411-4 POT High. Resistance should be near 2.5K ohm in neutral and near 10 ohm when full throttle.

- If: Resistances are correct.
 - Then replace the handle.

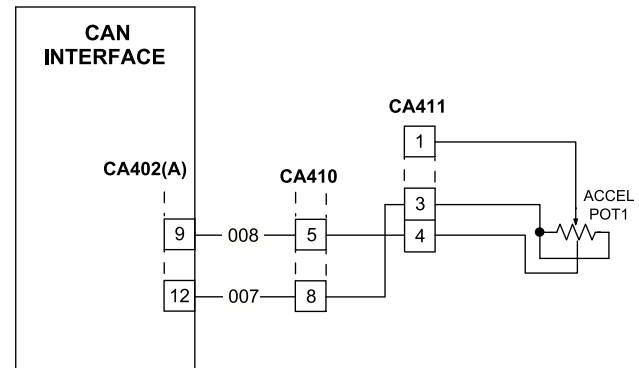


Figure 19100

Event Code 321

Input Issue #2

Occurs as a result of the quick inversion "belly button" input open.

Step 1: Verify the state of the SAS switch (use the readings in the analyzer mode A2.3.8).

- If: Switch state does show a closure when pressed and the warning still continues.
 - Then replace ACCESS 2 and 3 combination.
- If: Switch state does not show SAS switch ON or closed when pressed.
 - Then turn truck OFF remove handle switch cap and disconnect CA410 from handle. Verify continuity from PC410-2 to PC200-33 (near 100 ohm correct with tiller CAN ACCESS 8).
- If: Continuity shows open.
 - Then verify for open in handle and main harness from PC410-2 to PC200-33.
- If: Resistance is near 100 ohm.
 - Then the wiring is correct to PC410. Remove PC412 and verify continuity from PC412-1 and PC412-3 when the button is pressed.
- If: Switch has continuity when pressed (switch is correct).
 - Then replace the handle.
- If: Switch does not show continuity when pressed.
 - Then repair or replace switch assembly as necessary.

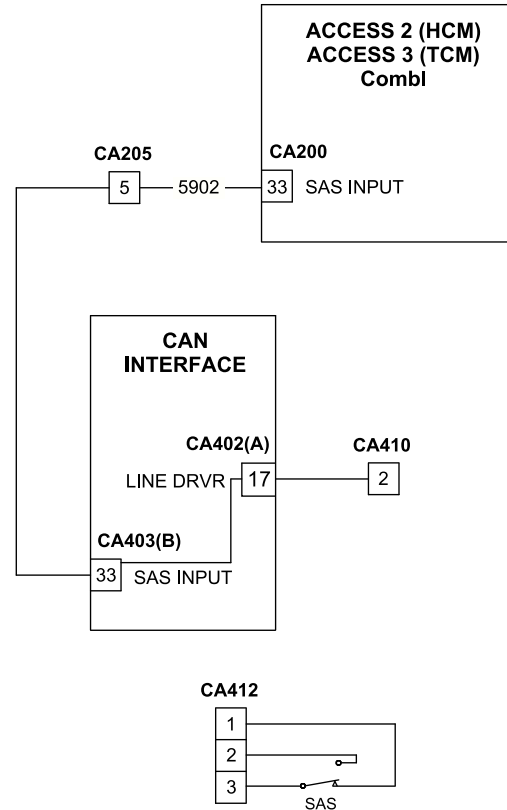


Figure 19103

Event Code 322

Input Issue #1

Not entered with ACCESS 3 codes.

Event Code 323

Safety Feedback

ACCESS 3 has detected an issue on the feedback of EVP driver, an internal issue. Replace ACCESS 3.

Event Code 324

Waiting For Node.

Issue in ACCESS 2; ACCESS 3 is waiting for ACCESS 2 to resolve the issue. This code is not entered.

Event Code 325

CAN Bus KO

CAN bus did not receive a message from the ACCESS 1. Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which causes a CAN issue. Also, a CAN issue has been caused, due to an encoder issue, when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN issue. When the traction moves slowly and draws high current address, address this issue prior to the CAN issue.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination as necessary.

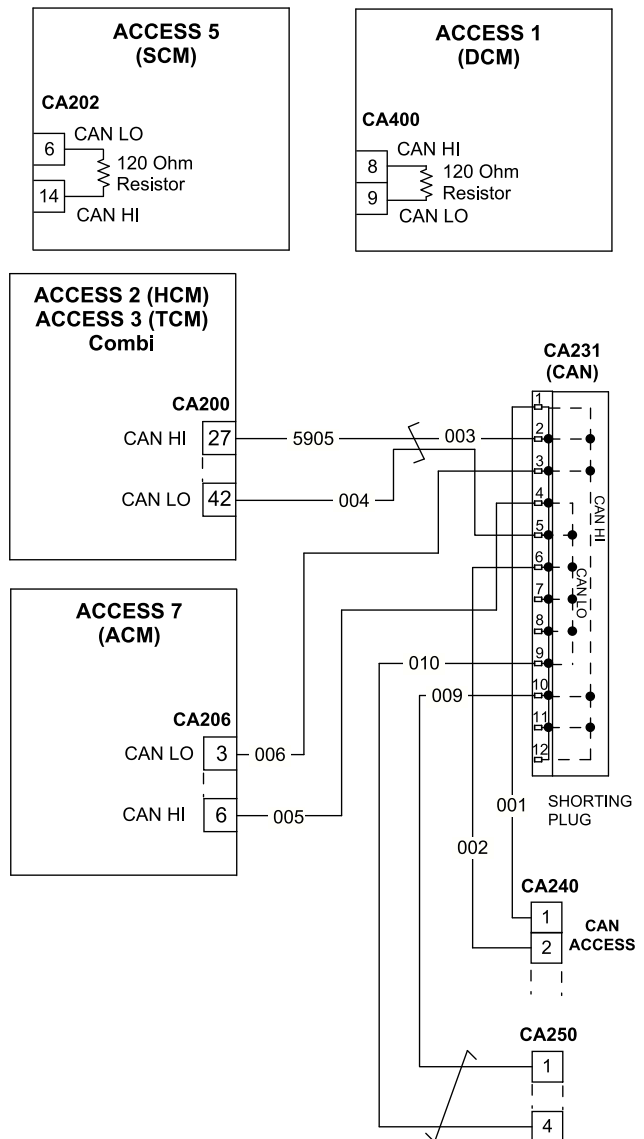


Figure 19098

Event Code 326

Truck Not Configured

An internal ACCESS 3 issue. Replace ACCESS 2 and 3 combination.

Event Code 327

POS AUX Short

The output of the built in smart driver, which supplies the positive to the electromechanical brake is high (24 V) when the tiller switch is open.

Step 1: Verify the wire harness is correctly connected to the smart driver output at PC200-30 and connects to the electric brake.

- If: Wires not correct.
 - Then repair or replace wiring as necessary.

Step 2: Disconnect wire 2927 (+) from the connector pin.

- If: Output stays at high value.
 - Then replace ACCESS 2 and 3 combination as necessary. The smart driver is probably shorted.

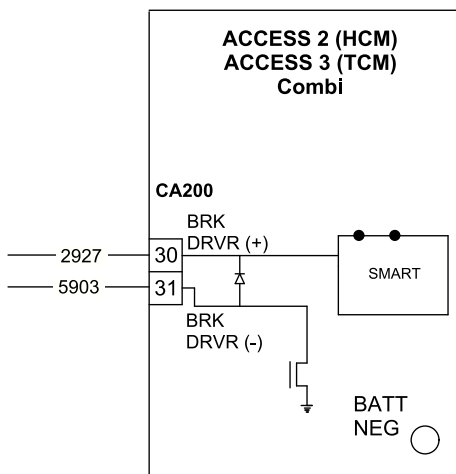


Figure 19104

Event Code 328

Waiting Slave

ACCESS receives a message that another ACCESS in the CAN network is in alarm condition. Resolve any other codes, clear this code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 329

Coil Short HW KO

The hardware circuit that manages short circuit protection of line contactor and the electric brake coils has an internal issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 330

Incorrect Setpoint

ACCESS 3 has detected an ACCESS 2 hydraulic function setpoint issue. Replace ACCESS 2 and 3 combination.

Event Code 331

Power MOS Shorted

Before switching the line contactor ON, the software verifies the power bridge. It turns ON alternating the low side and high side power mosfets (metal oxide semiconductor field-effect transistors) and expects the phases voltage to decrease down to battery negative (increase up to +BV). When phases voltage do not follow the command, this issue occurs. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 332

EPS In Alarm

Not displayed with ACCESS 3 codes.

Event Code 333

Current Gain

The maximum current gain parameters are at the deisue values, which means the maximum current adjustment procedure has not been carried out yet. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 334

Analog Input

Conversion of the analog inputs value has not changed for more than 400 milliseconds. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 335

Pump Warning

Not displayed with ACCESS 3 codes.

Event Code 336

Hardware Issue

ACCESS 3 microcontroller has detected that the ACCESS 2 microcontroller has an internal issue controlling the traction enable. Replace ACCESS 2 and 3 combination.

Event Code 337

AUX Driver Open

The driver of the electromechanical brake coil is not able to drive the load. This is an internal issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 338

Data Acquisition

Acquisition of the current gains. Issue ends when the acquisition completes.

Event Code 339

No CAN Message N5

No CAN messages from the slave microcontroller.

Other issues may cause this condition. Address first when other issues have occurred. Verify each ACCESS has power and negative, which causes a CAN issue. Also a CAN issue exists, due to an encoder issue when one or both the encoder channels is missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN alarm. When traction moves slowly and draws high current, address this issue prior to the CAN alarm.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

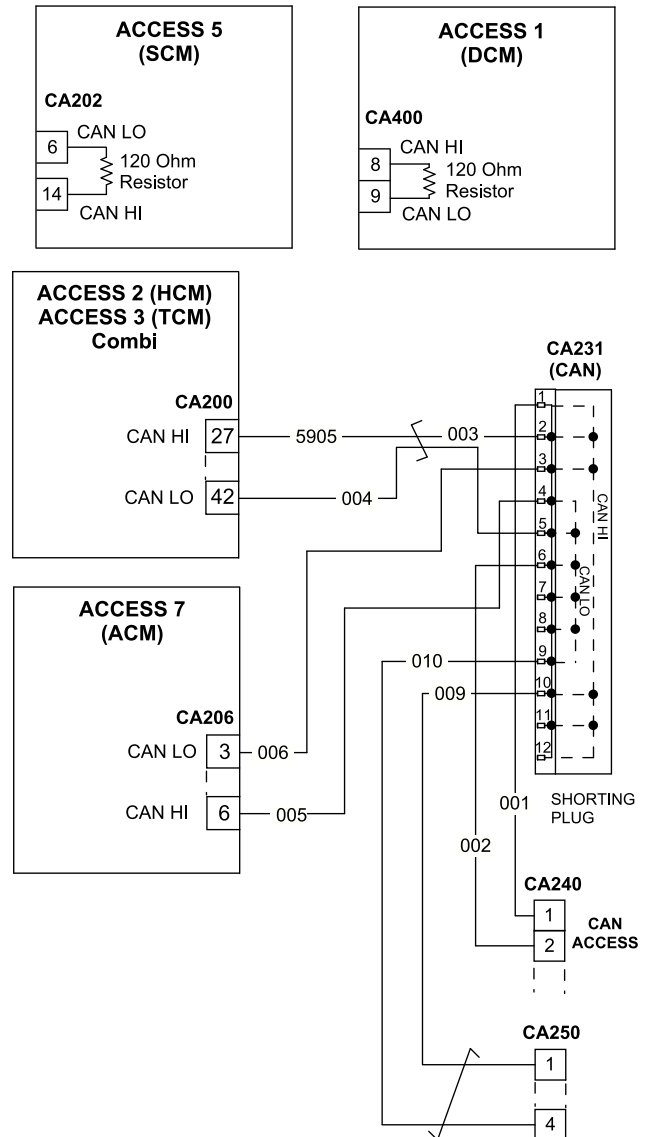


Figure 19098

Event Code 340

Check Up Needed

Planned maintenance needed. Set the CHECK UP DONE option to level ON after the maintenance is completed.

Event Code 341

Thermal Sensor KO

The output of the ACCESS thermal sensor is out of range. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 342

Wrong Set Battery

At start-up, the ACCESS verifies the battery voltage and is within a window around the nominal value.

Step 1: Verify the battery is correct (24 V).

- If: Battery is not correct.
 - Then replace existing battery with 24 V nominal battery.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination.

Event Code 343

Enable

Not entered with ACCESS 3 codes.

Event Code 344

Slip Profile

Issue exists on the choice of the parameters of the slip profile. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination. Parameters are incorrect.

Event Code 345

AUX Driver Shorted

The driver of the electromechanical brake coil is shorted.

Step 1: Verify short or a low impedance pull-down between CA200-31 and battery negative.

- If: No wiring short.
 - Then verify brake resistance.
- If: Brake is not in range (approximately 0 ohm).
 - Then replace the brake.
- If: Brake is within range (approximately 14 ohm).
 - Then the driver circuit is damaged in the ACCESS. Repair or replace ACCESS 2 and 3 combination as necessary.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 2 and 3 combination as necessary.

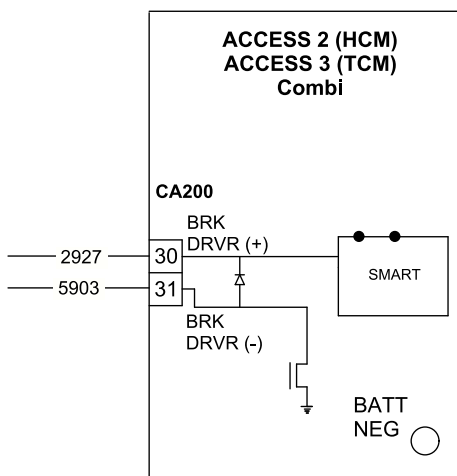


Figure 19104

Event Code 500

Occurs when the slave microcontroller does not receive the communication from the main microcontroller through a serial interface. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 501

EEPROM KO

Occurs if a test to write and read one location in EEPROM fails. The software expects to read the written value. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 502 - 505

Event Code 502 (Logic Failure #4): Occurs in the rest state if the output of the voltage amplifier of the phase Vw-Vv have a drift larger than ± 0.25 V.

Event Code 503 (Logic Failure #3): Occurs in the rest state if the output of the voltage amplifier of the phase Vu-Vw have a drift larger than ± 0.25 V.

Event Code 504 (Logic Failure #2): Occurs when the actual voltage between phases W and V of the motor is different from the desired.

Event Code 505 (Logic Failure #1): Occurs when the actual voltage between phases W and U of the motor is different from the desired.

Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

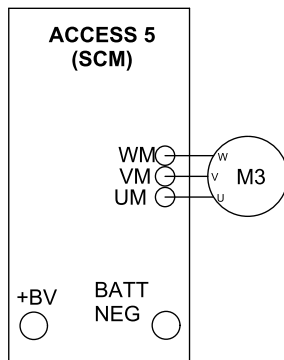


Figure 19105

Event Code 506

VMN Not Correct

Occurs in the initial rest state, after key ON, if the outputs of the motor voltage amplifiers are between 2.2 to 2.8 Vdc. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.

- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 507

Main Contactor Open

Occurs only when the setting CAN Bus is present. Then ACCESS 5 waits for CAN information that the traction has closed the main contactor. When this information delays by more than about 1.5 seconds, this issue occurs.

- If: Other event codes have caused the software to open the contactor.
 - Then verify other codes have not caused the software to open the line contactor.
- If: Other event codes have not caused the software to open the contactor.
 - Then verify other wiring to the line contactor.

Event Code 508

Standby I High

Occurs two ways: (1) In the initial rest state after key ON, when outputs of the current amplifiers between 2.2 to 2.8 Vdc (2) After the initial diagnosis, issue occurs when the outputs of the current amplifiers at rest have a drift larger than ± 0.15 V. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 509

High Current

Occurs if the circuit to limit current, through motor hardware, is either always active at key-ON or repeatedly active when the motor is turning.

Step 1: Verify current by in analyzer mode at A2.4.3 motor current (typical unloaded 20 to 30 A).

- If: Motor currents are high.
 - Then inspect motor for damage oversized load, verify steering CAN moves.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 510 - 512

Event Code 510 (Power Failure #3): Occurs when the current in the phase V at the motor is zero and the motor is commanded to move.

Event Code 511 (Power Failure #2): Occurs when the current in the phase U of the motor is zero and the motor is commanded for moving.

Event Code 512 (Power Failure #1): Occurs when the current in the phase W of the motor is zero and the motor is commanded for moving.

Step 1: Verify the 30 A power fuse on FU4 is not open.

- If: Fuse is open.
 - Then replace fuse.
- If: Fuse is not open.
 - Then verify positive power is connected properly at ACCESS 5 to the 30 A fuse.

Step 2: Verify the continuity of the power cable from ACCESS 5 to the phase V (510), U (511) or W (512) of the motor.

- If: Cable is open.
 - Then repair or replace cable as necessary.

Step 3: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

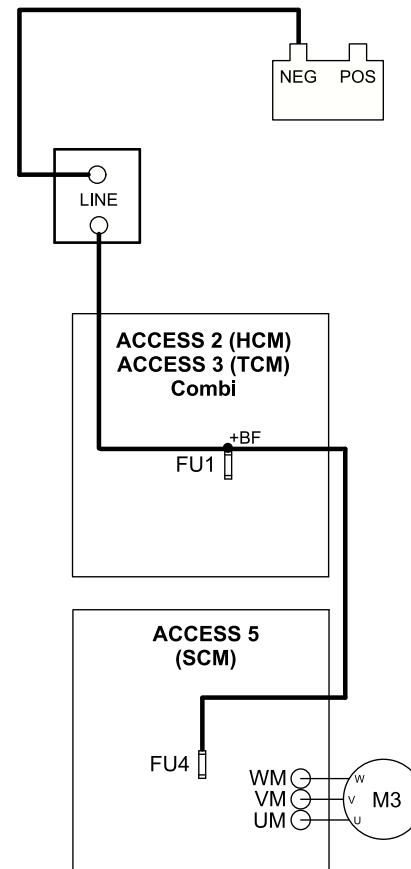


Figure 19106

Event Code 513

Bad Encoder Sign

It occurs in applications when the applied frequency (FREQUENCY) and the motor speed (ENC SPEED) have opposite sign. This event should not be entered. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

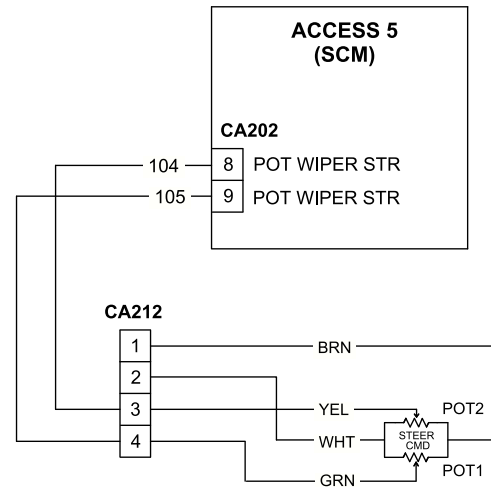


Figure 19107

Event Code 514

Steer Sensor KO

Occurs if the command potentiometer wipers at PC202-9 or PC202-8 changes with a command larger than MAX SP SLOPE (2 V/16 milliseconds). Used to catch a discontinuity in the voltages of the steer command potentiometer.

Step 1: Verify wiring from the twin potentiometer at PC212-3 wire 104 to PC202-8 and PC212-4 wire 105 at PC212-4 to PC202-9. Verify the steering command potentiometer voltages reading in the analyzer mode A2.4.5 and A2.4.6 change linearly and opposite of one another.

- If: Sensor is not changing or changing is erratic.
 - Then replace the twin steer sensor POT.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 515

Steer Hazard

ACCESS 5 limits the angle in the steering direction. No speed reduction occurs on the traction. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 516

Input Issue #1

The voltage at the safety contacts is higher than 12 V before the contacts are closed, verified initially at key ON. After an initial verification, the contacts close. With the safety contacts open the voltage is expected to be close to 0 V.

Step 1: Verify for wiring issues in main harness connector PC202-4 to PC200-7.

- If: Wiring issue found.
 - Then repair or replace harness as necessary.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

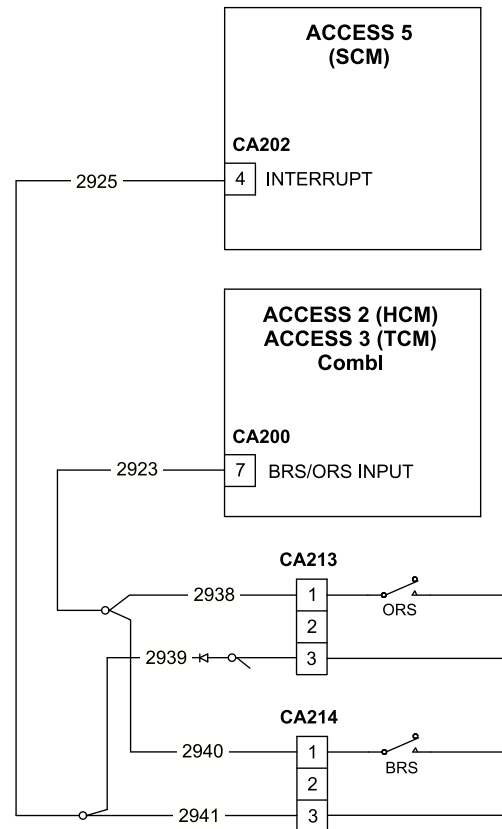


Figure 19108

Event Code 517

WRONG FEEDBACK RANGE

Event Code 518

CAN BUS KO SL

Event Code 519

Micro Slave #8

Encoder counting of the main microcontroller does not match encoder counting of slave microcontroller. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 520

MICRO SLAVE #3

Event Code 521

Clock PAL Not Correct

The main microcontroller sends an analog signal to the slave microcontroller to reset the slave microcontroller ON demand. When the slave microcontroller detects this analog signal external to a window from 2.2 to 2.8 and is not in the range to generate the reset ON demand, the slave microcontroller raises this issue. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.

- Then contact Crown Service.

Event Code 522

Motor Locked

Occurs when the current in the steering motor stays close to the maximum current longer than one second. Verify current shown in analyzer mode at A2.4.3 motor current (typical unloaded 20 to 30 A). Verify for a mechanical issue locking the motor. Raise the drive tire OFF the floor and verify steering turns freely.

- If: Event continues and steering turns freely.
 - Then inspect power cables to the steer motor from ACCESS 5.
- If: Cables are correct.
 - Then replace ACCESS 5.

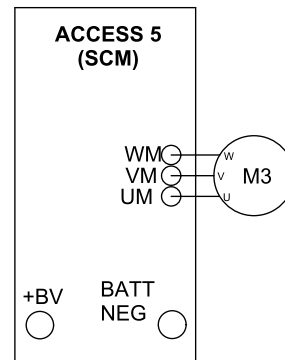


Figure 19105

Event Code 523

Micro Slave #4

When the slave microcontroller detects the stator voltage phasor rotates in the opposite direction respect to the commanded position, an issue occurs. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 524

FB Sensor POT Locked

Take care when working with the feedback potentiometer (POT3) when steering is disabled as movement of POT3 can cause unexpected steering movement. Keep hands clear. POT3 wiper at PC203-6 does not change (or changes in the opposite direction) value even when commanded.

Step 1: Verify steering is properly calibrated (drive tire gear box at right of the tire when handle is straight ahead).

- If: Steering is not properly calibrated.
 - Then follow the calibration procedure.

Step 2: Verify the feedback potentiometer is not mechanically loosened. Turn truck OFF and verify if POT3 is loose.

- If: POT3 is loose.
 - Then reattach POT3, turn ON truck and calibrate the steering system.
- If: POT3 is not loose.
 - Then verify any mechanical blocks of the steered wheel.
- If: No mechanical blocks are present.
 - Then turn key ON with code present. Verify steering is disabled due to code by moving the handle.

Step 3: Lift up the truck and manually turn steer wheel left facing the power unit. Verify the POT voltage rises in voltage by reading analyzer mode A2.4.8.

- If: Voltage decreases.
 - Then verify if POT3 is wired correctly (positive and negative swapped will cause the feedback to show backward).

Step 4: Verify the wiring is per PC211 from PC203. Also verify wiring to the POT3.

- If: Wiring is correct.
 - Then remove PC211 and read voltage pin 2 to positive and pin 1 to negative. Voltage should be 4 to 5 V.
- If: Voltage is not present.
 - Then verify at PC203 pin 1 (-) and pin 2 (+).

- If: Voltage is present.
 - Then issue exists in wiring to PC211.
- If: Voltage is not present.
 - Then replace ACCESS 5 (voltage is supplied by ACCESS 5).

Step 5: Wiring is correct and voltage is correct to the POT3 and manual movement of the steer does not change the POT3 voltage. Read the voltage from the wiper at PC203-6 and battery negative.

- If: No change in voltage when moving the POT3.
 - Then replace POT3.
- If: Voltage exists when moving the POT3.
 - Then replace ACCESS 5.

Step 6: Then calibrate the steer system, clear codes and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

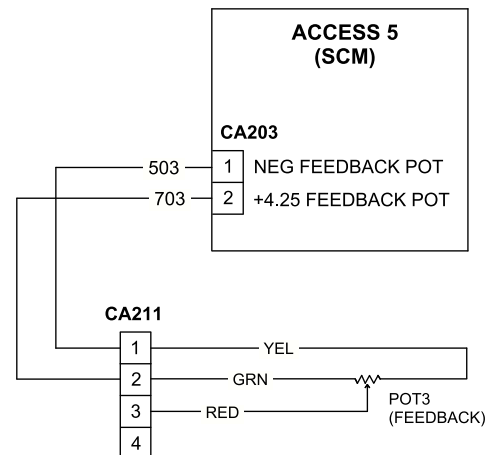


Figure 19109

Event Code 525

Moving Feedback POT

Be careful when working with the feedback potentiometer (POT3). POT 3 movement can cause unexpected steering movement. Occurs when the feedback potentiometer PC203-6 changes larger than 0.3 V in 16 milliseconds. Shows a discontinuity in the voltage of POT3.

Step 1: Verify wiring to the POT3 and calibrate the steer system (C2).

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 526

Current Gain

Occurs when the parameters to compensate for the gain of the current amplifiers (adjustment #03 and adjustment #04) have the deissue values (the maximum current was not regulated).

Step 1: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 527

No Sync

Every 16 milliseconds, inside the code cycle, the main microcontroller rises and then lowers an input for the slave microcontroller (SYNC). When the ACCESS 2 detects no edge for more than 100 milliseconds on this input, this issue occurs. A monitoring function: when the main microcontroller does not execute the code cycle, it does not update the SYNC signal and the slave microcontroller stops the steer and traction.

Step 1: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 528

ACCESS 2 Communication Issue

Event Code 529

Position Issue

Be careful when working with the feedback potentiometer (POT3). POT3 movement may cause unexpected steering movement. Occurs when there is an issue in the redundant test of the steer feedback sensors. POT3 is used together with the feedback encoder (ECR3). The angle of the steered wheel is measured with both of them: ECR3 and POT3 in the analyzer menu are expected to be equal. When they are different by more than 20 degrees, an event occurs. The most common cause of this event is connection issues between ACCESS 5 and the encoder. POT3 is part of this software and should be verified but typically a POT3 issue shows up as a different issue.

Step 1: Verify steering is properly calibrated (drive tire gear box located to the right of the tire when handle is straight ahead).

- If: Steering is not properly calibrated.
 - Then follow the calibration procedure.

Step 2: Verify the wiring at CA210 making sure pins from both the motor and the main harness are seated in the connector with the (secondary lock) insert for the Deutsch connector properly in place. Continue to verify the wiring and the connector back to PC203-4, PC203-7 and PC203-8.

- If: Wiring not correct.
 - Then correct per wiring diagrams.

Step 3: Verify POT3 voltage increases as the handle is turned to the left facing the power unit.

- If: Voltage decreases.
 - Then follow the calibration procedure (C2).

Step 4: Verify the POT3 wiper is wired correctly.

- If: POT3 wiper is not wired correctly.
 - Then replace the POT3.

Step 5: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.

- Then remove connector CA211 at POT3. Verify 4 to 5 V between PC211-2 (+) and PC211-1 (-). Proceed to Step 5.

Step 6: Verify the POT3 wiper is wired correctly.

- If: Voltage is not correct.
 - Then verify harness back to the ACCESS and again verify voltage at PC203-2 and PC203-1.
- If: Voltage is correct.
 - Then repair the harness as necessary.
- If: Voltage is not correct.
 - Then replace ACCESS 5.

Step 7: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then contact Crown Service.

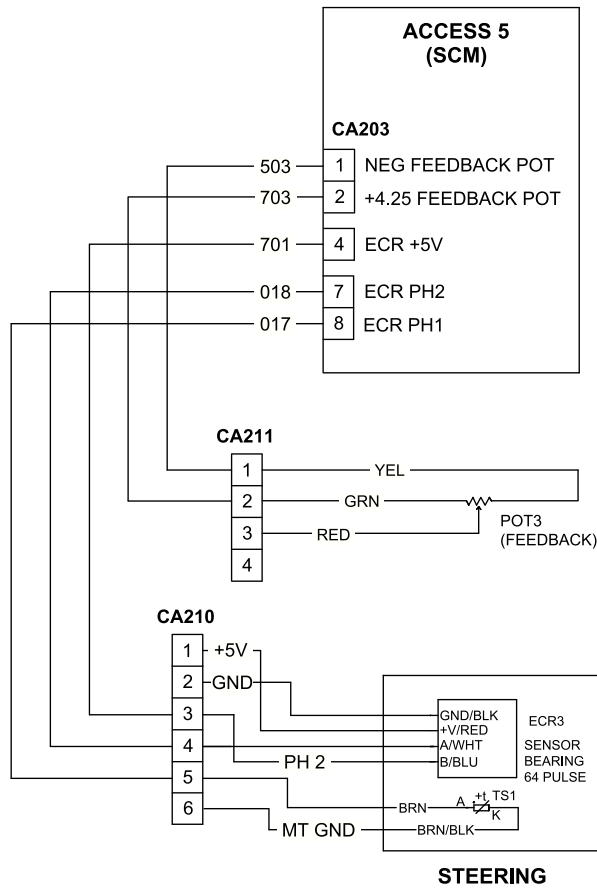


Figure 19110

Event Code 530

Waiting Data

Occurs only if CAN bus is present. At key-ON the ACCESS 5 requests a list of parameters via CAN Bus. From the request until the parameters are correctly received, this event occurs. The steer is not activated yet and the safety relays remain open when this event is present.

Event Code 531

Not Aligned

Does not allow traction. Occurs at the initial alignment when straight-ahead condition is not matched within six seconds. When, throughout this six second delay, the steer is not activated yet, the safety relays are open and the traction is stopped.

Event Code 532

Waiting For Traction

At key-ON, ACCESS 5 needs an agreement from the ACCESS 3 to close the safety contacts and to turn ON to operational mode. The steer is not activated yet and the safety relays remain open when this event is present.

Event Code 533

Encoder Issue

Occurs when encoder control is set ON and the actual frequency does not follow the commanded frequency. When this condition has occurred several times due to a mismatching between the encoder resolution used in the software and the actual encoder resolution or an incorrect connection between the two encoder channels.

Step 1: Verify encoder is functioning by reading the analyzer mode A2.4.7.

- If: ECR3 value is not changing while steering.
 - Then lift truck up and manually turn wheel. Then verify wiring is correct from the PC210 to PC202 and PC203.
- If: Wiring is correct and ECR3 is not functional.
 - Then verify voltage at ECR3 (PC210-1 positive and PC210-2 negative) is approximately 4 to 5 V.
- If: Voltage is not correct.
 - Then repeat the test at PC203-4 (+) and PC202-11 (-).
- If: Voltage is present at the ACCESS 5.
 - Then replace ECR3.
- If: Voltage is not present at the ACCESS 5.
 - Then replace ACCESS 5.

Step 2: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then contact Crown Service.

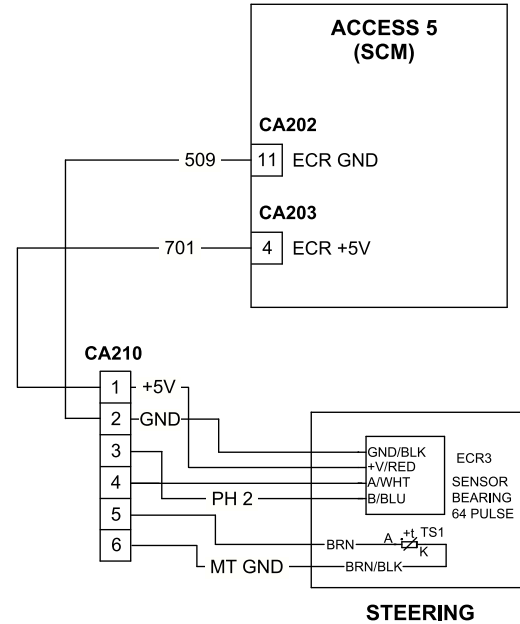


Figure 19111

Event Code 534

Gain EEPROM KO

The parameters to compensate for the gain of the current amplifiers (adjustment #03 and adjustment #04) are recorded in a non-volatile memory (eeprom) with a redundant handling. In fact every adjustment is recorded in three eeprom locations. Event occurs when the values in these three locations differ.

Step 1: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 535

Data Acquisition

Occurs when the acquiring the motor resistance or when adjusting the parameters to compensate for the gain of the current amplifiers (maximum current factory adjusted).

Step 1: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 536

Micro Slave KO

Occurs if the main microcontroller is detecting a direction of the steering issue not matched with the one that the slave microcontroller is detecting. Furthermore, this event occurs also if the main microcontroller is detecting no steering limitation meanwhile the slave microcontroller is detecting steering limitation. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 537

CAN Bus KO

Occurs only when the setting CAN bus is present. ACCESS 5 requests to receive the event messages from the traction. When these messages are delayed more than approximately one second, this event occurs. A CAN issue does not only mean an issue has occurred in the CAN network, but that the message did not arrive in a timely manner to the ACCESS.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.
- If: Wires correct.
 - Then proceed to Step 4.

Step 4: Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

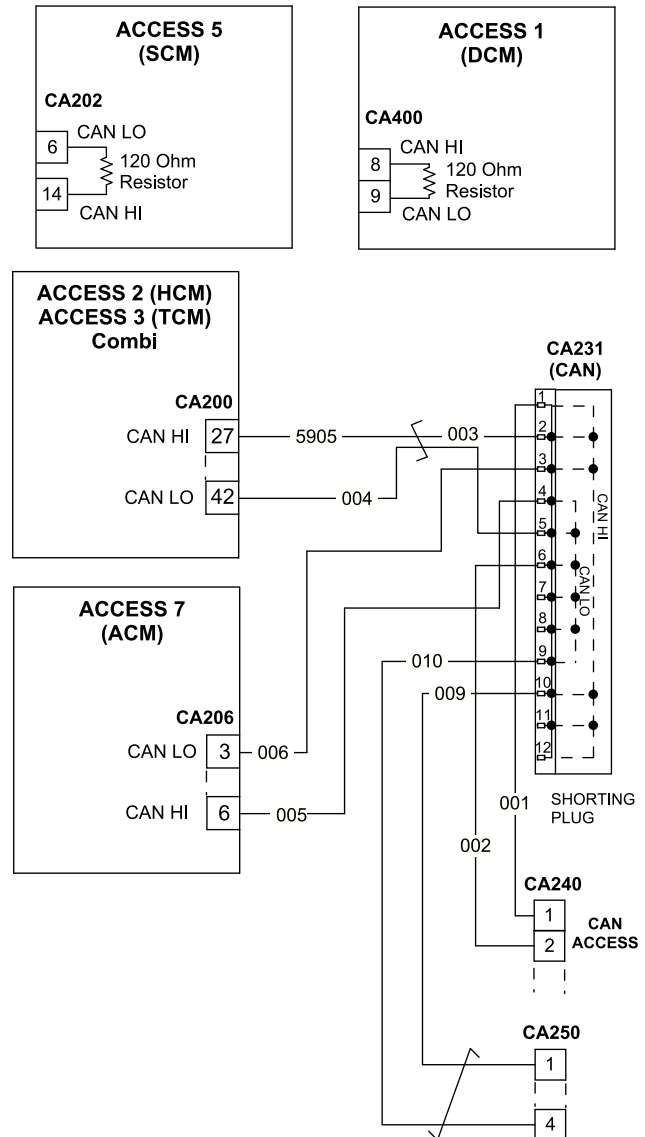


Figure 19098

Event Code 538

S.P. OUT OF RANGE

Occurs if the sum of the two wiper voltages from the command twin potentiometer (POT1 and POT2) is not in the range from 4.5 Vdc to 5.5 Vdc. Most likely causes are connection for POT1 and POT2 is not correctly made or the steer system is out of calibration.

Step 1: Verify steering is properly calibrated (drive tire gear box should be to the right of the tire when handle is straight ahead). Follow the calibration procedure (C2) if necessary.

Step 2: Verify wiring from the POT1 and POT2 to ACCESS 5. Verify pins in connectors carefully.

- If: Wires not correct.
 - Then correct.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Verify the POT voltage using analyzer mode A2.4.6 is approximately 2.5 V when the handle is straight ahead.

- If: POT is not near 2.5 V at this point.
 - Then center the command POT to near 2.5 V and calibrate steer system using calibration mode (C2).

Step 4: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

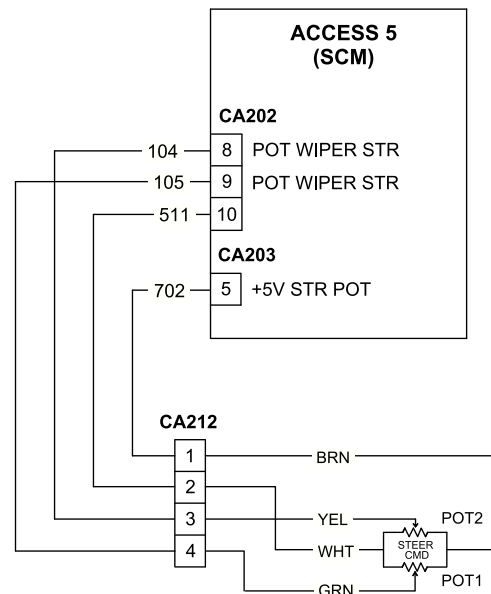


Figure 19112

Event Code 539

FB Out of Range

Feedback potentiometer (POT3) can move suddenly, so use caution. Occurs when the POT3 at PC203-6 is not in the range from 0.3 Vdc to 4.7 Vdc. The most likely causes of this code would be an incorrect POT3 connection feedback or the steer system not calibrated correctly.

Step 1: Verify steering is properly calibrated (drive tire gear box should be to the right of the tire when handle is straight ahead). POT3 voltage (using analyzer mode A2.4.8) is approximately 2.5 V when the handle is straight ahead.

- If: POT3 is not near 2.5 V at this point.
 - Then center POT3 to near 2.5 V and calibrate steer system using calibration mode (C2).

Step 2: Verify POT3 wiring (PC211 to PC203) and verify pins are correct.

- If: Wires not correct.
 - Then correct.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Read the voltage from the wiper at PC203-6 and battery negative.

- If: No change in voltage when moving POT3.
 - Then replace POT3.
- If: Voltage exists and changes with steer movement.
 - Then proceed to Step 5.

Step 4: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

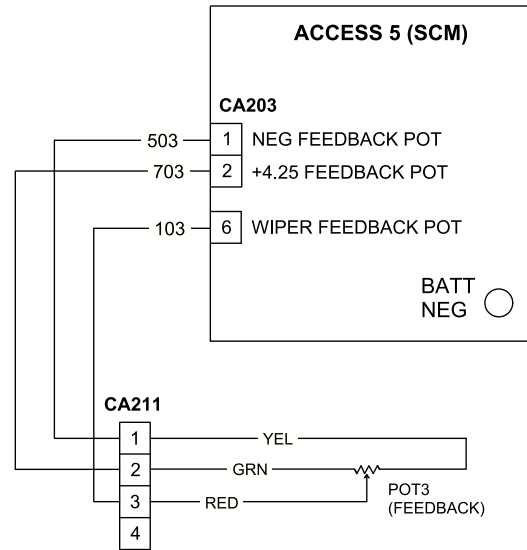


Figure 19113

Event Code 540

Micro Slave

Occurs when the information relating to status bus between the main microcontroller and the slave microcontroller is not updating the bus configuration. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 541

KM Open

Occurs if the slave microcontroller detects the main microcontroller safety contact open when expected being closed. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 542

KS Open

Occurs if the main microcontroller detects the slave microcontroller safety contact open instead of dosed. Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then replace ACCESS 5.
- If: Event still continues.
 - Then contact Crown Service.

Event Code 543

KM Closed

Occurs at key ON if the slave microcontroller detects the safety contact, of the main microcontroller, closed prior to be commanded. Occurs when PC202-5 is around 12 Vdc when keyed ON. The tips should be open and the voltage with respect to battery negative should be near battery volt). Verify the connection PC202-5 is approximately 12 Vdc when keyed ON.

- If: Voltage at PC202-4 is not close to 12 Vdc when first keyed ON.
 - Then verify wiring for PC202-5 is correct.
- If: Wiring is correct and issue continues.
 - Then replace ACCESS 5.
- If: Event continues.
 - Then contact Crown Service.

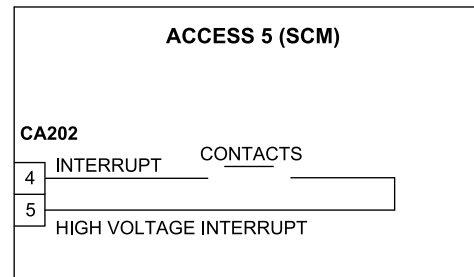


Figure 19114

Event Code 544

KS Closed

Occurs if the main microcontroller detects the safety contact, of the slave microcontroller, closed prior to being commanded. Connection at PC202-4 is approximately 12 Vdc when switching ON the key. The safety contacts are open and are expected to be connected to a voltage less than 12 Vdc with respect to battery negative.

- If: Voltage at PC202-4 is greater than 12 Vdc.
 - Then verify wiring for PC202-4 is correct.
- If: Wiring is correct and issue continues.
 - Then replace ACCESS 5.
- If: Event continues.
 - Then contact Crown Service.

Event Code 700 - 701

Event Code 700:

This is a self test made while running and in stand by mode. Possibly caused by a CAN bus malfunctioning, which blinds master-slave communication otherwise the issue is internal to the ACCESS.

Event Code 701:

CAN Bus communication has failed. Other issues may cause this condition. Address this code first when other issues have occurred. Verify each ACCESS has power and negative, which will cause a CAN issue. Also, a CAN issue has been caused, due to an encoder issue when one or both the encoder channels are missing. This condition results in the traction motor drawing high current. This high current may trigger a CAN issue. When the traction moves slowly and draws high current address, address this issue prior to the CAN issue.

Step 1: Verify the CAN Bus network uses two terminating 120 ohm resistors, located inside ACCESS 1 and ACCESS 5, running in parallel. Resistance is 60 ohm. Power OFF truck and disconnect battery. Locate CA240 near fuse block and disconnect. Measure the resistance PC240-1 CAN HI and PC240-2 CAN LO.

- If: Resistance is not approximately 60 ohm.
 - Then locate wiring issue in ACCESS 2 and 3 combination.
- If: Resistance is approximately 60 ohm.
 - Then ACCESS 1 and ACCESS 5 are wired correctly.

Step 2: Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO. Disconnect PC200 and verify continuity at PC200-27 to PC240-1 CAN HI then verify PC200-42 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue.
- If: Wires correct.
 - Then proceed to Step 3.

Step 3: Disconnect PC250 and verify continuity at PC250-4 to PC240-1 CAN HI and PC250-1 to PC240-2 CAN LO.

- If: Wires not correct.
 - Then locate wiring issue to ACCESS 8.

- If: Wires correct.
 - Then proceed to Step 4.
- Step 4:** Disconnect PC205 and verify continuity at PC205-6 to PC240-1 CAN HI and PC205-3 to PC240-2 CAN LO.
- If: Wires not correct.
 - Then locate wiring issue to ACCESS 7.
- If: Wires correct.
 - Then replace ACCESS 2 and 3 combination.

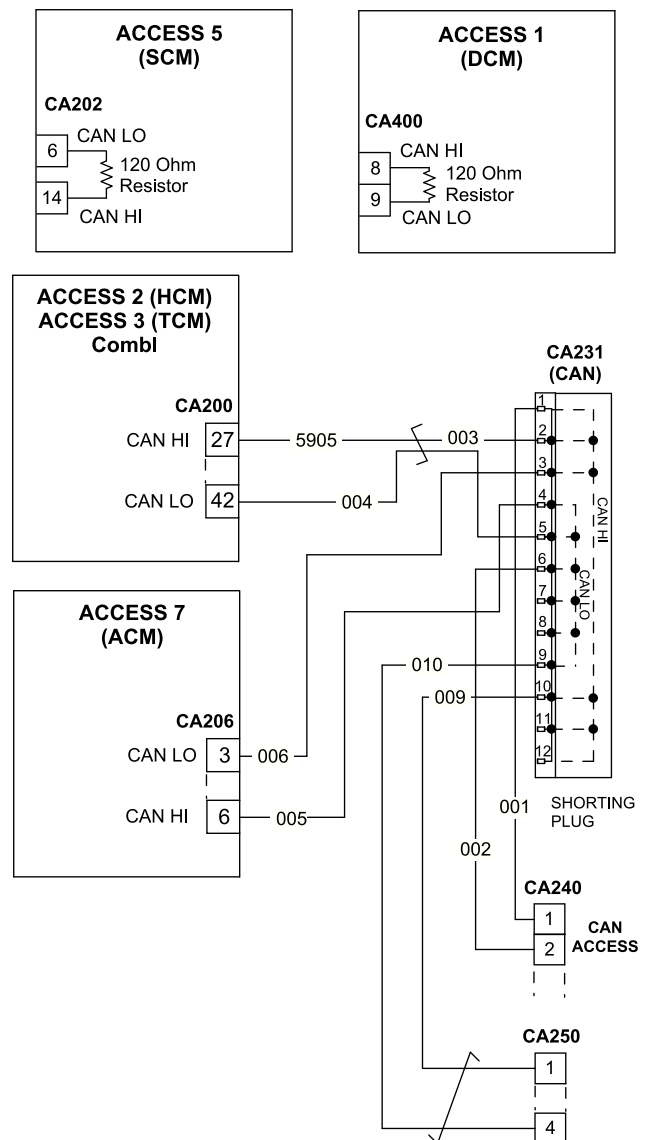


Figure 19098

No Event Code

Slow or Stop - Traction Control Hot

The temperature of the base plate is higher than 85°C (185°F). Maximum current decreases proportionally with the temperature increases from 85°C (185°F) up to 105°C (221°F). At 105°C (221°F), the current is limited to 0 A.

Step 1: Determine if the truck is being used in a heavy duty cycle.

- If: Truck used in a heavy duty cycle.
 - Then allow truck to cool before extended use.
- If: Truck not used in a heavy duty cycle.
 - Then proceed to Step 2.

Step 2: Read the temperature for ACCESS 3 base plate in analyzer mode A2.3.1.

- If: Temperature is not near 85°C (185°F).
 - Then ACCESS 3 should not be in this warning. Clear warning and re-key the truck.
- If: Warning clears.
 - Then return to operation.
- If: Warning continues.
 - Then replace ACCESS 2 and 3 combination.
- If: Temperature is near 85°C (185°F).
 - Then proceed to Step 3.

Step 3: Verify the cooling fan, located behind ACCESS 3, is functional. Verify analyzer test output mode A4.4 (must be in service mode 3). Turn the fan ON for 5 seconds.

- If: FN1 does not turn ON.
 - Then verify wiring is correct from fan, including CA201-1 to +BV and CA201-2 to CA200-28.
- If: Wiring not correct.
 - Then repair or replace as necessary.
- If: Wiring correct and fan does not function.
 - Then proceed to Step 4.

Step 4: Locate the CA201 under ACCESS 5. Disconnect and measure the voltage at PC201-1 (+) and PC201-2 (-). Repeat Step 3 and verify the DC voltage

goes from near 0 V to 24 V when fan output is turned ON (analyzer menu A4.4).

- If: Voltage is correct (ACCESS 3 working correctly).
 - Then replace the FN1.
- If: Voltage does not change 0 V to 24 V when FN1 is turned ON and the wiring is correct.
 - Then the driver in ACCESS 3 is not working properly. Replace ACCESS 2 and 3 combination.

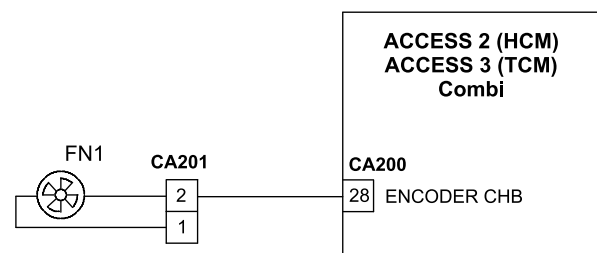


Figure 19115

Slow or Stop - Traction Motor Hot

Thermal sensor inside the motor measuring higher than 150°C (302°F).

Step 1: Verify wiring to the thermal sensor from ACCESS 2 and 3 combination to PC209-5 and PC209-6. Inspect at pins in CA209.

- If: Voltage is correct.
 - Then remove PC209-5 and PC209-6 from PC209 and jumper these temporarily.
- If: After re-key the motor thermal condition goes away.
 - Then ACCESS 3 is correct and the wiring to PC209 is correct. Proceed to Step 3.
- If: Wiring is correct and when jumper is put in place, the warning continues.
 - Then replace ACCESS 2 and 3 combination.

Step 2: Verify the resistance of the thermal sensor at JC209-5 to JC209-6. Resistance should be approximately 500 to 600 ohm at start up temperature.

- If: Resistance is not correct.
 - Then replace the thermal sensor.

Step 3: When condition continues, contact Crown Service.

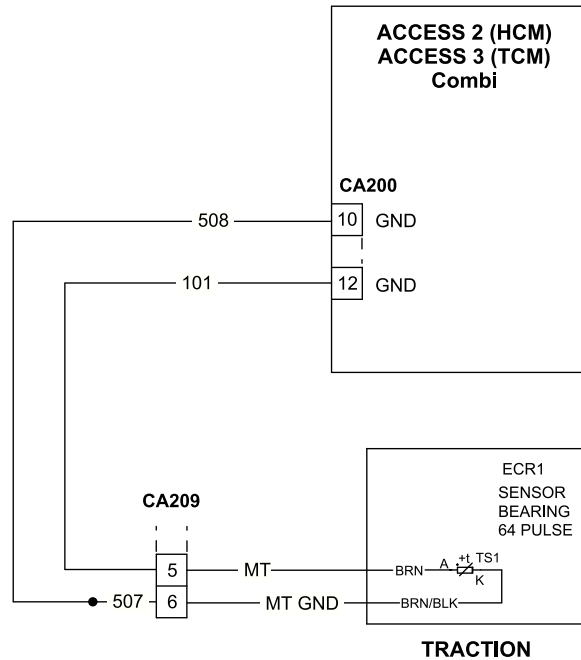


Figure 19116

Charge Battery - Battery Low

ACCESS 3 sensing the battery voltage is less than or equal to 25% of state of charge (SOC). No action taken.

Charge Battery - Truck stops 5:00

ACCESS 3 sensing the battery voltage is less than or equal to 22% of SOC. When no action is taken, the truck will time out and prevent lift and reduce travel speed. Display menus are unavailable at this point.

Charge Battery - Battery Down

ACCESS 3 sensing the battery voltage is lower than 22% SOC and the timer has expired. Traction speed is reduced to creep and no lift is available.

Release Travel Control

ACCESS 3 sensing a direction switch is ON at key ON.

Step 1: Return the throttle to neutral at retry.

- If: Resistance is not correct.
 - Then replace the thermal sensor.

Step 2: When warning continues, verify the wiring of the forward and reverse travel command (use the readings in analyzer modes A2.3.3 and A2.3.4).

- If: Inputs do not show a switch closure with his warning.
 - Then replace ACCESS 2 and 3 combination.
- If: Analyzer mode shows switches closed.
 - Then remove control handle, switch cap and disconnect CA410 from handle.

Step 3: When warning continues, verify FS and RS switches are open (analyzer modes A2.3.3 and A2.3.4).

- If: Switches are closed.
 - Then proceed to Step 4.
- If: Switches are open.
 - Then disconnect PC411.

Step 4: Verify continuity at PC411-5, reference PC411-7. Verify PC411-6, reference PC411-7.

- If: Continuity in these switches while in neutral.
 - Then replace the switch/POT assembly.
- If: No continuity.
 - Then replace the handle.

Step 5: Open the CAN tiller and disconnect PC402.

- If: Switches are open.
 - Then replace or repair harness PC402 to PC410.
- If: Switches are closed.
 - Then replace the CAN Tiller.

Step 6: Clear warning and re-key the truck.

- If: Warning clears.
 - Then return to operation.

- If: Warning continues.
 - Then replace ACCESS 2 and 3 combination.

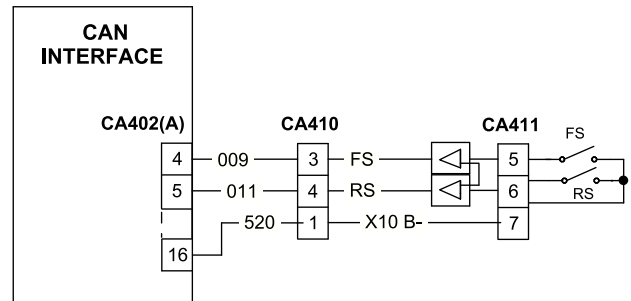


Figure 19101

Release Hydraulic Controls

ACCESS 2 sensing RAS and LOS switches pressed simultaneously.

Step 1: Release both switches and retry pressing only once. If warning continues proceed to Step 2.

Step 2: Verify the state of the RAS and LOS switches (use the readings in the analyzer modes A2.2.1, A2.2.2 and A2.2.3).

- If: Switches are open.
 - Then replace ACCESS 2 and 3 combination.
- If: Switches are closed.
 - Then remove control handle, switch cap and disconnect CA415 from handle.

Step 3: Verify using analyzer mode that the RAS and LOS switches are open.

- If: Switches are closed.
 - Then proceed to Step 4.

Step 4: Open the CAN tiller and disconnect PC402.

- If: Switches are open.
 - Then replace or repair harness PC402 to PC415.
- If: Switches are closed.
 - Then replace the CAN tiller.

Step 5: Clear warning and re-key the truck.

- If: Warning clears.
 - Then return to operation.
- If: Warning continues.
 - Then replace ACCESS 2 and 3 combination.

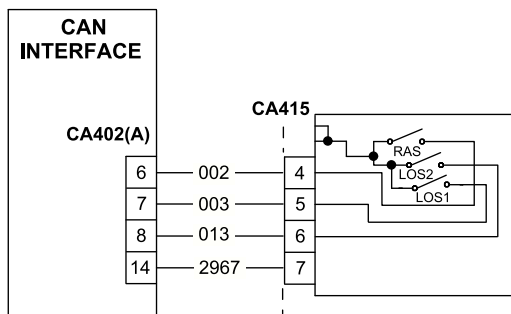


Figure 19117

Release Control Handle

ACCESS 3 sensing the handle is in travel position (BRS is ON) prior to key ON.

Step 1: Return handle to neutral and retry.

- If: Warning still continues.
 - Then proceed to Step 2.

Step 2: Verify the state of the BRS switch and ORS (use the readings in analyzer modes A2.3.10 and A2.3.11).

- If: Switches are open and the warning still continues.
 - Then replace ACCESS 2 and 3 combination.
- If: Switches BRS or ORS are ON or closed.
 - Then proceed to Step 3.

Step 3: Locate the BRS switch and the ORS switch in the knuckle area visually inspect to see if they are being actuated improperly and correct improper actuation.

- If: Switches are not actuated.
 - Then disconnect CA213 and CA214 and verify the switches open (analyzer modes A2.3.10 and A2.3.11).
- If: Switches are open.
 - Then repair or replace the switch as necessary.
- If: Switches are not open.
 - Then verify wiring verify continuity from PC213-3 back to CA200-7 and also PC214-3 back to CA200-7.
- If: Continuity is correct.
 - Then replace ACCESS 2 and 3 combination.

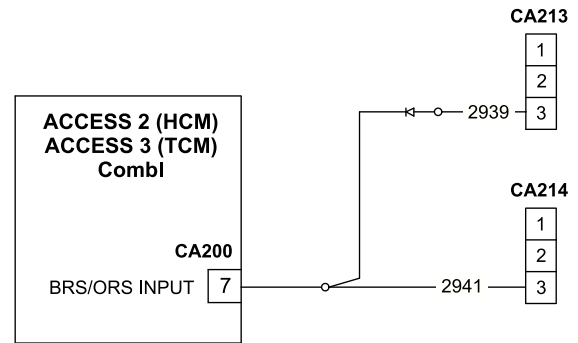


Figure 19118

Release Reverse Button

ACCESS 3 sensing the SAS button is pressed and held.

Step 1: Release the button and retry.

- If: Warning continues.
 - Then proceed to Step 2.

Step 2: Verify the state of the SAS switch using analyzer mode A2.3.8.

- If: Switch is open and the warning still continues.
 - Then replace ACCESS 2 and 3 combination.
- If: Switch SAS is ON or closed.
 - Then remove handle switch cap and disconnect CA410 from handle.

Step 3: Verify using analyzer mode that the SAS switch is open.

- If: Switch is closed.
 - Then proceed to Step 4.
- If: Switch is open.
 - Then disconnect connector ON handle PC412.

Step 4: Verify continuity at PC412-2 SAS reference PC412-1.

- If: Continuity while in SAS is not pressed.
 - Then replace the switch assembly.
- If: No continuity.
 - Then replace the handle.

Step 5: Open the CAN tiller and disconnect PC402.

- If: Switch is open.
 - Then replace or repair harness PC402 to PC410.
- If: Switch is closed.
 - Then replace the CAN tiller.

Step 6: Clear warning and re-key the truck.

- If: Warning clears.
 - Then return to operation.
- If: Warning continues.
 - Then replace ACCESS 2 and 3 combination.

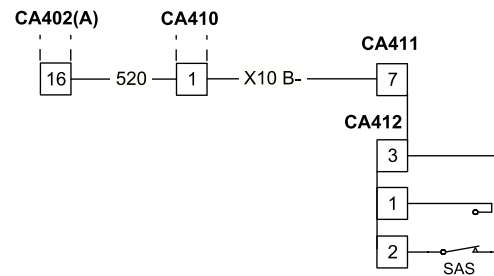


Figure 19119

STEER CONTROLLER HOT

Occurs when temperature of the base plate surpasses 75°C (167°F). Read the temperature using the analyzer mode A2.4.1. When temperature of ACCESS 5 surpasses 75°C (167°F), allow the truck to cool before continuing.

- If: Event continues with light use of the truck.
 - Then improve cooling of ACCESS 5.
- If: Event still continues.
 - Then replace ACCESS 5.

STEER MOTOR HOT

Occurs when thermal sensor inside the motor measures higher than 150°C (302°F).

Step 1: Verify wiring to the thermal sensor from ACCESS 5 to PC210-5 and PC210-6. Inspect at pins in motor connector.

- If: Wiring is correct.
 - Then remove PC210-5 and PC210-6 from PC210 and jumper these temporarily.
- If: After re-key, thermal condition goes away.
 - Then ACCESS 5 is correct and the wiring to PC210 is correct.

Step 2: Verify the resistance of the thermal sensor at JC210-5 to JC210-6 is approximately 500 to 600 ohm at start up temperature.

- If: Resistance is not correct.
 - Then replace the thermal sensor.

Step 3: Clear code and re-key the truck.

- If: Event clears.
 - Then return to operation.
- If: Event continues.
 - Then contact Crown Service.

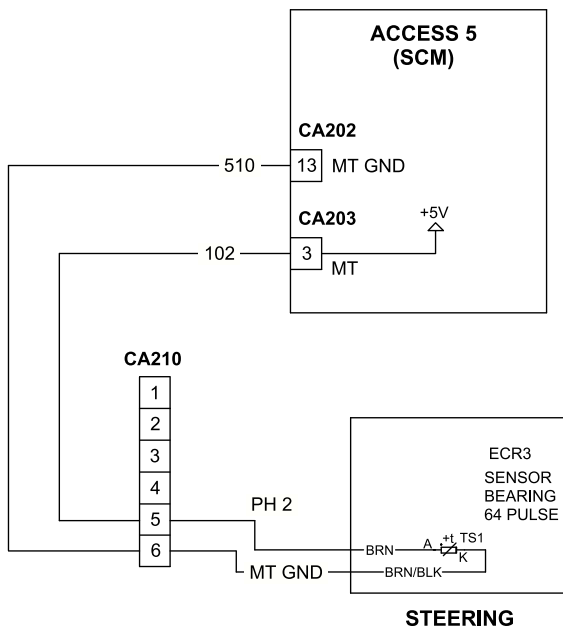


Figure 19120

Notes:



BRAKE

Notes:

Brake System

General

The brake is only activated when:

- The truck is idle (automatically through the traction controller).
- When the Emergency Disconnect is pulled.

It acts as a parking brake and becomes an emergency brake as soon as the Emergency Disconnect is pulled.

It is not used as a service brake and is therefore virtually wear-free.

The drive motor is used as a service brake in regenerative mode.

Servicing the Brake

Servicing is limited to checking the air gap every 1000 service hours.

Measuring the air gap

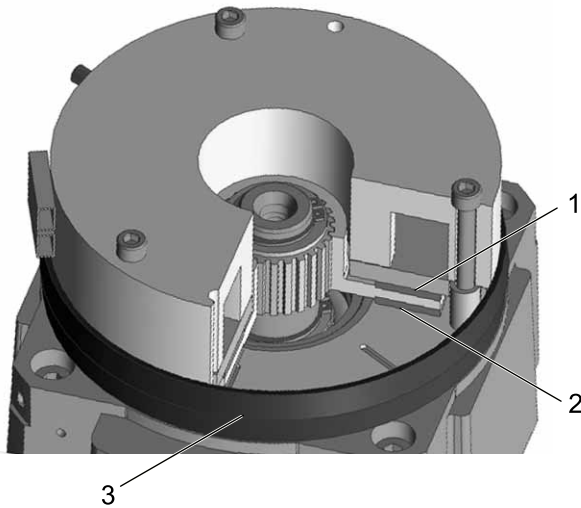


Figure 18866

The brake is mounted on the drive motor.

1. Switch off the truck and disconnect the battery.
2. Remove the panel.
3. Remove the dust shield ring (3). Refer to Figure 18866.
4. Apply weak pressurized air to the abrasion.

5. Use a feeler gauge to measure the air gap between the brake lining (2) and the armature disk (1).

Repair the brake if the air gap is > 0.5 mm (0.02 in). The air gap cannot be adjusted, a wear part kit is available. Refer to Brake Parts.

The wear part kit consists of the following:

- Friction plate
- Brake disk
- Elastic band and 2 screws to aid installation and to secure during transport.

Replacement

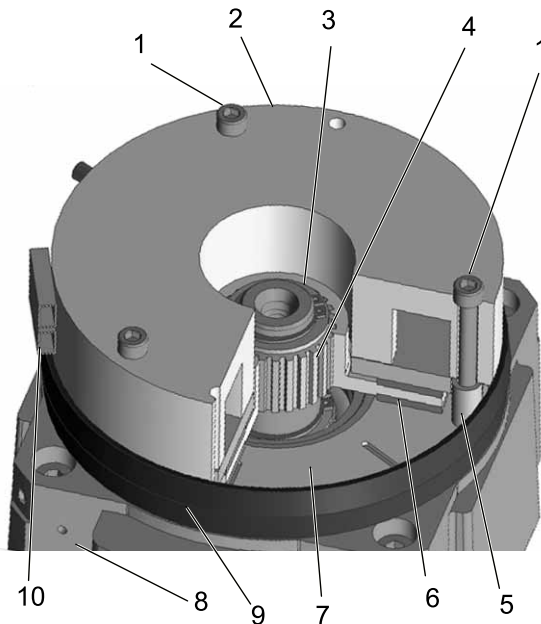


Figure 18869



WARNING

Oily brakes can cause accidents.

All brake components must be kept free of oil and grease. This includes the carrier.

Install wear part kit

Remove and disassemble the brake.

1. Switch off the truck and disconnect the battery.
2. Block load wheels.
3. Remove power unit panel.
4. Remove the connector from the brake (10). Refer to Figure 18868.
5. Remove dust shield ring (9).

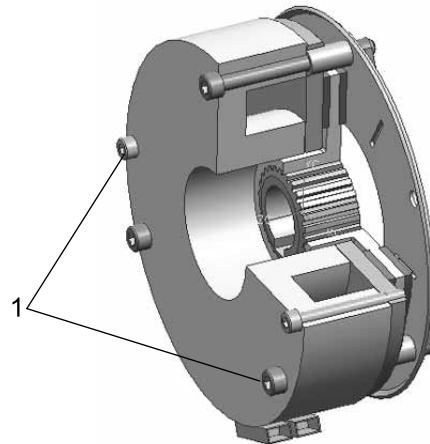


Figure 18868

6. Attach both screws (1) refer to Figure 18868, supplied with the wear part kit to the brake body and tighten them. This prevents the brake from falling apart, resulting in the loss of springs and pressure items.

NOTE

Now make sure that the mounting screws (1) and spacer sleeves (5) remain in the brake body. Refer to Figure 18869.

7. Loosen the three brake mounting screws (1) and remove the brake body (2) and spacer sleeves (5) from the motor (8). Refer to Figure 18867.
8. Remove the friction plate (7), the brake disk (6) and discard.

Replacing wear parts

9. Place the friction plate (7) in the correct position on the bearing plate of the motor (8). Refer to Figure 18869.
10. Place the brake disk (6) on the carrier (4) of the motor. Refer to Figure 18869.

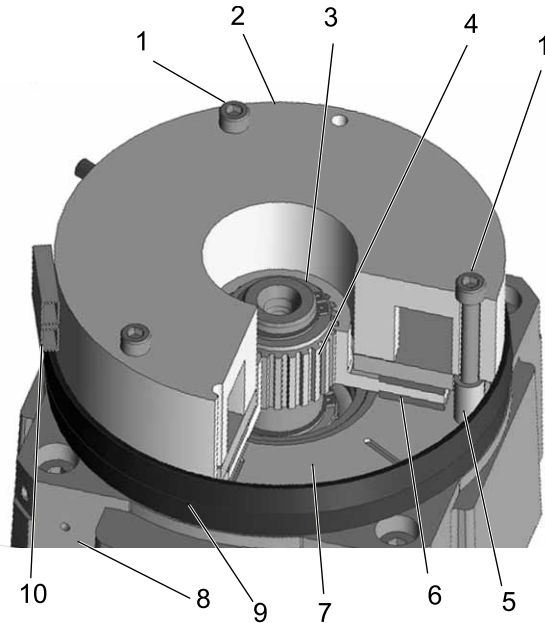


Figure 18869

11. Make sure the spacer bushings (1) are pushed up. Pull the elastic band (2) provided over the 3 brake mounting screws to secure them. Refer to Figure 18867.

Brake assembly

12. Place the brake on the motor in such a way that the connection bushing (10) for the power supply rests back on the wire.
13. Insert the mounting screws (1), then cut through the elastic band and discard.
14. Torque the mounting screws (1) to 10 Nm (7.5 ft lb).



WARNING

Possible brake failure. Remove the two transport securing screws, otherwise the brakes will not work!

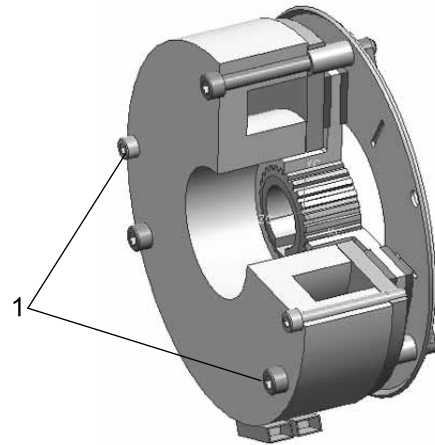


Figure 18868

15. Remove the two screws (1). Refer to Figure 18868.
16. Attach the dust shield ring (9).
17. Restore the electrical connections.
18. Test the brake.

Replace the brake

1. Place the brake on a work surface so that the elastic band is facing up.

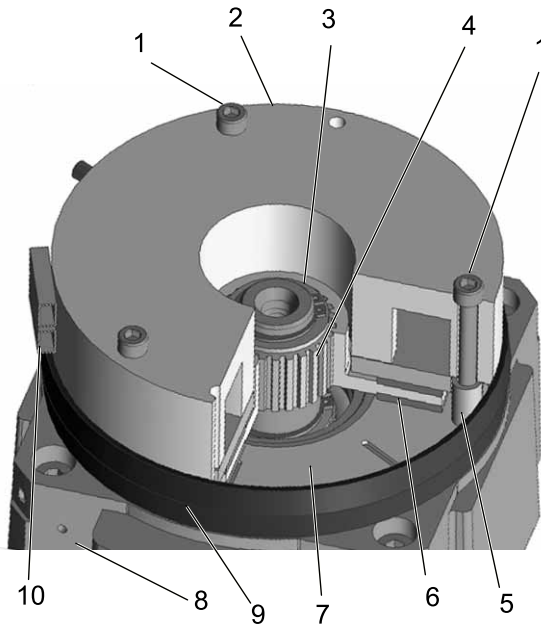


Figure 18869

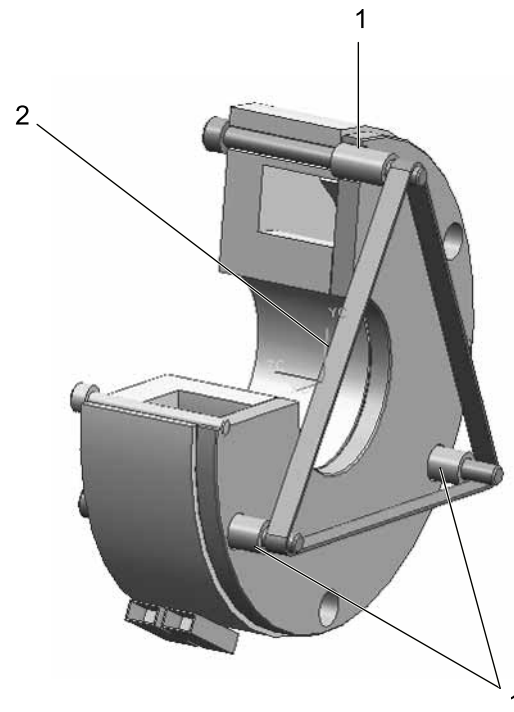


Figure 18867

Removal

1. Switch off the truck and disconnect the battery.
2. Block load wheels.
3. Remove power unit panel.
4. Remove the connector from the brake.
5. Remove the dust shield ring (9). Refer to Figure 18869.
6. Remove the retaining ring (3).
7. Remove the three brake mounting screws (1).
8. Remove and discard the magnetic body (2), carrier (4), brake disk (6), spacer sleeves (5) and friction plate (7). Refer to Figure 18869.

2. Remove the elastic band (2) and put it aside. Do not throw it away. Refer to Figure 18867.

Assemble

NOTE

Do not remove the elastic band or the screws. The brake will fall apart without this transport safety mechanism.

The brake is supplied pre-assembled. Two screws and one elastic band serve as a transport safety mechanism and assembly aid.

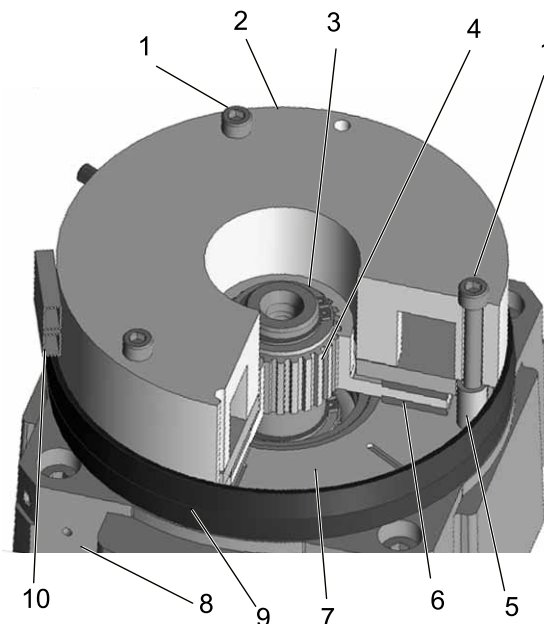


Figure 18869

3. Remove the friction plate (7), taking care not to lose the spacer sleeves (5).
4. Remove the carrier (4) and push it onto the drive shaft of the motor (8).
5. Secure the carrier (4) onto the drive shaft with the retaining ring (3).
6. Place the friction plate (7) in the correct position on the bearing plate of the motor.
7. Take out the brake disk (6) and remove the paper.
8. Place the brake disk (6) on the carrier (4) of the motor.

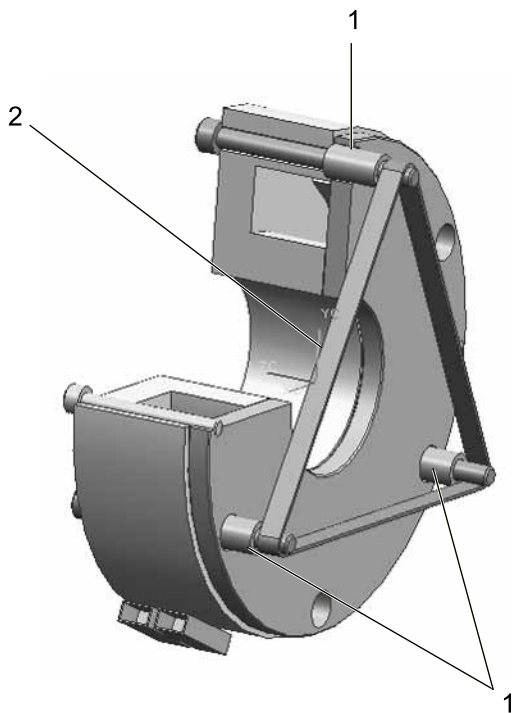


Figure 18867

9. Make sure the spacer bushings (1) are pushed up. Pull the elastic band (2) provided over the three brake mounting screws to secure them. Refer to Figure 18867.
10. Position the brake so that it is correctly aligned with the motor (8). The connection bushing (10) for the power supply must rest against the wire again.
11. Insert the mounting screws (1), then cut through the elastic band and discard.
12. Torque the mounting screws (1) to 10 Nm (7.5 ft lb).



Possible brake failure. Remove the two transport securing screws, otherwise the brakes will not work.

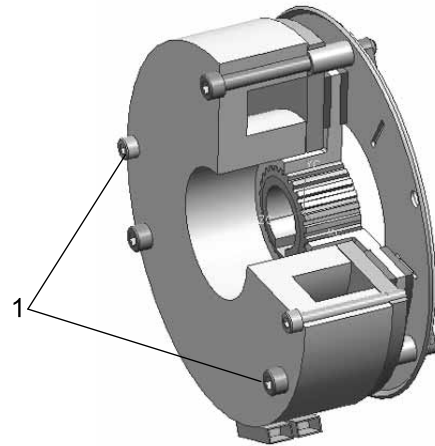


Figure 18868

13. Remove the two screws (1). Refer to Figure 18868.
14. Attach the dust shield ring (9).
15. Restore the electrical connections.
16. Test the brake.

Notes:



STEERING

Notes:

Steering

Steer Motor

NOTE

For the following procedures, refer to Figures 18986 and 19157.

Special Tools

- Hydraulic press and suitable supporting equipment for pressing on components.

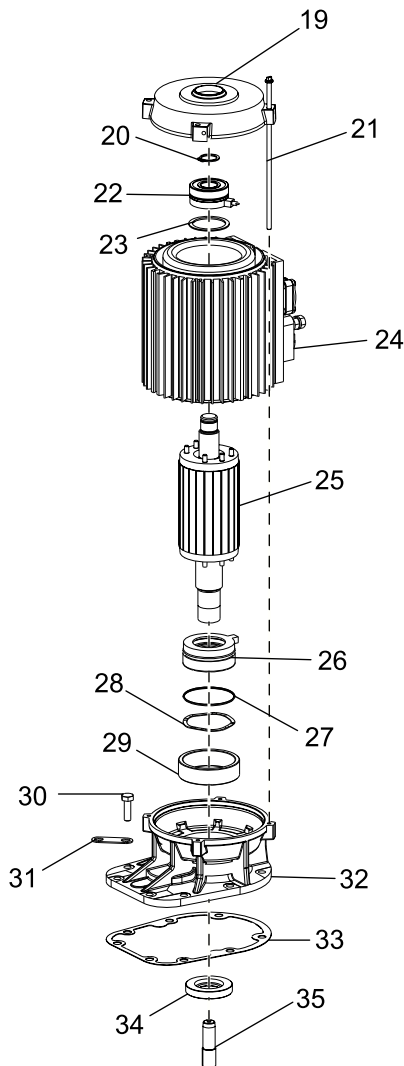


Figure 18986

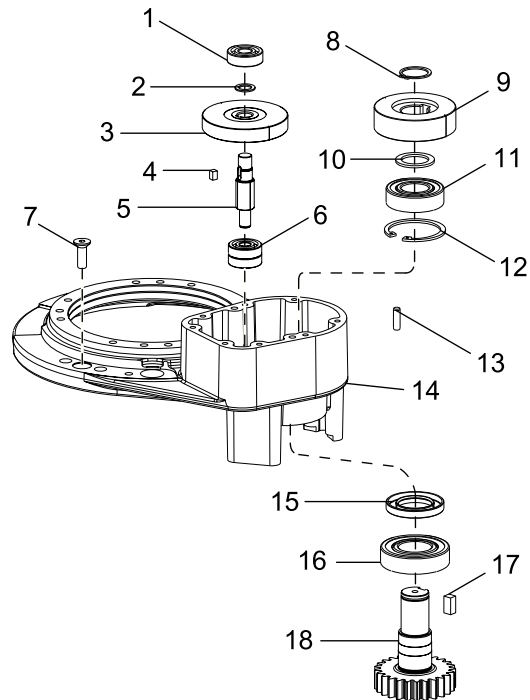


Figure 19157

Steer Motor Removal

- Switch off the truck and disconnect the battery.
- Prevent the truck from being switched on again. Chock wheels to prevent truck from rolling away. Refer to lockout/Tagout for safety procedure.
- Disconnect all connections from the steer motor.
- Remove the screws (30) securing the motor end cover (32) to the intermediate flange (14).
- Remove the bolt (21).
- Lift the steer motor off of the gear box housing and place on workbench.

Steer Motor Assembly

1. Remove the steer motor from the workbench and install into the intermediate flange (14) with gasket (33) in place.
2. Install the screws (30) into motor end cover (32) and secure to the intermediate flange (14), torque to 10 Nm (7.0 ft lb).
3. Attach the bolt (21) and torque to 2.0 Nm (18 in lb).
4. Connect all connections to steer motor assembly.
5. Connect battery and remove Lockout/Tagout safety devices, refer to Lockout/Tagout procedures.
6. Lubricate the steering gear teeth; refer to Lubrication and Adjustment for recommended lubricant.
7. Test the steering.

Repair Steer Motor

NOTE

For the following procedures, refer to Figures 18986 and 19157.

NOTE

When repairing the steer motor, replace all bearings and seals.

Preparation

1. Remove the steer motor and bring the steer assembly to a workbench. Refer to steer motor removal.

Disassemble Steer Motor

1. Remove the screws (30) and remove clamping joint (31).
2. Remove the end cap (32).



WARNING

Observe the manufacturer's safety instructions when handling solvents and lubricants.

3. Drain oil out of the steering motor assembly and dispose of it in accordance with environmental regulations.
4. Remove the O-ring (27) from the sensor bearing (26).

NOTE

Replace the sensor bearing if necessary.

5. Remove the shim (28) and ring (29) from the end cap (32).
6. Using a hydraulic press to remove the shaft seal (34) out of the end cap.
7. Remove the gasket (33).

NOTE

If you are using a new intermediate flange (14), the cylinder pins (13) must be removed and saved.

Pinion and Output Disassembly

8. Remove the retaining ring (8).
9. Remove the pinion shaft with the gear wheel (3), pinion (5), and bearing (1) out of the intermediate flange (14).
10. Remove the bearing (1), supporting ring (2), gear wheel (3) and key (4) off the pinion (5).
11. Remove the gear wheel (9).
12. Remove the supporting ring (34).
13. Press the output shaft (18) and the bearing (16) out of the intermediate flange (14).

Output Shaft Disassembly

14. Remove the key (17).
15. Remove the bearing (16) from the output shaft (18).
16. Press the bearing (15) out of the intermediate flange (14).
17. Remove the retaining (12) out of the intermediate flange (14).

Assemble Steer Motor

Assemble Output Shaft

1. Press the bearing (16) onto the output shaft (18).
2. Install the key (17).
3. Insert the key (4).
4. Press the gear onto the wheel (3).
5. Insert the washer (2).
6. Press on the bearing (1).
7. Lubricate the sealing lip of the shaft seal ring (15).
8. Press the shaft seal ring (15) into the intermediate flange (14).
9. Install the retaining ring (12) into the intermediate flange (14).
10. Press the bearing (6) and (11).
11. Press in the pre-assembled output shaft while supporting the inner ring of the bearing (15).
12. Press the washer (10) onto the output shaft.
13. Press the gear wheel (17) onto the output shaft (18) while supporting the output shaft.
14. Install the retaining ring (8).

Assemble Pinion Shaft

15. Press the pre-assembled pinion shaft into the bearing (6).

NOTE

If you are using a new intermediate flange (14), the cylinder pins (13) removed and saved from the replaced intermediate flange must be used.

16. Lubricate the sealing lip of the shaft seal ring (34).
17. Press the shaft seal ring (34) into the end cap (32).

NOTE

Be sure to use the correct oil grade. Freezer Condition trucks require a different oil than standard trucks.

18. Add gear oil, refer to Lubrication and Adjustment for correct lubricant. Capacity is approximately 0.25 l (8.5 fl oz).
19. Place the gasket (33) onto the intermediate flange.

20. Position the end cap (32) onto the intermediate flange and secure it with the screws (30). Do not forget to install the clamping joint (22).
21. Torque the screws (30) to 10 Nm (7.0 ft lb).
22. Install the ring (29) and spacer (28) in the end cap (32).
23. Install the sensor bearing (26) and the O-ring (27).
24. Lubricate steering gear teeth; refer to Lubrication and Adjustment for recommended lubricant.
25. Install steer motor assembly.
26. Connect all connections from to the steer motor.

Assuring proper wiring and cabling connections

1. Center tiller handle
 - Remove the tiller knuckle cover. Insert a 4 mm Allen wrench through the tiller knuckle machining and into the power unit. This pin will ensure the tiller is in the "straight forward" position. Use this pin every time "tiller center" position is required.
2. Switch truck ON.
3. If the drive tire moves immediately to the left or right and the ACCESS 5 module displays a 522 fault "motor locked", then the feedback loop is not closed properly. To close the loop correctly, switch the steer motor power cables of two motor phases.
4. If the line contactor pulls closed and no faults appear on the ACCESS 5 module, proceed with the calibration.
5. Switch truck OFF.

Adjusting Steer and Feedback Pot

1. Remove the power to ACCESS 5 module.

NOTE

It is important to remove power to the ACCESS 5 module to prevent inadvertent movement of the drive tire during POT adjustments.

2. Disconnect the battery.
 3. Remove the positive (+) battery cable from the ACCESS 5 30A fuse mount. Discharge the ACCESS 5 capacitors by touching the positive (+) and negative (-) battery connectors with a 100 ohm resistor.
 4. Position the drive tire in the "straight forward" position.
 5. Connect battery to truck.
 6. Switch truck ON.
 7. Adjust steering Pot.
- Ensure tiller handle is centered throughout Steer Input POT adjustment. Under Display menu - C2.1, a value of $2.5\text{ V} \pm 0.2\text{ V}$ should be displayed.
 - If not, loosen the Steer Pot mounting bracket.

NOTE

It may be necessary to adjust more than the one mounting bracket will allow. If so, it is not necessary to completely remove the Steer Pot mounting bracket. There will enough fastener thread engagement to loosen mounting bracket enough to disengage the rubber coupling from the bottom of the knuckle shaft.

- While truck is ON, adjust Steer Input Pot position until the C2.1 Steer Input Pot value is $2.5\text{ V} \pm 0.2\text{ V}$.
 - When desired voltage reading has been achieved, align rubber coupling with one of the four slots in the bottom of the knuckle shaft, then tighten the Steer Pot mounting bracket to the power unit.
8. Adjusting Feedback Pot
- Check gear box of the drive unit, should be on the right side of the drive tire.
 - Ensure drive tire is centered throughout Steer Feedback Pot adjustment. Under Display menu - C2.2, a value of $2.5\text{ V} \pm 0.2\text{ V}$ should be displayed.

- If not, loosen Feedback Pot mounting bracket, located under the steering gear.

NOTE

If so, it is not necessary to completely remove the Feedback Pot mounting bracket. There will enough Fastener-thread engagement to loosen mounting bracket enough to disengage the rubber coupling from the bottom of the Steering shaft.

- While truck is ON, adjust Feedback Pot position until the C2.2 Steer Feedback Pot value is $2.5\text{ V} \pm 0.2\text{ V}$.
- When desired voltage is achieved, align rubber coupling with one of the four slots in the bottom of the steering shaft and tighten Feedback Pot mounting bracket to the Drive Unit flange.
- While in this menu, note the maximum (full left) and minimum (full right). This information will be used later in the calibration.

NOTE

If either the Steer Input Pot or Steer Feedback Pot values are $\pm 2.5\text{ V}$, the performance of the steering system will vary from not working to working poorly. Repeat "Adjusting Steer and Feedback Pot" as needed until the correct values are achieved.

Tiller Center Position

1. Locate menu C2.3 Acquire Tiller Center. Press forward key and follow display instructions.
- Center tiller handle, then press Enter.

Drive Tire Position Adjustment

NOTE

Only when the Steer Input and Feedback Pots are adjusted properly should power be restored to the ACCESS 5 module.

1. Switch truck OFF.
 2. Disconnect the battery.
 3. Attach positive (+) battery power cable to the ACCESS 5 30A fuse mount.
 4. Connect battery to the truck.
 5. Make sure tiller handle and drive tire are centered.
 6. Switch the truck ON.
 7. Test to see if the drive tire moves in the same direction as the tiller handle. Move the tiller left then right. If the drive tire moves in the opposite direction, switch the positive (+) CA212-1 and (-) CA212-2 leads of the Steer Pot.
 8. Centering drive tire.
 - When the tiller is centered, adjust the position of the drive tire so it is in the "straight forward" position.
 - Move the tiller handle down into the travel zone. This will allow adjustments to be made in real time.
 - Locate C2.4 Adjust Drive Tire Center. Press next key and adjust scale value up or down until drive tire aligns with centered tiller.
- NOTE**
- This value may require further adjustment after vehicle is able to travel. Find a straight line on the traveling surface and attempt to travel along the center of the straight line. Evaluate the position of the drive tire to the tiller. If the drive tire is not positioned $\pm 90^\circ$ when the tiller is positioned $\pm 80^\circ$ then adjustments are necessary before calibration.*
- Remove the 4 mm Allen wrench from the tiller knuckle.
 - Move the tiller to the right -80° until the knuckle makes contact with stop.
 - Move the tiller handle down into the travel zone. This will allow adjustments to be made in real time.
 - Locate C2.5 Adjust Full Right Coarse and C2.6 Adjust Full Right Fine menus under Calibration menu. Adjust full right -90° drive tire position by using "Coarse" adjustment to get close and then use "Fine" to complete.
 - Move the tiller to the left $+80^\circ$ until knuckle makes contact with stop.
 - Locate C2.7 Adjust Full Left Coarse and C2.6 Adjust Full Left Fine menus under Calibration menu. Adjust full right $+90^\circ$ drive tire position by using "Coarse" adjustment to get close and then use "Fine" to complete.
 - Evaluate the drive tire position relative to the tiller. If the drive tire follows the tiller and full $\pm 90^\circ$ turns are acquired, then no more adjustments are necessary.
 - 9. Acquiring full left and right positions
 - Move the tiller to the left $+80^\circ$ until the knuckle makes contact with stop.
 - Locate C2.9 Set Maximum Feedback Pot under Calibration. Press next key and follow instructions on the display.
 - Tiller 90° Left, then press Enter.
 - Move the tiller to the right -80° until the knuckle makes contact with stop.
 - Locate C2.10 Set Minimum Feedback Pot under Calibration. Press next key and follow instructions on the display.
 - Tiller 90° right, then press Enter.
 - Verify tiller angle. Locate C2.11 Tiller Angle = Value. Press next key to view tiller angle constantly.
 - Rotate tiller from center to full left then to full right. The display should read 0, $+90^\circ$, -90° respectively.

10. Calibration Completion

Move to the end of the Calibration menu after C2.11 Tiller Angle. Press back key.

- Display will ask if you want to save. "SAVE? N or SAVE? Y".
- If SAVE? Y, press Enter key.
 - Display will ask to "RE-KEY".
 - Calibration is complete.
- If SAVE? N, press Enter key.
 - Truck will remain not functional until calibration is complete and saved.



LIFTING MECHANISM

Notes:

Mast

Torque Requirements

The four, 20 mm (0.75 in) diameter bolts that fasten the lower portion of power unit to main frame base plate torque must be 190 - 215 Nm (140 - 160 ft lb).

The two, 15.8 mm (0.625 in) diameter bolts that fasten upper portion of power unit to main frame torque must be 305 - 340 Nm (225 - 250 ft lb).

The four, 15.8 mm (0.625 in) diameter bolts that secure removable load wheel assemblies to main frame outriggers torque must be 225 - 250 Nm (165 - 185 ft lb).

The four 3/8-16 nuts that secure carriage cylinder clamps (two for each clamp) and cylinder to third stage mast torque must be 41 - 48 Nm (30 - 35 ft lb).

Fork Adjustments

With forks completely lowered and level, adjust so top surface of fork tip is a maximum of 65 mm (2.5 in) from the floor.

Maximum fork height is to be within ± 25 mm (± 1.00 in) of fork height specified on truck data plate.

Mast Testing (Assembled)



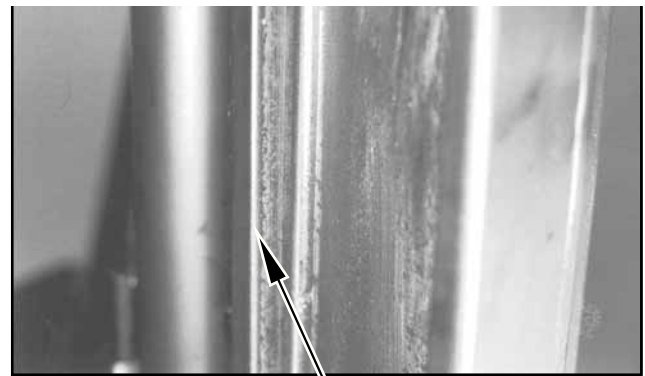
WARNING

Wear appropriate items, such as safety glasses, whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove the battery from the truck, disconnect tilt cylinders from the mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing the above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

1. Inspect each channel for the roller tracking path. The only area that should show wear is the back portion of the I-beam where the roller rides. Refer to Figure 17058. The I-beam should not show signs of any cutting or grooving. If grooving or cutting is evident, it will normally take place at side of the roller; 10 mm (0.375 in) from the channel face. If this type of wear is evident, a shim will have to be removed.
2. Once an adjustment has been made by removing or adding shims, a recheck of the mast channel will be required. To see the new wear pattern, clean the channel with a solvent that will remove lubricant and then wipe with a cloth. Spray channel with a thin coat of paint. This will allow a visible indication of where rollers are riding. Repeat as required.
3. Once mast meets requirements, lubricate mast with grease, Crown No. 063002-024 for standard or 063002-017 for freezer/corrosion application. When mast is raised near full extension, it should not lean right or left; instead it should appear even and straight. If a leaning condition exists, it is a sign the shimming is too loose or unbalanced and will need to be adjusted.



Channel Should Only Show Wear Here

Figure 17058

Flaking

It is not uncommon for a new mast to appear as if it is flaking or peeling. This appearance is an indication rollers are seating to mast channel and is considered normal. Eventually, this condition will disappear. Grease applied to the channel will retain these particles.

Mast Staging Bumper Replacement

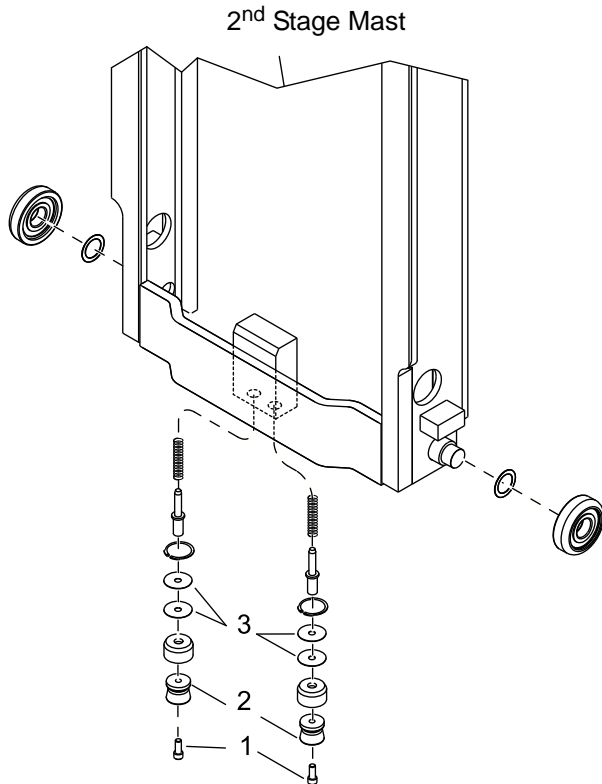


Figure 18726

1. Raise mast and replace bumper, item 2. Refer to Figure 18726.
2. Lower mast and check that mast bumpers contact their stops at same time. Adjust by adding or removing shims as required. Use shim 060030-277, 0.8 mm (0.031 in) thick, item 3. Refer to Figure 18726.
3. Apply thread locking adhesive to bumper screws and tighten, item 1. Refer to Figure 18726.

Disassembly



WARNING

Wear appropriate items, such as safety glasses, whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove battery from truck, disconnect tilt cylinders from mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

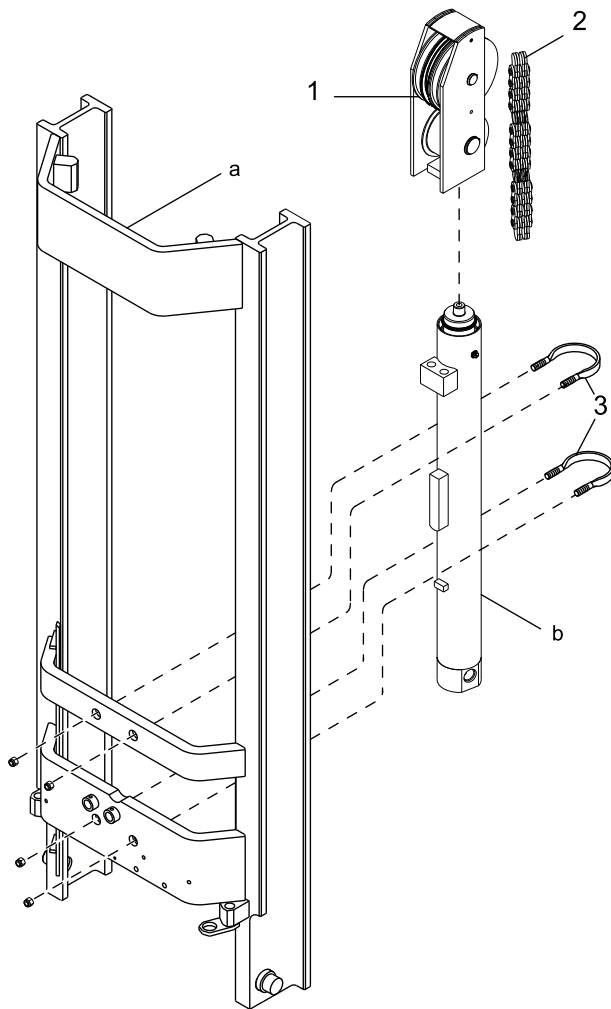


Figure 18727

- a Third Stage Mast
- b Carriage Cylinder

NOTE

Reach assembly (SHR trucks only) can be kept in an upright position much easier if it is extended. Block reach assembly to prevent premature retraction.

1. Extend reach assembly, disconnect and remove battery.
2. Remove load backrest and forks from carriage.
3. Remove safety shield.

4. Connect lifting device to carriage assembly (TT mast) and raise to get slack in chains. Remove yoke and chains, items 1 and 2, from carriage cylinder. The seals at top of carriage cylinder can be replaced if required. Refer to Figure 18727.
5. Unhook chains, control cables and hydraulic lines from carriage assembly and lower carriage to floor.

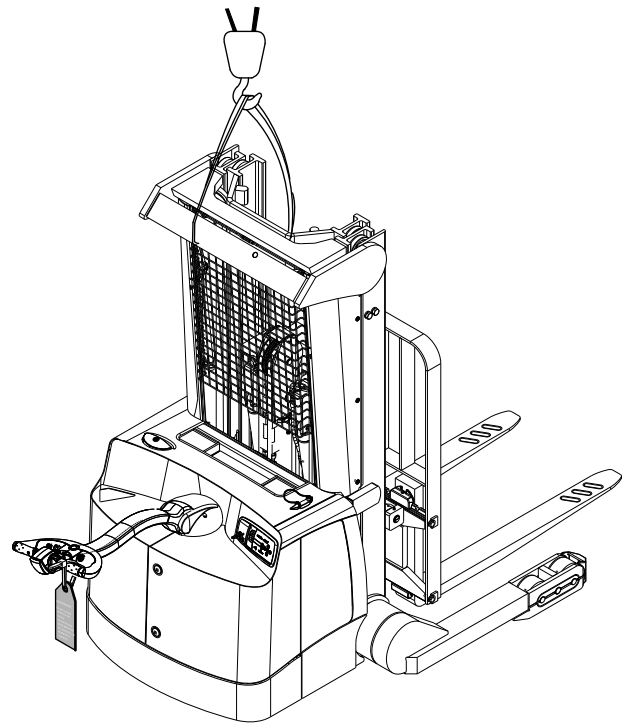


Figure 18733

6. Connect lifting device to top cross-brace of third stage mast (TT mast) or second stage mast (TL mast). Raise, until reach assembly can be slid forward to clear mast. Lower the mast to collapsed position. Refer to figure 18733.

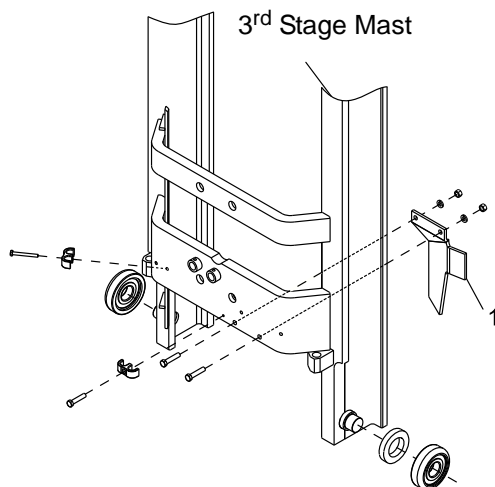


Figure 18728

7. Removal of carriage cylinder;
 - Remove guard, item 1. Refer to Figure 18728.
 - Remove hydraulic tube from carriage cylinder.
 - Have container in position to catch oil from cylinder.
 - Use cylinder clamp or braided strap around cylinder just below chain anchor and connect to lifting device. Refer to Figure 18728.
 - Remove clamps, item 3 and securing carriage cylinder and remove cylinder.
8. Secure lifting device to third stage mast (TT mast) or second stage mast (TL mast). Raise to achieve slack in chains.
9. Remove guides, from lift cylinders, right and left hand sides.
10. Remove control cables, hydraulic lines, chains and pulleys from top of second stage mast and bottom of third stage mast. Note position of all components, right and left hand sides are different.
11. Use lifting device to lift third stage mast (TT mast) out top of second stage mast. Lay third stage mast on floor.
12. Remove Height Limit switch, item 1. Height Limit Switch (LMS1) option available on TT and TL masts. Refer to figure 18729.
13. Connect lifting device to top cross brace of second stage mast. Raise slightly, remove screw and nut, that secure lift cylinder rams to second stage mast.

Seals at the top of lift cylinders can be replaced if required.

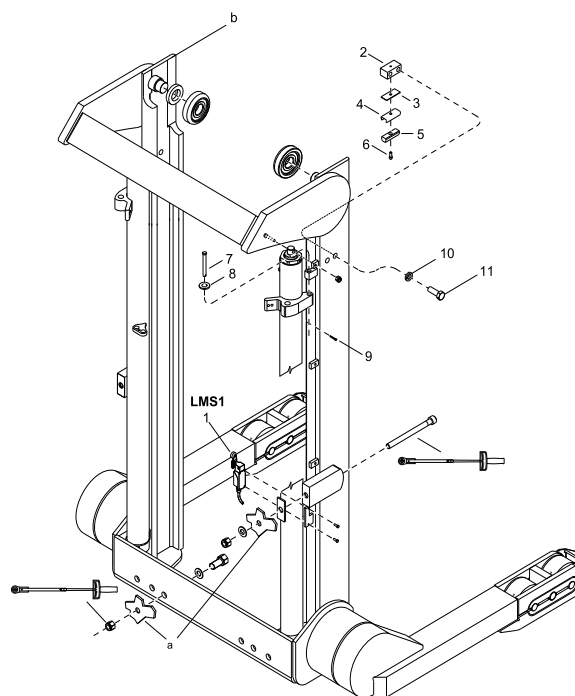


Figure 18729

- a Part of Power Unit
- b 1st Stage Mast

14. Raise second stage mast until stop block on main frame can be accessed thru hole at bottom of second stage mast. Remove stop block, items 2 - 6, from main frame. Refer to figure 18729.
15. Raise and remove second stage mast from top of main frame. Lay second stage mast on floor.
16. Most repairs can be completed without removing lift cylinders, however if their removal is required remove cross tube from left lift cylinder and from right hydraulic tube on right lift cylinder. Use container to catch oil.
17. Remove right hydraulic tube from right lift cylinder and from main frame. Use container to catch oil.
18. Use braided strap around left lift cylinder just below anchor block and connect to lifting device.
19. Remove cotter pin, washer and clevis pin, items 7 - 9. Refer to 18729.
20. Remove left lift cylinder from main frame.
21. Repeat procedure, to remove right lift cylinder.

NOTE

If amount of overhead room will not allow masts to be raised enough for removal, mast assembly will need to be unbolted from power unit and laid down. The following procedure should be followed if removal from power unit is necessary.

**WARNING**

Wear appropriate items, such as safety glasses, when ever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove battery from truck, disconnect tilt cylinders from mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

1. Disconnect and remove battery.
2. Remove load backrest, forks and carriage assembly.
3. Remove safety shield.
4. Disconnect cables and hydraulic lines from power unit to mast assembly. Use container to catch hydraulic fluid.
5. Raise Forks 70 - 150 mm (3 - 6 in) from floor. Wheel chock Load wheels on both outriggers. Raise rear of truck enough to get hardwood blocks, not to exceed 400 mm (16 in), under base plate of power unit, base plate of mast assembly and both outriggers behind load wheels. This block should carry weight of power unit and mast assembly when mounting bolts are removed. Block is positioned parallel with base Plates. Refer to figures 18731, 18732 and "Control of Hazardous Energy" for complete blocking instructions.
6. Loosen the four, 20 mm (0.75 in) bolts at the base plate.

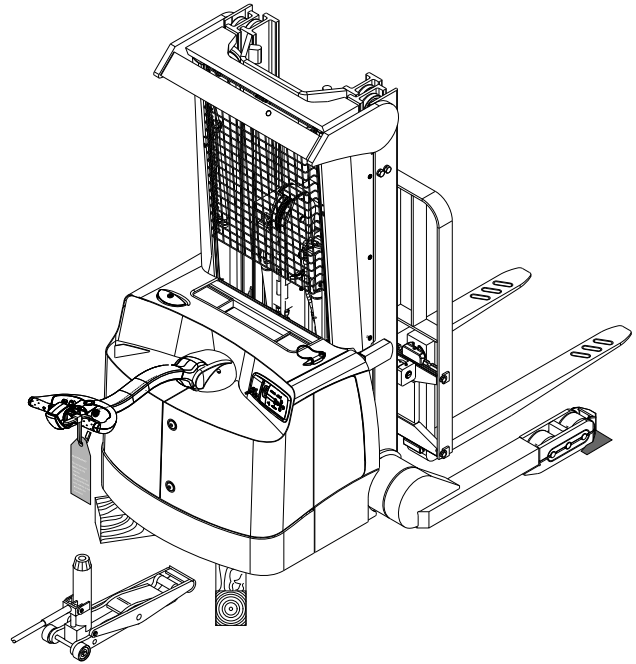


Figure 18731

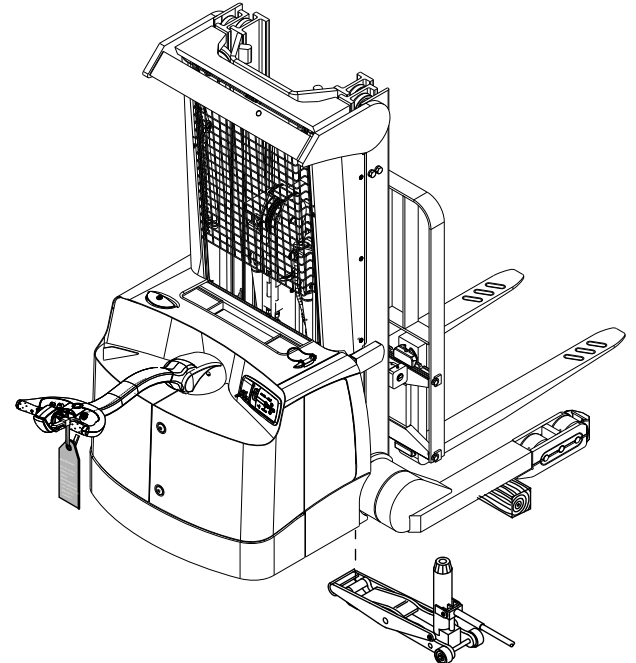


Figure 18732

LIFTING MECHANISM

Mast



7. Attach lifting device to top of main frame, refer to figure 18733, raise just enough to take weight off of hardwood block.

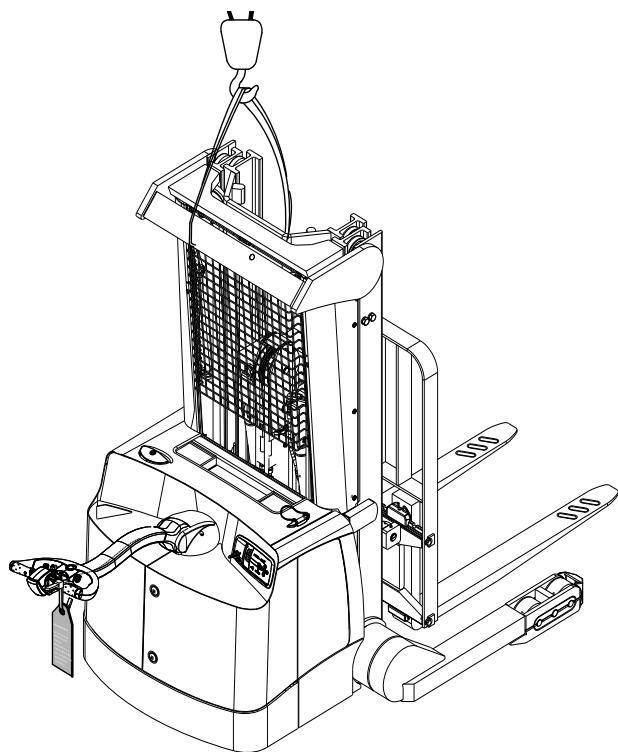


Figure 18733

8. Remove two, 15.8 mm (06.25 in) bolts at top of power unit. Weight of power unit and mast assembly should be on hardwood block at this time.
9. Remove four, 20 mm (0.75 in) bolts across base of power unit.
10. Move mast assembly away from power unit.
11. Move mast assembly to an area large enough to allow mast to be laid down and disassembled.
12. Lower mast assembly, with outriggers up, very carefully. Keep lifting device directly over top of main frame while lowering to prevent base plate from sliding on floor.
13. Refer to disassembly procedures in this section at this time if further disassembly is required.

NOTE

With mast assembly laid down, cylinder and mast assemblies must be removed by making all hook ups with lifting device as near center of assembly as possible to maintain balance.

Assembly

NOTE

Before assembly, refer to torque requirements, fork adjustment and mast staging procedures located in first part of this section.



WARNING

Wear appropriate items, such as safety glasses, whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove the battery from truck, disconnect tilt cylinders from mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.



CAUTION

Always block masts when working on masts in an elevated position, even though connected to a lifting device.

1. Use braided strap around right lift cylinder just below anchor block and connect to lifting device.
2. Lift and position right lift cylinder in main frame. Secure to main frame with clevis pin, washer and cotter pin, items 7 - 9. Refer to figure 18729.
3. Using device, lift and position left lift cylinder in main frame. Secure to main frame with clevis pin, washer and cotter pin, items 7 - 9. Refer to figure 18729.
4. Connect right hydraulic tube to right lift cylinder.
5. Install left cross tube to left lift cylinder and right tube.

6. Clean column roller studs at the top of the main frame and bottom of second stage mast. If any paint or rust is evident on the studs, remove with emery cloth and lubricate with grease, Crown No. 063002-024 for standard or 063002-017 for freezer/corrosion application.
7. Install two shims on each of the four studs, two at top of main frame and two at bottom of second stage mast. Place one shim 060030-085 and one column roller 074668-001 on each stud.
8. Attach lifting device to top cross member of second stage mast, lift and assemble second stage into main frame. Refer to figure 18733.
9. Once mast has been reassembled, column rollers travel and clearance should be checked.
10. Use lifting device to raise second stage mast so rollers are about 150 to 200 mm (6 to 8 in) below mounting holes for stop block in main frame.
11. Use a pry bar to shift mast channels to one side. Pry on opposite side to shift it against other side, then go back and pry on original side to shift it back again. This will seat rollers and force opposite side tight against mast channel. This is necessary to allow for accurate roller to channel clearance measurement. Once mast has shifted, retain light pressure to hold mast from slipping back.
12. Measure distance between channel and roller, about 10 mm (0.375 in) from channel face. Always measure from side the rollers are canted toward. If dimension is greater than 0.79 mm (0.031 in) add another shim behind roller. If dimension is less than 0.76 mm (0.030 in) and it does not appear to be tight, proceed in checking remaining channel rollers. Lower second stage and check running clearance. If shims need to be added, remove second stage mast, add shims as required, and install second stage mast back into main frame.

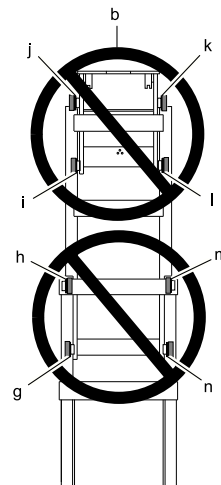
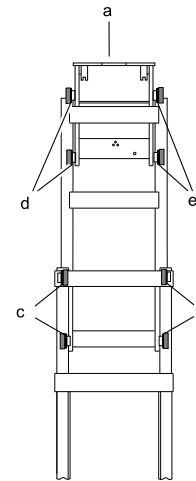


Figure 16950-01

- a CORRECT
- c 2 Shims (Mast)
- d 1 Shim (Carriage)
- e 2 Shims (Carriage)
- f 1 Shim (Mast)
- b INCORRECT
- g 1 Shim (Mast)
- h 2 Shims (Mast)
- i 1 Shim (Carriage)
- j 2 Shims (Carriage)
- k 1 Shim (Carriage)
- l 2 Shims (Carriage)
- m 1 Shim (Mast)
- n 2 Shims (Mast)

13. Accurate measurements can only be checked from one side. Once previously described dimensions are obtained, mast channel rollers for second stage to main frame will be within tolerance. When shims are installed it is always ideal to have an equal number of shims on each column roller stud. If an unequal number of shims required, it is very important that an equal distribution of shims per side be followed. Refer to Figure 16950-01.
14. Brush grease on main frame and second stage rails. Use Crown No. 063002-024 for standard or 063002-017 for freezer/corrosion application.
15. Raise second stage mast until access hole in mast channel is aligned with stop block mounting holes.
16. Assemble stop blocks, items 2 - 6, to main frame, inspect and replace if necessary, apply thread lock adhesive to screws. Refer to Figure 18729.
17. Secure tops of cylinders to brackets on second stage mast using the 6.3 mm (0.25 in) screw and nut.
18. Assemble Height Limit switch (LMS1), item 1. Height Limit Switch option available on TT and TL masts. Refer to figure 18729.
19. Install two shims on each of the four studs, two studs at top of second stage and two studs at bottom of third stage mast. Use appropriate shims as indicated in step 7 of Assembly. Place one roller on each stud.
20. Attach lifting device to top cross member of third stage mast (TT mast), lift and assemble third stage mast into second stage mast.
21. Use a lifting device to raise third stage mast (TT mast) so that rollers are about 300 to 400 mm (12 to 16 in) below rollers at top of second stage mast.
22. Use a pry bar to shift third stage mast (TT mast) channels to one side, pry on opposite side to shift it against other side, then go back and pry on original side to shift it back one more time. This will seat the rollers and force opposite side tight against second stage mast channel. Once mast has been shifted, retain light pressure to hold mast from slipping back.
23. Measure distance between channel and roller, about 10 mm (0.375 in) from channel face. If shims need to be added, remove third stage mast and install shims as required. Install third stage mast back into second stage mast and check running clearances.
24. Brush grease, Crown No. 063002-024 for standard or 063002-017 for freezer/corrosion application, on second and third stage rails (TT mast).
25. Assemble lift chains and chain pulleys to second stage mast.
26. Connect lift chains to third stage mast.
27. Assemble hydraulic hoses and pulleys, items 1 and 8, to second stage mast. Refer to figure 16637.
28. Assemble hose guides to lift cylinders, right and left hand sides. Refer to figure 18729.
29. Install control cable(s) and pulley(s) on second stage mast. Refer to figure 16637.
30. Lower mast completely. Use braided strap and place just below chain anchor bracket on carriage cylinder, connect to lifting device. Refer to figure 18729.
31. Inspect carriage cylinder clamps, item 3, for fatigue cracks and replace as required. Install both clamps with cut edges of clamp to outside of bend and torque nuts as specified previously.
32. Install two shims 060030-085 and one column roller 074668-001 on each of four studs on reach assembly. Use appropriate shims as indicated previously.
33. Attach lifting device to top cross brace of third stage mast. Raise mast and position reach assembly under third stage mast and lower mast over reach assembly. Refer to figure 18733.
34. Attach lifting device to reach assembly and raise reach assembly about 1525 mm (60 in). Check fit of reach assembly in third stage mast with pry bar to determine if it is tight. Continue to raise reach assembly up mast and check fit two or three more times as it is raised.
35. Raise until top roller of reach assembly is about 300 mm (12 in) below top of third stage mast. Use a pry bar to shift reach assembly to one side and pry on opposite side to shift it against other side, then go back and pry on original side to shift it one more time. This will seat rollers and force opposite side tight against third stage mast channel. Once reach assembly has been shifted, retain light pressure to hold reach assembly from slipping back.

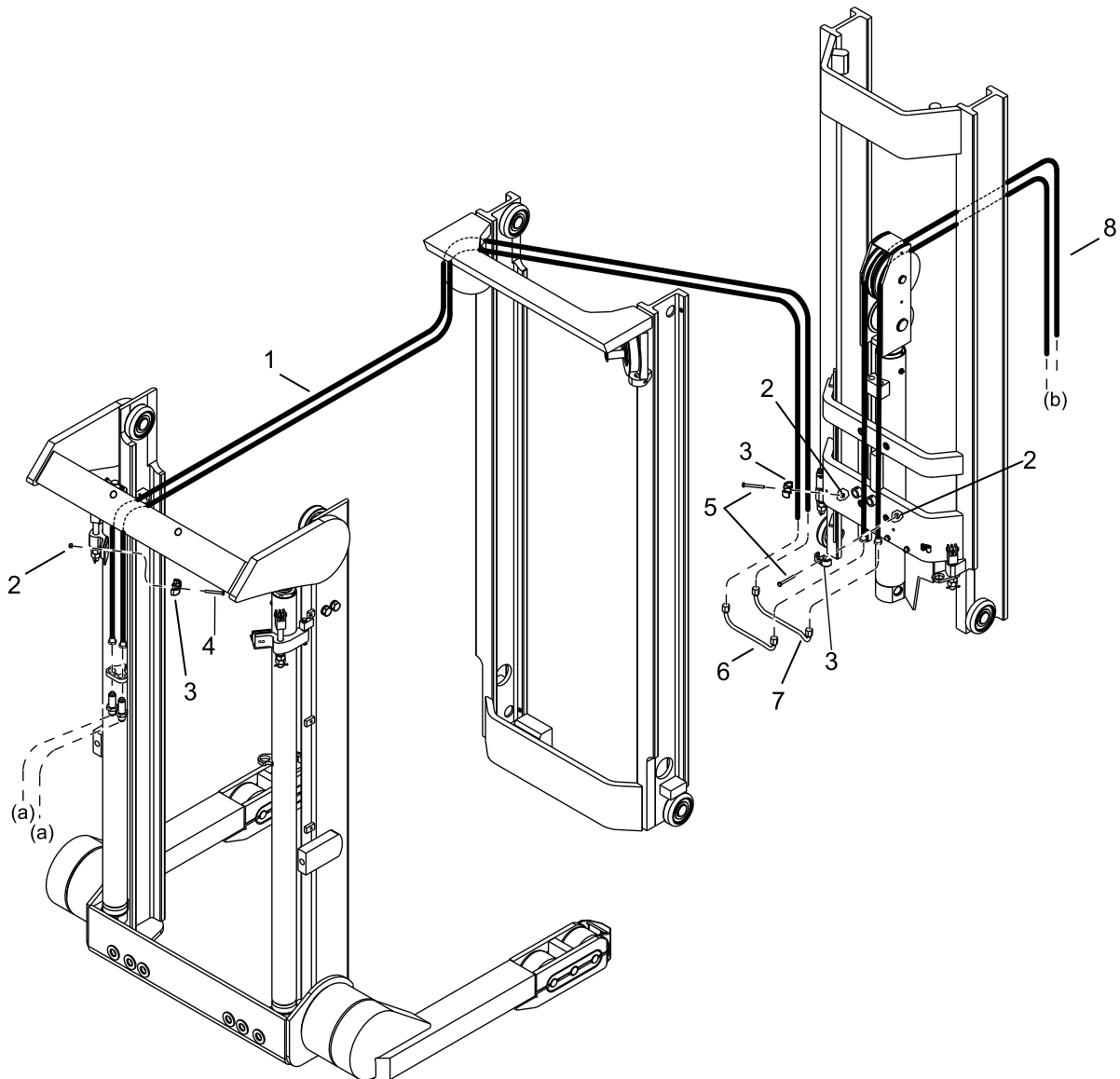


Figure 16637

- a To Hydraulic Mast
- b To Reach Manifold

36. Measure the distance between the channel and roller as described in step 12. Lower reach assembly and remove from mast if shims need to be changed. Install reach assembly back into third stage mast and check clearances.
37. Brush grease, Crown No. 063002-024 for standard or 063002-017 for freezer/corrosion application, on third stage rails (TT mast).
38. Attach carriage cylinder chains to reach assembly.
39. Install yoke on top of carriage cylinder, route carriage cylinder chain back to mast, connect to mast.

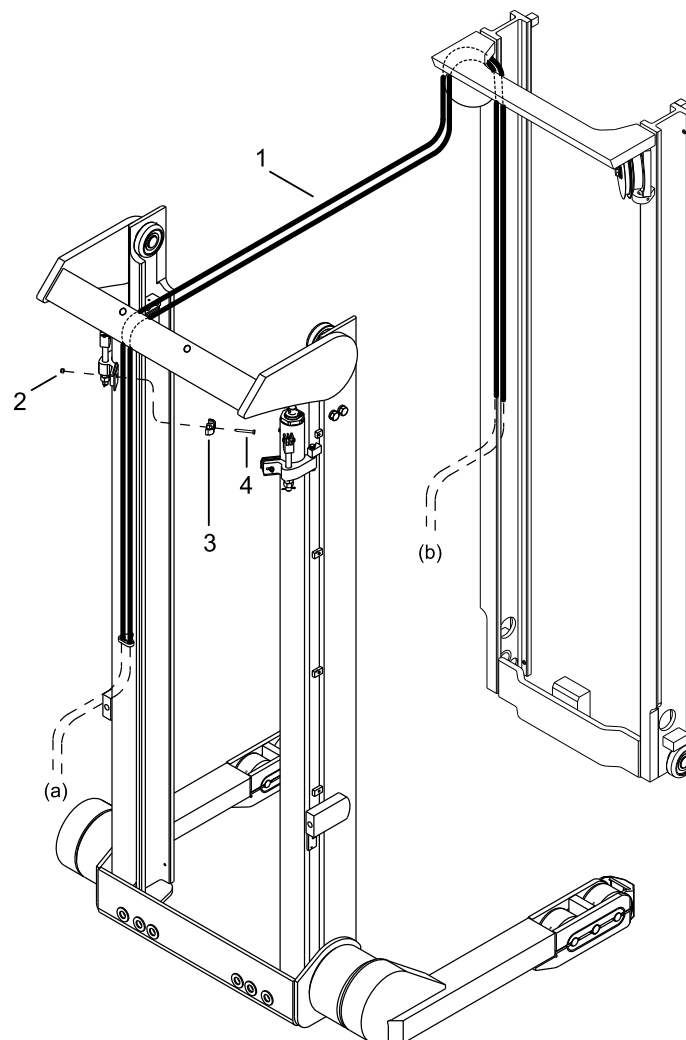


Figure 16645

- a To Hydraulic Mast
- b To Reach Assembly

40. Make connections of reach hoses to third stage mast, route thru yoke and make connections to reach assembly. Refer to figure 16645.
41. Install control cable grip springs and harness clamps to third stage mast, route control cable(s) thru yoke and make connections to reach assembly. Refer to figure 16645.
42. Assemble guard, item 1, over hydraulic tubes. Refer to figure 18726.
43. Install load backrest and forks to carriage.
44. Install safety shield.



CAUTION

Be sure all stops and safety devices are in place before cycling mast to check for proper operation.

45. Remove lifting device, install battery and check truck operation.

**WARNING**

AVOID HIGH PRESSURE FLUIDS - Escaping fluid under pressure can penetrate skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand. Any fluid injected into skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

Carriage hydraulic circuits need to be flushed after repair of reach cylinders and bled of all air. Before flushing and bleeding of system inspect all hydraulic connections and verify that all filters are installed and hydraulic fluid levels are adequate for test. Hydraulic system must be pressurized during the flushing and bleeding procedures.

Flushing

1. Remove hoses from sideshift cylinder and connect them together using a male connector.
2. Energize SVS sideshift solenoid selector valve, actuate manual valve at full speed in order to pump hydraulic oil through carriage hydraulics and then back through the filter.
3. Flush carriage hydraulics for at least 2 minutes, reversing flow frequently.
4. Reconnect hoses to sideshift cylinder.

Bleeding**WARNING**

AVOID HIGH PRESSURE FLUIDS - Escaping fluid under pressure can penetrate skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Any fluid injected into skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

Carriage hydraulic circuits need to be flushed after repair of reach cylinders and bled of all air. Before flushing and bleeding of system inspect all hydraulic connections and verify that all filters are installed and hydraulic fluid levels are adequate for test. Hydraulic system must be pressurized during the flushing and bleeding procedures.

1. Remove tilt and sideshift manifold cover.
2. Use an absorbent towel or receptacle to collect hydraulic fluid.
3. Loosen the "tee" fitting caps, ports (1) and (2) at top of tilt sideshift manifold. Refer to figure 16645.
4. To bleed air from mast accessory hoses, energize retract at maximum speed. Hold retract energized for 30 seconds. This will flush all air out of mast accessory circuit.
5. Extend reach carriage (SHR truck) to maximum extension and hold for 15 seconds. Retract reach to home position at maximum speed and hold for 15 seconds.
6. Tilt carriage up to maximum extension and hold for 15 seconds. Tilt down to home position and actuate tilt down for 15 seconds.
7. Extend sideshift cylinder to maximum extension. Energize sideshift right and hold for 15 seconds. Actuate sideshift left at maximum speed to home position and hold for 15 seconds.
8. Torque "tee" fitting caps, ports (1) and (2) at top of tilt and sideshift manifold to 15.8 Nm (139.5 in lb). Refer to Figure 16645.
9. Clean area thoroughly.

Notes:

Lift Chains

Lift chains are highly important components on fork lift trucks. The chain system on your mast was designed for efficient, reliable transmission of lifting force from hydraulic cylinder(s) to the mast, platform (if present) and forks. Safe, uninterrupted use of your lift truck depends on the proper care and maintenance of the lift chains.

Most complaints of unsatisfactory chain performance can be traced directly to inadequate maintenance. Highly stressed precision chains require periodic maintenance to deliver maximum service life.

Inspection

After every 100 hours of truck operation, lift chains should be inspected and lubricated. When used in an extremely corrosive environment, inspect chains every 50 working hours. During inspection, check for the following:

Wear

As the chain flexes on and off pulleys, the joints gradually wear.

The "stretch" a chain develops during usage is due to material being worn off of pin outside diameter and pin hole inside diameter on the inside plates.

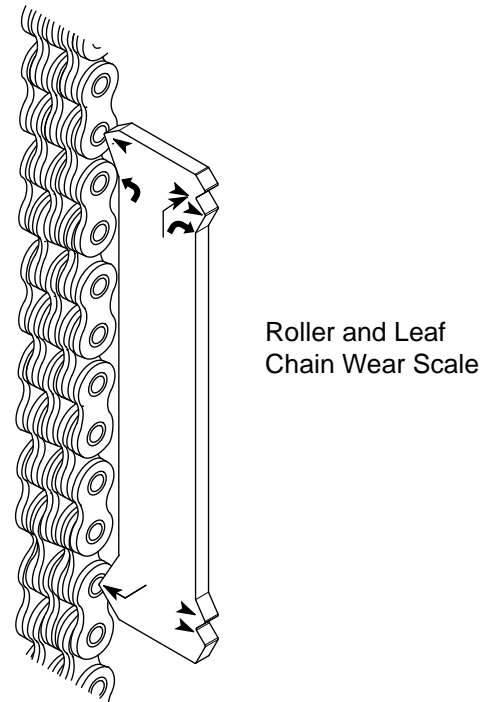
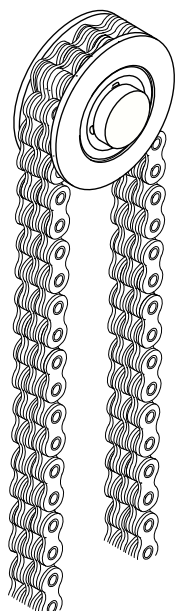


Figure 16844

Chain wear can be measured by using a 106440 wear scale or a steel tape (Refer to Figure 16844). When chains have elongated 3%, as represented on scale "A" (19 mm [0.75 in] or 25 mm [1.0 in] pitch chain) or scale "B" (16 mm [0.625 in] pitch chain) of the wear scale, they should be discarded. On chain with 19 mm (0.75 in) between pins, for example, 305 mm (12.0 in) of chain contains 16 pitches or links. When 16 pitches measure 314 mm (12.375 in) the chain should be replaced. On chain with 16 mm (0.625 in) between pins, 20 pitches or links equal 318 mm (12.5 in). When 20 pitches measure 327 mm (12.875 in) the chain should be replaced. Crown currently uses 16 mm (0.625 in) pitch (20 links in 318 mm [12.5 in]), 19 mm (0.75 in) pitch (16 links in 305 mm [12.0 in]) and 25 mm (1.0 in) pitch (12 links in 305 mm [12.0 in]) chain. When checking chain wear, be sure to measure a segment of chain that operates over a pulley. Do not repair chain(s) by cutting out the worn section and splicing in a new piece. If part of a chain is worn, replace lift chain(s). If truck has a matched set of lift chains replace both chains at same time.



With Forks Lowered
Check Either Front
or Rear Pulley for
Chain Wear

Figure 16845

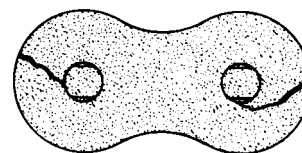
Rust and Corrosion

Chains used on lift trucks are highly stressed precision components. It is very important that "as-manufactured" ultimate strength and fatigue strength be maintained throughout the chain service life.

Corrosion will cause a major reduction in the load-carrying capacity of lift chain or roller chain because corrosion causes side plate cracking.

It is extremely important to protect lift chains from corrosion, whether in service or in storage. The initial factory lubrication on chains is an excellent rust and corrosion inhibitor. Factory lube is applied in a hot dip tank to insure complete penetration into the joint. Do not steam clean or degrease new chains. After the chain has been placed in service, factory lube must be supplemented by a maintenance lubrication program.

Refer to applicable lubrication and adjustment section for your particular truck series and/or the lubrication information later in this section.



Corroded Chain
(with Stress-Corrosion Cracks)

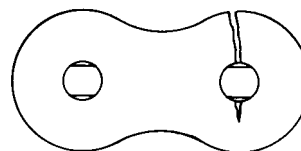
Figure 16846

Heavy motor oil serves both as a joint lubricant and corrosion inhibitor. During inspection, carefully examine external chain surfaces for the presence of an oily film. Under certain operating or environmental conditions it may be necessary to oil chains more frequently than 100 hour intervals. In all cases, the external surface of the chain must be protected with a film of oil.

Corroded chains should be inspected for cracked plates. Outside plates are particularly susceptible to stress corrosion cracking. If chains are heavily rusted or corroded they should be removed from the mast for a thorough inspection for cracked plates. If plates are cracked, both chains on the truck must be replaced. Oil chains when they are reinstalled on the mast.

Cracked Plates

The most common cause of plate cracking is fatigue failure. Fatigue is a phenomenon that affects most metals and many plastics. After many repeated heavy loads the plates may crack and the chains will eventually break.



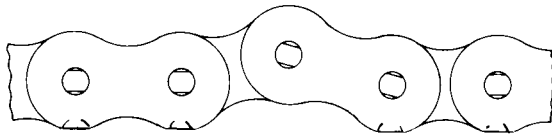
Fatigue Cracks

Figure 16847

Fatigue cracks are almost always found through the pin holes perpendicular to the pitch line. (Refer to Figure 16847) Contrast this failure mode to the random failures caused by stress-corrosion cracking. (Refer to Figure 16846) If any fatigue cracks are discovered during planned maintenance (PM) inspections, both lift chains should be replaced. Many apparently sound plates will be on the verge of cracking, making chain failure very likely.

Tight Joints

All joints in lift chain should flex freely. Tight joints resist flexure, increase internal friction, thus increasing chain tension required to lift a given load. Increased tension accelerates wear and fatigue problems. Refer to Figure 16848.



Tight Joints

Figure 16848

Tight joints in lift chains can be caused by:

1. Bent pins or plates,
2. Rusty joints,
3. Peened plate edges.

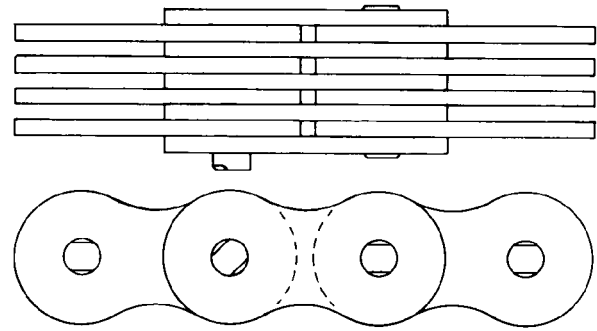
Oil rusty chains and replace chains that appear bent or peened. Peening of plate edges may be caused by worn pulleys, unusually heavy loads, or chain sliding past a guide or obstruction in the mast.

Protruding or Turned Pins

Heavily loaded chains operating with little lube generate tremendous friction between pin and plates (pin and bushing in roller chain). In extreme cases, the frictional torque in the joint can actually turn pins in the press-fit outside plates.

If chain is allowed to operate in this condition, the pins slowly work out of the chain, causing chain failure. Turned pins can be quickly spotted because the flats on the "V" heads are no longer in line. Refer to Figure 16849, pin has turned 45 degrees. Chains with turned or protruding pins should be replaced immediately.

Never attempt to repair the chain by driving pins back into the chain.



Protruding & Turned Pin

Figure 16849

Chain Side Wear

A continuous wear pattern on pin heads and outside plates indicates misalignment. Misalignment can be caused by two different factors: unequal chain tension or nonalignment between pulleys and chain anchors.

- **Unequal Chain Tension** - When a lift chain is installed or adjusted, care should be taken to "load" the chains evenly. When changing fork heel height or platform height for example, the chain anchors should be loosened until both forks come in contact with the floor. At this point both chains should display the same tension or slack. The chain anchor nuts should be tightened an equal number of revolutions on both chain anchors to put equal tension on chains. When the desired height setting is achieved the locking nut should be tightened to secure setting.
- **Non Alignment of Lifting Components** - Non alignment of the pulley and chain due to incorrect shimming of the mast or bent or damaged mast or cylinder components can also contribute to chain side wear. A check for this condition is to place the truck on a level area in your maintenance area. After supporting the fork carriage, disconnect each end of the lift chain at the chain anchor and visually inspect its alignment with the anchor slots.

Lift Chain Lubrication

The most important consideration in field maintenance of lift chains is LUBRICATION. Hard working, heavily loaded chains cannot be expected to give satisfactory wear life without scheduled periodic lubrication. Like all bearing surfaces, the precision-manufactured, hardened-steel, joint-wearing surfaces require a film of oil between mating parts to prevent rapid wear.

Maintaining an oil film on all chain surfaces will:

- Minimize joint wear (chain stretch).
- Prevent corrosion.
- Reduce the possibility of pin turning.
- Minimize tight joints in roller chain.
- Promote smooth, quiet chain action.
- Lower chain tension by reducing internal friction in the chain system.

Heavy motor oil is an excellent chain lubricant—even used motor oil is adequate to lubricate exposed lift chains.

Laboratory wear tests show SAE 40 oil to have greater ability to prevent wear than SAE 10 oil. Also, SAE 40 oil is superior to hydraulic fluid or automatic transmission fluid. Generally, the heaviest (highest viscosity) oil that will penetrate the joint works best.

Laboratory wear testing shows dry film lubes to be less effective in preventing joint wear than fluid petroleum based products.

Some aerosol spray lubes, such as Crown part number 063001-009, are effective, more convenient and less messy than applying motor oils.

Whatever method is used, the oil must penetrate the chain joint to prevent wear. Applying oil to external surfaces will prevent rust, but oil must flow into the live bearing surfaces for maximum wear life. (Refer to Figure 16850).

Apply oil to chains with a narrow paint brush. A plastic liquid detergent bottle makes a handy lube applicator. Flood the chain with oil over its entire length every lube-inspection period.

Frequency of lubrication will vary with operating conditions and environment. The best estimate of lube period is 100 hours actual operating truck time. Trucks parked outdoors, used in freezers or trucks in ex-

remely severe service, may require more frequent lubrication to maintain an oil film on all chain surfaces.

In dusty operating conditions, lubed chains will gather dust. Even under these conditions wear life will be greatly improved by periodic lubrication. Joints may acquire a "paste" made up of oil and dirt, but joint wear will still be much less than if the chain is allowed to run dry with metal-to-metal contact between pins and plates.

At 100 hour intervals, clean chains to remove accumulation of dirt and lubricate immediately. (Do not steam clean chains.)

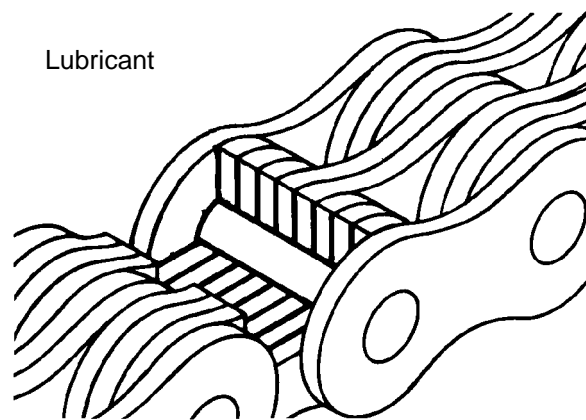


Figure 16850

Lift Chain Replacement

The first step in chain replacement is to find the chain part number in your service manual parts list.

An important factor in ordering replacement chain from the truck manufacturer is that special chains may be specified for your truck with certified minimum ultimate strength.

If the unit is equipped with two strands, replace chains as a pair. It will be virtually impossible to maintain uniform loading between the strands if a new chain is put into service opposite an old chain. The joints in the old chain will have worn through the hardest layer of the case-hardened pin. Therefore, the wear rate on the old chain will be greater than that on the new chain, greatly complicating the problem of maintaining equal chain tension.

The new chain will wear more slowly, causing it to bear the major portion of the load, resulting in premature wear and fatigue failure.

Never steam clean or degrease new chains. The manufacturer's grease is effective in reducing wear and corrosion. If the original factory lube is dried out or wiped off, soak the new chain in heavy engine oil for at least 0.5 hour prior to installing on truck.

After the existing chains have been removed from the mast, very carefully inspect chain anchors and sheaves. Broken, cracked, or worn anchors must be replaced. Replace worn sheaves, and check sheave bearings for wear. Do not paint the replacement chain before or after it has been installed. Paint will help prevent corrosion, but will prevent oil from reaching the pin surface for good joint lubrication.

Install the new chains, using new anchor pins. Existing pins may contain invisible fatigue cracks that could lead to pin failure. After chains have been connected to the anchors, adjust chain tension to obtain proper fork or platform height.

Correct chain installation and mast adjustment will increase chain service life.

Chain Anchors and Pulleys

An inspection of the chain system should include a close examination of chain anchors, anchor tension devices and pulleys.

Check chain anchors for wear, breakage, and radial misalignment. Anchors with worn or broken fingers should be replaced. Anchors should be adjusted to eliminate twisting or other misalignment in the chain. When chain is misaligned, the load is not distributed uniformly between the plates-prolonged operation will result in premature fatigue failure.

Pulleys with badly worn flanges and outside diameter should be replaced. Heavy flange wear indicates chain misalignment. Investigate cause by checking chain tension and mast shimming.

Leaf Chain Disconnect

To minimize the risk of damaging (cracking, etc.) the chain, refer to the following when disconnecting leaf chain.

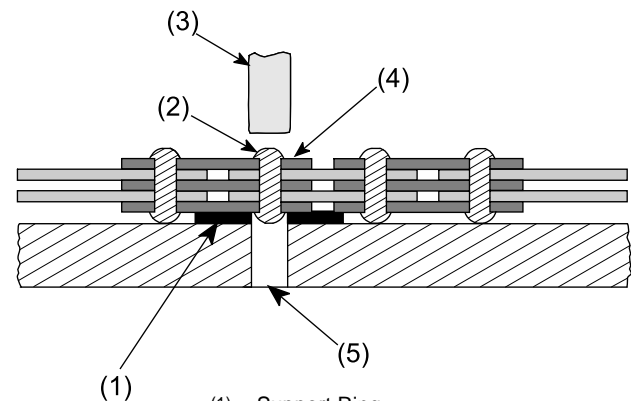
Tools Required:

1. A sturdy work surface with an opening slightly greater than the pin diameter, and should be thick enough to allow the pin to extend beneath the work surface as it is driven through the bottom pin link plate.
2. A support ring (flatwasher) with an inside diameter slightly greater than the pin diameter and a height equal to the head height of the pin.
3. Grinding wheel.
4. Pin punch with a diameter slightly less than the pin diameter, hammer or pressing equipment.

Disconnect Procedures:

(Refer to Figure 16851)

1. Grind the top head of the pin flush with the pin link plate. Be careful not to grind or damage the pin link plate.
2. Position the support ring over opening of the work surface. The support ring serves to support the bottom pin link plate and avoids damage to chain components while driving the pin through the chain.
3. Stand the chain on its side and seat pin in the support ring.
4. Remove the pin from the chain through the top pin link plate.



- (1) Support Ring
- (2) Grind Pin Flush with Link Plate
- (3) Grinding Wheel
- (4) Pin Link Plate
- (5) Work Surface Knock Out Aperture

Figure 16851

Notes:

Fork Inspection

⚠ DANGER

The following causes of fork failure may mean loss of equipment, damaged materials, bodily injury or loss of life. Make an inspection and measurement of the forks at each planned maintenance interval to check for wear, overload, fatigue, bends, etc. Refer to "Lubrication and Adjustment" chapter.

⚠ WARNING

- Use the proper fork for how it was designed to be used.
- Avoid using fork extensions.
- Do not modify forks.
- Only qualified personnel should make repairs.
- Visually inspect forks each work day.

⚠ WARNING

If the fork locking pin is not fully engaged, the fork could become unintentionally disengaged.

Abrasion

Abrasion gradually reduces the thickness of the fork. Be sure the fork thickness is within specifications. Do not allow forks to rub the floor during normal operation. If forks rub floor, check lift chain adjustment. Fork wear at the heel must not exceed 10 percent of the original thickness. At this point forks are adequate for approximately 80 percent of rated capacity. Refer to Chart 2. Use fork wear calipers, part no. 107330, or a measuring instrument such as a vernier or good 160 mm (6.0 in) scale. For allowable fork wear thickness, refer to Chart 1.

Allowable Wear Thickness Chart 1			
Standard Fork Thickness		Allowable 10% Wear Fork Thickness	
mm	in	mm	in
31.5	1.25	28.5	1.12
38.0	1.50	35.0	1.38
44.5	1.75	39.5	1.56
51.0	2.00	46.0	1.81
57.0	2.25	51.0	2.00
63.5	2.50	57.0	2.25

If using the fork wear calipers, refer to the following:

Refer to Figure 16854-01. The fork wear calipers have two measuring points or jaws. The inside jaws (2) measure 10% less than the outside jaws (1).

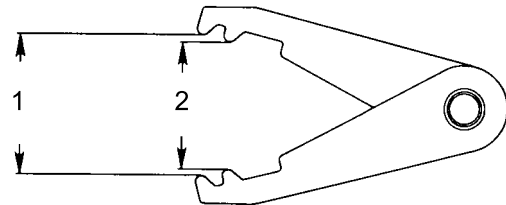


Figure 16854-01

- 1 Outside Jaws 100% (Fork Shank)
- 2 Inside Jaws 90% (Fork Blade)

Refer to Figure 16855-01. To set the outside jaws, measure the thickness of the middle of the shank (this point receives almost no wear). Set the calipers to the "feel" of the shank by lightly tapping on them with a metal object.

NOTE

Care should be taken when using the calipers to hold them square across the shank or an incorrect reading will result.

LIFTING MECHANISM

Fork Inspection

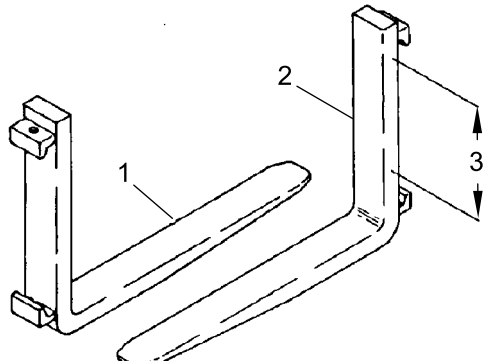


Figure 16855-01

- 1 Fork Blade
- 2 Fork Shank
- 3 Measure Here to Set Outside Jaws

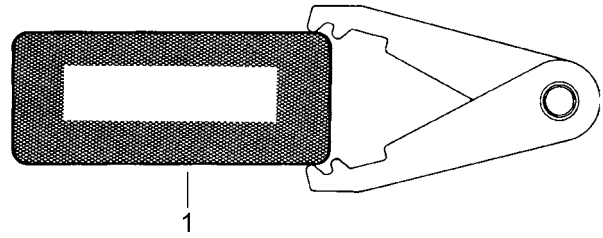


Figure 16856-01

1 Fork Shank Cross Section

Once the outside jaws are set, check to see if the inside jaws of the calipers pass over the flanks of the fork blade at any point between the end of the taper and the heel of the fork blade. After checking the blade, re-check the caliper setting by measuring the shank again making sure the setting was not inadvertently changed.

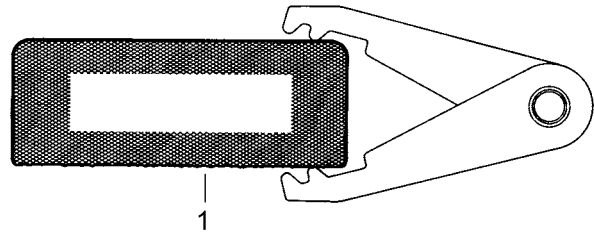


Figure 16857-01

1 Fork Blade Cross Section

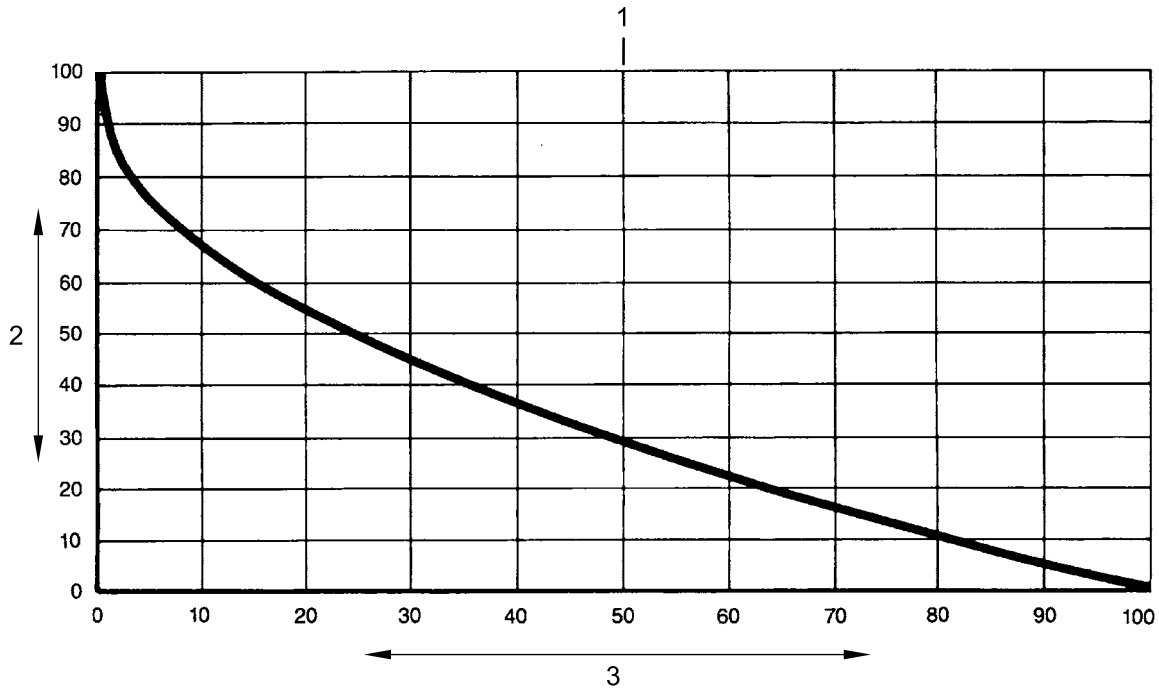


Figure 16858-01

- 1 Chart 2 - Wear vs. Capacity
- 2 Percentage Reduction in Fork Blade Thickness
- 3 Percentage Remaining of Specified Fork Capacity

Overloading

Know the capacity of the forks and truck. Fork capacity and load center is stamped on the fork. Refer to Figure 16859-01. Overloading can cause permanent deformation or serious fatigue conditions.

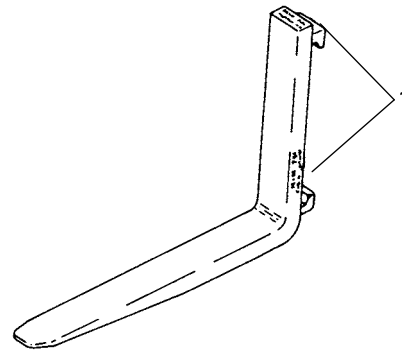


Figure 16859-01

- 1 Location of Capacity and Load Center Rating

LIFTING MECHANISM

Fork Inspection



Fatigue

A fatigue crack will normally start in the heel area of the fork. Cracks can usually be detected in the early stages by inspection of the heel area. Check for cracks that transverse the fork in an area up to 130 mm (5.0 in) either side of the outer heel radius. These cracks are a sign that the area has weakened and the fork needs to be replaced. Make a visual inspection for cracks each work day. If a more accurate inspection is necessary, use dye penetrants or magnaflux fork.

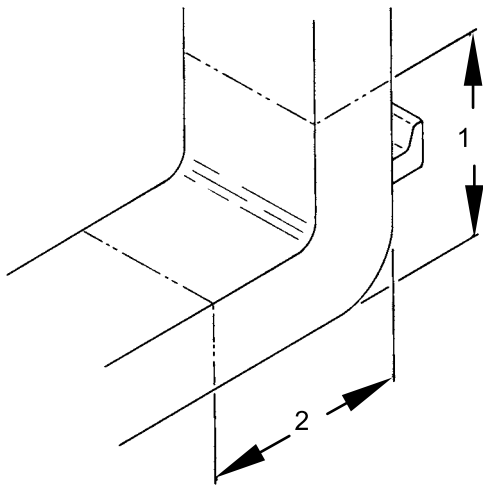


Figure 16860-01

- 1 130 mm (5.0 in)
- 2 130 mm (5.0 in)

Bent or Twisted Forks

Overloading, glancing blows against solid objects or picking up loads unevenly can bend or twist a fork, making fork replacement necessary. The maximum allowable difference in fork tip elevation from one fork to another is 3% of the fork length.

The angle between the top of the fork (blade) to the back surface of the vertical leg (shank) shall be less than 93°. Any angle greater will require fork replacement. The fork manufacturer or service technician with the expertise of equal competence are the only parties that should attempt to make such repairs.

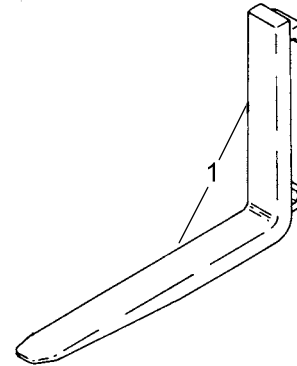


Figure 16861-01

- 1 93° Maximum

Use a carpenter's square to check the fork. Refer to Figure 16862-01. Hold the square against the shank staying above the radius of the heel as shown. Measure the distance closest to the radius of the heel of the fork blade and square (2). Add 31.8 mm (1.25 in) to this measurement and record. If the distance between the end of the square and blade (3) is greater than this calculation, replace blade (fork is deformed more than 93°).

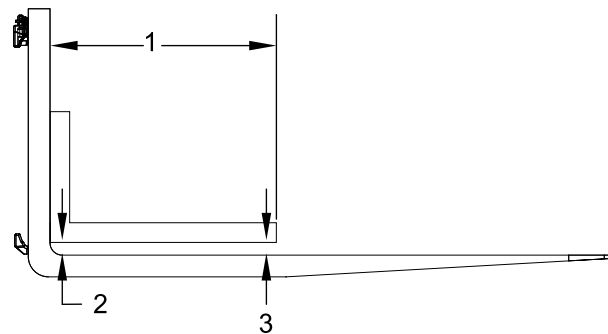


Figure 16862-01

- 1 609 mm (2.0 ft)
- 2 "x"
- 3 "x" + 31.8 mm (1.25 in)

Hanger

Check for cracks or damage to the fork pins and the area of fork attachment. Check carriage for excessive wear or cracks. Repair or replace parts if necessary.

 **WARNING**

If the fork locking pin is not fully engaged, the fork could become unintentionally disengaged.

Check condition of fork locking pin, spring, cam, etc. for proper operation (if forks are so equipped).

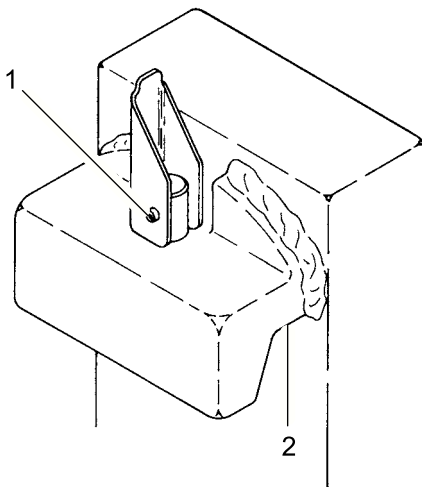


Figure 16863-01

- 1 Check Locking Pin, Spring, etc.
- 2 Check for Cracks Under Hanger

Notes:



CYLINDERS

Notes:

Cylinders

Cylinder Removal

Right and Left Hand Lift

The right or left hand lift cylinder can be removed from the truck and replaced as described below. DO NOT try to remove both cylinders at the same time, one cylinder should be removed and replaced completely before the second cylinder removal is started.

1. Move truck to service area on level floor below lifting device, if available, chock wheels and remove forks.



WARNING

Wear appropriate items, such as safety glasses and steel-toe shoes whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove the battery from the truck, disconnect tilt cylinders from the mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing the above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

2. Using two 100 x 100 x 305 mm (4 x 4 x 12 in) hardwood blocks, raise and block second stage mast 305 mm (12.0 in) above bottom cross brace of main frame. Lower mast completely.
3. Turn key switch OFF and disconnect battery.
4. Remove screw (1) holding ram to mount at top of 2nd stage mast. Do not remove screw from both cylinders, only the one that is going to be removed from truck. Refer to Figure 19133.

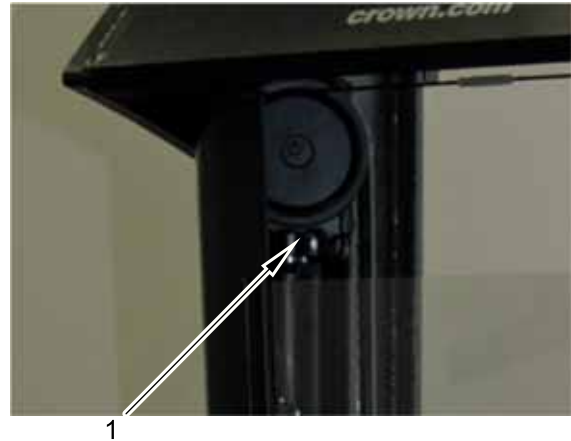


Figure 19133



WARNING

Make sure the platform the maintenance person rides on is secure and the individual is using an operator harness

5. Connect battery, turn key switch ON, raise mast and remove blocking.
6. Raise mast sufficiently to block at 1220 mm (49.0 in) if the truck has a collapsed height of 2260 mm or 2413 mm (89.0 in or 95.0 in), or at 1830 mm (72.0 in) if the trucks collapsed height is 2720 mm (107.0 in) or above. Use hardwood blocks (1), one beneath each I-beam of the second stage mast (2), resting on the lower main frame cross brace, securely clamp both blocks in place. Lower mast completely. The right (4) and left (5) hand lift cylinders will be defined as viewed from the operator's perspective. Refer to Figure 19134.

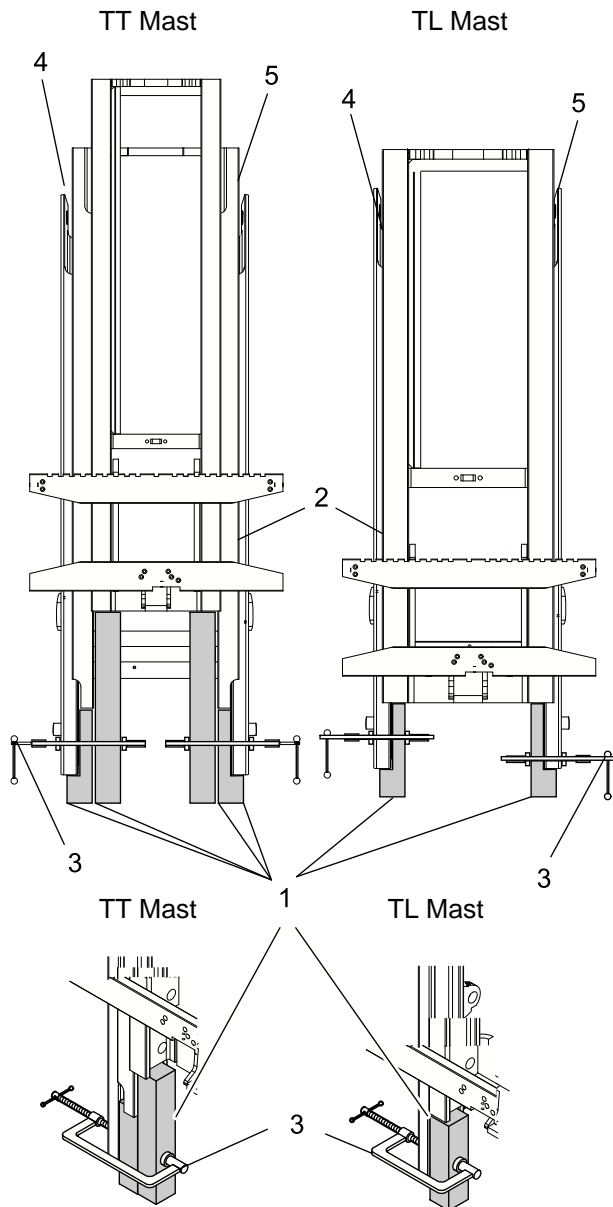


Figure 19134

7. Wrap and secure a large chain around the 2nd stage cross brace and the third stage cross brace as a safety precaution. When removing a lift cylinder, one of the two mast chains must also be disconnected, leaving the remaining mast chain holding the mast in position.
8. Turn key switch OFF and disconnect battery. Open Manual Lowering Valve (MVL) (1) on manifold block to relieve system pressure, refer to Figure 19135.



Figure 19135



WARNING

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under high pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which could eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

9. Place a shallow pan beneath the main frame and below the cylinder to be removed. Remove hydraulic line from bottom of cylinder. Cap cylinder fitting and line fitting to prevent contamination of hydraulic fluid, to protect fittings from damage, and to help contain hydraulic fluid.

NOTE

The limit switch (LMS1) is located on the mast for TL trucks and the carriage for TT trucks.

10. Move Limit Switch (LMS1) and wires to side. Remove chain anchor (2) from main frame mount and drape over cross brace (3). Refer to Figure 19136.

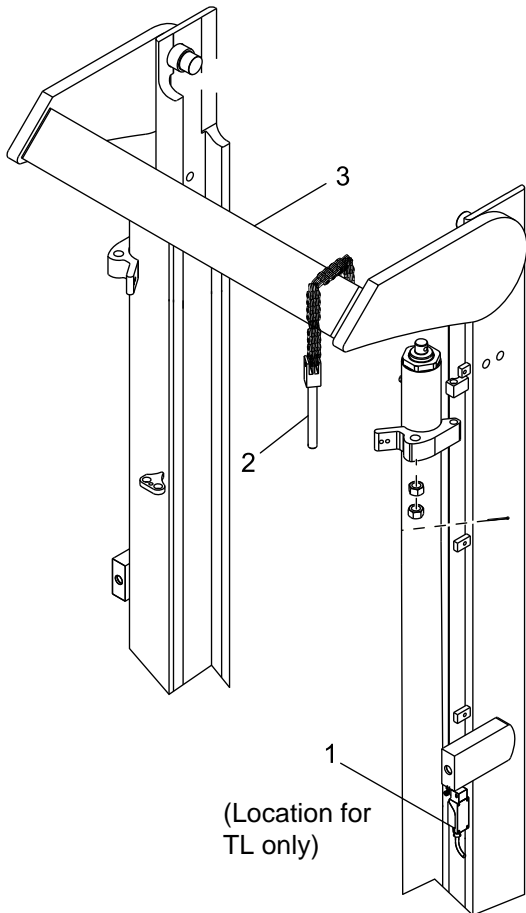


Figure 19136

11. Remove hose guide (1) at top of lift cylinder. Refer to Figure 19137.



Figure 19137

12. Remove hydraulic lines, hoses and spring (2) if removing left lift cylinder (1) from mounting bracket approximately 840 mm (33.0 in) from bottom of cylinder. Cap all hydraulic lines and hoses that were removed. Clean up any spilled hydraulic oil from truck. Refer to Figure 19138.

NOTE

There is no spring on the right lift cylinder.

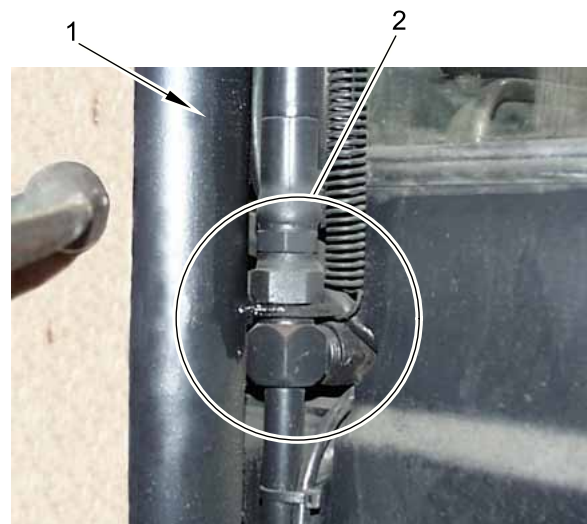


Figure 19138

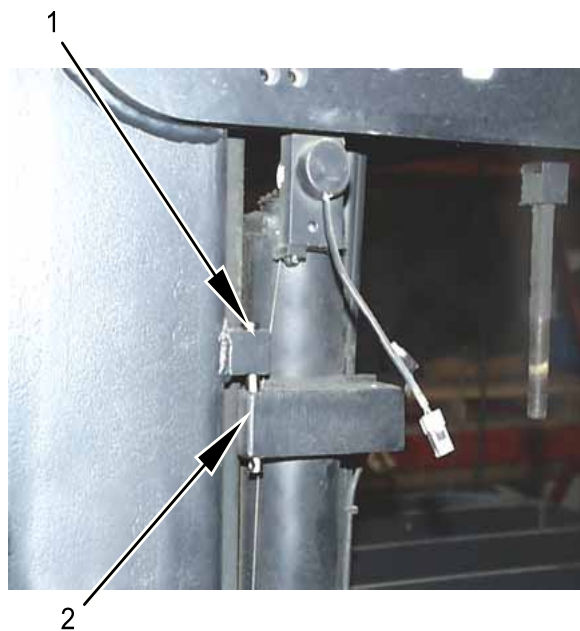


Figure 19139

13. Remove pin (1) holding top of cylinder to main frame. Refer to Figure 19139.
14. Put nylon strap (1) around top of cylinder just below mounting bracket (2). Refer to Figure 19140.
15. Connect lifting devise to strap and carefully lift cylinder above 2nd stage cross brace (3). Be very careful when lifting cylinder not to catch hydraulic hose mount (2) or the chain anchor (4) on 2nd stage cross brace. Refer to Figure 19140.



Figure 19140

16. Once cylinder base is above 2nd stage cross brace (3) bring cylinder out front, fork side, of mast. Refer to Figure 19140.

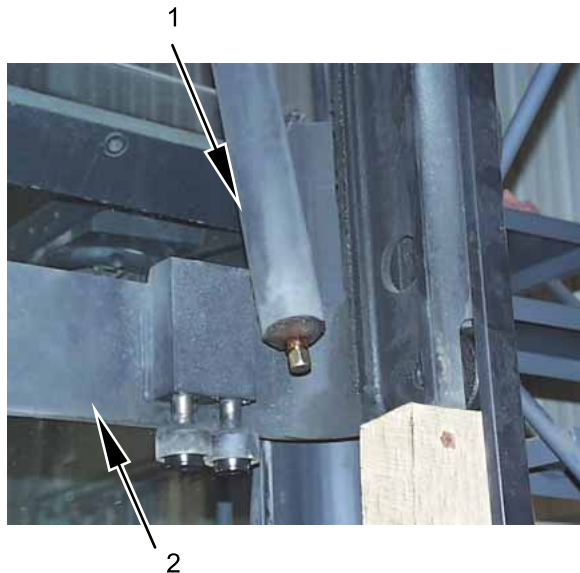


Figure 19141

Cylinder Replacement

1. Put cap on fitting at bottom of lift cylinder (1), if one is not already present. Refer to Figure 19141.
 2. Put nylon strap around top of cylinder just below mounting bracket and connect to lifting device.
3. Raise until bottom of cylinder (1) is over top of 2nd stage lower cross brace (2) and lower cylinder into position. Refer to Figure 19141.
4. Install the pin (1) back through main frame and cylinder mounting bracket (2). Install cotter pin through bottom of pin to secure in place. Refer to Figure 19139. Then remove strap from cylinder.
 5. If removed, remount limit switch back into position.
 6. Remove cap and reattach hydraulic line to bottom of cylinder.
 7. Install hose guide, at top of cylinder, and hoses back in position and secure using screw previously removed.
 8. Connect hydraulic hoses, lines and spring (2) if left lift cylinder was removed (1) to bracket on cylinder. Refer to Figure 19138.
 9. Install chain anchor back in position and replace both nuts. Try to put about same amount of tension on chain anchor (2) as before so that mast will remain straight.



WARNING

Make sure the platform the maintenance person rides on is secure and the individual is using an operator harness.



WARNING

Wear appropriate items, such as safety glasses and steel-toe shoes whenever performing maintenance work. Do not place fingers, hands or arms through mast or position them at pinch points.

In this section you may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around a truck that is not properly secured. Refer to truck Data Plate for truck weight information.

It will be necessary to disconnect and remove the battery from the truck, disconnect tilt cylinders from the mast, disconnect electrical connections and hydraulic lines. "Control of Hazardous Energy" section provides information for performing the above procedures along with some additional information on other procedures dealing with truck maintenance. This section should be read and reviewed prior to mast removal, installation and maintenance as outlined in this section.

⚠ WARNING

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under high pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which could eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

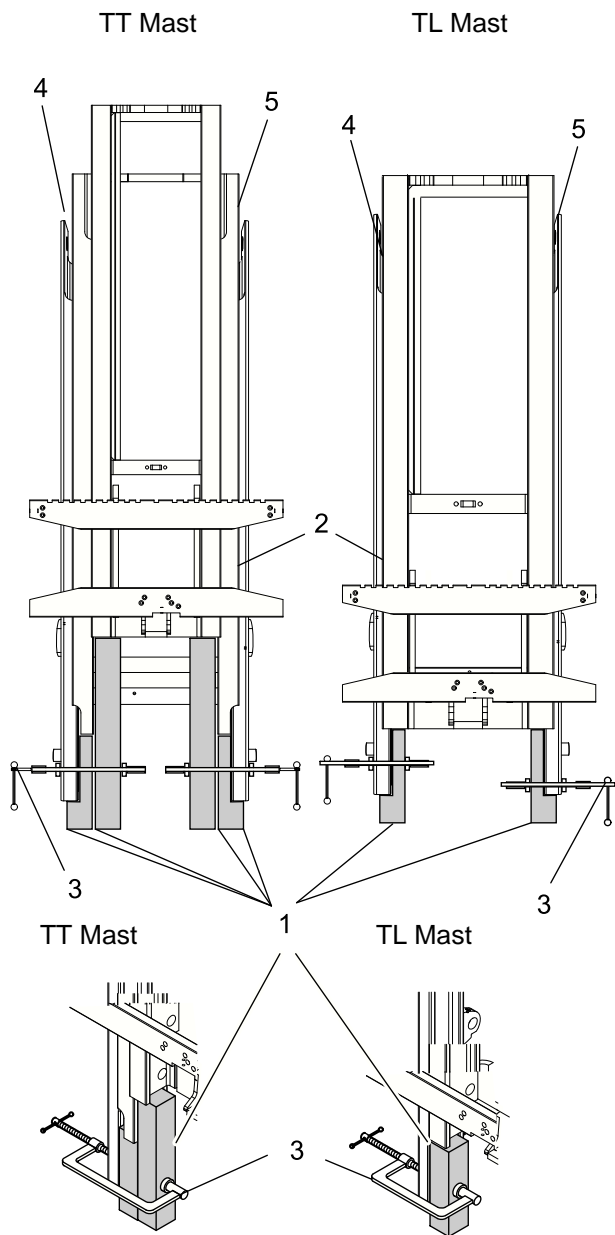


Figure 19134

10. Close Manual Lowering Valve (MVL) (1), connect battery, refer to Figure 19135, turn key switch ON, and very slowly raise mast. Guide cylinder ram back into position in top of 2nd stage mast making sure hole in ram and hole in bracket will line up.

11. Put screw (1) through hole in mast and ram. Refer to Figure 19133.
12. Raise mast enough to remove mast blocking (1), refer to Figure 19134, remove blocking, then lower mast completely and bleed right and left stage cylinders and carriage cylinder. Refer to Cylinder Maintenance.
13. Raise mast and check to be sure mast is straight when raised. If not, adjust chain anchor (2) tension to correct. Put cotter pin back into chain anchor (2) to secure in position.
14. Lower mast completely, turn key switch OFF. Check hydraulic fluid level and fill as required. Replace forks and remove wheel chocks.
15. Restart truck and check operation.

Great care and cleanliness should be exercised in disassembly and assembly of any hydraulic cylinders. Wipe all surfaces clean of dirt and oil before attempting disassembly.

Care should be taken when removing the ram from the cylinder to prevent damage to the packing on the piston end. After cylinder and wipers are removed, thoroughly wash all metallic parts in solvent and blow dry with compressed air. Carefully inspect the ram assembly and cylinder bore. Replace if scored, grooved, pitted, or worn. Minor damage to the cylinder bore can be removed with the use of a cylindrical honing tool. Place washed components in a clean container until assembly. Whenever new packing is required, new wiper rings should also be installed.

Lift Cylinder

Material covered in this section applies to all tilt, reach and lift cylinders.

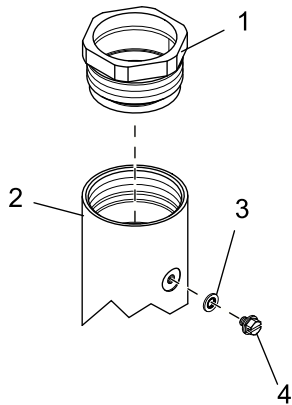


Figure 19146

Disassembly

Turn the cap (1) counterclockwise and unscrew it from the cylinder tube (2). Remove the cap (1) and carefully extract the ram assembly from the cylinder bore, never allowing the ram to come in contact with any sharp edges. Refer to Figure 19146.

Seals

The seals used in the cylinders are made of extremely durable, hard polyurethane which can be deformed temporarily to allow for installation without permanent damage.

Seal Removal

When an excessive amount of hydraulic oil is evident on the cylinder, where the ram exists from the cap, the rod packing is probably bad and should be replaced. The replacement of the packing can be accomplished without removing the ram assembly from the cylinder tube or truck.

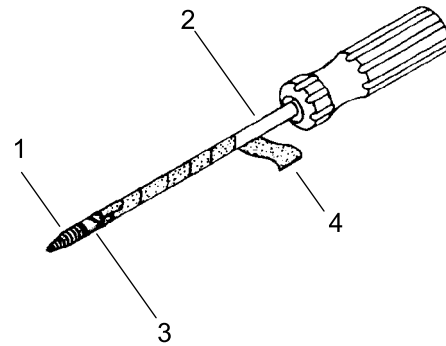


Figure 19147

Unfasten and remove the cap as explained in "Disassembly". If the packing is seated in the cap itself, a hooked tool should be used to remove the packing. If the packing is located below the cap and remains in the cylinder bore after the cap is removed, a pair of special tools can be used to facilitate packing removal. To make these tools, weld or braze a headless 4 mm self tapping screw to the end of a screwdriver (2). The screwdriver (2) must have at least 150 mm (6.0 in) of shank length with no larger than 4 mm (5/32 in) shank diameter. After attaching the screw to the screwdriver, grind off excess weld to a diameter of 4 mm (5/32 in) (3). Wrap the shank with electrical tape (4) from the tip of the screw to the screwdriver handle. This will prevent scratching of the cylinder bore or the ram. Refer to Figure 19147.

NOTE

Extreme care should be taken to prevent damage to cylinder wall and ram assembly. At this time, the wiper ring should also be removed since packing and wiper rings should always be replaced in pairs. Thoroughly clean the area where the seals seat. Any burrs, dirt or seal debris must be removed before reinstalling new seals.

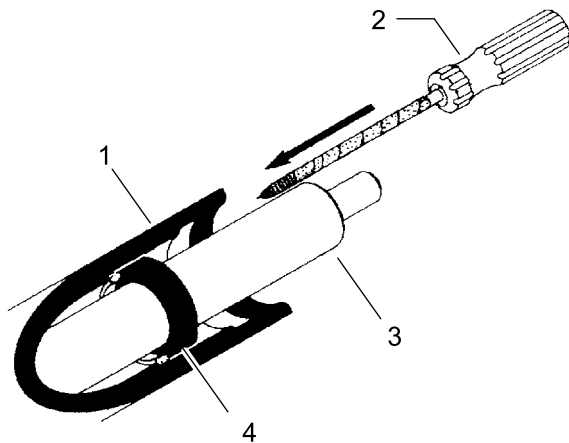


Figure 19148

Insert the tools between the ram (3) and the cylinder walls (1), 180 degrees apart, and screw into the face of the packing, refer to Figure 19148. After the threads are sufficiently secured into the packing, evenly pull on the screwdriver handles until the packing is removed.

CAUTION

Close inspection of seal seating critical areas should be made before the new seal is installed. Refer to Figures 19149 and 19154. Your seal failure may not have been caused by a worn seal, but rather, by burrs, nicks and dirt located on the seal seating area, causing the seal to deform and lose its sealing ability.

Seal Installation

Tools used to install hydraulic seals should be of soft metal or suitable plastic, free of burrs and sharp edges. Screwdrivers and other similar tools should not be used as they may damage the sealing edges.

The area in contact with the seal should be free of burrs, sharp edges and nicks.

If necessary to force seal over sharp edges, slots or undercuts, protective devices should be used.

Light lubrication should be applied to the seal and installation groove prior to installation. The same oil as will be used later in the cylinder should be applied.

Rod U-Cup Installation

1. A. Small U-Cup

• Installation Tools

- A groove alignment plug, refer to Figure 19149 is needed which should be flush with groove edge. Any metal or plastic material which is smooth and lubricated may be used.

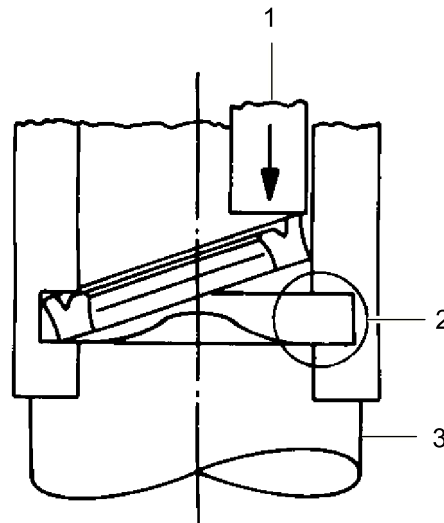


Figure 19149

- A soft metal or plastic pusher rod is needed.
- Squeeze U-cup together and insert end into bore first. When lower end is engaged in installation groove, release U-cup and force upper end downward using pusher rod (1) until U-cup snaps into critical seal seating area. Refer to Figure 19149.

2. Large U-Cup

• Installation Tool

- An installation tool made of any soft metal or hard plastic machined smooth and free of burrs with a fixed steel pin (3) and two movable pins (1 and 4) is required for this installation method. Refer to Figure 19150.

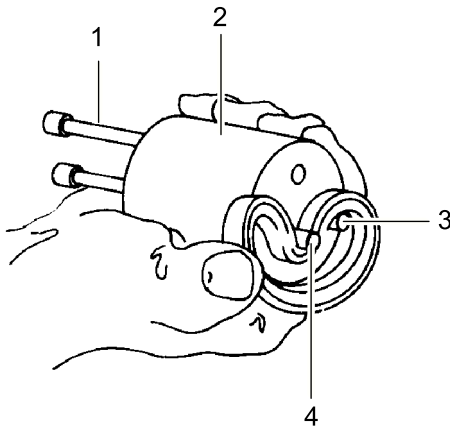


Figure 19150

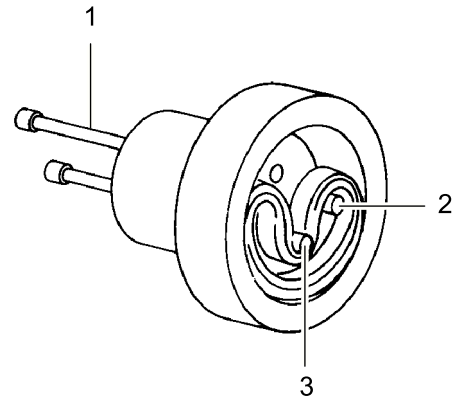


Figure 19152

• Installation Procedure

- Slip the U-cup over the fixed pin (3) and bend it over pin (4). Refer to Figure 19150.
- Continue bending U-cup until pin (1) can be pushed through the U-cup loop which locks U-cup in position. Refer to Figure 19150.
- Insert installation tool with mounted U-cup into cylinder bore until aligned with U-cup installation groove, refer to Figure 19151.

- Withdraw pin (3) and U-cup will completely snap into installation groove, refer to Figure 19153.

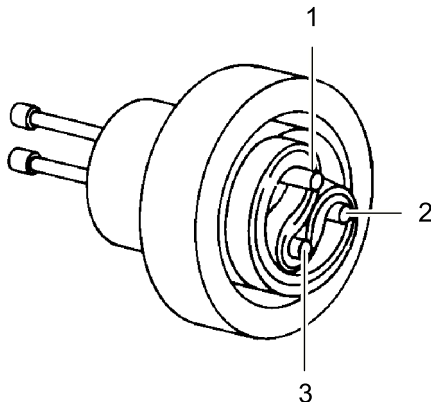


Figure 19151

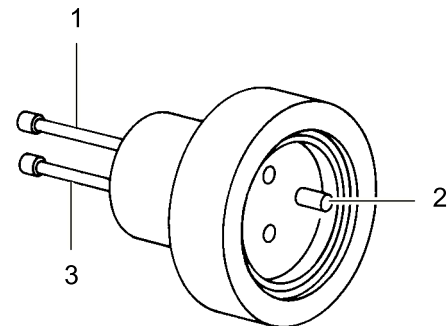


Figure 19153

- Withdraw pin (1) so that U-cup loop snaps into installation groove, refer to Figure 19152.

- Withdraw installation tool.

Cylinder U-cup Installation

For "lip first" installation, a sleeve (2) similar should be used to protect the seal (3) from damage on the threads and shoulders, refer to Figure 19154.

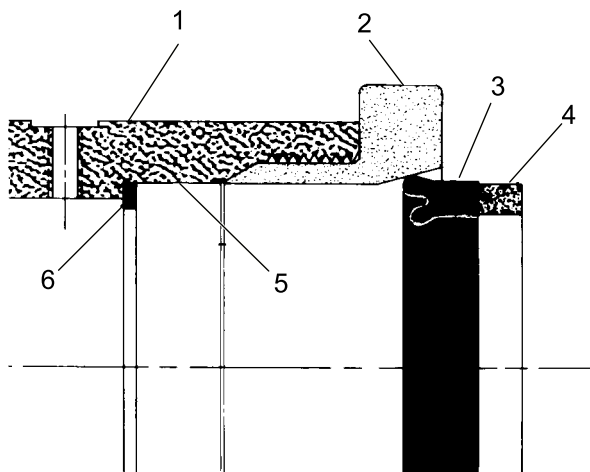


Figure 19154

Cylinder Assembly

After packing and seals are in place and the ram assembly has been installed, reattach the cap.



CAUTION

Care should be taken when inserting the cylinder cap, to prevent threads and sharp edges from damaging new seals and packing.

Cylinder - Summary

Occasionally, a slight creep of the fork assembly may occur. This may be due to internal leakage in the piston pack but it can also be caused by leakage in the solenoid or check valve. To seat these valves properly when this occurs, raise and lower the forks to flush out any foreign material from the valve seat. A thorough check of the system for leaks should be conducted if abnormal oil losses occur. The hydraulic system is designed to eliminate mechanical damage even if fittings become loose.

Cylinder Bleeding and Flushing

Most hydraulic circuits need to be flushed after repair of lift cylinders and bled of all air. Before flushing and bleeding of system inspect all hydraulic connections and verify that all filters are installed and hydraulic fluid levels are adequate for test. Hydraulic system must be pressurized during the flushing and bleeding procedures.



WARNING

AVOID HIGH PRESSURE FLUIDS-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

Bleeding - Carriage Cylinder

1. Slowly elevate carriage in free lift to approximately 1220 mm (49.0 in).
2. Slowly open carriage lift cylinder bleed screw and bleed air from cylinder until a solid stream of hydraulic fluid flows out of bleed screw.
3. Tighten bleed screw.

Bleeding - Stage Lift Cylinders

1. Slowly elevate carriage in free lift to approximately 1220 mm (49.0 in).
2. Slowly open stage lift cylinder bleed screw and bleed air from cylinder until a solid stream of hydraulic fluid flows out of bleed screw.
3. Tighten bleed screw.

Repeat above steps for the other stage lift cylinder.

Reach Cylinder

The reach cylinder is located near the top mast section. This reach cylinder is a double acting piston type cylinder. Extreme care should be taken when performing any type of repair. In the event of excessive oil leakage around the cap end of the cylinder or its inability to tilt the load, the cylinder will have to be removed from the truck and repaired.

Disassembly

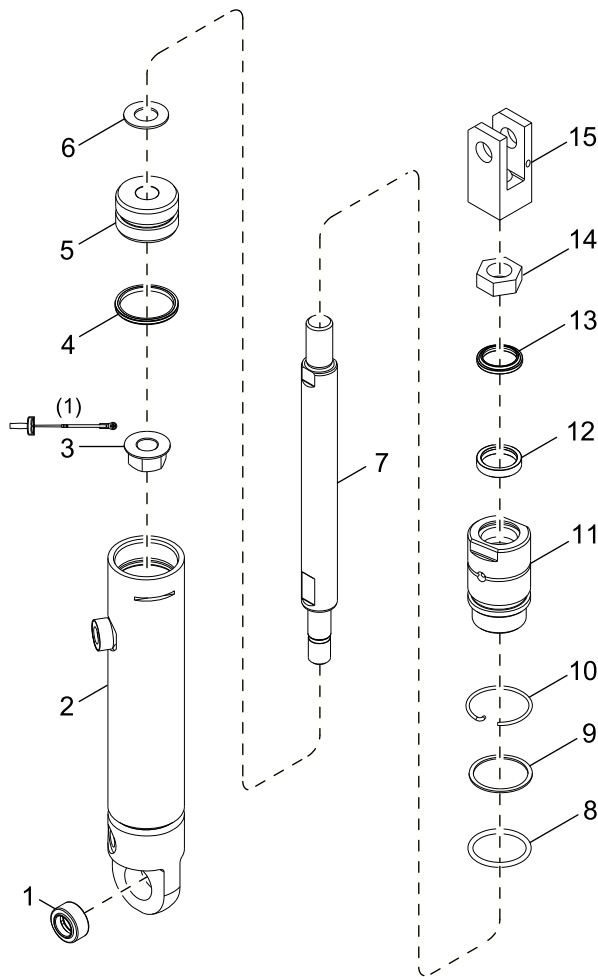


Figure 19203

(1) Torque to 285 to 312 Nm (210 to 230 ft lb)

Refer to Figure 19203. Before proceeding with disassembly, thoroughly clean the outside of the cylinder to remove all grease and dirt build-up.

1. Place the cylinder in a vise. Do not over tighten the tube assembly (2), which may be easily damaged. Use an adjustable spanner wrench (refer to Figure 19204) for disassembly. Use a face spanner wrench with 4.75 mm. (0.187 in) pins and a spread of at least 66.7 mm. (2.625 in).

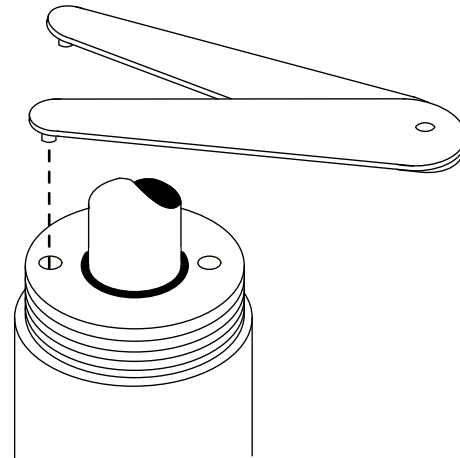


Figure 19204

2. Use a scraper or similar tool to remove any material (burrs, etc.) from the edge of the cylinder. If these materials are not removed, then piston removal may be difficult.
3. Use a spanner wrench to remove guide assembly (8 to 14). Rotate the guide (11) until the wire retainer (10) is completely unwound from the inside of the cylinder.

NOTE

Check the wire retaining ring to determine correct turning direction for removal. If the cap is turned in the wrong direction and the retaining ring end slips inside the cylinder, then removal of the ring is very difficult.

4. Remove the rod assembly, which includes 3 to 7, out of the end of the tube assembly. Inspect tube assembly for any signs of scoring. If scoring is evident, then tube assembly must be replaced. The tube assembly should be honed to remove any remaining burrs.

Rod Disassembly

Use wrench flats on rod to remove nut (3). Carefully remove all components off the end of the rod and place in safe area for reassembly. Inspect the rod for scoring or damaged material, then replace as necessary.

Seal Replacement

1. Use a small hooked tool to carefully pull the seals from their mounting grooves.



CAUTION

Never use a screwdriver to remove seals. This action can cause irreparable damage and leakage.

2. Remove all seals. Inspect the contact surfaces on piston and guide for scoring. If slight scoring is evident, then sand with a fine emery paper until all high surfaces have been removed. Heavily scored components must be replaced. Disassemble and inspect all parts. Wash all cylinder components in a good grade solvent then dry with air pressure.

NOTE

When cleaning piston and guide, be sure to clean seal seating areas. Protect eyes and face when using compressed air.

3. After all parts have been thoroughly cleaned, place in a dirt free area until ready for reassembly.

Cylinder Reassembly

1. Apply a coating of hydraulic oil (063001 001) to all seals before they are assembled. Install all seals by hand.
2. Reassemble and install rod assembly (items 3 to 7), which includes piston. Ensure piston is seated properly against the rod shoulder.
3. Apply thread locking adhesive (061004-004) to nut (3) then torque to 285 to 312 Nm (210 to 230 ft lb).
4. After installing the rod assembly into the tube assembly, carefully assemble the guide assembly (items 8 to 14) into tube.



CAUTION

Use care when inserting the guide to prevent sharp edges from damaging the new seals and packings.

Reach Cylinder Flushing and Bleeding Procedures

Hydraulic circuits need to be flushed after repair of reach cylinder and bled of all air. Before flushing and bleeding of system, inspect all hydraulic connections and verify that all filters are installed and hydraulic levels are adequate for test. The hydraulic system must be pressurized during the flushing and bleeding procedure. Be prepared to catch fluid in appropriate container if necessary.



CAUTION

Do not attempt to bleed a line by cracking an o-ring face seal fitting. This action will result in o-ring damage. Damaged o-rings must be replaced to prevent hydraulic fluid leakage.



WARNING

Avoid High Pressure Fluids-Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic lines. Tighten all connections before applying pressure. Keep hands and body away from pin holes which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand. Any fluid injected into the skin under high pressure should be considered a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had experience with this type of injury.

Flushing

1. Remove hoses from sideshift cylinder and connect together using a union connector.
2. Activate sideshift left or right at full speed to pump hydraulic oil through carriage hydraulics and then back through the filter.
3. Flush carriage hydraulics for at least two minutes, then reverse flow after one minute.
4. Remove union connector and reconnect hoses to sideshift cylinder.

Bleeding

1. Fully extend reach cylinders.

2. Block carriage so it can not tilt down or retract.
3. Remove hose from rod side of reach cylinder.
4. Use a receptacle to collect the hydraulic fluid. Perform a retract operation. Press switch cap to retract carriage then hold until a solid stream of hydraulic fluid flows out through the hose. This action passes hydraulic fluid through mast hoses and reach manifold.
5. Connect hose at reach cylinder.
6. Fully retract reach cylinders. Secure carriage in retracted position.
7. Remove hose from piston side of reach cylinder.
8. Use a receptacle to collect the hydraulic fluid. Perform an extend operation. Press switch cap to extend carriage then hold until a solid stream of hydraulic fluid flows out through the hose. This action passes hydraulic fluid through mast hoses and reach manifold.
9. Connect hose at reach cylinder.

SHR 5500

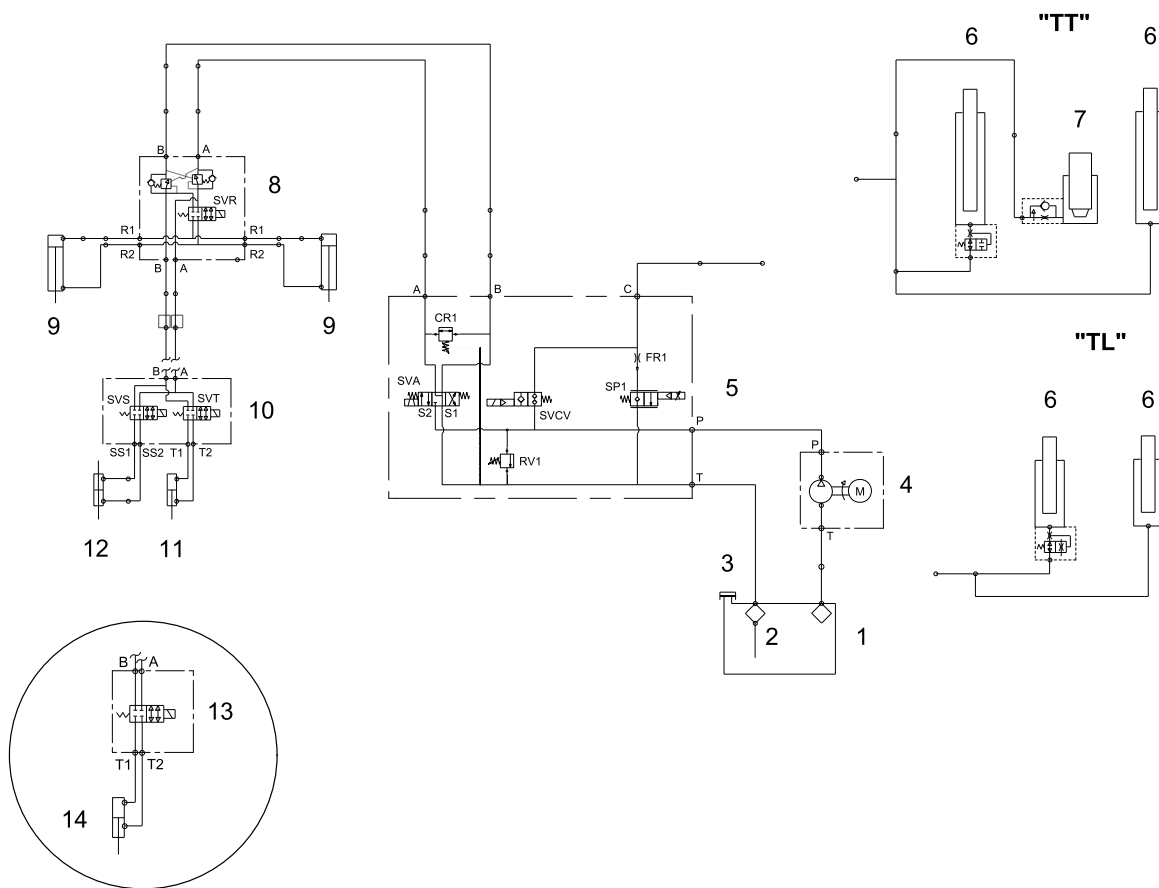


Figure 19205

- | | | | |
|---|-------------------|----|------------------------|
| 1 | Reservoir | 8 | Reach Manifold Block |
| 2 | Return Filter | 9 | Reach Cylinder |
| 3 | Breather | 10 | Tilt/SS Manifold Block |
| 4 | Motor/Pump Unit | 11 | Tilt Cylinder |
| 5 | Manifold Block | 12 | Sideshift Cylinder |
| 6 | Lift Cylinder | 13 | Tilt Manifold Block |
| 7 | Carriage Cylinder | 14 | Trucks with Tilt Only |

Notes:



PLATFORM

Notes:

Reach Carriage

Reach Assembly

The reach assembly on your truck is designed to lift, transport and deposit materials from racks where outriggers cannot enter into or under. After the truck has been positioned in front of the load and the forks adjusted to the proper height, the reach carriage can be extended.

The carriage is extended by pressing the switch cap, located on the control handle, away from the operator. Retracting the carriage is accomplished by pressing the switch cap towards the operator.



WARNING

Wear appropriate protective items, such as safety glasses, steel toe shoes, etc. whenever performing maintenance work. To avoid injury, do not place fingers, hands or arms through mast or position them at a pinch point at any time. You may be required to lift and block the truck and mast or raise and lower different components for removal and installation. Make sure lifting device and sling are sufficiently rated to withstand the weight being lifted. Never work under or around an unsecured truck. Refer to truck data plate for truck weight information. Refer to Control of Hazardous Energy.

Reach Inspection

Stops

Located at center of the reach box are two stops (134424). When installing stops, use thread locking adhesive (061004-004) to secure screws (050067-055) into position. Torque screws 176 to 231 Nm (130 to 170 ft lb).

Reach Cylinder Adjustment

Refer to Figure 19201 as follows. The reach extension is controlled by the stops (140479) on the front carriage. SHR should have a front carriage movement of 585 to 591 mm (23.07 to 23.43 in) as measured from the top front edge of the reach box (2).

Measure both sides (LH and RH) to ensure the reach cylinders (4) are extending the same amount and not putting reach mechanism into a bind.

After final adjustments, the jam nut, 060021-040 (3), on each reach cylinder assembly can be moved up against the shoulder on the piston rod. Apply thread locking adhesive (061004-004) to piston rod threads. Torque jam nut against piston rod end to 203.5 to 230.5 Nm (150 to 170 ft lb).

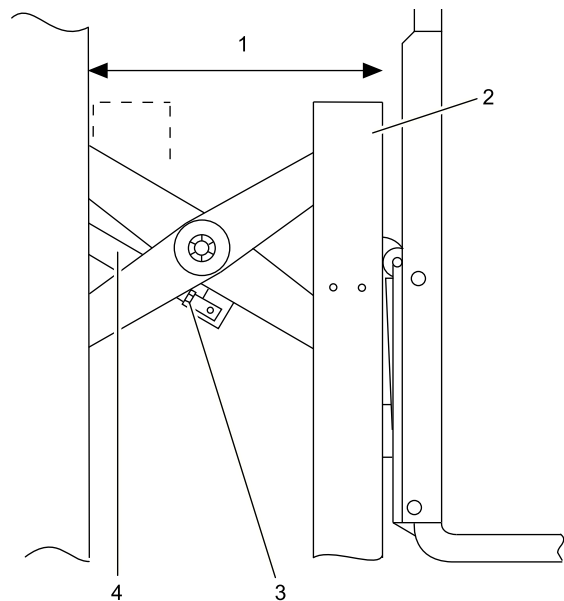


Figure 19201

- 1 585 to 591 mm (23.07 23.43 in)
- 2 Reach Box
- 3 Jam Nut
- 4 Reach Cylinder

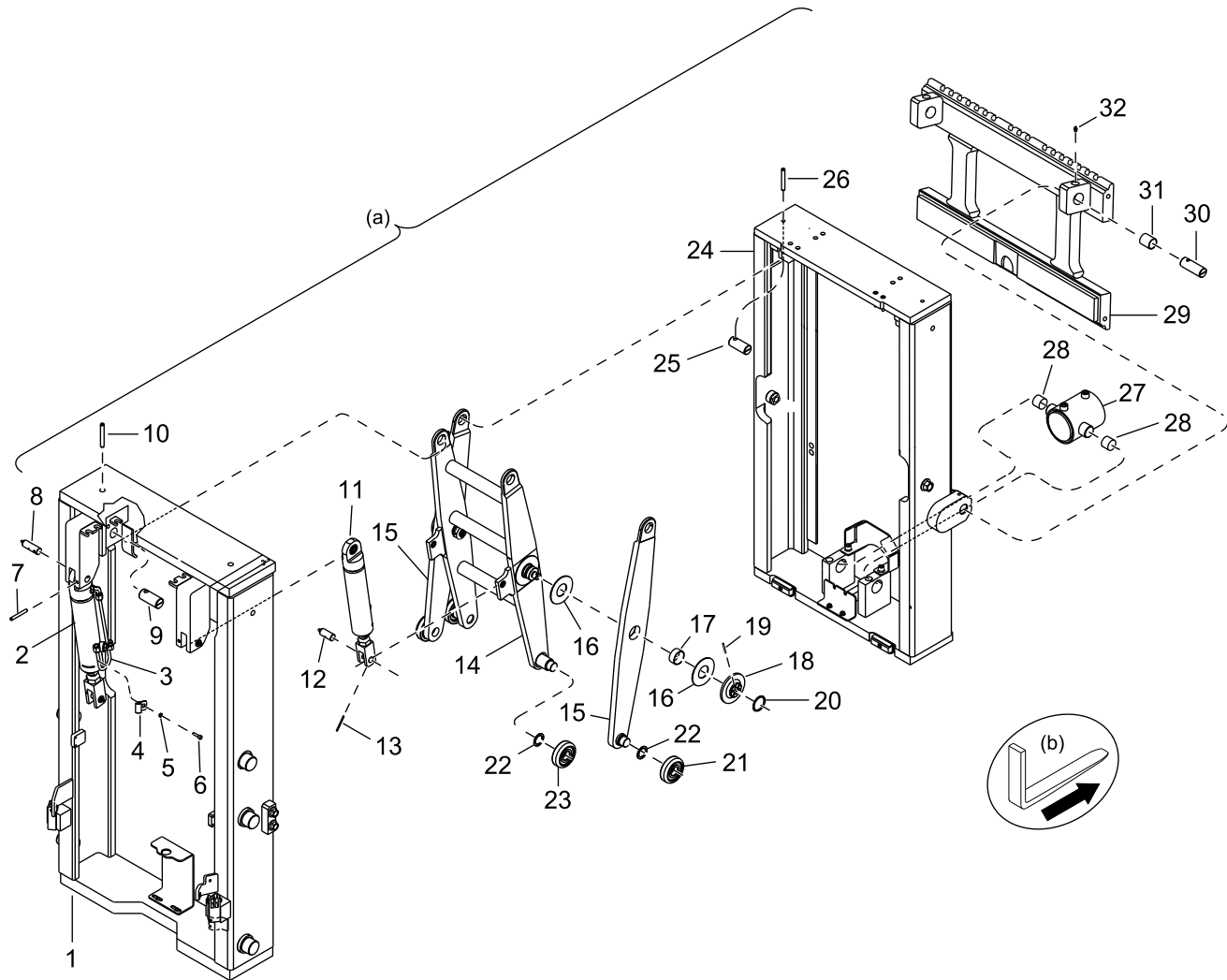


Figure 19202

- (a) TL Mast Shown
- (b) Left and Right Determined from Operator's Perspective

Disassembly

Refer to Figure 19202 as follows:

NOTE

Disconnect battery. If complete disassembly of reach assembly is required, removal of entire reach assembly from mast assembly will ease disassembly procedure.

1. Remove four screws holding load backrest (not shown) to carriage (29) and remove load backrest.
2. Remove forks (not shown) from fork plate.

3. Extend reach assembly and place a 50 x 100 x 200 mm (2 x 4 x 8 in) hardwood block (approximate size) in either left or right channel of reach support (1).
4. Retract reach assembly until column roller (21) on outer arm (15) is resting on hardwood block. The hardwood block will not allow assembly to retract when the reach cylinders are removed.

NOTE

Ensure hoist has a minimum lifting capacity of 905 kg (2000 lb).

- Remove two lubrication fittings (32) and bearing sleeves (31) from pivot shafts (30) at carriage top (29). Use hoist or other suitable means to support fork plate and remove pivot shafts.

NOTE

If truck is not equipped with tilt function, then disregard steps 6 through 8.

- Remove hydraulic lines from tilt cylinder (27) to manifold block (not shown) on support assembly. Allow hydraulic pressure to bleed off slowly.
- Remove tilt cylinder (27), if further disassembly is required take to a clean working area. Refer to Tilt Cylinder for proper disassembly procedure.
- If ball bushing (28) in tilt cylinder rod end requires replacement, use an arbor press to remove and replace it.
- Attach hoist to top cross bar of reach box (24). Remove roll pins (26) in pivot shafts (25), which connect outer arms to reach box. Remove pivot shafts and raise reach box to clear column rollers (23) on inner arm assembly (14).

NOTE

Reach cylinder removal includes steps 10 through 13.

- Remove roll pin (13) from pivot shaft (12) at rod end of reach cylinders (2 LH) and 11 (RH)). Remove pivot shafts (12) at rod end.
- Disconnect hydraulic lines from bulkhead located near top of reach cylinders.
- Remove screws (6) and lockwashers (5) to remove harness clamp (4) from tube assembly (3).
- Remove roll pin (7) from upper pivot shafts (8) and remove pivot shafts. Reach cylinders should be replaced on support assembly in same position as they were removed.
- Connect hoist to inner arm assembly (14) cross brace and lift until column rollers on outer arm assemblies can be rotated out of support assembly channel.
- Remove column rollers (21) and flat washers (22) from outer arms (15). Record amount and locations for reference during reassembly.
- Remove groove pin (19) and retaining ring (20) from locknut (18) at pivot center. Remove locknut with a hook type spanner wrench.

- Remove outer arm, thrust washers (16) and bearing sleeves (17). Record locations for reference during reassembly.
- Remove column rollers (23) and flat washers (22) from inner arm assembly (14). Record amount and locations for reference during reassembly.
- Remove roll pins (10) in pivot shafts (9) of inner arm assembly.

Bushing Replacement (Reach Assembly Components)

When removing old bushing, be sure seating area of bushing is not damaged in any manner. If damage does occur remove all burrs and rough edges completely.

When installing new bushings in a lubricated area be sure hole in the bushing is in proper alignment with the lubrication fitting to allow proper lubrication flow.

Apply a light coat of grease to bushing seat to ease installation and reduce possibility of damage to new bushings.

A bushing installation tool, shown in Figure 17055, enhances proper installation of new bushings.

NOTE

The installation tool can also be used effectively to remove worn or damaged bushings. Various sizes of bushings will necessitate use of various sizes of installation tools.

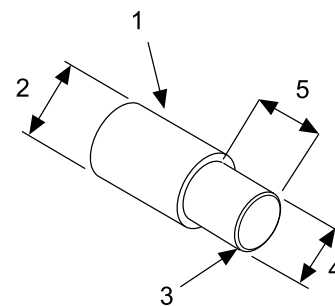


Figure 17055-01

- Bushing Installation Tool
- 0.13 mm (0.005 in) Smaller than the Bushing Outside Diameter
- 1.6 mm (0.062 in) Chamfer
- 0.13 mm (0.005 in) Smaller than the Bushing
- Equal to the Length of the Bushing

Ball bushings are removed and installed with greater ease when using an installation tool similar to the one shown in Figure 17056-01.

NOTE

Close inspection of all new bushings after installation is necessary to be sure wear surfaces are intact.

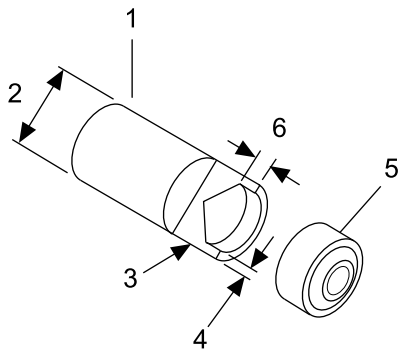


Figure 17056-01

- 1 Ball Bushing Installation Tool
- 2 0.13 mm (0.005 in) Smaller than the Ball Bushing Outside Diameter
- 3 Cut-away view of the Counterbore
- 4 3.2 mm (0.125 in)
- 5 Ball Bushing
- 6 0.5 mm (0.19 in)

Center Pivot Repair and Adjustment

NOTE

Be sure all areas of contact are thoroughly cleaned and free of any burrs or debris that could damage new thrust washers.

When replacing thrust washers (16 in Figure 19202) on both sides of the outer arm assembly, apply a light coat of grease to all surfaces.

For proper adjustment, tighten the lock nut (18) on the center pivot assembly snug to eliminate any abnormal drag. Loosen nut and retighten, then continue to tighten to next nearest groove pin (19) location.

Reassembly

NOTE

Before proceeding with reassembly, all parts should be clean and free of any burrs or rough edges which could damage new bushings or other parts during assembly. Apply a thin coat of grease to all bushings, thrust washers and pivot shafts.

1. Install inner arm assembly (22) into reach support (1).
2. Install pivot shafts (9) simultaneously, rather than individually, in inner arm assembly. Pivot shafts are slotted on the end to obtain proper alignment for installation of roll pin (10).
3. Install thrust washer (16) and bearing sleeves (17) at center pivot. Slide outer arms (15) on center pivot stud.
4. Install thrust washer (16), locknut (18), groove pin (19) and retaining ring (20).

NOTE

Refer to Center Pivot Repair and Adjustment, located in previous section, for proper center pivot adjustment.

5. Use an inside caliper to measure area of support assembly where column rollers (21) on outer arm (15) will travel. Record measurement.

6. Install column rollers (21) and flat washers (22) to outer arms. Measure distance between column rollers with an outside caliper. Subtract this dimension from dimension obtained in step 5 to determine the amount of flat washers required. Balance out the number of flat washers (Example: two right, two left). If an uneven number of flat washers are required, note to which side the extra flat washer was added and install all other odd flat washers to that side.
7. Measure the distance between outer arms at top. Measure distance between pivot blocks welded on fork carriage assembly (29). These dimensions should indicate that the outer arms will fit properly in the fork carriage assembly.
16. Place bushings (28) on tilt cylinder (27) pivot studs and install tilt cylinder assembly in carriage assembly. Check serial number plate to obtain capacity of truck to obtain proper tilt cylinder assembly and proper fork plate assembly (29).
17. Connect all hydraulic lines from tilt cylinder to manifold block at top of reach support.
18. Position fork plate assembly (29) with a hoist and install pivot shafts (30) bearing sleeves (31) and lubrication fittings (32).
19. Extend tilt cylinder piston rod and install tilt cylinder shaft (30) and pin (31).
20. Complete cylinder flushing and bleeding procedures as shown in Reach Cylinder section.

NOTE

Failure of the outer arms to fit into carriage assembly properly indicates inner arm assembly, carriage assembly, or outer arm assembly is bent or deformed in some way.

8. Attach carriage rollers (23) and flat washers (22) to inner arm assembly (14) studs.
9. Raise inner arm assembly until column rollers on outer arms can be fitted into channels of support assembly. Place 50 x 100 x 200 mm (2 x 4 x 8 in) approximate. length, hardwood block in either channel beneath column roller. Lower inner arm assembly until weight of arm assembly is on hardwood block.
10. Guide fork carriage assembly (24) onto inner arm carriage rollers (23).
11. Install pivot shafts (25) and roll pins (26).

NOTE

Reach cylinder removal includes steps 12 through 14.

12. Install pivot shafts (8) and roll pins (7).
13. Extend reach cylinders (2 (LH) and 11 (RH)) manually and install pivot shafts (12) and roll pins (13).
14. Connect hydraulic lines to bulkheads near top of reach cylinders.
15. Install screws (6), lockwashers (5) and harness clamp (4) to tube assembly (3).

NOTE

If truck is not equipped with tilt function, then disregard steps 16 and 17.

Notes:



GLOSSARY

Notes:

Glossary

Connectors on the SH/SHR 5500 Series truck are listed in chart form to assist the maintenance mechanic in locating these components on the Electrical Diagrams and on the truck.

The chart is in columns: **COMPONENT; LOCATION; FUNCTION; DIAGRAM.** The **COMPONENT** column

contains the abbreviation (or designator) of the component as it appears on the diagrams in the Maintenance Section. The **LOCATION** column gives the general location on the truck such as on platform or in power unit. The **FUNCTION** column explains the function or circuit of the device. The **DIAGRAM** column gives the grid point and page number of the appropriate wiring diagram.

CONNECTIONS			
	Location	Function	Diagram
CA200	COMBI AC1 (ACCESS 2&3)	Inputs & Outputs	DIA-8055-003 (B-1)
CA201	Bottom Left of Power Unit below ACCESS 5	Controller Cooling Fan	DIA-8055-003 (A-2)
CA202	EPS ACO (ACCESS 5)	Inputs & Outputs	DIA-8055-003 (B-3)
CA203	EPS ACO (ACCESS 5)	Inputs & Outputs	DIA-8055-003 (B-4)
CA204	HVC (ACCESS 7)	BNEG for Module	DIA-8055-004 (B-1)
CA205	HVC (ACCESS 7)	CAN Communication	DIA-8055-004 (B-1)
CA206	HVC (ACCESS 7)	Inputs & Outputs	DIA-8055-004 (B-1)
CA207	Mast Cable	SVT, SVS, SVR, LMS2	DIA-8055-004 (B-1)
CA208	Mast Cable	LMS1/LMS2	DIA-8055-004 (B-2)
CA209	M1- Traction Motor	ECR1	DIA-8055-004 (B-2)
CA210	M3 - Steer Motor	ECR3	DIA-8055-004 (B-3)
CA211	On Power Unit to Left of Steer Motor	POT3	DIA-8055-004 (B-3)
CA212	X10 Handle	POT1/POT2	DIA-8055-004 (B-3)
CA213	On ORS	ORS	DIA-8055-004 (B-3)
CA214	On BRS	BRS	DIA-8055-004 (B-3)
CA228	Power Unit Near Strobe Power Supply	Strobe Light (LGT3)	DIA-8055-006 (B-2)
CA230	Behind M1	Shorting Plug	DIA-8055-004 (B-4)
CA231	Behind M1	CAN Shorting Plug	DIA-8055-005 (B-1)
CA240	Left Side of Power Unit Near Fuses	CAN ACCESS	DIA-8055-005 (A-2)
CA250	Behind M1		DIA-8055-005 (A-2)
CA401	ACCESS 1	Display	DIA-8055-005 (B-2)
CA402	ACCESS 8	X10 Handle CAN	DIA-8055-005 (B-3)
CA403	ACCESS 8	COMBI AC1 CAN	DIA-8055-005 (B-3)
CA404	ACCESS 8	X10 Switches	DIA-8055-005 (B-4)
CA410	X10 Main PCB Handle	ACCESS 8 CAN	DIA-8055-005 (B-2)
CA411	X10 Main PCB Handle	POT1/FS/RS	DIA-8055-005 (C-2)

CONNECTIONS (Continued)

	Location	Function	Diagram
CA412	X10 Main PCB Handle	SAS	DIA-8055-005 (B-2)
CA413	X10 Main PCB Handle	HNS1/HNS2	DIA-8055-005 (B-2)
CA414	Control Handle - Fast Slow Switch	HSS	DIA-8055-005 (C-3)
CA415	Control Handle - Hydraulic PC Board	RAS/LOS1/LOS2	DIA-8055-005 (C-3)
CA417	X10 Control Handle	HNS1	DIA-8055-005 (C-3)
CA419	X10 Control Handle	HNS2	DIA-8055-005 (C-3)
CA430	Control Handle	ROS/RIS	DIA-8055-005 (C-4)
CA431	Control Handle	TBS/TDN	DIA-8055-005 (C-4)
CA432	Control Handle	SRS/SLS	DIA-8055-005 (C-4)
CA601	Power End Unit of Reach Harness	SVT, SVS, SVR, LMS1, LMS2	DIA-8055-004 (C-1)
CA608	Power Unit	Strobe/Work Lights/Fan	DIA-8055-006 (B-2)
CA609	Mast	Strobe Light (LGT3)	DIA-8055-006 (B-1)
CA908	Power Unit	Infolink CAN	DIA-8055-005 (C-2)



WIRING DIAGRAMS

Notes:

Introduction to Diagram Usage

Schematic

- Power up diagram. Illustrates the circuitry involved in getting the truck system to an operating mode (Can Interface, Access 1,2,3, Controller, Contactor, ect.).
- Circuitry which stands alone and is separate from truck operation is shown in block form with the pictorials detailing the circuitry (e.g. light package, displays, wire guidance, freezer condition).

Pictorials

- Terminal board and connector numbering on the pictorials are in two classes; power unit and platform. Power unit TB's and CA's are even 100's (200, 400, 600 etc.) and platform TB's and CA's are odd 100's (100, 300, 500 etc.). On manup trucks (SP, TS, TSP etc.), odd and even 100's will be present on the wiring diagrams. Man-down trucks, which don't have a platform (stand-up rider, pallet etc.), only even 100's will be present.
- Wiring starts at a central location (e.g. distribution board) and wiring connection points are numbered with the lowest number odd or even. The next wiring connection point from the distribution board are then numbered with the next group of 100's and so on for each connection point removed from the central location.
- Terminal board and connector numbering is sequential on each consecutive page. In this way a wiring address giving a connector number or terminal board number will indicate which direction to look in the diagrams for the other end of the wire. When wiring goes to a component and not a terminal board or connector, a reference terminal board is used and is shown with a dashed line box with the reference terminal board number in parenthesis. This terminal board will not appear on the truck and only present as a wiring directory.
- Input/Output arrows may appear at terminal boards and connectors. These indicate whether what the wire is carrying is incoming or outgoing. This is helpful when tracing the origin of the signal or voltage.

- The truck has been sectioned with one page covering each section. When options affect the wiring in a section, an additional page is added which duplicates wiring that is identical and adds the option wiring. In this way only one page of the truck section is required for the applicable truck configuration.
- Wiring that is identified by color rather than number will typically be a cable or wires with vendor componentry.
- Page titles, listed at the beginning of the electrical diagrams, indicate the subsystem or section of truck wiring that is covered by each page.

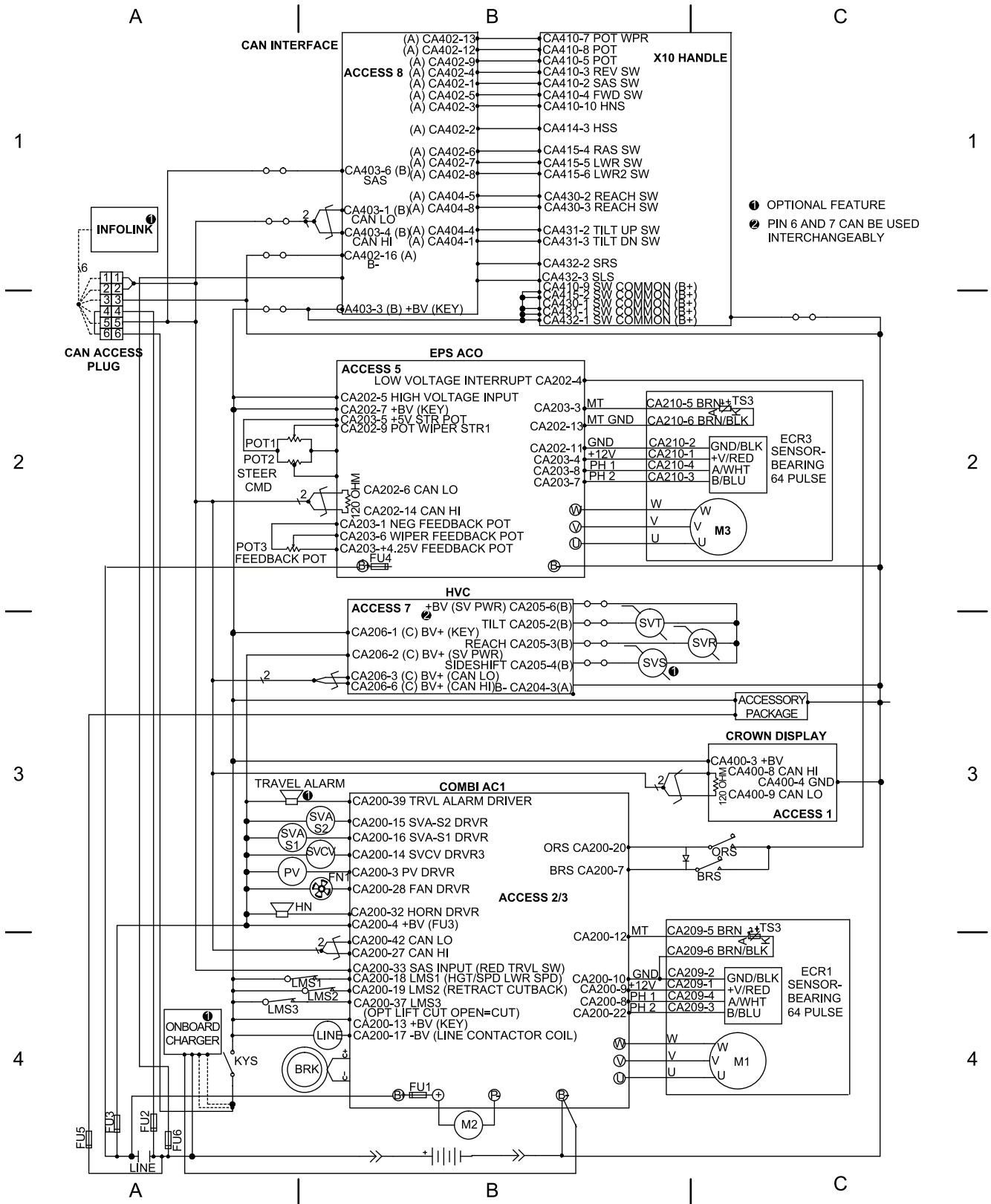
Notes:

This electrical diagram index lists the diagrams with portion of truck covered by each diagram.

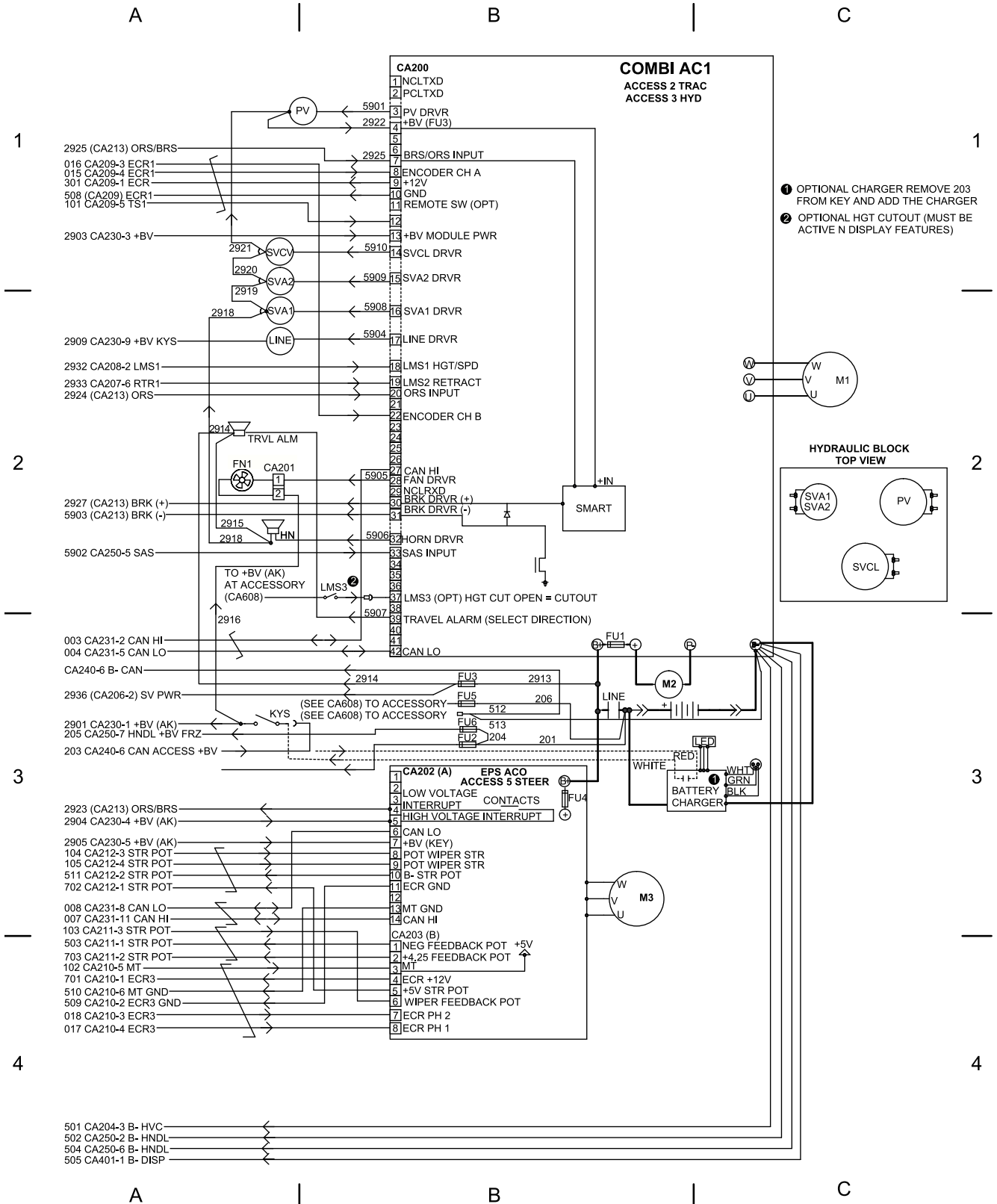
Title	Page Number	Revision
Schematic Wiring Diagram	DIA-8055-002	02 - 11/09
Traction	DIA-8055-003	02 - 11/09
Hydraulic	DIA-8055-004	02 - 11/09
Steering/Handle	DIA-8055-005	02 - 11/09
Strobe/Work Lights/Fan	DIA-8055-006	02 - 11/09
Power Cables	DIA-8055-007	01 - 4/08
Wire Harnesses	DIA-8055-008	01 - 4/08

WIRING DIAGRAMS

Schematic



138942 C

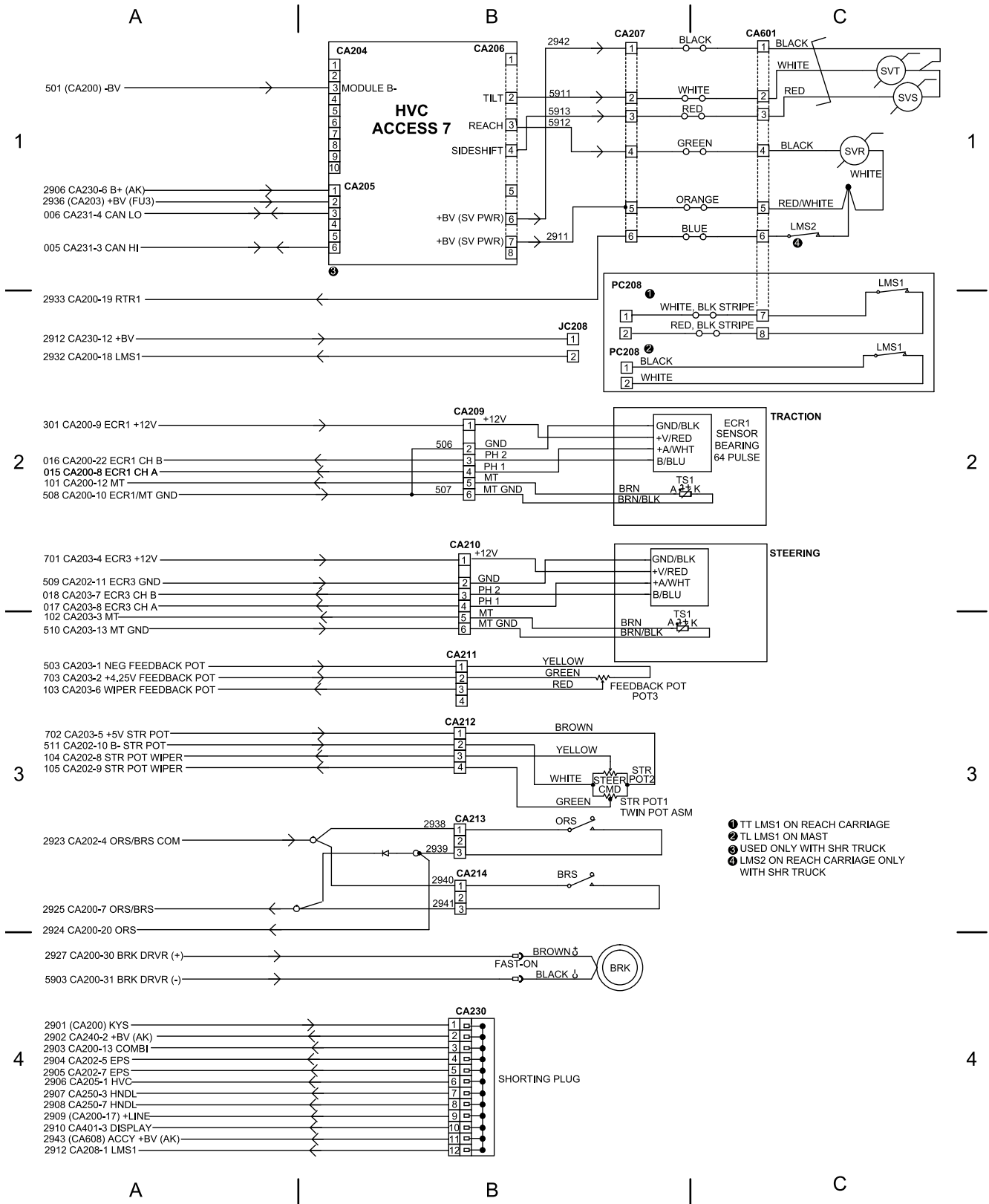


- ① OPTIONAL CHARGER REMOVE 203 FROM KEY AND ADD THE CHARGER
- ② OPTIONAL HGT CUTOUT (MUST BE ACTIVE N DISPLAY FEATURES)

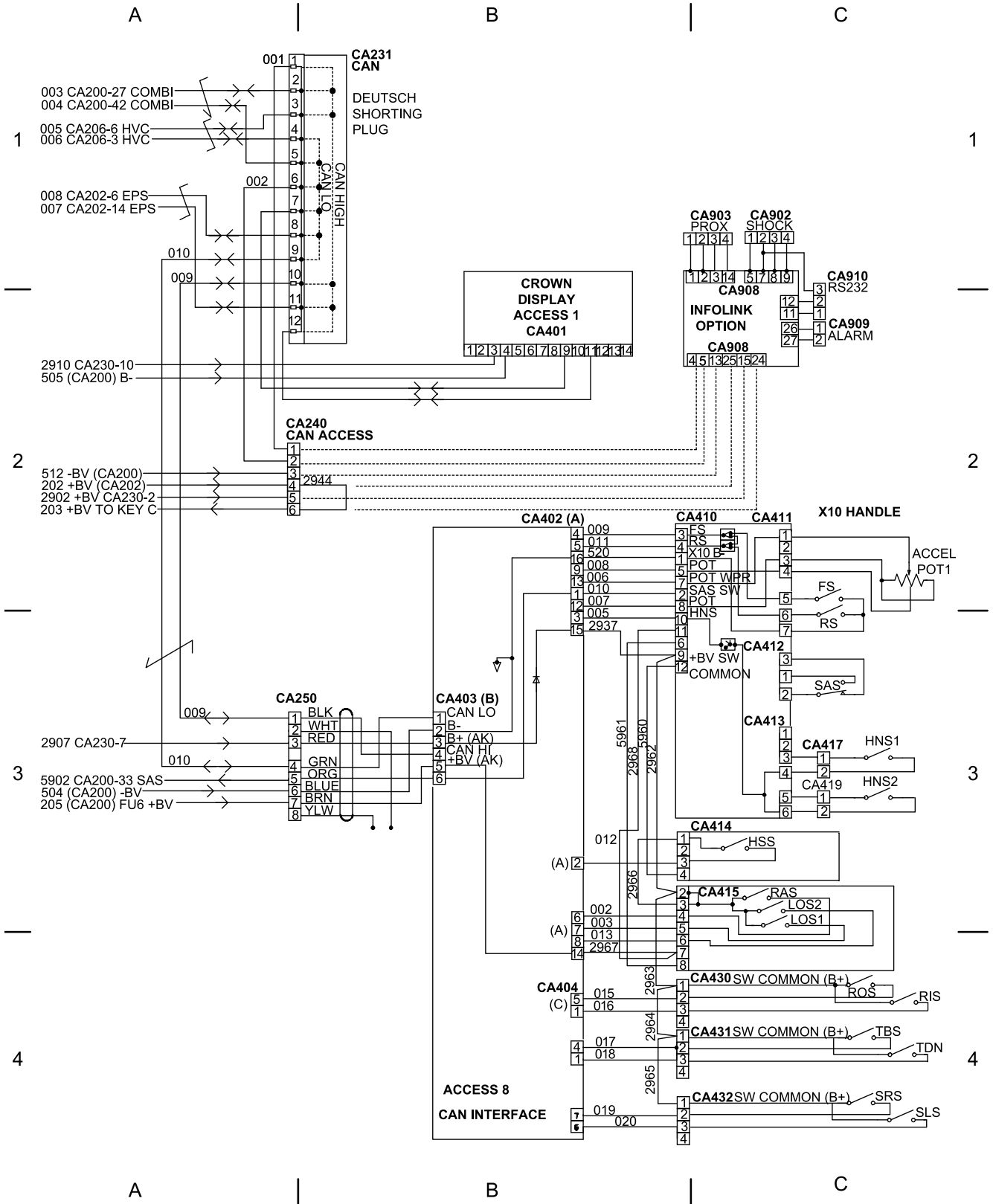
138943 C

WIRING DIAGRAMS

Hydraulic



138944 C



138945 C

WIRING DIAGRAMS

Strobe/Work Lights/Fan



A | B | C

1

1

2

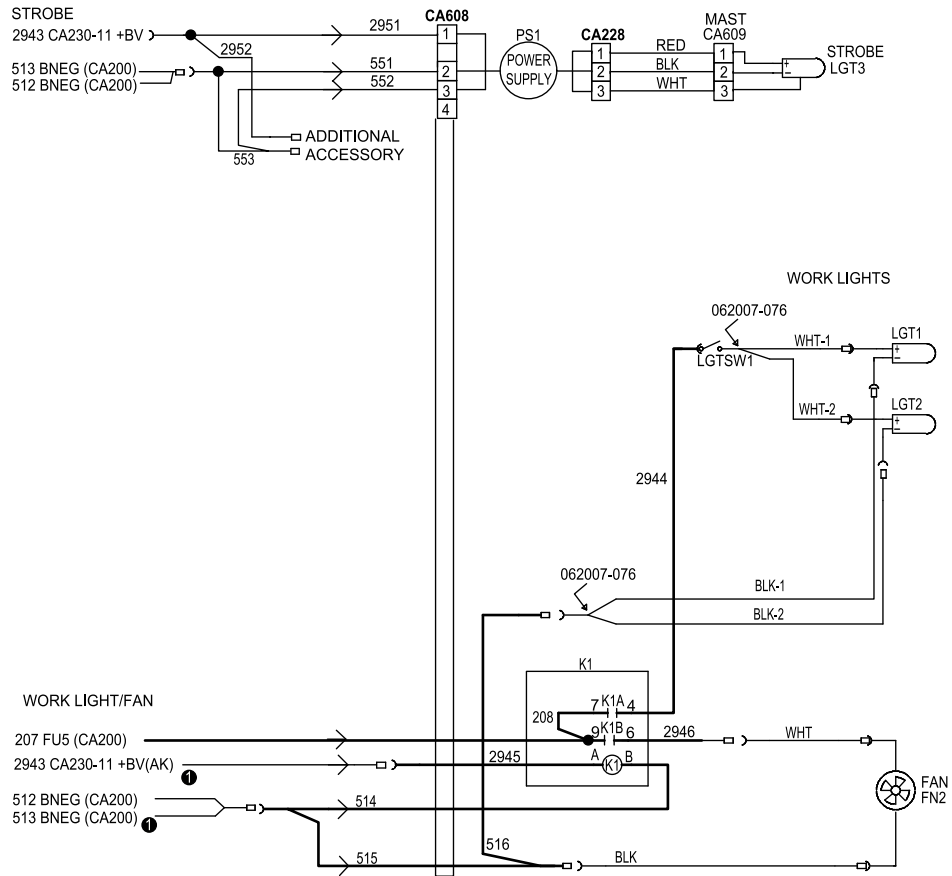
2

3

3

4

4

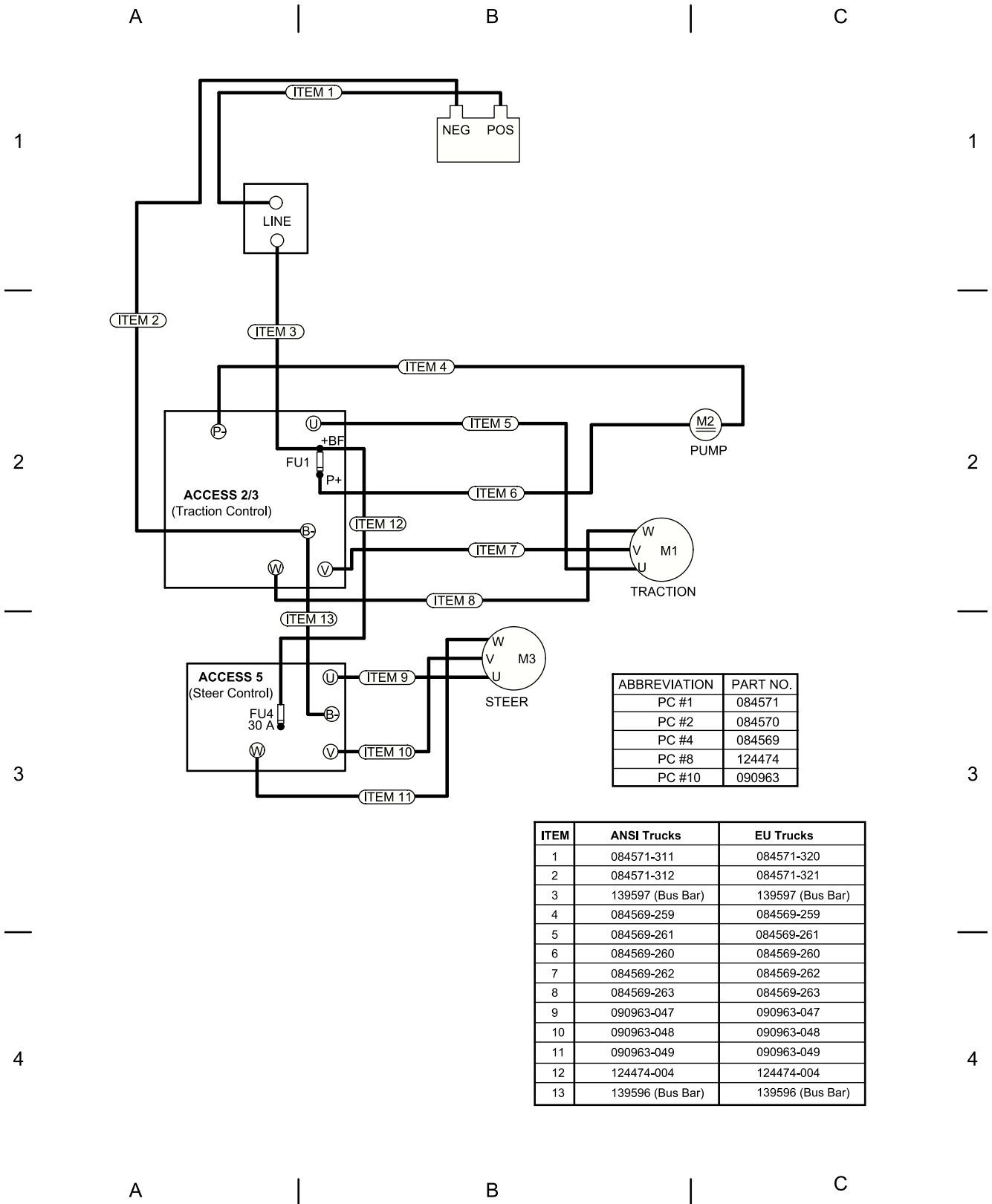


NOTES:

- ① WHEN USED IN COMBINATION WITH STROBE, CONNECT WIRE 2952 TO 2945 AND 552/553 TO 514/515 SUPPLIED BY THE STROBE HARNESS 142232
- ② BOLD WIRE IS ACCESSORY HARNESS 144614

A | B | C

138947 B



138946 C

Wire Harnesses	
Harnesses	Components Connected By:
139595	Main Power Unit Harness - PC200, PC201, PC202, PC203, PC204, PC205, PC206, PC209, PC210, PC211, PC212, PC213, PC214, PC230, PC231, PC240, PC250, PC401, JC207, JC208, B-, SVCV, PV, SVAL, SVAR, HORN, TRAVEL ALM, ACCESSORY, FREEZER, FUSES, LINE COIL, LINE CONTACTOR, KYS
140569	SHR Mast Cable Harness - PC601
140575-001	SHR Reach Cable Harness - SVR, SVT, SVS, JC601
144561	InfoLink Harness
142232	Strobe Light Harness - PC609, JC228, JC608
142233	Work Light Harness - LGT SW1, LGT1, LGT2, +BV, B-



HYDRAULIC SCHEMATIC

Notes:

SH 5500

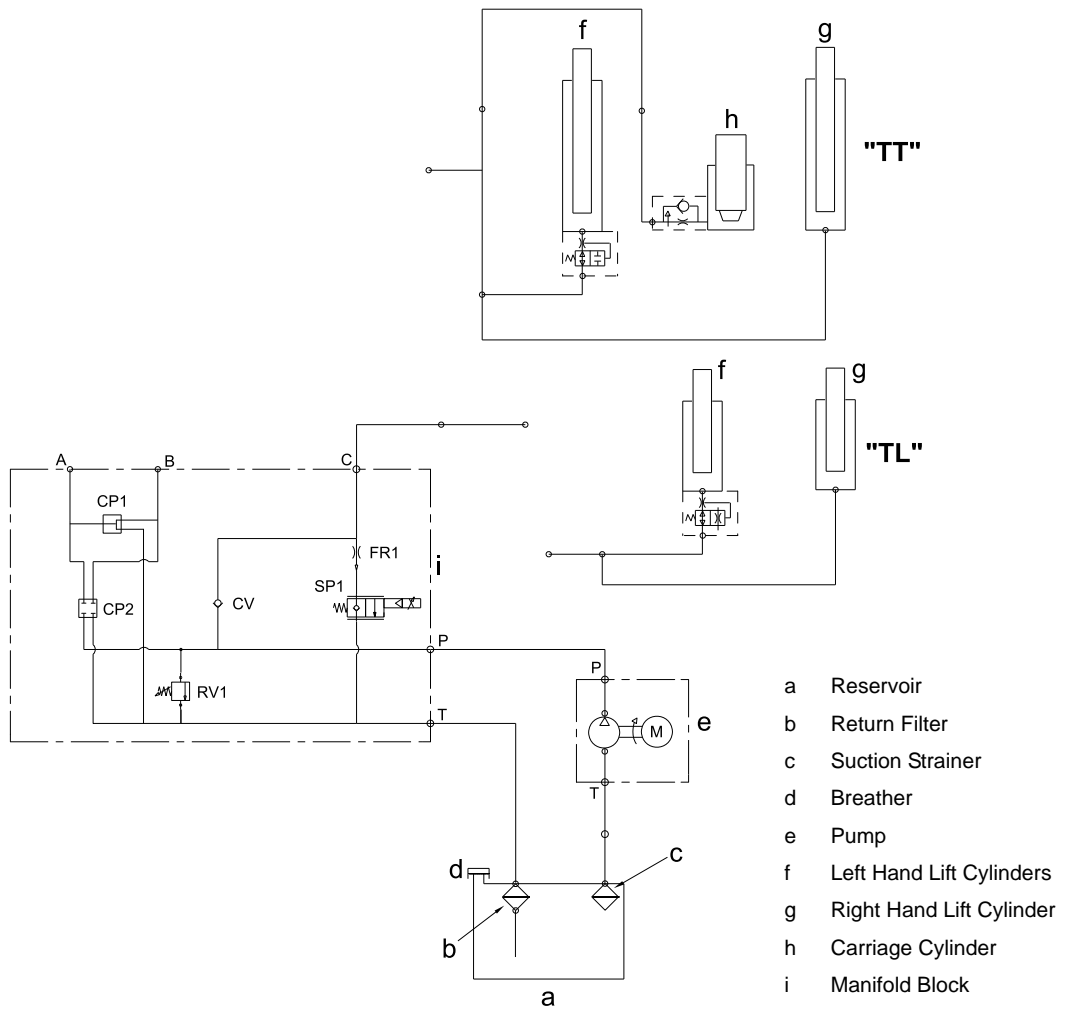


Figure 17402-01

HYDRAULIC SCHEMATIC

Hydraulic Schematic



SH 5500 w/Auxiliary

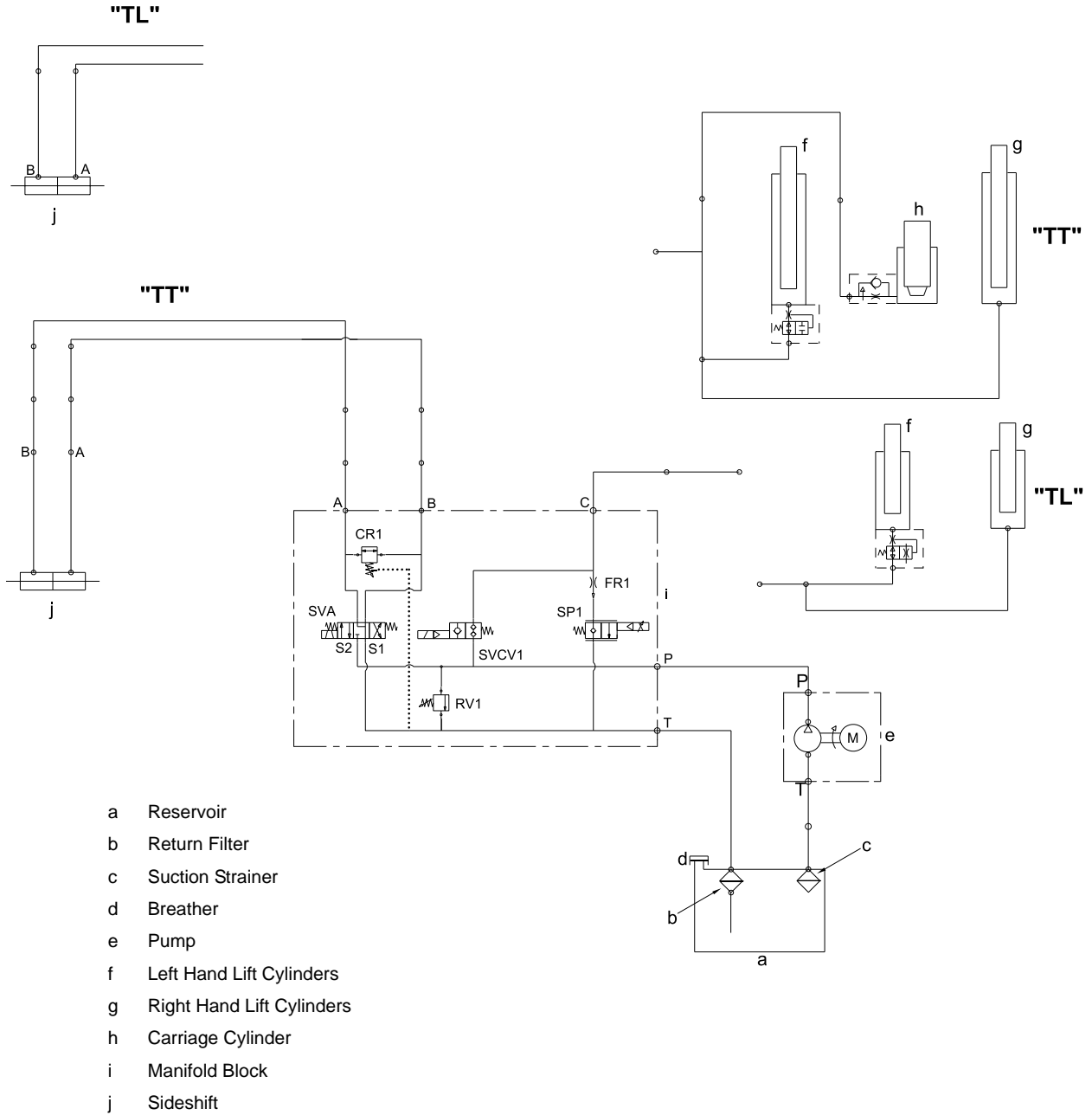


Figure 17403-01

SHR 5500

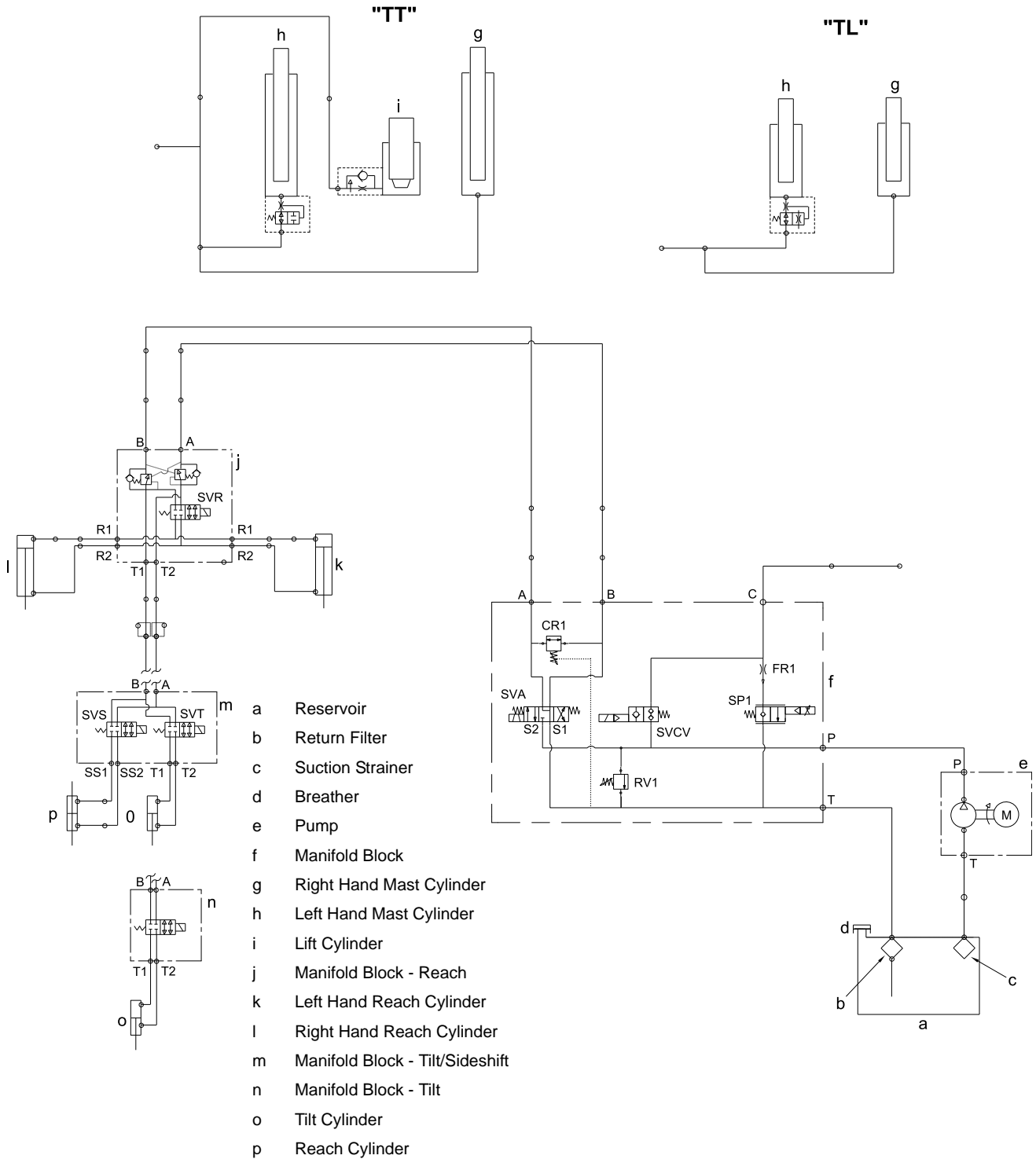


Figure 17404-02

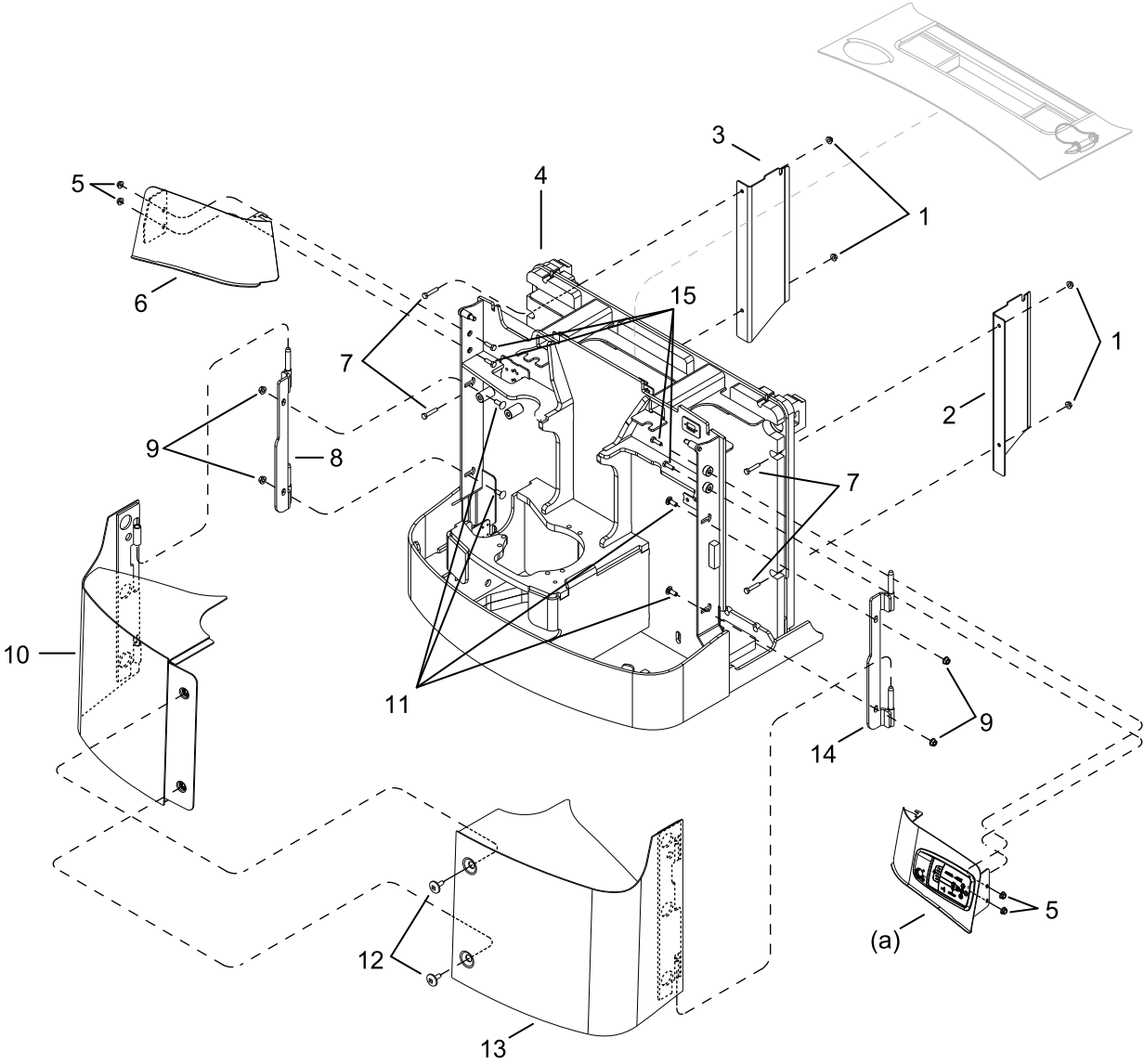
Notes:



POWER UNIT PARTS

POWER UNIT PARTS

Power Unit - Covers/Doors



(a) See Electrical Parts

Figure 16543



POWER UNIT PARTS

Power Unit - Covers/Doors

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	060059-028	Nut	4
2	135775-001	Cover LH	1
3	135775-002	Cover RH	1
4	(1)	Frame	1
5	060059-028	Nut	4
6	139756-001	Cover Standard	1
	139756-002	Cover Options	1
7	060063-005	Screw	4
8	139754	Hinge Weldment LH	1
9	060080-001	Nut	4
10	139753	Door LH	1
11	060017-092	Screw	4
12	115453	Latch Screw	2
13	139752	Door RH	1
14	139755	Hinge Weldment RH	1
15	060063-004	Screw	4

(1) Contact Factory

Always Specify Model, Data & Serial Number

POWER UNIT PARTS

Power Unit - Covers/Doors

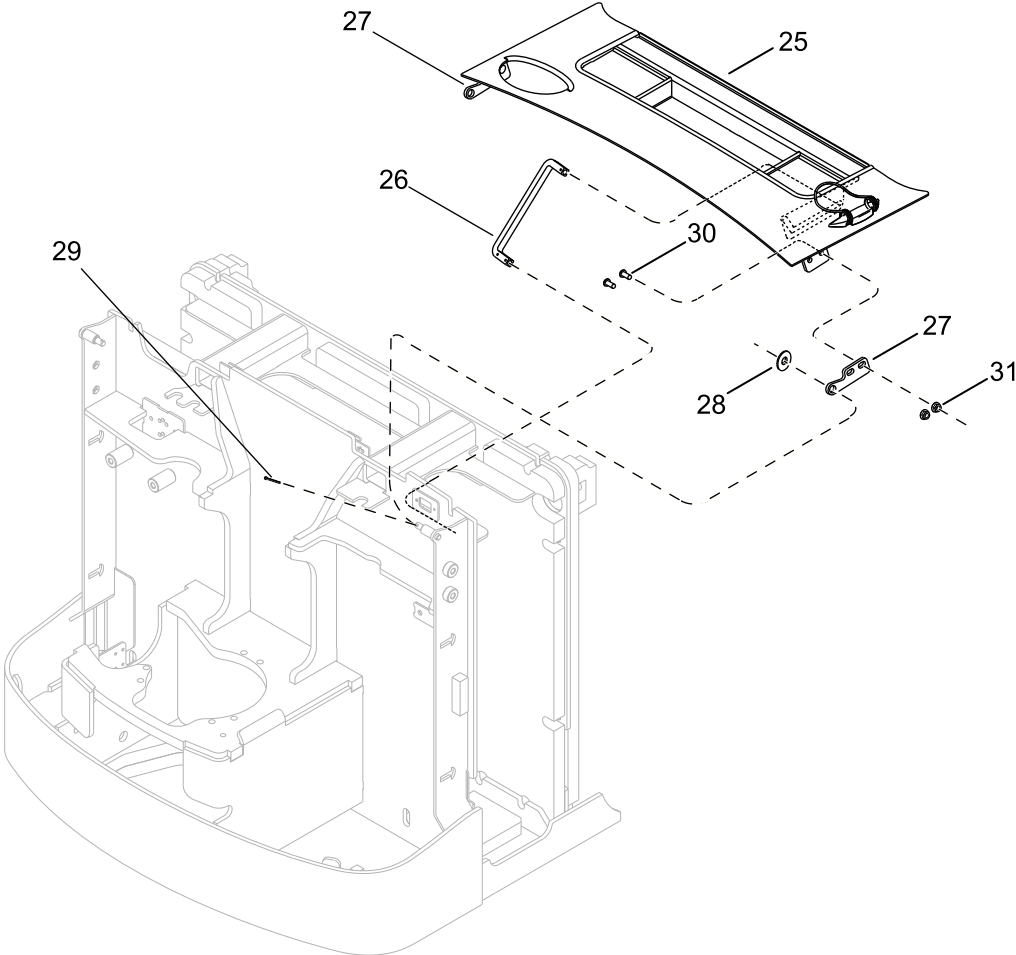


Figure 18739



POWER UNIT PARTS

Power Unit - Covers/Doors

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
25.....	139796	Cover 170 mm (6.62 in) Battery Compartment	1
	139797	Cover 335 mm (13.12 in) Battery Compartment	1
26.....	140373	Rod	1
27.....	139786	Top Cover Hinge	2
28.....	060030-177.....	Washer	8
29.....	060038-006.....	Cotter Pin	4
30.....	060062-027.....	Screw	4
31.....	060059-027.....	Nut	4

Always Specify Model, Data & Serial Number

POWER UNIT PARTS

Battery Retainers/Rollers

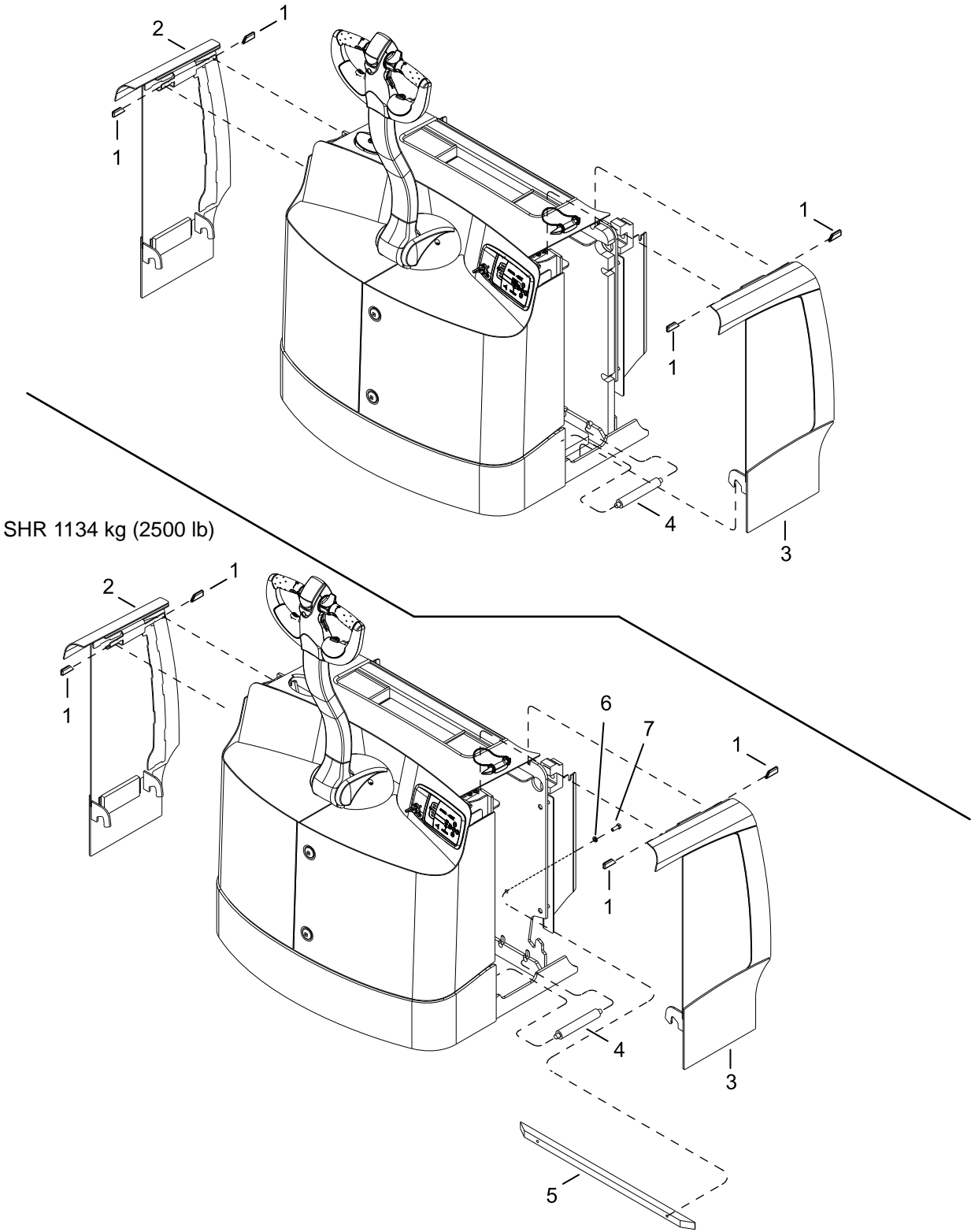


Figure 16562

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	130578	Side Cover Sleeve	4
2	(1)	Cover LH	1
3	(2)	Cover RH	1
4	074130-005	Roller ⁽³⁾	6
	074130-006	Roller ⁽⁴⁾	6
	074130-007	Roller ^{(3) (5)}	6
5	117631-004	Spacer ⁽⁵⁾	1
6	060017-007	Screw ⁽⁵⁾	2
7	060005-009	Lockwasher ⁽⁵⁾	2

- (1) See Chart 1
- (2) See Chart 2
- (3) 170 mm (6.62 in) Battery Compartment
- (4) 335 mm (13.12 in) Battery Compartment
- (5) SHR 1134 kg (2500 lb) Only

Chart 1 - INDEX 2 - Cover LH		
Part Number	Battery Compartment	
	mm	(in)
139765-001 ⁽⁶⁾	170	(6.62)
139765-002 ⁽⁷⁾	170	(6.62)
139765-003 ⁽⁸⁾	170	(6.62)
139767-001 ⁽⁶⁾	335	(13.12)
139767-002 ⁽⁷⁾	335	(13.12)
139767-003 ⁽⁸⁾	335	(13.12)
⁽⁶⁾ Australia ⁽⁷⁾ North America ⁽⁸⁾ Europe		

Always Specify Model, Data & Serial Number

POWER UNIT PARTS

Battery Retainers/Rollers

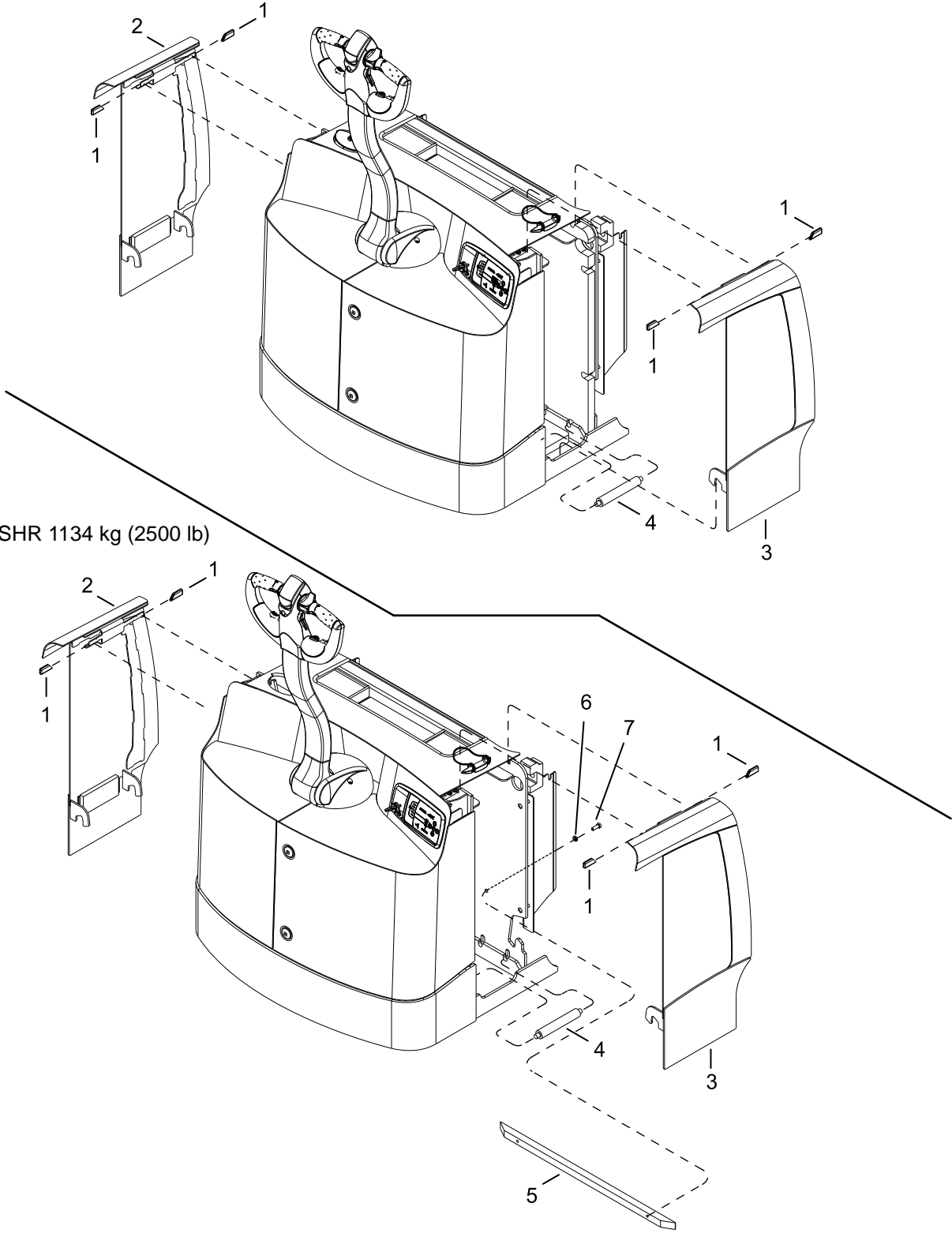


Figure 16562

Chart 2- INDEX 3- Cover RH		
Part Number	Battery Compartment	
	mm	(in)
139764-001 ⁽⁶⁾	170	(6.62)
139764-002 ⁽⁷⁾	170	(6.62)
139764-003 ⁽⁸⁾	170	(6.62)
139766-001 ⁽⁶⁾	335	(13.12)
139766-002 ⁽⁷⁾	335	(13.12)
139766-003 ⁽⁸⁾	335	(13.12)
⁽⁶⁾ Australia ⁽⁷⁾ North America ⁽⁸⁾ Europe		

POWER UNIT PARTS

Safety Shield/Safety Grill

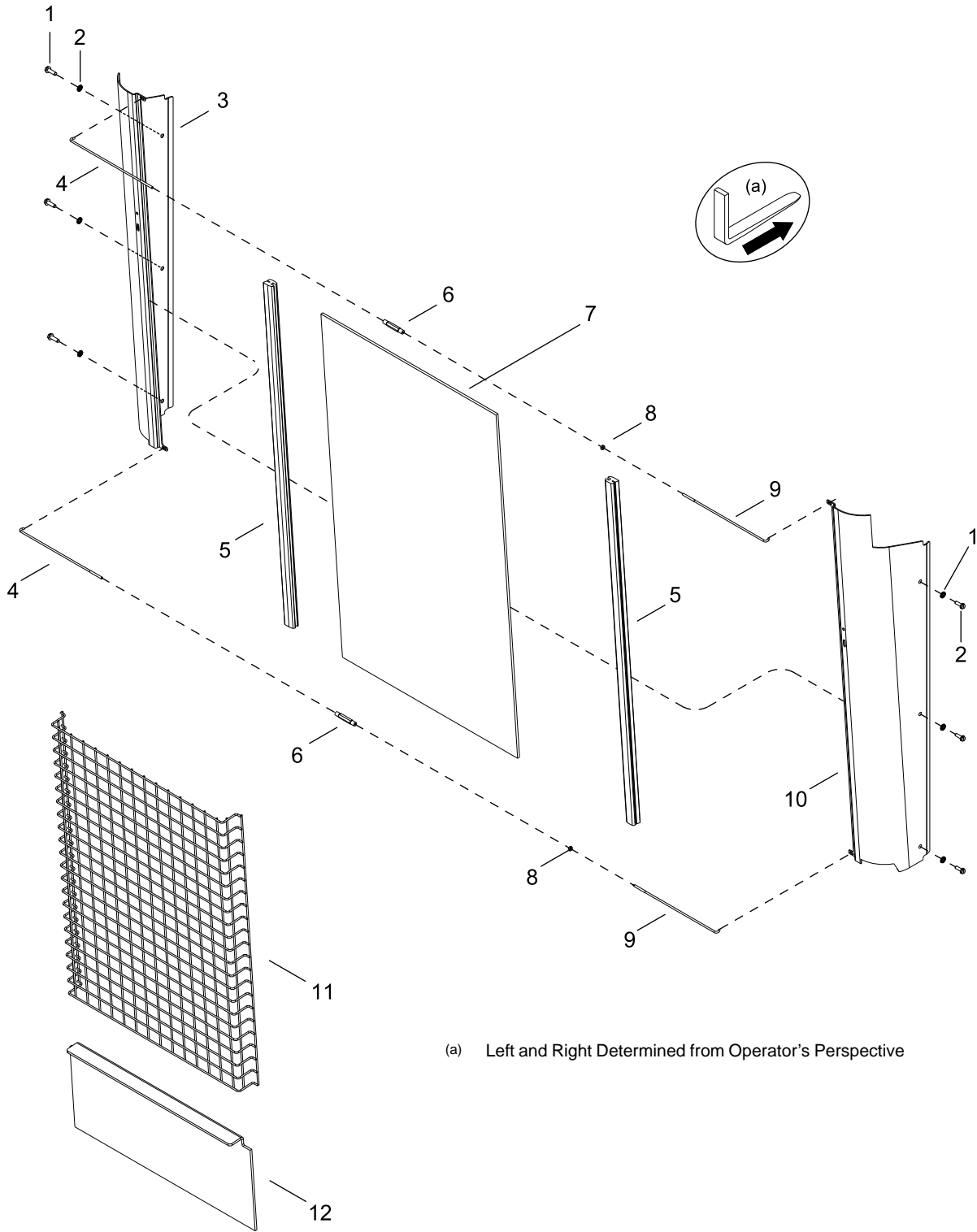


Figure 17648

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	060032-066*	Screw (1) (3) (6)	6
	060032-066*	Screw (2) (4) (5)	8
2	060089-005*	Washer (1) (3) (6)	6
	060089-005*	Washer (2) (4) (5)	8
3	*	Mast Guard (LH) (8)	1
4	125614-002	Rod Tension (LH)	2
5	123459-006*	Rubber Molding (1) (2) (3) (4) (5)	2
	123459-007*	Rubber Molding (6)	2
	123459-008*	Rubber Molding (1) (7)	2
	123459-009*	Rubber Molding (2) (4) (7)	2
6	125615	Turnbuckle	2
7	140341-001*	Shield	1
	140341-003*	Shield (1) (7)	1
	140341-004*	Shield (4) (7)	1
	140341-005*	Shield (2) (7)	1
8	060021-024	Nut	2
9	125614-001	Rod Tension (RH)	2
10	*	Mast Guard (RH) (8)	1
11	140342-001*	Screen	1
	140342-002*	Screen (1) (7)	1
	140342-004*	Screen (2) (7)	1
12	140343*	Shield	1

- (1) 3225 mm (127 in) Lift Height
- (2) 3810 mm (150 in) Lift Height
- (3) 3962 mm (156 in) Lift Height
- (4) 4877 mm (192 in) Lift Height
- (5) 5334 mm (210 in) Lift Height - Australia Only
- (6) 2667 mm (105 in) Lift Height - Australia Only
- (7) Euro Trucks
- (8) See Chart

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

POWER UNIT PARTS

Safety Shield/Safety Grill

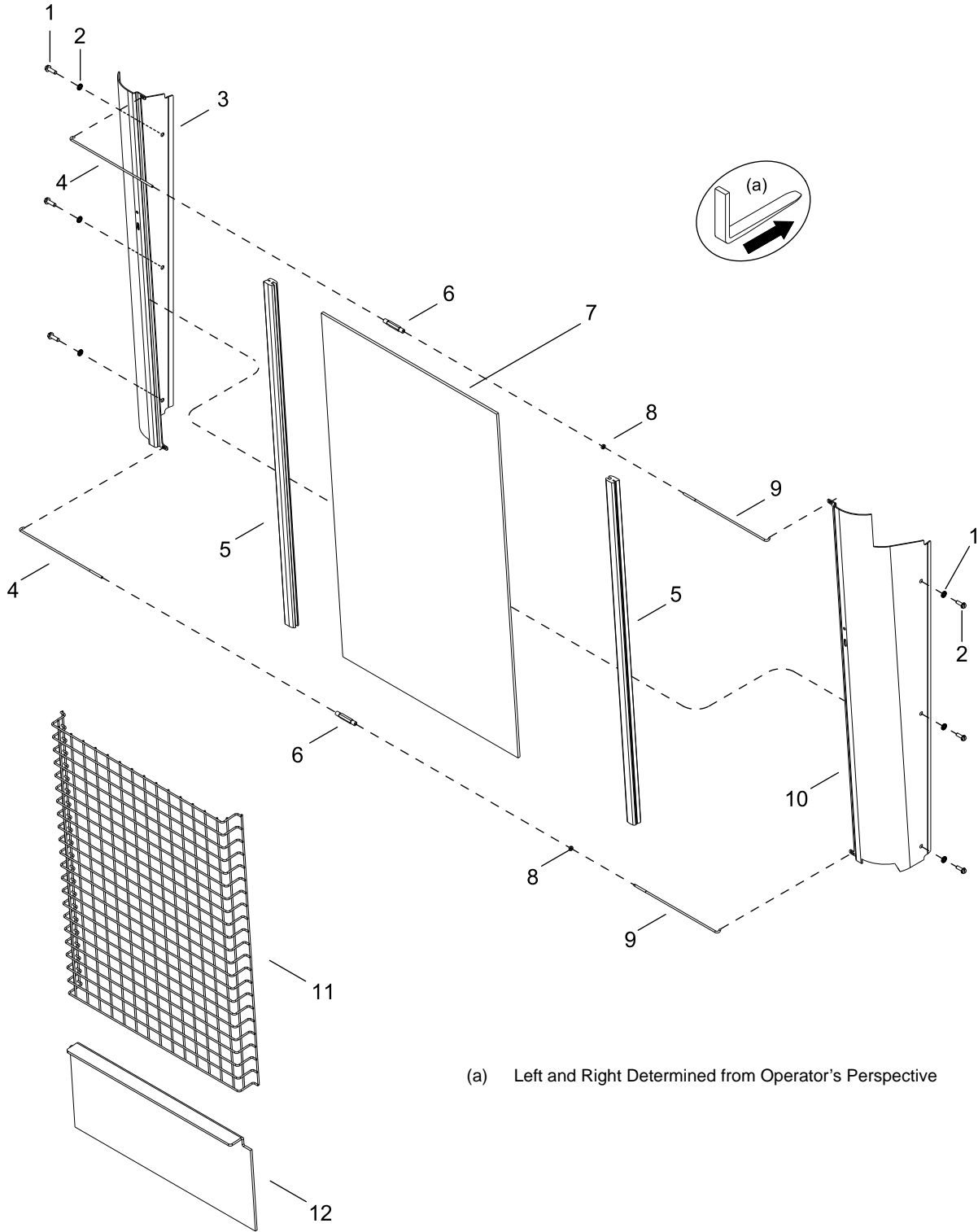


Figure 17648

Index 3 Mast Guard (Left Hand)

Part Number	Lift Height mm (inch)					
	2667 (105) ⁽¹⁾	3225 (127)	3810 (150)	3962 (156)	4877 (192)	5334 (210) ⁽¹⁾
140340-001				X		
140340-002	X					
141413-002		X				
141413-003					X	
141413-004			X			
141413-005						X

⁽¹⁾ Australia Only

Index 10 Mast Guard (Right Hand)

Part Number	Lift Height mm (inch)					
	2667 (105) ⁽¹⁾	3225 (127)	3810 (150)	3962 (156)	4877 (192)	5334 (210) ⁽¹⁾
140339-001				X		
140339-002	X					
141412-002		X				
141412-003					X	
141412-004			X			
141412-005						X

⁽¹⁾ Australia Only

Notes:



HYDRAULIC PARTS

HYDRAULIC PARTS

Hydraulic System without Accessories - Power Unit



- (a) To Mast
- (b) SH Truck w/o Accessories
See Manifold Block - No Accessories
- (c) Torque Value 13 Nm (10 ft lb)

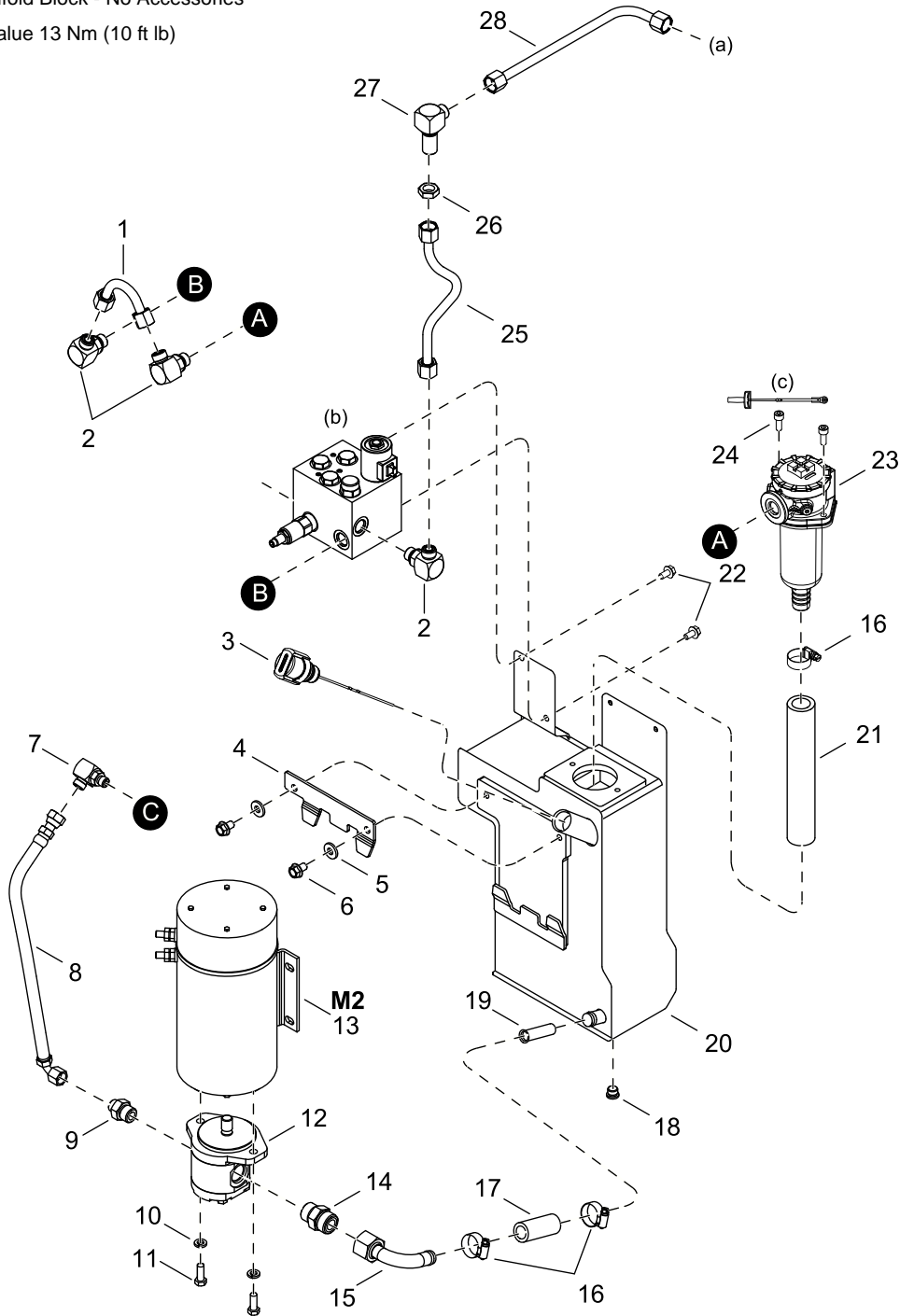


Figure 16522-01



HYDRAULIC PARTS

Hydraulic System without Accessories - Power Unit

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139734-002	Hydraulic Sub-Assembly	1
1	135172	Tube	1
2	064280-008	90° Adapter	3
3	141290	Breather & Dipstick	1
4	135170	Motor Mount Plate	1
5	060030-167	Flatwasher	2
6	060075-043	Screw	2
7	064280-006	90° Adapter	1
8	064362-030	Hose	1
9	064279-015	Adapter	1
10	060005-009	Lockwasher	2
11	060017-096	Screw	2
12	139738	Pump	1
13	114330	Pump Motor	1
14	064279-012	Adapter	1
15	139739	Tube	1
16	061022-001	Clamp	3
17	064100-141	Hose	1
18	064091-002	Plug w/O-Ring	1
19	142215	Suction Strainer	1
20	135161	Reservoir	1
21	064100-142	Hose	1
22	060063-045	Screw	2
23	139735	Filter	1
	141466	Filter Element	1
	148115	Oil Filter Gasket	1
24	060063-031	Screw	2
25	135171	Tube	1
26	064325-008	Nut	1
27	064326-008	Fitting	1
28	135173-002	Tube 170 mm (6.62 in) Battery Compartment	1
	135173-001	Tube 335 mm (13.12 in) Battery Compartment	1

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Hydraulic System with Accessories - Power Unit

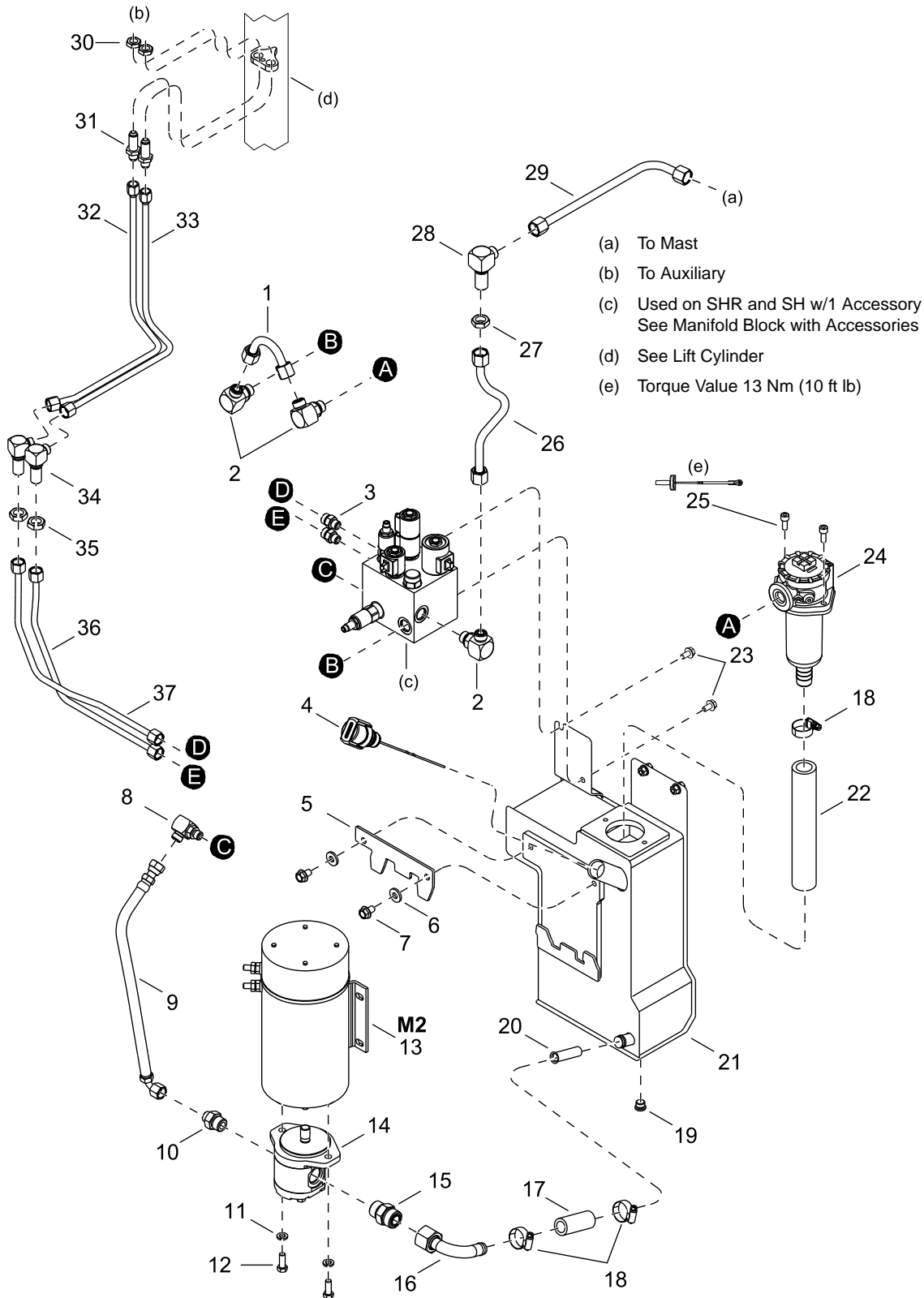


Figure 16514-01



HYDRAULIC PARTS

Hydraulic System with Accessories - Power Unit

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139734-001	Hydraulics Sub Assembly	1
1	135172	Tube	1
2	064280-008	90° Adapter	3
3	064279-010	Adapter	2
4	141290	Breather & Dipstick	1
5	135170	Motor Mount Plate	1
6	060030-167	Flatwasher	2
7	060075-043	Screw	2
8	064280-006	90° Adapter	1
9	064362-030	Hose	1
10	064279-015	Adapter	1
11	060005-009	Lockwasher	2
12	060017-096	Screw	2
13	114330	Pump Motor	1
14	139738	Pump	1
15	064279-012	Adapter	1
16	139739	Tube	1
17	064100-141	Hose	1
18	061022-001	Clamp	3
19	064091-002	Plug w/O-Ring	1
20	142215	Suction Strainer	1
21	135161	Reservoir Weldment	1
22	064100-142	Hose	1
23	060063-045	Screw	2
24	139735	Filter	1
	141466	Filter Element	1
	148115	Oil Filter Gasket	1
25	060063-031	Screw	2
26	135171	Tube	1
27	064325-008	Nut	1
28	064326-008	Fitting	1
29	135173-002	Tube ⁽¹⁾	1
	135173-001	Tube ⁽²⁾	1
30	064030-003	Nut	2
31	064033-002	Fitting	2
32	135175-002	Tube ⁽¹⁾	1
	135175-001	Tube ⁽²⁾	1
33	135176-001	Tube ⁽¹⁾	1
	135176-002	Tube ⁽²⁾	1
34	064326-006	Fitting	2
35	064325-006	Nut	2
36	139733	Tube	1
37	135174	Tube	1

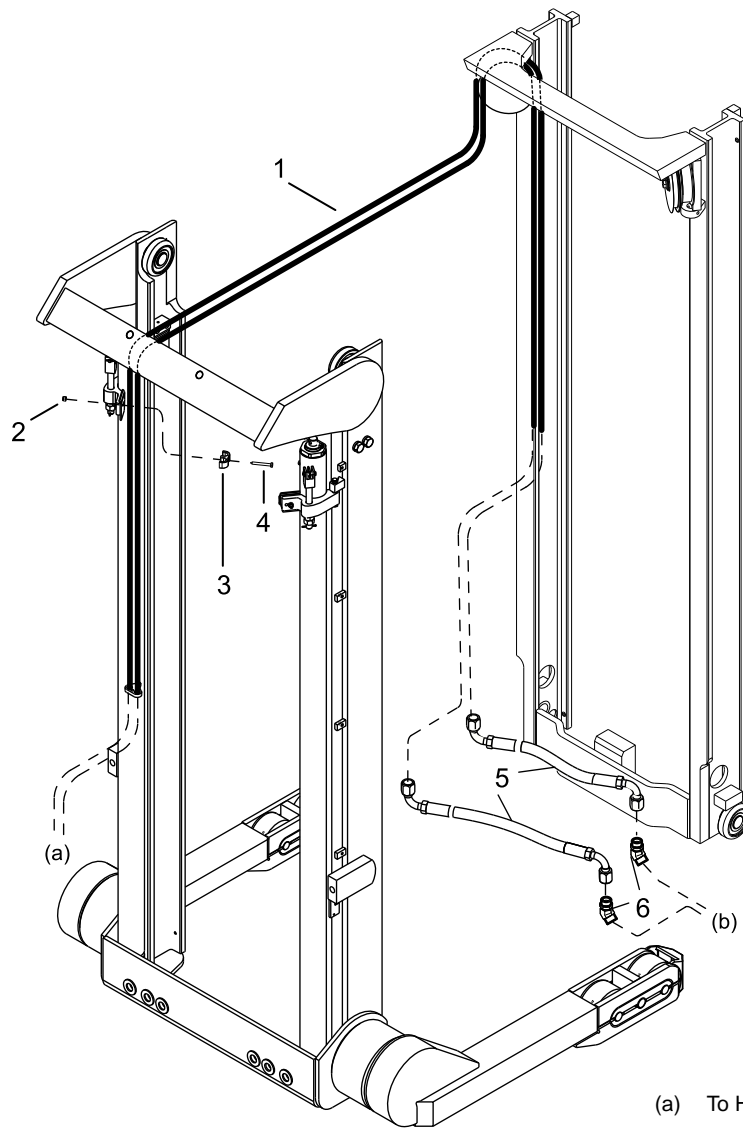
⁽¹⁾ 170 mm (6.62 in) Battery Compartment

⁽²⁾ 335 mm (13.12 in) Battery Compartment

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Hydraulic System - Accessories TL Mast



- (a) To Hydraulic Manifold
- (b) To Reach Assembly

Figure 16645-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064254-319	Hose Assembly ⁽¹⁾	2
	064061-014	O-Ring	4
	064254-320	Hose Assembly ⁽²⁾	2
	064061-014	O-Ring	4
	064254-322	Hose Assembly ⁽³⁾	2
	064061-014	Ring	4
2	060042-006	Nut	1
3	123281	Hose Guide	1
4	060015-015	Screw	1
5	064254-311	Hose Assembly (SH)	1
	064061-014	O-Ring	2
	064254-321	Hose Assembly (SH)	1
	064061-014	O-Ring	2
	064253-276	Hose Assembly (SHR Not Shown)	2
	064061-004	O-Ring	2
	064061-014	O-Ring	2
6	064098-002	Elbow 45° (SH)	2
	064061-002	Elbow 90° (SHR Not Shown)	2

⁽¹⁾ 3226 mm (127 in) TL Mast

⁽²⁾ 3810 mm (150 in) TL Mast

⁽³⁾ 2667 mm (105 in) TL Mast

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Hydraulic System - Accessories TT Mast

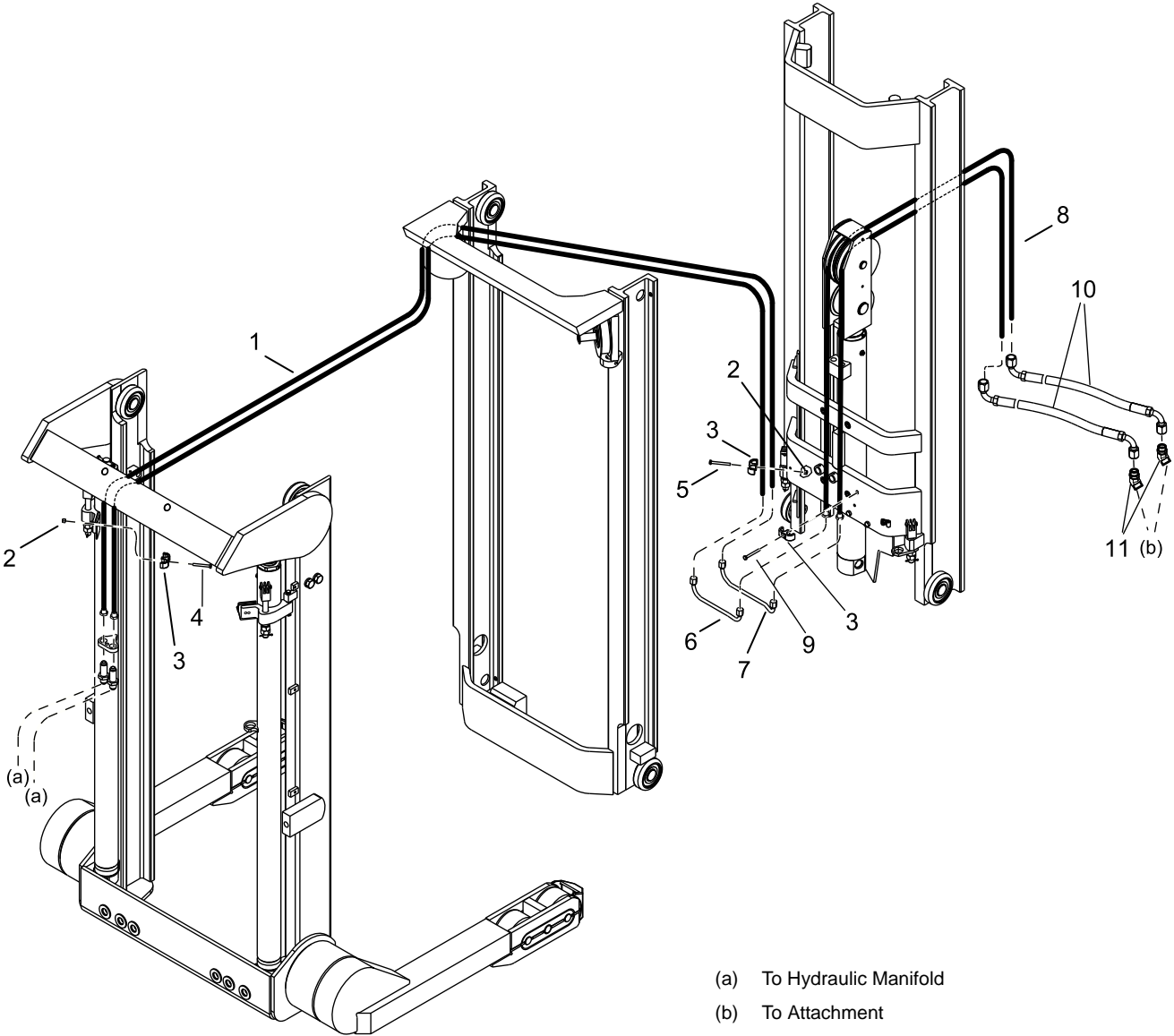
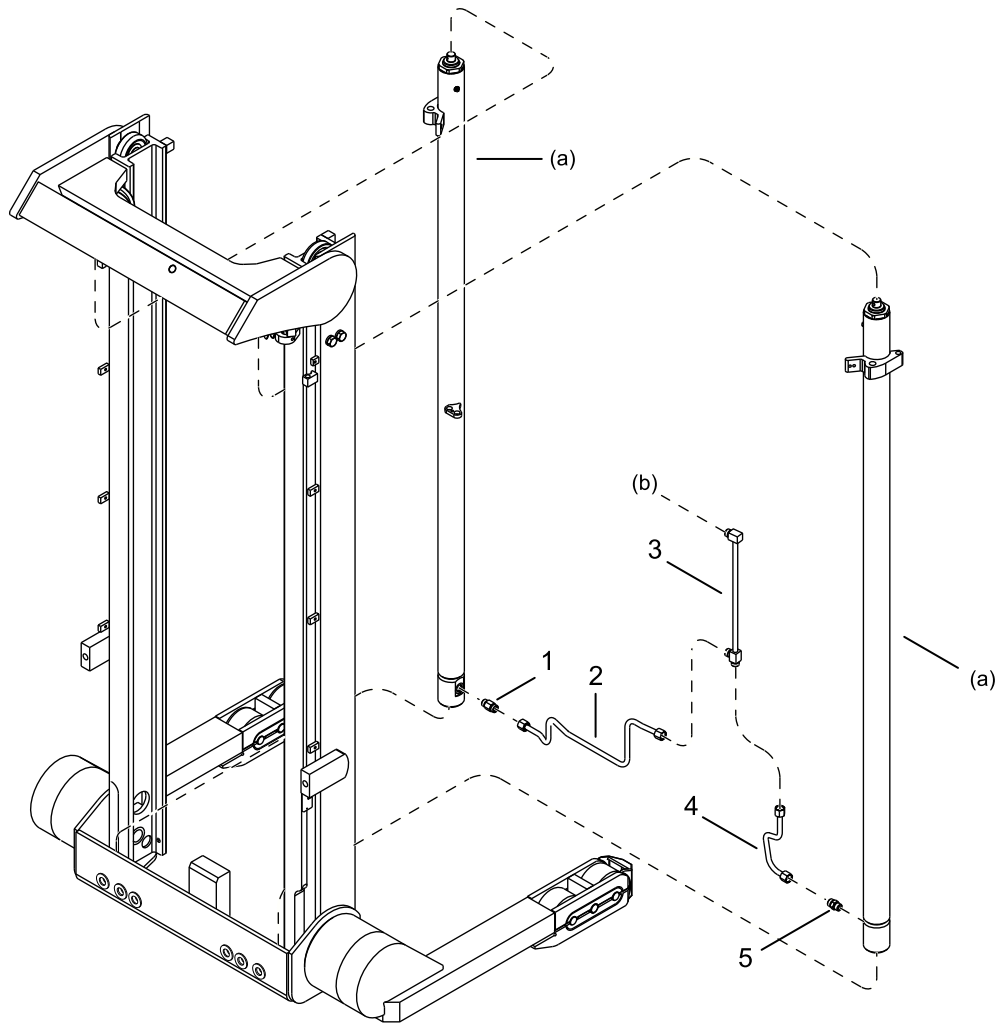


Figure 16637-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064254-317	Hose Assembly ⁽¹⁾	2
	064061-029	O-Ring	4
	064254-204	Hose Assembly ⁽²⁾	2
	064061-029	O-Ring	4
	064254-205	Hose Assembly ⁽³⁾	2
	064061-029	O-Ring	4
2	060042-006	Nut	2
3	123281	Hose Guide	3
4	060015-015	Screw	1
5	060015-049	Screw	1
6	121728	Tube Assembly	1
7	121729	Tube Assembly	1
8	064254-318	Hose Assembly ⁽¹⁾	2
	064061-029	O-Ring	4
	064254-214	Hose Assembly ⁽²⁾	2
	064061-029	O-Ring	4
	064254-215	Hose Assembly ⁽³⁾	2
	064061-029	O-Ring	4
9	060015-054	Screw	1
10	064254-277	Hose Assembly (SHR)	2
	064254-264	Hose Assembly (SH Not Shown)	2
	064061-029	O-Ring	4
11	064061-002	Elbow 90°	2

- ⁽¹⁾ 3962 mm (156 in) TT Mast
- ⁽²⁾ 4877 mm (192 in) TT Mast
- ⁽³⁾ 5334 mm (210 in) TT Mast

Always Specify Model, Data & Serial Number



- (a) See Cylinder Parts
- (b) To Hydraulic Manifold

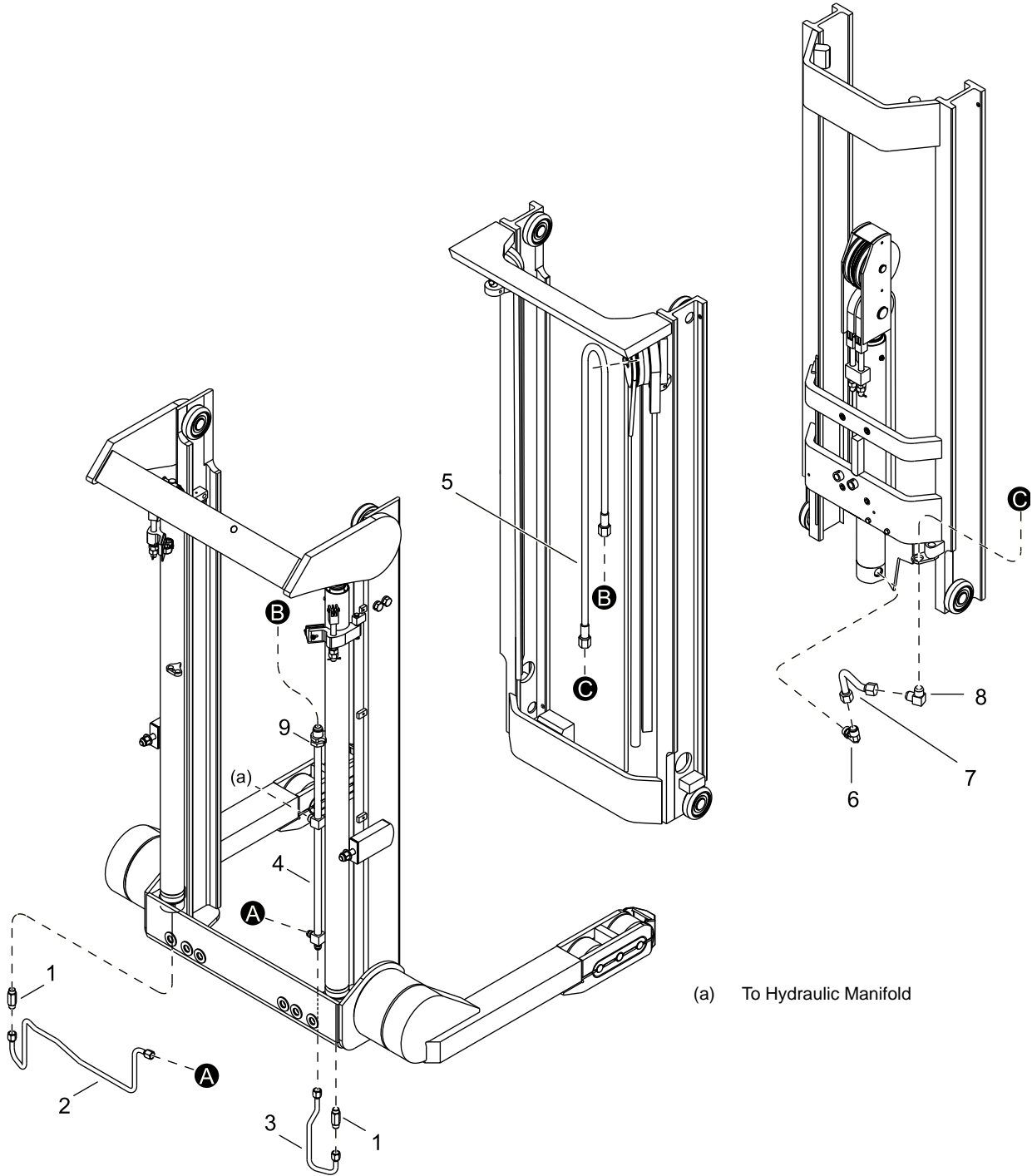
Figure 16627

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064464-001	Flow Limiter	1
2	140565	Tube Assembly	1
3	135177	Tube Assembly	1
4	140564	Tube Assembly	1
5	064279-008	Adapter	1

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Hydraulic System Mast TT



(a) To Hydraulic Manifold

Figure 16628

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064090-004	Connector	2
2	121856	Tube Assembly	1
3	126129	Tube Assembly	1
4	135178	Tube Assembly	1
5	064263-031	Hose Assembly - 3962 mm (156 in)	1
	064263-001	Hose Assembly - 4877 mm (192 in)	1
	064263-002	Hose Assembly - 5334 mm (210 in)	1
6	064061-016	Elbow	1
7	121737	Tube Assembly	1
8	064097-004	Elbow	1
9	064030-010	Nut Bulkhead	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach TL

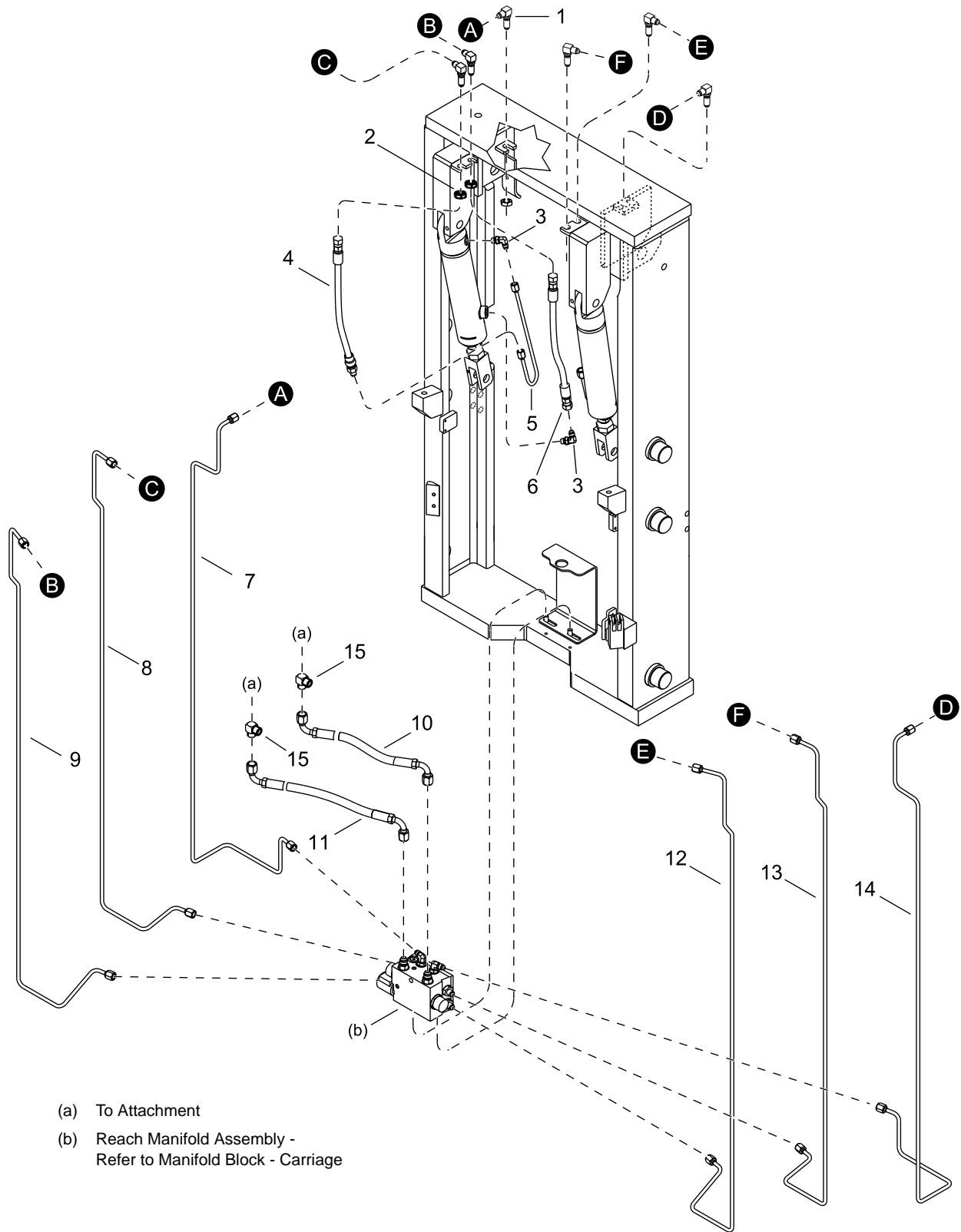


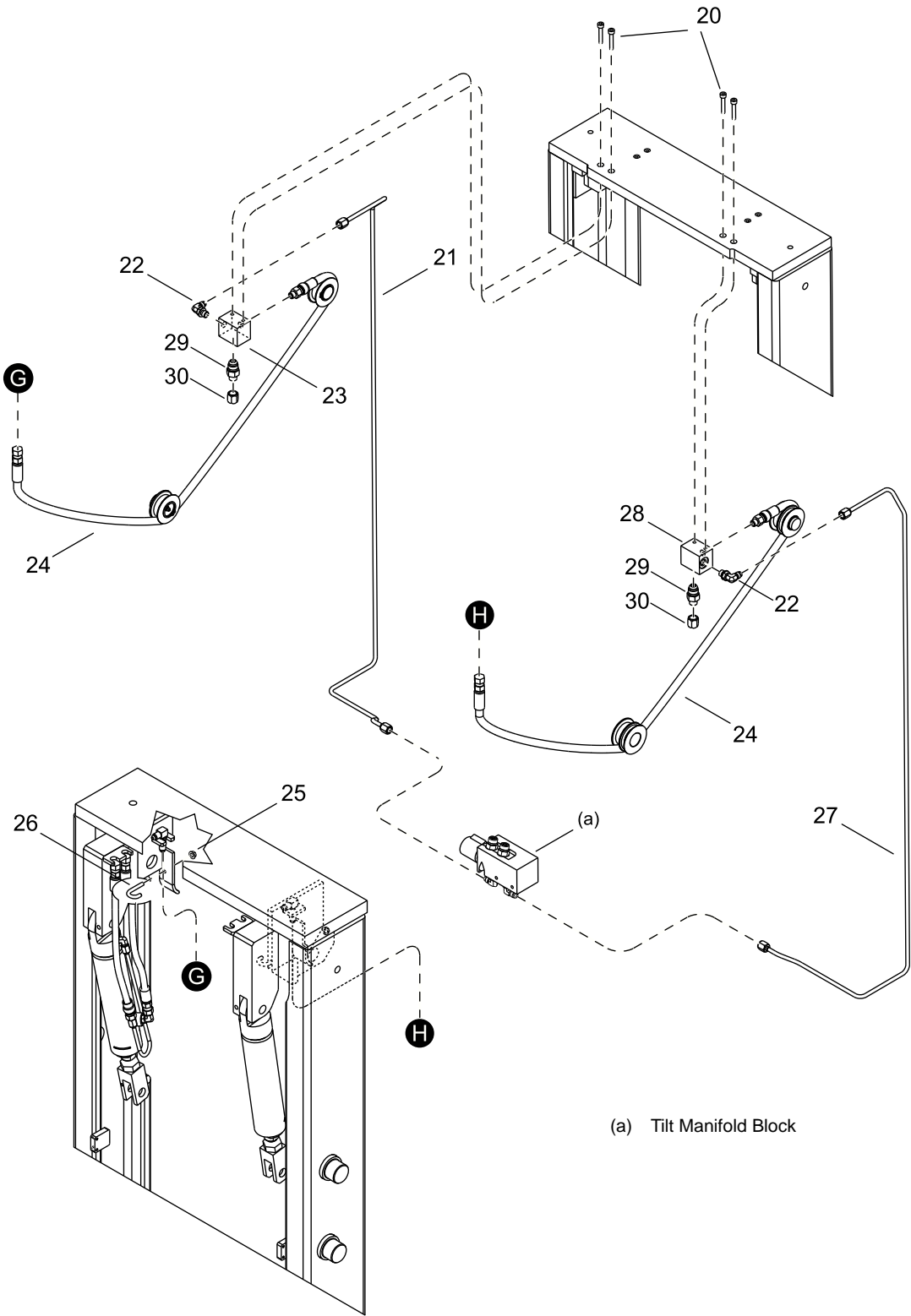
Figure 17162-03

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064034-003	Bulkhead Fitting	6
2	064030-004	Nut	6
3	064061-004	90° Elbow	4
	064019-031	O-Ring	8
4	064252-049	Hose Assembly	2
	064019-031	O-Ring	4
5	077389-005	Tube Assembly	2
	064019-031	O-Ring	4
6	064252-050	Hose Assembly	2
	064019-031	O-Ring	4
7	137159-002	Tube Assembly	1
8	137156-002	Tube Assembly	1
9	137155-002	Tube Assembly	1
10	064301-013	Hose Assembly	1
	064019-031	O-Ring	2
11	064301-012	Hose Assembly	1
	064019-031	O-Ring	2
12	134387-002	Tube Assembly	1
13	134388-002	Tube Assembly	1
14	137154-002	Tube Assembly	1
15	064061-002	Elbow 90° (SHR)	2
	064098-002	Elbow 45° (SH Not Shown)	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach TL



(a) Tilt Manifold Block

Figure 17163



HYDRAULIC PARTS

System Hydraulics - Reach TL

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20.....	050005-012.....	Screw	4
21.....	137157-002.....	Tube Assembly	1
22.....	064061-004.....	90° Elbow	2
	064019-031	O-Ring	4
23.....	137160-001.....	Hydraulic Block	1
24.....	064253-275.....	Hose Assembly	2
	064019-031	O-Ring	4
25.....	050068-002.....	Nut	2
26.....	134373	J Hook	2
27.....	137158-002.....	Tube Assembly	1
28.....	137160-002.....	Hydraulic Block	1
29.....	064004-002.....	Connector	2
	064019-031	O-Ring	2
	064019-029	O-Ring	2
30.....	064128-002.....	Cap	2

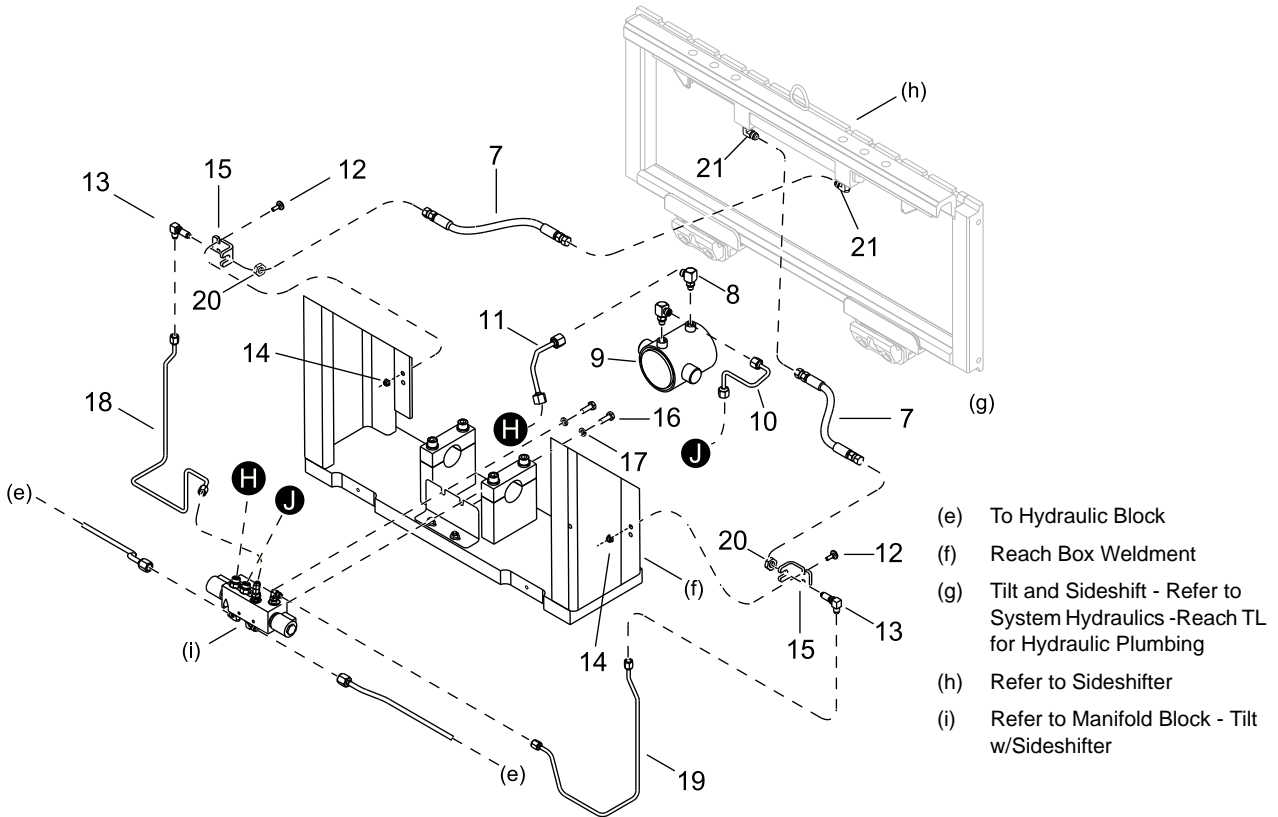
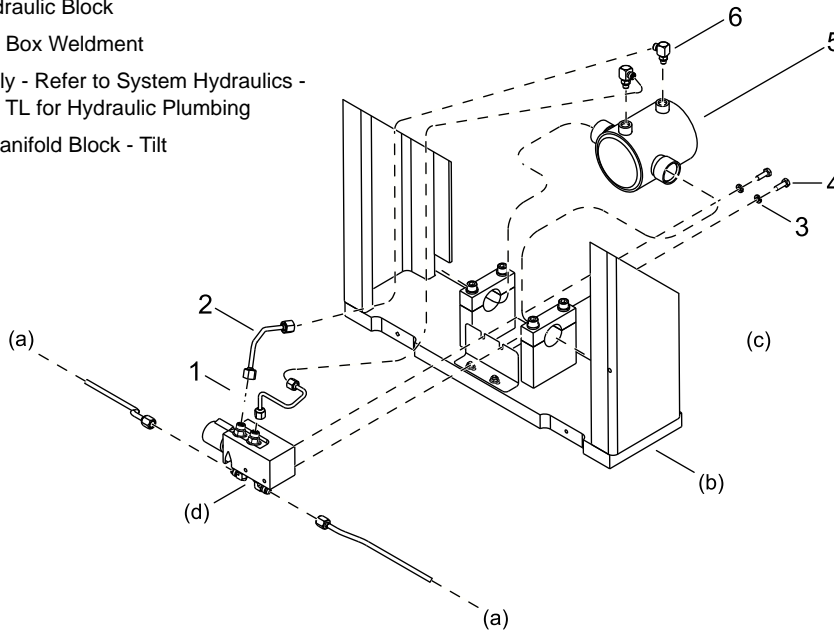
Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach/Tilt TL



- (a) To Hydraulic Block
- (b) Reach Box Weldment
- (c) Tilt Only - Refer to System Hydraulics - Reach TL for Hydraulic Plumbing
- (d) See Manifold Block - Tilt



- (e) To Hydraulic Block
- (f) Reach Box Weldment
- (g) Tilt and Sideshift - Refer to System Hydraulics - Reach TL for Hydraulic Plumbing
- (h) Refer to Sideshifter
- (i) Refer to Manifold Block - Tilt w/Sideshifter

Figure 17164-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134385	Tube Assembly	1
2	134386	Tube Assembly	1
3	060005-007	Lockwasher	2
4	060015-006	Screw	2
5	134371	Tilt Cylinder	1
6	064280-004	90° Adaptor	2
	064019-031	O-Ring	4
7	064253-276	Hose Assembly	2
	064019-004	O-Ring	2
	064019-014	O-Ring	2
8	064280-004	90° Adaptor	2
	064019-031	O-Ring	4
9	134371	Tilt Cylinder	1
10	134385	Tube Assembly	1
11	134386	Tube Assembly	1
12	050025-003	Bolt	4
13	064034-003	Bulkhead Fittings	2
14	050068-002	Nut	4
15	136728	Bracket	2
16	060015-006	Screw	2
17	060005-007	Lockwasher	2
18	137153-002	Tube Assembly	1
19	137152-002	Tube Assembly	1
20	069030-004	Nut	2
21	064061-002	Elbow 90°	2
	064019-031	O-Ring	4

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach TT

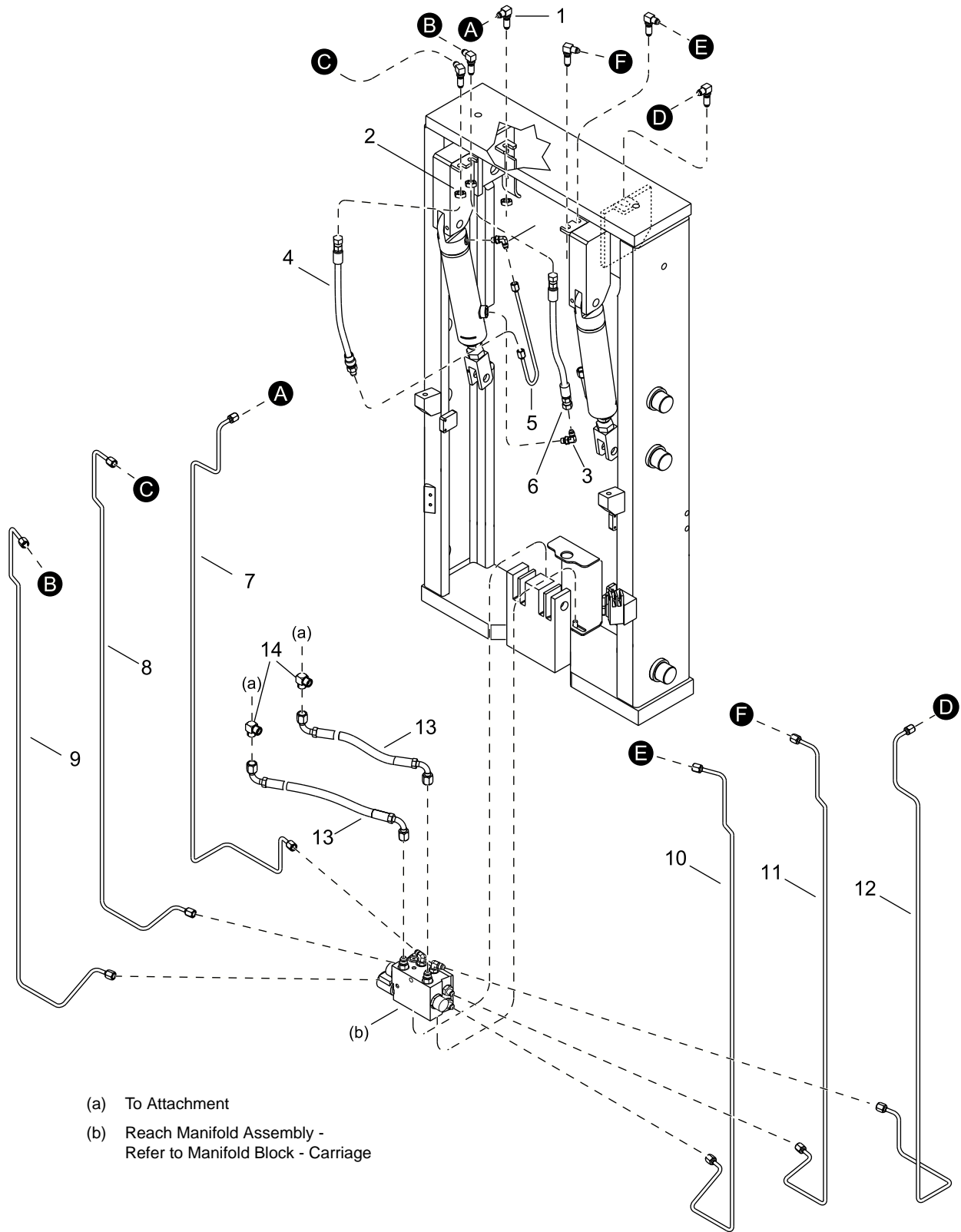


Figure 18503-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	064034-003	Bulkhead Fitting	6
2	064030-004	Nut	6
3	064061-004	90° Elbow	4
	064019-031	O-Ring	8
4	064252-049	Hose Assembly	2
	064019-031	O-Ring	4
5	077389-005	Tube Assembly	2
6	064252-050	Hose Assembly	2
	064019-031	O-Ring	4
7	137159-001	Tube Assembly	1
8	137156-001	Tube Assembly	1
9	137155-001	Tube Assembly	1
10	134387-001	Tube Assembly	1
11	134388-001	Tube Assembly	1
12	137154-001	Tube Assembly	1
13	064254-311	Hose Assembly	1
	064061-014	O-Ring	2
	064254321	Hose Assembly	1
	064061-014	O-Ring	2
14	064061-002	Elbow 90°	2
	064061-031	O-Ring	4

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach TT

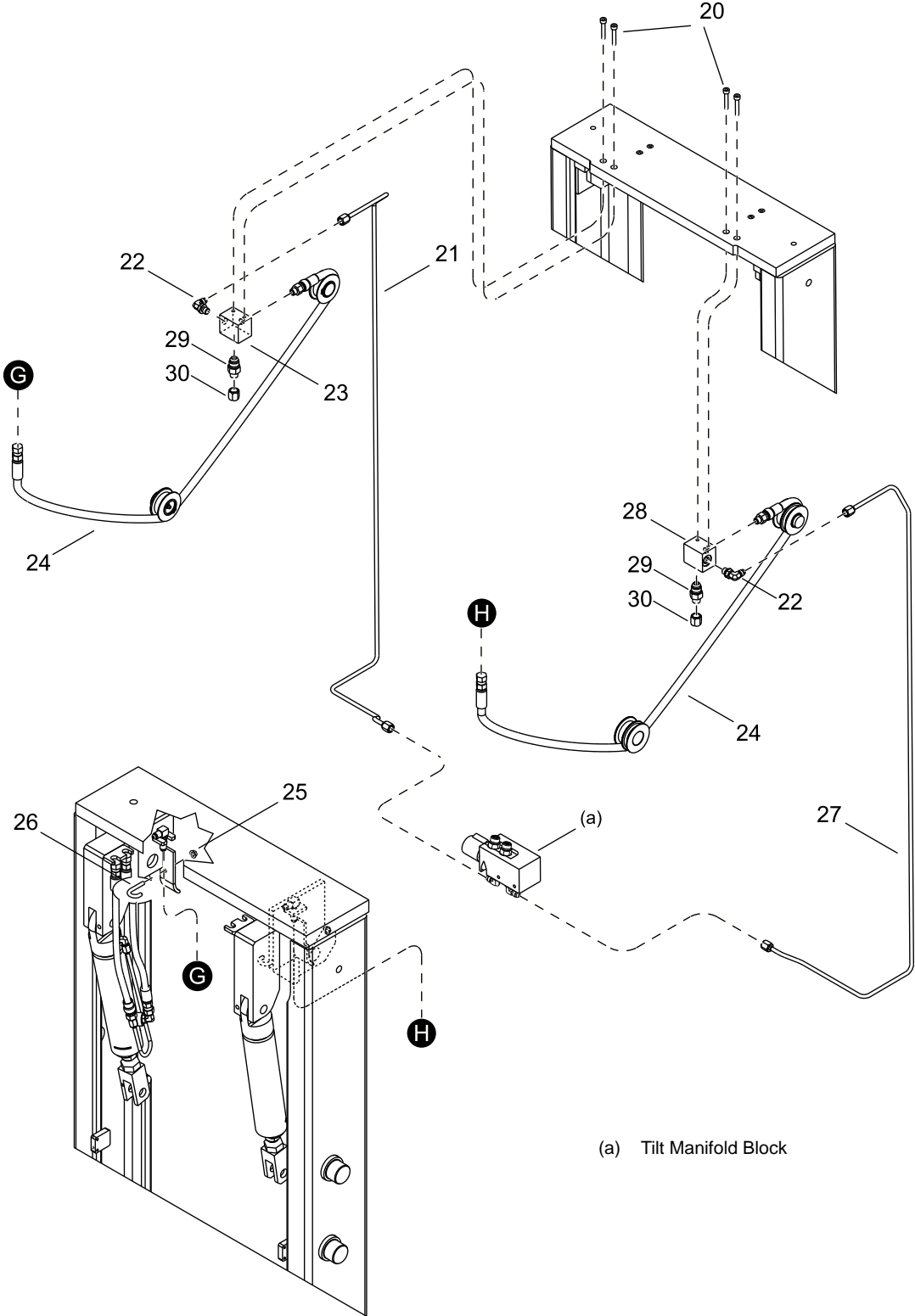


Figure 17163



HYDRAULIC PARTS

System Hydraulics - Reach TT

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20.....	050005-012.....	Screw	4
21.....	137157-001.....	Tube Assembly	1
22.....	064061-004.....	90° Elbow	2
	064019-031.....	O-Ring	4
23.....	137160-001.....	Hydraulic Block	1
24.....	064253-275.....	Hose Assembly	2
	064019-031.....	O-Ring	4
25.....	050068-002.....	Nut.....	2
26.....	134373	J Hook.....	2
27.....	137158-001.....	Tube Assembly	1
28.....	137160-002.....	Hydraulic Block	1
29.....	064004-002.....	Connector	2
30.....	064128-002.....	Cap	2

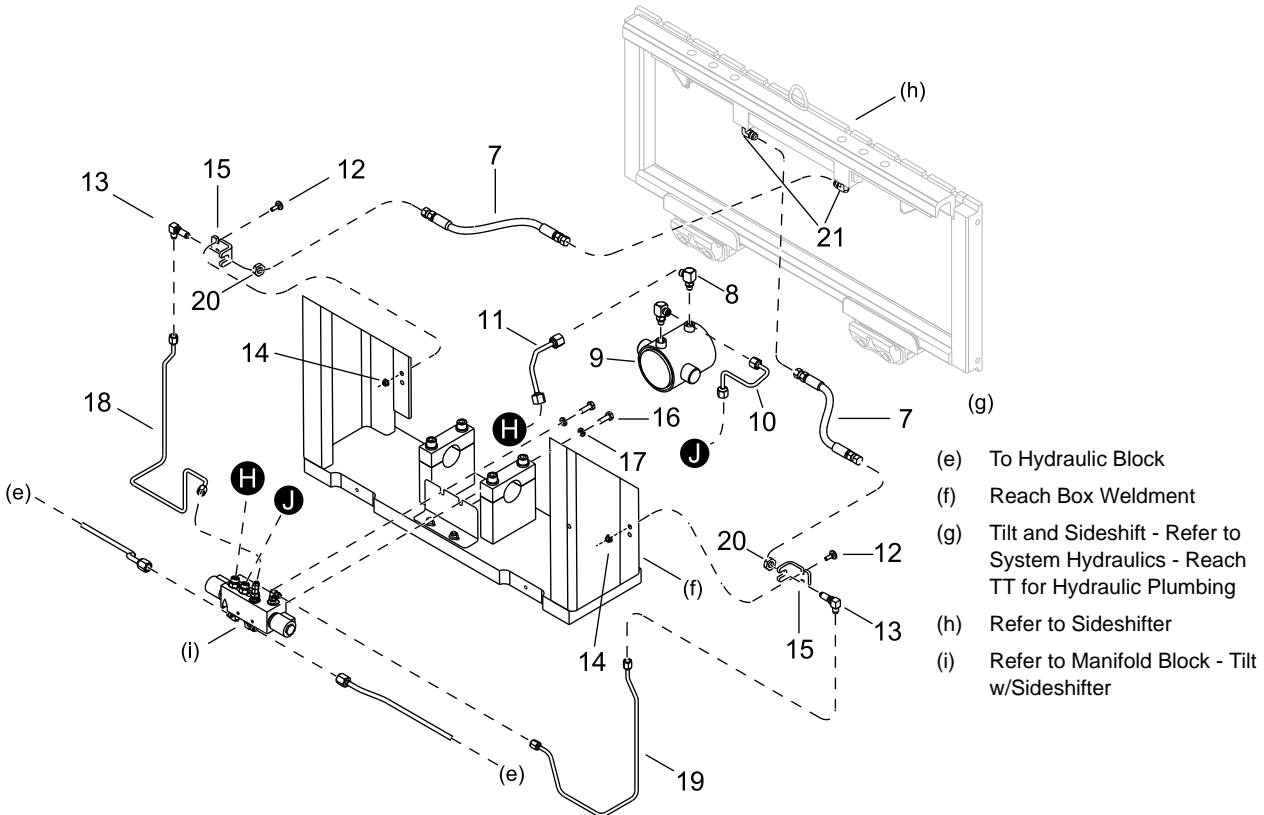
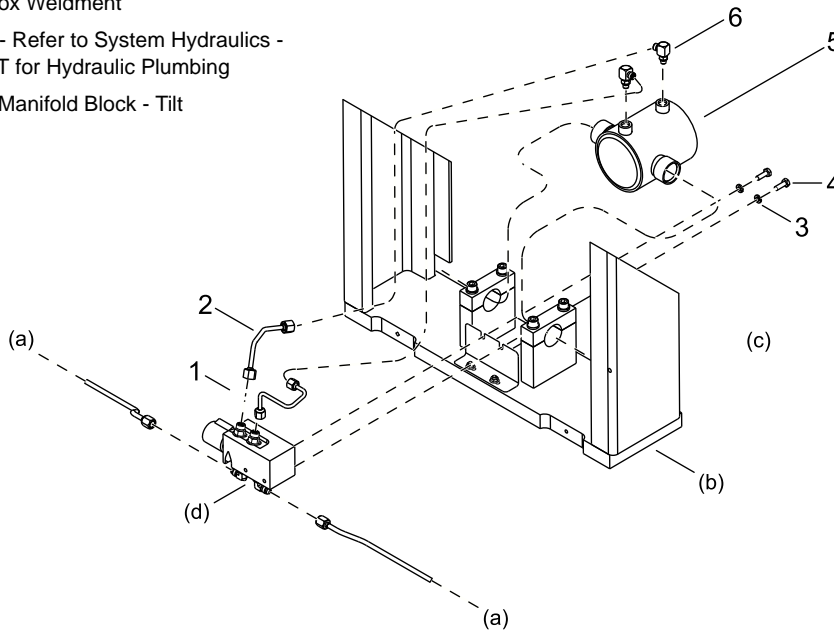
Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

System Hydraulics - Reach/Tilt TT



- (a) To Hydraulic Block
- (b) Reach Box Weldment
- (c) Tilt Only - Refer to System Hydraulics - Reach TT for Hydraulic Plumbing
- (d) Refer to Manifold Block - Tilt



- (e) To Hydraulic Block
- (f) Reach Box Weldment
- (g) Tilt and Sideshift - Refer to System Hydraulics - Reach TT for Hydraulic Plumbing
- (h) Refer to Sideshifter
- (i) Refer to Manifold Block - Tilt w/Sideshifter

Figure 18561-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134385	Tube Assembly	1
2	134386	Tube Assembly	1
3	060005-007	Lockwasher	2
4	060015-006	Screw	2
5	134371	Tilt Cylinder	1
6	064280-004	90° Adaptor	2
	064019-031	O-Ring	4
7	064253-277	Hose Assembly	2
	064019-004	O-Ring	4
	064019-014	O-Ring	4
8	064280-004	90° Adaptor	2
	064019-031	O-Ring	4
9	134371	Tilt Cylinder	1
10	134385	Tube Assembly	1
11	134386	Tube Assembly	1
12	050025-003	Bolt	4
13	064034-003	Bulkhead Fittings	2
	064019-031	O-Ring	4
14	050068-002	Nut	4
15	136728	Bracket	2
16	060015-006	Screw	2
17	060005-007	Lockwasher	2
18	137153-001	Tube Assembly	1
19	137152-001	Tube Assembly	1
20	064030-004	Nut	2
21	064061-002	Elbow 90°	2
	064019-031	O-Ring	4

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Lift Pump

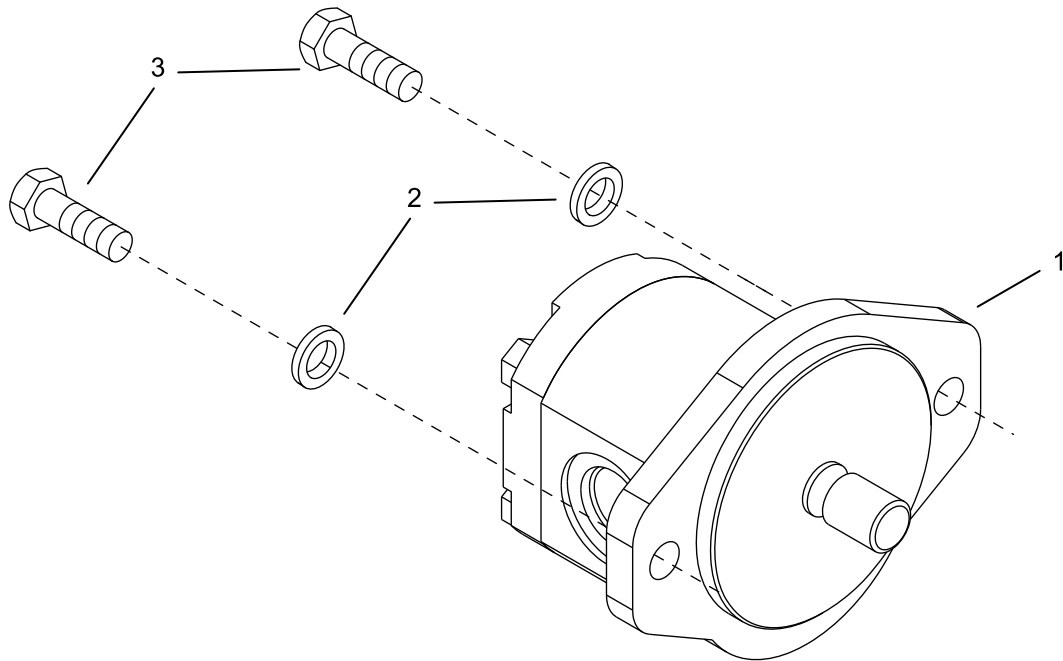


Figure 16535-01



HYDRAULIC PARTS

Lift Pump

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	139738	Lift Pump	1
2	060005-009	Lockwasher	2
3	060017-096	Screw	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Lift Pump Motor

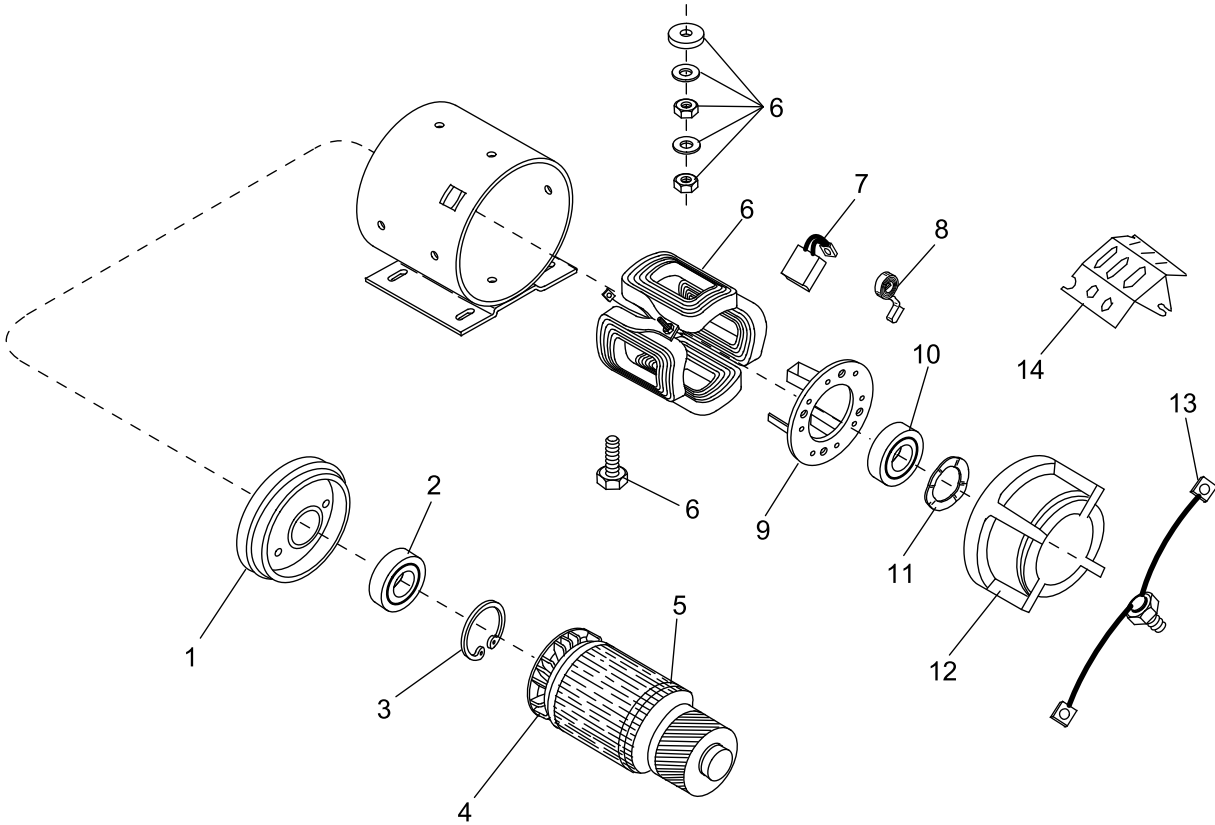


Figure 16534



HYDRAULIC PARTS

Lift Pump Motor

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	114330	24 V Pump Motor	1
1	116696	Endhead Drive	1
2	065081-023	Bearing	1
3	060009-147	Retaining Ring	1
4	116699	Fan	1
5	116700	Armature Assembly Includes Index 4	1
6	116698	Field Coil Kit	1
7	118913	Brush Set Includes 4 Brushes	1
8	116702	Brush Spring	4
9	116703	Brush Box and Plate Assembly	1
10	116705	Bearing	1
11	116706	Wavy Washer	1
12	116707	Endhead Commutator	1
13	116704	Lead Assembly	1
14	116708	Brush Cover Plate	1
	147088	Pump Motor Kit ⁽¹⁾	1

⁽¹⁾ Includes Terminal Insulator, Insulating Washer & Backboard Insulator

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Manifold Block without Accessories

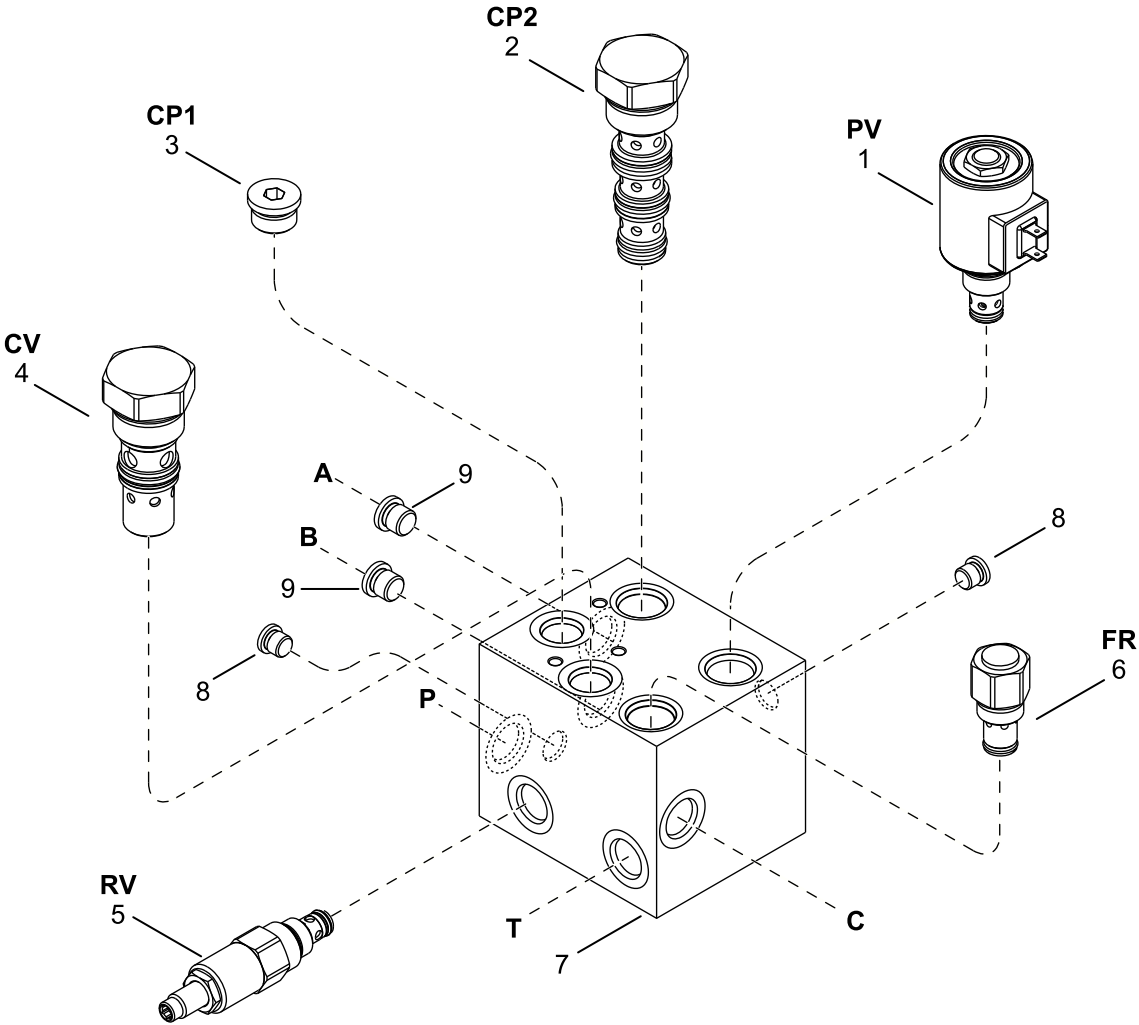
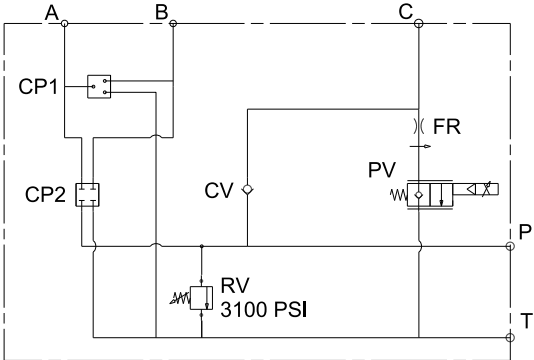


Figure 16530

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139737	Valve Assembly Used on SH without Accessories Only	1
1	134152-002	Solenoid Valve	1
	104164-005	Coil	1
	111790-003	Seal Kit	1
2	140610-001	Plug Valve	1
	123977	Seal Kit	1
3	064091-001	Plug w/O-Ring	1
4	140611-001	Check Valve	1
	111790-001	Seal Kit	1
5	140608-001	Relief Valve	1
	111790-001	Seal Kit	1
6	123704-002	Flow Regulator Valve	1
	125169	Seal Kit	1
7	142810	Manifold Block	1
8	064091-006	Plug w/O-Ring	2
9	064091-002	Plug w/O-Ring	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Manifold Block with Accessories

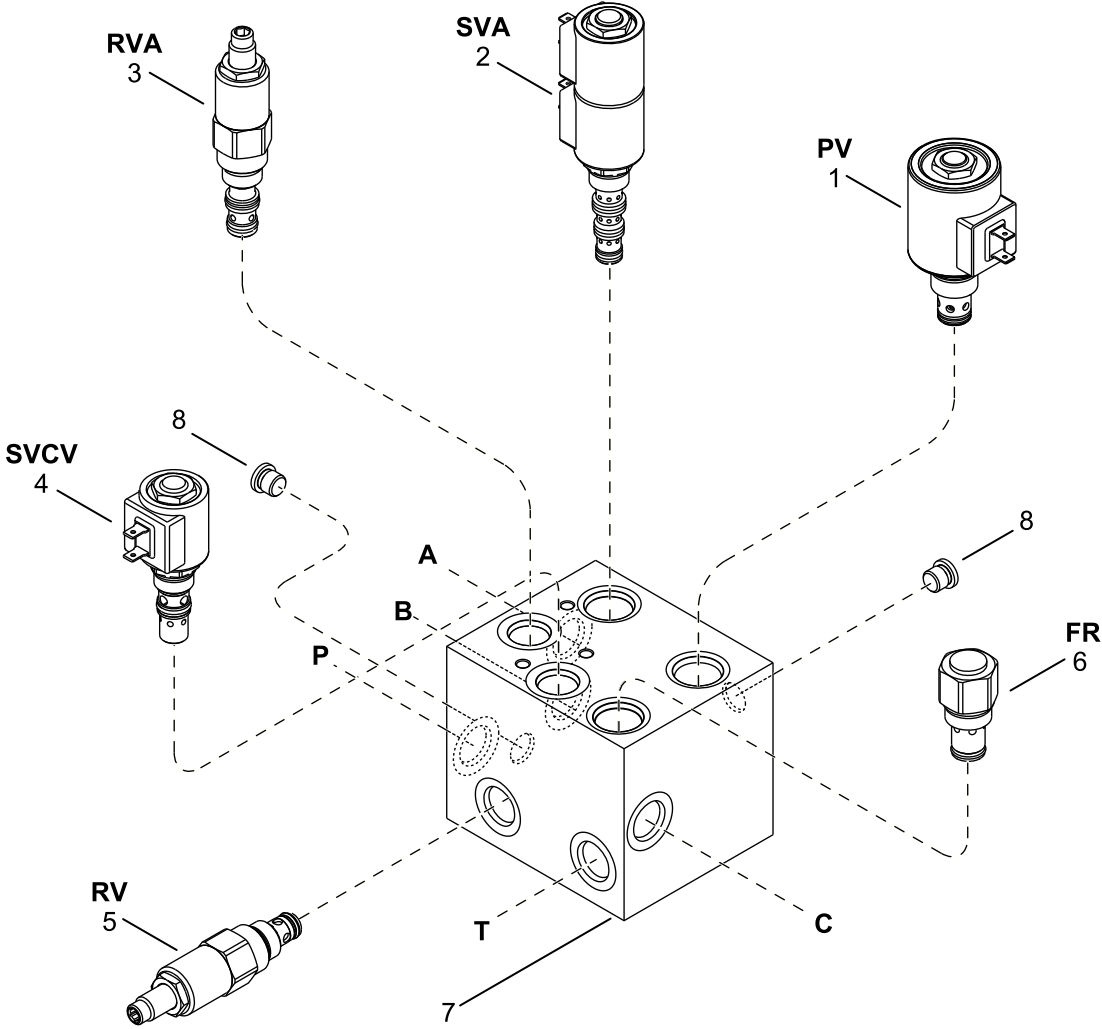
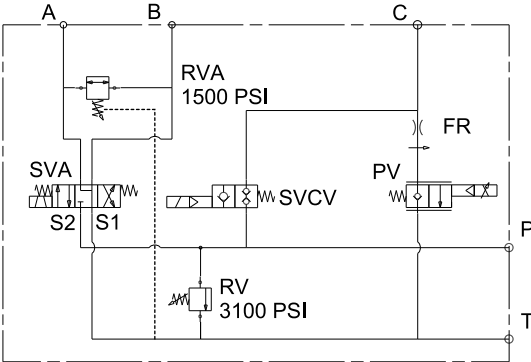


Figure 16527



HYDRAULIC PARTS

Manifold Block with Accessories

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139736	Valve Assembly Used on SHR and SH w/1 Accessory	1
1	134152-002	Solenoid Valve	1
	104164-005	Coil	1
	111790-003	Seal Kit	1
2	140607-001	Solenoid Valve	1
	104164-002	Coil	2
	123977	Seal Kit	2
3	140606-001	Relief Valve	1
	111790-032	Seal Kit	1
4	140605-001	Solenoid Valve	1
	104164-002	Coil	1
	111790-005	Seal Kit	1
5	140608-001	Relief Valve	1
	111790-001	Seal Kit	1
6	123704-002	Flow Restrictor Valve	1
	125169	Seal Kit	1
7	142810	Manifold Block	1
8	064091-006	Plug w/O-Ring	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Manifold Block - Carriage

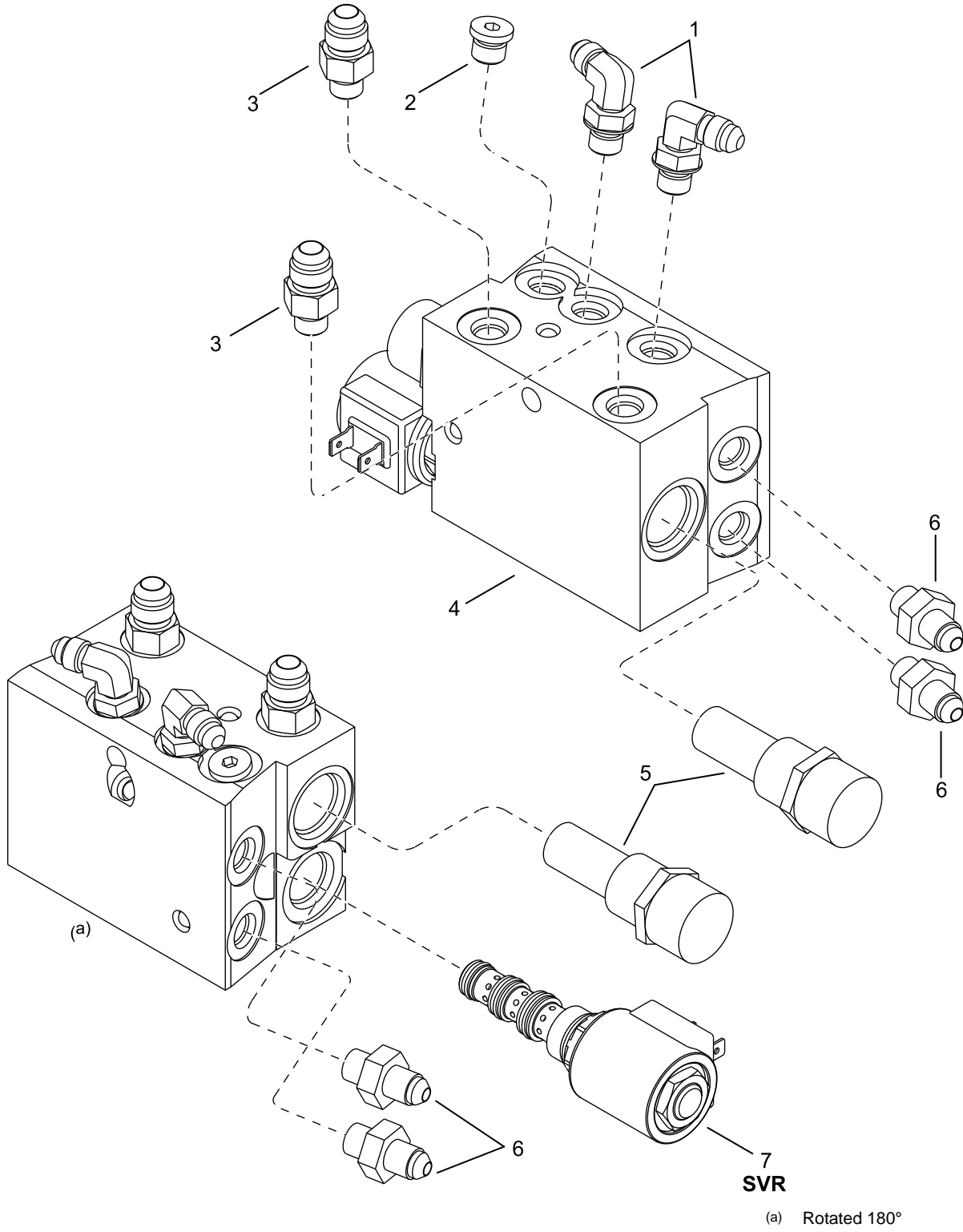


Figure 16566

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	140700	Reach Manifold Assembly	1
1	064061-004	90° Elbow	2
2	064091-006	Plug w/O-Ring	1
3	064004-002	Connector	2
4	125928	Manifold Block Assembly	1
	122166	Manifold Block	1
	046271-312	Expansion Plug	4
5	121819	Counterbalance Valve	2
	111790-002	Seal Kit	2
6	064004-007	Connector	4
7	122167-003	Solenoid Valve	1
	104164-002	Coil	1
	123977	Seal Kit	1

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Manifold - Tilt

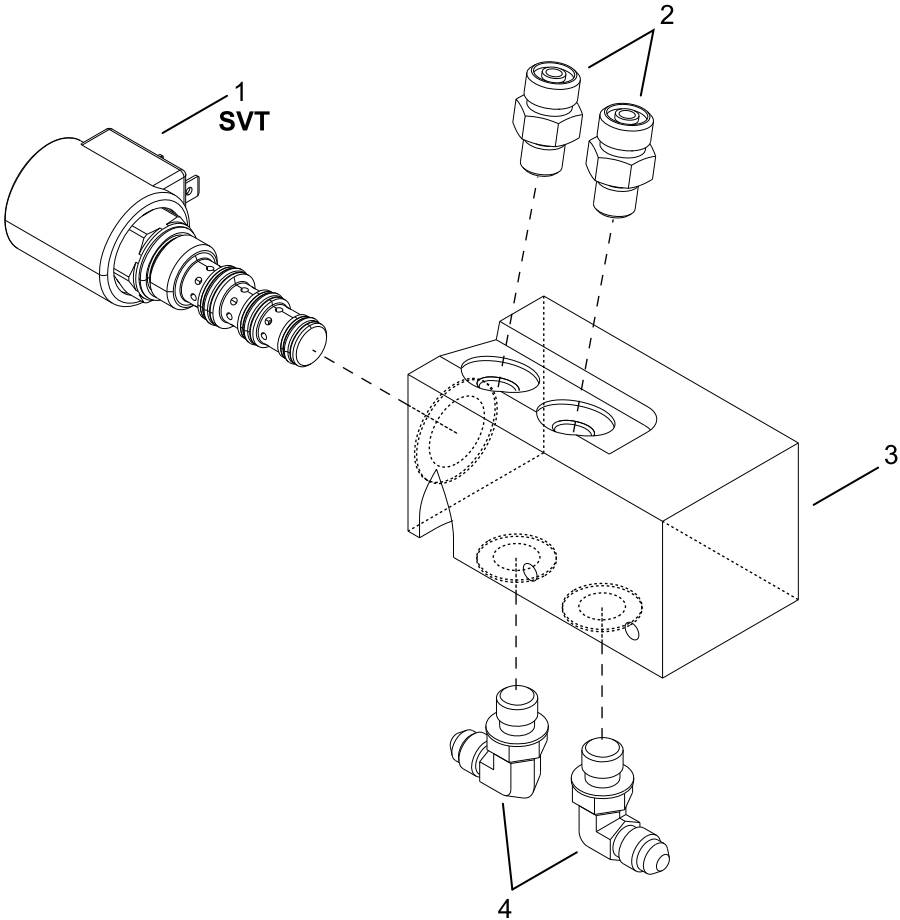


Figure 16567

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	140701	Tilt Manifold Assembly	1
1	122167-003	Solenoid Valve	1
	104164-002	Coil	1
	123977	Seal Kit.	1
2	064279-004	Adapter	2
3	122172	Manifold Block - Tilt	1
4	064061-004	90° Elbow.	2

Always Specify Model, Data & Serial Number

HYDRAULIC PARTS

Manifold - Tilt/Sideshifter

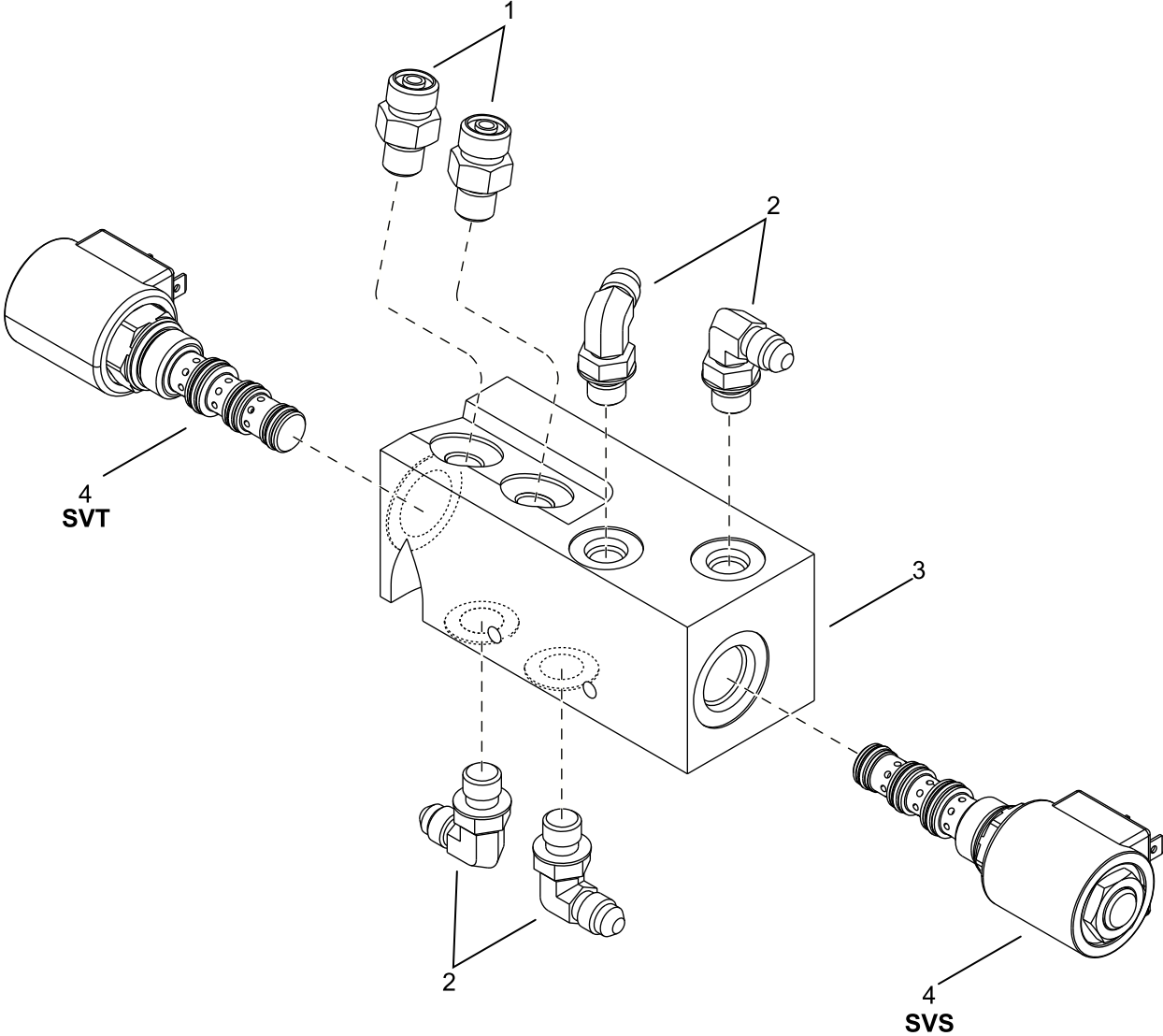


Figure 16568

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	140702	Manifold Block Tilt/SS Assembly	1
1	064279-004	Adapter	2
2	064061-004	90° Elbow	4
3	125929	Manifold Block Assembly	1
	122171	Manifold Block Tilt/SS	1
	064271-312	Expansion Plug	3
4	122167-003	Solenoid Valve	2
	104164-002	Coil	2
	123977	Seal Kit	2

Always Specify Model, Data & Serial Number

Notes:



DRIVE UNIT PARTS

DRIVE UNIT PARTS

Drive Unit

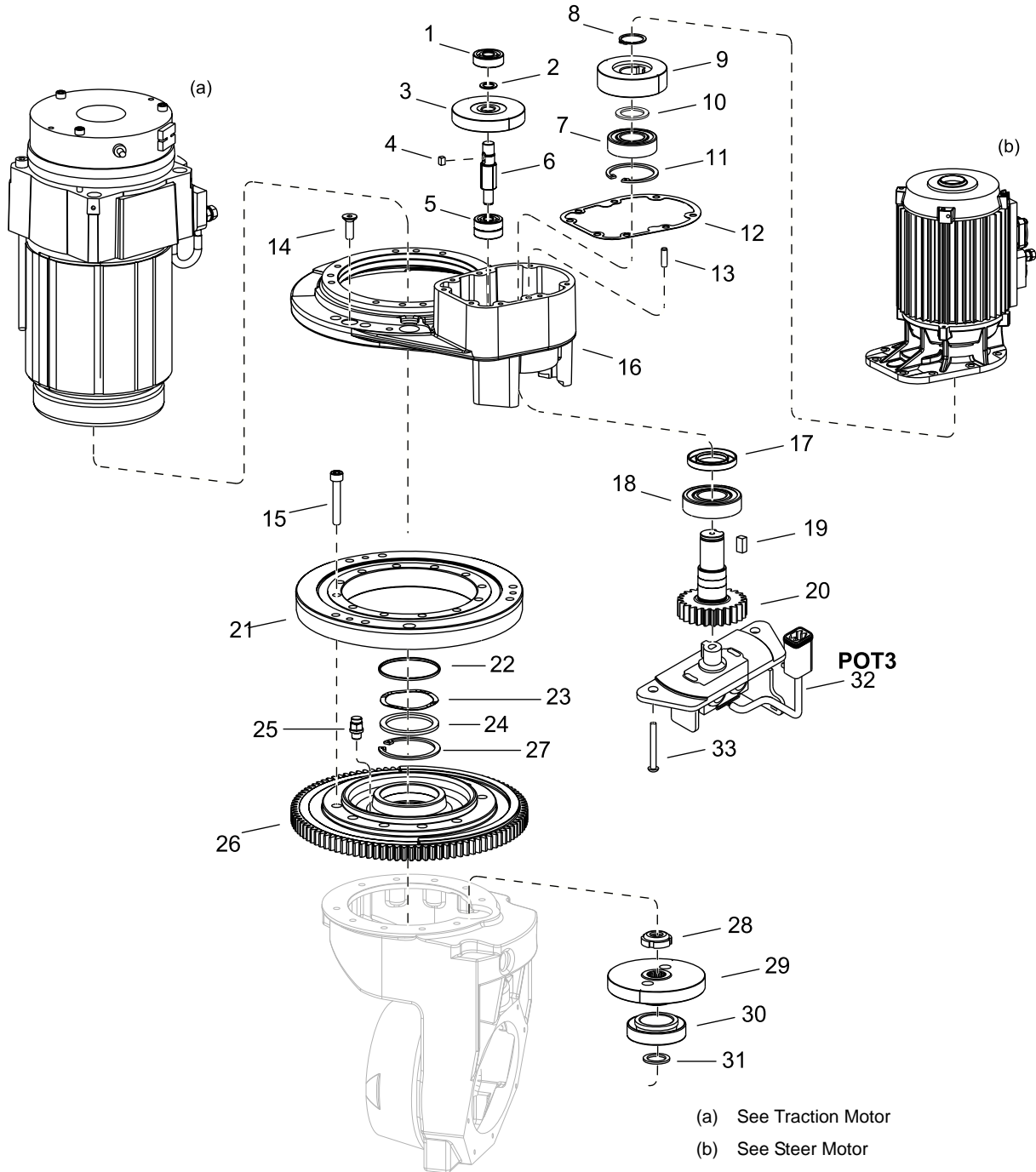


Figure 17428

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	822158	Bearing	1
2	822164	Washer	1
3	821434	Gear	1
4	821587	Woodruff Key	1
5	822159	Bearing	1
6	821431	Pinion	1
7	822161	Bearing	1
8	821459	Retaining Ring	1
9	821432	Gear	1
10	821444	Washer	1
11	822163	Retaining Ring	1
12	821469	Seal	1
13	821456	Pin	2
14	050003-061	Screw	3
15	821607	Screw	10
16	821563	Flange	1
17	822165	Seal	1
18	822160	Bearing	1
19	821588	Woodruff Key	1
20	821560	Gear	1
21	821460	Bearing	1
22	821470	O-Ring	1
23	821463	Washer Set	1
24	822156	Washer	1
25	821454	Breather	1
26	821446	Gear	1
27	822155	Retaining Ring	1
28	821462	Nut	1
29	821562	Gear	1
30	821603	Bearing	1
31	821466	Washer	1
32	815096	FB Potentiometer	1
33	060065-013	Screw	2

Always Specify Model, Data & Serial Number

DRIVE UNIT PARTS

Drive Unit

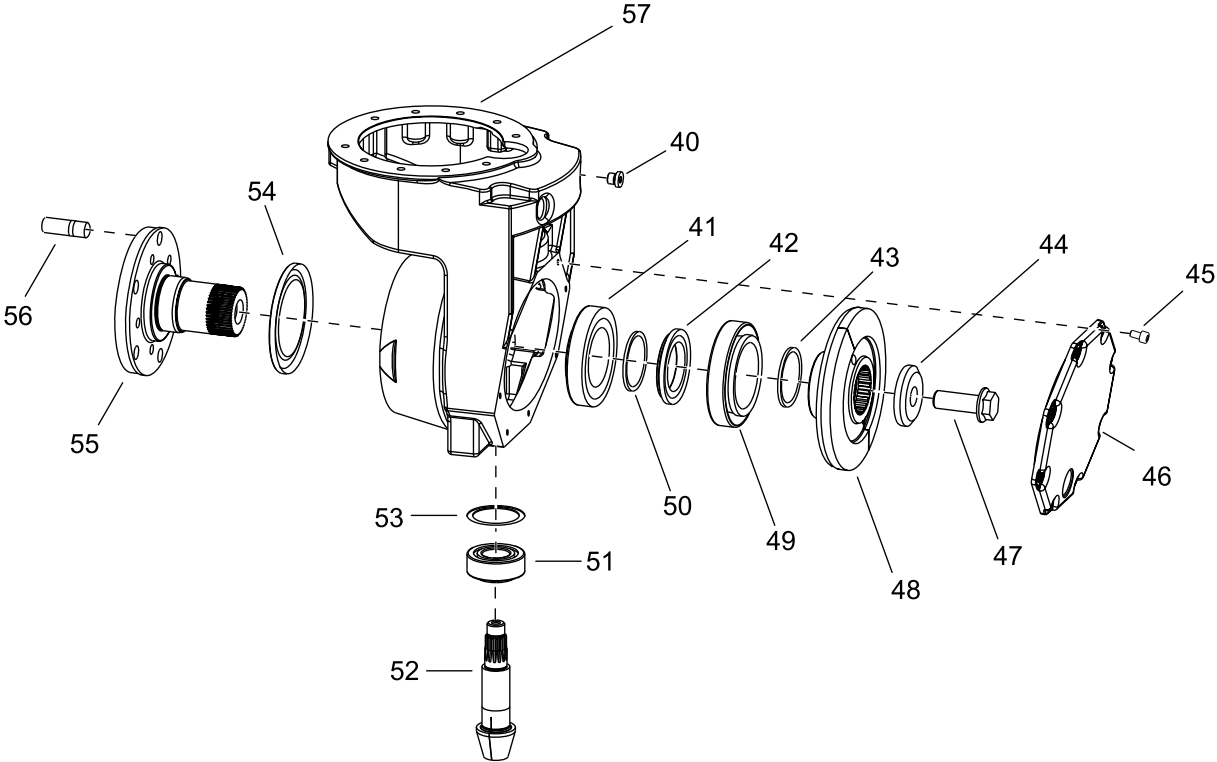


Figure 18743

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40.....	822154	Screw	2
41.....	821606	Bearing	1
42.....	821436	Bushing	1
43.....	821610	Washer	1
44.....	821452	Washer	1
45.....	822661	Screw	8
46.....	822658	Cap	1
47.....	821461	Screw	1
48.....	821455	Gear Set	1
49.....	821605	Bearing	1
50.....	821609	Washer	1
51.....	821604	Bearing	1
52.....	821455	Gear Set	1
53.....	822150	Washer	1
54.....	821608	Seal	1
55.....	821437	Shaft	1
56.....	821442	Pin	5
57.....	821595	Gear Box Housing	1

Always Specify Model, Data & Serial Number

DRIVE UNIT PARTS

Steering Feedback Assembly

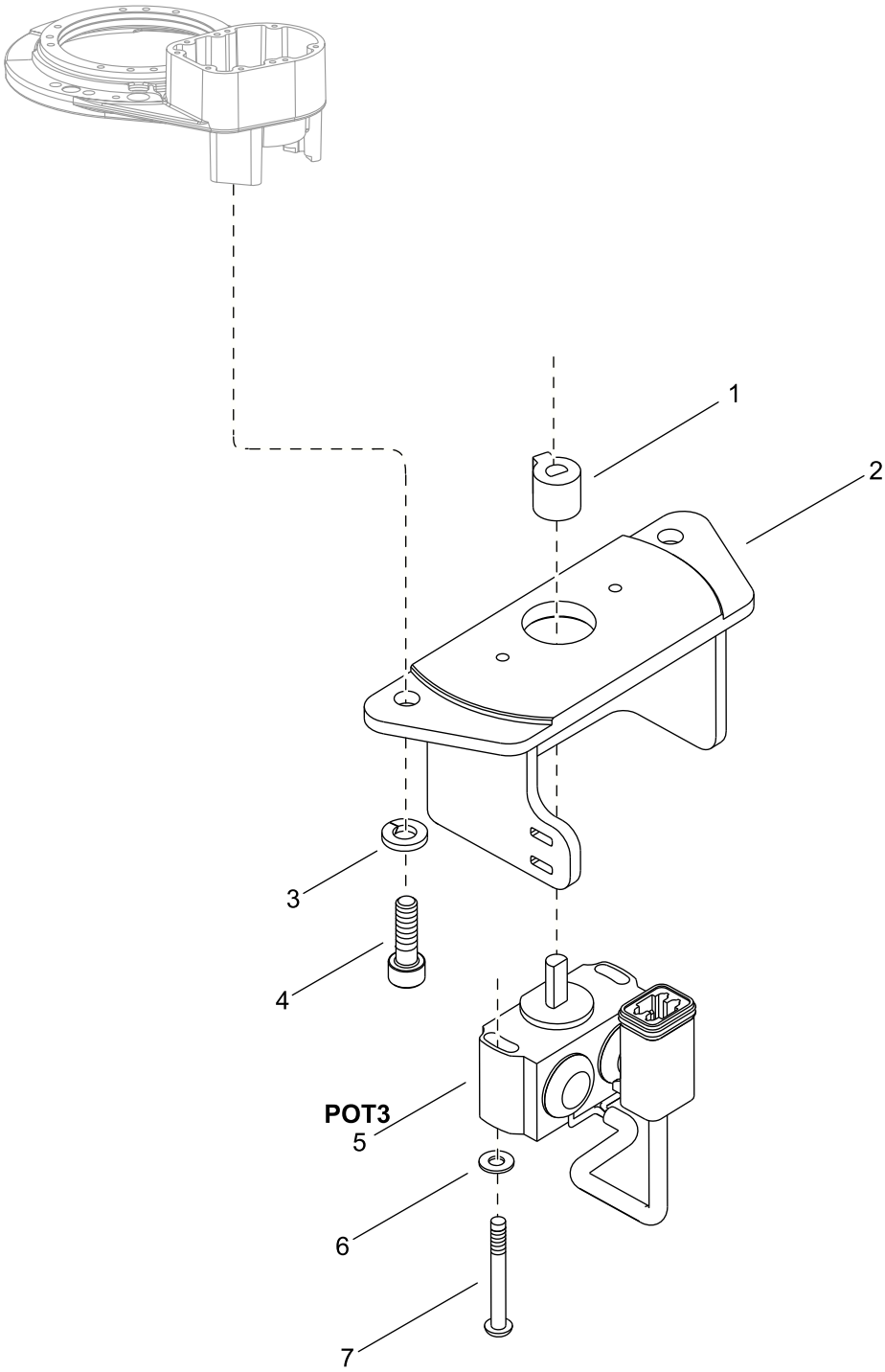


Figure 19296

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	140558	Rubber Coupling	1
2	140426	Feedback Bracket	1
3	060005-007	Lockwasher	2
4	060062-006	Screw	2
5	815096	Feedback Potentiometer	1
6	060030-045	Flatwasher	2
7	060065-015	Screw	2

Always Specify Model, Data & Serial Number

DRIVE UNIT PARTS

Traction Motor

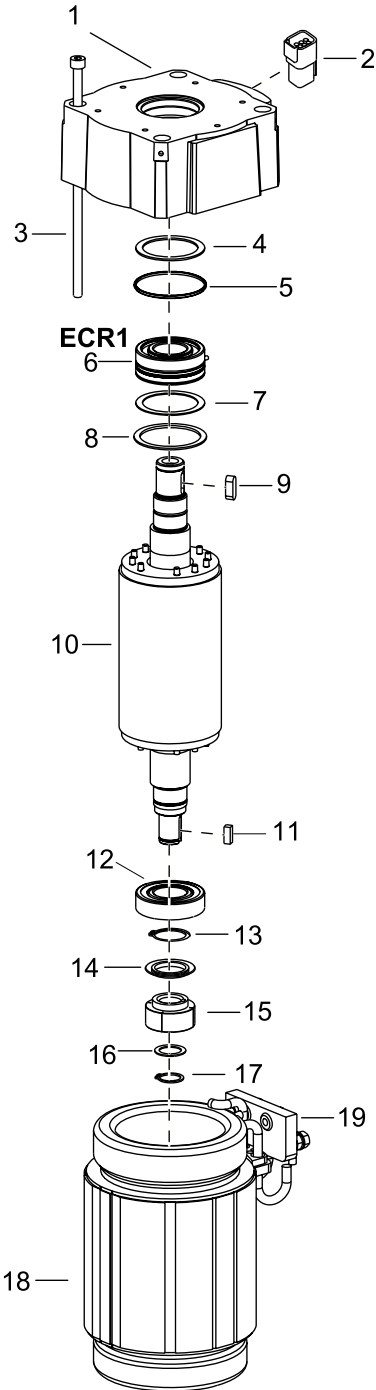


Figure 17429-01

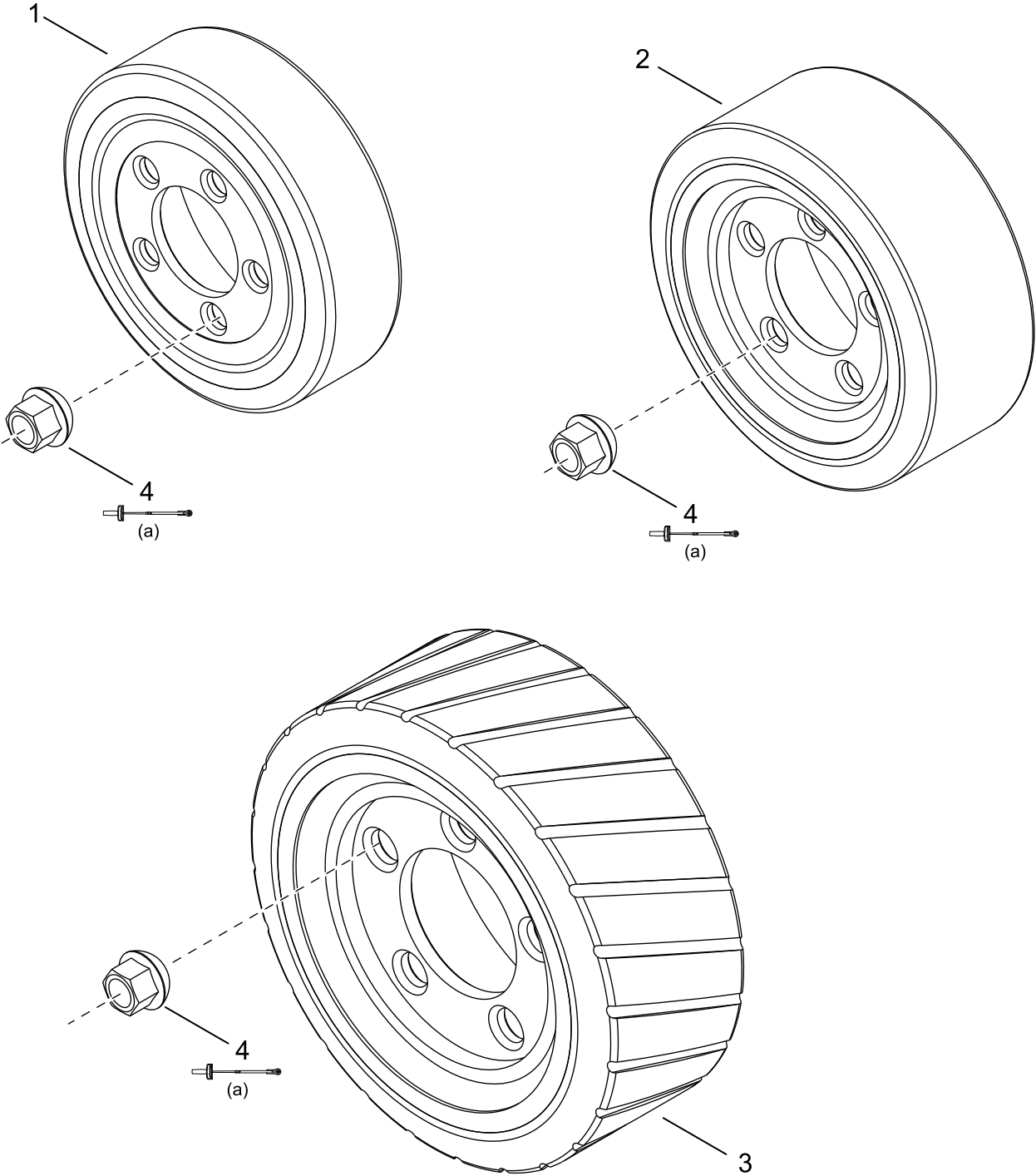
INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	821581	Traction Motor	1
1	821564	Cover Motor End	1
2	062756-004	Deutsch Connector	1
	062798-007	Connector Insert	1
3	821570	Screw	4
4	821597	Shim	1
	821598	Shim	1
5	821470	O-Ring	1
6	821566	Sensor Bearing	1
7		Washer ⁽¹⁾	1
8	821596	Retaining Ring	1
9	821571	Woodruf Key	1
10	821594	Rotor	1
11	821586	Woodruf Key	1
12	821601	Bearing	1
13	050012-008	Retaining Ring	1
14		Washer ⁽¹⁾	1
15	821561	Gear	1
16	822152	Washer	1
17	822153	Retaining Ring	1
18	821557	Stator	1
19	146060	Insulator Terminal Block, Traction	1

⁽¹⁾ Not Available - Contact Factory

Always Specify Model, Data & Serial Number

DRIVE UNIT PARTS

Drive Tire



(a) See "Drive Tire Replacement" for torque values and sequence

Figure 16625-01



DRIVE UNIT PARTS

Drive Tire

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	802846	Drive Tire (Vulkollan®)	1
2	140346-001	Drive Tire (Poly)	1
3	140346-002	Drive Tire (Poly, Siped)	1
4	050062-001	Nut	5

Always Specify Model, Data & Serial Number

Notes:



ELECTRICAL PARTS

ELECTRICAL PARTS

Electrical Components - Power Unit

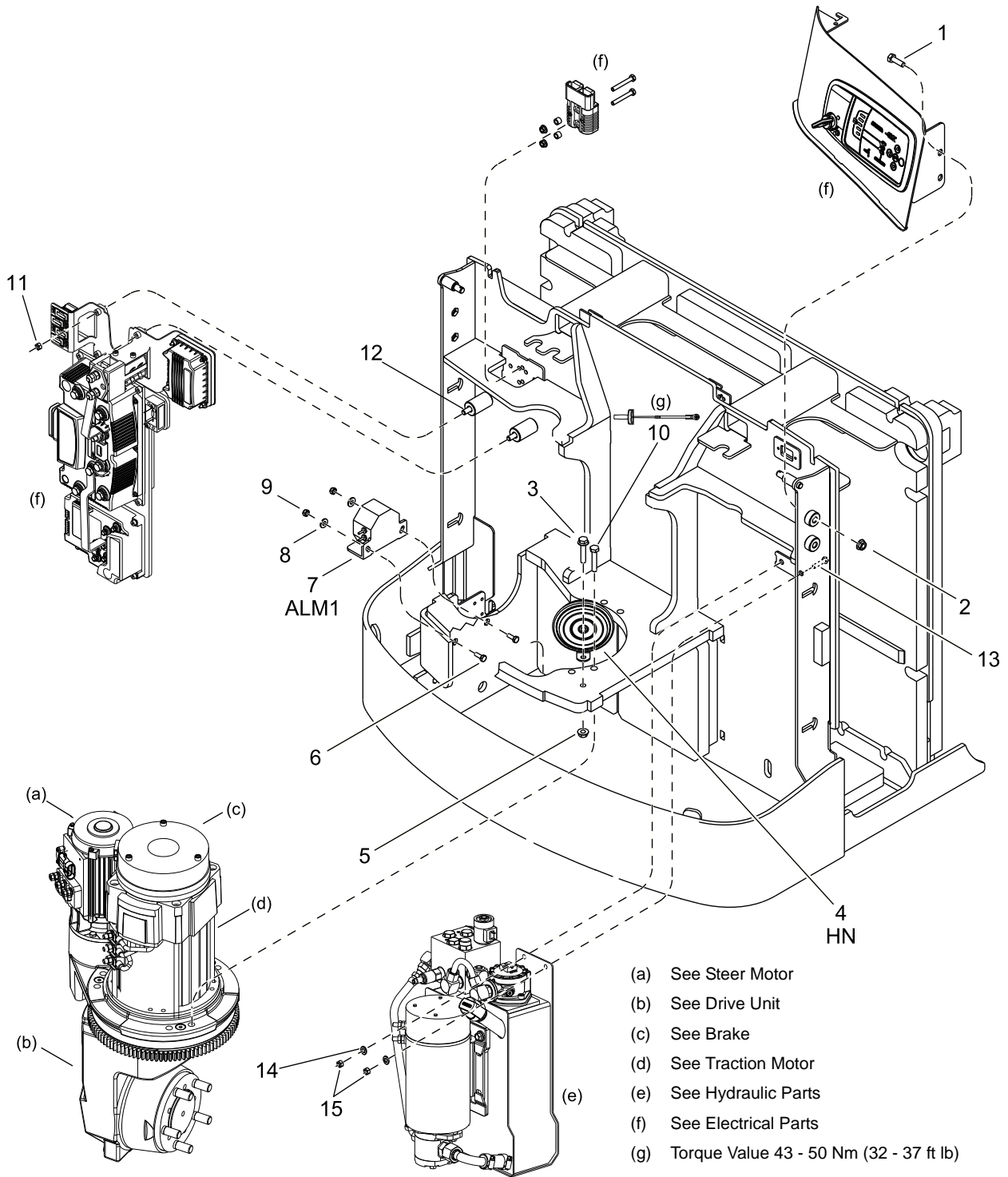


Figure 17165-01



ELECTRICAL PARTS

Electrical Components - Power Unit

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	060063-004	Screw	2
2	060059-028	Nut	2
3	050067-025	Screw	1
4	078708-002	Horn	1
5	050068-003	Nut	1
6	060062-063	Screw ⁽¹⁾	2
7	115565	Alarm ⁽¹⁾	1
8	060030-132	Flatwasher ⁽¹⁾	2
9	050008-027	Nut ⁽¹⁾	2
10	060075-044	Bolt	6
11	060059-001	Nut	2
12	060063-007	Screw	2
13	060063-006	Screw	2
14	060030-017	Flatwasher	2
15	060059-028	Nut	2

⁽¹⁾ Only used on trucks with Travel Alarm Option

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Panel - SH - SH F/C

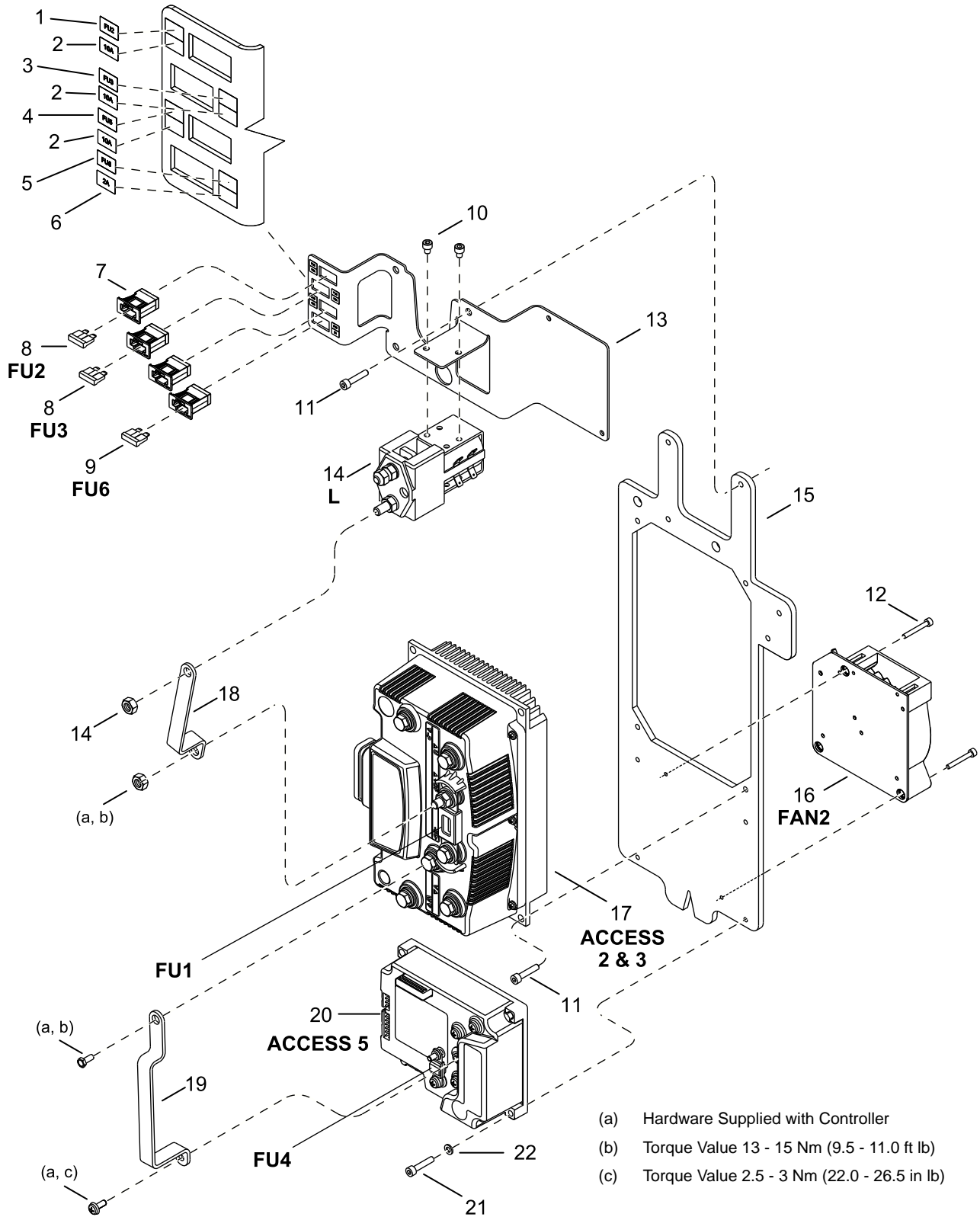


Figure 17023-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139597-001	Control Panel (SH)	1
0	139597-002	Control Panel (SH F/C)	1
1	079566-130	Label	1
2	079566-135	Label	3
3	079566-131	Label	1
4	079566-133	Label	1
5	079566-134	Label	1
6	079566-136	Label	1
7	814469	Fuse Holder Housing	4
8	805751-001	Fuse	2
9	805751-002	Fuse ⁽¹⁾	1
10	060061-036	Screw	2
11	050005-060	Screw	7
12	060065-025	Screw	2
13	135157	Bracket	1
14	110613-001	Contact Assembly	1
15	135156	Electrical Panel	1
16	813941-004	Fan Assembly	1
17	140440	Controller	1
	802816-012	Fuse	1
18	140574	Bus Bar	1
	065003-175	Sleeving	1
19	140573	Bus Bar	1
	065003-175	Sleeving	1
20	140441	Controller	1
	819583-001	Fuse	1
21	050005-006	Screw	4
22	060030-217	Flatwasher	2

⁽¹⁾ Used on 139597-002 Only

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Panel - SHR - SHR F/C

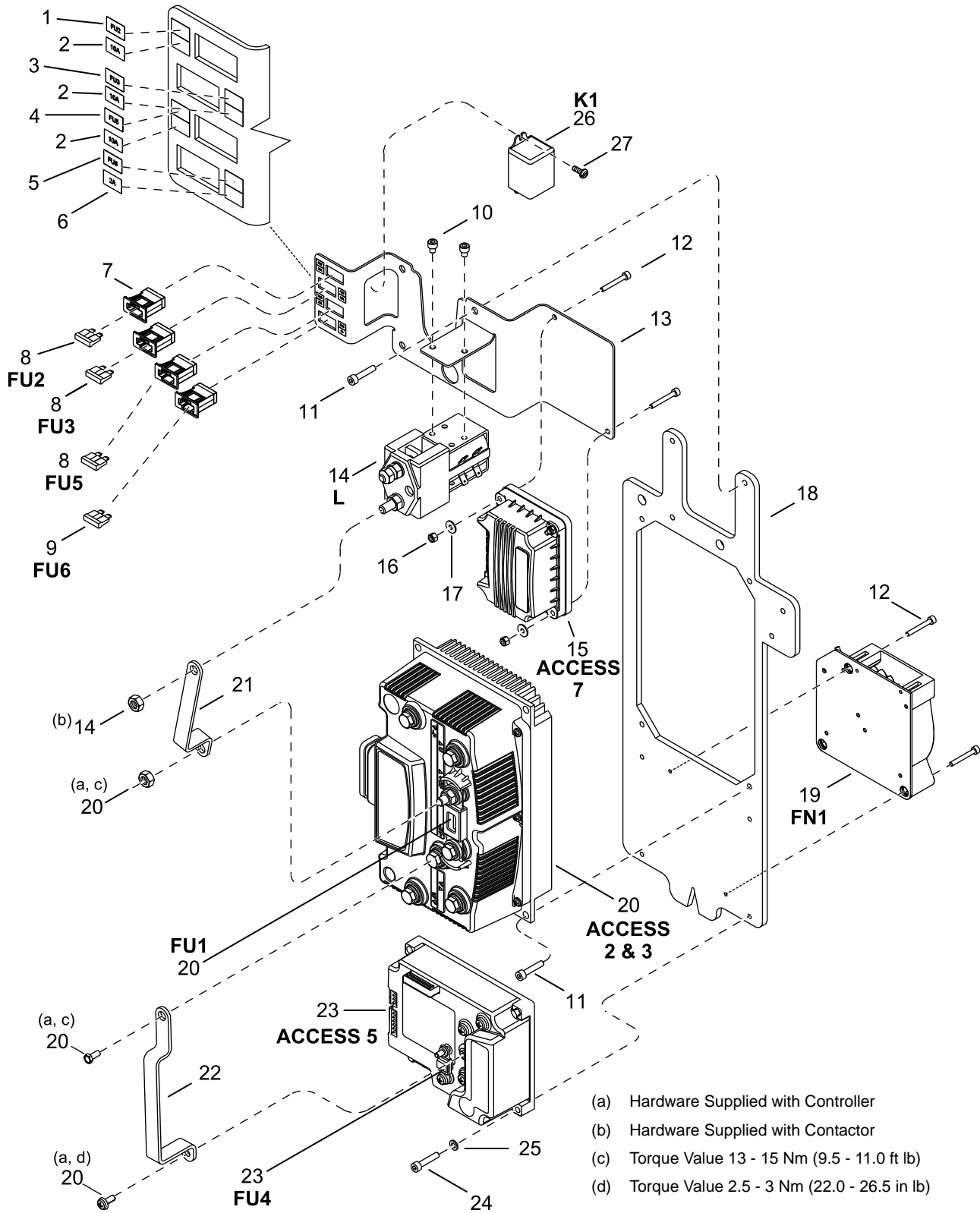


Figure 17010-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139596-001	Control Panel (SHR)	1
0	139596-002*	Control Panel (SHR F/C)	1
1	079566-130	Label	1
2	079566-135	Label	3
3	079566-131	Label	1
4	079566-133	Label	1
5	079566-134	Label	1
6	079566-136	Label	1
7	814469	Fuse Holder Housing	4
8	805751-001	Fuse	2
9	805751-002	Fuse ⁽¹⁾	1
10	060061-036	Screw	2
11	050005-060	Screw	7
12	060065-025	Screw	4
13	135157	Bracket	1
14	110613-001	Contactactor	1
15	140442	Controller	1
16	060059-036	Nut	2
17	050009-003	Flatwasher	2
18	135156	Electrical Panel	1
19	813941-004	Fan Assembly	1
20	140440	Controller	1
	802816-012	Fuse	1
21	140574	Bus Bar	1
	065003-175	Sleeving	1
22	140573	Bus Bar	1
	065003-175	Sleeving	1
23	140441	Controller	1
	819583-001	Fuse	1
24	050005-006	Screw	4
25	060030-217	Flatwasher	2
26	062337-008	Accessory Relay	1
27	060012-076	Screw	2

(1) Used on 139596-002 Only

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

Model Function

W	P
WB	P
WR	P
PE 3500	1A
PE 4500	Line
PC 3500	1A
PC 4500	Line
PR 4500	Line
SP 3000	1A
SP 3200	1A
TR 3500	1A
RR 3000	FW
RR 3500	FW
RD 3000	RW
RD 3500	FW
SH	Line
SHR	Line

NOTE: On EV100 SCR motor control systems, the contactors controlled by the control card (i.e. forward, reverse, 1A, FW), regardless of battery voltage, require 24 volt coils. Refer to Electrical Parts for the correct contactor part number and function.

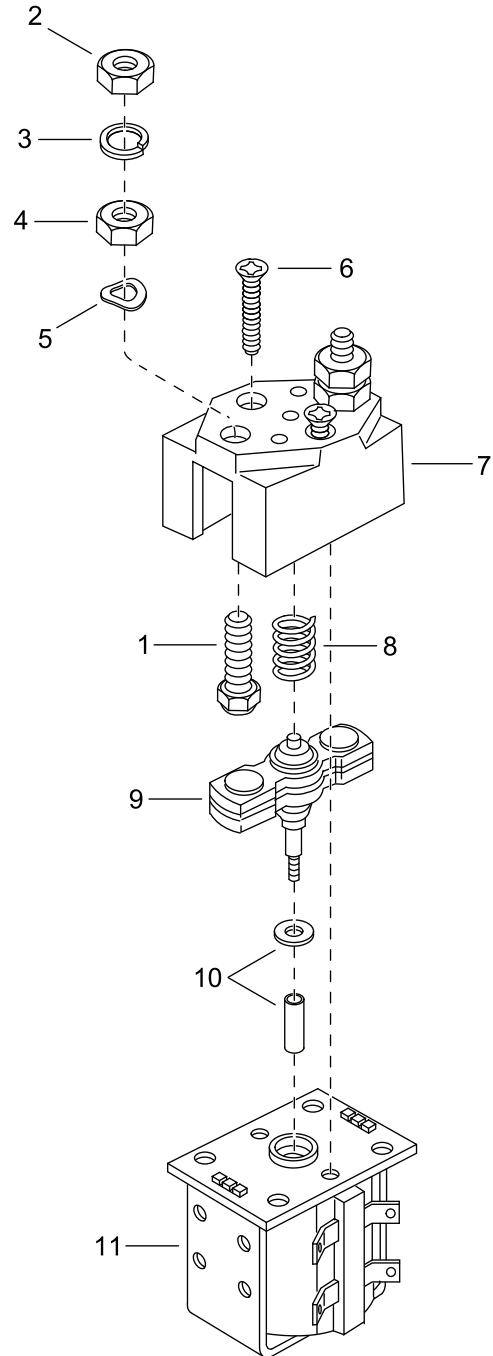


Figure 18677

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	110613-001	Contactor Assembly (24V)	1
1	114434	Fixed Contact	1
2	060059-001	Nut	2
3	060005-031	Lockwasher	2
4	060059-004	Nut	2
5		Spring Washer	1
6	107351	Screw	2
7	114436	Cover	1
8	114437	Return Spring	1
9	114435	Moving Contact	1
10	123601	Bushing	1
11	117160	Coil	1
	120091	Contactor Tip Kit (Includes Index 1, 2, 3, 4, 5, 9 & 10)	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle - SH

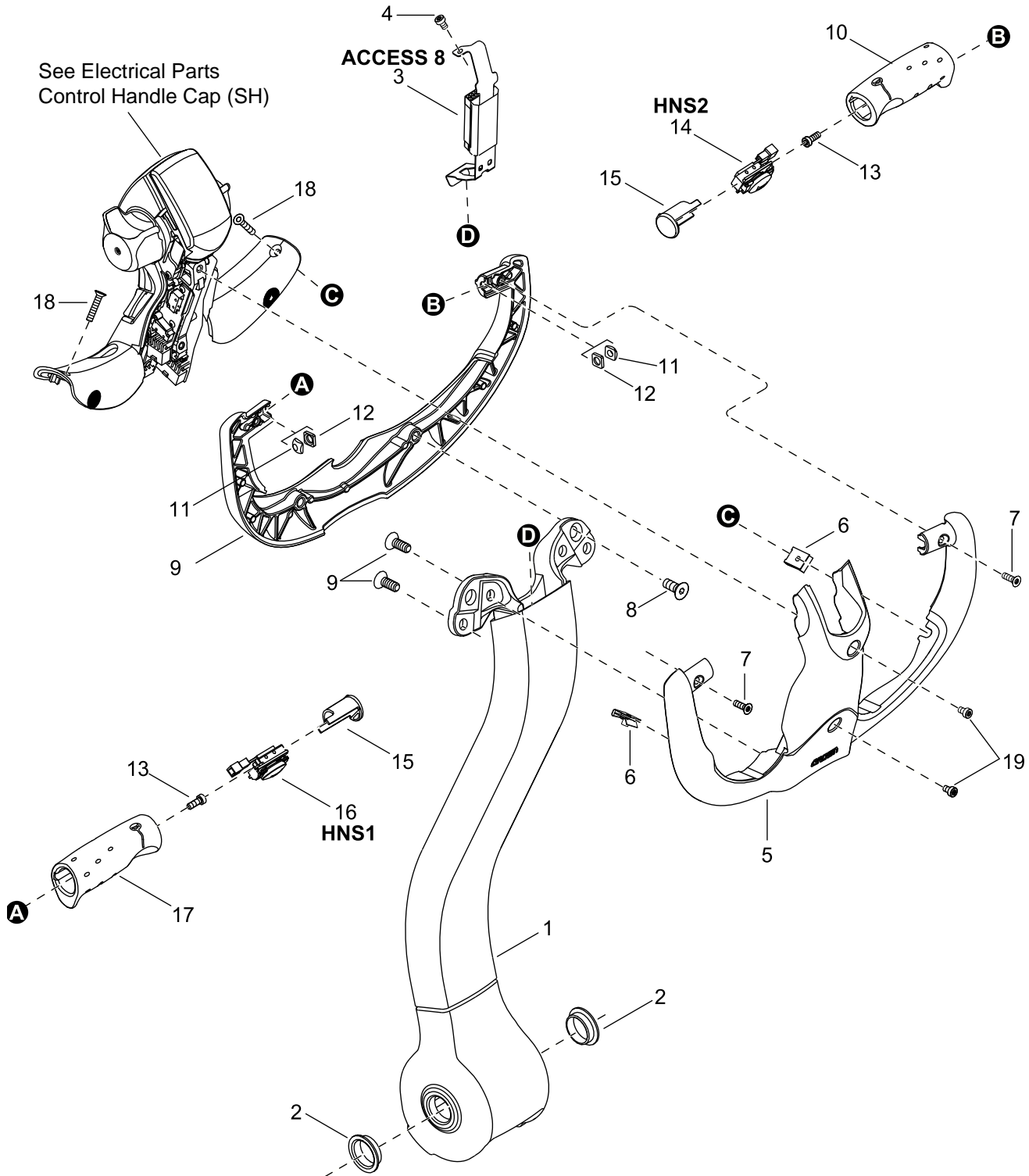


Figure 18626

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816234	Tiller Arm Assembly	1
1	816230	Tiller	1
2	051058-001	Bushing	2
3	819035	Can-Interface Card	1
4	812894-002	Screw	1
5	808986	Lower Shell	1
6	792940	U-Nut Retainer	2
7	812893-003	Screw	2
8	812893-005	Screw	6
9	808985	Upper Shell	1
10	808987-002	Handgrip	1
11	814286	Nut	2
12	814287	Washer	2
13	812894-005	Screw	2
14	811932-002	Horn Switch	1
15	810336	Plug	2
16	811932-001	Horn Switch	1
17	808987-001	Handgrip	1
18	812893-004	Screw	2
19	812894-002	Screw	2

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH

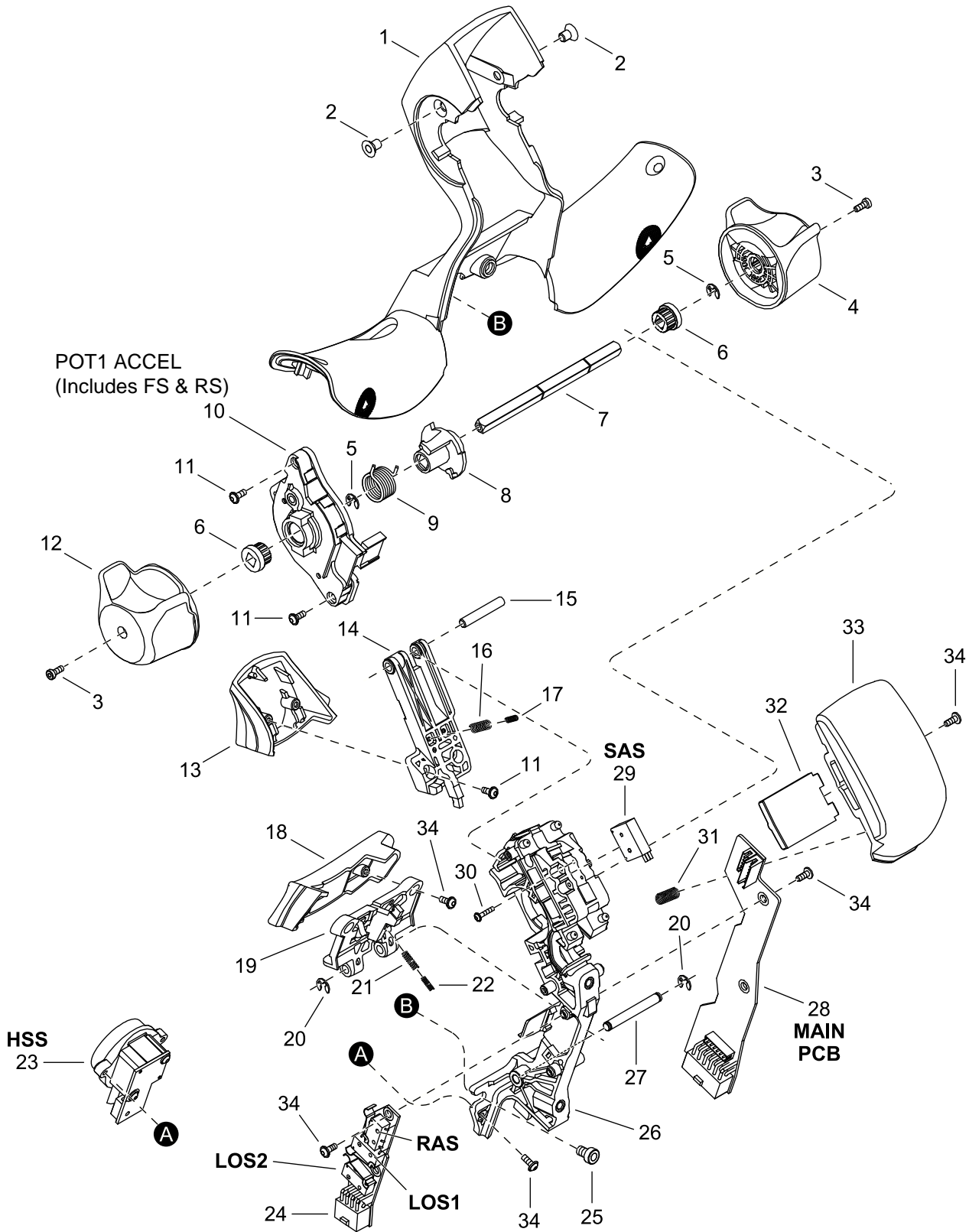


Figure 20244

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	811949-003	Control Handle Cap Assembly	1
1	808951-001*	Switch Cover	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812884	Spring	1
10	813533	Traction Potentiometer	1
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-022	Spring	1
23	811941	Fast/Slow Switch	1
24	812942-002	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812941	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion

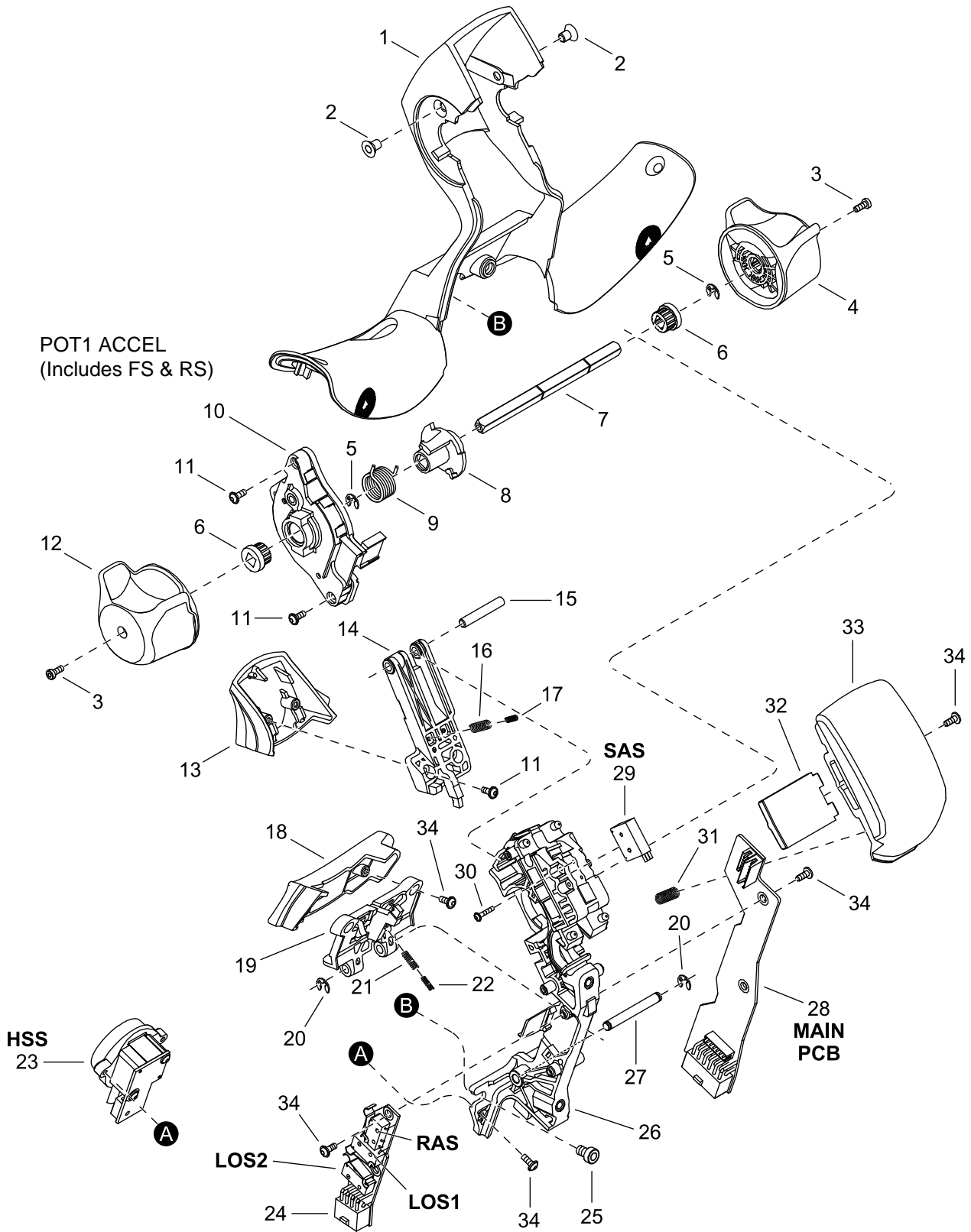


Figure 20244



ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	811949-004*	Control Handle Cap Assembly	1
1	808951-001*	Switch Cover	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812884	Spring	1
10	813534*	Traction Potentiometer	1
	812315	Heater Not Shown	1
	803469-021	Screw Not Shown	2
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-022	Spring	1
23	812877*	Fast/Slow Switch	1
24	812273-002*	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812272	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
The truck data number represents truck features.
Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH Sideshift

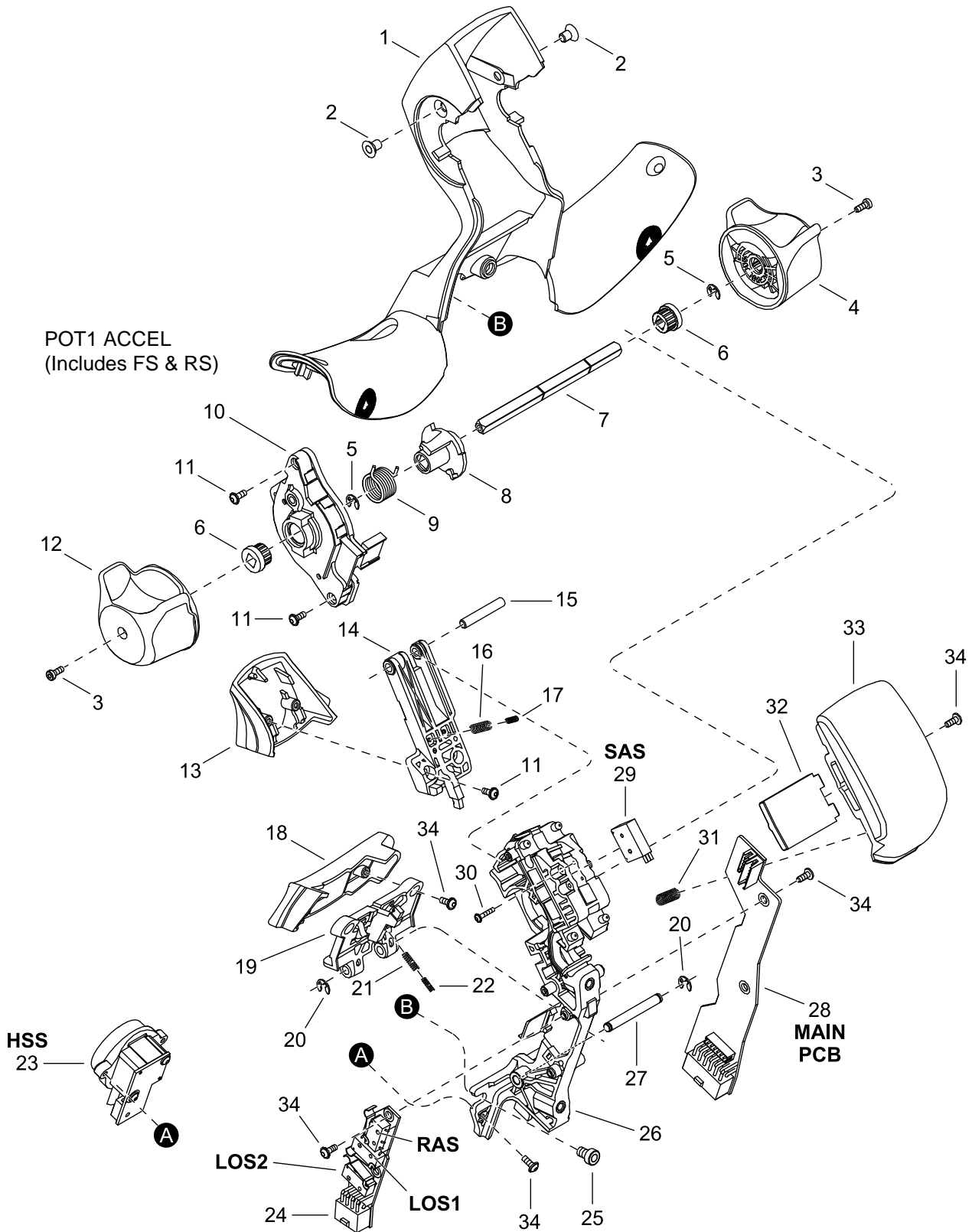


Figure 20244

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	811949-005*	Control Handle Cap Assembly	1
1	808951-002*	Switch Cover	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812884	Spring	1
10	813533	Traction Potentiometer	1
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-022	Spring	1
23	811941	Fast/Slow Switch	1
24	812942-002	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812941	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH Sideshift

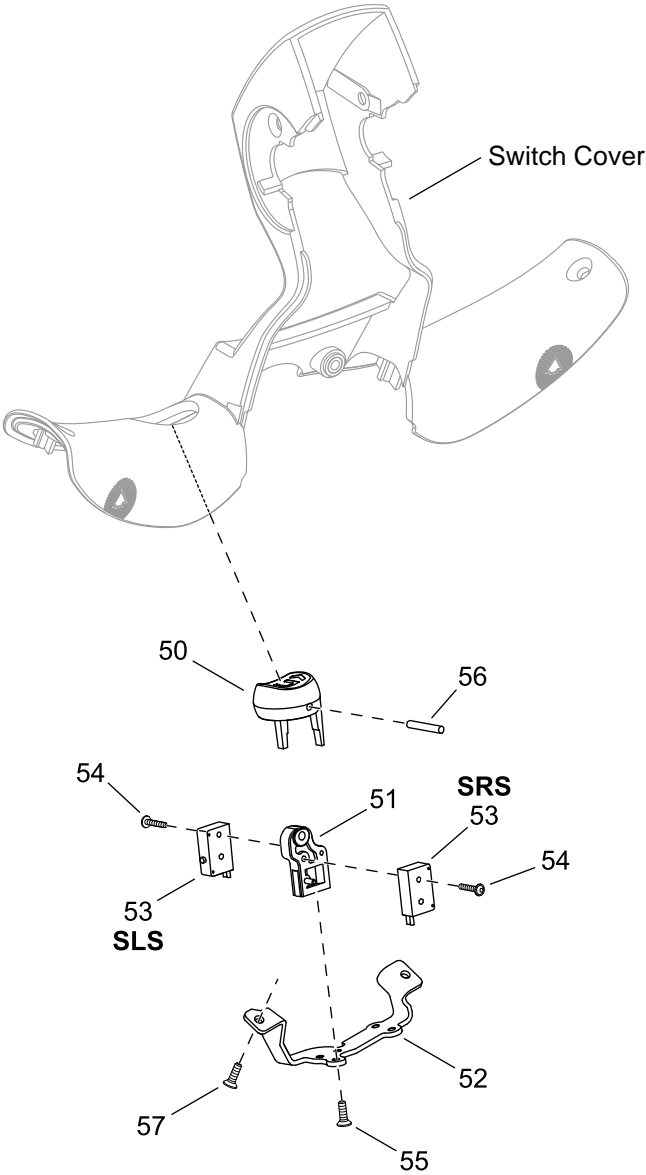


Figure 17227-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50.....	812365-001*	Cap - Sideshift.....	1
51.....	812366*	Switch.....	1
52.....	812879*	Frame.....	1
53.....	812895*	Switch Assembly.....	2
54.....	803469-019*	Screw.....	2
55.....	803469-020*	Screw.....	2
56.....	050052-005*	Pin.....	1
57.....	803469-017*	Screw.....	2

812878-001..... Sideshift Switch (Includes Index 50 thru 56)

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion & Sideshift

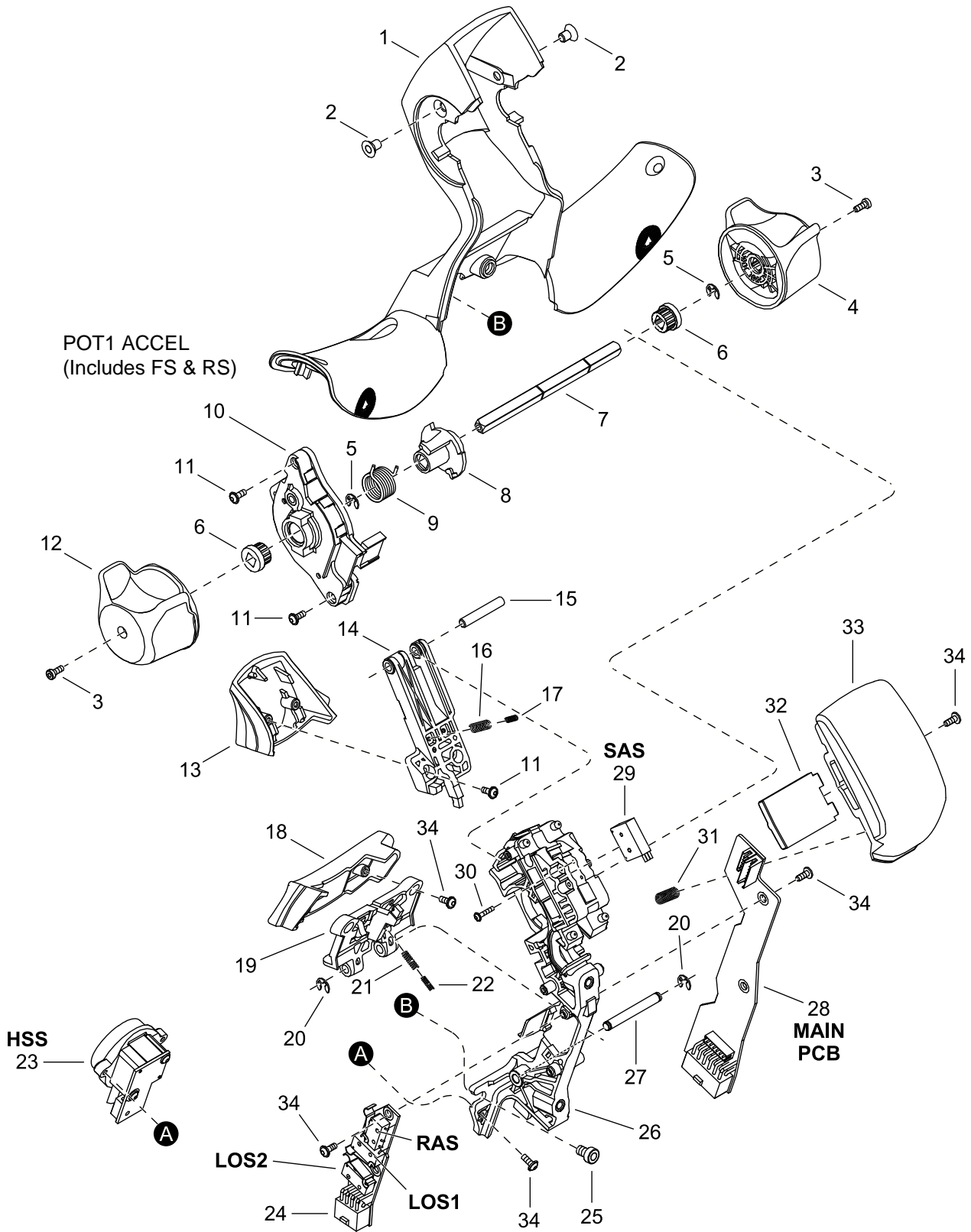


Figure 20244



ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion & Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	811949-009*	Control Handle Cap Assembly	1
1	808951-002*	Switch Cover	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812884	Spring	1
10	813534*	Traction Potentiometer	1
	812315	Heater Not Shown	1
	803469-021	Screw Not Shown	2
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-022	Spring	1
23	812877*	Fast/Slow Switch	1
24	812273-002*	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812272	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion & Sideshift

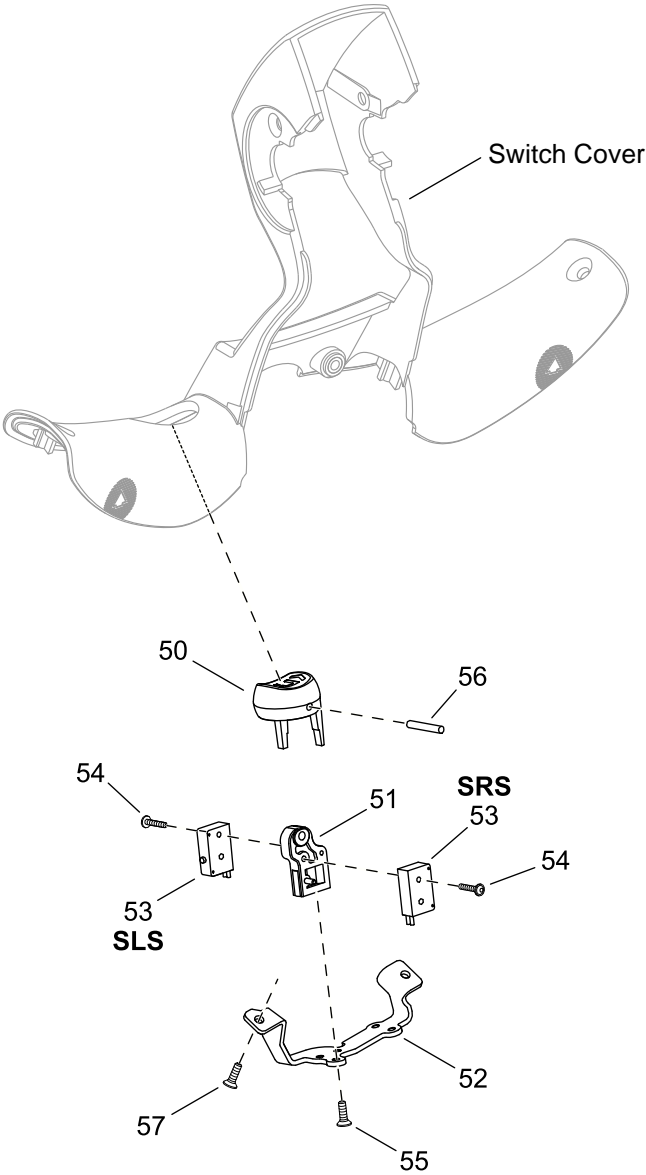


Figure 17227-02



ELECTRICAL PARTS

Control Handle Cap - SH Freezer/Corrosion & Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	812365-001*	Cap - Sideshift	1
51	812366*	Switch	1
52	812879*	Frame	1
53	812895*	Switch Assembly	2
54	803469-019*	Screw	2
55	803469-020*	Screw	2
56	050052-005*	Pin	1
57	803469-017*	Screw	2

812878-001 Sideshift Switch (Includes Index 50 thru 56)

* To select appropriate part number, refer to truck data number.
The truck data number represents truck features.
Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle - SHR

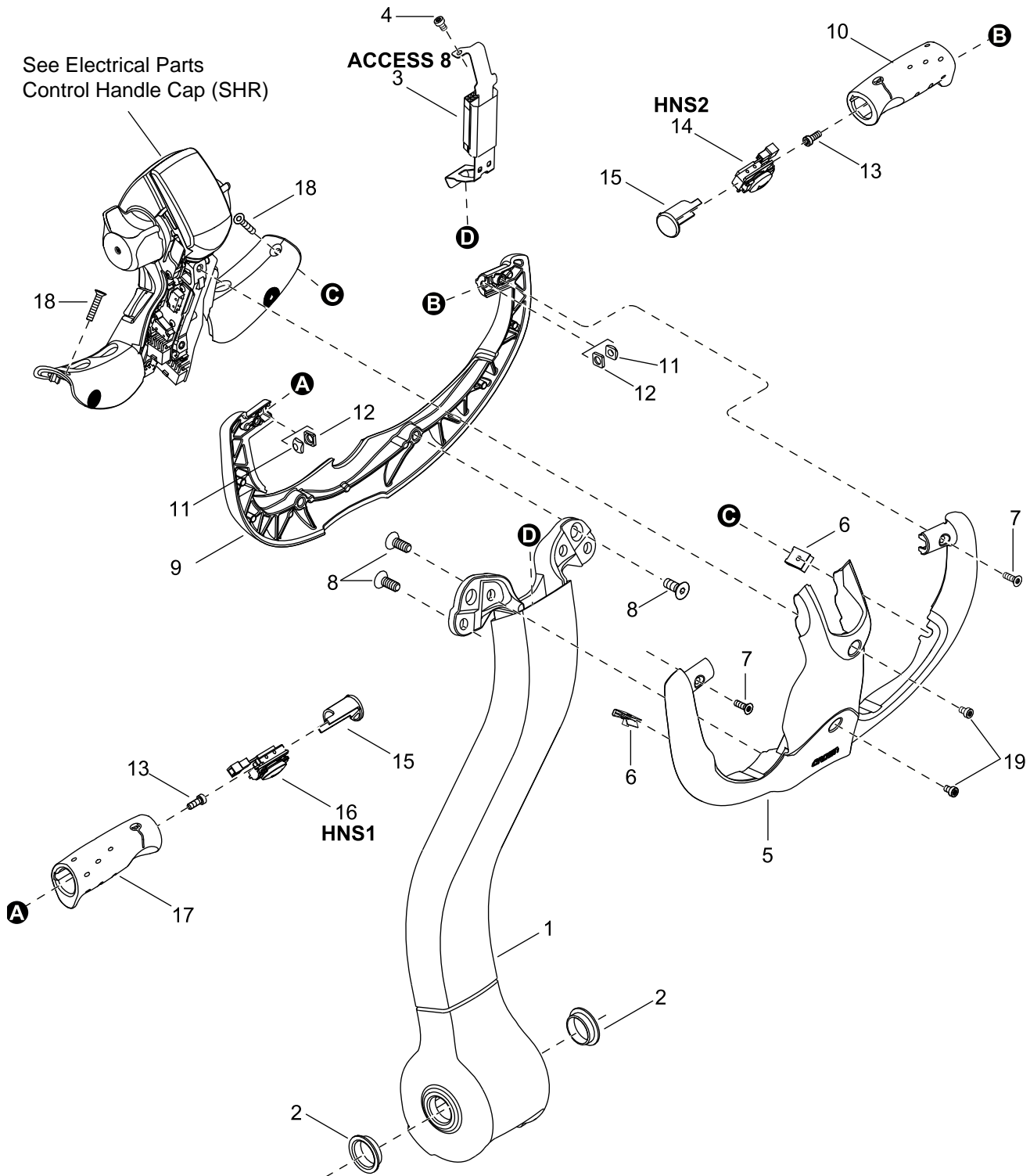


Figure 17166

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816234	Tiller Arm Assembly	1
1	816230	Tiller	1
2	051058-001	Bushing	2
3	819035	Can-Interface Card	1
4	812894-002	Screw	1
5	808986	Lower Shell	1
6	792940	U-Nut Retainer	2
7	812893-003	Screw	2
8	812893-005	Screw	6
9	808985	Upper Shell	1
10	808987-001	Handgrip	1
11	814286	Nut	2
12	814287	Washer	2
13	812894-005	Screw	2
14	811932-002	Horn Switch	1
15	810336	Plug	2
16	811932-001	Horn Switch	1
17	808987-002	Handgrip	1
18	812893-004	Screw	2
19	812894-002	Screw	2

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR

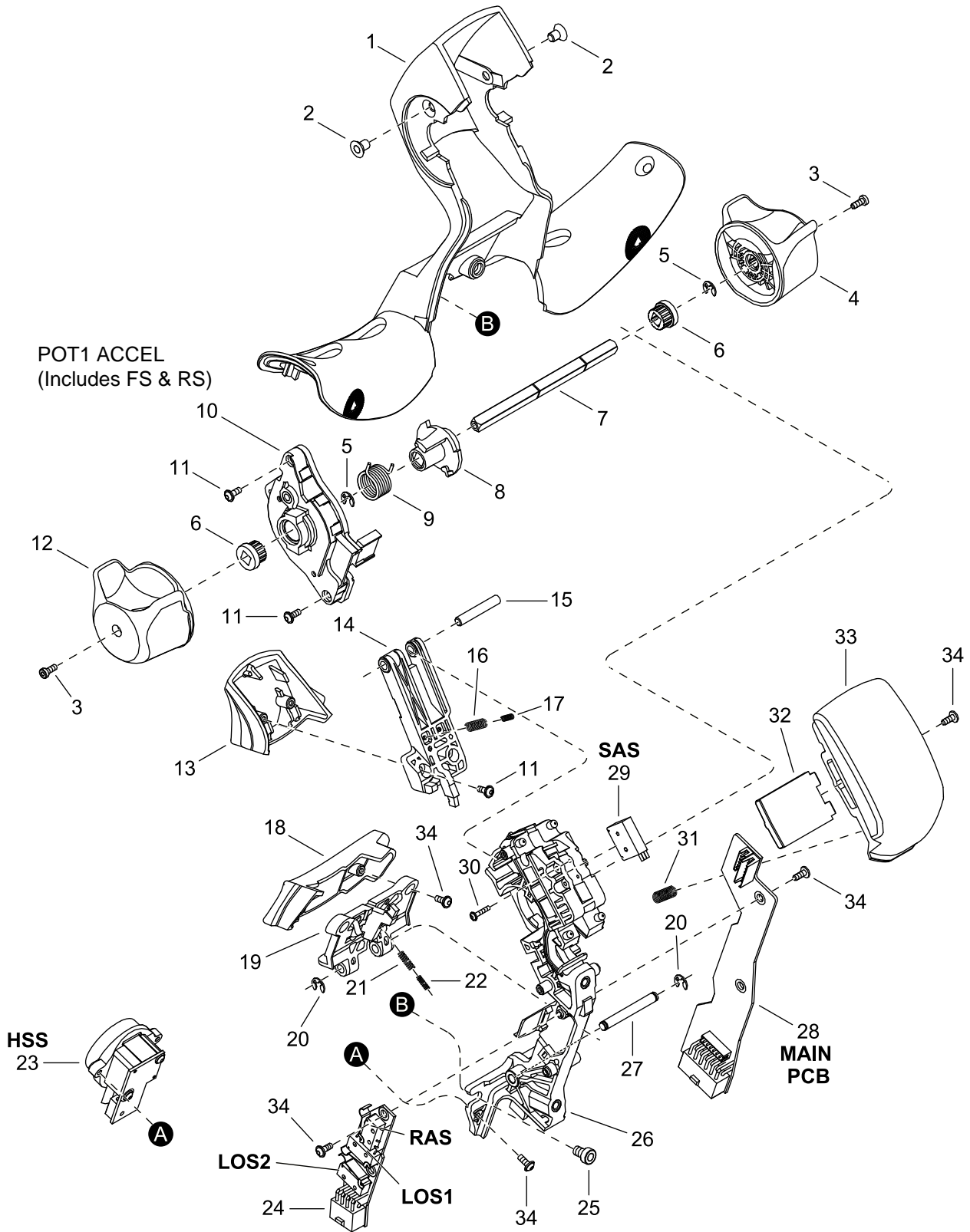


Figure 20254

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816229-011	Control Handle Cap Assembly	1
1	808951-010	Switch Cover - Tilt	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812844	Spring	1
10	813533*	Traction Potentiometer	1
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-023	Spring	1
23	811941	Fast/Slow Switch	1
24	812942-002	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812941	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion

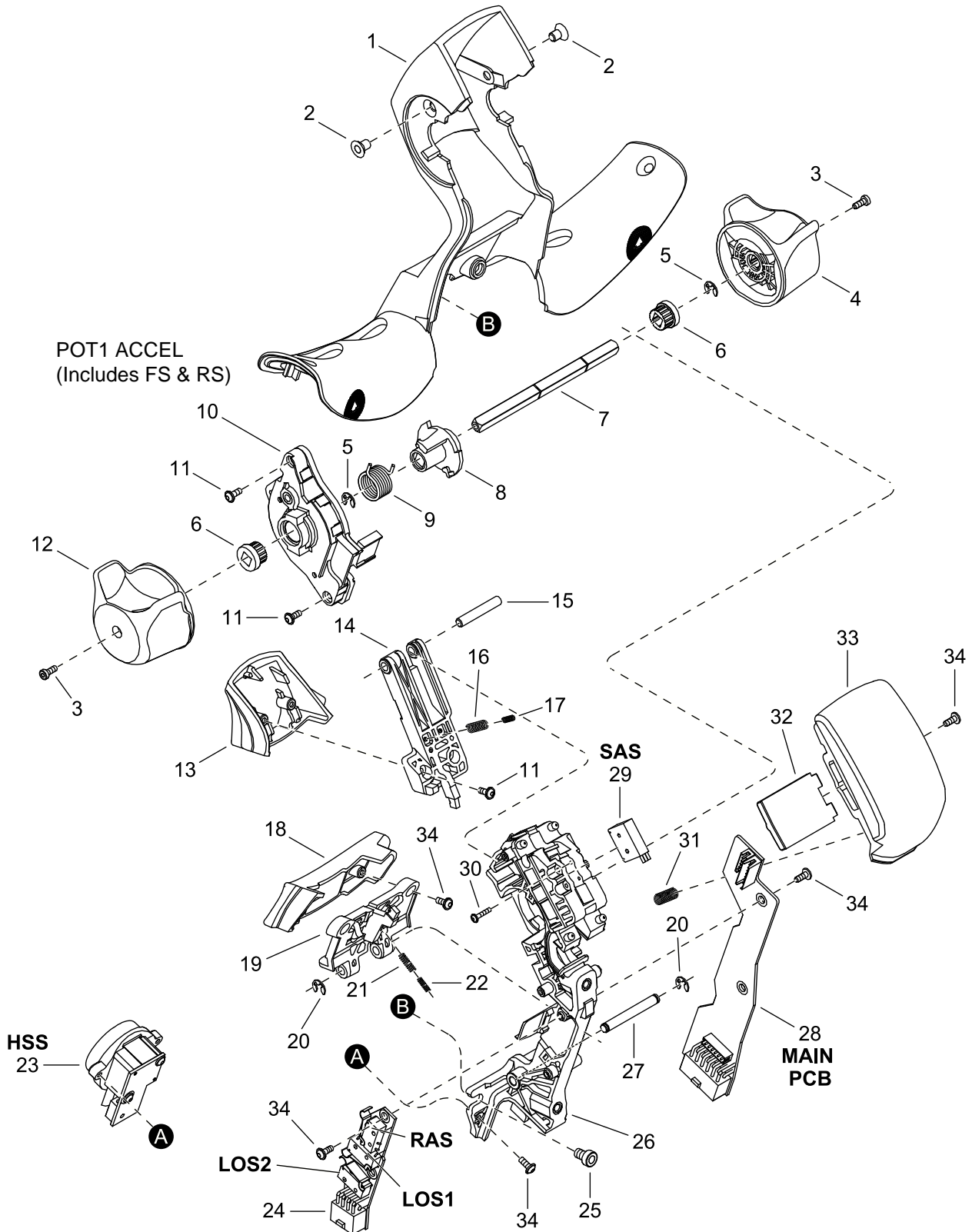


Figure 20254



ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816229-012*	Control Handle Cap Assembly	1
1	808951-010	Switch Cover - Tilt	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812844	Spring	1
10	813533*	Traction Potentiometer	1
	813534*	Traction Potentiometer	1
	812315	Heater Not Shown	1
	803469-021	Screw Not Shown	2
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-023	Spring	1
23	812877*	Fast/Slow Switch	1
24	812273-002*	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812272	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Sideshift

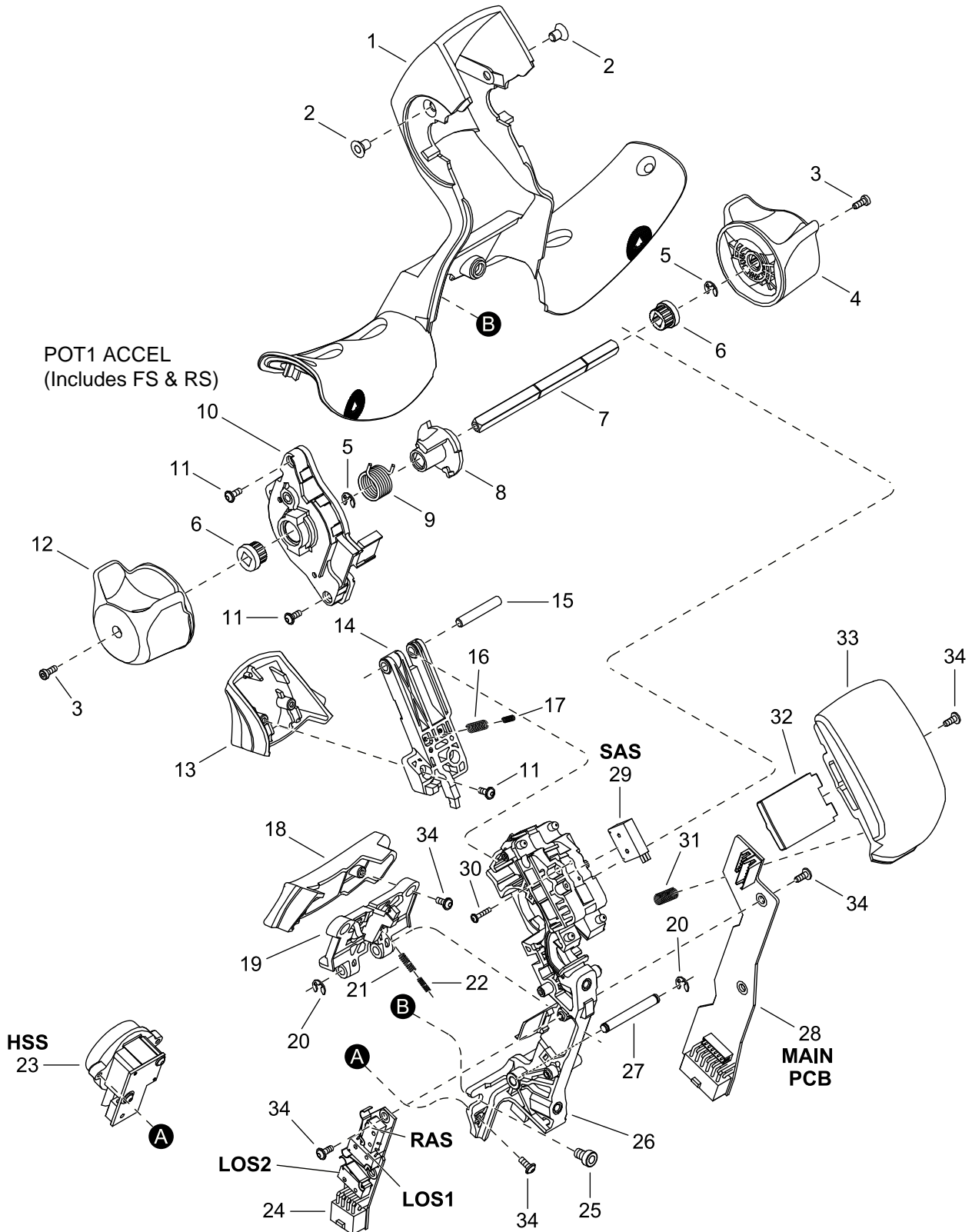


Figure 20254



ELECTRICAL PARTS

Control Handle Cap - SHR Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816229-013*	Control Handle Cap Assembly	1
1	808951-007*	Switch Cover - Tilt & Sideshift	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812844	Spring	1
10	813533*	Traction Potentiometer	1
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-023	Spring	1
23	811941	Fast/Slow Switch	1
24	812942-002	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812941	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
The truck data number represents truck features.
Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Sideshift

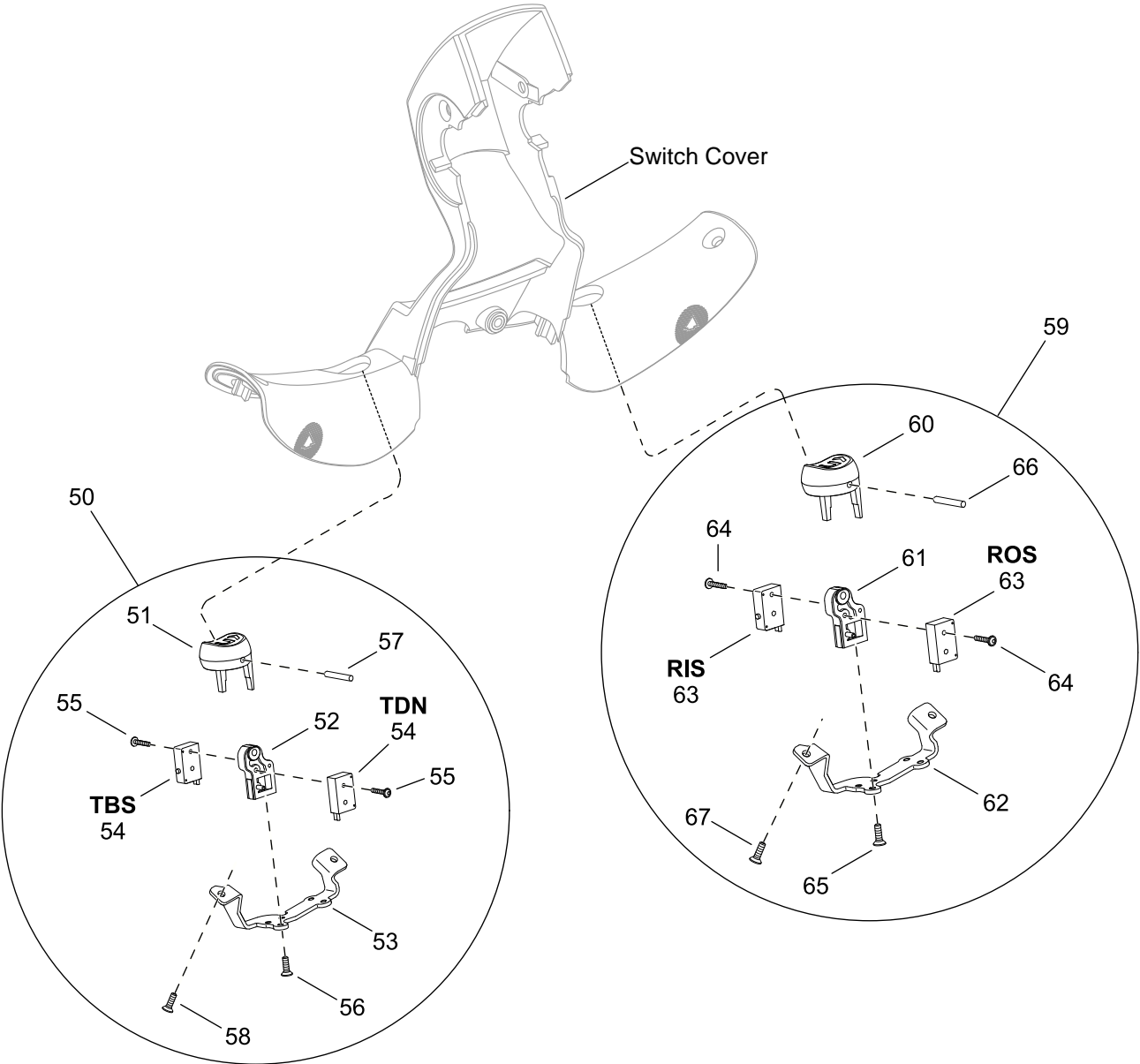


Figure 18629-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	812878-003*	Switch Assembly - Tilt	1
51	812365-003*	Cap - Tilt	1
52	812366	Bracket	1
53	812879	Frame	1
54	812895	Switch Assembly	2
55	803469-019	Screw	2
56	803469-020	Screw	2
57	050052-005	Pin	1
58	803469-017	Screw	2
59	812878-002*	Switch Assembly - Reach	1
60	812365-002*	Cap - Reach	1
61	812366	Bracket	1
62	816277-002	Frame	1
63	812895	Switch Assembly	1
64	803469-019	Screw	2
65	803469-020	Screw	2
66	050052-005	Pin	1
67	803469-017	Screw	2

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Sideshift

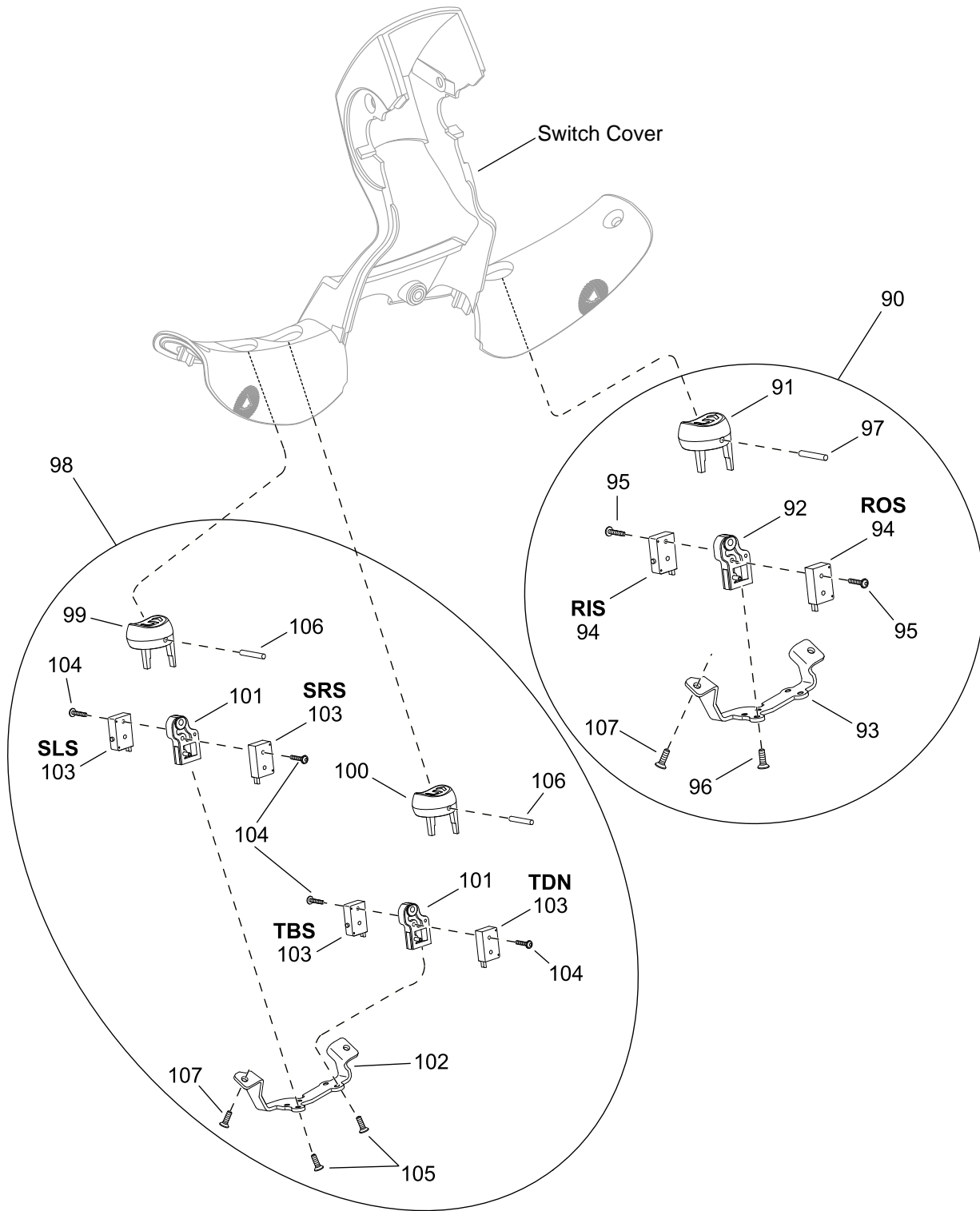


Figure 19291-01



ELECTRICAL PARTS

Control Handle Cap - SHR Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
90	812878-002	Switch Assembly - Reach	1
91	812365-002	Cap - Reach	1
92	812366	Bracket	1
93	816227-002	Frame	1
94	812895	Switch Assembly	2
95	803469-019	Screw	2
96	803469-020	Screw	2
97	050052-005	Pin	1
98	812878-004	Switch Assembly - Tilt & Sideshift	1
99	812365-003	Cap - Tilt	1
100	812365-001	Cap - Sideshift	1
101	812366	Bracket	2
102	812879	Frame	1
103	812895	Switch Assembly	4
104	803469-019	Screw	4
105	803469-020	Screw	4
106	050052-005	Pin	2
107	803469-017	Screw	4
	812878-007	Reach, Tilt & Sideshift (Includes Index 90 - 106)	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

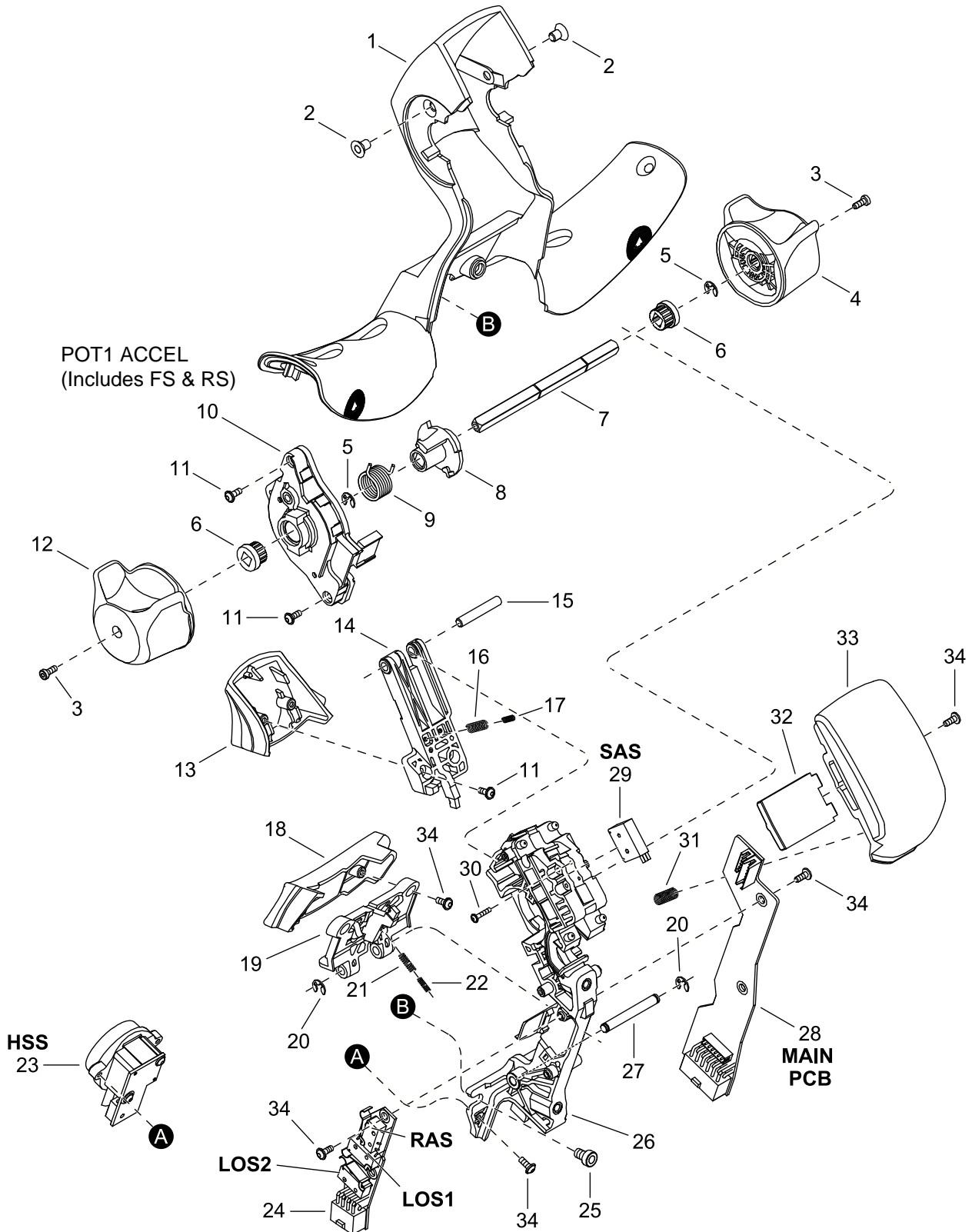


Figure 20254



ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	816229-014*	Control Handle Cap Assembly	1
1	808951-007*	Switch Cover - Tilt & Sideshift	1
2	812893-002	Screw	2
3	812894-004	Screw	2
4	808993-001	Thumbwheel	1
5	050012-076	Retaining Ring	2
6	810335	Bushing	2
7	811937	Shaft	1
8	810333	Spring Activator	1
9	812844	Spring	1
10	813533*	Traction Potentiometer	1
	813534*	Traction Potentiometer	1
	812315	Heater Not Shown	1
	803469-021	Screw Not Shown	2
11	803469-017	Screw	4
12	808993-002	Thumbwheel	1
13	808989	Lift Cover	1
14	810331	Support	1
15	811939	Shaft	1
16	051057-023	Spring	1
17	051057-028	Spring	1
18	808990	Lower Cover	1
19	810332	Support	1
20	050012-075	Retaining Ring	2
21	051057-021	Spring	1
22	051057-023	Spring	1
23	812877*	Fast/Slow Switch	1
24	812273-002*	Hydraulic PC Board Includes RAS, LOS1 & LOS2	1
25	812894-002	Screw	2
26	810328	Support	1
27	811940	Shaft	1
28	812272	Main PC Board	1
29	811935	Switch	1
30	803469-018	Screw	2
31	051057-026	Spring	4
32	811936	Button Bridge	1
33	808992	Button	1
34	803469-017	Screw	9

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

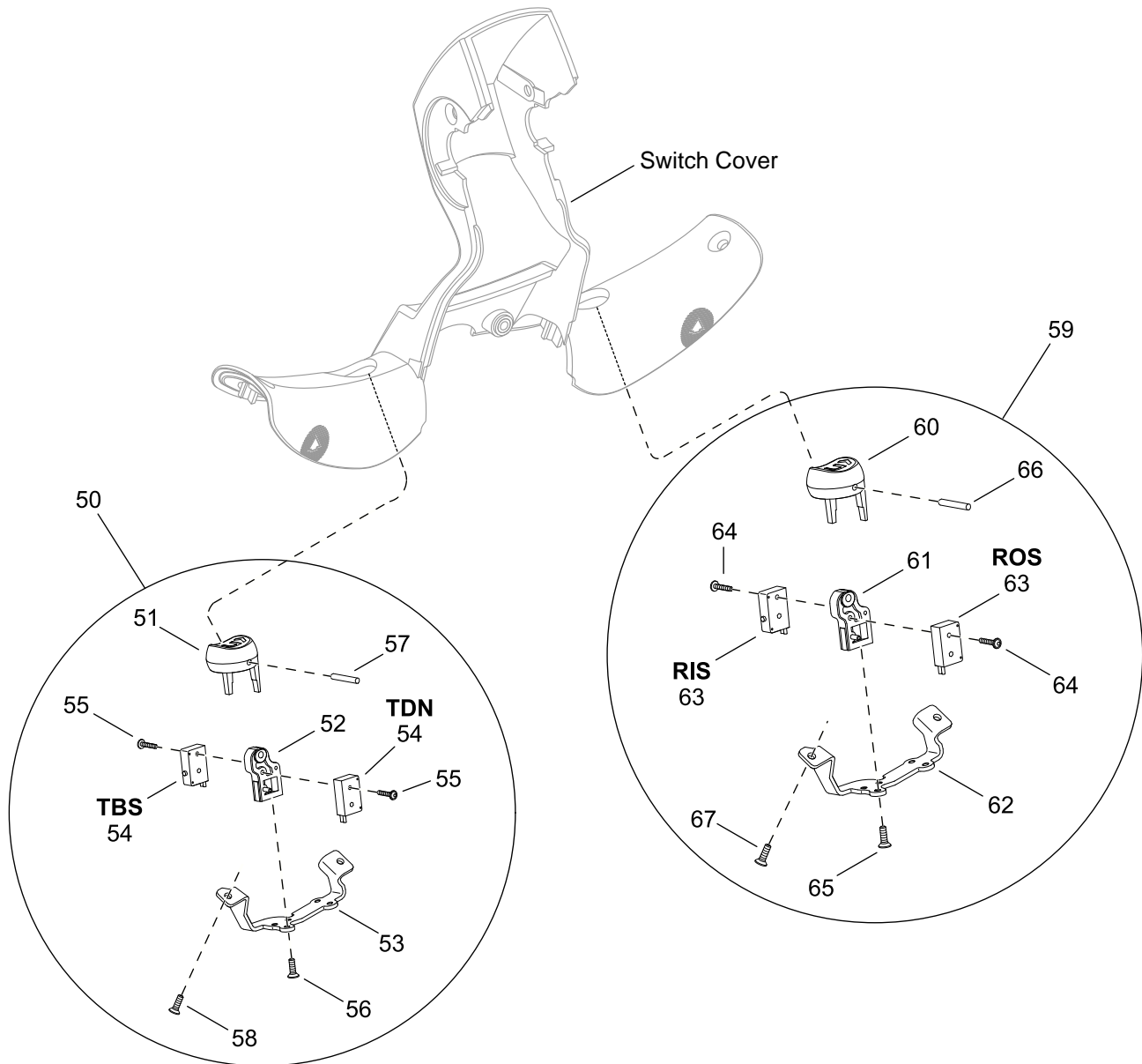


Figure 18629-02



ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	812878-003*	Switch Assembly - Tilt	1
51	812365-003*	Cap - Tilt	1
52	812366	Bracket	1
53	812879	Frame	1
54	812895	Switch Assembly	2
55	803469-019	Screw	2
56	803469-020	Screw	2
57	050052-005	Pin	1
58	803469-017	Screw	2
59	812878-002*	Switch Assembly - Reach	1
60	812365-002*	Cap - Reach	1
61	812366	Bracket	1
62	816277-002	Frame	1
63	812895	Switch Assembly	1
64	803469-019	Screw	2
65	803469-020	Screw	2
66	050052-005	Pin	1
67	803469-017	Screw	2

* To select appropriate part number, refer to truck data number.
The truck data number represents truck features.
Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

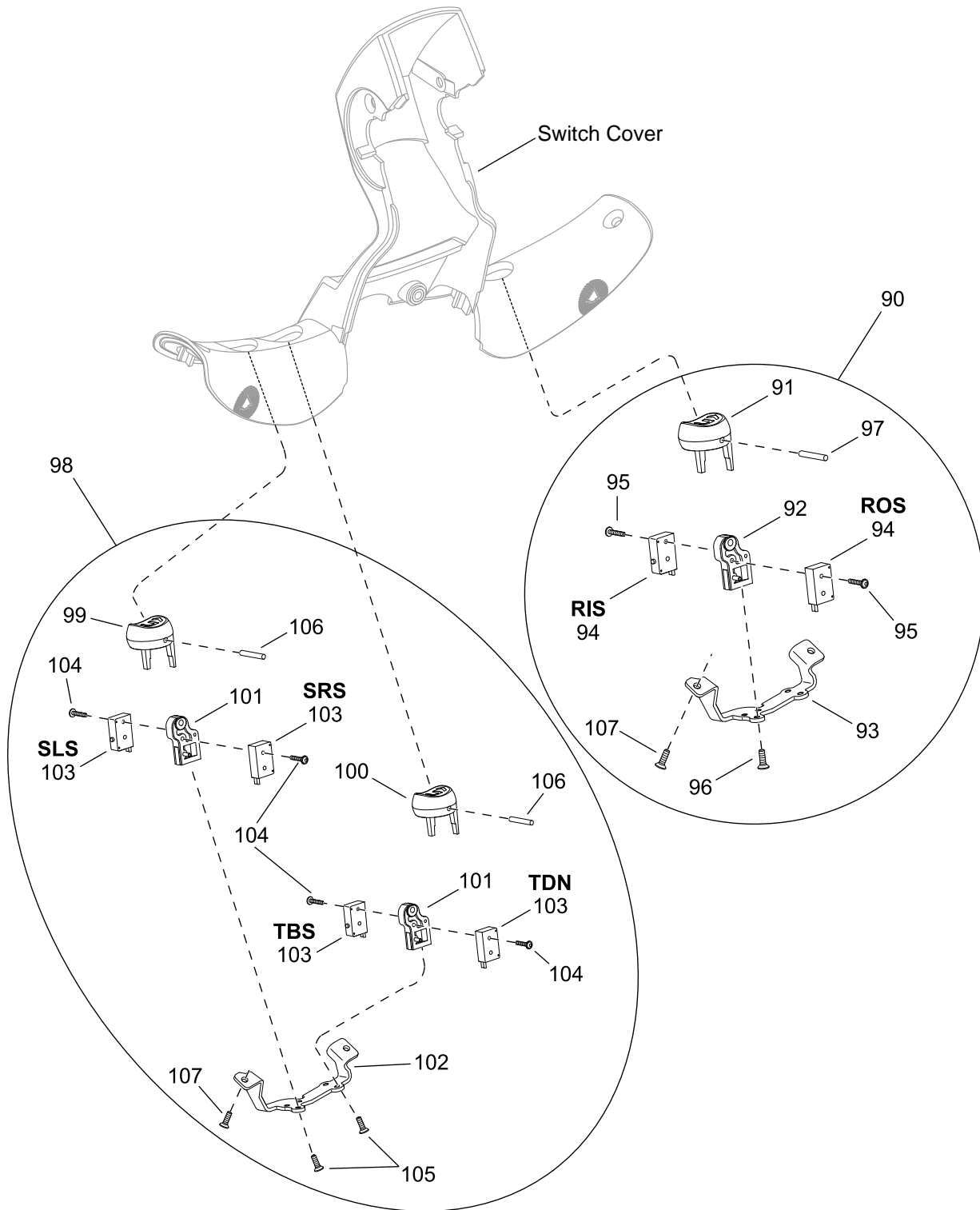


Figure 19291-01



ELECTRICAL PARTS

Control Handle Cap - SHR Freezer/Corrosion & Sideshift

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
90	812878-002	Switch Assembly - Reach	1
91	812365-002	Cap - Reach	1
92	812366	Bracket	1
93	816227-002	Frame	1
94	812895	Switch Assembly	2
95	803469-019	Screw	2
96	803469-020	Screw	2
97	050052-005	Pin	1
98	812878-004	Switch Assembly - Tilt & Sideshift	1
99	812365-003	Cap - Tilt	1
100	812365-001	Cap - Sideshift	1
101	812366	Bracket	2
102	812879	Frame	1
103	812895	Switch Assembly	4
104	803469-019	Screw	4
105	803469-020	Screw	4
106	050052-005	Pin	2
107	803469-017	Screw	4
	812878-007	Reach, Tilt & Sideshift (Includes Index 90 - 106)	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Emergency Disconnect

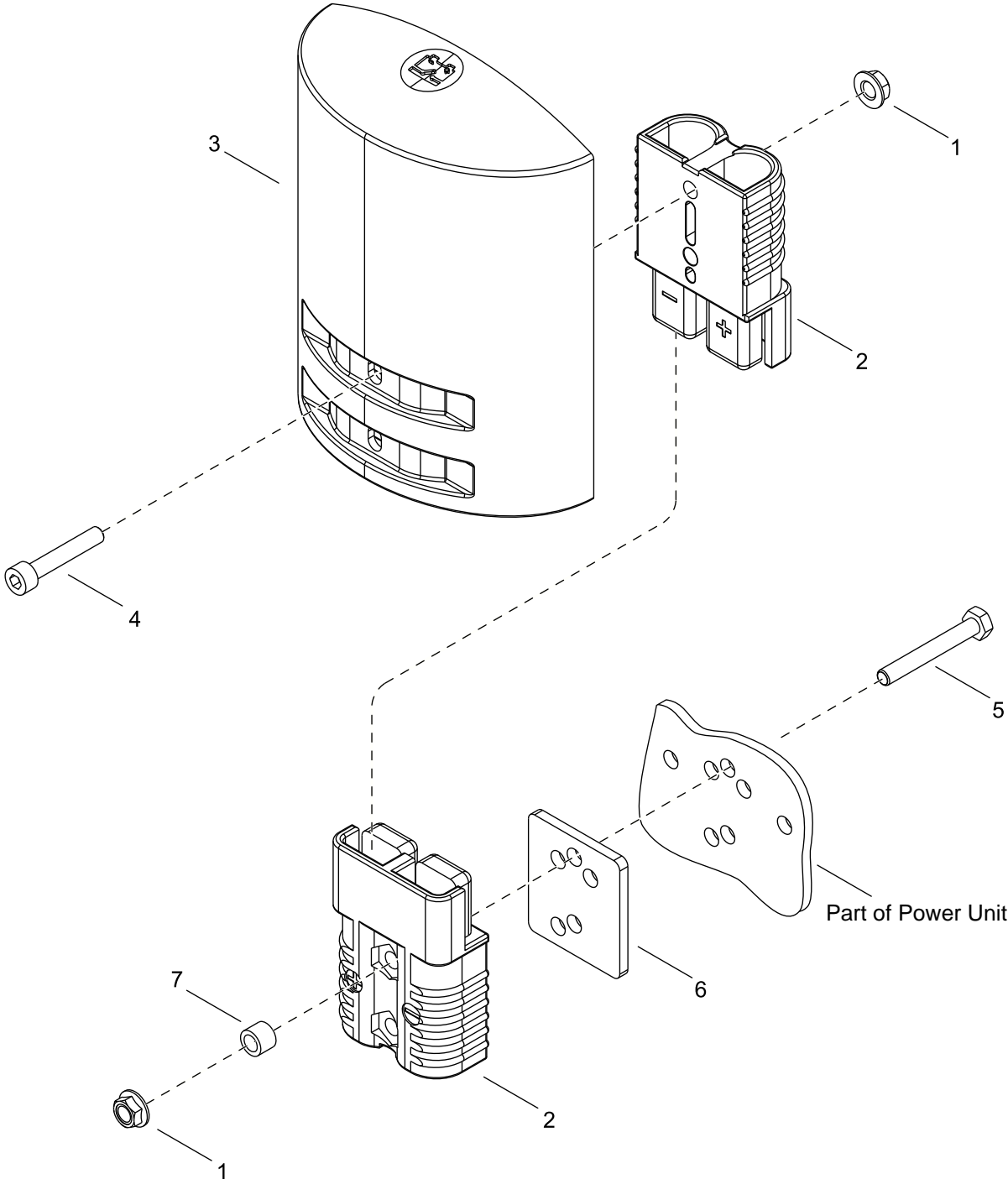


Figure 17657

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	060059-027	Nut	4
2	078723-002	Battery Connector Gray	2
	078723-007	Battery Connector Red ⁽¹⁾	2
3	045239-001-03	Handle Upper	1
4	050005-012	Screw	2
5	050007-012	Bolt	2
6	135197	Spacer	1
7	135198	Spacer	2

(1) SHR 5520 - Australia

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

ACCESS 1 Display

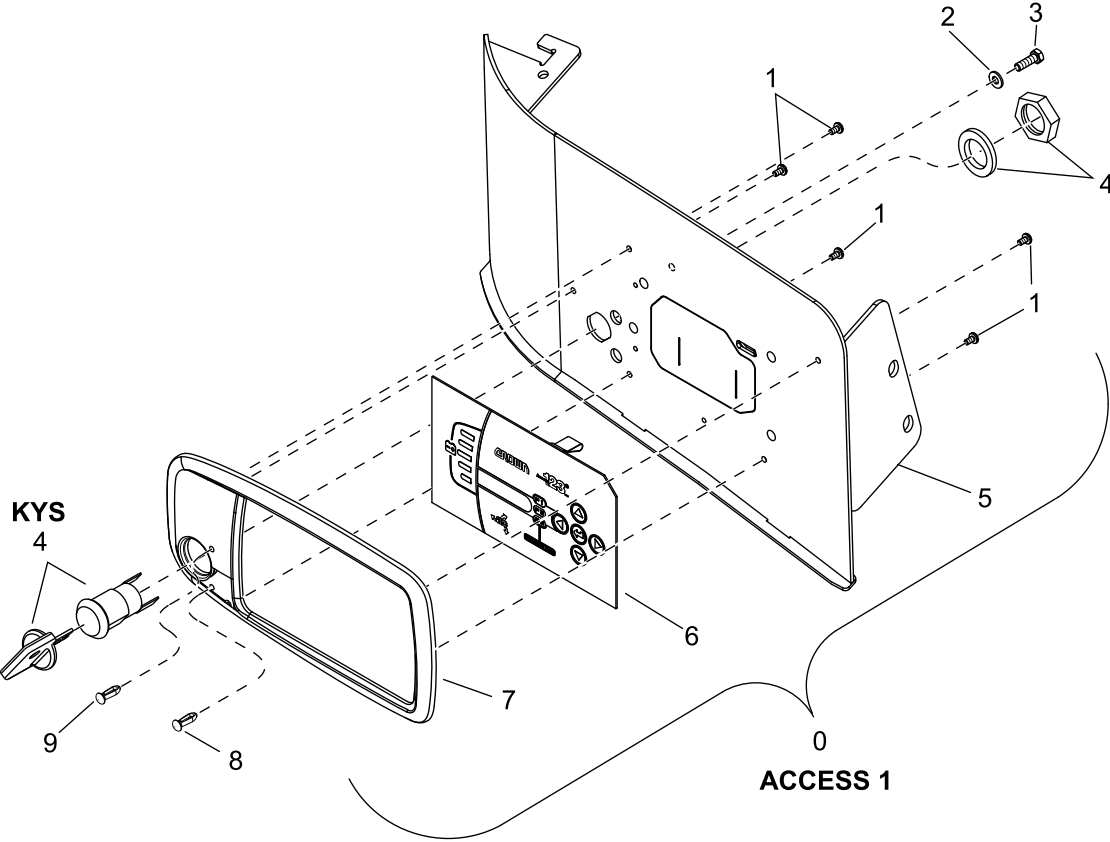


Figure 17256-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	139757	Access 1 Assembly	1
1	060012-074	Screw	1
2	060030-044	Flatwasher	4
3	060061-010	Screw	4
4	146286	Key Switch Assembly	1
	146289	Key Switch	1
	107151-001	Key	1
	107763	Key Ring	1
	077633*	Toggle Switch Includes Nut	1
	094136*	Nut	1
5	139758-001	Display Cover	1
6	139393	Key Pad	1
7	140417	Bezel	1
8	109127-001	Green Clip Arrow	1
9	109127-003	Red Clip Arrow	1

* To select appropriate part number, refer to truck data number.
 The truck data number represents truck features.
 Refer to Introduction.

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Battery Charger

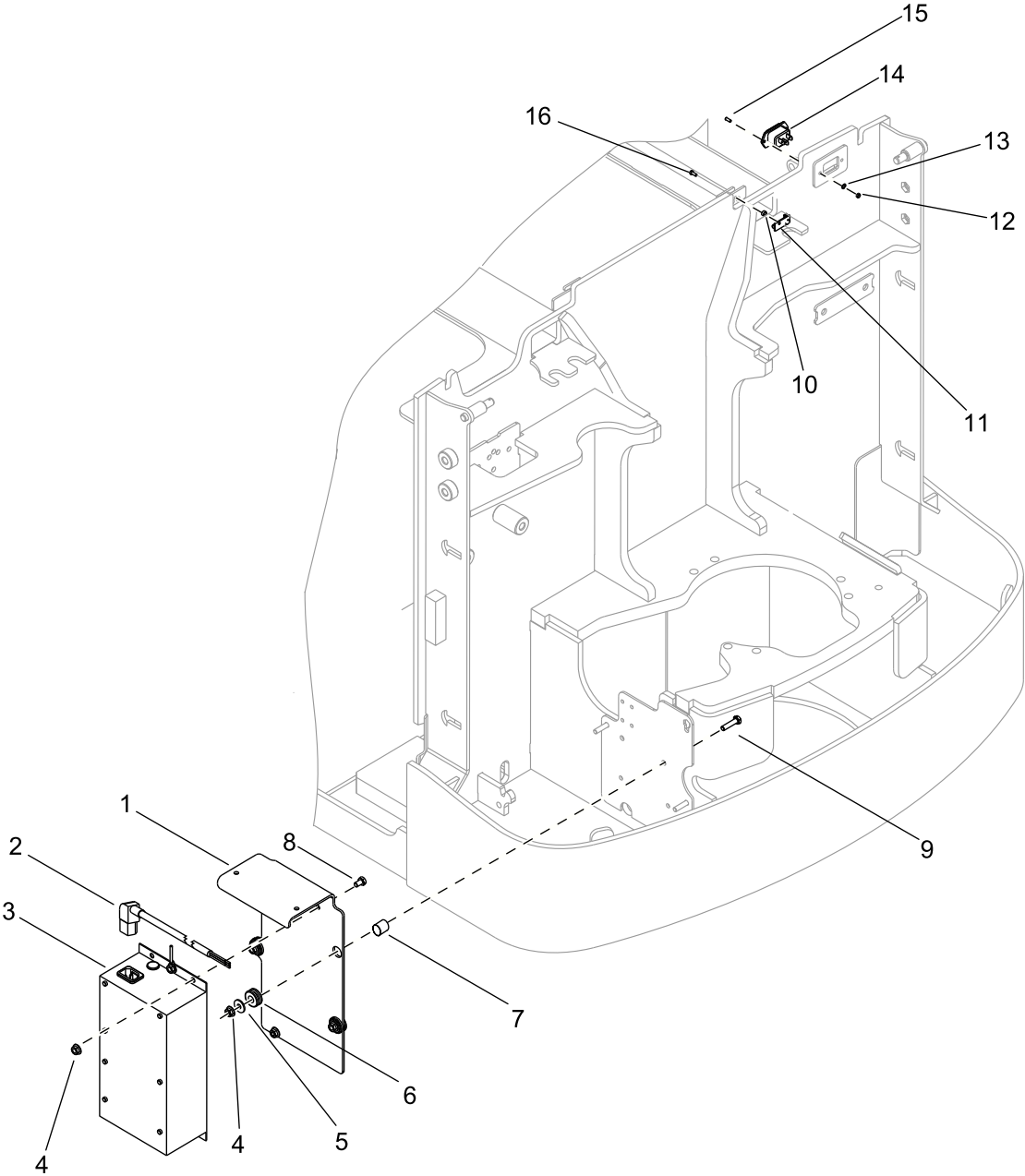


Figure 19250

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	135199	Charger Bracket	1
2	142512	Cord ⁽¹⁾ ⁽²⁾ ⁽³⁾	1
3	144020	Charger ⁽¹⁾	1
	810696	Charger ⁽²⁾ ⁽³⁾	1
4	060059-027	Nut	6
5	050009-013	Flatwasher	3
6	065004-004	Grommet	3
7	075591-225	Tube	1
8	050006-022	Screw	3
9	050006-027	Screw	3
10	131175	Spacer	1
11	810562-002	LED PCB	1
12	050008-004	Nut	2
13	060005-002	Lockwasher	2
14	126451-002	Power Inlet	1
15	050003-070	Screw	2
16	050004-025	Screw	1
	142669	Extension Cord ⁽¹⁾	1
	810696	Extension Cord ⁽²⁾	1
	808859	Extension Cord ⁽³⁾	1
	062007-063	Terminal	1

⁽¹⁾ North America

⁽²⁾ Australia

⁽³⁾ Europe

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Connectors

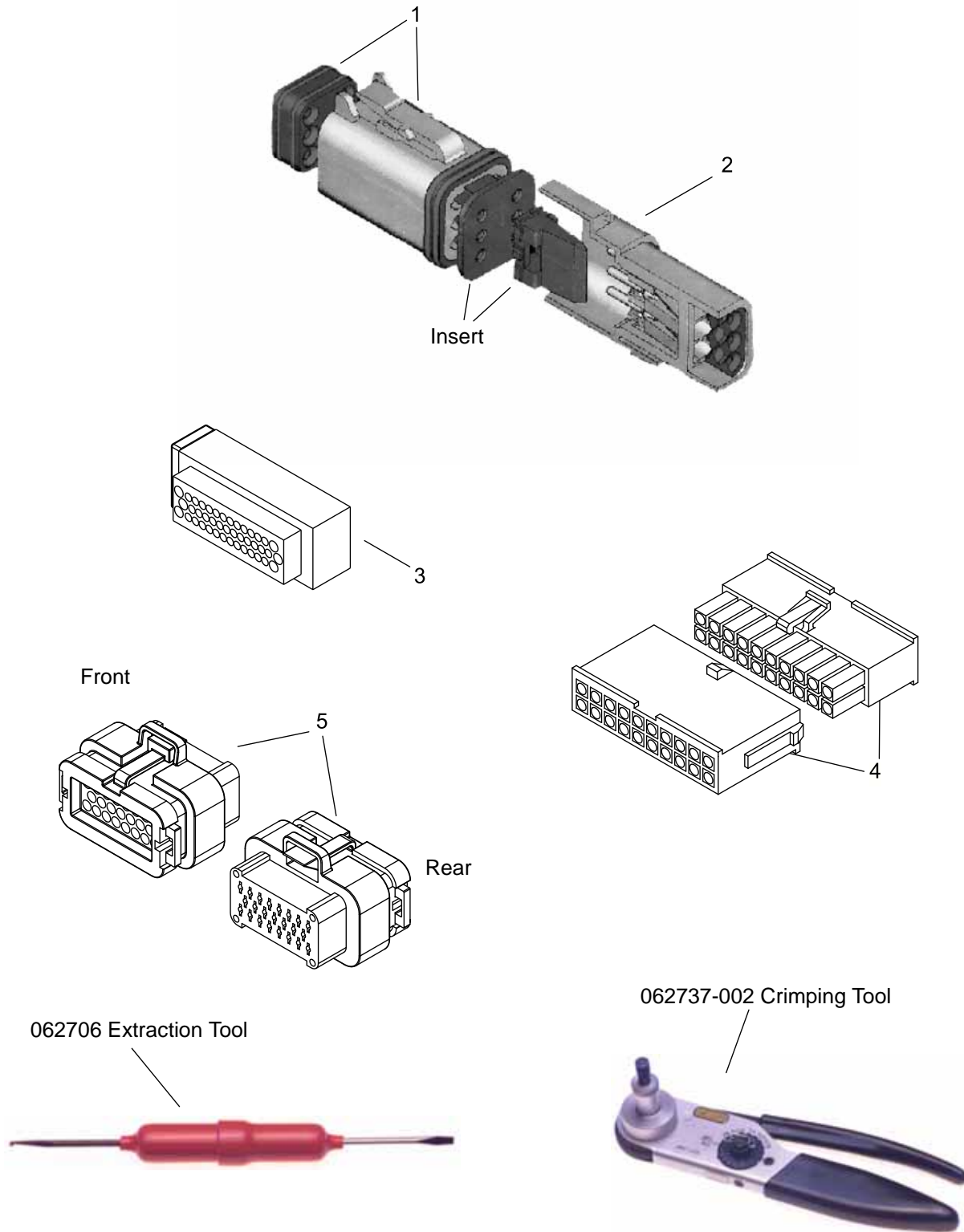


Figure 17844-01

Connector Part Number Chart						
Index	Connector	Designation	# of Terminals	Terminal	Insert	Seal Plug
1	062701-001 ⁽¹⁾	PC201	2	062704-004	062703-002	-
	062755-004 ⁽¹⁾	PC209	6	062797-004	062798-008	-
	062755-004 ⁽¹⁾	PC210	6	062797-004	062798-008	-
	062701-003 ⁽¹⁾	PC211	4	062704-004	062703-006	-
	062755-003 ⁽¹⁾	PC212	4	062797-004	062798-006	-
	062701-002 ⁽¹⁾	PC213	3	062704-004	062703-004	-
	062701-002 ⁽¹⁾	PC214	3	062704-004	062703-004	-
	062701-006 ⁽¹⁾	PC230	12	062704-004	062703-012	-
	062701-006 ⁽¹⁾	PC231	12	062704-004	062703-012	-
	062701-004 ⁽¹⁾	PC240	6	062704-004	062703-008	-
	062701-011 ⁽¹⁾	PC250	8	062704-004	062703-010	-
2	062702-004 ⁽¹⁾	JC207	6	062704-004	062703-007	-
	062702-001 ⁽¹⁾	JC208	2	062704-004	062703-001	-
3	062881-001	PC200	42	062882-001	-	-
4	116851-009	PC202	14	116858	-	819279-001
	116851-005	PC203	8	116858	-	819279-004
	116851-011	PC204	10	116858	-	819279-005
	119851-003	PC205	6	116858	-	819279-003
	116851-005	PC206	8	116858	-	819279-004
	062535-007	JC608	4	062536-001	-	-
	062535-015	PC609	3	062536-002	-	-
	062535-014	JC228	3	062536-001	-	-
5	062720-004	PC401	14	062721-001	-	-
⁽¹⁾ Uses 062737-002 Crimping Tool and 062706 Extraction Tool.						

ELECTRICAL PARTS

Control Cables - TL Mast

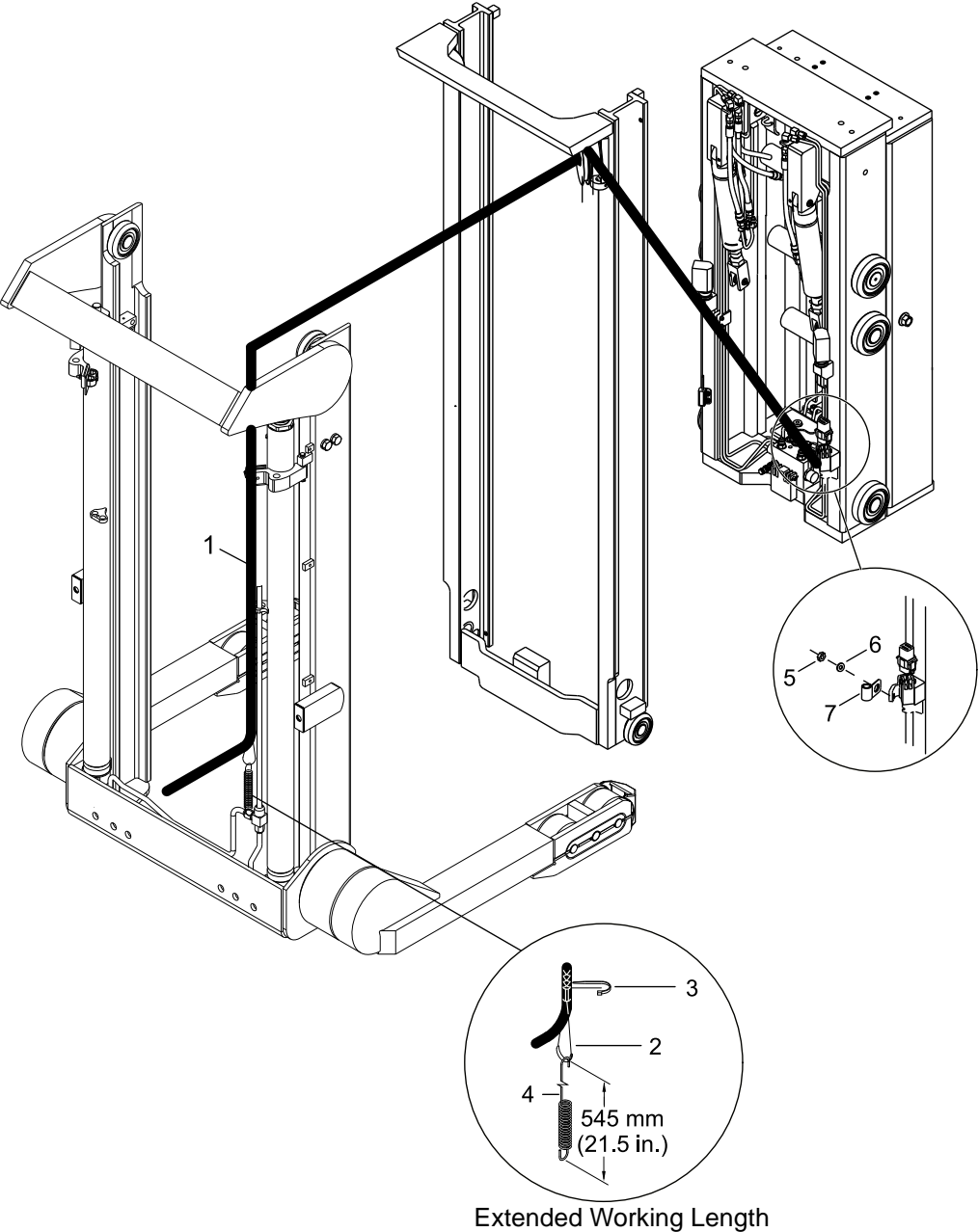


Figure 18769-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	140569-001	Control Cable - 3226 mm (127 in)	1
	140569-002	Control Cable - 3810 mm (150 in)	1
	140569-006	Control Cable - 2667 mm (105 in)	1
2	105449	Cable Grip	1
3	061003-004	Cable Tie	1
4	122914	Extension Spring	1
5	060042-006	Nut	1
6	060030-012	Flatwasher	1
7	061002-011	Harness Clamp	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Cables - TL Mast



Control Cable - TL Mast with Reach

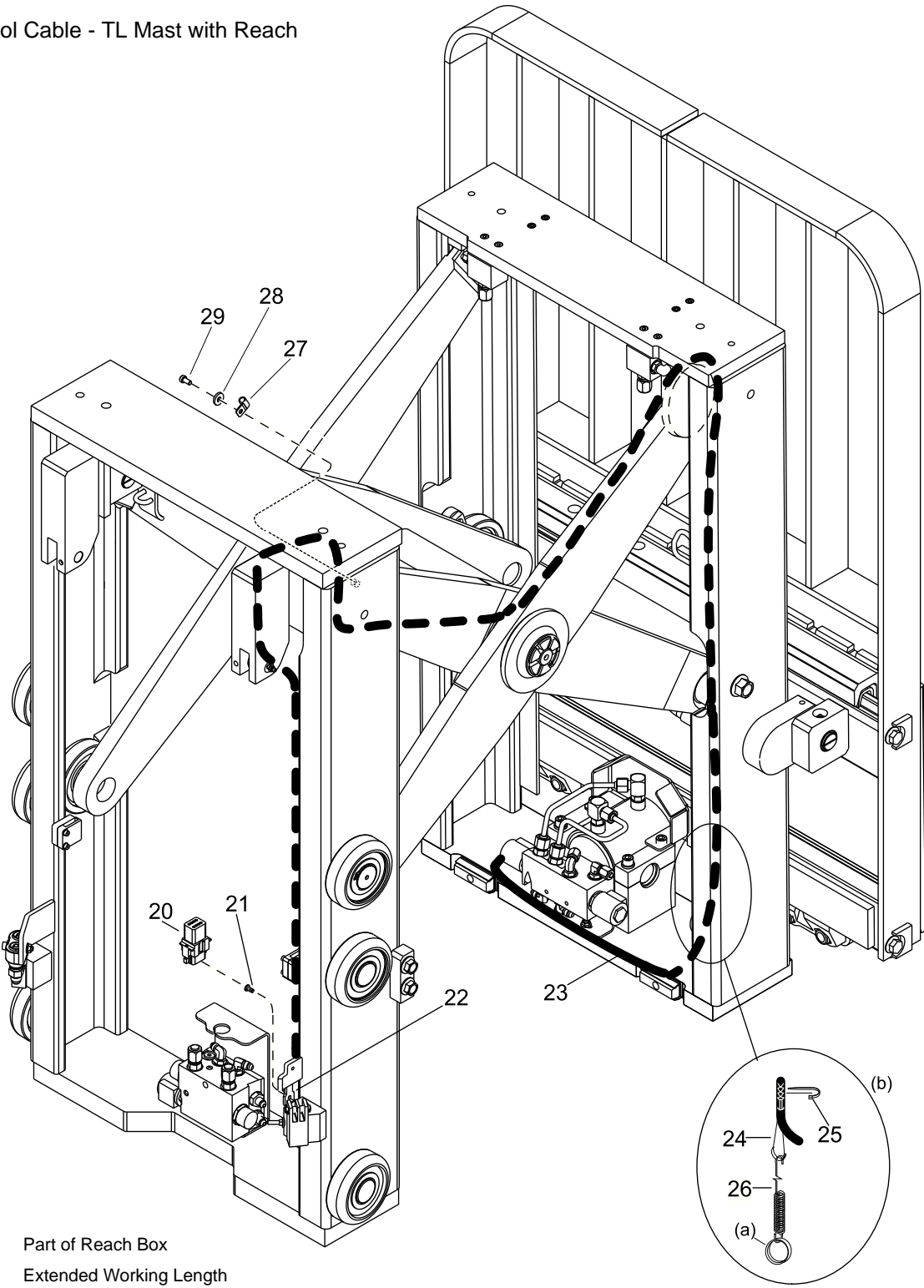


Figure 19305



ELECTRICAL PARTS

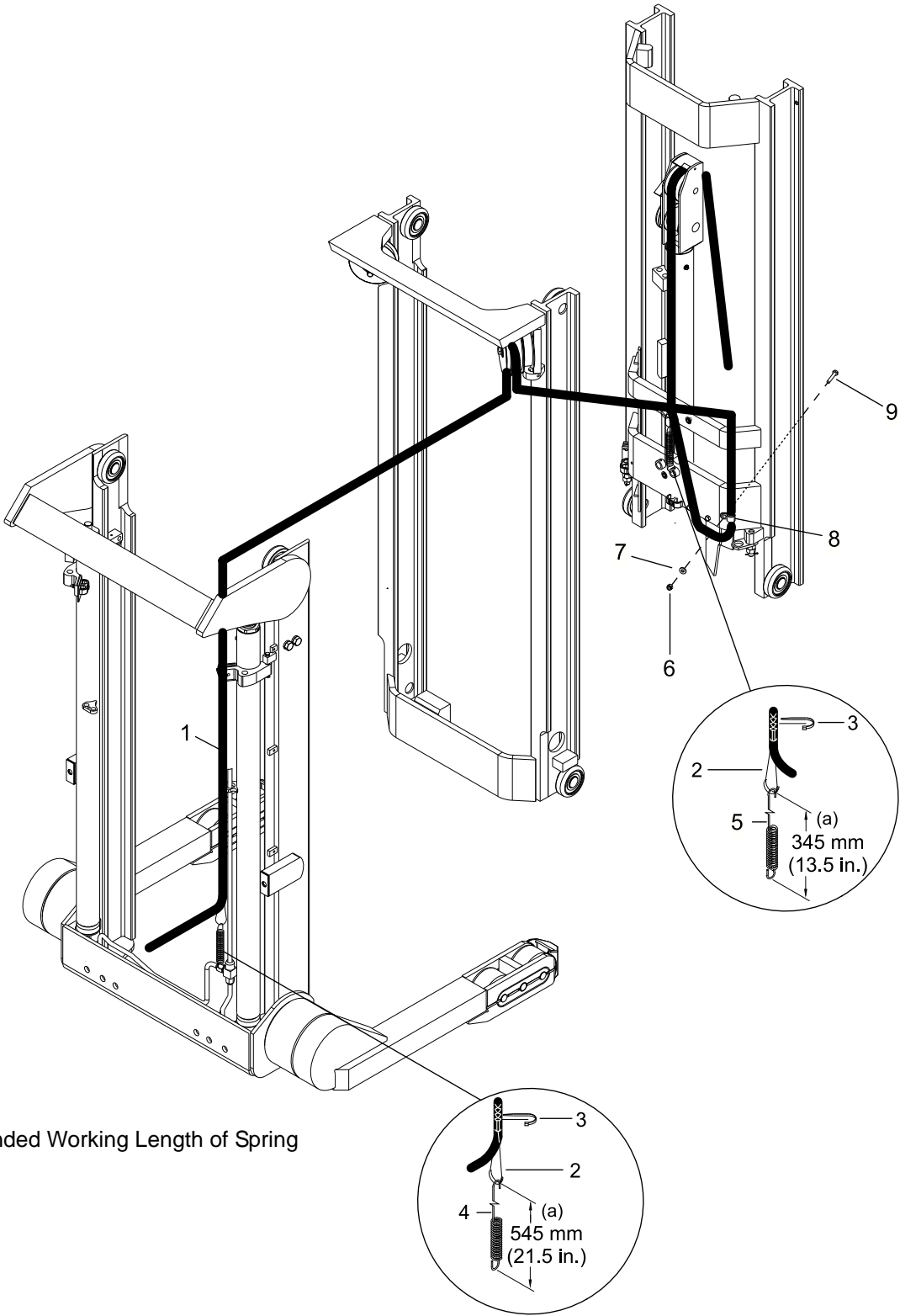
Control Cables - TL Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20	062702-005	Connector	1
	062703-009	Connector Insert	1
21	060061-032	Screw	1
22	062749-002	Connector Clip	1
23	140575-001	Reach Lead Assembly	1
24	084531	Cable Grip	1
25	061003-002	Cable Tie	1
26	089544	Extension Spring	1
27	061002-001	Harness Clamp	1
28	050010-010	Flatwasher	1
29	050005-057	Screw	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Cables - TT



(a) Extended Working Length of Spring

Figure 17853-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	140569-003	Control Cable - 3962 mm (156 in)	1
	140569-004	Control Cable - 4877 mm (192 in)	1
	140569-005	Control Cable - 5334 mm (210 in)	1
2	105449	Cable Grip	2
3	061003-004	Cable Tie	2
4	122914	Extension Spring	1
5	085429	Extension Spring	1
6	060042-006	Nut	1
7	060030-012	Flatwasher	1
8	061002-011	Harness Clamp	1
9	060015-008	Screw	1

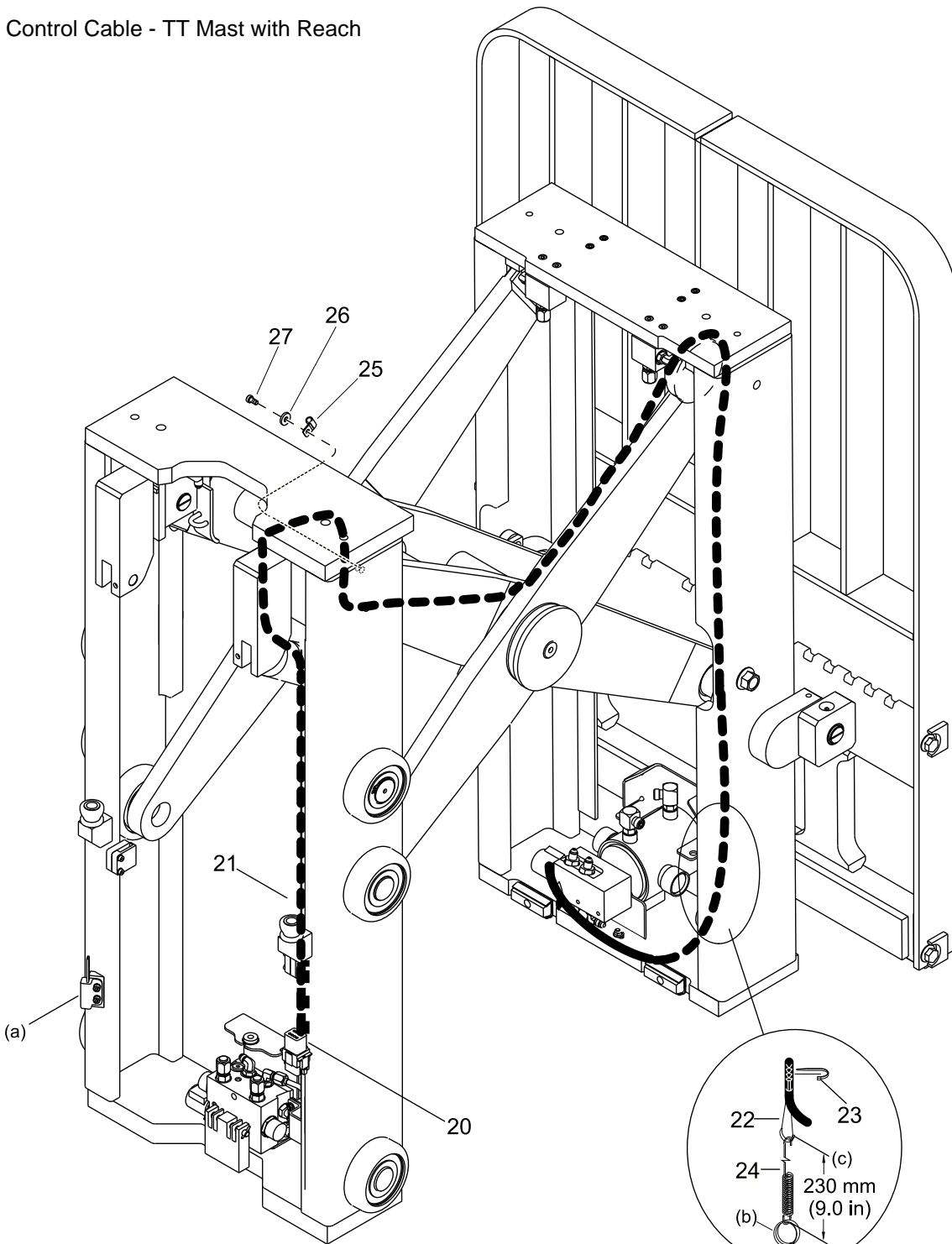
Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Control Cables - TT



Control Cable - TT Mast with Reach



- (a) LMS1 connects to terminal 7 & 8 of Index 2
- (b) Part of Reach Box
- (c) Extended Working Length of Spring

Figure 19301-01



ELECTRICAL PARTS

Control Cables - TT

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20	062702-005	Connector	1
	062703-009	Connector Insert	1
	062749-002	Connector Clip	1
	060061-032	Screw	1
21	140575-001	Reach Lead Assembly	1
22	084531	Cable Grip	1
23	061003-002	Cable Tie	1
24	089544	Extension Spring	1
25	050010-010	Lockwasher	1
26	050005-057	Screw	1
27	061002-001	Harness Clamp	1

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Strobe Light

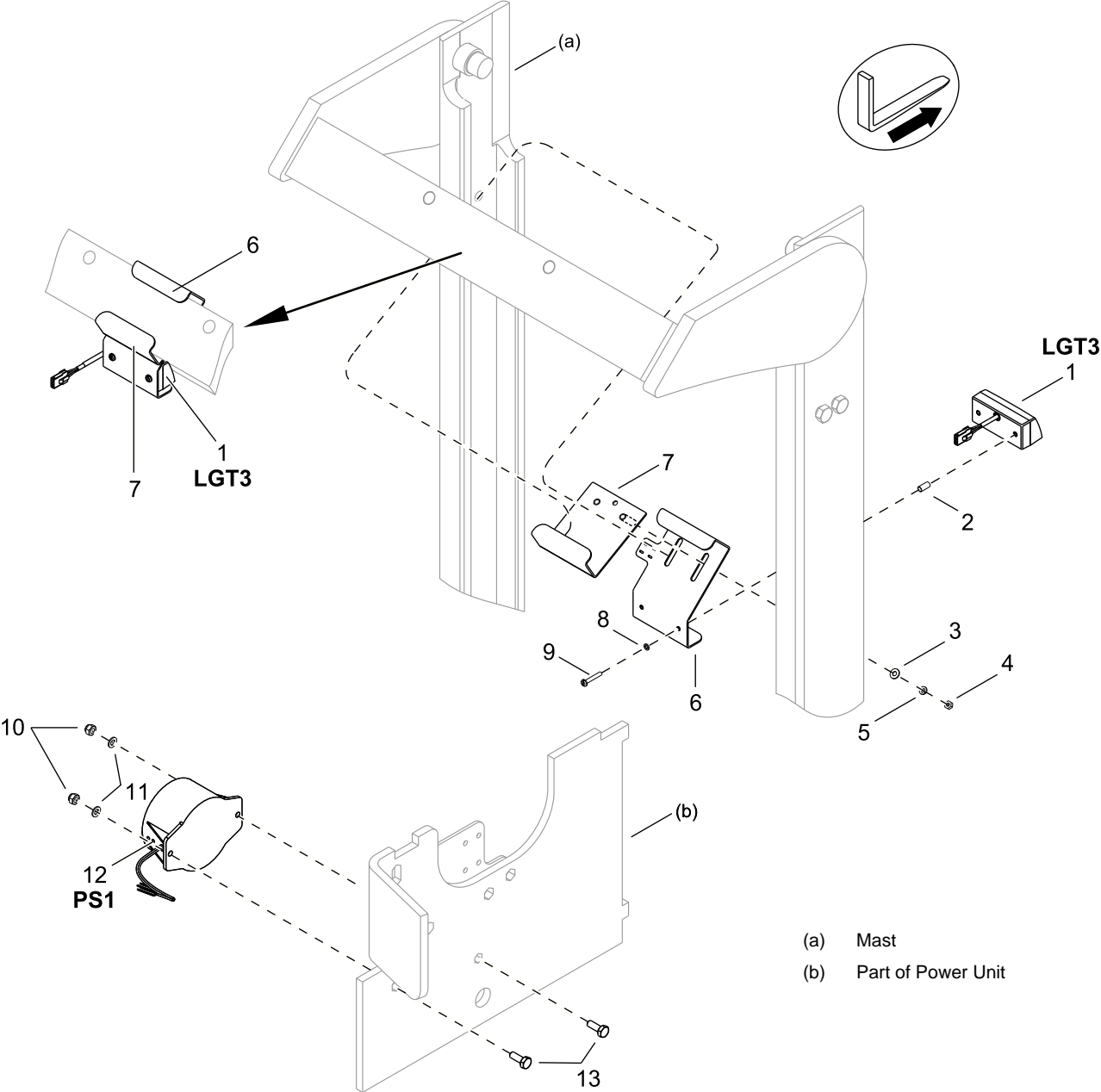


Figure 17685-02



ELECTRICAL PARTS

Strobe Light

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	125616-001	Flashing Light Assembly	1
	126628	Cable Duct	1
2	076901-002	Spacer	2
3	060030-132	Flatwasher	2
4	060021-006	Nut	2
5	060005-007	Lockwasher	2
6	142237	Bracket	1
7	142238	Bracket	1
8	065005-056	Lockwasher	2
9	060013-043	Screw	2
10	050008-010	Nut	2
11	050009-007	Flatwasher	2
12	062693	Strobe Power Supply	1
13	060061-010	Screw	2

Always Specify Model, Data & Serial Number

ELECTRICAL PARTS

Mast Mounted Work Lights

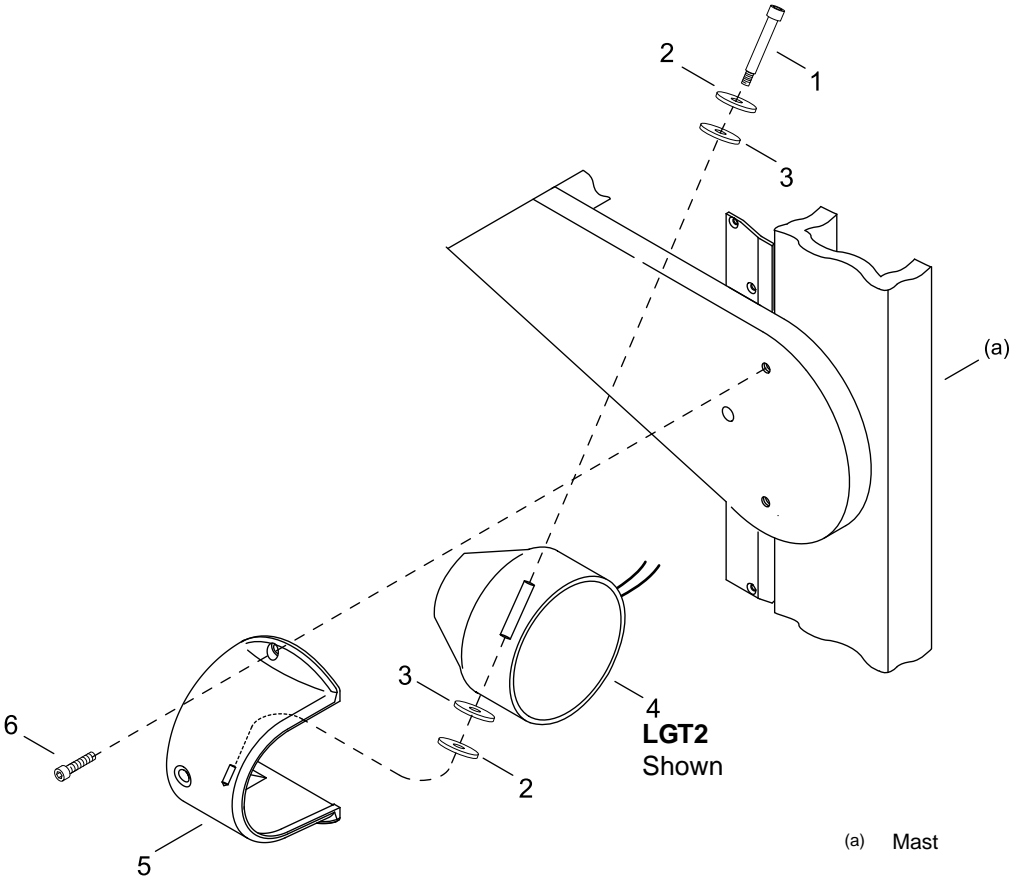


Figure 17689



ELECTRICAL PARTS

Mast Mounted Work Lights

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	060045-026	Screw	2
2	060030-161	Flatwasher	4
3	123980	Rubber Spacer	4
4	104296-005	Spotlight	2
5	123962	Work Light Machining	2
6	060017-045	Screw	4

Always Specify Model, Data & Serial Number

Notes:



BRAKE PARTS

BRAKE PARTS

Brake System

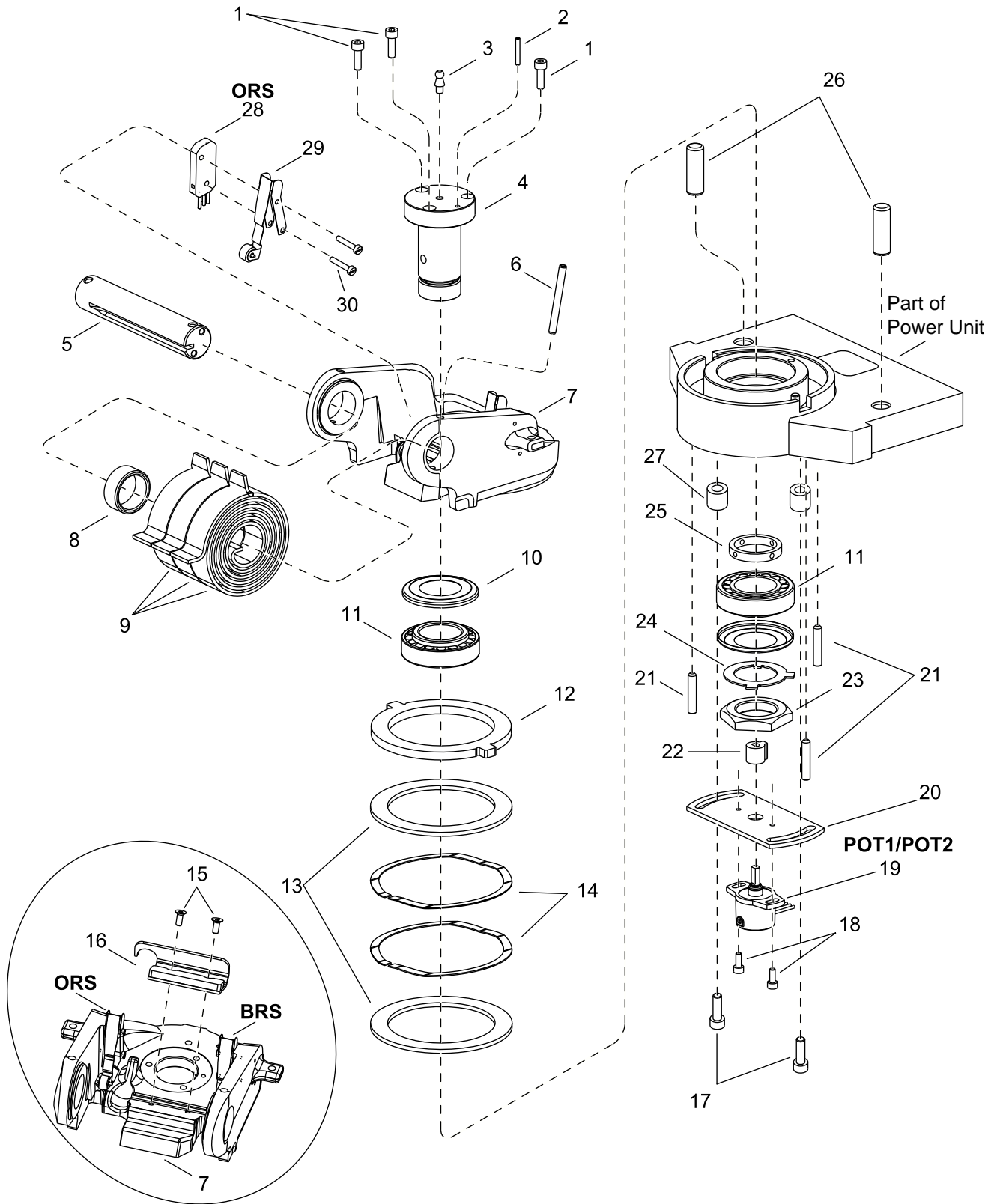


Figure 17586-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	050005-005	Screw	3
2	050000-007	Roll Pin	1
3	054011-006	Grease Fitting	1
4	134338	Knuckle Mount Shaft	1
5	805760	Axle	1
6	050000-015	Roll Pin	1
7	134336	Tiller Knuckle	1
8	803353	Spacer	1
9	803013	Spring	3
10	134341	Metallic Seal	2
11	055056-002	Ball Bearing	2
12	134360	Thrust Plate	1
13	134374	Spacer Plate	2
14	134378	Wave Spring	2
15	050003-010	Screw	2
16	805738	Sheet Damper	1
17	050005-016	Screw	2
18	060065-015	Screw	2
19	818949	Steer Sensor Assembly	1
20	134356	Pot Mount Bracket	1
21	060062-068	Screw	3
22	140558	Rubber Coupling	1
23	134348	Nut	1
24	134346	Tab Washer	1
25	134345	Spacer Ring	1
26	050052-004	Roll Pin	2
27	134395	Spacer	2
28	130774	Microswitch Assembly	2
29	803310	Switch	2
30	050004-032	Screw	4

Always Specify Model, Data & Serial Number

BRAKE PARTS

Brake

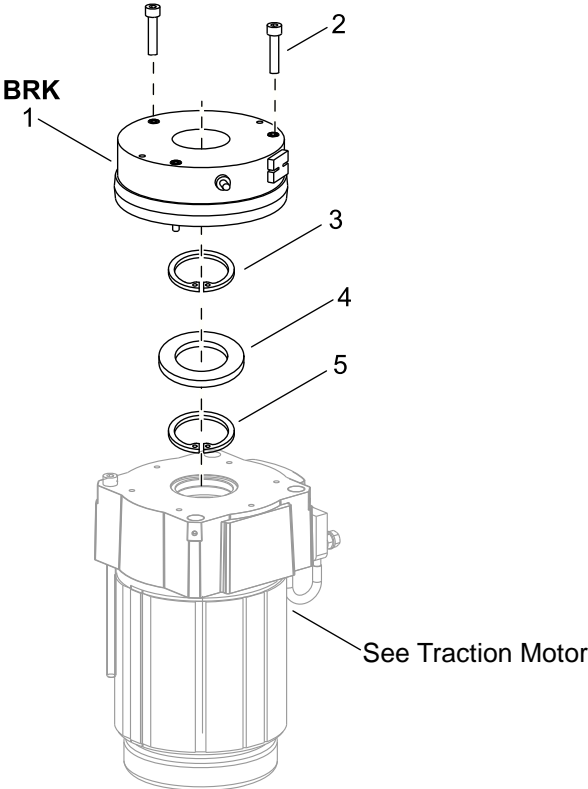


Figure 19054-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	821567	Maintenance Free Brake	1
2	060062-002	Screw	3
3	821458	Retaining Ring	1
4	821466	Washer	1
5	050012-008	Retaining Ring	1
	821580	Brake Wear Kit (Includes Brake Disc, Friction Plate and Screws)	1

Always Specify Model, Data & Serial Number

Notes:



STEERING PARTS

STEERING PARTS

Steer Motor

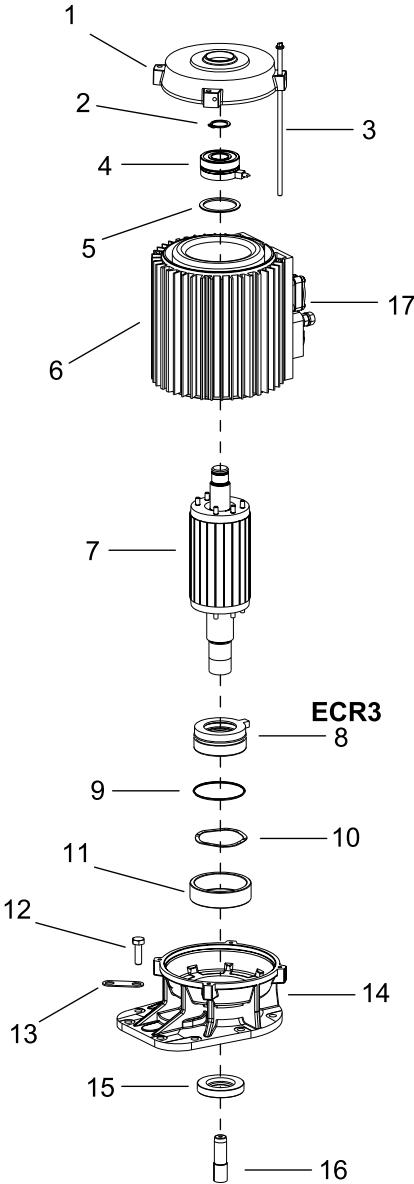


Figure 17472-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	821421	Steer Motor Assembly	1
1	821451	Cover Motor End	1
2	050012-003	Retaining Ring	1
3	821465	Bolt	4
4	822157	Bearing	1
5	821449	Retaining Ring	1
6	821559	Stator	1
7	821430	Rotor	1
8	821565	Bearing	1
9	821438	O-Ring	1
10	822169	Washer	1
11	821435	Ring	1
12	822162	Screw	1
13	821468	Connector	1
14	821443	Cover Motor End	1
15	822166	Seal	1
16	821433	Gear	1
17	146059	Insulator Terminal Block, Steer	1

Always Specify Model, Data & Serial Number

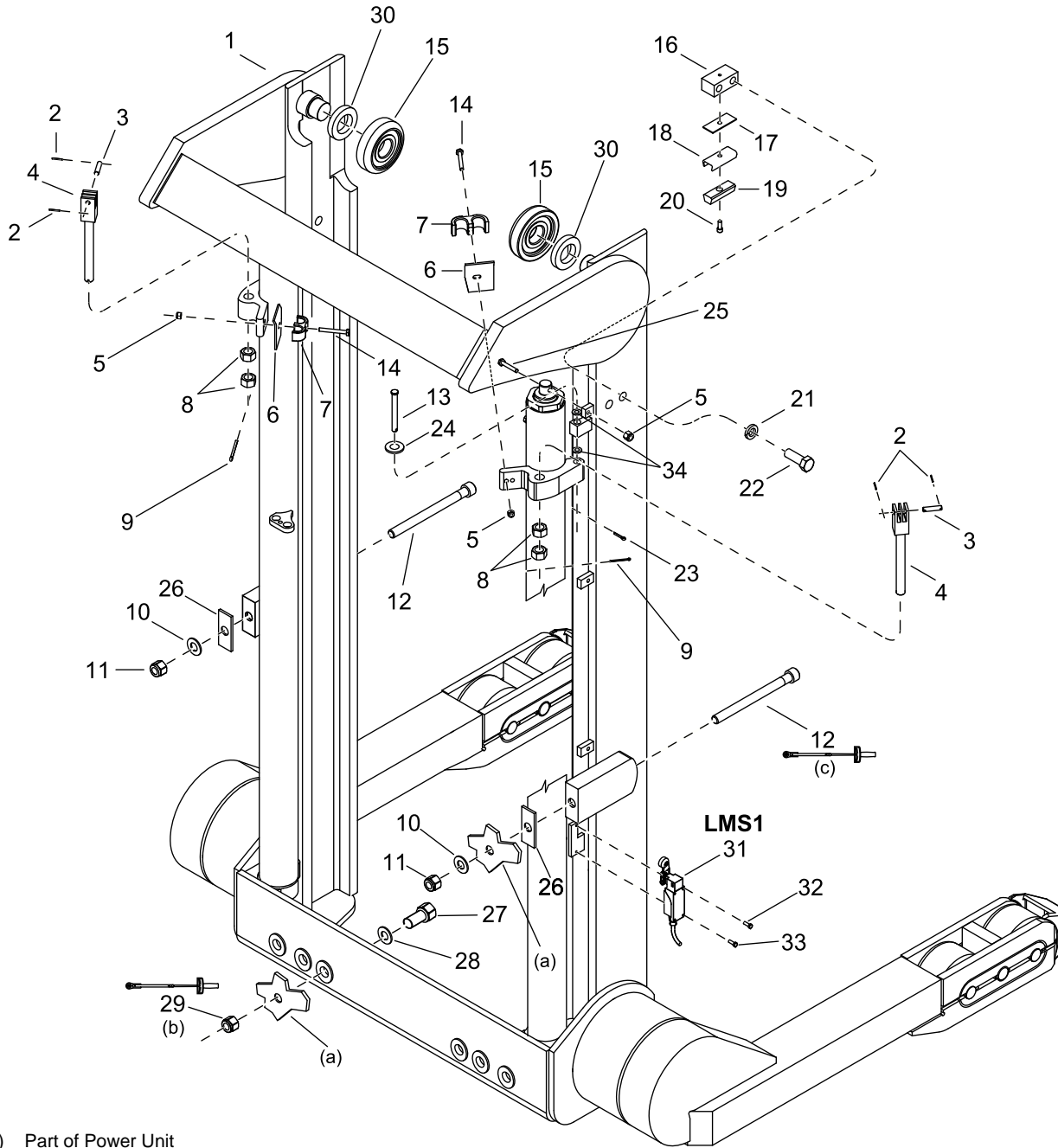
Notes:



LIFTING MECHANISM PARTS

LIFTING MECHANISM PARTS

Mast - TL



- (a) Part of Power Unit
- (b) Torque Value 305 - 339 Nm (225 - 250 ft lb)
- (c) Torque Value 190 - 215 Nm (140 - 160 ft lb)

Figure 17578-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	Contact Factory	Main Frame	1
2	060000-055	Roll Pin	4
3	086499	Pin	2
4	075385-001	Chain Anchor	2
5	060042-006	Nut	4
6	121679	Guide	2
7	123281	Clamp	2
8	060021-028	Nut	4
9	060038-003	Cotter Pin	2
10	060030-260	Flatwasher	2
11	060042-001	Nut	2
12	060020-048	Screw	2
13	076470-025	Clevis Pin	2
14	060015-015	Screw	2
15	074668-001	Column Roller	2
16	080069	Stop Block	2
17	074481-001	Stop Shim	AR
18	107563-001	Bracket	2
19	092747-001	Poly Stop	2
20	060015-016	Screw	2
21	060005-014	Lockwasher	4
22	060020-015	Screw	4
23	060038-017	Cotter Pin	2
24	060030-191	Washer	2
25	060015-043	Screw	2
26	121681-006	Shim	AR
	121681-012	Shim	AR
27	060023-009	Screw	4
28	060030-280	Flatwasher	4
29	060080-009	Nut	4
30	060030-085	Washer	AR
31	123316-011	Limit Switch Assembly	1
32	060013-020	Screw	1
33	060013-021	Screw	1
34	060030-039	Flatwasher	4

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Mast - TL



2nd Stage Mast

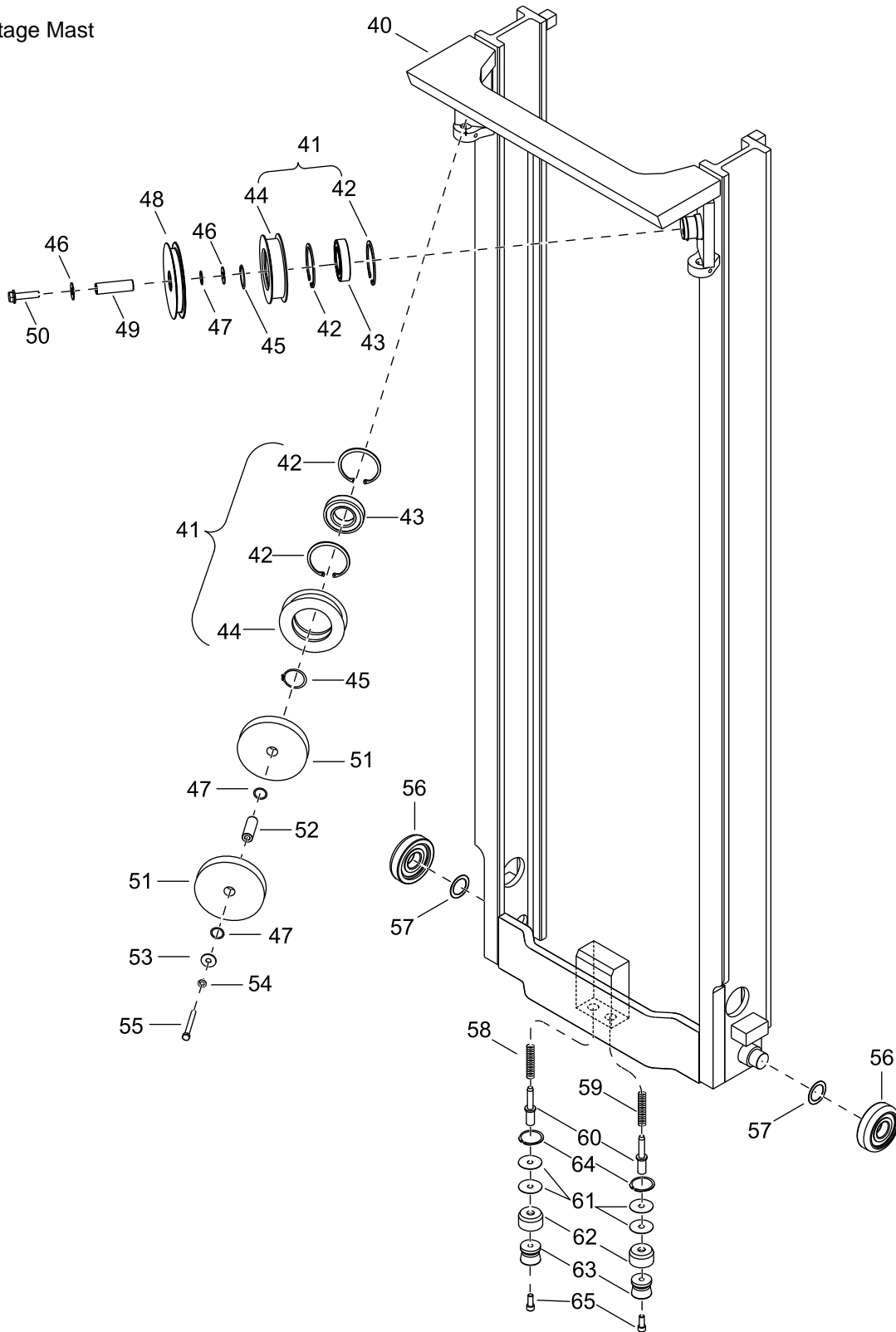


Figure 17579

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40	135039-102	2nd Stage Mast - 2667 mm (105 in)	1
	135039-103	2nd Stage Mast - 3225 mm (127 in)	1
	135039-105	2nd Stage Mast - 3810 mm (150 in)	1
41	117556-001	Chain Pulley Assembly	2
42	060009-062	Retaining Ring	4
43	065081-045	Ball Bearing	2
44	117557-001	Chain Pulley	2
45	060009-043	Retaining Ring	2
46	060030-332	Flatwasher	2
47	060030-192	Flatwasher	2
48	127513-001	Pulley	1
49	127874-006	Shaft	1
50	060019-073	Screw	1
51	119655-001	Pulley	2
52	121624-001	Shaft	1
53	060030-078	Flatwasher	1
54	060005-009	Lockwasher	1
55	060017-059	Screw	1
56	074668-001	Column Roller	2
57	060030-085	Flatwasher	AR
58	122399	Compression Spring	1
59	128011	Compression Spring	1
60	128014	Spring Ram	2
61	060030-277	Flatwasher	AR
62	121622	Lower Stop	2
63	124019	Bumper	2
64	060009-101	Retaining Ring	2
65	060017-056	Screw	2

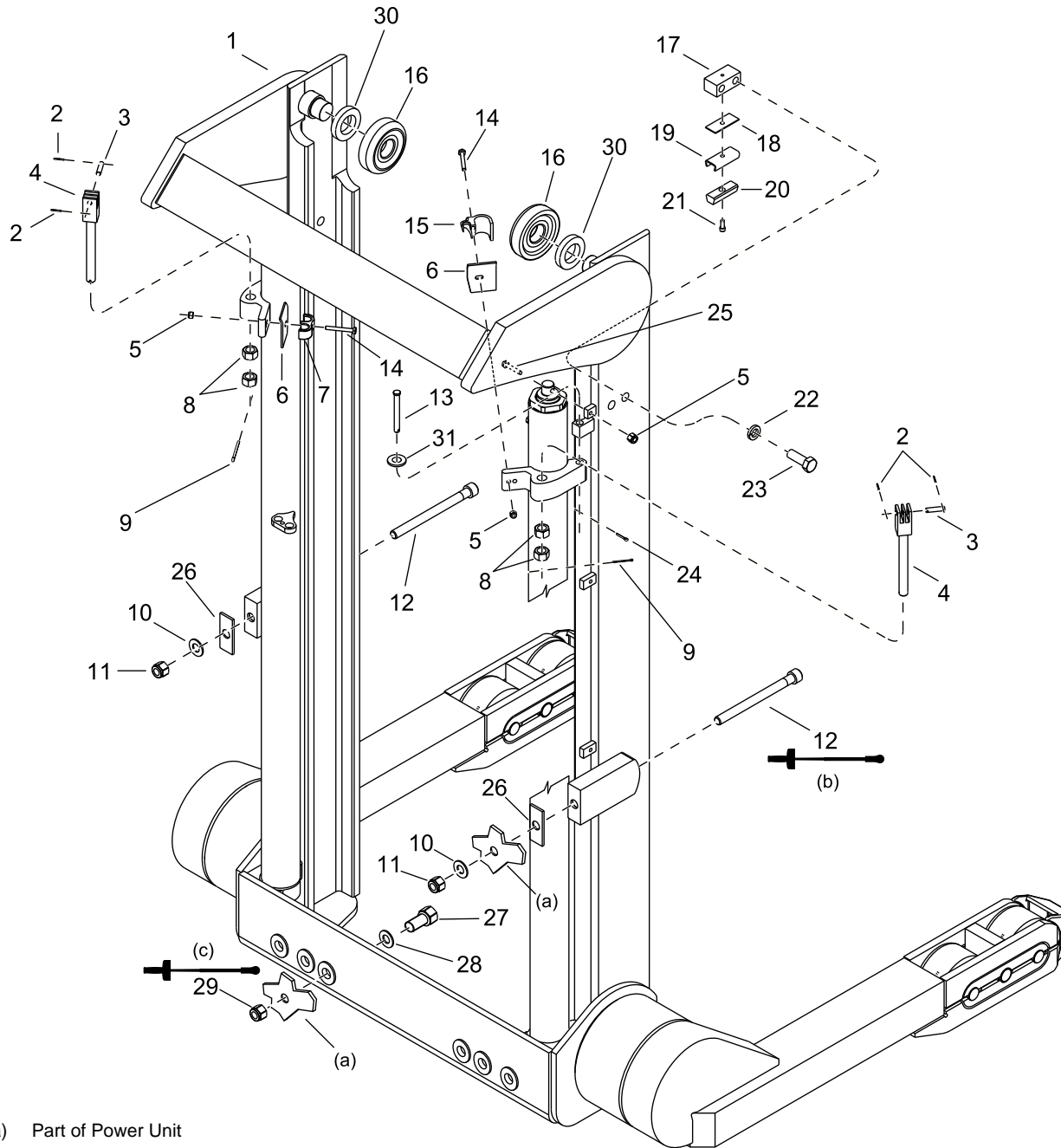
Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Mast - TT



Main Frame



- (a) Part of Power Unit
- (b) Torque Value 190 - 215 Nm (140 - 160 ft lb)
- (c) Torque Value 305 - 339 Nm (225 - 250 ft lb)

Figure 17570-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	Contact Factory	Main Frame	1
2	060000-055	Roll Pin	4
3	086499	Pin	2
4	075385-001	Chain Anchor	2
5	060042-006	Nut	4
6	121679	Guide	2
7	123281	Clamp	1
8	060021-028	Nut	4
9	060038-003	Cotter Pin	2
10	060030-260	Flatwasher	2
11	060042-001	Nut	2
12	060020-048	Screw	2
13	076470-025	Clevis Pin	2
14	060015-015	Screw	2
15	121667	Guide	1
16	074668-001	Column Roller	2
17	080069	Stop Block	2
18	074481-001	Stop Shim	AR
19	107563-001	Bracket	2
20	092747-001	Polystop	2
21	060015-004	Screw	2
22	060005-014	Lockwasher	4
23	060020-015	Screw	4
24	060038-017	Cotter Pin	2
25	060015-043	Screw	2
26	121681-006	Shim	AR
	121681-012	Shim	AR
27	060023-009	Screw	4
28	060030-280	Washer	4
29	060080-009	Nut	4
30	060030-085	Washer	AR
31	060030-191	Washer	2

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Mast - TT

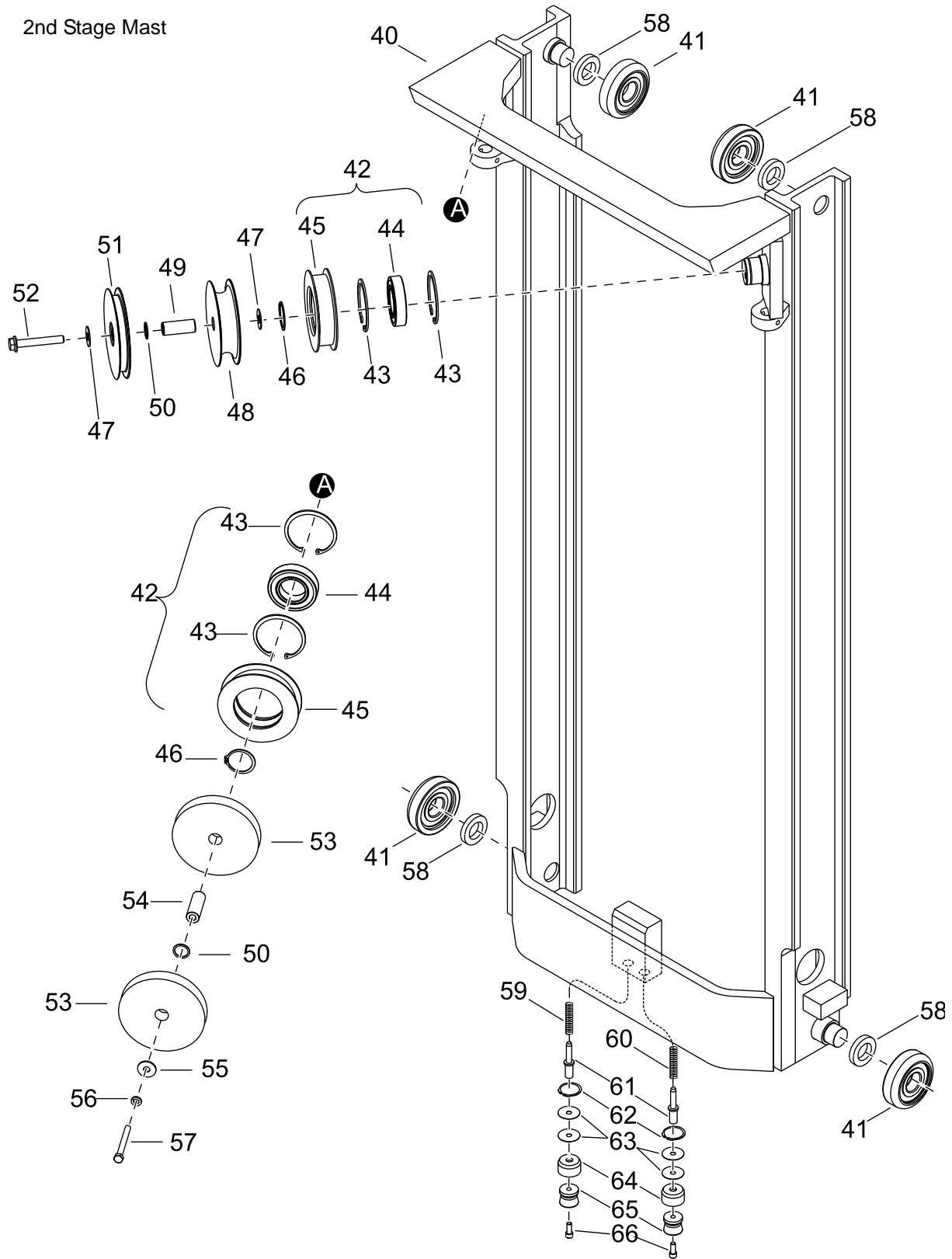


Figure 17571-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40	135038-002	2nd Stage Mast - 3962 mm (156 in)	1
	135038-004	2nd Stage Mast - 4877 mm (192 in)	1
	135038-005	2nd Stage Mast - 5334 mm (210 in)	1
41	074668-001	Column Roller	4
42	117556-001	Chain Pulley Assembly	2
43	060009-062	Retaining Ring	4
44	065081-045	Bearing	2
45	117557-001	Pulley	2
46	060009-043	Retaining Ring	2
47	060030-332	Washer	2
48	127791	Pulley	1
49	127874-001	Shaft	1
50	060030-192	Washer	2
51	127513-001	Pulley	1
52	060019-071	Screw	1
53	119655-001	Pulley	2
54	121624-001	Shaft	1
55	060030-078	Washer	1
56	060005-009	Lockwasher	1
57	060017-059	Screw	1
58	060030-085	Washer	AR
59	122399	Compression Spring	1
60	128011	Compression Spring	1
61	128014	Ram Spring	2
62	060009-101	Retaining Ring	2
63	060030-277	Flatwasher	AR
64	121622	Lower Stop	2
65	124019	Bumper	2
66	060017-056	Screw	2

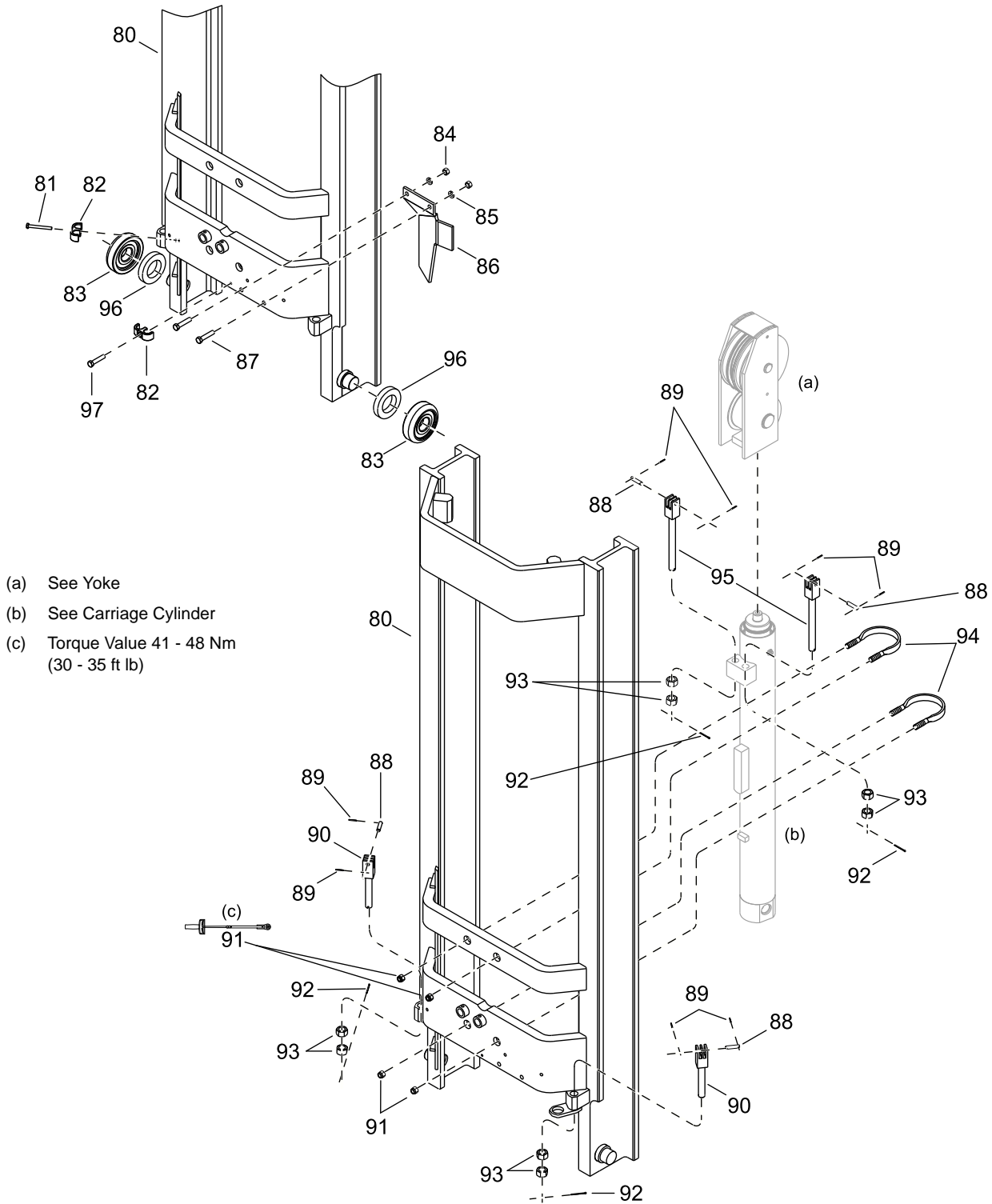
Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Mast - TT



3rd Stage Mast



- (a) See Yoke
- (b) See Carriage Cylinder
- (c) Torque Value 41 - 48 Nm
(30 - 35 ft lb)

Figure 17572-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
80	135042-002	3rd Stage Mast - 3962 mm (156 in)	1
	135042-004	3rd Stage Mast - 4877 mm (192 in)	1
	135042-005	3rd Stage Mast - 5334 mm (210 in)	1
81	060015-049	Screw	1
82	123281	Clamp	2
83	074668-001	Column Roller	2
84	060021-011	Nut	2
85	060005-009	Lockwasher	2
86	121738	Guard	1
87	060017-032	Screw	2
88	086499	Pin	4
89	060000-055	Roll Pin	8
90	075385-004	Chain Anchor	2
91	060042-018	Nut	4
92	060038-003	Cotter Pin	4
93	060021-028	Nut	8
94	121795	Clamp	2
95	075385-003	Chain Anchor	2
96	060030-085	Washer	AR
97	060015-054	Screw	1

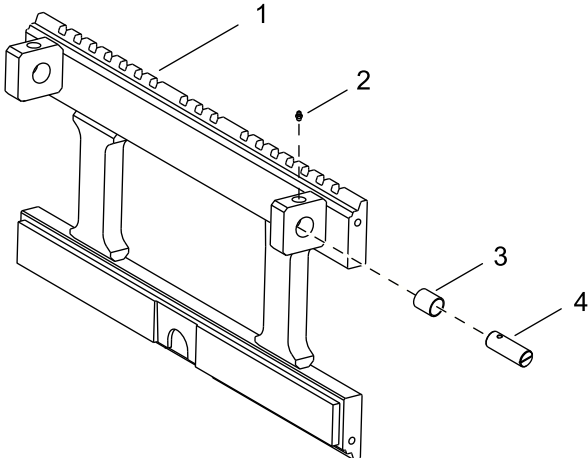
Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Fork Carriage SH/SHR - TT/TL



TT and TL Mast with Tilt



TT and TL Mast with Tilt and Sideshift

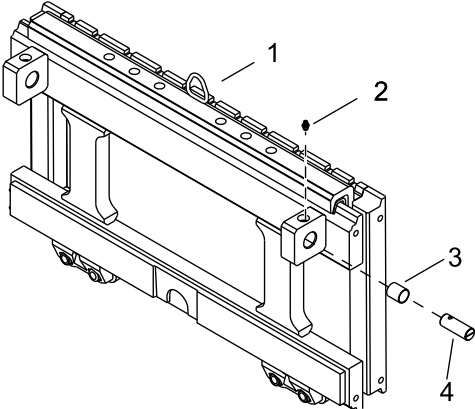


Figure 19641

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134379-001*	Carriage TT Mast with Tilt	1
	134379-002*	Carriage TL Mast with Tilt	1
	127757-004*	Carriage TT and TL Mast with Tilt and Sideshift	1
2	076048-001	Lubrication Fitting	2
3	065007-045	Bearing Sleeve	2
4	134429	Shaft	2

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated



100 mm (4 in) O.D. Tandem Load Wheels

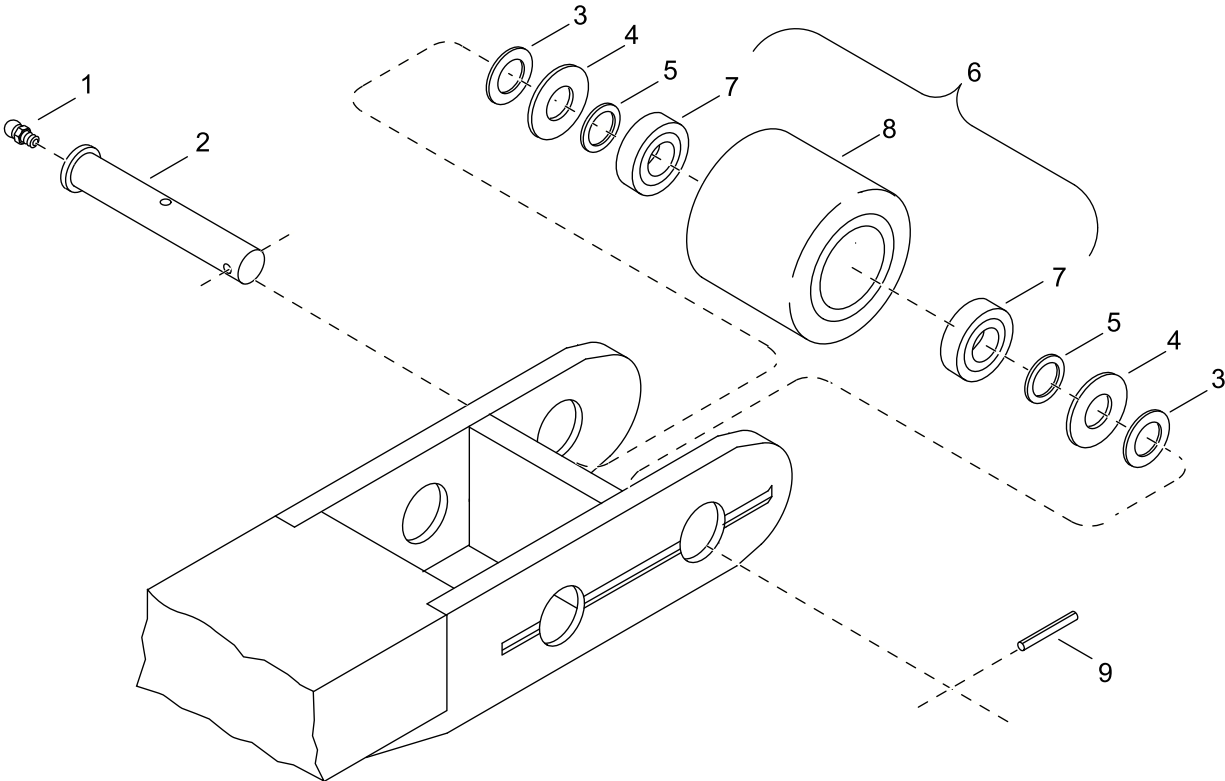


Figure 17539-01



LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	076048-001	Lubrication Fitting	4
2	073962-006	Axle	4
3	060030-068	Flatwasher (0.8 mm)	AR
4	060030-109	Flatwasher (3.0 mm)	8
5	060030-110	Flatwasher (1.5 mm)	8
6	083585-xxx-88	Wheel Assembly ⁽¹⁾	4
7	065081-021	Ball Bearing	8
8	083585-xxx	Poly Wheel ⁽¹⁾	4
9	060000-030	Roll Pin	4

⁽¹⁾ Refer to Field Application Guide for all available compounds to complete part number.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated



127 mm (5 in) O.D. Tandem Load Wheels

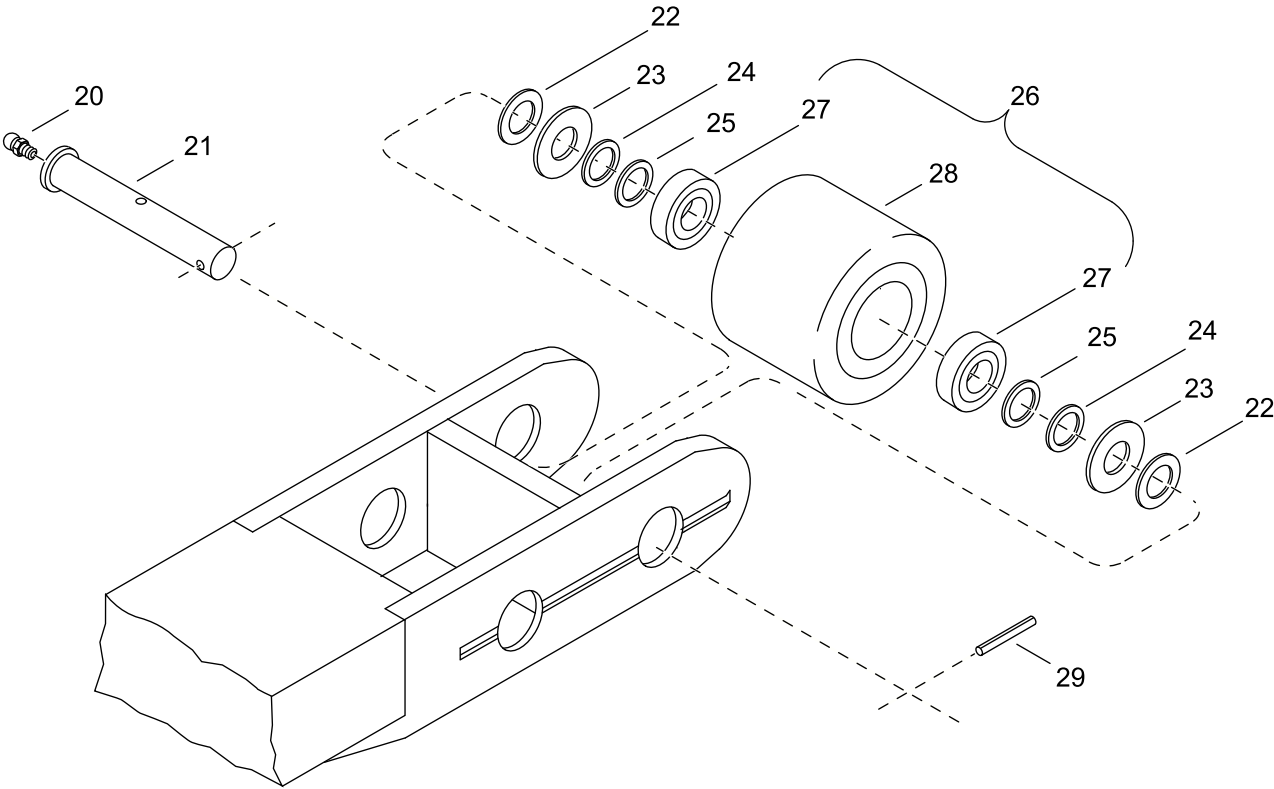


Figure 17540-01



LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20	076048-001	Lubrication Fitting	4
21	073962-006	Axle	4
22	060030-127	Flatwasher (0.8 mm)	8
23	060030-278	Flatwasher (3.0 mm)	8
24	060030-093	Flatwasher (1.5 mm)	8
25	060030-289	Flatwasher (0.8 mm)	AR
26	115032-xxx-88	Wheel Assembly ⁽¹⁾	4
27	065081-057	Ball Bearing	8
28	115032-xxx	Poly Wheel ⁽¹⁾	4
29	060000-030	Roll Pin	4

⁽¹⁾ Refer to Field Application Guide for all available compounds to complete part number.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated



215 mm (8.5 in) O.D. Load Wheels

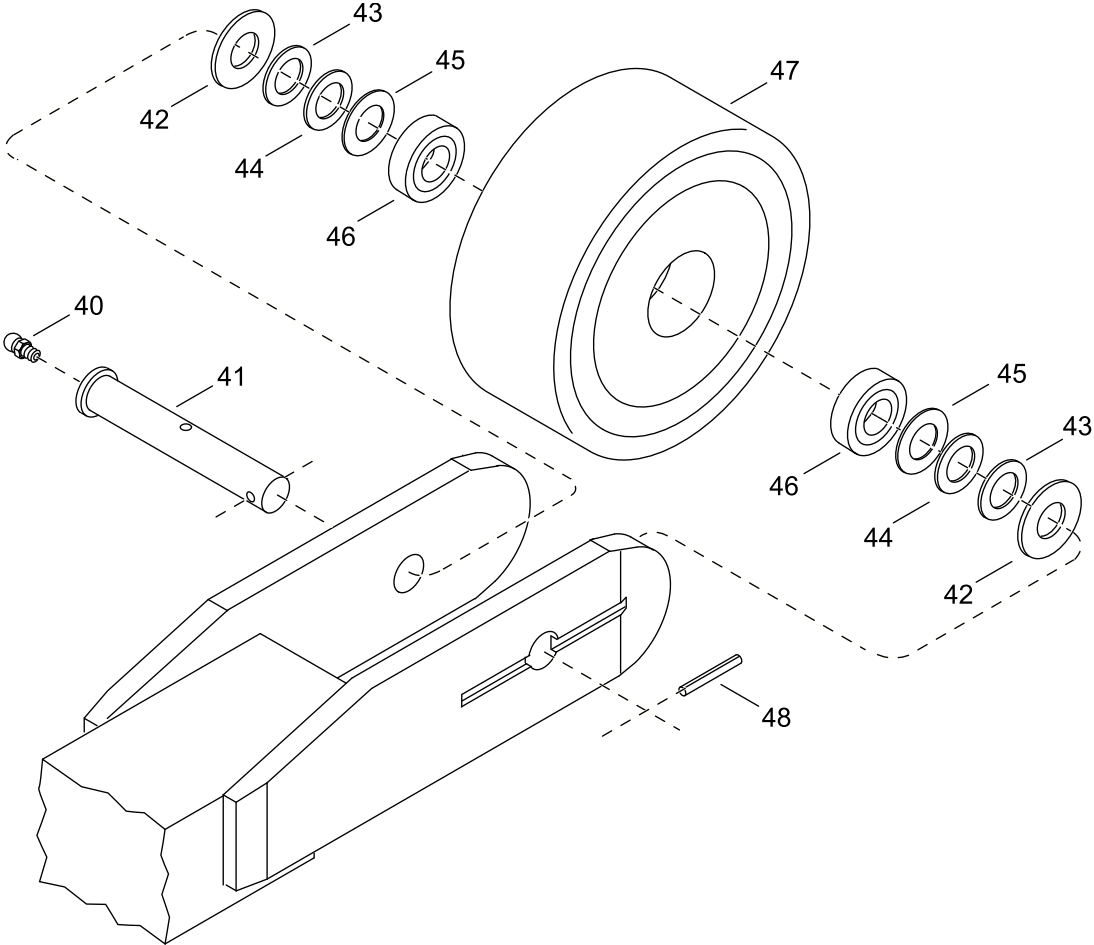


Figure 17541



LIFTING MECHANISM PARTS

Load Wheels - Non-Articulated

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40	076048-001	Lubrication Fitting	2
41	074659-004	Axle	2
42	060030-111	Flatwasher (3.2 mm)	AR
43	060030-113	Flatwasher (2.4 mm)	AR
44	060030-112	Flatwasher (1.5 mm)	AR
45	060030-085	Flatwasher (0.8 mm)	AR
46	065081-008	Ball Bearing	4
47	099722-001	Poly Wheel	2
48	060000-051	Roll Pin	2

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Articulated



100 mm (4 in) O.D. Tandem Load Wheels

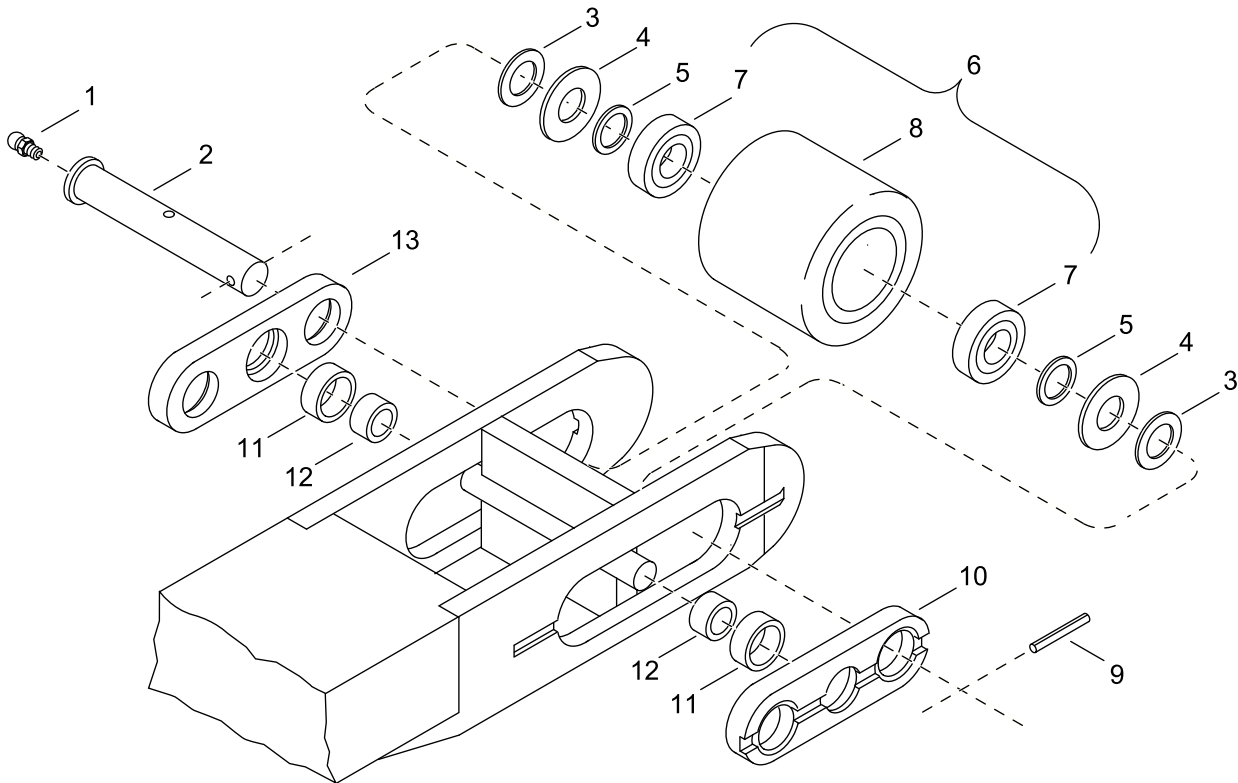


Figure 18829

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	076048-001	Fitting	4
2	073962-006	Axle	4
3	060030-068	Flatwasher (0.8 mm)	AR
4	060030-109	Flatwasher (3 mm)	8
5	060030-110	Flatwasher (1.5 mm)	AR
6	083585-xxx-88	Wheel Assembly ⁽¹⁾	4
7	065081-021	Ball Bearing	8
8	083585-xxx	Poly Wheel ⁽¹⁾	4
9	060000-030	Roll Pin	4
10	122451-001	Pivot Plate	2
11	065084-013	Bearing	4
12	111859-002	Sleeve	4
	061004-021	Adhesive	1
13	122451-002	Pivot Plate	2

⁽¹⁾ Refer to Field Application Guide for all available compounds to complete part number.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Articulated



127 mm (5 in) O.D. Tandem Load Wheels

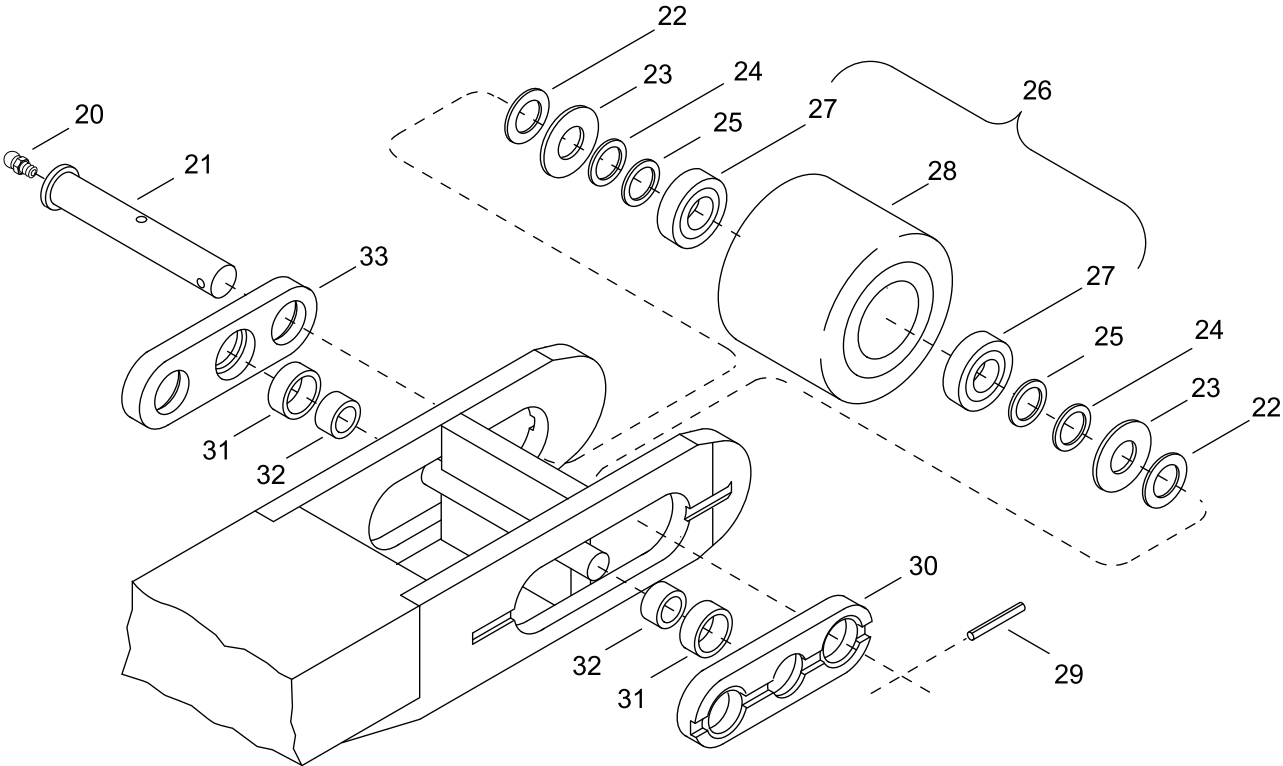


Figure 18830

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
20.....	076048-001.....	Fitting	4
21.....	073962-006.....	Axle	4
22.....	060030-127.....	Flatwasher (0.8 mm)	8
23.....	060030-278.....	Flatwasher (3 mm)	8
24.....	060030-093.....	Flatwasher (1.5 mm)	8
25.....	060030-289.....	Flatwasher (0.8 mm)	AR
26.....	115032-xxx-88	Wheel Assembly ⁽¹⁾	4
27.....	065081-057	Ball Bearing	8
28.....	115032-xxx	Poly Wheel ⁽¹⁾	4
29.....	060000-030.....	Roll Pin	4
30.....	121786-002.....	Pivot Plate	2
31.....	065084-015.....	Bearing	4
32.....	111858-002.....	Sleeve	4
	061004-021.....	Adhesive	1
33.....	121786-001.....	Pivot Plate	2

⁽¹⁾ Refer to Field Application Guide for all available compounds to complete part number.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Wheels - Articulated



265 mm (10.5 in) O.D. Load Wheels

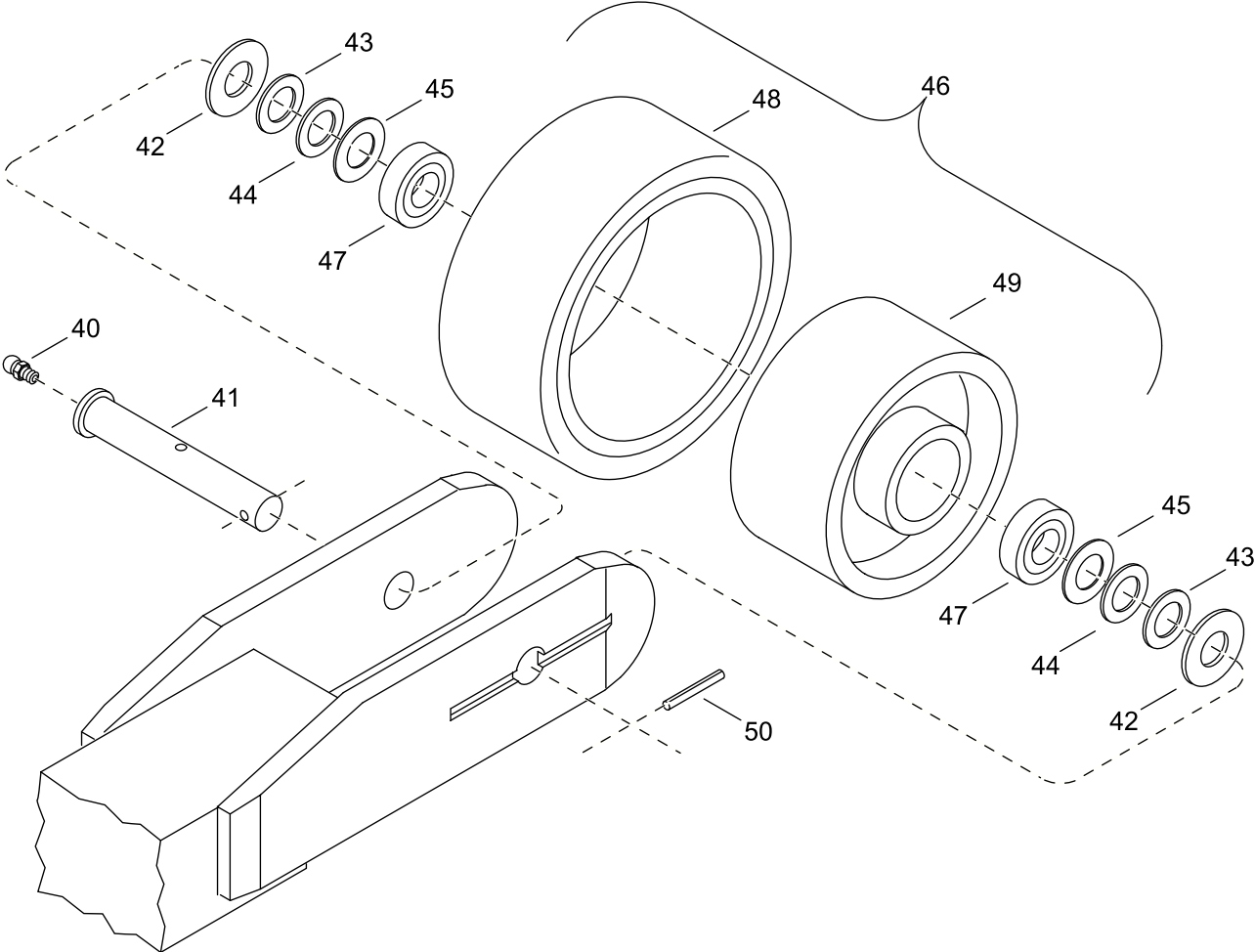


Figure 18831

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40	076048-001	Fittings	2
41	074659-004	Axle	2
42	060030-111	Flatwasher (3.2 mm)	AR
43	060030-113	Flatwasher (2.4 mm)	AR
44	060030-112	Flatwasher (1.5 mm)	AR
45	060030-085	Flatwasher (0.8 mm)	AR
46	113018-060	Wheel Assembly	2
47	065081-008	Ball Bearing	4
	105090-060	Poly Wheel	2
48	105088-060	Tire	2
49	105086	Hub	2
50	060000-051	Roll Pin	2

Always Specify Model, Data & Serial Number

Wheel Series	Compound Number	Shore A Hardness	Composition	Application Type			
				Wet/Freezer Resistant to Chunking	Dock Boards Rough Floors Floor Debris Resistant to Chunking	Heavy Loads Long Runs Resistant to Extreme Heat	Floor Debris Resistant to Flat Spotting
100 Series Light Duty	101	93A	polyether	•	•		
	102	95A	polyester	•	•		
200 Series Mid-Range	201	83A	polyester	•	•		
	202	83A	polyester	•	•		
	203	83A	polyester	•	•		
	204	85A	polyester	•	•		
	205	87A	polyether	•	•		•
300 Series High Capacity	301	95A	polyether	•	•	•	•
	302	95A	polyester	•	•	•	•
	303	95A	polyester	•	•	•	•
	304	95A	polyester	•	•	•	•
	305	95A	polyether	•	•	•	•
	306	97A	polyether	•	•	•	•
400 Series Heavy Duty	401	93A	vulkollan				
	402	99A	polyether				

100 Series Light Duty wheel compounds are best suited for light loads and intermittent use.
 200 Series Mid-Range wheels are designed for light to medium loads and short to medium runs.
 300 Series High Capacity are for the typical demands of most applications. High capacity wheels feature compounds designed for high capacities and long runs.
 400 Series Heavy Duty wheels are designed for maximum capacities and extreme runs.

Shore A Hardness Scale



30A is comparable to a rubber band. Typically more cut and tear resistant and provide a smoother ride.
 60A is comparable to a car tire. Provide improved travel speeds (less rolling resistance) and generate less heat.

Polyester vs. Polyether

These elements of polyurethane chemical composition can be found in each compound series.

Polyester - provides greater cut and tear resistance and overall durability.

Polyether - provides greater load bearing capacity and heat resistance.

Notes:

LIFTING MECHANISM PARTS

SH Yoke w/o Accessories - TT

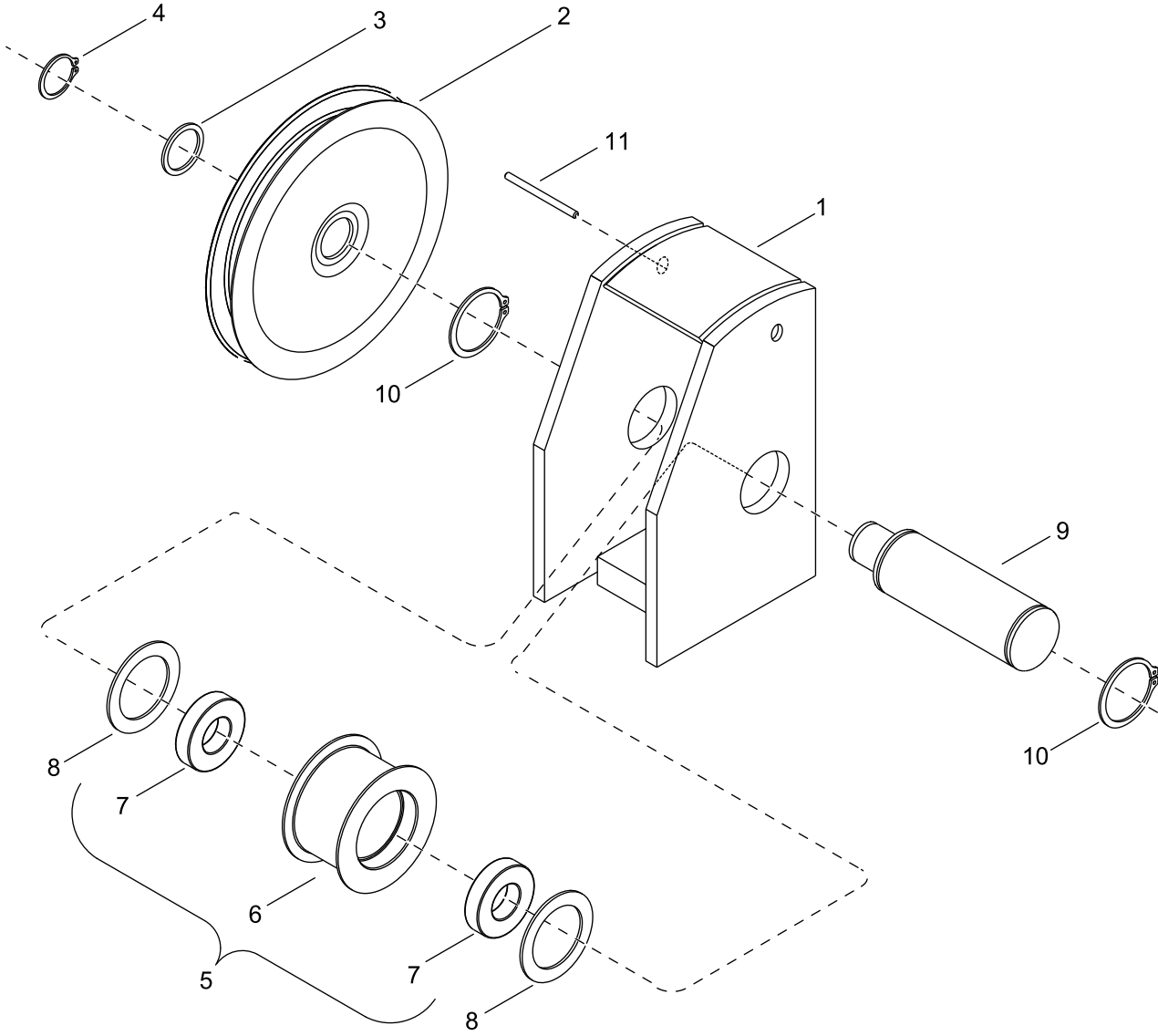


Figure 18650-01



LIFTING MECHANISM PARTS

SH Yoke w/o Accessories - TT

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	140482	Yoke Assembly	1
1	140483	Yoke	1
2	127513-002	Pulley	1
3	060030-192	Washer	1
4	060009-011	Retaining Ring	1
5	117575-003	Pulley Assembly	1
6	117576-003	Pulley	1
7	065081-027	Ball Bearings	2
8	060030-057	Washer	2
9	123401-001	Shaft	1
10	060009-018	Retaining Ring	2
11	060000-067	Roll Pin	1

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Yoke w/Accessories - TT

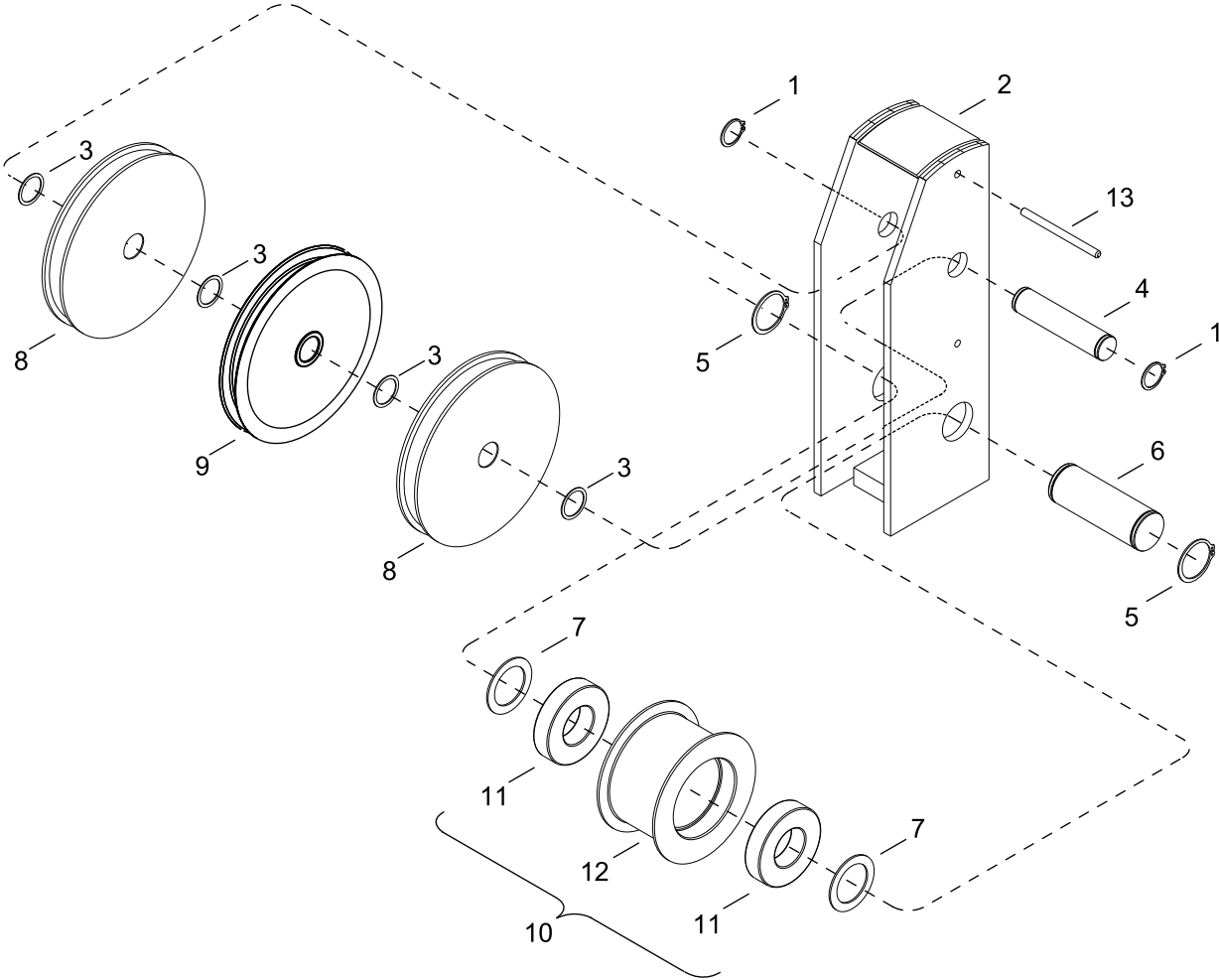


Figure 17498



LIFTING MECHANISM PARTS

Yoke w/Accessories - TT

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	121802	Yoke Assembly	1
1	060009-011	Retaining Ring	2
2	121628	Yoke	1
3	060030-329	Flatwasher	4
4	123183-002	Shaft	1
5	060009-018	Retaining Ring	2
6	123181-003	Shaft	1
7	060030-057	Washer	2
8	119655-002	Pulley	2
9	127583-001	Pulley	1
10	117575-003	Pulley Assembly	1
11	065081-027	Ball Bearings	2
12	117576-003	Pulley	1
13	060000-112	Roll Pin	1

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Lift Chain - TL Mast

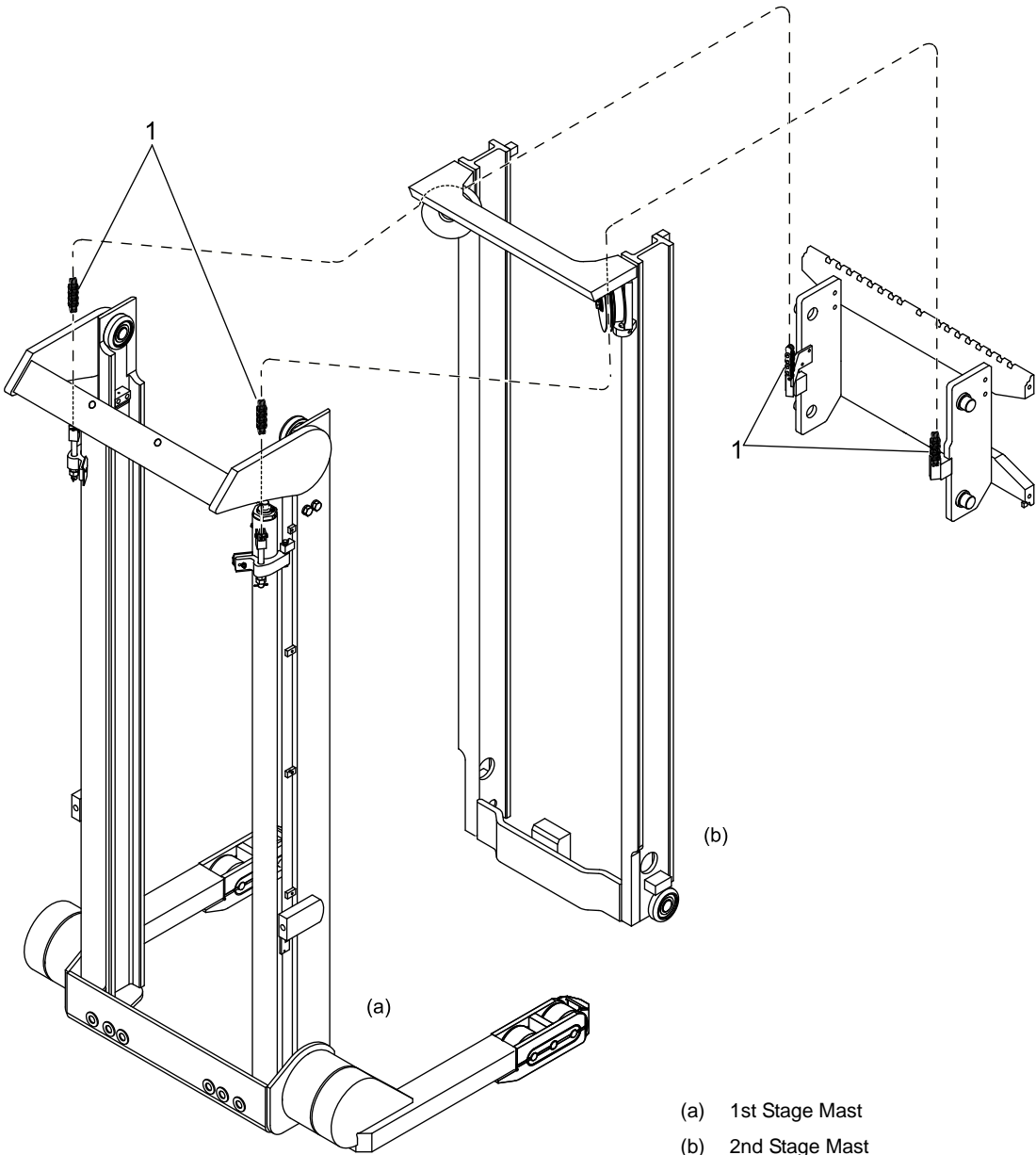


Figure 18678-01

INDEX PART NUMBER PART NAME NUMBER REQUIRED

1..... * Mast Chain ⁽¹⁾ 2

⁽¹⁾ See Chart 1

When ordering chain, order the number of feet of 073991-067 for your particular truck. The appropriate minimum order quantity is listed in the charts. Cut chain to length required for your truck. Replace both chains at the same time.

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

CHART 1 - SH/SHR Mast Chain Index 1								
Truck Type	Lift Height*		Length Required*			Part Number	Minimum Order Required m (ft)	
	mm	in	mm	in	Links		Each	Per Truck
TL	2667	105	1848	72.75	97	073991-067	2.13 (7)	3.96 (13)
	3226	127	2115	78.75	105	073991-067	2.13 (7)	4.27 (14)
	3810	150	2381	92.25	123	073991-067	2.44 (8)	4.88 (16)

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Lift Chain - TT Mast

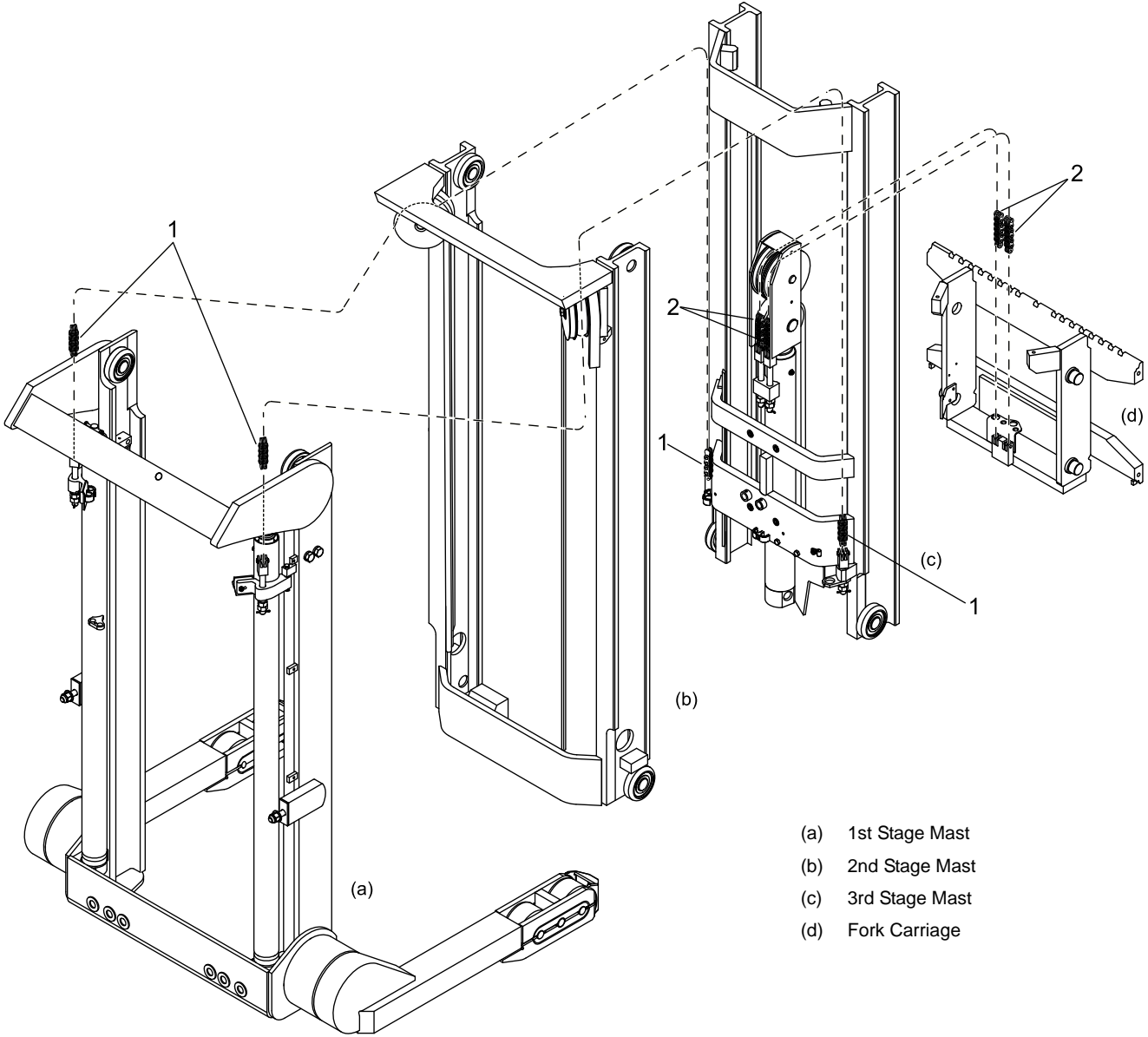


Figure 18676

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1.....*		Mast Chain ⁽¹⁾	2
2.....*		Carriage Chain ⁽²⁾	2

(1) See Chart 1

(2) See Chart 2

CHART 1 - SH/SHR Mast Chain Index 1										
Truck Type	Lift Height*		Length Required*			Part Number	Minimum Order Required			
							Each		Per Truck	
TT	mm	in	mm	in	Links		mm	in	mm	in
	3962	156.0	1772	69.75	93	073991-067	1.83	6.0	3.66	12.0
	4877	192.0	2115	83.25	111	073991-067	2.13	7.0	4.27	14.0
	5334	210.0	2267	89.25	119	073991-067	2.44	8.0	2.44	16.0

CHART 2 - SH/SHR Reach/Carriage Chain Index 2										
Truck Type	Lift Height*		Length Required*			Part Number	Minimum Order Required			
							Each		Per Truck	
TT	mm	in	mm	in	Links		mm	in	mm	in
	3962	156.0	1219	48.0	64	073991-067	1.22	4.0	2.44	8.0
	4877	192.0	1391	54.75	73	073991-067	1.52	5.0	2.74	9.0
	5334	210.0	1467	57.75	77	073991-067	1.52	5.0	3.05	10.0

When ordering chain, order the number of feet of 073991-067 for your particular truck. The appropriate minimum order quantity is listed in the charts. Cut chain to length required for your truck. Replace both chains at the same time.

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Load Backrest

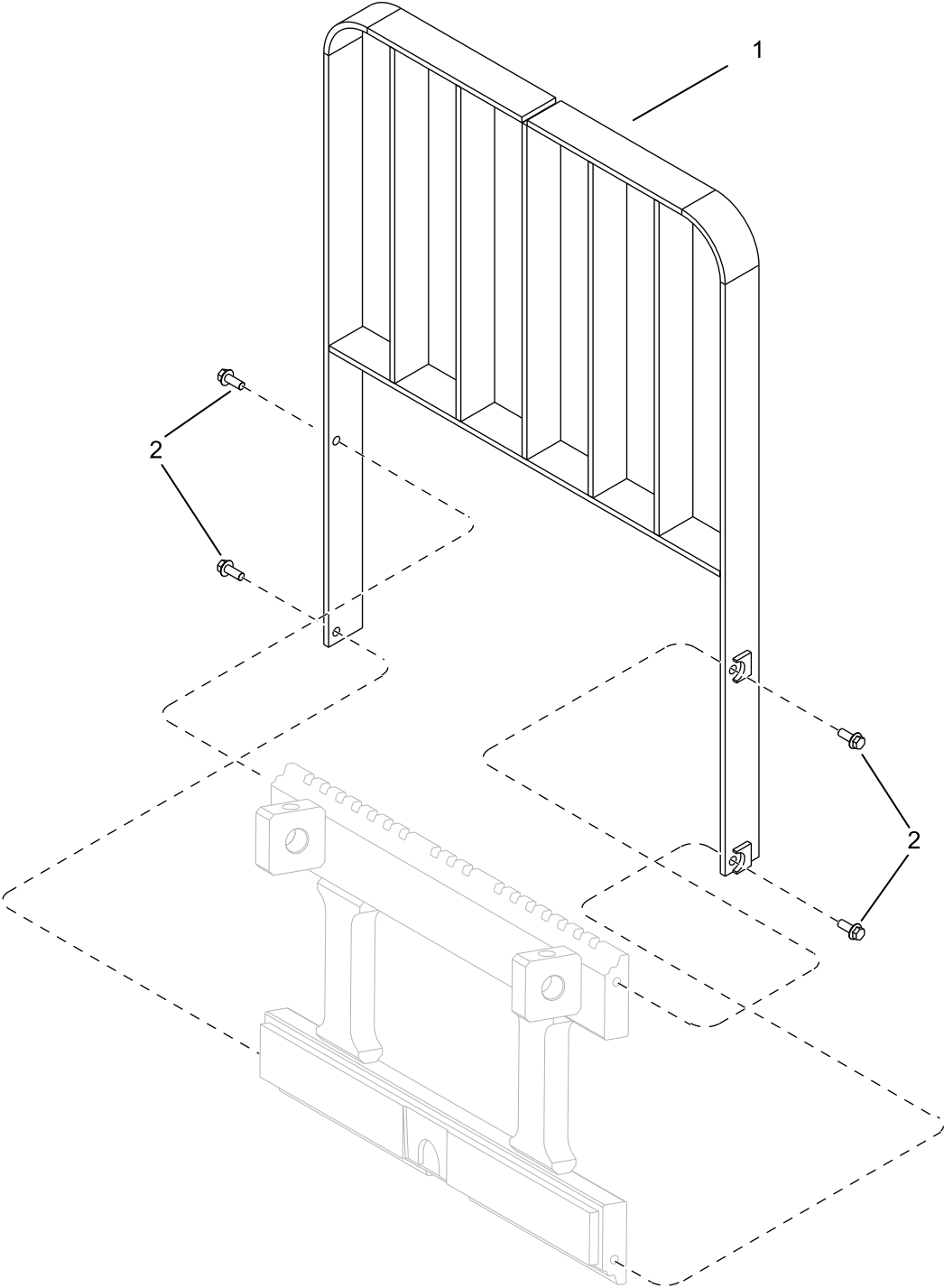


Figure 16610-01



LIFTING MECHANISM PARTS

Load Backrest

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	131102	Load Backrest	1
2	050067-044	Screw	4

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Fork

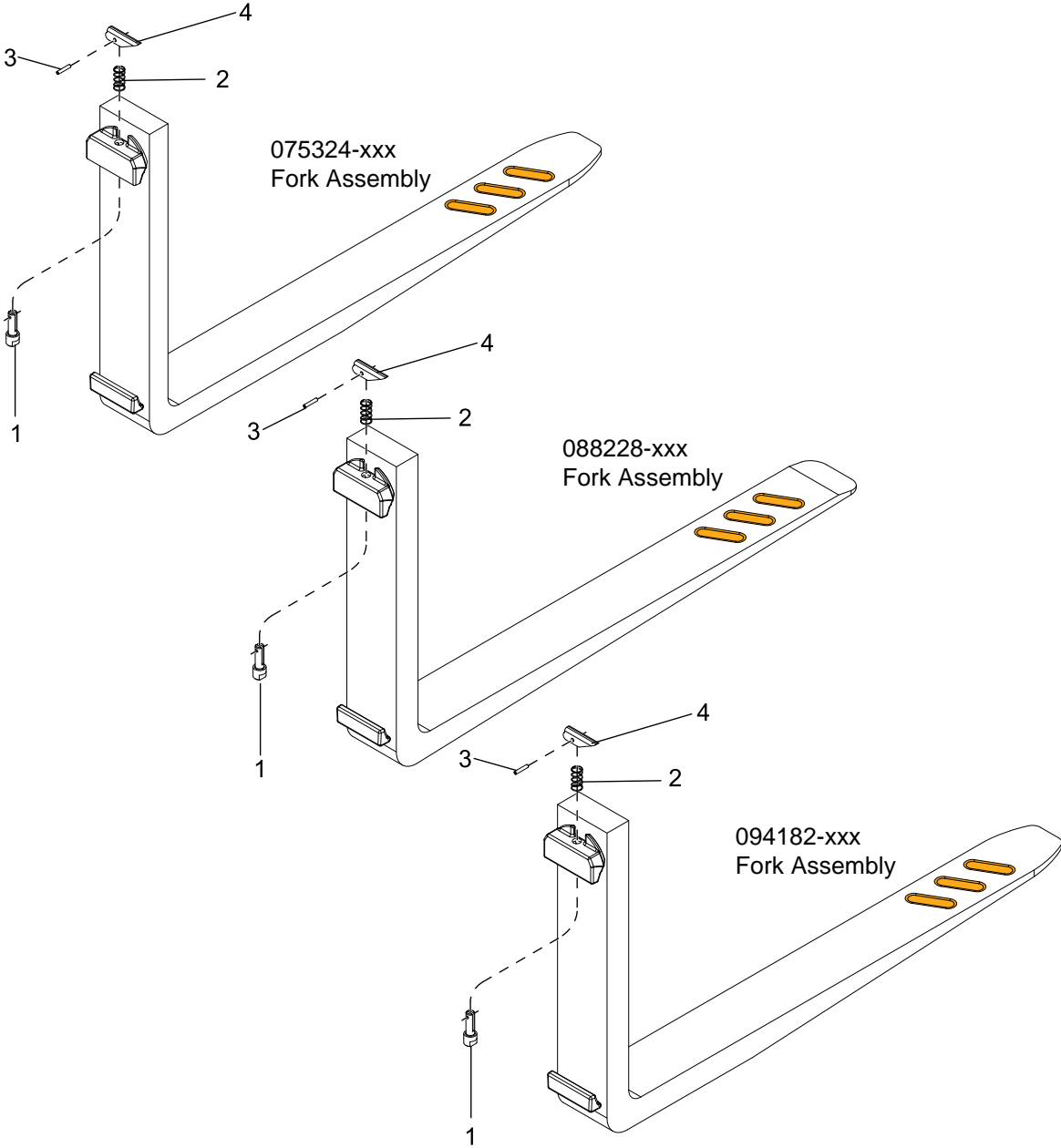


Figure 14309

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	103442	Pin Assembly	1
	103443	Pin	1
2	104329	Spring	1
3	060000-061	Roll Pin	1
4	075248	Handle	1

Fork Assemblies noted in Charts include Index 1 through 4

Always Specify Model, Data & Serial Number

LIFTING MECHANISM PARTS

Fork

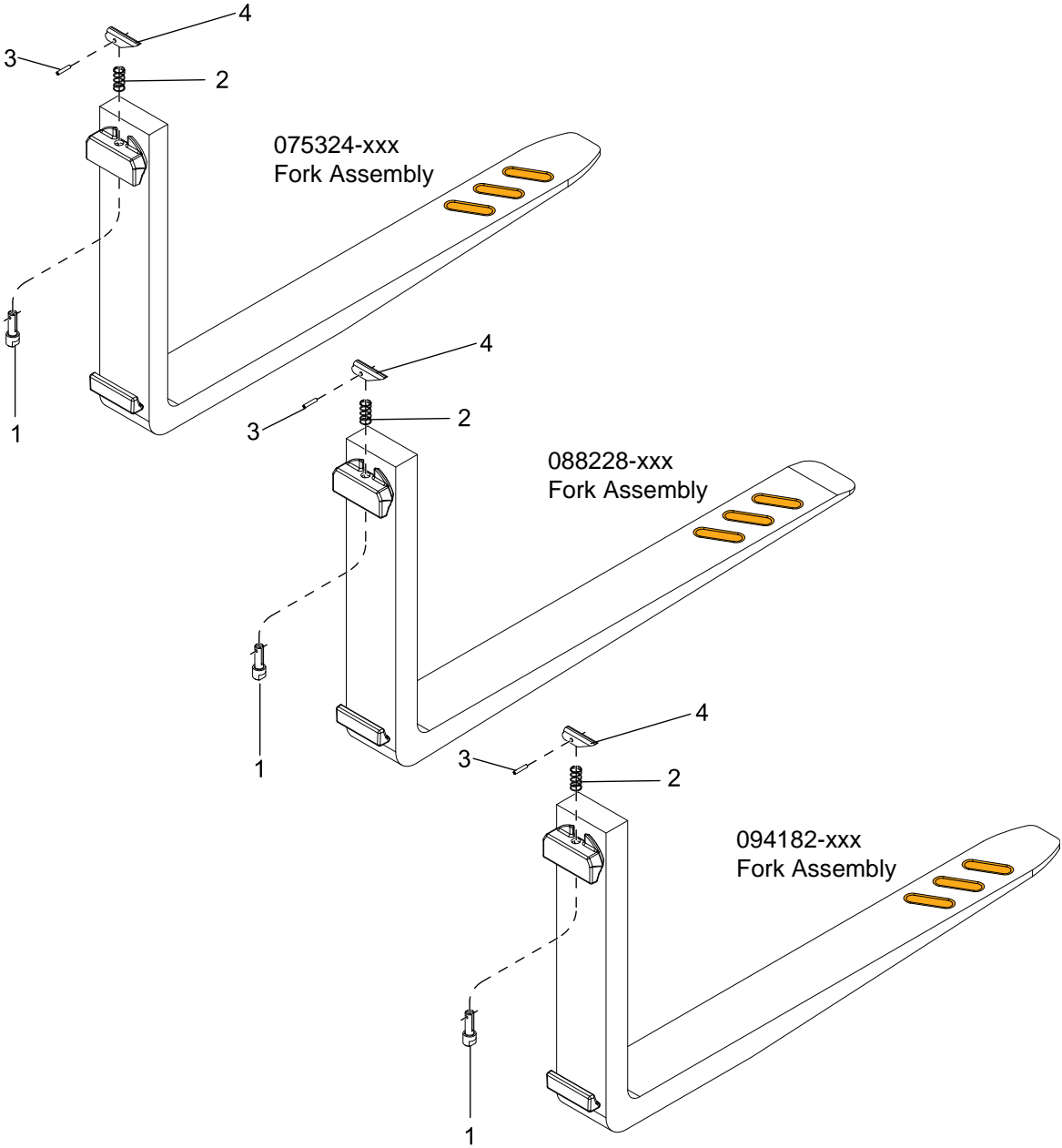


Figure 14309

Model, Fork Designation Chart				
Series	Capacity	Fork Assembly Base Part Number		
		075324-xxx	094182-xxx	Polished Fork Full Taper 088228-xxx
W	1815 kg (4000 lbs)		X	
WB	455 - 1360 kg (1000 - 3000 lbs) 1815 kg (4000 lbs)	X	X	
WR	910 - 1360 kg (2000 - 3000 lbs)	X		
RC RC 3000 RC 5500	1360 kg (3000 lbs) 1585 - 1815 kg (3500 - 4000 lbs)	X	X	X X
SC SC 4000, 4500	1360 kg (3000 lbs) 1585 - 1815 kg (3500 - 4000 lbs)	X	X	X X
RR 3000, 3500 RR 5000, 5200 RR 5700	1585 - 2040 kg (3500 - 4500 lbs)		X	X
RS 3000, 3500	1815 kg (4000 lbs)		X	X
RD 3000, 3500 RD 5000, 5200 RD 5700	1360 kg (3000 lbs)	X	X	X
SH	1815 kg (4000 lbs)		X	X
SHR	1130 - 1360 kg (2500 - 3000 lbs) 1585 kg (3500 lbs)	X	X	X X

Fork Length Chart				
Fork Length		Fork Assembly Part Number		
mm	in	075324-xxx	094182-xxx	Polished Fork Full Taper 088228-xxx
760	30	-001	-001	-001
915	36	-002	-002	-002
990	39	-006	-006	-006
1065	42	-003	-003	-003
1145	45	-005	-005	-005
1220	48	-004	-004	-004
Following Part Numbers Not Used on RR, RS, & RD Series Trucks				
1370	54	-007	-007	-007
1525	60	-008	-008	-008

Notes:



CYLINDER PARTS

CYLINDER PARTS

Mast Cylinder - TL

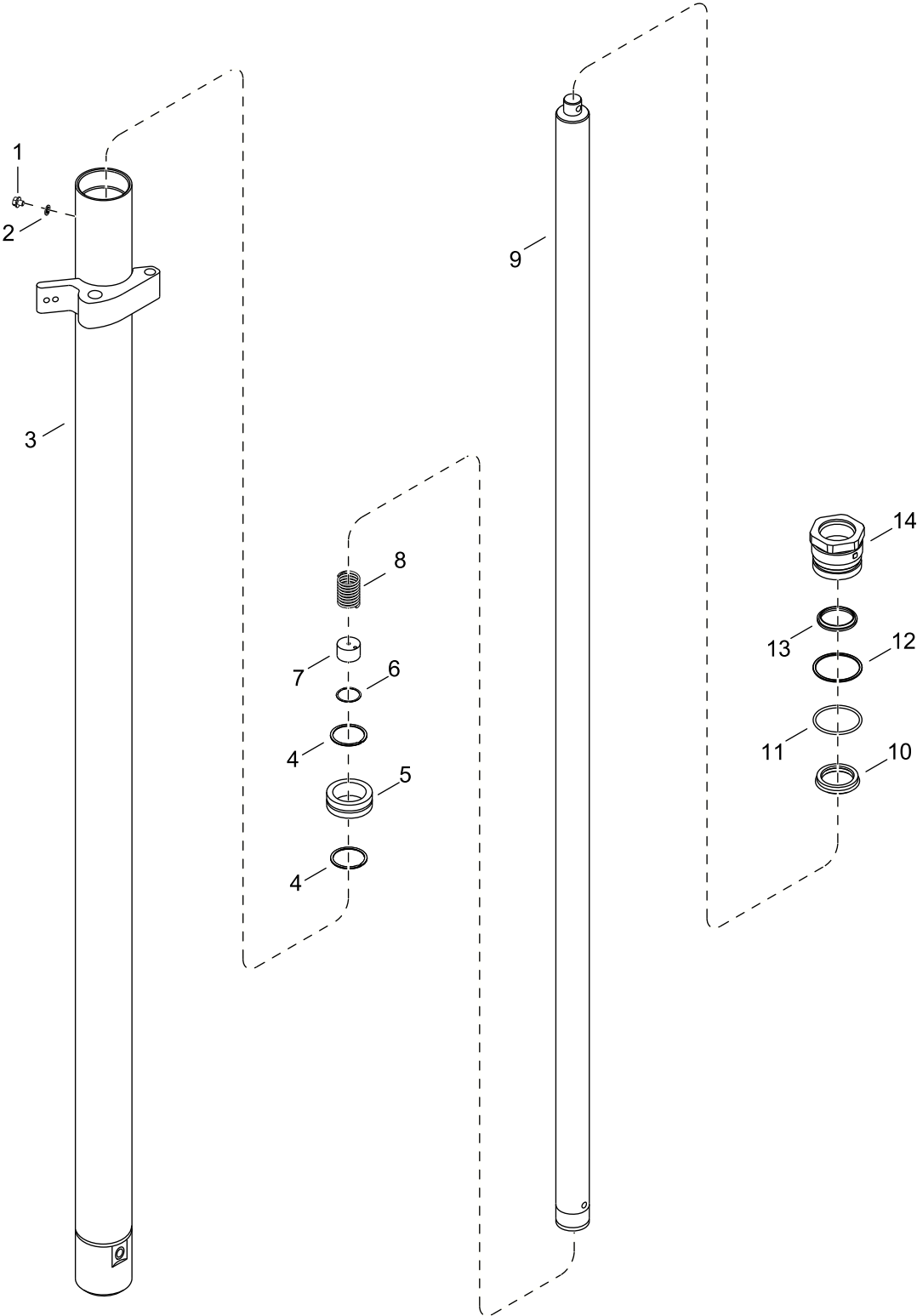


Figure 17476

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0.....	* (1)	RH Mast Cylinder Assembly	1
	* (1)	LH Mast Cylinder Assembly	1
1.....	060015-078	Screw	1
2.....	074240	Seal	1
3.....	* (1)	RH Mast Cylinder	1
	* (1)	LH Mast Cylinder	1
4.....	060009-047	Retaining Ring	2
5.....	073975-002	Bushing	1
6.....	060009-167	Retaining Ring	1
7.....	124179	Shutoff Piston	1
8.....	091428	Compression Spring	1
9.....	* (1)	Ram	1
10.....	064132-002	Packing Rod	1
11.....	064019-037	O-Ring	1
12.....	064074-010	Backup Ring	1
13.....	064135-001	Wiper Ring	1
14.....	135030	Cap	1

(1) See Chart 1

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Chart 1 - Mast Cylinder Parts - TL

Lift Height		Index 0 Mast Cylinder Assembly		Index 3 Mast Cylinder		Index 9 Ram
mm	(in)	RH	LH	RH	LH	
2667	(105)	139952-102	139953-102	140454-102	140455-102	135029-102
3226	(127)	139952-103	139953-103	140454-103	140455-103	135029-103
3810	(150)	139952-105	139953-105	140454-105	140455-105	135029-105

Always Specify Model, Data & Serial Number

CYLINDER PARTS

Mast Cylinder - TT

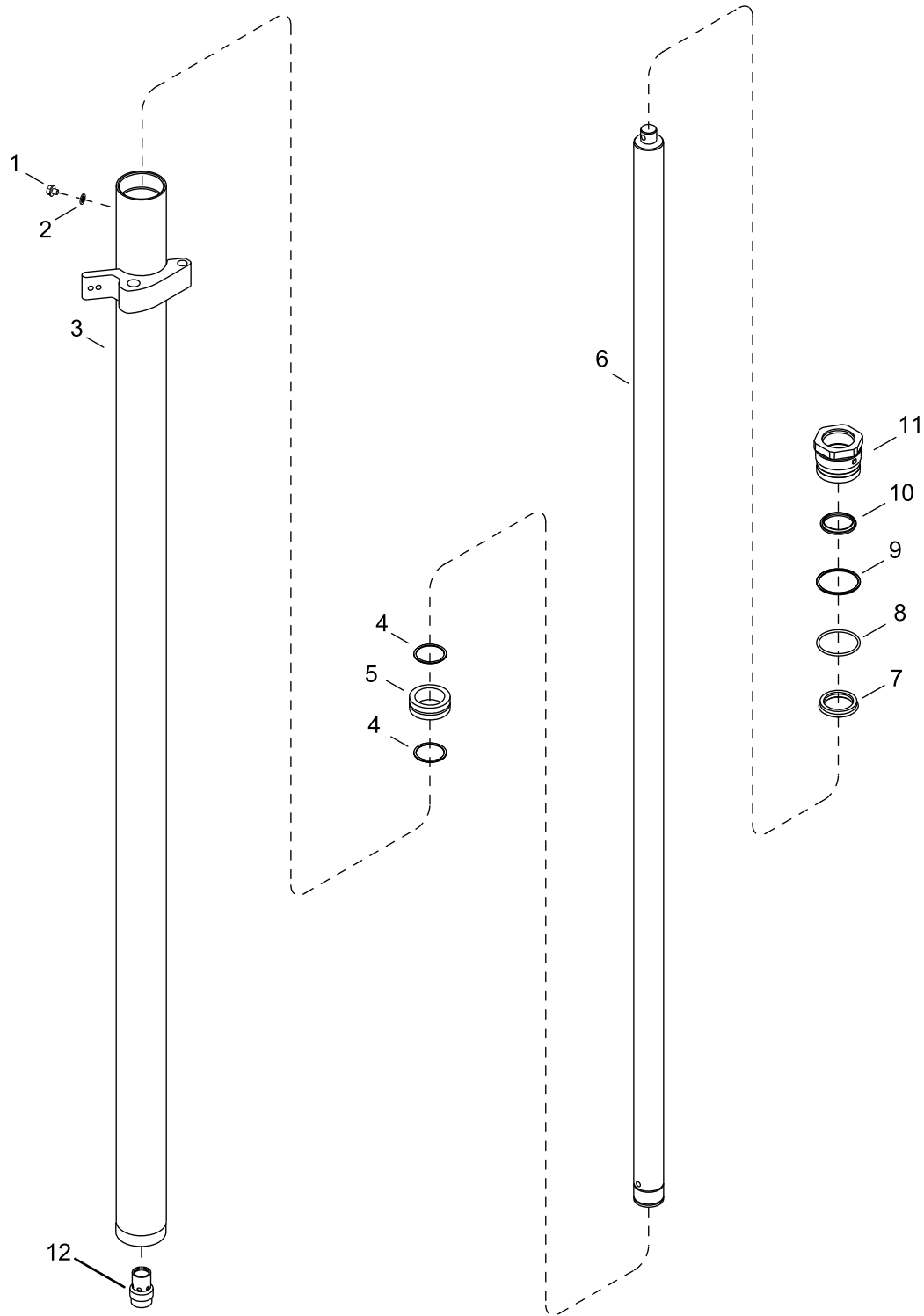


Figure 17488

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	* (1)	RH Mast Cylinder Assembly	1
	* (1)	LH Mast Cylinder Assembly	1
1	060015-078	Screw	1
2	074240	Seal	1
3	* (1)	RH Mast Cylinder	1
	* (1)	LH Mast Cylinder	1
4	060009-047	Retaining Ring	2
5	073975-002	Bushing	1
6	* (1)	Ram	1
7	064132-002	Packing Rod	1
8	064019-037	O-Ring	1
9	064074-010	Backup Ring	1
10	064135-001	Wiper Ring	1
11	135030	Cap	1
12	124251-004	Velocity Fuse ⁽²⁾	1

(1) See Chart 1

(2) Used on Left Hand Cylinder Assembly Only

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Chart 1 - Mast Cylinder Parts - TT

Lift Height		Index 0 Mast Cylinder Assembly		Index 3 Mast Cylinder		Index 6 Ram
mm	(in)	RH	LH	RH	LH	
3962	(156)	135028-002	135031-002	121664-002	121677-002	135029-002
4877	(192)	135028-004	135031-004	121664-004	121677-004	135029-004
5334	(210)	135028-005	135031-005	121664-005	121677-005	135029-005

Always Specify Model, Data & Serial Number

CYLINDER PARTS

Carriage Cylinder

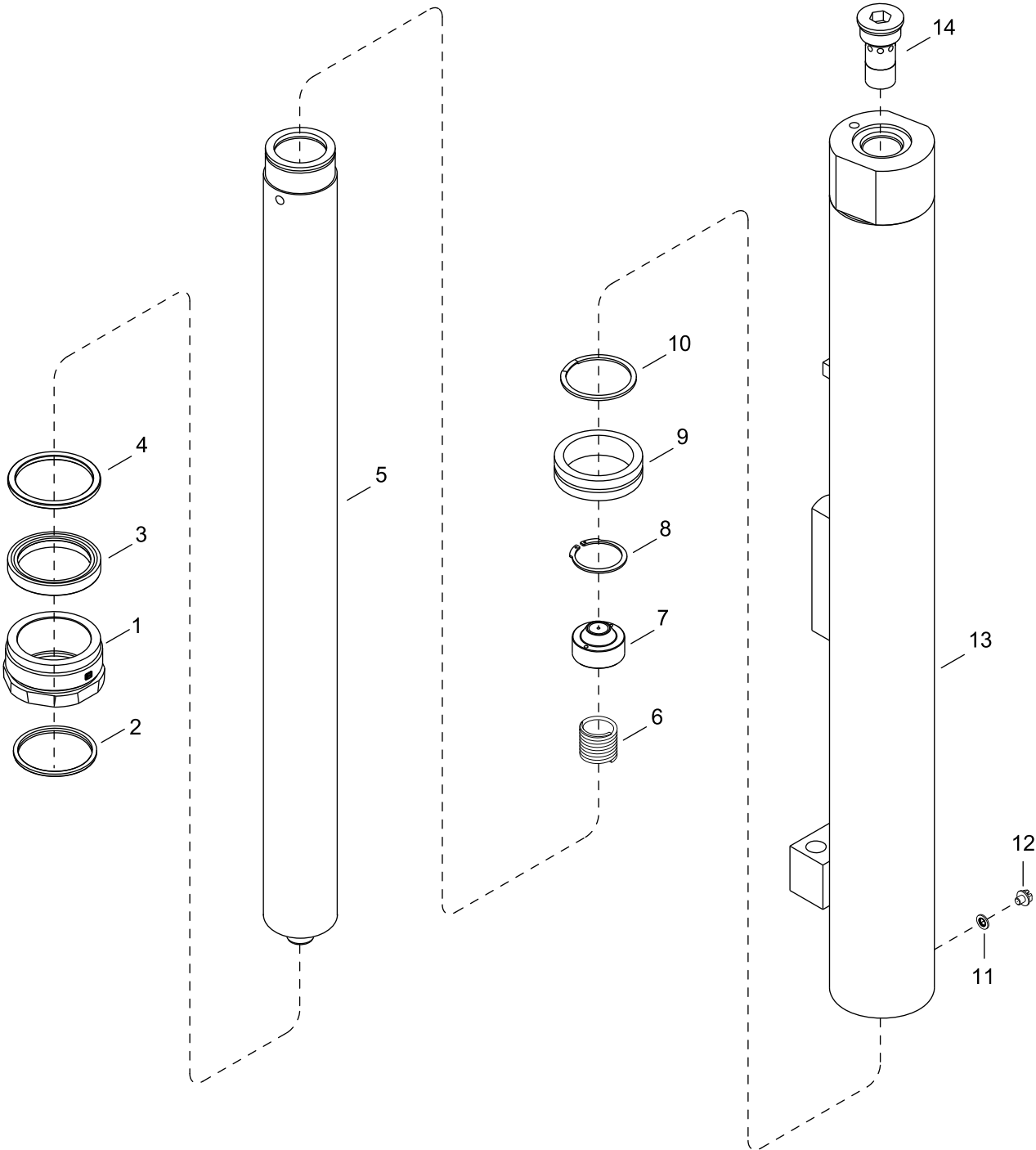


Figure 17494

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0.....	* (1)	Cylinder Assembly	1
1.....	135035	Cap	1
2.....	064135-006	Wiper Ring	1
3.....	064132-056	Packing Rod	1
4.....	081161-030	Collar	1
5.....	* (1)	Ram	1
6.....	103487	Compression Spring	1
7.....	127489-002	Piston Shutoff	1
8.....	060009-100	Retaining Ring	1
9.....	084882-002	Bushing	1
10.....	060009-049	Retaining Ring	1
11.....	074240	Seal	1
12.....	060015-078	Screw	1
13.....	* (1)	Cylinder Weldment	1
14.....	064463-001	Flow Regulator	1

(1) See Chart 1 - Carriage Cylinder Parts

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Chart 1 - Carriage Cylinder Parts				
Lift Height		Index 0 Mast Cylinder Assembly	Index 5 Ram	Index 13 Cylinder
mm	(in)			
3962	(156)	135033-002	135034-002	130394-002
4877	(192)	135033-004	135034-004	130394-004
5334	(210)	135033-005	135034-005	130394-005

Always Specify Model, Data & Serial Number

CYLINDER PARTS

Reach Cylinder

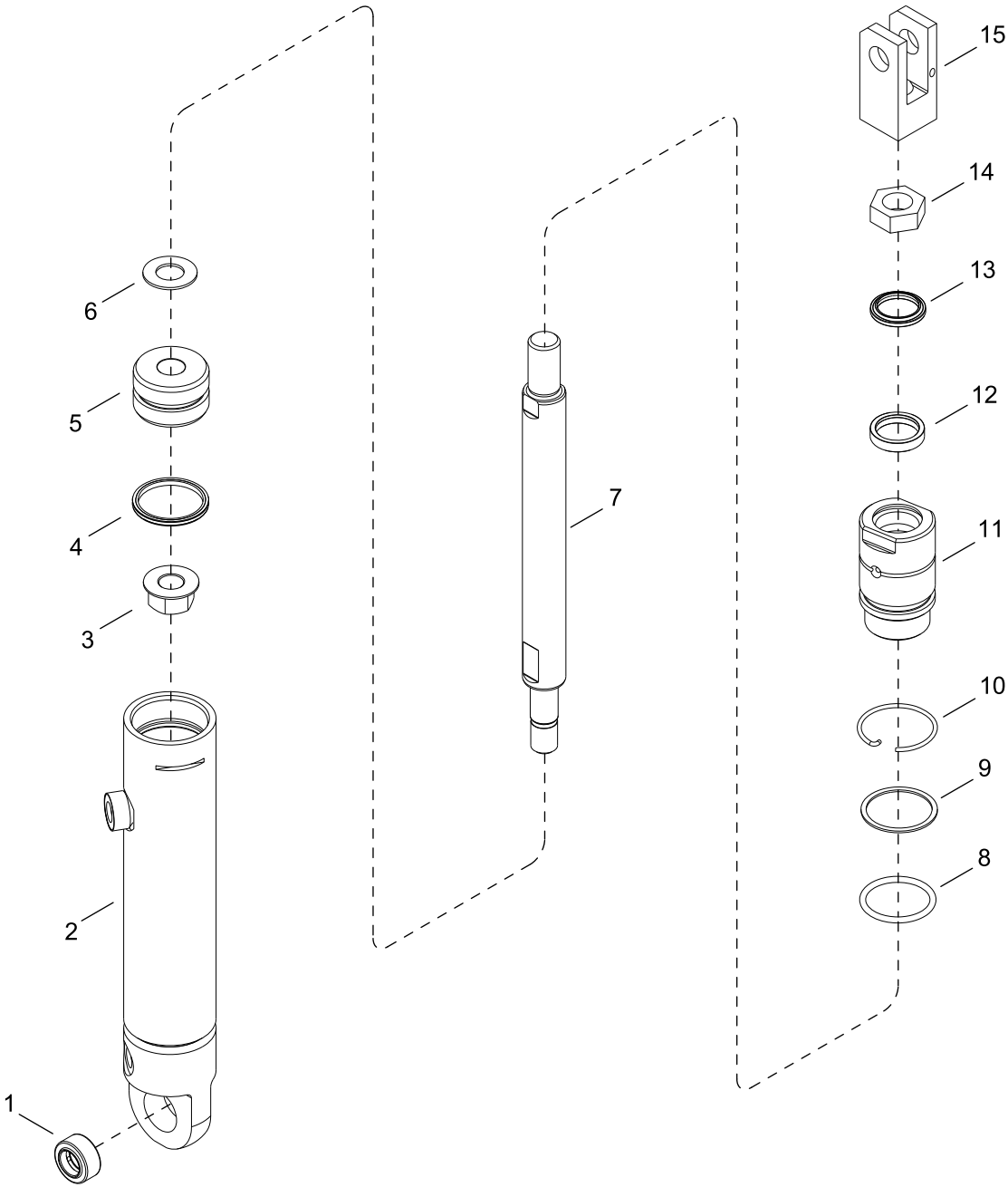


Figure 17496

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	132419	Reach Cylinder Assembly - RH.	1
	133460	Reach Cylinder Assembly - LH.	1
1	065012-010	Bushing	1
2	132420	Tube - RH.	1
	132421	Tube - LH.	1
3	060080-011	Nut	1
4	064216-005	Seal	1
5	132396	Piston	1
6	060030-344	Washer	1
7	132397-001	Piston Rod	1
8	064019-015	O-Ring	1
9	064074-005	Backup Washer	1
10	133459-001	Wire Retainer	1
11	132398	Rod Guide	1
12	064132-050	Packing Rod	1
13	064135-019	Wiper Ring	1
14	060021-040	Nut	1
15	136694	End Rod	1

Always Specify Model, Data & Serial Number

CYLINDER PARTS

Tilt Cylinder

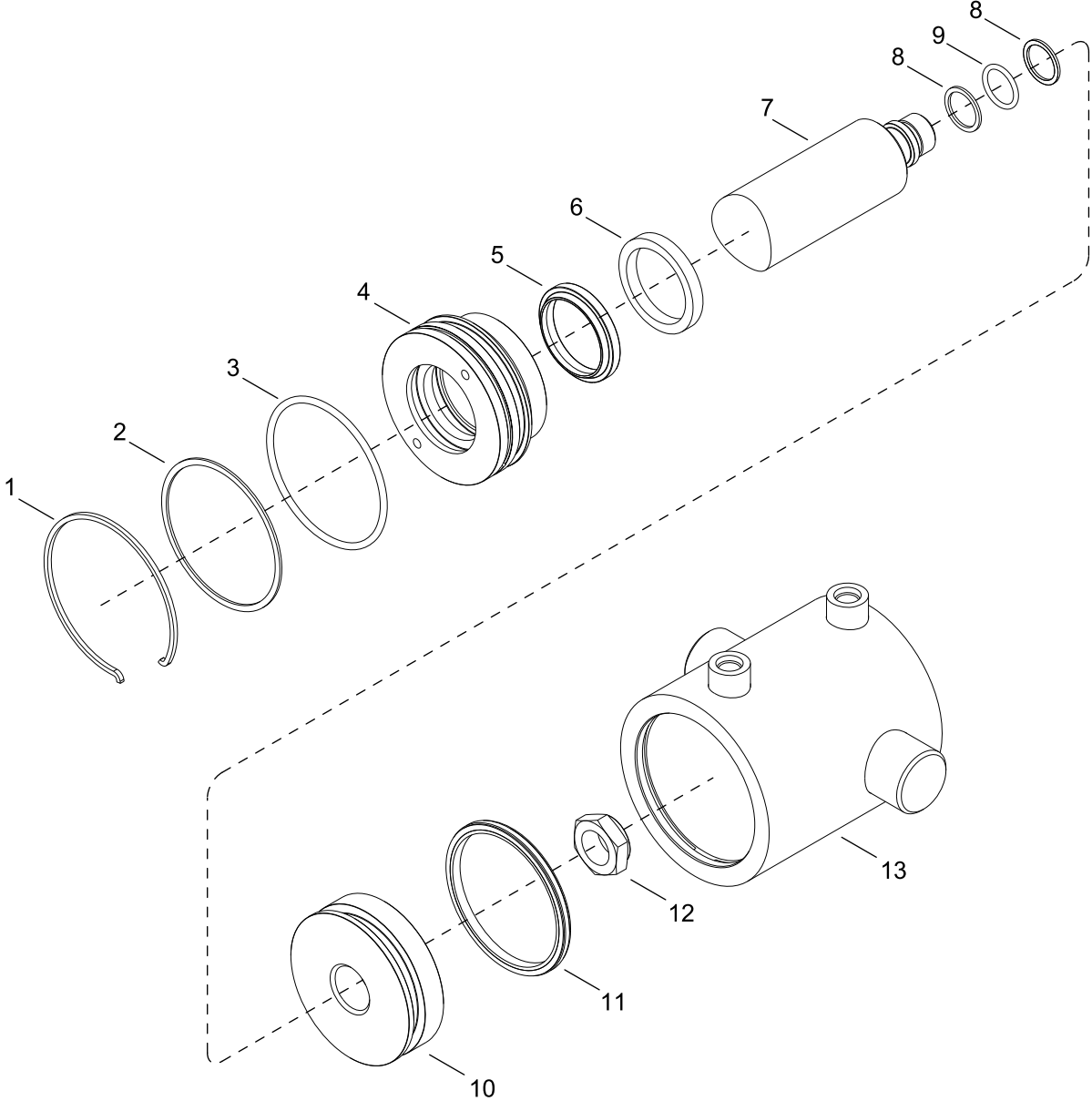


Figure 17497

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	134371	Tilt Cylinder	1
1	073981-003	Retainer Wire	1
2	064074-008	Backup Ring	1
3	064019-033	O-Ring	1
4	134364	End Cap	1
5	064069-013	Wiper Ring	1
6	064132-040	Packing Rod	1
7	075941	Piston Rod	1
8	064074-007	Backup-Ring	2
9	064019-032	O-Ring	1
10	116279	Piston	1
11	064216-009	Seal	1
12	060042-002	Nut	1
13	116281	Cylinder Tube	1

Always Specify Model, Data & Serial Number

CYLINDER PARTS

Sideshift Cylinder

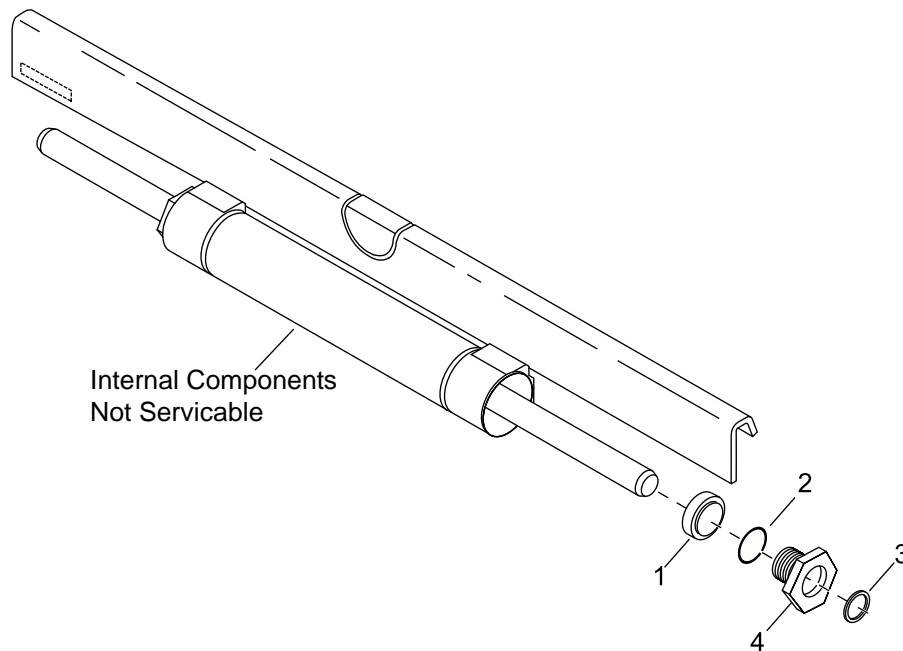


Figure 18841

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0.....	127572	Sideshifter Cylinder 760 mm (30.0 in).....	1
1.....	116865	Rod Seal	2
2.....	O-Ring 70 Duro	2
3.....	116860	Rod Wiper Seal	2
4.....	126902	Retainer Seal Carrier	2
	126903	Seal Kit	1

Always Specify Model, Data & Serial Number

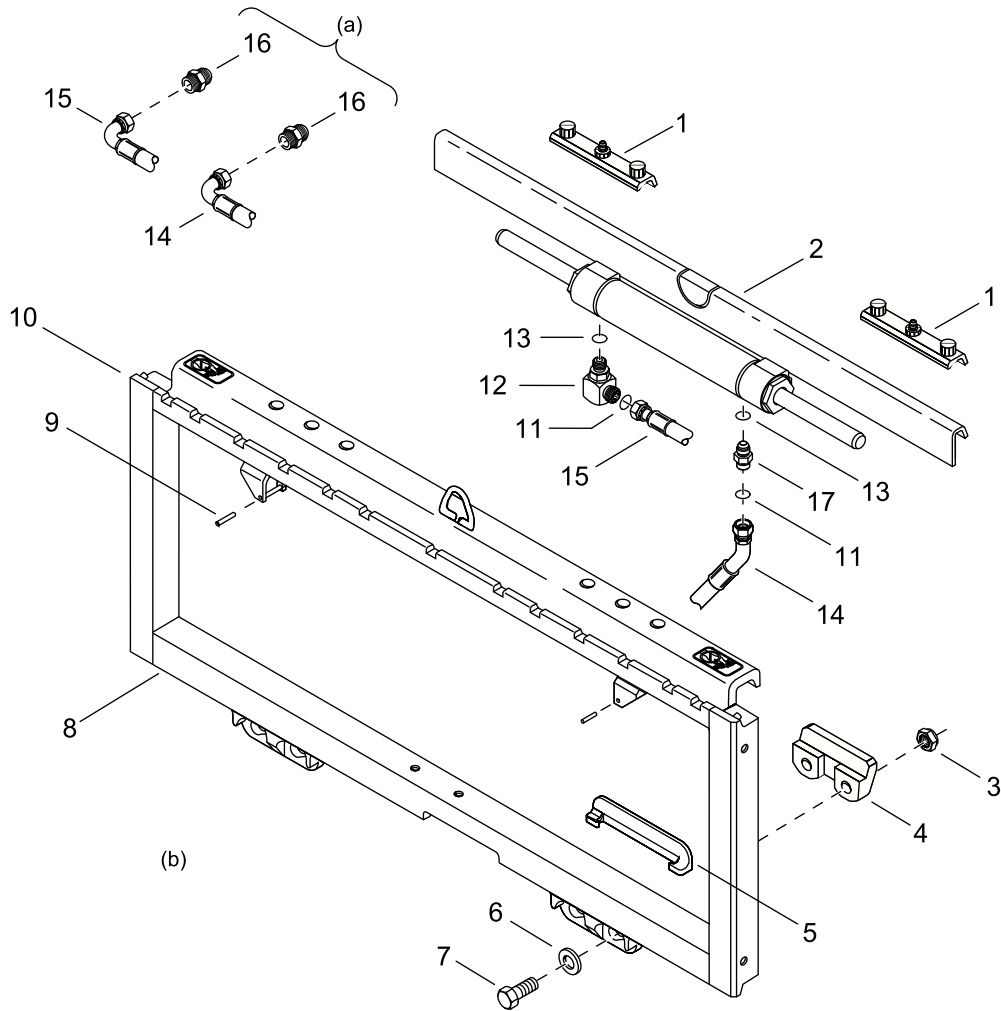
Notes:



PLATFORM PARTS

PLATFORM PARTS

Sideshift



- (a) To Accessory Manifold Block
- (b) Maximum Sideshift 205 mm (8.0 in)
Operating Pressure:
Maximum: 24,130 kPa (3500 psi)
Minimum: 13,790 kPa (2000 psi)

Figure 18842

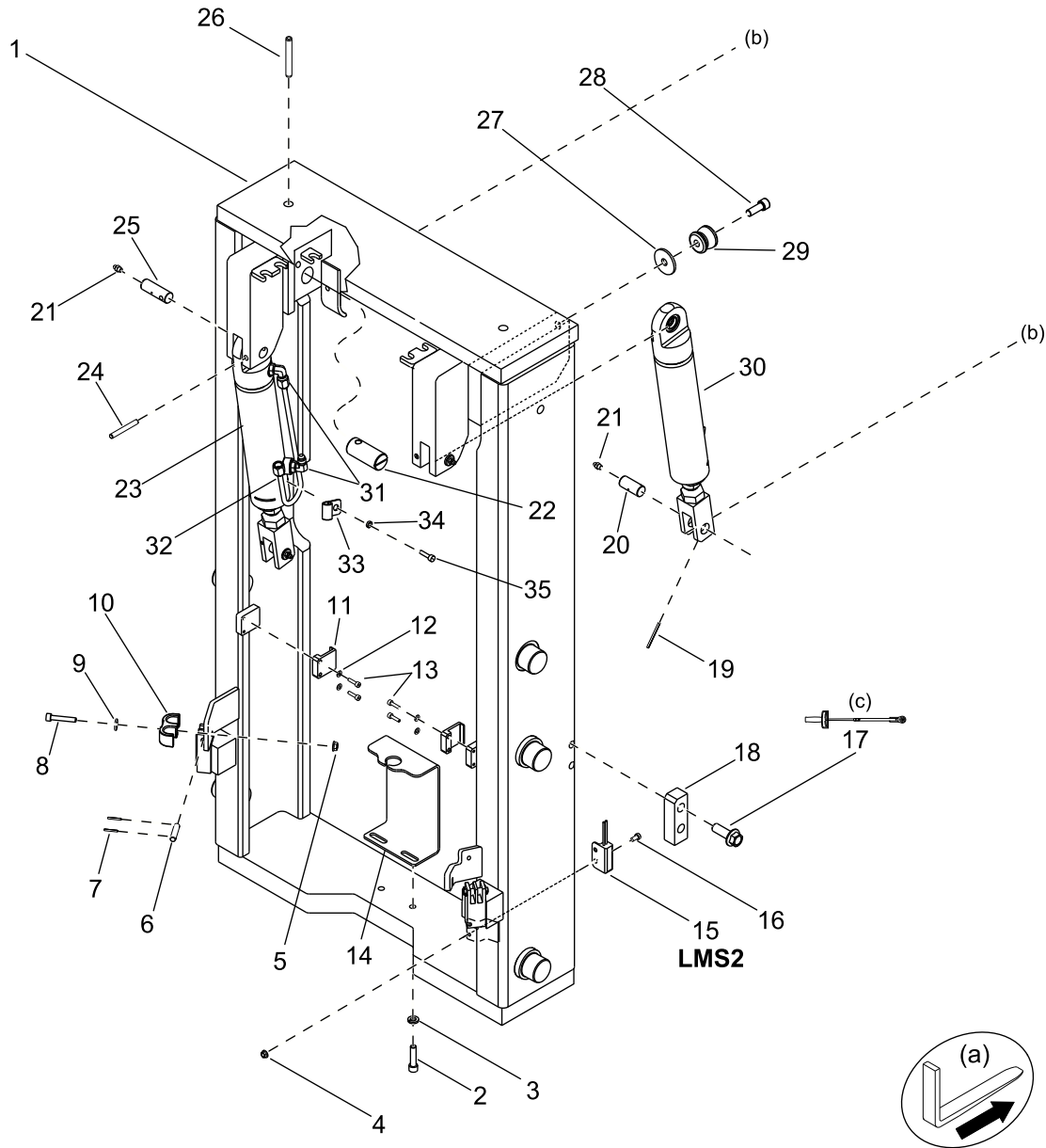
INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	127757-004	Sideshifter 760 mm (30.0 in)	1
1	131989	Upper Bearing	2
2	127572	Cylinder See Cylinder Parts	1
3	094004	Nut	4
4	126843	Lower Hook	2
5	131990	Lower Bearing	2
6	116876	Flatwasher	4
7	060020-019	Capscrew	4
8		Faceplate ⁽¹⁾	1
9	060000-030	Roll Pin	2
10	126844	Fork Stop	2
11	126845	Flow Restrictor 1.5 mm (0.06 in)	2
12	064280-006	Elbow 90°	1
13	064019-101	O-Ring	2
14	064301-009	Hose Assembly	1
15	064255-352	Hose Assembly	1
16	064004-022	Connector	2
17	064004-003	Connector	1
	127167	Sideshifter Assembly Kit Includes Indexes 1 Thru 12, 14, 15, 16 & 17	1

⁽¹⁾ Not Serviceable. Replace sideshifter when faceplate is needed.

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TL Mast



- (a) Left and Right is Determined from Operator's Perspective
- (b) To Inner Arm Weldment
- (c) Torque Value 108 - 117 Nm (80 - 86 ft lb)

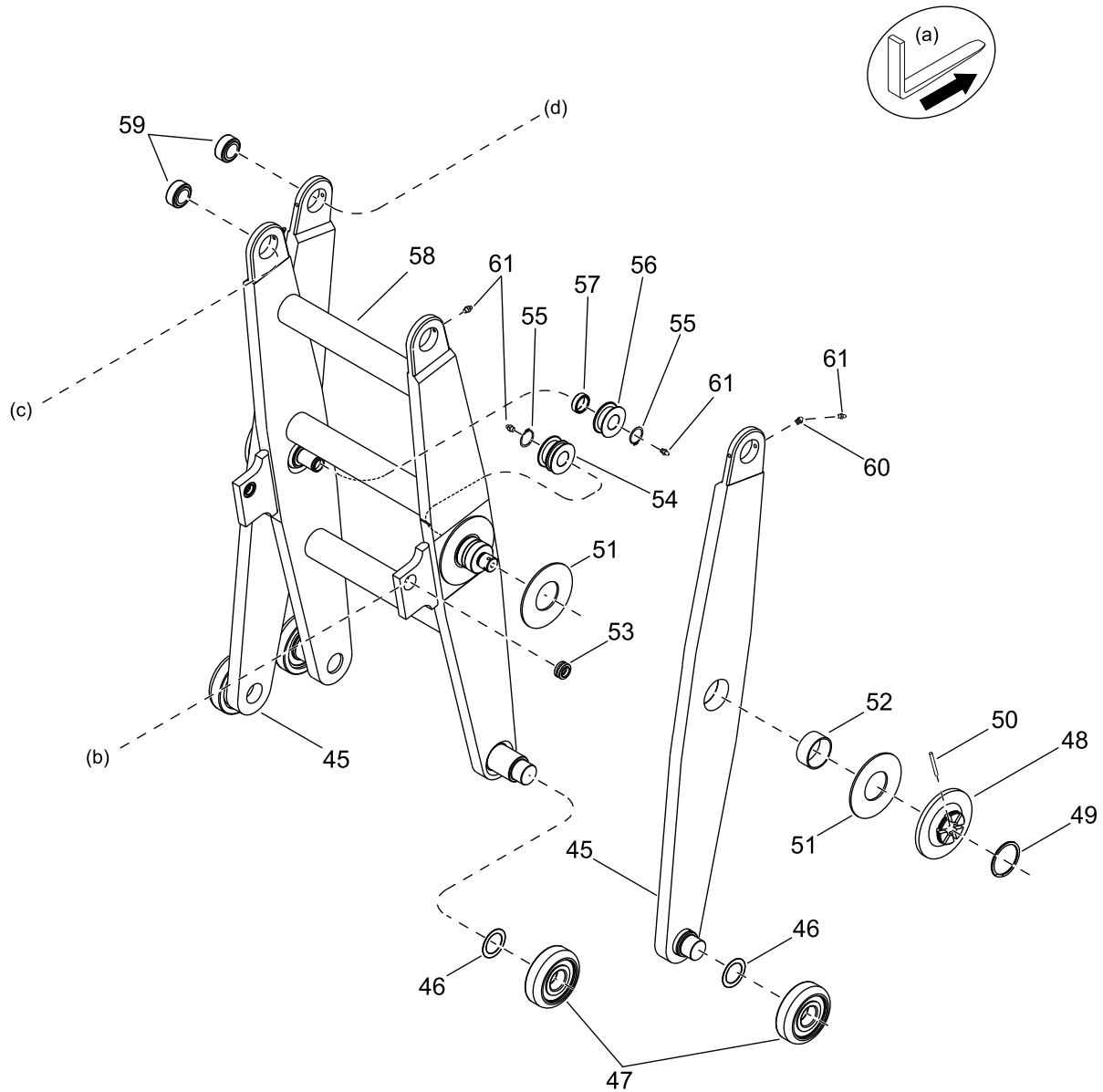
Figure 17599-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134391	Reach Support	1
2	060016-088	Screw	2
3	060005-008	Lockwasher	2
4	050068-001	Nut	2
5	050068-002	Nut	1
6	086499	Pin	2
7	060000-055	Roll Pin	4
8	050005-012	Screw	1
9	060030-012	Washer	1
10	123281	Clamp	1
11	134376	Clamp	2
12	050009-004	Flatwasher	4
13	050005-054	Screw	4
14	136727	Bracket	1
15	062825-001	Proximity Sensor	1
16	050005-057	Screw	2
17	050067-045	Screw	4
18	134426	Stopper	2
19	060000-090	Roll Pin	2
20	088892	Pivot Cylinder Shaft	2
21	076048-001	Lubrication Fitting	4
22	134375	Shaft	2
23	133460	Reach Cylinder (LH)	1
24	060000-104	Roll Pin	2
25	113516	Pin	2
26	060000-029	Roll Pin	2
27	060030-340	Flatwasher	AR
28	060017-086	Screw	2
29	124018	Bumper	2
30	132419	Reach Cylinder (RH)	1
31	064061-004	Elbow 90°	4
32	077389-005	Tube Assembly	2
33	061002-001	Harness Clamp	2
34	060005-004	Lockwasher	2
35	060013-002	Screw	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TL Mast



- (a) Left and Right is Determined from Operator's Perspective.
- (b) To Reach Cylinder
- (c) To Reach Support Weldment
- (d) To Reach Box Weldment

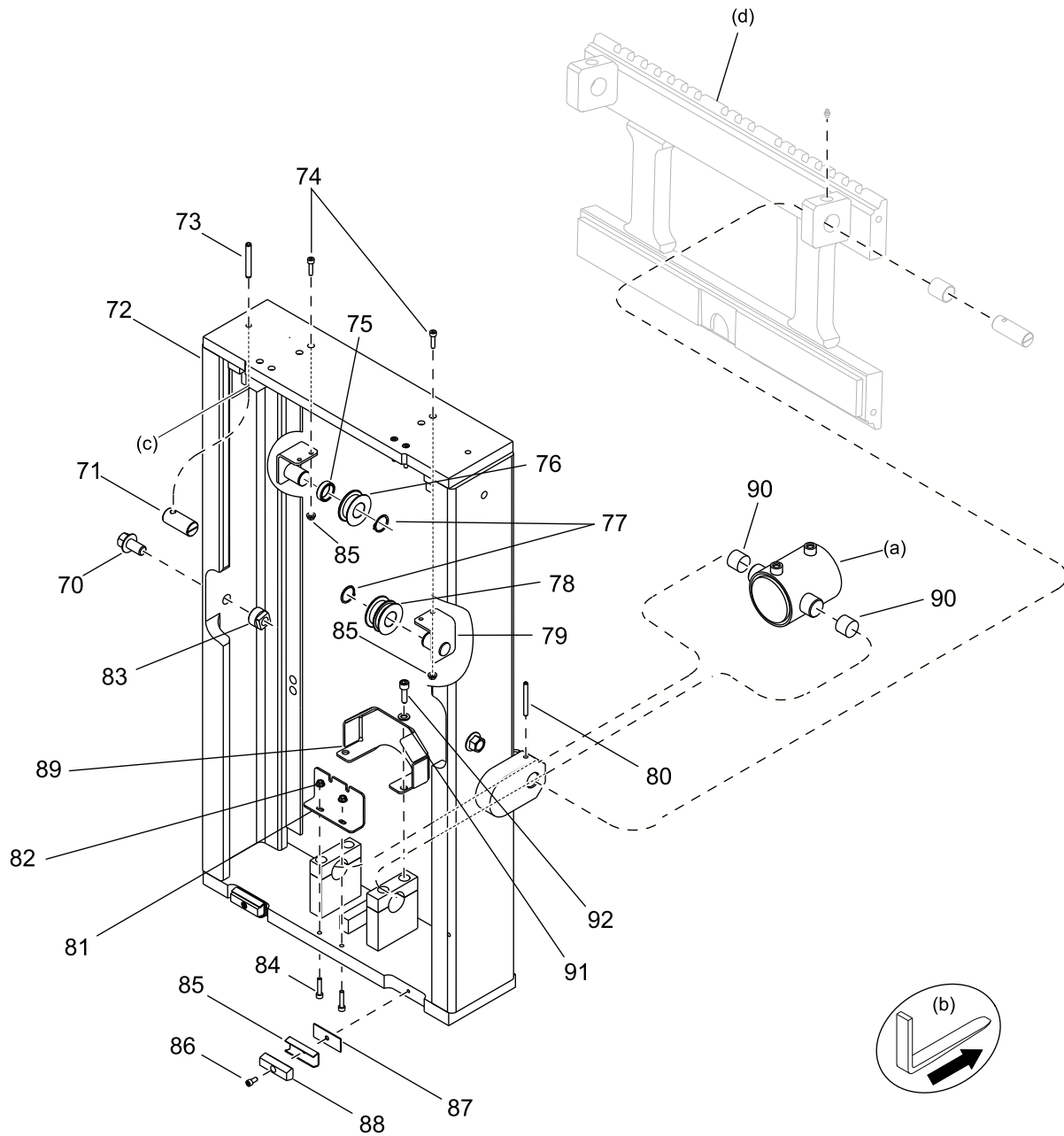
Figure 18715

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
45	134350	Outer Arm	2
46	060030-080	Flatwasher	AR
47	074668-001	Column Roller	4
48	082384	Lock Nut	2
49	060009-049	Retaining Ring	2
50	060077-002	Groove Pin	2
51	082381	Thrust Washer	4
52	065007-052	Bearing Sleeve	2
53	065012-001	Ball Bushing	2
54	136729	Pulley	1
55	060009-036	Retaining Ring	2
56	136730	Pulley	1
57	136726	Spacer	1
58	134355-002	Inner Arm	1
59	065012-007	Ball Bushing	4
60	089297	Lubrication Fitting Body	2
61	076048-001	Lubrication Fitting	6

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TL Mast



- (a) See Tilt Cylinder
- (b) Left and Right is Determined from Operator's Perspective
- (c) To Outer Arm Weldment
- (d) Refer to Fork Carriage

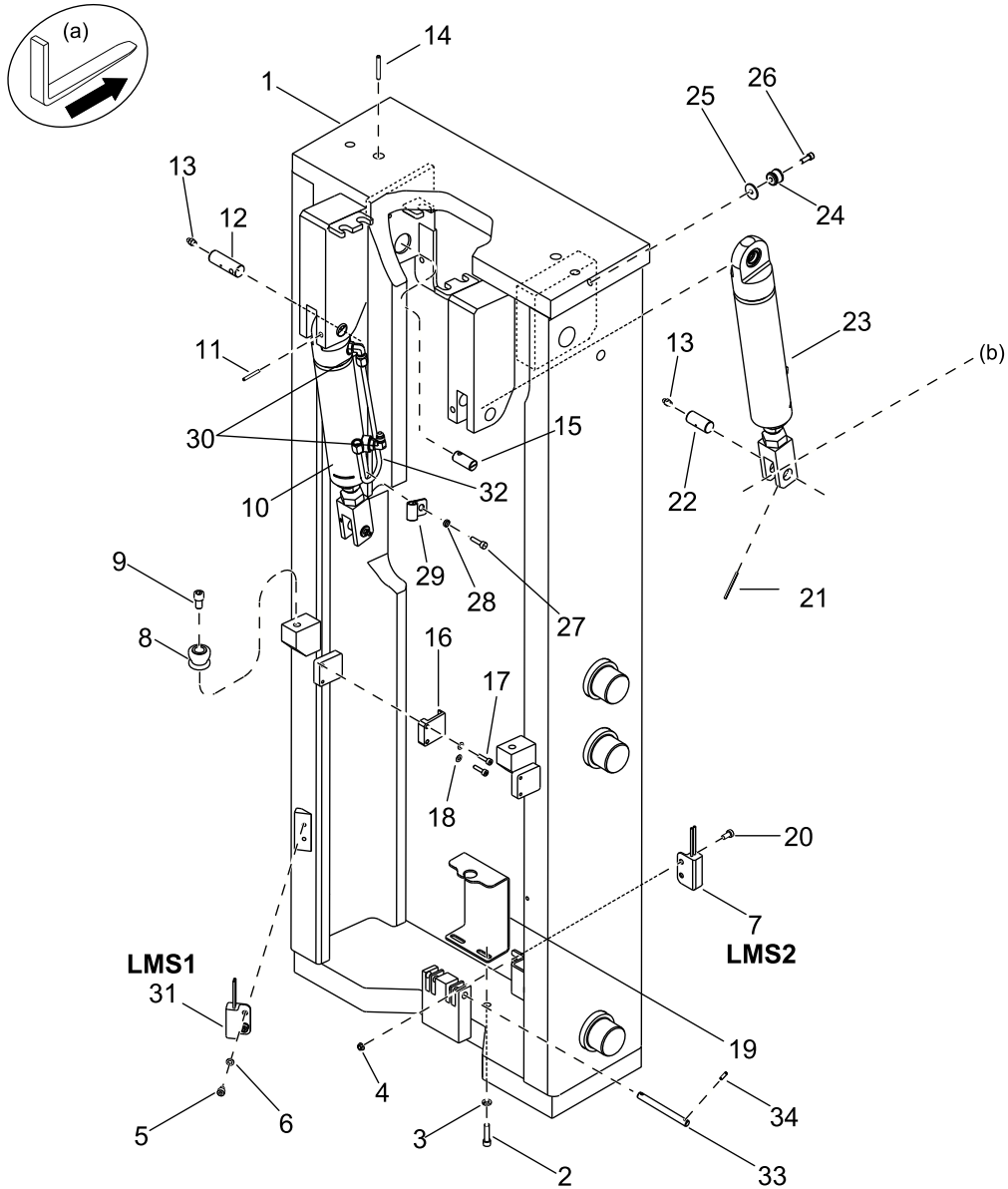
Figure 17600-03

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
70	050067-055	Screw	2
71	134375	Shaft	2
72	134326-002	Reach Box	1
73	060000-029	Roll Pin	2
74	060062-013	Screw	4
75	136726	Spacer	1
76	136730	Pulley	1
77	060009-036	Retaining Ring	2
78	136729	Pulley	1
79	134372	Pulley Bracket	2
80	060000-012	Roll Pin	2
81	137162	Bracket	1
82	050068-002	Nut	6
83	134424	Stopper	2
84	050005-016	Screw	2
85	092746-001	Bracket	2
86	060015-068	Screw	2
87	074481-001	Stop Shim	AR
88	092747-001	Poly Stop	2
89	142931	Tube Cover	1
90	065007-018	Bushing	2
91	060005-009	Lockwasher	4
92	060017-026	Screw	4

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TT Mast



- (a) Left and Right is Determined from Operator's Perspective
- (b) To Inner Arm Weldment

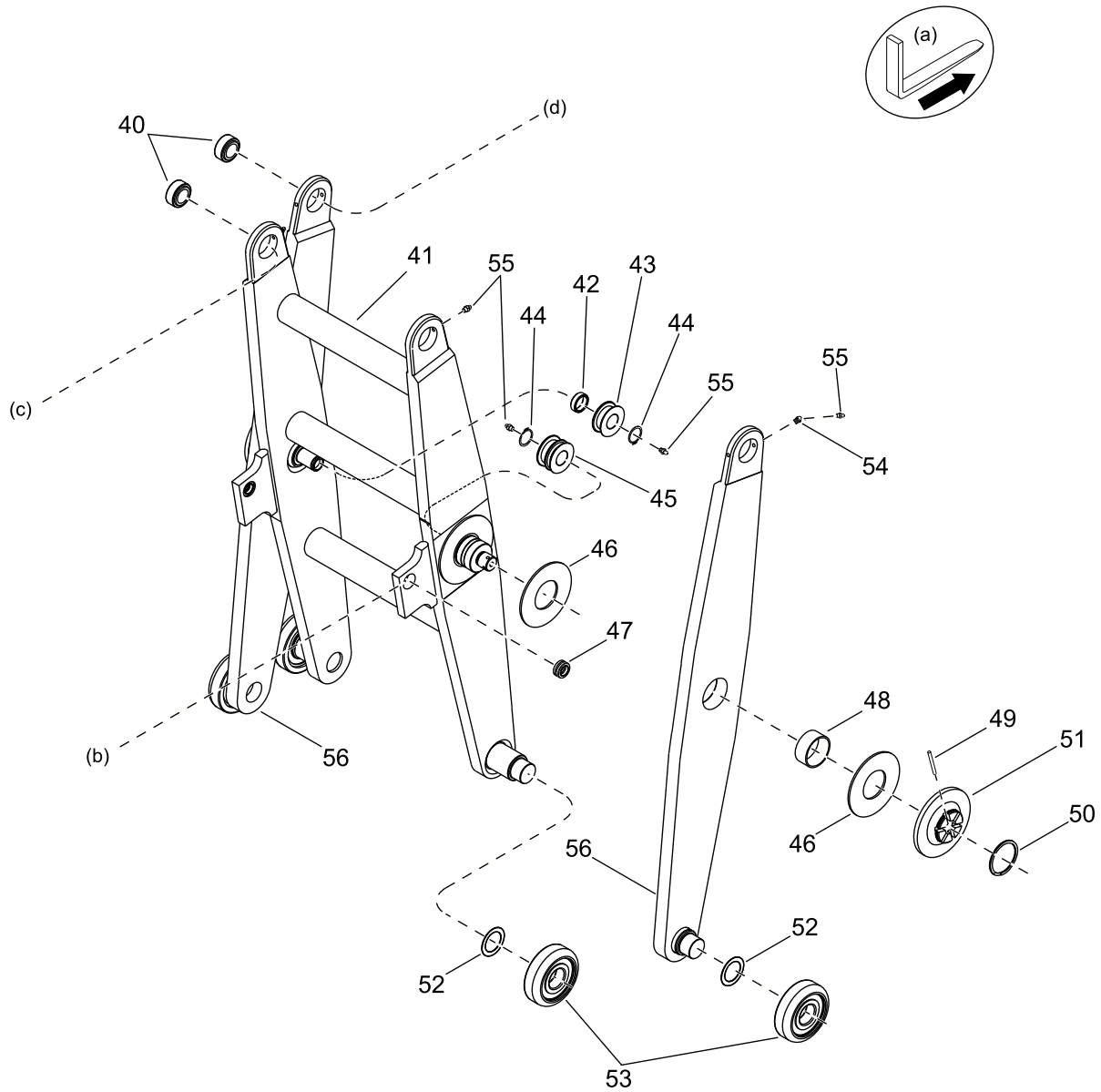
Figure 17616-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134390	Reach Support	1
2	060016-088	Screw	2
3	060005-008	Lockwasher	2
4	050068-001	Nut	2
5	050005-090	Screw	2
6	060005-005	Lockwasher	2
7	062825-001	Proximity Sensor	1
8	124018	Bumper	2
9	060017-050	Screw	2
10	133460	Reach Cylinder (LH)	1
11	060000-104	Roll Pin	2
12	113516	Pin	2
13	076048-001	Lubrication Fittings	4
14	060000-029	Roll Pin	2
15	134375	Shaft	2
16	134376	Clamp	2
17	050005-054	Screw	4
18	050009-004	Flatwasher	4
19	136727	Bracket	1
20	050005-057	Screw	2
21	060000-090	Roll Pin	2
22	088892	Pivot Cylinder Shaft	2
23	132419	Reach Cylinder (RH)	1
24	124018	Bumper	2
25	060030-340	Flatwasher	AR
26	060017-086	Screw	2
27	060013-002	Screw	2
28	060005-004	Lockwasher	2
29	061002-001	Harness Clamp	2
30	064061-004	Elbow 90°	4
31	062825-002	Proximity Sensor	1
32	077389-005	Tube Assembly	2
33	084985	Pin	1
34	060000-055	Roll Pin	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TT Mast



- (a) Left and Right is Determined from Operator's Perspective
- (b) To Reach Cylinder
- (c) To Reach Support Weldment
- (d) To Reach Box Weldment

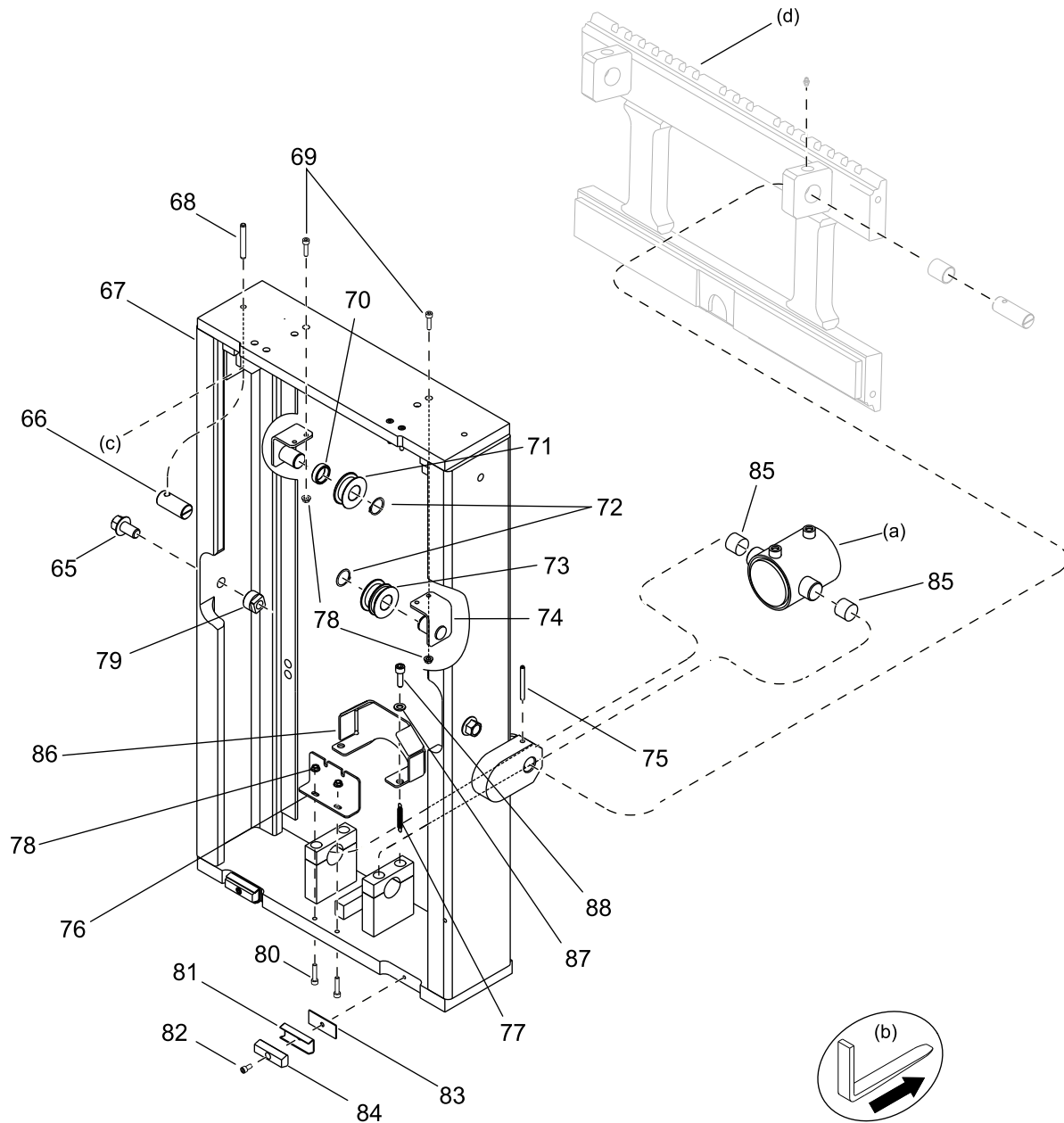
Figure 18730

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
40	065012-007	Ball Bushing	4
41	134355-001	Inner Arm	1
42	136726	Spacer	1
43	136730	Pulley	1
44	060009-036	Retaining Ring	2
45	136729	Pulley	1
46	082381	Thrust Washer	4
47	065012-001	Ball Bushing	2
48	065007-052	Sleeve Bearing	2
49	060077-002	Groove Pin	2
50	060009-049	Retaining Ring	2
51	082384	Lock Nut	2
52	060030-080	Flatwasher	AR
53	074668-001	Column Roller	4
54	085297	Lubrication Fitting Body	2
55	076048-001	Lubrication Fitting	6
56	134350	Outer Arm	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt - TT Mast



- (a) See Tilt Cylinder
- (b) Left and Right is Determined from Operator's Perspective
- (c) To Outer Arm Weldment
- (d) Refer to Fork Carriage

Figure 17617-02



PLATFORM PARTS

Reach w/Tilt - TT Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
65	050067-055	Screw	2
66	134375	Shaft	2
67	134326-001	Reach Box	1
68	060000-029	Roll Pin	2
69	060062-013	Screw	4
70	136726	Spacer	1
71	136730	Pulley	1
72	060009-036	Retaining Ring	2
73	136729	Pulley	1
74	134372	Pulley Bracket	2
75	060000-012	Roll Pin	2
76	137162	Bracket	1
77	089544	Spring	1
78	050068-002	Nut	6
79	134424	Stopper	2
80	050005-016	Screw	2
81	092746-001	Bracket	2
82	060015-068	Screw	2
83	074481-001	Stop Shim	AR
84	092747-001	Poly Stop	2
85	065007-018	Bushing	2
86	142931	Tube Cover	2
87	060005-009	Lockwasher	4
88	060017-026	Screw	4

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt & SS - TL Mast

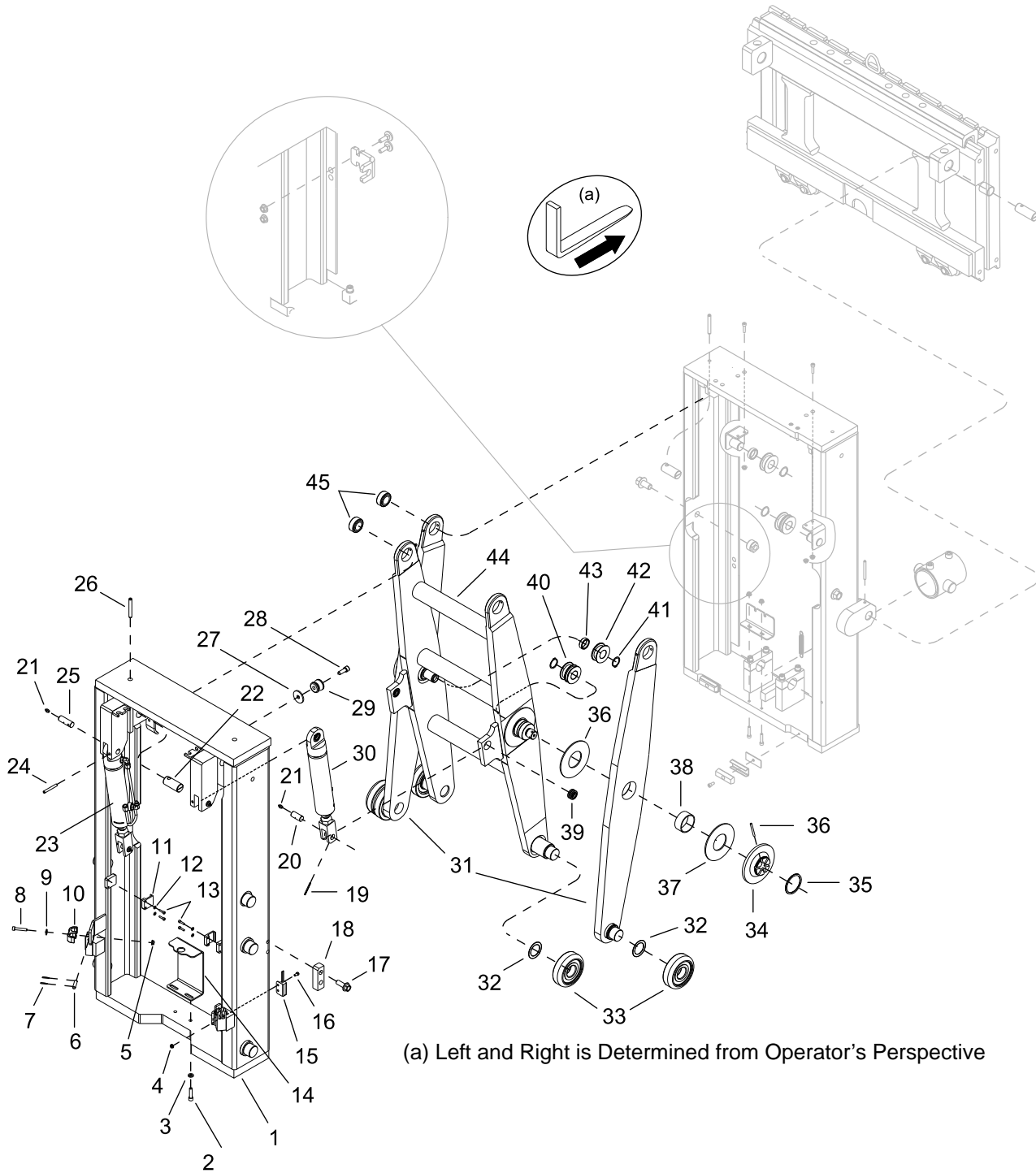


Figure 17601-01



PLATFORM PARTS

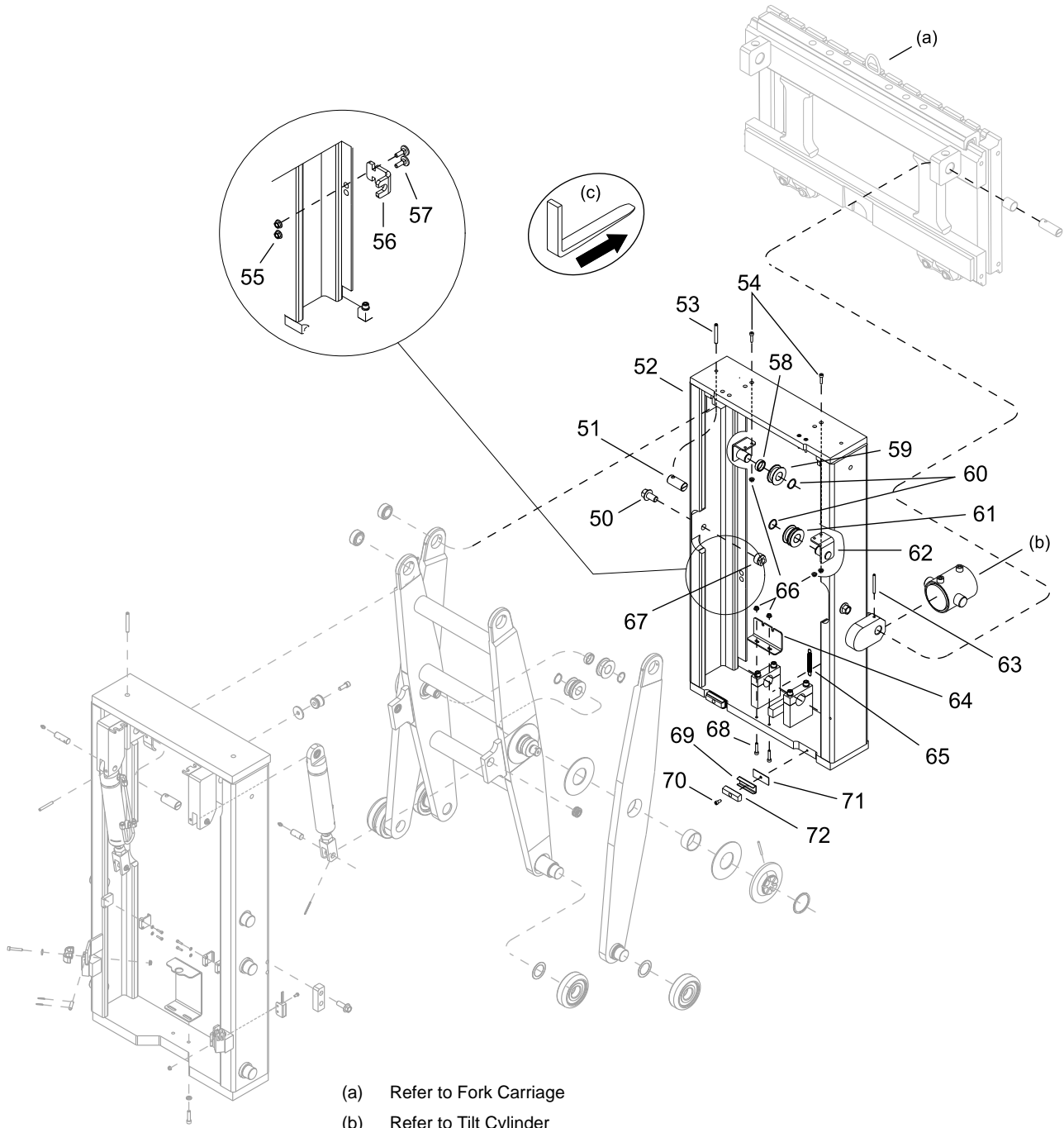
Reach w/Tilt & SS - TL Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134391	Reach Support Weldment	1
2	060016-088	Screw	2
3	060005-008	Lockwasher	2
4	050068-001	Nut	2
5	050068-002	Nut	2
6	086499	Pin	2
7	060000-055	Roll Pin	4
8	050055-012	Screw	1
9	060030-012	Washer	1
10	123281	Clamp	1
11	134376	Clamp	2
12	050009-004	Flatwasher	4
13	050005-054	Screw	4
14	136727	Bracket	1
15	062825-002	Switch	1
16	050005-090	Screw	2
17	050067-045	Screw	4
18	134426	Stopper	2
19	060000-090	Roll Pin	2
20	088892	Shaft	2
21	076048-001	Lubrication Fitting	2
22	134375	Shaft	2
23	133460	Reach Cylinder (LH)	1
24	060000-104	Roll Pin	2
25	113516	Pin	2
26	060000-029	Roll Pin	2
27	060030-340	Flatwasher	AR
28	060017-086	Screw	2
29	124018	Bumper	2
30	132419	Reach Cylinder (RH)	1
31	134350	Outer Arm Weldment	2
32	060030-080	Flatwasher	AR
33	074668-001	Column Roller	2
34	082384	Lock Nut	2
35	060009-049	Retaining Ring	2
36	060077-002	Groove Pin	2
37	082381	Thrust Washer	4
38	065007-052	Bearing Sleeve	2
39	065012-001	Ball Bearing	2
40	136729	Pulley	1
41	060009-036	Retaining Ring	2
42	136730	Pulley	1
43	136726	Spacer	1
44	134355-002	Inner Arm Weldment	1
45	065012-007	Ball Bearing	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt & SS - TL Mast



- (a) Refer to Fork Carriage
- (b) Refer to Tilt Cylinder
- (c) Left and Right is Determined from Operator's Perspective

Figure 17602-02



PLATFORM PARTS

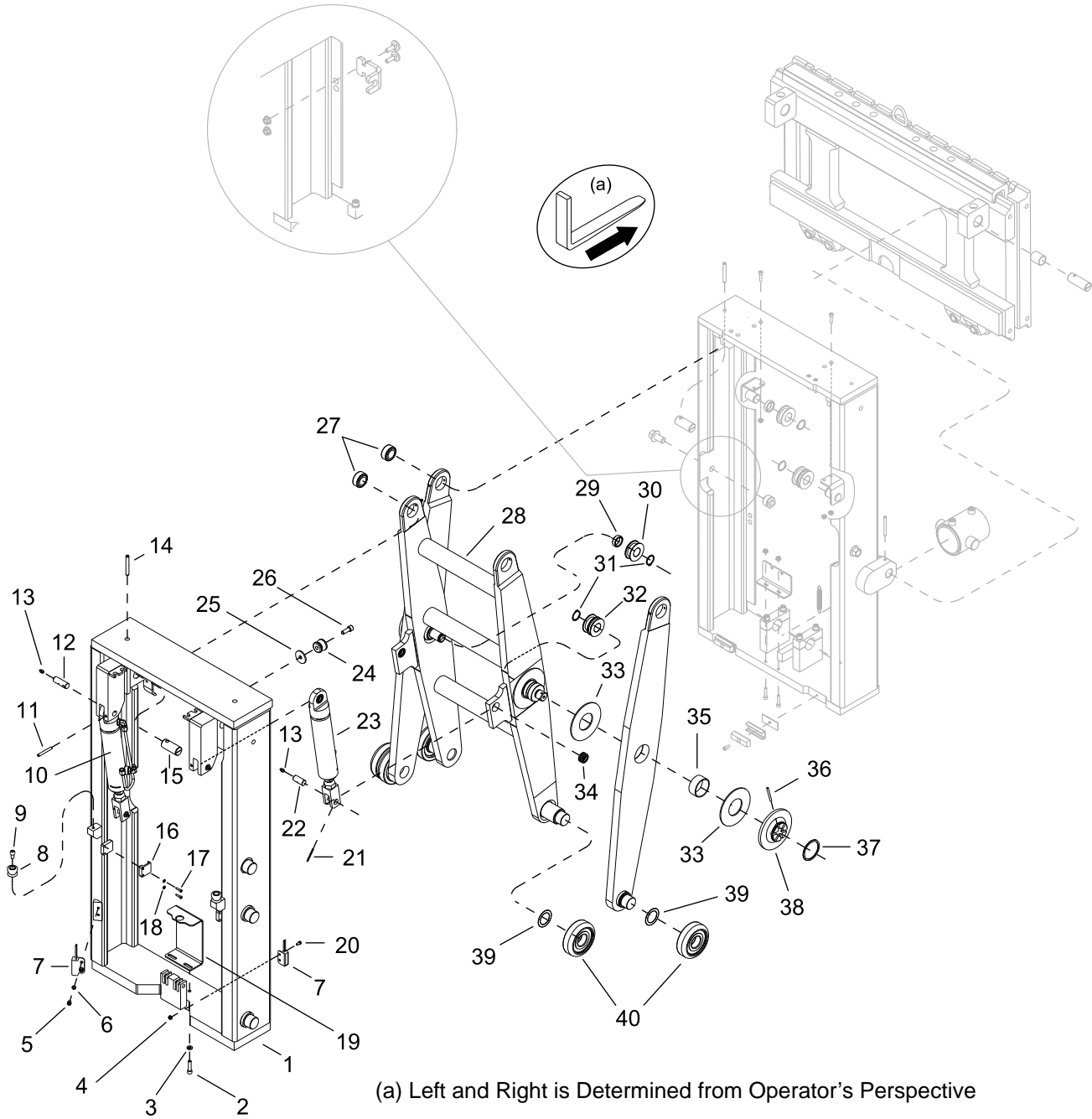
Reach w/Tilt & SS - TL Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	050067-055	Screw	2
51	134375	Shaft	2
52	134326-002	Reach Box Weldment	1
53	060000-029	Roll Pin	2
54	060062-013	Screw	4
55	050068-002	Nut	4
56	136728	Bracket	2
57	050025-003	Carriage Bolt	4
58	136726	Spacer	1
59	136730	Pulley	1
60	060009-036	Retaining Ring	2
61	136729	Pulley	1
62	134372	Pulley Bracket	2
63	060000-012	Roll Pin	2
64	137162	Bracket	1
65	089544	Spring	1
66	060015-006	Screw	2
67	134424	Stopper	2
68	050005-016	Screw	2
69	092746-001	Bracket	2
70	060015-068	Screw	2
71	074481-001	Stop Shim	AR
72	092747-001	Poly Stop	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt & SS - TT Mast



(a) Left and Right is Determined from Operator's Perspective

Figure 17643-01



PLATFORM PARTS

Reach w/Tilt & SS - TT Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	134390	Reach Support Weldment	1
2	060016-068	Screw	2
3	060005-008	Lockwasher	2
4	050068-001	Nut	2
5	050005-090	Screw	2
6	060005-005	Lockwasher	2
7	062825-001	Switch	2
8	124018	Bumper	2
9	060017-050	Screw	2
10	133460	Reach Cylinder (LH)	1
11	060000-104	Roll Pin	2
12	113516	Pin	2
13	076048-001	Lubrication Fittings	2
14	060000-029	Roll Pin	2
15	134375	Shaft	2
16	134376	Clamp	2
17	050005-054	Screw	4
18	050009-004	Flatwasher	4
19	136727	Bracket	1
20	050005-057	Screw	2
21	060000-090	Roll Pin	2
22	088892	Pinot Cylinder Shaft	2
23	132419	Reach Cylinder (RH)	1
24	124018	Bumper	2
25	060030-340	Flatwasher	AR
26	060017-086	Screw	2
27	065012-007	Ball Bearing	2
28	134355-001	Inner Arm Weldment	1
29	136726	Spacer	1
30	136730	Pulley	1
31	060009-036	Retaining Ring	2
32	136729	Pulley	1
33	082381	Thrust Washer	4
34	065012-001	Ball Bushing	2
35	065007-052	Sleeve Bearing	2
36	060077-002	Groove Pin	2
37	060009-049	Retaining Ring	2
38	082384	Lock Nut	2
39	060030-080	Flatwasher	AR
40	074668-001	Column Roller	2

Always Specify Model, Data & Serial Number

PLATFORM PARTS

Reach w/Tilt & SS - TT Mast

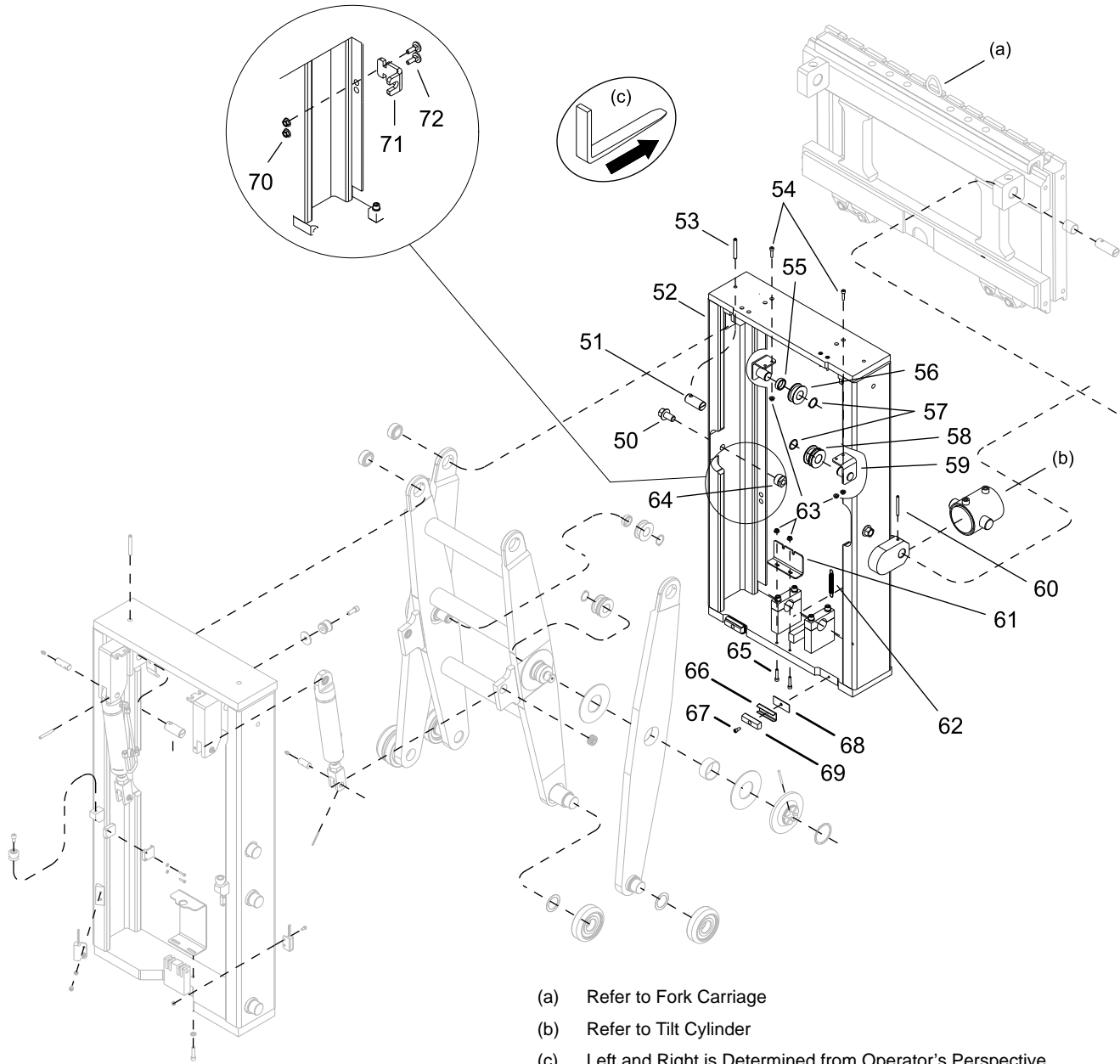


Figure 17644-02

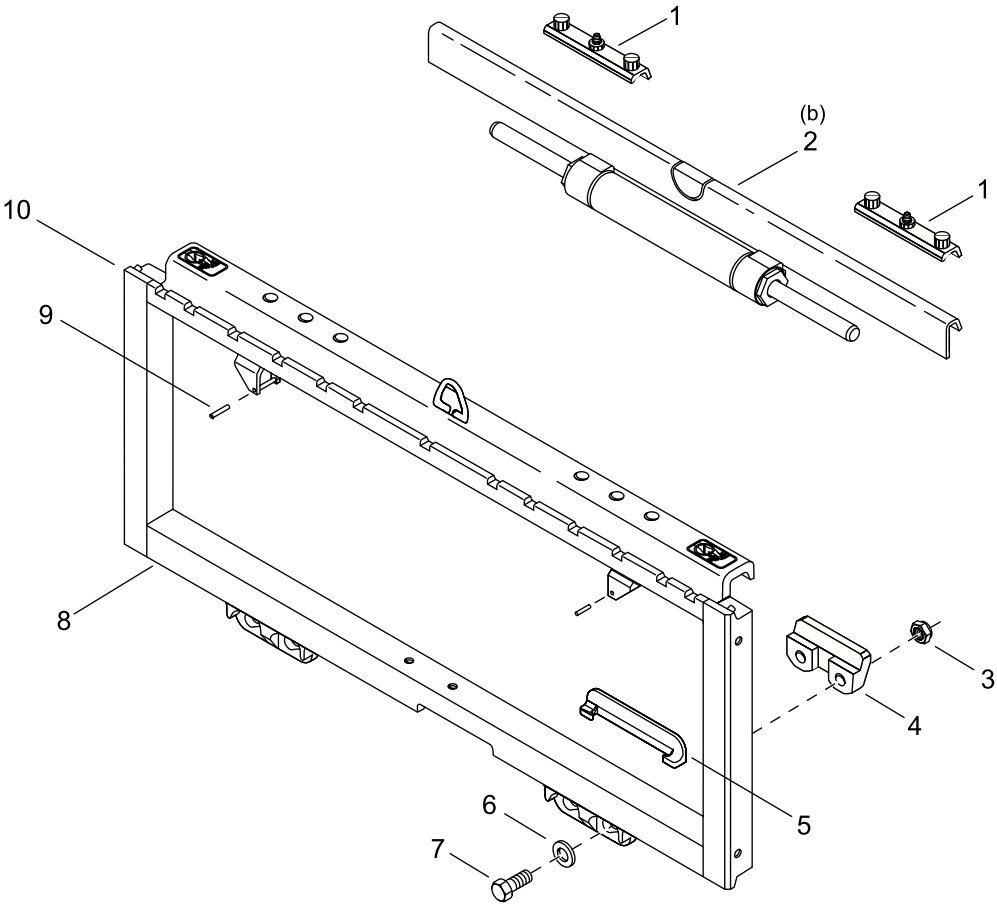


PLATFORM PARTS

Reach w/Tilt & SS - TT Mast

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	050067-055	Screw	2
51	134375	Shaft	2
52	134326-001	Reach Box Weldment	1
53	060000-029	Roll Pin	2
54	060062-013	Screw	4
55	136726	Spacer	1
56	136730	Pulley	1
57	060009-036	Retaining Ring	2
58	136729	Pulley	1
59	134372	Pulley Bracket	2
60	060000-012	Roll Pin	2
61	137162	Bracket	1
62	089544	Spring	1
63	050068-002	Nut	6
64	134424	Stop	2
65	050005-016	Screw	2
66	092746-001	Bracket	2
67	060015-068	Screw	2
68	074481-001	Stop Shim	AR
69	092747-001	Poly Stop	2
70	050068-002	Nut	4
71	136728	Bracket	2
72	050025-003	Carriage Bolt	4

Always Specify Model, Data & Serial Number



- (a) To Accessory Manifold Block
- (b) Maximum Sideshift 205 mm (8.0 in)

Figure 19646

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	127757-004	Sideshifter 760 mm (30.0 in)	1
1	131989	Upper Bearing	2
2	127572	Cylinder, refer to Cylinder Parts	1
3	094004	Nut	4
4	126843	Lower Hook	2
5	131990	Lower Bearing	2
6	116876	Flatwasher	4
7	060020-019	Capscrew	4
8		Faceplate ⁽¹⁾	1
9	060000-030	Roll Pin	2
10	126844	Fork Stop	2

⁽¹⁾ Not Serviceable. Replace Sideshifter when faceplate is needed.

Always Specify Model, Data & Serial Number

Notes:



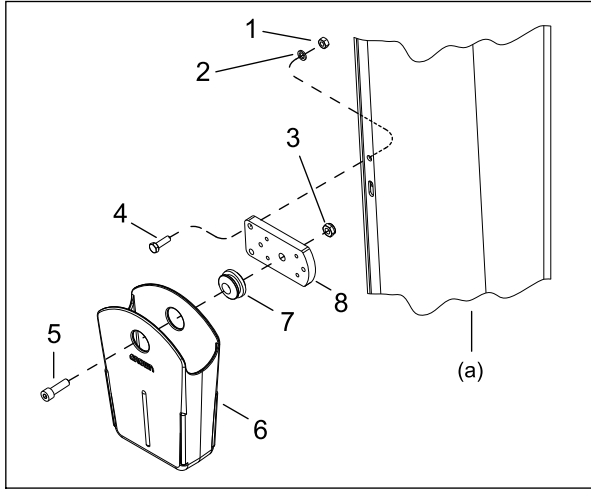
LABELS AND DECALS

LABELS AND DECALS

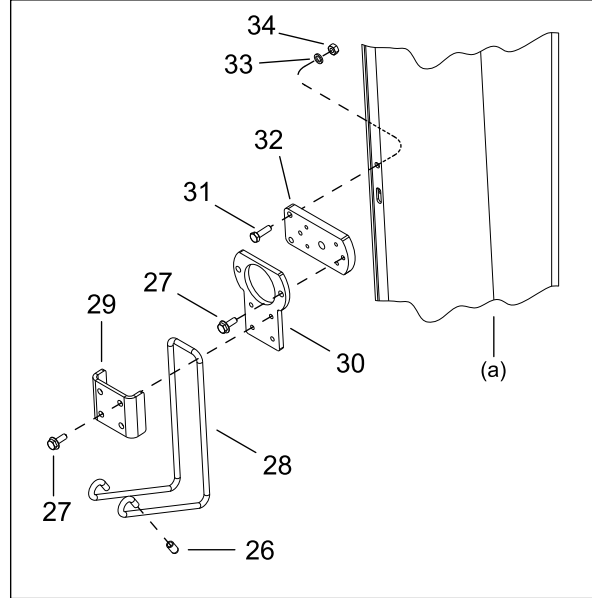
Work Assist



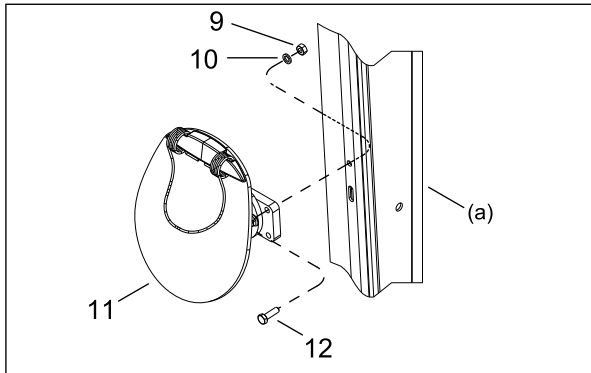
Storage Pocket Kit 141461



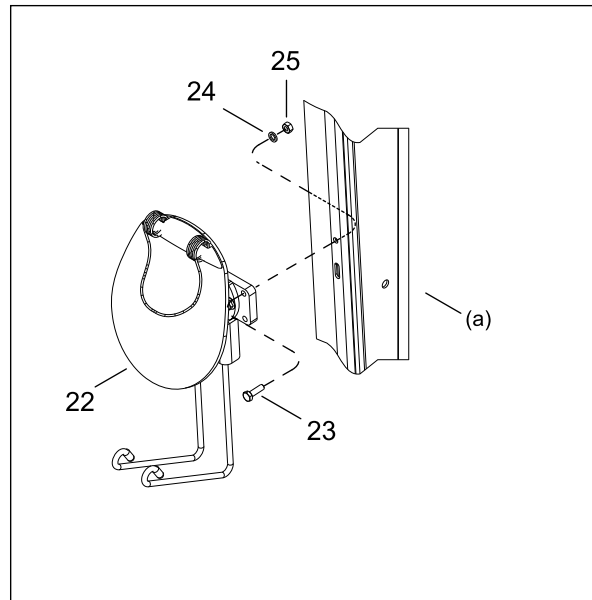
Hook Kit 141463



Clip Pad Kit 141462



Clip Pad & Hook Kit 141460



(a) Part of Mast Guard

24 V Fan Kit 141459

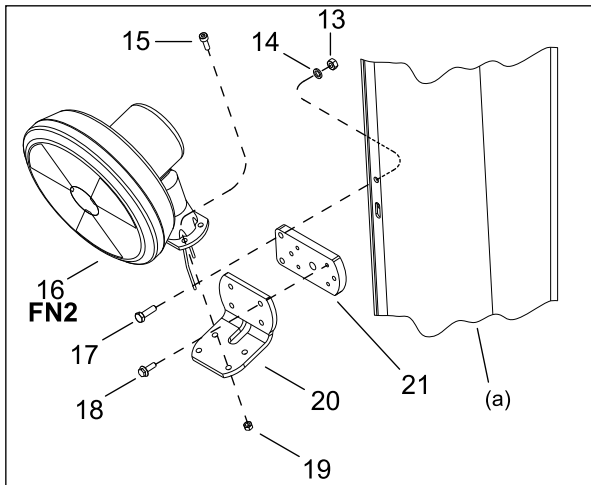


Figure 17697

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
0	141461	Storage Pocket Kit.	1
1	060059-005	Nut	2
2	060030-274	Flatwasher	2
3	060042-010	Nut	1
4	060062-006	Screw	2
5	060016-013	Screw	1
6	125502	Storage Pocket.	1
7	125503-002	Pocket Mount.	1
8	141411	Mounting Plate.	1
0	141462	Clip Pad Kit	1
9	060059-005	Nut	2
10	060030-274	Flatwasher	2
11	141618	Clip Pad Assembly	1
12	060062-006	Screw	2
0	141459	24V Fan Kit	1
13	060059-005	Nut	2
14	060030-274	Flatwasher	2
15	060061-038	Screw	4
16	127259-007	24V Fan	1
17	060062-006	Screw	2
18	060061-013	Screw	4
19	060059-002	Nut	4
20	129286	Fan Bracket	1
21	141411	Mounting Bracket.	1
	087245-085	2 Conductor Lead Assembly (Not Shown).	1
	062007-063	Terminal Tab (Not Shown)	2
	061003-004	Cable Tie (Not Shown).	6
0	141460	Clip Pad & Hook Kit.	1
22	141617	Clip Pad & Hook Assembly	1
23	060062-006	Screw	2
24	060030-274	Flatwasher	2
25	060059-005	Nut	2
0	141463	Hook Kit.	1
26	130125	Cap	2
27	060062-040	Screw	6
28	130071	Wire Holder	1
29	130060	Clamp Bracket	1
30	130050-002	Mounting Plate.	1
31	060062-006	Screw	2
32	141411	Mounting Plate.	1
33	060030-274	Flatwasher	2
34	060059-005	Nut	2

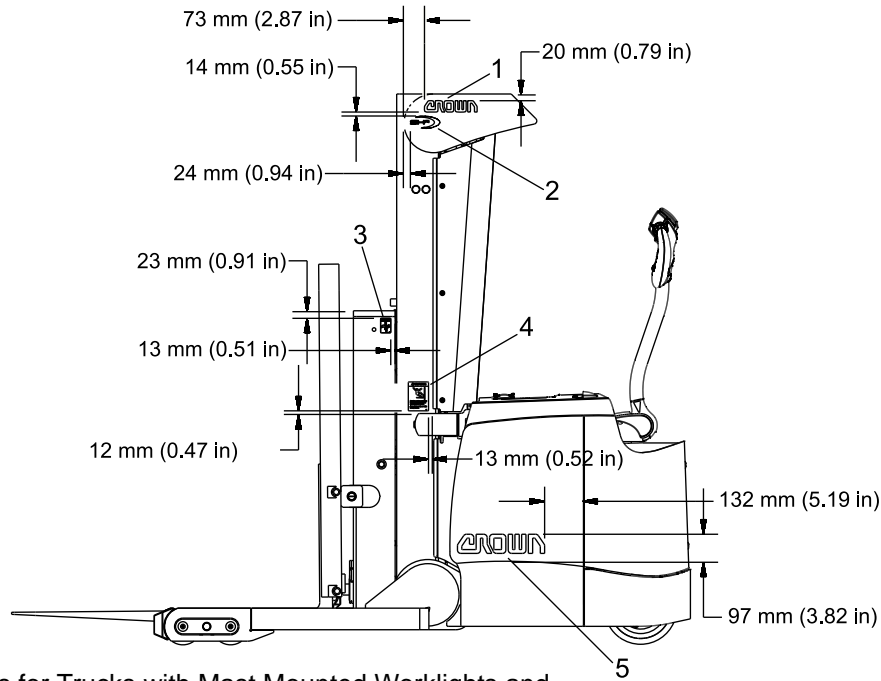
Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals



Mounting Locations for Trucks without Mast Mounted Worklights and Trucks with 333 mm (13.12 in) Battery Compartment



Mounting Locations for Trucks with Mast Mounted Worklights and Trucks with 168 mm (6.62 in) Battery Compartment

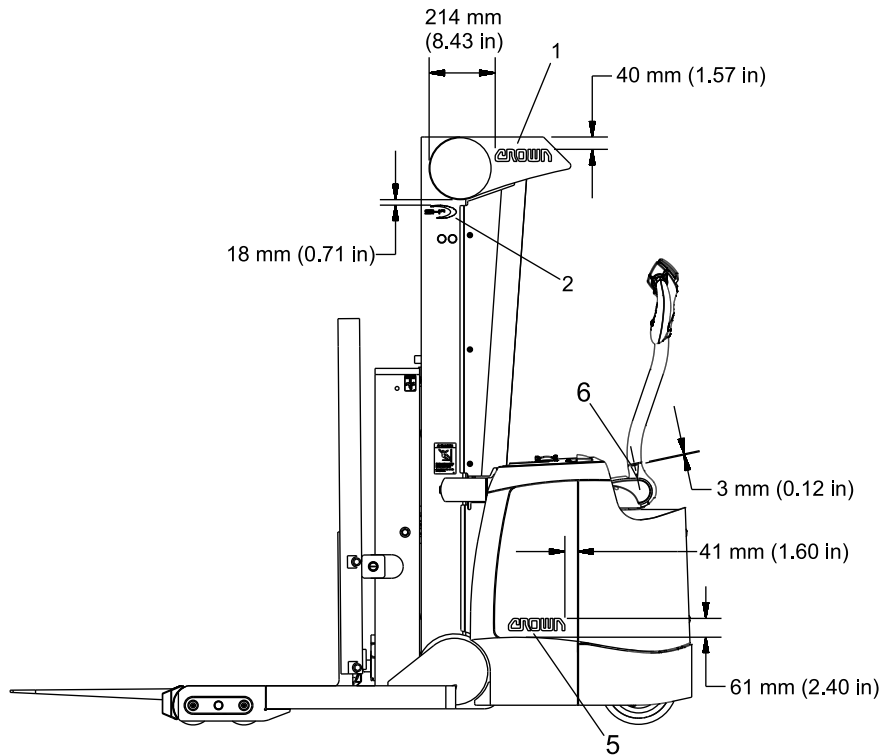


Figure 18925

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
1	106158-022	Crown Decal	2
2	069372-041*	SHR Momentum Decal	2
	069372-043*	SH Momentum Decal	2
3	069006-(1)	Hands Off Warning	2
4	069009-(1)	Stand On Warning	2
5	106158-001*	Crown Decal 168 mm (6.62 in) Battery Compartment	2
	106158-020*	Crown Decal 333 mm (13.12 in) Battery Compartment	2
6	069718	Brake Override Decal	2
	069815-001	RH Zone	1
	069815-002	LH Zone	1

(1) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals

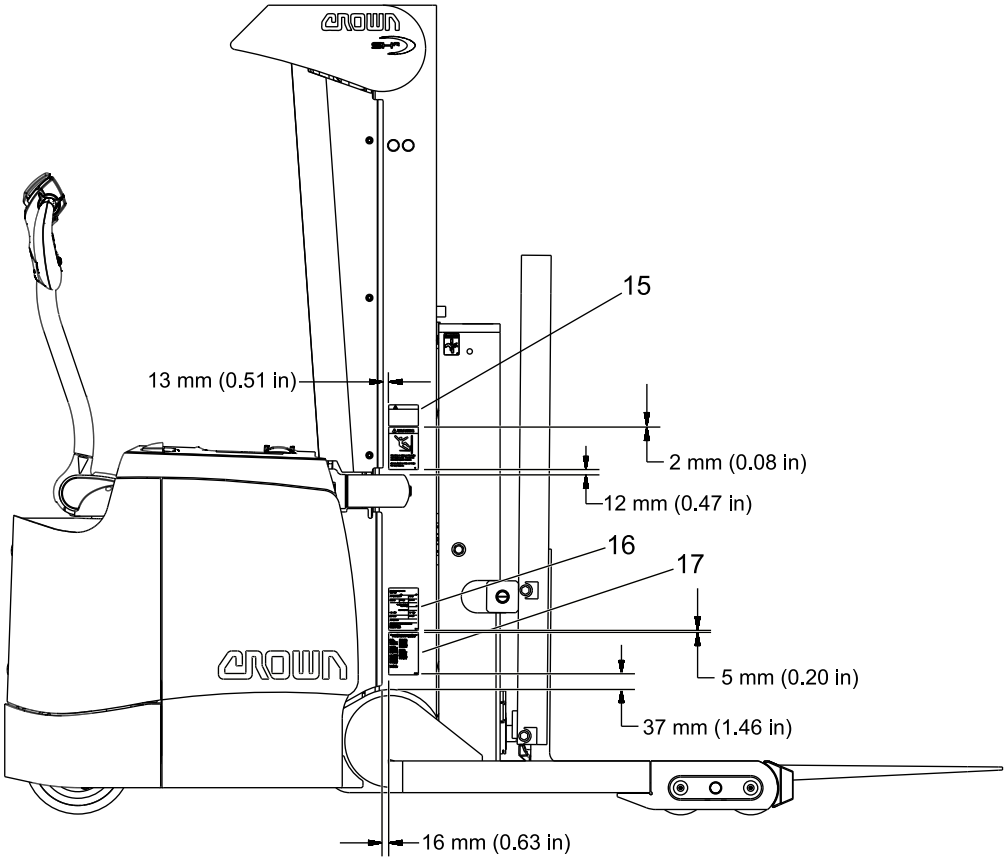


Figure 18926

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
15	069091-(¹)	Unsupported Load Warning	1
16	Data Plate (²)	1
17	069320-005	Patent Label	1

(¹) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

(²) Contact Factory for replacement.

Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals

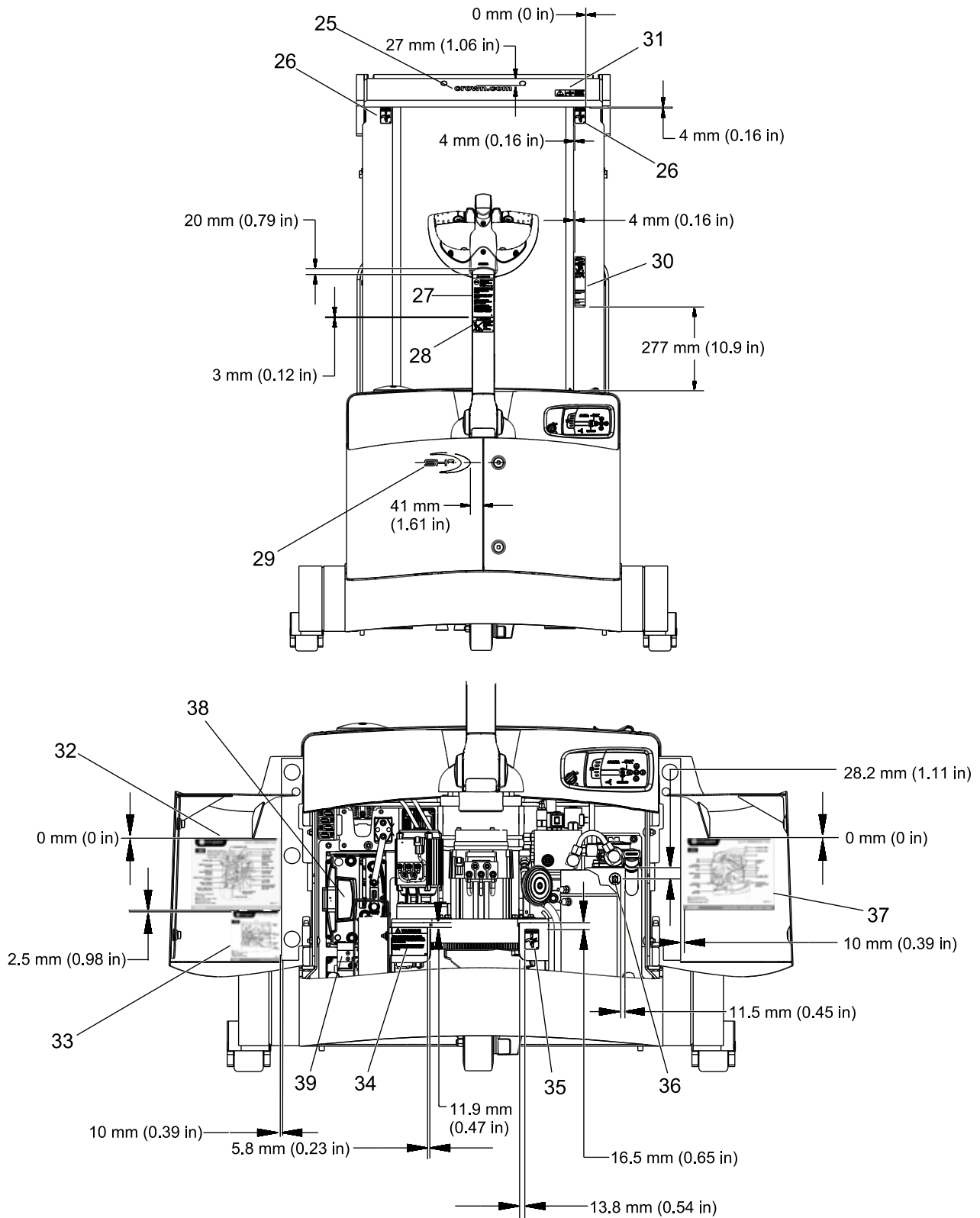


Figure 18927-01

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
25	069374-001	crown.com Decal	1
26	069006-(1)	Hands Off Warning	2
	869006-006	Hands Off Warning (SAA)	1
27	069054-(1)	Moving Vehicle Warning	1
	869054-006	Moving Vehicle Warning (SAA)	1
28	069036-(1)	No Riding Warning	1
	869036-006	No Riding Warning (SAA)	1
29	069372-042*	SHR Large Decal	1
	069372-044*	SH Large Decal	1
30	069717-001*	Capacity Plate SHR 5500 ⁽²⁾	1
	069720-001*	Capacity Plate SH 5500 ⁽²⁾	1
31	069105-(1)	No Hands Text Warning	1
32	069816-(1)*	SHR Electric Control Power Map Label	1
	069818-(1)*	SH Electric Control Power Map Label	1
33	069721-(1)*	SHR Power Unit Overview Label	1
	069834-(1)*	SH Power Unit Overview Label	1
34	069012-(1)	Electrical Additions Warning	1
	869012-006	Electrical Additions Warning (SAA)	1
35	069006-(1)	Hands Off Warning	1
36	069154	Hydraulic Oil Label	1
37	069817-(1)*	SHR Hydraulic Control Power Map Label	1
	069819-(1)*	SH Hydraulic Control Power Map Label	1
38	069724	ACCESS 2 & 3 Label	1
39	069725	ACCESS 5 Label	1

(1) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

(2) Contact Factory for replacement.

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals

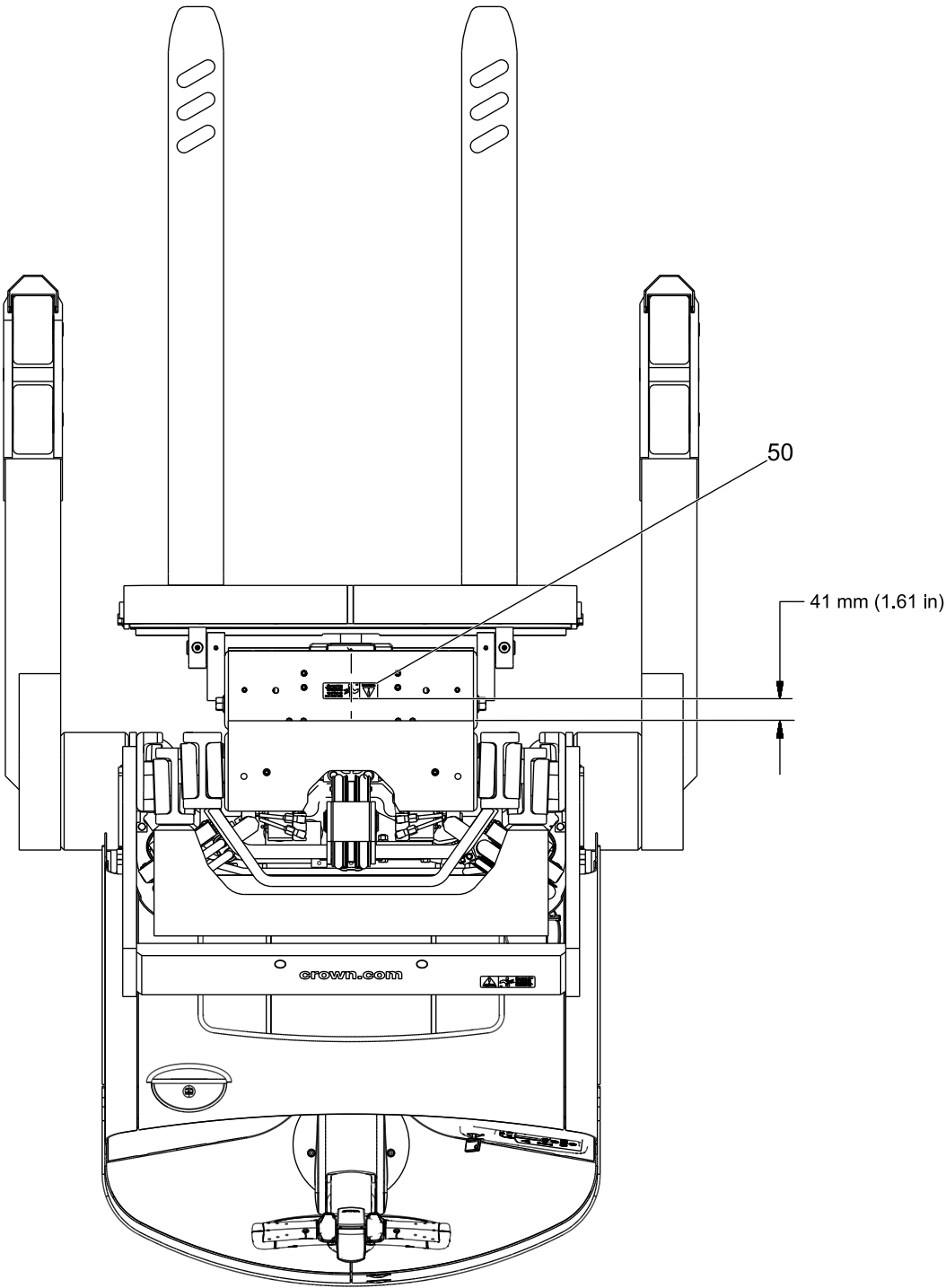


Figure 18928

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
50	069105-(¹)	No Hands Text Warning	1

(¹) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals

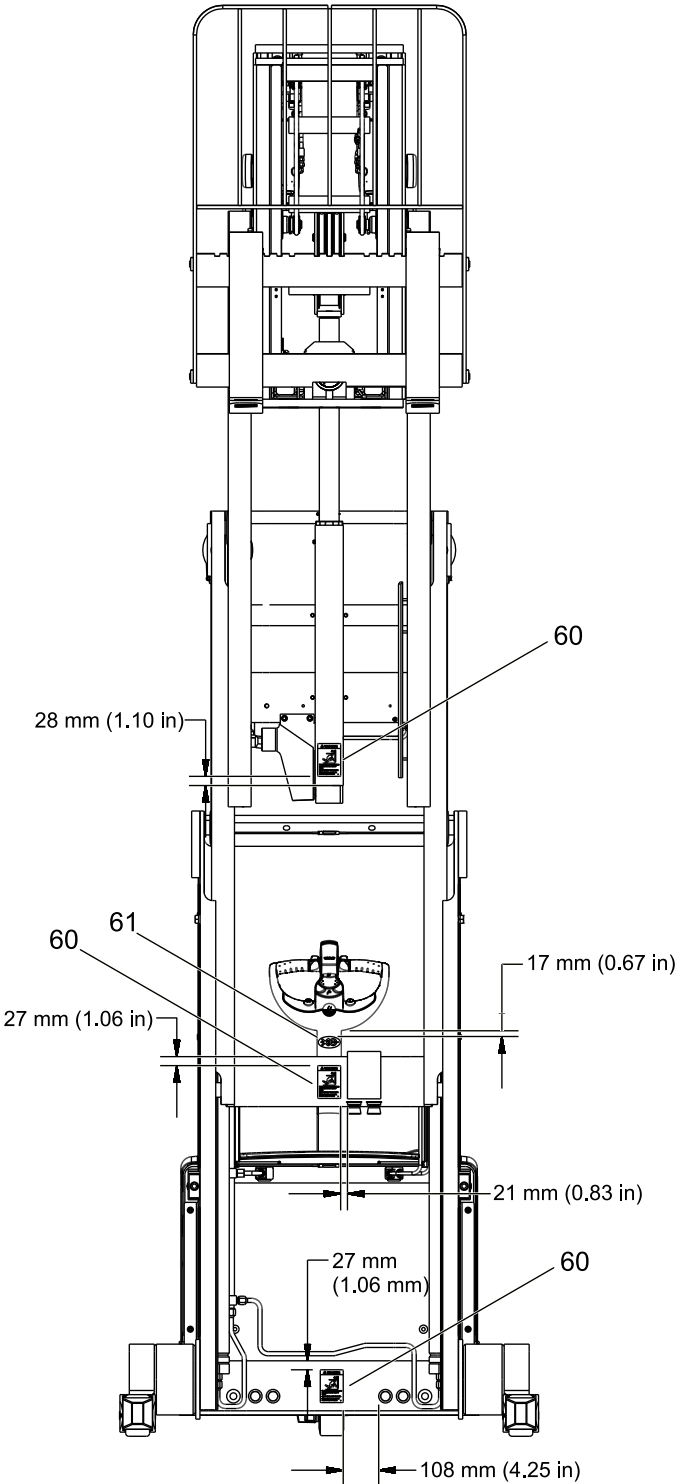


Figure 18931



LABELS AND DECALS

Labels and Decals

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
60	069010-(¹)	Stand Under Warning	3
61	069493	X10 Label	1

(¹) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

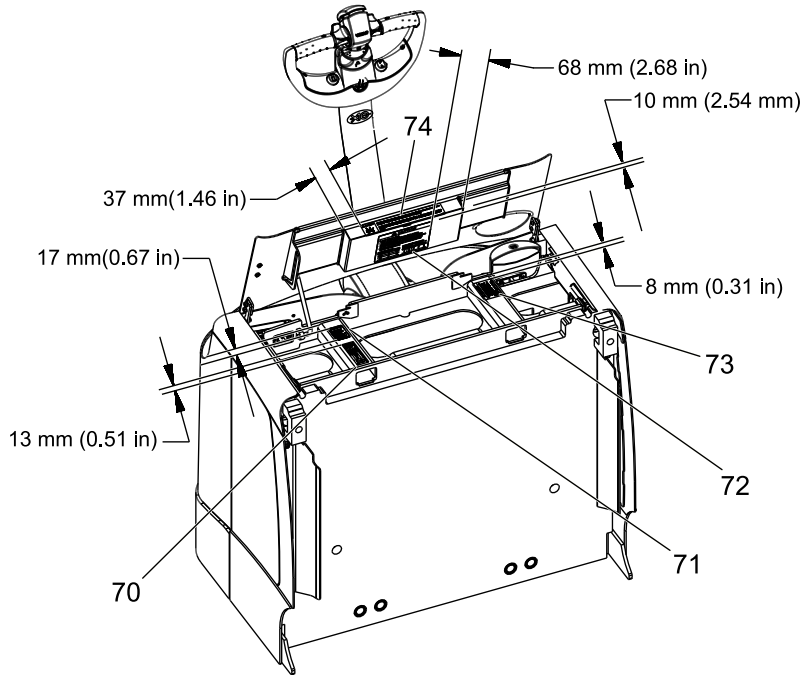
Always Specify Model, Data & Serial Number

LABELS AND DECALS

Labels and Decals



168 mm (6.62 in) Battery Compartment



333 mm (13.12 in) Battery Compartment

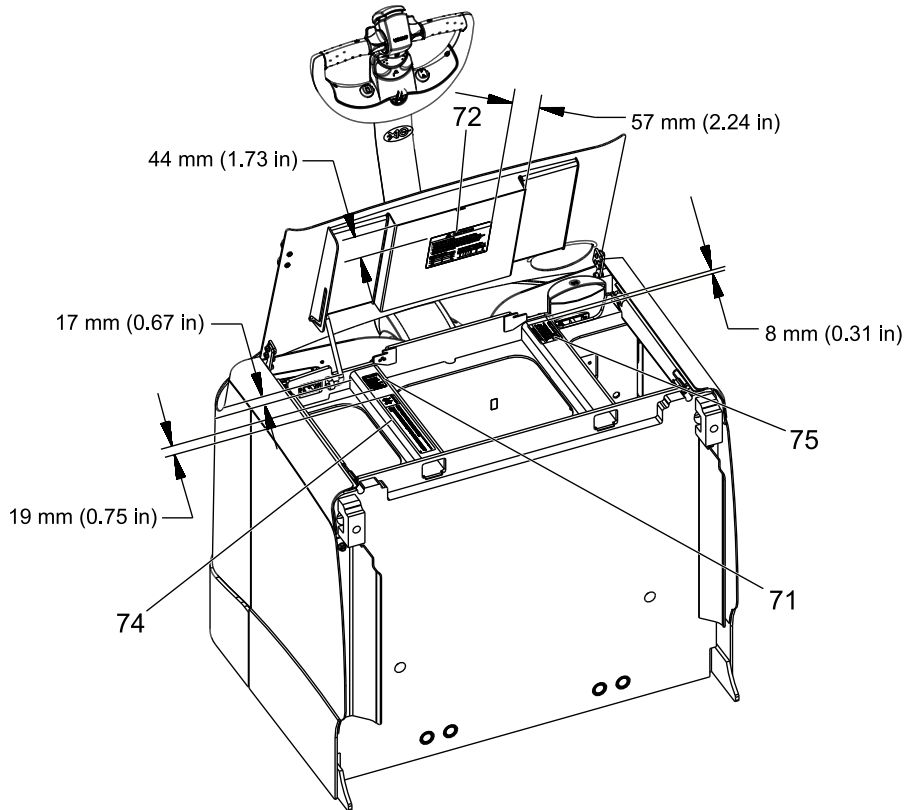


Figure 19144-02

INDEX	PART NUMBER	PART NAME	NUMBER REQUIRED
70	069296	Battery Charge Decal	1
71	069047-(¹)	Caution Charger Hook Up	1
	869047-006	Caution Charger Hook Up (SAA)	1
72	069060-(¹)	Caution Charger	1
	869060-006	Caution Charger (SAA)	1
73	069112-003*	Battery Size Warning 168 mm (6.62 in) Battery Compartment	1
74	069723-(¹)	Danger Battery Label	1
	869723-006	Danger Battery Label (SAA)	1
75	069112-004*	Battery Size Warning 333 mm (13.12 in) Battery Compartment	1
	148128	Warning Labels Kit	1
	148129	Labels & Decals Kit	1

(¹) Choice of dash number depends on language. Use the following dash numbers for the language indicated: -001 German, -002 French, -003 Spanish, -004 Dutch, -005 Italian, -006 English.

* To select appropriate part number, use the data number to determine truck features. Refer to Introduction.

Always Specify Model, Data & Serial Number

Notes:

