



SP 3400 Series Maintenance Manual



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SAFETY



Notes:



SAFETY

SYMBOLS USED IN THE MANUAL

Symbols Used in the Manual

Safety Symbols

To provide guidance and clearly identify potential hazard points, we have used graphic illustrations in the manual:

Danger!



This symbol indicates a danger to life.

You or other people could be seriously or fatally injured if you fail to comply with this safety instruction.

Warning!



This symbol represents risk of injury and/or potentially significant material damage.

You or other people could be seriously injured and/or significant material damage could occur if you fail to comply with this safety instruction.

Caution!



This symbol represents potential minor injuries and/or potential minor material damage.

You or other people could be slightly injured and/or minor material damage could occur if you fail to comply with this safety instruction.

Information



This symbol is used with additional information and instructions.

Option

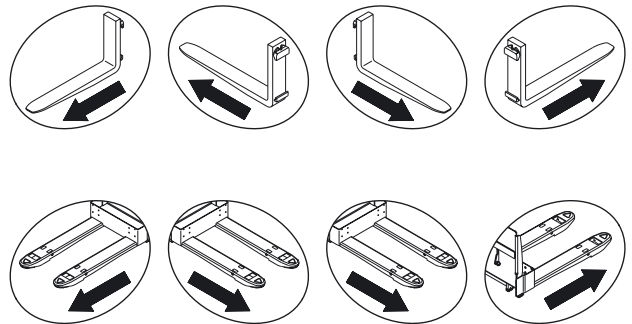
Option

This symbol is used with text describing optional equipment. This is not included with the standard version.

General Symbols

Fork direction

This symbols are used to show the direction of view in a figure. The direction of the forks is used as reference.



SAFETY

GENERAL SAFETY INSTRUCTIONS



General Safety Instructions

Maintenance and Repair Instructions

Danger!



Observe the safety instructions in the maintenance manual and the truck operator manual.

Failure to do so could result in serious or even fatal injuries to maintenance and other personnel.

Motorised trucks can become hazardous if maintenance and servicing work are neglected. For this reason maintenance and inspections must be performed at sufficiently short intervals. There must be suitably trained personnel and proper guidelines at your place of work.

Maintenance and Repair

- Always carry out work in accordance with the test and maintenance schedule enclosed in these maintenance instructions and any applicable service bulletins.
- Only qualified and authorized personnel may carry out work on the truck.
- Keep fire protection equipment at hand and do not use a naked flame to check fluid levels or to test for leaks.
- Use groundwater neutral, non-flammable solvents for cleaning. Always perform cleaning work over an oil separator. Protect the electrical system against damp.
- Keep the work place and battery charging station clean, dry and well ventilated.

- Do not allow oils to penetrate the ground or the drain system. Used oil must be recycled correctly. Oil filters and dehumidifying inserts must be treated as special waste. Observe the local authority regulations.
- Immediately neutralize and thoroughly rinse any spilled battery fluid.
- Keep the truck clean. This will facilitate tracing loose or faulty components.
- Maintain the legibility of the data capacity plate and data plate, warning and instruction decals.
- Truck modifications and additions may only be performed with Crown's prior written approval.
- The reliability, safety and suitability of Crown trucks can only be ensured by using original Crown parts.

Before Parking the Truck

- Brake until the truck comes to rest.
- Lower the fork carriage fully.
- Apply the parking brake.
- Switch off the truck and remove the key.
- When parking on a slope or incline always chock all wheels.

Before Working on the Truck

- Jack up the truck so that the drive wheel is clear of the ground. Apply the Emergency Disconnect and disconnect the battery.



SAFETY

GENERAL SAFETY INSTRUCTIONS

- Prevent the truck from rolling away and lowering.
- When working on the mast, fork carriage or lifting mast always apply a chock to prevent accidental lowering.
- Allow sufficient room for manoeuvre when testing the truck, to avoid endangering yourself and other people.

Before Starting the Truck

- Test the safety mechanisms.
- Get into the travel position.
- Test the lifting mechanism, travel direction switch, speed control, steering, warning mechanism and brakes.

Warning and Instruction Decals on the Truck

In the course of periodic maintenance work, check that the warning and instruction decals on the truck are complete and legible.

- Clean any dirty decals.
- Replace any faulty or missing decals.
- A description and the location of the warning and instruction decals used on the truck are given in chapter 10.9 of the parts manual.



Notes:



SAFETY

CONTROL OF HAZARDOUS ENERGY

Control of Hazardous Energy

In the interest of safety Crown has developed guidelines for proper energy control when performing service and maintenance on the SP 3400.

Before performing any service or maintenance on the SP 3400, 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

Warning



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

Follow the battery's and charger manufacturer's instructions concerning practices and procedures for charging, maintenance and repair.

Safety Rules

- Wear protective clothing such as a rubber apron, gloves, boots and a 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 (0.120 kg to 1 litre of water)

[one pound to one US gallon of water] will neutralise acid spilled on clothing, the 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 the battery. Arcing will result.
- Do not allow dirt, cleaning solution or other foreign materials to enter cells. Impurities in electrolyte have a neutralising effect, reducing the available charge.

Make certain the charger being used matches the voltage and amperage of the truck battery. This voltage is listed on the truck data 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 and damage to the battery and charger could result.

Make sure that the battery used meets the weight, size and voltage requirements of the truck (refer to data plate). **Never operate the truck with an undersized battery.**

SAFETY

CONTROL OF HAZARDOUS ENERGY

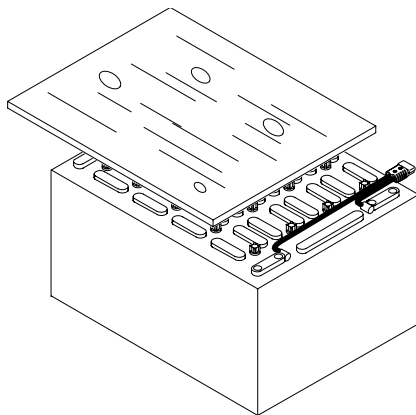


Battery Removal.

Warning



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 tipover protection. Do not allow any metallic object to come into contact with the top of the battery cells. This may cause a short circuit when removing and transporting the battery. Use an insulator (such as plywood) to cover the top of the battery before and during removal.



Battery Installation

Warning



Make sure that the battery used meets the weight, size and voltage requirements of the truck (refer to data plate). NEVER operate truck with an under-sized battery.

Warning



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 tipover protection. Do not 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.

Lockout - Tagout

Always turn key switch to “off”, remove key and apply tag to steering wheel or twist grip with cable tie, warning others that the truck is being serviced (Figure 8262).

8251

When maintenance is to be performed and the battery will be left in the truck:



8262

Disconnect battery, 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 truck's 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.



SAFETY

CONTROL OF HAZARDOUS ENERGY

Brake

Danger



Extreme care must be taken when using the Drive/Tow switch to release the brakes!

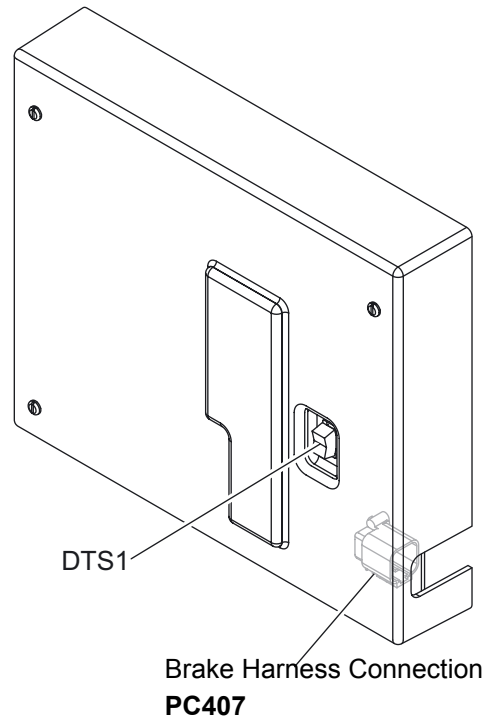
The truck will be free-wheeling and the brake pedal in the operator compartment will have no effect on braking.

Brakes will only be applied when DTS1 is moved from the Tow to the Drive position.

The brakes can be released through the use of the Drive/Tow switch (DTS1) during a maintenance situation. **When using this method to release the brakes, the truck will not have brakes available for stopping. The truck will not have traction control and the power steering system will not work.**

1. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
2. Chock wheels or make sure truck is secured by some means to keep it from rolling away.
3. When towing the truck make sure all operators are informed of the truck's lack of braking.
4. Move switch DTS1 from the *Drive* position to the *Tow* position.
5. Insert brake harness, PC407, to distribution panel.
6. Move truck to area intended for maintenance.
7. Move DTS1 from the Tow to the *Drive* position. Disconnect battery.

8. Disconnect brake harness from distribution panel and connect to original connection, CA407.



12367

SAFETY

CONTROL OF HAZARDOUS ENERGY

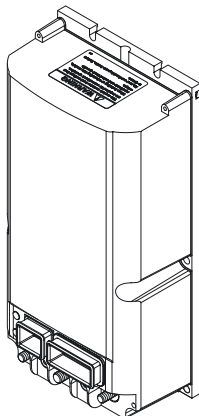


Capacitance

Due to capacitance voltage present in the Access 3 module, whenever performing maintenance which may permit contact with the bus bars and associated power cables, discharge the capacitors.

1. Move truck to a secure non traffic maintenance area with a level floor.
2. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section. Disconnect battery.
3. Turn and hold the key switch to the "start" position for 30 seconds. Voltage lowered below 1 V.
4. Turn key switch to "off", remove key.

Or allow 5 minutes after battery disconnect for capacitors to discharge.



Access 3

12368

Hydraulic System

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.

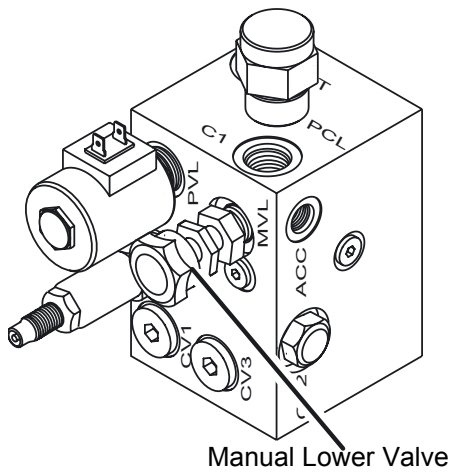
Any fluid injected into the skin under high pressure should be considered as a serious medical emergency despite an initial normal appearance of the skin. There is a delayed onset of pain, and serious tissue damage may occur. Medical attention should be sought immediately by a specialist who has had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

Depressurising the hydraulic system

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

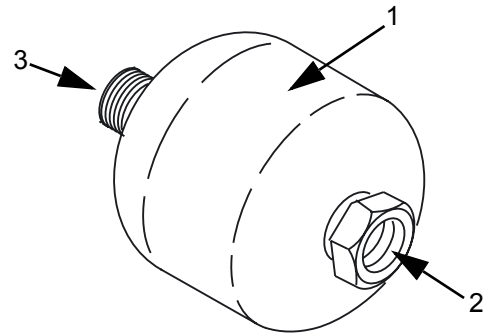
5. Move truck to a secure non traffic maintenance area with a level floor.
6. No load on forks.
7. Completely lower load engaging means (mast) or, if required for maintenance, block mast sections at appropriate height as described in Mast of this section.
8. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
9. Open power unit doors and locate the lift manifold.

10. Open the manual lower valve to remove hydraulic pressure.



Manual Lower Valve

12369-EU

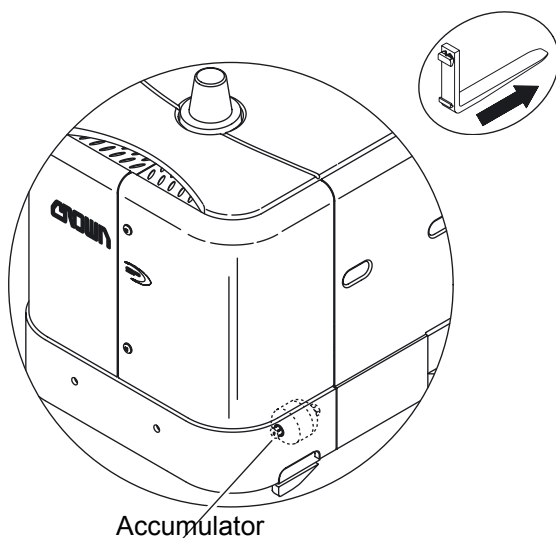


8266-EU

- 1 Accumulator
- 2 Hydraulic Line Connection
- 3 Gas Valve

Accumulator

The accumulator (hydraulic system shock absorber) contains a charge of inert gas such as dry nitrogen. Do not tamper with the gas valve on the accumulator in an attempt to reduce the amount of this charge. Use accumulator charging equipment and procedures as described in chapter 2 of this manual.



Accumulator

10575-EU

SAFETY

CONTROL OF HAZARDOUS ENERGY



Lifting and Blocking

Required tools

- Hydraulic Jack
Capacity 3 620 kg (8 000 lbs), Crown part number: 12259
Minimum collapsed height: 60 mm (2.25 inch)
Maximum raised height: 400 mm (16 inch)
- Jack Stand
Capacity 4 500 kg (10 000 lbs). Commercially available.
- Appropriately sized hard wood blocks and wedges.

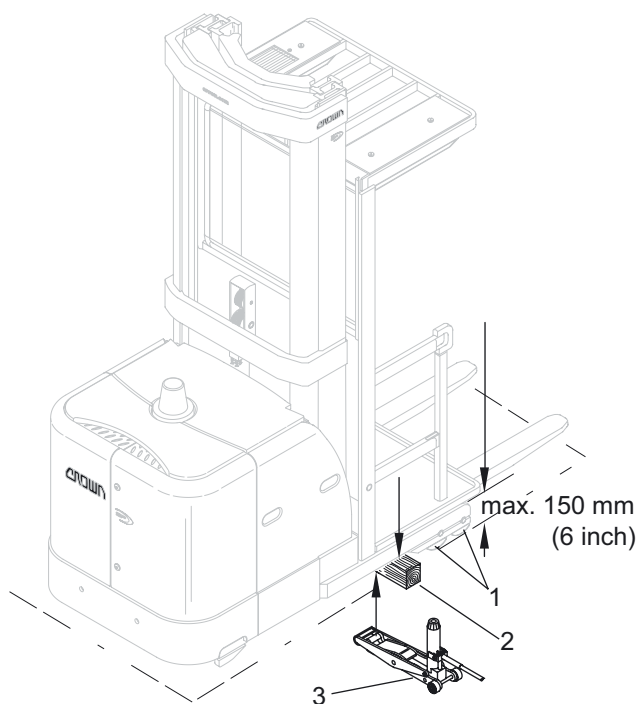
Raising the Side

Danger



Risk of tipover!

Truck stability decreases dramatically if load wheels are raised more than 13 mm (0.5 inch).



10576-EU

1. Move truck to a secure, traffic-free maintenance area with a level floor.
2. No load on forks.
3. Raise the platform to max. 150 mm (6 inch) from floor (Figure 10576-EU).
4. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
5. Attach a sling and an overhead lifting device to all cross members of the mast to prevent the truck from accidental tipping over.



SAFETY

CONTROL OF HAZARDOUS ENERGY

6. Place a wedge in front of the load wheel remaining on the floor. Place a jack (3, Figure 10576-EU) under the truck and raise the truck. Do not exceed 13 mm (0.5 inch) distance from floor to load wheels (1, Figure 10576-EU).
7. Place hard wood block(s) under the frame and relieve the jack.
3. Raise the platform to min., 70 mm and max. 150 mm (6 inch) from floor (Figure 10576-EU).
4. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.
5. Attach a sling and an overhead lifting device to all cross members of the mast to prevent the truck from accidental tipping over.

Raising the Drive Wheel

Danger



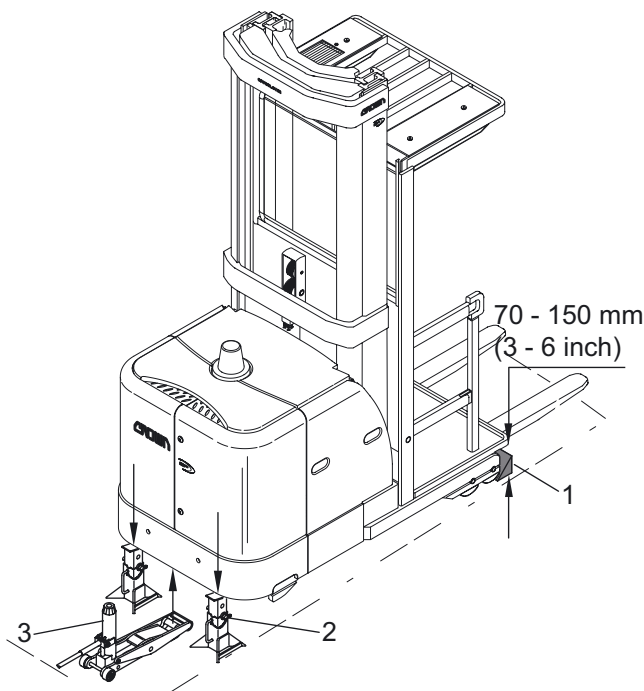
Risk of tipover!

Attach sling and overhead lifting device to all cross members of the mast to prevent truck from tipping over when raising the side of the truck.

Caution



Before raising the truck verify that the jack does not interfere with the wire guidance sensors!



10577-EU

7. Set height of the two jack stands (4, Figure 10577-EU) as required **but do not exceed 400 mm (16 inch)**.
8. Place a jack (3, Figure 10577-EU) under the truck skirt and raise the truck until the jack stands fit under the skirt. Relieve the jack.
1. Move truck to a secure, traffic-free maintenance area with a level floor.
2. No load on forks.

SAFETY

CONTROL OF HAZARDOUS ENERGY

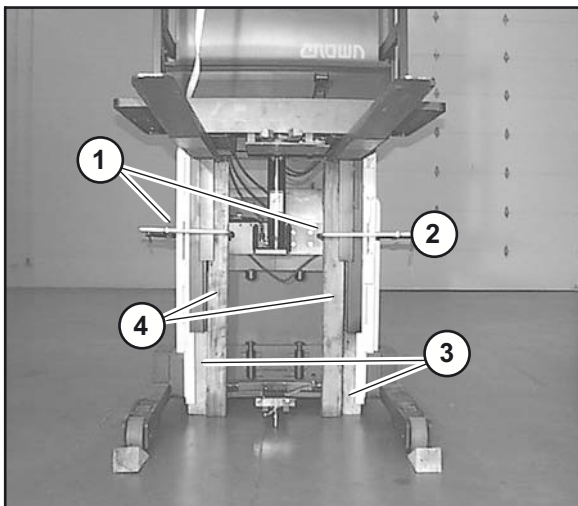


Blocking Masts

Use 100 mm x 100 mm (4 inch x 4 inch) or larger, suitably long hardwood blocks to support mast channels. Block both mast rails of each stage to maintain truck stability.

Remove any carriage mounted accessory (e.g. roll loader, etc.) before blocking masts. These accessories add significant weight to the mast.

1. Move truck to a secure traffic-free maintenance area with a level floor.
2. Chock truck wheels. Refer to Lifting and Blocking in this section.
3. Connect battery.
4. Raise forks and position suitably long blocks (3, Figure 8357-1-EU) under first stage mast. Do not block the first stage mast if work is to be carried out at the main frame base. Position blocks under the platform only as described in step 6.
5. Using clamps (1, Figure 8357-1-EU), secure blocks to mast channel.
6. Using the manual lowering valve, lower platform and position suitably long blocks (4, Figure 8357-1-EU) under platform frame in mast channels.
7. Using clamps (1, Figure 8357-1-EU), secure blocks to mast channel or first stage block.
8. Continue to lower platform until platform frame rests on blocks.
9. Lockout or tagout truck as described in Battery - Lockout/Tagout in this section.



8357-1-EU



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.

SAFETY

CLEANING METHODS





INTRODUCTION



Notes:

General

The present manual is designed for Customer Service engineers who wish to familiarise themselves with the maintenance work required for the various truck components.

It also contains troubleshooting sections which can be used to identify and remedy truck faults.

Information



This book is not an operating manual. It is designed solely for specialist personnel who have been trained and authorised to carry out the work described in the manual.

- The truck model number

- The truck serial number

This information can be found on the truck's data plate. Only if this information is provided can the order be processed quickly, correctly and reliably.

Please refer to the Technical Specifications Sheet for the utilisable loads, technical data and dimensions for this series. Brochures can be obtained from your CROWN dealer or from the following address:

CROWN Gabelstapler GmbH & Co.KG
Moosacher Str. 52
80809 Munich
GERMANY

Tel.: +49 (0)89 / 93 002 -0
Fax: +49 (0)89 / 93 002 -175 or 133

Operating Instructions

This manual contains **no** operating instructions. An operating instructions manual is supplied with the vehicle. Additional copies can be ordered as required.

With the help of this manual you and your personnel will be able to ensure the long service life, operational safety and error free functioning of your CROWN vehicle.

Service Training

CROWN offers the appropriate vehicle related training for service personnel. Details on this training can be obtained from CROWN on request.

Ordering Spare Parts

The maintenance manual does not cover spare parts. These are listed in a separate parts manual.

Spare parts can be ordered by quoting:

- The truck specification number

INTRODUCTION

USING THE MANUAL



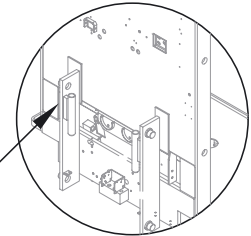
Using the Manual

The manual is divided into chapters. The following table shows how the manual is structured.

Manual Structure	
Chapter	Content
IDX	Lubrication & Adjustment
MA	Safety
ITD	Introduction
1	Lubrication & Adjustment
2	Hydraulic System
3	Drive Unit
4	Electrical System
5	Brake System
6	Steering
7	Lifting Mechanism
8	Cylinders
9	Platform
10	Tools

Following pages explain the model & truck data numbering system.

Battery Weight/kg		D.C. Voltage
Max.	Min.	
Max. AMP Hr.	Hour Rate	Rated Capacity
		kg
Truck Weight Less Battery $\pm 5\%$		kg
Max. Grade With 300 mm Max. Fork Height		%
Load Tyre Tread Width		mm
Model Number		Fork Length
		mm
Serial Number	Year Manf.	Max. Tilt Back
		°
Truck Data Number		
Crown Gabelstapler GmbH & Co. KG		Crown Equipment
Roding, Germany		Galway, Ireland
314-80		



13602

Data Plate

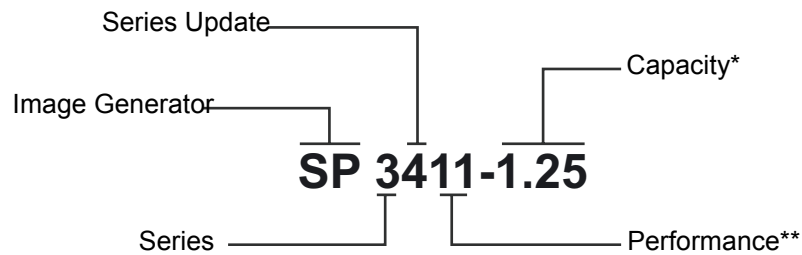
The data plate for the SP 3400 Series truck is located on the platform and includes a model number and truck data number. From these two numbers, you can identify truck model, series, series updates, determine performance, capacity and specific truck data. The fol-



INTRODUCTION

MODEL NUMBER

Model Number



Example of the model number shown above (SP 3011-1.25) is a SP 3000 Series truck. It's equipped with a single speed raise & lower, 2.6 kW drive motor. The rated capacity is 1 250 kg.

* Capacity

Actual rated capacity may vary, depending on special equipment or modifications. Consult the capacity plate located on the overhead guard.

** Performance Key

- 11/12 = Single speed raise and two speed lower, 2.6 kW drive motor.
- 21/22 = Two speed raise and lower, 3.0 kW drive motor.

INTRODUCTION

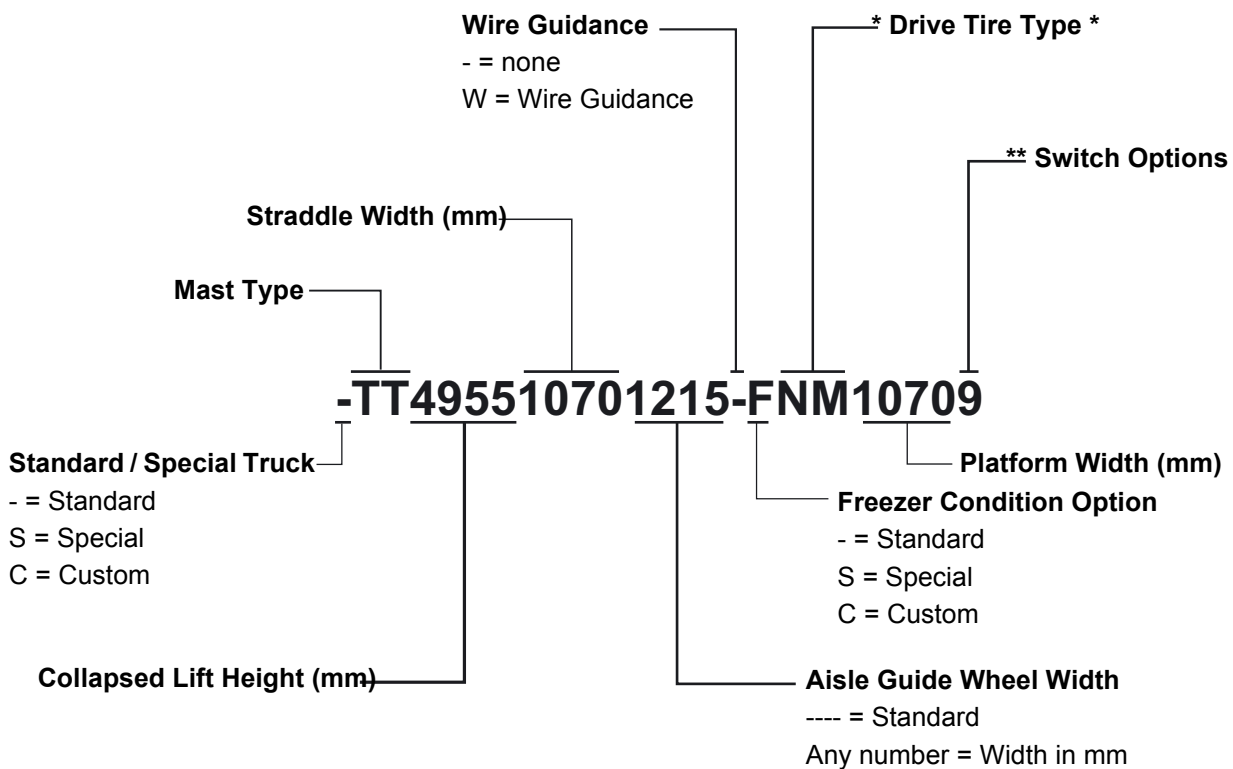
TRUCK DATA NUMBER



Truck Data Number

The truck data number provides you and your Crown dealer with a wealth of information to ensure selection of proper parts for your Crown truck. You may simply provide this number to your Crown dealer, or use the following breakdown if selecting your own part numbers or service information from this manual.

An example of a truck data number shown below is a standard truck with telescopic triple stage mast, 4 955 mm lift height, straddle width of 1 070 mm, aisle guide wheel width of 1 215 mm, without wire guidance, with freezer condition, non-marking drive tire, platform width of 1 070 mm, with fork override switch, zone select switch, work light, dome light, fan and spot light..





INTRODUCTION

TRUCK DATA NUMBER

Truck Data Number Tables

* Drive Tire Type	
Identifier	Meaning
--	Standard
NM	Non - marking
DS	Diagonal siped (22%)
RS	Razor siped

** Switch Options	
Identifier	Meaning
1	Standard
2	Fork Override
3	Fork Override, Zone Select
4	Work, Dome, Fan
5	Fork Override Switch, Work, Dome, Fan
6	Fork Override Switch, Zone Select, Work, Dome, Fan
7	Work, Dome, Spot, Fan
8	Fork Override Switch, Work, Dome, Spot, Fan
	Fork Override Switch, Zone Select, Work, Dome, Spot, Fan



Notes:



LUBRICATION & ADJUSTMENT



Notes:



LUBRICATION & ADJUSTMENT

GENERAL

General

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.

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.

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

CHART 1 - LUBE IDENTIFICATION

TYPE O LUBRICANT		PART NO.	PACKAGE QTY.
A.	Gear Lube 80W-90 (Typical)	063002-003	1 Quart
AA.	Automatic Transmission Fluid Freezer Applications 32° F (0 °C) and Below	063001-010	1 Quart
B.	Grease (Multi-Purpose)	063002-034 063002-045	14.5 oz. Cartridge (40) 14.5 oz. Cartridges
* BB.	Grease (Low Temp.)	063002-017 063002-046	14.5 oz. Cartridge (40) 14.5 oz. Cartridges
C.	Oil (SAE 40)		
D.	Hydraulic Oil	063001-001 063001-015	1 Gallon (6) 1 Gallon
* DD.	Hydraulic Oil (Low Temp.)	063001-006	1 Gallon
DDD.	Hydraulic Oil (Standard for Blending)	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 and Cable Lube	363107-001 363107-012	15 oz. Can (12) 15 oz. Cans
	Premium Chain and Cable Lube	363115-001 363115-012	12 oz. Can (12) 12 oz. Cans
H.	Rubber & Vinyl Dressing		
I.	Grease (Lift Pump Coupling)	063002-039 063002-040	1 lb. 1 oz.
J.	Brake Fluid — Dot 5	063004-002 063004-003	12 oz. 1 Gallon
K.	Grease (Wheel Bearing)	063002-034 063002-045	14.5 oz. Cartridge (40) 14.5 oz. Cartridges
L.	Metal Assembly Spray	063002-021	11 oz. Spray

LUBRICATION & ADJUSTMENT

GENERAL


CHART 1 - LUBE IDENTIFICATION

M.	Silicon Grease (Clear)	063002-020	5.3 oz. Tube
N.	Brake & Parts Cleaner	363102-001 363102-012	15 oz. Can (12) 15 oz. Cans
	Low V.O.C. Brake & Parts Cleaner	363103-002 363103-012	15 oz. Can (12) 15 oz. Cans
	Non-Flammable Brake & Parts Cleaner	363116-001 363116-012	15 oz. Can (12) 15 oz. Cans
O.	Penetrating Lubricant	363104-001 363104-012	20 oz. Can (12) 20 oz. Cans
P.	Premium Formula Multi-Purpose Grease	363108-001 363108-012	11 oz. Can (12) 11 oz. Cans
Q.	White Lithium Grease	363110-001 363110-012	11 oz. Can (12) 11 oz. Cans
R.	Choke & Carburetor Cleaner	363109-001 363109-012	20 oz. Can (12) 20 oz. Cans
S.	Contact Cleaner	363106-001 363106-012	10 oz. Can (12) 10 oz. Cans
T.	Electrical Connector Oxidation & Corrosion Inhibitor	127189-001	30 cc

* Trucks operated in below freezing temperatures must use Low Temp. Hydraulic Oil & Grease.



LUBRICATION & ADJUSTMENT GENERAL

Before performing maintenance to the truck, move truck 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 performed.

Caution!



Be sure battery connectors are disconnected and all wheels are chocked before proceeding.

To obtain maximum life of any industrial equipment, a well planned maintenance program should be followed. The following information is intended to provide guidelines for proper lubrication intervals, and are according to hours of truck operation and/or a specific number of days or months. These recommended figures should be used as an aid in maintaining safe and efficient truck operation. Some operating conditions will require more frequent checks and lubrication than listed. Applications with much dust or moisture will require modification of the schedule to fit that particular application.

Only high grade lubricants and fluids should be used. Sources of these lubricants may be from almost any of the oil companies; those listed below are typical and any lubricant with equal specifications may be used. (See CHART 1 - LUBE IDENTIFICATION on page 27).

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

Component Accessibility

For regular maintenance, access to various truck components is accomplished by removing covers, panels and/or doors. The following is a general explanation of what cover, panel, etc. must be removed to allow for the most efficient access when performing service and/or maintenance to components. Refer to the illustrations in this section as an aid in locating parts that re-

quire attention. More details are given in following sections on hydraulics, electrical, brakes, etc..

The top cover can be opened to allow access to battery connector, battery cell caps, check battery condition, strobe light, additional mechanical and electrical components.

The battery side covers can be removed to service and/or remove battery.

The power unit doors can be opened to allow access to the following: drive unit, traction panel, lift/power panel, drive motor, electric brake and related components, steer motor/encoder and related components, lift pump(s) and motor(s), hydraulic reservoir, filter, strainer and related components.

Located under the platform are the horn, pallet grab, fork pins and associated parts.

The console on the platform when removed will allow access to side-gate switches, steering command encoder, display panel, terminal boards and associated platform electrical wiring.

Located on the front side of the platform are the chain slack switches, pallet grab linkage and limit switch(es).

The control module must be removed to gain access to directional and lift switches, various control switches and linkages.

Refer to the illustrations and charts in this section as a guide for inspection and adjustment that may be necessary. This information used with a Planned Maintenance Inspection Report for Stockpickers available from your Crown dealer will be very helpful to a good maintenance program.

Information

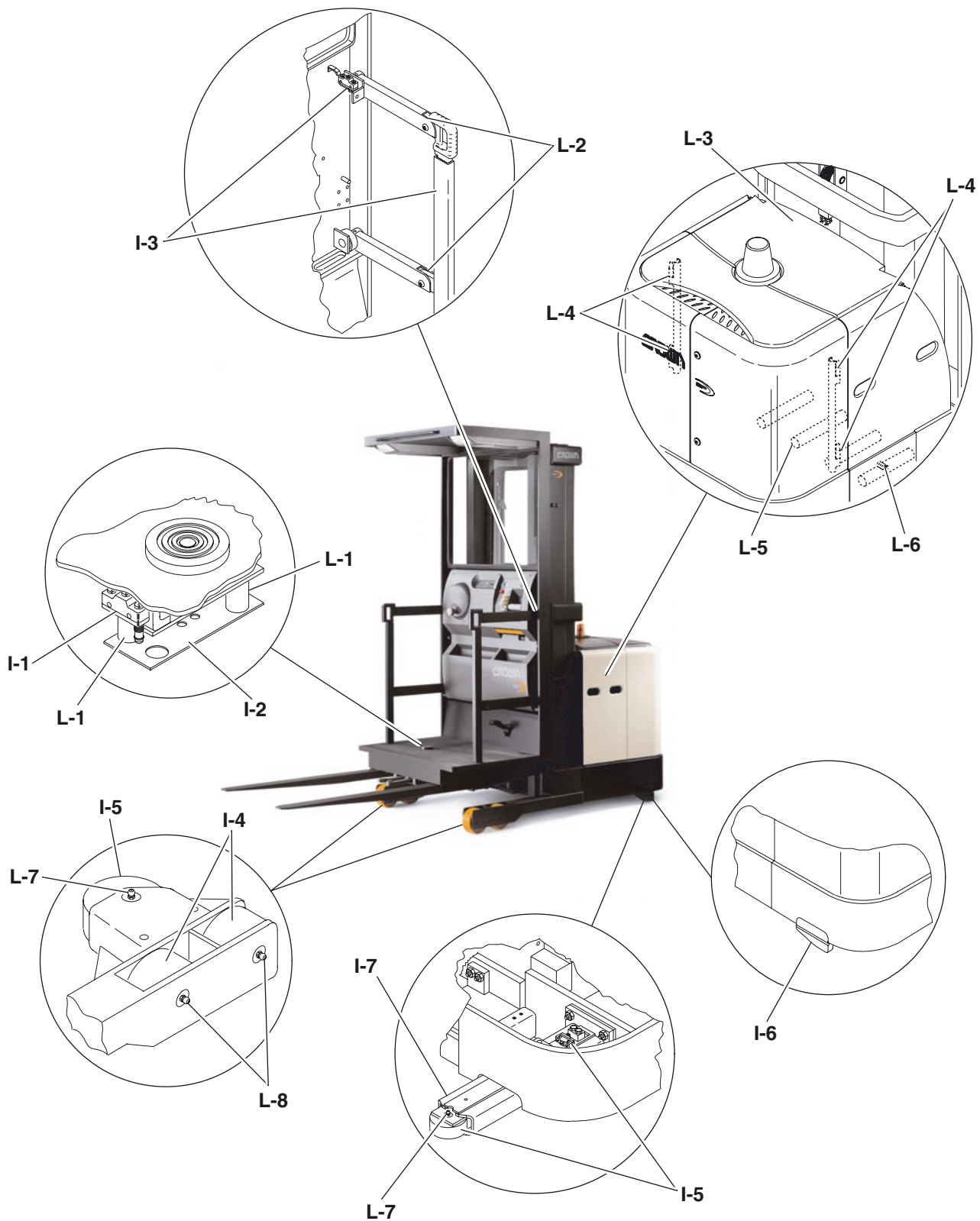


The illustrations on the following pages may differ from the original truck!

LUBRICATION & ADJUSTMENT CHARTS



Charts



12370



LUBRICATION & ADJUSTMENT CHARTS

LUBRICATION CHART

Index	Component	Lube Type	Qty.	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
L-1	Brake Pedal Guides	C	AR	I			
L-2	Platform Gates	C	AR	I			
L-3	Battery Cover Hinge	C	AR	L			
L-4	Power Unit Door Hinges	C	AR	I			
L-5	Battery Rollers	B	AR	L			
L-6	Battery Restraint Threads	B	AR	I			
L-7	Aisle Guide Wheels (option)	B	AR	L			
L-8	Load Wheel Axles	B	AR	L			

L = Lubricate

I = Check

Chg. = Change

AR = As Required

See CHART 1 - LUBE IDENTIFICATION on page 27 for Lube Type explanation and capacity.

See Illustration 12370 for Lubrication locations.

INSPECTION AND ADJUSTMENT CHART

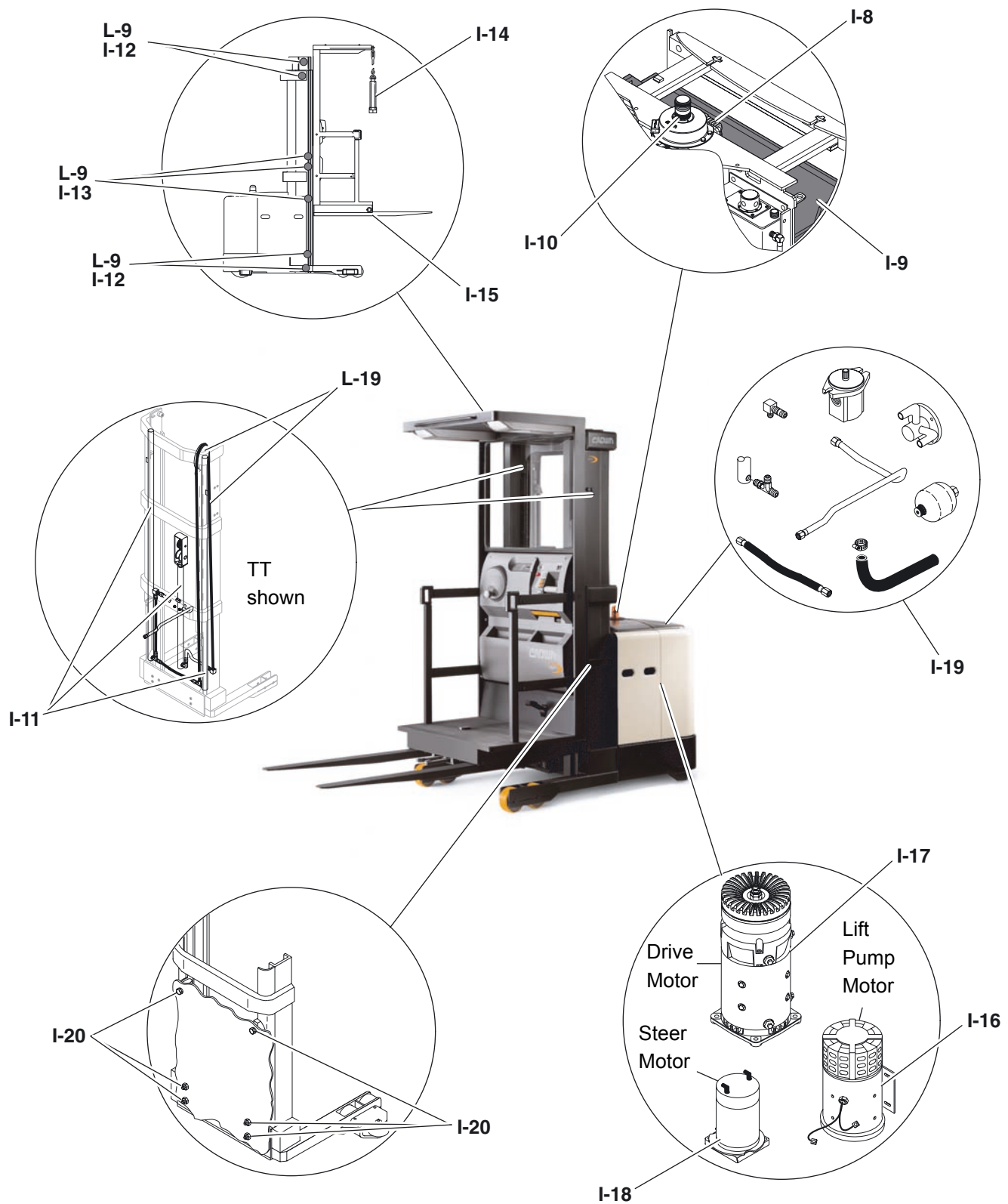
Index	Component	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
I-1	Brake Pedal Switch	I			
I-2	Brake Pedal Mechanism	I			
I-3	Platform Gates and Switches	I			
I-4	Load Wheels	I			
I-5	Aisle Guide Wheels and Switches (Option)	I			
I-6	Skids (Option)	I			
I-7	Aisle Guide Skids (option)	I			

I = Inspect and/or Adjust.

See Illustration 12370 for component locations.

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

LUBRICATION & ADJUSTMENT CHARTS



12371



LUBRICATION & ADJUSTMENT CHARTS

LUBRICATION CHART							
Index	Component	Lube Type	Qty.	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
L-9	Mast Channels, Column Rollers	E	AR	I			
L-19	Hose and Pulley (Plastic)	H	AR	I			

See CHART 1 - LUBE IDENTIFICATION on page 27 for Lube Type explanation and capacity. See Illustration 12371 for Lubrication locations.

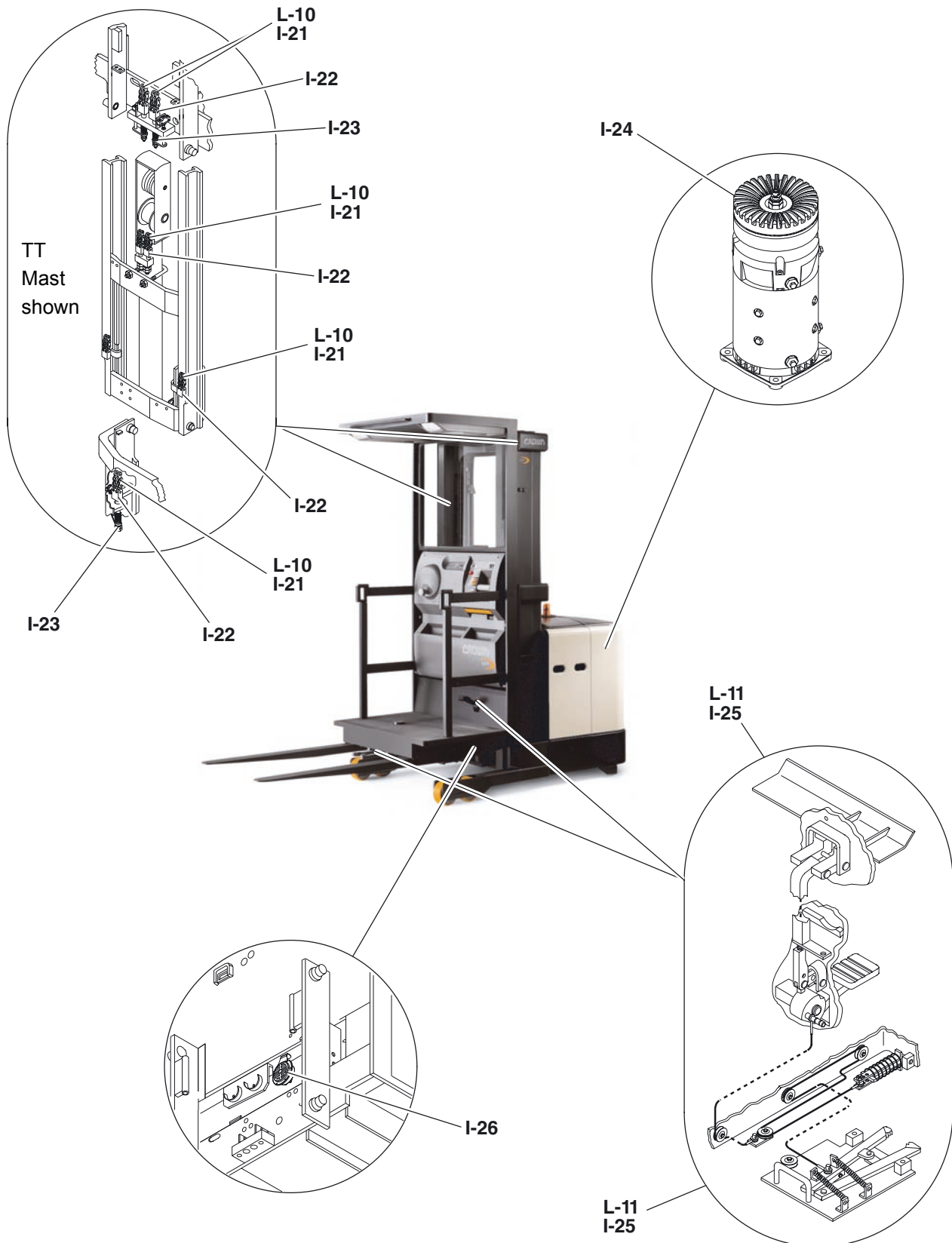
INSPECTION AND ADJUSTMENT CHART							
Index	Component			<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
I-8	Battery Connector			I			
I-9	Battery			I			
I-10	Strobe Light/Flashing Light			I			
I-11	Lift Cylinders and Restraints			I			
I-12	Column Rollers - Mast			I			
I-13	Column Rollers - Platform			I			
I-14	Operator Harness (not EU), Notseilvorrichtung (EU)						I
I-15	Forks			I			
I-16	Motor Brushes - Lift			I			
I-17	Motor Brushes - Drive			I			
I-18	Motor Brushes - Power Steering			I			
I-19	Hydraulic Lines, Fittings, Hoses			I			
I-20	Power Unit to Mast Bolts			I			

I = Inspect and/or Adjust.

See Illustration 12371 for component locations.

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

LUBRICATION & ADJUSTMENT CHARTS



12372



LUBRICATION & ADJUSTMENT CHARTS

LUBRICATION CHART							
Index	Component	Lube Type	Qty.	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
L-10	Lift Chain	G	AR	I			
L-11	Pallet Grab Linkage	C	AR	I			

L = Lubricate

I = Check

Chg. = Change

AR = As Required

See CHART 1 - LUBE IDENTIFICATION on page 27 for Lube Type explanation and capacity.

See Illustration 12372 for Lubrication locations.

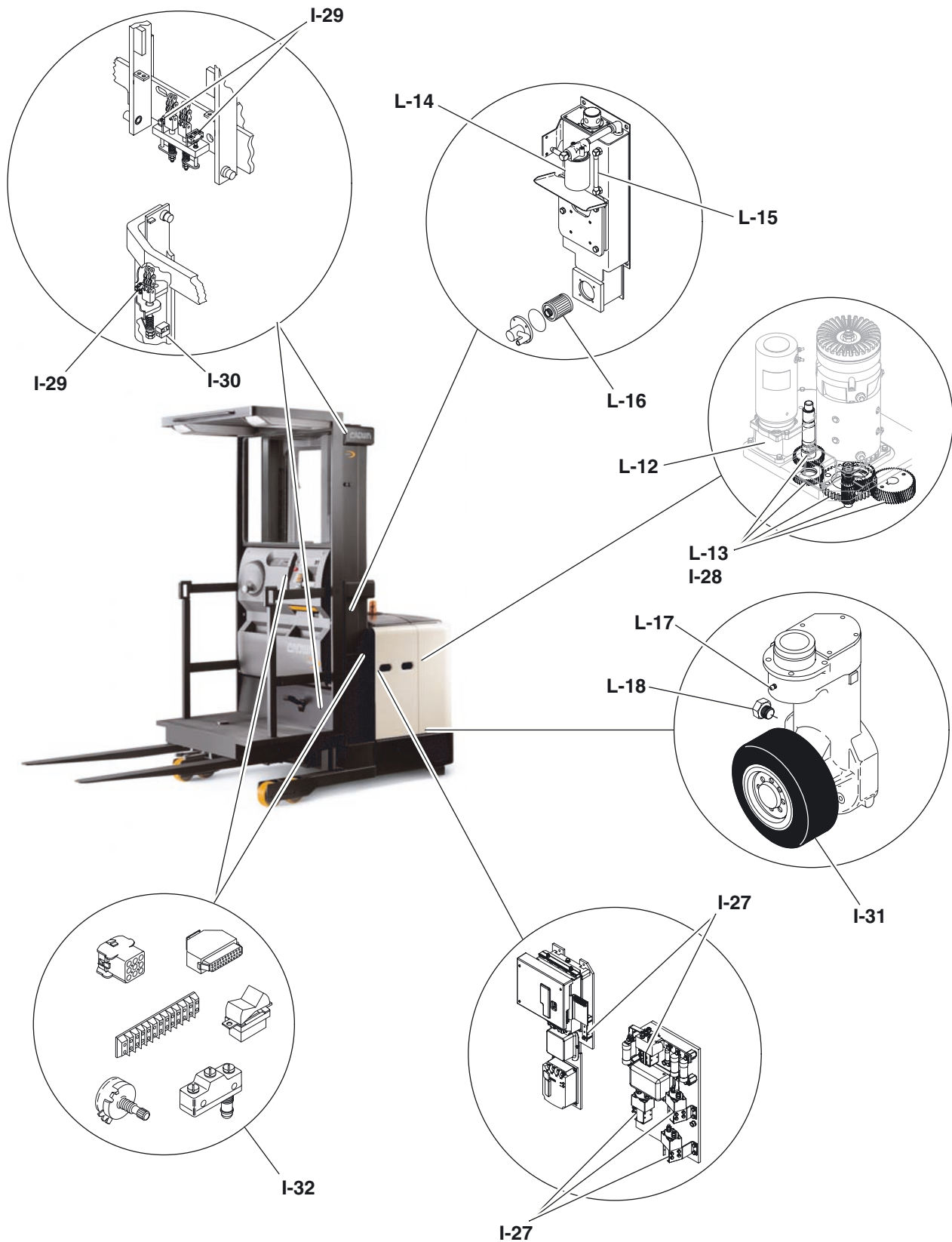
INSPECTION AND ADJUSTMENT CHART						
Index	Component	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.	
I-21	Lift Chains	I				
I-22	Chain Anchors and Retainers	I				
I-23	Chain Slack Linkage	I				
I-24	Brake Friction Plates and Operation		I			
I-25	Pallet Grab Linkage and Operation (Option)	I				
I-26	Horn	I				

I = Inspect and/or Adjust.

See Illustration 12372 for component locations.

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

LUBRICATION & ADJUSTMENT CHARTS



12373



LUBRICATION & ADJUSTMENT CHARTS

LUBRICATION CHART

Index	Component	Lube Type	Qty.	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
L-12	Steering Gearbox Oil Level	‡ DDD	1 l (1 qt.)	*Chg.		Chg.	
L-13	Steering Gears	F	AR	I			
L-14	Hydraulic Filter			I	*Chg.		Chg.
L-15	Hydraulic Reservoir - Single Pump	D	13.2 l (14 qt.)	I			Chg.
	Hydraulic Reservoir - Dual Pump	D	17.5 l (18.5 qt.)	I			Chg.
L-16	Hydraulic Strainer						Chg.
L-17	Drive Unit Thrust Bearing	B	AR	L			
L-18	Drive Unit Fluid Level	A	0.7 l (0.75 qt.)	I			Chg.

L = Lubricate

I = Check

Chg. = Change

AR = As Required

* Change first time only as noted, thereafter check at 250 hr./60 da. intervals and change at longer interval as noted.

See CHART 1 - LUBE IDENTIFICATION on page 27 for Lube Type explanation and capacity.

‡ Use "DDD" (see CHART 1 - LUBE IDENTIFICATION, page 27) hydraulic oil in steering gearbox for both normal and low temperature applications.

See Illustration 12373 for Lubrication locations.

INSPECTION AND ADJUSTMENT CHART

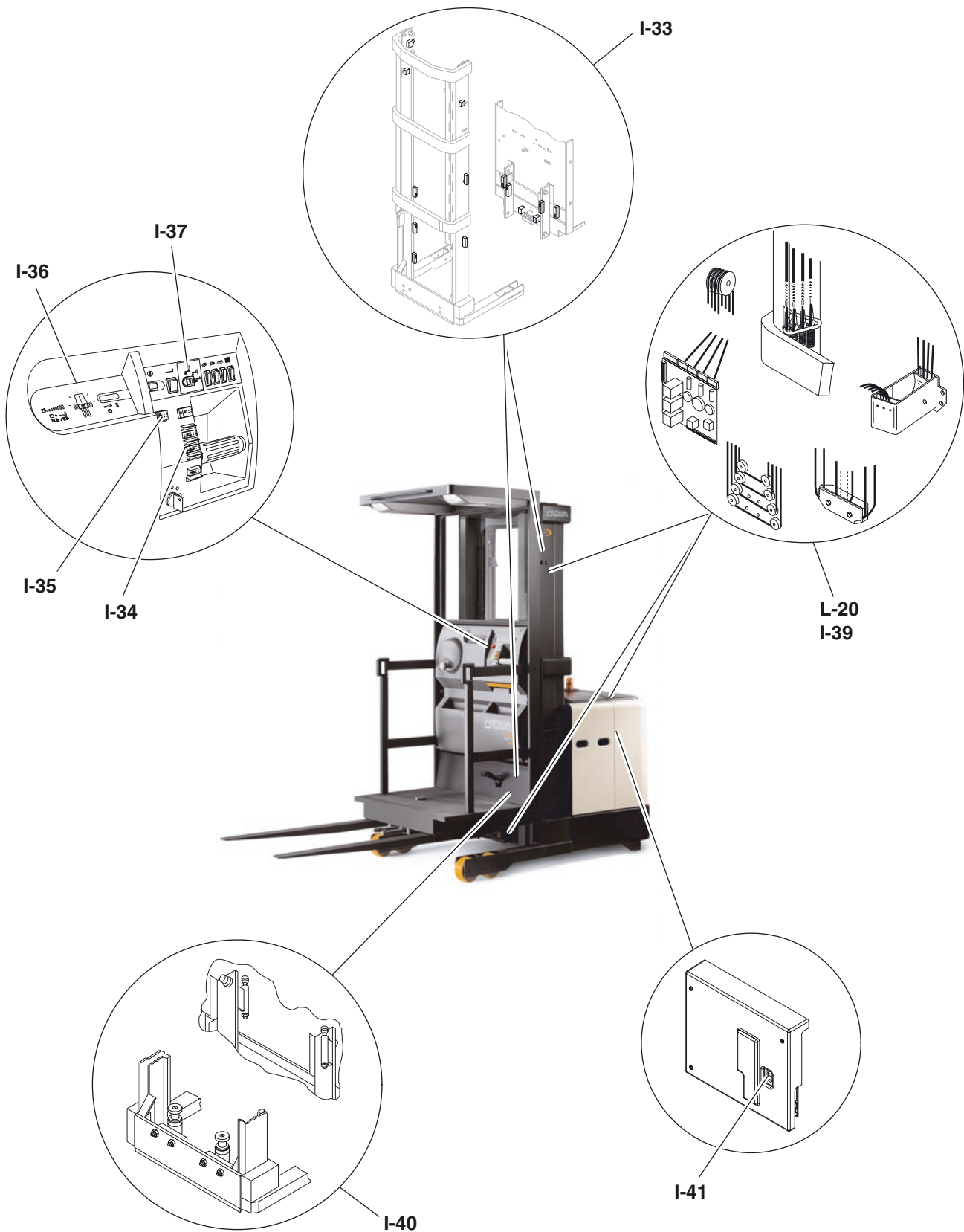
Index	Component	<u>60 da.</u> 250 hr.	<u>90 da.</u> 500 hr.	<u>6 mo.</u> 1000 hr.	<u>12 mo.</u> 2000 hr.
I-27	Contactors Tips	I			
I-28	Steering Gears and Sprockets	I			
I-29	Chain Slack Switch	I			
I-30	Stop Blocks	I			
I-31	Drive Tire	I			
I-32	All Electrical Termination Points	I			

I = Inspect and/or Adjust.

See Illustration 12373 for component locations.

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

LUBRICATION & ADJUSTMENT CHARTS



12374



LUBRICATION & ADJUSTMENT CHARTS

LUBRICATION CHART							
Index	Component	Lube Type	Qty.	60 da. 250 hr.	90 da. 500 hr.	6 mo. 1000 hr.	12 mo. 2000 hr.
L-20	Control Cables and Pulleys (Plastic)	H	AR	I			

L = Lubricate

I = Check

Chg. = Change

AR = As Required

INSPECTION AND ADJUSTMENT CHART					
Index	Component	60 da. 250 hr.	90 da. 500 hr.	6 mo. 1000 hr.	12 mo. 2000 hr.
I-33	Limit Switches - Mast and Platform	I			
I-34	Travel and Lift Controls	I			
I-35	Power Disconnect	I			
I-36	Panel Indicator Lights	I			
I-37	Panel Switches	I			
I-38	Cable Tension Devices	I			
I-39	Control Cables and Guides	I			
I-40	Mast Cushion Mechanism	I			
I-41	Tow Switch	I			

I = Inspect and/or Adjust.

See Illustration 12374 for component locations.

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

LUBRICATION & ADJUSTMENT

COMPONENTRY



Componentry

Accumulator

Location: front, lower right side of power unit

Purpose: shock absorber for lift/lower hydraulic system.

Data: precharge 3445 kPa (500 psi). See section 2 for charging procedures

Adjustment: none required.

ALM1

Status Alarm

Location: steering command assembly.

Purpose: draws operator attention to changing truck status.

Data: controlled by display module.

Adjustment: none required.

BRES1, BRES2 (Option)

Battery Restraint Switch

Location: power unit skirt.

Purpose: monitor presence of battery retainer/side cover and disable travel if battery retainer is not present.

Data: wired normally open, held closed when battery retainer/side cover is in place.

Adjustment: none required.

BRK1

Brake

Location: traction motor.

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

Data: Access 3 release via operator request, spring applied.

Adjustment: refer to section M5.0.

BRS1

Brake Switch

Location: platform below floorboard.

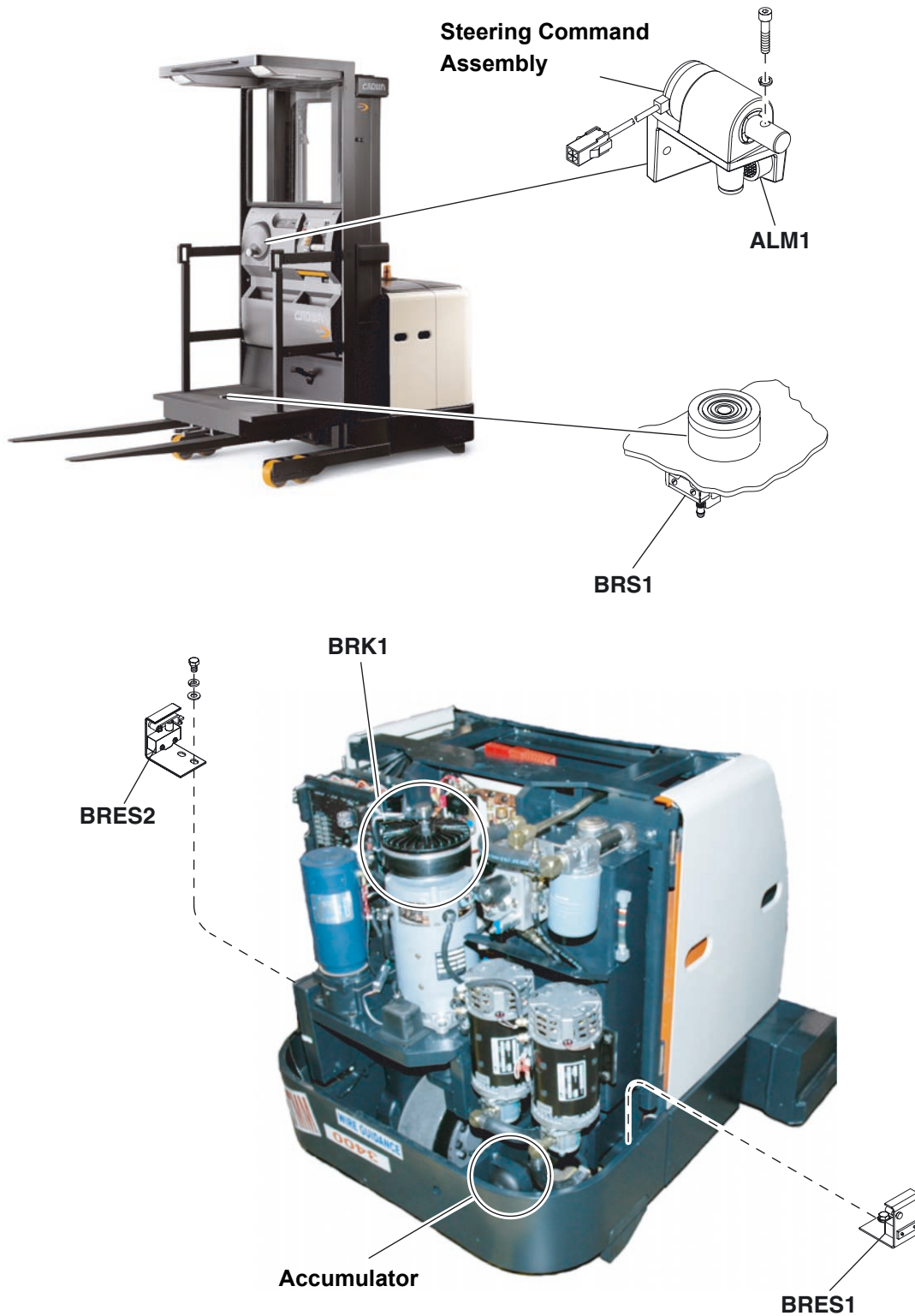
Purpose: allows operator to release or apply brake.

Data: wired normally open, held closed when operator is depressing brake pedal.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



12338

LUBRICATION & ADJUSTMENT COMPONENTRY



CHS1, CHS2

Chain Slack Switches (TT Mast Only)

- Location:** base of platform - mast side.
- Purpose:** prohibits lowering when free lift chain becomes slack.
- Data:** wired normally open, held closed as chains maintain proper tension.
- Adjustment:** none required.

CHS3, CHS4

Chain Slack Switches

- Location:** top of mainframe.
- Purpose:** prohibits lowering when mast chains become slack.
- Data:** wired normally open, held closed as chains maintain proper tension.
- Adjustment:** none required.

CV1

Check Valve (only 3427 / 3422)

- Location:** lift/lower manifold.
- Purpose:** prevent back flow into pump P1.
- Data:** not applicable.
- Adjustment:** none required.

CV2

Check Valve

- Location:** lift/lower manifold (high speed lift/lower only).
- Purpose:** prevent back flow into pump P1.
- Data:** not applicable.
- Adjustment:** none required.

CV3

Check Valve

- Location:** lift/lower manifold (high speed lift/lower only).
- Purpose:** prevent back flow into pump P2.
- Data:** not applicable.
- Adjustment:** none required.

Cylinder

Free Lift (TT Mast Only)

- Location:** 3rd stage mast.
- Purpose:** raise platform.
- Data:** not applicable.
- Adjustment:** none required.

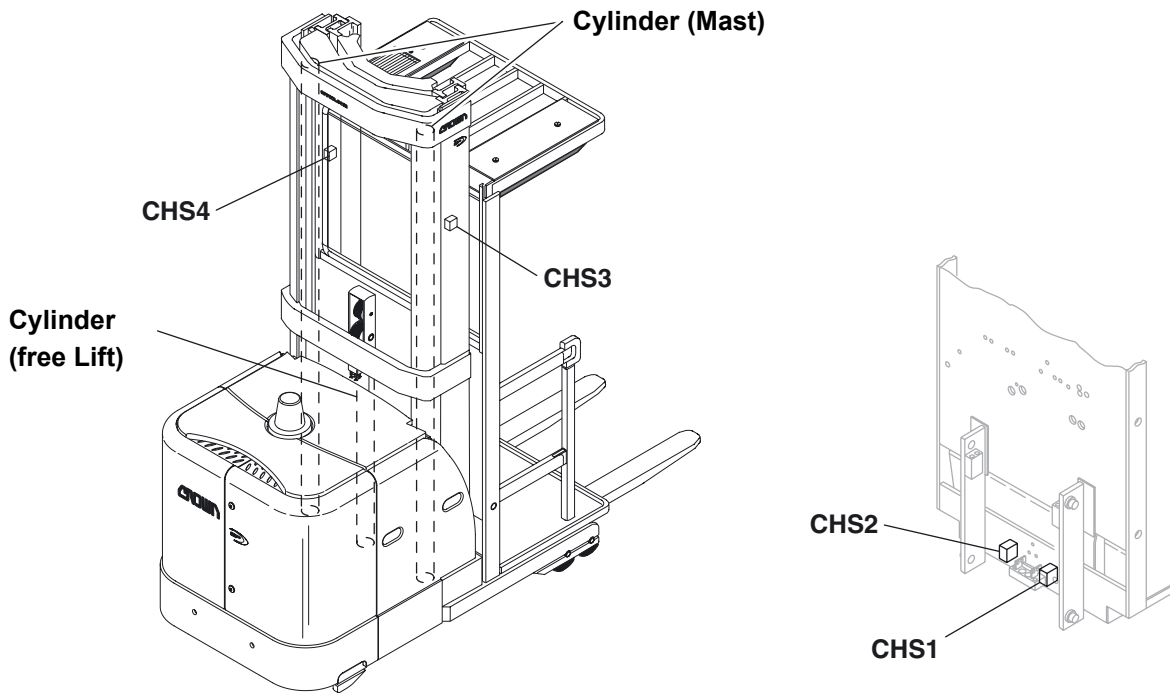
Cylinder

Mast

- Location:** main frame.
- Purpose:** raise TL or TT mast and platform on TL mast trucks.
- Data:** not applicable.
- Adjustment:** none required.

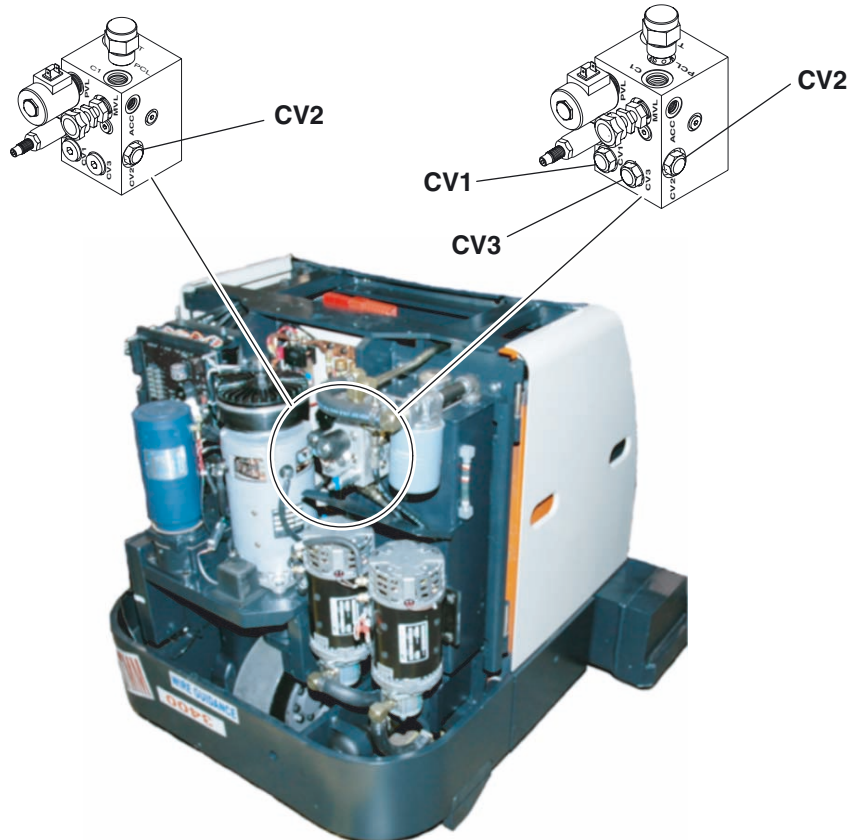


LUBRICATION & ADJUSTMENT COMPONENTRY



One Speed Lift Manifold

Two Speed Lift Manifold



12339

LUBRICATION & ADJUSTMENT COMPONENTRY



DCM

Display Module

Location: operator compartment.

Purpose: display for operator information (including direction, speed and position), service mode messages and indicators.

Adjustment: none required.

DPS

Display Switch

Location: switch panel.

Purpose: permits selection of different operation modes of the message display.

Data: three position, on-off-on, rocker switch.

Adjustment: none required.

DTS1

Drive / Tow Switch

Location: distribution panel.

Purpose: to release brake allowing truck to be towed.

Data: two position, on-on, lever handle switch.

Adjustment: none required.

ECR1

Steering Command Encoder

Location: steering command assembly.

Purpose: provide steering command input to steering module.

Data: 5 V D.C., 32 pulses per revolutions.

Adjustment: none required.

ECR2

Steering Feedback Encoder

Location: in front of traction motor.

Purpose: provide steer wheel movement feedback to steering module.

Data: 5 V D.C., 256 pulses per revolution.

Adjustment: none required.

ECR3

Traction Speed Encoder

Location: traction motor.

Purpose: provide drive speed and direction information for control system based on motor speed and direction of revolution.

Data: 5 V D.C., 32 pulses per revolution.

Adjustment: none required.

ECR4

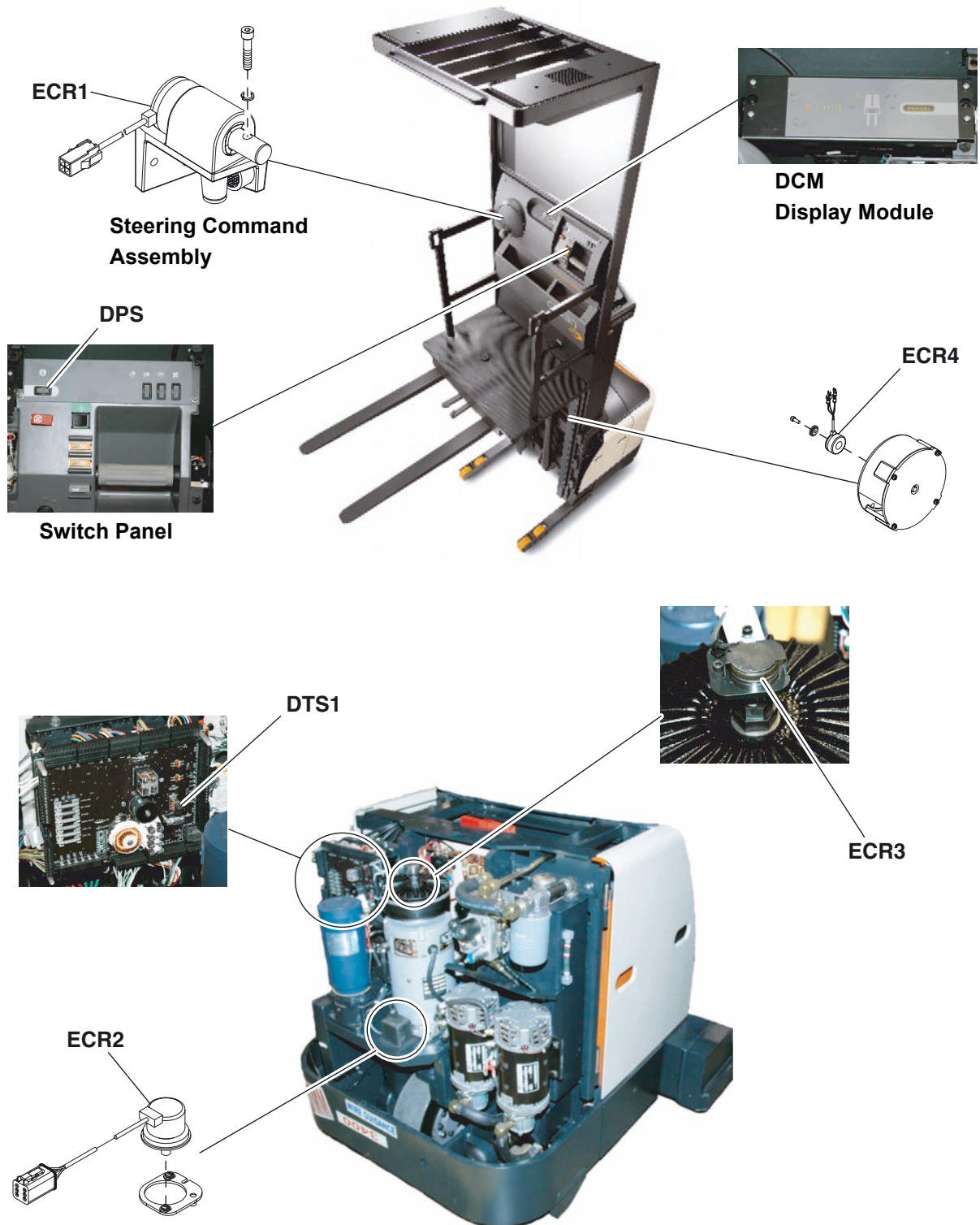
Lift Height Sensor

Location: lower rear platform.

Purpose: provide measured height of forks.

Data: 5 V D.C., 32 pulses per revolution.

Adjustment: none required.



12340

LUBRICATION & ADJUSTMENT COMPONENTRY



ED1

Emergency Disconnect Main Contactor

Location: lift/power panel.

Purpose: provide ability to turn off power control circuitry.

Data: positive voltage provided through K1 relay, negative voltage controlled by SCM.

Adjustment: none required.

ED2

Emergency Disconnect Traction & Steering Contactor

Location: lift/power panel.

Purpose: provide ability to disconnect power between MRC1 and SCM.

Data: 24 V contactor.

Adjustment: none required.

EDS

Emergency Disconnect Switch

Location: control module.

Purpose: resets the emergency disconnect contactor, removing battery power from steering, lift, traction and control circuits.

Data: wired normally closed. Pressing switch button actuates switch.

Adjustment: none required.

Fan

Operator Fan

Location: overhead console.

Purpose: operator comfort.

Data: 24 V.

Adjustment: none required

FILTER

Return

Location: near upper portion of reservoir.

Purpose: remove contaminants from hydraulic fluid.

Data: 10 micron.

Adjustment: none required.

FNS

Fan Switch

Location: switch panel.

Purpose: allows operator to turn on/off fan.

Data: three position, on-off-on, rocker switch.

Adjustment: none required.

FS

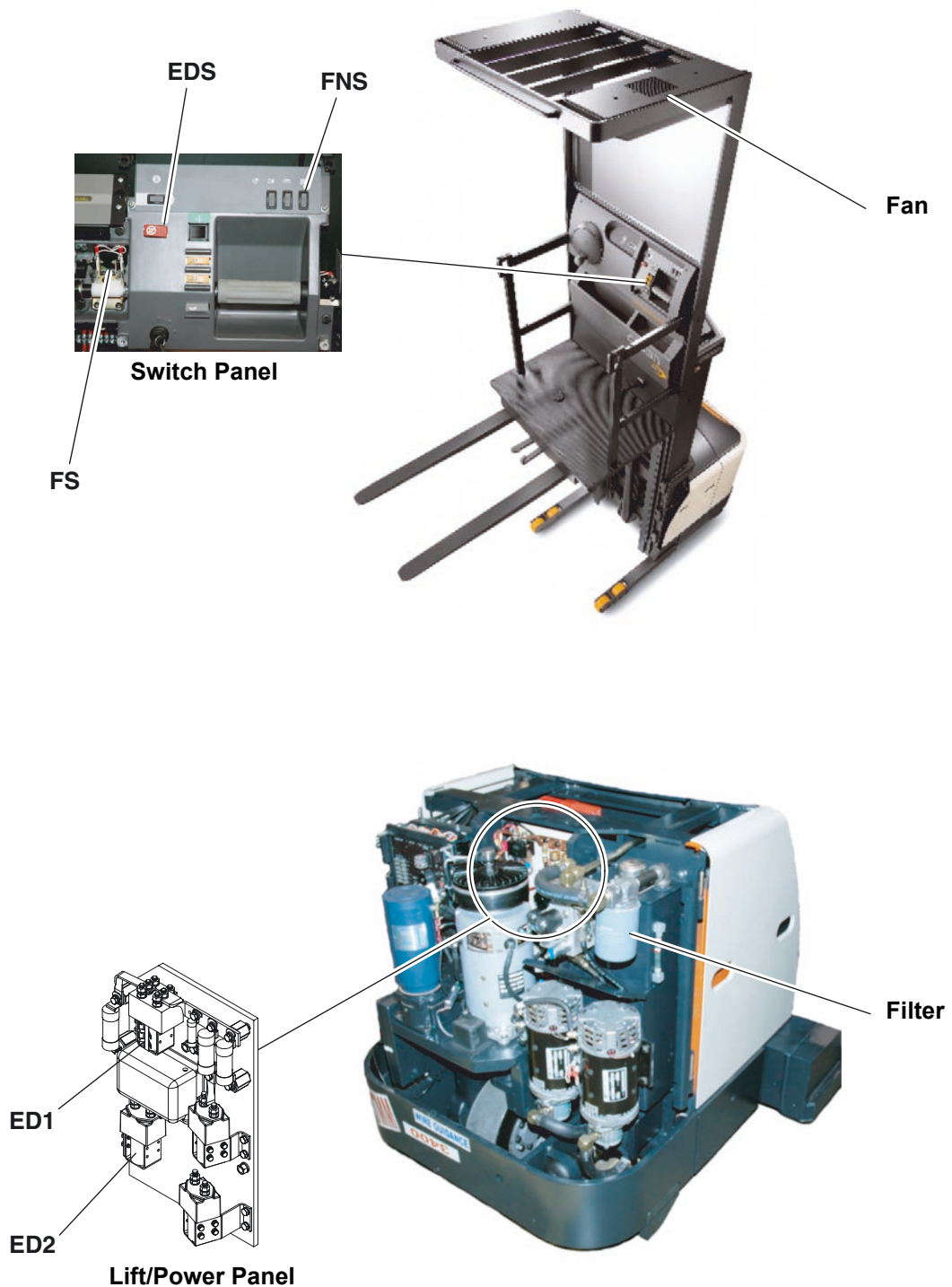
Forward Switch

Location: control module.

Purpose: provides a signal to traction controller that forward travel direction is being requested by the operator.

Data: wired normally open. Rotating twist grip away from operator actuates switch.

Adjustment: none required.



12341

LUBRICATION & ADJUSTMENT

COMPONENTRY



FU1

Lights and Fan Fuse

Location: distribution panel.

Purpose: protect work, dome, spot and strobe light, fan and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

FU2

Control Fuse

Location: distribution panel.

Purpose: protect control circuitry from overcurrent.

Data: 15A.

Adjustment: none required.

FU3

Options Fuse

Location: distribution panel.

Purpose: protect options and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

FU4

Manual Brake Fuse

Location: distribution panel.

Purpose: protect brake and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

FU5

Brake Outer Coil Fuse

Location: distribution panel.

Purpose: protect brake outer coil and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

FU6

Brake Inner Coil Fuse

Location: distribution panel.

Purpose: protect brake inner coil and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

FU8

Pump Motor 1 Fuse

Location: lift/power panel.

Purpose: protect lift pump motor 1 and associated wiring from overcurrent.

Data: 175A Typ ALS.

Adjustment: none required.

FU9

Pump Motor 2 Fuse

Location: lift/power panel.

Purpose: protect lift pump motor 2 and associated wiring from overcurrent.

Data: 175A Typ ALS.

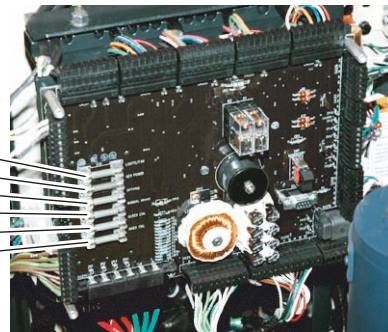
Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY

Distribution Panel

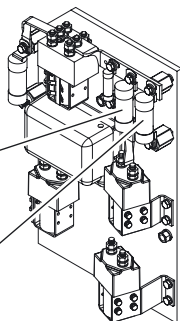
FU1
FU2
FU3
FU4
FU5
FU6



FU8

FU9

Lift/Power Panel



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LUBRICATION & ADJUSTMENT COMPONENTRY



FU10

Steer Module Fuse

Location: lift power panel.

Purpose: protect power steering module and associated wiring from overcurrent.

Data: 30A.

Adjustment: none required.

GCM

Guidance Control Module

Location: below steering gearbox.

Purpose: controls automatic guidance system (wire guidance).

Data: see section 4.

Adjustment: see section M4.3.

FU11

Freezer Condition Power Unit Fuse

Location: freezer condition panel.

Purpose: protect freezer condition components equipped on power unit and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

GTS1, GTS2, GTS3, GTS4

Side Gate Switches

Location: console.

Purpose: prevents lift/lower and traction when gates are up.

Data: wired normally open, held closed when gates are down.

Adjustment: none required.

FU12

Freezer Condition Platform Fuse

Location: freezer condition panel.

Purpose: protect freezer condition components equipped on platform and associated wiring from overcurrent.

Data: 15A.

Adjustment: none required.

GTS5, GTS6 (SAA Only - not shown)

Rear Gate Switches

Location: rear post.

Purpose: prevents lift/lower and traction when gates are up.

Data: wired normally open, held closed when gates are down.

Adjustment: none required.

FU13

Traction Motor Fuse

Location: lift power panel.

Purpose: protect traction motor and associated wiring from overcurrent.

Data: 140A Typ ACK.

Adjustment: none required.

GUS

Guidance Switch

Location: control module.

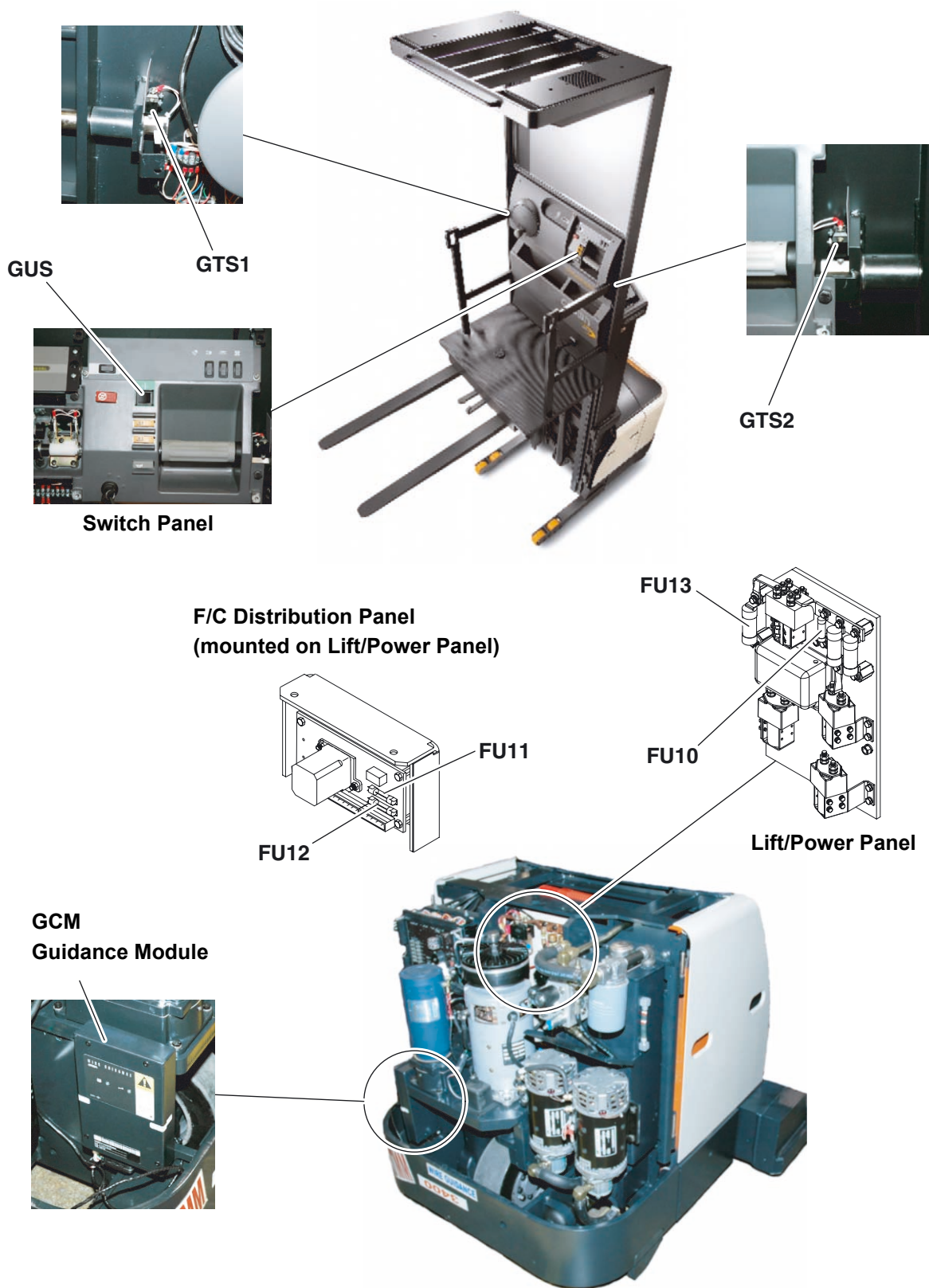
Purpose: allows operator to select manual or automatic steering.

Data: wired normally open, held closed while in manual steering mode.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT COMPONENTRY



HN1

Horn

Location: on power unit side of platform, near the bottom.

Purpose: provide operator controlled audible warning.

Data: 24-48 V, 0.4 A.

Adjustment: none required.

HN2

Back-Up or Travel Alarm

Location: platform side of power unit near bottom.

Purpose: alert pedestrians of truck movement request.

Data: reverse and/or forward switch.

Adjustment: none required.

HNS1

Horn Switch

Location: control module.

Purpose: allows operator to sound horn.

Data: wired normally open. Pushing horn button actuates switch.

Adjustment: none required.

HSLCS

High Speed Lower Cutout Switch

Location: platform - between platform wall and mast.

Purpose: cutouts out high speed lower when platform is 305 mm (12 in.) from floor. Used as reset with lift height sensor (ECR4).

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

HSRCS

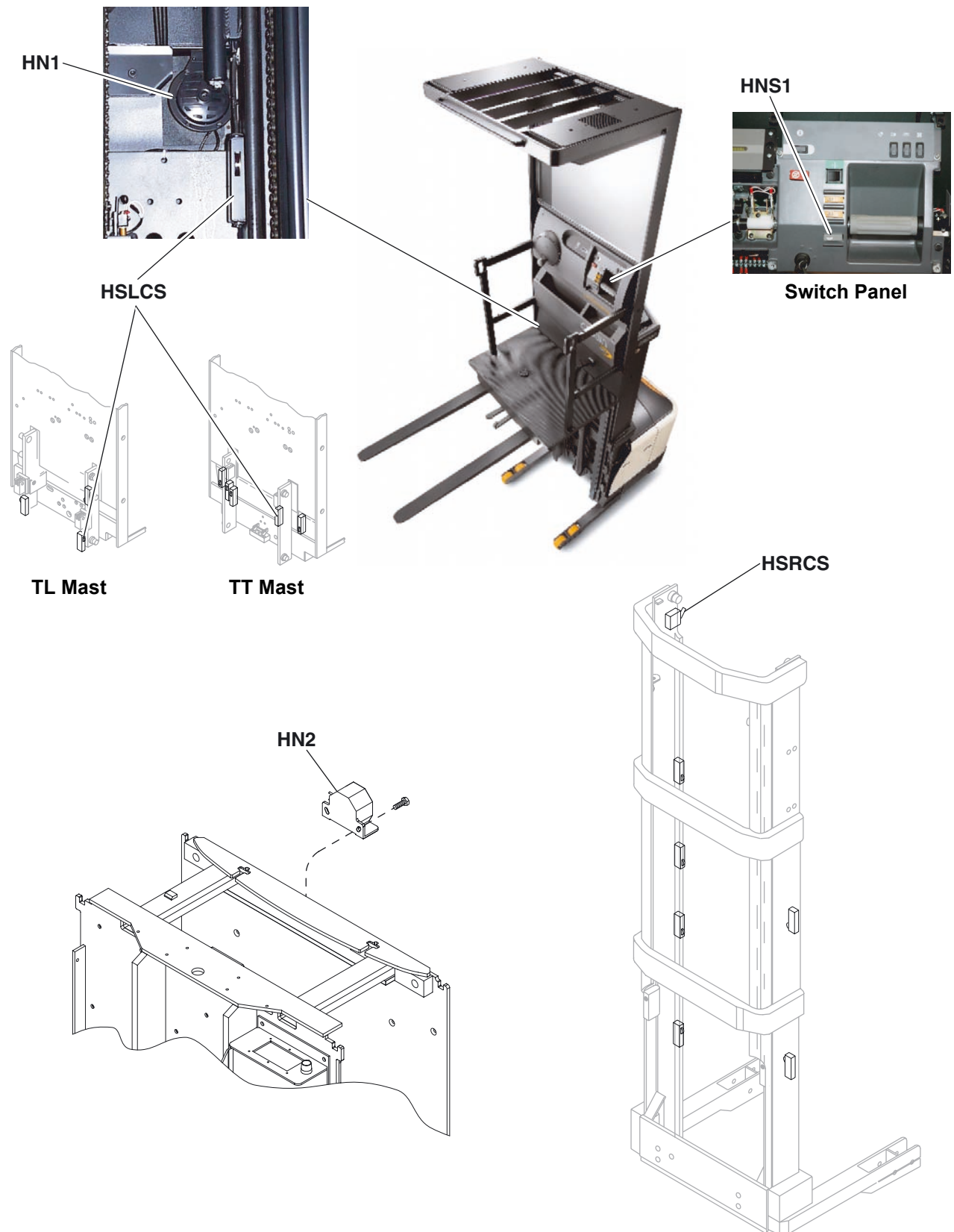
High Speed Raise Cutout Switch

Location: near top of mainframe.

Purpose: cutouts out high speed raise when platform is 180 mm (7 in.) from maximum lift height.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.



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LUBRICATION & ADJUSTMENT

COMPONENTRY



HTS24

610 mm (24 in.) Height Limit Switch

Location: platform - between platform wall and mast.

Purpose: cutouts out travel speed when platform is 610 mm (24 in.) or greater from maximum lift height and steer angle is greater than 10°. Brake force is at 100 percent.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

HTS60

1525 mm (60 in.) Height Limit Switch

Location: TL mast trucks - lower portion of mainframe between platform and mainframe.

TT mast trucks - lower portion of platform between platform and mainframe.

Purpose: reduces travel speed to speed 1 when platform is 1525 to 3050 mm (60 to 120 in. in.) from maximum lift height and if steer angle is within 10° of straight ahead travel. Travel speed is reduced to speed 2 if steer angle is greater than 10°. Brake force reduced to 67 percent.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

HTS120

3050 mm (120 in.) Height Limit Switch

Location: TL/TT mast trucks with collapsed height of 3330 mm (131 in.) and lift height of 7925 mm (312 in.) or less - lower portion of mainframe between platform and mainframe. TT mast trucks with collapsed height of 3630 mm (143 in.) and lift height of 6095 mm (143 in.) or greater - lower portion of platform between platform and mainframe.

Purpose: reduces travel speed to speed 2 when platform is 3050 to 3810 mm (120 to 150 in. in.) from maximum lift height and if steer angle is within 10° of straight ahead travel. Brake force remains at 67 percent. Travel speed is reduced to speed 3 if steer angle is greater than 10°. Brake force reduced to 33 percent.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

HTS150

3810 mm (150 in.) Height Limit Switch

Location: mainframe.

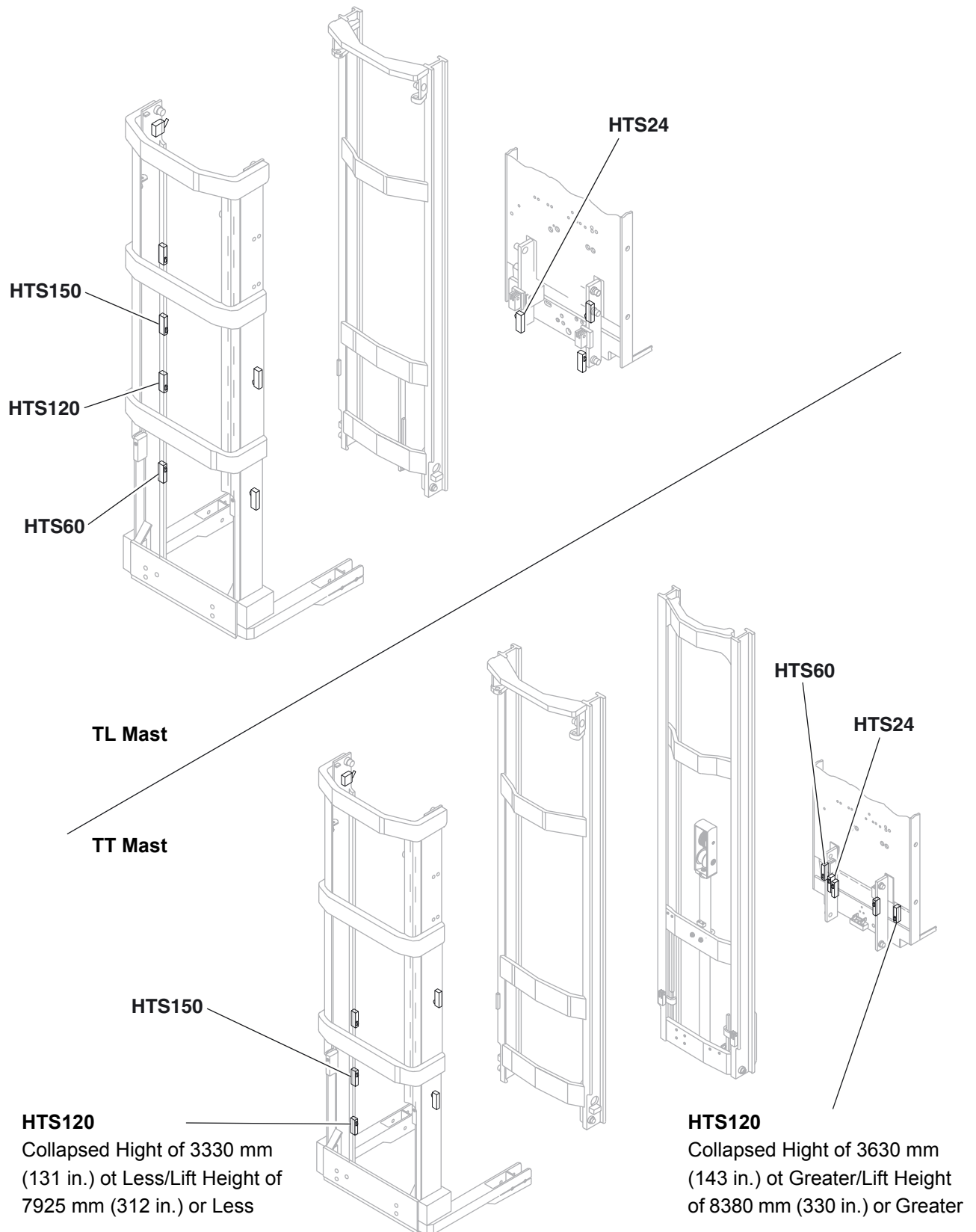
Purpose: reduces travel speed to speed 3 when platform is 3810 to 4570 mm (150 to 180 in.) from maximum lift height and if steer angle is within 10° of straight ahead travel. Travel speed is reduced to speed 4 if steer angle is greater than 10°. Brake force reduced to 33 percent.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.



LUBRICATION & ADJUSTMENT COMPONENTRY



12345

LUBRICATION & ADJUSTMENT

COMPONENTRY



HTS180

4570 mm (180 in.) Height Limit Switch

Location: mainframe.

Purpose: reduces travel speed to speed 4 when platform is above 4 570 mm (180 in.) Steer angle is limited to 10°. Brake force is at 33 percent.

Data: wired normally closed.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

K1

Power Up Relay

Location: distribution panel.

Purpose: provides control circuitry power.

Data: 24 V D.C. coil energized upon key-switch test position closure.

Adjustment: none required.

K2

Module Power

Location: distribution panel.

Purpose: provides power to display traction, steering and guidance modules.

Data: 24 V D.C. coil energized by key switch

Adjustment: none required.

K5

Steer Motor Relay

Location: traction panel.

Purpose: provides current path for steer motor.

Data: 24 V D.C. coil energized by steer module.

Adjustment: none required.

K11

Freezer Condition Relay

Location: freezer condition distribution panel.

Purpose: provide power to thermostat circuits.

Data: 24 V D.C. coil energized when THS2 calls for heat (closes) and THS3 is in temperature range.

Adjustment: none required.

K12

Freezer Condition Relay

Location: freezer condition distribution panel.

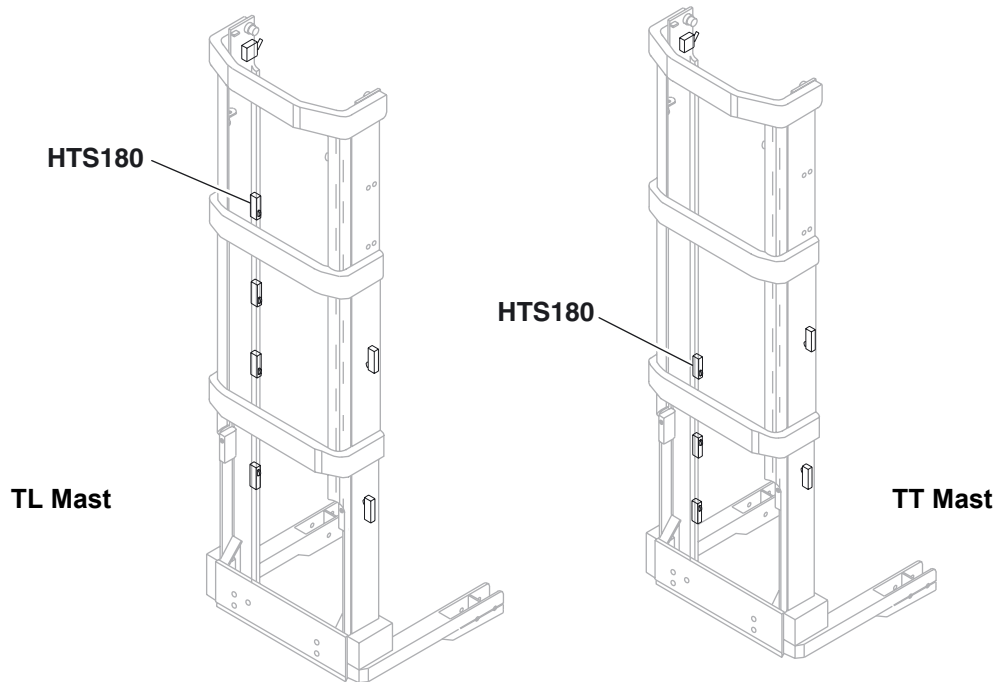
Purpose: provide power to heater circuits.

Data: 24 V D.C. coil energized when THS2 calls for heat (closes) and THS3 is in temperature range.

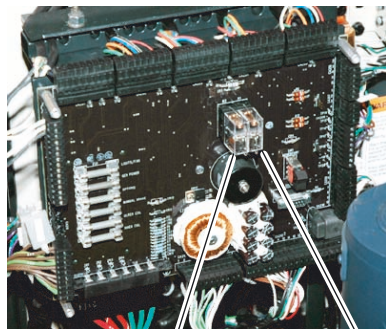
Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY

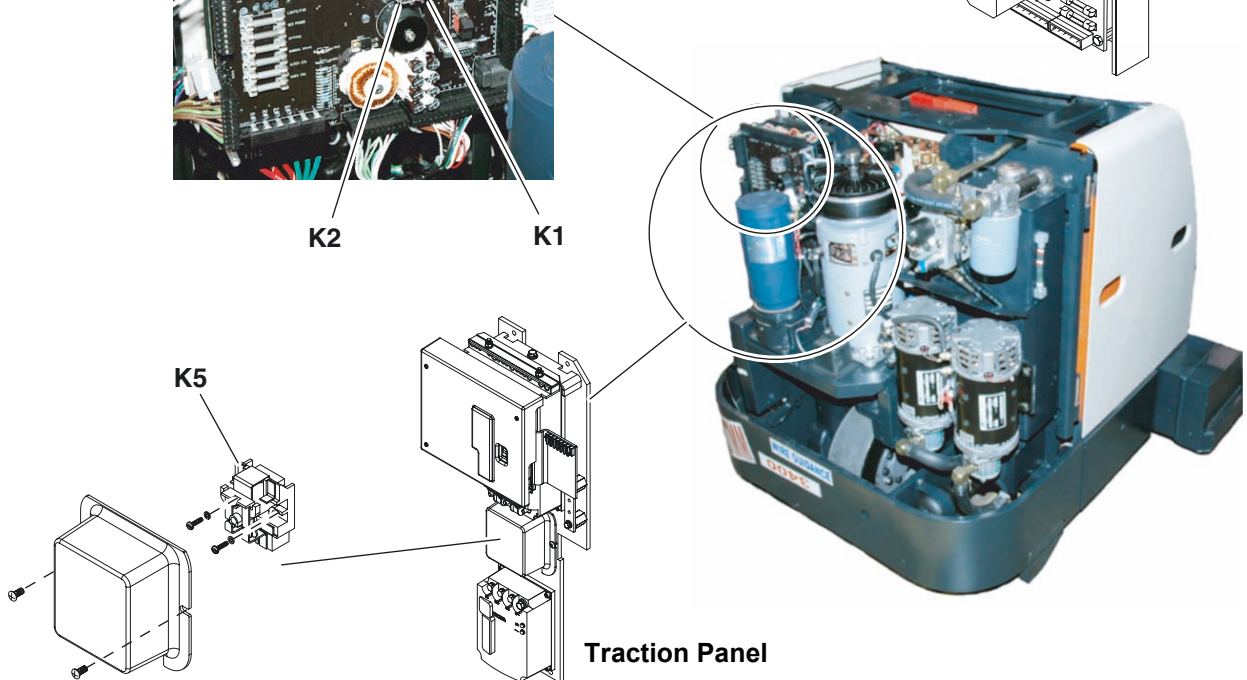
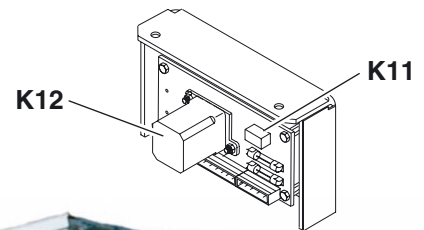


Distribution Panel



K2 K1

**F/C Distribution Panel
(Mounted on Lift/Power Panel)**



Traction Panel

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LUBRICATION & ADJUSTMENT COMPONENTRY



KYS

Key Switch

Location: control module.

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

Data: key operated selector switch. Energizes K1+K2+ED1 with start position and maintains K1 with on position.

Adjustment: none required.

LCS1

Lower Cutout Switch

Location: right, lower portion, mast side of platform.

Purpose: prevents lowering at set height.

Data: wired normally closed held open with mast channel.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

LGS1

Dome Light Switch

Location: switch panel.

Purpose: allows operator to turn on/off dome light.

Data: two position, on-off, rocker switch

Adjustment: none required.

LGS2

Work Light Switch

Location: switch panel.

Purpose: allows operator to turn on/off work light.

Data: two position, on-off, rocker switch.

Adjustment: none required.

LGS3

Spot Light Switch

Location: switch panel

Purpose: allows operator to turn on/off spot light.

Data: two position, on-off, rocker switch.

Adjustment: none required.

LGT1

Strobe or Flashing Light

Location: power unit.

Purpose: visual warning of lift truck presence.

Data: 24 V.

Adjustment: none required.

LGT2, 5

Work Lights

Location: overhead console or mast.

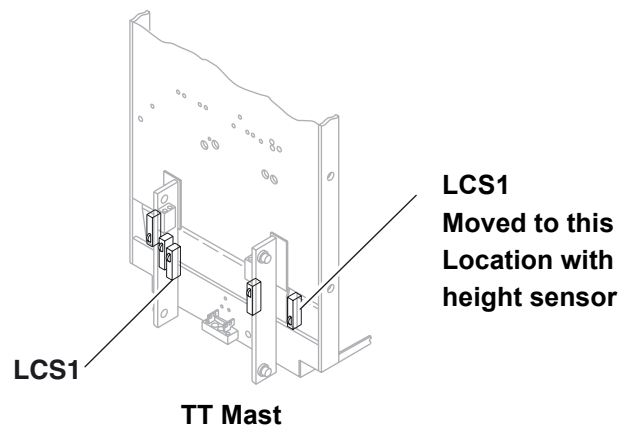
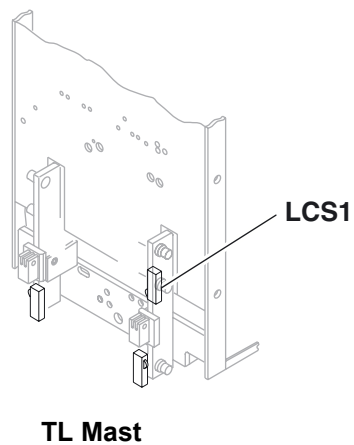
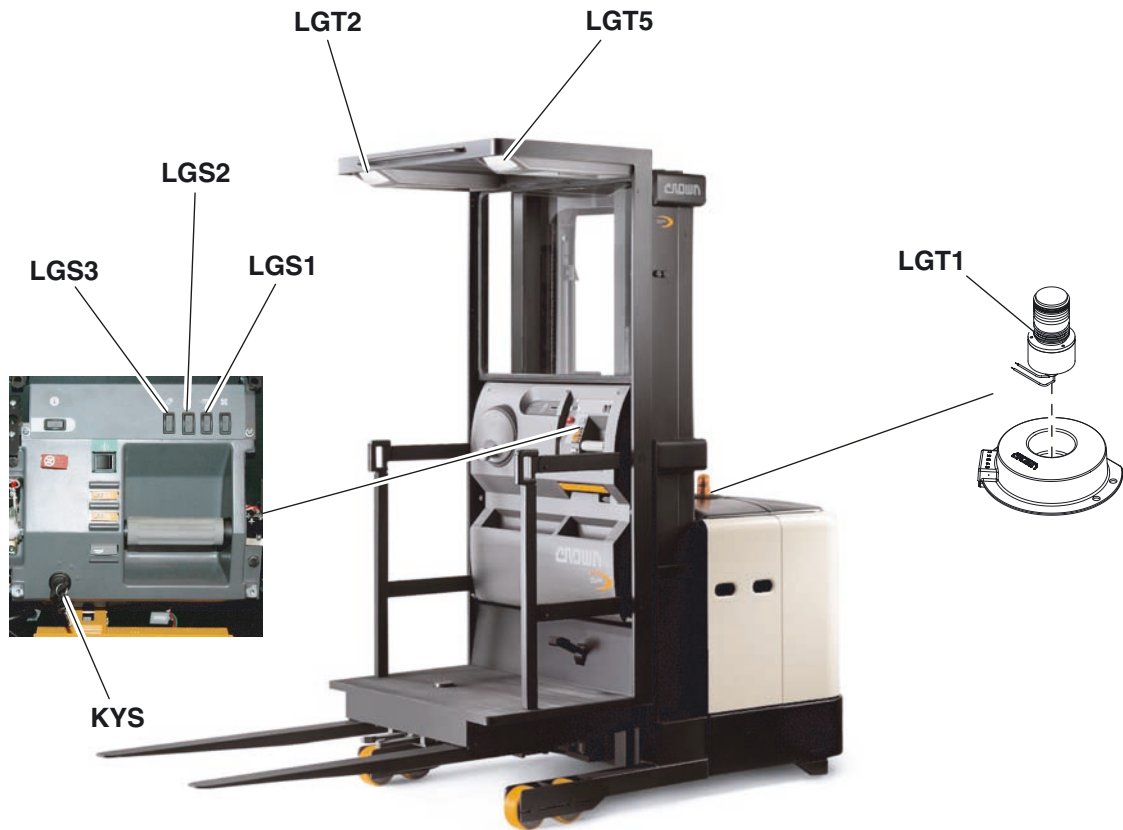
Purpose: provide work area light outside operator compartment.

Data: 12 V.

Adjustment: minimal manual directional adjustment.



LUBRICATION & ADJUSTMENT COMPONENTRY



12347

LUBRICATION & ADJUSTMENT COMPONENTRY



LGT3, 6 Dome Lights

Location: overhead console.

Purpose: provide light inside operator compartment.

Data: 12 V.

Adjustment: none available.

LGT4, 7 Spot Lights

Location: overhead console.

Purpose: provide work area light outside operator compartment.

Data: 24 V.

Adjustment: none available.

LOS1 Low Speed Lower Switch

Location: control module.

Purpose: allows operator to lower platform.

Data: wired normally open, held closed by depressing the lower button (partially on trucks with high speed lower).

Adjustment: none required.

LOS2 High Speed Lower Switch

Location: control module.

Purpose: allows operator to lower platform.

Data: wired normally open, held closed by fully depressing the lower button.

Adjustment: none required.

M1 Traction Motor

Location: drive unit.

Purpose: provide driving force for traction.

Data: see page 316

Adjustment: none required.

M2 Power Steering Motor

Location: steering gearbox.

Purpose: provide driving force for steering.

Data: steering module provides steering control via steering command encoder ECR1 and power unit steered wheel encoder ECR2.

Adjustment: none required.

M3 Lift Pump Motor

Location: reservoir.

Purpose: provide driving force for hydraulic pump supplying hydraulic oil flow for lift.

Data: energized via P1 contactor.

Adjustment: none required.

M4 Lift Pump Motor

Location: reservoir.

Purpose: provide driving force for hydraulic pump supplying hydraulic oil flow for high speed lift.

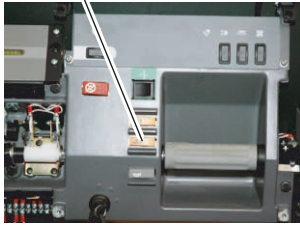
Data: energized via P2 contactor.

Adjustment: none required.

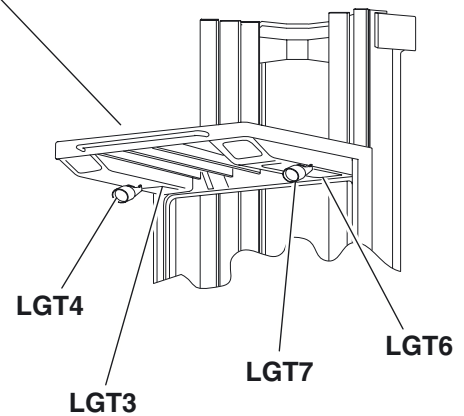


LUBRICATION & ADJUSTMENT COMPONENTRY

LOS1 & LOS2



Switch Panel



M2

M1

M3

M4



12348

LUBRICATION & ADJUSTMENT COMPONENTRY



MRC1

Traction Module

Location: traction panel.

Purpose: controls braking and traction motor speed via operator input from BRS1 and POT1.

Data: transistor control circuitry.

Adjustment: refer to section M4.2.

MVL

Manual Valve Lowering

Location: lift/lower manifold.

Purpose: provide means to lower platform without powering up truck.

Data: not applicable.

Adjustment: none required.

ORS1

Override Switch

Location: switch panel.

Purpose: when raise lower cutout programmed for override is encountered, actuating switch permits continuation of function.

Data: momentary contact switch.

Adjustment: none required.

P1

Low Speed Lift Pump Contactor

Location: lift/power panel.

Purpose: provide battery volts to pump motor 1 upon coil being energized.

Data: positive voltage provided through RAS1 switch, negative voltage controlled by steering module.

Adjustment: none required.

P1 PUMP

Low Speed Lift Pump

Location: M3 lift pump motor.

Purpose: provide hydraulic flow for lift.

Data: not applicable.

Adjustment: none required.

P2

High Speed Lift Pump Contactor

Location: lift/power panel.

Purpose: provide battery volts to pump motor 2 upon coil being energized.

Data: positive voltage provided through RAS2 switch, negative voltage controlled by steering module.

Adjustment: none required.

P2 PUMP

High Speed Lift Pump

Location: M4 lift pump motor.

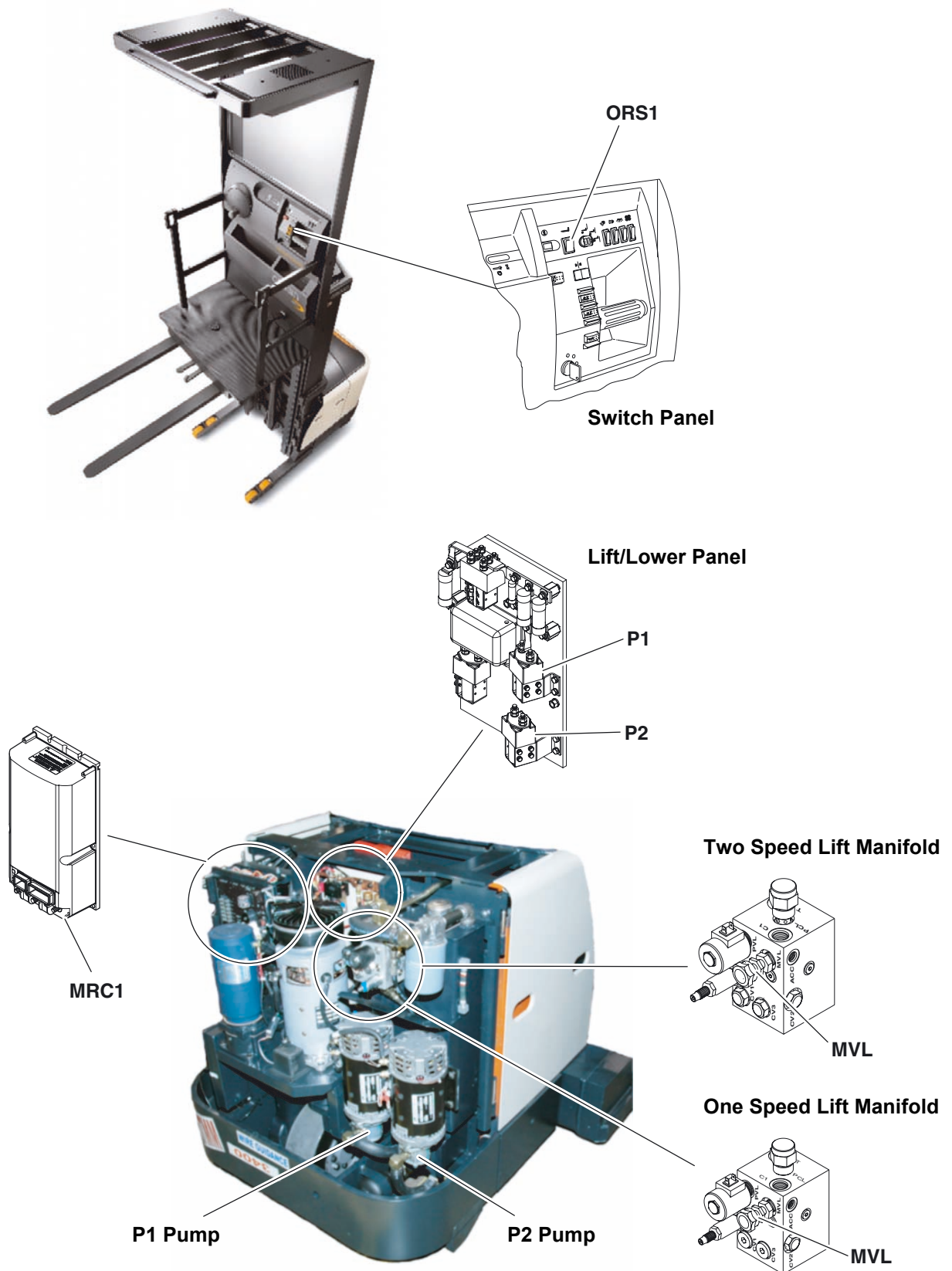
Purpose: provide hydraulic flow for high speed lift.

Data: not applicable.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT COMPONENTRY



POT1

Traction Request Potentiometer

Location: control module.

Purpose: provide traction input to controller MRC1.

Data: ---

Adjustment: refer to section M4.5 - control module.

RAS1

Low Speed Raise Switch

Location: control module.

Purpose: allows operator to raise platform.

Data: wired normally open, held closed by depressing the raise button (partially on trucks with high speed raise).

Adjustment: none required.

PS1

Light Power Supply

Location: overhead console.

Purpose: provide 12 V for work lights.

Data: 24 V D.C. input, 12 V D.C. output.

Adjustment: none required.

RAS2

High Speed Raise Switch

Location: control module.

Purpose: allows operator to raise platform.

Data: wired normally open, held closed by fully depressing the raise button.

Adjustment: none required.

PS2

Light Power Supply

Location: overhead console.

Purpose: provide 12 V for dome lights.

Data: 24 V D.C. input, 12 V D.C. output.

Adjustment: none required.

RCS1, RCS2

Raise Cutout Switches

Location: left side of mainframe.

Purpose: prevents raise at programmed height.

Data: wired normally open held closed with mast channel.

Adjustment: loosen mounting bolts and adjust so switch actuates when roller contacts actuating channel and resets when roller loses contact.

PVL

Proportional Lowering Valve

Location: lift/lower manifold.

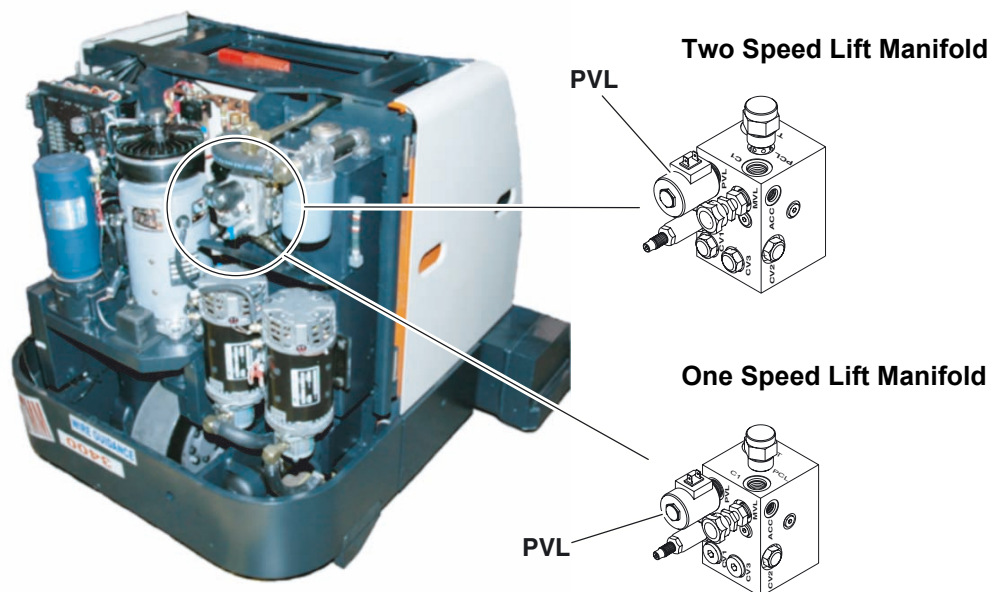
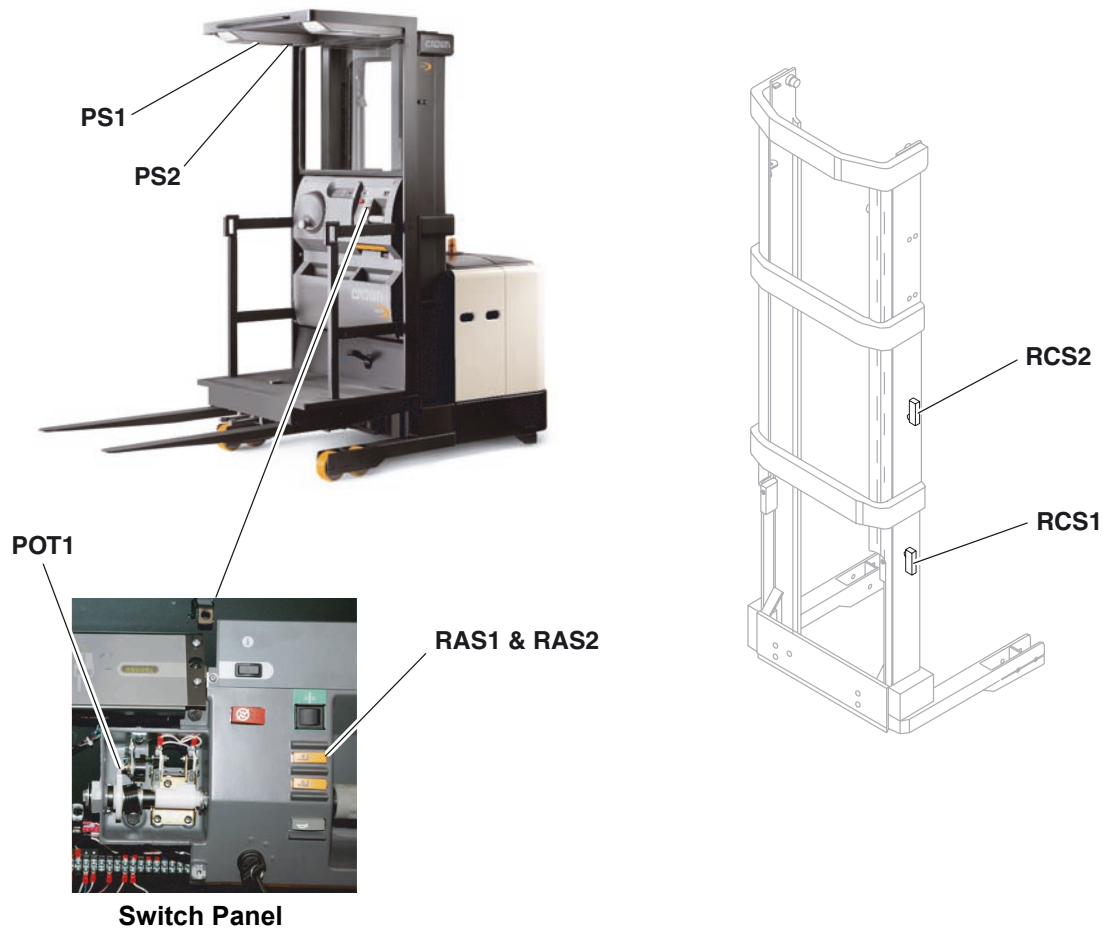
Purpose: provide proportional flow control of lowering functions.

Data: 24 V D.C.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT

COMPONENTRY



RES1

Resistor

Location: overhead console.

Purpose: reduce fan speed.

Data: 25 W, 10 Ω .

Adjustment: none required.

RES2, RES3

Freezer Condition Heater

Location: aisle guide wheel brackets.

Purpose: RES2 applies heat to aisle guide switch RGS2 and RES3 applies heat to aisle guide switch RGS1.

Data: 50 W, 15 Ω .

Adjustment: none required.

RES4, RES5

Freezer Condition Heater

Location: battery restraint switch brackets.

Purpose: RES4 applies heat to battery restraint switch BRES2 and RES5 applies heat to battery restraint switch BRES1.

Data: 50 W, 15 Ω .

Adjustment: none required.

RES6, RES7

Freezer Condition Heater

Location: main frame.

Purpose: RES6 applies heat to chain slack switch CHS3 and RES7 applies heat to chain slack switch CHS4.

Data: 25 W, 30 Ω .

Adjustment: none required.

RES8, RES9

Freezer Condition Heater

Location: platform gate.

Purpose: RES8 applies heat to gate switches GTS1 and RES9 applies heat to gate switches GTS2.

Data: 50 W, 15 Ω .

Adjustment: none required.

RES10

Freezer Condition Heater

Location: control module.

Purpose: applies heat to emergency disconnect switch EDS.

Data: 10 W, 70 Ω .

Adjustment: none required.

RES11

Freezer Condition Heater

Location: control module.

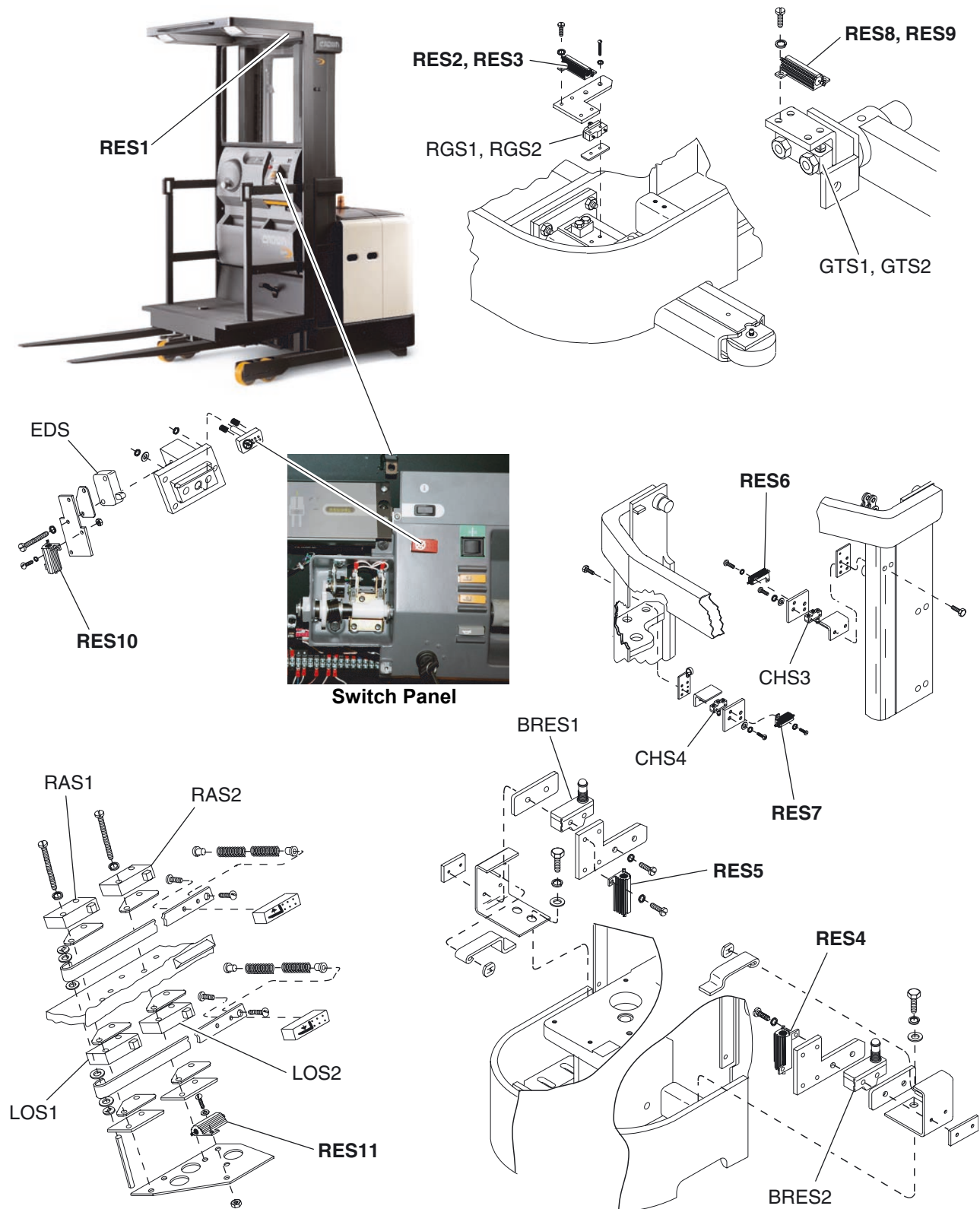
Purpose: applies heat to raise and lower switches LOS1, LOS2, RAS1 & RAS2.

Data: 25 W, 30 Ω .

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT

COMPONENTRY



RES12

Freezer Condition Heater

Location: control module.

Purpose: applies heat to horn switch HNS1.

Data: 25 W, 30 Ω .

Adjustment: none required.

RES16

Freezer Condition Heater

Location: below floorboard.

Purpose: applies heat to brake switch BRS1.

Data: 25 W, 30 Ω .

Adjustment: none required.

RES13

Freezer Condition Heater

Location: control module.

Purpose: applies heat to forward switch FS.

Data: 10 W, 70 Ω .

Adjustment: none required.

RES17

Freezer Condition Heater

Location: mast side of platform.

Purpose: applies heat to limit switch HTS24.

Data: 24 V, 10 W.

Adjustment: none required.

RES14

Freezer Condition Heater

Location: control module.

Purpose: applies heat to reverse switch RS.

Data: 10 W, 70 Ω .

Adjustment: none required.

RES18

Freezer Condition Heater

Location: main frame.

Purpose: applies heat to limit switch HTS60.

Data: 24 V, 10 W.

Adjustment: none required.

RES15, RES19

Freezer Condition Heater

Location: platform (TT).

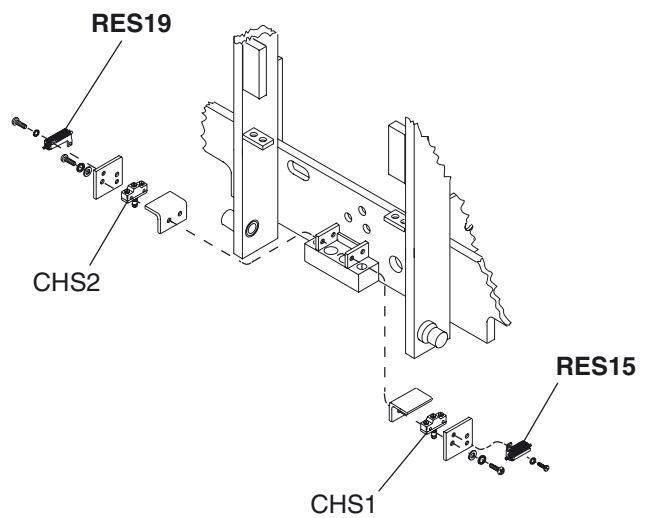
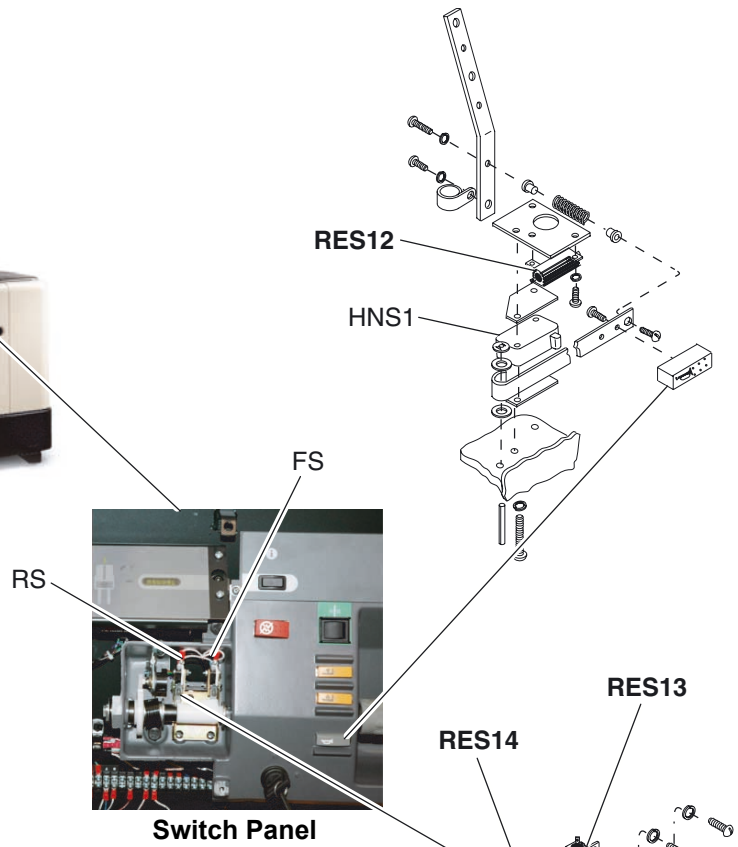
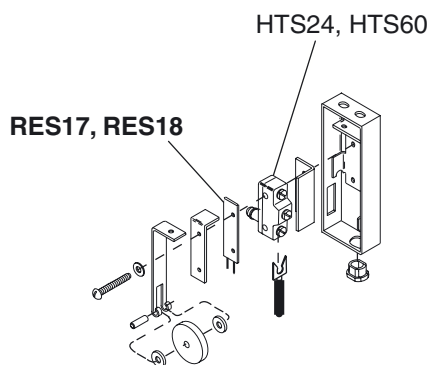
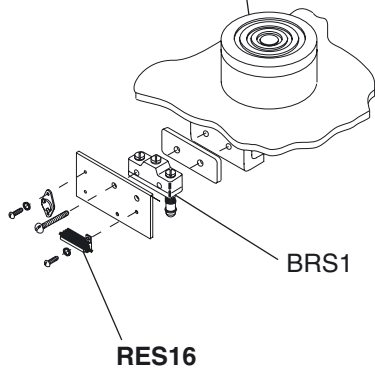
Purpose: RES15 applies heat to chain slack switch CHS1 and RES19 applies heat to chain slack switch CHS2.

Data: 25 W, 30 Ω .

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT

COMPONENTRY



RES20, RES21

Freezer Condition Heater

Location: rear gate post.

Purpose: RES20 applies heat to rear gate switches GTS6, GTS8 and RES21 applies heat to rear gate switches GTS5, GTS7.

Data: 50 W, 15 Ω .

Adjustment: none required.

RES30

Freezer Condition Heater

Location: mainframe.

Purpose: applies heat to limit switch HTS120.

Data: 24 V, 10 W.

Adjustment: none required.

RES31

Freezer Condition Heater

Location: mainframe.

Purpose: applies heat to limit switch HTS150.

Data: 24 V, 10 W.

Adjustment: none required.

RES32

Freezer Condition Heater

Location: mainframe.

Purpose: applies heat to limit switch HTS180.

Data: 24 V, 10 W.

Adjustment: none required.

Reservoir

Location: power unit.

Purpose: hydraulic oil storage.

Data: capacity - 13 liters (3.5 gal.) for single speed lift and 17 liters (4.5 gal.) for high speed lift.

Adjustment: none required.

RGS1, RGS2

Rail Guide Switches

Location: aisle guide wheel bracket mounted under power unit.

Purpose: provide ability to turn on automatic steering.

Data: wired normally closed held open.

Adjustment: none required.

RS

Reverse Switch

Location: control module.

Purpose: informs traction controller reverse travel direction is being requested by the operator.

Data: wired normally open. Rotating twist grip toward operator actuates switch.

Adjustment: none required.

RV1

Relief Valve

Location: lift/lower manifold.

Purpose: limit operating pressure for lift circuit.

Data: not applicable.

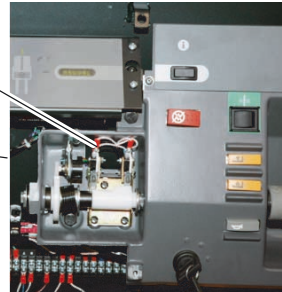
Adjustment: refer to section M2.4.



LUBRICATION & ADJUSTMENT COMPONENTRY

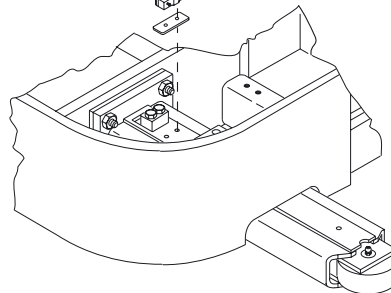


RS



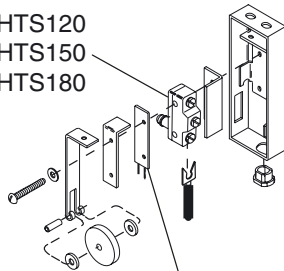
Switch Panel

RGS1, RGS2



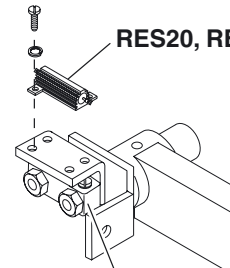
Reservoir

HTS120
HTS150
HTS180



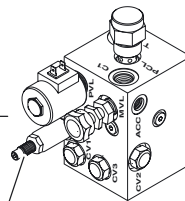
RES30
RES31
RES32

RES20, RES21



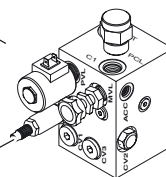
GTS5, GTS6

Two Speed Lift Manifold



RV1

One Speed Lift Manifold



RV1



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LUBRICATION & ADJUSTMENT

COMPONENTRY



SB10

Suppressor Block

Location: platform.

Purpose: suppress electrical noise from operation of horn.

Data: not applicable.

Adjustment: none required.

SB30

Suppressor Block

Location: overhead console.

Purpose: suppress electrical noise from operation of fan.

Data: not applicable.

Adjustment: none required.

SB11

Suppressor Block

Location: steering command assembly.

Purpose: suppress electrical noise from platform communications (steering).

Data: not applicable.

Adjustment: none required.

SCM

Steering Control Module

Location: traction panel.

Purpose: control steering operation.

Data: see section M4.3 and M6.0.

Adjustment: none required.

SB21

Suppressor Block

Location: below strobe light.

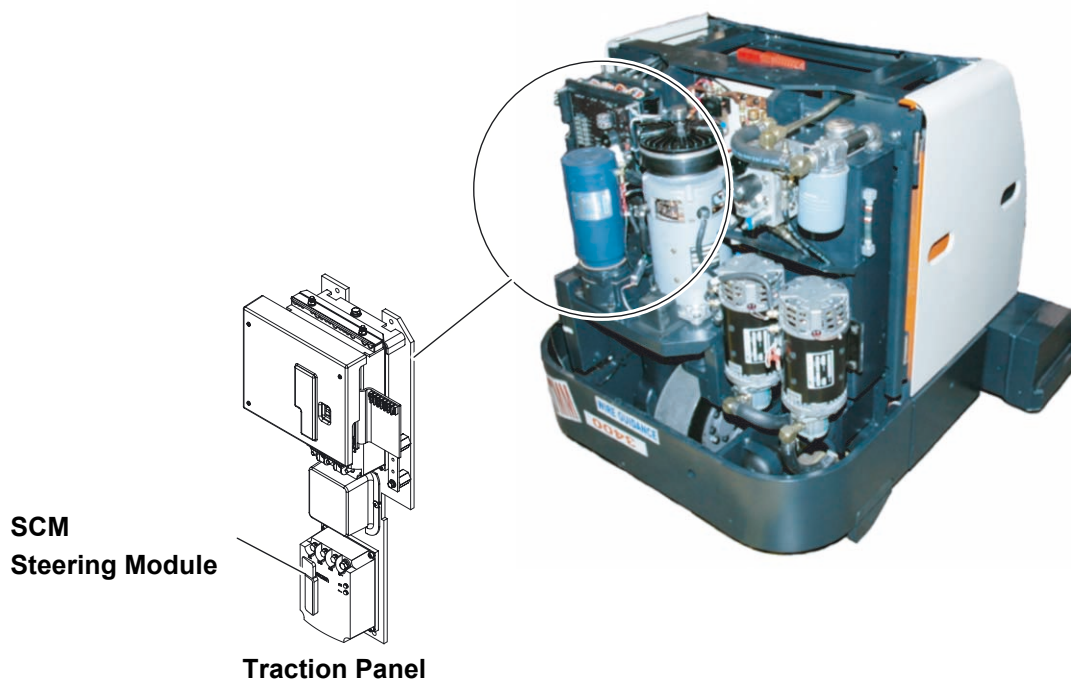
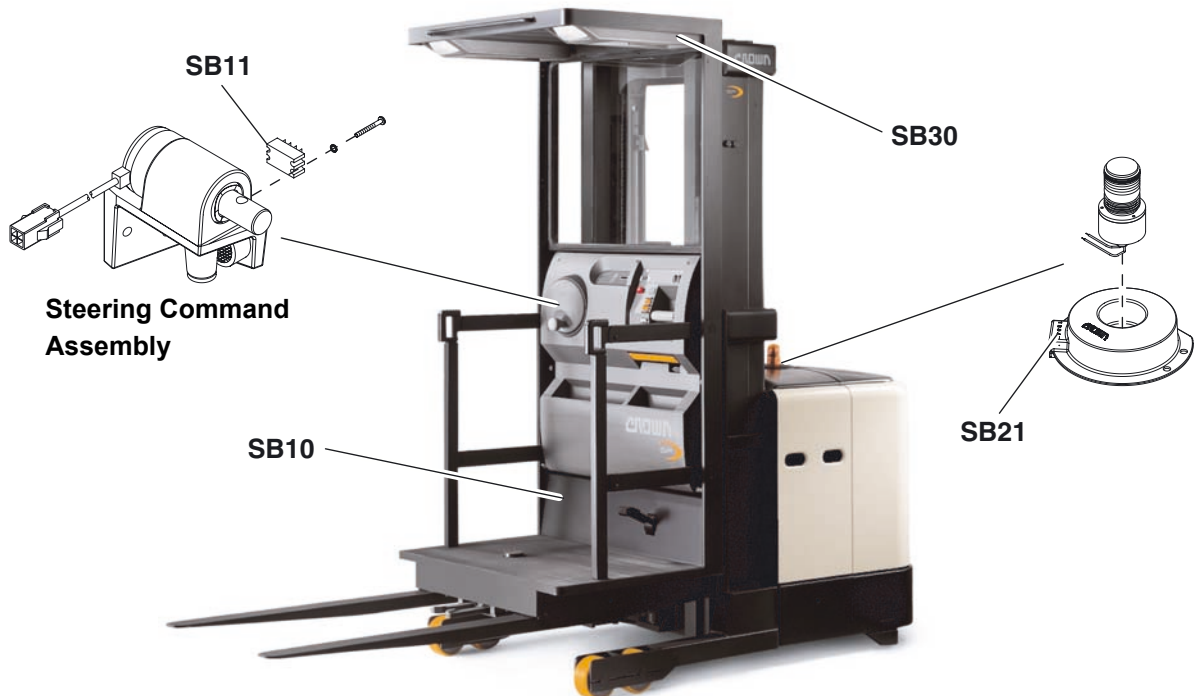
Purpose: suppress electrical noise from operation of strobe light.

Data: not applicable.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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LUBRICATION & ADJUSTMENT COMPONENTRY



Sensor Bar Load Wheel Wire Guidance

Location: base of mainframe.

Purpose: sense signal strength from guide wire embedded in floor.

Data: see section M4.3 - wire guide system.

Adjustment: none required.

Sensor Bar Steer Wheel Wire Guidance

Location: front and center of power unit below skirt.

Purpose: sense signal strength from guide wire embedded in floor.

Data: see section M4.3 - wire guide system.

Adjustment: none required.

Strainer Suction

Location: hydraulic reservoir.

Purpose: remove contaminants from hydraulic fluid.

Data: 100 mesh.

Adjustment: none required.

Test Port

Location: lift/lower manifold.

Purpose: quick pressure gauge connect/disconnect.

Data: not applicable.

Adjustment: none required.

THS2 Power Unit Thermostat

Location: power unit battery wall between power unit and mast.

Purpose: provide ability to turn on power unit heaters.

Data: wired normally closed. Contact closes at 49 °C (120 °F) and opens at 68 °C (140 °F).

Adjustment: none required.

THS3 Platform Thermostat

Location: mounted to plate assembled to brake switch, BRS1, located under platform floor.

Purpose: provide ability to turn on platform heaters.

Data: wired normally closed. Contact closes at 4 °C (40 °F) and opens at 15 °C (60 °F).

Adjustment: none required.

ZSS Zone Select Switch

Location: switch panel.

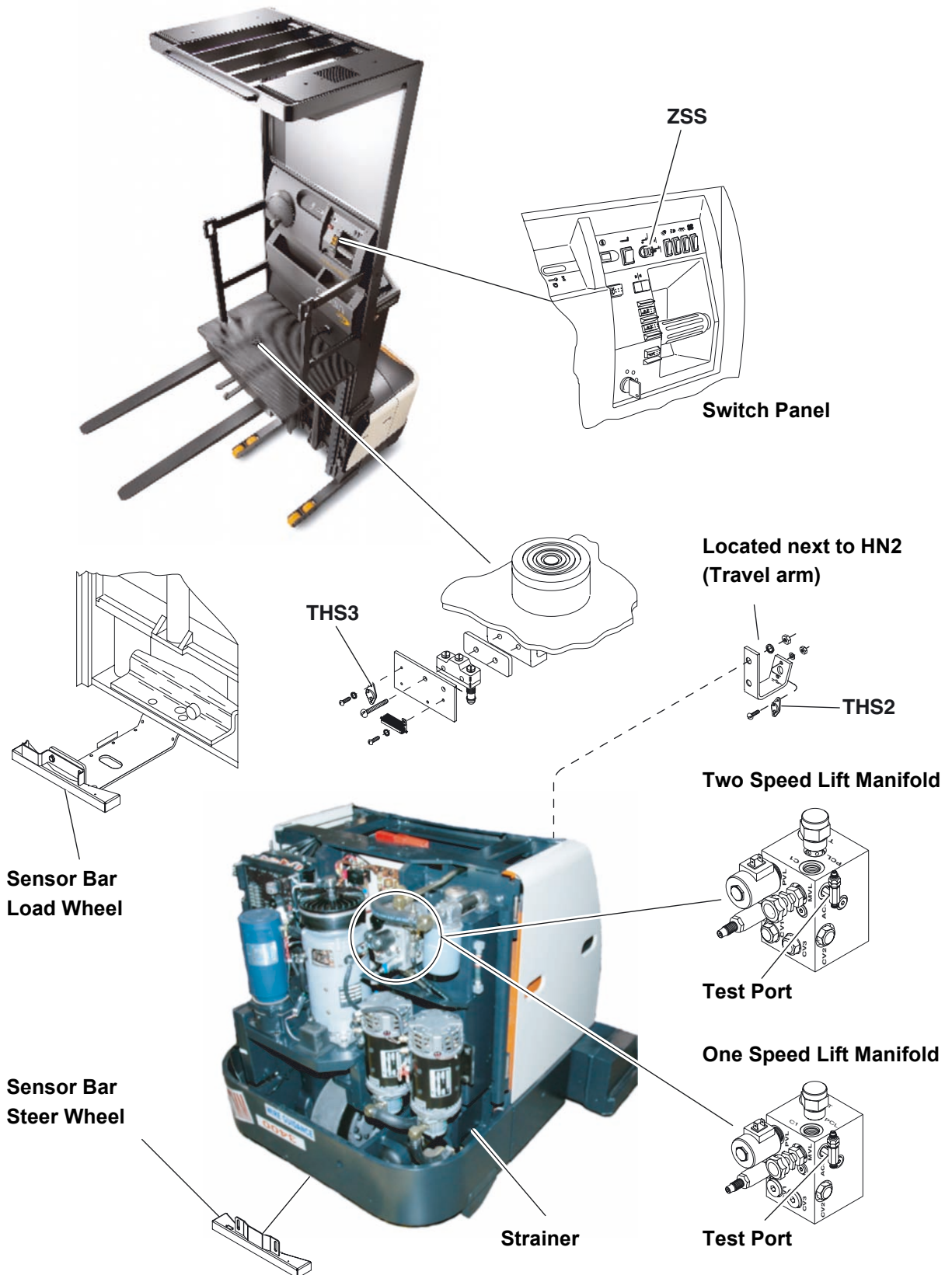
Purpose: allows selection of lift height cutout.

Data: three position key switch.

Adjustment: none required.



LUBRICATION & ADJUSTMENT COMPONENTRY



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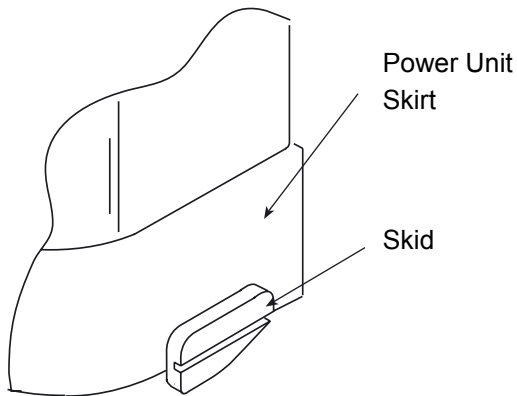
LUBRICATION & ADJUSTMENT

SKIDS



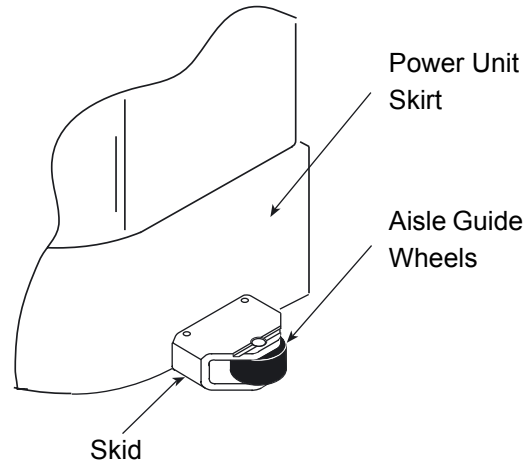
Skids

On trucks equipped without aisle guide wheels, skids are located in the lower left and right corner of the power unit skirt.



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On trucks equipped with aisle guide wheels; skids are mounted on the bottom of the front (power unit end) aisle guide wheel supports.



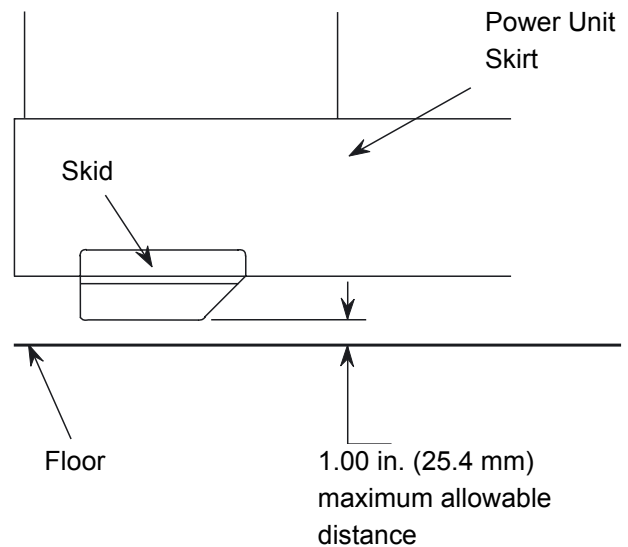
3260

Caution!



These skids are used to maintain truck stability and should be periodically inspected.

Check to be sure skid mounting bolts are secure and measure the distance from the bottom of skid to level floor. The maximum allowable distance from skid to level floor is 1.00 in. (25.4mm).





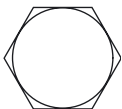
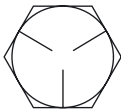
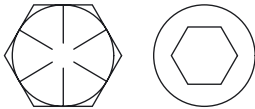
LUBRICATION & ADJUSTMENT

TORQUE VALUES

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, IN.
	SAE—Grade 2	Low Carbon Steel	1/4 through 1 1/2
	SAE—Grade 5	Medium Carbon Steel, Quenched and Tempered	1/4 through 1 1/2
	SAE—Grade 8	Medium Carbon Alloy Steel, Quenched and Tempered	1/4 through 1 1/2

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.

LUBRICATION & ADJUSTMENT

TORQUE VALUES



TORQUE CHART

BOLT DIAMETER	GRADE 5 DRY TORQUE REQUIREMENT			GRADE 8 DRY TORQUE REQUIREMENT		
	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.

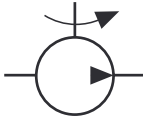
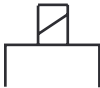
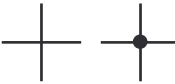
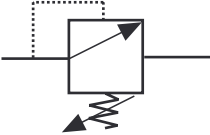


HYDRAULIC SYSTEM



Notes:

Hydraulic Symbols

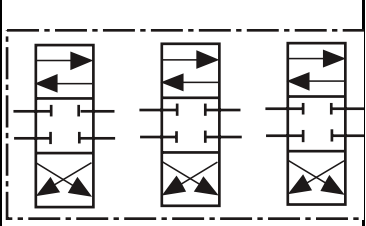
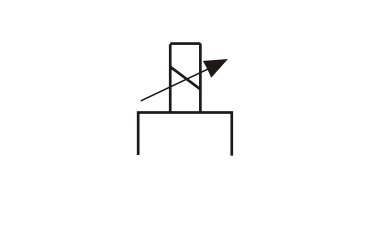
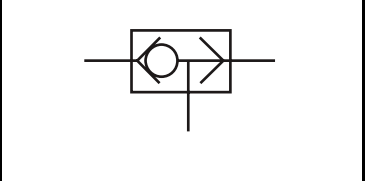
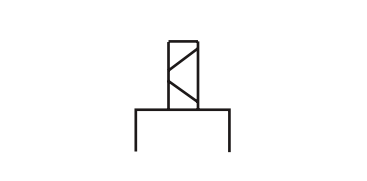
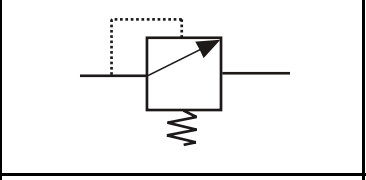
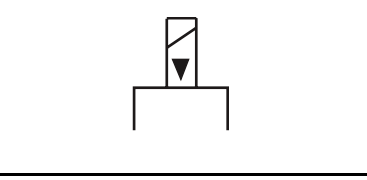
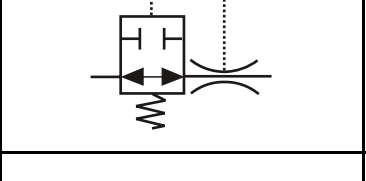
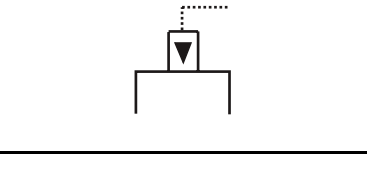
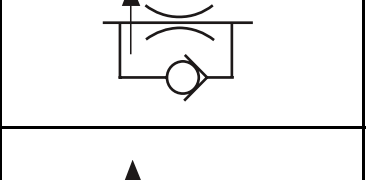
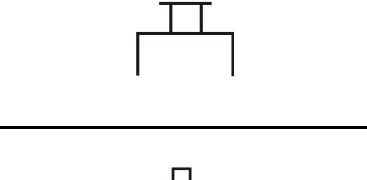
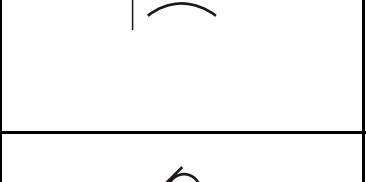
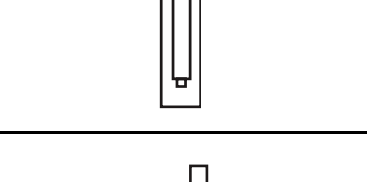
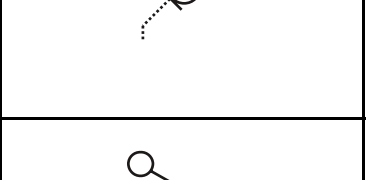
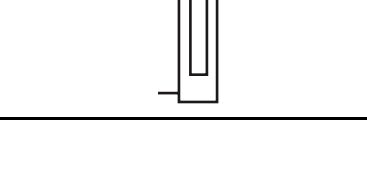
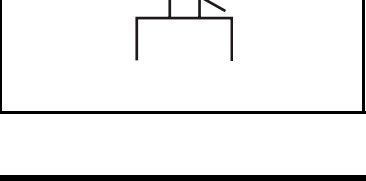
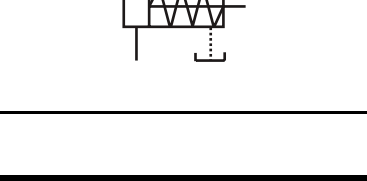
Symbol	Meaning	Symbol	Meaning
	Vented reservoir with lines above the fluid level		Electric motor with uni-directional turn and speed
	Vented reservoir with lines above the fluid level		Hydraulic pump with fixed displacement and single direction of turn
	Filter or strainer		Spring, (bias to normal de-energised position)
	Hydraulic line with full flow		Solenoid single coil or winding
	Control line or drainage with restricted flow		Assembly housing, manifold block
	Lines crossing; not connected		Throttle, adjustable
	Lines crossing and connected		Throttle, fixed
	Plugged port		Relief valve, adjustable
	Accumulator gas charged diaphragm type		Check Valve

HYDRAULIC SYSTEM

HYDRAULIC SYMBOLS



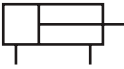
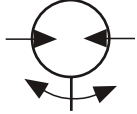
Symbol	Meaning	Symbol	Meaning
	2/2 way valve (2 ways, 2 connections)		Hydraulic steer unit
	3/2 way valve (3 ways, 2 connections)		Torque generator
	3/2 way valve (3 ways, 2 connections); Spring bias solenoid control		Shut-off valve, manual
	4/2 way valve (4 ways, 2 connections)		Bypass flow control with controlled flow, pressure-regulated
	4/3 way valve (4 ways, 3 connections)		Flow divider/combiner
	4/3 way valve (4 ways, 3 connections); manual activation and spring centred		Single counterbalance valve assembly in manifold
	Flow meter		Electric motor with uni- directional turn and variable speed

Symbol	Meaning	Symbol	Meaning
	Valve block with 3 operating units		Proportional solenoid
	Shuttle valve		Dual solenoid
	Relief valve, fixed setting		Solenoid valve, pilot operated
	Velocity fuse		Hydraulic pilot operated
	Pressure-compensated flow control with reverseflow bypass; fixed.		Manual actuator
	Pressure-compensated flow control with reverseflow bypass; fixed.		Single-acting cylinder, with cushion
	Pilot check valve(pilot to open)		Single-acting cylinder ram type
	Manual lever actuator		Single-acting cylinder with spring returned (rod end vented)

HYDRAULIC SYSTEM

HYDRAULIC SYMBOLS



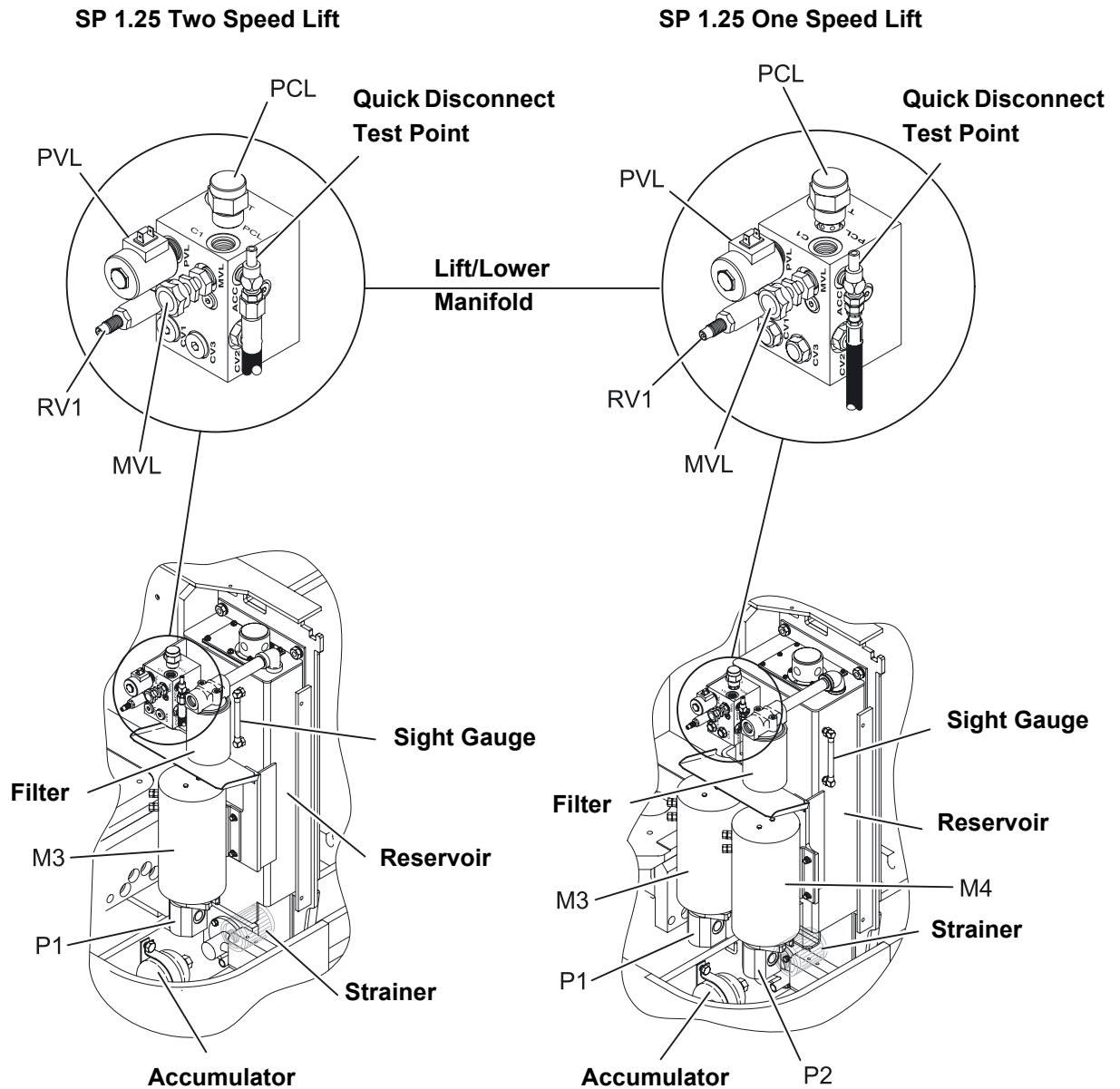
Symbol	Meaning	Symbol	Meaning
	Double-acting cylinder; equal area		Thermometer
	Double-acting cylinder; unequal area		Pressure gauge
	Pressure switch		Hydraulic motor, bi-directional

General

The hydraulic system in your truck is powered by gear type pumps. These pumps, P1 & P2, supply oil flow for lift and accessory functions.

Maximum pressure is limited by an adjustable relief valve, RV1, (refer to section M2.4). The setting for RV1 is noted on the hydraulic schematics. Refer to the service manual index for pump, valve and manifold information.

The Figure 11890 shows hydraulic component location in the power unit.



11890

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



Hydraulic Circuits

These pages contain a brief description of the hydraulic circuits for SP trucks which are typical of current standard units. Your unit may vary. Refer to section HYD in this manual for appropriate schematic.

Lift Circuit - One Speed Lift

When lift is selected, oil is drawn from the hydraulic reservoir to hydraulic pump P1. P1 supplies pressurized oil to the lift/lower manifold block. Oil enters the manifold block through port P1 and goes directly to check valve CV2. Oil passes through the manifold block until it exits port C1. Pressurized oil enters the lift cylinders and begins to extend the mast.

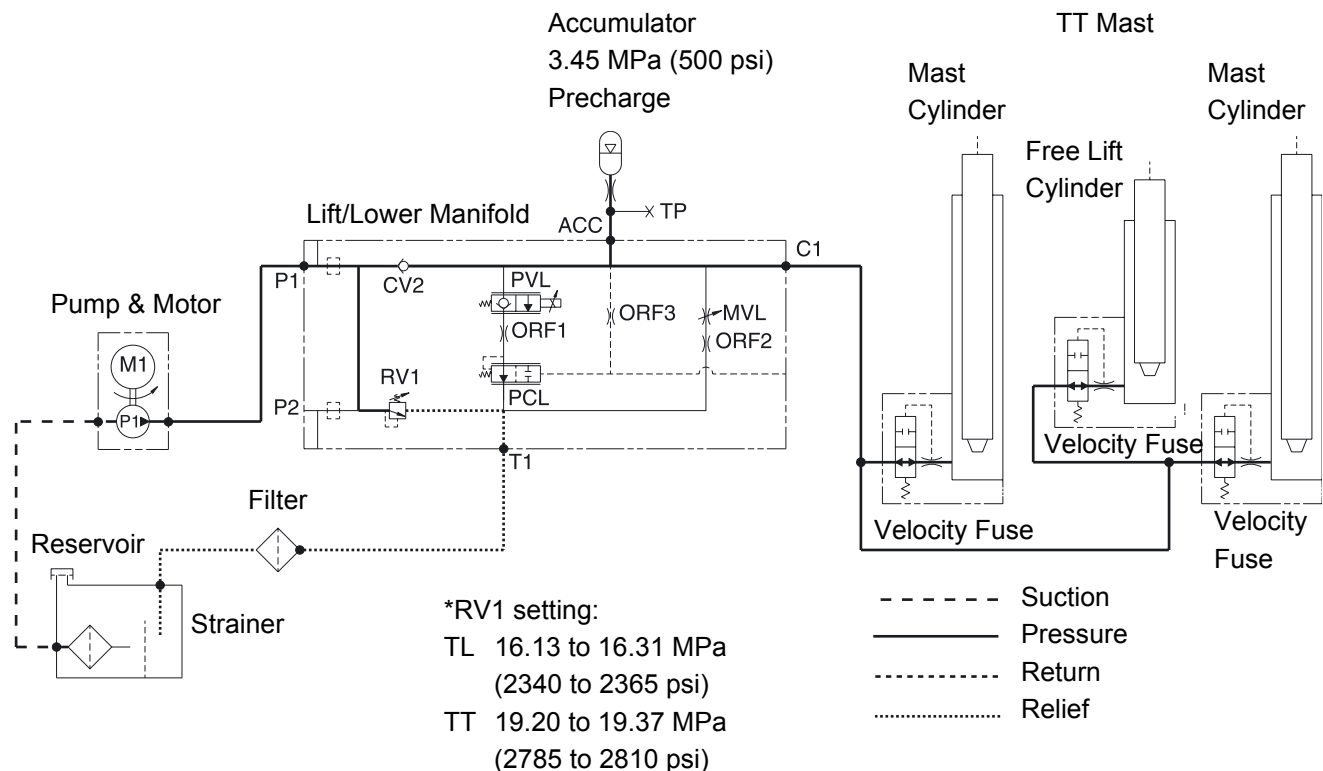
Relief Valve Operation

During lift function, relief valve RV1 monitors hydraulic pressure. If oil pressure exceeds the relief pressure

setting, the relief valve is forced open, allowing pressurized oil to bypass the lift circuit. From the relief valve, oil exits from the manifold block through port T1. From port T1, oil passes through the return line filter then back to the reservoir.

Accumulator Operation

The accumulator is used as a shock absorber for the lift/lower hydraulic system. If the platform is stopped suddenly, the change in oil flow exerts pressure on the hydraulic system. The accumulator absorbs this oil pressure change by using a gas pressurized bladder located within the accumulator. The bladder acts as a pillow to the pressurized oil, cushioning the applied pressure within the hydraulic circuit. The typical symptom of a bad or de-pressurized accumulator is abrupt starting and stopping of the platform during lift or lower.



12381

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



Lower Circuit - One Speed/Two Speed Lower

When lower is selected, oil begins to exit the lift cylinder. Oil leaving the cylinder is monitored by the internal velocity fuse in each cylinder.

Velocity fuses are designed to prevent sudden release of hydraulic oil from the cylinder under a condition such as a line rupture. If a cylinder line ruptures, oil exiting the cylinder would create pressure on the velocity fuse, forcing the fuse to close. This will block the oil from exiting the cylinder.

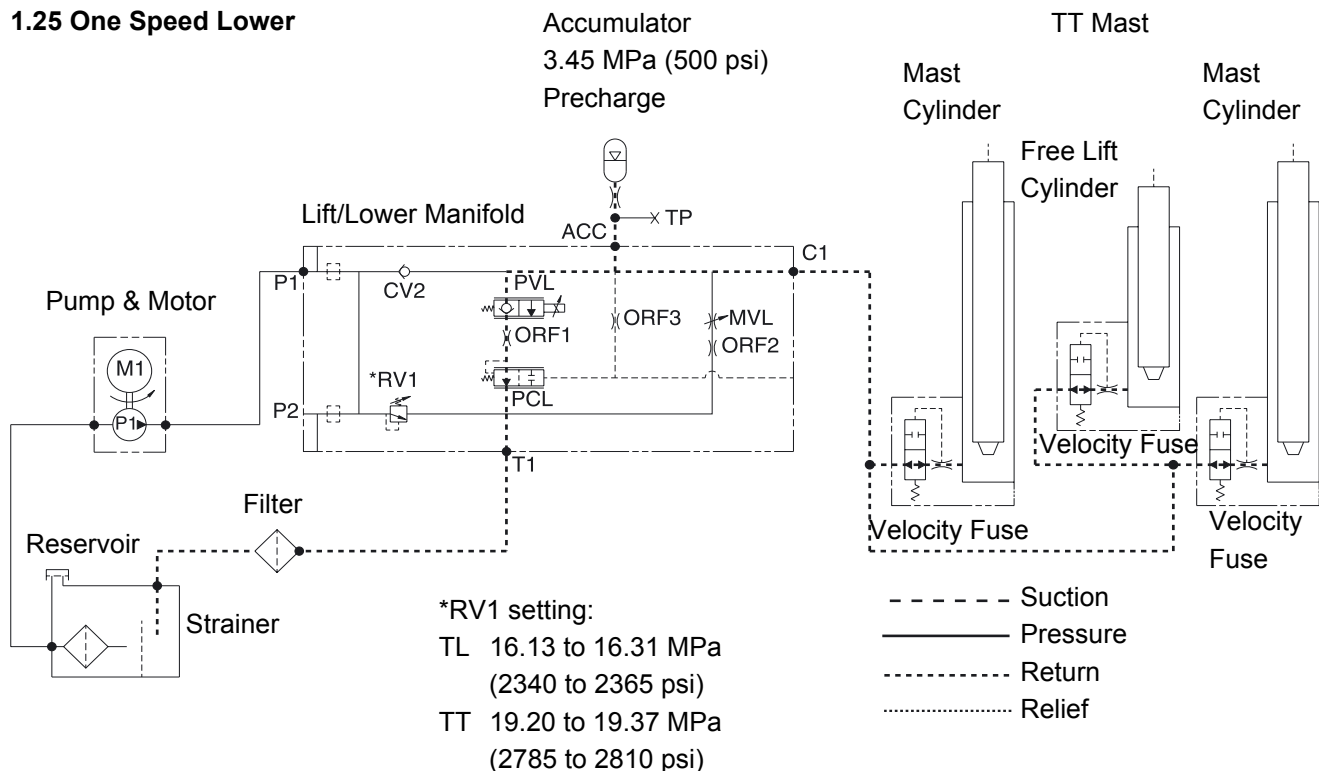
Lower

When the lower button is depressed, oil exits the lift cylinders and enters the lift/lower manifold block through port C1. The oil passes through the open envelope (envelope without a check valve) of the proportional solenoid valve PVL which is in the energized position. Oil is directed from PVL to the pressure compensator valve PCL. PCL limits the maximum oil rate. Once the oil exits PCL, it is directed out of the manifold through port T1. From port T1, oil enters the return line filter then back to the reservoir.

A partially opened proportional valve performs slow speed lowering. High speed lowering is accomplished by completely opening the proportional valve.

For accumulator operation, see previous page.

1.25 One Speed Lower

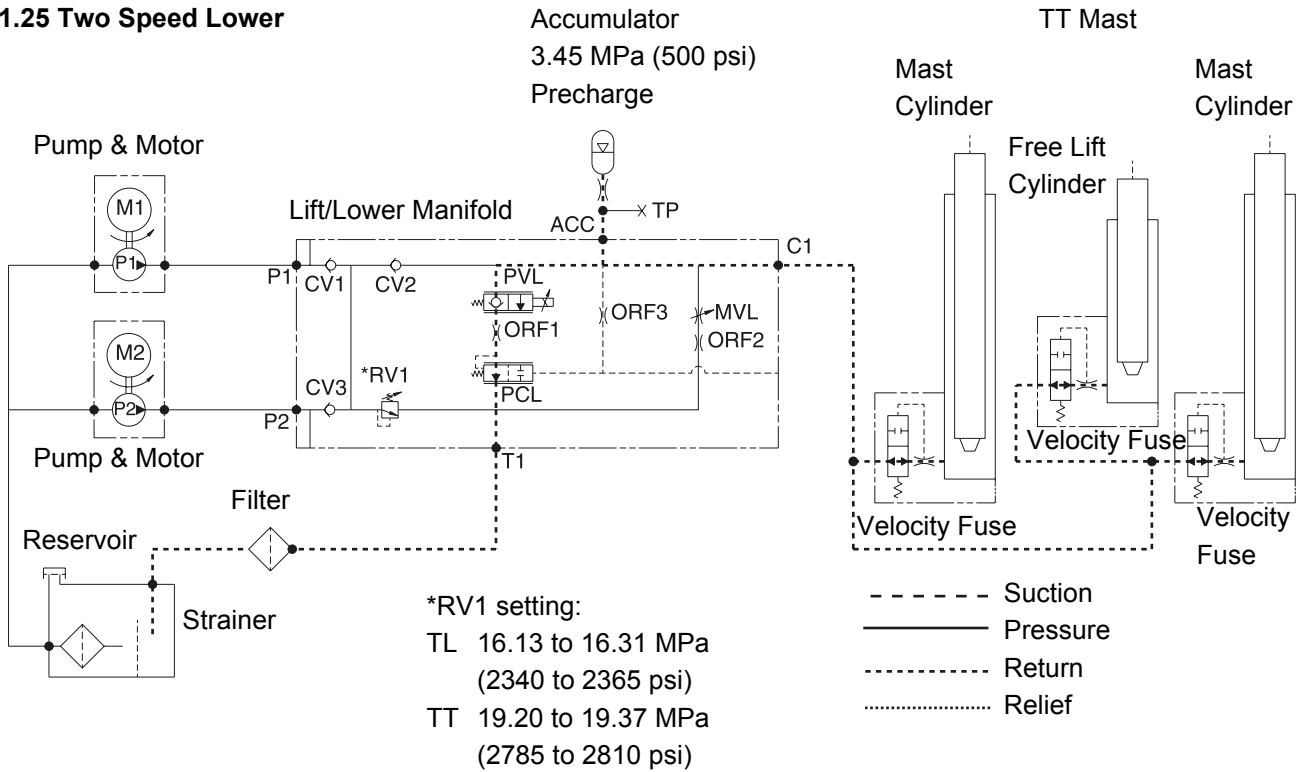


12382



HYDRAULIC SYSTEM HYDRAULIC CIRCUITS

1.25 Two Speed Lower



12384

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

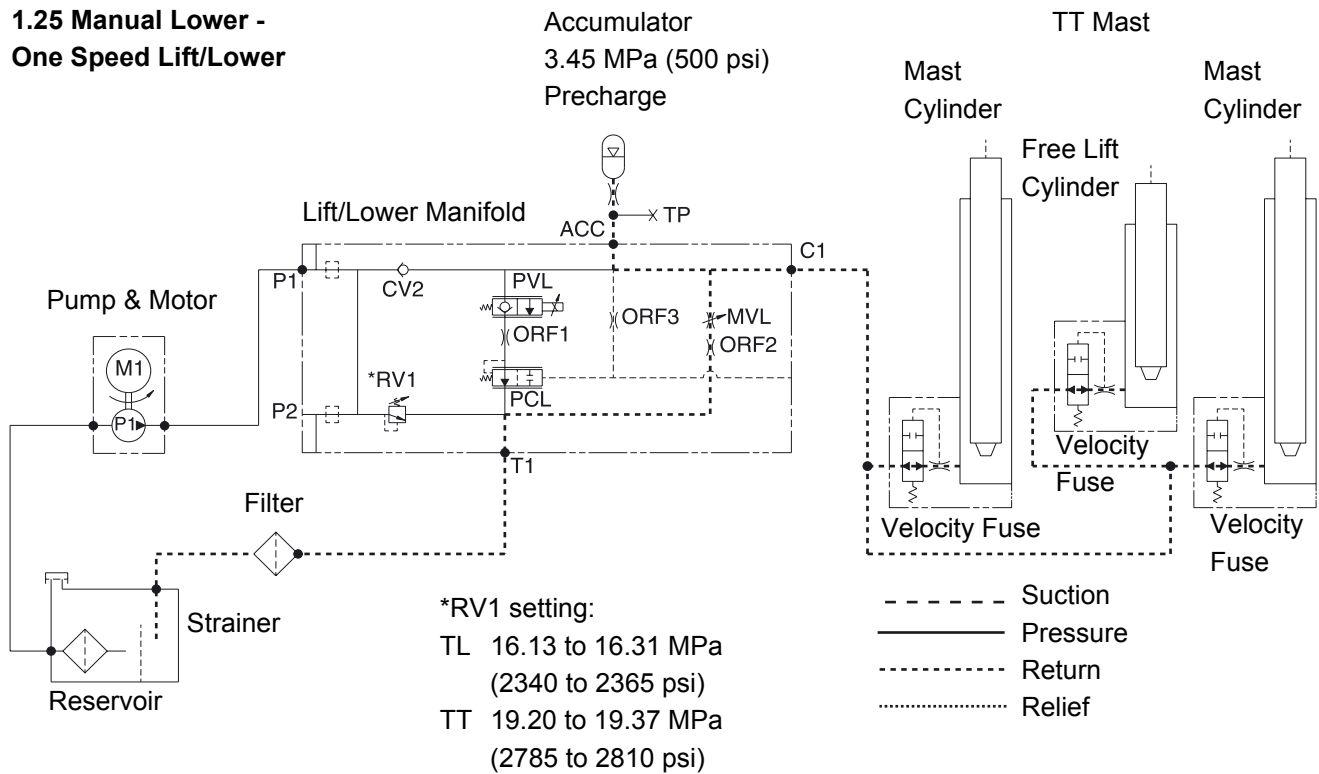


Manual Lower Circuits

The manual lowering feature is used to lower the mast during truck down situations. The manual lowering valve MVL is located on the lift/lower manifold block. When MVL is actuated, oil trapped in the cylinder is

released. Oil enters the lift/lower manifold through port C1. From port C1, the oil flow is directed to the manual lowering valve's open envelope (envelope without check valve). Oil exits the manifold through port T1. From port T1, the oil enters the return line filter then back to the reservoir.

1.25 Manual Lower - One Speed Lift/Lower

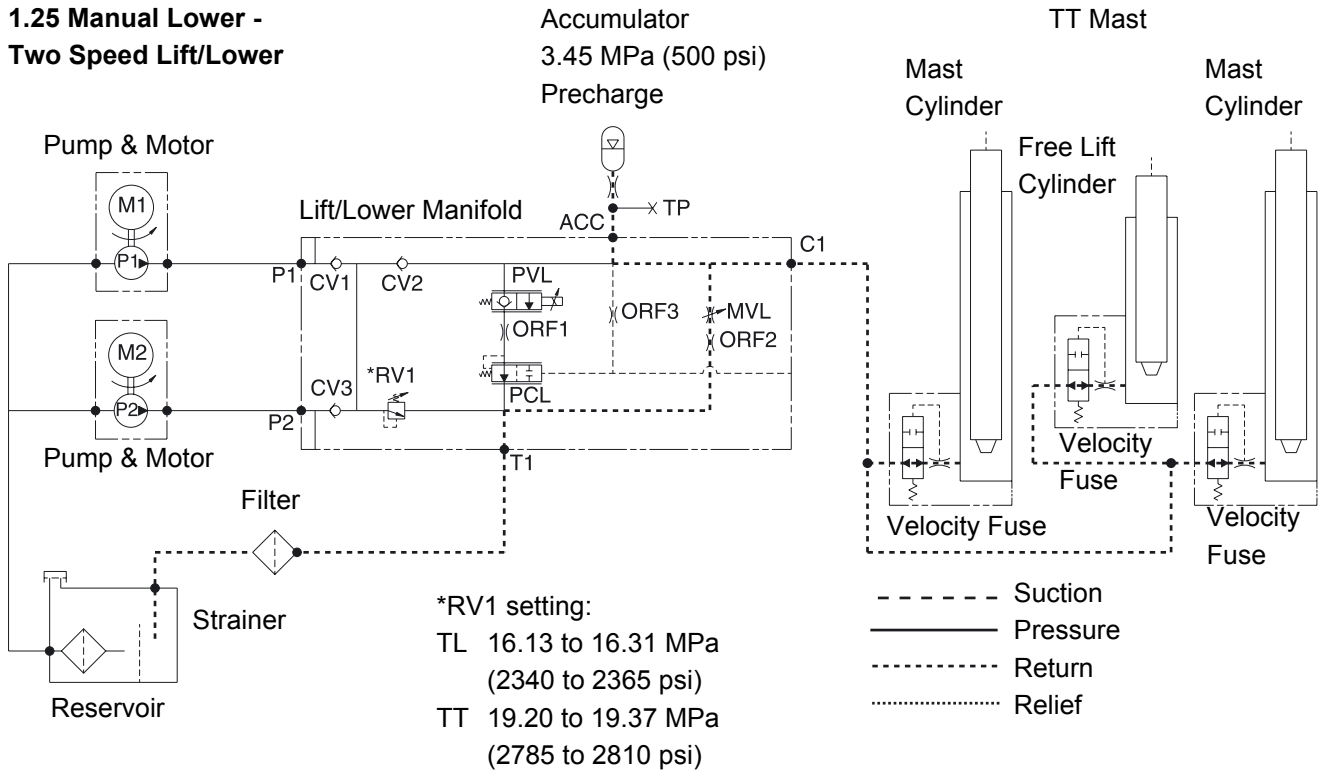


12385



HYDRAULIC SYSTEM HYDRAULIC CIRCUITS

1.25 Manual Lower - Two Speed Lift/Lower



12386

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

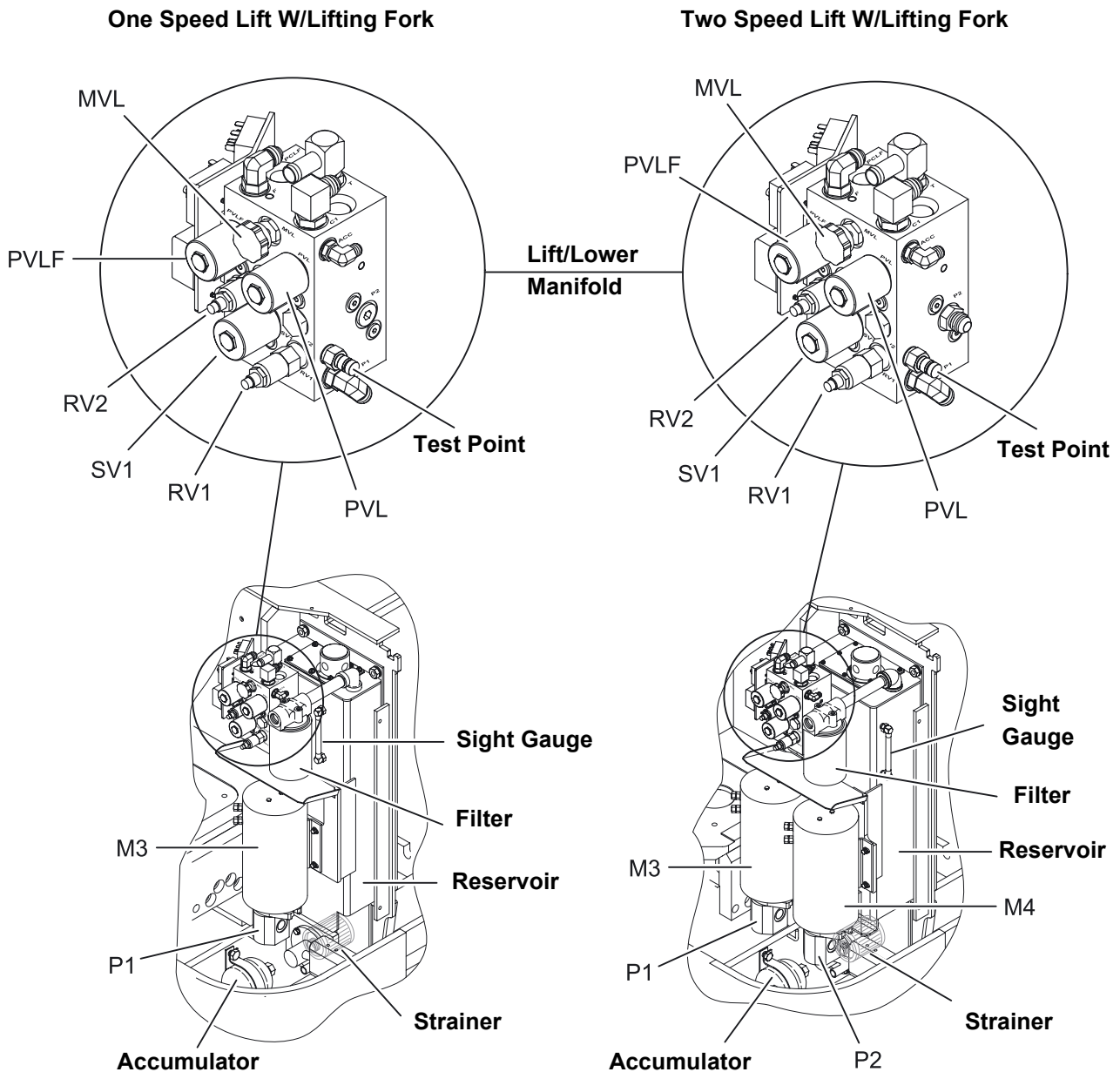


The hydraulic system in your truck is powered by gear type pumps. These pumps, P1 & P2, supply oil flow for lift and accessory functions.

is noted on the hydraulic schematics. Refer to the service manual index for pump, valve and manifold information.

Maximum pressure is limited by an adjustable relief valve, RV1, (refer to section M2.4). The setting for RV1

The Figure 13836 shows hydraulic component location in the power unit.



13836



HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

These pages contain a brief description of the hydraulic circuits for SP trucks which are typical of current standard units. Your unit may vary. Refer to section HYD in this manual for appropriate schematic.

pressure within the hydraulic circuit. The typical symptom of a bad or de-pressurized accumulator is abrupt starting and stopping of the platform during lift or lower.

Lift Circuit - One Speed Lift

When lift is selected, oil is drawn from the hydraulic reservoir to hydraulic pump P1. P1 supplies pressurized oil to the lift/lower manifold block. Oil enters the manifold block through port P1 and goes directly to check valve CV2. Oil passes through the manifold block until it exits port C1. Pressurized oil enters the lift cylinders and begins to extend the mast.

Lifting Fork Lift Circuit

Depressing both lifting fork raise buttons starts the lift pump and energizes solenoid valve SV1. Energizing SV1 opens a path for oil flow to the lifting fork cylinder and PVLV blocks the path for oil flow to the reservoir. The lift pump draws oil from the reservoir through a filter. Pressurized oil then flows through the energized solenoid valve SV1. Pressurized oil exits port F to flow control valve, unrestricted, into the lifting fork cylinder.

Relief Valve Operation

During lift function, relief valve RV1 monitors hydraulic pressure. If oil pressure exceeds the relief pressure setting, the relief valve is forced open, allowing pressurized oil to bypass the lift circuit. From the relief valve, oil exits from the manifold block through port T1. From port T1, oil passes through the return line filter then back to the reservoir.

Accumulator Operation

The accumulator is used as a shock absorber for the lift/lower hydraulic system. If the platform is stopped suddenly, the change in oil flow exerts pressure on the hydraulic system. The accumulator absorbs this oil pressure change by using a gas pressurized bladder located within the accumulator. The bladder acts as a pillow to the pressurized oil, cushioning the applied

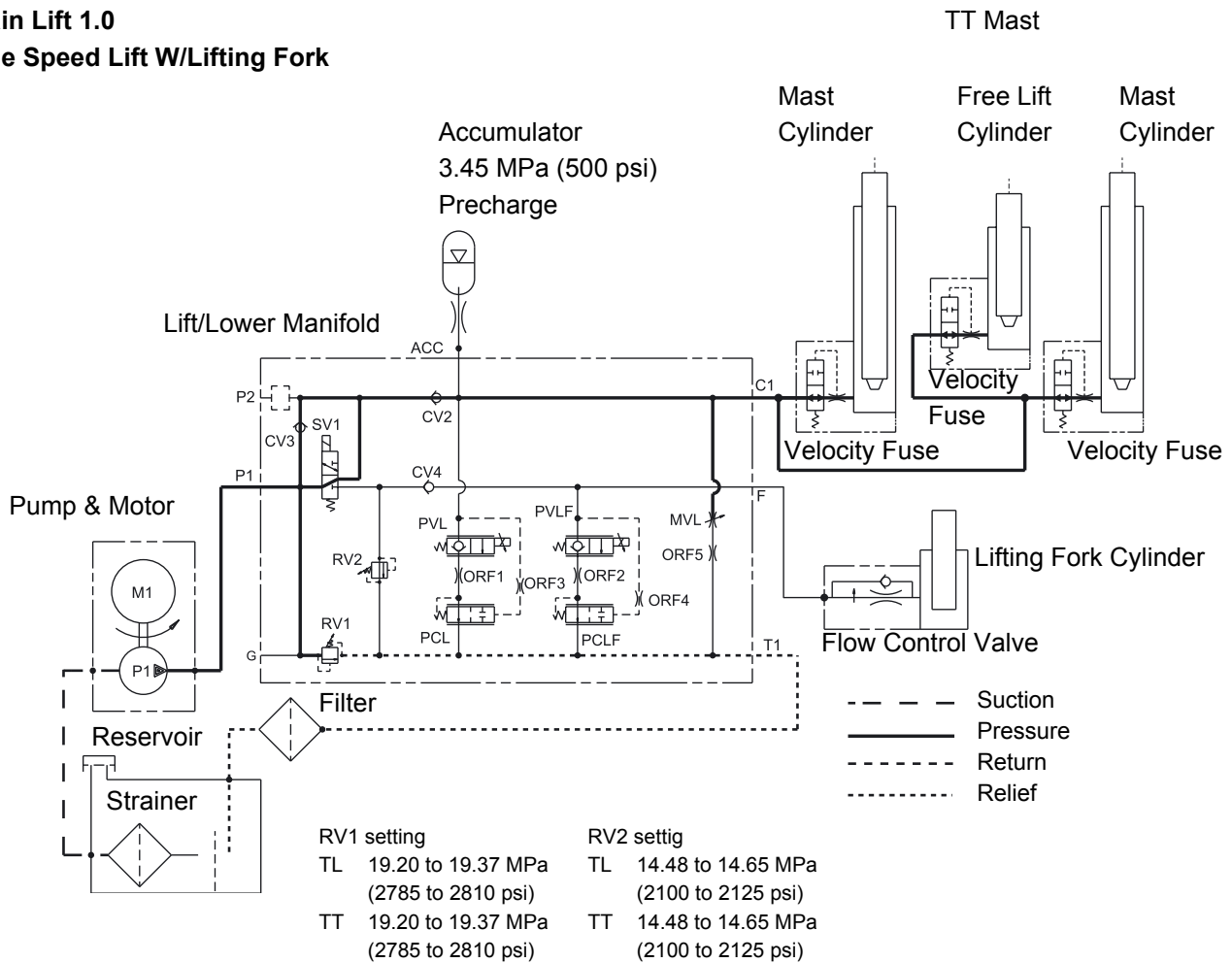
HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



Main Lift 1.0

One Speed Lift W/Lifting Fork



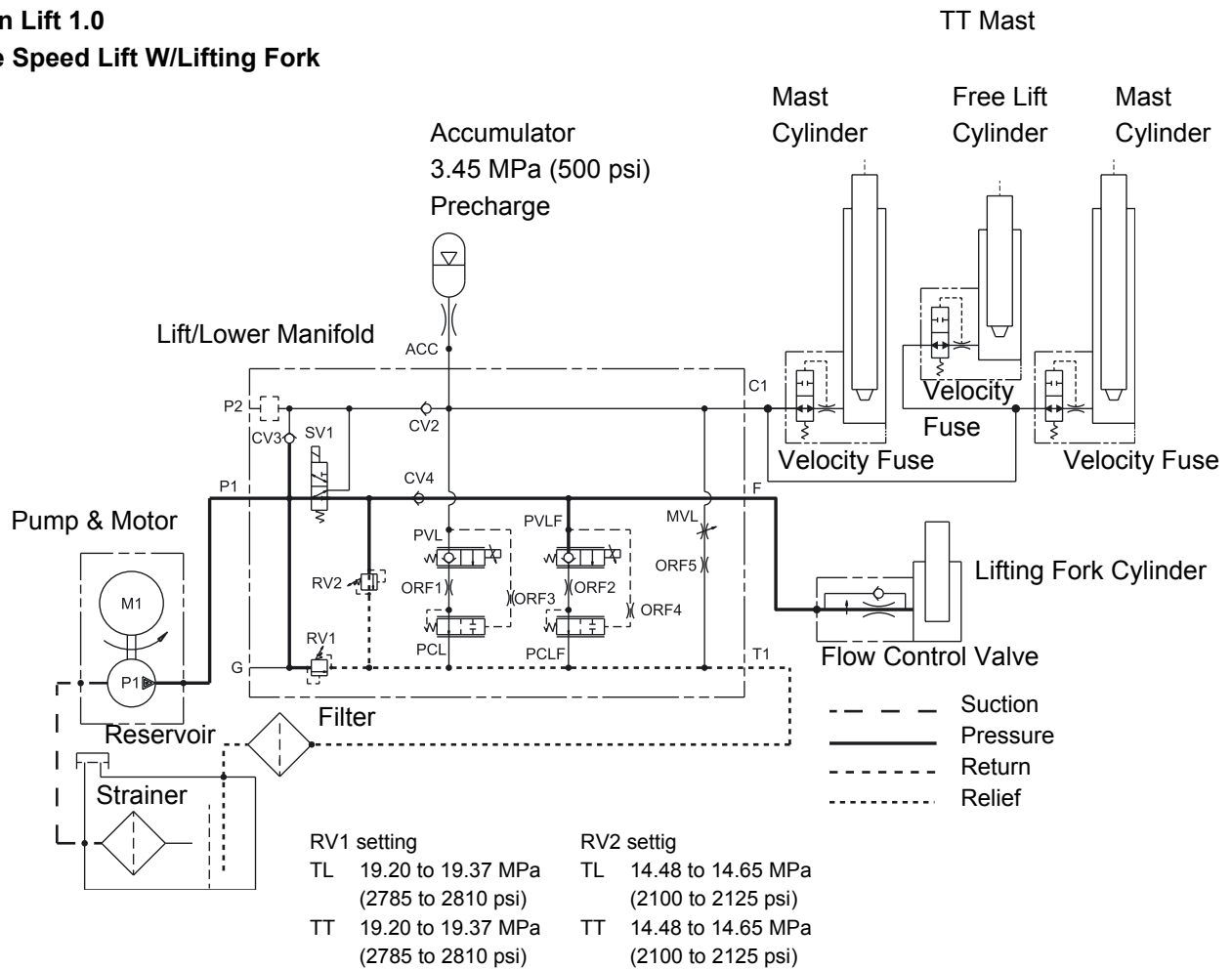
13859



HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

Main Lift 1.0 One Speed Lift W/Lifting Fork



13860

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



Lift Circuit - Two Speed Lift W/Lifting Forks

tom of a bad or de-pressurized accumulator is abrupt starting and stopping of the platform during lift or lower.

Low Speed Lift

When the lift button is depressed to the first detent, oil is drawn from the hydraulic reservoir to hydraulic pump P1. The hydraulic pump supplies pressurized oil to the lift/lower manifold block. The oil enters the manifold block through the port P1 and goes directly to check valve CV1 and CV3. The oil passes through the manifold block until it exits port C1. Pressurized oil enters the lift cylinders and begins to extend the mast.

High Speed Lift

When the lift button is completely depressed, pump P2 turns on simultaneously with pump P1. The hydraulic pump P2 supplies pressurized oil to the lift/lower manifold block. The oil enters the manifold block through port P2 and goes directly to check valve CV3 and CV1. This oil passes through the manifold block where it joins the oil supplied from the pump P1 out to the lift cylinders.

Relief Valve Operation

During the lift function, relief valve RV1 monitors hydraulic pressure. Oil pressure exceeding the relief pressure setting will force RV1 open, allowing the pressurized oil to bypass the lift circuit. Oil exits the manifold block through port T1. From port T1, oil passes through the return line filter then back to the reservoir.

Accumulator Operation

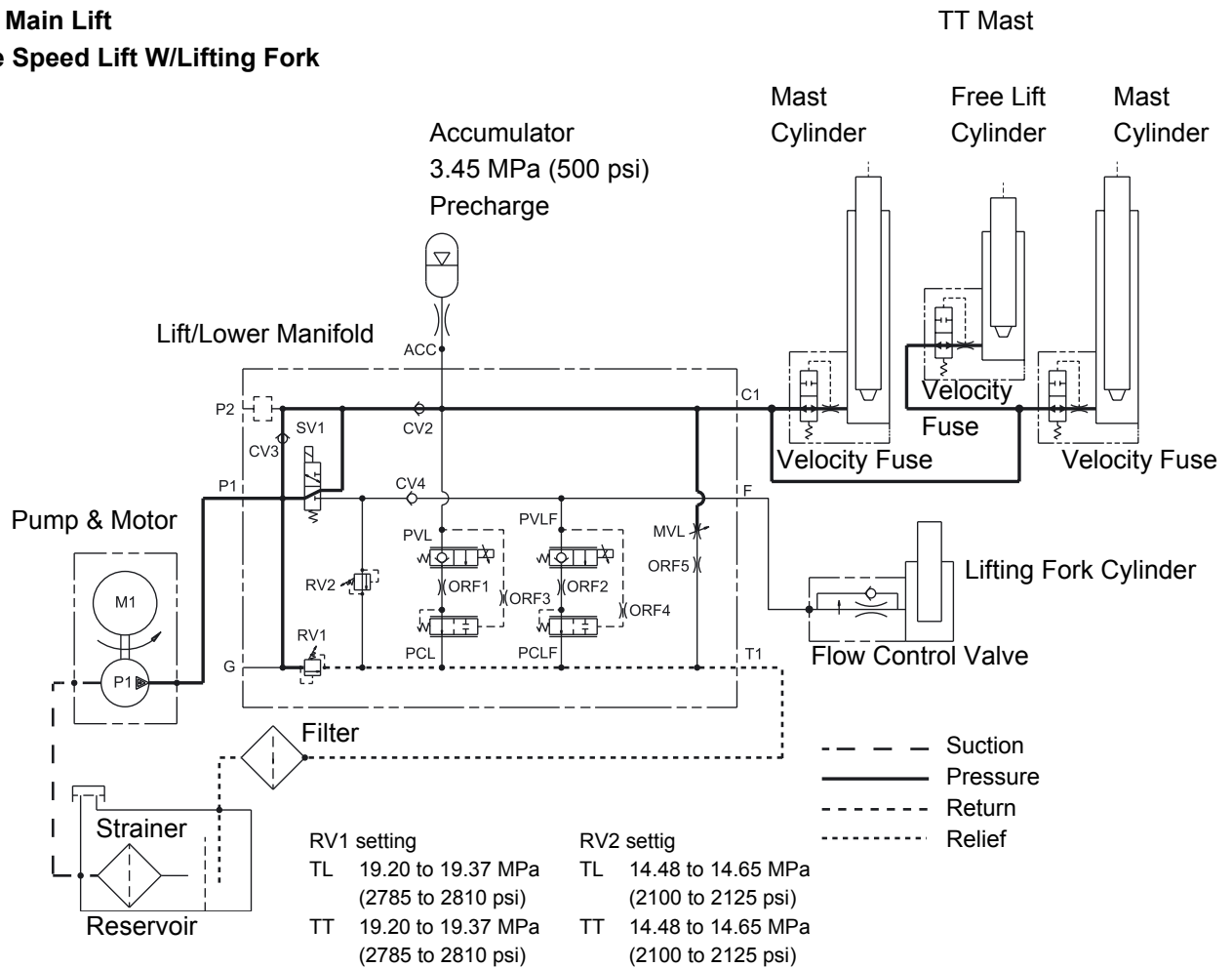
The accumulator is used as a shock absorber for the lift/lower hydraulic system. If the platform is stopped suddenly, the change in oil flow exerts pressure on the hydraulic system. The accumulator absorbs this oil pressure change by using the gas pressurized bladder located within the accumulator. The bladder acts as a pillow to the pressurized oil, cushioning the applied pressure within the hydraulic circuit. The typical symp-



HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

1.0 Main Lift One Speed Lift W/Lifting Fork



13862



Lower Circuit - One Speed/Two Speed Lower

When lower is selected, oil begins to exit the lift cylinder. Oil leaving the cylinder is monitored by the internal velocity fuse in each cylinder.

Velocity fuses are designed to prevent sudden release of hydraulic oil from the cylinder under a condition such as a line rupture. If a cylinder line ruptures, oil exiting the cylinder would create pressure on the velocity fuse, forcing the fuse to close. This will block the oil from exiting the cylinder.

Lower

When the lower button is depressed, oil exits the lift cylinders and enters the lift/lower manifold block through port C1. The oil passes through the open envelope (envelope without a check valve) of the proportional solenoid valve PVL which is in the energized position. Oil is directed from PVL to the pressure compensator valve PCL. PCL limits the maximum oil rate. Once the oil exits PCL, it is directed out of the manifold through port T1. From port T1, oil enters the return line filter then back to the reservoir.

A partially opened proportional valve performs slow speed lowering. High speed lowering is accomplished by completely opening the proportional valve.

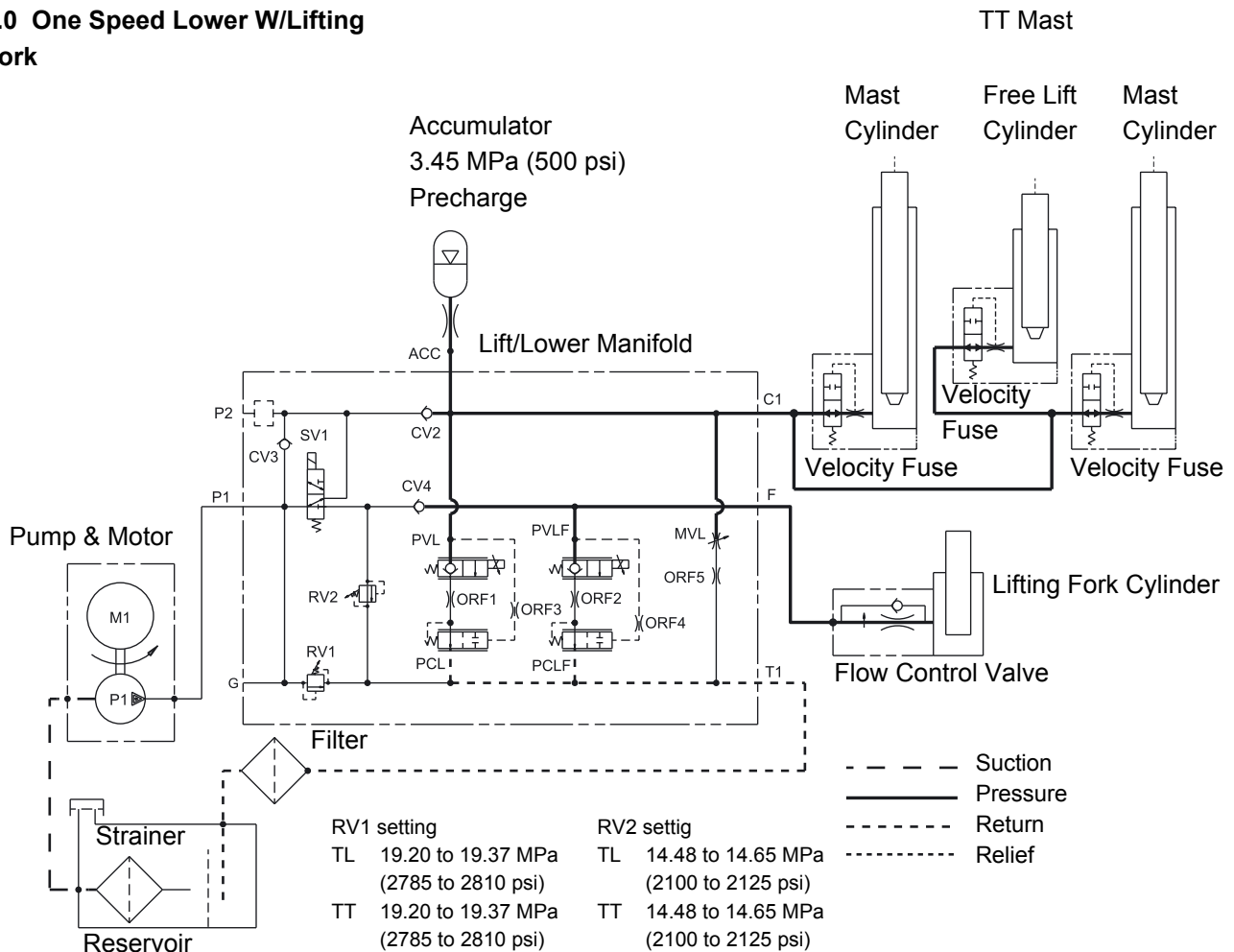
For accumulator operation, see previous page.

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



1.0 One Speed Lower W/Lifting Fork



13861

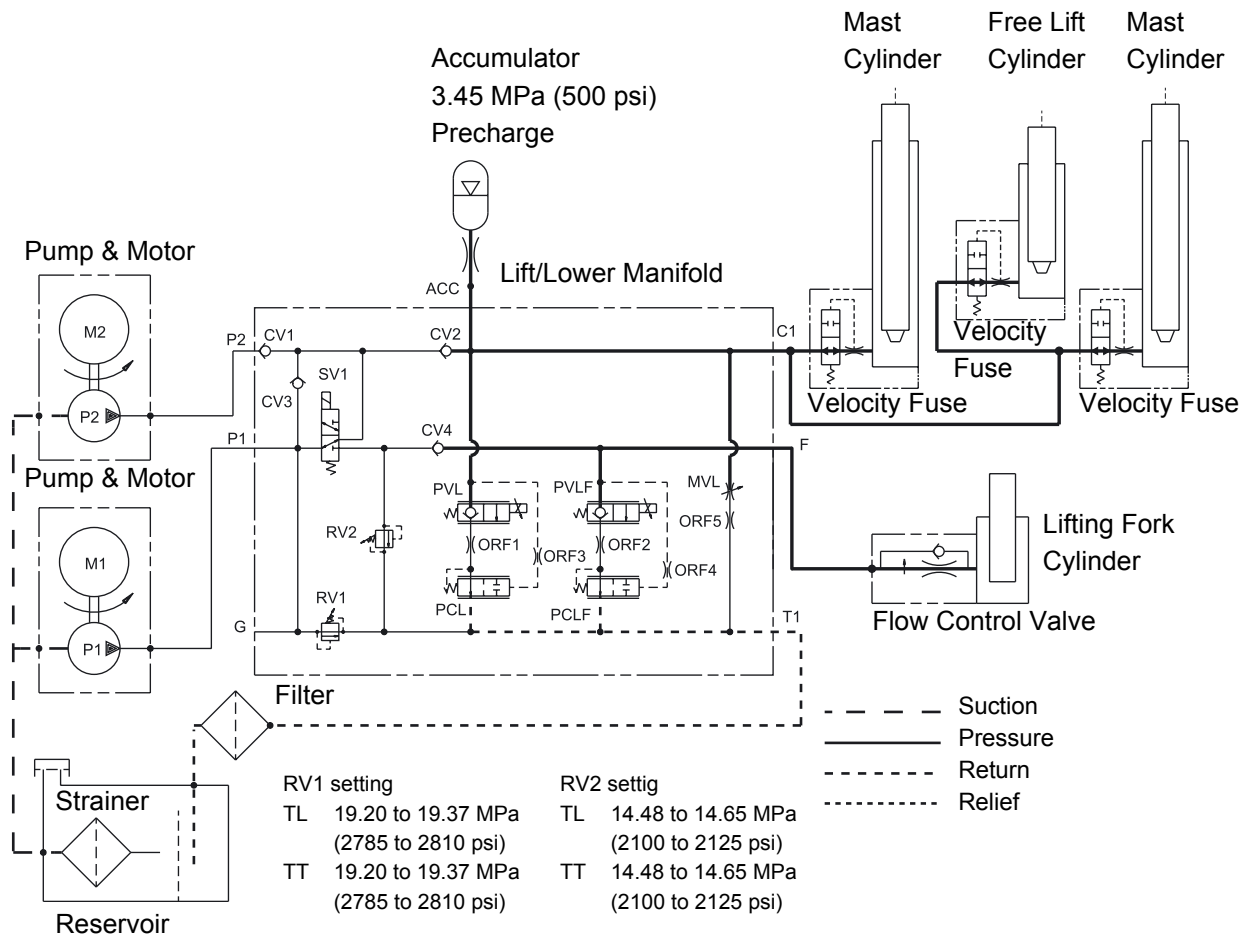


HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

1.0 Two Speed Lower W/Lifting Fork

TT Mast



13864

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS

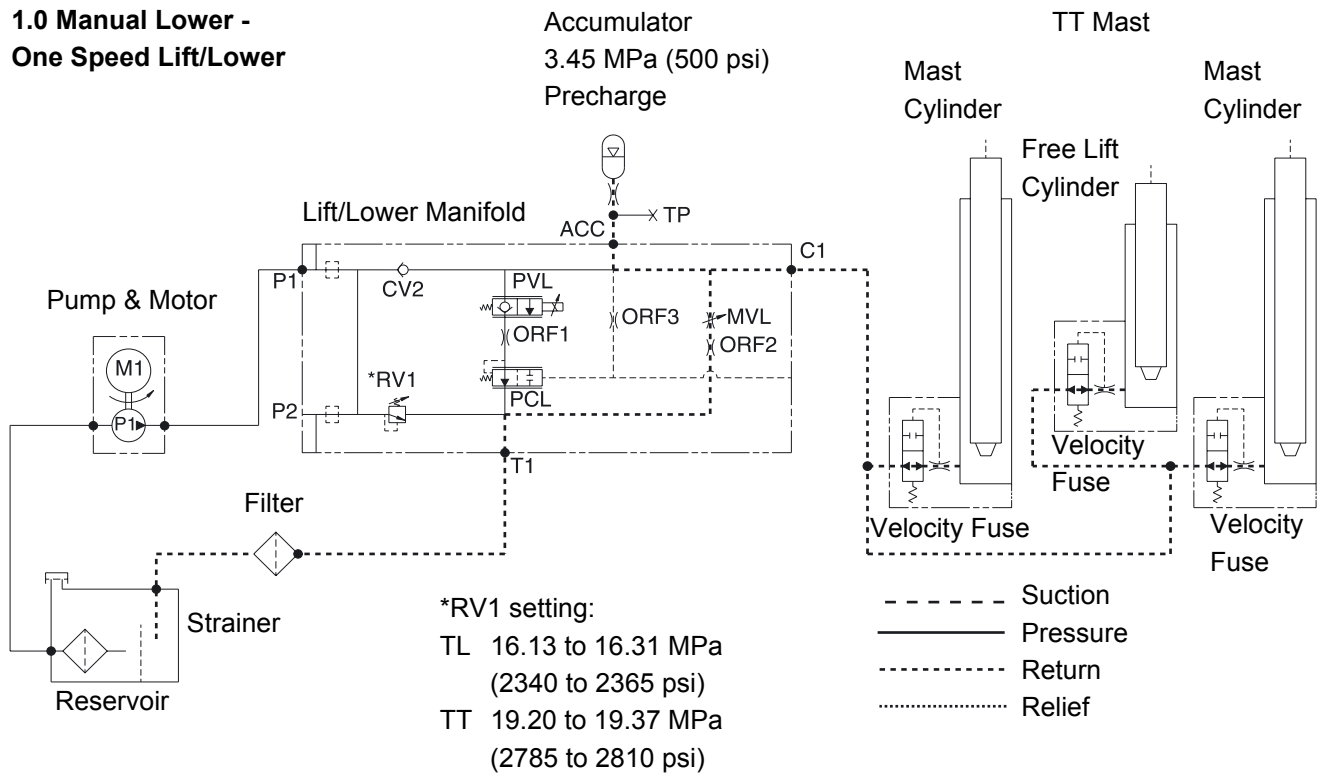


Manual Lower Circuits

The manual lowering feature is used to lower the mast during truck down situations. The manual lowering valve MVL is located on the lift/lower manifold block. When MVL is actuated, oil trapped in the cylinder is

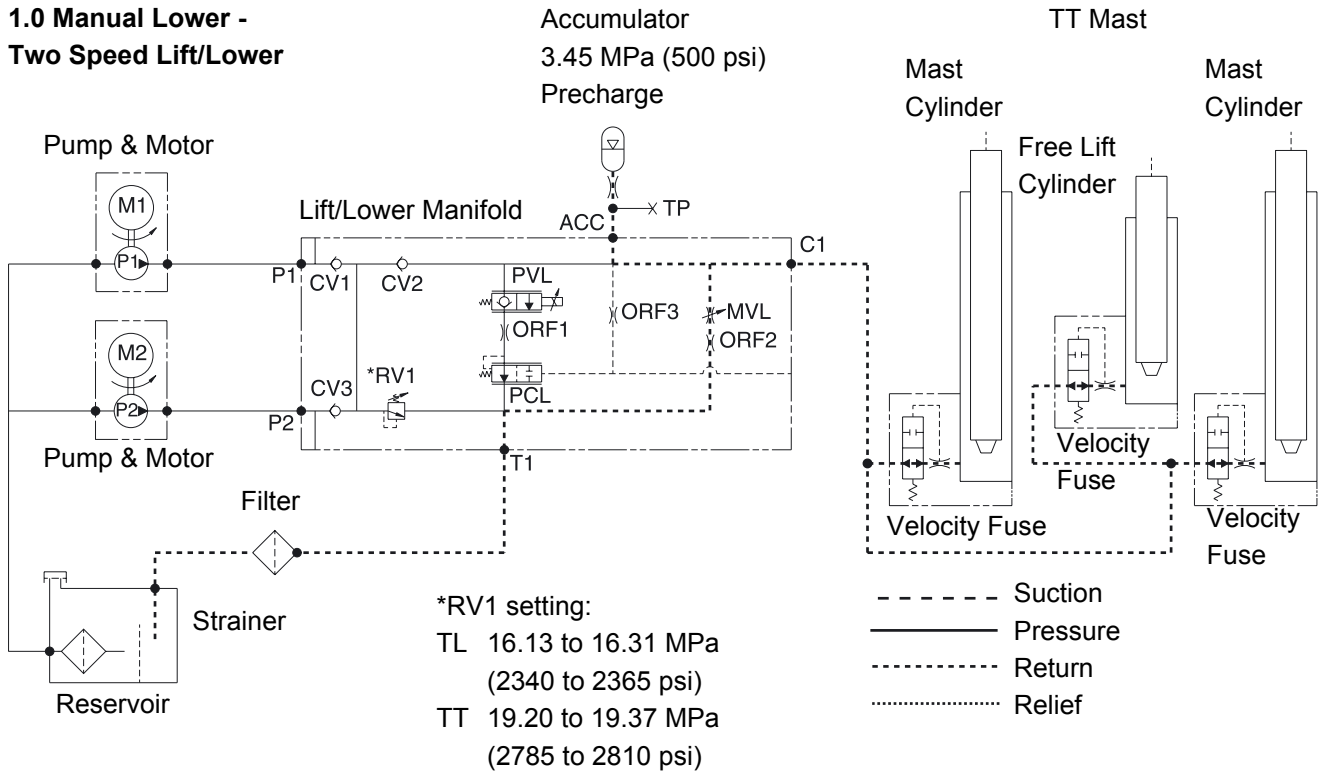
released. Oil enters the lift/lower manifold through port C1. From port C1, the oil flow is directed to the manual lowering valve's open envelope (envelope without check valve). Oil exits the manifold through port T1. From port T1, the oil enters the return line filter then back to the reservoir.

1.0 Manual Lower - One Speed Lift/Lower



12385

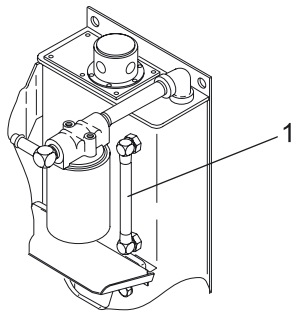
**1.0 Manual Lower -
Two Speed Lift/Lower**



12386

Reservoir

With all cylinders in the retracted position and after all air has been bled from the hydraulic system, fill reservoir so the oil level is at the high mark on the reservoir sight gauge (1). The total capacity of the hydraulic system at this level should be approximately 13 litres (3.5 gallons) for trucks with one speed lift, and 17 litres (4.5 gallons) for trucks with two speed lift.



3243-01

Hydraulic Lines and Fittings

- Blow air through all hose 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 must be replaced if it collapses in normal operating position.
- All hoses and lines are to be clear of any surface or edge which will cause damaging wear and cuts, or on which they can become caught.
- All connections are to be leak free.

HYDRAULIC SYSTEM

HYDRAULIC CIRCUITS



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

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.

Filter

The spin on filter cartridge has been tightened by Crown. When replacing filter, apply a film of oil 063001-001 to the seal and hand tighten until seal snugly contacts filter head.

Information



Do not tighten filter with the use of a wrench. A wrench should only be used for removal of the filter.

Use only a good grade of hydraulic oil such as Mobil DTE 24 (Crown No. 063001-001) or equal. On trucks equipped to operate in below freezing temperatures, Mobil Aero HFA or equal is recommended (Crown No. 063001-006).

Information



Do not use hydraulic brake fluid.

Drift Test

All drift tests should be conducted with a capacity load (refer to serial plate for the rated capacity of your truck). The material used for the test load must be evenly stacked within the limits of a 1220 mm (four foot) square pallet and must be secured to the fork carriage with the forks spread to their maximum width.

Caution!



Never stand or work under a suspended load.

Lift Drift Test

Elevate the test load above staging height. After five minutes, measure the distance the forks have drifted. Drifting in excess of 15 mm (0.5 in) over a five minute period is considered unacceptable.

Information



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

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

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



HYDRAULIC SYSTEM HYDRAULIC CIRCUITS

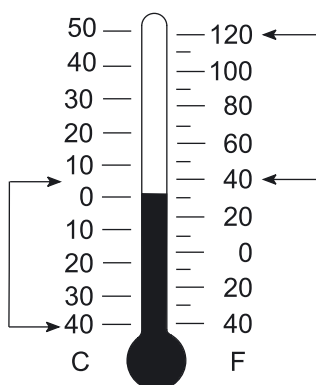
Freezer Preparation

Crown trucks require a low temperature hydraulic oil, Crown P/N 063001-006 (gal.), 100% low temperature oil is too thin if used in higher ambient temperatures and therefore could shorten the life of cylinder packings and pumps.

For truck applications operating continually in temperatures at or above 4° C (40° F), use 100% standard hydraulic oil (063001-001).

For truck applications primarily operating in a freezer environment, use 100 % low temperature hydraulic oil (063001-006).

Standard Hydraulic Oil (063001-001 [100%])



Low-Temp Hydraulic Oil 063001-006 [100%])

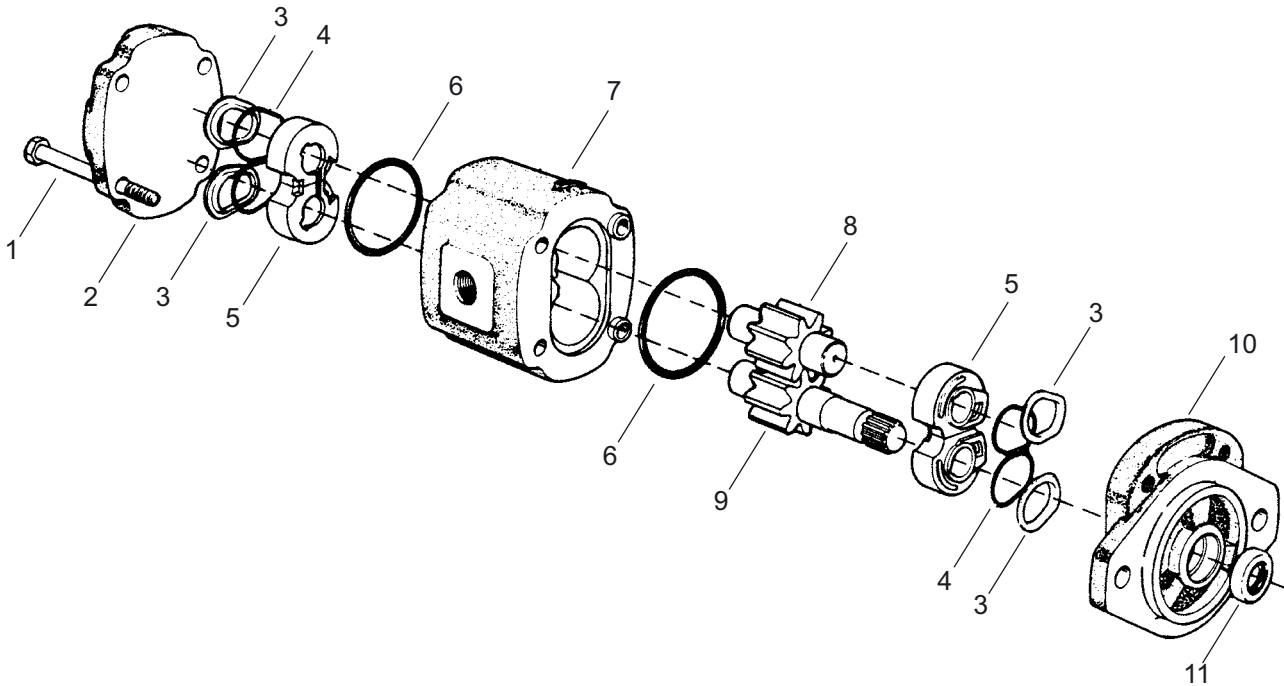
13865

HYDRAULIC SYSTEM

HYDRAULIC PUMP



Hydraulic Pump



9221

Pump - Gear

Overhaul the pump only in a clean, dust-free location, using clean tools and equipment. Dirt or grit will damage the highly polished machined surfaces and will result in leakage or premature failure of the pump.

Before beginning the disassembly, scribe match marks on the body assembly, the end cover and mounting flange to insure that the pump will be reassembled properly.

This pump can be assembled for either clockwise or counter-clockwise rotation as viewed from the end of the splined drive gear assembly. Arrows are moulded in to the body assembly and the word "ROTATION" appears on the mounting flange to aid in determining the pumps rotation. Note which direction the arrow is pointing next to the word "ROTATION" prior to disassembly.

Oil Seal Removal

The oil seal (1, Fig. 9221) is best removed by applying pressure simultaneously to the pump inlet and outlet ports. This has the effect of pressurizing the seal cavity and forcing out the oil seal while ensuring that the pressure on each side of the lobe seals (3, 4 Fig. 9221) is equalized so that these seals are not displaced.

If the oil seal is distorted and leaking badly, it may not be possible to build up sufficient pressure to remove it in this way.

In this case, disassemble the pump as far as step 5 of the "Disassembly Procedure" and clamp the mounting flange securely in a soft-jawed vice. The seal can then be removed with the use of a seal removing tool. Be careful not to damage the mounting flange seal bore or the drive shafts sealing surface.



HYDRAULIC SYSTEM

HYDRAULIC PUMP

Oil Seal Replacement

1. Make sure the seal housing in the pump mounting flange is clean and free from burrs.
2. Pack the space between the lips of the seal with a high melting point, mineral based grease.
3. Seat the oil seal.
 - If the mounting flange has been removed:
Start the oil seal squarely into the housing, with the garter spring facing inward and press home to the full depth of the recess.
 - If the pump is assembled:
Slide an “Assembly Sleeve” (available from Crown [#93170]) over the shaft splines until it comes in contact with the shaft shoulder. Lightly grease the sleeve. Slide the oil seal, with the garter spring facing inwards, over the sleeve and start it squarely into the housing.
4. Press the seal into the full depth of the recess.
5. Remove the Assembly Sleeve.
5. Fit an “Assembly Sleeve” tool (available from Crown [#93170]) over the splines on the drive shaft before withdrawing the mounting flange. Lightly tap the mounting flange clear of the two hollow dowels in the pump body and slide it squarely off of the shaft.
6. Carefully lift out the body O-ring seal (6, Fig. 9221), the two backing washers (3, Fig. 9221) and the lobe seal (4, Fig. 9221).
7. Hold the pump body vertically with the mounting flange end downward and with one hand underneath to prevent the bushings (5, Fig. 9221) from falling out. Tap the side of the body with a rawhide mallet to dislodge the lower bushings, and slide them carefully out of the body. Keep the bushings as a pair and place them on or near the mounting flange.
8. Invert the body and lift out the drive (9, Fig. 9221) and the idler (8, Fig. 9221) gears.
9. Remove the remaining pair of bushings as described in step 7 and place on or near the end cover.

Pump Disassembly

1. Remove the bolts which hold the pump to the lift motor.
2. Lightly mark or scribe the end cover (2, Fig. 9221), the body (7, Fig. 9221) and the mounting flange (10, Fig. 9221) to ensure re-assembly in the correct relationship. Also note the direction of rotation of the pump.
3. Loosen the bolts and lock washers (1, Fig. 9221) and pull out the bolts.
4. Remove the end cover (2, Fig. 9221) and carefully lift out the two backing washers (3, Fig. 9221), the lobe seals (4, Fig. 9221) and the body O-ring seals (6, Fig. 9221). The body seal is a moulded rubber

seal on early pumps but changed to an O-ring on newer units (Specify when ordering).

Parts Inspection

Wash all metal parts thoroughly with a good cleaning fluid. Inspect, in the order disassembled, for wear and damage.

Body

To obtain high efficiency the design allows for the tips of the gear teeth to wipe the walls of the body bores when the pump is running. Pressure will force the gears against the inlet side of the bores a wear pattern will be visible in this area.

If excessive wear of the bushing inserts or gear journals occurs, this wear pattern will deepen to form a

HYDRAULIC SYSTEM

HYDRAULIC PUMP



step in the bore. Examine the body bores and if a pronounced step is felt, the body should be rejected.

It is not advisable to fit worn bushings into a new body. Check to make sure the two hollow dowels are not loose.

Composite Bushings.

Information



If new bushings are to be used in an old body, check for any burrs at the edge of the wear track. If present, this burr must be polished out or it may hold the bushing faces away from the gears and increase the internal leakage.

Examine the bearing inserts for signs of wear and check the bushing faces adjacent to the gears for scoring or pitting.

Make sure the holes and slots in the bushings are not plugged. Light scores on the bushings faces can be polished out on a lapping plate

Gears.

Information



Bushings and/or gears are matched for widths within 5 μm (0.0002 inch) and can only be sold and replaced as a matched pair.

Examine the gears for discoloration, caused by overheating. Check the shafts for scoring. Make sure the contact marks on the teeth are evenly distributed across each tooth surface and that none of the teeth are chipped.

End Cover

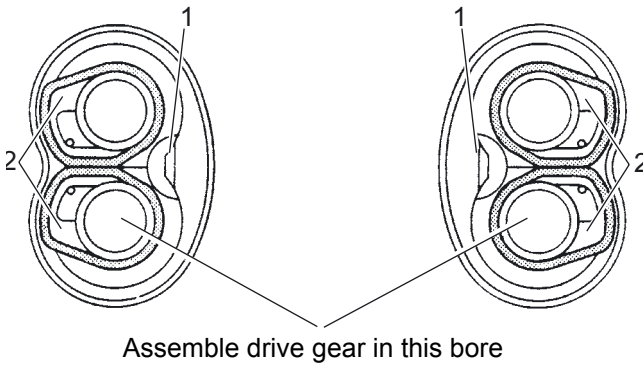
Examine the cover to insure flatness and inspect for scoring and pitting.

Mounting Flange

Check for damage and check the condition of the oil seal. If the seal needs replacement, refer to the "Oil Seal Replacement" section

Pump Reassembly

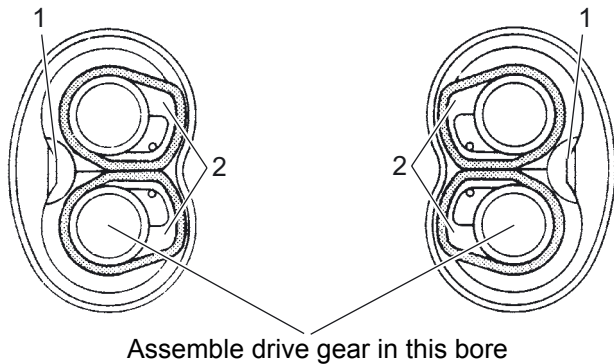
Clockwise Rotation



9223-EU-CW

- 1 Flat
- 2 Bushing lobes

Counter - Clockwise Rotation

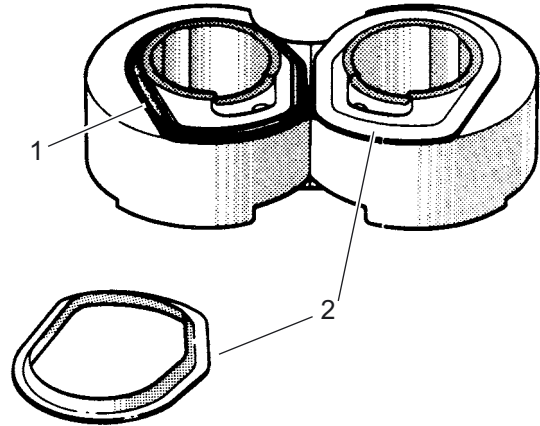


9223-EU-CC

- 1 Flat
- 2 Bushing lobes

Make sure that all pump components are perfectly clean and lubricated with the hydraulic oil to be used in the pump, prior to assembly.

Prepare the bushings (index 5) for mounting flange end of the body for assembly as follows:.



9222-EU

- 1 Lobe Seal
- 2 Backing Washers

– Place the bushings on the workbench with their lobes up and the flats in contact. Lubricate the lobe seal (1, Fig 9222-EU) with a mineral based grease and fit it around the bushing lobes. Fit a backing washer (2, Fig 9222-EU) inside each lobe seal. When fitted correctly, the backing washer must be level and flush with the top surface of the bushing lobes.

10. Prepare the bushings for the cover end of the body for installation into the pump in the same manner.
11. Pack the space between the lips of the oil seal (11, Fig. 9221, Page 106) with a high melting point, mineral based grease.
12. Pick up the body and hold it with the hollow dowels up and with the fingers of one hand inside the bores of the body, ready to support the bushings.
13. Pick up the mounting flange bushing complete with lobe seal and backing washers, and slide them into the body bores with the lobes facing outwards and away from the flat at the intersection of the body bores. The bushings must be inserted squarely into the bores and must be kept square to each

HYDRAULIC SYSTEM PUMP REASSEMBLY



other. Do not use force when installing the bushings. If the bushings should cock in the bores, remove them and examine for scored body walls. Light scoring can be stoned out with a fine grit hand stone.

14. Lubricate the body seals O-ring (6, Fig. 9221, Page 106) with a mineral based grease and seat it in the body.
15. Refer to figure 9223-EU-CC and 9223-EU-CW on page 109 to find the position of the drive gear bore for the direction of rotation you require. Lay the pump body on its side and slide the drive gear (9, Fig. 9221, Page 106) through the drive gear bore so that the shaft protrudes out of the hollow dowel end of the body.
16. Slide the "Assembly Sleeve" (Part No. 93170) over the end of the splined shaft. Hold the drive gear journal with one hand and slide the mounting flange (10, Fig. 9221, Page 106) squarely over the shaft and onto the two hollow dowels, flush against the body. The "Assembly Sleeve" provides a lead-in for the oil seal. Remove the "Sleeve" and clamp the mounting flange in a soft jawed vice with the pump body above the flange. If the sleeve is stuck on the splines it can be removed by tightening a 1/4"-28 bolt into the end of the "Assembly Sleeve".
17. Check that the bushings are flush against the mounting flange face and that the lobe seals (4, Fig. 9221, Page 106) and backing washers (3, Fig. 9221, Page 106) have not become dislodged. Check to see that the arrow on the body, adjacent to the word "ROTATION" is pointing in the correct pump rotation.
18. Mesh the idler gear (8, Fig. 9221, Page 106) with the drive gear. If the original gears are being replaced on a new shaft, make sure that the marked side of the teeth are in contact so the bedded-in position of the teeth is maintained.
19. Pick up the bushings for the end cover side of the pump, complete with lobe seals and backing wash-

ers and slide them over the gear journals with the lobes facing outward and away from the flats in the bores. Again, the bushings must be installed squarely and without force.

20. Lubricate the body seal O-ring (6, Fig. 9221, Page 106) and seat it in the body.
21. Place the end cover in position, aligning the scribe marks made earlier.
22. Insert the bolts and lock washers into the body and hand tighten into the tapped holes in the mounting flange. Apply a torque load of 47 - 50 Nm (34 to 36 ft lbs.) to each bolt head.
23. Pour a small amount of hydraulic oil into the ports and check the pump for freeness and direction of rotation.

START UP PROCEDURE

A pump that has been re-assembled with new gears, bushings or body must be carefully broke-in before it is subjected to full load working conditions.

When test rig facilities are not available the following procedure must be carried out:

1. Install the pump on the application.
2. Where the pump speed is variable set the speed to 1 500 1/min.; otherwise run the pump at its normal operating speed.
3. Run the pump at this speed for a period of 10 minutes at minimum pressure, that is, with the hydraulic system unloaded.
4. If the pump operating pressure can be directly controlled, ensure that the pressure is progressively increased up to full working requirements over the first hour of operation. In circumstances where the pressure cannot be directly controlled the same effect can be obtained by progressively increasing the work load on the machine, over the same period of time.



HYDRAULIC SYSTEM PUMP REASSEMBLY

5. During this period make frequent checks of the pump casing temperature, or the oil temperature, if a temperature gauge is included in the system. The temperature should not exceed that experienced under normal working conditions. If the temperature does rise excessively then it is possible that the pump has been assembled incorrectly and it must be dismantled to check this. If no fault is found then further period of running-in at low pressure, as in step 3, must be carried out.

HYDRAULIC SYSTEM

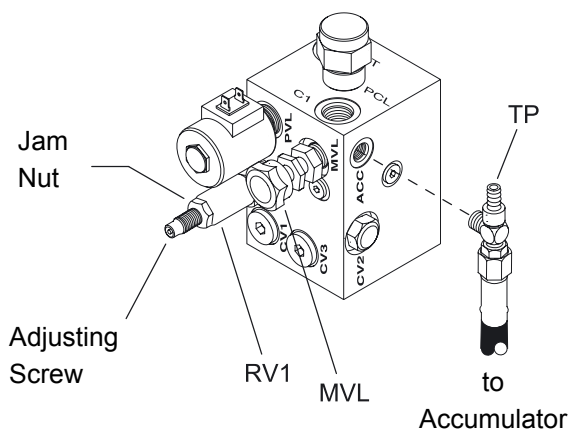
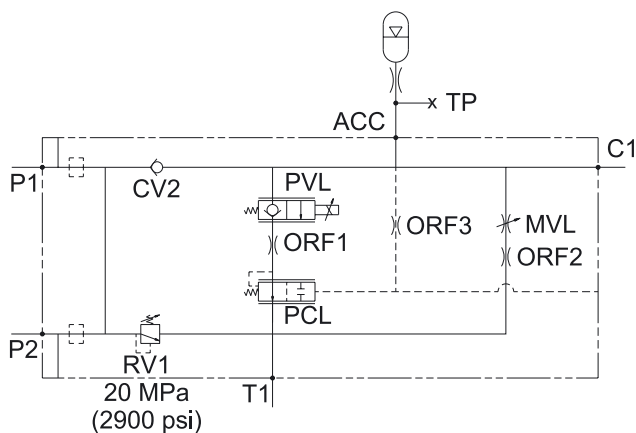
LIFT/LOWER CONTROL VALVE



Lift/Lower Control Valve

Relief Valve- RV1 Operation

The lift system is protected from excessive oil pressure by RV1. This relief valve senses pressure at the valve inlet. If the pressure within the system exceeds the pre-set level, the relief valve will open and relieve pressure by directing oil to the reservoir thus maintaining a maximum pressure limit for the system.



13824

Adjustment (1.25 Trucks)

To adjust lift relief valve (RV1), refer to Figure 13824 and proceed as follows:

1. Connect a 0 - 35 MPa (0 - 5000 psi.) pressure gauge to the test port on the lift/lower manifold.
2. If the truck is capable of two-pump operation, insure that both pumps are running when the relief valve is being set.
3. Operate the hydraulic system until the oil temperature is between 37° and 54° C (100° and 130° F).
4. Loosen the jam nut on the lift relief valve (RV1) so the relief valve can be adjusted.
5. Lift against a weight large enough to prevent platform raise. Hold the RAISE button in completely so that the lift pump(s) are running.
6. Adjust lift relief valve (RV1) until pressure gauge reads within the pressure range as shown in Chart 1. Then tighten the jam nut to secure the pressure setting.

CHART 1

MAST TYPE	SET PRESSURE MPa	SET PRESSURE psi
TL	16.13 - 16.31	2340 - 2365
TT	19.20 - 19.37	2785 - 2810

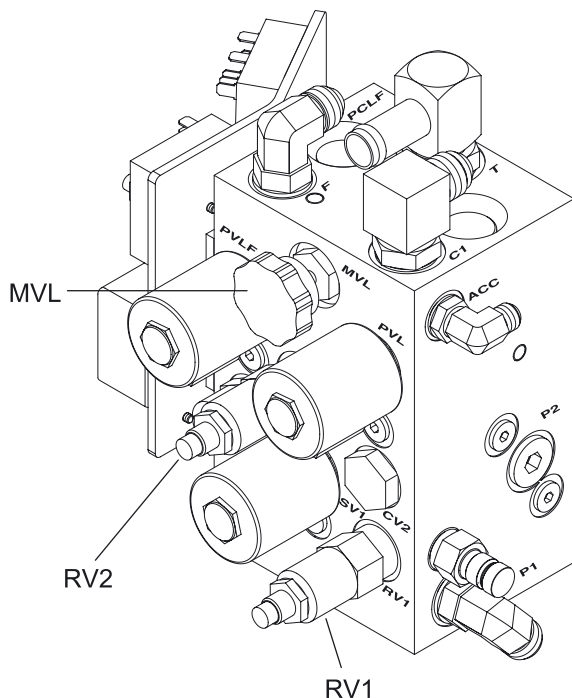
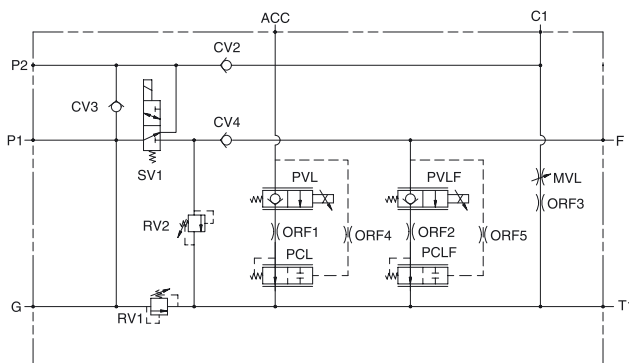
7. Lower the platform using either the manual lowering valve or the solenoid valve. Then raise the platform and recheck the pressure setting. Readjust the valve setting if the pressure is not within the range shown in Chart 1. Make certain to tighten the jam nut on the relief valve to secure the pressure setting.
8. Apply security sealant to the relief valve threads.



HYDRAULIC SYSTEM LIFT/LOWER CONTROL VALVE

Relief Valve- RV1 & RV2 Operation

The lift system is protected from excessive oil pressure by RV1 and RV2. These relief valves sense pressure at the valve inlet. If the pressure within the system exceeds the preset level, the relief valves will open and relieve pressure by directing oil to the reservoir thus maintaining a maximum pressure limit for the system.



13825

Adjustment (1.0 Trucks)

To adjust lift relief valves (RV1 & RV2), refer to Figure 13825 and proceed as follows:

1. Connect a 0 - 35 MPa (0 - 5000 psi.) pressure gauge to the test port on the lift/lower manifold.
2. If the truck is capable of two-pump operation, insure that both pumps are running when the relief valves are being set.
3. Operate the hydraulic system until the oil temperature is between 37° and 54° C (100° and 130° F).
4. Loosen jam nuts on lift relief valves (RV1 & RV2) so the relief valves can be adjusted.
5. Lift against a weight large enough to prevent platform raise. Hold the RAISE button in completely so that the lift pump(s) are running.
6. Adjust lift relief valve (RV1) until pressure gauge reads within the pressure range as shown in Chart 2. Then tighten the jam nut on lift relief valve (RV1) to secure the pressure setting.

CHART 2

MAST TYPE	RV1 set Pressure (MPa)	RV1 set Pressure (psi)	RV2 set Pressure (MPa)	RV2 set Pressure (psi)
1,0 TL	19.20-19.37	2785-2810	14.48-14.65	2100-2125
1,0 TT	19.20-19.37	2785-2810	14.48-14.65	2100-2125

7. Using aux raise, adjust lift relief valve (RV2) until pressure gauge reads within the pressure range as shown in Chart 2. Then tighten the jam nut on lift relief valve (RV2) to secure the pressure setting.

HYDRAULIC SYSTEM

LIFT/LOWER CONTROL VALVE



8. Lower the platform using either the manual lowering valve or the solenoid valve. Then raise the platform and recheck the pressure settings for both relief valves. Readjust the valve settings if the pressure is not within the ranges shown in Chart 2.

Make certain to tighten the jam nuts on the relief valves to secure the pressure settings.

9. Apply security sealant to the relief valve threads.

CHART 3

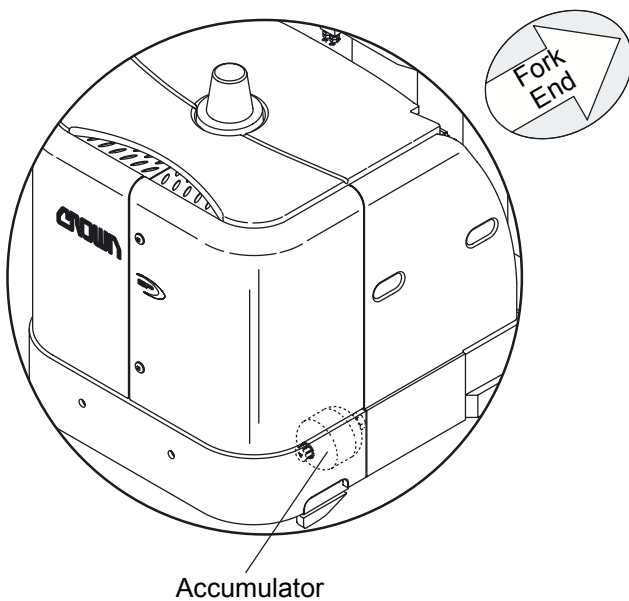
Troubles	Probable Cause	Remedy
Oil leaks around manifold.	Defective O-rings in cartridge valves or port connector fittings	Replace O-rings.
Platform will not raise (pump(s) runs).	Relief valve stuck in the open position.	Replace relief valve.
	Solenoid valves or manual valve stuck in the open (free flow) position.	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.	Check valve stuck in the open position.	Actuate lift button several times to try to dislodge debris. If that does not work, replace check valve.
Platform will not raise capacity load.	Relief valve RV1 not adjusted properly or stuck in open position.	Readjust relief valve. See CHART 1.
Platform or forks drift down in excess of drift test.	Defective O-rings on check valves, solenoid valves, manual valve or relief valve.	Replace O-rings or back-up rings. Check valve cavity at O-ring sealing area for nicks or rough surfaces.
	Debris caught in check valve seats.	Actuate the valve(s) and try to dislodge debris. If that does not work, replace valve.
	Manual valve not closed properly.	Close manual valve or replace.
Platform will not lower.	Solenoid coil failure.	Replace solenoid coil.
	Cylinder malfunction.	Refer to chapter 8.
	Electrical malfunction.	Refer to chapter 4.
Lifting forks will not raise, pump(s) run	Relief valve RV2 stuck in open position or not adjusted properly.	Readjust relief valve.
		Replace RV2 relief valve.
	Solenoid valve SV1 or SV3 stuck in actuated position.	Check to see that valves are not over-tightened (18-19 Nm or 160-170 in. lbs.). Check for faulty coil.
Lifting forks will not lower	Solenoid valve SV3 stuck in actuated position.	Check to see that valves are not over-tightened (18-19 Nm or 160-170 in. lbs.). Check for faulty coil.
	Electrical malfunction.	Refer to chapter 4.



HYDRAULIC SYSTEM ACCUMULATOR

Accumulator

The accumulator is a device in which compressed gas and oil is stored for the purpose of absorbing shock. When the oil pressure in the line rises, incoming oil compresses the gas. As the surge of oil pressure passes, the gas expands to its original size, forcing out oil. This reduces vibrations and shock in the system and reduces shock when contacting stops during lift and lower.



10573

Use an inert gas, such as Nitrogen for precharging or topping off of accumulators. Size "T" bottle dry nitrogen, 8.5 m³ (300 cu. ft.), 2600 P.S.I. (17.9 MPa) is recommended.

Warning!



Never use oxygen as a charging agent for accumulators. Use only dry nitrogen as a charging agent for accumulators.

If the gas pressure in the nitrogen bottle is higher than the maximum operating pressure of the accumulator, a gas pressure reducing valve must be used.

Crown has available a 103623-004 Accumulator Charging Tool, designed for charging and testing bladder and/or diaphragm type nitrogen charged accumulators.

The accumulator must be removed from the truck prior to testing or charging.

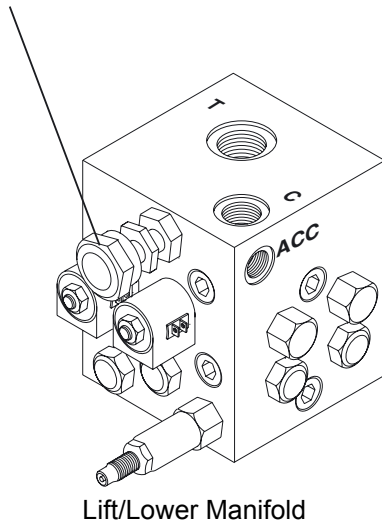
Precharging

1. Lower platform completely.
2. Turn key switch Off, disconnect battery and chock wheels.
3. Open the power unit doors and locate the lift manifold. Open the manual valve (MV1) to remove oil pressure from oil side of the accumulator.

HYDRAULIC SYSTEM ACCUMULATOR

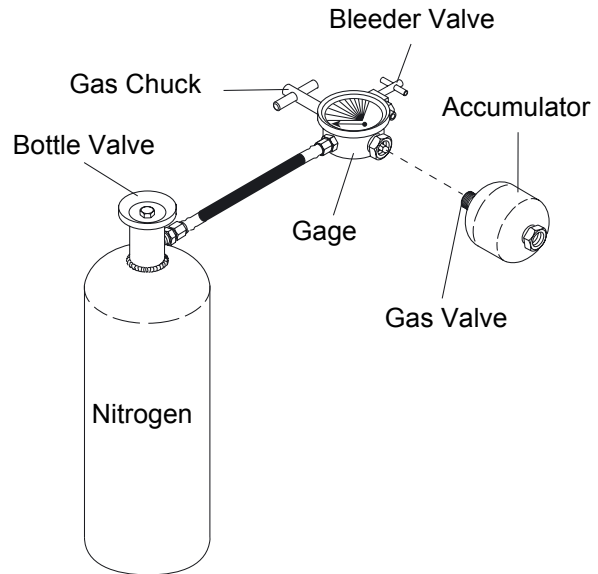


Manual Valve MV1



Lift/Lower Manifold

3241



3239

4. Disconnect the hose from the accumulator, located below the oil reservoir, loosen mounting clamp and remove accumulator. Refer to Illustration 1.

Information



Since this procedure disconnects oil line, care should be taken to catch as much oil as possible.

5. Remove dust cap from accumulator gas valve.
6. Use thread sealing and lubricating compound on pipe threads of gage.
7. Attach one end of charging hose to the nitrogen bottle and the other end to the accumulator charging tool. Refer to Illustration 3. Procedure is similar when using only charging hose with or without other accessories.
8. Back gas chuck stem all the way out before attaching assembly to accumulator gas valve.

9. Use wrench to tighten gas chuck swivel nut onto accumulator gas valve. Close bleeder valve.
10. Use gas chuck stem to loosen gas valve in accumulator.
11. Slowly open nitrogen bottle valve to fill accumulator. Once the pointer on the gage starts to deflect unscrew the gas chuck stem one full turn. The charge should be over a 2 to 4 minute period to assure a proper charge and to prevent damage to accumulator. Shut off when gage indicates proper charge. Use the gas chuck stem to tighten gas valve in accumulator to 11 Nm (8 ft. lb.). The pre-charge pressure setting is 3445 kPa (500 p.s.i.).



HYDRAULIC SYSTEM ACCUMULATOR

Caution!



Do not loop or twist hose as it will stiffen when gas pressure is released from nitrogen bottle.

Never loosen swivel nut attached to gas valve in accumulator without first backing gas chuck stem out all the way.

Do not reduce accumulator precharge by depressing valve core (high pressure may rupture rubber valve seat).

12. If desired precharge pressure is exceeded, make sure nitrogen bottle valve is closed, then open bleeder valve slightly, but only momentarily, to reduce pressure.
13. Once desired accumulator charge has been achieved, remove Accumulator charging tool.
14. With the use of sealing spray or soapy water, check accumulator for leaks.
15. Replace dust cap on accumulator and install on truck.
16. Reconnect battery.
17. To bleed air from the accumulator, the empty forks should be raised to sufficiently pressurize the lift cylinders.

Information



Since this procedure disconnects oil line, care should be taken to catch as much oil as possible.

18. Slowly loosen the hose connection at the accumulator until an air-oil mixture is released.

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 experience with this type of injury.

19. Continue until a solid stream of oil is achieved.
20. Tighten connector.
21. Remove wheel chocks and return truck to service.

HYDRAULIC SYSTEM MAINTENANCE



Maintenance

The following Troubleshooting Chart contains general information necessary to effectively solve the more common hydraulic problems. Know the system to the best of your ability. Understand the components and their function within the system. Develop a systematic pattern to locate and solve the various hydraulic problems that occur. The ability to identify problems and

proceed in solving the problem grows with experience. The following chart contains symptom, probable cause and remedy. The information is general in nature and a remedy may simply refer you to a maintenance section that has more complete troubleshooting. Use the chart(s) carefully and completely. Do not make the system more complicated than necessary. Do not overlook the simplest reason(s) for a hydraulic problem.

Hydraulics Troubleshooting Chart

Symptom	Probable Cause	Remedy
Hydraulic oil foaming	Introduction of air into pump	Check reservoir oil level. Check for proper oil viscosity. Check plumbing.
	Water in oil	Check reservoir.
Hydraulic oil overheating *	Oil too thin *	Change to proper viscosity oil.
	Oil contaminated	Change filters and fill with clean oil.
	Introduction of air into pump	Check plumbing.
	Oil level low	Fill reservoir to proper level.
Platform/Lifting Forks will not raise	Mast assembly binding	Inspect mast for damage or misalignment.
	# Carriage damaged/misaligned	# Inspect carriage for malfunction.
	Lift motor or pump not operating	Refer to pump troubleshooting.
	Manual lowering valve open	Refer to valve assembly troubleshooting, page 114.
	Relief valve setting incorrect	Reset relief valve.



HYDRAULIC SYSTEM MAINTENANCE

Symptom	Probable Cause	Remedy
Platform/Lifting Forks will not lower	Velocity fuse actuated	Check for severe oil leak. Check for more than capacity load. Flow control valve reset. Raise slightly to reset velocity fuse.
	Chain slack switch actuated	Platform/Forks resting on obstruction. Raise slightly to eliminate chain slack.
	Solenoid valve malfunction	Refer to valve assembly troubleshooting, page 114.
	Binding in mast assembly	Inspect mast & platform for damage, misalignment, etc.
	# Carriage binding	# Inspect carriage for damage or misalignment.
Lowers too slow	Debris in flow control valve	Cycle through lift/lower to free possible debris.
	Line restriction	Check plumbing.
	Accumulator malfunction	Check accumulator operation.
	Binding in mast assembly	Inspect mast & platform for damage, misalignment, etc.
	# Carriage binding	# Inspect carriage for damage or misalignment.
Lowers too fast	Debris in flow control valve	Cycle through lift/lower to free possible debris.
	External oil leak	Check plumbing for leak(s).
	Accumulator malfunction	Refer to accumulator maintenance section, page 115.
No hi-speed raise	HSRCS switch malfunction	Check HSRCS switch operation.
	RAS switch malfunction in control module	Refer to switch information chapter 4.
No hi-speed lower	HSLCS switch malfunction	Check HSLCS switch operation.
	LOS switch malfunction in control module	Refer to switch information section 4.
	Solenoid valve malfunction	Refer to valve assembly troubleshooting, page 114.
	Line restriction	Check plumbing.
No cushion during raise or lower	Accumulator malfunction	Charge accumulator properly. Refer to page 115.
	Damaged cushion springs or bumpers	Inspect for damage.

HYDRAULIC SYSTEM MAINTENANCE



Symptom	Probable Cause	Remedy
Will not lift capacity load	Relief valve not adjusted properly	Adjust relief valve. Refer to valve assembly, page 112.
	Mast binding	Inspect mast for damage, misalignment, etc.
	# Carriage binding	# Inspect carriage for damage or misalignment.
	Hydraulic component(s) malfunction	Refer to hydraulic pump page 106 & misalignment.
Platform drifts down (in excess of drift test)	Debris in lift/lower valve	Cycle through lift/lower to free possible debris.
	Lift cylinder packings leaking	Refer to cylinder information chapter 8.
Accumulator loses charge	Accumulator valve leaking, cracked, deformed, etc.	Repair. Refer to accumulator maintenance, page 115.
Abnormal hydraulic oil usage	External leak	Check plumbing, cylinder, other hydraulic components.
Lift pump & motor overheating *	Relief valve setting too high	Reset relief valve. Refer to hydraulic maintenance, page 112.
	Exceeding capacity load	Check load weight.
	Worn or damaged pump & motor	Inspect pump & motor. Repair or replace.
	Fluid level low	Inspect fluid level. Fill system to proper level. Refer to chapter 2.
Failure of platform to raise and lower smoothly	Lift chains not adjusted properly	Adjust chains.
	Mast and/or platform binding	Inspect mast & platform for damage, wear, etc.
	# Carriage binding	# Inspect carriage for damage or misalignment.
	Hydraulic component malfunction	Inspect pump, motor, valve, cylinder, etc. for damage, leaks, wear, etc.
	Accumulator malfunction	Refer to page 115.
	Air trapped in cylinder	Bleed.

* Be sure the truck has been performing its normal duty cycle at this time. Trucks equipped to operate in freezer require a thinner weight oil.

Pertains to Lifting Fork Stockpickers Only.



DRIVE UNIT

Notes:



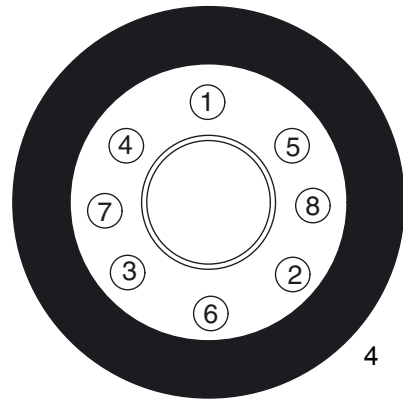
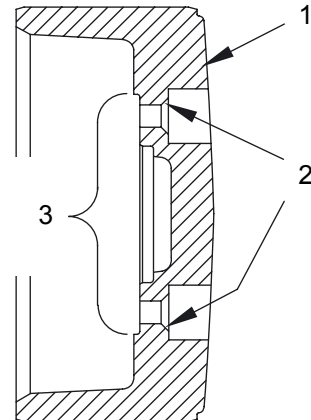
DRIVE UNIT DRIVE TIRE REPLACEMENT

Drive Tire Replacement

When replacing the drive tire, make sure the composition and size are such that maneuverability and braking requirements are maintained. The drive tire is a “press-on” type; press the old tire off the hub and press new tire on.

1. Disconnect battery and chock wheels.
2. Raise and block the power unit so drive tire is off of the floor. Loosen and remove the 8 lug bolts and remove wheel and hub from drive unit.
3. Remove old drive tire and replace with new drive tire. The outside of the hub must be pressed flush with the outside edge of the tire.
4. Inspect hub and remove any paint that may be present on tapered lug seats or on inner hub face that contacts truck axle. See Illustration 11150.
5. Finger tighten lug bolts, then tighten to 135/150 Nm (100/110 ft. lbs.) making sure that they are tightened in the sequence shown in Illustration 11150.

If Present, Remove Paint on Tapered Lug Seats and on Inner Hub Face that Contacts Truck Axle.



11150

- 1 Hub
- 2 Tapered lug seats
- 3 Inner hub face
- 4 Tighten lug nuts in sequence shown

6. Remove blocks, lower power unit, connect battery and remove wheel chocks.

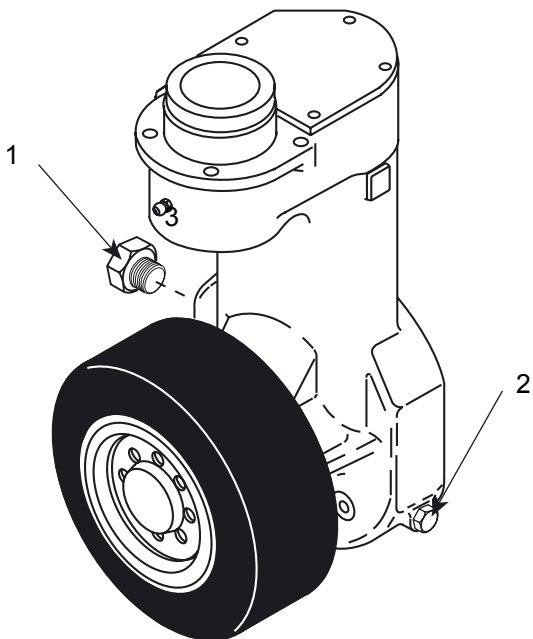
DRIVE UNIT

DRIVE UNIT LUBRICATION



Drive Unit Lubrication

The drive unit has a capacity of approximately 1000 ml (1.5 pints) of 90W gear lube Crown no. 063002-003. The drive unit has a capacity of approximately 1000 ml (1.5 pints) of 90W gear lube, Crown no. 063003-003 (or 063001-023, ATF for trucks operating in freezer applications below 0°C [32°F]). Remove drain plug to completely drain unit. To fill, remove fill plug. Add gear oil until present at oil level check plug. Refer to Illustration 3512.

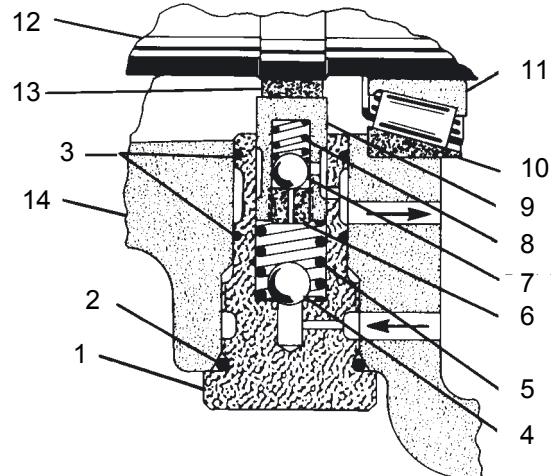


3512

- 1 Fill & Oil level check plug
- 2 Drain plug

Oil Pump Disassembly (Refer to Illustrations 1895 & 13131)

1. Disconnect battery and chock wheels.



1895

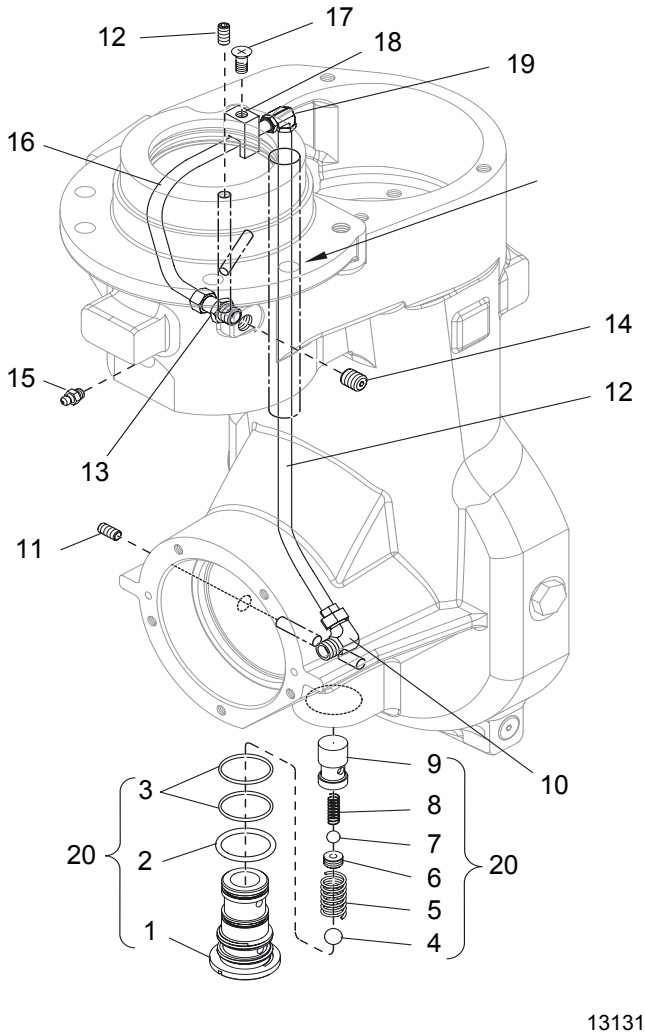
- 1 Oil pump housing
- 2 O-ring
- 3 O-ring
- 4 Ball
- 5 Spring
- 6 Plug special
- 7 Ball
- 8 Spring
- 9 Piston
- 10 Bearing cup
- 11 Bearing cone
- 12 Axle
- 13 Cam
- 14 Drive unit housing



DRIVE UNIT

DRIVE UNIT LUBRICATION

2. Remove drain plug (23); drain oil from drive unit.



3. Remove oil pump housing (1) from drive unit and move to a clean work area for further disassembly.
4. Check O-rings (2) and (3) for damage and replace if necessary.

5. Remove piston (9), spring (8) and ball (7) from oil pump housing.
6. Remove special pipe plug (6), spring (5) and ball (4) from oil pump housing.
7. Thoroughly clean housing and all parts.

Oil Pump Assembly (Refer to Illustrations 1895 & 13131)

Inspect all component parts and drive unit casting for dirt and burrs before assembly.

1. Place ball (4) and spring (5) into oil pump housing (1).
2. Place ball (7), spring (8) and special pipe plug into piston (9). Lubricate piston with oil to aid in smooth action and install piston into oil pump housing installed in drive unit housing.
3. Install O-rings (2) and (3) onto pump body.
4. Oil pump body and port thoroughly and screw pump assembly into casting until seated.
5. Apply hydraulic sealer (06104-005) to drain plug and replace drain plug. Fill drive unit with 1000 ml (1.5 pints) of 90W gear lube, Crown no. 063002-003 (or 063001-023, ATF for trucks operating in freezer applications below 0°C [32°F]).

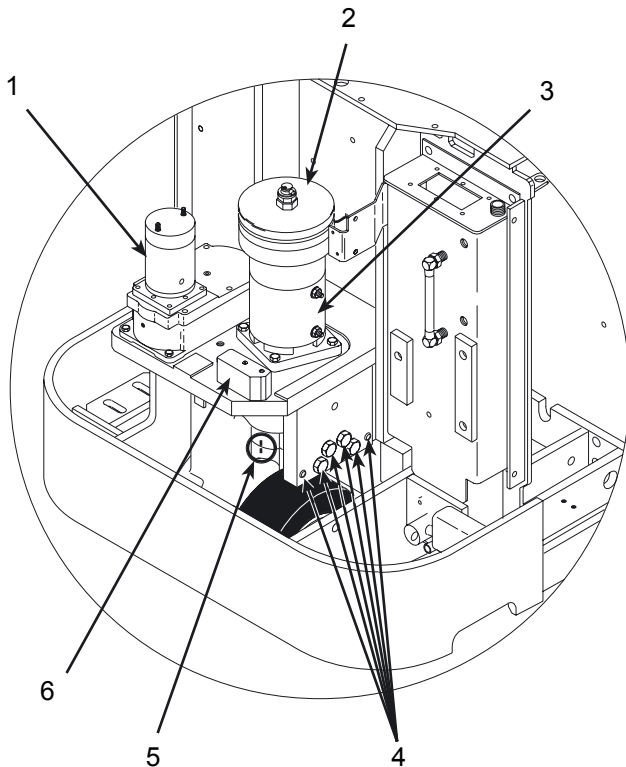
DRIVE UNIT

DRIVE UNIT REMOVAL & INSTALLATION (REFER TO ILLUS-



Drive Unit Removal & Installation (Refer to Illustration 3272)

secure the drive motor and electric brake to the drive unit and remove.



- 1 Steering motor and gearbox assembly
- 2 Electric brake
- 3 Drive motor
- 4 Drive unit mounting bolts and dowel pins
- 5 Alignment marks on drive unit and drive unit mounting bracket
- 6 Steering encoder (ECR2)

1. Disconnect battery and chock wheels.
2. Open power unit doors.
3. Disconnect all electrical wiring to the drive motor and electric brake. Remove the 4, 7/16" bolts that

Information



Make note of all electrical connections removed in step 3.

4. Remove the drain plug in the bottom of the drive unit with a 1/4" hex key wrench and allow gear oil to drain.
5. Raise and block power unit. Remove the drive tire. Refer to drive tire replacement when assembling drive tire.
6. Remove the 4, 3/4" bolts and the 2 dowel pins that fasten the drive unit to the power unit. When reattaching the drive unit with these bolts, apply a small amount of thread locking adhesive (061004-009) and tighten to 340-370 Nm (250 - 275 ft. lbs.).
7. Stabilize the drive unit and raise and block the power unit until the drive unit will clear the power unit.
8. Move the drive unit to a clean work area for further disassembly.
9. Reverse steps 1 thru 7 to install drive unit. Align the marks on the drive unit and the drive unit mounting bracket. This ensures that the steered wheel is in the straight ahead position.
10. Apply hydraulic sealer (06104-005) to drain plug and replace drain plug. Fill drive unit with 1000 ml (1.5 pints) of 90W gear lube, Crown no. 063002-003 (or 063001-023, ATF for trucks operating in freezer applications below 0°C [32°F]).

3272



ELECTRICAL SYSTEM



Notes:



ELECTRICAL SYSTEM ENCODERS

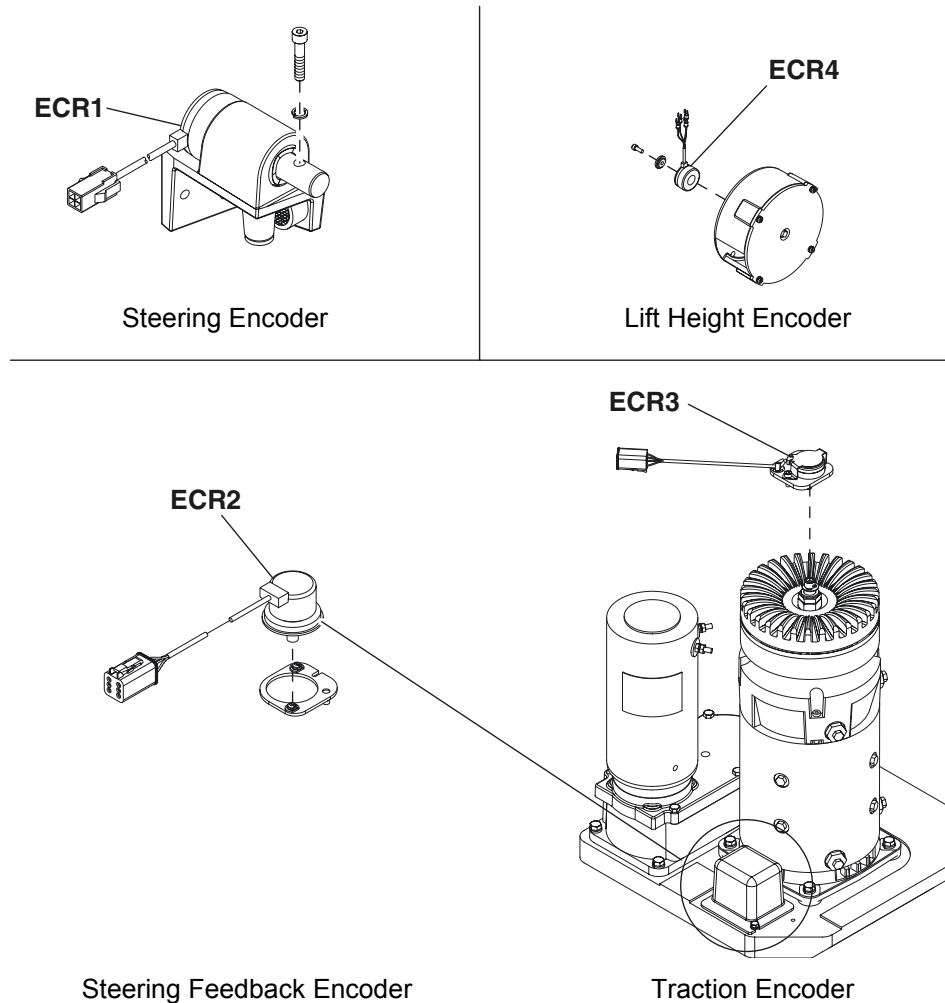
Encoders

Encoders are used to verify direction, speed, position and height on Crown lift trucks.

The encoder utilizes a magnetic "scale ring" and hall effect sensors to detect the periodic flux and to convert

it into electrical signals. Through these signals the encoder can detect direction, speed, position and height.

The encoders are located in various locations depending on application. Refer to Illustration 12401. There is no adjustment required of encoders. If the encoder does not work properly, check connections and current for proper voltage.



12401

ELECTRICAL SYSTEM

ENCODERS





ELECTRICAL SYSTEM

ELECTRICAL WIRING

Electrical Wiring

Color

Wiring Color Codes

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

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.

ABBREVIATION	COLOR	NUMBER	CIRCUIT FUNCTION
BLK	Black	0**	Digital Signal
BRN	Brown	1**	Analog Signal
RED	Red	2**	Battery Positive
ORG	Orange	3**	+12 V (DC - DC converter)
YEL	Yellow	4**	Third DC - DC converter
GRE	Green	5**	Battery Negative
BLU	Blue	6**	Isolated Negative
VIO	Violet	7**	+5 V (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			

ELECTRICAL SYSTEM

ELECTRICAL WIRING



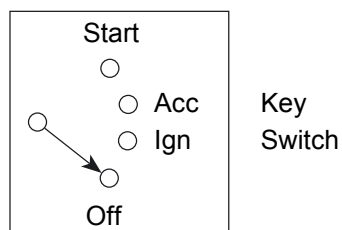
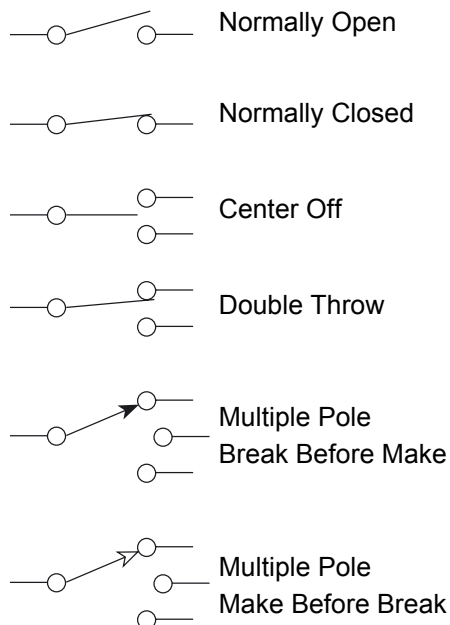
Power Cables

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.

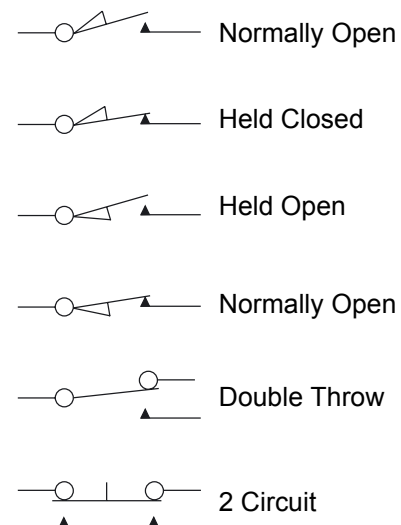
ABBREVIATION	PART NO.
PC#1	084571
PC#2	084570
PC#4	084569
PC#6	084568
PC#10	090963
PC#1/0	084572
PC#2/0	084573
PC#3/0	086749

Symbols

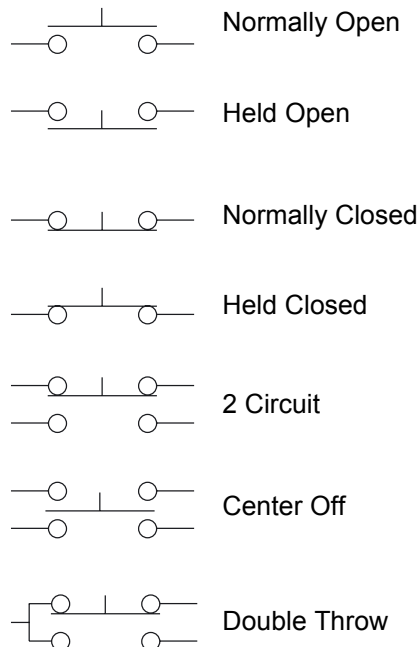
Maintained Contact Switches Operator Actuated



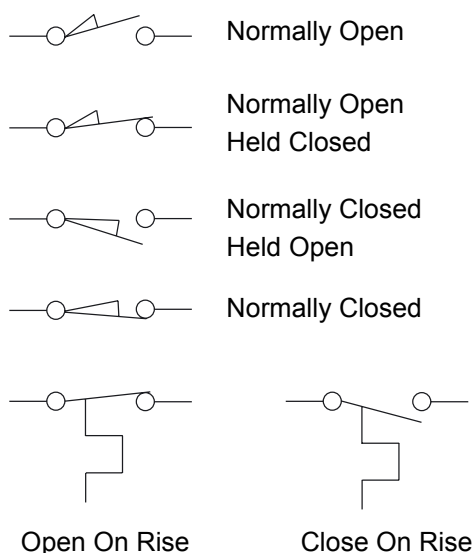
Momentary Contact Switches Mechanically Operator Actuated



Momentary Contact Switches Operator Actuated



Momentary Contact Switches Mechanically Actuated



ELECTRICAL SYSTEM

ELECTRICAL WIRING



Basic Symbols

	Thermistor		PM Motor		Rheostat
	Mov or Transorb		Wound Motor Armature		Zener Diode
	Suppressor		Motor Field		Diode
	Current Shunt		Lamp		SCR
	Connection Point		Tach Sensor		
	Power Termination		Encoder		
	Mast Cable		LED		
	Common Isolated		Fuse		
	Battery Negative		Transformer		
	Horn		SIP Resistor		
	Coil		Battery		
	Solenoid Valve or Relay With Suppression		Inductor		
	Normally Closed		Polarized Capacitor		
	Normally Open		Non-Polarized Capacitor		
	Plug PC		LVDT		
	Connector CA		Resistor		
	Jack JC		Potentiometer		
	Test Point				

3805



Notes:

ELECTRICAL SYSTEM

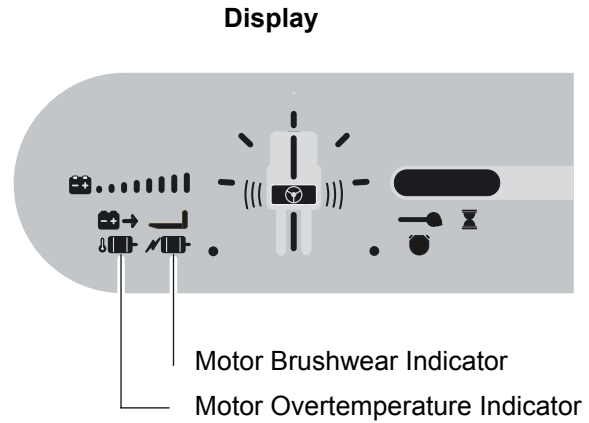
MOTOR MONITORING SYSTEM (MMS)



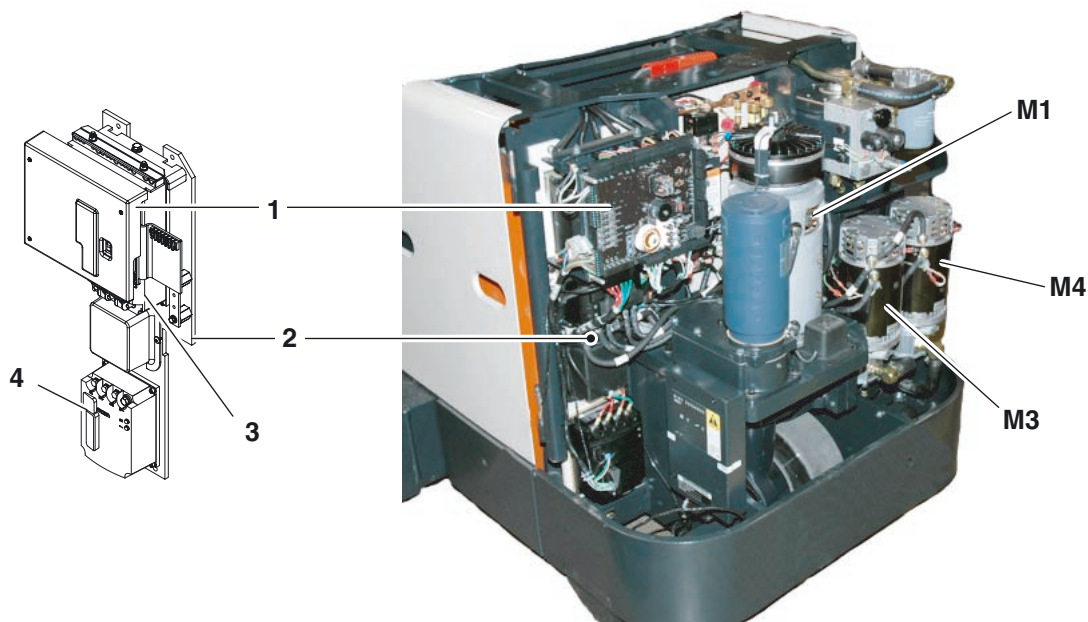
Motor Monitoring System (MMS)

Nine inputs of the truck management system are used to monitor the traction motor and both pump motors. Each motor contains one temperature sensor and two brushwear sensors. The information is communicated to the traction controller. The information is then communicated to the display. The display will light the appropriate LED and tell the operator which motor the overtemperature or the brushwear event is occurring. A Motor Monitoring System (MMS) event will not inhibit

any truck functions. The traction controller will only check the status when passing through neutral.



3513-01



12522

- 1 Distribution Panel
- 2 Traction Panel
- 3 Access 3 (MRC1)
- 4 SCM
- M1 Traction Motor
- M3 Lift Pump Motor
- M4 Lift Pump Motor



ELECTRICAL SYSTEM

MOTOR MONITORING SYSTEM (MMS)

Overtemperature Sensors

To test the over temperature sensor in the traction motor remove one lead from the sensor terminal. Cycle the traction forward and reverse, the over temperature icon on the display will light up. The character display will read "TRACTION" and an event code will be logged in the event history. Reconnect the lead and the over temperature indication will be removed after one minute. To test the over temperature sensors in the pump motors jumper CA215-2 to TP4. Cycle the traction, the over temperature icon will light. The character display will read "LIFT1" and an event code will be logged in the event history. Repeat with jumper on CA215-3 for "LIFT2". Refer to the event history Chart 1.

Brushwear Sensors

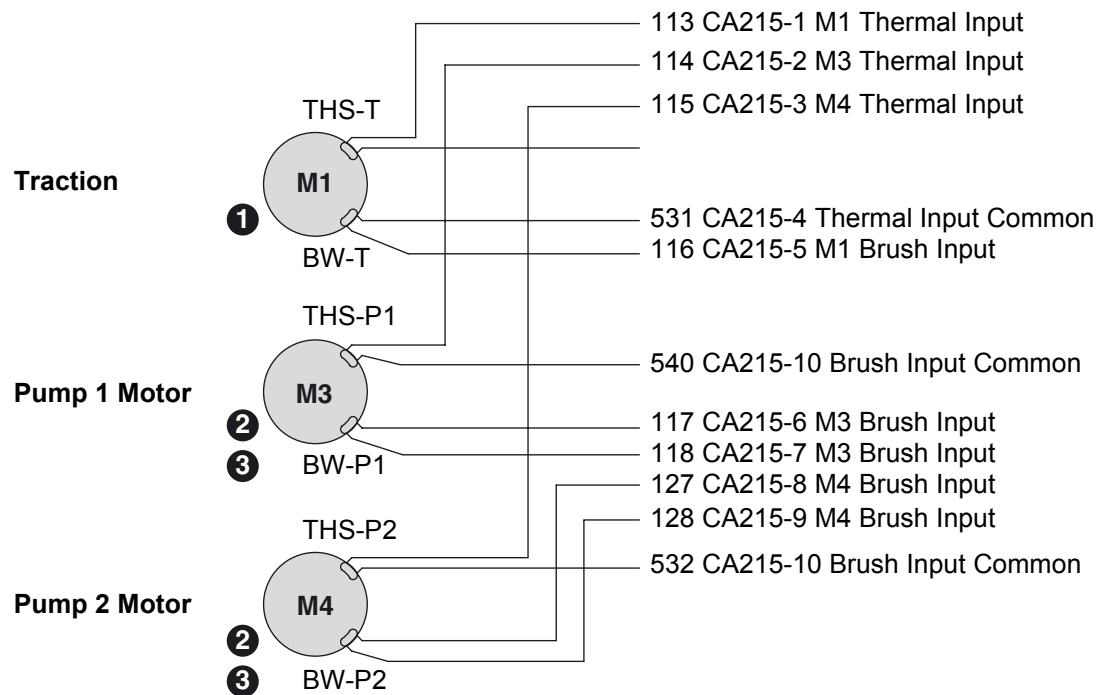
To test the brushwear sensors in the traction motor remove one lead from the sensor terminals. Cycle the traction forward and reverse, the brushwear icon on the display will light up. The character display will read "TRACTION" and an event code will be logged on the event history. Reconnect the lead and the brushwear indication will be removed after one minute. To test the brushwear sensors in the pump motors jumper CA215-6 to TP4. Cycle the traction, the brushwear icon will light. The character display will read "LIFT1" and an event code will be logged in the event history. Repeat with jumper on CA215-8 for "LIFT2". Refer to the event history Chart 1.

Active Sensor	Character Display	Icon	Event Code
Overtemperature 1	Traction (M1)	Overtemperature	833
Overtemperature 2	Lift 1 (M3)	Overtemperature	834
Overtemperature 3	Lift 2 (M4)	Overtemperature	835
Brushwear 1A	Traction (M1)	Brushwear	836
Brushwear 1B	Traction (M1)	Brushwear	836
Brushwear 2A	Lift 1 (M3)	Brushwear	837
Brushwear 2B	Lift 1 (M3)	Brushwear	837
Brushwear 3A	Lift 2 (M4)	Brushwear	838
Brushwear 3B	Lift 2 (M4)	Brushwear	838
Chart 1			

Condition	Output Pin	Nominal Voltage	Voltage Range
No Event	CA215-5 / CA215-1	2.53 Volts	2.06 to 2.99 Volts
M1 Over Temp	CA215-1	3.45 Volts	3.00 to 3.90 Volts
M3 Over Temp	CA215-1	0.60 Volts	0.00 to 1.09 Volts
M4 Over Temp	CA215-1	1.58 Volts	1.10 to 2.05 Volts
M1 Brush Wear	CA215-5	3.45 Volts	3.00 to 3.90 Volts
M3 Brush Wear	CA215-5	0.60 Volts	0.00 to 1.09 Volts
M4 Brush Wear	CA215-5	1.58 Volts	1.10 to 2.05 Volts
Chart 2			

ELECTRICAL SYSTEM

MOTOR MONITORING SYSTEM (MMS)



12523

- 1 M1 Thermal and Brushwear Switches Open Upon Event.
- 2 M3/M4 Thermal Switches Close Upon Event.
- 3 M3/M4 Brushwear Switches Short to Motor Negative or Positive Upon Event.



ELECTRICAL SYSTEM

EVENT CODES

Event Codes

General

This section provides troubleshooting aids to facilitate analysis of truck failures. By using the appropriate troubleshooting aids (based on event codes displayed through the use of the service terminal or display module), InfoPoint® truck wiring diagrams, and information provided in the truck service manual; most problems should be easily detected and corrected.

Caution!



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, 2 watt resistor (062033-030) between positive (+) and negative (-) of capacitor for 3 or more seconds.

Warning!



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

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 or encoders. The last component to suspect is the motor control system. In all instances, you should begin your

troubleshooting procedure at the driven device, proceed to input devices, then, and only then, move on to the control to which these devices attach.

Check the Event Code Listing

Check the event code listing in this manual guide for description of the possible problem, to identify the components affected and corrective actions to be taken.

No Event Code?

When the truck malfunctions and no event code is displayed it usually means the malfunction is not electrical. If the truck powers up but a code is not displayed, the malfunction is probably mechanical or hydraulic rather than electrical. Information regarding mechanical and hydraulic troubleshooting is located in the appropriate section of the service manual.

To Locate Malfunctioning Components

Component and wiring location maps are provided at strategic locations to help you quickly determine the physical location of item in question. All components are clearly marked at the connection points.

Test Points

Test points referenced in the event code descriptions are located on the distribution panel.

Event Codes

201 to 228 - Steering Module (SCM)

311 to 399 - Traction Module (MRC1)

411 to 442 - Wire Guidance (GCM)

800 to 838 - Display Module (DCM)

ELECTRICAL SYSTEM

EVENT CODES



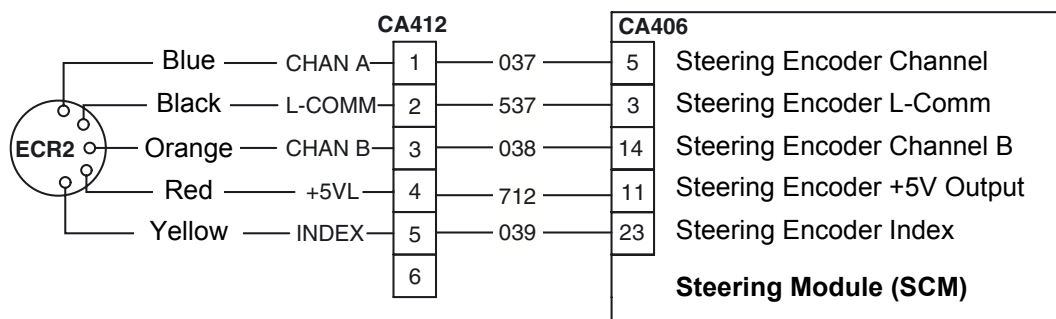
Event Code 201

Steering feedback encoder (ECR2) count out of tolerance.

Traction disabled.

Step 1: Check ECR2 wire connections at CA412 then from CA412 to CA406.

- **If:** Encoder connections are bad.
Then repair/clean connections.
- **If:** Encoder connections are OK.
Then using the service terminal adjust ECR2 as described in section M4.5 of service manual.
- **If:** Encoder event code persists.
Then replace and adjust ECR2 as described in section M4.5 of service manual.



Steer Feedback Encoder

12105

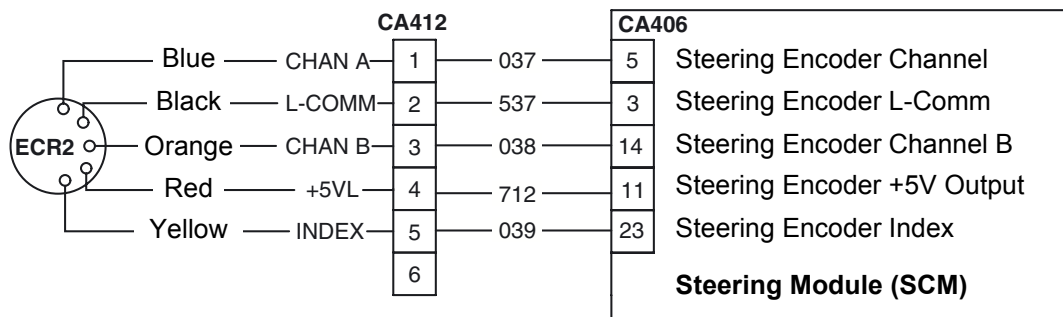
Event Code 202

Steering feedback encoder (ECR2) raw counts are greater than 35 counts between reads.

Traction disabled.

Step 1: Check condition and adjustment of encoder (ECR2).

- **If:** Encoder appears damaged.
Then replace encoder.
- **If:** Encoder is OK and event codes persists.
Then using the service terminal adjust ECR2 as described in section M4.5 of service manual.
- **If:** Encoder adjustment is OK.
Then replace and adjust ECR2 as described in section M4.5 of service manual.



Steer Feedback Encoder

12105

ELECTRICAL SYSTEM

EVENT CODES



Event Code 204

Steering feedback encoder (ECR2) shows no index.

Traction disabled.

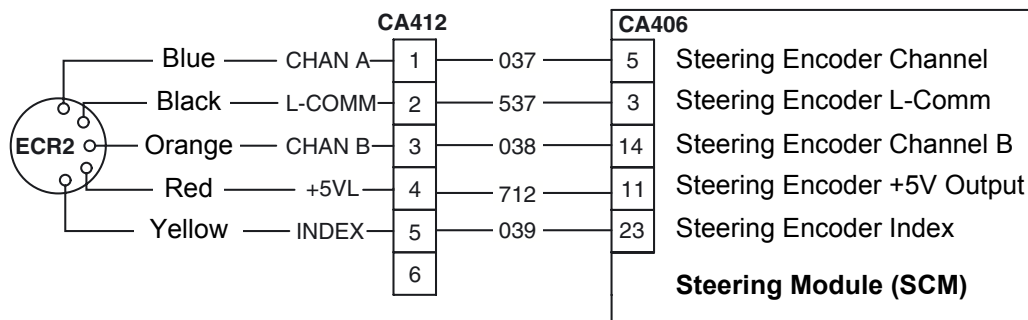
Step 1: Check the yellow wire between ECR2 and connection module CA412-5 also wire #039 from CA412-5 to steer module CA406-23.

Information



On index +5V, off index 0V.

- **If:** Wiring is broken or a poor connection exists. Then repair.
- **If:** Encoder wire connections are OK and event code persists. Then adjust ECR2 as described in section M4.5 of service manual.
- **If:** Event code persists after adjustment. Then replace and adjust ECR2 as described in section M4.5 of service manual.



Steer Feedback Encoder

12105



ELECTRICAL SYSTEM EVENT CODES

Event Code 208

Steering module (SCM) selftest detects no movement.

Steering and traction disabled.

Step 1: Check steering relay K5 power circuit. Check for poor or loose connections of wires #2941 between FU10 and CA407-2, wire #2912 between CA407-3 and K5, wire #291 between CA407-1 and K5, wire #052 between CA407-4 and negative bus, wire #2981 and #2943 between K5 and steer motor.

- **If:** Wiring problem exists.
Then repair wiring.
- **If:** Wiring is OK.
Then visually check K5 relay for closure.
- **If:** Relay K5 closes and there is no power through the tips.
Then proceed to step 2.
- **If:** Relay K5 closes and there is power through the tips.
Then proceed to step 3.
- **If:** Relay K5 does not close.
Then check K2 tips.
- **If:** K2 tips are OK.
Then check wires #5938 between CA406-8 and K5 coil also wire #2961 between CA213-9 and K5 coil.
- **If:** Wire connections are good and the event code persists.
Then proceed to step 2.

Step 2: Check steer motor (M2) brushes.

- **If:** Brushes worn.
Then replace both brushes and brush springs.

- **If:** Brushes are OK.
Then check wiring and connections between M2 and K5.

- **If:** Wiring is OK.
Then proceed to step 3.

Step 3: Check for B+ at CA405-3 and B- at CA405-4 of SCM.

- **If:** B+ is not present.
Then check wiring between CA405-3 and K2.
- **If:** B- is not present.
Then check wiring between CA405-4 and K2.
- **If:** Wiring is OK and event code persists proceed to step 4.

Step 4: Check steering relay K5 tips.

- **If:** K5 relay tips are worn or burnt.
Then replace relay.
- **If:** K5 relay tips are good.
Then check the SCM for power output. Connect DVOM positive lead to TB407-2 and negative lead to TB407-4. Power up the truck within a few seconds the meter should indicate battery volts.
- **If:** There is power output.
Then proceed to step 5.
- **If:** There is no power output.
Then check FU10.
- **If:** FU10 is good.
Then replace SCM.

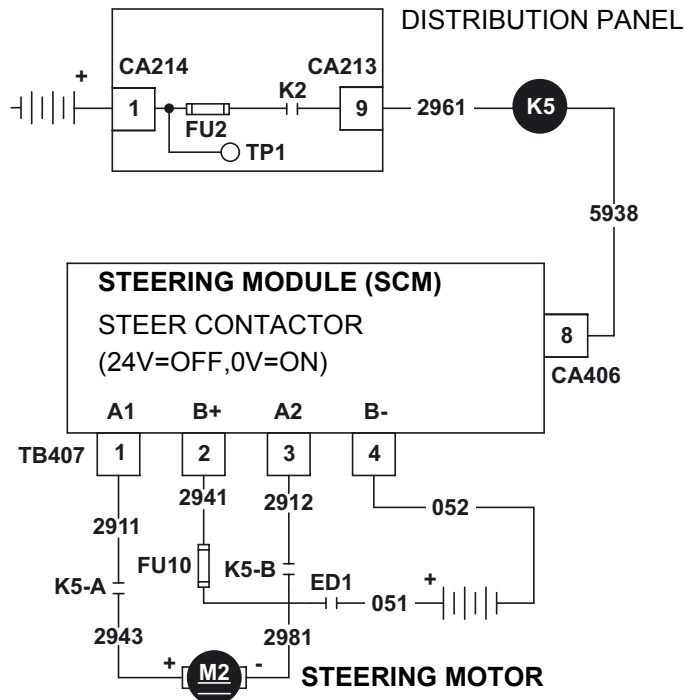
Step 5: With the truck powered down jack up the power unit until the steer wheel is off the floor (block the power unit). By hand, check the drive unit for movement left to right. Drive unit should be able to be moved.

ELECTRICAL SYSTEM

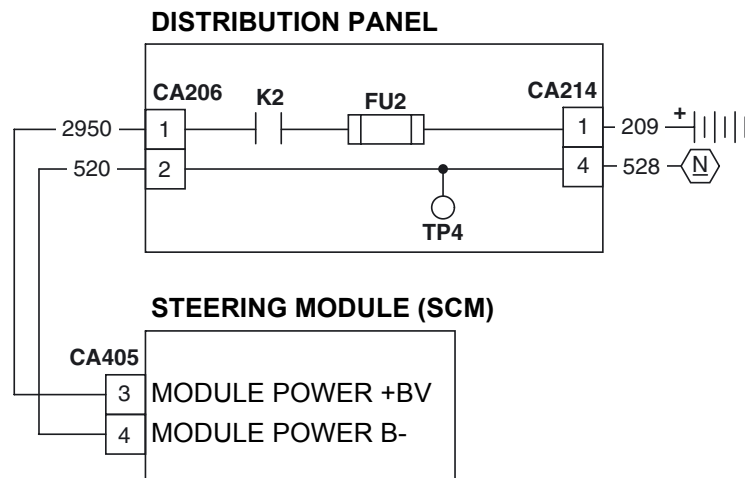
EVENT CODES



- **If:** Drive unit cannot be moved.
Then check the associated mechanical components (i.e. steering gear box, gears, drive unit steer bearing).
- **If:** Drive unit moves freely.
Then check internal components of the steering gearbox (i.e. keys, shafts, etc.).
- **If:** Drive unit and gearbox are OK and event code persists.
Then replace SCM.



12106



12411



ELECTRICAL SYSTEM EVENT CODES

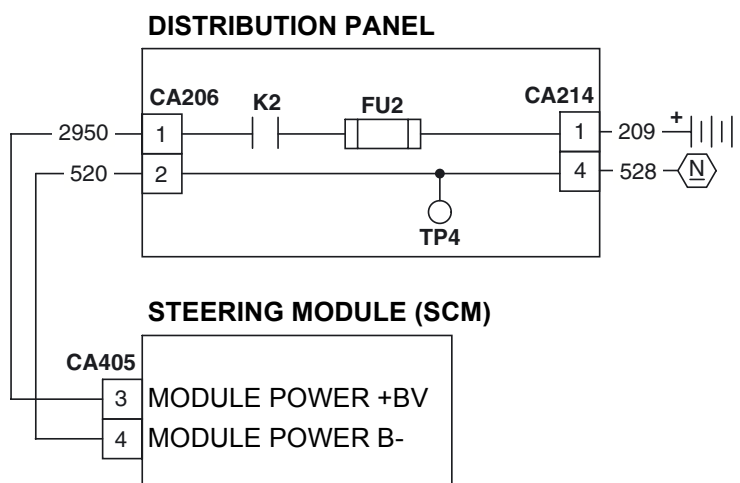
Event Code 209

Steering module (SCM) positive 12-volt power supply output is out of tolerance.

Steering, traction and lift disabled.

Step 1: Using a DVOM check for +BV between CA405-3 and battery negative.

- **If: 0V.**
Then check connection and condition of wire #2950 from CA405-3 to CA206-1.
- **If: Wiring is OK and event code persists.**
Then replace SCM.



12411

ELECTRICAL SYSTEM

EVENT CODES



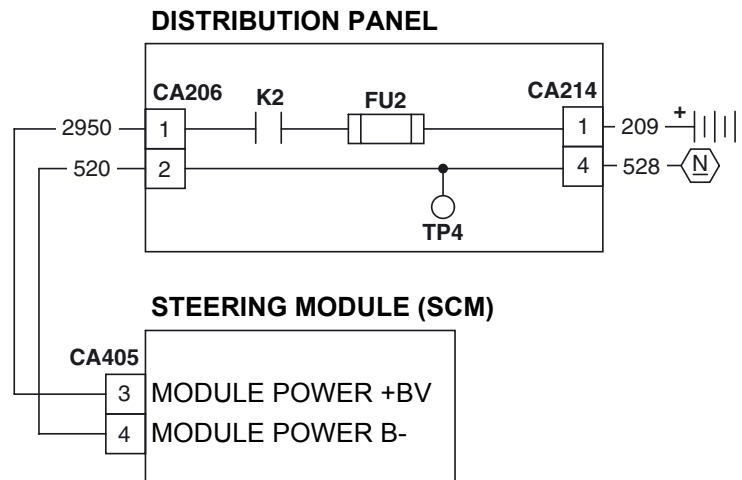
Event Code 210

Steering module (SCM) negative 12-volt power supply is out of tolerance.

Steering, traction and lift disabled.

Step 1: Using a DVOM check for -BV between CA405-4 and battery positive.

- If: 0V.
Then check connection and condition of wire #520 from CA405-4 to CA206-2.
- If: Wiring is OK and event code persists.
Then replace SCM.



12411



ELECTRICAL SYSTEM

EVENT CODES

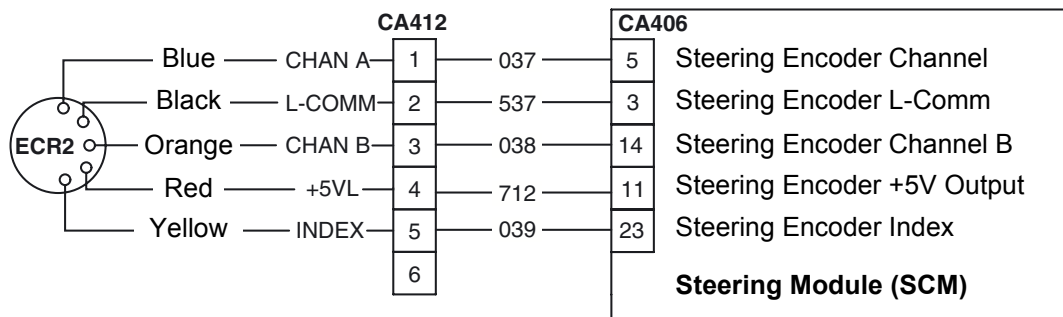
Event Code 211

Steering module (SCM) auxiliary 5-volt power supply is out of tolerance.

Steering, traction and lift disabled.

Step 1: Check wiring for a short between encoder ECR2 and connector module CA412-2, -4 then to steer module CA406-3, -11.

- **If:** Short exists.
Then repair.
- **If:** Wiring connections are OK.
Then replace ECR2 as it may be internally shorted.
- **If:** Event code persists.
Then replace SCM.



Steer Feedback Encoder

12105

ELECTRICAL SYSTEM

EVENT CODES



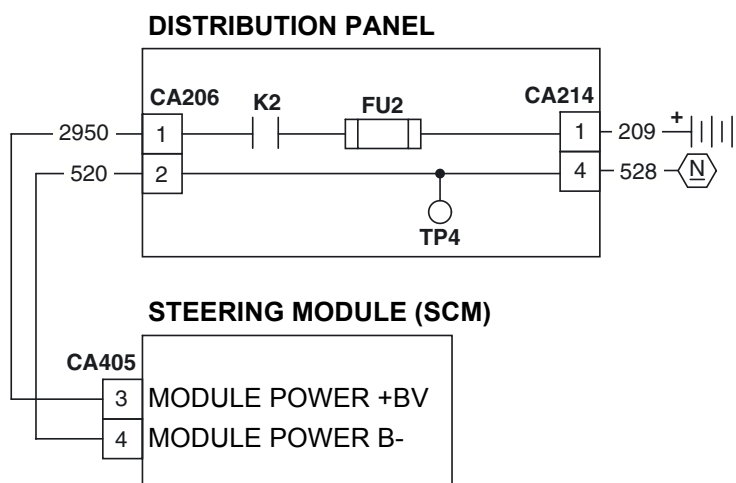
Event Code 212

Steering module (SCM) positive 12-volt battery is out of tolerance.

Steering, traction and lift disabled.

Step 1: Using a DVOM check for +BV between CA405-3 and CA405-4.

- If: Less than 7.8V.
Then check connection and condition of wire #2950 from CA405-3 to CA206-1. Also wire #520 from CA405-4 to CA206-2.
- If: Wiring is OK and event code persists.
Then replace SCM.



12411

ELECTRICAL SYSTEM EVENT CODES

Event Code 213

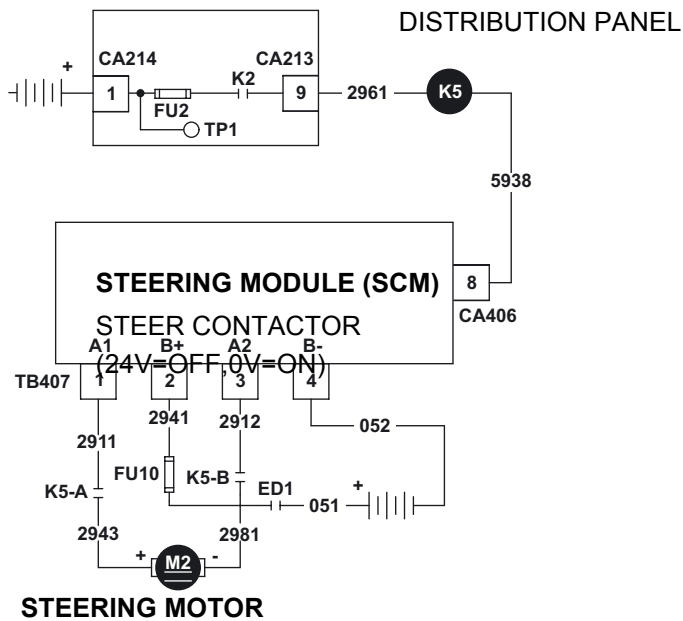
Steering module (SCM) bridge fuse blown.

Steering, traction and lift disabled.

Step 1: Check fuse FU10.

- **If:** FU10 is bad.
Then replace.

- **If:** FU10 is good.
Then check wire #2941 between FU10 and CA407-2 also wire #052 between CA407-4 and negative bus for loose or failed connections.
- **If:** Connection is bad.
Then repair.



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 215

Steering is not responding properly to the left.

Steering, traction and lift disabled.

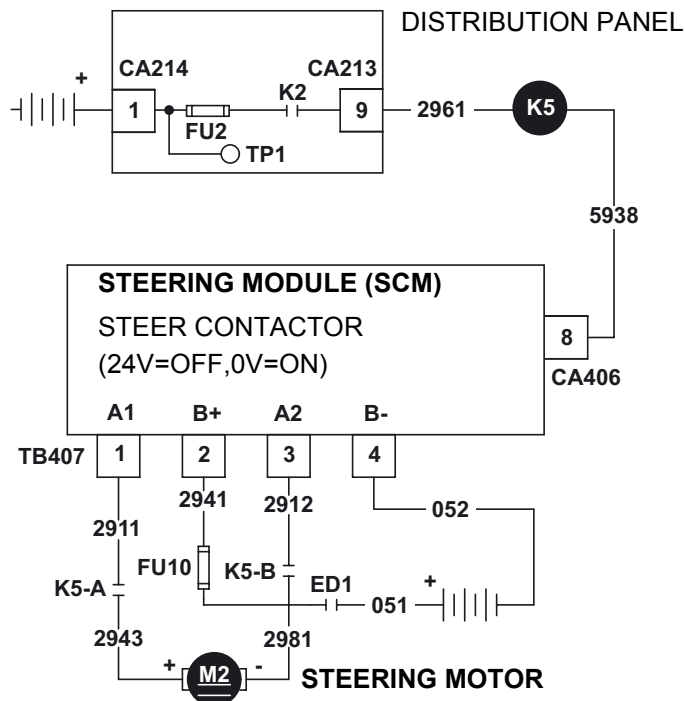
Step 1: Check steer motor wiring for correct polarity (positive lead is wire #2943 and negative wire #2981).

- **If:** Wiring is reversed.
Then correct wiring.
- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Check for obstructions around steer wheel.

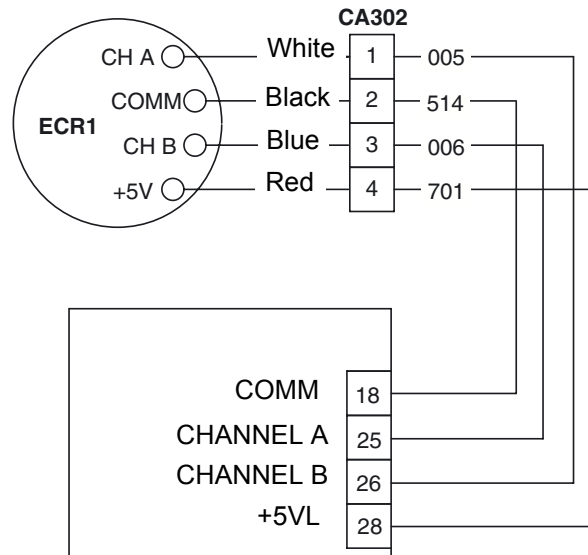
- **If:** Obstructions exists.
Then clear obstruction.
- **If:** No obstruction.
Then proceed to step 3.

Step 3: Steering encoder (ECR1) may have an internal component issue. Change ECR1 and check operations.



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STEER ENCODER



DISPLAY MODULE (DCM)
CA304 INPUTS/OUTPUTS

12155

ELECTRICAL SYSTEM

EVENT CODES



Event Code 216

Steering is not responding properly to the right.

Steering, traction and lift disabled.

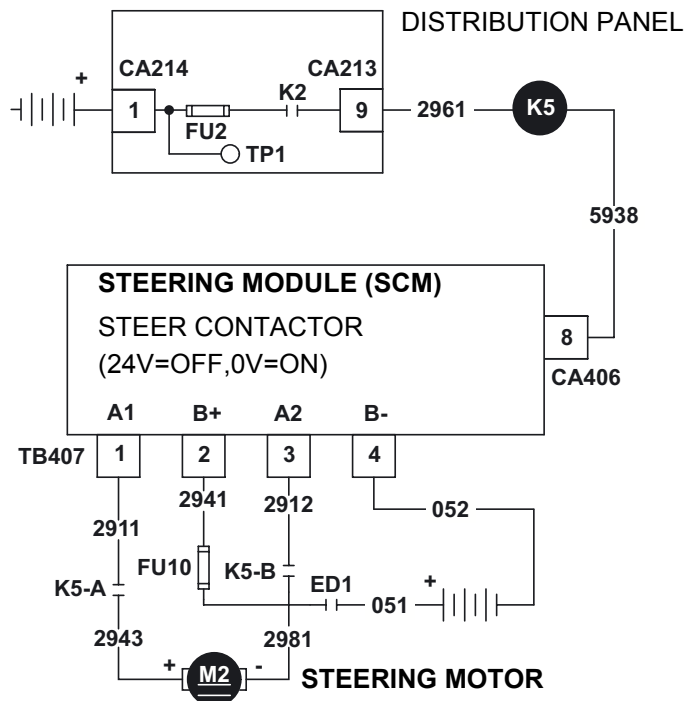
Step 1: Check steer motor wiring for correct polarity (positive lead is wire #2943 and negative wire #2981).

- **If:** Wiring is reversed.
Then correct wiring.
- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Check for obstructions around steer wheel.

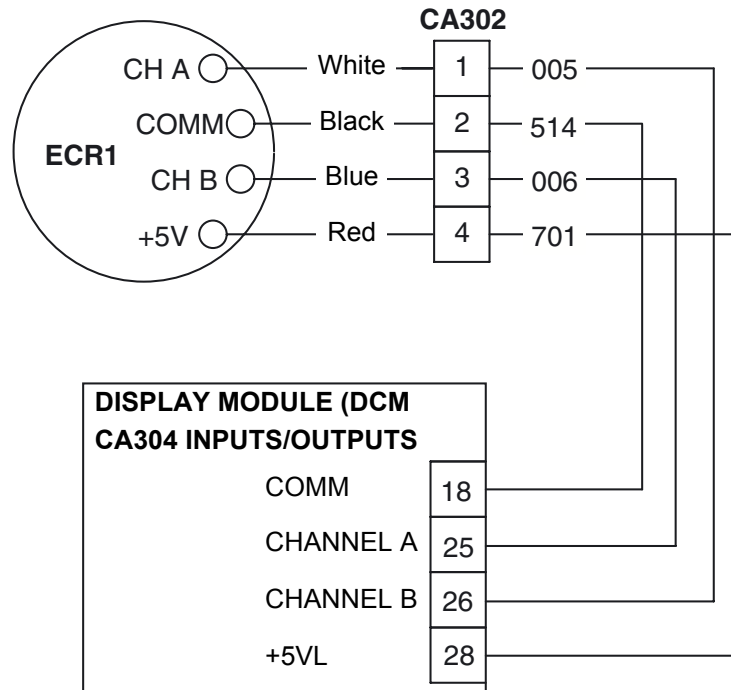
- **If:** Obstructions exists.
Then clear obstruction.
- **If:** No obstruction.
Then proceed to step 3.

Step 3: Steering encoder (ECR1) may have an internal component issue. Change ECR1 and check operations.



12106

STEER ENCODER



12155

ELECTRICAL SYSTEM

EVENT CODES



Event Code 217

No steer wheel movement upon command.

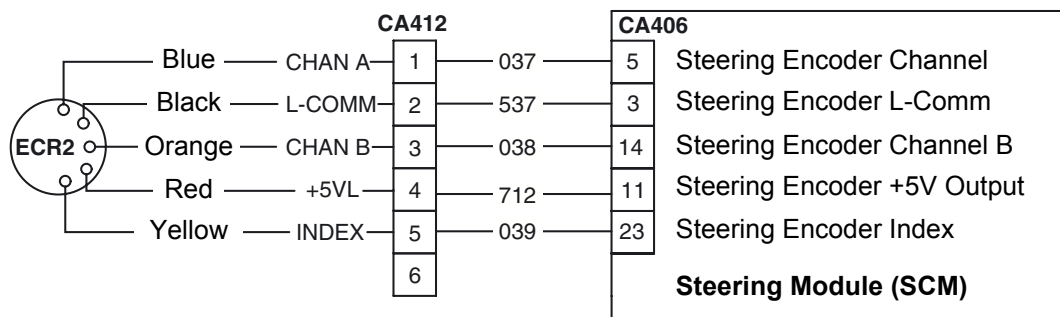
Steering, traction and lift disabled.

Step 1: Check steer motor condition. Also wiring of steer motor and feedback encoder ECR2.

- **If:** Steer motor electrical connections loose or bad.
Then repair.
- **If:** Steer motor connections are good.
Then check for loose or broken wire connections between ECR2 and CA412.
- **If:** Wiring problem exists.
Then repair.
- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Check steer motor brushes, obstructions and steering components.

- **If:** Steer motor brushes are worn, preventing operation.
Then replace.
- **If:** Steer motor brushes are OK.
Then check for obstructions around the steer wheel.
- **If:** Obstructions are present.
Then clear the obstruction.
- **If:** No obstructions exist.
Then check steering gearbox shafts and keys.
- **If:** A component problem is found.
Then repair.



Steer Feedback Encoder

12105

Event Code 218

Raise cutout switches do not match truck setups.

Lift disabled.

Step 1: Check for incorrect setups for raise cutouts. Connect service terminal and access "View Cutouts & Zones".

- **If:** The lift cutout setups do not match the truck configuration.
Then access "Calibration Truck Setups; Lift Cutouts & Zones" and modify.
- **If:** The setups match the truck configuration.
Then using the service terminal access "View Truck Setups; Lift Cutouts & Zones" verify that raise cutouts are enabled.

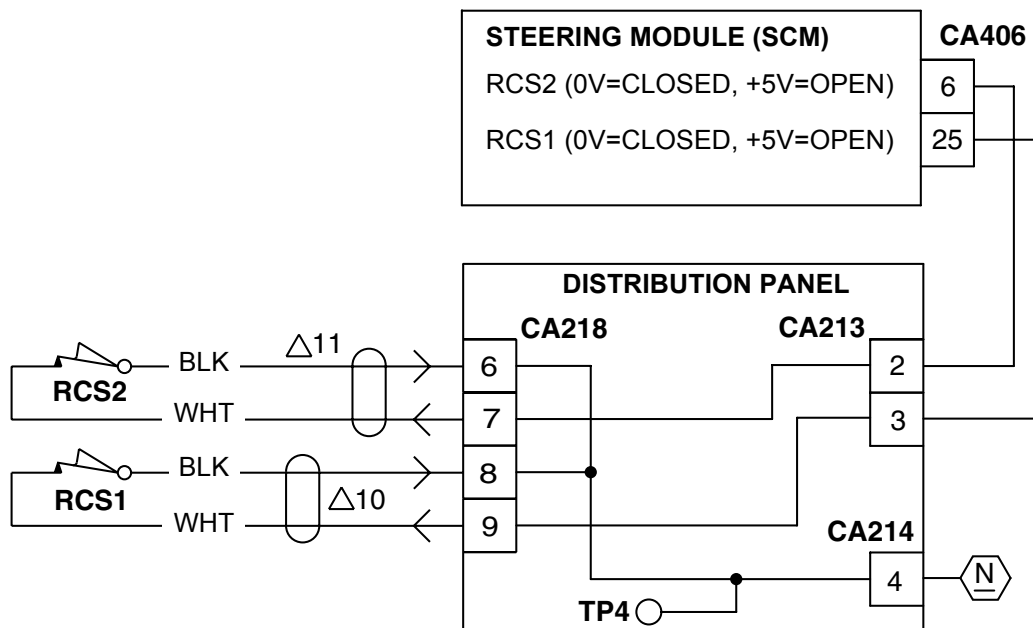
- **If:** Raise cutouts are enabled.
Then proceed to step 2.

Step 2: Check wire connections between raise cutout switches and CA218-6, -7, -8, -9 also wires between CA213-2, -3 and CA406-6, -25 for shorts or loose connections.

- **If:** Wire problems exist.
Then repair.
- **If:** Wire connections are OK.
Then proceed to step 3.

Step 3: If the truck is configured as single lift cutout with "no override", verify that jumper is in place between CA218-6, -7.

- **If:** Jumper is not present.
Then install jumper.



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 221

Steering module (SCM) general purpose driver test indicates a GP driver output active prior to turn "ON".

Steering, traction and lift disabled.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace SCM.

Event Code 222

Steering module (SCM) general purpose driver test detected a short during power up diagnostics.

Steering, traction and lift disabled.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace SCM.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 223

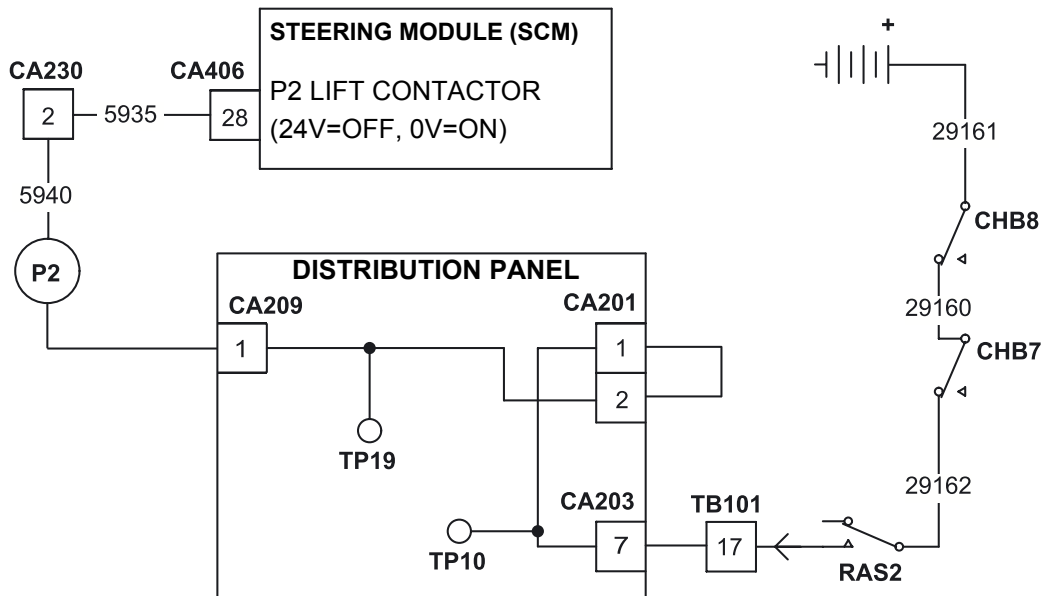
Short detected in steering module (SCM) P2 coil driver circuit.

Steering, traction and lift disabled.

Check wire #5935 between CA406-28 and CA230-2
also wire #5940 from CA230-2 to P2 contactor coil for
a short to battery negative or truck frame.

- **If:** Short exist.
Then repair.

- **If:** Wiring is not shorted.
Then check P2 suppressor.
- **If:** Suppressor is OK.
Then check for a shorted P2 contactor coil. Refer
to the service manual for coil resistance.
- **If:** The P2 contactor coil is not shorted and event
code persist.
Then replace SCM.



13515

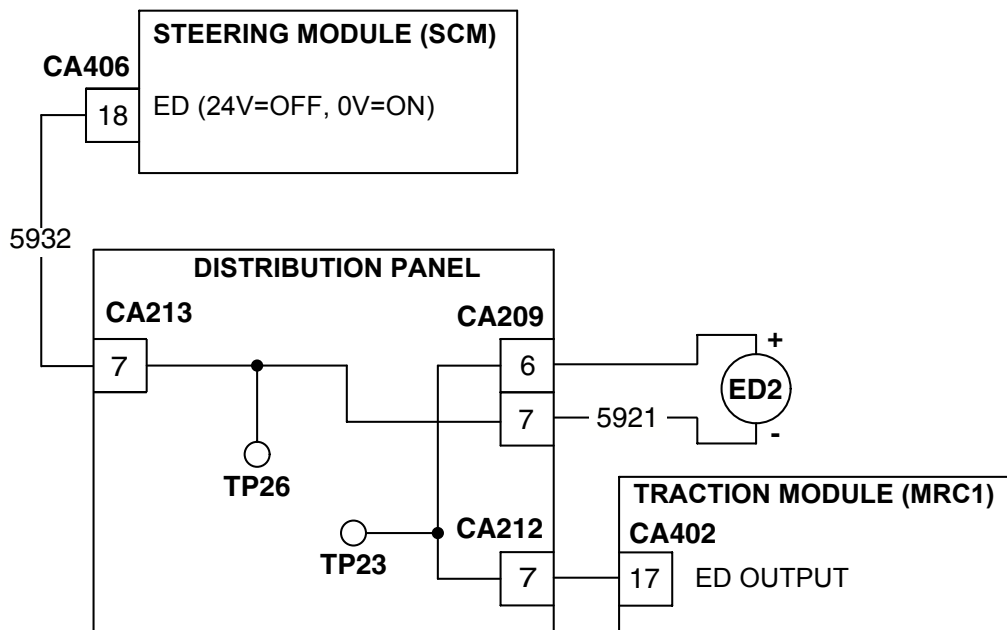
Event Code 224

Short detected in steering module (SCM) ED2 contactor coil driver circuit.

Steering, traction and lift disabled.

Step 1: Check wire #5932 between CA406-18 and CA213-7 also wire #5921 between CA209-7 and ED2 contactor coil for a short to battery negative or truck frame.

- **If:** Short exist.
Then repair.
- **If:** Wiring is not shorted.
Then check ED2 suppressor.
- **If:** Suppressor is OK.
Then check for a shorted ED2 contactor coil. Refer to the service manual for coil resistance.
- **If:** The ED2 contactor coil is not shorted and event code persists.
Then replace SCM.



12109

ELECTRICAL SYSTEM

EVENT CODES



Event Code 227

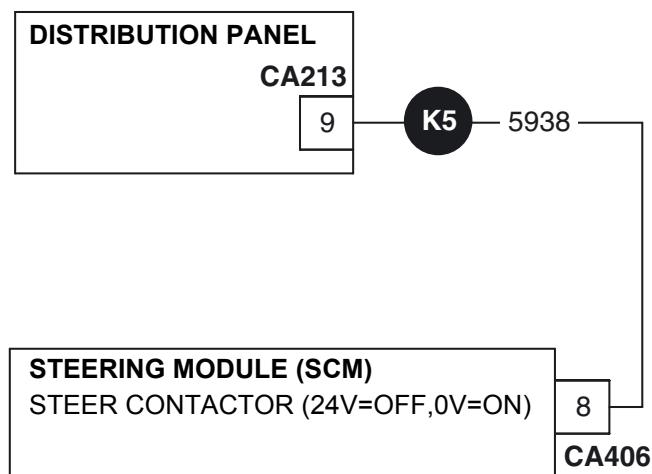
Short detected in steering module (SCM) K5 relay coil driver circuit.

Steering, traction and lift disabled.

Step 1: Check wire #5938 between CA406-8 and K5 relay coil for a short to battery negative or truck frame.

- **If:** Short exists.
Then repair.

- **If:** Wiring is not shorted.
Then check for a shorted K5 contactor coil resistance should be 190 to 194 ohms.
- **If:** Short exists.
Then replace K5.
- **If:** The K5 contactor coil is not shorted and event code persists.
Then replace SCM.



12110

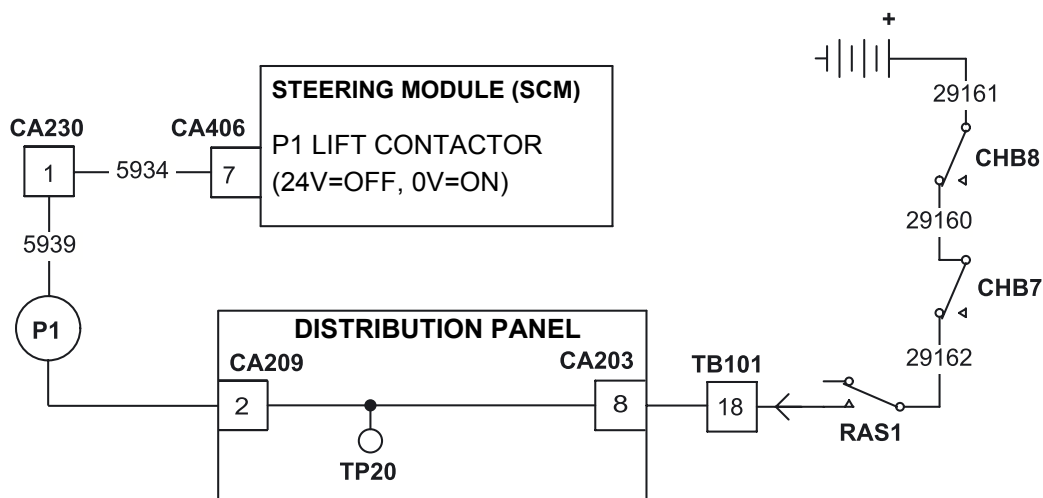
Event Code 228

Short detected in steer module (SCM) P1 coil driver circuit.

Steering, traction and lift disabled.

Check wire #5934 between CA406-7 and CA230-1 also wire #5939 from CA230-1 to P1 contactor coil for a short to battery negative or truck frame.

- **If:** Short exist.
Then repair.
- **If:** Wiring is not shorted.
Then check for a shorted P1 contactor coil. Refer to the service manual for coil resistance.
- **If:** The P1 contactor coil is not shorted and event code persists.
Then replace SCM.



13516

Event Code 311

Access 3 module (MRC1) internal 15-volt power supply out of range.

Steering, traction and lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

Event Code 312

Access 3 module (MRC1) internal power base 15-volt power supply out of range.

Traction disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 313

Access 3 module (MRC1) internal power base negative 12 volt power supply out of range.

Traction disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

Event Code 314

Access 3 module (MRC1) CAN 5-volt supply out of range.

Steering, traction and lift disabled.

Step 1: Using a DVOM check CAN volts between CA403-2 (positive) and CA403-10 (negative) should be +4.5V to +5.5V.

- **If:** Less than +4.5V.
Then check CAN lines for short.
- **If:** No short exists and event code persists.
Then replace MRC1.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 315

Access 3 module (MRC1) encoder 5-volt power supply out of range.

Traction disabled.

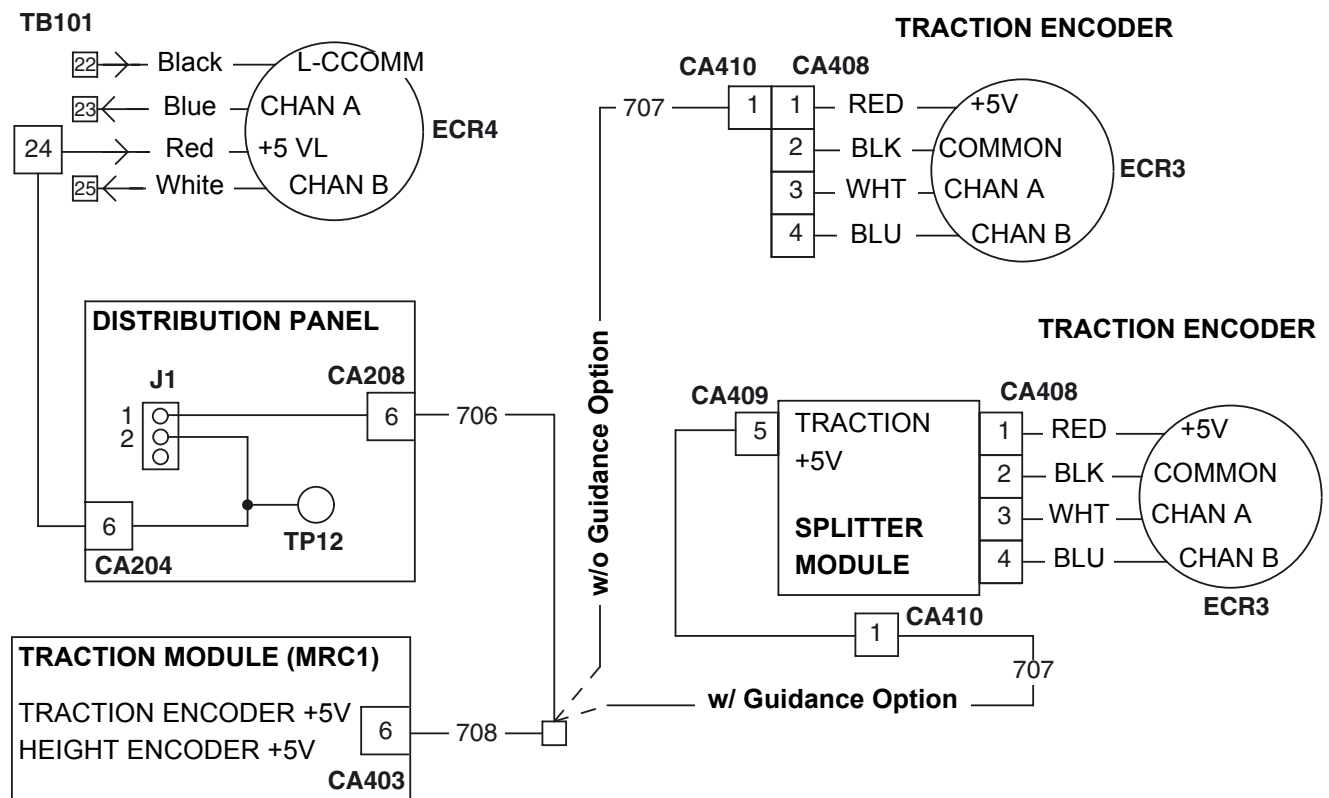
Step 1: Truck powered up connect DVOM negative lead to B- with the positive lead check for +4.5V to +5.5V at CA403-6.

- **If:** Less than +4.5V.

Then check wires #708, #706 and 707 for shorts to frame. Also blue mast cable wire from CA204-6 to TB101-24 and red wire from TB101-24 to ECR4.

Trucks with wire guidance check wire #713 from CA410-1 to CA409.

- **If:** Wiring is not shorted to frame.
Then disconnect wire #706 at CA208-6 and check voltage at CA403-6.
- **If:** Voltage is +4.5V to +5.5V.
Then replace ECR4.
- **If:** Less than +4.5V.
Then disconnect wire #707 at CA410-1 and check voltage at CA403-6.
- **If:** Voltage is +4.5V to +5.5V.
Then replace ECR3.



12206

ELECTRICAL SYSTEM

EVENT CODES



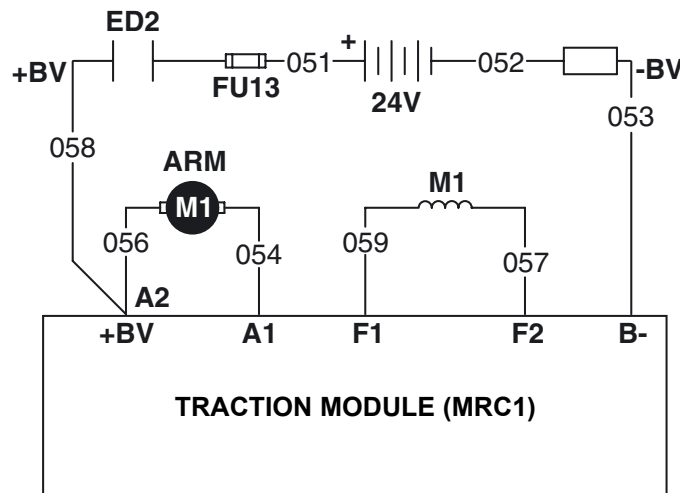
Event Code 316

Access 3 module (MRC1) over voltage occurred in traction motor circuit during regenerative braking.

Traction disabled.

Step 1: This is caused by an open circuit in the traction motor. Components to check include: ED2 contactor tips, FU13, cables and connections from battery to traction motor.

- **If:** No problem is found and event code persists. Then replace MRC1.



12208



ELECTRICAL SYSTEM EVENT CODES

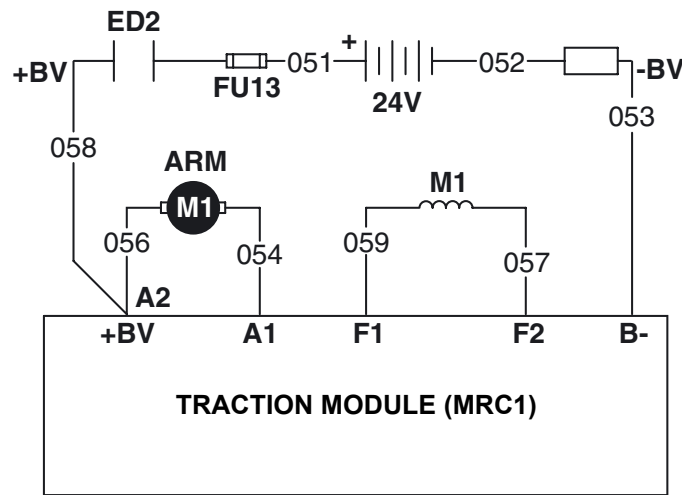
Event Code 317

Over current condition occurred in traction motor armature circuit.

Traction disabled.

Step 1: Check traction motor (M1) A1 power cable connection and condition at M1 and MRC1.

- **If:** Wiring is correct.
Then check M1 armature.
- **If:** M1 armature is bad.
Then replace armature or M1.



12208

ELECTRICAL SYSTEM

EVENT CODES



Event Code 318

Voltage on brake low when ED2 is closed.

This condition occurs when low voltage is sensed on MRC1 CA402-18 and CA402-19 simultaneously.

Steering, traction and lift disabled.

Step 1: Using a DVOM check for a voltage drop across FU13.

- **If:** Voltage drop occurs.
Then replace FU13.

- **If:** No voltage drop.
Then proceed to step 2.

Step 2: Check condition of ED2 contact tips.

- **If:** Corroded.
Then clean tips with crocus cloth.

- **If:** ED2 tips are clean proceed to step 3.

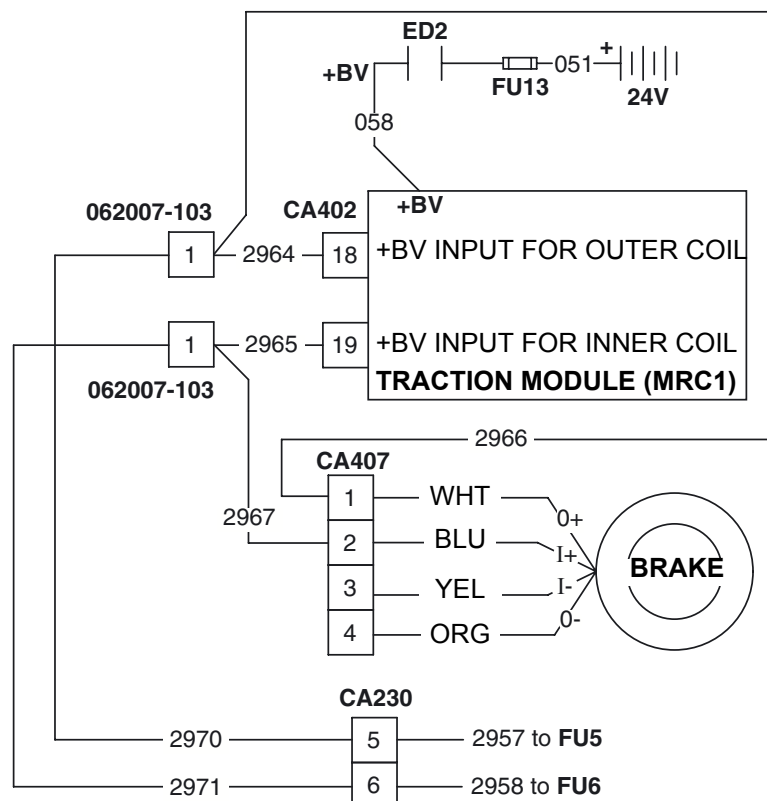
Step 3: Truck powered up connect DVOM negative lead to B- with the positive lead check for +BV at CA407-1 and CA407-2.

- **If:** Zero volts at one or both terminals.
Then check fuses FU5 & 6.

- **If:** Fuses are good.
Then check connection of wire #2957 from CA209-8 to CA230-5 and wire #2970 from CA230-5 to connection point of wires #2964 and #2966.

- **If:** Connections are good.
Then check connections of wire #2958 from CA209-9 to CA230-6 and wire #2971 from CA230-6 to connection point of wires #2965 and #2967.

- **If:** No problem is found and event code persists.
Then replace MRC1.



12207



ELECTRICAL SYSTEM

EVENT CODES

Event Code 319

Over current condition occurred in traction motor (M1) field circuit.

Traction disabled.

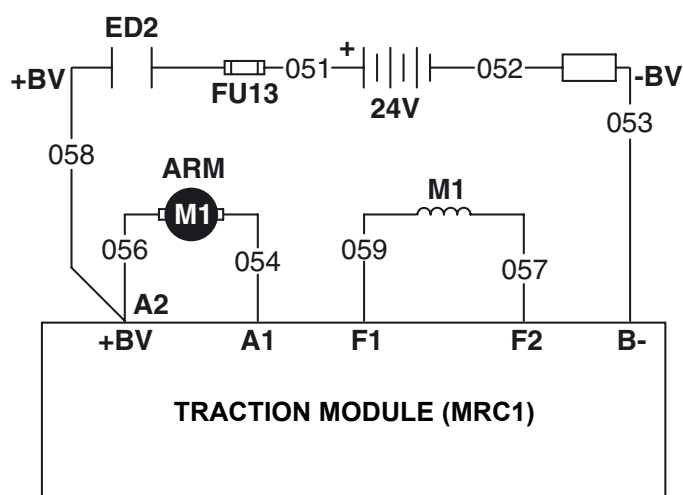
Step 1: Check motor fields for a short.

- **If:** Shorted.
Then repair.

- **If:** OK.
Then proceed to step 2.

Step 2: Check Traction motor (M1) F1 and F2 power cable connection and conditions at M1 and MRC1.

- **If:** No problem is found and event code persists.
Then replace MRC1.



12208

ELECTRICAL SYSTEM

EVENT CODES



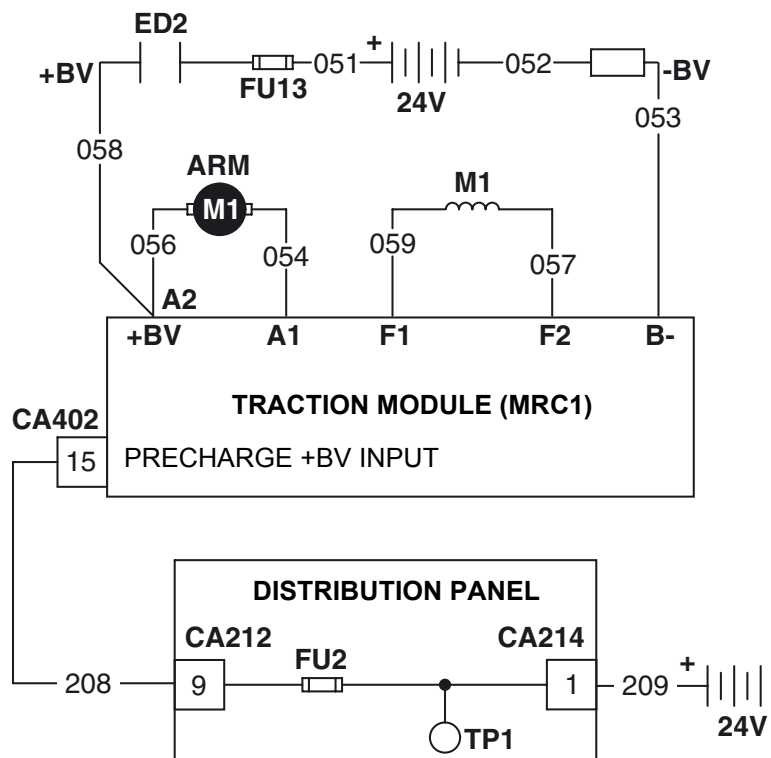
Event Code 321

Incorrect voltage at precharge input CA402-15 of Access 3 module (MRC1) before closure of ED1.

Steering, traction and lift disabled.

Step 1: With the battery plugged in connect DVOM negative lead to B- and the positive lead to CA402-15 on MRC1. Battery volts should be present.

- **If:** Battery volts are not present.
Then check FU2.
- **If:** FU2 is good.
Then check wire condition and connections from CA402-15 to CA212-9.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12209



ELECTRICAL SYSTEM EVENT CODES

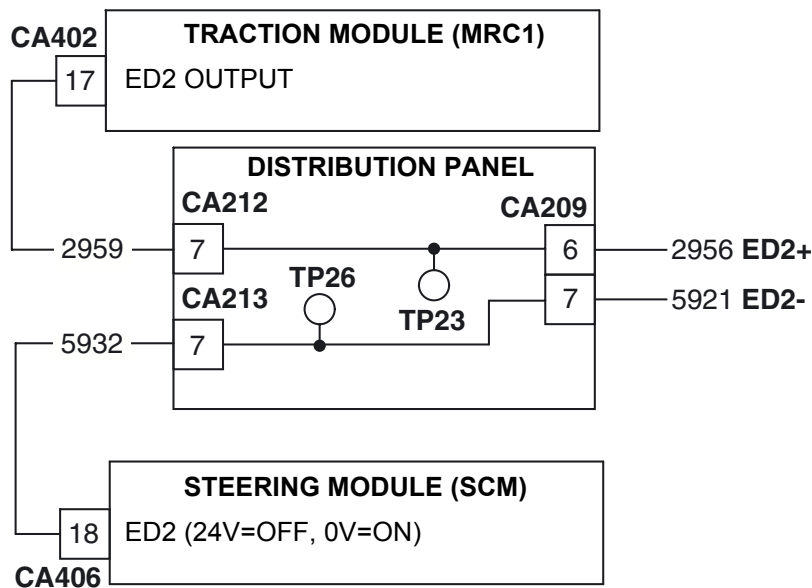
Event Code 322

Access 3 module (MRC1) battery volts (B+) present at CA402-17 before ED2 contacts close.

Steering, traction and lift disabled.

Step 1: Short to battery positive exists. Battery volts on CA402-17 should only be present when the brake pedal is depressed.

- **If:** No short exist.
Then verify that no open circuit exists between CA402-17, CA212-7, CA209-6 and ED2 coil. Also between CA406-18, CA213-7, CA209-7 and ED2 coil.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12210

ELECTRICAL SYSTEM

EVENT CODES



Event Code 323

Access 3 module (MRC1) command to traction motor (M1) armature not sensed within range.

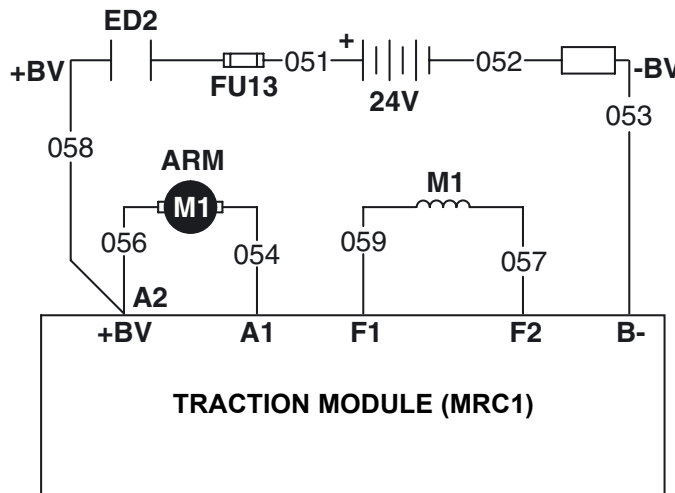
Traction disabled.

Step 1: Check power cables condition and connection at MRC1, A1 and B+ also M1 connections.

- If: Connections are OK.
Then proceed to step 2.

Step 2: Check condition of motor brushes and armature.

- If: Brushes and armature are OK and event code persists.
Then replace MRC1.



12208



ELECTRICAL SYSTEM

EVENT CODES

Event Code 324

Access 3 module command to motor field present but not sensed within limits.

Traction disabled.

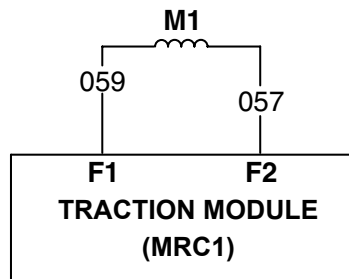
Information



Check ED2 contactor for binding.

Step 1: Isolate motor field by removing cable #059 from F1 on the traction Motor (M1). Check motor field continuity by connecting a DVOM to F1 and F2 of M1.

- **If:** An open circuit exists.
Then repair or replace M1.
- **If:** Motor field is OK.
Then check power cable connections.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12211

ELECTRICAL SYSTEM

EVENT CODES



Event Code 326

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: Check power and control wiring connection to module.

- **If:** No wiring issues exists and event code persists.
Then replace MRC1.

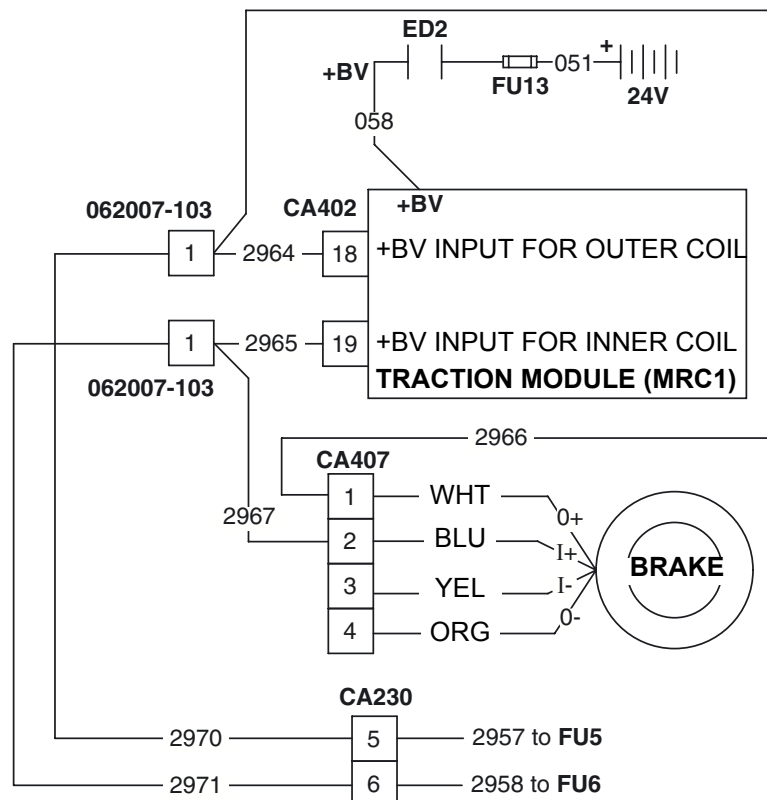
Steering, traction and lift disabled. Should be 0 volts at CA402-18, -19 when ED2 is open.

Step 1: With a DVOM check for positive voltage at CA402-18 and CA402-19 without depressing the brake pedal.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then with a DVOM check resistance of PVL coil, should be approximately 28 ohms.
- **If:** PVL coils ohms are correct and event code persists.
Then replace MRC1.

Event Code 327

Access 3 module (MRC1) voltage present at CA402-18 and/or CA402-19 when ED2 contactor is not energized.



12207



ELECTRICAL SYSTEM EVENT CODES

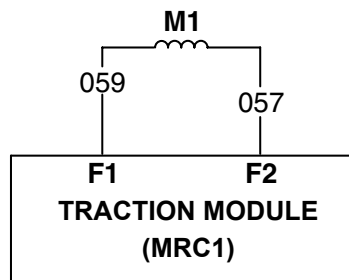
Event Code 328

ED2 contactor coil shorted.

Steering, traction and lift disabled.

Step 1: Disconnect wire #5921 from ED2 coil. With a DVOM check the resistance of ED2 coil. Coil resistance should be 40 to 47 ohms.

- **If:** Shorted.
Then replace coil.
- **If:** Coil is not shorted.
Then check for a short between wire #2956 to CA209-6 and wire #5921 to CA209-7.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12211

ELECTRICAL SYSTEM

EVENT CODES



Event Code 331

ECR 3 (traction feedback encoder) counts out of range.

Traction disabled.

Step 1: Chock load wheels and raise truck so drive tire is off the floor. Separate brake connector CA407 then insert the brake plug into connector CA210 on the distribution panel. Power up truck and manually release the brake.

Step 2: Check for +5 volts by connecting the positive lead of DVOM to CA410-1 (CA409-1 wire guided truck) and negative to CA410-2 (CA409-2 wire guided truck).

- **If: +5 volts present.**
Then proceed to step3.
- **If: 0 volts (not wire guided).**
Then check condition and connection of wire #707 from CA410-1 to splice and wire #708 from splice to CA403-6. Also check wire #533 from CA410-2 to CA403-14.
- **If: Wiring is OK and 0 volts between CA403-6 & -14.**
Then replace MRC1.

- **If: 0 volts (wire guided).**
Then check condition and connection of wire #709 from CA409-1 to CA417-22. Also check wire #534 from CA409-2 to CA417-23.
- **If: Wiring is OK and 0 volts between CA417-22 & -23.**
Then replace GCM.

Step 3: Check A/B channel counts. Connect DVOM negative lead to wire #533 at CA410-2 (wire #534 at CA409-2 wire guided truck) and positive lead to wire #031 at CA410-3 (wire #033 at CA409-3 wire guided truck). After connecting the leads 0V or +5V should be present, moving the rotor slowly 0V and +5V will alternate. Rotating the rotor rapidly voltage will be a constant +2.5V.

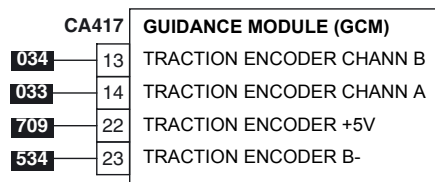
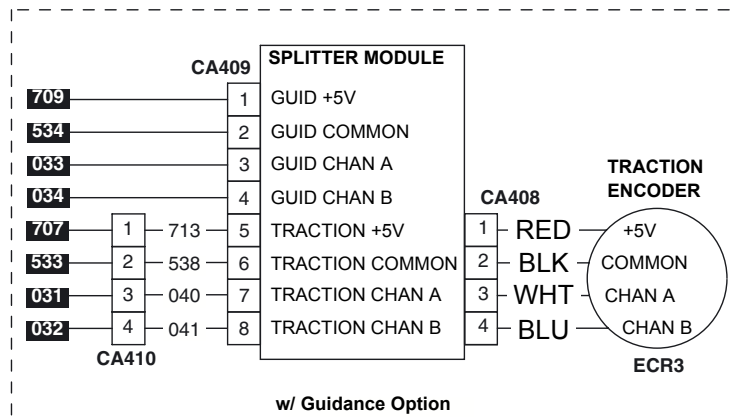
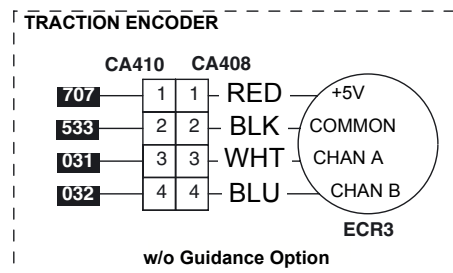
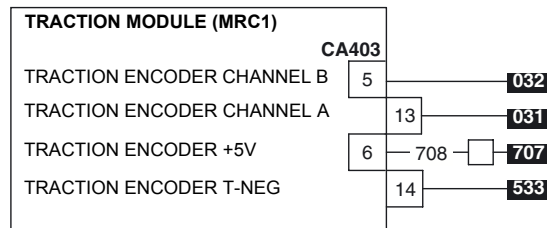
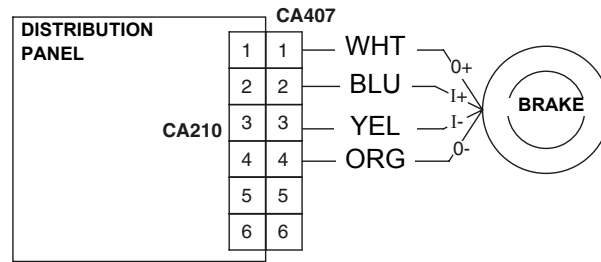
Check B channel by connecting the positive lead to wire # 032 at CA410-4 (wire #034 at CA409-4 wire guided trucks).

- **If: Either channel A or B fails this test.**
Then replace the encoder.
- **If: Both channel A and B pass the test and the fault persists.**
Then an internal quadrature error may exist. Replace ECR3.



ELECTRICAL SYSTEM

EVENT CODES



12213

ELECTRICAL SYSTEM

EVENT CODES



Event Code 332

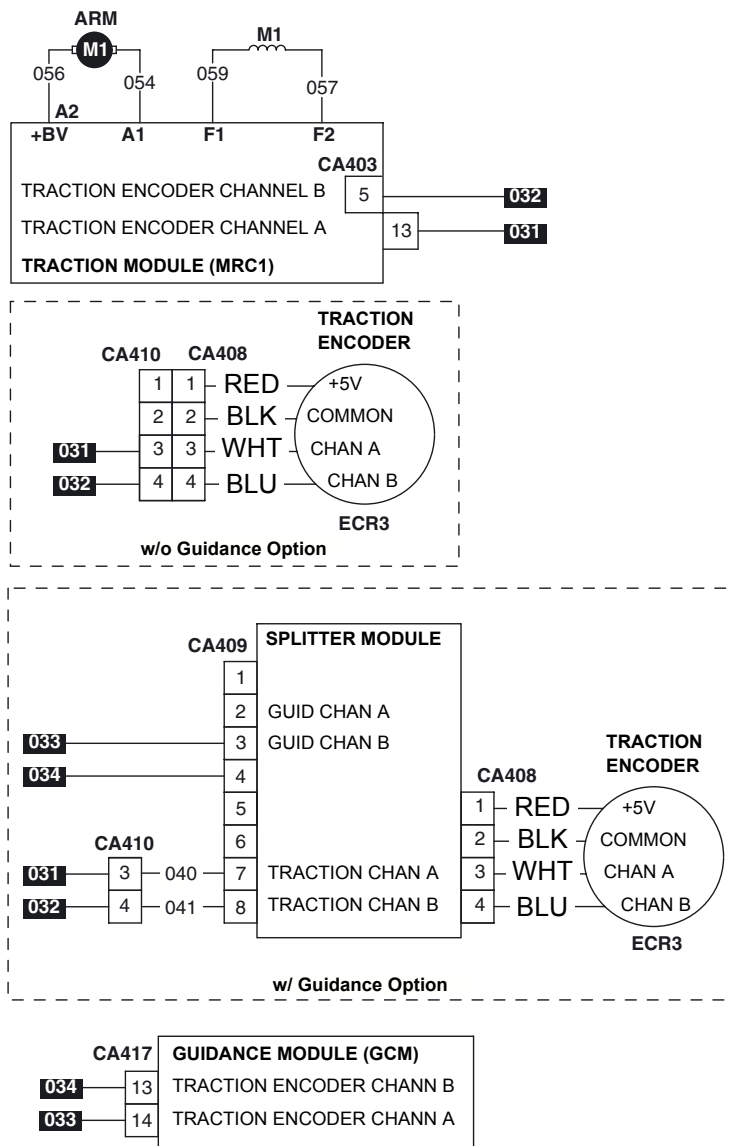
ECR3 (traction feedback encoder) feedback opposite traction command.

Traction disabled.

Step 1: Truck without wire guidance check wire #031 from CA410-3 to CA403-13 also wire #032 from CA410-4 to CA403-5.

Truck with wire guidance check wire #033 from CA409-3 to CA417-14 also wire #034 from CA409-4 to CA417-13.

- **If:** Wires are reversed.
Then correct.
- **If:** Wires are correct.
Then check wiring of traction motor field and armature cables.



12214



ELECTRICAL SYSTEM

EVENT CODES

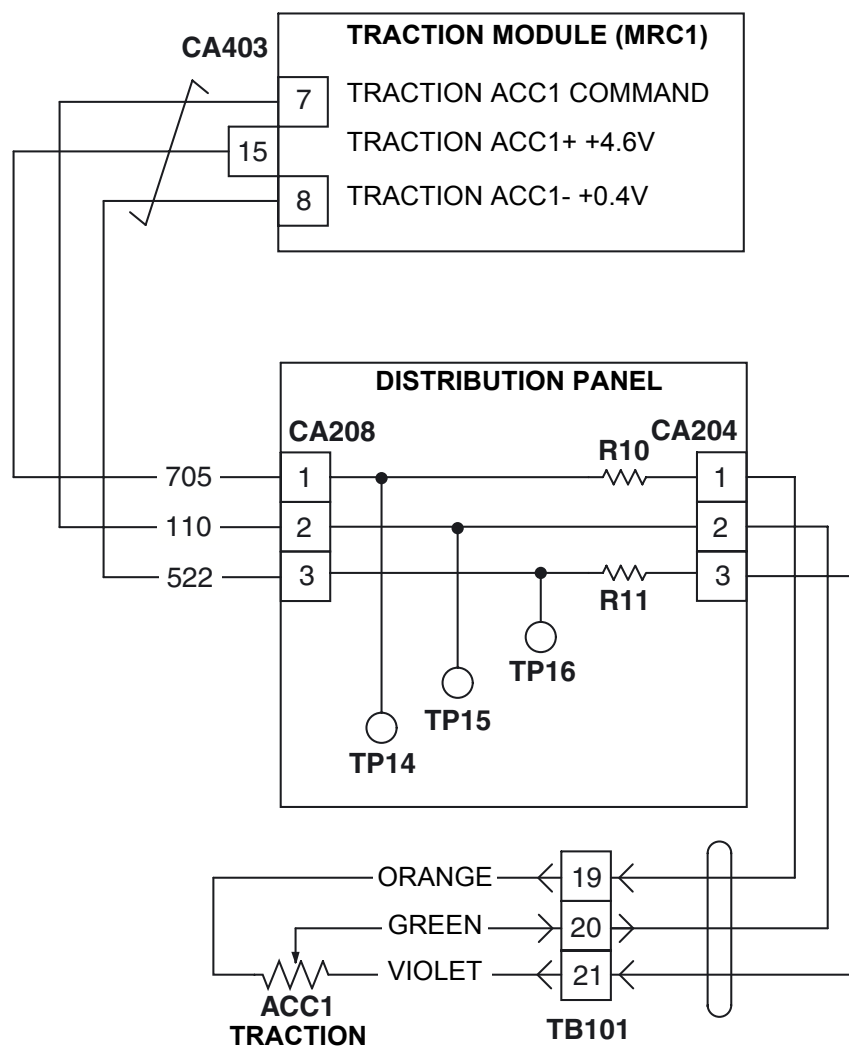
Event Code 333

POT1 (traction command potentiometer) above electrical limit.

Traction disabled.

Step 1: Connect service terminal and access Traction Analyzer, Traction Input, View Throttle. Center position voltage 2.4 to 2.6 volts, full forward travel position 4.62 volts, full reverse travel position 0.4 volts.

- **If:** Voltage is above specified range.
Then adjust POT 1 and calibrate.
- **If:** POT1 cannot be adjusted.
Then check wire connections at TB101-19, -20, -21, CA204-1, -2, -3, CA208-1, -2, -3 and CA403-7, -8, -15.
- **If:** Wiring OK.
Then replace POT1 and calibrate.



12215

ELECTRICAL SYSTEM

EVENT CODES



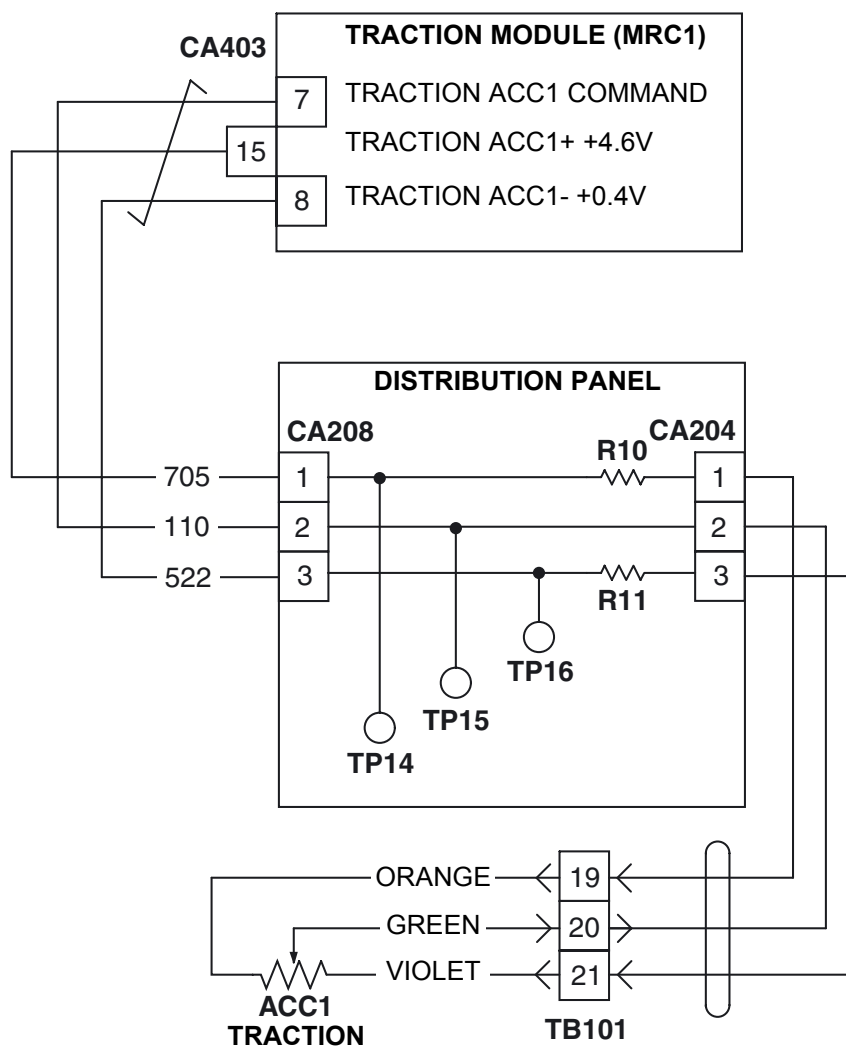
Event Code 334

POT1 (traction command potentiometer) below electrical limit.

Traction disabled.

Step 1: Connect service terminal and access Traction Analyzer, Traction Input, View Throttle. Center position voltage 2.4 to 2.6 volts, full forward travel position 4.62 volts, full reverse travel position 0.4 volts.

- If: Voltage is below specified range.
Then adjust POT 1 and calibrate.
- If: POT1 cannot be adjusted.
Then check wire connections at TB101-19, -20, -21, CA204-1, -2, -3, CA208-1, -2, -3 and CA403-7, -8, -15.
- If: Wiring OK.
Then replace POT1 and calibrate.



12215



ELECTRICAL SYSTEM

EVENT CODES

Event Code 335

Access 3 module (MRC1) battery current sensor power interruption.

Steering, traction and lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

Event Code 336

Steering module (SCM) timeout error.

Steering, traction and lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace SCM.

ELECTRICAL SYSTEM

EVENT CODES



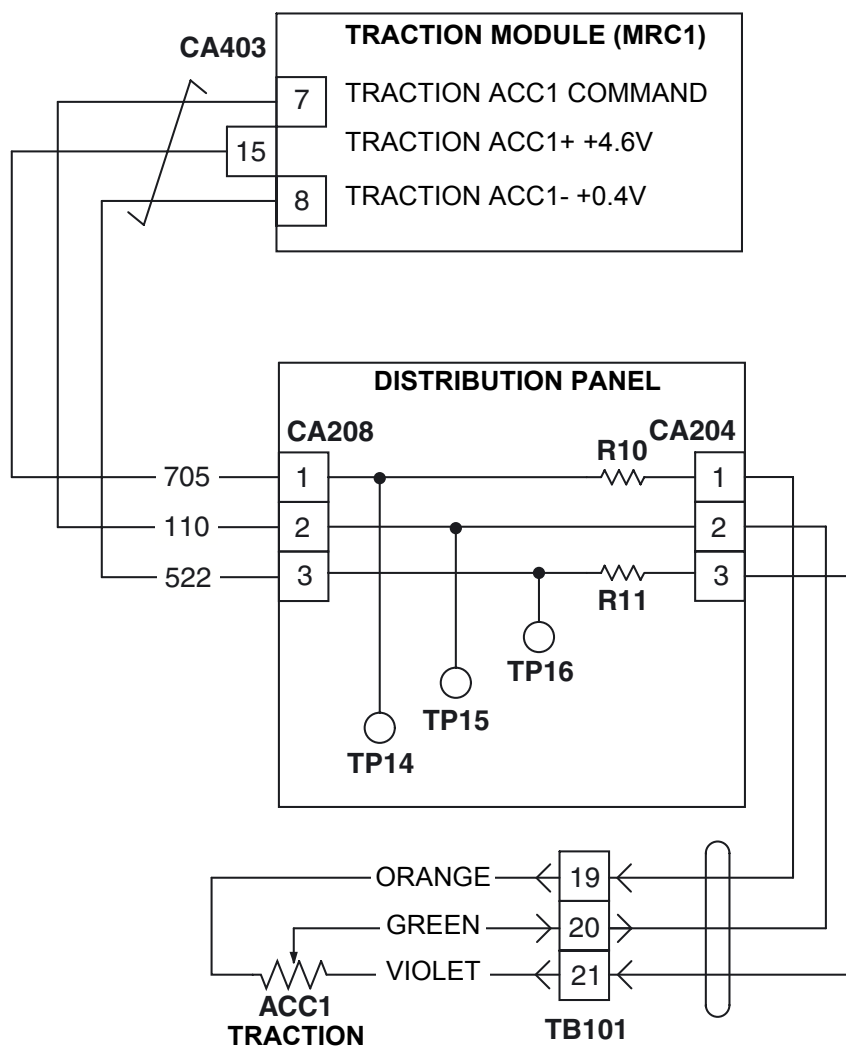
Event Code 337

During calibration, insufficient voltage range from POT1 (traction command potentiometer).

Traction disabled.

Step 1: Connect service terminal and access Traction Analyzer, Traction Input, View Throttle. Center position voltage 2.4 to 2.6 volts, full forward travel position 4.62 volts, full reverse travel position 0.4 volts.

- If: Voltage is above specified range.
Then adjust POT 1 and calibrate.
- If: POT1 cannot be adjusted.
Then check wire connections at TB101-19, -20, -21, CA204-1, -2, -3, CA208-1, -2, -3 and CA403-7, -8, -15.
- If: Wiring OK.
Then replace POT1 and calibrate.



12215



ELECTRICAL SYSTEM

EVENT CODES

Event Code 339

Traction disabled.

Access 3 module (MRC1) detected low battery.

Steering, traction and lift disabled.

Step 1: Check battery state of charge, battery condition and connections.

- **If:** Battery and connections are OK and the event code persists.
Then replace MRC1.

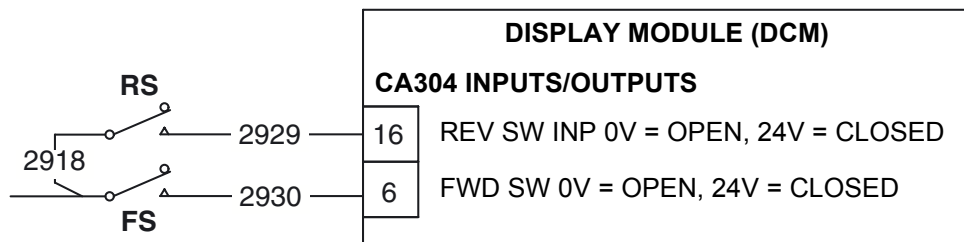
Step 1: Connect service terminal and access Traction Analyzer, Traction Input, View Throttle. Center position voltage 2.4 to 2.6 volts, full forward travel position 4.62 volts, full reverse travel position 0.4 volts.

- **If:** Voltage is out of specified range.
Then adjust POT1 and calibrate.
- **If:** Voltage is correct.
Then on the service terminal access Show, View Switch Status and check operation of FS switch.

Event Code 341

POT1 (traction command potentiometer) does not match forward switch (FS) signal.

- **If:** Forward switch is OK.
Then check FS and RS switches for proper wiring.



12217

ELECTRICAL SYSTEM

EVENT CODES



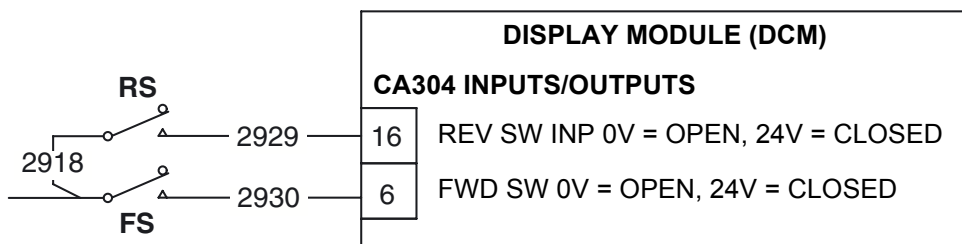
Event Code 342

POT1 (traction command potentiometer) does not match reverse switch (RS) signal.

Traction disabled.

Step 1: Connect service terminal and access Traction Analyzer, Traction Input, View Throttle. Center position voltage 2.4 to 2.6 volts, full forward travel position 4.62 volts, full reverse travel position 0.4 volts.

- **If:** Voltage is out of specified range.
Then adjust POT1 and calibrate.
- **If:** Voltage is correct.
Then on the service terminal access Show, View Switch Status and check operation of RS switch.
- **If:** Reverse switch is OK.
Then check RS and FS switches for proper wiring.



12217

Event Code 343

Both forward switch (FS) and reverse switch (RS) closed at same time.

Traction disabled.

Step 1: Check for physical damage to switches, wiring or mounting.

Event Code 344

Access 3 module (MRC1) inner brake coil current too high.

Traction disabled.

Step 1: Check for short circuit in brake coil or wiring between MRC1 and brake coil.

Step 2: Check brake coil resistance, range is 2.49 to 5.52 ohms. Normal reading at 20 deg. C (68 deg. F) is 3.56 ohms.

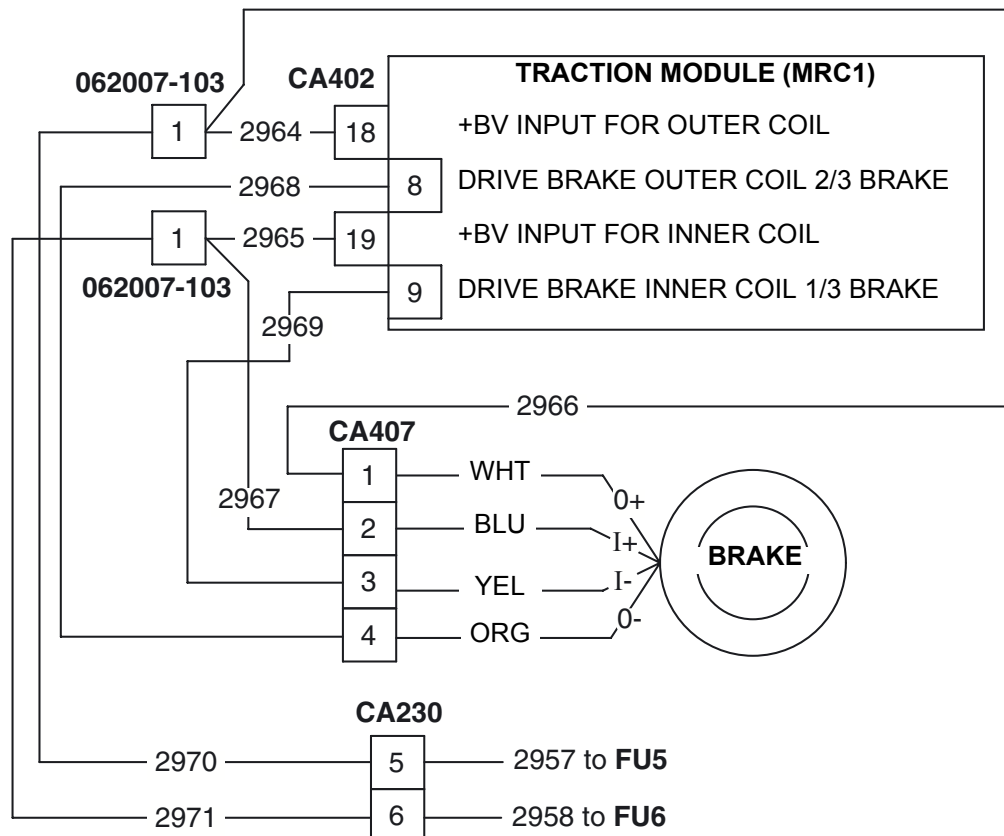
- **If:** Outside these ranges, the following should be considered:

- Cold temperature greatly decreases resistance of coil, thereby increasing coil current draw.

- If in a cold environment, warm coil and recheck resistance readings.

- If resistance is still outside range after coil is warm replace brake coil.

- **If:** Coil resistance checks OK.
Then pull FU6, disconnect CA407 check resistance between CA407-2 and CA407-3. Resistance should be within specified range above.
- **If:** Resistance is not within specified range.
Then check wiring between MRC1 and brake coil.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12218

ELECTRICAL SYSTEM

EVENT CODES



Event Code 345

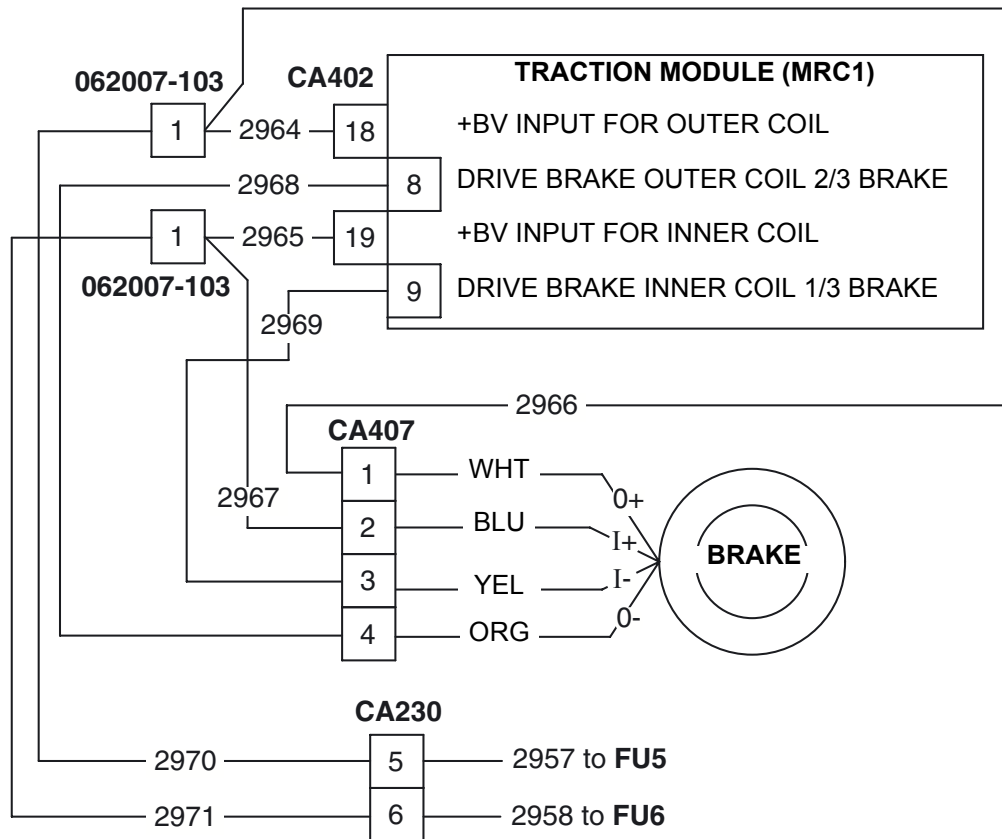
Access 3 module (MRC1) inner brake coil resistance too high.

Traction disabled.

Step 1: Check FU6 for open circuit.

- **If:** Fuse is bad replace.

- **If:** Fuse is good.
Then disconnect CA407 and with a DVOM check inner coil resistance between CA407-2 and CA407-3. Resistance should be between 2.49 and 5.52 ohms at 20 deg. C (68 deg. F).
- **If:** Resistance is out of specified range.
Then replace brake coil.



12218



ELECTRICAL SYSTEM

EVENT CODES

Event Code 346

Access 3 module (MRC1) outer brake coil resistance too low.

Traction disabled.

Step 1: Check for short circuit in brake coil or wiring between MRC1 and brake coil.

Step 2: Check brake coil resistance, range is 0.95 to 2.1 ohms. Normal reading at 20 deg. C (68 deg. F) is 1.4 ohms.

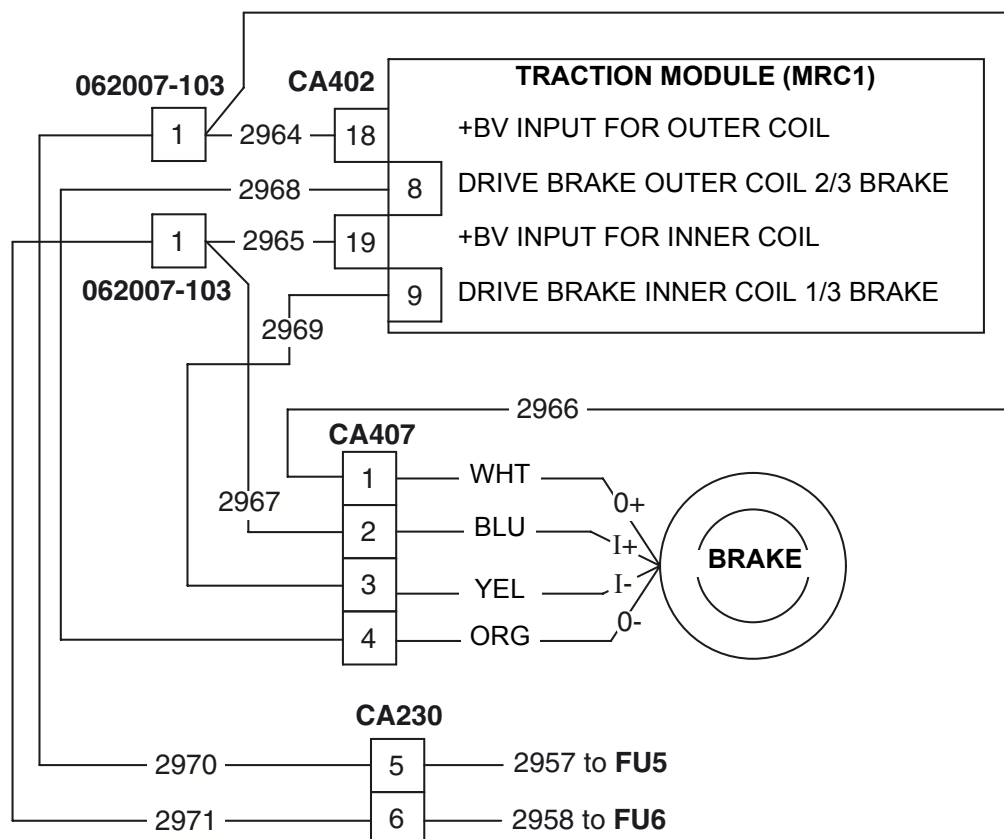
- **If:** Outside these ranges, the following should be considered:

- Cold temperature greatly decreases resistance of coil, thereby increasing coil current draw.

- If in a cold environment, warm coil and recheck resistance readings.

- If resistance is still outside range after coil is warm replace brake coil.

- **If:** Coil resistance checks OK.
Then pull FU5, disconnect CA407 check resistance between CA407-1 and CA407-4. Resistance should be within specified range above.
- **If:** Resistance is not within specified range.
Then check wiring between MRC1 and brake coil.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12218



ELECTRICAL SYSTEM

EVENT CODES

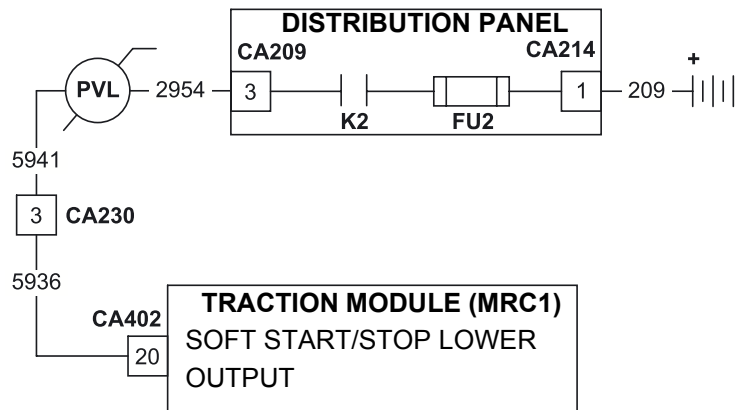
Event Code 348

Access 3 module (MRC1) soft start lower (PVL/PVLF) current high.

Lift disabled.

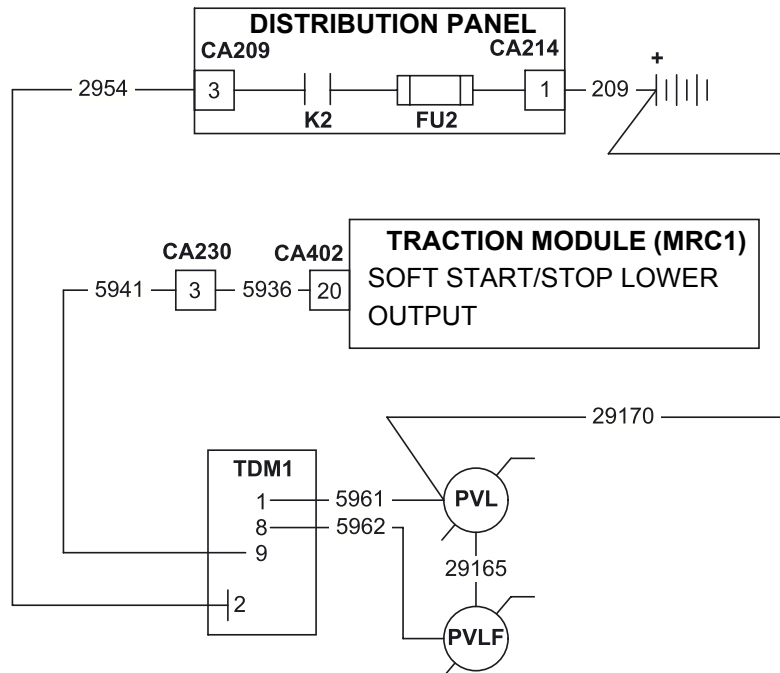
Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then with a DVOM check resistance of PVL/PVLF coil, should be approximately 28 ohms.
- **If:** PVL/PVLF coils ohms are correct and event code persists.
Then replace MRC1.



1.25SP

1.0SP



13517

ELECTRICAL SYSTEM

EVENT CODES



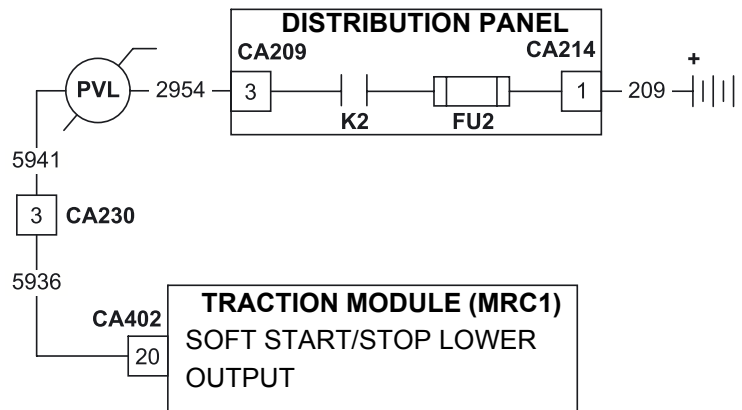
Event Code 349

Access 3 module (MRC1) soft start lower (PVL/PVLF) current low.

Lift disabled.

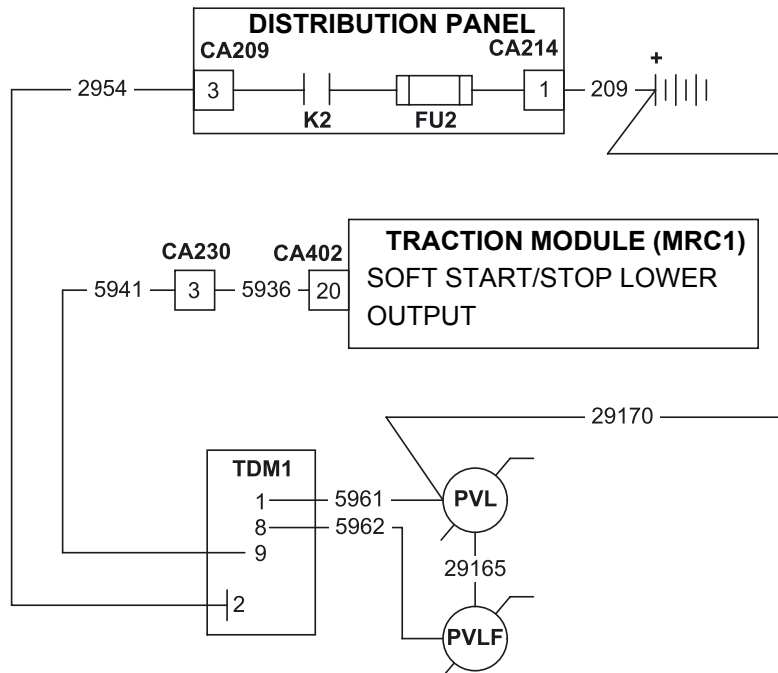
Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then with a DVOM check resistance of PVL/PVLF coil, should be approximately 28 ohms.
- **If:** PVL/PVLF coils ohms are correct and event code persists.
Then replace MRC1.



1.25SP

1.0SP



13517



ELECTRICAL SYSTEM EVENT CODES

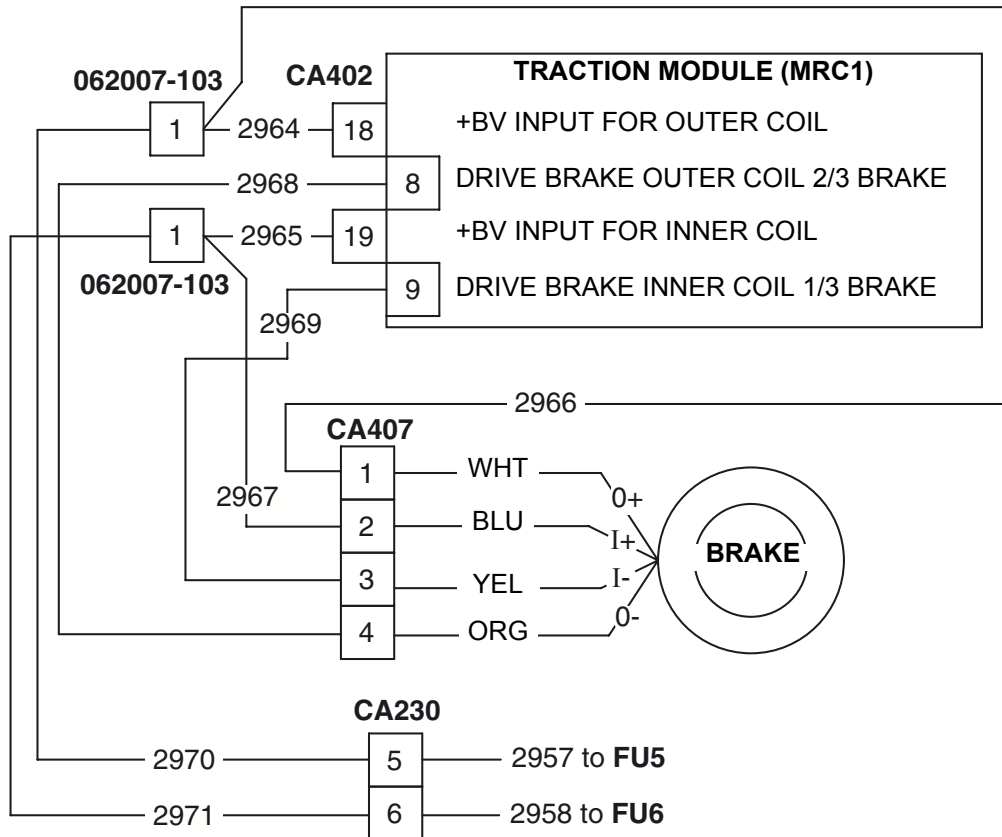
Event Code 351

Access 3 module (MRC1) inner brake coil short circuit.

Traction disabled.

Step 1: Then disconnect CA407 and with a DVOM check inner coil resistance between CA407-2 and CA407-3. Resistance should be between 2.49 and 5.52 ohms at 20 deg. C (68 deg. F).

- **If:** Resistance is out of specified range.
Then replace brake coil.



12218

ELECTRICAL SYSTEM

EVENT CODES



Event Code 352

Access 3 module (MRC1) outer brake coil short circuit.

Traction disabled.

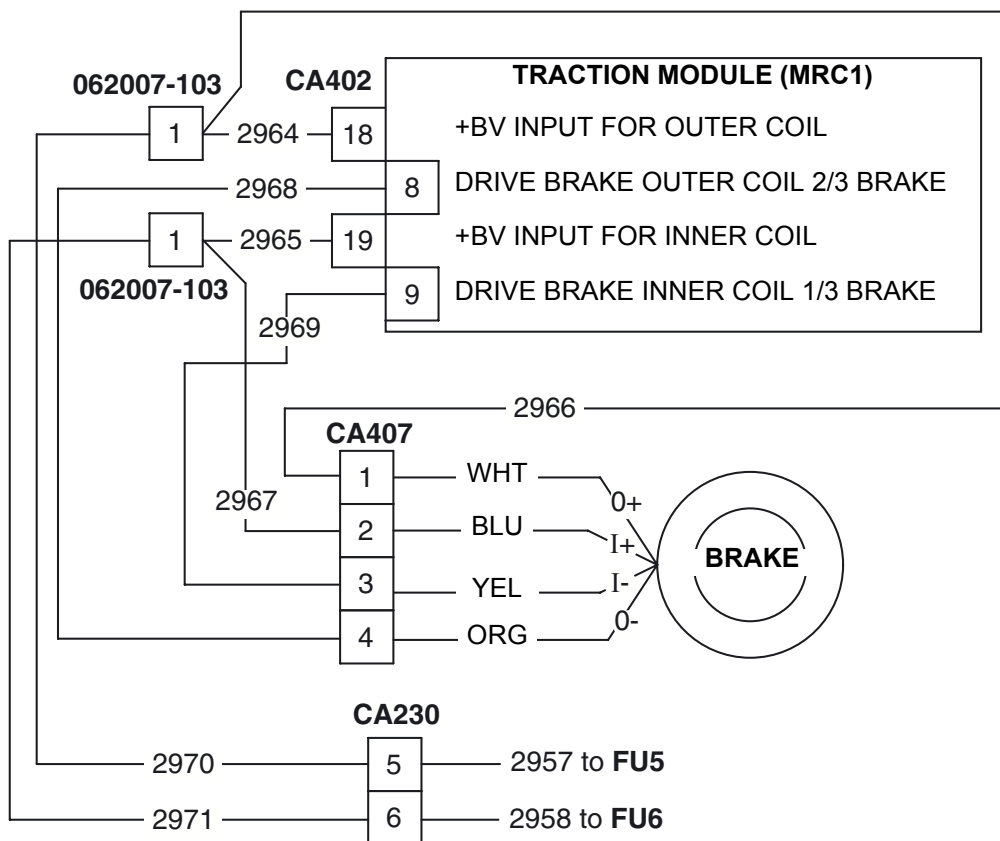
Step 1: Check brake coil resistance, range is 0.95 to 2.1 ohms. Normal reading at 20 deg. C (68 deg. F) is 1.4 ohms.

- **If:** Outside these ranges, the following should be considered:
 - Cold temperature greatly decreases resistance of coil, thereby increasing coil current draw.

- If in a cold environment, warm coil and recheck resistance readings.

- If resistance is still outside range after coil is warm replace brake coil.

- **If:** Coil resistance checks OK.
Then pull FU5, disconnect CA407 check resistance between CA407-1 and CA407-4. Resistance should be within specified range above.
- **If:** Resistance is not within specified range.
Then check wiring between MRC1 and brake coil.
- **If:** No problem is found and event code persists.
Then replace MRC1.



12218



ELECTRICAL SYSTEM EVENT CODES

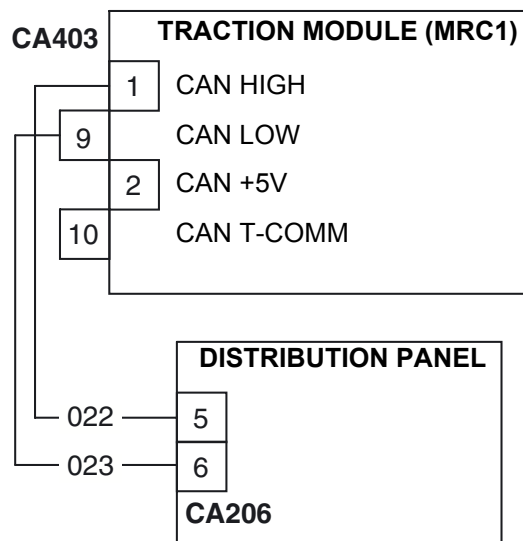
Event Code 353

Access 3 (MRC1) CAN read time-out.

Steering, traction and lift disabled.

Step 1: Check connection and condition of wire #022 from CA206-5 to CA403-1 also wire #023 from CA206-6 to CA403-9.

- **If:** Wiring problem exists.
Then repair.
- **If:** Wiring is OK and the event code persists.
Then replace MRC1.



12359

ELECTRICAL SYSTEM

EVENT CODES



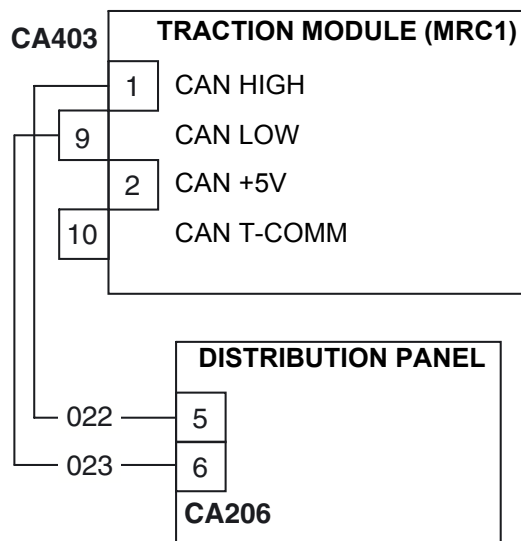
Event Code 354

Access 3 (MRC1) CAN write time-out.

Steering, traction and lift disabled.

Step 1: Check connection and condition of wire #022 from CA206-5 to CA403-1 also wire #023 from CA206-6 to CA403-9.

- **If:** Wiring problem exists.
Then repair.
- **If:** Wiring is OK and the event code persists.
Then replace MRC1.



12359

Event Code 355

Access 3 module (MRC1) software incompatible with hardware.

Steering, traction and lift disabled.

Step 1: MRC1 software version is incorrect. Verify truck model and serial number and program module accordingly.

Event Code 356

Access 3 module (MRC1) corrupted setup values.

Steering, traction and raise disabled.

Step 1: Connect service terminal and check programmed setups.

- **If:** Setup values are incorrect.
Then enter correct values.
- **If:** Values are correct and event code persists.
Then replace MRC1.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 357

Access 3 module (MRC1) corrupted setup values.

Steering, traction and raise disabled.

Step 1: Connect service terminal and check programmed setups.

- **If:** Setup values are incorrect.
Then enter correct values.
- **If:** Values are correct and event code persists.
Then replace MRC1.

Event Code 358

Access 3 module (MRC1) corrupted setup values.

Steering, traction and lift disabled.

Step 1: Connect service terminal and check programmed setups.

- **If:** Setup values are incorrect.
Then enter correct values.
- **If:** Values are correct and event code persists.
Then replace MRC1.

Event Code 362

Access 3 module (MRC1) soft start lower low speed load short.

Lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

ELECTRICAL SYSTEM

EVENT CODES



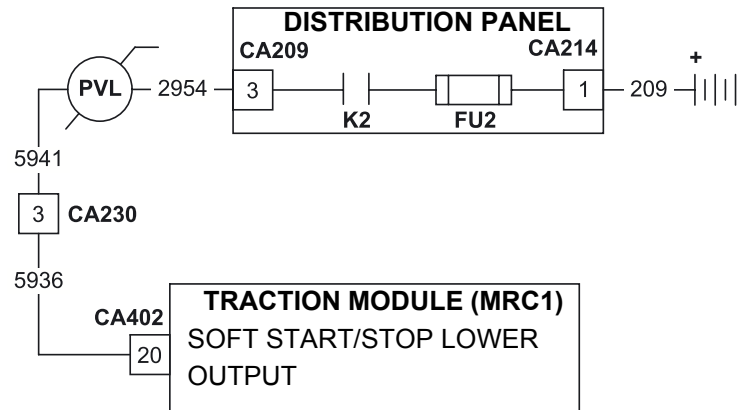
Event Code 363

Access 3 module (MRC1) soft start lower short.

Lift disabled.

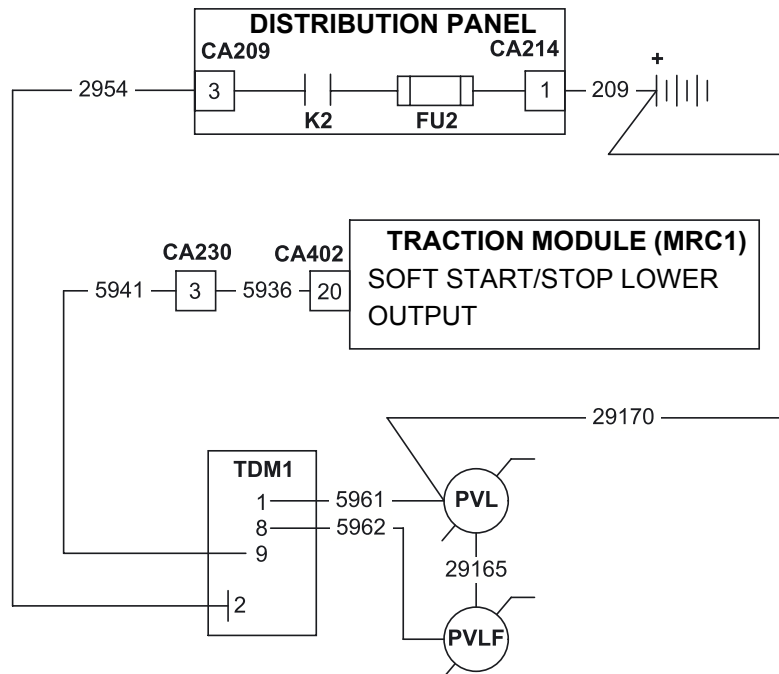
Step 1: Test is run after ED closes (traction, lift and lower not selected).

- If: Event is logged.
Then check lower switches and associated wiring for short.
- If: No problem found and event code persists.
Then replace MRC1.

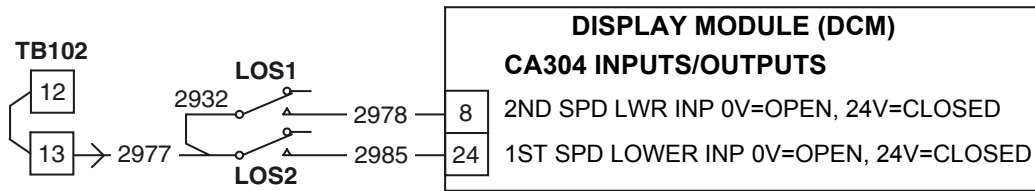


1.25SP

1.0SP



13517



12413

Event Code 364

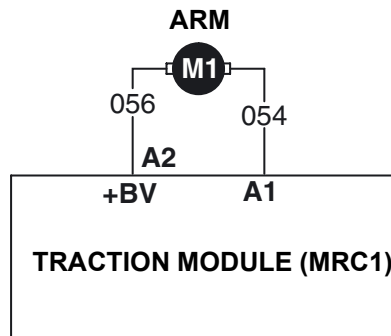
Traction motor (M1) armature shorted.

Steering, traction and lift disabled.

Step 1: Check drive motor armature and Access 3 module (MRC1) for loose or incorrect connections.

Step 2: Raise truck so drive tire is off the floor. Disconnect A1 lead from Access 3 module (MRC1). Power up the truck and attempt to travel.

- **If:** Event code changes.
Then check M1 armature.
- **If:** Event code remains the same.
Then replace MRC1.



12360

ELECTRICAL SYSTEM

EVENT CODES



Event Code 365

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: Check control wiring and for proper software.

- **If:** Wiring and software check OK.
Then replace MRC1.

Event Code 366

Access 3 module (MRC1) internal fault.

Traction disabled.

Step 1: Check control wiring.

- **If:** Wiring checks OK.
Then replace MRC1.

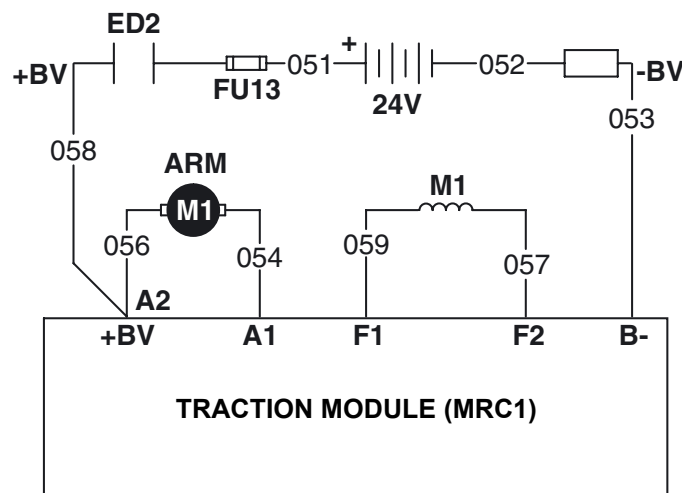
Event Code 367

Open circuit between battery positive and Access 3 module (MRC1) terminal A1.

Steering, traction and lift disabled.

Step 1: Check FU13, ED2 contactor tips and wiring connections.

- **If:** FU13, ED2 and wiring is OK and event code persists.
Then check motor brushes and armature.
- **If:** Motor brushes and armature are OK and event code persists.
Then replace MRC1.



12208

Event Code 368

Access 3 module (MRC1) temperature below limit for proper operation.

Traction disabled.

Step 1:

- If the truck has been left idle in a blast freezer for an extended period of time this event code may register.
- If this event code cannot be cleared after leaving the truck powered up for a period of time, move the truck to a warmer location.
- If the event code persists replace MRC1.

Event Code 369

Access 3 module (MRC1) temperature above limit for proper operation.

Traction disabled.

Step 1: Make sure traction motor (M1) fuse FU13 size is correct (140 amp).

Step 2: Check the MRC1 power cables for loose or corroded terminals.

Step 3: Make sure MRC1 mounting surface has been fully coated with thermal transfer grease and that full contact is being made between both mounting surfaces.

Check tightness of module mounting screws.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 371

Access 3 module (MRC1) soft start lower high speed load short.

Lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace MRC1.

Event Code 372

Traction motor (M1) armature current too low or too high during regenerative braking.

Traction disabled.

Step 1: Verify that brakes are not dragging or misadjusted.

Event Code 373

Traction motor (M1) field current too low or too high.

Traction disabled.

Step 1: Check M1 field for a short or open.

- **If:** Either a short or open exists.



ELECTRICAL SYSTEM EVENT CODES

Event Code 374

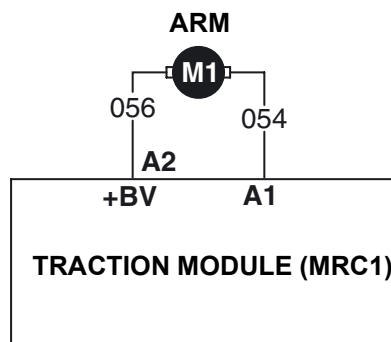
Traction motor (M1) armature open circuit.

Traction disabled.

Step 1: Check M1 armature for an open circuit.

Step 2: Check lead condition/connections at M1 A1/A2 and Access 3 module (MRC1) +BV/A1. Also brushes, brush holder, brush springs and armature.

- **If:** Open exists due to one of the above.
Then repair or replace M1.
- **If:** M1 and lead connections OK and the event code persists.
Then replace Access 3 module (MRC1).



12360

Event Code 375

Traction motor (M1) sensed field input exceeds limits for off condition.

Steering, traction and lift disabled.

Step 1: If truck does not operate check wiring.

- **If:** Wiring OK.
Then check motor field at F1/F2 for a short.
- **If:** No short exists and event code persists.
Then replace MRC1.

Event Code 376

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 377

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 378

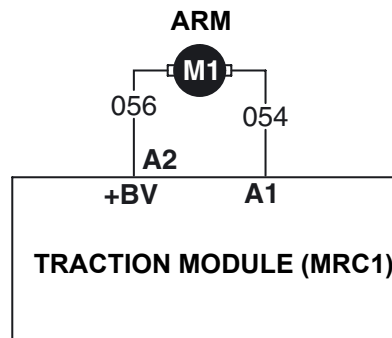
Traction motor (M1) armature shorted.

Steering, traction and lift disabled.

Step 1: Check M1 armature and Access 3 module (MRC1) +BV/A2/A1 for loose or incorrect connections.

Step 2: Raise truck so drive tire is off the floor. Disconnect A1 lead from Access 3 module (MRC1). Power up the truck and attempt to travel.

- **If:** Event code changes.
Then replace M1 armature/motor.
- **If:** Event code remains the same.
Then replace MRC1.



12360



ELECTRICAL SYSTEM EVENT CODES

Event Code 379

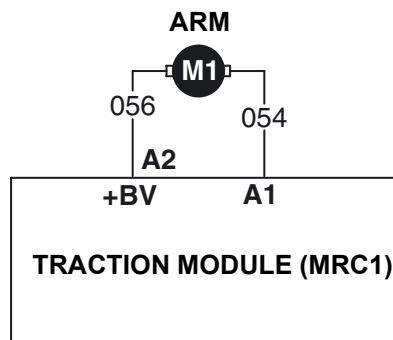
Traction motor (M1) field shorted.

Steering, traction and lift disabled.

Step 1: Check M1 and Access 3 module (MRC1) terminals F1/F2 for loose connections.

Step 2: Raise truck so drive tire is off the floor. Disconnect F1 lead from Access 3 module (MRC1). Power up the truck and attempt to travel.

- **If:** Event code changes.
Then replace M1 field/motor.
- **If:** Event code remains the same.
Then replace MRC1.



12360

Event Code 381

Access 3 module (MRC1) internal short circuit.

Steering, traction and lift disabled.

- **If:** Event code persists.
Then replace MRC1.

Event Code 382

Access 3 module (MRC1) internal short circuit.

Steering, traction and lift disabled.

- **If:** Event code persists.
Then replace MRC1.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 383

Access 3 module (MRC1) inner brake short circuit.

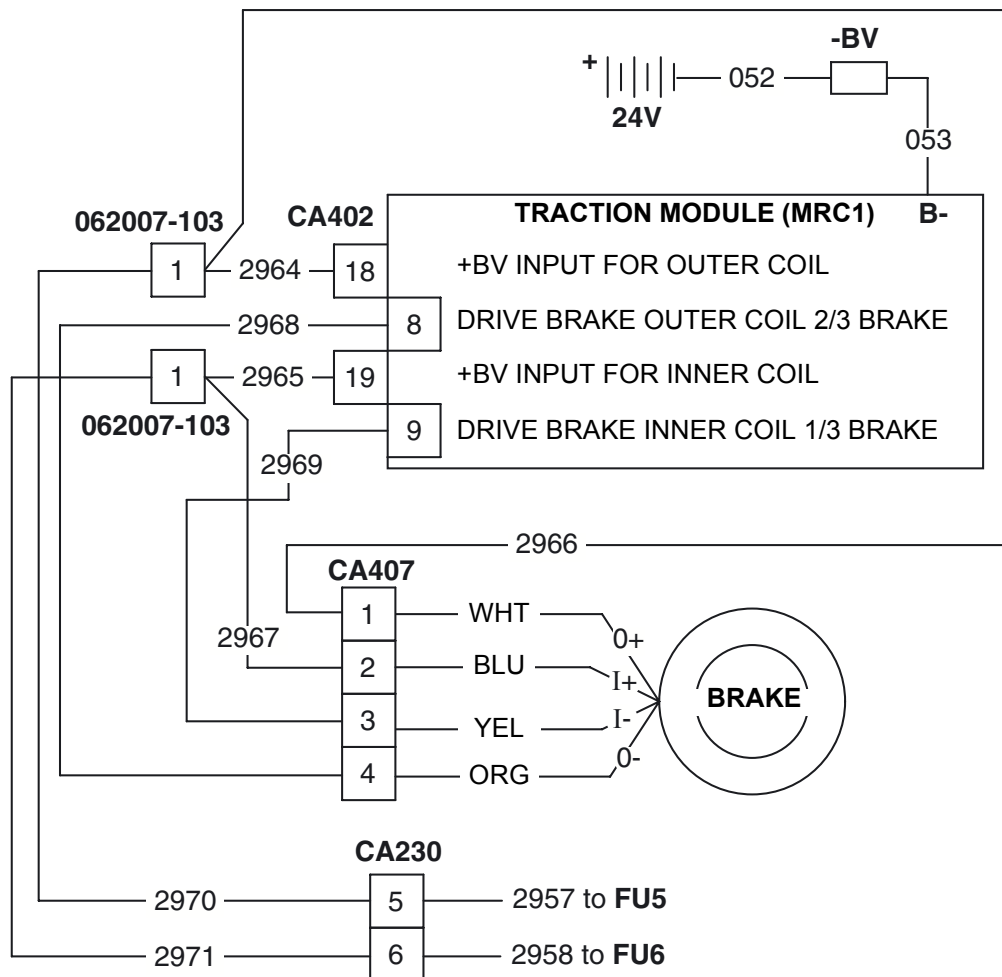
Steering, traction and lift disabled.

Step 1: Measure voltage between CA402-9 and battery negative.

- **If:** Less than 5 volts.
Then check for a short circuit between CA402-9 and battery negative.

Step 2: Disconnect brake at CA407. Measure resistance of inner coil CA407-2 & 3 resistance should measure 2.49 to 5.52 ohms.

- **If:** Resistance is out of range.
Then replace brake.
- **If:** Resistance is OK and event code persists.
Then replace MRC1.



12361

Event Code 384

Access 3 module (MRC1) outer brake short circuit.

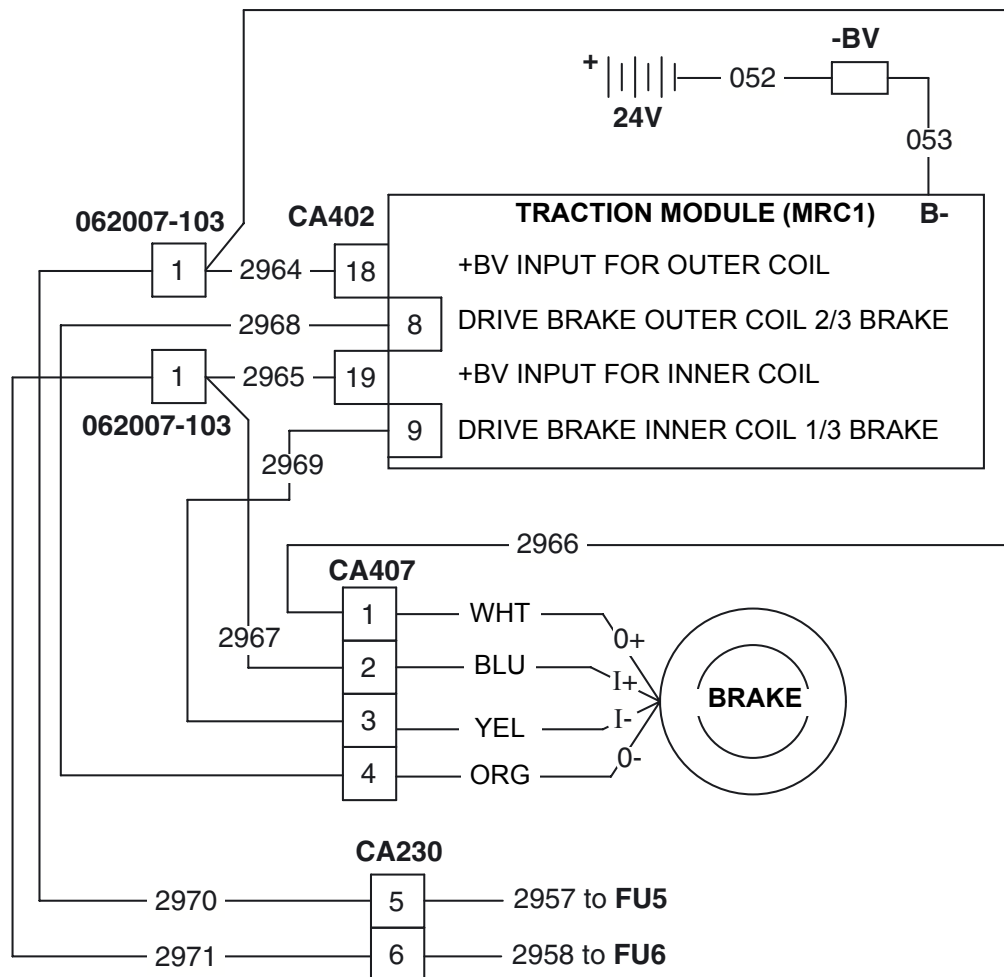
Full traction disabled.

Step 1: Truck powered up ED2 closed measure voltage between CA402-8 and battery negative.

- **If:** Less than 5 volts.
Then check for a short circuit between CA402-8 and battery negative.

Step 2: Disconnect brake at CA407. Measure resistance of outer coil CA407-1 & 4 resistance should measure 0.95 to 2.1 ohms.

- **If:** Resistance is out of range.
Then replace brake.
- **If:** Resistance is OK and event code persists.
Then replace MRC1.



12361

ELECTRICAL SYSTEM

EVENT CODES



Event Code 385

Access 3 module (MRC1) over temperature condition.

No action taken.

Step 1: Has duty cycle of truck changed?
Traction used more than lift and/or long runs with capacity loads MRC1 may need to cool.

Step 2: Check for dirt insulating the MRC1, loose and/or corroded power cable connections.

Step 3: Insure MRC1 mounting surface is in full contact with truck mounting surface. Also insure heat transfer grease is present.

Step 4: Check tightness of Access 3 mounting screws.

Event Code 386

Access 3 module (MRC1) incorrect battery voltage.

Steering, traction and lift disabled.

Step 1: Insure battery installed is correct voltage for truck.

Event Code 387

Access 3 module (MRC1) software not compatible with Display module (DCM) software.

Steering, traction and lift disabled.

Step 1: Verify MRC1 is programmed for the SP application.

Step 2: Verify DCM is programmed.

Step 3: Verify MRC1 and DCM are programmed with compatible software versions.



ELECTRICAL SYSTEM

EVENT CODES

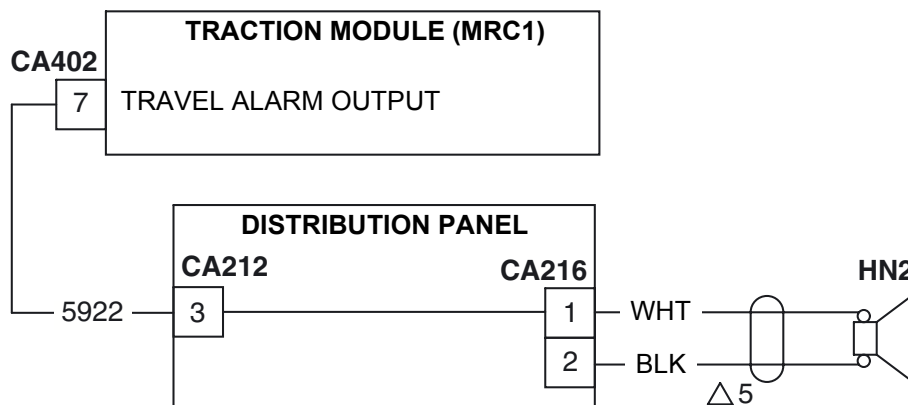
Event Code 388

Access 3 module (MRC1) travel alarm (HN2) shorted or open.

Steering, traction and lift disabled.

Step 1: MRC1 verifies OFF and ON status of HN2.
Check HN2 operations.

- **If:** HN2 is bad.
Then replace.
- **If:** HN2 is good.
Then check wiring conditions and connections between CA216-1, -2. Also wire #5922 between CA212-3 and CA402-7.
- **If:** Wiring is OK and the event code persists.
Then replace MRC1.



12388

Event Code 391

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 393

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 392

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

ELECTRICAL SYSTEM

EVENT CODES



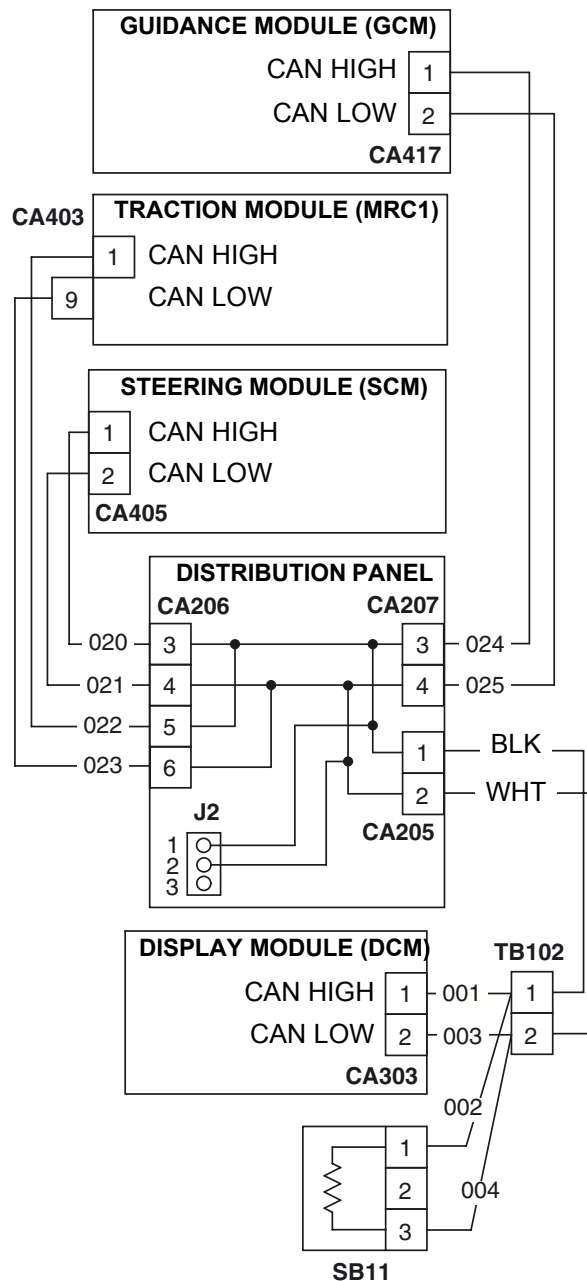
Event Code 394

Step 1: Check condition and connections of CAN wiring from distribution panel to MRC1, SCM, DCM and GCM.

Access 3 module (MRC1) no CAN communication between modules at power up.

- If: Poor connections or corrosion exists. Then repair/clean.

Steering, traction and lift disabled.



12362



ELECTRICAL SYSTEM

EVENT CODES

Event Code 396

Access 3 module (MRC1) ECR3 count differs from Guidance module (GCM) ECR3 count.

Traction disabled.

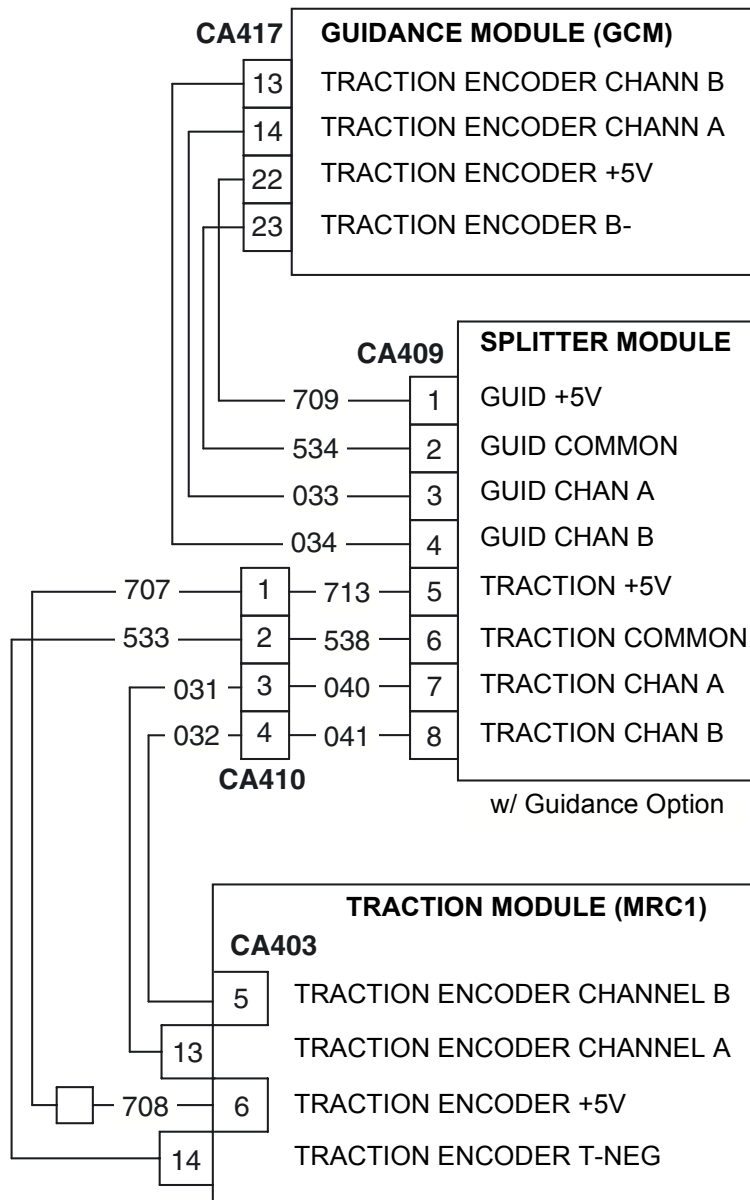
– Splitter module CA409 -1, -2, -3, -4 to GCM CA417-22, -23, -14, -13.

– CA409-5, -6, -7, -8 to CA410-1, -2, -3, -4.

– CA410-1, -2, -3, -4 to CA403-6, 14-, 13-, 5.

Step 1: Wiring for loose or corroded connections from:

- **If:** Wiring problem or corrosion exists. Then repair or clean.



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 397

Access 3 module (MRC1) internal fault.

No action taken.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 398

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 399

Access 3 module (MRC1) internal fault.

Steering, traction and lift disabled.

Step 1: If truck does not operate check power and control wiring.

- **If:** Wiring OK and event code persists.
Then replace MRC1.

Event Code 411

Guidance module (GCM) fails to come out of reset upon power-up.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.

- **If:** Event code persists.
Then replace GCM.

Event Code 412

Guidance module (GCM) fails to program upon power-up.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.

- **If:** Event code persists.
Then replace GCM.

Event Code 413

Guidance module (GCM) CAN setup failed.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.

- **If:** Event code persists.
Then replace GCM.



ELECTRICAL SYSTEM

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Event Code 414

Guidance module (GCM) CAN write message failed.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 415

Guidance module (GCM) program interrupt.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 416

Guidance module (GCM) real time Interrupt occurs.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 417

Guidance module (GCM) analog to digital conversion failed.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 418

Guidance module (GCM) software error occurred.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

ELECTRICAL SYSTEM

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Event Code 419

Truck tracking outside wire guidance slow down limits.

Traction disabled and brakes applied.

Step 1: Check load wheel and steer wheel sensor bars.

- **If:** Bar height is not 3.25" from the floor (bottom of bar to floor surface).
Then adjust bar height.
- **If:** Bar height OK.
Then proceed with step 2.
- **If:** Load wheel sensor bar bracket is bent.
Then straighten mounting bracket.
- **If:** Mounting OK.
Then proceed with step 2.
- **If:** Sensor bar(s) are damaged.
Then replace sensor bar(s).
- **If:** Condition OK.
Then proceed with step 2.

Step 2: Connect the service terminal and access "View Encoder Counts" "Wheel Angle". With the wheel

straight ahead as indicated by the drive unit alignment marks verify that ECR2 is in "Index".

- **If:** ECR2 is in "Index".
Then proceed to step 3.
- **If:** ECR2 is not in "Index".
Then adjust as described in section M4.5 of the service manual.

Step 3: Re-calibrate guidance.

- **If:** Tracking is OK.
Then truck is operation ready.
- **If:** Event code persists.
Then proceed to step 4.

Step 4: Check floor condition as poor floors affect guidance. Operate the truck though out the warehouse noting the areas that guidance is effected.

- **If:** Guidance is being effected by poor floor conditions.
Then have the floor surface repaired.
- **If:** Floor repair is not feasible.
Then alert operators to the condition and to use extreme care when in guidance.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 421

Wire guidance lost while tracking.

Traction disabled and brakes applied.

Step 1: Driving the truck off the end of the wire before turning guidance off can cause this event.

- **If:** Truck was driven off the end of the wire before turning guidance off.
Then there is nothing wrong with the guidance system.
- **If:** The truck was not driven off the end of the wire.
Then proceed to step 2.

Step 2: Check load wheel and steer wheel sensor bars.

- **If:** Bar height is not 3.25" from the floor (bottom of bar to floor surface).
Then adjust bar height.
- **If:** Bar height OK.
Then proceed with step 2.
- **If:** Load wheel sensor bar bracket is bent.
Then straighten mounting bracket.
- **If:** Mounting OK.
Then proceed with step 2.
- **If:** Sensor bar(s) are damaged.
Then replace sensor bar(s).

- **If:** Condition OK.
Then proceed with step 2.

Step 3: Connect the service terminal and access "View Encoder Counts" "Wheel Angle". With the wheel straight ahead as indicated by the drive unit alignment marks verify that ECR2 is in "Index".

- **If:** ECR2 is in "Index".
Then proceed to step 4.
- **If:** ECR2 is not in "Index".
Then adjust as described in section M4.5 of the service manual.

Step 4: Recalibrate guidance.

- **If:** Tracking is OK.
Then truck is operation ready.
- **If:** Event code persists.
Then proceed to step 5.

Step 5: Center the truck over the wire and connect the service terminal and view wire guide sensors.

- **If:** Sensor bar(s) signal is zero.
Then check line driver signal output.
- **If:** There is no signal from the line driver.
Then proceed to step 7.
- **If:** Line drive signal is OK.
Then proceed with step 7.
- **If:** The sensor bar signal is OK.
Then proceed to step 8.

ELECTRICAL SYSTEM

EVENT CODES



Step 6: Remove sensor connectors and check for +5V dc power to the sensor. LW connector CA418 and SW connector CA419, pin 3 is battery negative and pin 5 is supply positive.

- **If:** There is no voltage at CA418 or CA419.
Then check wire harness continuity. LW connector CA418-3 to guidance module CA417-4 and CA418-5 to guidance module CA417-3. SW connector CA419-3 to guidance module CA417-16 and CA419-5 to guidance module CA417-15.
- **If:** Continuity test failed.
Then replace harness.
- **If:** Continuity test passed.
Then replace GCM.

Step: 7 The line driver outputs the guidance signal. Should AC power to the line driver be lost it will continue to operate off the backup batteries for approximately one hour (dependent on battery condition) after which there will be no guidance signal to the truck.

- **If:** AC power to the line driver lost.
Then alert all operators to stop operation of wire guided equipment until the line driver is repaired.
- **If:** The line driver is not operational.
Then check AC power at J3.
- **If:** There is no AC power at J3.
Then contact the appropriate personnel for repairs.

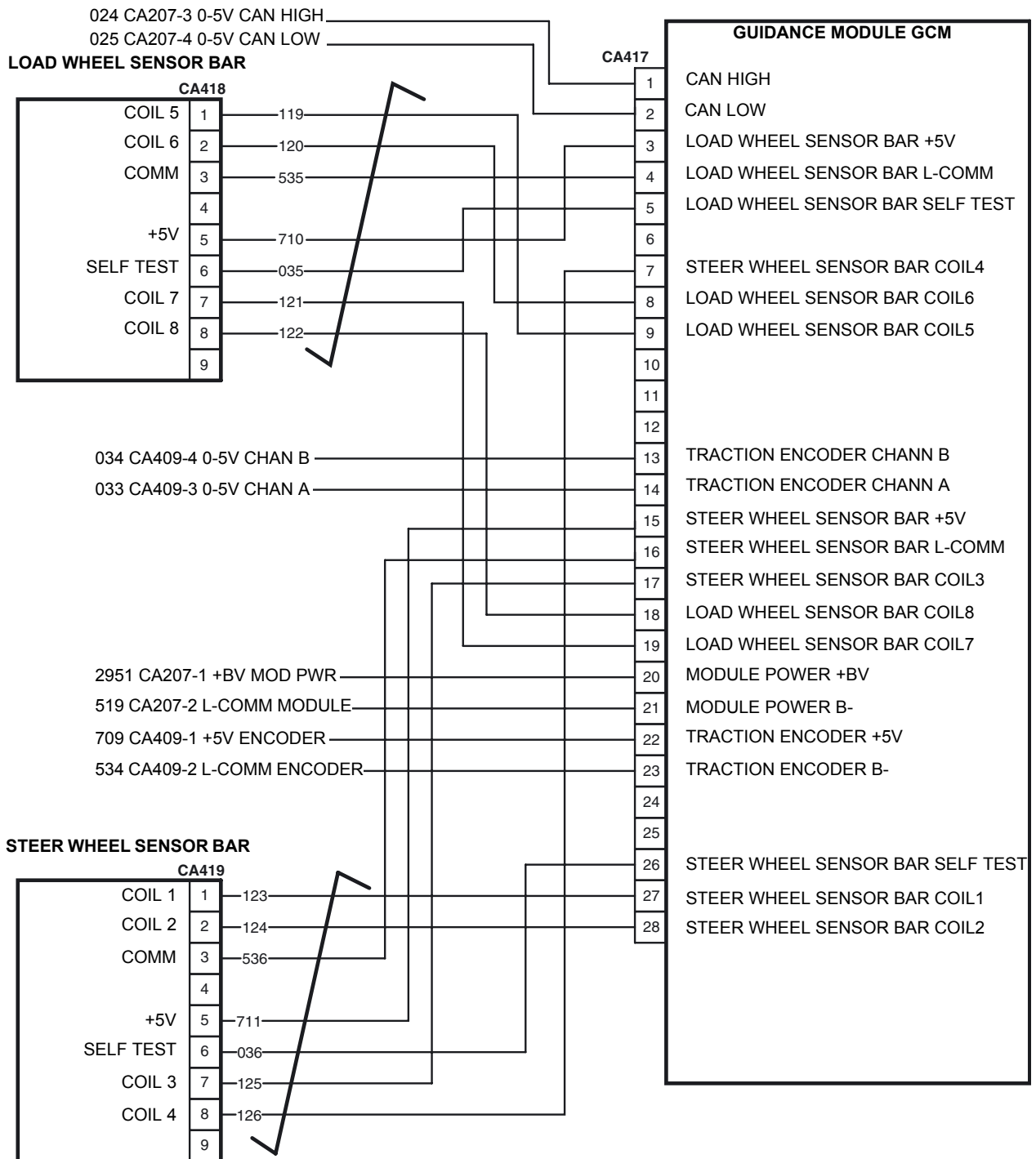
Step 8: Check floor condition as poor floors affect guidance. Operate the truck through out the warehouse noting the areas that guidance is effected.

- **If:** Guidance is being effected by poor floor conditions.
Then have the floor surface repaired.
- **If:** Floor repair is not feasible.
Then alert operators to the condition and to use extreme care when in guidance.



ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

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Event Code 422

Steering module (SCM) does not detect guidance module (GCM)

Traction disabled and brakes applied.

Step 1: Using a DVOM check for battery volts at guidance module connector CA417-20, 21.

Checking CA417-20, connect positive lead to CA407-20 and the negative lead to TP4 on distribution panel.

Checking CA417-21, connect negative lead to CA407-21 and positive lead to TP1 on distribution panel.

- **If:** Battery volts present.
Then proceed to step 2.

- **If:** Battery volts not present at CA417-20 or 21.
Then check connections and condition of wire #2951 between CA417-20 and CA207-1 also wire #519 from CA417-21 and CA207-2.

- **If:** Wires are loose or damaged.
Then repair.

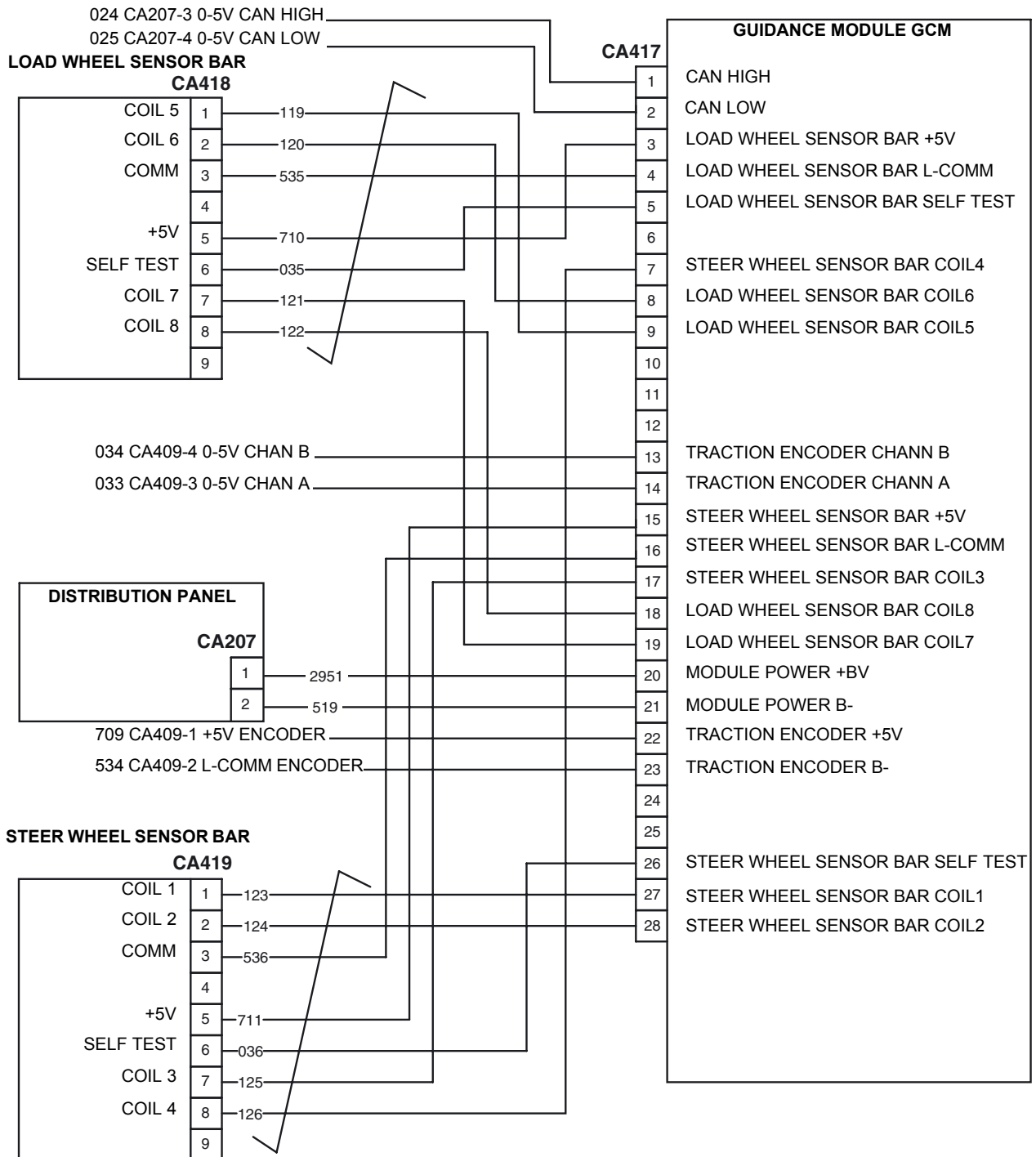
Step 2: Check CAN wire connections between GCM CA417-1, -2 and CA207-3, -4

- **If:** Wires are loose or damaged.
Then repair.
- **If:** Wires are OK and the event code persists.
Then replace the GCM.



ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 423

Guidance module (GCM) is not detected at power up.

Traction disabled and brakes applied.

Step 1: Using a DVOM check for battery volts at guidance module connector CA417-20, 21.

Checking CA417-20, connect positive lead to CA407-20 and the negative lead to TP4 on distribution panel.

Checking CA417-21, connect negative lead to CA407-21 and positive lead to TP1 on distribution panel.

- **If:** Battery volts present.
Then proceed to step 2.

- **If:** Battery volts not present at CA417-20 or 21.
Then check connections and condition of wire #2951 between CA417-20 and CA207-1 also wire #519 from CA417-21 and CA207-2.

- **If:** Wires are loose or damaged.
Then repair.

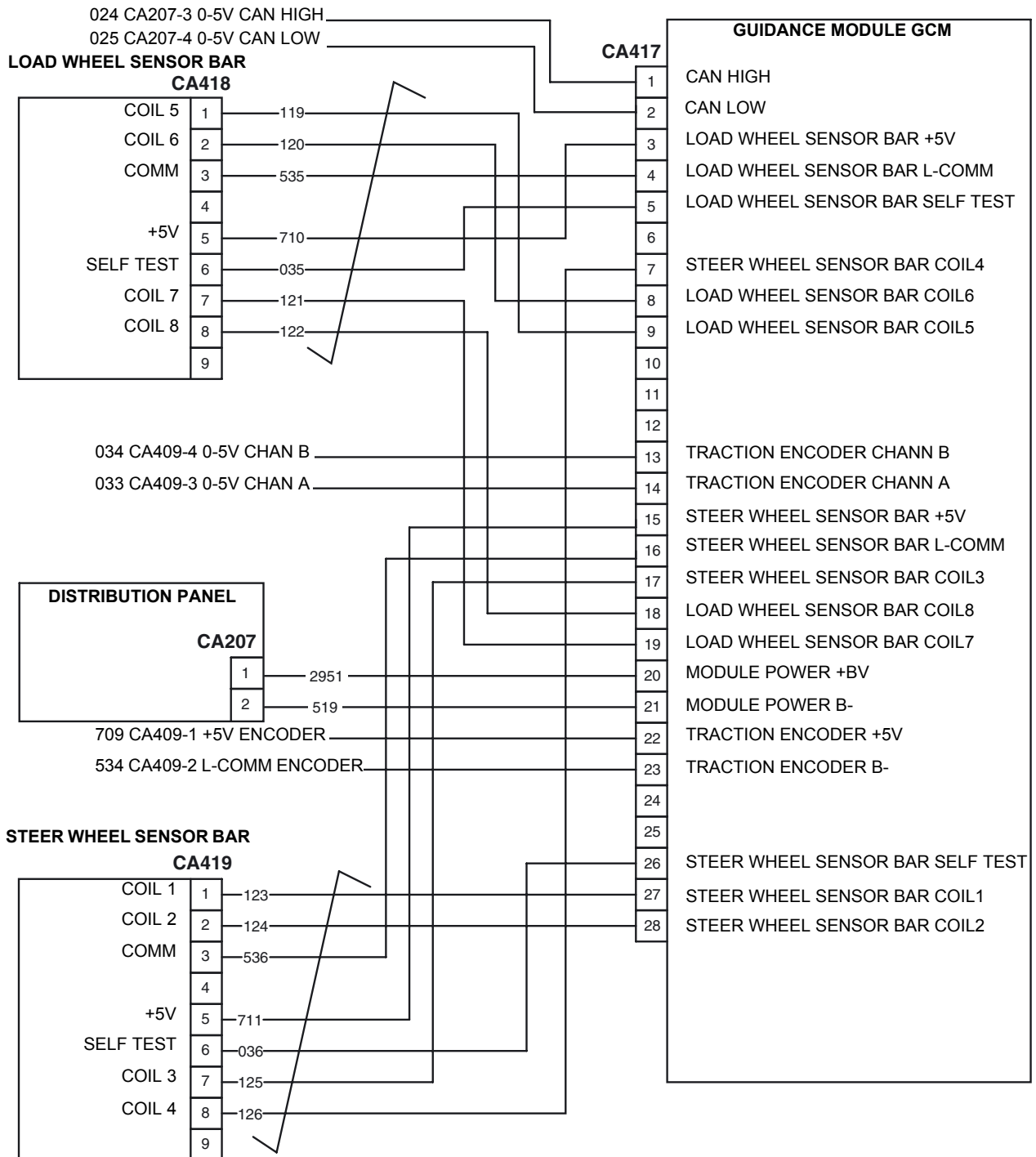
Step 2: Check CAN wire connections between GCM CA417-1, -2 and CA207-3, -4.

- **If:** Wires are loose or damaged.
Then repair.
- **If:** Wires are OK and the event code persists.
Then replace the GCM.



ELECTRICAL SYSTEM

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ELECTRICAL SYSTEM

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Event Code 424

Auto guidance is requested but wire guidance has been disabled via the service terminal.

Traction disabled and brakes applied.

Step 1: Connect service terminal to truck and access "Truck Options" press forward until the "Wire Guidance" option appears.

- **If:** Guidance is not active.
Then press "Yes" to activate guidance.



ELECTRICAL SYSTEM EVENT CODES

Event Code 425

Guidance module (GCM) traction encoder (ECR3) is not counting.

Traction disabled and brakes applied.

Information



Event code 396 may also be logged.

Step 1: Check wiring for loose or corroded connections from:

- GCM CA417-22, -23, -14, -13 to splitter module CA409-1, -2, -3, -4.
- CA409-5, -6, -7, -8 to CA410-1, -2, -3, -4.
- CA410-1, -2, -3, -4 to CA403-6, -14, -13, -5.

- **If:** Wiring problem or corrosion exists.
Then repair.

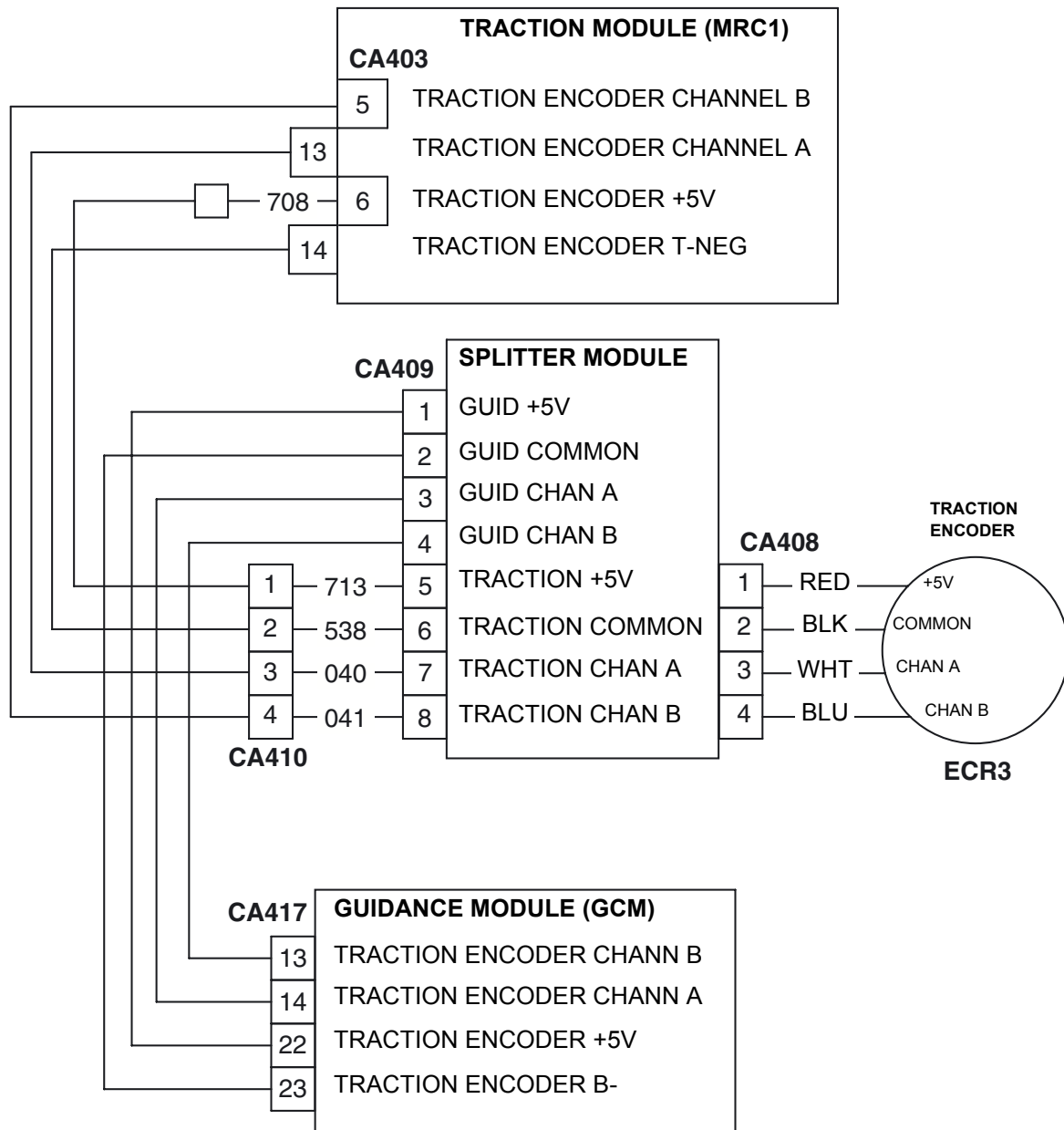
- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Using a DVOM check for +5V between GCM CA417-23, -23 (-22 positive).

- **If:** +5V is not present.
Then replace MRC1.
- **If:** +5V is present.
Then check for +5V at splitter module CA408-1, -2 (-1 positive).
- **If:** +5V is present.
Then replace ECR3.

ELECTRICAL SYSTEM

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ELECTRICAL SYSTEM EVENT CODES

Event Code 426

Guidance module (GCM) sensor amplifier failed selftest.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 427

Load wheel sensor bar failed selftest.

Traction disabled and brakes applied.

Step 1: Check load wheel sensor bar for damage.

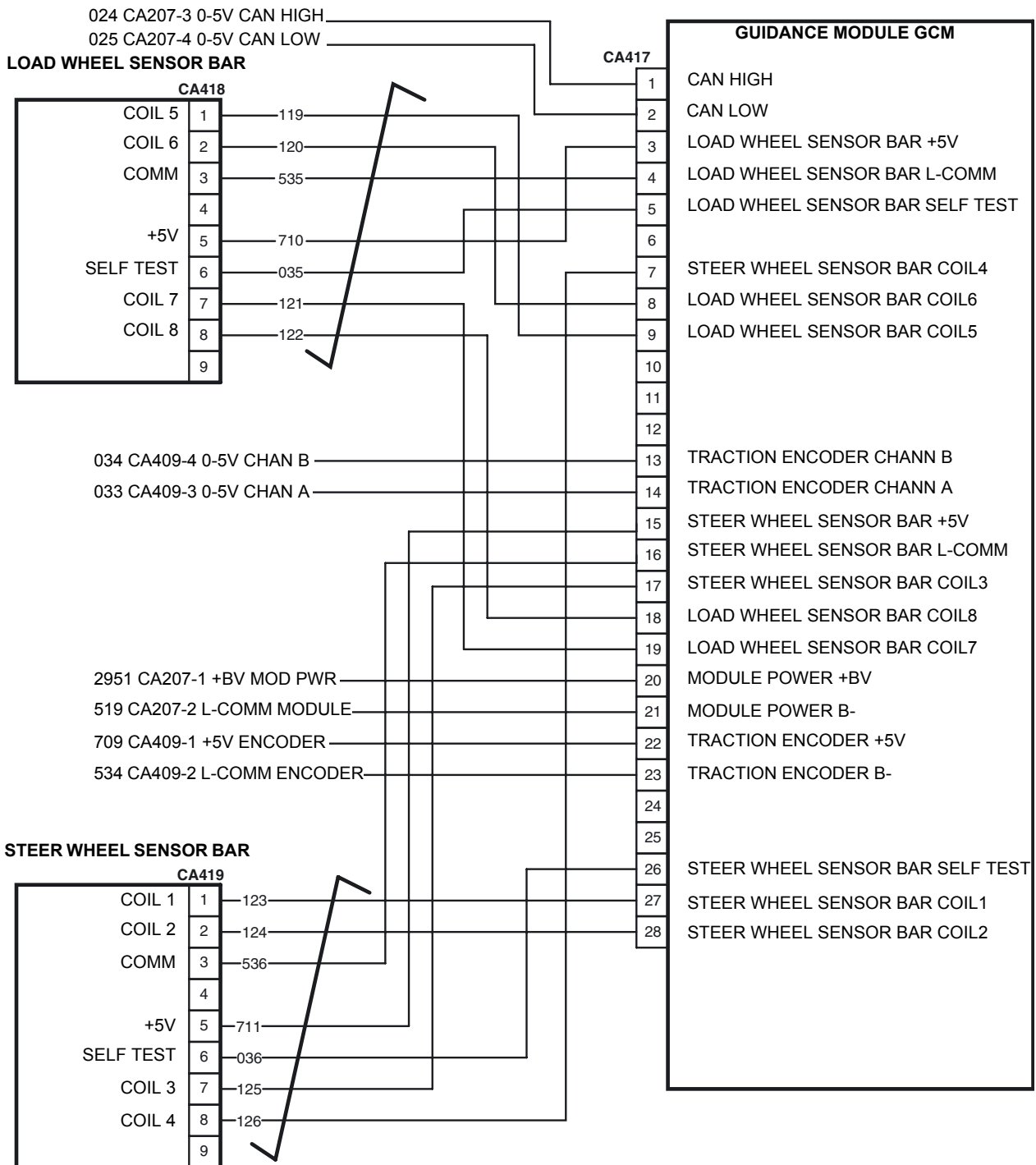
- **If:** Load wheel sensor bar is damaged.
Then replace load wheel sensor bar.
- **If:** Load wheel sensor bar appears OK.
Then proceed with step 2.

Step 2: Check connector and wiring from load wheel sensor bar CA418 to guidance module CA417.

- **If:** Wiring or connections are bad.
Then repair.
- **If:** Wiring and connections are good.
Then replace load wheel sensor bar.

ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 428

Steer wheel sensor bar failed selftest.

Traction disabled and brakes applied.

Step 1: Check steer wheel sensor bar for damage.

- **If:** Steer wheel sensor bar is damaged.
Then replace steer wheel sensor bar.

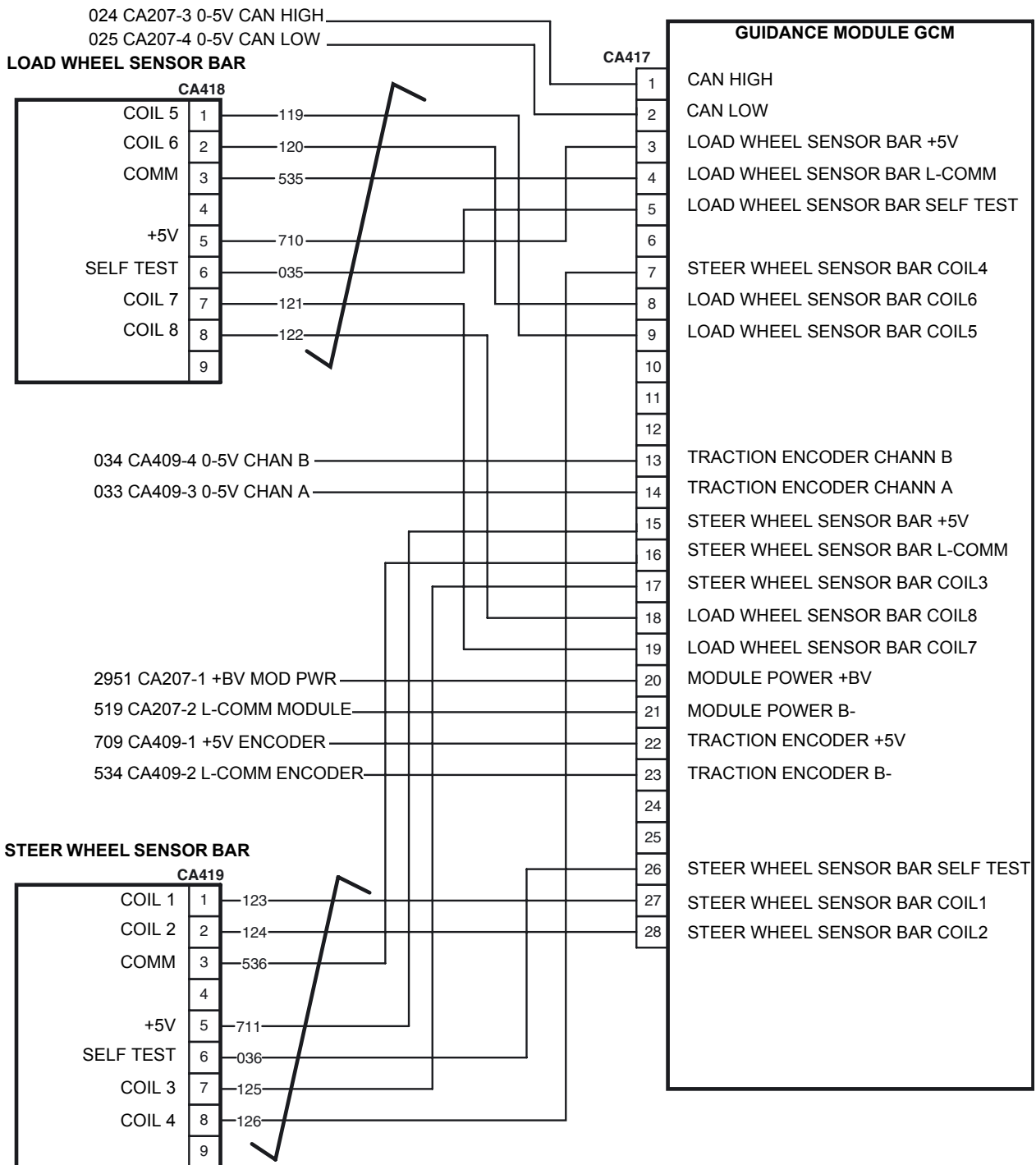
- **If:** Steer wheel sensor bar appears OK.
Then proceed with step 2.

Step 2: Check connector and wiring from steer wheel sensor bar CA419 to guidance module CA417.

- **If:** Wiring or connections are bad.
Then repair.
- **If:** Wiring and connections are good.
Then replace steer wheel sensor bar.

ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 429

Guidance module (GCM) traction speed sensor input failed.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 431

Guidance module (GCM) steering feedback sensor input failed.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 432

Guidance module (GCM) 5 volt supply is out of tolerance.

Traction disabled and brakes applied.

Step 1: Check for shorts in the sensor bar and/or SS1 traction tach wiring.

- **If:** Wiring is shorted or damaged.
Then replace wiring.
- **If:** Wiring is okay and fault persists.
Then replace GCM.

Event Code 433

Guidance module (GCM) load wheel sensor bar negative 5 volt supply is out of tolerance.

Traction disabled and brakes applied.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 434

Guidance module (GCM) steer wheel sensor bar negative 5 volt supply is out of tolerance.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 435

Guidance module (GCM) positive 12 volt supply is out of tolerance.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 436

Guidance module (GCM) invalid software instruction encountered.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 437

Guidance module (GCM) division by zero was attempted.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 438

Guidance module (GCM) software interrupt.

Traction disabled and brakes applied.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace GCM.

Event Code 439

Detected intermittent connection to the inner coils of the steer wheel sensor bar.

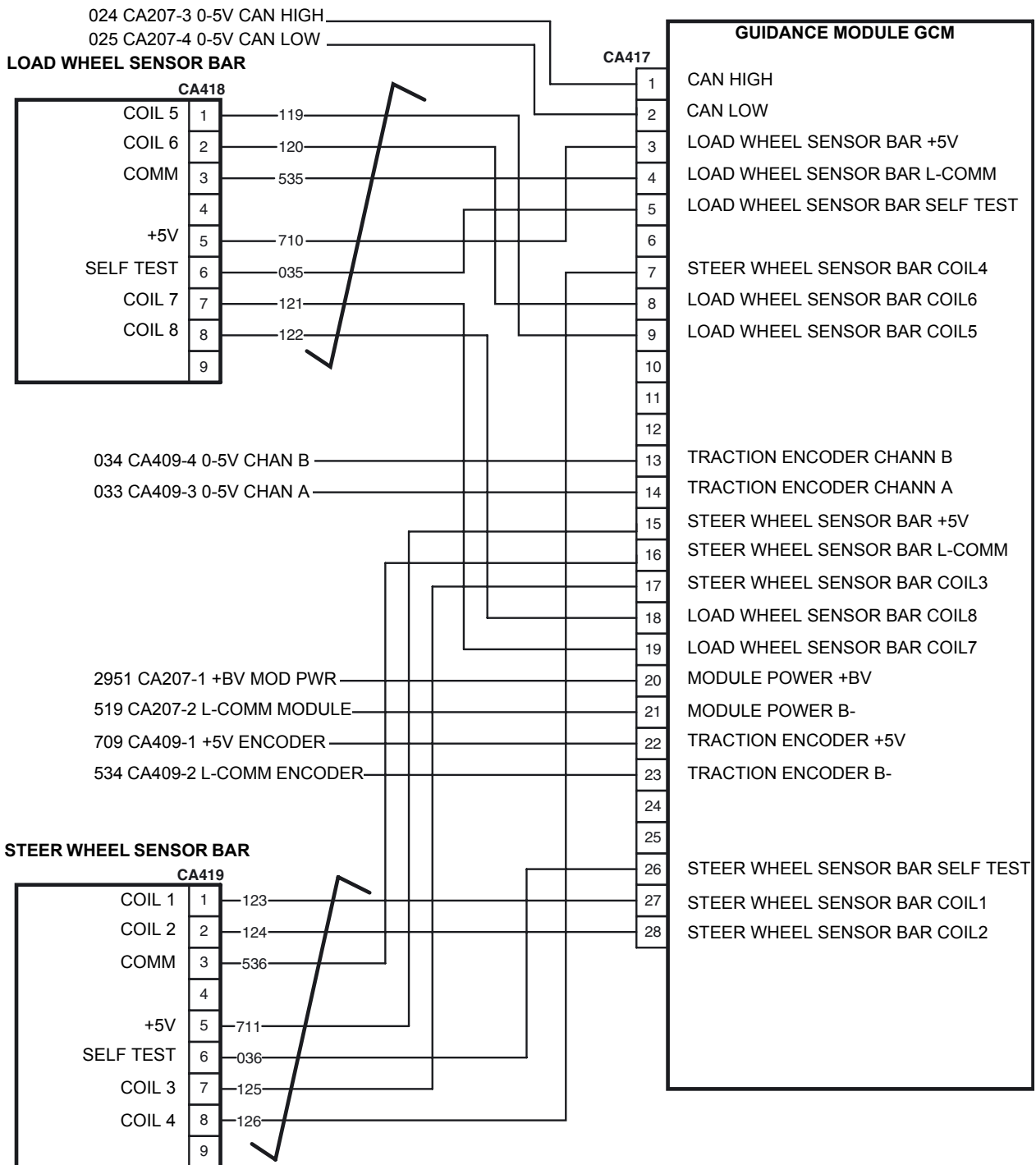
Traction disabled and brakes applied.

Step 1: Check connector and wiring from the steer wheel sensor bar CA419 to guidance module CA417.

- **If:** Wiring is damaged or connections are bad.
Then repair.
- **If:** Wiring and connections are OK.
Then check sensor bar by part substitution.
- **If:** Fault persists.
Then replace GCM.

ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 441

Detected intermittent connection to the inner coils of the load wheel sensor bar.

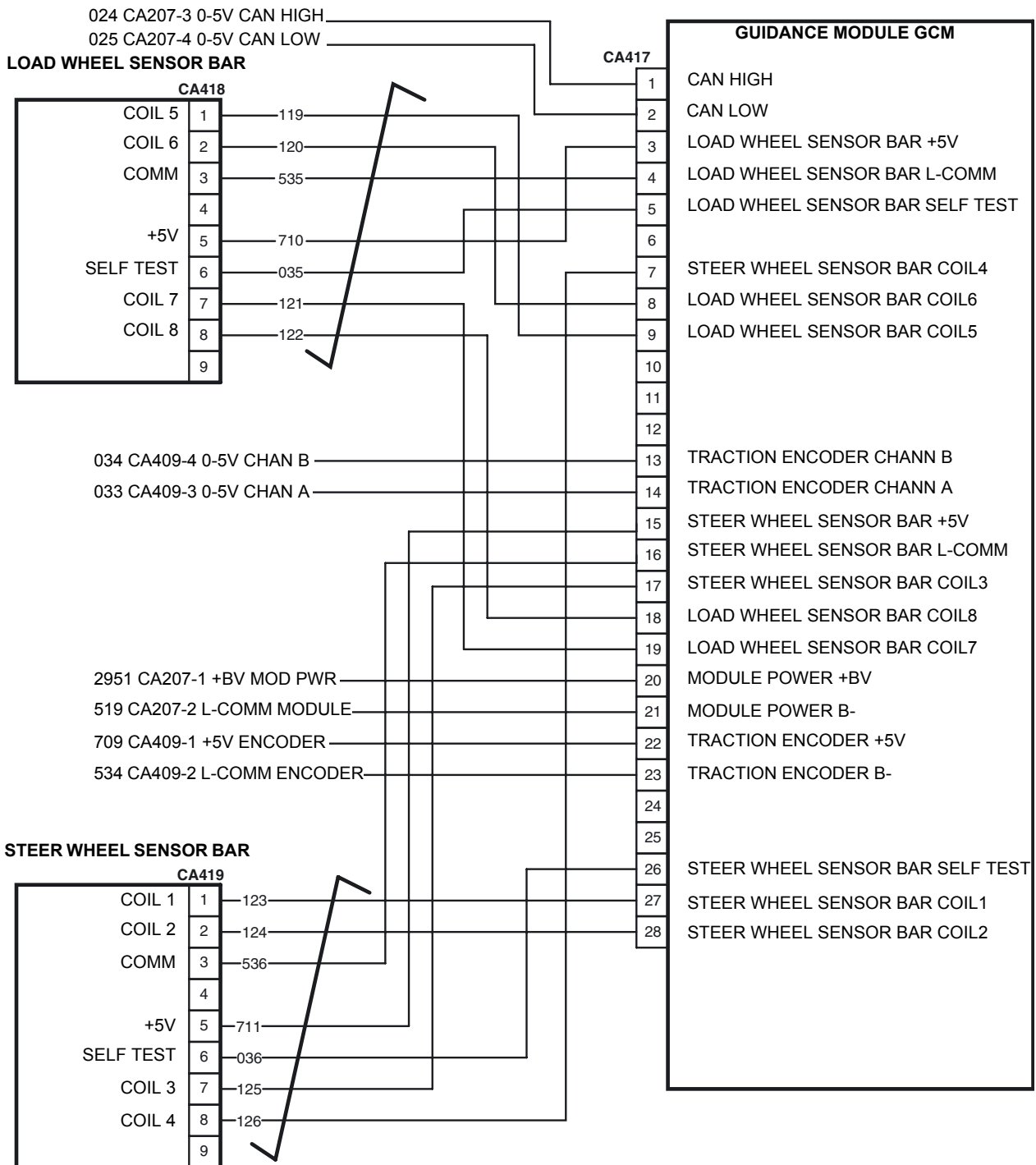
Traction disabled and brakes applied.

Step 1: Check connector and wiring from the steer wheel sensor bar CA418 to guidance module CA417.

- **If:** Wiring is damaged or connections are bad.
Then repair.
- **If:** Wiring and connections are OK.
Then check sensor bar by part substitution.
- **If:** Fault persists.
Then replace GCM.

ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 442

Guidance module (GCM) software is not compatible with the display/steering module software.

Traction disabled and brakes applied.

Step 1: Connect the service terminal to the truck and access system information. Press forward until "Software P/N" is displayed.

- **If:** The part number is 122690-001-02 or higher and fault persists.
Then contact factory for recommendations.
- **If:** The part number is lower than 122690-001-02.
Then refer to TSB 402.

ELECTRICAL SYSTEM

EVENT CODES



If: Fault persists.
Then replace GCM.

Event Code 800

Display module (DCM) service terminal initiate failure.

Steering, traction and lift disabled.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.

- **If:** Event code persists.
Then replace DCM.

Event Code 801

Display module (DCM) steering encoder (ECR1) command count failed to clear.

Traction disabled.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace DCM.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 802

Display module (DCM) ECR1 voltage of 4.75 v to 5.24 v is out of tolerance.

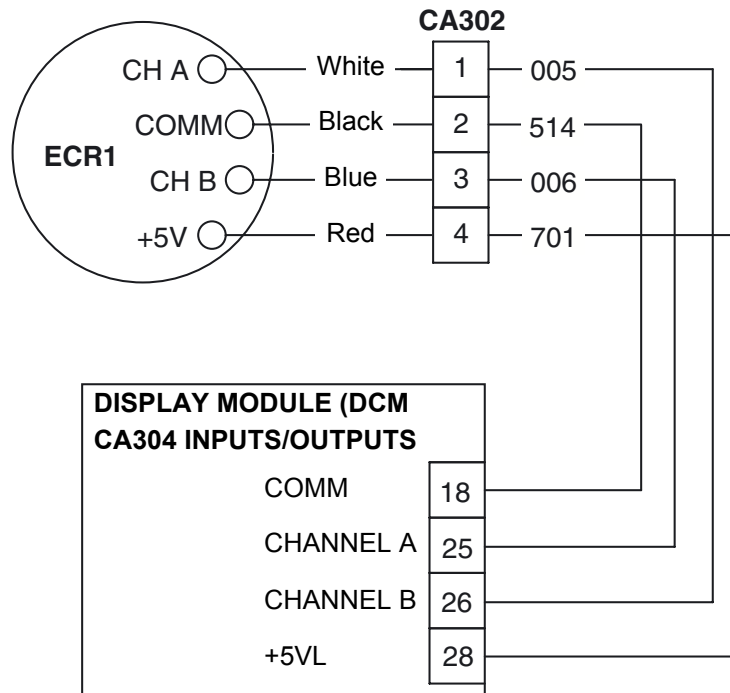
Steering and traction disabled.

Step 1: Check for the presence of 5 volts at CA302-2, -4.

- **If:** 5 volts is presence.
Then replace ECR1.

- **If:** 5 volts is not present.
Then check wire connections/continuity of wire #514 between CA302-2 and CA304-18 also wire #701 between CA302-4 and CA304-28.
- **If:** Connection/continuity is bad.
Then repair.
- **If:** Connection/continuity is good.
Then replace DCM.

STEER ENCODER



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 803

Display module (DCM) positive +12-volt power supply voltage +10.79 v to +13 v is out of tolerance.

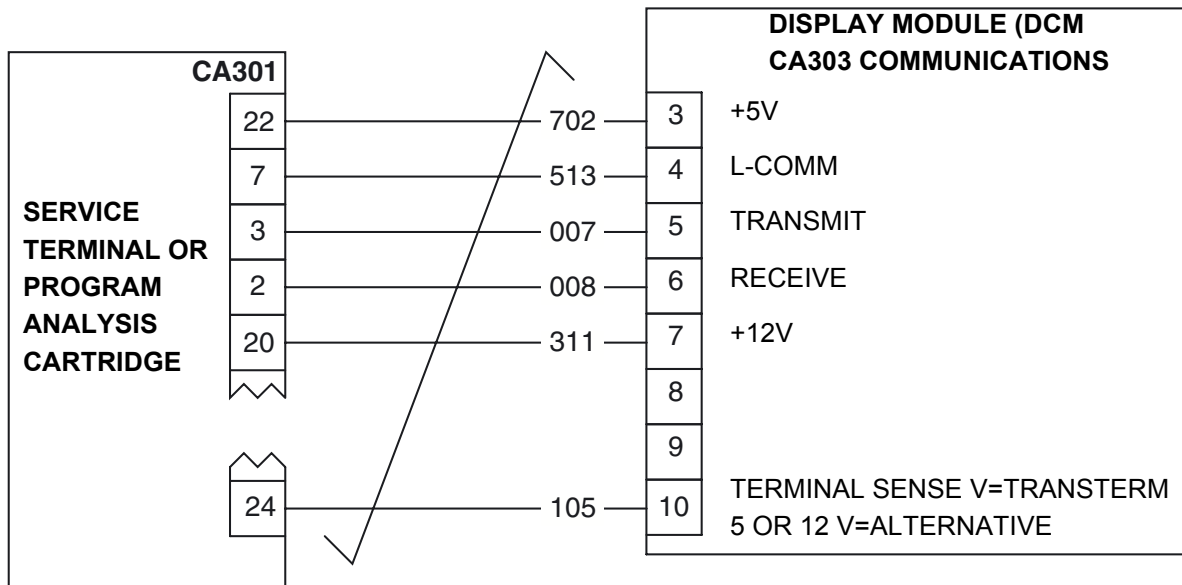
Steering, traction and lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists and the service terminal is connected to the truck.

Then disconnect service terminal and power up the truck.

- **If:** Event code clears.
Then check the service terminal.
- **If:** Event code persists.
Then check connections/continuity of wire #513 between CA301-7 and CA303-4 also wire #311between CA301-20 and CA303-7.
- **If:** Connection/continuity is good and event code persists.
Then replace DCM.



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 804

Display module (DCM) negative -12-volt power supply voltage -5 v to -13.2 v is out of tolerance.

Steering, traction and lift disabled.

Step 1: Turn key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace DCM.

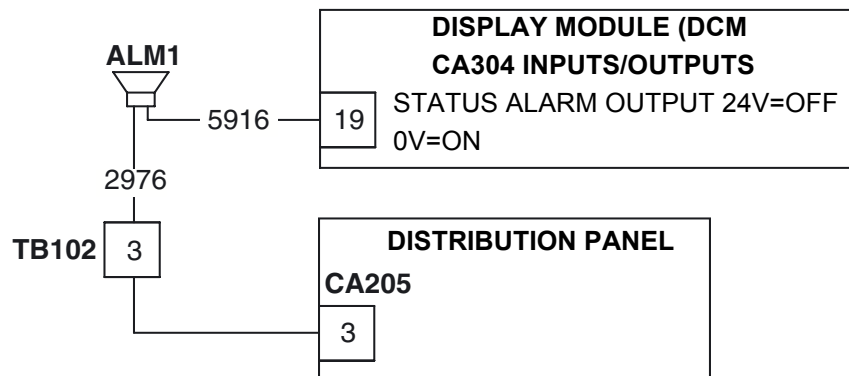
Event Code 805

Display module (DCM) alarm (ALM1) driver output shorted.

No action taken truck will operate and alarm may sound.

Step 1: Check wire #5916 between CA304-19 and alarm (ALM1) also wire #2976 between alarm and TB102-3 for shorts to truck frame.

- **If:** Shorts are found.
Then repair.
- **If:** Wiring is OK.
Then disconnect and insulate wire #5916 from the alarm and power up the truck.
- **If:** Event code clears.
Then replace ALM1.
- **If:** Event code persists.
Then replace DCM.



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 806

Display module (DCM) detected invalid lift setup configuration.

Lift disabled.

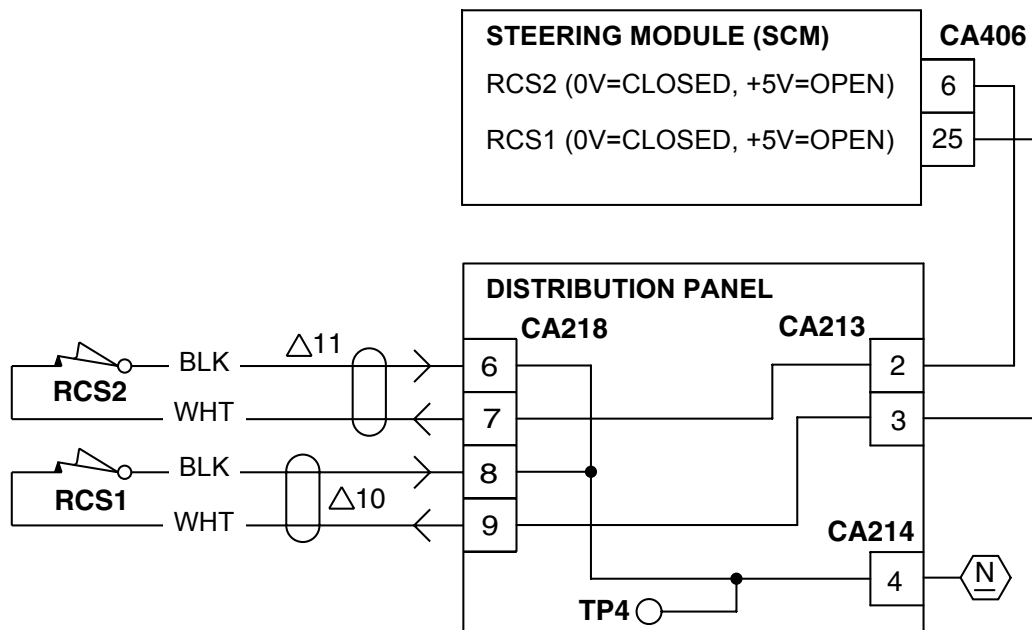
Step 1: Programmed lift cutout or zones setups must match truck configuration. Connect service terminal and access "View Truck Setups". Press forward until "View Cutout & Zones".

- **If:** Setups do not match the truck configuration.
Then access calibration of lift cutouts or zones and enter the correct value(s).

- **If:** Values are correct and event code persists.
Then proceed to step 2.

Step 2: If the truck is configured as a single lift cutout with "no override", verify the jumper is in place between CA218-6 & -7.

- **If:** Jumper is not present.
Then install jumper.
- **If:** Jumper is present and event code persists.
Then replace DCM.



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ELECTRICAL SYSTEM

EVENT CODES

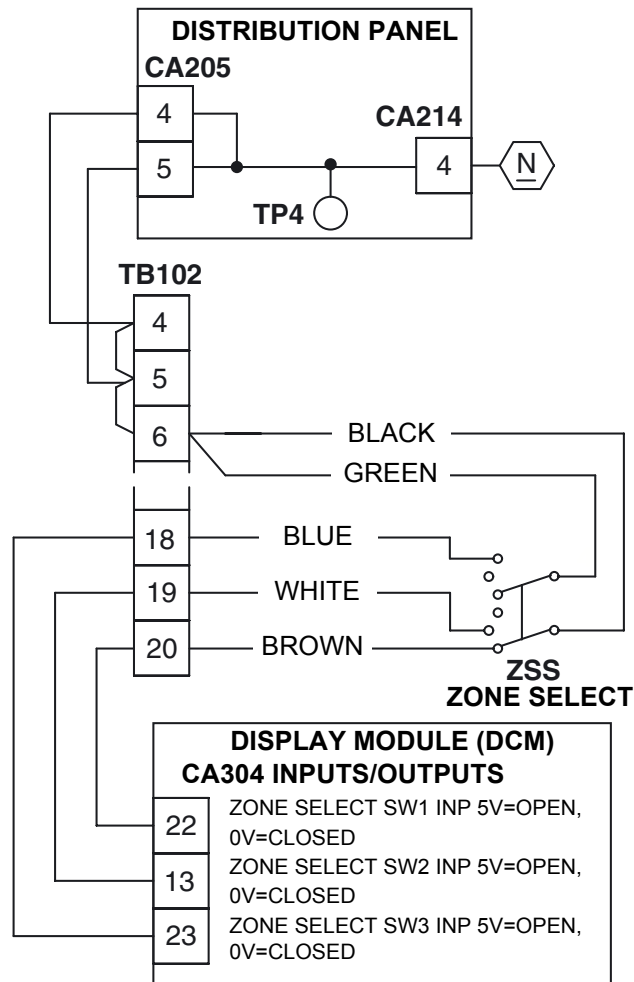
Event Code 807

Display module (DCM) zone select switch (ZSS) or wiring broken.

No action taken.

Step 1: Check zone select switch (ZSS).

- **If:** Zone switch is broken.
Then replace.
- **If:** Zone switch is enabled in Truck Setups but switch is not present.
Then connect the service terminal access calibra-
- tion cutout & zones and disable zone select feature.
- **If:** Zone select is enabled in Truck Setups and zone switch (ZSS) is present.
Then check wire connection from zone switch to TB102-18, -19, -20 and from TB102 to CA304-13, -22, -23.
Also check the green and black wires that attach to the ZSS.
- **If:** Wire connections and wires are OK and event code persists.
Then replace DCM.



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 808

Display module (DCM) zone select switch (ZSS) or wiring shorted.

Lift disabled.

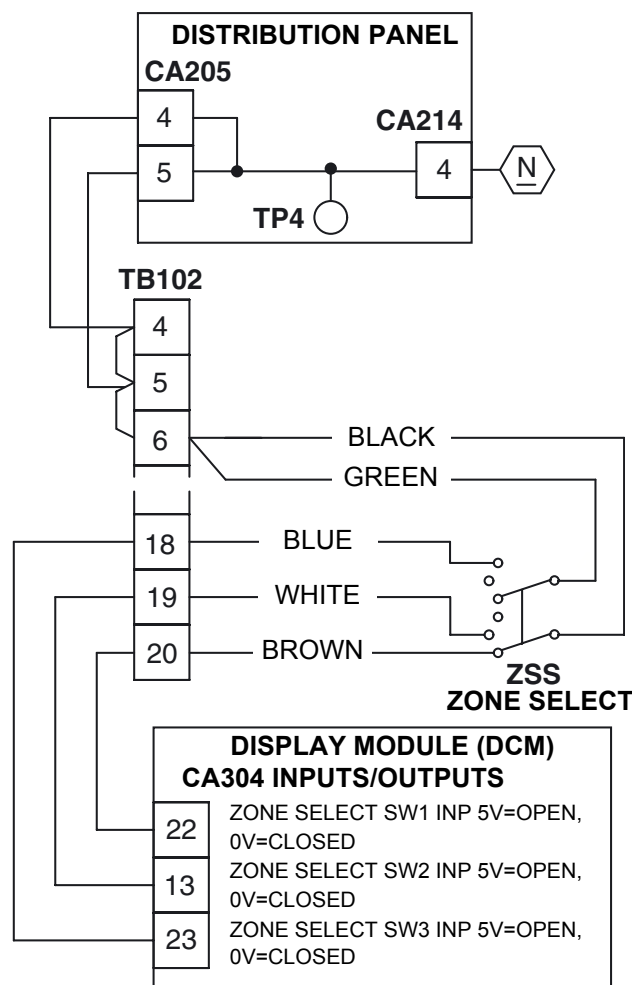
Step1: Check condition of wiring between switch TB102-18, -19, 20 and CA304-13, -22, -23.

- **If:** Wires are shorted.
Then repair.

- **If:** Wires are OK proceed to step 2.

Step 2: With a DVOM check zone select switch for internal shorts. Each individual internal switch must be isolated from the other.

- **If:** Switch is shorted.
Then replace ZSS switch.
- **If:** Switch is OK and event code persists.
Then replace DCM.



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ELECTRICAL SYSTEM

EVENT CODES

Event Code 809

Display module (DCM) zone select switch (ZSS) is detected but not enabled in setups.

Lift disabled.

Information



If the truck has "Zone Select" option refer to step 1.

If the truck does not have "Zone Select" option refer to step 2.

Step 1: Connect service terminal to truck and access calibration "Lift Cutout or Zones" and enable zone select feature.

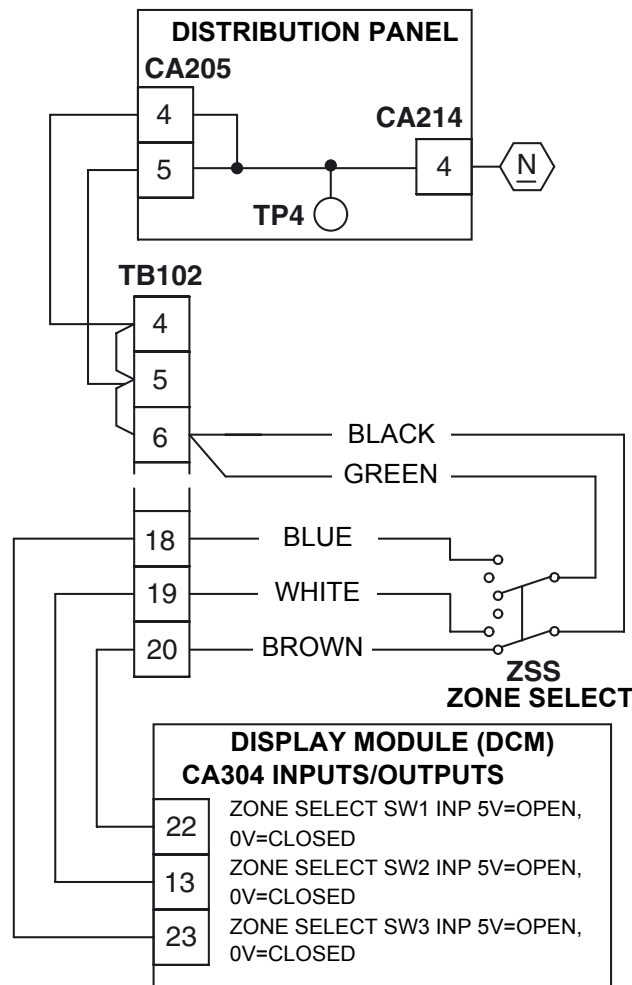
- **If:** Event code persists.
Then replace DCM.

Step 2: Connect service terminal and access calibration "Lift Cutout or Zones".

- **If:** Zone select is enabled.
Then disable feature.
- **If:** Zone select is disabled.
Then connect a DVOM negative lead to TP102-6, with the positive lead check for the presence of 5 volts at TP102-18, -19, -20.
- **If:** Any terminal is "0" volts and there is no short to negative.
Then replace DCM.
- **If:** Any terminal is shorted to negative.
Then repair short.

ELECTRICAL SYSTEM

EVENT CODES



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Event Code 810

Display module (DCM) lift setups are not detected by steering module (SCM).

Lift disabled.

Step 1: Turn the key "off" then "on".

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists.
Then replace display module (DCM).

Event Code 811

Display module (DCM) invalid zone select switch (ZSS) setup is detected.

Lift disabled.

Step 1: Connect the service terminal and access calibration "Truck Setups". Press forward until "Lift Cutouts or Zones" appear, enter the correct lower cutout configuration setups.

- **If:** Event code persists.
Then replace DCM.



ELECTRICAL SYSTEM

EVENT CODES

Event Code 812

Display module (DCM) encoder (ECR1) count out of tolerance.

Traction disabled.

Step 1: Check condition of encoder ECR1 and mounting hardware.

- **If:** Encoder appears damaged.
Then replace encoder ECR1.
- **If:** Encoder mounting hardware is worn or loose.
Then repair mounting hardware.
- **If:** Mounting hardware is OK and the fault persists.
Then replace DCM.

Event Code 813

Display module (DCM) RS232 port failure.

No action taken.

Step 1: Turn the key “off” then “on”.

- **If:** Event code clears.
Then truck is operation ready.
- **If:** Event code persists and the service terminal is plugged into truck.
Then disconnect service terminal.
- **If:** Event code clears.
Then check service terminal.
- **If:** Event code persists.
Then replace DCM.

Event Code 814

Access 3 communication error.

Steering, traction and lift disabled.

Step 1: Check condition of battery and cable connections. Low or poor battery condition and/or cable connections can cause this event.

Step 2: Check BDI settings. Discharging the battery below recommended level can cause this event.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 827

Height encoder (ECR4) count out of tolerance.

Steering, traction and lift disabled.

Step 1: Check position of J1 jumper. Must be in J1-2 position for linear height.

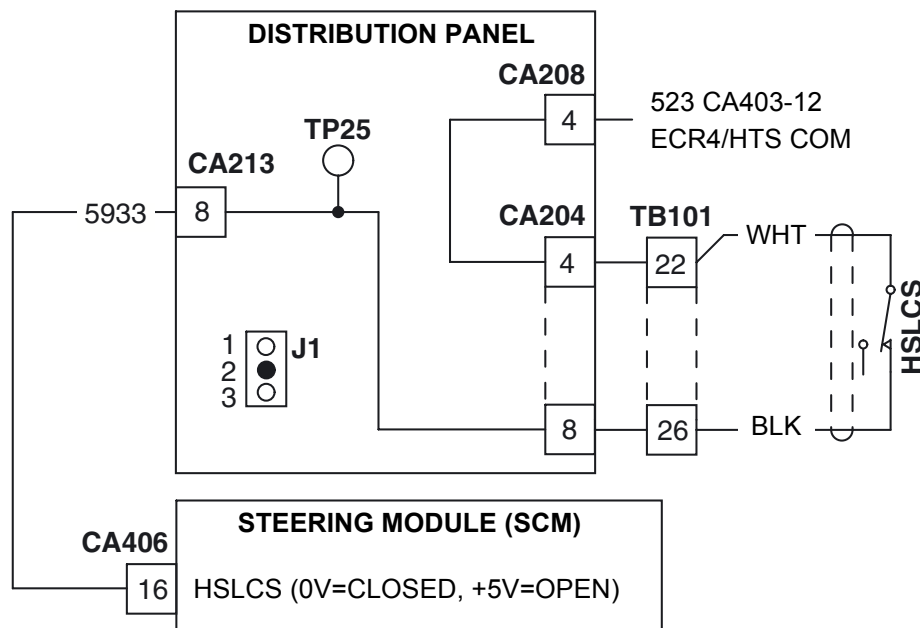
Step 2: High speed lower cutout switch (HSLCS) resets ECR4 counter. Check operation of HSLCS by connecting DVOM positive lead to TB101-26 (disconnect Red/Blk lead) and negative lead to TB101-22. DVOM on ohms manually activate switch.

- **If:** Switch operates proceed to step 3.
- **If:** Switch fails to operate.
Then check switch wiring.

- **If:** Switch wiring is OK.
Then replace switch.

Step 3: Check for presence of +5V between TB101-22 and the Red/Blk disconnected at TB101-26.

- **If:** 0V.
Then check for presence of +5V between CA204-4 and -8.
- **If:** +5V I presence.
Then replace mast cable #3.
- **If:** 0V.
Then check wire #5933 between CA213-8 and CA406-16.



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ELECTRICAL SYSTEM EVENT CODES

Event Code 828

Height reset failure, encoder (ECR4) count out of tolerance.

Full traction and lift disabled.

Step 1: Check position of J1 jumper. Must be in J1-2 position for linear height.

Step 2: High speed lower cutout switch (HSLCS) resets ECR4 counter. Check operation of HSLCS by connecting DVOM positive lead to TB101-26 (disconnect Red/Blk lead) and negative lead to TB101-22. DVOM on ohms manually activate switch.

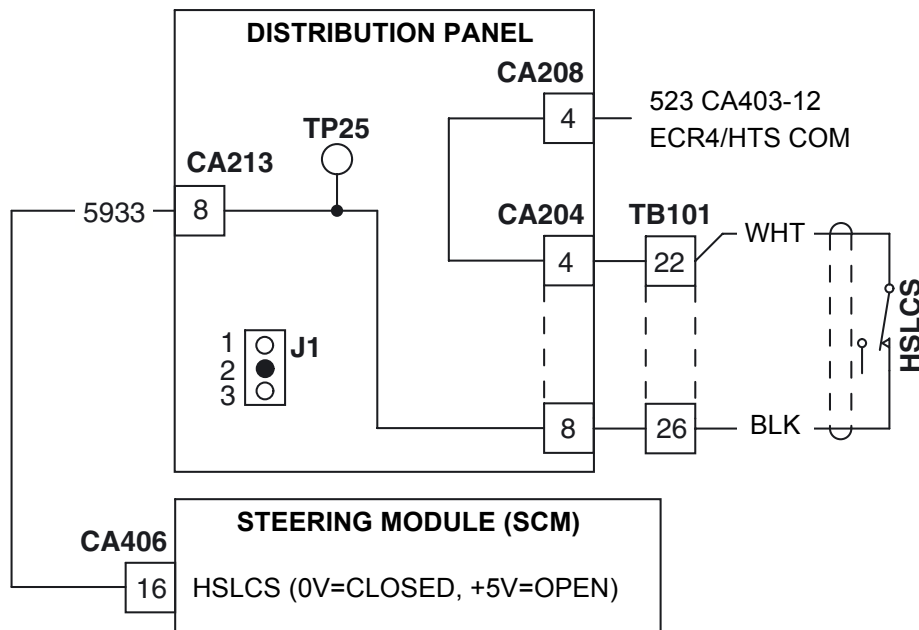
- **If:** Switch operates proceed to step 3.

- **If:** Switch fails to operate.
Then check switch wiring.

- **If:** Switch wiring is OK.
Then replace switch.

Step 3: Check for presence of +5V between TB101-22 and the Red/Blk disconnected at TB101-26.

- **If:** 0V.
Then check for presence of +5V between CA204-4 and -8.
- **If:** +5V I presence.
Then replace mast cable #3.
- **If:** 0V.
Then check wire #5933 between CA213-8 and CA406-16.



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 829

Raise command and encoder (ECR4) counts not increasing.

Full traction and lift disabled.

Step 1: Check wiring connections and condition between height encoder (ECR4) assembly to TB101-22, -23, -24, -25. Then between TB101-22, -23, -24, -25 and CA204-4, -5, -6, -7. Also between CA208-4, -5, -6, -7 and MRC1 CA403-3, -11, -12, -6.

- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Using a DVOM check for +5V between CA208-4, -6. Positive lead on CA208-6 and negative lead on C208-4.

- **If:** 0 Volts.
Then replace Access 3 module (MRC1).
- **If:** +5V is present.
Then connect DVOM positive lead to CA208-5 (ECR4 CHA). Raise platform +2.5V should be present.
- **If:** +2.5V is not present.
Then replace ECR4.

- **If:** +2.5V is present.
Then connect DVOM positive lead to CA208-7 (ECR4 CHB). Raise platform +2.5V should be present.

- **If:** +2.5V is not present.
Then replace ECR4.

- **If:** +2.5V is present.
Then proceed to step 3.

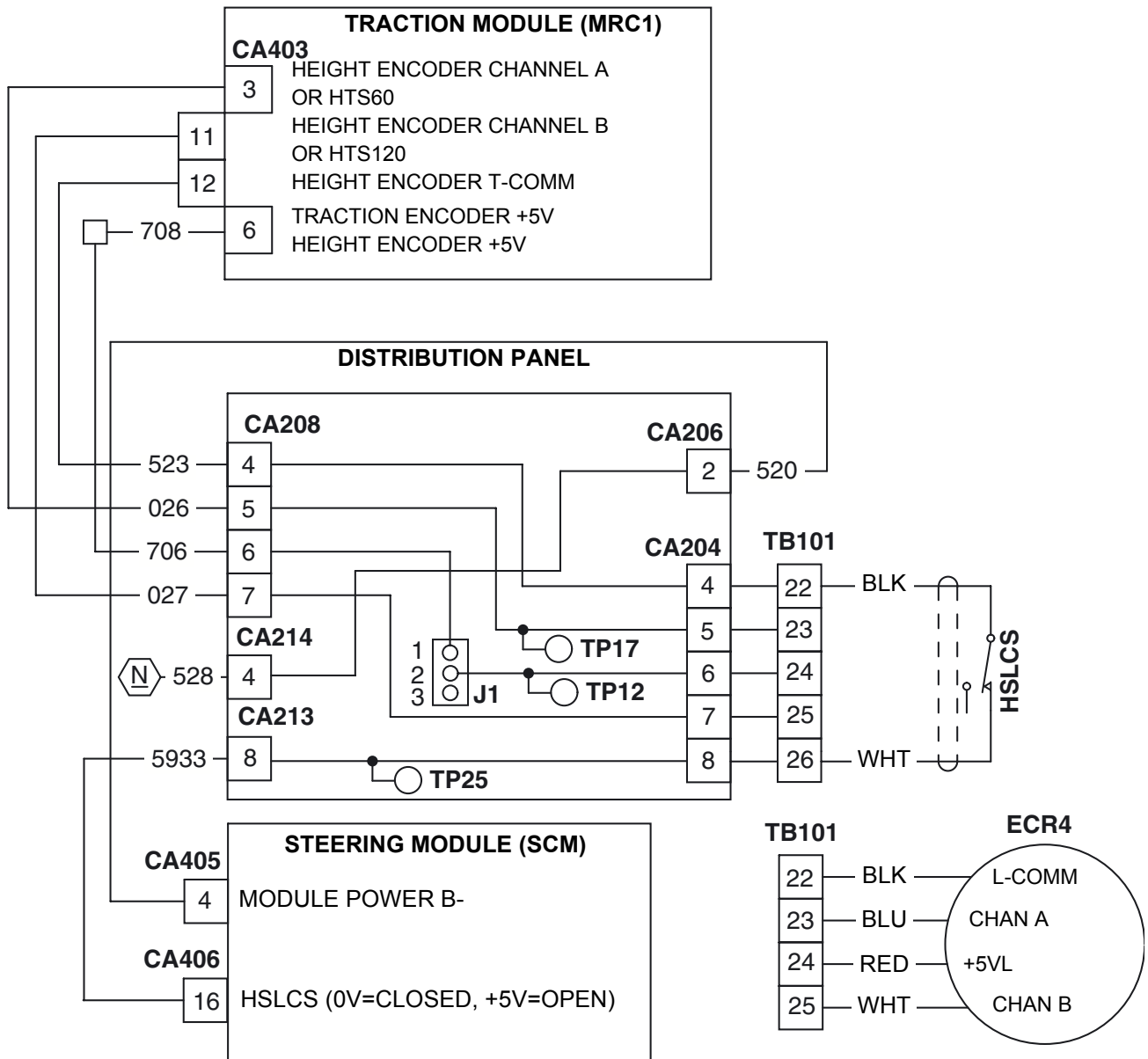
Step 3: Check wiring connections and condition between HSLCS and TB101-22, -26. Also check operation of HSLCS switch.

- **If:** Wiring and switch operation is OK.
Then check wiring connection and condition between TB101-26 and CA204-8. Also wiring between CA213-8 and SCM CA406-16.
- **If:** Wiring is OK.
Then using a DVOM check for +5V between CA213-8 and CA208-2. Positive lead on CA213-8 and negative on CA208-2. When HSLCS is open +5V must be present.
- **If:** +5V is not present.
Then replace SCM.



ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

EVENT CODES



Event Code 831

Lower command given and encoder (ECR4) counts not decreasing.

No action taken.

Step 1: Check wiring connections and condition between height encoder (ECR4) assembly to TB101-22, -23, -24, -25. Then between TB101-22, -23, -24, -25 and CA204-4, -5, -6, -7. Also between CA208-4, -5, -6, -7 and MRC1 CA403-3, -11, -12, -6.

- **If:** Wiring is OK.
Then proceed to step 2.

Step 2: Using a DVOM check for +5V between CA208-4, -6. Positive lead on CA208-6 and negative lead on CA208-4.

- **If:** 0 Volts.
Then replace Access 3 module (MRC1).
- **If:** +5V is present.
Then connect DVOM positive lead to CA208-5 (ECR4 CHA). Raise platform +2.5V should be present.
- **If:** +2.5V is not present.
Then replace ECR4.

- **If:** +2.5V is present.
Then connect DVOM positive lead to CA208-7 (ECR4 CHB). Raise platform +2.5V should be present.

- **If:** +2.5V is not present.
Then replace ECR4.

- **If:** +2.5V is present.
Then proceed to step 3.

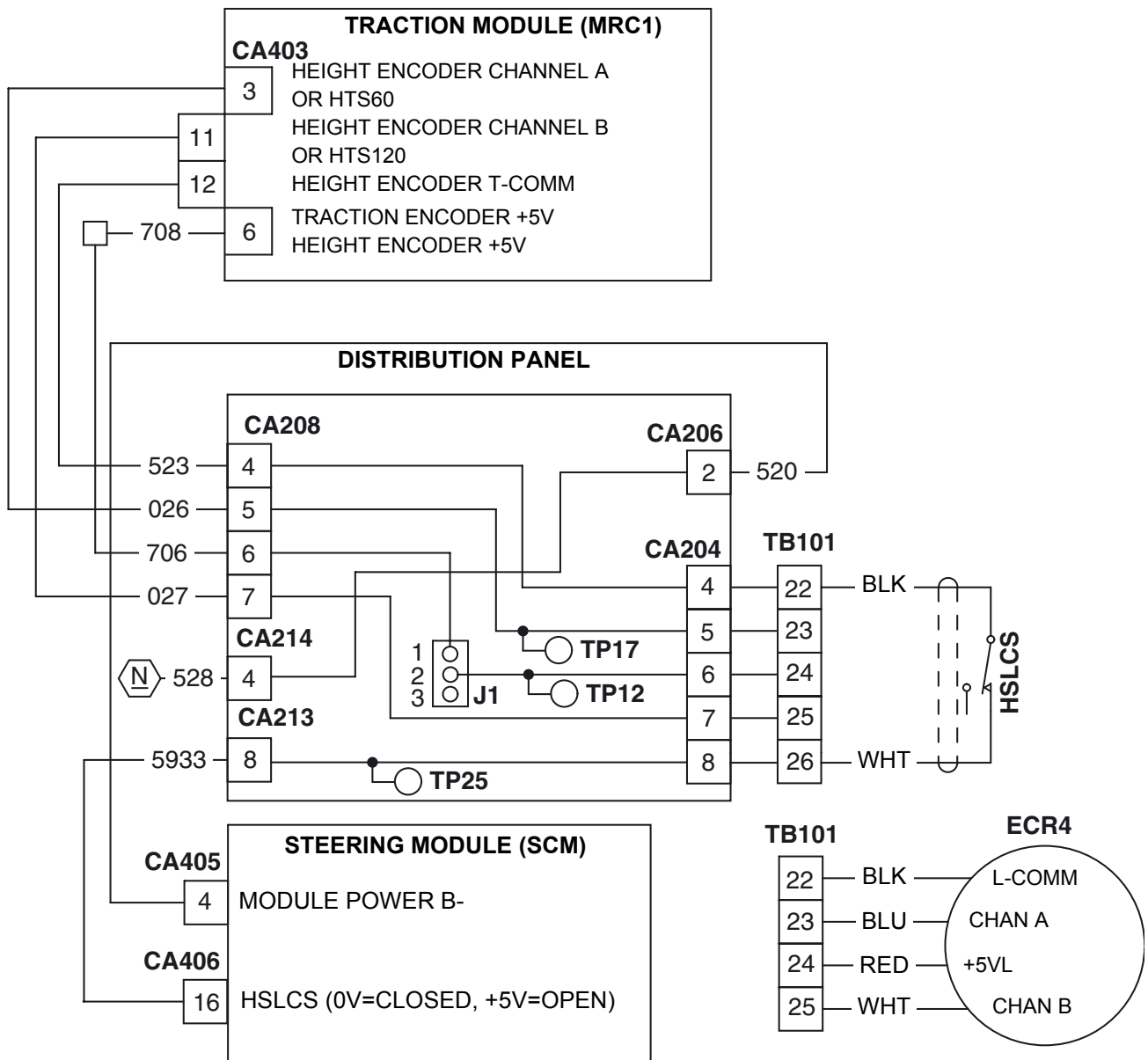
Step 3: Check wiring connections and condition between HSLCS and TB101-22, -26. Also check operation of HSLCS switch.

- **If:** Wiring and switch operation is OK.
Then check wiring connection and condition between TB101-26 and CA204-8. Also wiring between CA213-8 and SCM CA406-16.
- **If:** Wiring is OK.
Then using a DVOM check for +5V between CA213-8 and CA208-2. Positive lead on CA213-8 and negative on CA208-2. When HSLCS is open +5V must be present.
- **If:** +5V is not present.
Then replace SCM.



ELECTRICAL SYSTEM

EVENT CODES



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ELECTRICAL SYSTEM

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Event Code 832

Height reset switch (HSLCS) did not change state when encoder (ECR4) counts indicate a reset.

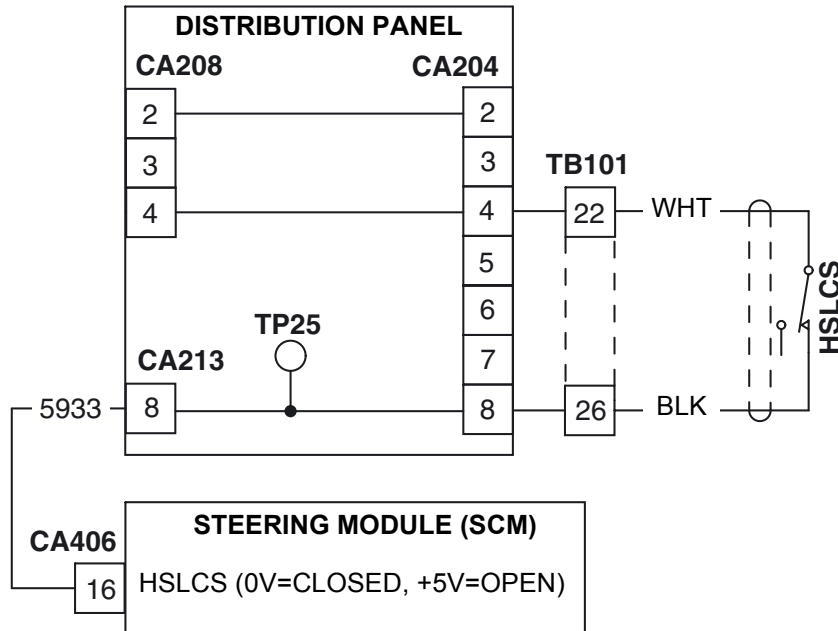
Full traction and lift disabled.

Step 1: Check wiring connections and condition between HSLCS and TB101-22, -26. Also check operation of HSLCS switch.

- **If:** Wiring and switch operation is OK.
Then check wiring connection and condition be-

tween TB101-26 and CA204-8. Also wiring between CA213-8 and SCM CA406-16.

- **If:** Wiring is OK.
Then using a DVOM check for +5V between CA213-8 and CA208-2. Positive lead on CA213-8 and negative on CA208-2. When HSLCS is open +5V must be present.
- **If:** +5V is not present.
Then replace SCM.



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ELECTRICAL SYSTEM EVENT CODES

Event Code 833

Traction motor (M1) over temperature.

No action taken.

Step 1: Verify duty cycle of M1 traction motor is not excessive or unusual.

Step 2: Check for loose connections, corroded terminals and brush condition.

Step 3: Make sure traction motor is clean.

Step 4: Check brake, traction motor, drive unit condition to ensure mechanical binding does not exist.

Event Code 834

Lift motor (M3) over temperature.

No action taken.

Step 1: Verify duty cycle of M3 lift motor is not excessive or unusual.

Step 2: Check for loose connections, corroded terminals and brush condition.

Step 3: Make sure lift motor is clean.

Step 4: Check lift motor and pump assembly to ensure mechanical binding does not exist.

Step 5: Check lift circuit relief pressure.

Event Code 835

Lift motor (M4) over temperature.

No action taken.

Step 1: Verify duty cycle of M4 lift motor is not excessive or unusual.

Step 2: Check for loose connections, corroded terminals and brush condition.

Step 3: Make sure lift motor is clean.

Step 4: Check lift motor and pump assembly to ensure mechanical binding does not exist.

Step 5: Check lift circuit relief pressure.

Event Code 836

Traction motor (M1) brush wear indication.

No action taken.

Step 1: Check condition of M1 brushes and brush springs.

- **If:** Worn.
Then replace.

ELECTRICAL SYSTEM

EVENT CODES



Event Code 837

Lift motor (M3) brush wear indication.

No action taken.

Step 1: Check condition of M3 brushes and brush springs.

- **If:** Worn.
Then replace.

Event Code 838

Lift motor (M4) brush wear indication.

Lift motor (M3) brush wear indication.

No action taken.

Step 1: Check condition of M3 brushes and brush springs.

- **If:** Worn.
Then replace.



ELECTRICAL SYSTEM TUNE UP

Tune Up

Service Terminal

The Service Terminal enables the Service Technician to monitor the service condition (malfunction) history of the Truck as well as perform calibration procedures.

Caution!



Before performing any work, be sure to refer to and follow all recommended safety precautions set out in "Control Of Hazardous Energy" in the applicable Crown Service Manual. In addition, Crown recommends that all mechanics wear appropriate protective items, such as safety glasses, work gloves, and steel toed shoes, whenever performing maintenance work on Crown equipment.

Description

The Service Terminal is a hand held unit containing a keyboard and liquid crystal, 2-line display. Included

with the terminal is a detachable interconnecting cable, with the necessary connectors. The Terminal (Crown No. 101528-001) and interconnecting cable (Crown No. 118845 for SP3400 trucks) are supplied in a foam filled, shock resistant carrying case (Crown No. 118954). To obtain the entire Service Terminal Kit, order Crown No. 118207.

When the Service Terminal is connected to the electronic system and the truck is powered up, each valid keystroke on the keyboard will be accompanied by an audible "chirp" for positive operator feedback.



0702P

ELECTRICAL SYSTEM

TUNE UP



Service Terminal Operation

Truck setups and adjustments are input to traction control through the use of the Crown Service Terminal. Interconnection of the terminal to the truck electronic system is through a connector located on the platform wall directly below the control module.

Once the terminal is plugged in, (2) refer to Figure 1, and truck is powered up, select one of the Main Menu modes. Use the flowcharts for keystrokes and resulting messages on the display. Messages outlined by a box are displayed on the terminal. A line leading from a display message to a term (ie. FWD) represents the keystroke selected. The line leading from the term to a box is the resultant message on the display. Lines leading from one message to another without a term, are messages which automatically appear without keypad input.



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Keyboard Commands

The following chart describes the keys of the Terminal.

Key	Description
ABORT	Use of this key will stop the last command entered into the terminal and request operator to select CAL, DISP, ERASE, or SHOW.
CAL	Selects calibration mode
DISP	Selects mode of operation to display past service history.
ERASE	Selects mode of operation to erase past service history.
STD	NA
LAST	Used in display mode to show last service number logged in memory.
ALL	Used in erase mode to select all past history for erasure.
2-DIGIT	Used in display, erase and show modes. Selects service number to be acted upon in display and erase modes.
BACK	Used in display, erase and show modes. Selects next lower service number or previous log position from last log in display and erase modes, steps through screens in show mode.
FWD	Used in display, erase and show modes. Selects next higher service number or next log number in sequence in display and erase modes, steps through screens in show mode.
YES	Used to answer question presented on screen. After this key is depressed, the command is carried out.
SHOW	Use this key to display various truck related functions and configurations on all trucks.
ENTER	Used in excepting numerical entries.

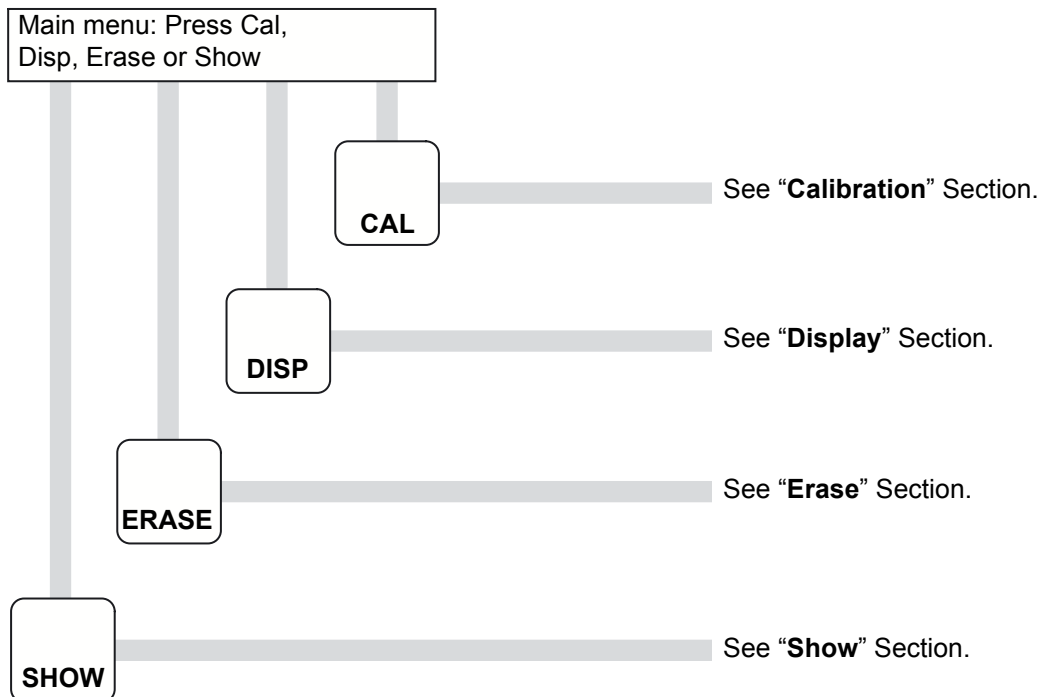
Information



If at any time a command is used in an incorrect sequence or mode, the terminal will abort to a no mode selected condition. Display will show:

**INVALID INPUT: PRESS CALDISP,
ERASE, OR SHOW.**

MAIN MENU

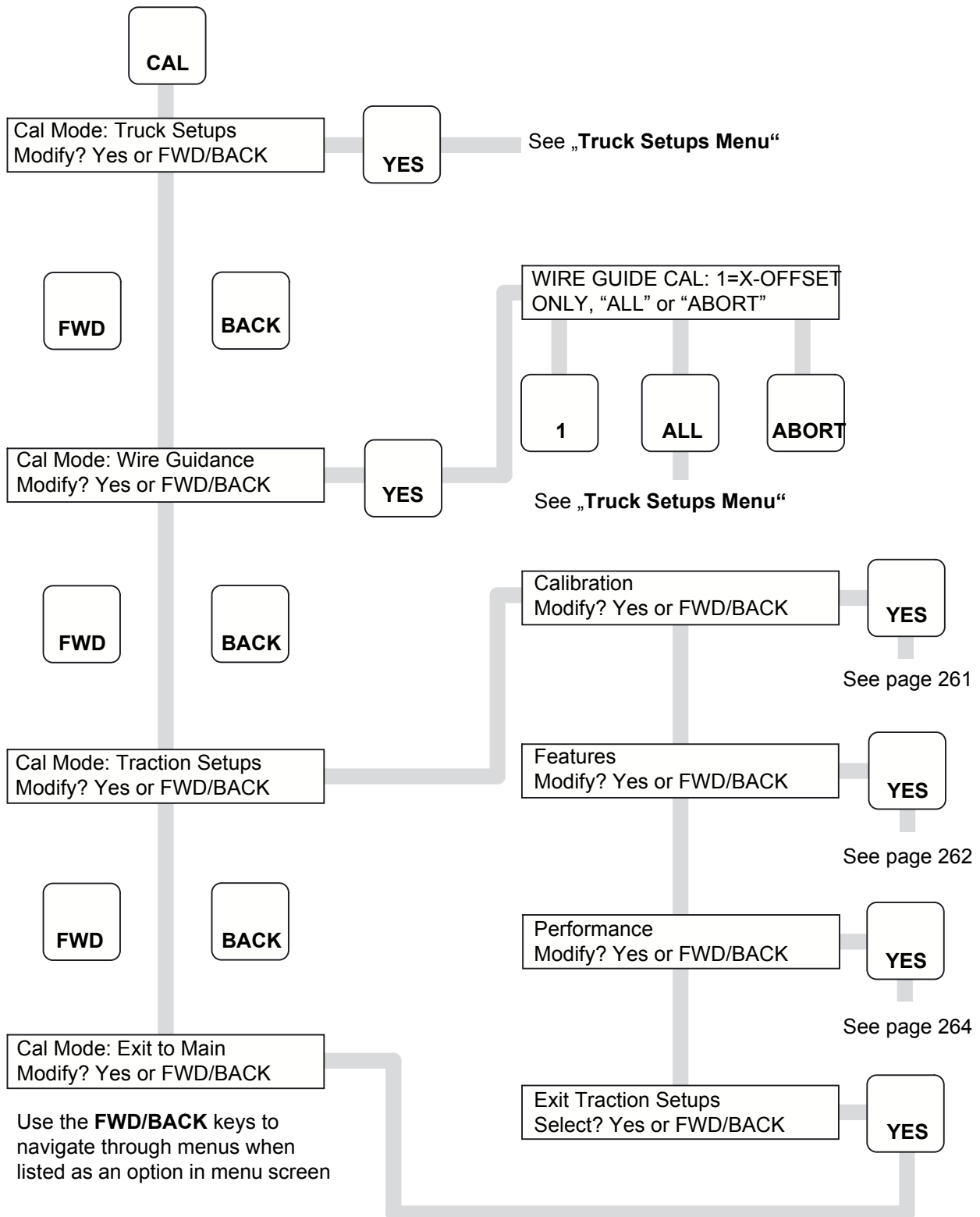


12492-01

ELECTRICAL SYSTEM CALIBRATION



Calibration

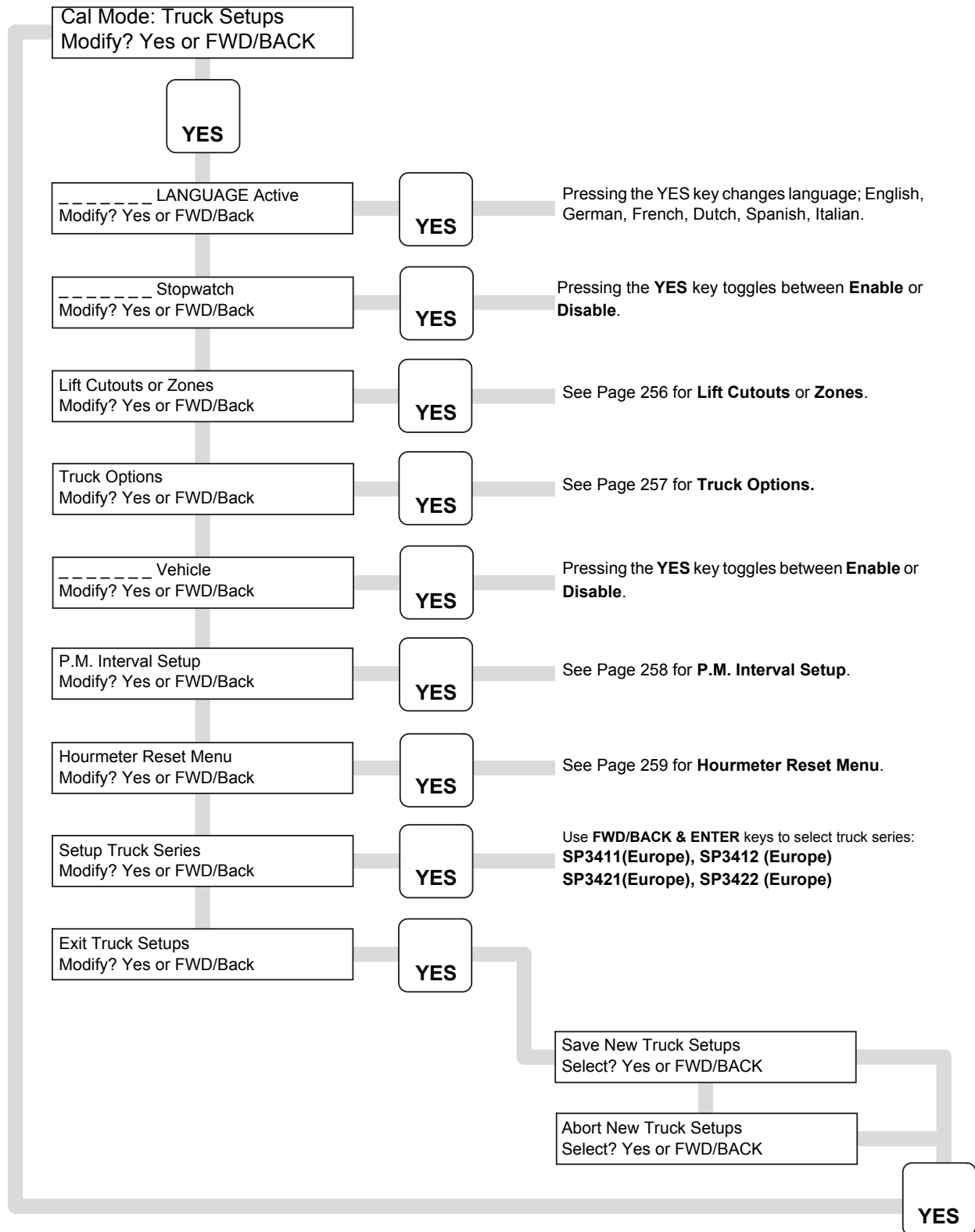


12493-01



ELECTRICAL SYSTEM CALIBRATION

Truck Setup Menus



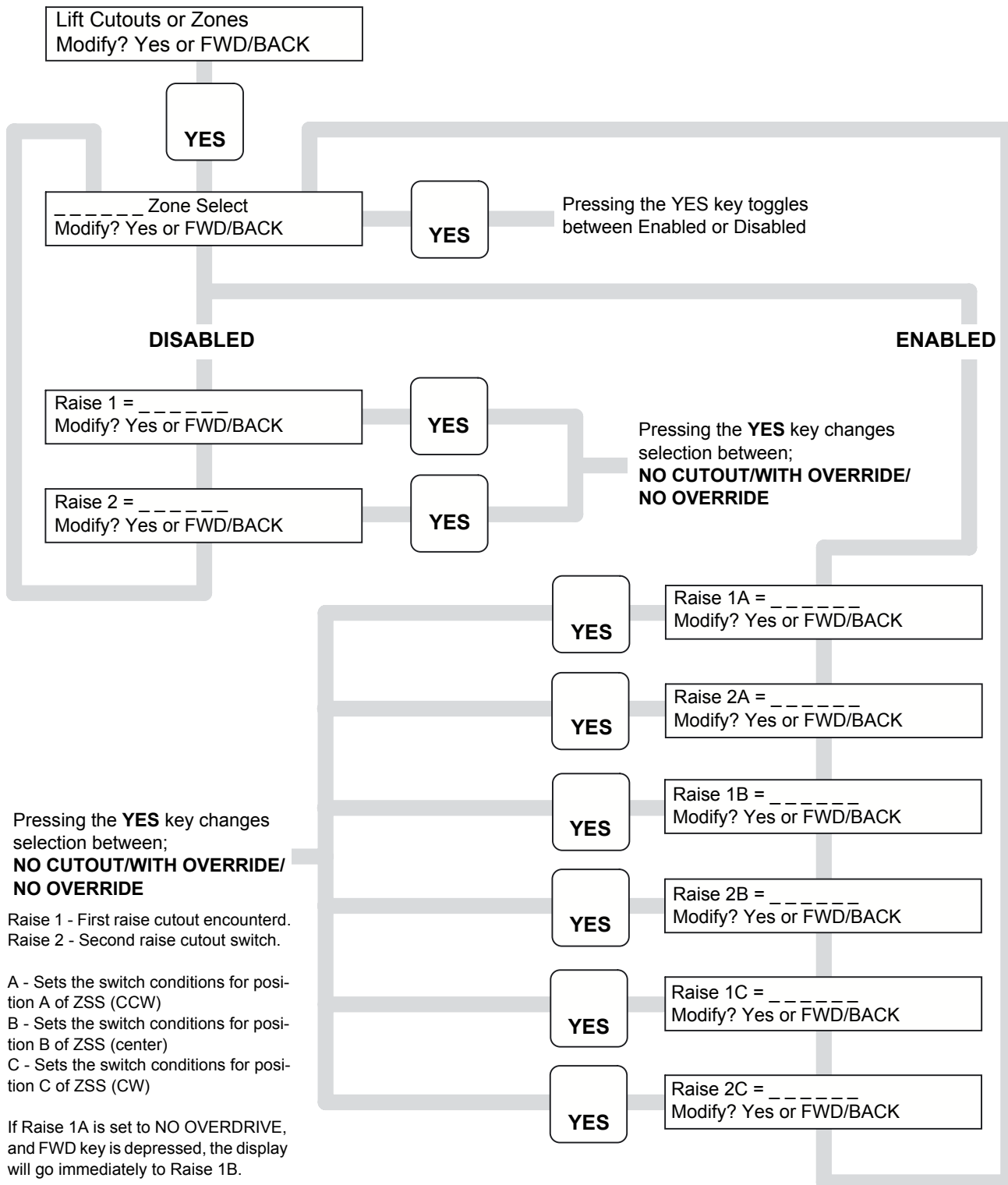
13341

ELECTRICAL SYSTEM

CALIBRATION



Lift Cutouts or Zone Menus

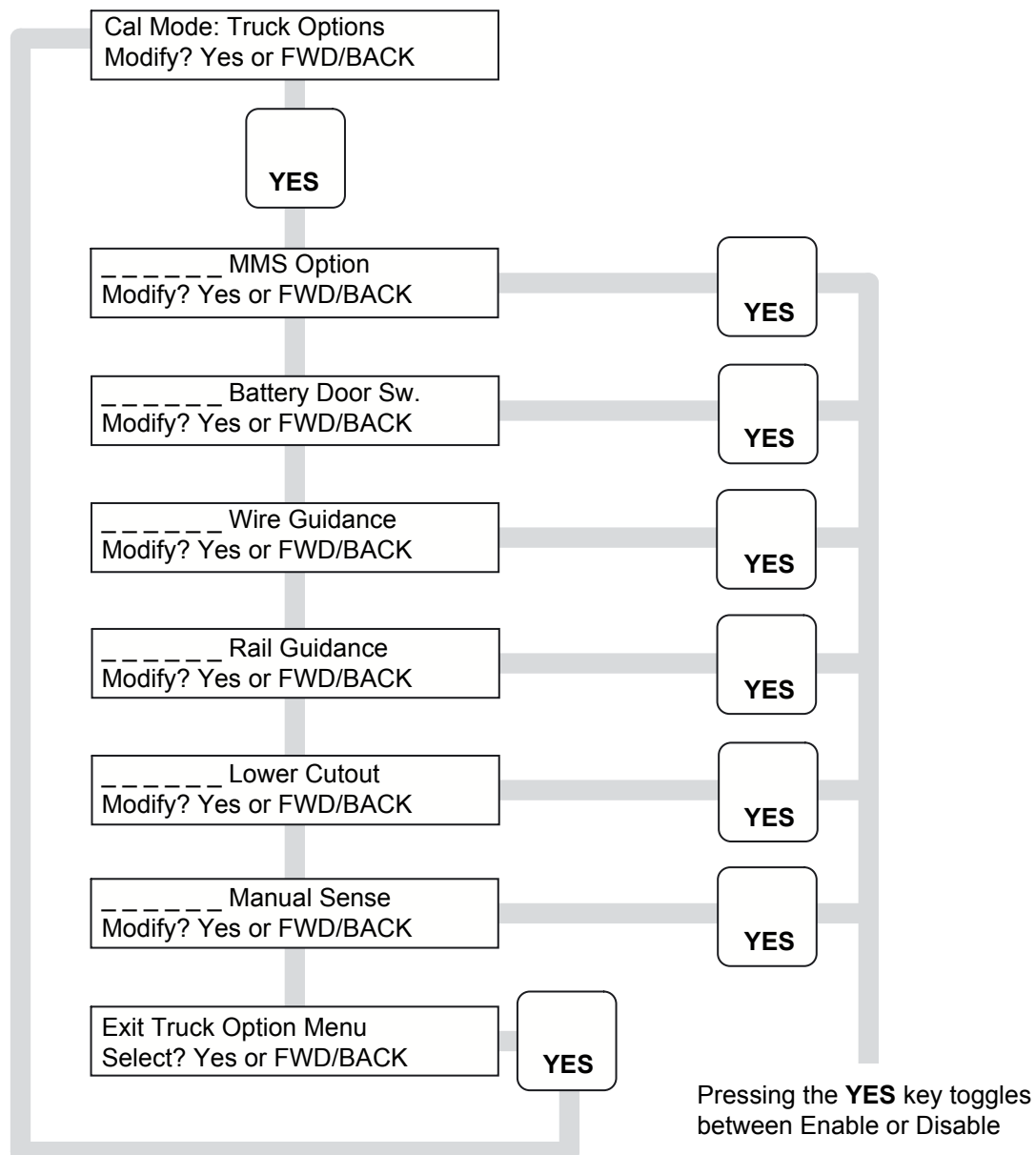


13342



ELECTRICAL SYSTEM CALIBRATION

Truck Option Menus

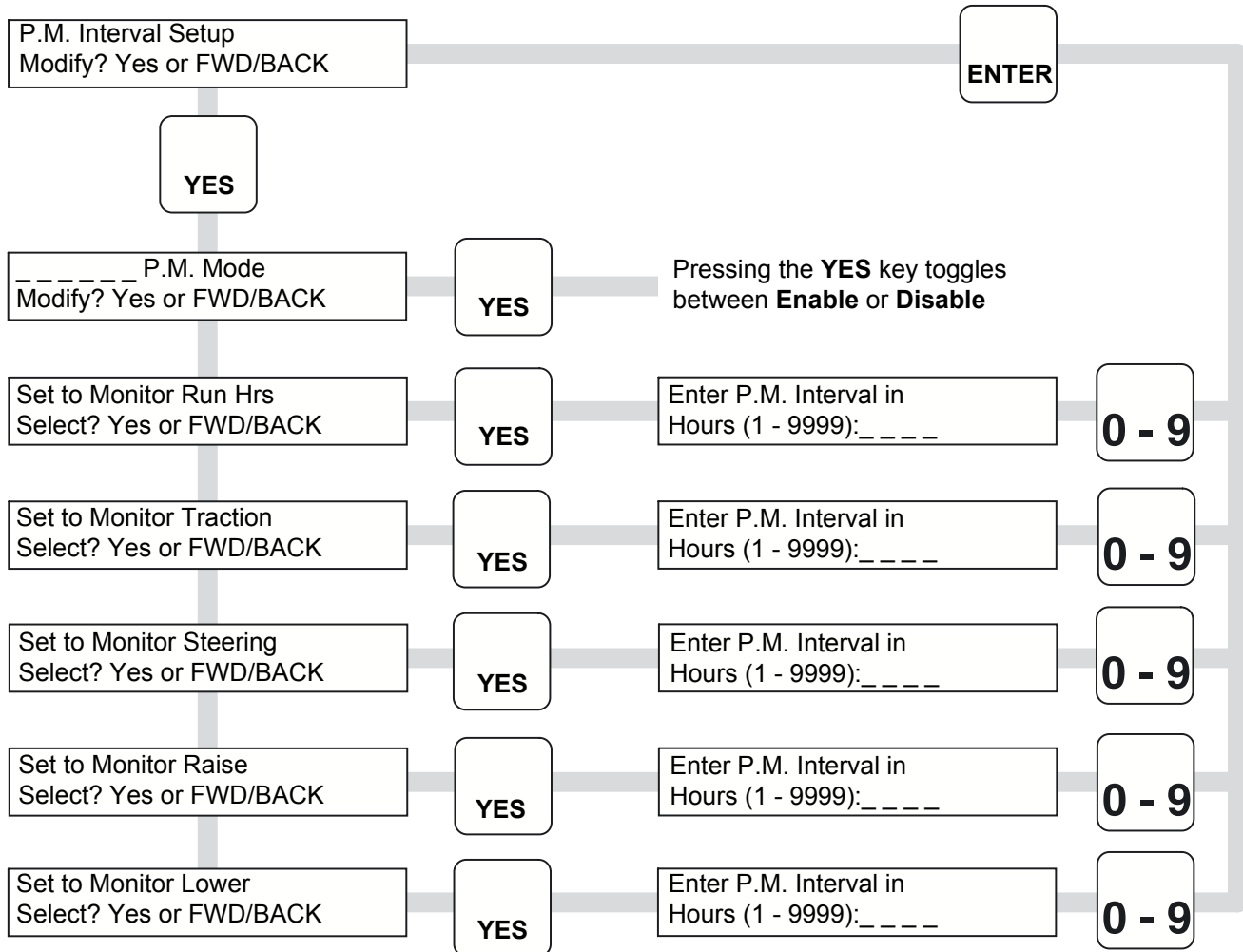


12496-01

ELECTRICAL SYSTEM CALIBRATION



P.M. Interval Setup Menus

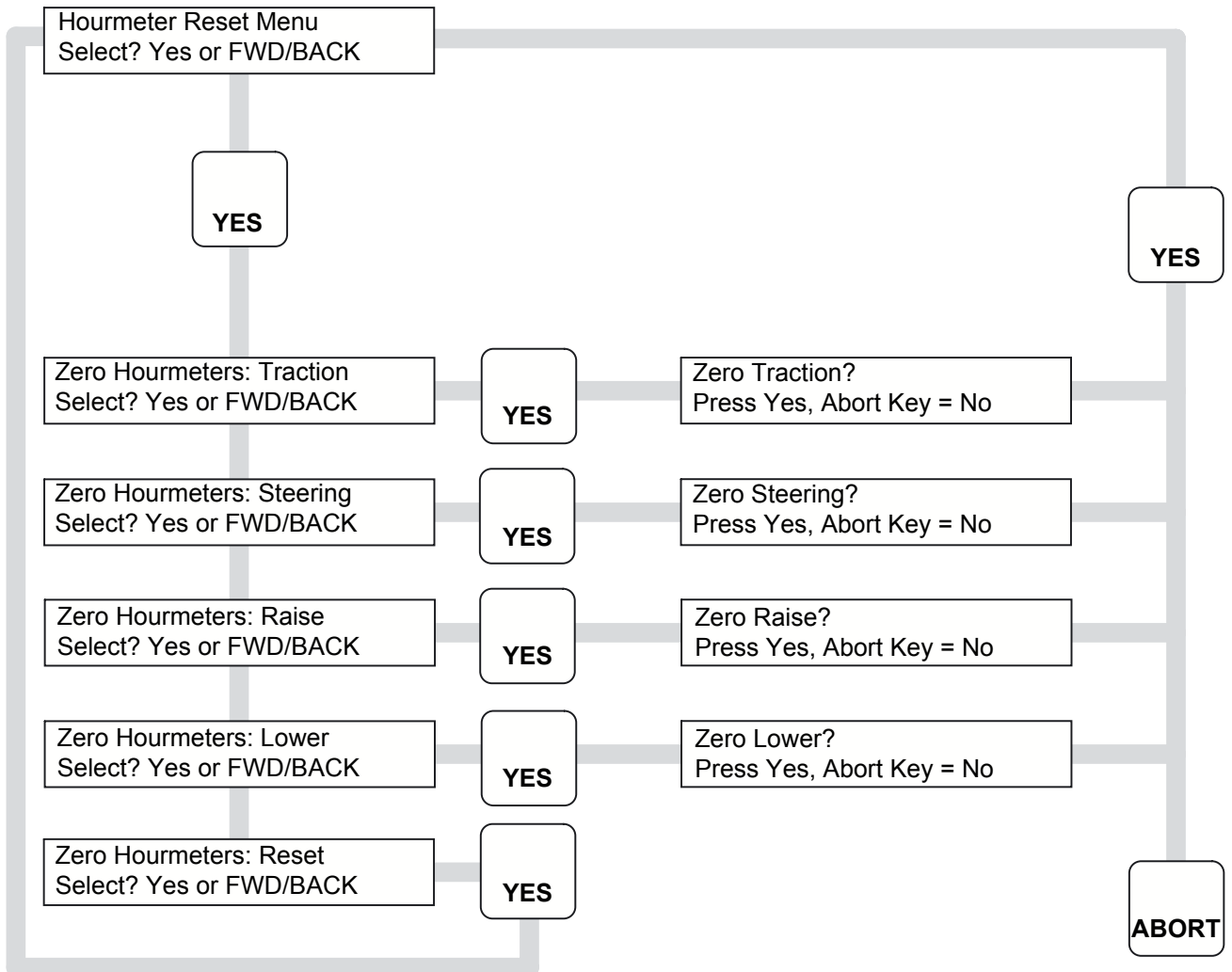


12497-01



ELECTRICAL SYSTEM CALIBRATION

Hourmeter Reset Menus

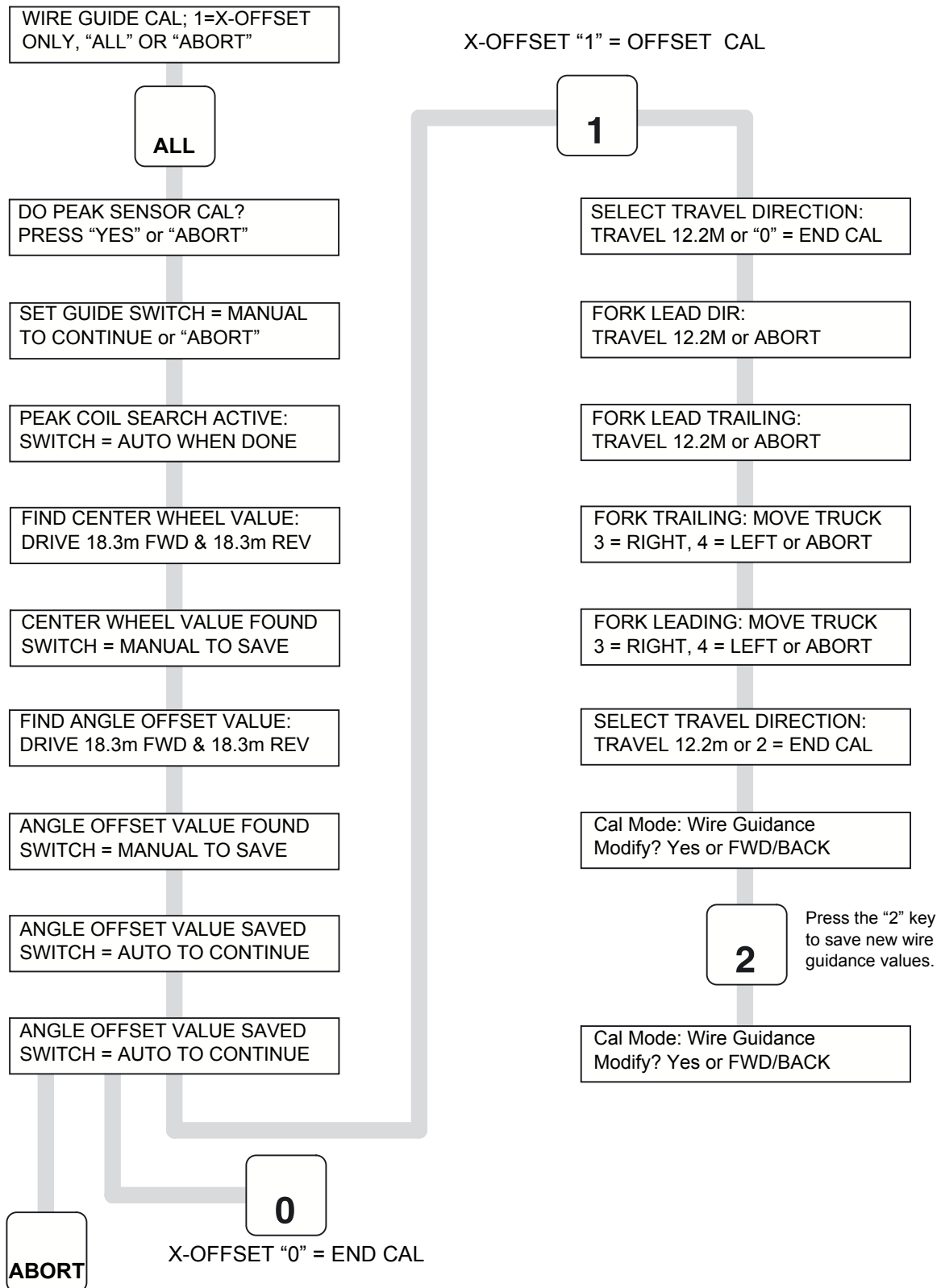


12498-01

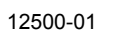
ELECTRICAL SYSTEM CALIBRATION



Wire Guidance Calibration Menus



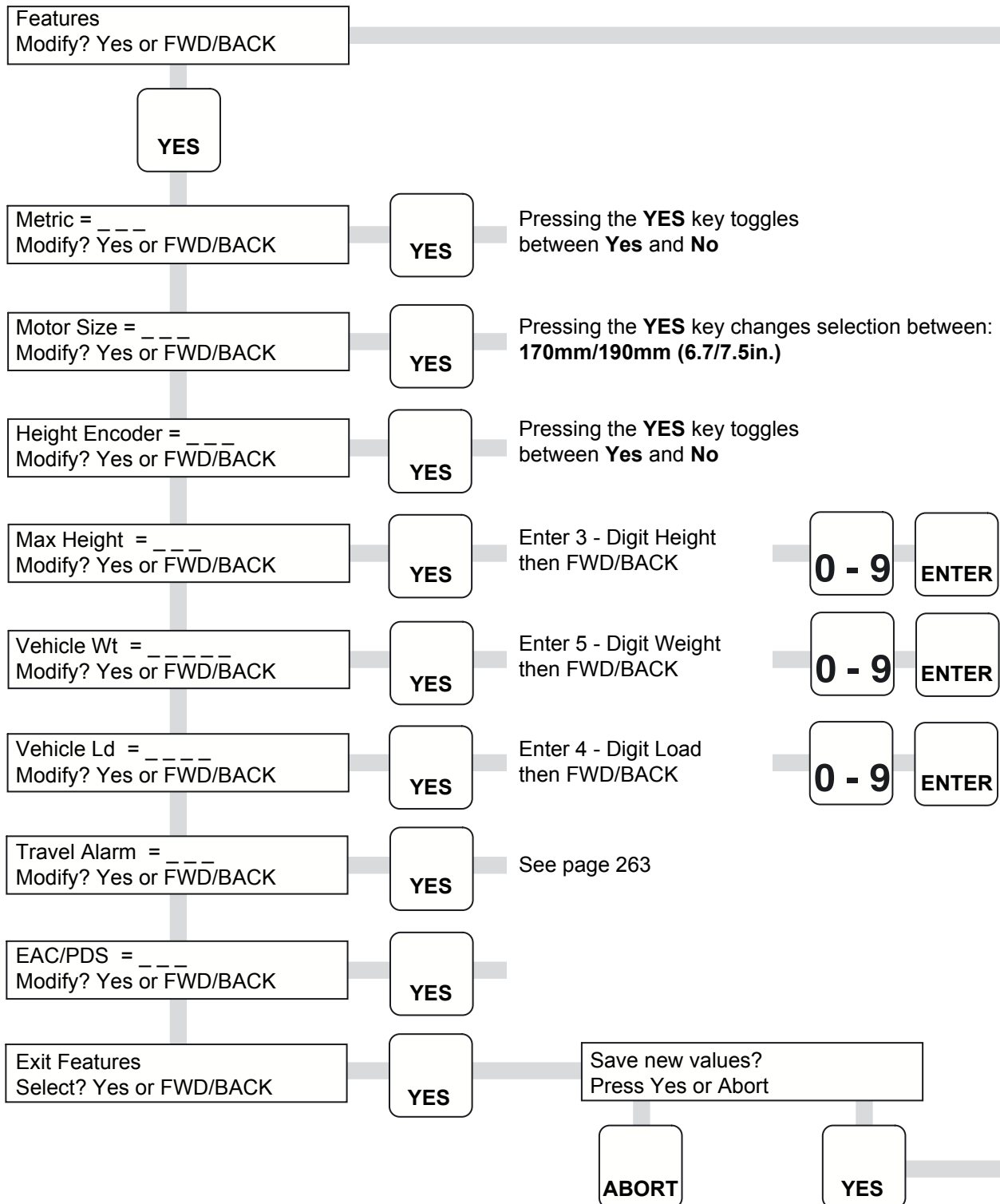
12499-01



ELECTRICAL SYSTEM CALIBRATION



Traction Setups/Features Menus

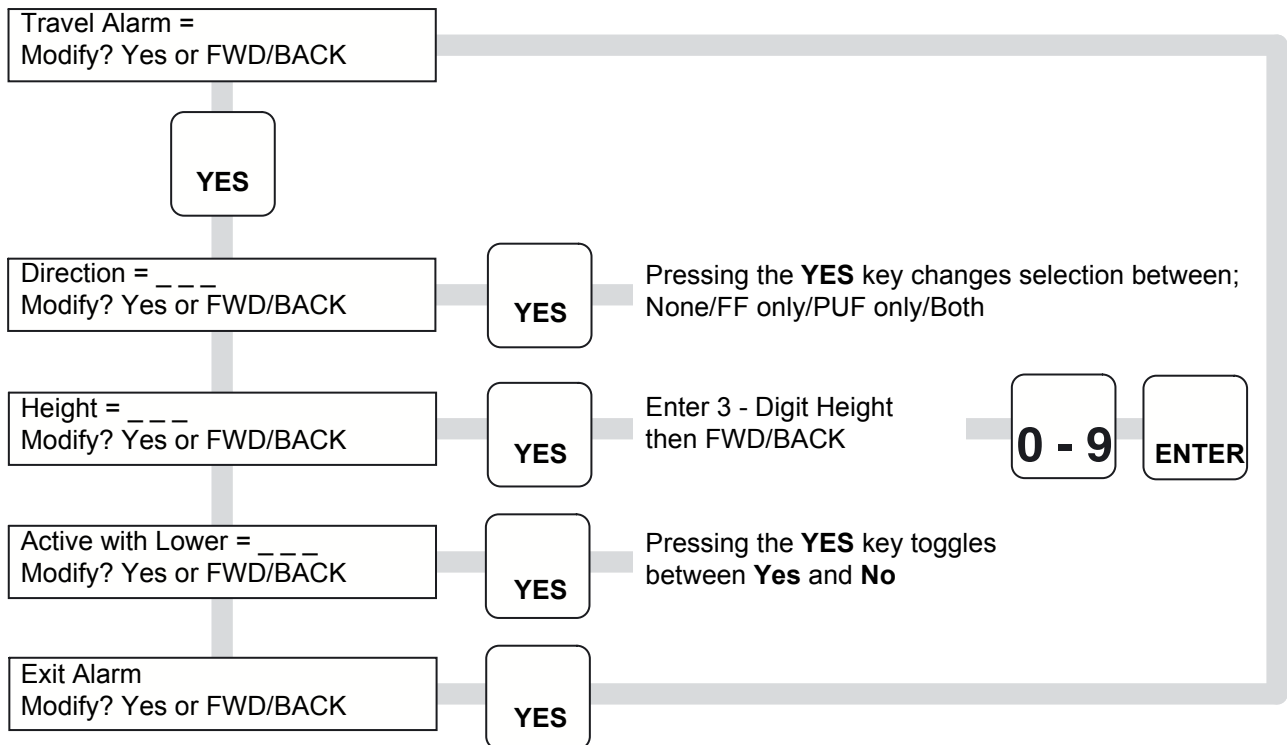


13343



ELECTRICAL SYSTEM CALIBRATION

Features/Travel Alarm Menus



12502-01

ELECTRICAL SYSTEM CALIBRATION



Traction Setups/Performance Menus

Performance Modify? Yes or FWD/BACK			
YES			
Max. Travel Spd = _._ _ Modify? Yes or FWD/BACK	YES	Enter speed x.xx	0 - 9 ENTER
BDI = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Coast = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Plug = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Accel = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Free-Range Adj < 1524 mm = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Free-Range Adj > 1524 mm = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER
Guide Speed Adj < 1524 mm = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9 ENTER

Continued on next page

12503-01

Refer to Chart 1 on page -414 for default values and adjustments.



ELECTRICAL SYSTEM CALIBRATION

Traction Setups/Performance Menus (cont'd)

From previous page

Guided Speed Adj > 1524 mm = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
No Speed Height Free Range = _ Modify? Yes or FWD/BACK	YES	Enter 3 - Digit Height	0 - 9	ENTER
No Speed Height Guided = _ Modify? Yes or FWD/BACK	YES	Enter 3 - Digit Height	0 - 9	ENTER
1.6 km/h Height Free Range = _ Modify? Yes or FWD/BACK	YES	Enter 3 - Digit Height	0 - 9	ENTER
1.6 km/h Height Guided = _ Modify? Yes or FWD/BACK	YES	Enter 3 - Digit Height	0 - 9	ENTER
FF Brake = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
PUF Brake = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
Main Lower Speed = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
Axe Lower Speed = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
Soft Stop = _ Modify? Yes or FWD/BACK	YES	Enter value between 1 and 9	1 - 9	ENTER
Exit Performance Select? Yes or FWD/BACK	YES	Save new values? Press Yes or Abort YES ABORT Performance Modify? Yes or FWD/BACK		

Refer to Chart 1 on page -414 for
default values and adjustments

13344

ELECTRICAL SYSTEM

CALIBRATION


CHART 1

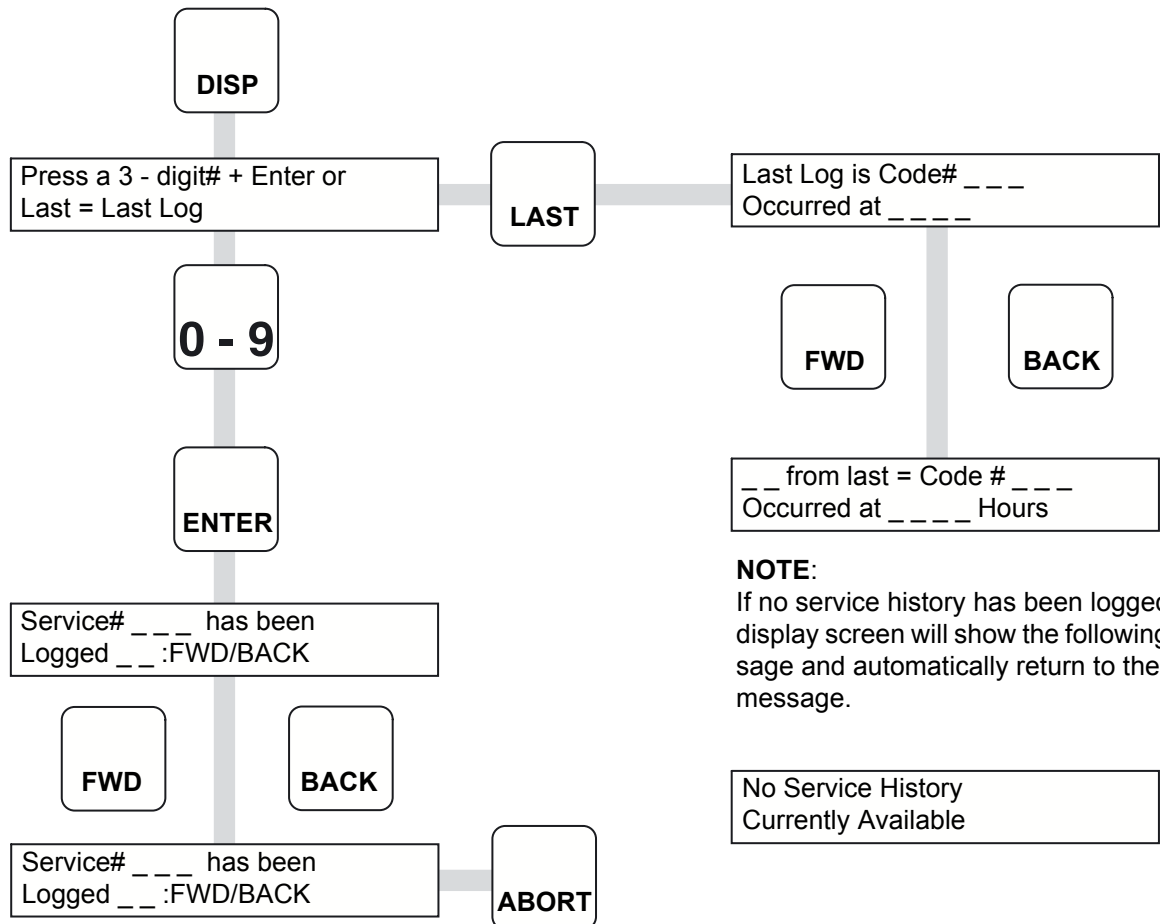
Menu Option	Factory Settings	Adjustment Range
Max Travel Speed =		Standard speed in power unit first direction will be displayed. If a speed less than standard is desired, press YES to modify, and enter desired speed.
BDI =	5	This adjusts the electronic system that monitors the battery's state of charge. Changing this setting will effect the battery discharge lift lock-out level. Adjusting to a setting of 1 will take the battery to its deepest discharge. Adjusting to a setting of 9 will decrease the level of discharge.
COAST =	9	Adjusting to a setting of 1 will provide the shortest coasting distance. Adjusting to a setting of 9 will provide the longest coasting distance.
PLUG =	6	Adjusting to a setting of 1 will provide the longest plugging distance. Adjusting to a setting of 9 will provide the shortest plugging distance.
ACCEL =	7	The factory setting of 7 will be displayed. Adjusting to a setting of 1 will provide the longest acceleration time. Adjusting to a setting of 9 will provide the shortest acceleration time.
Free-Range Adj < 60 =	9	This setting adjusts the travel speed when the truck is free ranging (rail/wire guidance off) and the forks are below 1524 mm (60 in.). Factory setting of 9 will provide the maximum travel speed for the truck. Adjusting to a setting of 1 will provide 50% of maximum travel speed.
Free-Range Adj >60 =	9	This setting adjusts the travel speed when the truck is free ranging (rail/wire guidance off) and the forks are above 1524 mm (60 in.). Factory setting of 9 will provide the maximum travel speed for the truck. Adjusting to a setting of 1 will provide 50% of maximum travel speed.
Guided Speed Adj < 60 =	9	Adjusts travel speed when guidance is on and forks are below 1524 mm (60 in.). Factory setting of 9 will provide the maximum travel speed for the truck. Adjusting to a setting of 1 will provide 50% of maximum travel speed.
Guided Speed Adj > 60 =	9	Adjusts travel speed when guidance is on and forks are above 1524 mm (60 in.). Factory setting of 9 will provide the maximum travel speed for the truck. Adjusting to a setting of 1 will provide 50% of maximum travel speed.
No Speed Height Free Range =		Enter lift height where travel is cutout. Default is 10160 mm.
No Speed Height Guided =		Enter Desired Speed If Required
1.6 km/h Height Free Range =		Enter 3 - Digit Height
1.6 km/h Height Guided =		Enter 3 - Digit Height
FF Brake =	6	This affects the braking effort of the drive motor brake when travelling in fork first (FF) direction. Factory setting of 6 will be displayed. Adjusting to a setting of 1 will provide the least braking. Adjusting to a setting of 9 will provide the most braking.



ELECTRICAL SYSTEM CALIBRATION

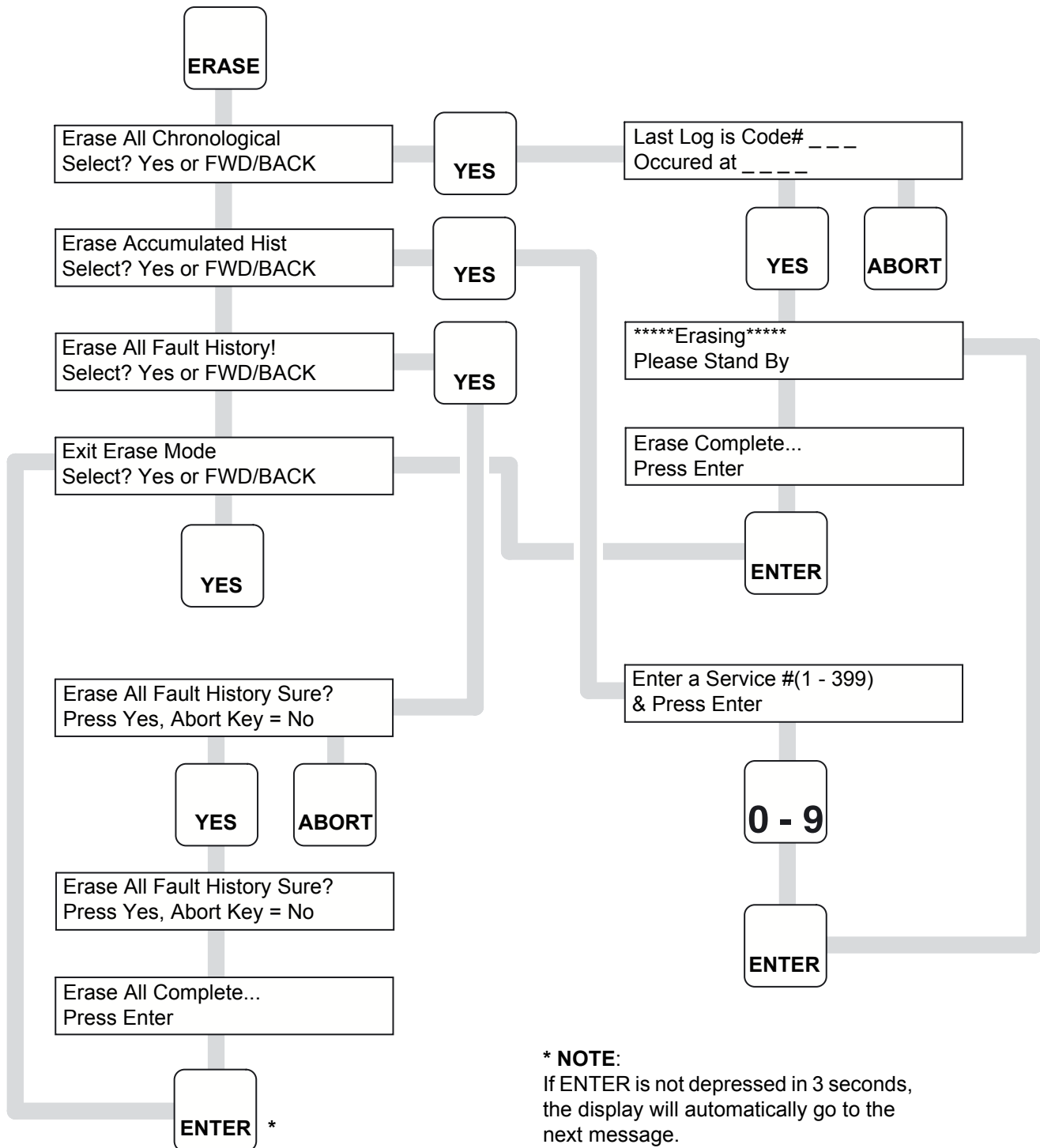
CHART 1

PUF Brake =	6	This affects the braking effort of the drive motor brake when travelling in power unit first (PUF) direction. Factory setting of 6 will be displayed. Adjusting to a setting of 1 will provide the least braking. Adjusting to a setting of 9 will provide the most braking.
Main Lower Speed =	5	This setting affects low speed lowering. Factory setting of 5 is approx. 12 m/min. (40 ft./min.). Adjusting the setting to 9 increases lowering speed. Adjusting setting to 1 decreases lowering speed.
Auxiliary Lower Speed =	5	This setting affects low speed lowering. Factory setting of 5 is approx. 12 m/min. (40 ft./min.). Adjusting the setting to 9 increases lowering speed. Adjusting setting to 1 decreases lowering speed.
Soft Stop =	1	Setting of 1 is softest, setting of 9 is hardest



12505-01

ELECTRICAL SYSTEM CALIBRATION



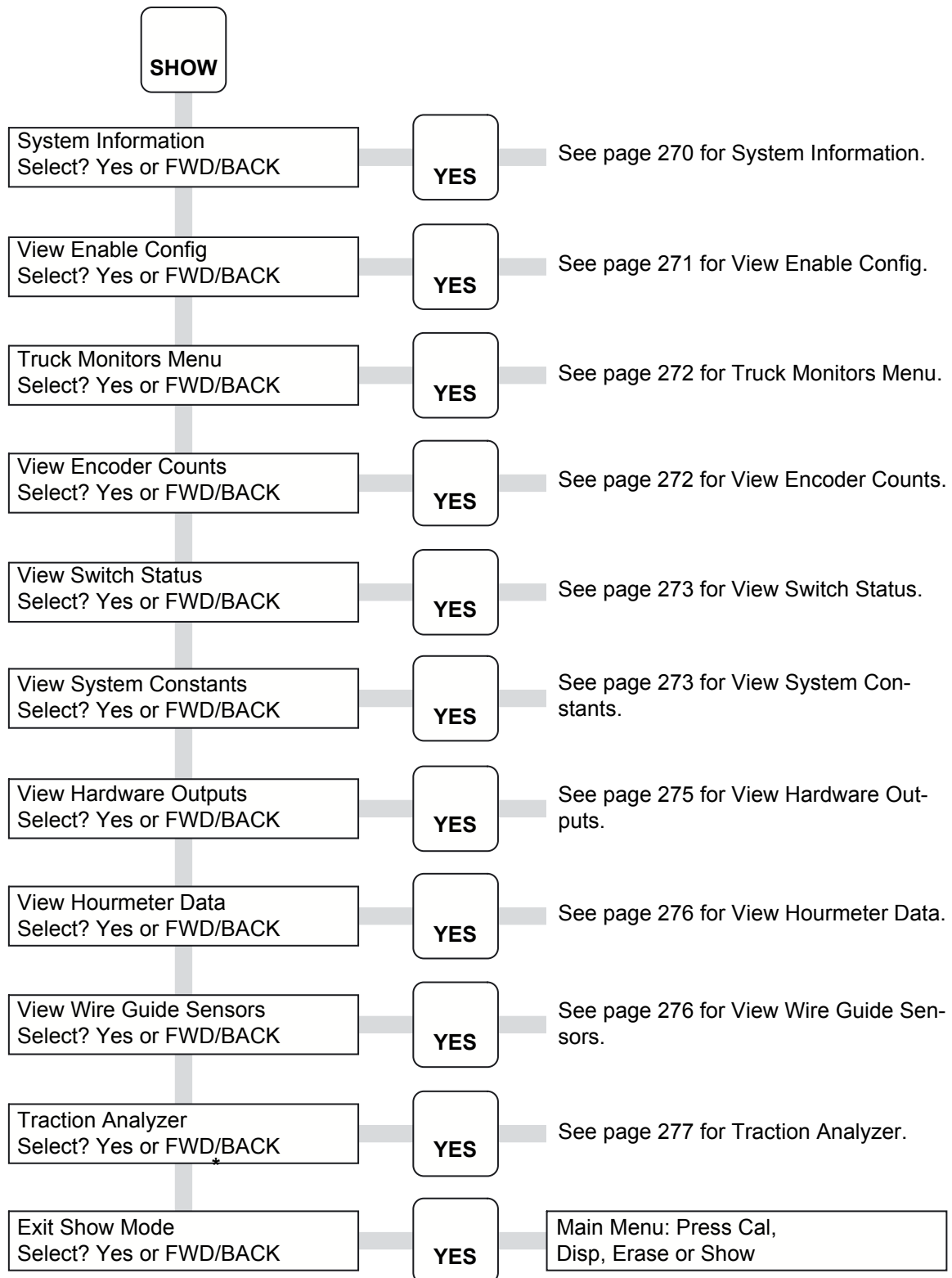
*** NOTE:**

If ENTER is not depressed in 3 seconds,
the display will automatically go to the
next message.

12506-01



ELECTRICAL SYSTEM CALIBRATION

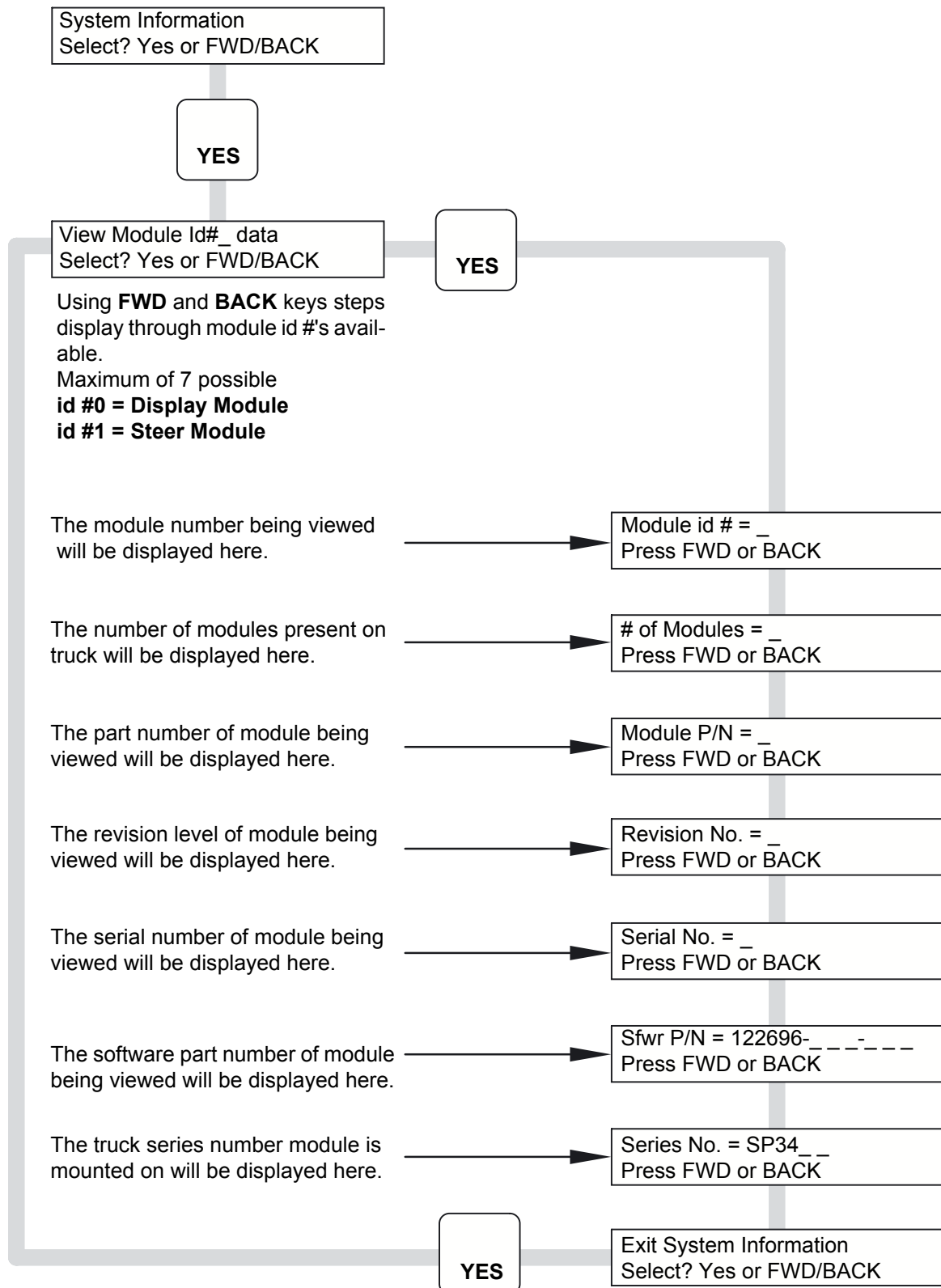


12507-01

ELECTRICAL SYSTEM CALIBRATION



System Information Menus

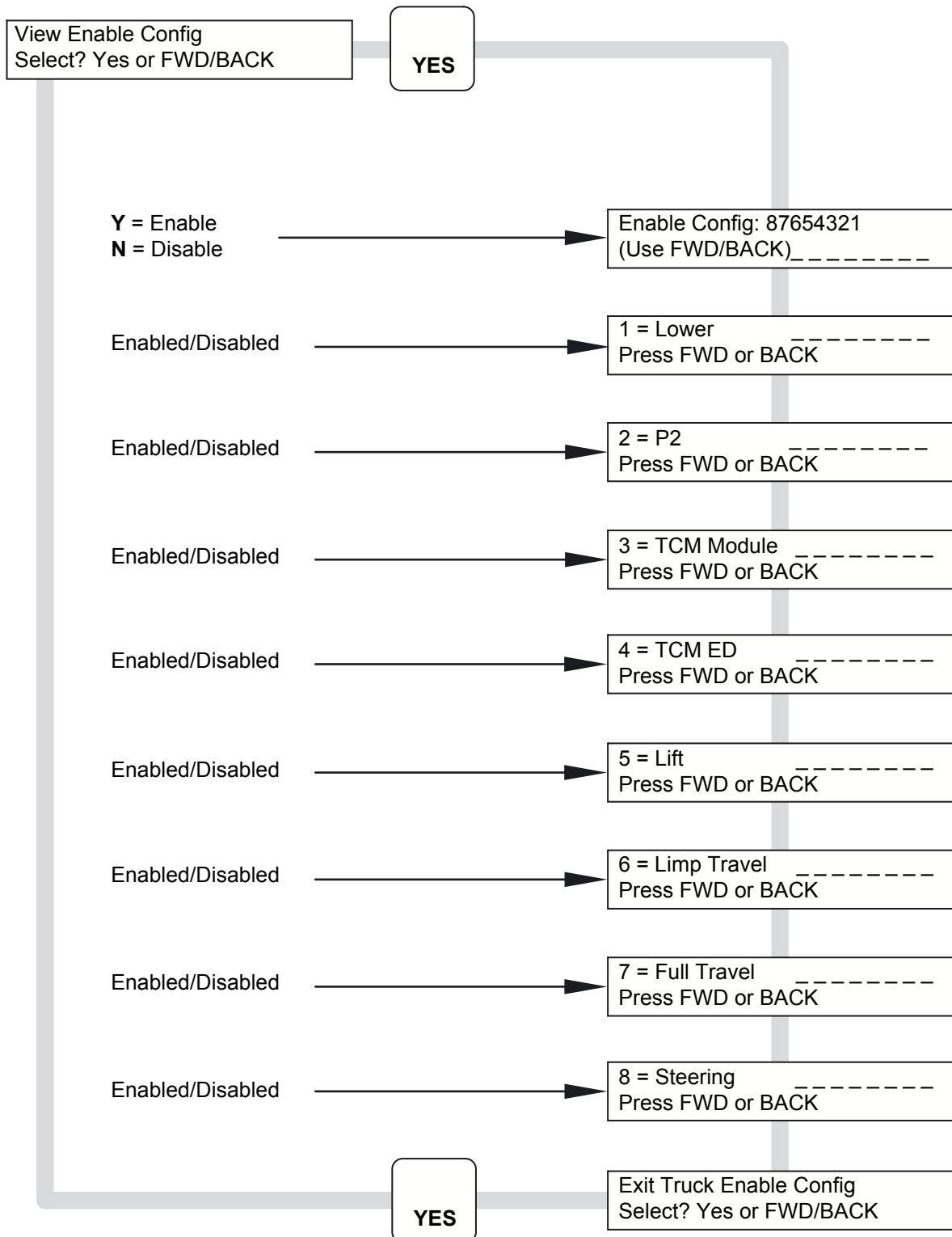


12508-01



ELECTRICAL SYSTEM CALIBRATION

View Enable Config Menus



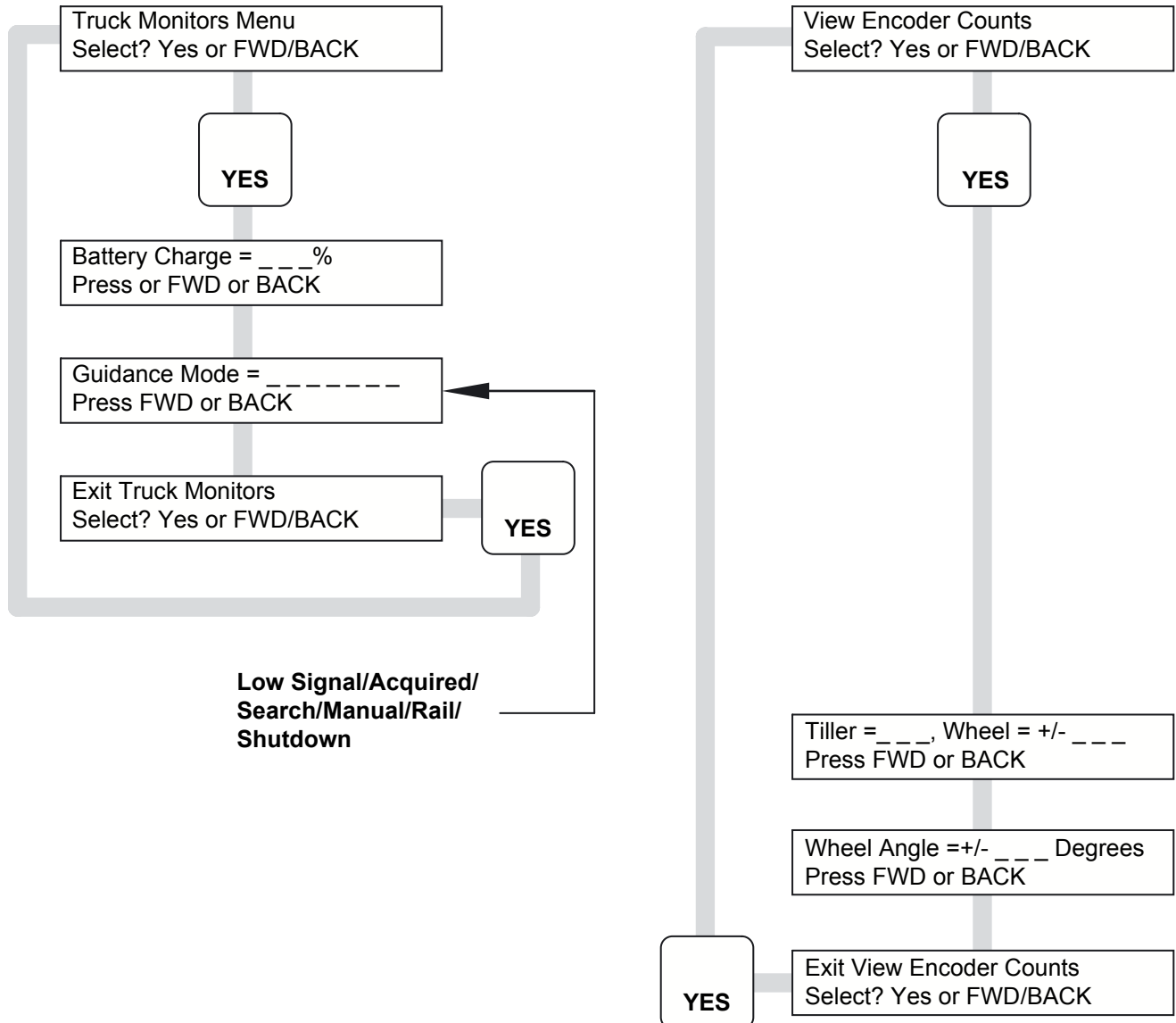
12509-01

ELECTRICAL SYSTEM

CALIBRATION



Truck Monitors Menus / View Encoder Counts Menu

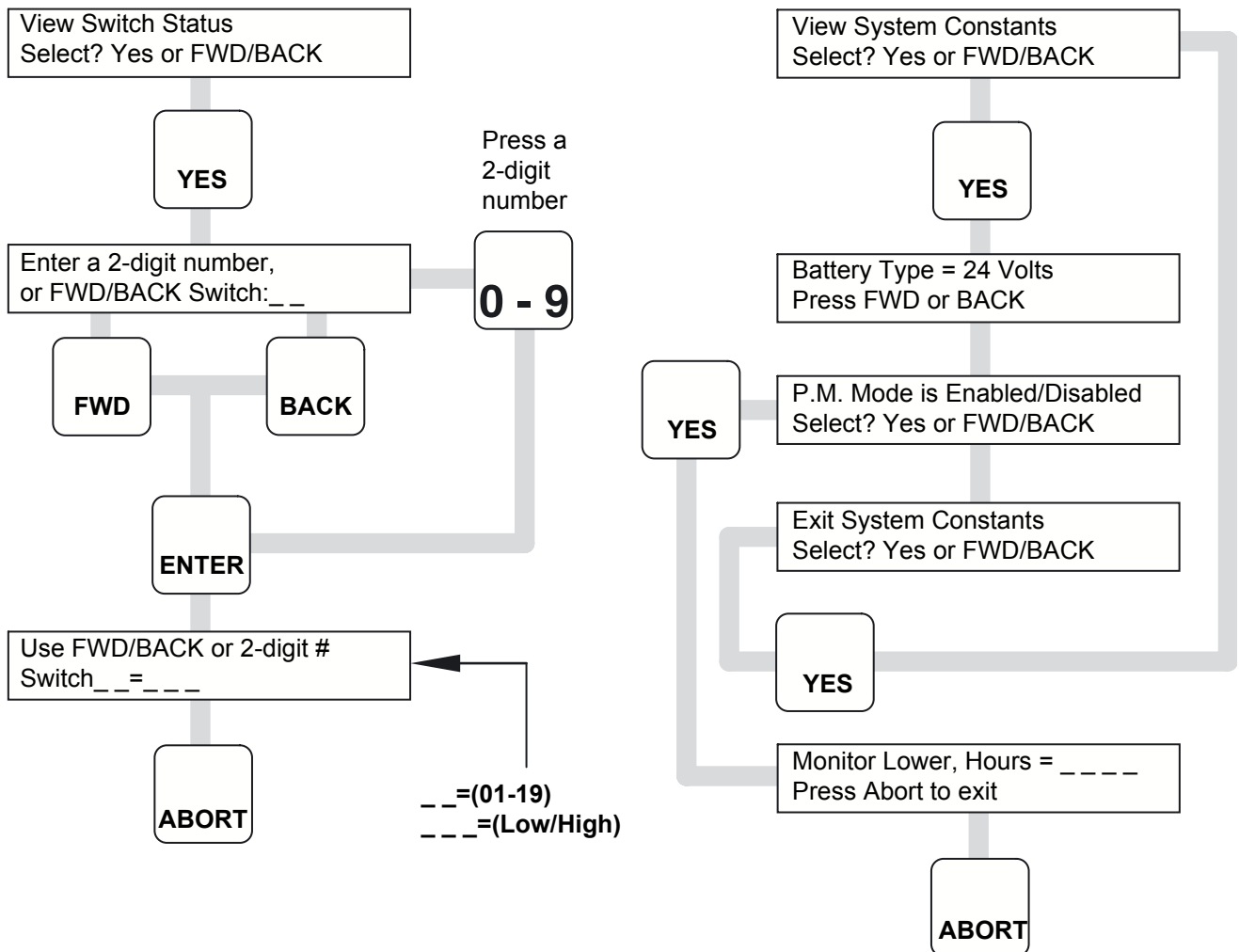


12510-01



ELECTRICAL SYSTEM CALIBRATION

View Switch Status Menus / View System Constants Menus



13345

ELECTRICAL SYSTEM

CALIBRATION

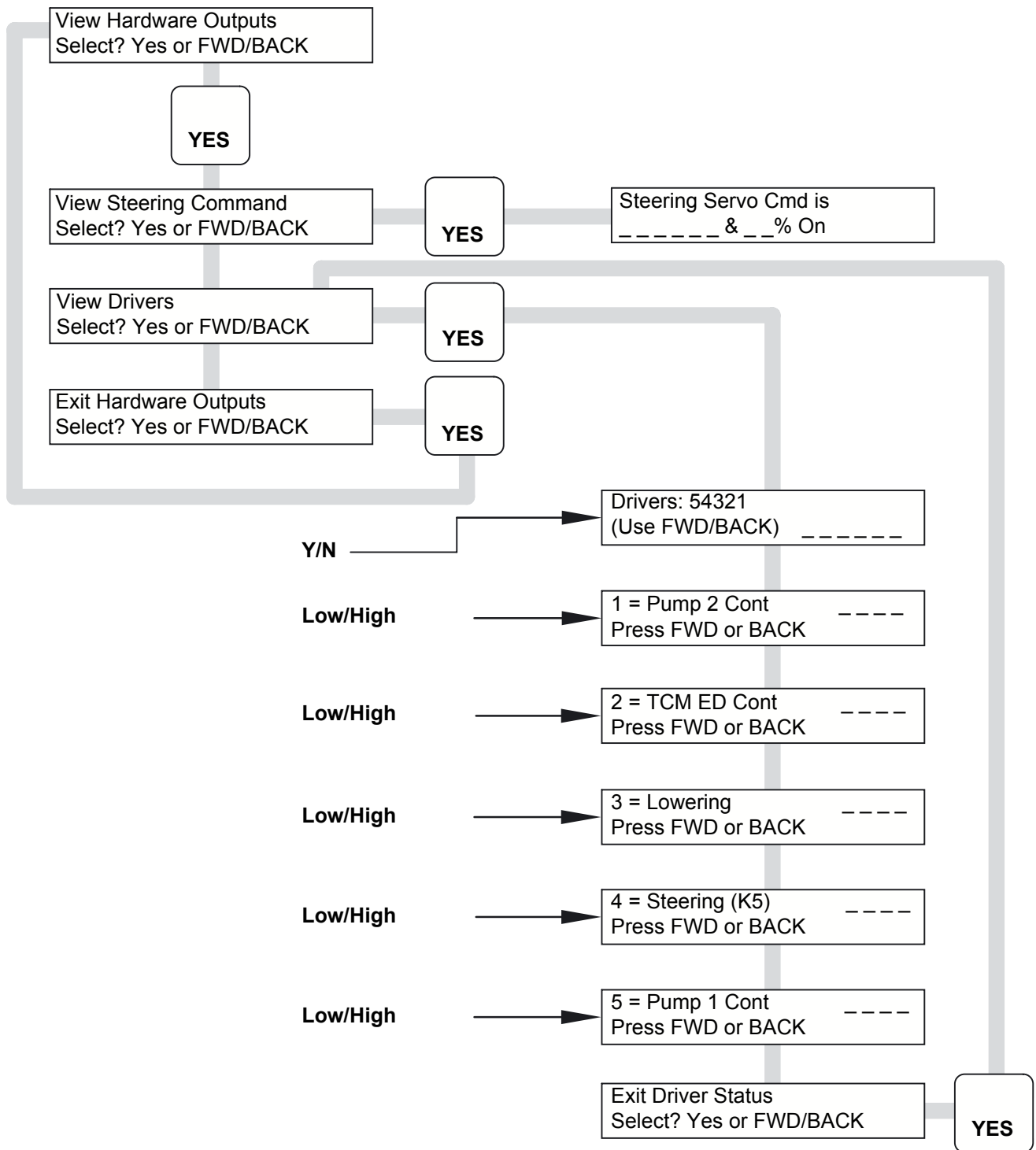

CHART 2

Switch #	Name	Status	
		High	Low
01	ORS1	Selected	Not Selected
02	LCS1	Below c/o	Above c/o
03	LOS1	Selected	Not Selected
04	RAS1	Selected	Not Selected
05	RS	Selected	Not Selected
06	FS	Selected	Not Selected
07	BRES1, 2	Open	Closed
08	RCS1	Above c/o	Below c/o
09	RCS2	Above c/o	Below c/o
10	KYS (start)	Selected	Not Selected
11	DPS (option)	Selected	Not Selected
12	DPS (mode)	Selected	Not Selected
13	ZSS	Shows Switch Position (A, B, C)	
14	HTS180	Above 4570mm (180in.)	Below 4570mm (180in.)
15	DMS	Selected	Not Selected
16	GUS	Selected	Not Selected
17	HSLCS	Above c/o	Below c/o
18	CHS3, 4	Open	Closed
19	LOS2	Selected	Not Selected
20	CHB4, 5	Closed	Open



ELECTRICAL SYSTEM CALIBRATION

View Hardware Outputs Menus

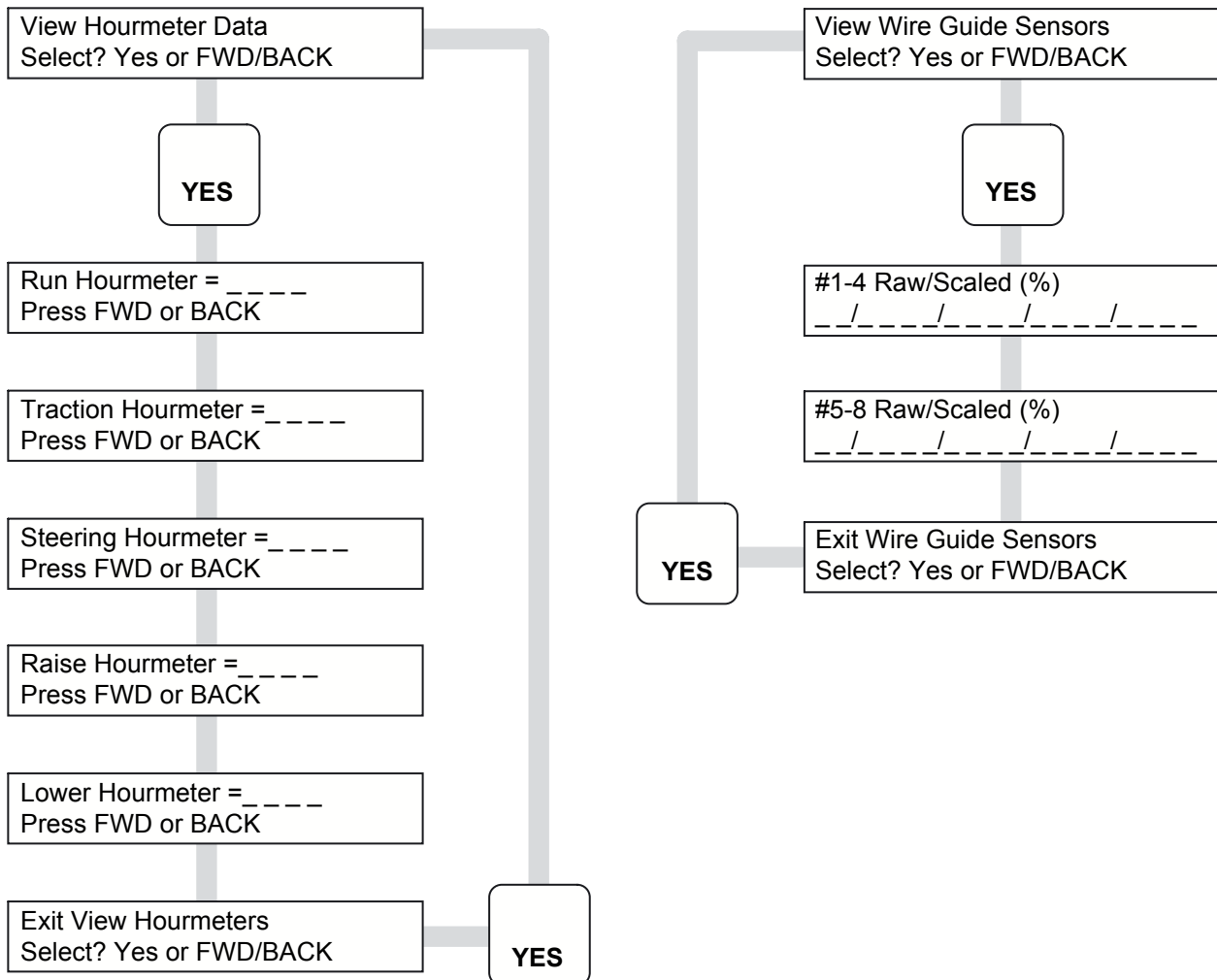


12512-01

ELECTRICAL SYSTEM CALIBRATION



View Hourmeter Data Menus / View Wire Guide Sensors Menus

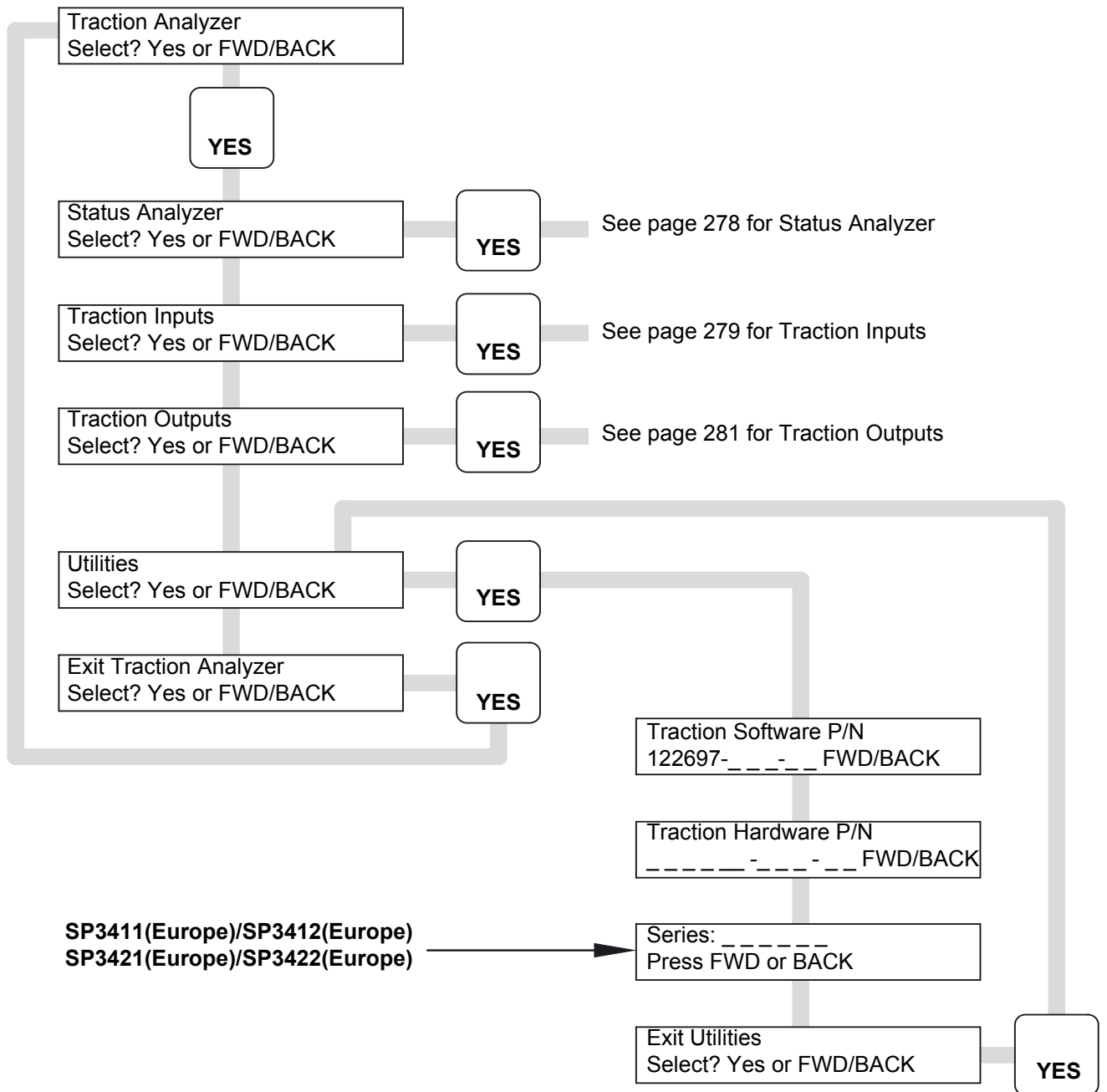


12513-01



ELECTRICAL SYSTEM CALIBRATION

Traction Analyzer Menus

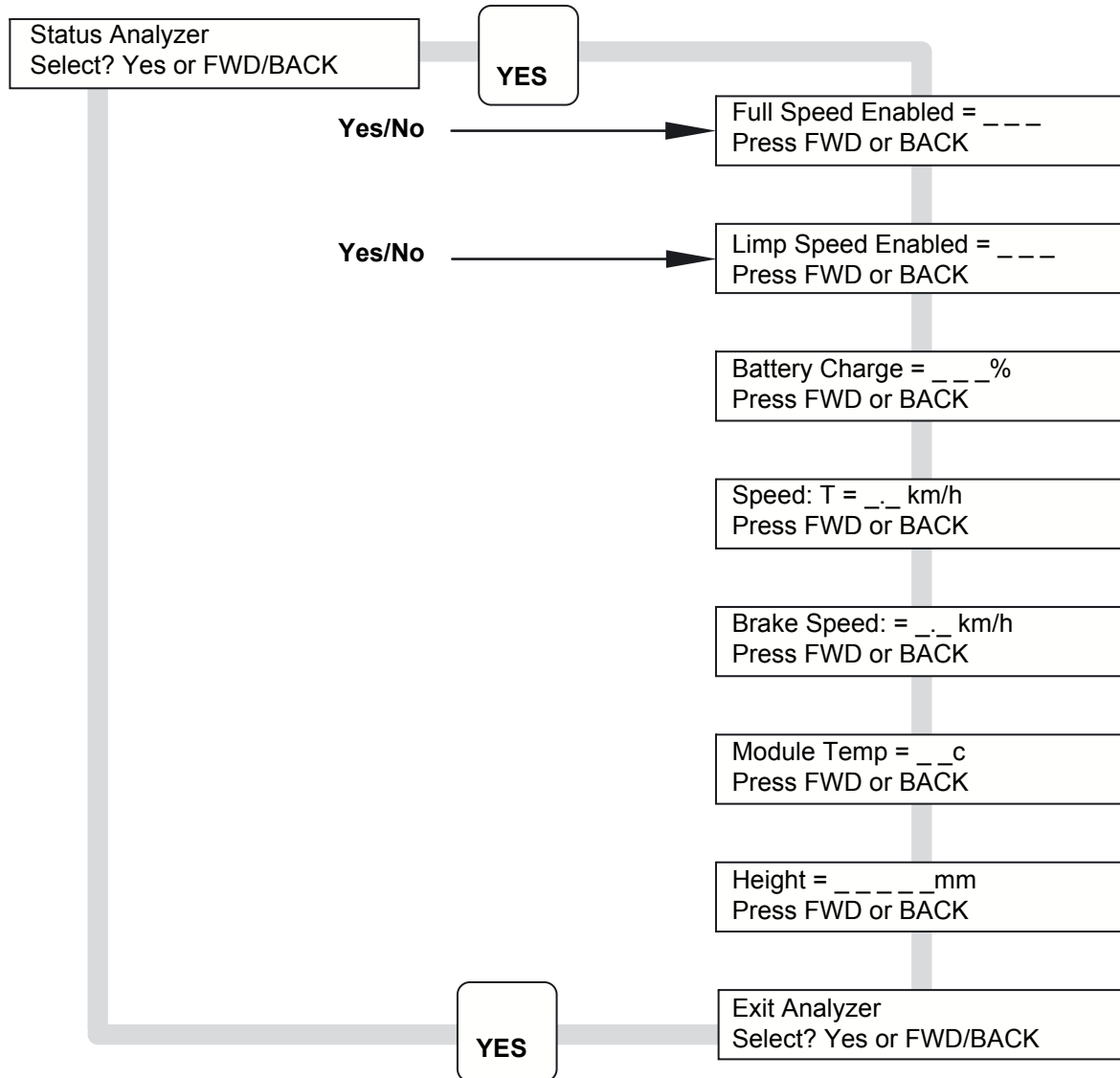


13360

ELECTRICAL SYSTEM CALIBRATION



Status Analyzer Menus

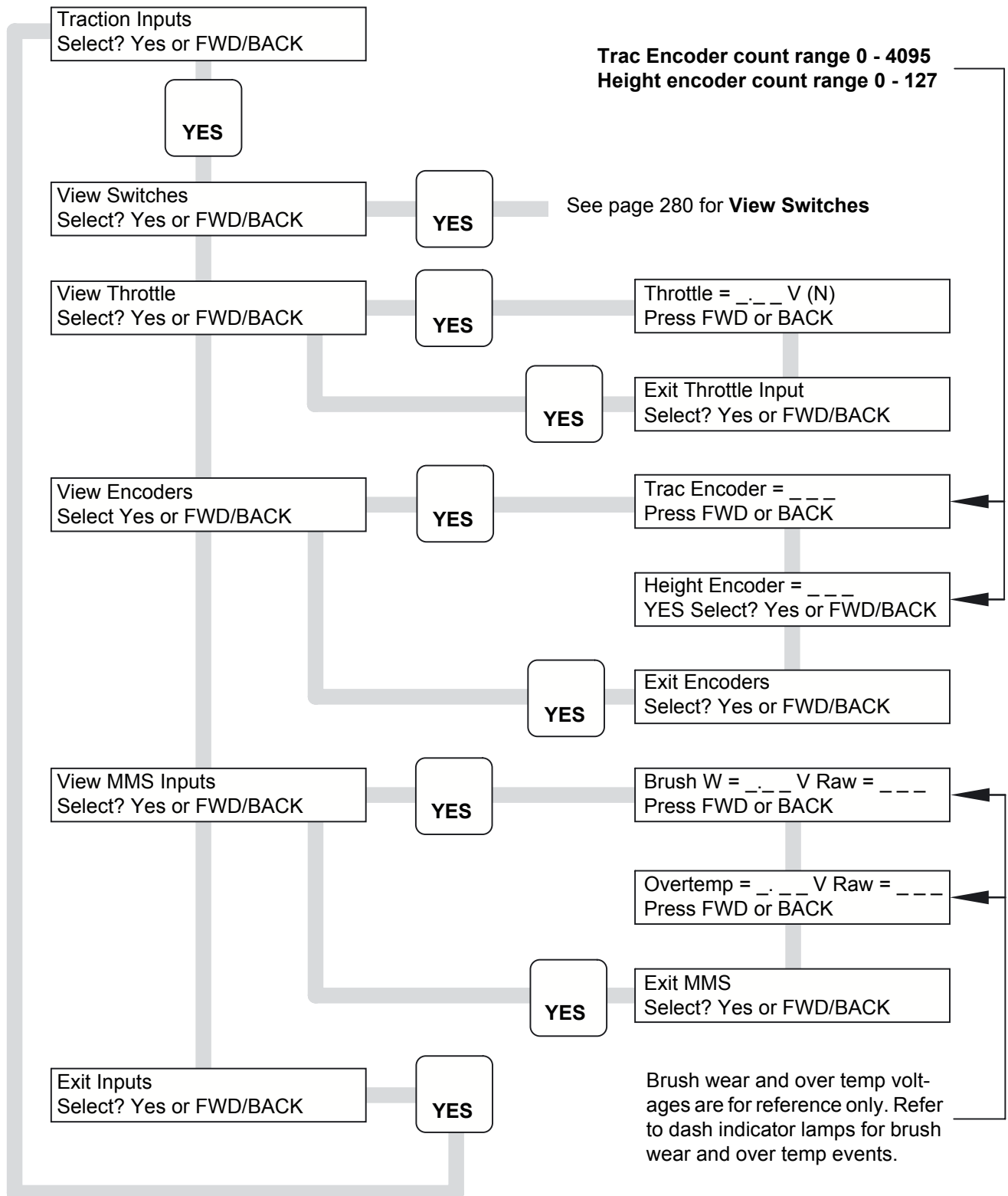


13361



ELECTRICAL SYSTEM CALIBRATION

Traction Inputs Menus



12516-01

ELECTRICAL SYSTEM CALIBRATION



View Switches Menu

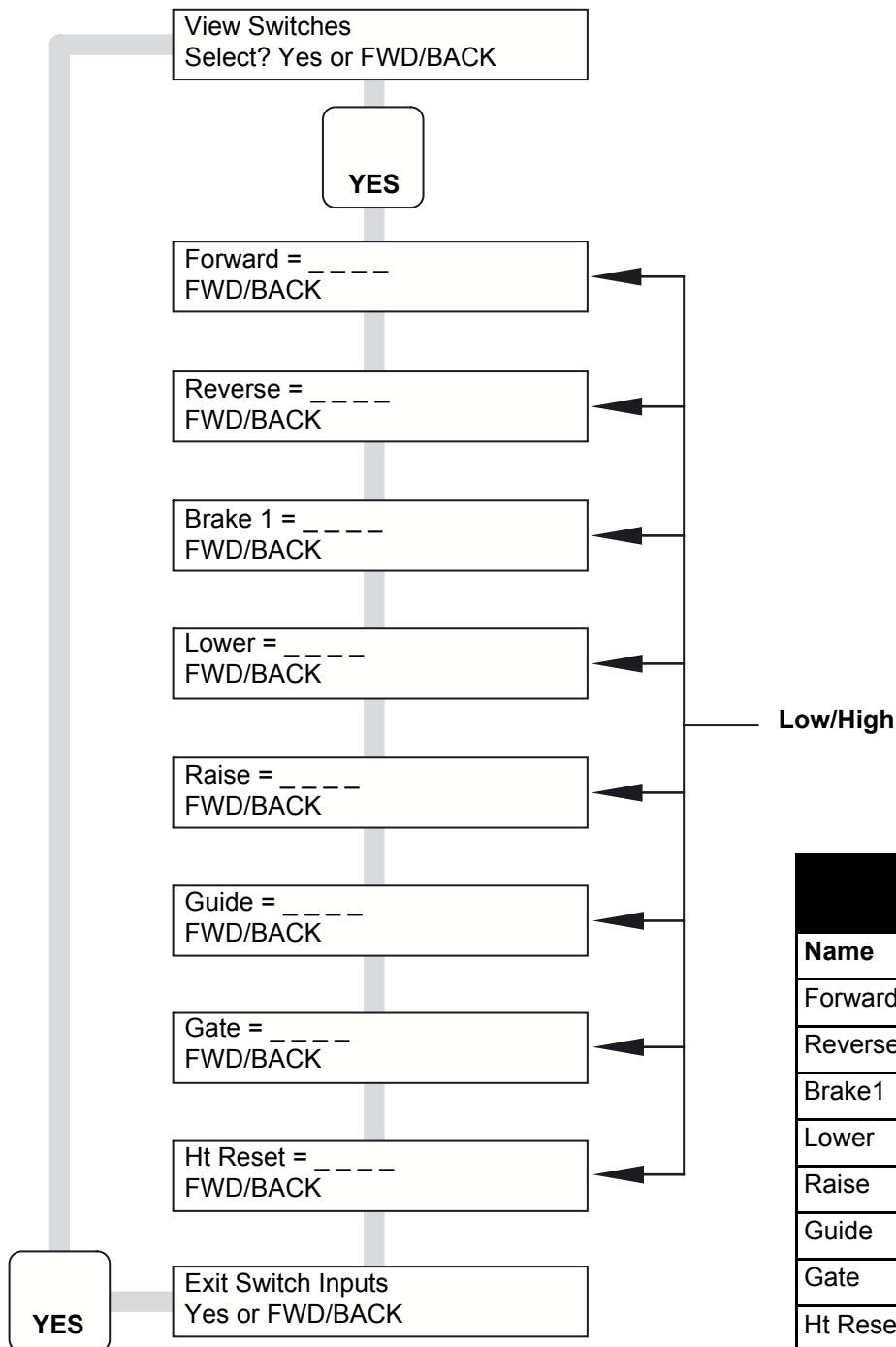


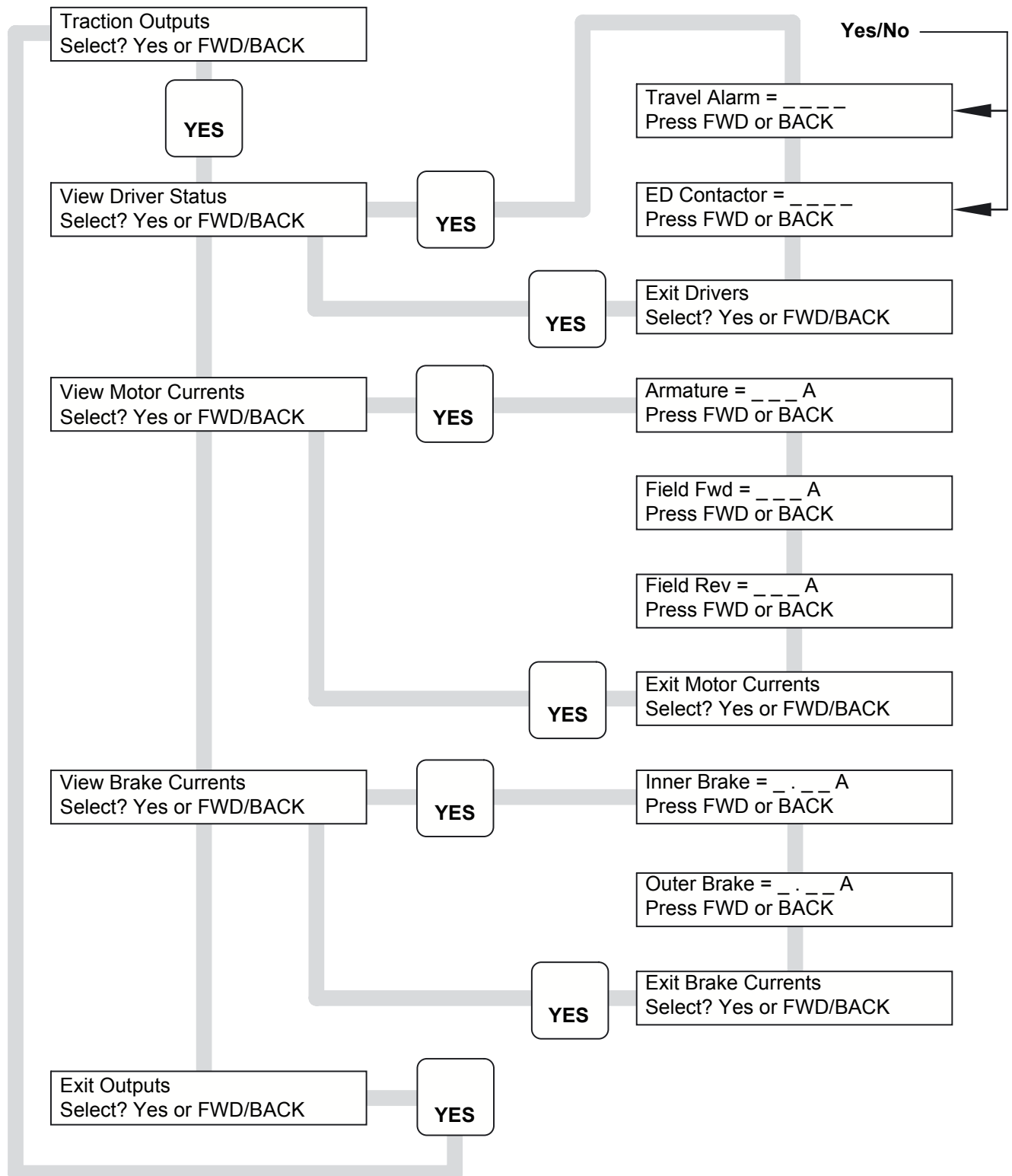
CHART 3		
Name	Switch	High
Forward	FS	Forward selected
Reverse	RS	Reverse selected
Brake1	BRS1	Pedal depressed
Lower	LOS	Lower selected
Raise	RAS	Raise selected
Guide	GUS	Guidance selected
Gate	GTS	Gates down
Ht Reset	HSLCS	At or above switch

12517-01



ELECTRICAL SYSTEM CALIBRATION

Traction Outputs Menus



12518-01

ELECTRICAL SYSTEM

WIRE GUIDANCE SYSTEM



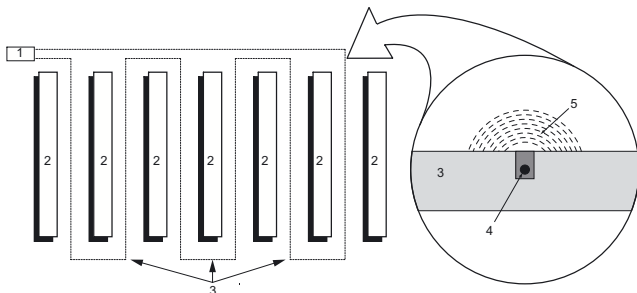
Wire Guidance System



7819

The Wire Guidance System automatically steers the lift truck down the aisle without the use of guide rails.

A Line Driver produces a set frequency of 5.2 kHz, 6.25 kHz, 7.0 kHz, or 10 kHz. This signal is transmitted through a wire embedded in the floor down the middle of each aisle (see Fig. 7747_EU).



7747_EU

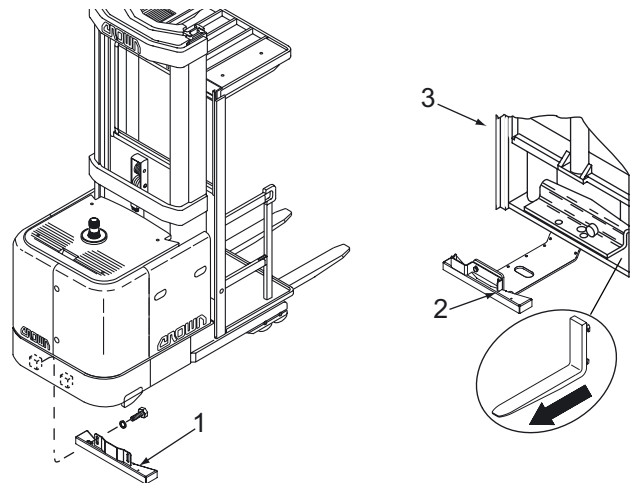
- 1 Line driver
- 2 Storage Racks
- 3 Floor
- 4 Wire, embedded in the floor and sealed
- 5 Transmitted signal

Sensor bars are mounted on the centre line of both ends of the truck, near the floor (see Fig. 7748_EU).

This sensor bars contain coils which act as antennas to receive the transmitted signal. The closer a coil gets to being directly over the wire, the higher the amplitude of signal received by the coil. Using the coil signal amplitude comparisons, the truck will “sense” the signal path. With this data, steering is electronically controlled to follow the signal.

A guidance selector switch (GUS) in the switch panel on the truck selects manual or automatic steering.

When in the manual mode, truck steering is controlled by the operator. Steering remains in the operator's control when switching to automatic until the guidance signal is detected. When the guidance signal is detected, steering control is automatically changed to the guidance system.



7748_EU

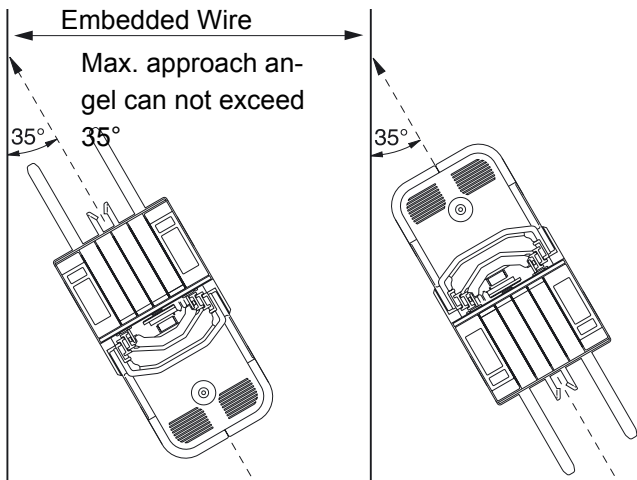
- 1 Steered wheel sensor
- 3 Load wheel sensor
- 3 Base of main frame, located under platform (rotated for clarity)

To align a truck to the wire guide signal, the approach angle must be within 35° (See Fig. 3) and traction speed must be below 4 km/h (2.5 m.p.h.). The brakes are automatically applied when the approach angle and/or approach speed are not within limits, when in the automatic mode. Traction speed is limited to 2.4 km/h (1.5 m.p.h.) in the automatic mode until the



ELECTRICAL SYSTEM WIRE GUIDANCE SYSTEM

truck is aligned with the wire. When aligned, the acquisition speed limit is removed.



7749_EU

Enabling of the “Auto Sense Mode” via the service terminal causes the audible alarm to sound three short “beeps” whenever either sensor bar detects the guide wire signal and the guidance selector switch (GUS) is in the manual mode. At this time the operator may choose to place the truck in “automatic” to eliminate the alarm.

Each sensor bar contains four (4) coils which act as separate antennas. When the amplitude of guidance signals received are compared, the higher amplitude signals are from the coils in closer proximity to the embedded wire. The sensors mounted on the truck, electronically “sense” where the truck is in reference to the guidance signal.

When guidance selector switch (GUS) is in the “automatic” mode, the steering module provides the correct polarity and amplitude of voltage to the steering motor to keep the truck entered over the guidance signal. Feedback from the steering feedback encoder (ECR-2) verifies the steered wheel is turned in the direction and at the speed required.

Whenever the guidance signal strength drops to near the minimum required to guide the truck, the guidance module outputs a signal to illuminate the signal

strength light (Signal). The steering module sends the signal to the traction controller for 2.4 km/h (1.5 m.p.h.) maximum traction speed. If signal strength returns, the signal strength indicator is turned off and the traction speed limit is removed.

If there is loss of the guidance signal, or if signal strength is below the minimum required to guide the truck, the guidance module will output signals to operate the alarm and apply the brake. It will also turn the “automatic” indicator off and turn the “manual” indicator on. The guidance selector switch (GUS) must be placed in the “manual” position to release the brake.

Operation Modes

Manual

When the guidance selector switch (GUS) is in the “manual” position, truck steering is in the operator’s control.

Automatic

When the guidance selector switch (GUS) is placed in the “automatic” position, the electronics enter the search mode. At this time the guidance signal has not been detected by the sensors. The “auto” and “manual” indicators are both on and traction speed is limited to 2.4 km/h (1.5 m.p.h.). Steering control remains in the manual mode.

When either sensor bar detects the guidance signal, Auto Acquisition mode will be indicated by a display change. If traction speed at this time is greater than 4 km/h (2.5 m.p.h.) or the angle of the truck to the wire is greater than 35°, the brakes will be applied.

To release the brakes, guidance selector switch (GUS) must be placed in the manual position. If the angle and speed of the truck are within the limits when the signal is detected the manual indicator is turned off and steering is controlled by the electronics. Traction speed is still limited to 2.4 km/h (1.5 m.p.h.).

ELECTRICAL SYSTEM

WIRE GUIDANCE SYSTEM



When travelling in the *forward* direction, the guidance system will align the truck with the wire when **all** of the following parameters have been met:

- Truck less than 100 mm (4 in.) from wire
- Truck angle less than 6° from wire
- Steer wheel less than 12° from centre

When travelling in *reverse* direction the guidance system will align the truck with the wire when **all** of the parameters are met:

- truck less than 19 mm (3/4 in.) from wire
- truck angle less than 1°
- steer wheel less than 6° from centre

When the truck is adequately aligned, the auto tracking mode is indicated by a 1 second operation of the alarm. In this mode the truck is automatically guided by the electronics and the traction speed limit is removed.

Three (3) variations to normal operation are encountered during the Auto Tracking mode:

1. Auto Field Strength
2. Auto Track Deviation
3. Auto Wire Lost.

Auto Field Strength variation is encountered when the guidance signal received by the sensors decreases to near the minimum required to continue Auto Track-

ing Mode. When entering Auto Field Strength the alarm is sounded for 1 second, the field strength indicator is turned on and traction speed is limited to 2.4 km/h (1.5 m.p.h.). When the guidance signal received returns to above minimum levels the alarm is sounded for 1 second, the field strength indicator is turned off and the speed limit removed.

Auto Track Deviation is encountered if the centre of the truck leaves the guidance signal by 19 mm - 38 mm (0.75 - 1.50 inch), an angle of 1° - 1.8° or the steer wheel angle is 6° - 12° from centre. When this happens the alarm is sounded, manual steering indicator is turned on and traction speed is limited to 2.4 km/h (1.5 m.p.h.). When the truck returns to acceptable tracking characteristics, the alarm is sounded for 1 second, the manual steering indicator is turned off and the traction speed limit is removed.

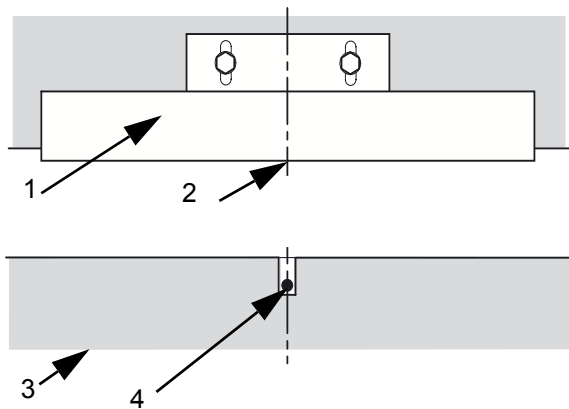
Auto Wire Lost will occur if **one or more** of four (4) situations are present:

1. Guidance signal lost
2. Centring of truck leaves signal path is more than 38 mm (1.5 inch)
3. Angle of truck to guidance signal is more than 1.8°
4. Steer wheels are turned more than 12° during Auto Track.

The truck is allowed to deviate more immediately following a travel direction change. When in Auto Wire Lost, the alarm is operated continuously and the brake is applied. Guidance selector switch (GUS) must be placed in the "manual" position to release the brakes after this situation occurs.

Sensors

The sensor bars are fastened to adjustable brackets which permit adjusting the distance between the sensor bars and the floor. When the line driver current output is set as specified in section "Line Driver Output" on page 289, the sensor bar should be level and 82 mm (3.25 inch) from the floor (see Fig. 7750_EU).



7750_EU

- 1 Sensor Bars
- 2 Truck Centre Line
- 3 Floor
- 4 Wire

Voltage required by the sensor bar to operate is 5 volts, between terminals 5 (positive) and 3 (negative).

Calibration

Wire guidance calibration sets up components of the wire guidance system to guide the truck automatically while centred over the signal wire embedded in the floor. It is important to calibrate the truck at the installation with the *highest* field reading. If the truck has been calibrated on wire at the lowest strength, on wire with a higher strength, the system can become saturated and allow the truck to weave.

Components which affect wire guidance calibration include the front and rear sensor bars, the guidance module, the steering module and the steering angle feedback encoder (ECR-2).

Information



Whenever any of these components are changed or adjusted, the wire guidance system must be recalibrated.

Wire guidance calibration consists of four (4) parts:

1. Peak sensor coil search
2. Centre steer wheel position
3. Vehicle angle
4. X-offset position.

Peak sensor coil search determines the maximum coil value of each coil when passed over an active guide wire. The maximum values are compared and each channel is given a value to be multiplied by so all coils will appear equal (at least 95). This is electronic correction for weak coils.

Steer wheel position calibration determines the steer wheel centre position which will provide straight line travel.

Vehicle angle calibration determines angular deviation of the truck assembly which would cause "dog-tracking".

X-offset position calibration corrects parallel offset of the longitudinal axis of the truck to the guidance wire.

To perform the wire guidance calibration procedures, the Service Terminal must be used. Refer to the Service Terminal Instruction Book for a detailed step by step procedure.

ELECTRICAL SYSTEM

WIRE GUIDANCE SYSTEM



Troubleshooting

Components concerned only with wire guidance are functionally checked by the software diagnostics and are covered by service numbers 411 to 442. Refer to the Service Terminal Handbook for all troubleshooting and diagnostic information.

Two (2) conditions can exist which would cause unsatisfactory wire guidance performance by not tracking properly:

- Incorrect feedback information from the steering feedback assembly
- Saturated sensor bar coils.

The incorrect feedback information in the first condition can occur if the wheels move slightly without turning the encoder input shaft or from a misaligned feedback encoder. Refer to section "Encoders" for information and alignment procedures.

To check if the coils in the sensor bars are saturated as stated in the second condition, with truck centred over the guide wire, use the Service Terminal to check the RAW values of each coil as described in the SHOW-8 mode of operation in the Service Terminal Instruction Book. The outboard sensor raw and scaled values will be substantially lower than the inboard sensor values, due to signal appearance.

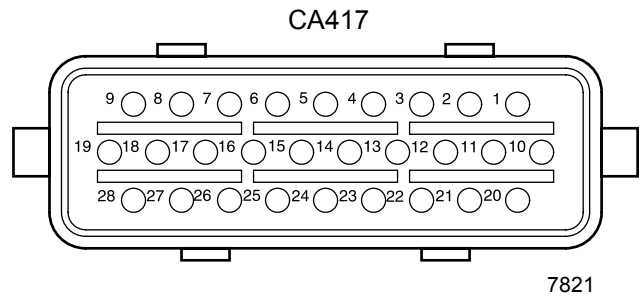
When each individual coil is directly over the guide wire (see Service Terminal Operator Book for determining when a coil is directly over the guide wire) and the RAW values are above 90% and the wire amplitude can not be adjusted down, the sensor bar should be raised to bring the RAW values into the 70% to 80% range. Typically this will not be required since the sensor height described earlier in this section is correct for the line amplitude, measured with field strength meter (Part No. 112953), as referenced in "Line Driver Output" on page 289. Always maintain a level relationship between the sensor bar and the floor.



ELECTRICAL SYSTEM

GUIDANCE MODULE (GCM)

Guidance Module (GCM)



Pin assignment

Connector CA417				(Sheet 1 of 2)
Pin No.	Wire Colour	Function	Voltage Level	Connection
1	BLK	Serial +	0 - 5 V	CA207-3
2	WHT	Serial -	0 - 5 V	CA207-4
3	BLU	Load wheel sensor bar +5 V	5 V	CA418-5
4	YEL	Load wheel sensor bar Batt. -	Batt. Negative	CA418-3
5	ORG	Load wheel sensor bar self test	$V_{\max} = 5 V_{pp}$	CA418-6
6	---	Not used	---	---
7	BRN	Steer wheel sensor bar coil 4	$V_{\max} = 2 V_{pp}$	CA419-8
8	BLK	Steer wheel sensor bar coil 6	$V_{\max} = 2 V_{pp}$	CA419-2
9	GRN	Steer wheel sensor bar coil 5	$V_{\max} = 2 V_{pp}$	CA419-1
10	---	Not used	---	---
11	---	Not used	---	---
12	---	Not used	---	---
13	BLK	Traction tachometer CHA	0 - 5 V	CA416-3
14	WHT	Traction tachometer CHB	0 - 5 V	CA416-2
15	BLU	Steer wheel sensor bar +5 V	5 V	CA419-5

ELECTRICAL SYSTEM

GUIDANCE MODULE (GCM)

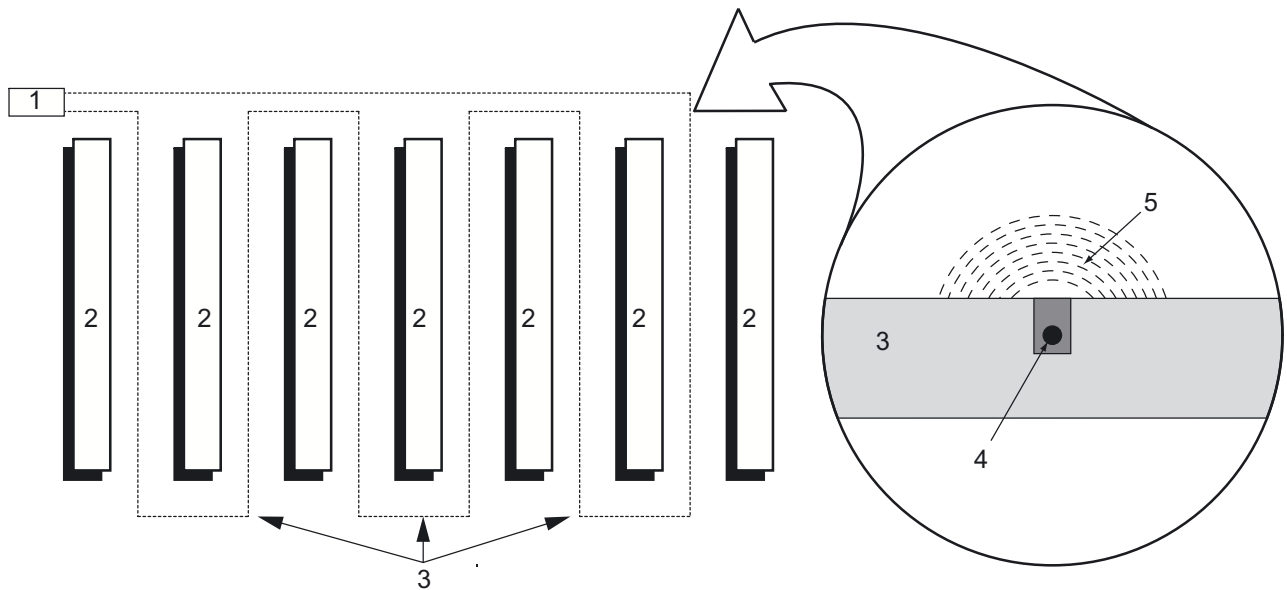


Connector CA417				(Sheet 2 of 2)
16	YEL	Steer wheel sensor bar Batt. -	Batt. Negative	CA419-3
17	RED	Steer wheel sensor bar coil 3	$V_{\max} = 2 V_{pp}$	CA419-7
18	BRN	Steer wheel sensor bar coil 8	$V_{\max} = 2 V_{pp}$	CA418-8
19	RED	Steer wheel sensor bar coil 7	$V_{\max} = 2 V_{pp}$	CA418-7
20	RED/WHT	Batt. + input to guidance module	24 V	FU7
21	GRN	Batt. - input to guidance module	Batt. Negative	Neg. Bus
22	RED	Traction tachometer +5 V	5 V	CA416-1
23	BLK	Traction tachometer Batt. -	Batt. Negative	CA416-4
24	---	Not used	---	---
25	---	Not used	---	---
26	ORG	Steer wheel sensor bar self test	$V_{\max} = 5 V_{pp}$	CA419-6
27	GRN	Steer wheel sensor bar coil 1	$V_{\max} = 2 V_{pp}$	CA419-1
28	BLK	Steer wheel sensor bar coil 2	$V_{\max} = 2 V_{pp}$	CA419-2



ELECTRICAL SYSTEM GUIDANCE MODULE (GCM)

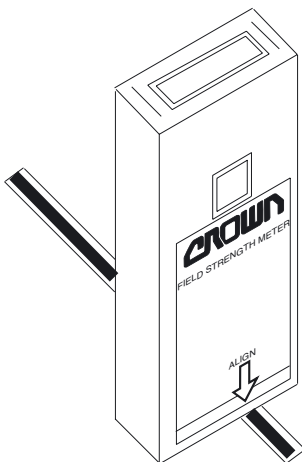
Line Driver Output..



7747_EU

- 1 Line driver
- 2 Storage Racks
- 3 Floor
- 4 Wire, embedded in the floor and sealed
- 5 Transmitted signal

The Crown line driver is equipped with a current meter which accurately displays the line current within the conductor. This reading, however, due to floor conditions (wire depth, metal reinforcement material, electrical conduit, etc.) may not indicate the actual field strength. Therefore, to meet the field strength required to properly guide the vehicle, the line driver output will have to be adjusted. Refer to the Installation of Wire Guidance Line Driver Instructions, PF6669. Crown has designed a field strength meter for use in setting up and/or checking guide wire signal strength (5.0 kHz to 10.0 kHz) in wire guidance installations. The field strength meter, Crown part number 112953, will indicate actual peak to peak voltage of the radiated signal from the guide wire in the floor.



1550

Verify that the line driver output signal is of the correct amplitude prior to performing an alignment on the truck.

ELECTRICAL SYSTEM GUIDANCE MODULE (GCM)



This reading represents what the truck is seeing when the sensors are set at the recommended height from the floor. Refer to the Field Strength Cross Reference chart for optimum field strength values.

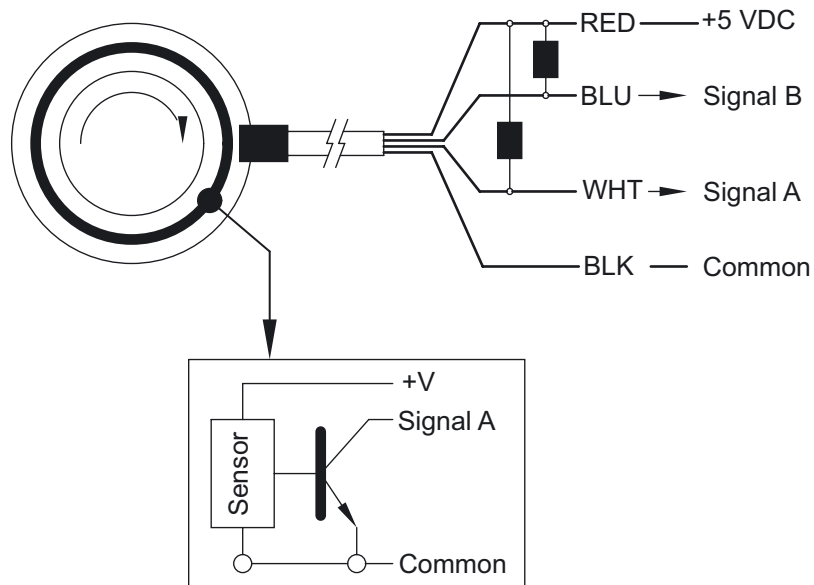
Field Strength Cross Reference Chart

Frequency in kHz	Field Strength Values
6.25 kHz	168 - 190
5.2 kHz	100 -118

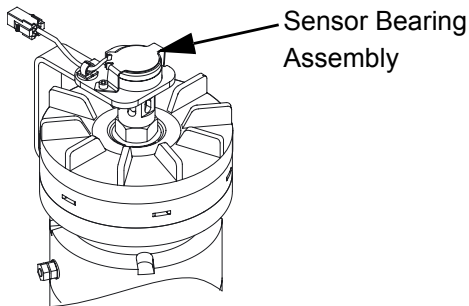
Crown recommends calibration of this meter annually. Any repairs needed for calibration will incur a reasonable charge. Please allow a minimum of 3 weeks for normal calibration.

Meters needing repair may require additional time. For information regarding the field strength meter, refer to Technical Service Bulletin No. 317.

Sensor Bearing



10637_EU



10636

Sensor is used to verify travel speed and direction on Crown Wire Guidance equipped SP Trucks.

The sensor bearing utilizes a magnetic “scale ring” and hall effect sensors to detect the periodic flux and to convert it into electrical signals. Through these signals the sensor can detect speed and direction of the truck.

The sensor is located on top of the brake assembly mounted on the drive motor armature shaft. A bracket is mounted to the brake assembly to keep the sensor bearing assembly stationary during rotation of the bearing. There is no adjustment required of the sensor bearing. If the sensor bearing does not work properly, check the connections and the current for proper voltage.

ELECTRICAL SYSTEM

CHECKING TRUCK STEERING SYSTEM



Checking Truck Steering System

The truck steering system should be thoroughly checked *before* the alignment procedure is attempted. The system operates through the existing truck steering mechanism. Slack, lag or excessive wear within this system will prevent guidance within specifications.

Verify the following (see Fig. 12400, page 293):

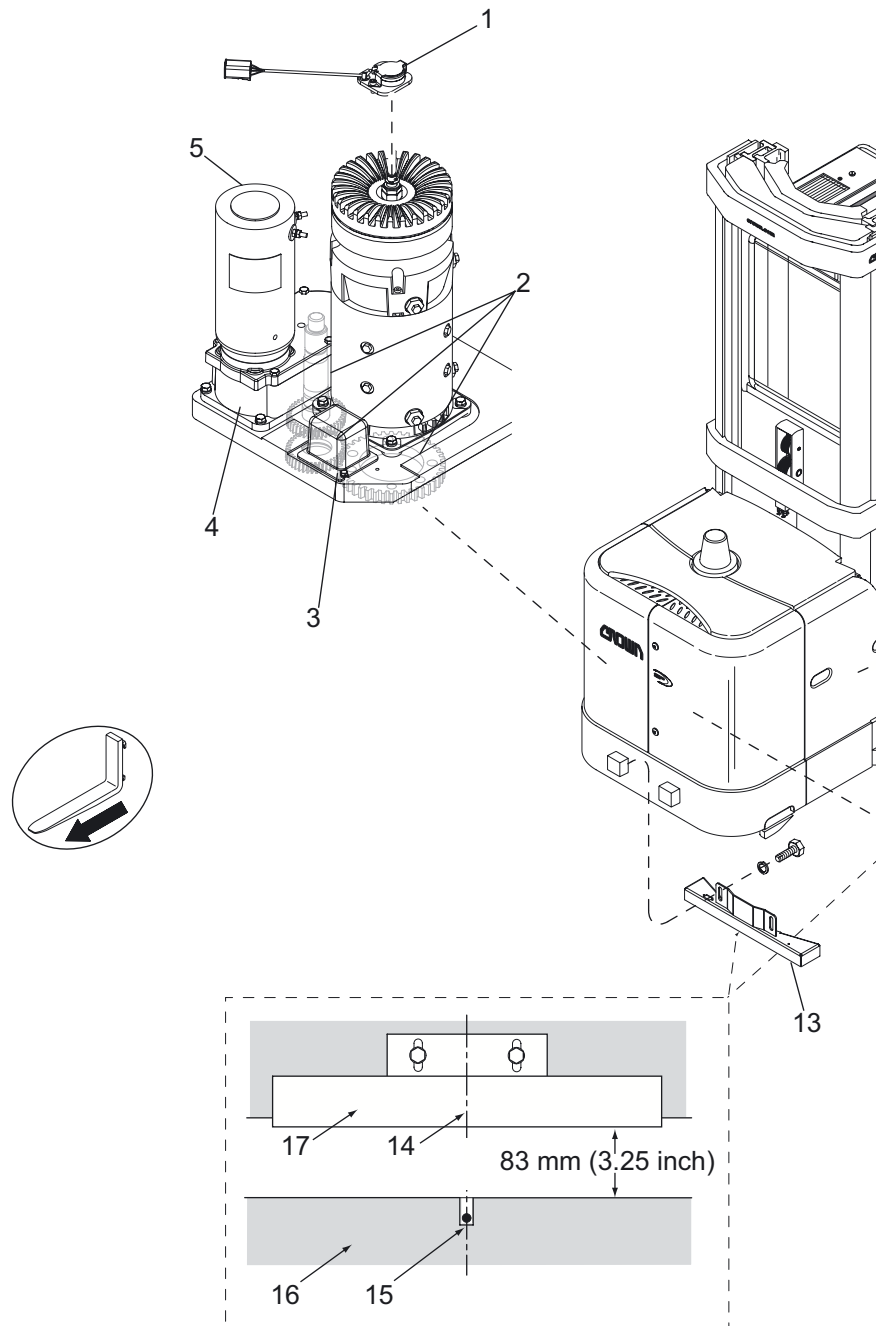
- Steering feedback encoder is set to index (I) when drive unit alignment marks are aligned.
- Steering gears-condition and lubrication.
- Steering servo motor and brushes.
- Steering gearbox-condition and lubrication.
- Drive unit stud and mounting bolts.
- Drive unit thrust bearing and lubrication.
- Drive tire condition and type (poly only).
- Look for drive tire debris such as shrink wrap.
- Load wheel condition, including bearings.
- Look for load wheel debris such as shrink wrap.
- Steer wheel sensor condition, orientation and height adjustment.
- Load wheel sensor condition, orientation and height adjustment.
- Sensor bearing condition.



ELECTRICAL SYSTEM

CHECKING TRUCK STEERING SYSTEM

Truck Steering System Components



ELECTRICAL SYSTEM

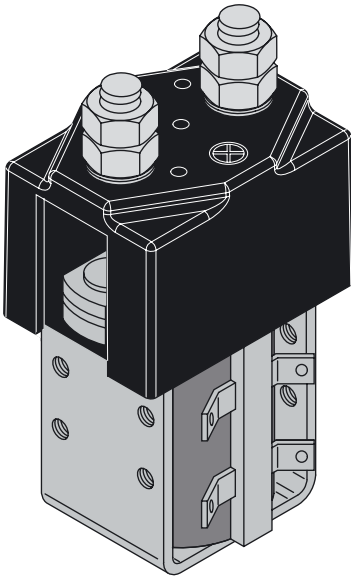
CHECKING TRUCK STEERING SYSTEM



Legend for Figure 12400_EU

1	Sensor bearing assembly	2	Steering gears
3	Steering feedback encoder	4	Steering gearbox
5	Steering servo motor	6	Base of main frame (located under platform, rotated for clarity)
7	Load wheel sensor	8	Load wheels
9	Drive unit stud	10	Drive unit thrust bearing
11	Drive Tire	12	Drive unit mounting bolts
13	Steered wheel sensor	14	Truck centre line
15	Wire	16	Wire
17	Sensor bars		

Contactors



10554

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, discoloured, 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 Ohm.
- If reading does not fall within the limits, replace.

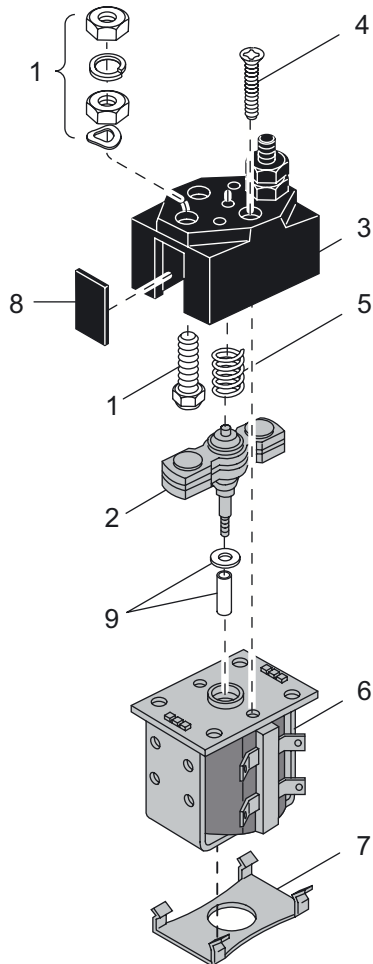
ELECTRICAL SYSTEM

CONTACTORS



Component Replacement

Refer to the parts manual when replacing components.



Contact Replacement

1. Remove electrical connections to contacts (coils do not have to be disconnected for this procedure).
2. Remove two (2) screws (Index 4) from top of contacts and lift contact assembly from truck.
3. Disassemble and replace contacts.
4. Place contact assembly on coils and fasten securely with two (2) screws (Index 4).
5. Connect cables.

Coil Replacement

1. Disconnect all electrical wiring.
2. Remove four (4) mounting bolts from mounting bracket and lift entire contactor from truck.
3. Remove two (2) screws (Index 4) and separate contact assembly from coil assembly.
4. Select replacement coil and transfer plunger (Index 2) from coil being replaced to replacement coil.
5. Reassemble contact assembly to coil assembly and secure with two (2) screws (Index 4).
6. Mount contactor on truck and reconnect all electrical wiring.

1158-1



ELECTRICAL SYSTEM

STEERING FEEDBACK

Steering Feedback

Gear Assembly

Whenever assembling the steering feedback gears, it is important that all gear backlash be removed. If this is not done, steering accuracy and response is reduced.

Refer to Illustration 12488.

Place the nyliner bearing onto the gear shaft. Next place one end of the torsion spring into the small hole on the gear as shown. Slide the 18 T gear onto the gear shaft aligning the other end of the torsion spring with the small hole on that gear. Slide the second nyliner bearing onto the gear shaft. Install the third nyliner bearing on top as shown.

Turn the top gear until the larger hole on both gears are aligned, approximately 2 teeth. Slide a 1/8" drill bit into the holes from the bottom to keep the gears aligned.

Slide gear shaft up through the power unit. Once the gears are meshed with the steering gearbox and drive unit gears, install the flatwasher(s) (AR) and the retaining ring to keep the gear assembly from sliding out.

Slide the flatwasher onto the encoder shaft and insert into the gear shaft assembly. Make sure the extension spring is installed. If necessary rotate the gear shaft so the set screw faces straight back to allow for easy access for tightening. Tighten set screw to secure encoder shaft to gear shaft.

Make certain the set screw is tightened on the flat part of the encoder shaft. Remove drill bit from gear assembly.

The steer wheel feedback encoder must be set to "index" when the steered wheel is in the straight ahead

position. To set and check the steering feedback encoder:

1. Connect the service terminal to the connector on the platform below the control module, enter the "SHOW" menu of terminal operation and select the "VIEW ENCODER COUNTS" menu. If truck has not been given a steering command since power up, steering time-out will be 1 second. If a steering command has been given since power up, steering time-out is 2 minutes. To obtain the 1 second time-out for improved steering alignment efforts, turn tiller slightly. Time-out will change to 1 second.
2. After time-out, form a straight line with the alignment mark on the steered wheel drive unit and the alignment mark on the drive unit mounting bracket. The steered wheel is now in the straight ahead position.
3. Observe the Wheel counts on the service terminal display. Since the steered wheel is in the straight ahead position the display should show an I plus a number. If only a number is present, open the power unit doors and locate the steering feedback module. Remove the steering feedback cover. Loosen the two (2) screws holding the encoder in place. Turn the encoder very slowly until the I plus a number appears on the service terminal display. While maintaining encoder position to keep this display on the service terminal, secure adjustment with the two screws. Make certain the cleats holding the encoder have their flat surfaces turned away from the encoder.
4. Exit "SHOW" menu and disconnect the service terminal.
5. Install cover, close power unit doors and return to operation.

ELECTRICAL SYSTEM

STEERING FEEDBACK

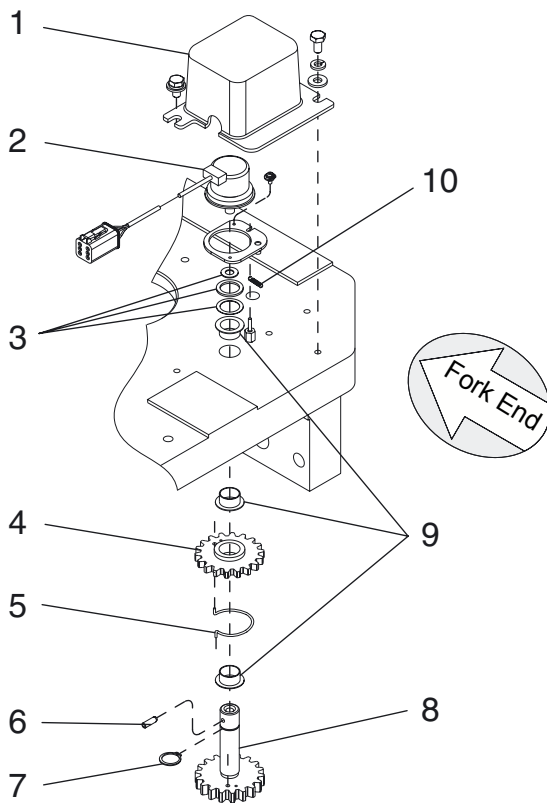


Caution!



The steering indicators will not represent the proper steer angle. The steering feedback encoder must be set to ensure the steered wheel is set to straight ahead position.

- 1 Cover
- 2 ECR2
- 3 Flatwashers
- 4 18 T Gear
- 5 Torsion Spring
- 6 Set Screw
- 7 Retaining Ring
- 8 18 T Gear & Shaft
- 9 Nyliner Bearing
- 10 Extension Spring



12488



ELECTRICAL SYSTEM

CONTROL MODULE

Control Module

General

The Control Module, located in the operator compartment, contains all operator controls within easy reach.

A planned maintenance program should include checking these operator controls for binding, sticking or other unusual operation. An audio check should also be made. Press buttons or turn twist grip in both directions slowly, while listening for switch actuation-resetting (signified by a “click”). There should be a “double click” for two speed lift/lower.

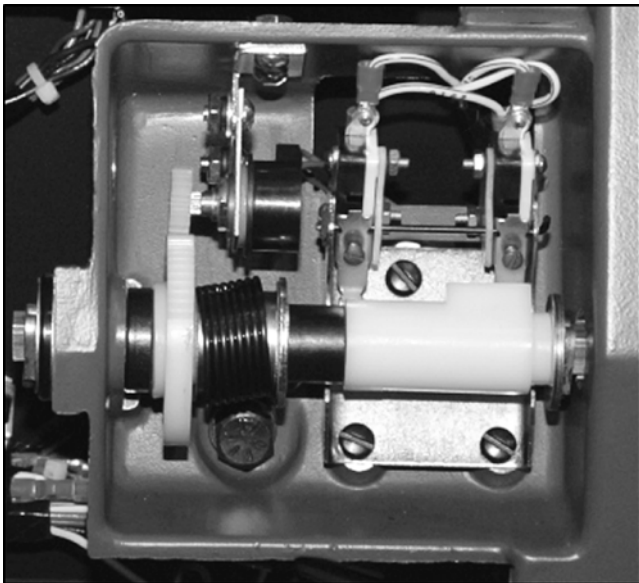
Access

Caution!



Disconnect battery before performing disassembly procedures.

To gain access to components in the directional and speed control compartment, remove six (6) mounting screws from console and lift console from platform wall.



12546

Warning!



When making “live” voltage checks, chock load wheels of truck, raise drive wheel clear of floor and place hardwood blocks under truck frame.

Connect a voltmeter from battery negative (TB102-5) to the terminal board point that corresponds to the normally open side of the switch in question. Battery voltage should appear after the appropriate switch is closed. If battery voltage is not seen, there is an open circuit, incorrect switch connection or a bad switch

To access remaining switches, remove three (3) mounting bolts from control module housing. Lift control module from wall and rotate down. While in this position, do not apply unnecessary pressure to the module which may damage the wiring harness. Due to weight, some form of support may be needed.

Reverse disassembly procedure for assembly.

ELECTRICAL SYSTEM

CONTROL MODULE



Troubleshooting

The following instructions are included to help isolate a problem to the control module prior to disassembly. Make an audio check of switch actuation and reset as described previously.

Voltage readings can be made at TB101 and TB102 to verify switch operation. Remove six (6) mounting screws from console and lift console from platform wall. TB101 is the terminal board to the left; TB102 is the terminal board on the right.

When making voltage checks, the battery must be connected, keyswitch cycled "TEST" to "ON", gates closed and brake pedal depressed. Connect the negative meter lead to TB102-5 for all voltage checks. Refer to Chart 1 for test point of each switch.

Chart 1

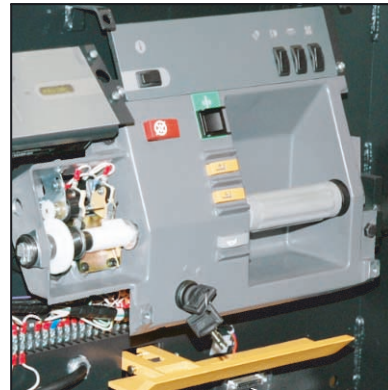
Switch	Test Point
RAS1	TB101-18
RAS2	TB101-17
KYS (Ignition)	TB101-1
KYS (test)	TB101-10
HNS	TB101-27

With switch actuated, voltage readings will be battery voltage. If a voltage less than battery voltage is measured, it could mean a bad connection, faulty switch, pinched wire or anything that could introduce resistance in the line. For example, if battery voltage is read on one side of a switch, but a voltage less than battery voltage is obtained from other side of switch, the switch contacts are making poor contact and should be replaced.

Adjustment

Components which are adjustable are contained within the directional and speed control compartment.

Acceleration Potentiometer (POT1)s



12547

Check or set up the throttle potentiometer as follows:

- Attach service terminal to the truck (1) with truck powered up, refer to Illustration 12547.
 - Press "SHOW"
 - Press "BACK" two times to "Traction Analyser"
 - Press "YES"
 - Press "FWD" two times to "Traction Inputs"
 - Press "YES"
 - Press "FWD" two times to "View Throttle"
 - Press "YES"
 - Read "Throttle = ____V"
- Throttle reading should be $2.50\text{ V} \pm 0.1\text{ V}$.



ELECTRICAL SYSTEM CONTROL MODULE

- When installing a new potentiometer before meshing the gears adjust the reading to approximately 2.50 V.
other. (i.e., 0.15 and 0.21 is OK, 0.15 and 0.27 is not.)
- Mesh gear teeth, tighten screws on mounting bracket and proceed as follows:
 - Loosen potentiometer nut.
 - Rotate potentiometer back or forward to obtain $2.50\text{ V} \pm 0.1\text{ V}$.
 - Secure adjustment with nut observing that above range is maintained.
 - Rotate twist grip from stop to stop.
 - Voltage should vary smoothly from approximately 0.4 V to 4.6 V with centre position of 2.5 V.

Directional Switches (FS & RS)

- With twist grip in neutral position, turn adjustment screws on both directional switches, slowly clockwise until switch activates.
- Turn both screws 1/2 turn counter-clockwise.
- Observe voltage reading $2.5\text{V} \pm 0.1\text{V}$ in centre position and record.
- Slowly turn twist grip until one of the directional switches activates (signified by a “click”).
- Record voltage reading on the service terminal.
- Slowly turn twist grip the opposite way until other directional switch activates (signified by a “click”).
- Record voltage reading on the service terminal.
- Difference of each reading from the nominal centre position reading should be within $\pm 0.1\text{V}$ of each

ELECTRICAL SYSTEM

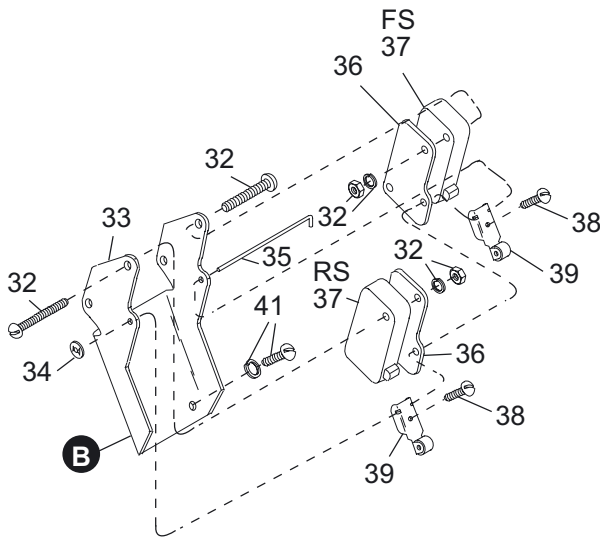
CONTROL MODULE



Component Replacement

FS and RS

(Refer to Illustration 3234)



3234

- Remove three screws and lock washers (41).
- Move switch and bracket assembly over top of cams and out.
- Remove mounting bolts (32) of switch to be replaced.
- Transfer wires to replacement switch and tighten screws.
- Assemble switch, insulator and spacer.
- Secure in place with screws, lock washers and nuts.
- Move switch and bracket assembly under cam, on top of posts and secure in place.
- Adjust both switches as described in Adjustments.

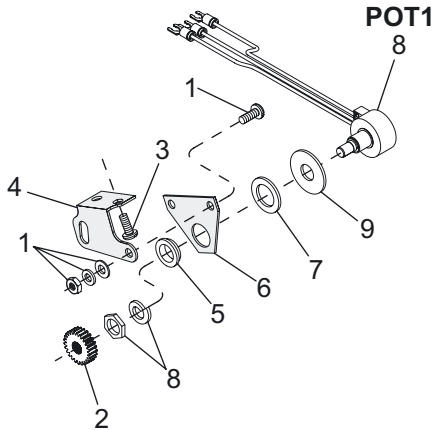
Actuator Arm

(Refer to Illustration 3234)

- Remove three (3) screws and lock washers (41).
- Move switch and bracket assembly over top of cams and out.
- Remove nut (34) from rod (35) and slide rod out until actuator (39) to be replaced can be removed.
- Remove adjusting screw (38) and install in replacement actuator.
- Slide rod into switch bracket, aligning actuator over switches so rod goes through pivot point.
- Install nut.
- Move switch and bracket assembly under cam, on top of mounting posts and secure in place.
- Adjust both switches as described in Adjustments.

Potentiometer (POT1)

(Refer to Illustration 12548)



12548

- Turn potentiometer so wires are pointing out back of panel.
- Slide pinion gear (2) on potentiometer shaft so gear teeth will mesh completely.
- Adjust potentiometer as described in Adjustments.
- Make certain mounting bracket screws are tightened.
- Loosen screws (1) on adjustable mounting bracket (6).
- Access to lower pivot point is through hole on left side of directional and speed control compartment.
- Push potentiometer back so gear teeth unmesh.
- Slide pinion gear (2) off potentiometer shaft.
- Disconnect potentiometer wires at TB101, noting location for proper installation.
- Remove insulator (5).
- Pull potentiometer (8) from mounting bracket and remove insulator (7) and washer (9).
- Place insulator and washer, with washer against potentiometer, on replacement potentiometer.
- Slide potentiometer through hole in mounting bracket and assemble insulator (5) so small diameter slides through hole in bracket.

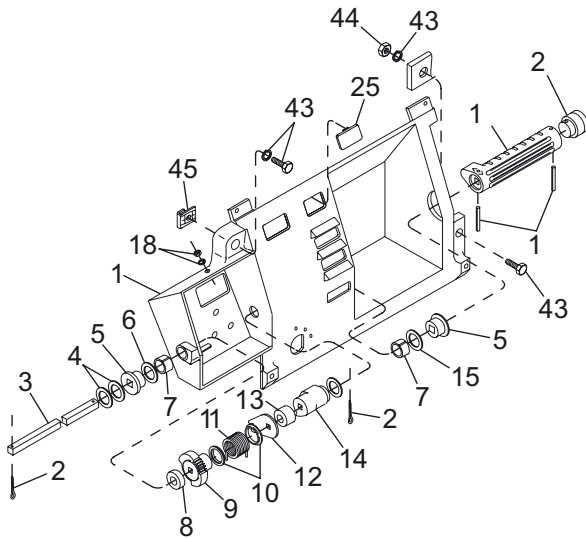
ELECTRICAL SYSTEM

CONTROL MODULE



Cam Torsion Spring, Stop

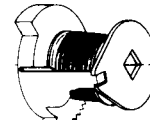
(Refer to Illustration 3238-01)



3238-01

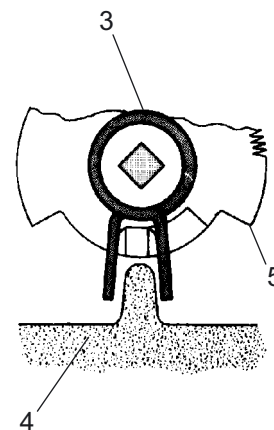
- Remove two cotter pins (2).
- Remove washers (4) on outside of housing (1).
- Make note of physical arrangement of components with respect to each other and arrows on twist grip.
- Slowly slide twist grip with square shaft to the right.
- Replace component in question.
- When assembling apply some grease (Crown No. 063002-025) to inside of torsion spring.
- Install one washer (4) onto square shaft.
- Slide cam (14) onto shaft so cam lobes are toward switches when arrows on twist grip are towards top.
- Install spacer (13).

- Assemble Stop and Return Assembly (9, 10, 11, 12) before installing on square shaft, as shown in Illustration 1346-01.



1346-01

- Install Stop and Return Assembly (5) on shaft, making certain torsion spring (3) is over tab in Control Module Housing (4) as shown in Illustration 1347-01.



1347-01

- Install spacer (8, Illustration 3238-01) and slide shaft through housing making certain split bushing, washer and bushing (5, 6, 7) remain in housing.
- Install cotter pin (2) in shaft inside directional and speed control compartment.
- Install washers (4) as required to remove any lateral movement of twist grip when final cotter pin is installed.
- Perform switch and potentiometer adjustments as necessary, beginning with potentiometer adjustment.

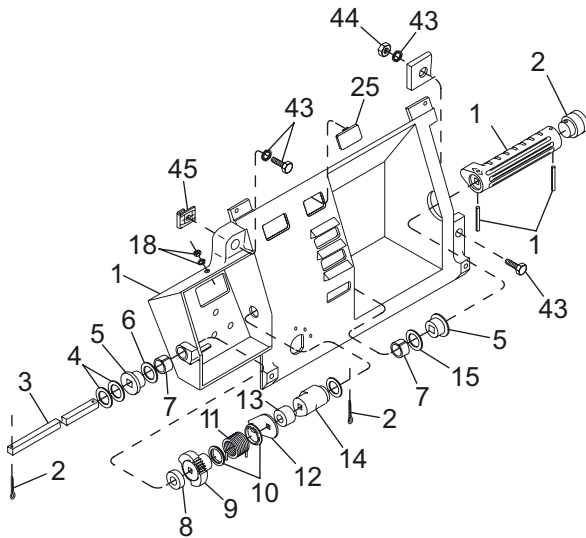


ELECTRICAL SYSTEM CONTROL MODULE

Twist Grip

- Assemble roll pins in each end of grip.

(Refer to Illustration 3238-01)



3238-01

- Remove roll pin from each end of twist grip (17).
- Slide twist grip to the right, out of control module housing to access extension (24) on end of twist grip.
- Remove extension from twist grip and remove grip from module.
- Depending on operator preference, position replacement grip with lobe toward module or away from module with arrows up.
- Trucks are manufactured with lobe toward module.
- Install grip in module.
- Align key on extension with slot in grip and assemble extension to grip.
- Slide grip onto square shaft, lining up hole in shaft with hole in grip.

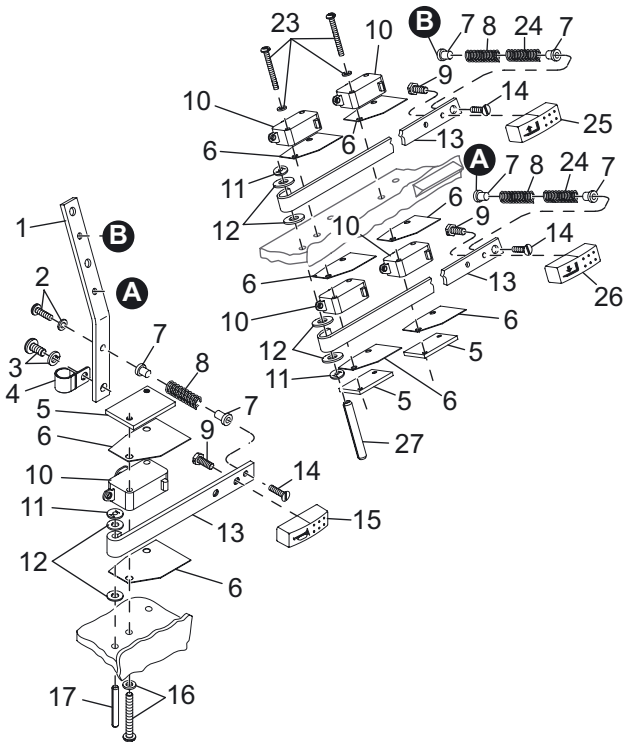
ELECTRICAL SYSTEM

CONTROL MODULE



RAS1, RAS2, LOS1, LOS2, HNS, EDS

Switch replacement is accomplished by using the parts breakdown in Illustration 3236-01 for component location.



3236-01

When replacing HNS, the keyswitch will need to be removed to allow access to the mounting screws.

Switch terminals are to be tightened within 3.8 - 4.6 Nm (55 - 65 inch ounces).

Button Return Springs

To replace Raise, Lower and Horn button return springs proceed as follows (Refer to Illustration 3236-01):

- Secure the control module with a wire, between the top mounting bolt hole of the control module and the platform wall.

- Remove three mounting screws (23) from spring plate (22).
- Lift spring plate from assembly.
- The raise and lower buttons require two compression springs (16, 17) and the horn button requires one spring (17).
- Replace spring(s) in question and assemble on respective actuator lever spring guide (15).
- Position spring plate so spring guides locate springs.
- Start mounting screws. Mounting screw closest to keyswitch also holds wiring harness clamp.
- When screws are started and harness clamp is in place, tighten screws.
- Remove wire securing control module.

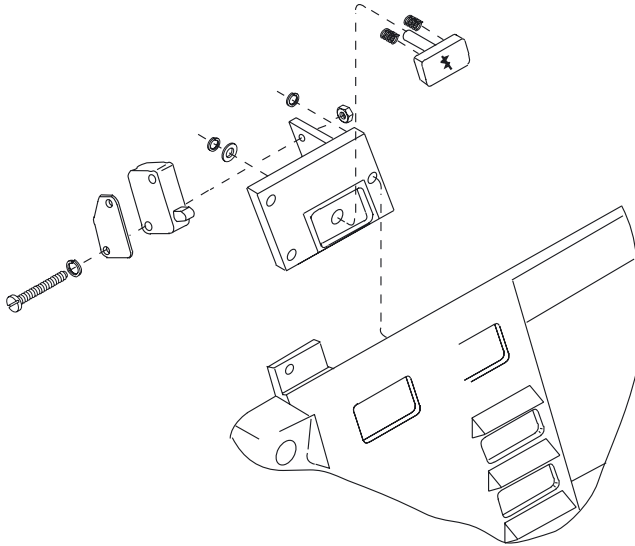
Buttons

(Refer to Illustration 3236-01)

- To replace buttons, remove two (2) screws (14) from button and remove.
- Position replacement button correctly and secure in place with screws.

Power Disconnect Button Springs

(Refer to Illustration 3237)



3237

- Remove screw, lock washer and flatwasher from button post while holding button depressed.
- Pull button and springs from module.
- Replace springs, insert button through housing and secure in place with screw, lock washer and flatwasher.

After assembly, test all controls for proper operation.

Notes:



ELECTRICAL SYSTEM BATTERY

Battery

The care and maintenance of the 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, create an arc or sparks in the vicinity of the 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 (one pound to one gallon of water) applied to spilled acid until bubbling stops, neutralizes the acid for safe handling and disposal.

Leakage voltage from battery terminals to battery case can cause misleading trouble symptoms with the truck electrical system. Since components of the truck electrical system are insulated from truck frame, leakage voltage 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, the sum of the voltages at both terminals will equal battery volts. This leakage voltage will discharge the battery. As battery cleanliness deteriorates, the usable charge of the battery decreases due to this self discharge.

Although a leakage voltage 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 the unit.

Safety Rules

- Wear protective clothing, such as, 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 (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.

ELECTRICAL SYSTEM

BATTERY



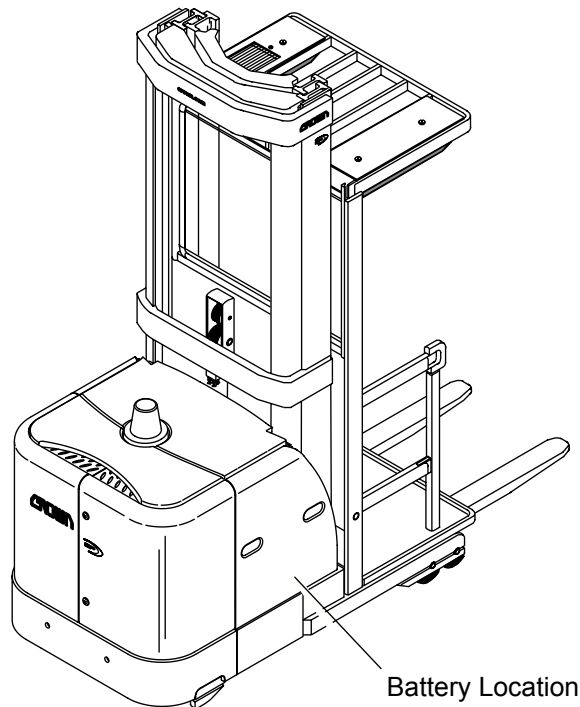
Checking

Battery electrolyte level should be checked before each charge of the battery. The level should be maintained at 13mm (0.5 in.) above plates or just below the lower lip of the filler hole at all times. If low, add distilled water or approved local supply (consult battery manufacturer) at the 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 the battery proper care.

The battery on your SP 3200 Series Stockpicker is located in front of the operator's platform.



10588

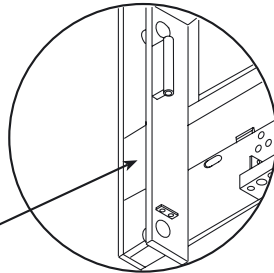
1. Charge the battery only in areas designated for that use.
2. Make certain the charger being used matches the voltage and amperage of the truck battery. This voltage is listed on the truck data plate and is located on the lower portion of the platform.



ELECTRICAL SYSTEM BATTERY

Typical Data Plate

BATTERY WEIGHT LBS. MAX. MIN.		D.C. VOLTAGE
MODEL		BATT. TYPE
SERIAL NUMBER		HOURLY RATE
MAX. AMP. HR. CAPACITY		MAX. TILT BACK
MAX. GRADE WITH 12 IN. MAX. FORK HEIGHT		%
LOAD TIRE TREAD WIDTH		
180° TRAVERSE SIDESHIFT		
MAST IDENTIFICATION		FORK LENGTH
SEE PLATE IN OPERATORS AREA FOR CAPACITIES. THIS TRUCK AS RELEASED FROM THE FACTORY CONFORMS TO THE MANDATORY REQUIREMENTS OF THE ANSI B56.1 STANDARD. CROWN EQUIPMENT CORP. NEW BREMEN, OH 45869		



Lower Right Corner of
Mast Side of Platform

3. 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.
4. Before charging, make sure the battery cells contain the correct amount of water. Charging batteries with a low water level might result in damage to the cells. When checking water levels, never use a match or lighter. Battery fumes are explosive.
5. Before connecting the battery cable to the truck's receptacle, make sure the key switch is off and all controls are in the off position and the brakes are applied. The battery cable must be fully connected before the truck is used. If the plug is not making good contact, heat will weld the two parts of the 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 the battery.
7. Battery cover should be closed except when charging.
8. The charging requirements will vary depending on the use of the truck. The battery should be given an equalizing charge on a weekly basis. This charge should normally be an additional three hours at the 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 under-sized battery or incorrect voltage battery. Refer to Chart 1 for battery weights and type.

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 the unit during the service period.

Caution!



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

ELECTRICAL SYSTEM

BATTERY



Consult the charger manufacturer's manual covering your charger for hints on operation and maintenance. Some of the basic rules are as follows:

Placing battery on charge:

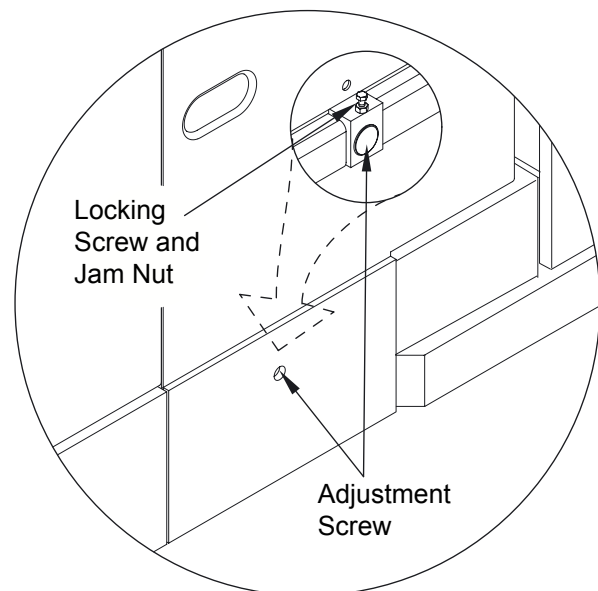
- Park truck at charging station with forks lowered and key removed.
- Make certain charger control is in the off position.
- Connect battery to charger and make certain connectors are mated completely.
- Set timer for specified time. Set for Normal (Daily Charge, except one night a week when the Equalize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

Removing battery from charge:

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

Battery Stop Adjustment

To minimize the side to side (lateral) movement of the battery in the truck, the battery covers are equipped with adjustable stops. First, the battery must be centered in the power unit, then the adjustment screw on each battery retainer should be adjusted until it just contacts the battery surface. Snug the locking screw down on the adjustment screw and tighten jam nut. Do not over tighten the locking screw. Once the battery stops are adjusted, the battery covers should be removable without loosening the battery stop adjustments. Any time a battery of different size is installed, this adjustment is necessary. Refer to Illustration 10589.



10589

BATTERY WEIGHT		BATTERY TYPE	BATTERY RATING		
MINIMUM	MAXIMUM		VOLTAGE	HOURLY RATE	CAPACITY
690 kg (1520 lbs.)	860 kg (1900 lbs.)	"E"	24	6	1085

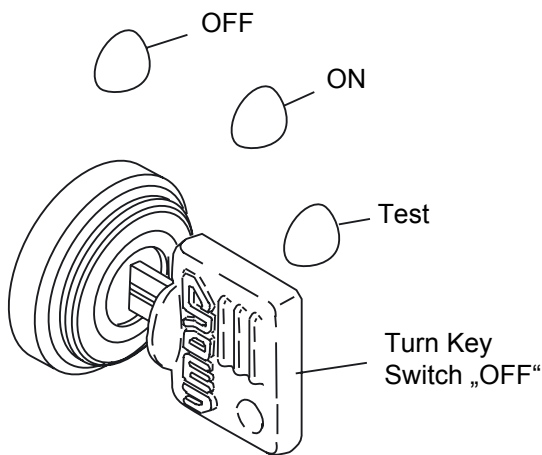
Battery Removal

Caution!



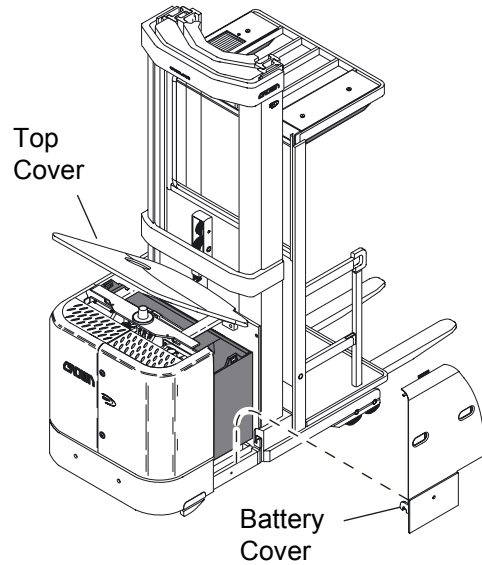
Don't allow any metallic object to come in contact with the top of the battery cells. This may cause a short circuit when removing, installing or transporting the battery. Use an insulator (such as plywood) to cover the top of the battery before and during removal and installation.

1. Turn key switch off.



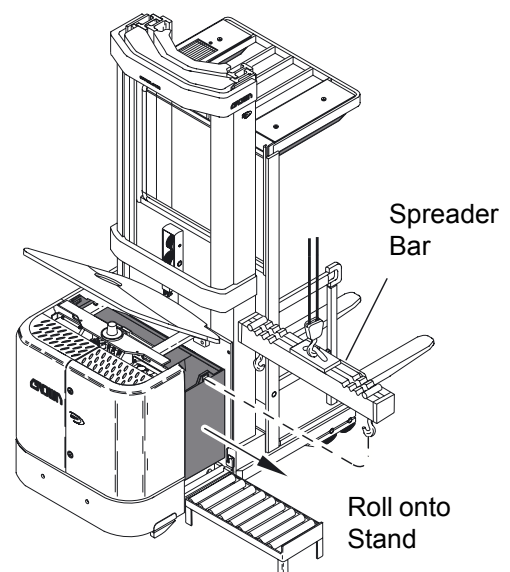
3171

2. Open top cover and disconnect battery.



10590

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



10591

ELECTRICAL SYSTEM

BATTERY



Battery Installation

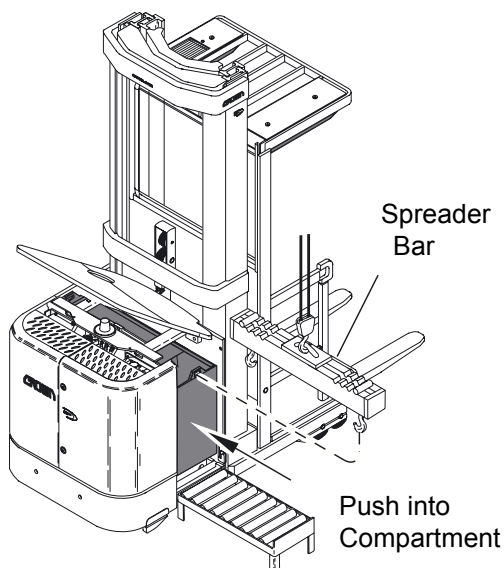
Caution!



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, installing or transporting the battery. Use an insulator (such as plywood) to cover the top of the battery before and during removal and installation.

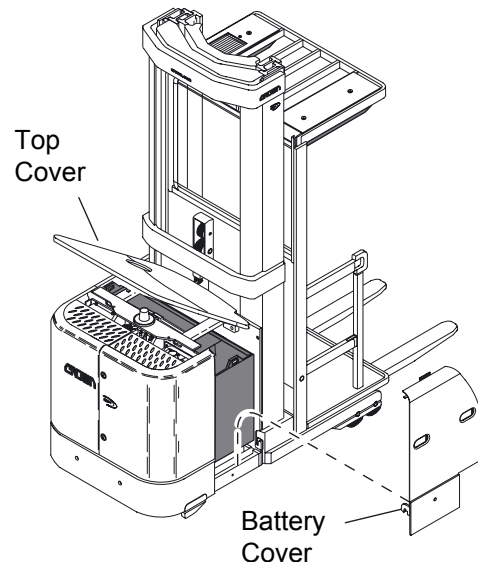
Make certain same battery or battery of equal weight is loaded into truck for truck stability. See data plate for minimum battery weight and type.

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



10592

3. Remove roller stand and install battery cover. Make sure battery retainers are properly adjusted for the battery installed.



10590

Warning!



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

4. Connect battery and close top cover.
5. Turn key switch on and check truck operation.



ELECTRICAL SYSTEM BATTERY

Battery Cleaning

Always keep vent plugs tightly in place when cleaning battery. When properly watered and charged, the battery will remain clean and dry. All that is necessary is to 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 the solution of soda and water, brushing the soda solution beneath the connectors and removing grime from the covers. Then rinse the battery with cool water from a low pressure supply to remove the soda and loosened dirt. If batteries stay wet consistently, they may be either overcharge or overfilled. This condition should be investigated and corrected.

Trouble Shooting

Records of battery specific gravity readings, charger used, truck used, etc. can be the most effective trouble-

shooting aid. Contact your dealer for charts designed specifically for this purpose.

Voltage readings of each cell taken at the 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 however 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.

Caution!



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

ELECTRICAL SYSTEM

MOTORS



Motors

	TRACTION 020994	TRACTION with SENSORS 021008-001
Brushes:		
No. of Brush Holders	1	1
No. of Brush Assemblies	4	8
No. of Brush Springs	4	8
Brush Length - New	33 mm (1.3 in.)	33 mm (1.3 in.)
Spring Tension on New Brushes	1360 g (48 oz.)	1360 g (48 oz.)
Min. Brush Length - Replace	16 mm (.62 in.)	16 mm (.62 in.)
Spring Tension Before Replacement	907 g (32 oz.)	907 g (32 oz.)
Commutator:		
Max. Diameter - New	74 mm (2.92 in.)	85.3 mm (3.36 in.)
Min. Diameter - Reslotting	72 mm (2.85 in.)	82.3 mm (3.24 in.)
Min. Diameter - Replace	70 mm (2.75 in.)	81.0 mm (3.19 in.)
Bearings:		
Lubricant	Hi Temp (Chevron SRI-2 or equivalent) 25 - 30% Fill	Hi Temp (Chevron SRI-2 or equivalent) 25 - 30% Fill
Cond. of Performance:		
No Load	12 V	12 V
Max. Amperes	-	12 A
RPM	-	650 min ⁻¹
Field Resistance:		
each at 24° C (75° F)	0.34 Ω	0.37 Ω
Armature Resistance:		
each at 24° C (75° F)	0.0055 Ω	0.0038 Ω
Measured Between Bars	1 and 10	1 and 9
Frame Diameter:		
	170 mm (6.70 in.)	190 mm (7.5 in.)
Direction of Rotation:		
	Reversible	Reversible



ELECTRICAL SYSTEM MOTORS

	LIFT 114330	LIFT with SENSORS 118838
Brushes:		
No. of Brush Holders	4	4
No. of Brush Assemblies	4	4
No. of Brush Springs	4	48
Brush Length - New	28 mm (1.10 in.)	28 mm (1.10 in.)
Spring Tension on New Brushes	1560 g (55 oz.)	1560 g (55 oz.)
Min. Brush Length - Replace	15 mm (.60 in.)	15 mm (.60 in.)
Spring Tension Before Replacement	992 g (35 oz.)	992 g (35 oz.)
Commutator:		
Max. Diameter - New	54 mm (2.12 in.)	54 mm (2.12 in.)
Min. Diameter - Reslotting	52 mm (2.05 in.)	52 mm (2.05 in.)
Min. Diameter - Replace	49 mm (1.93 in.)	49 mm (1.93 in.)
Bearings:		
Lubricant	Sealed	Sealed
Cond. of Performance:		
No Load	6 V	6 V
Max. Amperes	27 A	27 A
RPM	3000 min ⁻¹	3000 min ⁻¹
Field Resistance:		
each at 24° C (75° F)	0.0035 Ω	0.0035 Ω
Armature Resistance:		
each at 24° C (75° F)	0.0045 Ω	0.0045 Ω
Measured Between Bars	1 and 8	1 and 8
Frame Diameter:	170 mm (6.70 in.)	170 mm (6.70 in.)
Wound in:	Series	Series
Direction of Rotation:	CWDE	CWDE

Notes:



BRAKE SYSTEM

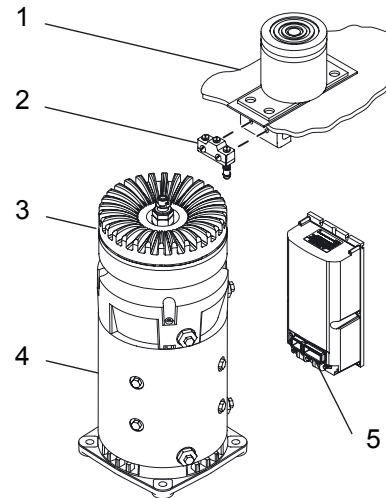


Notes:

General

There are two sources of drive wheel braking, a 3-step, spring applied, electromagnetically released, friction disc brake on the drive motor armature shaft and motor braking, typically called regenerative braking.

When a brake request is made the operator depresses the brake pedal, which activates a switch (BRS1). The "Access 3" microprocessor then determines the amount of braking force to be applied based on the programmed truck weight (includes battery and maximum allowable fork load) and the maximum allowable speed for the particular travel direction and fork height. The braking force is split between the motor regenerative braking and the 3-step friction brake. The motor regenerative portion is made as large as practical in order to reduce wear on the 3-step friction brake. The forward and reverse brake force can be further electronically adjusted through the Service Terminal (Traction Set-ups) in order to address tire slide for the particular floor condition in the application.



12202-01

- 1 Part of Platform
- 2 BRS1
- 3 Brake
- 4 Drive Motor
- 5 Access 3 Module

Braking Force

When a brake request is made by releasing the brake pedal, switch BRS1, located below the platform floor is activated. "Access 3" microprocessor determines the amount of braking force to be applied. The braking force is split between the motor regenerative braking and the 3-step disc brake. The forward and reverse brake force can be independently adjusted through the Service Terminal (Cal Mode: Traction Setups/Performance)

Brake Force Adjustment

1. Braking force should be checked under the following conditions:
 - Forks lowered.
 - On a floor surface typical of application.
 - Both forward and reverse travel directions.
 - With and without a load.
2. Brake force should be adjusted to produce the shortest possible stopping distance without causing the braking wheel to slide or the load to become unstable. A brake setting of 6 or 7 is typical for a properly functioning brake system on smooth dry concrete floors. For reference, a typical stopping distance when traveling at 8 km/h (5 mph) in the power unit first direction, with no load is approxi-

BRAKE SYSTEM

BRAKING FORCE



mately 2.1 meters (7.0 feet). Travel speed at the point of brake application can be displayed using the service terminal "Show/Traction Analyzer/Status Analyzer/Brake Speed".

3. If floor conditions are such that tire slide occurs or a more/less aggressive stop is desired, braking force can be increased or decreased with a corresponding increase or decrease in stopping distance.

Caution!



The customer shall verify that the stopping distance in any part of the application doesn't prevent the operator from performing a specific task safely, or result in braking characteristics that are significantly different from other similar vehicles being used in the facility. An alternative is for the customer to train the operator to reduce travel speed and/or allow for longer stopping distances.

4. If brake force adjustments are necessary, verify the settings in steps 5 and 6 before proceeding to step 7.
5. Using the service terminal, verify truck model (Cal Mode: Truck Setups) vehicle weight, and service load (Cal Mode: Traction Setups/Features) are correct. Information for these settings can be found on truck's data and capacity plates.
6. Verify the drive brake torque gap setting is correct (refer to Chart 1).
7. To adjust braking force in the forks first (FF) or power unit first (PUF) direction, use the service terminal to adjust performance settings FF Braking or PUF Braking (Cal Mode: Traction Setups/Performance). Adjusting to a higher number will increase braking force (reduce stopping distance). Adjusting to a lower number will decrease braking force (increase stopping distance or reduce tire slide).

BRAKE ADJUSTMENT

Air Gap Adjustment

The "air gap", referred to on this truck, is the distance between the brake armature and the electromagnet body with brakes applied. Refer to Figure 12203-01. As the brake pads and rotor wear normally, the air gap will increase and should be readjusted, or parts checked and replaced, when it exceeds 1.0 mm (0.040 in).

Information

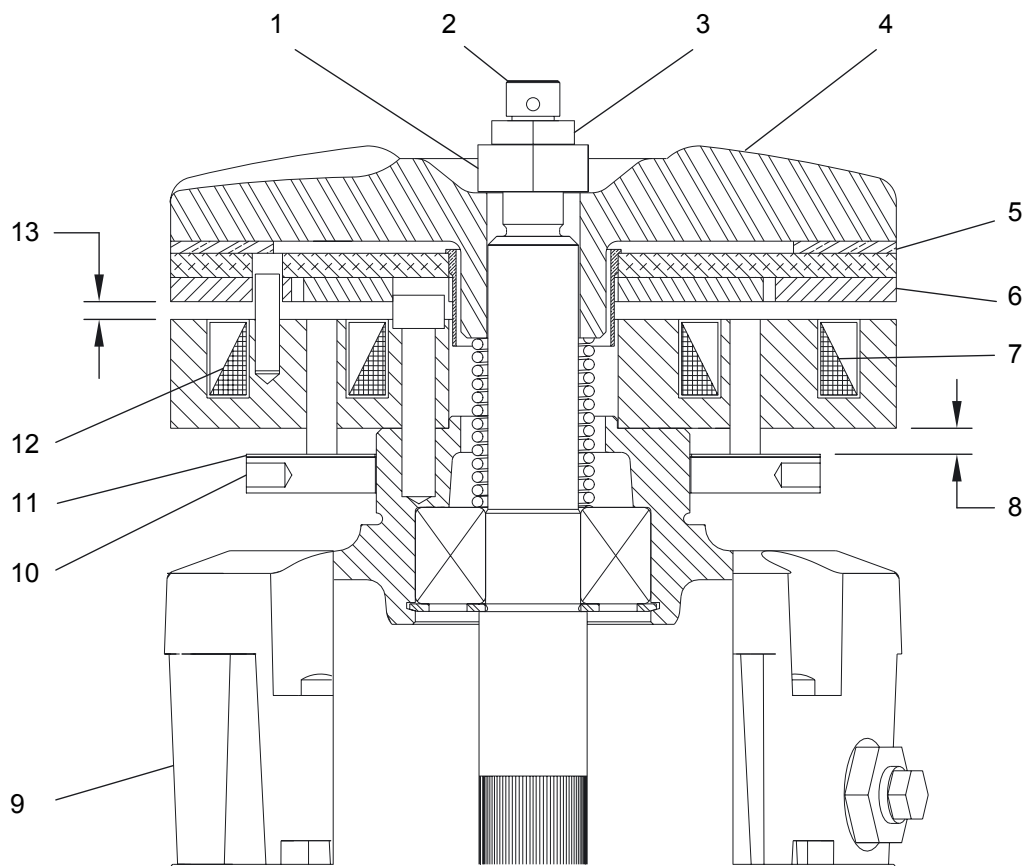


If the air gap measures more than 1.0 mm (0.040 in), the brake may not release properly. If the brake pad thickness is less than 2.8 mm (0.110 in), the brake pads and rotor should be replaced.

1. Chock load wheels. Open power unit doors to access brake assembly.
2. Release brake, using drive/tow switch. Refer to "Control of Hazardous Energy" section of this manual.
3. Using low pressure air, remove any dirt between armatures and magnet body.
4. To minimize the risk of possible damage to the encoder, remove encoder.
5. With a 22.2 mm (0.875 in) open end wrench, loosen the top nut.
6. Using a 28.5 mm (1.125 in) open end wrench, turn the 28.5 mm (1.125 in) hex nut down until the air gap is 0.13 mm (0.005 in) at its tightest location. One complete turn of the nut will change the gap 1.4 mm (0.056 in) or 1/6 (60 degrees) turn will change gap 0.235 mm (0.009 in).
7. Torque 22.2 mm (0.875 in) hex nut to 122 Nm (90 ft. lbs.).

8. Apply brake, using drive/tow switch.

9. Remove chocks and check operation.



12203-01

- 1 28.5 mm (1.125 in) Hex Nut
- 2 Motor Shaft
- 3 22.2 mm (0.875 in) Hex Nut
- 4 Rotor
- 5 Brake Pads
- 6 Armature
- 7 Electromagnet
- 8 Torque Adjuster Gap
- 9 Drive Motor
- 10 Torque Adjuster Plate
- 11 Adjuster Disc
- 12 Electromagnet
- 13 Air Gap

Torque Gap Adjustment

The "torque gap", referred to on this truck, is the distance between the torque adjuster plate and the electromagnet. Refer to Figure 12203-01. The torque plate is factory preset and no adjustment is required, however, through routine maintenance it may be necessary to replace components and the gap may need to be reset to factory specifications. The torque gap will vary with each trucks GVW.

Information



Refer to the capacity plate for truck GVW as equipped with maximum battery and capacity load.

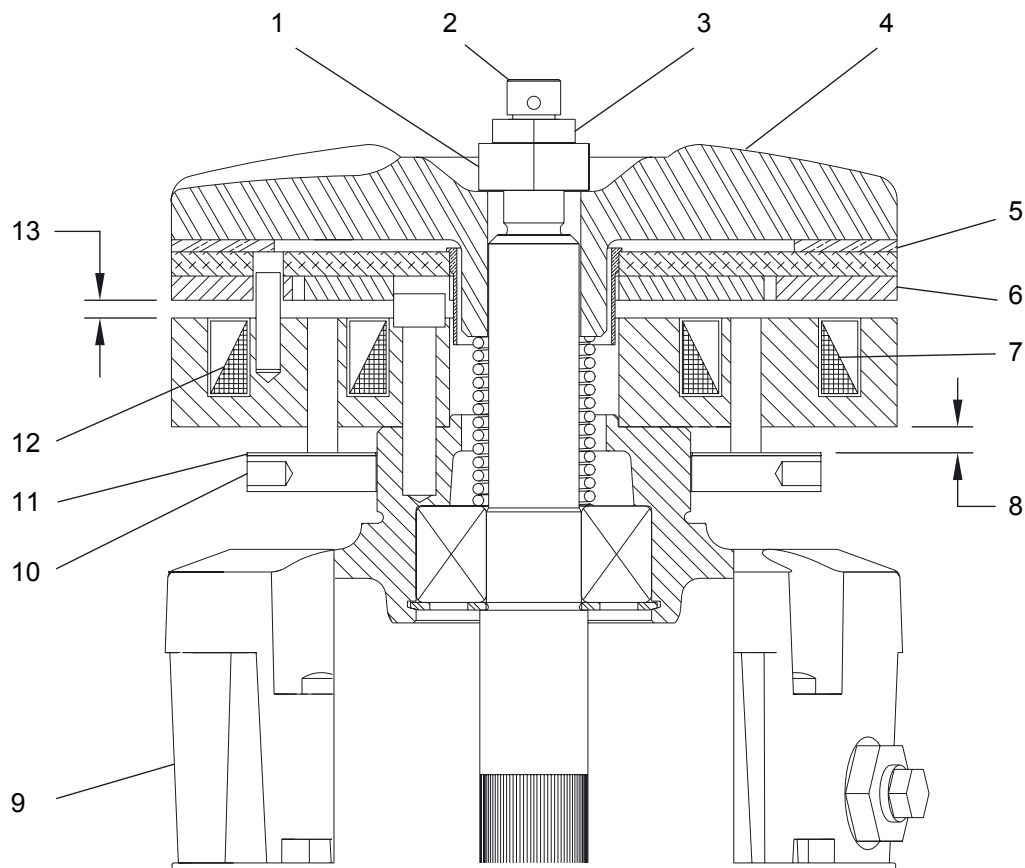
BRAKE SYSTEM

BRAKING FORCE



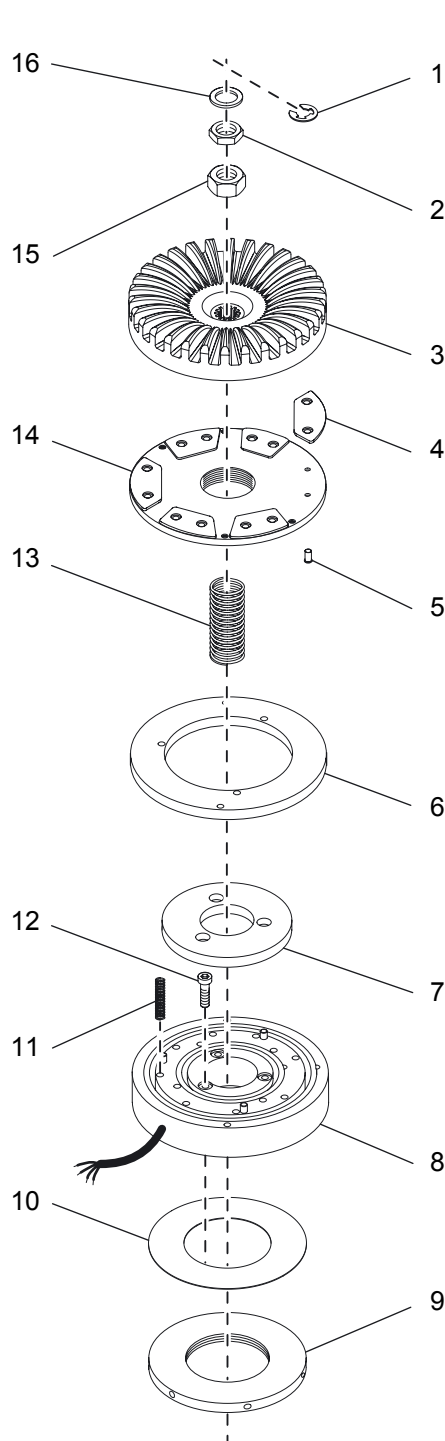
CHART 1			
Torque Gap		GVW (capacity load and max. battery)	
mm	in	kg	lbs
0.00	0.00	greater than 6509	greater than 14350
0.51	0.02	6214 - 6508	13700 - 14349
1.02	0.04	5919 - 6213	13050 - 13699
1.52	0.06	5625 - 5918	12400 - 13049

CHART 1			
2.03	0.08	5330 - 5624	11750 - 12399
2.54	0.10	5035 - 5329	11100 - 11749
3.05	0.12	4740 - 5034	10450 - 11099
3.56	0.14	4445 - 4739	9800 - 10449
4.06	0.16	4150 - 4444	9150 - 9799
4.57	0.18	3856 - 4149	8500 - 9149
5.08	0.20	less than 3855	less than 8500



12203-01

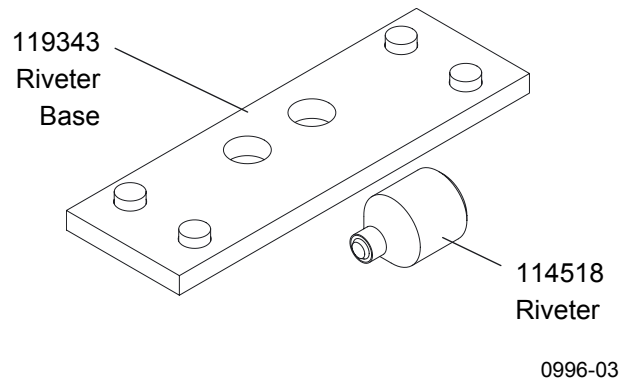
- | | | | |
|---|----------------------------|----|-----------------------|
| 1 | 28.5 mm (1.125 in) Hex Nut | 8 | Torque Adjuster Gap |
| 2 | Motor Shaft | 9 | Drive Motor |
| 3 | 22.2 mm (0.875 in) Hex Nut | 10 | Torque Adjuster Plate |
| 4 | Rotor | 11 | Adjuster Disc |
| 5 | Brake Pads | 12 | Electromagnet |
| 6 | Armature | 13 | Air Gap |
| 7 | Electromagnet | | |



- 1 Retaining Ring
- 2 22.2 mm (0.875 in) Hex Nut
- 3 Rotor
- 4 Brake Pad
- 5 Rivet
- 6 Outer Armature
- 7 Inner Armature
- 8 Magnet Body
- 9 Torque Adjuster Plate
- 10 Adjuster Disc
- 11 Spring
- 12 7.9 mm (0.312 in) Screw
- 13 Compression Spring
- 14 Brake Pad Assembly
- 15 28.5 mm (1.125 in) Hex Nut
- 16 Flatwasher

Rotor and Brake Pad Replacement

Tools are available from Crown to permit replacement of the pads on the brake pad assembly. When used with a press, these tools allow the correct positioning of the pads and correct setting of the rivets. A press is required to insure the rivets provide the compression strength needed to keep brake pads stationary.



0996-03

To disassemble rotor and brake pad assembly:

- 12204-01 1. Block load wheels, disconnect battery and open power unit doors.
- 2. Disconnect brake connector from CA407.
- 3. Remove retaining ring, washers and two hex nuts.

BRAKE SYSTEM

BRAKING FORCE

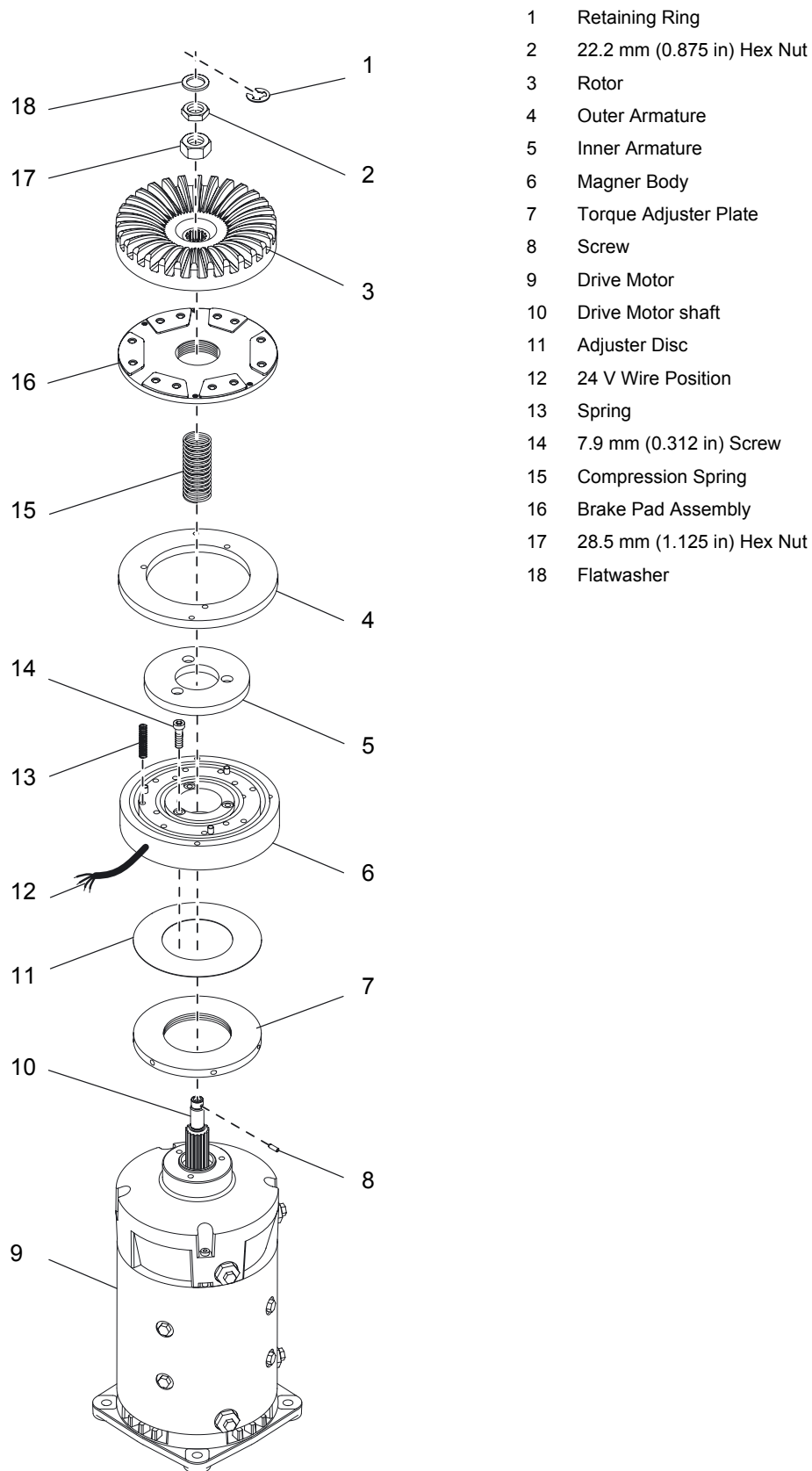


4. Remove rotor and brake pad assembly.
5. Follow "Brake Assembly" procedure when reassembling the brake.

Brake Assembly

Before assembling brake, inspect all components for wear, grooves, nicks or other damage. If any abnormal wear or damage appears that may affect brake operation, replace with new parts. Assemble brake as follows:

1. Turn torque adjuster plate down as far as possible to reduce spring force. Place adjuster disc on torque adjuster plate.
2. Apply a light coat of multipurpose grease (063002-024) to the motor end cap threads and on top of the torque adjuster plate.
3. Position magnet body on the motor so the coil wires are positioned as shown in Figure 12205-01. Apply blue thread locking adhesive (061004-026) to the three 7.9 mm (0.312 in) screws and secure magnet to motor with screws.
4. Assemble springs, inner and outer armatures to magnet body. Apply a light coat of multipurpose grease (063002-024) to entire bottom of brake pad plate assembly. Be careful not to contaminate brake pads with grease.
5. Install compression spring over armature shaft.
6. Slip rotor on motor shaft, hub first. Thread 28.5 mm (1.125 in) hex nut onto motor shaft. Turn nut down until the rotor moves down and almost touches the brake pads. Proper air gap adjustment will be made later.
7. Thread the 22.2 mm (0.875 in) hex nut onto motor shaft. Add flatwasher(s) and install retaining ring on motor shaft.
8. Set torque adjuster gap to its original factory setting. See TORQUE GAP ADJUSTMENT procedures.
9. Connect wire harness to brake assembly.
10. Adjust air gap. See AIR GAP ADJUSTMENT procedures.
11. Check brake operation and stopping distance. See adjustment procedures in truck settings section of this manual.



12205-01

BRAKE SYSTEM

BRAKING FORCE



CHART 2		
Problem	Probable Cause	Remedy
Brakes will not release	Air gap more than 1.0 mm (0.040 in.)	Adjust
	Open circuit in brake circuitry or wiring	Check floorboard switches and all associated wiring
	Armatures movement restricted by dirt, foreign material	Clean with low pressure air
Brakes drag	Air gap less than 0.25 mm (0.010 in.)	Adjust
	Brake pad mounting plate or rotor distorted	Replace
	Armatures movement restricted by dirt, foreign material	Clean with low pressure air
Brakes grab	Incorrect stopping distance adjustment	Adjust (See Traction Setups PUF Brake and FF Brake)
	Brake pad mounting plates or rotor distorted	Replace
Stopping distance too long	Incorrect stopping distance adjustment	Adjust (See Traction Setups PUF Brake and FF Brake)
	Brake pads loose or soiled with grease	Replace
Abnormal noise and chatter when brakes applied	Brake pad mounting plate or rotor distorted	Replace
	Brake pads worn out, loose, soiled with grease, foreign material embedded	Replace
Abnormal braking force for lift height or brakes applied without request	Rotor thin, cracked or spline worn	Replace
	WIRE GUIDE TRUCKS: Guide wire lost power or truck off guide wire	Troubleshoot wire guidance system
	Open circuit in brake circuitry or wiring	Check all switches and associated wiring

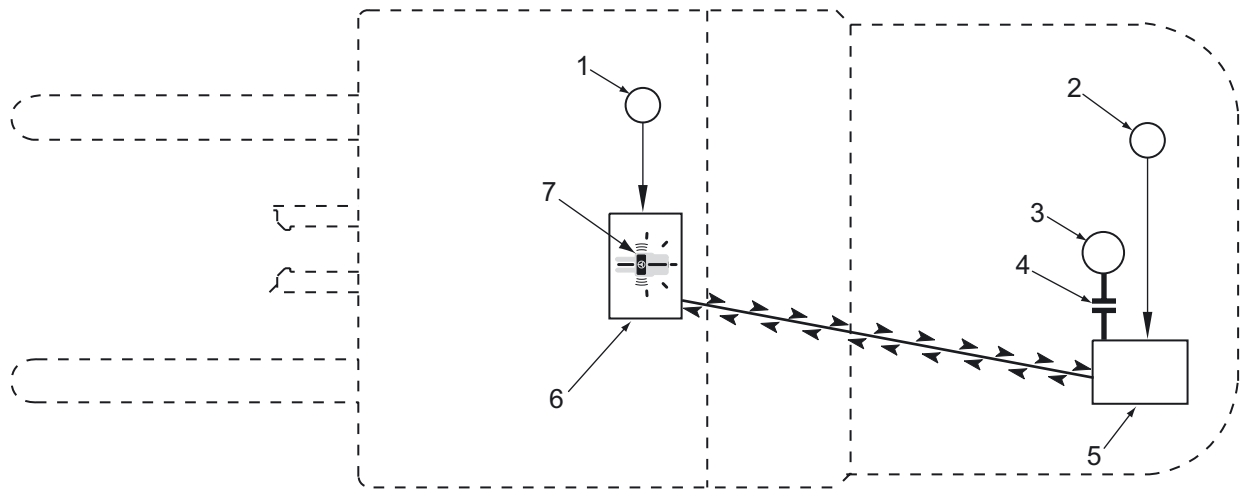


STEERING



Notes:

System Description



3269-1_EU

- 1 Steering Command Encoder (ECR1)
- 3 Drive Motor (M2)
- 5 Steering Control Module (SCM)
- 7 Steering Indicator Lights

- 2 Steering Feedback Encoder (ECR2)
- 4 Steering Relay (K5)
- 6 Platform Display Module (DCM)

The electronic power steering utilizes a servo motor to steer the drive wheel. Movement of the steering wheel turns the steering command encoder (ECR1) which sends data to the platform display module (DCM). This information is converted to a direction, rate and position signal. This information is compared with the position and direction information that is received from the power unit steering feedback encoder (ECR2). A composite signal representing the difference is calculated in the power unit steering control module (SCM) and is then applied to the steering motor (M2). Travel speed and lift height may be limited in relation to steer wheel position.

Steering Direction

The truck will turn in the direction the steering wheel is rotated when travelling forward or power unit first direction. If your truck is equipped with wire guidance, the truck will be automatically steered once the guide wire is acquired. Refer to section 4.3 for wire guidance operation.

Steering Wheel Direction Indicator

Caution!



If the drive tire is physically turned while the truck is "off", on power up, the steering indicators will not represent the proper steer angle. The steering wheel must be rotated so drive unit and encoder pass through index to reset the electronics.

Five indicator lights around the power unit end of the truck image on the display panel provide a visual indication of approximate steer wheel turn angle.

When the centre indicator only is glowing green, the angle of the steered wheel from straight ahead is within $\pm 1^\circ$. If the centre indicator and first indicator to either side of the centre are glowing, the steered wheel angle is between 1° and 9° in the indicated direction. The first indicator next to the centre indicator being the only indicator "ON", indicates steered wheel position between 10° and 34° in the indicated direction.

STEERING

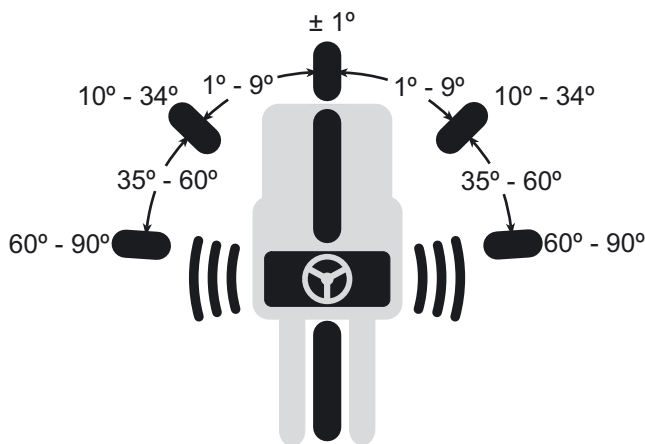
STEERING WHEEL ADJUSTMENT



The second and third indicator on either side being glowing indicates a steer angle between 35° and 60° in the indicated direction. When the third indicator on either side of the centre indicator is the only indicator “ON”, the steer angle is between 60° and 90°.

Steering will be limited to no more than 10° of straight ahead if the forks are raised 4 570 mm (180 inch) or more. An alarm will sound and a message will be displayed (on the display panel) informing you that steering is limited.

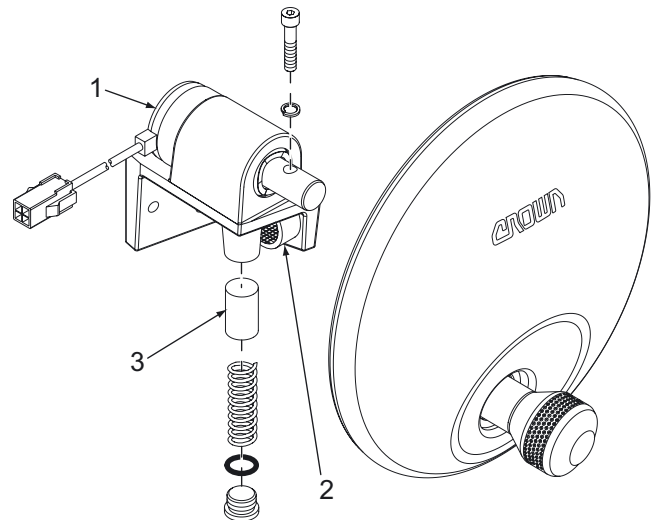
If steering is positioned beyond 10° of straight ahead and raise is selected, an alarm will sound notifying you that raise is limited to 4 570 mm (180 inch). A message will be displayed (on the display panel) informing you that lift is limited to 4 570 mm (180 in.). To raise the forks higher, you must steer the truck no more than 10° from straight ahead travel.



3303-1_EU

removes his hand, then the friction block needs to be replaced.

This is located behind the steering wheel. To gain access, you must first remove the 6 screws securing the console cover on. With the cover removed, the steering command assembly will be visible. Refer to Figure 12219_EU.



12219_EU

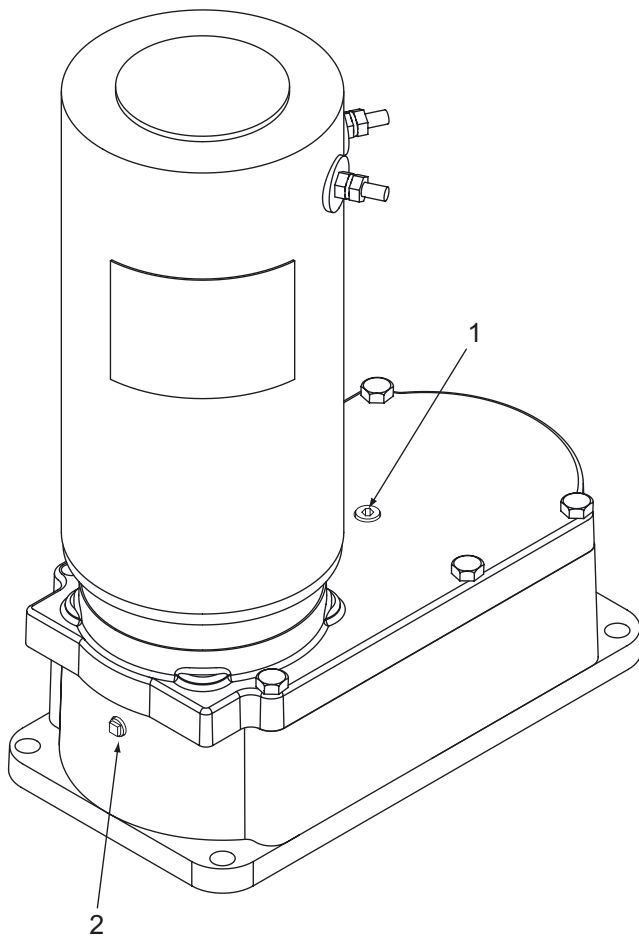
- 1 Steering Command Encoder (ECR1)
- 2 Alarm (ALM1)
- 3 Friction Block

Steering Wheel Adjustment

To prevent the steering wheel from rotating “Free Wheeling”, after the operator’s hand has been removed, a friction block is used to keep the steering wheel from rotating.

The friction block is tightened against the steering wheel shaft. There is no adjustment to this friction block. If the steering wheel rotates after the operator

Steering Motor Gearbox



3246-01_EU

- 1 Fill Plug
- 2 Level Indicator Plug

The steering motor gearbox should be filled to the level indicator plug on the end of the gearbox with hydraulic oil (see Figure 3246-01_EU). Refer to Chapter 1, table *Lubricants* for recommended products. Capacity of the gearbox is approx. 1 L (2 pints).

STEERING

STEERING MOTOR GEARBOX



Notes:



LIFTING MECHANISM



Notes:

Lift Chains

Lift chains are a major component of a fork lift truck. The chain system on this mast is designed to transmit the lift force from the hydraulic cylinder to the fork reliably and efficiently. Safe, uninterrupted truck operation depends on careful servicing and maintenance of the lift chains.

Most complaints about the chain performance are due to lack of maintenance. Highly stressed precision chains require regular maintenance to ensure a long useful life.

Inspection

The chain must be inspected every 100 hours for any signs of faults or damage. If used in a corrosive or dusty environment, this interval must be reduced to 50 hours. If this cannot be performed on the truck, the lift chains must be removed.

The inspection should include the following:

- Chain wear and elongation.
- Pitting due to rust or corrosion, in particular on the outer surfaces of the connection plates.
- Pins turning in or extruding from the outside plates.
- Loss of freedom of movement.
- Damage to the anchor bolt attachment
- Wear and corrosion to the anchor bolt and anchor. Wear between the bolts and the connection plates.

The following sections cover the above items in detail.

Cleaning

Never use chemical solvents or steam to clean the chains.

The lubricant applied at the factory will be removed from the inner plate surfaces.

The chain surface should be cleaned with paraffin, a hard bristle brush and lint-free cloth.

After inspection apply another film of chain spray or chain oil. The oil acts both as a lubricant and as an anti-corrosive protection.

Wear

Caution!



The maximum allowed chain elongation is 3%.

If the chain has elongated by 3% replace the detachable chain anchors, anchor bolts and lift chains!

The chain bends as it passes over the chain rollers. This leads to a gradual wearing of the joints.

Any slack a chain undergoes during its lifetime is due to wear to the links and the chain plate eyelet.

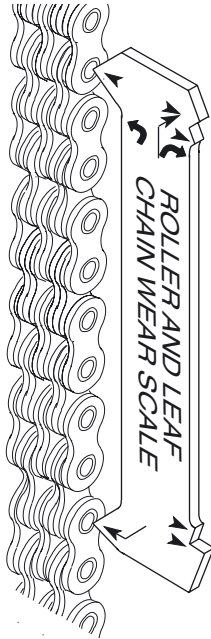
When checking for chain wear be sure to measure a part of the chain which passes over the guide pulleys. Never repair chains by cutting out the worn section and replacing it with a new section. If a chain is worn, always replace both lift chains.

LIFTING MECHANISM

WEAR



Chain wear can be measured with a wear gauge (Crown No. 106440) or a steel tape measure (see Fig. 2771).

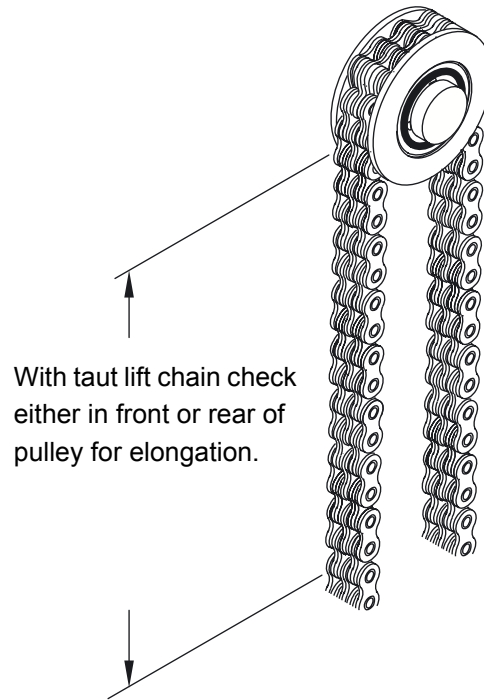


2771

The Crown wear gauge has two scales: scale "A" is used for 19.05 mm (0.75 inch) pitch chains and 25.4 mm (1 inch) pitch chains. Scale "B" is used for 15.88 mm (0.625 inch) pitch chains.

Before testing the chain elongation it is important to tension the lift chain if necessary. For non-detachable lift chains the weight of the fork carriage or mast is sufficient.

If the lift chain is detached it must be kept taut during measurement.



7771_EU

The chain elongation test must cover at least ten links (if a steel tape measure is used), over at least three different points in a section of the chain which always passes over a pulley during operation.

Chain Elongation			
Chain Pitch	Number of Links	Length New	Wear Limit
25.4 mm 1 inch	12	305 mm 12 inch	314 mm 12.375 inch
19.05 mm 0.75 inch	16	305 mm 12 inch	314 mm 12.375 inch
15.88 mm 0.625 inch	20	318 mm 12.5 inch	327 mm 12.875 inch

If just one of the faults mentioned in this chapter is detected, chains together with their chain anchors

or bolts must be immediately replaced. If 2 chains are used paired, replace in pair.

Danger!

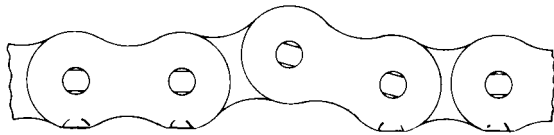


Never repair damaged chains!

This can result in fatal accidents.

Freedom of Movement of Chain Links

Each individual chain link must flex freely. Tight joints (Fig. 2775si) increase friction and the chain tension during lifting. Excessive chain tension in turn accelerates material wear.



2775si

Possible causes of stiff joints are as follows:

- Bent pins or plates
- Rusty joints.
- Peened plate edges.
- Plate edge distortion is caused by:
- Ruptured chain pinion.
- Constant overloading of the chain.
- Chain striking the mast components.

Immediately replace any chains with stiff joints.

Chain Tension

When installed, both lift chains should have the same chain tension to ensure even distribution of the load over the two chains when lifting.

When replacing the forks make sure that both forks lie evenly on the surface. If they are not even, compensate the chain length via the chain anchor so that both chains have the same chain tension.

After adjusting, tighten the counternuts of the chain anchor again (for correct torques see Chapter 1, Torque table).

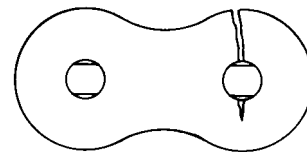
Chain Anchor and Pulleys

In the course of checking the chain system, the chain anchors, chain bolts and pulleys must be checked for wear.

On the chain anchor watch out for wear and cracking of the individual fingers. If one of the above problems occurs replace the chain anchor.

Pulleys with heavily worn flanges and contact surfaces must be replaced. Worn flanges are due to misalignment. The chain tension and mast roller setting must be checked.

Worn Connection Plates



2774si

Generally speaking, material wear is the cause of worn or missing connection plates. The plates near the chain pin hole (Fig. 2774si) can crack after a large number of lifting cycles with heavy loads.

LIFTING MECHANISM

WEAR



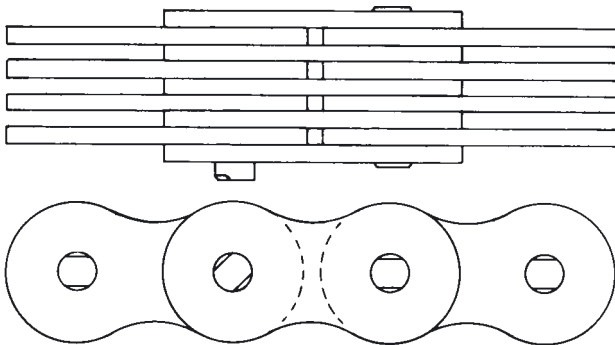
Replace both chains immediately if cracking shows or plates are missing. If 2 chains are used paired, replace in pair.

Protruding or Turned Chain Pins

Danger!



Never attempt to repair the chain by driving pins back into the chain. This can result in accidents with severe or even fatal injuries if the chain tears. Fit new chains.



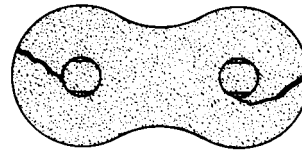
2776si

Considerable frictional forces between the connection plates and the pins occur when lifting heavy loads with an insufficient or non-existent film of oil. In extreme cases the frictional torque in the joints can be such that the pins turn and gradually work out of the chain (Fig. 2776si). This can result in chain failure.

Turned pins can be rapidly identified if the flat ends are not all pointing in the same direction.

Chains with twisted or protruding pins must be replaced immediately. If 2 chains are used paired, replace in pair.

Corrosion



2773si

The chains used on fork lift trucks are highly stressed precision components. It is particularly important to maintain the original fatigue strength throughout its useful life.

Corrosion considerably reduces the capacity of a lift chain. It results in cracking in the side plates.

Lift chains must therefore be protected from corrosion. The layer of grease applied in the factory hot dip galvanizing process is an excellent protection and fully penetrates the joints.

Do not remove this initial layer! After commissioning the chain supplement the factory lubrication through a regular lubrication schedule.

Rust film on lift chains can be removed and neutralised by cleaning with chain oil. **Always replace heavily corroded and rusting chains. The risk of cracking as a result of rust is too great.**

Chain Lateral Wear

Wear traces along a stretch of the chain on the pin heads and the outer plates indicate misalignment. This can have one of two causes: uneven chain tension or misalignment between the pulleys and the chain anchors.

Uneven Chain Tension

When fitting or adjusting the chains make sure that they are evenly charged. If for example the fork heel height or the platform height are changed, the chain anchors must be loosened until both forks touch the ground. Both chains must have equal amounts of air or tension at this point. The lower chain anchor nuts must be tightened by the same number of turns. When the required height has been reached, fix the setting with the top (chain side) lock nut and its respective lock washer.

Misaligned Lift Components

Misalignment of the chain pinion and the chain due to the wrong number of washers on the mast or a damaged mast or cylinder components can also contribute to wearing of the chain sides.

To test whether this is the case, proceed as follows: Place the truck on a horizontal surface in the service station. Support the fork carriage and detach both ends of the lift chain from the chain anchor and visually inspect the alignment with the anchor slots.

Lift Chain Lubrication

Lubrication is the most important factor in lift chain maintenance. It considerably affects the chain's useful life.

Highly stressed chains under constant use cannot last sufficiently long if they are not regularly lubricated within a planned maintenance schedule.

As with all contact surfaces, the tensiled steel precision moving parts require a durable lubricant film between the contact surfaces to avoid excessive wear.

Maintaining a lubricant film on all the chain surfaces provides the following benefits:

- Restricts joint wear to a minimum (chain elongation).
- Avoids corrosion.
- Reduces the risk of chain bolts turning.
- Restricts the danger of chain joints turning in to a minimum.
- Ensures an even movement of the chains and thus reduces noise levels.
- Reduces the chain tension due to less friction in the chain system.

Key factors when considering which lubricant to use are as follows:

- High degree of penetration in the narrowest of gaps
- Maximum tolerance of pressure and shearing forces before the lubricant film comes off.
- Suitability to the operating temperature range, especially important for cold store trucks.

You will find details of Crown approved chain oils in the Lubricant table in Chapter 1 of this manual.

Lubrication intervals depend on the operating conditions and the environment. Trucks parked outdoors, in cold stores or which are subjected to extreme weather conditions must be lubricated more frequently.

Dust will gather on oiled chains in dusty environments. However, even in these conditions, regular lubrication can considerably reduce wear.

A paste mixture of oil and dirt will gather on the chain joints, but they will not wear as fast as they would if they were left to dry, leaving a metal to metal contact between the pins and plates.

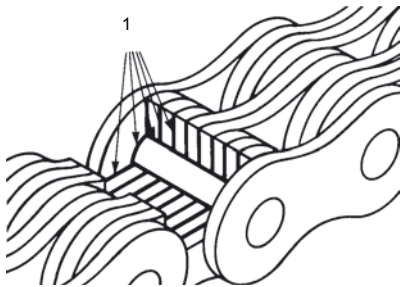
LIFTING MECHANISM

WEAR



Note: A lift chain must never be allowed to dry.

In dusty operating conditions the multi-plate chains can be more efficiently lubricated than roller chains. Multi-plate chains consist of several plates. Therefore they provide several paths for the lubricant to reach the chain bolt (see Fig. MS-3400-065) and allow the oil to penetrate to the bearing surface on the chain bolt, even when the chain is dirty.



MS-3400-065

1 Oil film

In normal operating conditions the chains should be cleaned and immediately lubricated every 100 service hours. In extreme conditions this interval must be reduced accordingly.

Separating Lift Chains

Lift chains are supplied by the meter and must be cut to the required length.

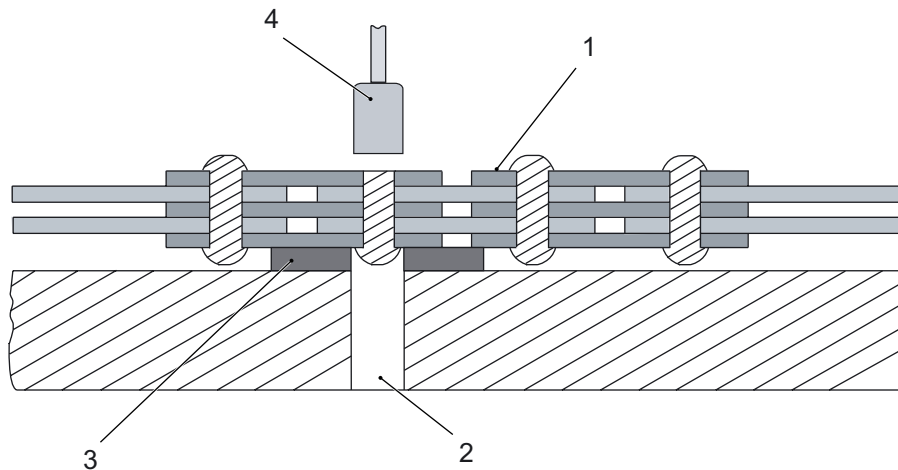
Tools and Equipment Required

- A secure working plate with a hole slightly larger than the head diameter of a chain bolt. The hole must be deeper than the chain bolt length.
 - A bearing ring (washer) with a hole slightly larger than the head diameter of a chain bolt. The bearing ring thickness must be slightly larger than the height of the head of a chain bolt.
 - A grinder.
 - A hole with a diameter slightly shorter than the chain bolt and a hammer. Or a press with a suitable mandrel.
- Carefully grind the head of the chain bolt. The inner plate surface must not be damaged.
 - Place the bearing ring onto the hole in the working plate. The bearing ring prevents the inner plate surface from being damaged when you drive out the chain bolt.
 - Place the head of the chain bolt to be driven out into the bearing ring.
 - Make sure the chain bolt, the bearing ring and the hole are aligned in the working plate and drive the chain bolt out.

Caution!



Wear protective glasses.



MS-3400-066

- 1 Connecting plate
- 2 Hole in working plate

- 3 Backring
- 4 Grinder

Notes:

FEM / ISO Forks

General

Warning!



The following causes of fork failure may mean loss of equipment, damaged materials, bodily injury or loss of life.

- *Use the proper fork for which it is designed.*
- *Avoid using fork extensions.*
- *Do not modify forks.*
- *Inspect forks visually each work day.*

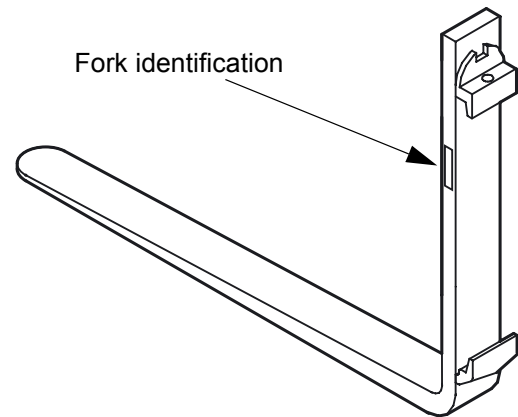
The forks must be inspected by trained personnel .

Forks shall be inspected at intervals of not more than 12 months and whenever any defect or permanent deformation is detected. Severe applications may require more frequent inspections.

Fork Identification

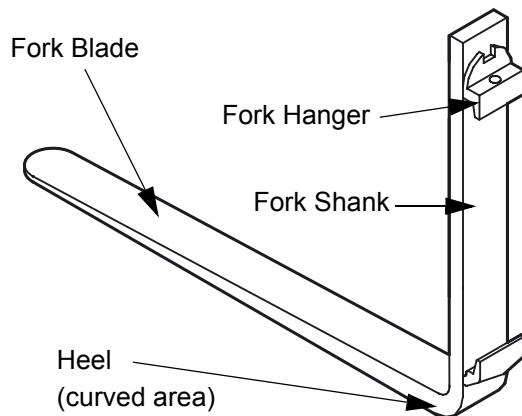
The data plate is on the side of the fork back (Fig. 0345) and comprises the following data:

- Capacity
- Load centre of gravity
- Manufacturing Data (Month / Year)
- Company logo
- Manufacturing site



M0345

Terms



M0344

LIFTING MECHANISM

FEM / ISO FORKS



FEM / ISO Fork Inspection

Fork inspection shall be carried out carefully by trained personnel with the aim of detecting any damage, failure deformation, etc., which may impair safe use.

Any defect fork shall be *immediately* withdrawn from service and not returned to service until it has been repaired and tested.

Repair

Danger!



Never carry out repair welding to surface cracks, damaged or worn parts around the heel of the fork.

Only the manufacturer of the fork arm or an expert of equal competence shall decide if a fork arm may be repaired for return to service.

Fork repair must be carried out in accordance with the recommendations of the fork arm manufacturer.

Inspection Intervals

Forks shall be inspected at intervals of not more than 12 months and whenever any defect or permanent deformation is detected. Severe applications may require more frequent inspections.

Crack Inspection.

Danger!



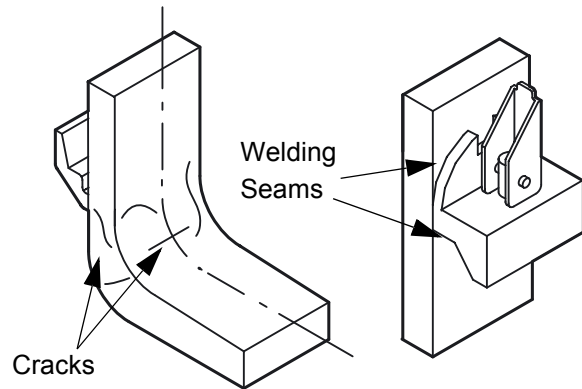
Forks showing signs of cracking, distortion or wear beyond the stated tolerance levels must be de-commissioned. They endanger the life.

Inspect all fork tine surfaces for signs of cracks.

Fatigue cracking tends to occur around the heel of the forks. Check this area with particular care. If necessary

carry out a non-rupturing crack test (paint penetration process or Magnaflux®).

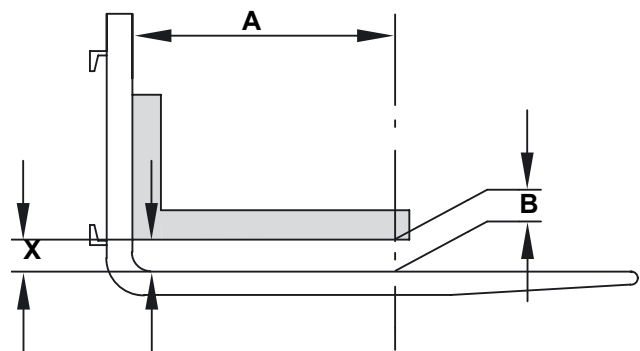
For upper and lower fork hangers (Fig. M0346-347) including their fork back attachments check for cracks on the welding seam. If any cracking is discovered which could affect safety remove the relevant fork.



M0346-347

Fork Blade Warping

Measure the angle deflection between the top of the fork blade and the front of the fork shank (Fig. M0353). If dimension X is outside the tolerance range, the fork must be aligned by a specialist and re-checked.



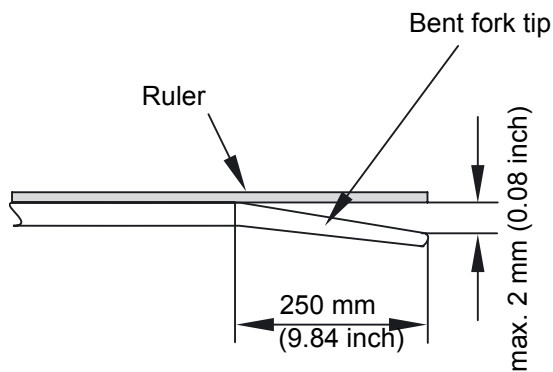
M0353

A 500 mm (19.7 inch)

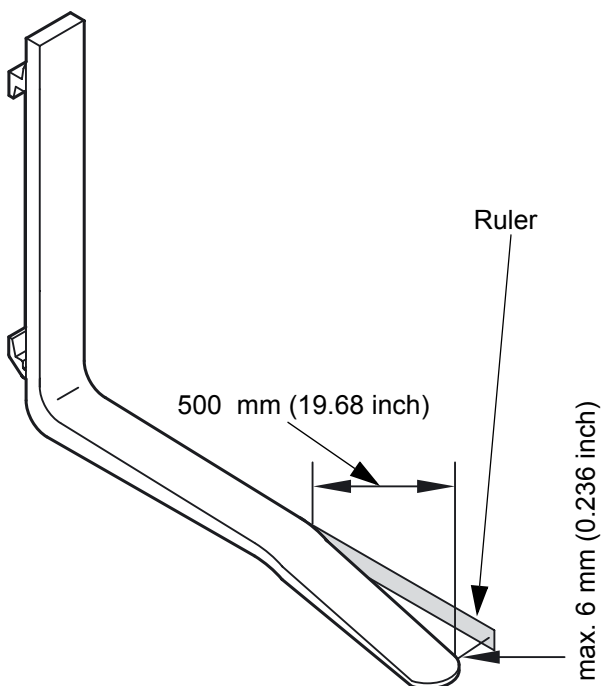
B X - 17 mm (0.67 inch) or X + 8.5 mm (0.345 inch)

Fork Tip Straightness Test

Check the straightness of fork tip (Fig. M0350 and M0351). If the tolerance level has been exceeded, decommission the fork.



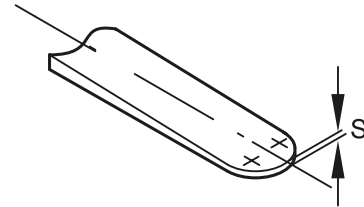
M0350



M0351

Measuring the Fork Tip Height

If the fork tip width **S** is less than **a/6 mm** (**a** = fork shank thickness) do not use the fork (Fig. 0355).



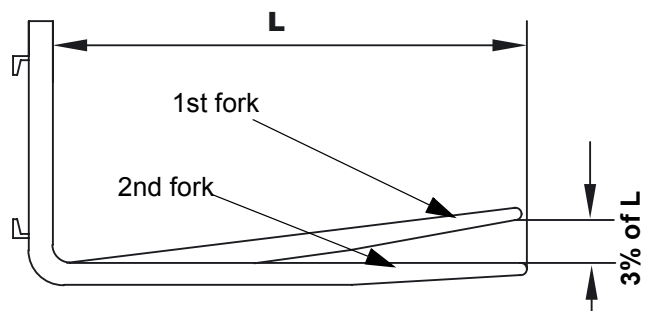
M0355

Fork Tine Height Difference

Check the height of the fork tines in relation to each other (Fig. M0354) if the fork is fixed to the fork carriage. If the difference is greater than 3% of the fork blade length the fork tines must be correctly aligned.

Example: If the length of the fork blade is 1 150 mm (45 inch), the maximum permissible deviation is approx. 35 mm (1.378 inch).

However, this would prevent the fork from working. In practice, forks must be aligned if the maximum deviation is 10 mm (0.39 inch).



M0354

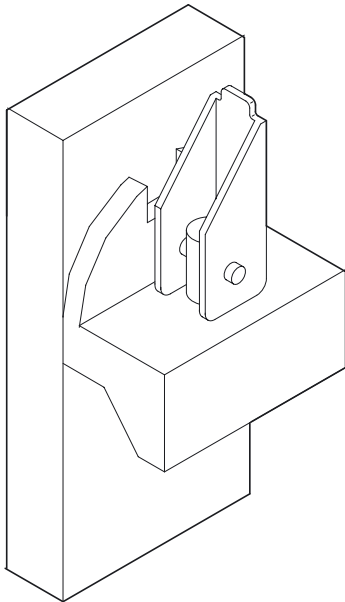
LIFTING MECHANISM

FEM / ISO FORKS



Fork Stop

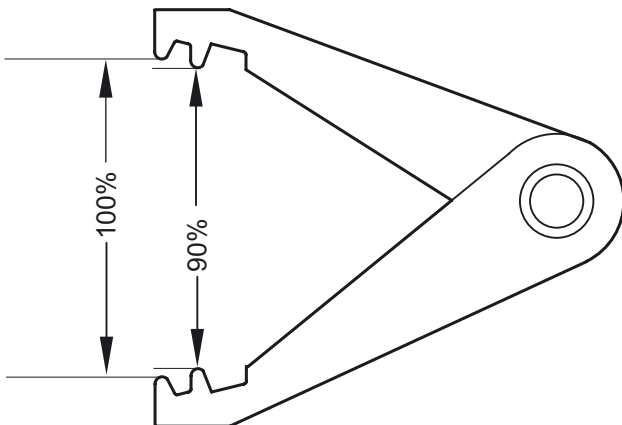
Check the stop mechanism (Fig. M0356) on both fork tines. The mechanism should lock securely, otherwise the fork must be de-commissioned until repaired..



M0356

Fork Blade Abrasion Check

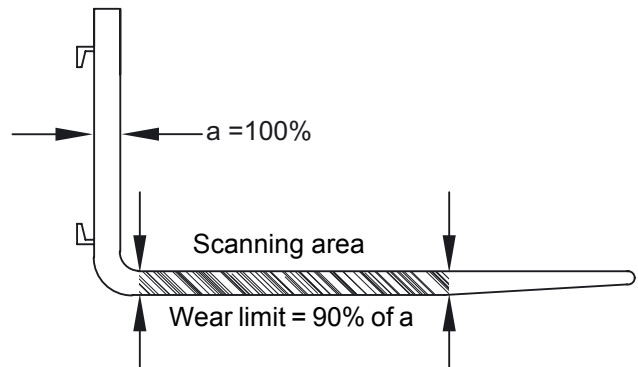
Check the fork blade for abrasion. The heel is particularly sensitive to wear. If the width is 90% or less than the original value, the fork must be taken out of service. For the inspection, use the callipers with part no. 107330 (see Fig. 0357).



M0357

This callipers has 2 opposite tappets. The outer tappet is used to determine the original fork blade thickness at a section with nearly no wear. This is the fork shank. This determines the 100% value. The inner tappets correspond to 90% of the value previously obtained.

Scan the thickness of the fork shank using the outer tappets (Point a = 100% in Fig. MS-2232-013). Fix the callipers.



MS-2232-013

Now use the inner tappets (90%) to scan the fork blade between the shank and the start of the curved area. If the callipers fits at any point over the fork blade, then the fork is worn. Take the fork out of service.



LIFTING MECHANISM PLATFORM FORK BLADES

Platform Fork Blades

General:

Warning!



The following causes of fork failure may mean loss of equipment, damaged materials, bodily injury or loss of life.

- Use the proper fork for which it is designed.
- Avoid using fork extensions.
- Do not modify forks.
- Inspect forks visually each work day.

The forks must be inspected by trained personnel .

Forks shall be inspected at intervals of not more than 12 months and whenever any defect or permanent deformation is detected. Severe applications may require more frequent inspections.

New Fork Thickness	Wear Limit Thickness	New Fork Thickness	Wear Limit Thickness
31.5 mm	28.5 mm	1.25 inch	1.12 inch
38.0 mm	35.0 mm	1.50 inch	1.38 inch
44.5 mm	39.5 mm	1.75 inch	1.56 inch
51.0 mm	46.0 mm	2.00 inch	1.81 inch
57.0 mm	51.0 mm	2.25 inch	2.00 inch
63.5 mm	57.0 mm	2.5 inch	2.25 inch

Table Standard Fork Thickness and Wear Limit

Fork Inspection

Warning!



When performing any type of inspection, adjustment, maintenance, etc. beneath the platform, blocks should be positioned under each side of the platform. See chapter "Safety".

Fork Blade Abrasion Check

Abrasion gradually reduces the thickness of the fork. Be sure the fork thickness is up to standard.

Do not allow forks to rub the floor during normal operation (if forks do 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 worn out and have to be removed from service.

Crown has a fork wear callipers (part no.107330) available for use or a measuring instrument such as a vernier or good six inch scale may be used. For allowable fork wear thickness refer to chart "Table Standard Fork Thickness and Wear Limit".

If you are using the fork wear callipers refer to the following:

The fork wear callipers has two measuring points or jaws. The inside jaws measure 10% less than the outside jaws (see Fig. M0357 on page 348).

To set the outside jaws, use a measuring instrument such as a vernier or machinist six inch scale and set outside jaws to the nominal value the new fork blade for this truck would have.

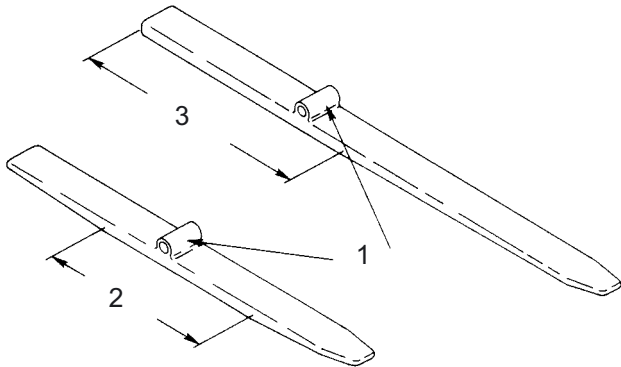
Care should be taken when using the callipers to hold them square an incorrect reading will result.

Once the outside jaws are set, check to see if the inside jaws of the callipers pass over the fork flanks between the two ends of taper (2, Fig. 9239-EU) or between the end of taper and end of fork (3, Fig. 9239-EU) depending on how your fork was manufactured (check thickest

LIFTING MECHANISM PLATFORM FORK BLADES

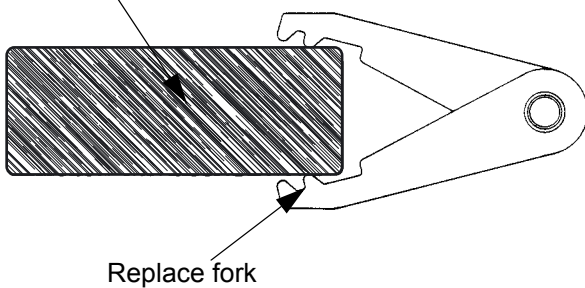


part of fork). If the inside jaws pass over the fork flanks, replace fork.



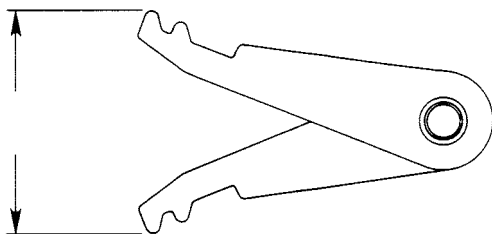
9239-EU

Fork blade cross section



9240-EU

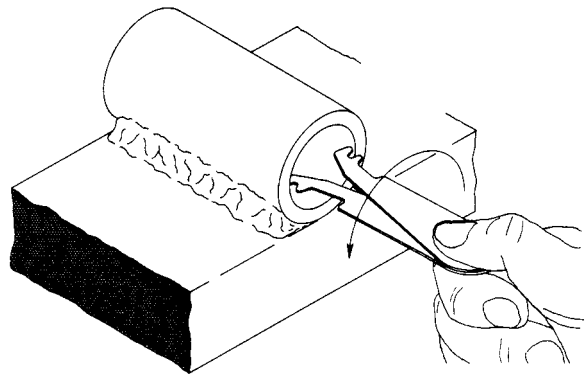
Mounting Support and Platform Bore Measurement.



9241-EU

To check for elongation (wear) of the mounting support and platform bore, the outside jaws of the fork wear callipers are used by rotating the legs of the callipers so that the jaws are on the outside (Fig. 9241-EU).

- Check the mounting support and platform bore by placing the outside jaws into the bore and locate the largest diameter of the bore by rotating the callipers 180°.
- Set the jaws to the feel of the bore by lightly tapping on them with a metal object. Be careful to hold the callipers square across the bore or an incorrect reading will result.



9242-EU

- After the jaws are set, remove callipers and using a measuring instrument such as a verniers or machinist six inch scale, measure across the outside jaws.

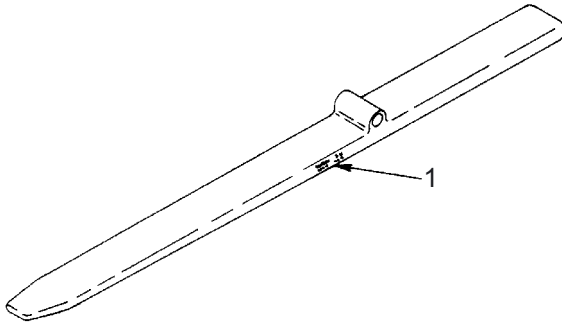
The maximum allowable measurement for the mounting support bore is 43.7 mm (1.72 inch) and 42.6 mm (1.68 inch) for the platform bore.



LIFTING MECHANISM PLATFORM FORK BLADES

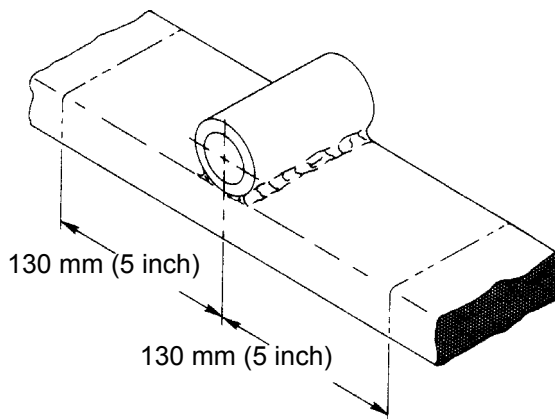
Overloading

Know the capacity of the forks and truck. The fork capacity and load center is stamped on the fork (see 1, Fig. 9244-EU). Overloading can cause permanent deformation or serious fatigue conditions.



9244-EU

Fatigue



9245-EU

The entire fork should be visually inspected for fatigue cracks each work day. Normally, a fatigue crack will start in an area about the mounting support of the fork.

Pay particular attention for cracks that transverse the fork in an area up to 130 mm (5 inch) either side of the mounting support.

Fatigue cracks are a sign that an area of the fork has weakened and the fork needs to be replaced. If a more accurate inspection is necessary, carry out a non-rup-

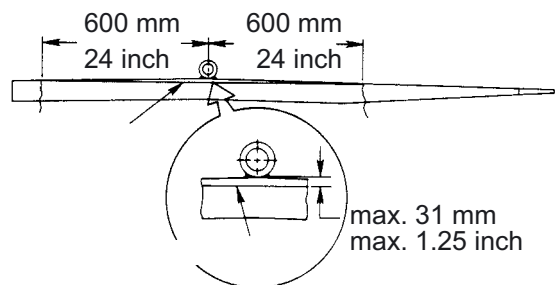
turing crack test (paint penetration process or Magnaflux®).

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 maximum deformation from fork straightness shall be less than 183°. Any angle greater will require fork repair or replacement. The fork manufacturer or repairman with the expertise of equal competence are the only parties that should attempt to make such repairs.

To check the fork for straightness, a cord string, carpenters chalk line or a straight edge 1 200 mm (4 feet) or longer can be used. For an example of checking fork straightness, a cord string will be used here (refer to Fig. 9247-EU).



9247-EU

Measure 600 mm (24 inch) from both sides of the centre of the mounting support and mark edge of fork.

Hold cord string taunt between these two points being sure the string at both points is even with the top of fork.

Measure the maximum perpendicular distance from the cord string to top of fork. If this measurement is greater than 31 mm (1.25 inch), the fork is deformed more than 183° and should be replaced.

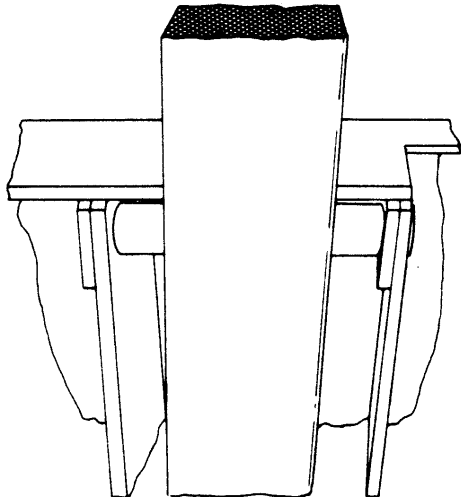
LIFTING MECHANISM

PLATFORM FORK BLADES



Hanger

Check for cracks or damage in the area of fork attachment. Check platform and fork rod for excessive wear or cracks. Repair or replace parts if necessary.



Bottom view of platform

9248-EU



CYLINDERS

Notes:

Safety

Warning!



Risk of serious injury from pressurized hydraulic oil.

Pressurized hydraulic oil can penetrate the skin. This is a serious medical emergency which requires immediate medical attention.

The skin will not show any obvious initial damage and the physical effects will not be manifested immediately. Seek medical assistance if your skin has been affected by pressurized hydraulic oil.

Always repair hydraulic components in a clean working environment.

Immediately protect cleaned and de-greased components with a thin coating of hydraulic oil. Use the same grade as is used in the truck.

Protect all components from re-contaminating until they are installed again.

Immediately seal any open hydraulic ports on repaired assemblies with filler plugs. This also applies to the open ports and lines on the truck when you remove any hydraulic components.

Do not refinish any cylinder surfaces! Replace any damaged components.

When carrying out repairs always replace all the seals in the assembly. Never recycle seals which have already been used.

For your personal protection:

- Depressurize the hydraulic system before starting assembly work on the hydraulic system.
- After carrying out assembly work carefully check to see that all ports are tightened before re-pressurising the system.
- Wear protective clothing, safety glasses and safety gloves when tracing leaks or bleeding the system.
- Use a piece of absorbent paper to trace leaks, never use your hands.
- Follow the hydraulic oil manufacturer's safety instructions when handling these oils.

General Instructions for Repairing Hydraulic Components

Hydraulic systems are sensitive to dirt.

Thoroughly clean any hydraulic components you have removed before dismantling them and placing them on a workbench.

CYLINDERS

ROD SEAL ASSEMBLY

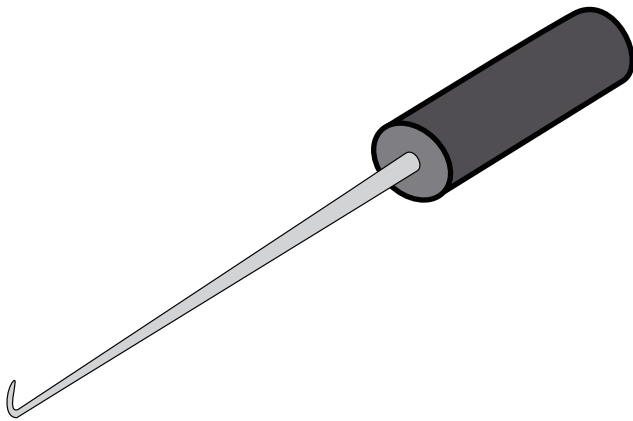


Rod Seal Assembly

General

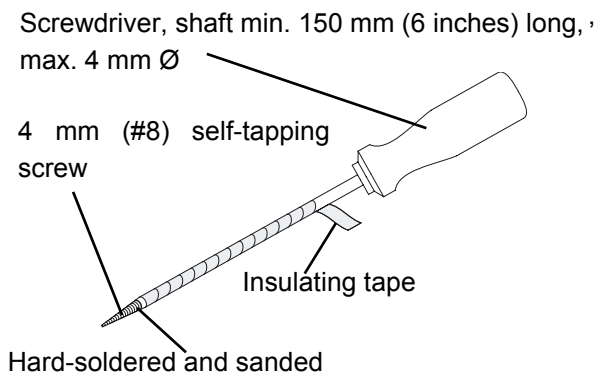
All tools and equipment used for rod seals must be burr-free and not have sharp edges. The tools should be made either of soft metal (aluminium, brass) or a suitable plastic.

Do not use hooks to remove seals. The same rule applies: Burr-free, rounded tips and made of soft metal to avoid damaging the seal seat.



MS-0000-500

Screwdrivers or similar tools will damage the seal seats and the seals. This will result in leaks.



MS-2232-016

To remove rod seals from the lift cylinder and the free-lift cylinder, you will require 2 specially produced tools (see Figure MS-2232-016).

If the seal has to be pushed over sharp edges, cracks or nicks, use appropriate protective devices.

We will now demonstrate 2 procedures – depending on the seal rod diameter – for ensuring safe assembly.

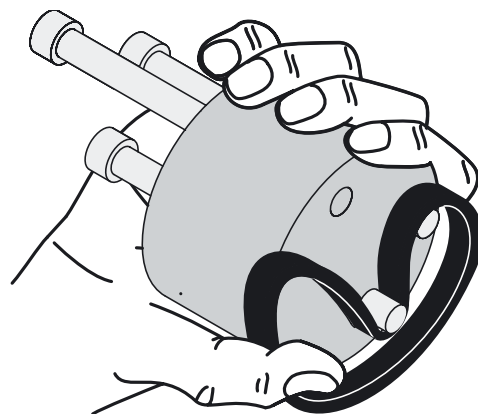
Large Rod Seal Assembly

Tools required:

- Tool body (outer diameter must fit the internal diameter of the cylinder cap).
- Three pins (1, 2 and 3). Pin (1) is fixed; pins (2) and (3) are moveable.

Assembly:

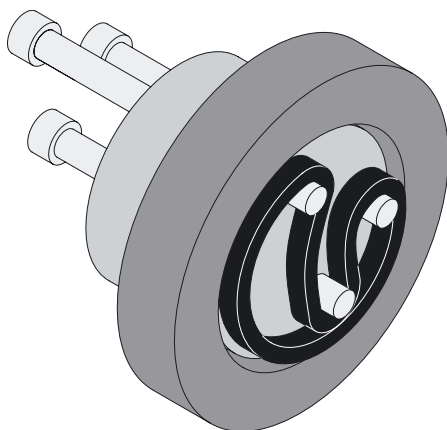
- Apply a thin coating of hydraulic oil to the rod seal and the seal seat in the cylinder cap.
- Place the rod seal over the fixed pin (1).



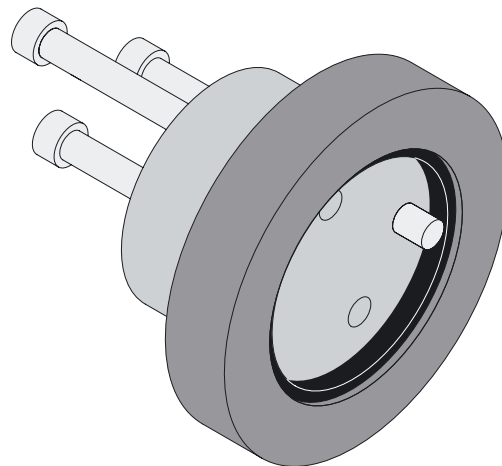
MS-2232-019

- Bend the rod seal under pin (2) (see Fig. MS-2232-019).

- Bend the loop created in this way so far up that pin (3) can be pushed into the loop.
- Now push the tool body into the cylinder cap until the rod seal is aligned with the seal seat (see Fig. MS-2232-020).
- Now pull back pin (2). The rod seal is now fully seated in the seal seat.

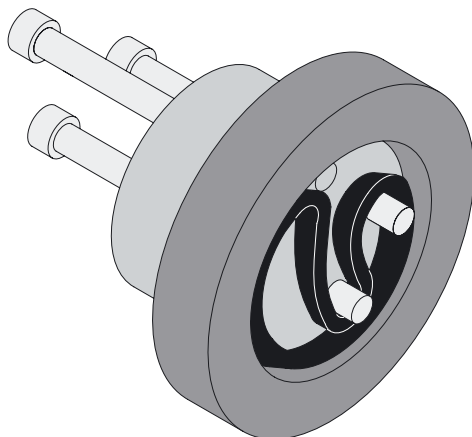


MS-2232-020



MS-2232-021

- Pull back pin (3). A section of the rod seal snaps into the seal seat (Fig. MS-2232-022).



MS-2232-022

- Pull the tool body out of the cylinder cap.

Small Seal Rod Assembly

Tools required:

- Groove aligning arbor. The outer diameter must fit the internal diameter of the cylinder cap. The arbor should end at the bottom of the seal seat.
- Arbor to drive in the seal.

Assembly:

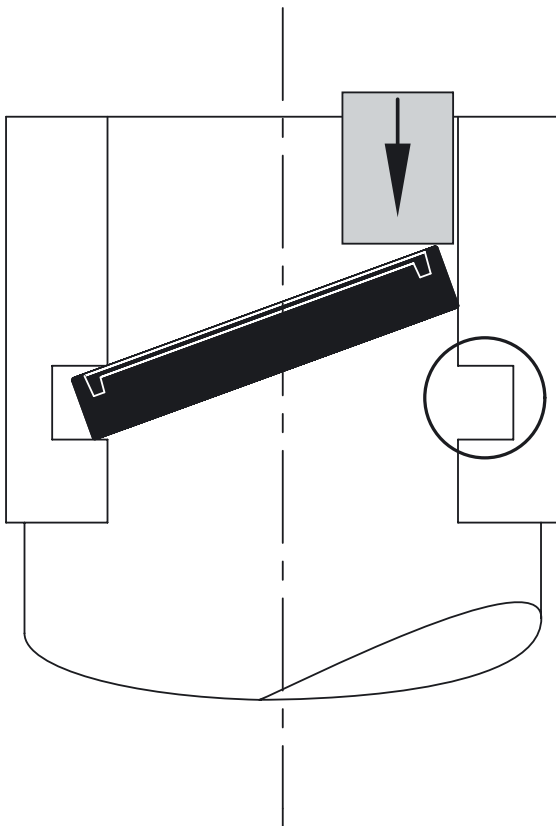
- Apply a thin coating of hydraulic oil to the rod seal and the seal seat in the cylinder cap.
- Place the cylinder cap onto the groove aligning arbor.
- Gently squeeze the rod seal together.
- Place the rod seal at one point of the seal seat.

CYLINDERS

ROD SEAL ASSEMBLY



- Press the rod seal and the arbor into the seal seat.

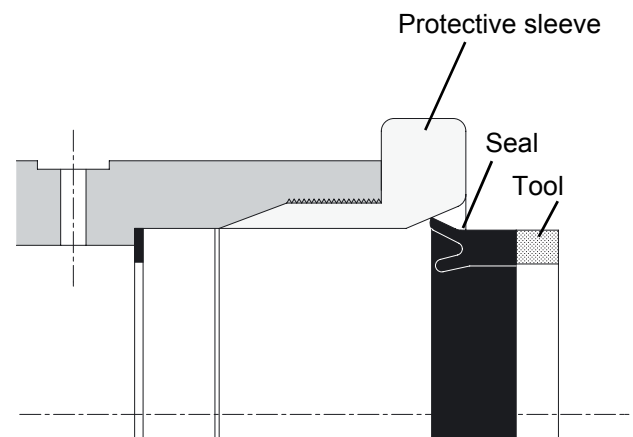


MS-2232-024

Rod Seal Assembly, Sealing Lip First

The sealing lip is sensitive and must not be damaged. You therefore require special protective sleeves when pushing the seal over the thread and holes.

Sealing lip assembly direction: Always to the pressure side!

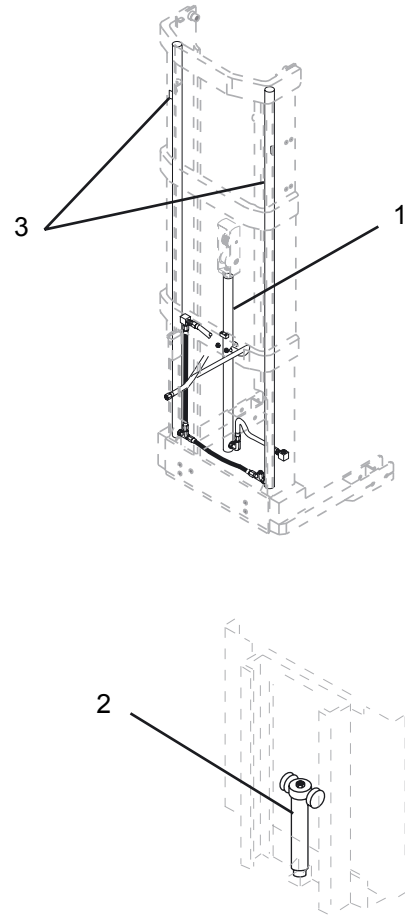


MS-2232-025

Maintenance

Mast, Free Lift and Auxiliary Fork Cylinders

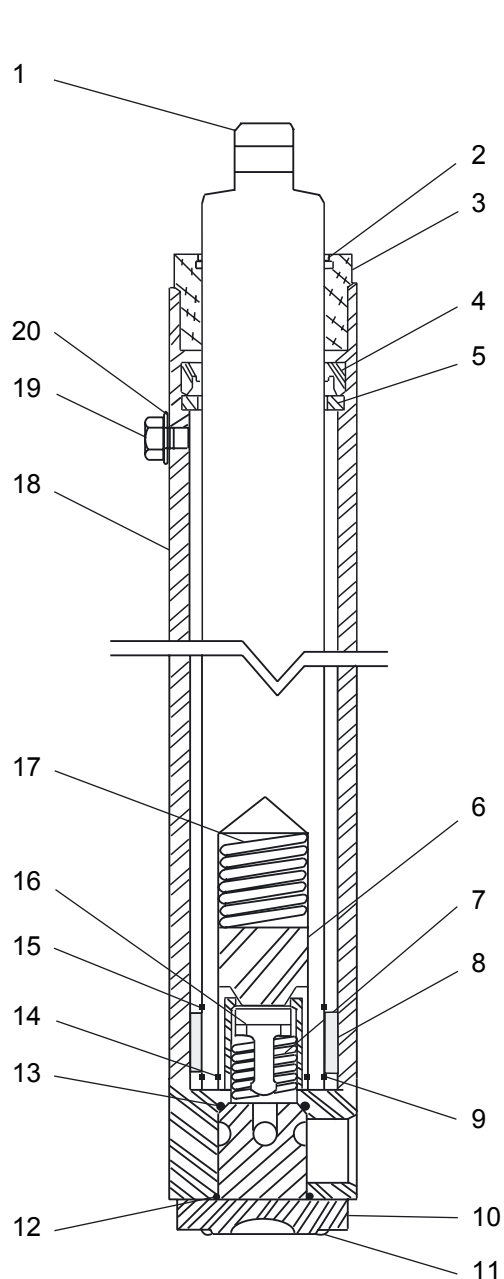
The free lift cylinder, mast cylinders and auxiliary fork cylinder (shown in Illustration 3742) are single acting ram type cylinders. When lift is selected, pressurized oil enters the bottom of the cylinders forcing the ram to extend. When lowering, the weight of the mast assembly platform or fork carriage and load forces the oil out to retract the cylinders.



3742

- 1 Free Lift Cylinders TT only
- 2 auxiliary fork Cylinder 1.0SP only
- 3 Mast Cylinder

CYLINDERS MAINTENANCE



3229

- 1 Ram
- 2 Wiper Ring
- 3 Cap
- 4 Rod Packing
- 5 Collar
- 6 Piston
- 7 Compression Spring
- 8 Bushing
- 9 Retaining Ring
- 10 Cap
- 11 Screw
- 12 O-Ring
- 13 O-Ring
- 14 Retaining Ring
- 15 Retaining Ring
- 16 Poppet
- 17 Spring
- 18 Cylinder
- 19 Bleed Screw
- 20 Seal

Located in the bottom of the lift cylinders are velocity fuses. These devices monitor oil flow. Should a break occur in a hydraulic line, excess oil flow from the cylinder will force the velocity fuse piston down blocking oil flow, thereby locking the ram in place.

Inspection

Before disconnecting battery and initial cylinder repair, a careful inspection should be made of the cylinder assembly throughout a complete lift and lower sequence. Check yoke area for signs of abnormal wear, damage, etc. Check rams for any signs of nicks, scratches, surface imperfections, etc. that allow abnormal leakage, improper cylinder operation or create seal damage. Check wiper rings and complete cap area for component wear and/or leakage that is abnormal.

Warning!

AVOID HIGH PRESSURE FLUIDS—Escaping fluids 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 an excessive amount of hydraulic oil is evident on the top of the cylinder where the ram exits 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 from the cylinder tube or truck. Refer to ACCESSING ROD PACKING and ROD PACKING REPLACEMENT located in this section.

Disassembly

Great care and cleanliness should be exercised in the disassembly and assembly of any hydraulic cylinder. Wipe all surfaces clean of dirt and oil before attempting disassembly.

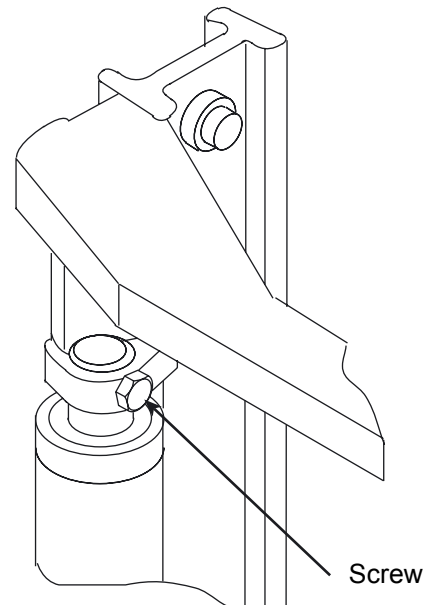
Caution!

When cleaning piston, be sure to clean seal seating areas. Protect eyes and face when using compressed air.

Care should be taken when removing the ram from the cylinder to prevent damage. After cylinder components are disassembled and seals, o-rings and wipers are removed, thoroughly wash all metallic parts in solvent and blow dry with low air pressure. As the cylinder is repaired, be aware of component part condition. Replace a worn or damaged part. In addition, correct or replace a part that may be causing other premature wear. If slight scoring of the tube and/or ram is evident, sand with aluminum oxide cloth or honing tool until high areas are removed. Heavily scored components must be replaced. After all parts are inspected, wash all cylinder components in a good grade solvent and dry with low pressure air. Place washed components in a clean container until reassembly.

Accessing Rod Packing- Mast Cylinder

1. Disconnect battery and chock load wheels.
2. Remove screw located at the top of mast cylinder ram. See Illustration 3262.



3262

3. Attach a hoist to the top cross brace of the second stage mast and raise high enough for easy access to cylinder cap. Block mast.

CYLINDERS

MAINTENANCE



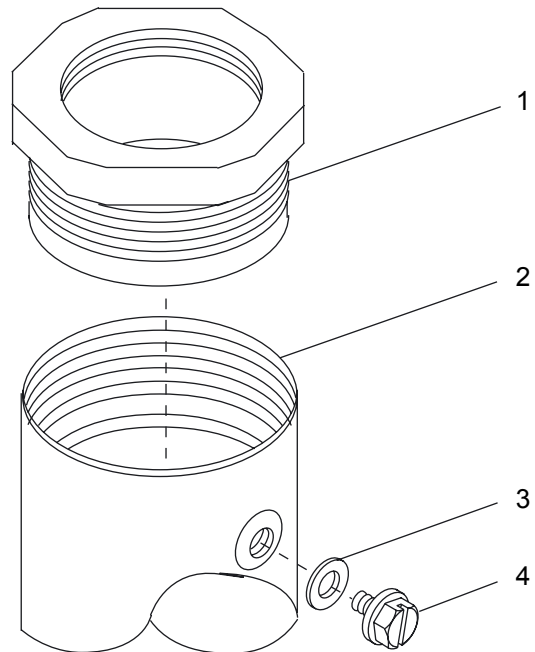
Accessing Rod Packing - Free Lift Cylinder

1. Using a hoist, raise platform approximately 76 mm (3 in.), disconnect battery and chock load wheels.
2. Place blocks under each side of platform.
3. Disconnect chains from the front of cylinder.
4. Remove screw from yoke. Lift yoke from cylinder ram and set aside.

Caution!



Be careful not to “kink” control cables or hydraulic hoses.



0388

Accessing Rod Packing- Auxiliary Fork Cylinder

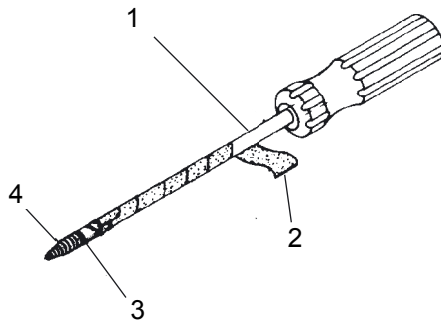
1. Raise the fork carriage approximately 915 mm (36 in.), disconnect battery and chock load wheels.
2. Place blocks under each side of the fork carriage.
3. Remove screw from the top of the cylinder.

Rod Packing Replacement

1. Remove bleeder screw.
2. Disassemble the cap from the top of the cylinder. See Illustration 0388.

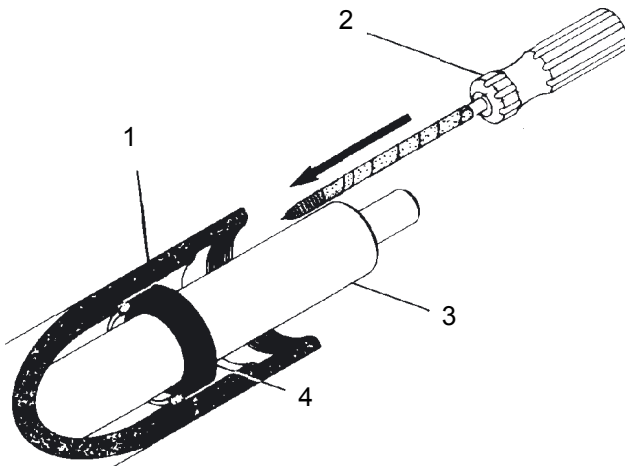
- 1 Cap
- 2 Cylinder Tube
- 3 Seal
- 4 Bleed Screw

3. The packing can now be removed. To facilitate packing removal, a pair of special tools can be made. Refer to Illustration 0390S. To make these tools, weld or braze a headless No. 8 metal screw (4 mm self-tapping) to the end of a screwdriver. The screwdriver must have at least 152 mm (6 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.). Wrap the shank with electrical tape from the tip of the screw to the screwdriver handle. This will prevent scratching of the cylinder tube or the ram.



0389S

- 1 Screwdriver 150 mm (6 in.) Shaft Length (MIN.)
 - 2 Tape
 - 3 Weld, Grind off Excess Max. Dia. of 4 mm (5/32 in.)
 - 4 No. 8 Metal Screw Headless (4 mm Self-Tapping)
4. Insert the tools between the ram and the cylinder walls, 180° apart, and screw into the face of the packing (See Illustration 0390S). After the threads are sufficiently secured into the packing, pull evenly on the screwdriver handles until the packing is removed.



0390S

- 1 Cylinder Tube
- 2 Seal Pulling Tool
- 3 RAM
- 4 Seal

Information



Extreme care should be taken to prevent damage to cylinder wall and ram assembly.

At this time, the wiper ring should also be removed from the cap since rod 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 installing new seals.

Caution!



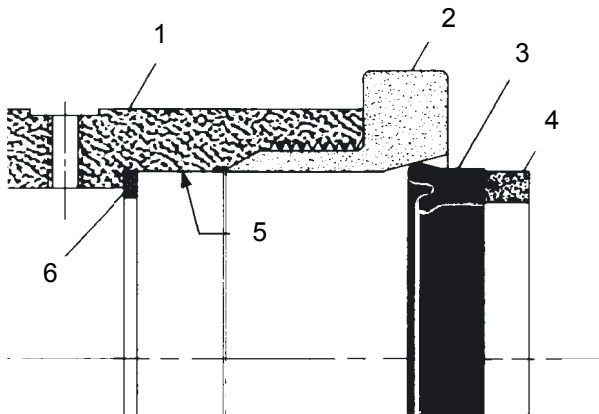
Close inspection of seal seating critical areas should be made before the new seal is installed. Your seal failure may not have been caused by a worn seal, but rather by burrs, nicks and dirt located on the seal seating area, causing the seal to deform and lose its sealing ability.

5. Lightly apply clean hydraulic oil to new seals and seal contact areas of cylinder and installation tools. Install rod packing in cylinder, "lip" first. A sleeve similar to that shown in Illustration 0391 should be used to protect the seal from damage on threads and shoulders.

CYLINDERS MAINTENANCE



Mast Cylinder Removal

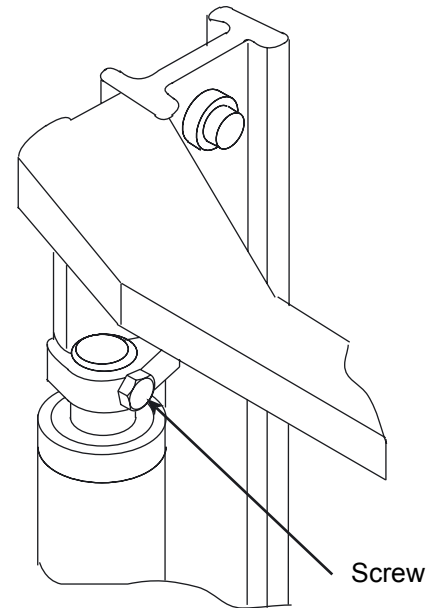


0391

- 1 Cylinder Tube
- 2 Sleeve
- 3 Seal
- 4 Forcing Tool
- 5 Critical Seal Seating Area
- 6 Collar

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. Crown has sleeves (Poly-Pak Seal Tools) available for installing new seals. Refer to exploded view of cylinder parts breakdown (Section 08.1 or 08.3) for correct seal tool.

6. Install wiper ring and assemble cap to cylinder.
7. Apply hydraulic sealant (061004-023) to bleed screw threads and install screw.
8. Connect chains and install yoke.
9. Cycle cylinder to check operation and leakage.
10. Bleed air from cylinder previous to placing truck back into service.



3262

1. Disconnect battery and block load wheels.
2. Remove screw located at the top of mast cylinder ram.

3. Attach a hoist to the top cross brace of the second stage mast and lift mast to approximately 1524 mm (60 in.). Block mast.

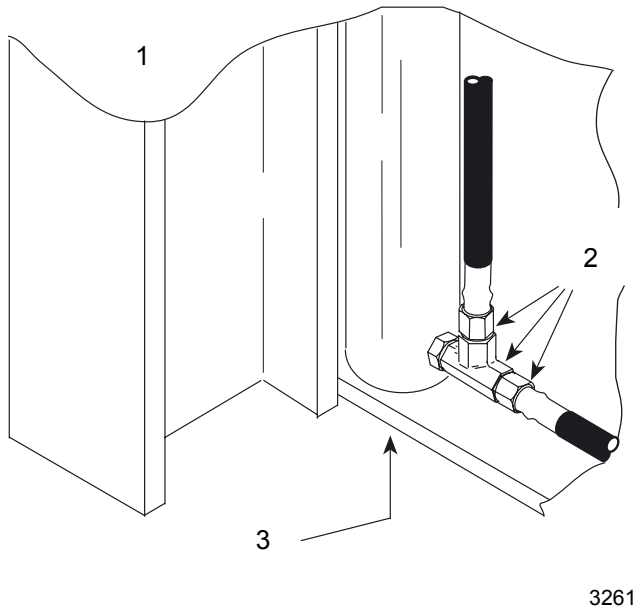
Warning!



Wear appropriate safety items, such as safety glasses and shoes, whenever performing maintenance work. To avoid injury, do not place fingers, hands, arms, or feet through mast or position them at pinch points.

Make sure lifting device is sufficiently rated to lift various parts of the mast sections either individually or as a group. Make sure that the blocking material is strong enough to withstand the weight. Never work under or around a truck that is not properly blocked.

4. Disconnect hydraulic hoses and cylinder bolts at bottom of cylinder. Be prepared to catch hydraulic oil.



- 1 Part of Mainframe
- 2 Remove hoses and fittings
- 3 Remove bolts

5. Attach hoist to cylinder to secure. Remove control cable and hose guides.

6. Remove cylinder.

Auxiliary Fork Cylinder Removal

1. Disconnect battery and chock load wheels.
2. Raise the fork carriage approximately 915 mm (36 in.) and place blocks under each side of the platform.
3. Attach hoist to the fork carriage.
4. Remove chains from the front of the fork carriage assembly.
5. Remove forks.

6. Slide fork carriage down and out of the carriage slot.
7. Remove the screw from the underside of the cylinder, holding the cylinder to the platform.
8. Remove the two screws from the bracket in the center of the cylinder.
9. Remove cylinder.

Free Lift Cylinder Removal

1. Using a hoist, raise platform approximately 76 mm (3 in.). Disconnect battery and chock load wheels.
2. Place blocks under each side of platform.
3. Disconnect chains from the front of cylinder. Refer to Illustration 3741.
4. Remove screw from yoke. Lift yoke from cylinder ram and set aside.

Caution!



Be careful not to "kink" control cables or hydraulic hoses.

5. Attach hoist to cylinder to secure and disconnect hydraulic hoses at bottom of cylinder.
6. Disassemble cylinder mounting bolts located at the middle of and below the cylinder. Refer to Illustration 3741.
7. Remove the cylinder.

CYLINDERS MAINTENANCE



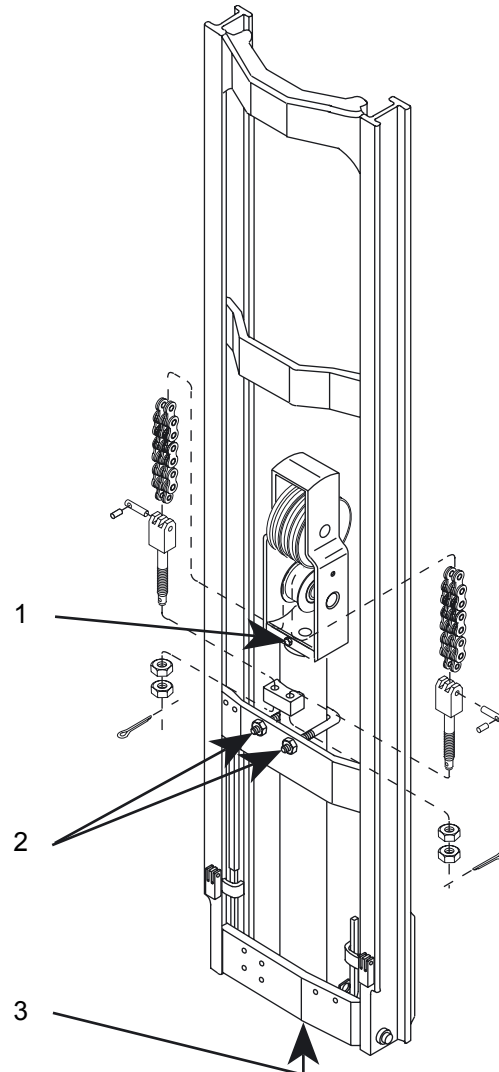
Free Lift, Mast and Auxiliary Fork Cylinder Assembly

Before assembling cylinder, coat all seals, ram, tube, etc. with clean hydraulic oil. When installing ram into cylinder tube, never allow ram to come in contact with any sharp edges. Extreme care must be taken not to damage seals or the surfaces they operate on. Apply thread locking adhesive (061004-026) to velocity fuse cap screws.

Free Lift, Mast and Auxiliary Fork Cylinder Installation

To install cylinder, reverse removal procedures. Apply thread locking adhesive (061004-019) to lower cylinder mounting bolts.

After the cylinder is installed on the truck, but before the truck is put back into operation, air must be bled from the hydraulic system. Without a load on the forks, raise platform approximately 150 - 305 mm (6 - 12 in.) to pressurize the cylinder. Loosen the small bleeder screw, located at the top of the cylinder until all air escapes and only a solid stream of oil continues to flow from the screw. Tighten the screw and completely lower mast and platform to relieve all pressure in cylinder. Loosen bleed screw 2-3 revolutions. Remove oil from threads with degreaser and dry with low pressure air. Apply hydraulic sealant (061004-023) to threads and secure screw.



3741

- 1 Yoke Mounting Screw
- 2 Cylinder Mounting Screws
- 3 Cylinder Mounting Screw



PLATFORM

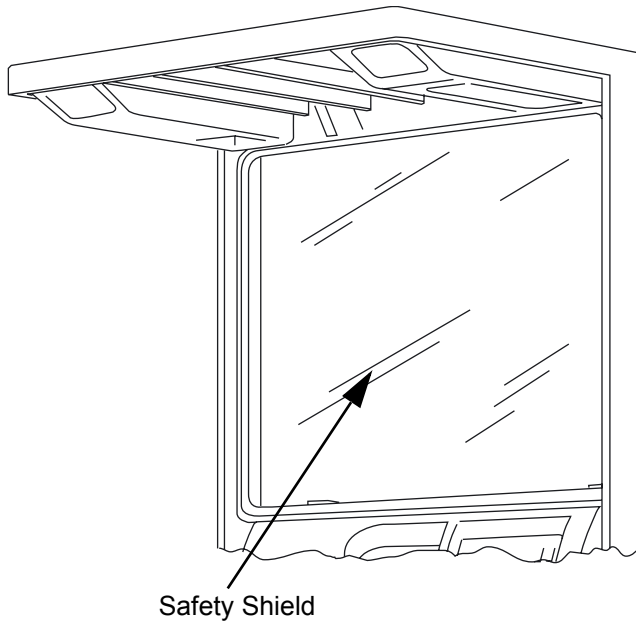


Notes:



PLATFORM SAFETY SHIELD INSTALLATION

Safety Shield Installation



4018-EU

To perform maintenance to certain areas of the mast or platform assembly, it may be necessary to remove the safety shield.

The safety shield is mounted in rubber molding so that it is fully suspended. The molding and safety glass should be assembled as shown in Fig. 2942S-EU.

The wedge locking strip must be pressed into the open groove to secure the glass in place.

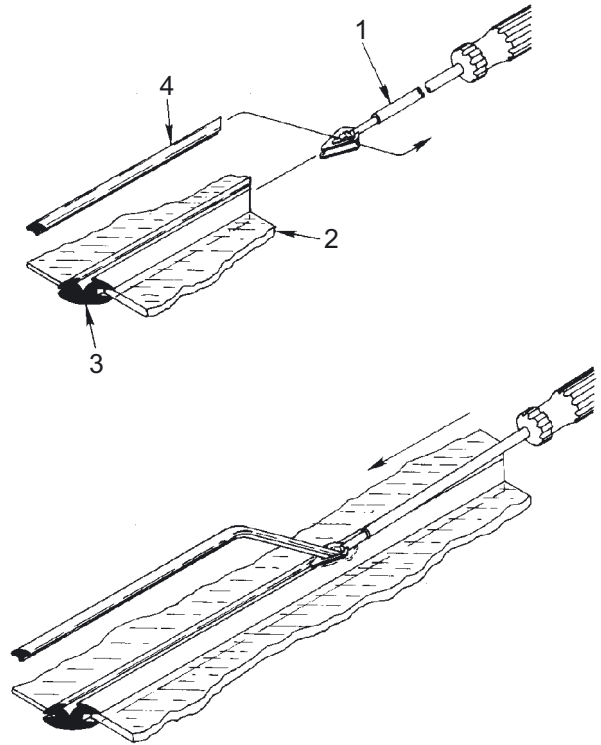
A special tool (Part No. 103792) will greatly aid in the installation of the wedge locking strips.

To use the tool, the strip must be fed through the throat of the tool head (as shown in Fig. 2942S-EU), leaving approximately 25 mm (1 inch) of strip exposed beneath the head.

The tool should then be inserted into the "V" slot in the main molding body.

Once started with both the strip and body ends flush, clamp the end with your thumb and push the tool through the slot.

If the tool seems to push relatively hard, heat should be applied to the molding. This will liquefy the film which covers the molding and act as a lubricant.



2942S-EU

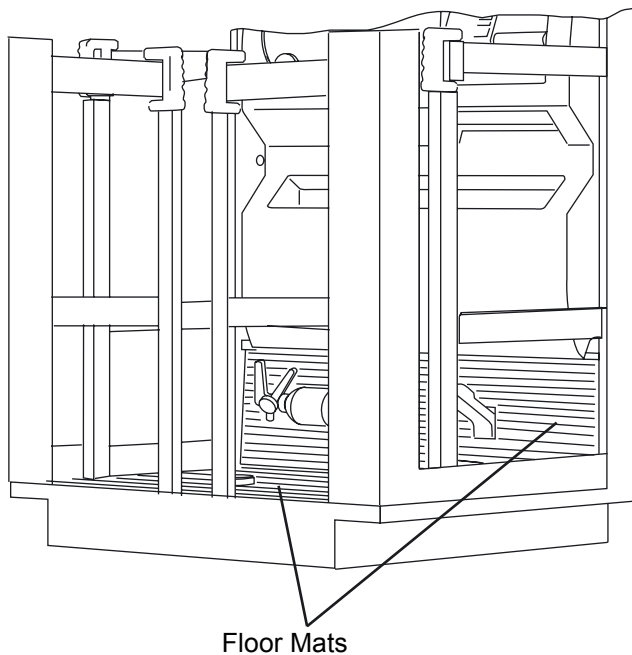
- 1 Wedge Insertion Tool (Part No. 103792)
- 2 Glass
- 3 Main Moulding Body
- 4 Wedge Locking Strip

PLATFORM

FLOOR MAT REPLACEMENT



Floor Mat Replacement



3789-EU

Should a mat need replacement, thoroughly clean the platform's floor surface.

- Apply a thin coat of cement (Part No. 061007-001) to the back side of the mat and to the platform floor.
- Do not apply cement to the back side of the mat if it is a sponge type surface, rather apply a heavier coat to the platform floor.
- Allow the cement to dry until it becomes tacky (approximately 10 - 15 minutes).
- Place the mat in position and apply pressure to insure good contact between surfaces.

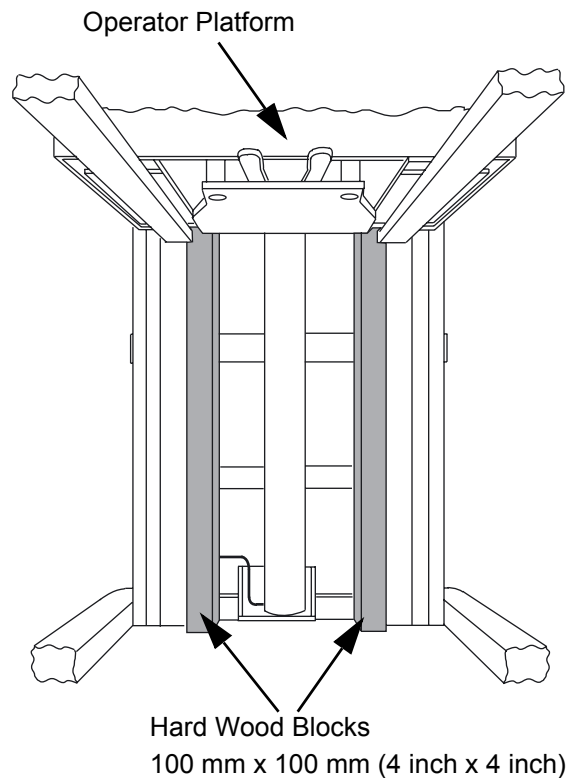
Forks

Fork Inspection

Warning!



When performing any type of inspection, adjustment, maintenance, etc. beneath the platform, blocks must be positioned under each side of the platform, along the mast channel. Refer to Fig. 3247-EU



3247-EU

Visually inspect forks for cracks, deformation, proper installation, etc. The platform needs to be raised accordingly to inspect the portion of fork beneath the platform. See chapter "Lifting Mechanism" for additional information.

Fork Replacement

Removal

- Raise platform approximately 600 mm (2 ft.) and block securely with hardwood blocks.
- Wrap a chain as tight as possible around floor of platform. As the fork pins are removed this chain will help support the heel of the fork.
- Form a basket hook-up with a sling about the area of the fork that will balance the fork weight evenly.
- Remove retaining ring from end of fork rod.

Caution!



Shorter tapered fork lengths will tend to be heavier in the heel area. Care must be taken to handle fork safely after removal.

- Raise the hoist to assume the fork weight and carefully remove fork pin.

Installation

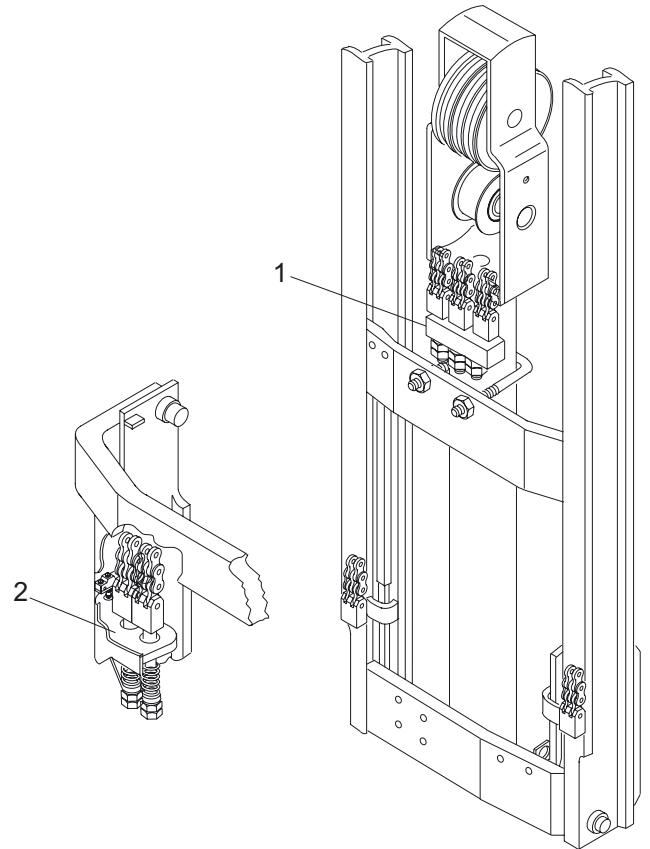
- Fork installation requires a balanced fork hook-up to the hoist with a basket type sling arrangement that allows for the fork to be raised safely into position.
- Install fork pin and retaining ring to fork pin.
- Shims are used in the heel area of the fork to obtain the proper position of the fork tip. The fork tip height should be the same as fork height at the rear edge of the platform. Be sure measurement is taken on a level surface.
- Apply thread locking adhesive to the screws securing shims to platform.

- After forks have been properly inspected, replaced etc. remove chain from around floor of platform and blocks from under platform.

- Raise the platform clear of blocks for easier block removal.

Lower platform completely and measure fork height from floor: **Fork height should be approximately 75 mm (3 inch) from top of fork to floor at maximum lowered position.**

The lift chain will have to be lengthened to lower fork height or shortened to raise fork height.



3788-EU

On the TL mast, fork height is adjusted at the chain anchors (2, Fig 3788-EU) located close to the top of the main frame on both sides.

PLATFORM PALLET GRAB (OPTION)



Adjustment for fork height on the TT mast is made at the chain anchors (1, Fig 3788-EU) located on the free lift cylinder.

With the platform totally lowered, adjust the chain length: **Fork height should be maximum 75 mm (3 inch) from top of fork to floor at maximum lowered position.** If possible, allow 6 mm (0.25 inch) clearance between underside of operator platform and top of outrigger.

Pallet Grab (Option)

The pallet grab is located beneath the operator platform. Mechanical linkage connects the mounting plate located beneath the platform to the operator release handle located below the control module.

The pallet grab is foot applied and hand released. The platform must be blocked securely (see page 371, Fig. 3247-EU) with hard wood 100 mm x 100 mm (4 inch x 4 inch) during any maintenance procedure related to the pallet grab.

Release Handle Adjustment

The release handle is in a near horizontal position and should be parallel to cutout in console when the pallet grab is not being used (pedal in the “up” position).

To maintain this position an adjustment can be made to the push rod connecting the handle to the latch located on the power unit side of the platform.

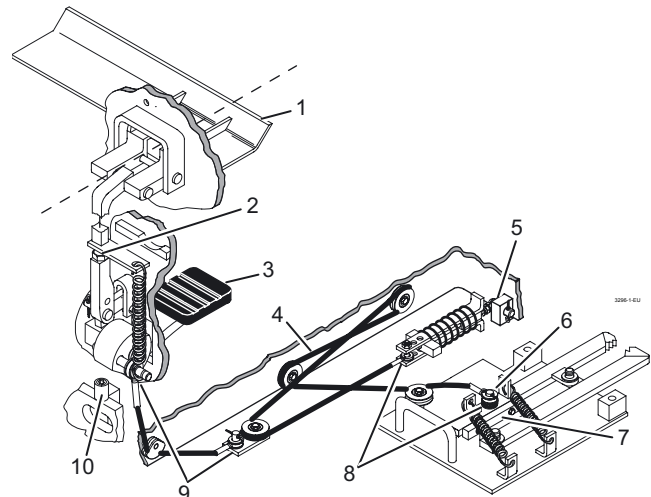
Remove the pin from the connecting rod and latch. Loosen “jam” nut securing the push rod end to the push rod. Turn rod end counter-clockwise to lengthen push rod and this will rotate the release handle down. Turn rod end clockwise to shorten push rod and this will rotate the handle up.

Pedal Adjustment

The pedal has spring tension applied to it constantly during normal released and applied conditions.

When the pedal is in the “up” or released position, the backside of the pedal is contacting a plastics stop.

- **The plastics stop prevents metal to metal contact between the pedal and the platform framework. The plastics stop has a centre mount bolt that can be removed with a 5/32 inch hex wrench key. Slide the plastics stop off the bolt and install a new replacement plastics stop if worn.**



3296-01-EU

- 1 Release Handle
- 2 Release Handle Adjustment
- 3 Pedal
- 4 Cable (F)
- 5 Pedal Adjustment (lock nut)
- 6 Point G
- 7 Plastic Stop
- 8 Cable (F) Anchor Points
- 9 Cable (E) Anchor Points
- 10 Plastic Stop

The pedal position, in the released position, can be adjusted somewhat to make sure it latches properly. Dur-



PLATFORM PALLET GRAB (OPTION)

ing normal operation a slightly lower, released pedal position may develop that could make a pedal latch impossible.

Refer to Figure 3296-01-EU on page 372. To adjust pedal height slightly, loosen the lock nut and turn nut clockwise until pedal height and operation is correct.

The adjustment must be made from beneath the floor of the platform. Be sure platform is blocked securely with hardwood blocks before performing work under platform. If correct pedal height can not be achieved, through this adjustment, component parts have worn and replacement is recommended.

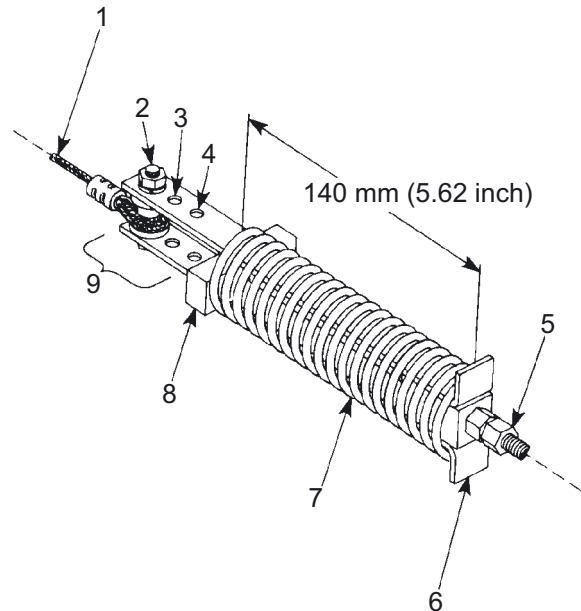
Pallet Grab Removal

Should cable "E" or "F", springs, pulleys, etc (see Fig. 3296-01-EU, page 372) need replacement the pallet grab can be removed from the floor of the platform by removing the two hex socket head bolts near the rear of the platform with a 3/8 inch hex wrench key.

Hold the pallet grab in position until both bolts are removed. The grab can be rotated down on the "L" shaped mounting bracket located on underside of platform floor.

Be careful that the grab does not slip from this bracket. Remove cotter pin, flatwasher and cable from point (G) in Fig. 3296-01-EU, page 372. The pallet grab can now be moved to a suitable work area.

When reassembling pallet grab the override spring, in the grab released position should measure 140 mm (5.62 inch) overall length. Refer to Fig. 2945S-EU.I



2945S-EU

- 1 Cable "F"
- 2 1st cable mounting hole
- 3 2nd cable mounting hole
- 4 3rd cable mounting hole
- 5 Lock nut
- 6 Retainer
- 7 Override spring
- 8 Rod
- 9 Cable mounting holes

Attach cable "F" to the 1st hole in the end of the retainer. If the cable has stretched slightly or a replacement cable has been installed, the 2nd or 3rd hole can be used to maintain the proper spring length and cable tension etc.

Two cables are used in the pallet grab mechanism, they are referred to as cable "E" and "F".

Cable "E" is the shorter of the two with approximately 370 mm (14.5 inch) overall length. Cable "F" is the longer cable, approximately 1 345 mm (53 inch) over-

PLATFORM PALLET GRAB (OPTION)



all length. Refer to Fig. 3296-01-EU, page 372 for cable connections, routing, etc.

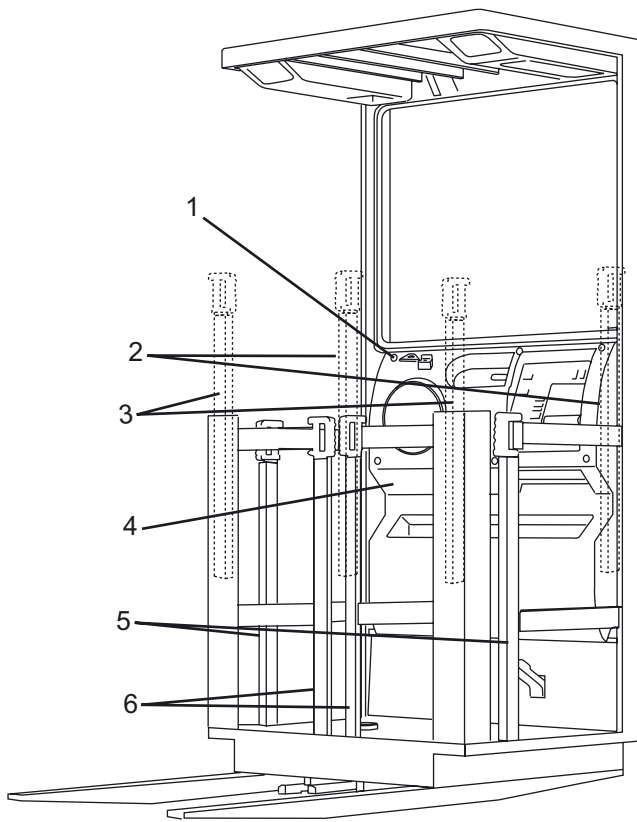
A plastic stop is located at the rear of the right pallet grab arm and should be inspected for wear, damage, etc. The stop is secured in position with two bolts for simple installation or removal as necessary.

Be sure all springs, retainers, rollers, etc. are positioned and working properly before installing mounting plate with associated parts to the underside of the platform.



PLATFORM OPERATOR COMPARTMENT GATES

Operator Compartment Gates



3861-EU

- 1 Console mounting screws
- 2 Side gates upright
- 3 rear gates upright position
- 4 Console
- 5 Side gates down position
- 6 Rear gates down position

The stockpicker platform has operator compartment gates that can be rotated “up” to allow for easy entry or exit when the platform is in the “lowered” position.

The sidegate upper pivot shaft actuates switches as it is rotated. The truck will not travel or raise until the gates are in the “down” position.

When raising the sidegates, the lower pivot shaft has a coil spring attached that aids the operator. A plastic stop, located on the floor of the platform directly below

each gate upright, acts as a rest when the gates are “down”.

To gain access to the sidegate upper pivot shaft, switches, etc. the console must be removed from the platform. Refer to chapter “*Electrical System*” for switch information.

To remove the console, remove the 6 console mounting screws shown in Fig 3861-EU, page 375.

On 1 370 mm, 1 525 mm and 1 625 mm (54 inch, 60 inch and 64 inch) wide platforms two additional covers must be removed. They are located on both sides of the console and are held in place by four screws, two on top and two on the bottom of each cover.

PLATFORM

OPERATOR COMPARTMENT GATES



Spring Replacement

Removal

Danger!

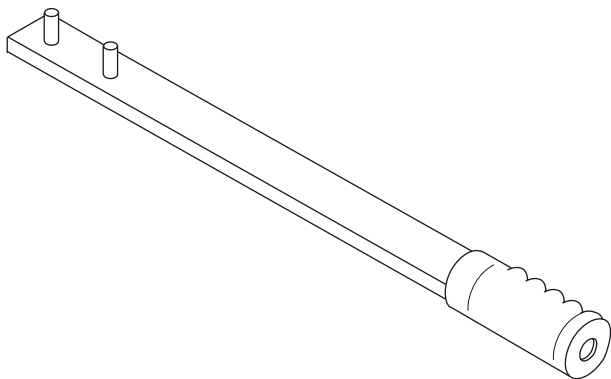


Pretensioned spring.

You could be seriously injured if you don't follow the instructions for disassembly.

To replace a weak or broken coil spring on the bottom pivot shaft, either left or right, the following information must be followed.

Use only a face spanner wrench Part No. 104712 that has two 5/32 in. pins, at a spread of 15/16 in. Refer to Fig. 2946-EU.



2946-EU

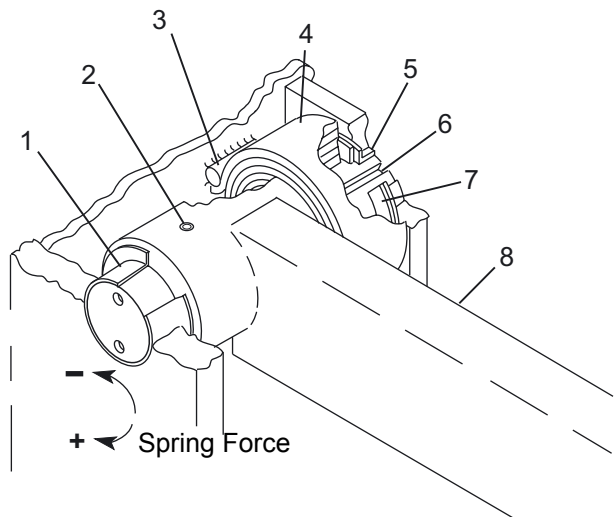
The lower pivot shaft is designed to accept the spanner wrench Part. No. 104712. With the gate in the down position, place spanner wrench on the lower pivot shaft.

- Using a hammer and 3/16 Inch Ø punch to drive the roll pin partially 12 - 19 mm (1/2 to 3/4 inch) out.
- Keep spanner wrench on the shaft, remove punch and rotate gate to up position.

Be prepared: In the next step, as the roll pin is removed, the spring tension will be transferred to the spanner wrench! You will have to assume the load when the roll pin is pulled out.

- Pull roll pin from shaft making sure that spanner wrench is still on shaft.
- **Using spanner wrench rotate shaft until all spring tension is relieved.** Remove shaft and note the position of spacers, bearings, etc. for correct position at assembly.

Installation



3301-EU

- 1 Bushing
- 2 Roll pin
- 3 Spring stop
- 4 Torsion spring
- 5 Bushing
- 6 Shaft "V" slot
- 7 Shim
- 8 Gate

- Refer to Fig. 3301-EU. Position coil spring with outer flange next to small stop welded to platform wall that keeps the coil spring from rotating when all parts are assembled properly.



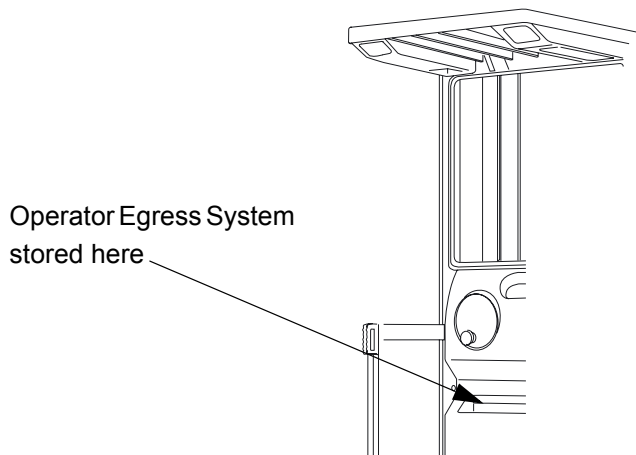
PLATFORM OPERATOR EGRESS SYSTEM

- After all parts are in proper position and the gate is held in the “up” position, use spanner wrench to turn the pivot shaft to increase spring force until the roll pin can be installed through the lower gate and the pivot shaft.

The pivot shaft will need to be turned approximately 40° to 45° to allow for roll pin installation with the gate in the “up” position.

Operator Egress System

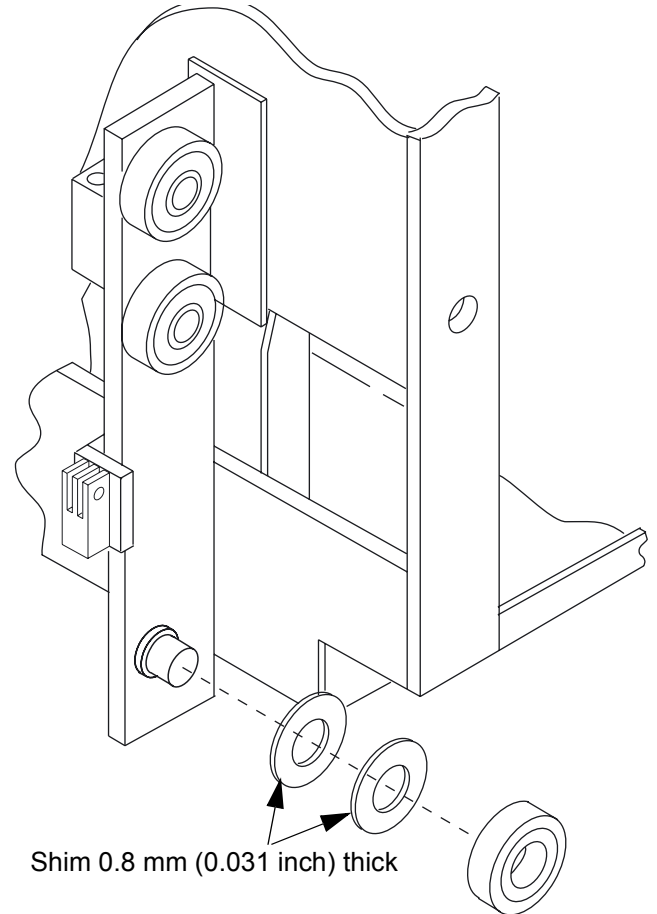
The Operator Egress System consists of a harness & rope assembly. This unit is for use by the operator in the event of his being trapped on an elevated platform in an emergency situation. The Operator Egress System is packed in a clear plastic bag and is stored in the tray beneath the console. Instructions for use are attached to the assembly.



4017-EU

Platform Removal & Shimming

Basics



3307-EU

The mast on the SP 3000 is designed to be at its tightest point when fully extended and at its loosest when fully lowered.

This allows the mast and platform rollers to move freely as the mast extends while providing maximum stability when fully extended.

Each mast is designed to be wider at the bottom than the top. If the mast were shimmed so that it was tight when fully collapsed, it would not fully extend because of mast channel to roller binding causing detrimental

PLATFORM

PLATFORM REMOVAL & SHIMMING



effects to the mast channel. The mast should only be checked for tightness when near or at full extension.

The shims used on the SP 3000 truck are 0.8 mm (0.031 inch) thick. Refer to *Chapter 7.0* of this manual for mast shim procedures.

Platform Removal and Shimming, TL Mast

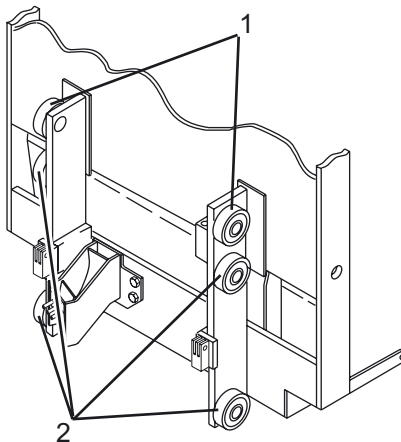
Warning!



Danger for live and limb.

Do not place any part of your body through mast or at a pinch point.

Always block mast stages and platform before performing maintenance work in this areas.



3790-EU

- 1 Not adjustable column rollers
- 2 Adjustable column rollers

3. Use a pry bar to shift the platform to one side, this will force the opposite side tight against the mast channel. Once the platform has shifted, retain slight pressure to hold the platform in position. This is necessary to seat each platform roller against the roller stud shoulder to allow for an accurate measurement.
4. Measure the distance between the channel and the roller, 10 mm (3/8 inch) from the channel face. Always measure the side the roller is canted toward. A clearance of 0 mm - 0.75 mm (0 inch to 0.030 inch) should be obtained.
5. Check only the centre and lower platform rollers since the top rollers are not adjustable. If the dimension is greater than 0.75 mm (0.030 inch), another shim will need to be added behind the roller.

It will be necessary to remove the platform from the mast to shim platform rollers. If the dimension is zero and it does not appear to be tight, proceed to check the remaining platform column rollers.

Removing the Platform for Shimming

Warning!



Make sure lifting devices used are sufficiently rated to lift various parts of the mast sections and platform either individually or as a group. Make sure that the blocking material is strong enough to withstand the weight. Never work under or around a truck that is not properly blocked.

1. Lower the second stage and block both sides of the mast when it is 800 mm or more (31 inch)

Shimming

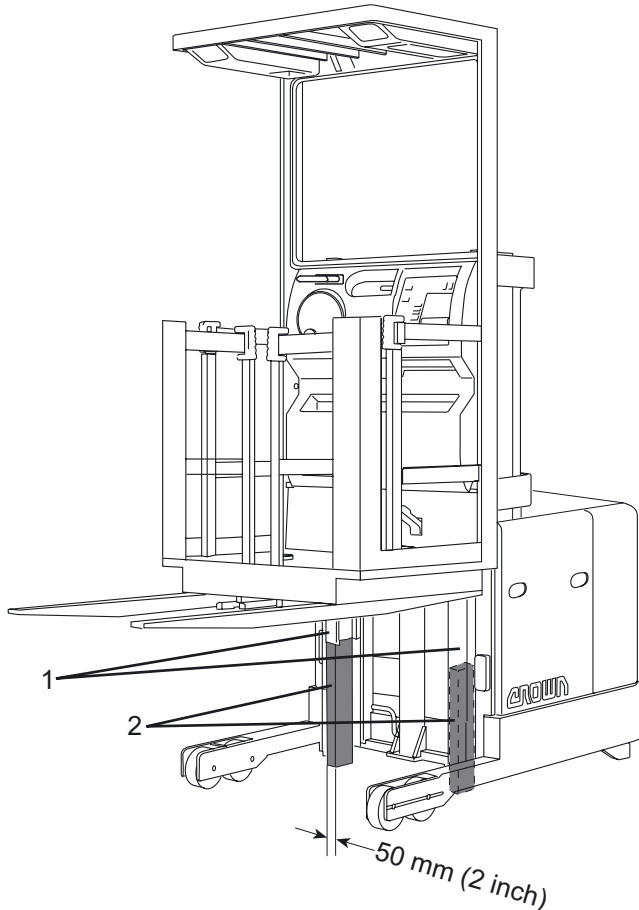
1. Raise platform to full extension.
2. Use a man-carrying platform to get into position to measure the platform roller clearance.



PLATFORM PLATFORM REMOVAL & SHIMMING

above the floor. Use hard wood blocks with 50 mm x 100 mm (2 inch x 4 inch) cross section.

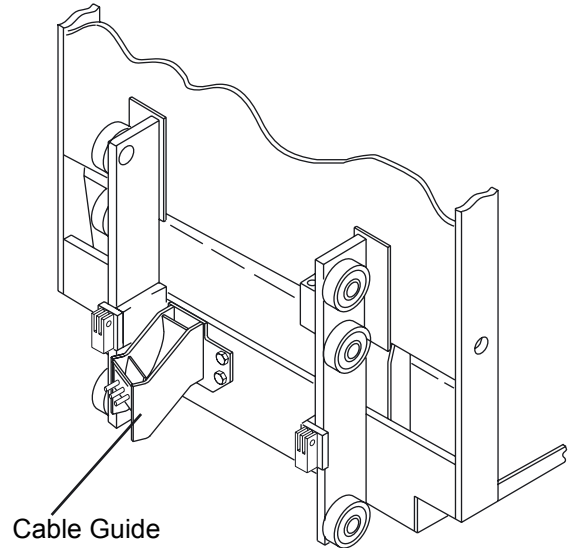
also have to disconnect all electrical connections at the platform.



3793-EU

- 1 Mast stages
- 2 Hard wood block 100 mm x 50 mm (4 in. x 2 in.)

2. Disconnect the battery.
3. With a hoist raise the platform approximately 3 in. (75mm) to allow the mast chains to slack. Note that the combined weight of the platform and forks will be approximately between 500 kg (1 100 lbs.) and 650 kg (1430 lbs.).
4. Remove the cable guide (Fig. 3794-EU) located at the bottom of the platform. *Important: If you want to remove the platform entirely from the mast, you*



3794-EU

5. Disconnect the mast lift chains from the platform by removing the chain pins and secure with tie straps.
6. With hoist lower platform to floor making sure that cables, hoses, or lift chains do not become tangled with platform to prevent any damage to them.
7. Slide platform away from mast approximately 125 mm (5 in.) to fully expose platform rollers.
8. Remove rollers and note shims on each stud. Remove the rollers carefully, many times the shims will cling to the back of the roller and fall off after removal.
9. Shim the platform rollers as required. Please note that it is best to shim the platform rollers evenly. That is, an equal number of shims on each roller. However, if this is not possible follow the shim procedures as described in *Chapter 7*.
Example: Two shims on both left side platform rollers and one shim on both of the right side rollers

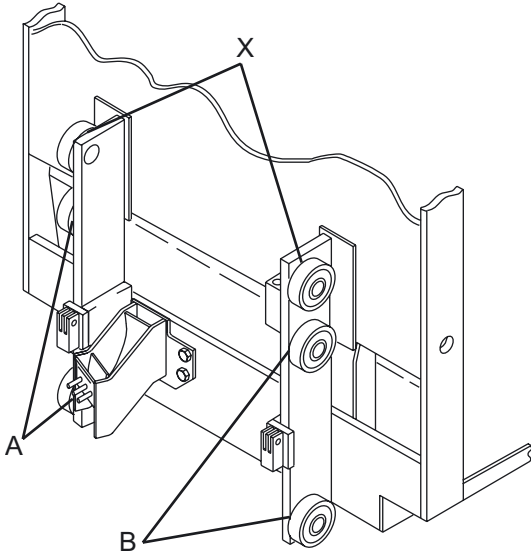
PLATFORM

PLATFORM REMOVAL & SHIMMING



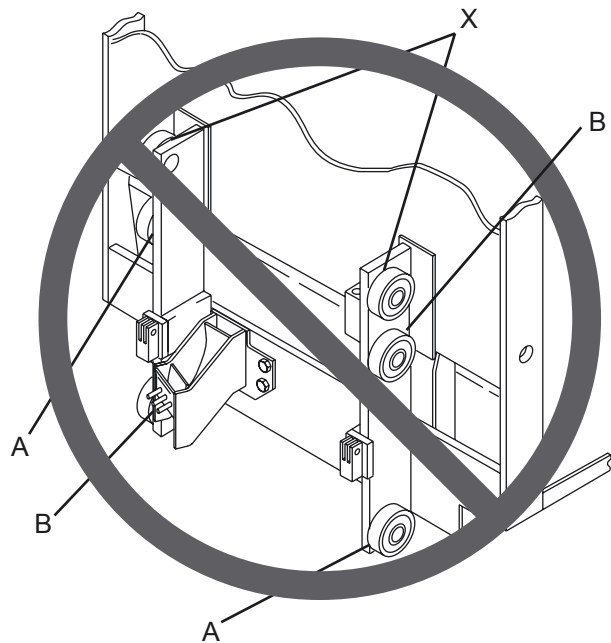
Correct Method Shimming Method

See Figure 3795-A. Two shims on both left side platform rollers (A) and one shim on both of the right side rollers (B). Non adjustable rollers are marked as (X).



3795-A

Incorrect Shimming Method



3795-B

See Figure 3795-B. Let's assume, (A) is a number of one shim and (B) is a number of two shims. In this case the uneven number of shims per side is not wanted. Non adjustable rollers are marked as (X).

Installing the Platform

1. Install platform back into mast carefully. With hoist extend platform to full height and check for tight spots. Make sure that all cables hoses and chains are not pinched, cut, or damaged in any way while hoisting the platform up the mast. If any tight spots are found make corrections to shims as required.
2. If no tight spots are found, lower platform with hoist and reassemble chains, pulleys, etc. in reverse order of removal.
3. Connect battery and check truck operation.



PLATFORM PLATFORM REMOVAL & SHIMMING

Platform Removal & Shimming TT Mast

Warning!

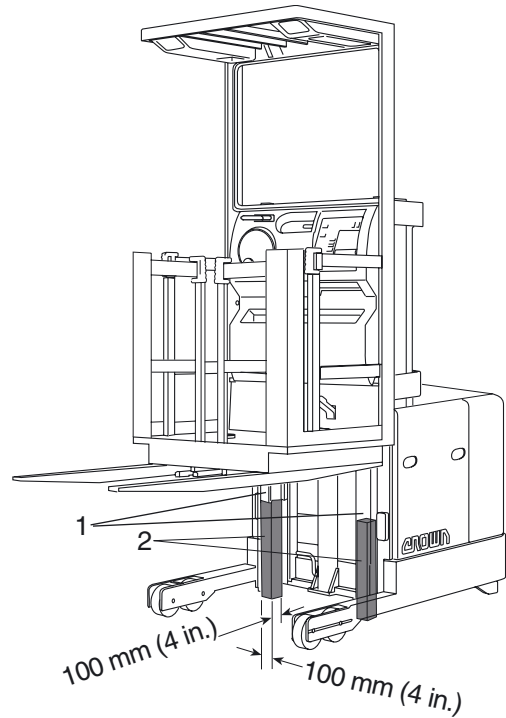


Danger for live and limb.

Do not place any part of your body through mast or at a pinch point.

Always block mast stages and platform before performing maintenance work in this areas.

1. In order to shim the platform rollers it is necessary to remove the platform from the mast.
2. Elevate carriage through free lift and stop platform 50 mm (2 in.) short of spring loaded stops making contact with stop bar on third stage mast.
3. Use a man-carrying platform to get into position to measure the platform roller clearance.
4. Use a pry bar to shift the platform to one side, this will force the opposite side tight against the mast channel. This is necessary to seat each platform roller against the roller stud shoulder to allow for an accurate measurement. Once the platform has shifted, retain slight pressure to hold the platform in position.
5. Measure the distance between the channel and the roller, 10 mm (3/8 inch) from the channel face. Always measure the side the roller is canted toward. A clearance of 0 mm - 0.75 mm (0 inch to 0.030 inch) should be obtained.
6. If the dimension is greater than 0.75 mm (0.030 inch), another shim will need to be added.
7. Raise the mast until the third stage is a minimum of 760 mm (30 in.) from the floor. The second stage should be approximately 400 mm (16 in.) from the floor. Block the second stage using 100 mm x 100 mm (4 in. x 4 in.) hardwood blocks with minimum 380 mm (15 in.) length...
8. Disconnect the battery.



3796-EU

- 1 2nd mast stage
- 2 Hard wood block 100 mm x 100 mm (4 in. x 4 in.) minimum 380 mm (15 in.) long.

It will be necessary to remove the platform from the mast to shim platform rollers. If the dimension is zero and it does not appear to be tight, proceed to check the remaining platform column rollers.

PLATFORM

PLATFORM REMOVAL & SHIMMING



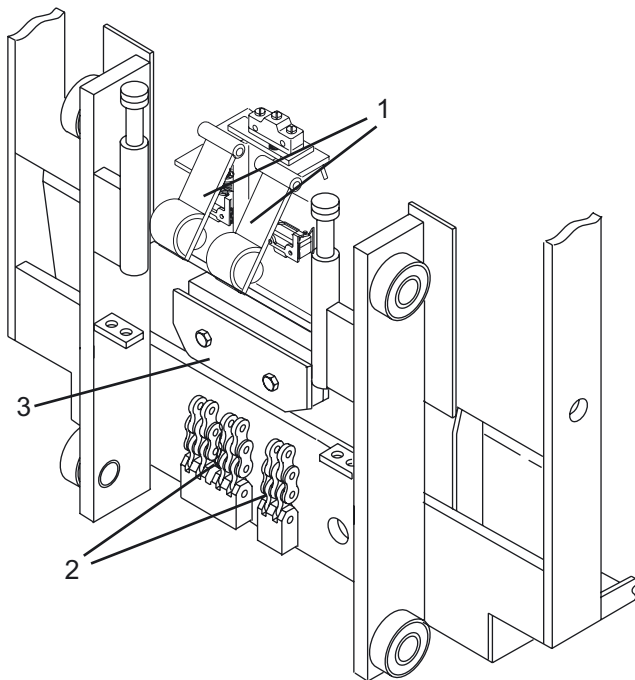
Removing the Platform for Shimming

Warning!



Make sure lifting devices used are sufficiently rated to lift various parts of the mast sections and platform either individually or as a group. Make sure that the blocking material is strong enough to withstand the weight. Never work under or around a truck that is not properly blocked.

1. With a hoist raise the platform approximately 3 in. (75mm) to allow the mast chains to slack. Note that the combined weight of the platform and forks will be approximately between 500 kg (1 100 lbs.) and 650 kg (1430 lbs.).



3797-EU

- 1 Chain slack mechanism
- 2 Free lift chains
- 3 Cable guide

2. See Fig. 3797-EU. Disconnect the free lift chains (2) from platform and secure to mast with tie

straps. Secure chain slack mechanism (1) in place so that it does not fall out.

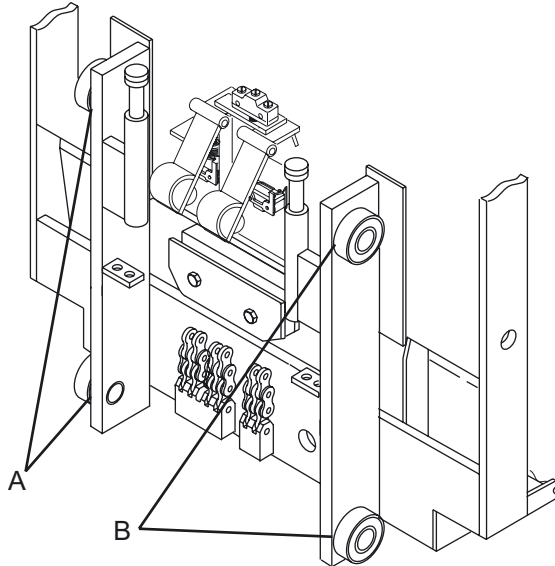
3. Remove cable guide assembly (3) from platform. Support the cable guide from a couple of the eye bolts that are used for the cable grips and springs
4. With a hoist lower the platform to floor making sure that cables, hoses, or lift chains do not become tangled with platform to prevent any damage to them.
5. With hoist lower platform to floor making sure that cables, hoses, or lift chains do not become tangled with platform to prevent any damage to them.
6. Slide platform away from mast approximately 125 mm (5 in.) to fully expose platform rollers.
7. Remove rollers and note shims on each stud. Remove the rollers carefully, many times the shims will cling to the back of the roller and fall off after removal.
8. Shim the platform rollers as required. Please note that it is best to shim the platform rollers evenly. That is, an equal number of shims on each roller. However, if this is not possible follow the shim procedures as described in *Chapter 7*.
Example: Two shims on both left side platform rollers and one shim on both of the right side rollers



PLATFORM PLATFORM REMOVAL & SHIMMING

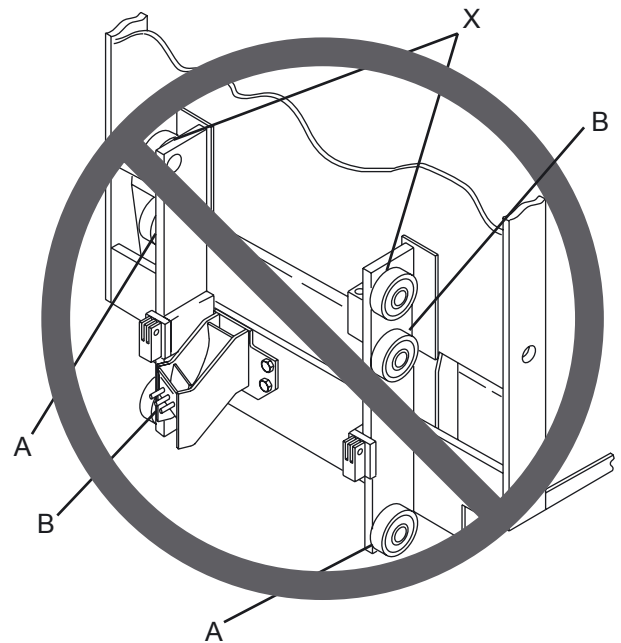
Correct Method Shimming Method

See Figure 3798-A. Two shims on both left side platform rollers (A) and one shim on both of the right side rollers (B).



3798-A

Incorrect Shimming Method



3795-B

See Figure 3798-B. Let's assume, (A) is a number of one shim and (B) is a number of two shims. In this case the uneven number of shims per side is not wanted.

Installing the Platform

1. Install platform back into mast carefully.
2. Remove yoke from free lift cylinder and suspend it from the third stage mast so that it will be moved toward the power unit a minimum of 40 mm (1.5 in.) to prevent any damage to the yoke assembly while raising or lowering the platform.
3. With hoist, extend platform to full height and check for tight spots. Make sure that all cables, hoses, and chains are not pinched, cut, or damaged in any way while hoisting the platform up the mast. If any tight spots are found make corrections to shims as required.
4. If no tight spots are found lower platform with hoist and reassemble chains, pulleys, etc. in reverse order of removal.

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PLATFORM REMOVAL & SHIMMING



5. Connect battery and check truck operation.



ELECTRICAL COMPONENTS



Notes:



ELECTRICAL COMPONENTS INDEX

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Components of the SP 3400 truck have been listed in chart form to assist the maintenance mechanic in locating these components on the schematic diagrams.

The chart is in columns: COMPONENT; LOCATION; FUNCTION; DIAGRAM. The COMPONENT column

contains the abbreviation 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 then explains the function or circuit of that device. The DIAGRAM column gives the page number of the diagram on which the component can be found.

Audible Indicators

Component	Location	Function	Schematic Diagram(s) on Page(s)
ALM1	Steering Command	Status Alarm	400, 401, 407
HN1	Platform (Below Floorboard)	Horn	400, 401, 402, 403
HN2	Power Unit (Platform Side)	Travel Alarm	400, 401, 404

Battery

Component	Location	Function	Schematic Diagram(s) on Page(s)
Battery	Battery Compartment	Power	400, 401, 414

Connections

Component	Location	Function	Schematic Diagram(s) on Page(s)
CA201	Distribution Panel	Height Switches	404
CA202	Distribution Panel	Mast Cable 1	
CA203	Distribution Panel	Mast Cable 2	404, 413
CA204	Distribution Panel	Mast Cable 3	404
CA205	Distribution Panel	Mast Cable 4	404, 413
CA206	Distribution Panel	Communications to Steer Module	404
CA207	Distribution Panel	Communications to Guidance	
CA208	Distribution Panel	Lift / Lower Panel	
CA209	Distribution Panel	Braking	
CA210	Distribution Panel	Steering	

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Connections (Continued)			
Component	Location	Function	Schematic Diagram(s) on Page(s)
CA211	Distribution Panel	Guidance	404
CA212	Distribution Panel	Traction	
CA213	Distribution Panel	Power	
CA214	Distribution Panel	Travel Alarm	
CA215	Distribution Panel	Freezer Conditioning	
CA216	Distribution Panel	Options	
CA217	Freezer Distribution Panel	Freezer Conditioning	404, 413
CA218	Distribution Panel	Raise Cutout, RGS, BRES	404
CA230	Main Harness	Lift / Lower	405, 406
CA301	Platform	Service Terminal Port	407
CA302	Steering Wheel	Steering Encoder	
CA303	Display	Communications	
CA304	Display	Inputs / Outputs	
CA402	Traction Control Module	Traction Motor Connections	408
CA403	Traction Control Module	SRO Inputs	
CA405	Steer Module	Communications	409
CA406	Steer Module	Inputs / Outputs	
CA407	Main Harness	Brake	405, 406
CA408	Splitter Module		410
CA409	Splitter Module		
CA410	Splitter Module		
CA412	Main Harness	Steering Feedback	409
CA417	Guidance System	Guide Module	411
CA418	Guidance System	LW Sensor Bar	
CA419	Guidance System	SW Sensor Bar	
CA501	Overhead Guard Left Hand	Power Supplies	412
CA503	Overhead Guard Right Hand	Fan	
CA807	Contactor Panel	Heaters Power	413
CA808	Contactor Panel	Input Power to F/C Panel	
TB101	Platform	Control	400,401, 413
TB102	Platform	Miscellaneous	
TB407	Steering Module	Power	409, 414



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Connections (Continued)

Component	Location	Function	Schematic Diagram(s) on Page(s)
TB502	Overhead Guard Left Hand	Dome Light	412
TB602	Distribution Panel	Freezer Conditioning	413
TB603	Motor Controller	Power Cables	408

Contactors

Component	Location	Function	Schematic Diagram(s) on Page(s)
ED1	Lift / Lower Panel	Emergency Disconnect	400, 401, 405, 406, 414
ED2	Traction Panel	Emergency Disconnect Traction and Steering	
P1	Lift / Lower Panel	Pump 1	
P2	Lift / Lower Panel	Pump 2	

Fuses

Component	Location	Function	Schematic Diagram(s) on Page(s)
FU1	Distribution Panel	Light / Fan	400, 401, 404
FU2	Distribution Panel	Control	
FU3	Distribution Panel	Options	
FU4	Distribution Panel	Brake	
FU5	Distribution Panel	Outer Coil (Field)	
FU6	Distribution Panel	Inner Coil (Armature)	
FU8	Lift / Lower Panel	Pump Motor 1	400, 401, 414
FU 9	Lift / Lower Panel	Pump Motor 2	
FU10	Lift / Lower Panel	Steer Module	400, 401, 409, 414
FU11	F/C Distribution Panel	F/C Power Unit	413
FU12	F/C Distribution Panel	F/C Platform	
FU13	Lift / Lower Panel	Traction Motor	400, 401, 408, 414

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Lights			
Component	Location	Function	Schematic Diagram(s) on Page(s)
LGT1	Power Unit	Strobe Flashing	400, 401, 404
LGT2	Overhead Guard	Left Worklight	412
LGT3	Overhead Guard	Right Domelight	
LGT4	Overhead Guard	Left Spotlight	
LGT5	Overhead Guard	Right Worklight	
LGT6	Overhead Guard	Right Domelight	
LGT7	Overhead Guard	Right Spotlight	

Miscellaneous			
Component	Location	Function	Schematic Diagram(s) on Page(s)
BRK1	Traction Motor	Brake	400, 401
DB1	Platform	Lower Override	402
DB2	Platform		
FAN1	Overhead Guard	Fan	412
LWSB	Power Unit	Load Wheel Sensor Bar	411
PS1	Overhead Guard Left Hand	Power Supply Lights	412
PS2	Overhead Console	Power Supply Lights	
SWSB	Power Unit	Steered Wheel Sensor Bar	411
TDM1	Power Unit	Lowering Solenoids Delay	401
TDM2	Power Unit	Lowering Solenoids Delay	

Motors			
Component	Location	Function	Schematic Diagram(s) on Page(s)
M1	Power Unit	Traction Motor	400, 401, 408, 414
M2	Power Unit	Power Steering	400, 401, 409, 414
M3	Power Unit	Hydraulic Pump 1	400, 401, 408
M4	Power Unit	Hydraulic Pump 2	



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Relays

Component	Location	Function	Schematic Diagram(s) on Page(s)
K1	Distribution Panels	Power Up	400, 401, 404
K2	Distribution Panel	Diagnostic Travel Inhibit	
K3	Distribution Panel	Auxiliary Lift	401
K5	Traction Panel	Steer Motor	400, 401, 409, 414
K11	F/C Distribution Panel	F/C Power Up	413
K12	F/C Distribution Panel	F/C Heater Power	

Resistors

Component	Location	Function	Schematic Diagram(s) on Page(s)
RES1	Overhead Console	Fan Speed Reduction	412
RES2	Power Unit Guide Wheel Bracket	RGS1 Heater	413
RES3	Power Unit Guide Wheel Bracket	RGS2 Heater	
RES4	Power Unit (Skirt, Left Side)	BRES1 Heater	
RES5	Power Unit (Skirt, Right Side)	BRES2 Heater	
RES6	Power Unit	CHS1 Heater	
RES7	Power Unit	CHS2 Heater	
RES8	Platform	GS1 Heater	
RES9	Platform	GS2 Heater	
RES10	Control Module	EDS Heater	
RES11	Control Module	Heater for Raise and Lower Switches	
RES12	Control Module	HNS Heater	
RES13	Control Module	Forward Switch Heater	
RES14	Control Module	Reverse Switch Heater	
RES15	Platform (Power Unit Side)	CHS1 Heater	
RES16	Platform (Below Floorboard)	BRS Heater	
RES18	Main Frame	HTS Heater	
RES19	Platform (Power Unit Side)	CHS2 Heater	
RES20	Platform	DMS1	

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Resistors (Continued)

Component	Location	Function	Schematic Diagram(s) on Page(s)
RES21	Platform	CHB7 Heater	413
RES22	Platform	GTS3 or R3, L3	
RES23	Platform	GTS4 or R4, L4	
RES26	Platform	LOS3 Auxiliary Lift	
RES27	Platform	LOS4 Auxiliary Lift	
RES28	Platform	RAS3 Auxiliary Lift	
RES29	Platform	RAS4 Auxiliary Lift	

Sensors

Component	Location	Function	Schematic Diagram(s) on Page(s)
ECR1	Platform	Steering Wheel	400, 401, 407
ECR2	Power Unit	Steering Feedback	400, 401, 409
ECR3	Traction Motor	Traction Speed	400, 401, 410
ECR4	Platform	Lift Height	400, 401, 402, 403
POT1	Control Panel	Traction Accelerator	400, 401

Solenoid Valves

Component	Location	Function	Schematic Diagram(s) on Page(s)
SV1	Power Unit	Auxiliary Lift Selection	401, 406
PVL	Power Unit	Proportional Valve, Lowering	400, 401, 405, 406
PVLF	Power Unit	Proportional Valve, Lowering	401, 406

Suppressor Blocks

Component	Location	Function	Schematic Diagram(s) on Page(s)
SB10	Platform	Horn	401, 406, 402, 403
SB11	Steering Command	Platform Communications	402, 403
SB21	Below Strobe Light	Strobe Light	402, 403, 404



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Suppressor Blocks (Continued)

Component	Location	Function	Schematic Diagram(s) on Page(s)
SB30	Overhead Console	Fan	412

Switches

Component	Location	Function	Schematic Diagram(s) on Page(s)
BRES1	Power Unit	Battery Restraint 1	402, 403, 404, 413
BRES2	Power Unit	Battery Restraint 2	
BRS1	Platform	Brake 1	400, 401, 402, 403
CHB4	Main Frame	Right Hand Chain Break	400, 401, 404, 409
CHB5	Main Frame	Left Hand Chain Break	
CHB7	Platform	Right Hand Chain Break	400, 401, 402, 403
CHB8	Platform	Left Hand Chain Break	
CHS1	Main Frame	Chain Slack 1	400, 401, 402, 403, 413
CHS2	Main Frame	Chain Slack 2	
CHS3	Bottom of Platform	Chain Slack 3	400, 401, 404, 413
CHS4	Bottom of Platform	Chain Slack 4	
DMS1	Platform	Two hand Control	400, 401, 402, 403, 413
DPS	Switch Panel	Display Mode Selection	400, 401, 402, 403
DTS1	Distribution Panel	Drive / Tow	403
EDS	Control Module	Emergency Disconnect	400, 401, 402, 403
FNS	Switch Panel	Fan	400, 401
FS	Control Module	Forward Travel	400, 401, 402, 403, 413
GTS1	Platform	Gate Left	
GTS2	Platform	Gate Right	
GTS3	Platform	Gate Right 1.0 SP	400, 401, 413
GTS4	Platform	Gate Left 1.0 SP	
GUS	Control Module	Guidance	400, 401, 402, 403
HNS1	Control Module	Horn	
HSLCS	Platform (Power Unit Side)	High Speed Lower Cutout	400, 401, 402, 403, 413
KYS	Control Module	Key	400, 401, 402, 403
LGS1	Switch Panel	Dome Light (LGT3 & LGT6)	402, 403

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Switches (Continued)			
Component	Location	Function	Schematic Diagram(s) on Page(s)
LGS2	Switch Panel	Work Light (LGT2 & LGT5)	400, 401
LGS3	Switch Panel	Spot Light (LGT4 & LGT7)	
LCS1	Platform	Lower Cutout	400, 401, 402, 403
LMS1	Platform	Auxiliary Lift Speed Limit	400, 401
LOS1	Control Module	Low Speed Lower	400, 401, 402, 403
LOS2	Control Module	High Speed Lower	
LOS3	Auxiliary Forks	Auxiliary Lower	400, 401, 413
LOS4	Auxiliary Forks	Auxiliary Lower	
ORS1	Switch Panel	Override	400, 401, 402, 403
RAS1	Control Module	Low Speed Raise	
RAS2	Control Module	High Speed Raise	
RAS3	Auxiliary Forks	Auxiliary Raise	400, 401, 413
RAS4	Auxiliary Forks	Auxiliary Raise	
RCS1	Main Frame	Raise Cutout	402, 403, 404
RCS2	Main Frame	Raise Cutout	
RGS1	Power Unit Guide Wheel Bracket	Left Hand Rail Guide	400, 401, 402, 403
RGS2	Power Unit Guide Wheel Bracket	Right Hand Rail Guide	
RS	Control Module	Reverse Travel	400, 401, 402, 403
THS1	Power Unit (Platform Side)	F/C Thermostat	413
THS2	Platform (Below Floorboard)	F/C Thermostat	
ZSS	Switch Panel	Zone Select Switch (Lift Cutout)	400, 401, 402, 403

System / Modules			
Component	Location	Function	Schematic Diagram(s) on Page(s)
Display Module	Platform	—	400, 401, 407
Distribution Panel	Traction Panel	—	404, 413, 414
Distribution Panel F/C	Traction Panel	—	413



ELECTRICAL COMPONENTS

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System / Modules (Continued)			
Component	Location	Function	Schematic Diagram(s) on Page(s)
Guidance Module	Steering Panel	—	400, 401, 411
Service Terminal	Handset	—	400, 401, 407
Steering Module	Traction Panel	—	400, 401, 409
Traction Controller (MRC1)	Transistor Panel	—	400, 401, 405, 406, 408, 410, 414

ELECTRICAL COMPONENTS

INDEX



Notes:



SCHEMATIC DIAGRAMS

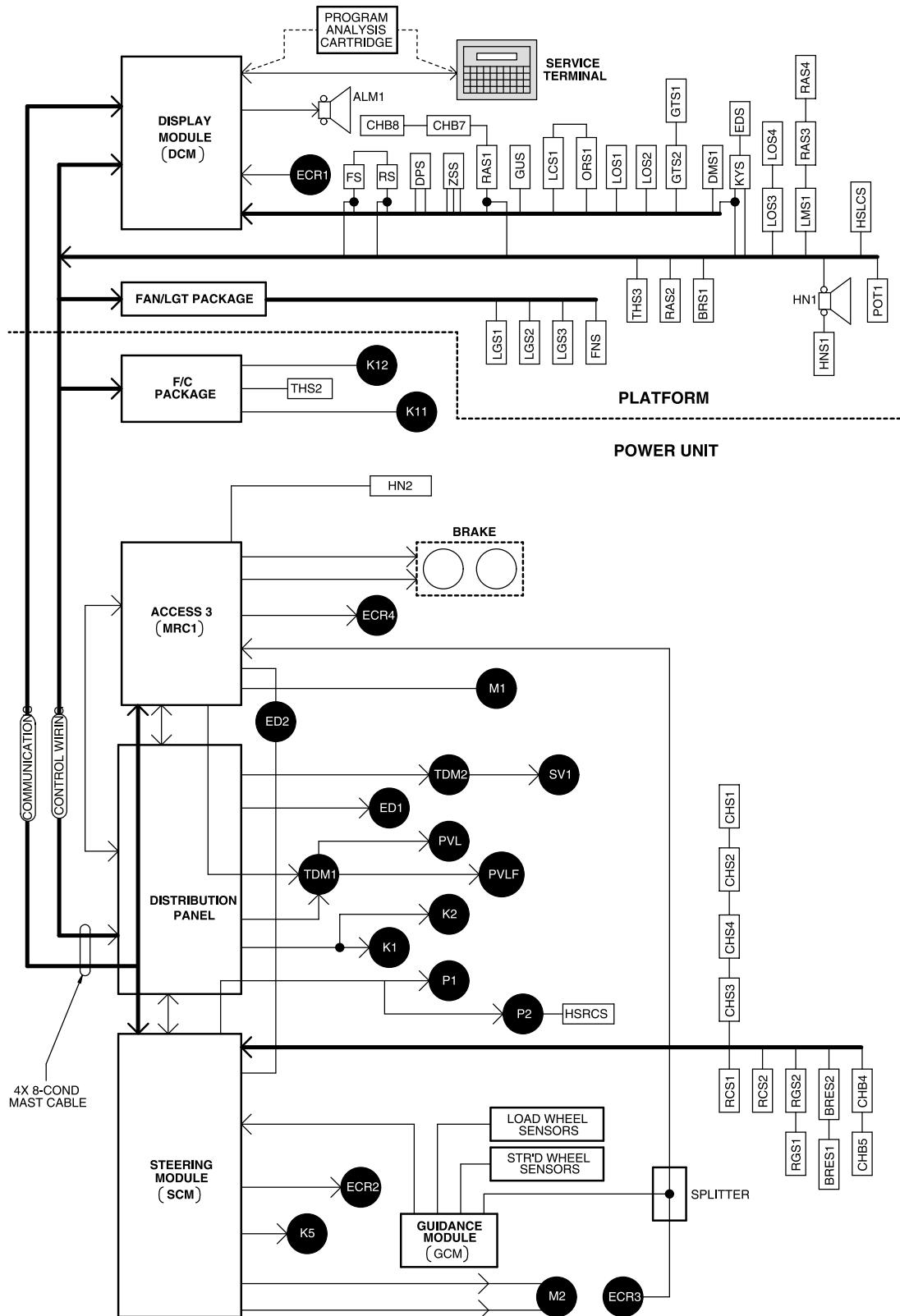
Notes:



SCHEMATIC DIAGRAMS

BLOCK DIAGRAM

Block Diagram



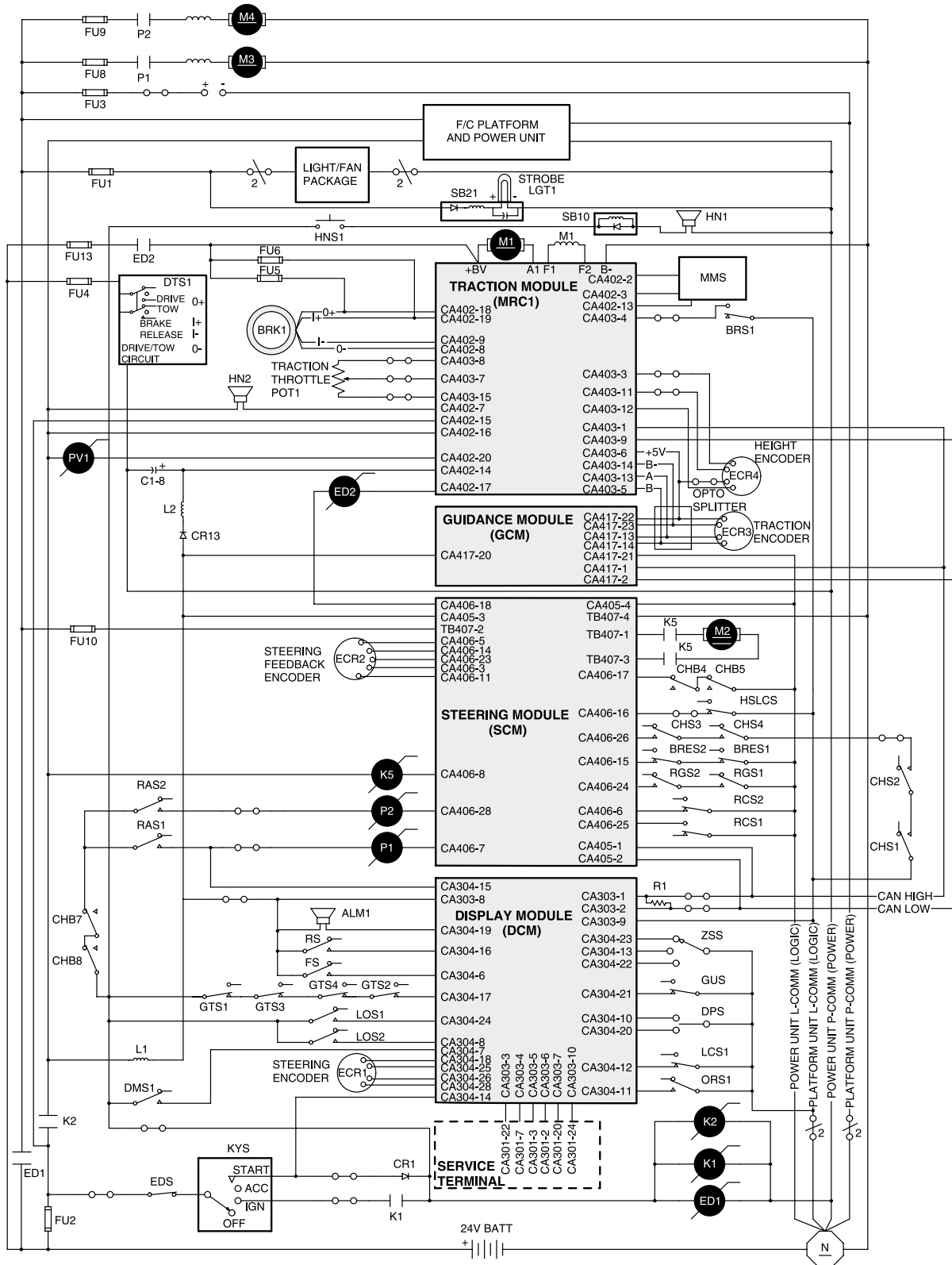
138383A

SCHEMATIC DIAGRAMS

SCHEMATIC, STANDARD



Schematic, Standard



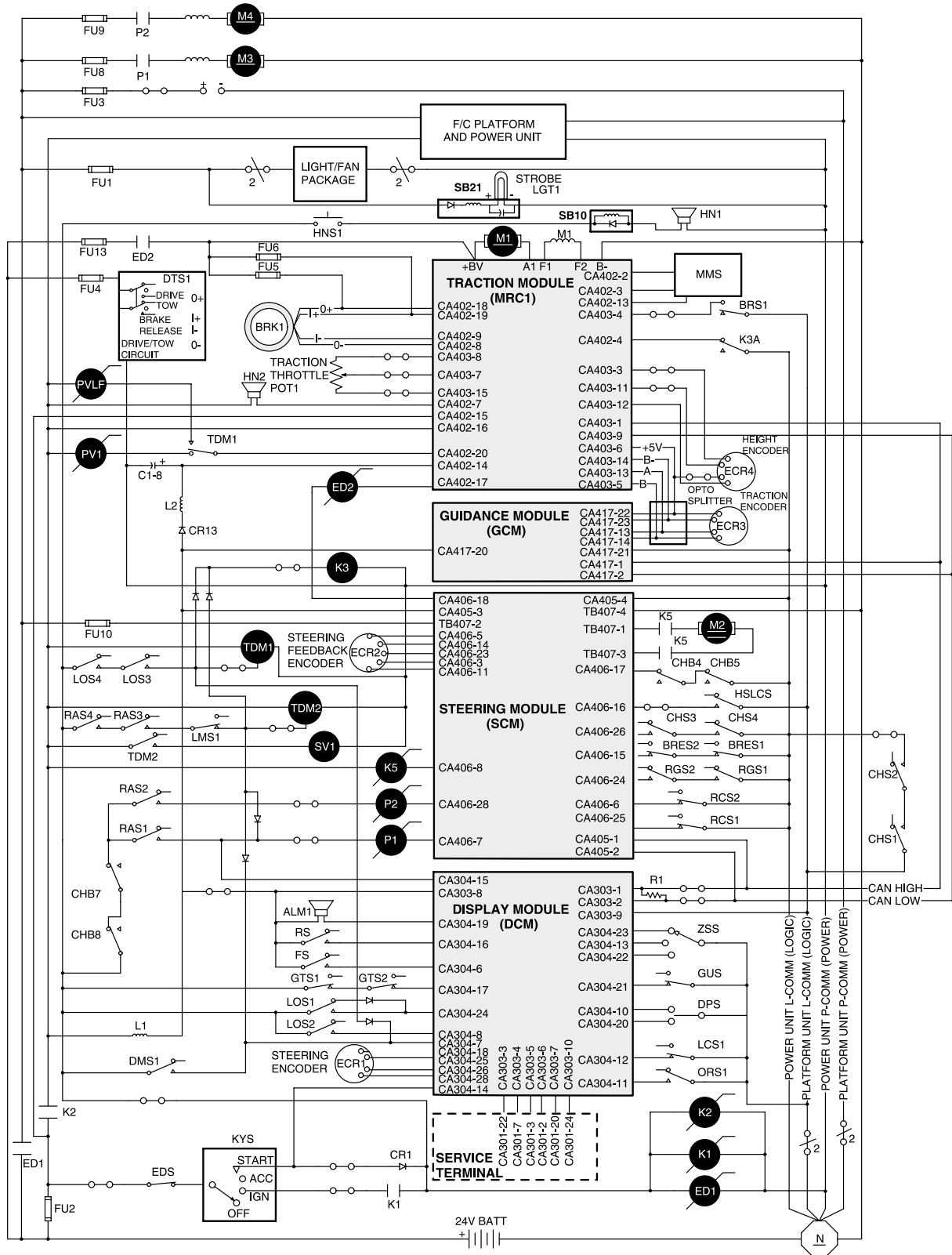
137307B Sh 1



SCHEMATIC DIAGRAMS

SCHEMATIC WITH OPTIONS

Schematic with Options



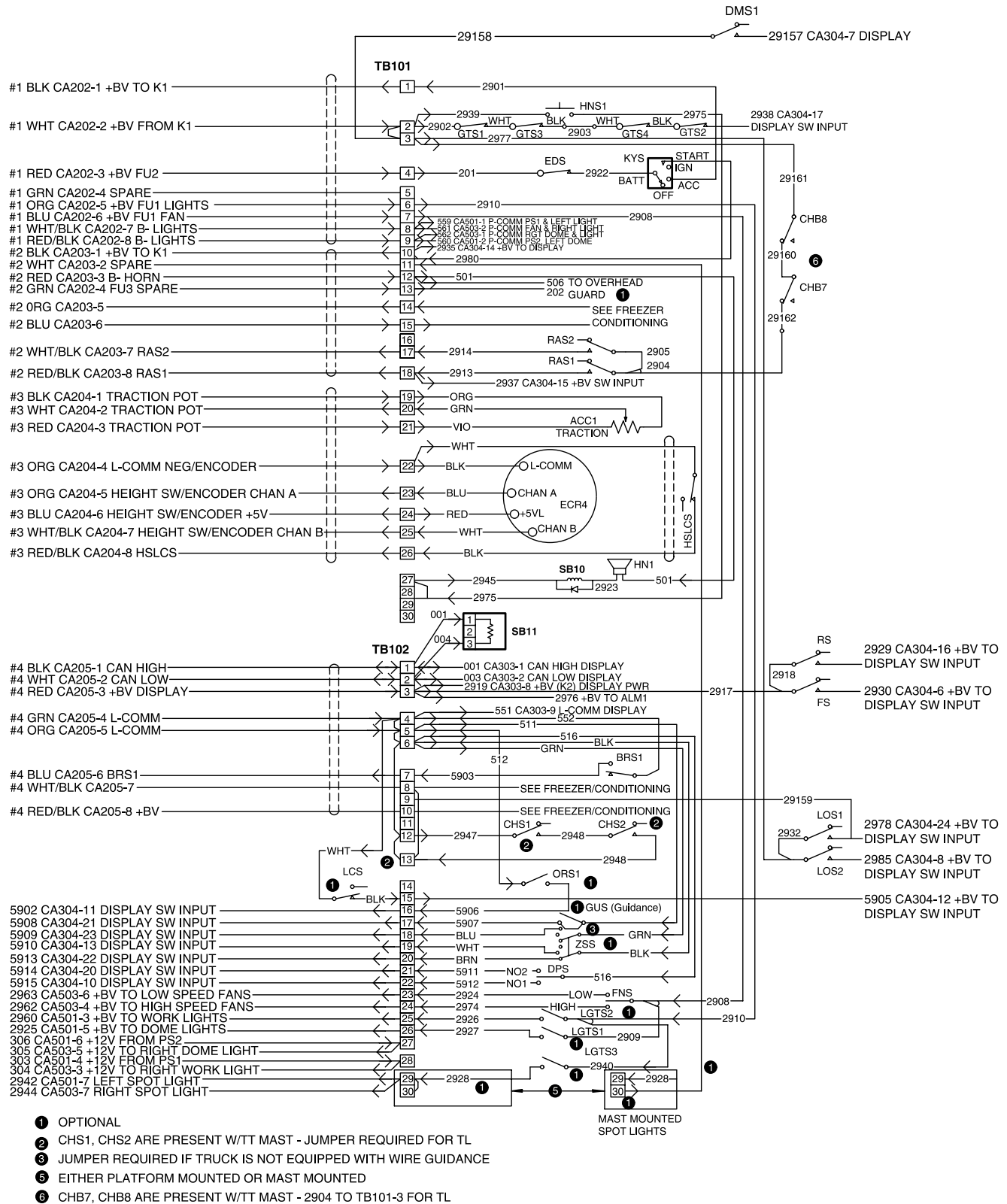
137307B Sh 2

SCHEMATIC DIAGRAMS

PLATFORM, STANDARD

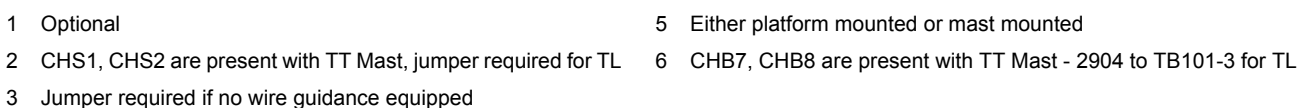


Platform, Standard



137276B Sh 1

Platform, Auxiliary Fork Lift

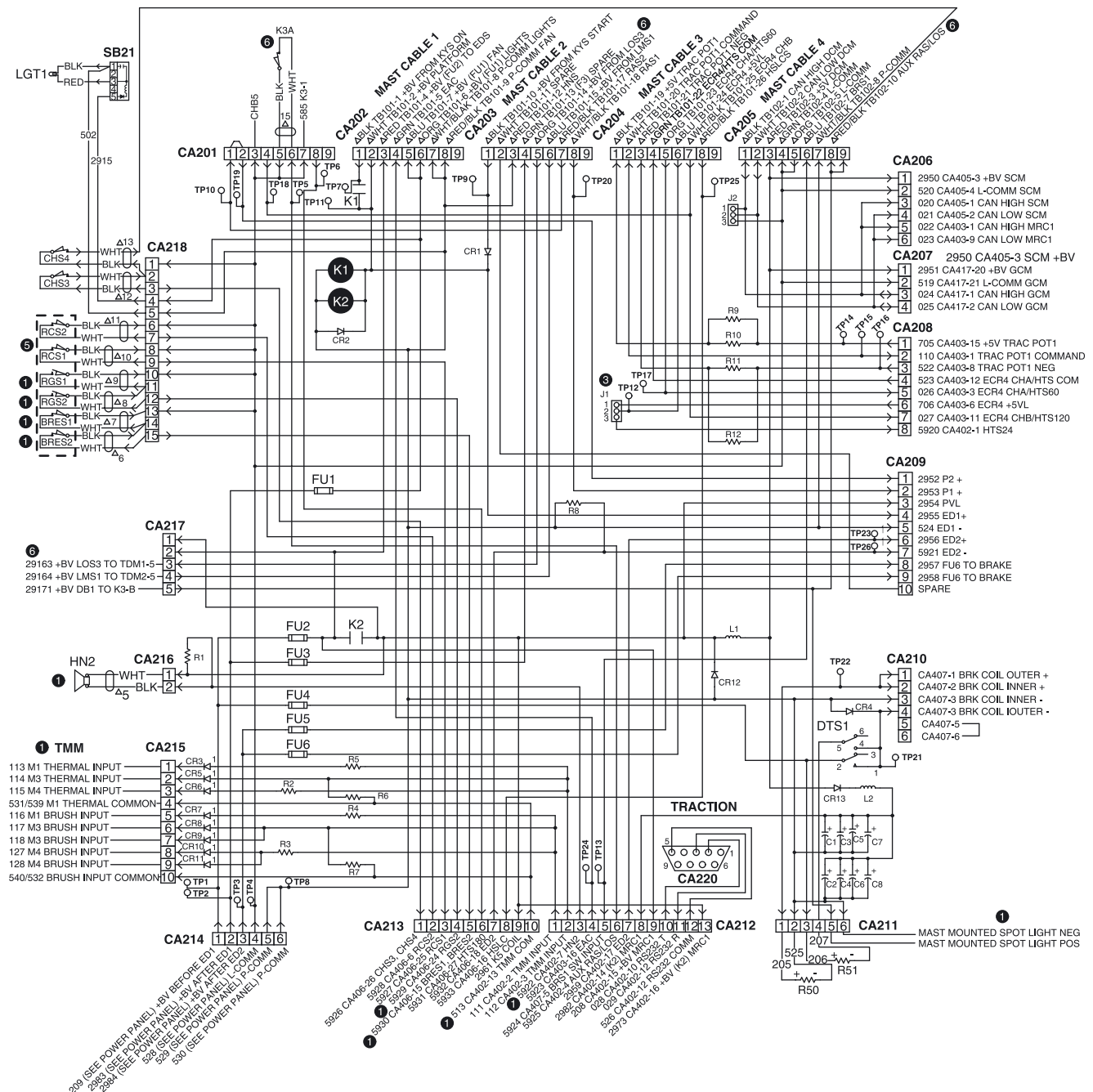


SCHEMATIC DIAGRAMS

DISTRIBUTION PANEL



Distribution Panel



- 1 Optional
- 2 J1-1 to J1-2 for HGT Encoder, J1-2 to J1-3 for HGT Switches
- 5 Install green jumper wire from CA218-6 to CA218-7 if a single "NO OVERRIDE" LIFT CUTOFF is required
- 6 Auxiliary Fork Lift install jumper wire on standard truck between CA201-5 and CA201-6

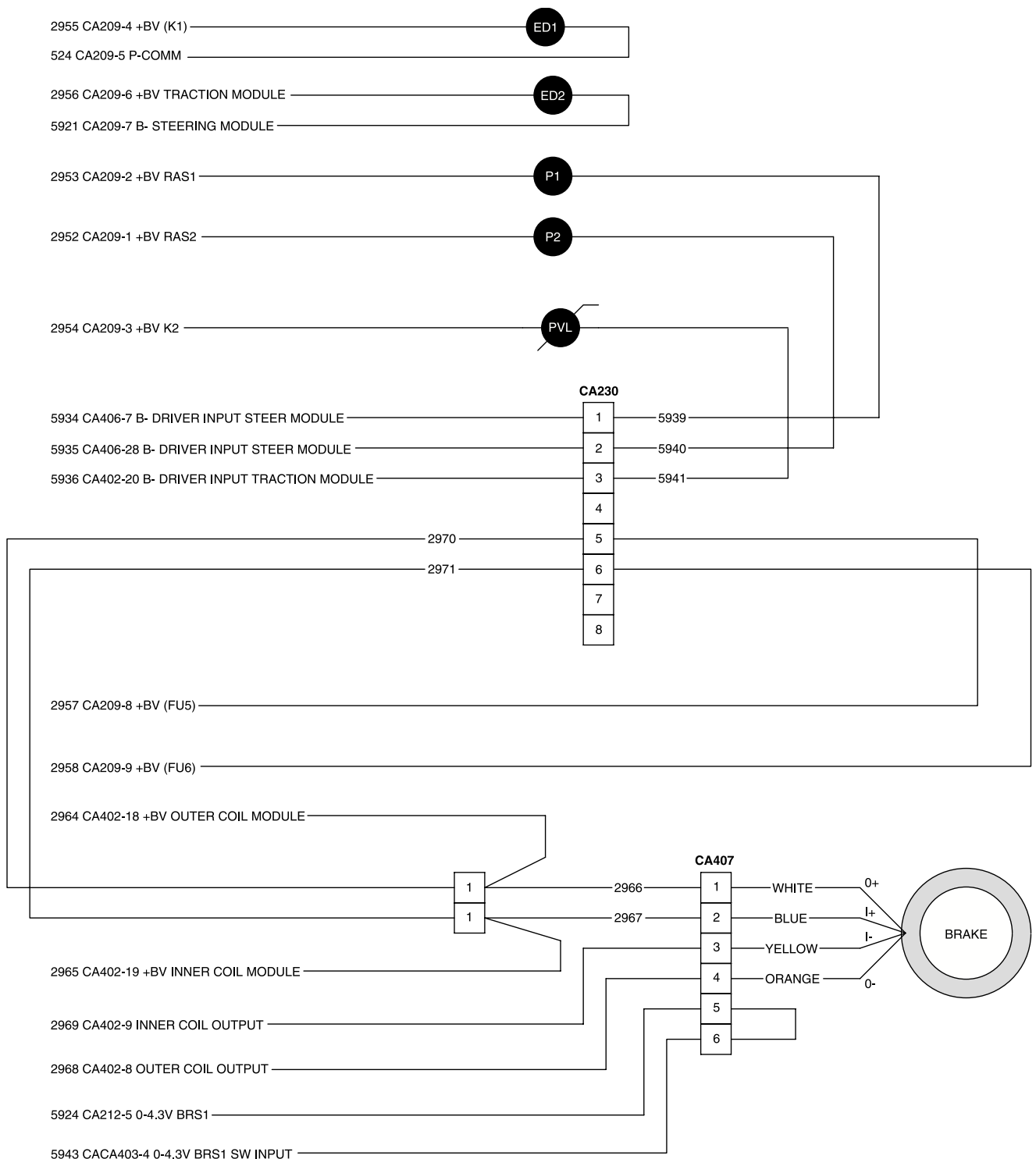
137275B_EU



SCHEMATIC DIAGRAMS

TRACTION, STANDARD

Traction, Standard



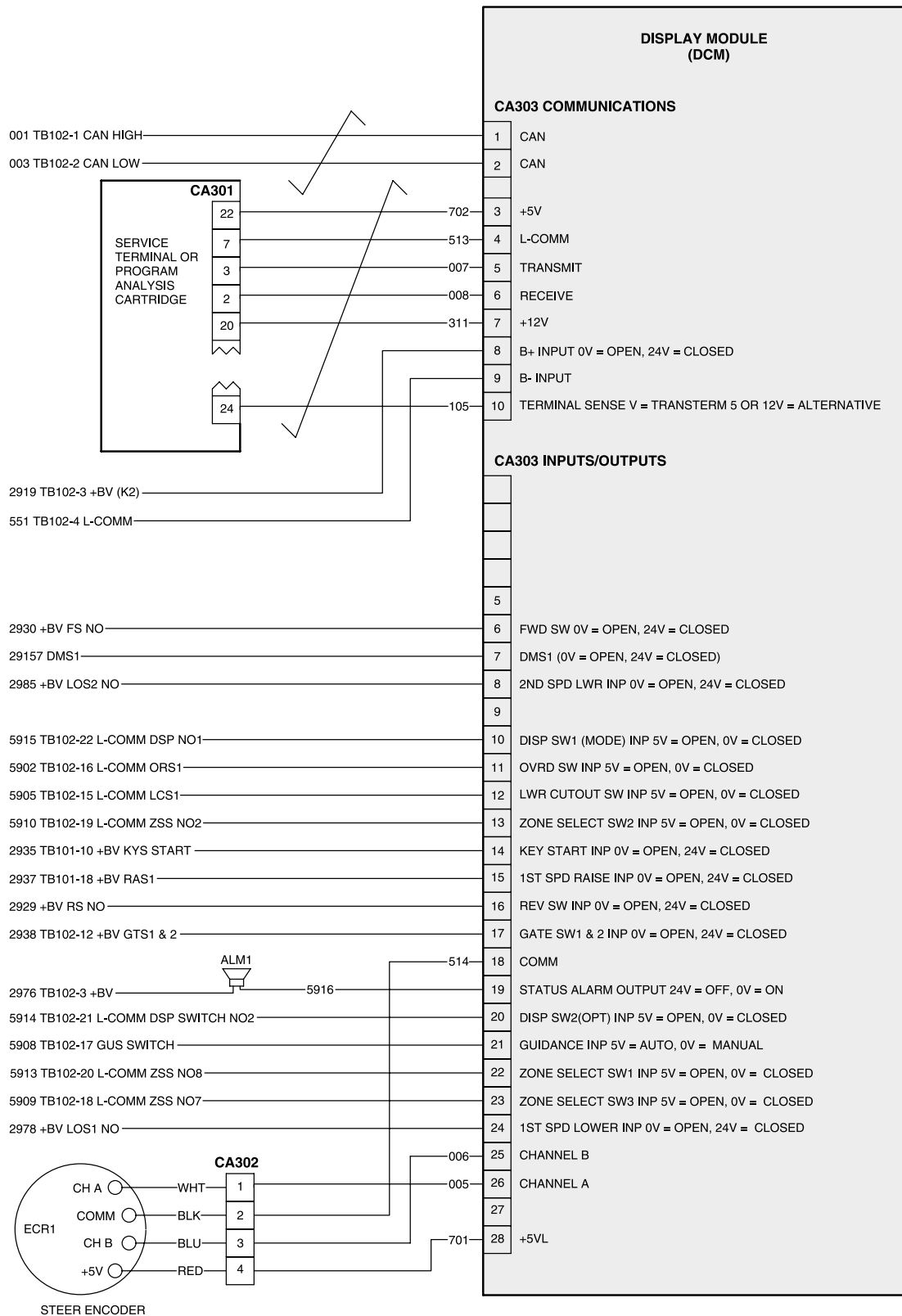
137274 A Sh 3



SCHEMATIC DIAGRAMS

DISPLAY MODULE (DCM)

Display Module (DCM)



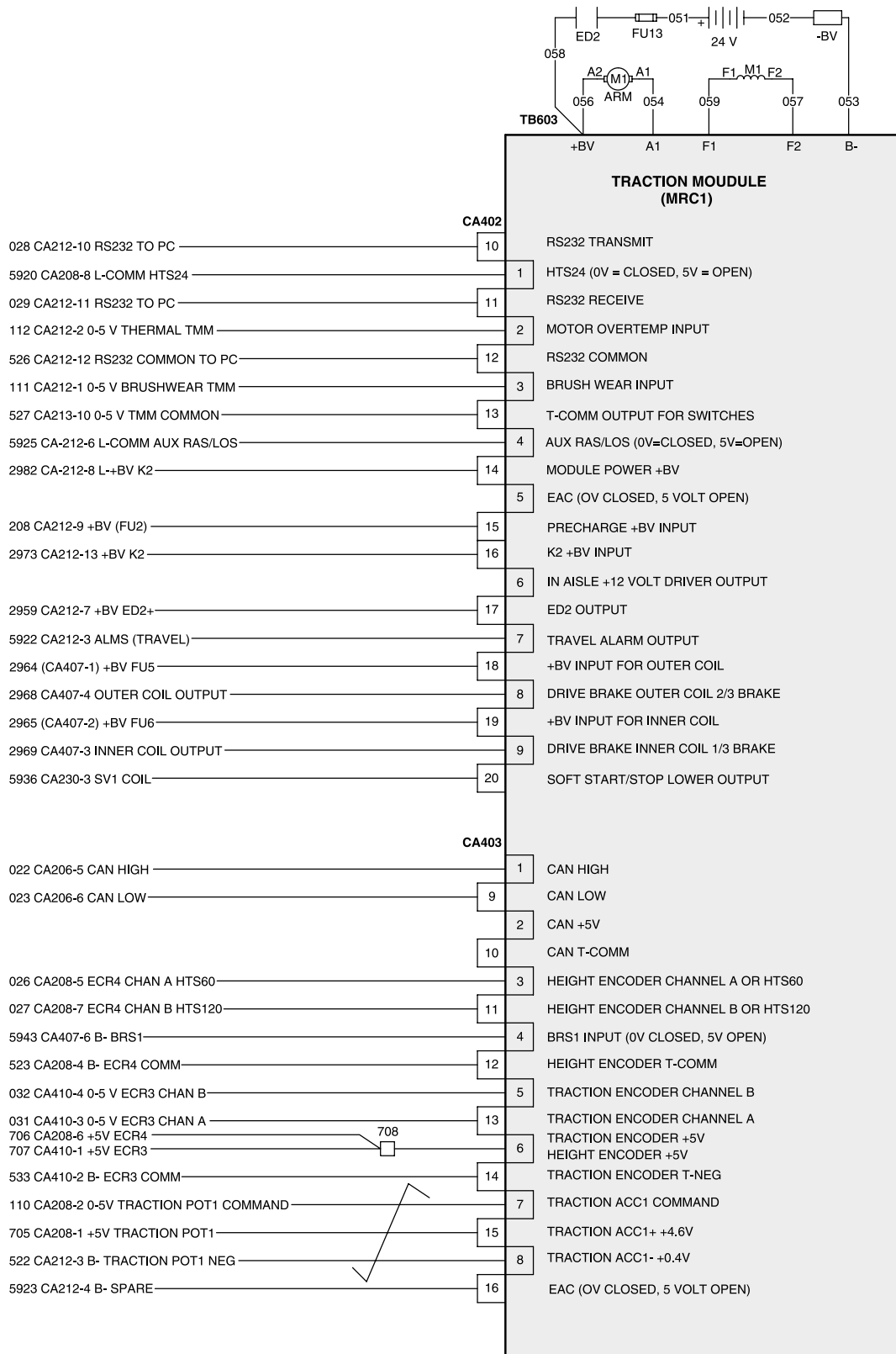
137306 A

SCHEMATIC DIAGRAMS

TRACTION MODULE (MRC1)



Traction Module (MRC1)



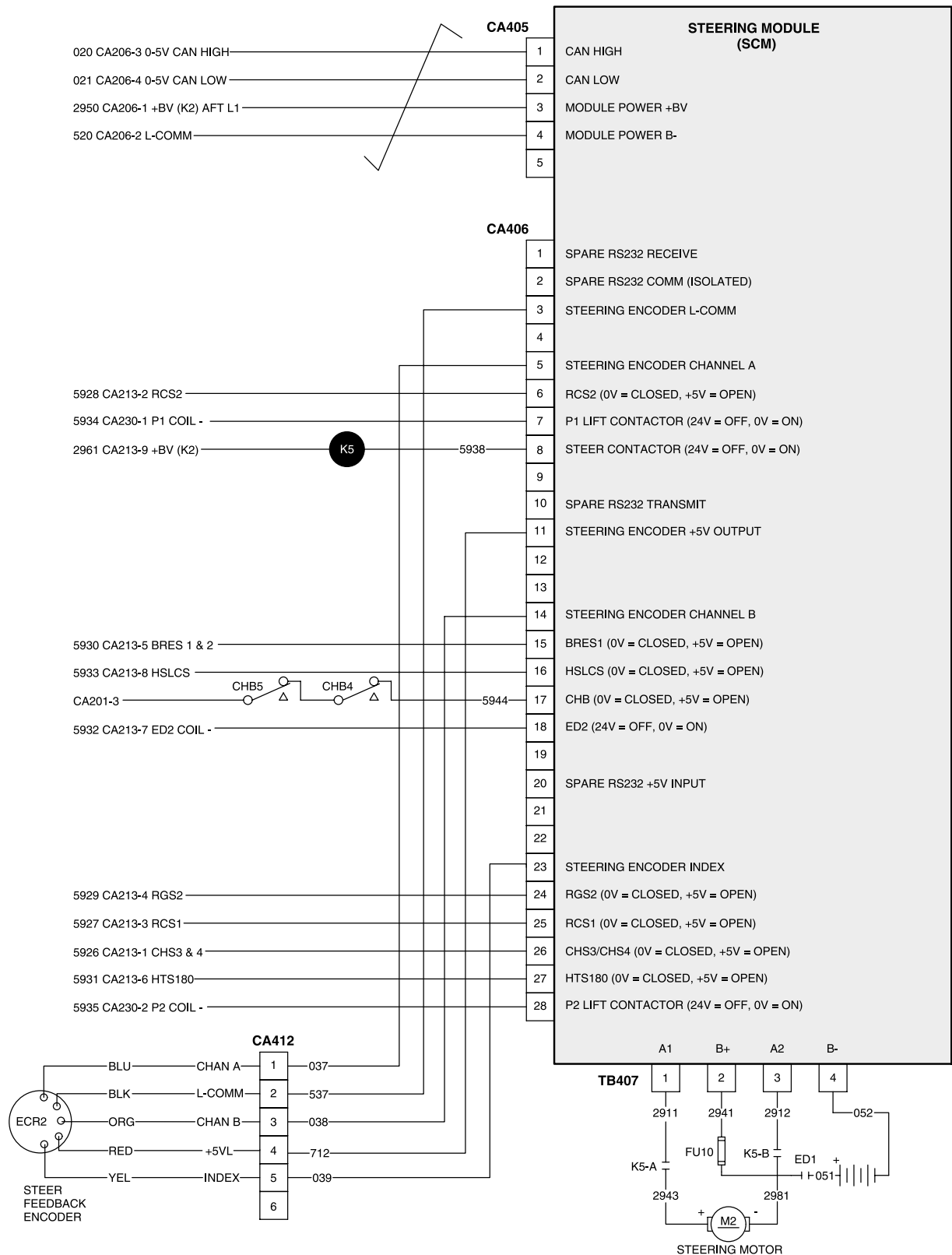
137274 A Sh 1



SCHEMATIC DIAGRAMS

STEERING MODULE (SCM)

Steering Module (SCM)



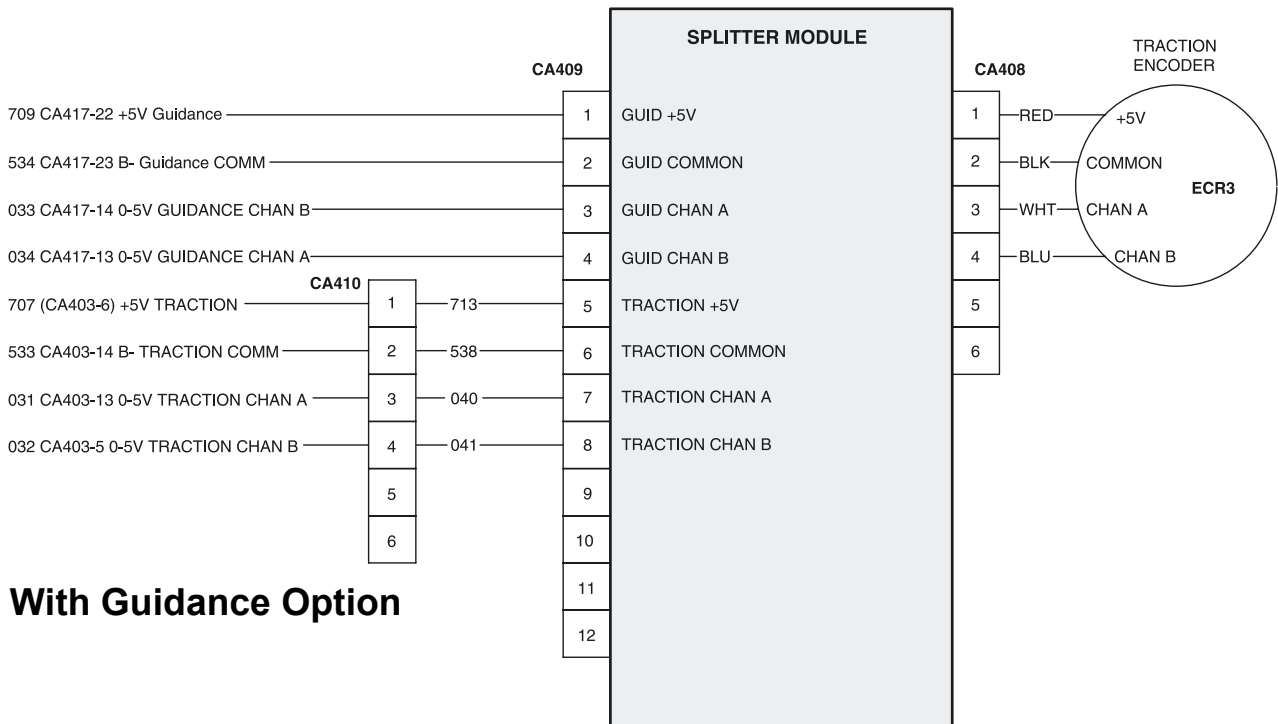
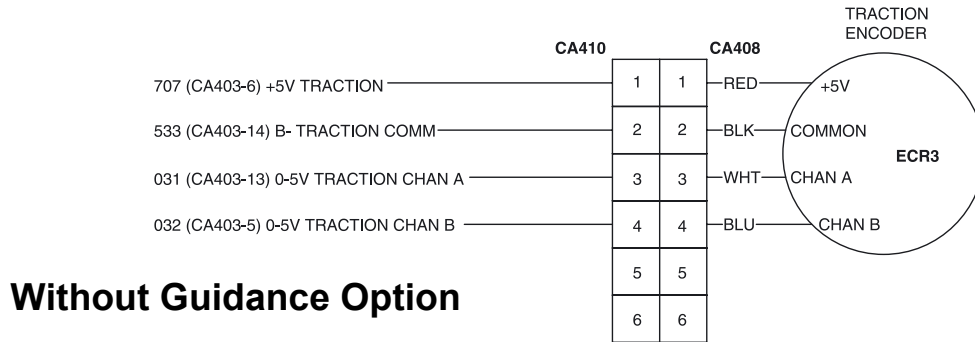
137305 A Sh 1

SCHEMATIC DIAGRAMS

TRACTION CONTROL



Traction Control

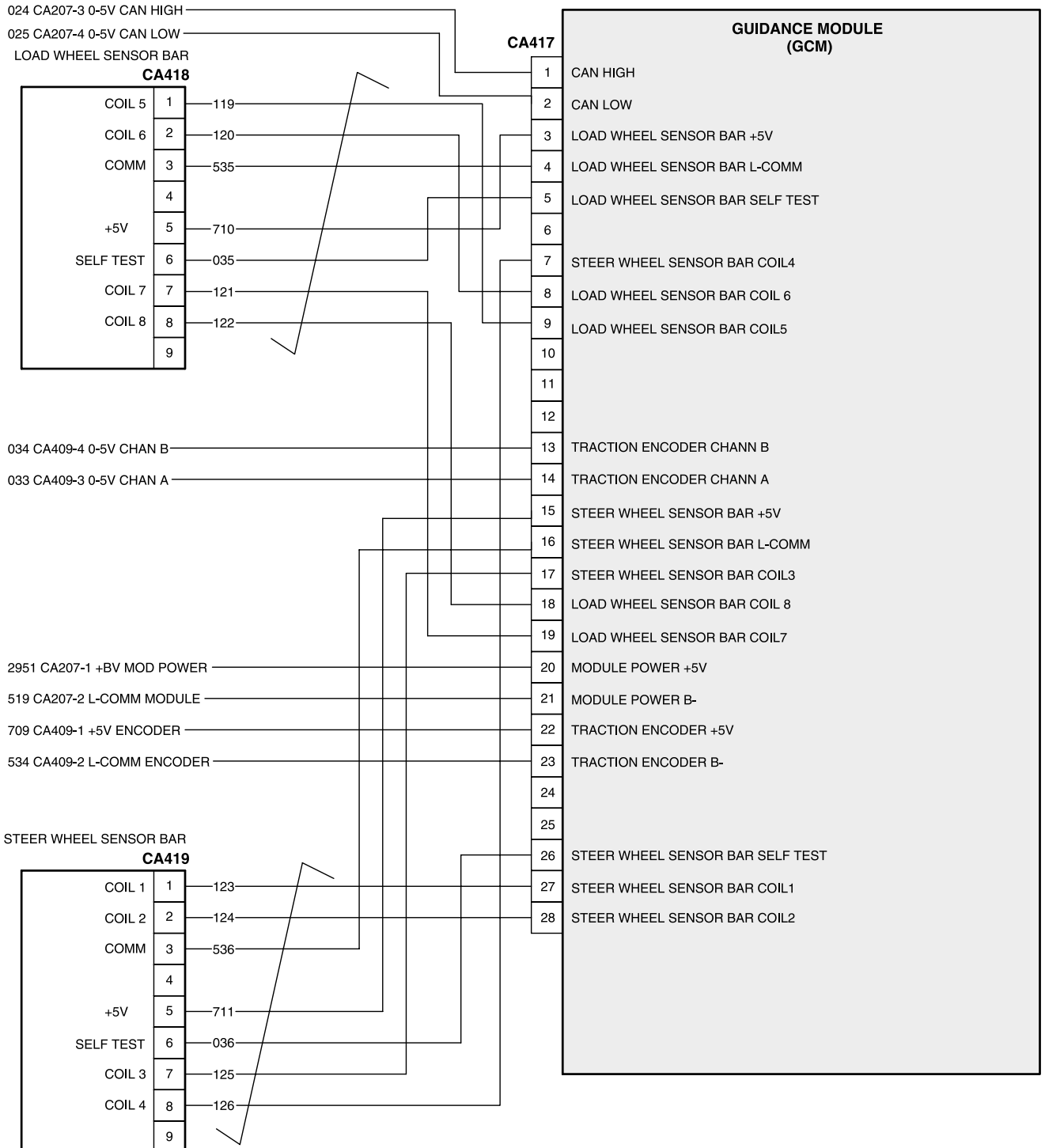




SCHEMATIC DIAGRAMS

GUIDANCE CONTROL MODULE (GCM)

Guidance Control Module (GCM)



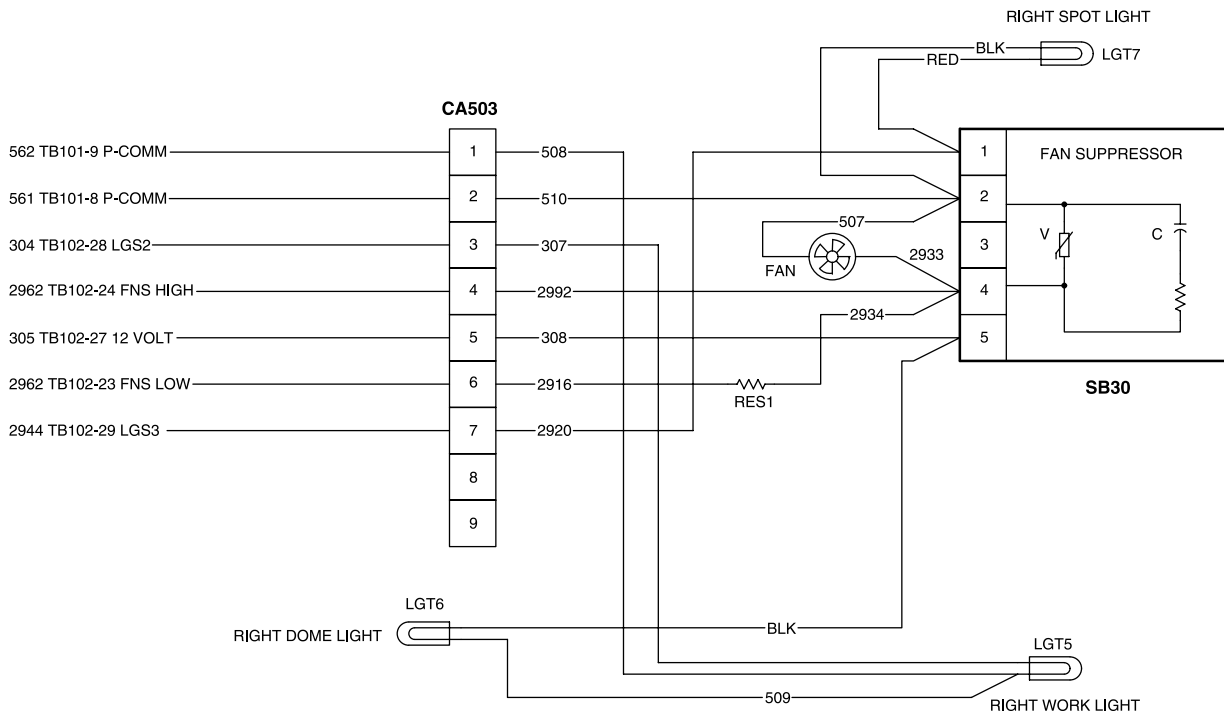
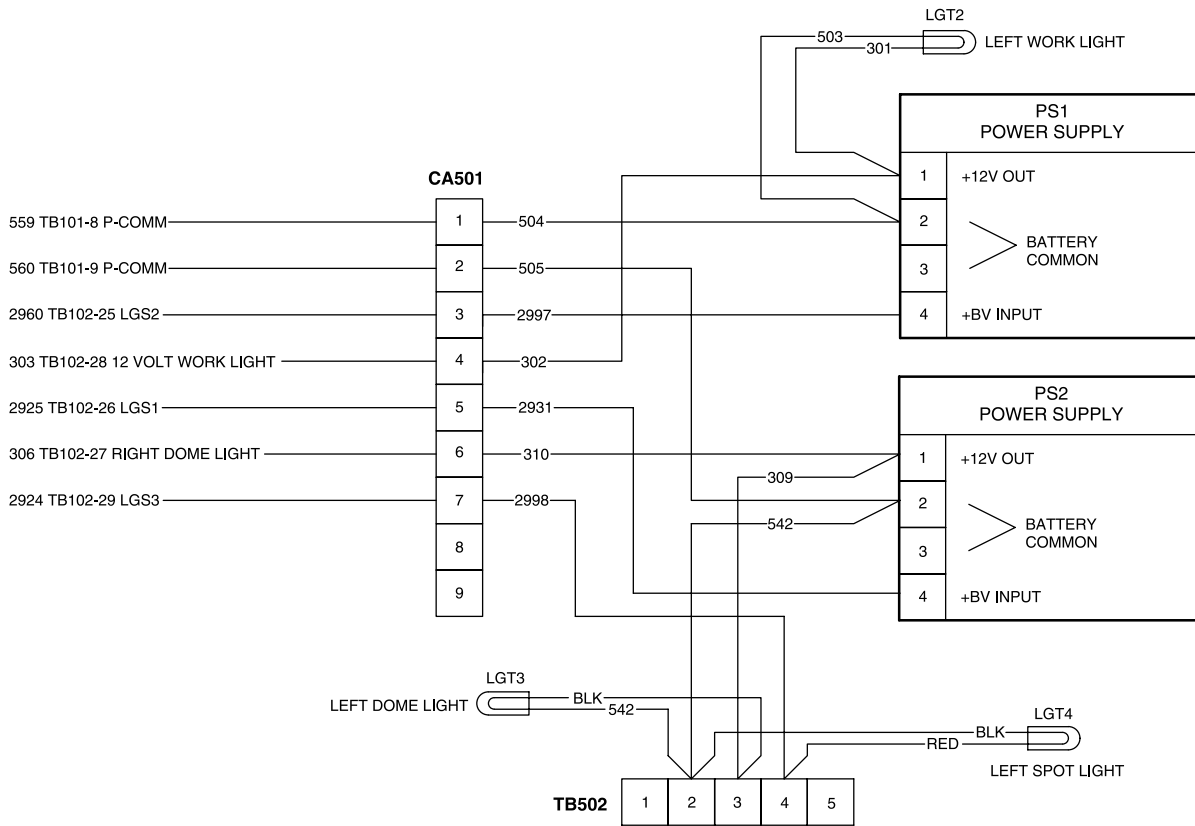
137305 A Sh 2

SCHEMATIC DIAGRAMS

LIGHTS, FAN, POWER SUPPLY



Lights, Fan, Power Supply



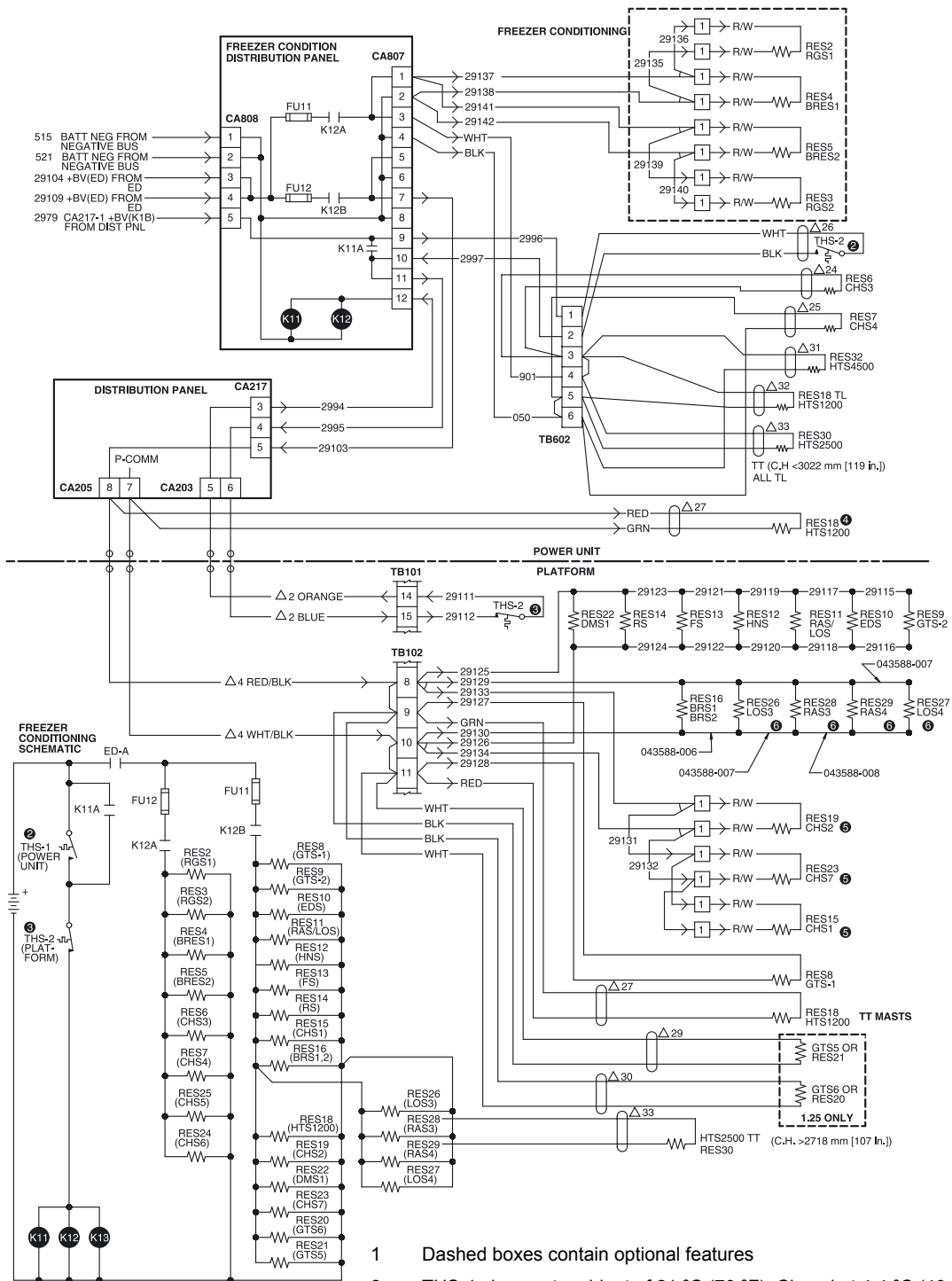
137276 B Sh 3



SCHEMATIC DIAGRAMS

FREEZER CONDITION

Freezer Condition



- 1 Dashed boxes contain optional features
- 2 THS-1 shown at ambient of 21 °C (70 °F). Closed at 4.4 °C (40 °F), open at 60 °C (140 °F)
- 3 THS-2 shown at ambient of 21 °C (70 °F). Closed at 4.4 °C (40 °F), open at 60 °C (140 °F)
- 4 Wired in this manner on TL Mast only
- 5 Wired in this manner on TT Mast only
- 6 Wired in this manner on 1.0 SP only

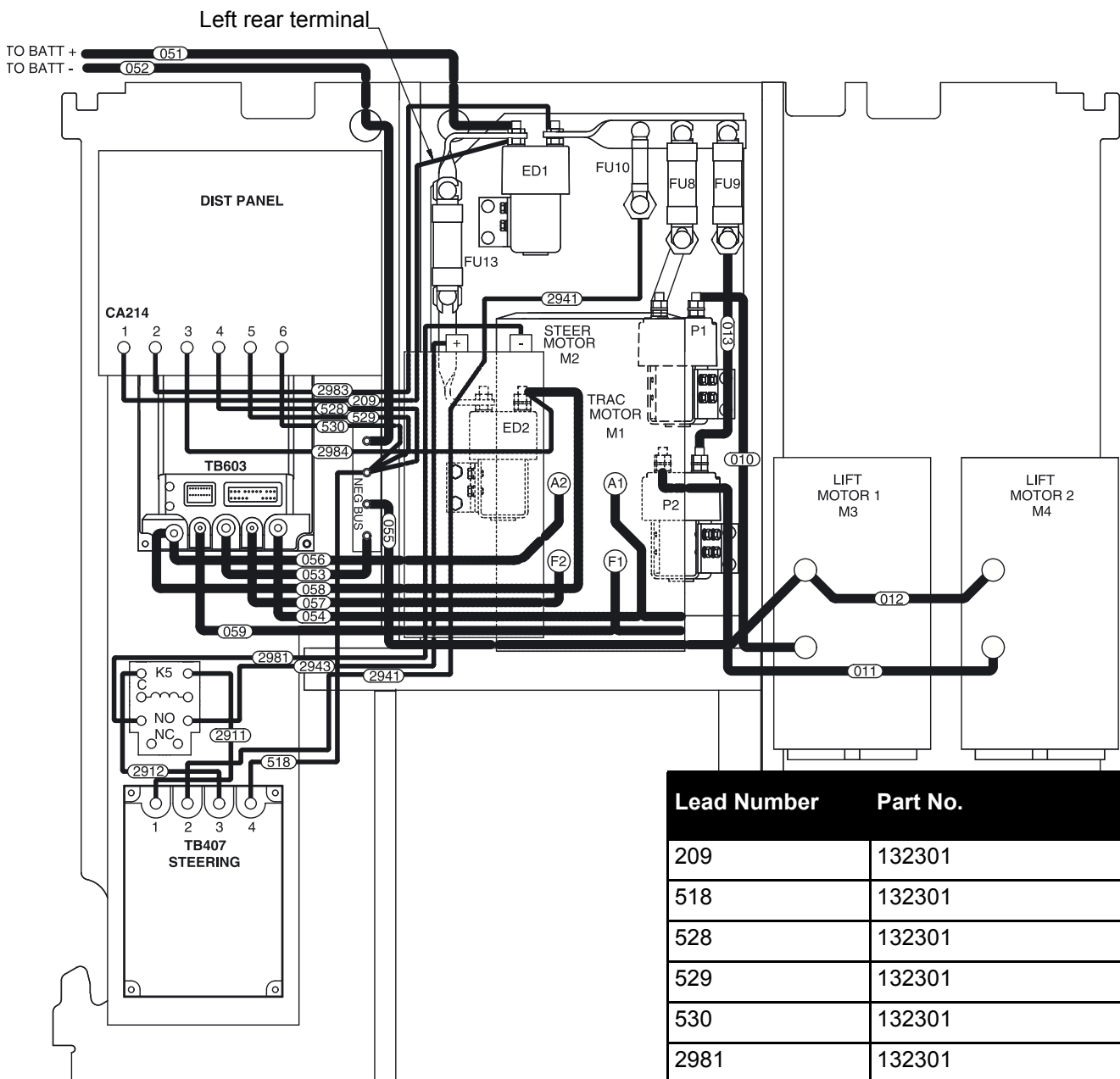
133458 B Sh 3_EU

SCHEMATIC DIAGRAMS

POWER CABLES



Power Cables



Lead Number	Part No.
209	132301
518	132301
528	132301
529	132301
530	132301
2981	132301
2943	132301
2911	090963-26
2912	090963-27
2941	132301
2983	132301
2984	132301

131681 B Sh 1_EU



SCHEMATIC DIAGRAMS

POWER CABLES

Order Information

Power Cable No.	Part No. for SP3420/SP3450	Part No. for SP3405	Part No. for SP3410	Part No. for SP3411/SP3412	Part No. for SP3421/SP3422
051	084573-160	084572-253	084573-160	043156-004	043156-004
052	084573-161	084572-254	084573-161	043156-005	084572-272
053	084572-272	084572-272	084572-272	084572-272	084571-223
054	084571-223	084571-223	084571-223	084571-223	084571-228
055	084571-228	084571-228	084571-228	084571-228	084571-273
056	084571-273	084571-273	084571-273	084571-273	084568-065
057	084568-065	084568-065	084568-065	084568-065	084571-274
058	084571-274	084571-274	084571-274	084571-274	084568-064
059	084568-064	084568-064	084568-064	084568-064	084571-229
010	084571-229	084571-229	084571-229	084571-229	084572-272
011	084571-230	---	---	---	084571-230
012	084571-231	---	---	---	084571-231
013	084571-294	---	---	---	084571-294

SCHEMATIC DIAGRAMS

WIRE HARNESS



Wire Harness

Platform

Harness Components connected by:	
117927	Overhead Guard Left-Dome Light, Worklight, TB502, PS1, PS2, CA501
117928	Overhead Guard Right-SB30, Do me Light, Worklight, Fan, RES1, CA503
117895	To Overhead Guard Left CA301 from TB101, TB102, CA303, CA304
117896	To Overhead Guard Right CA503 from TB101, TB102
118175	* Zone Select Switch Assembly to TB102 (includes switch)
118845	Service Terminal Harness
132304	Switch Panel to TB101, TB102, DPS1 & 2, ORS1, LGS1, 2 & 3, FNS
136473	Auxiliary Mast DB1, DB2, LMS1, LOS3, LOS4, RAS3, RAS4, TB101, TB102
136477-001	* Trucks with TT Mast - Horn, Horn filter, (CHB7, CHB8, (CHS1, CHS2) to TB101 and TB102
136477-003	* Trucks with TL Mast - Horn, Horn Filter CHS1, CHS2 CHB7, CHB8 to TB101
136714	Control Module switches to TB101 and TB102, CA301, CA302 (ECR1), CA303, CA304, GS1, GS2, HNS1, KYS, RAS1, RAS2, LOS1, LOS2, GUS, EDS, FS, RS

* Wire harness selection depends on truck configuration.

Power Unit

Harness Components connected by: (Sheet 1 of 2)	
118842	* Strobe Light SB21 to CA216
119275-001	* RES6 & RES7 Chain Slack Switch Heaters Harness
119276-001	* THS2 Thermostat Harness
119277	* BRES2 Switch Heater Harness
119278	* BRES1 Switch Heater Harness
119279	* Main Freezer Condition Harness CA217, CA807, CA808
132244	ED1, ED2, P1, P2, PVL, PVLF One OR Two Speed PC209, JC230,
132263	* Wire Guidance, PC207, PC409, PC410, PC417, PC418, PC419
132281	Main Power Unit PC206, PC208, PC212, PC213, PC230, PC402, PC403, PC405, PC406, JC407, JC410, PC412, K5
132301	ED Power PC214, K5, ED1, ED2, Steering Module, Power Steering Motor

* Wire harness selection depends on truck configuration.



SCHEMATIC DIAGRAMS

WIRE HARNESS

Harness	Components connected by: (Sheet 2 of 2)
132476	Drive/Tow PC211 R50, R51
133420	Motor Monitoring System Module MMS PC215, M1 Brush, M3 Brush, M4 Brush, M1 Temp, M3 Temp, M4 Temp
136487	Auxiliary Lift CA201, CA217, ED1, K3, PVL, PVLF, SV1, TDM1, TDM2 (Lifting Forks)

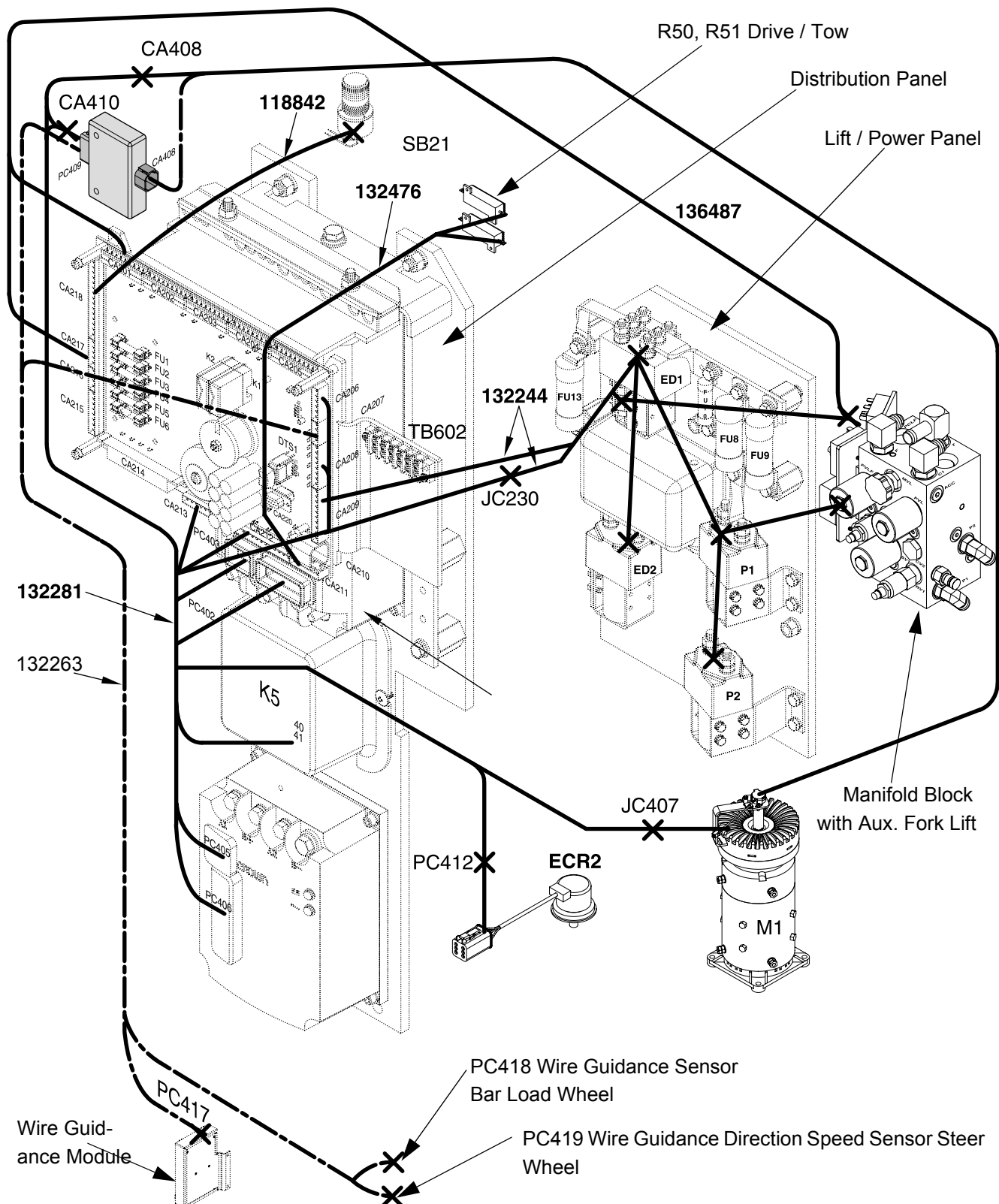
* Wire harness selection depends on truck configuration.

SCHEMATIC DIAGRAMS

POWER UNIT

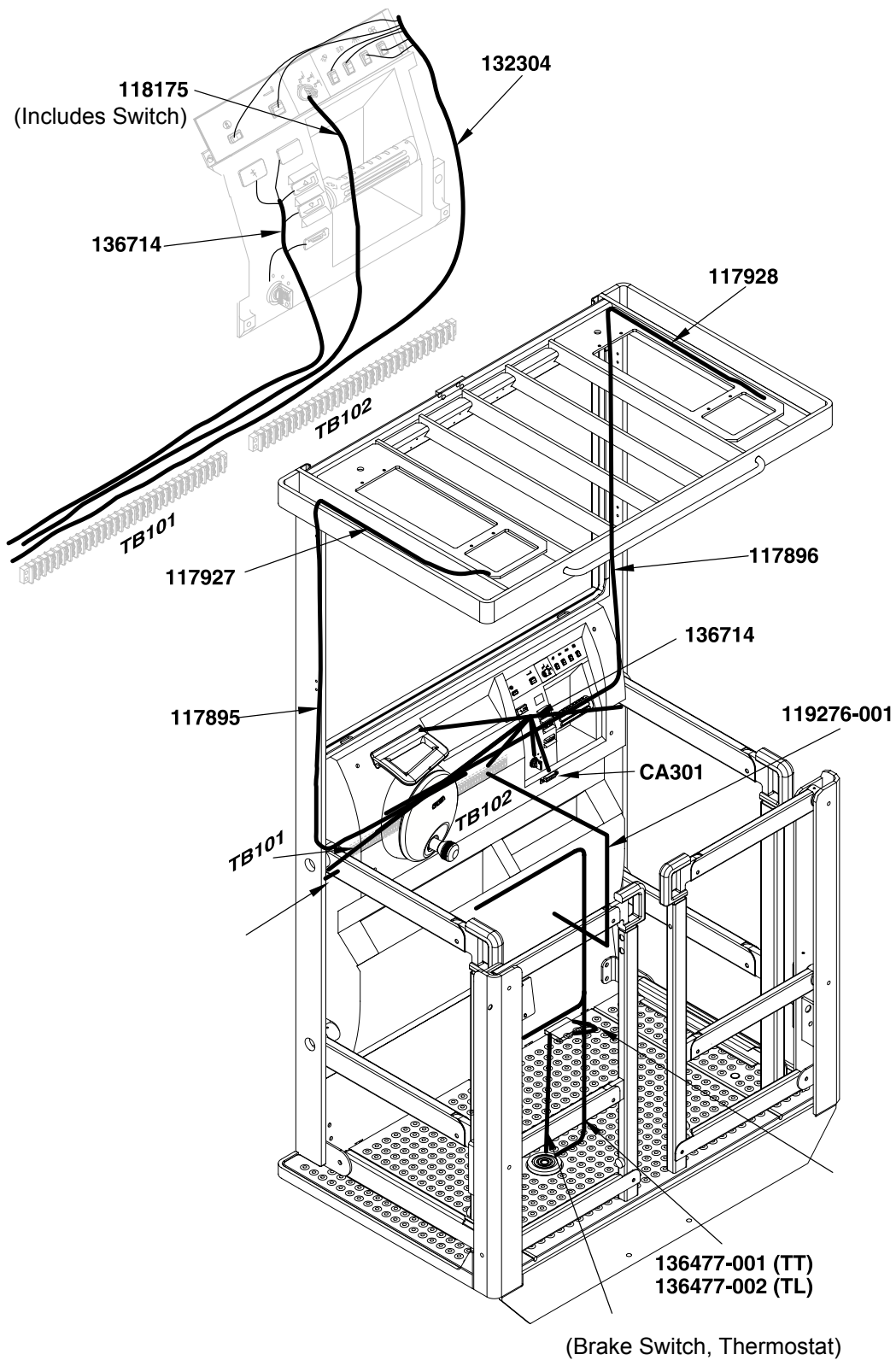


Power Unit



132274

Platform



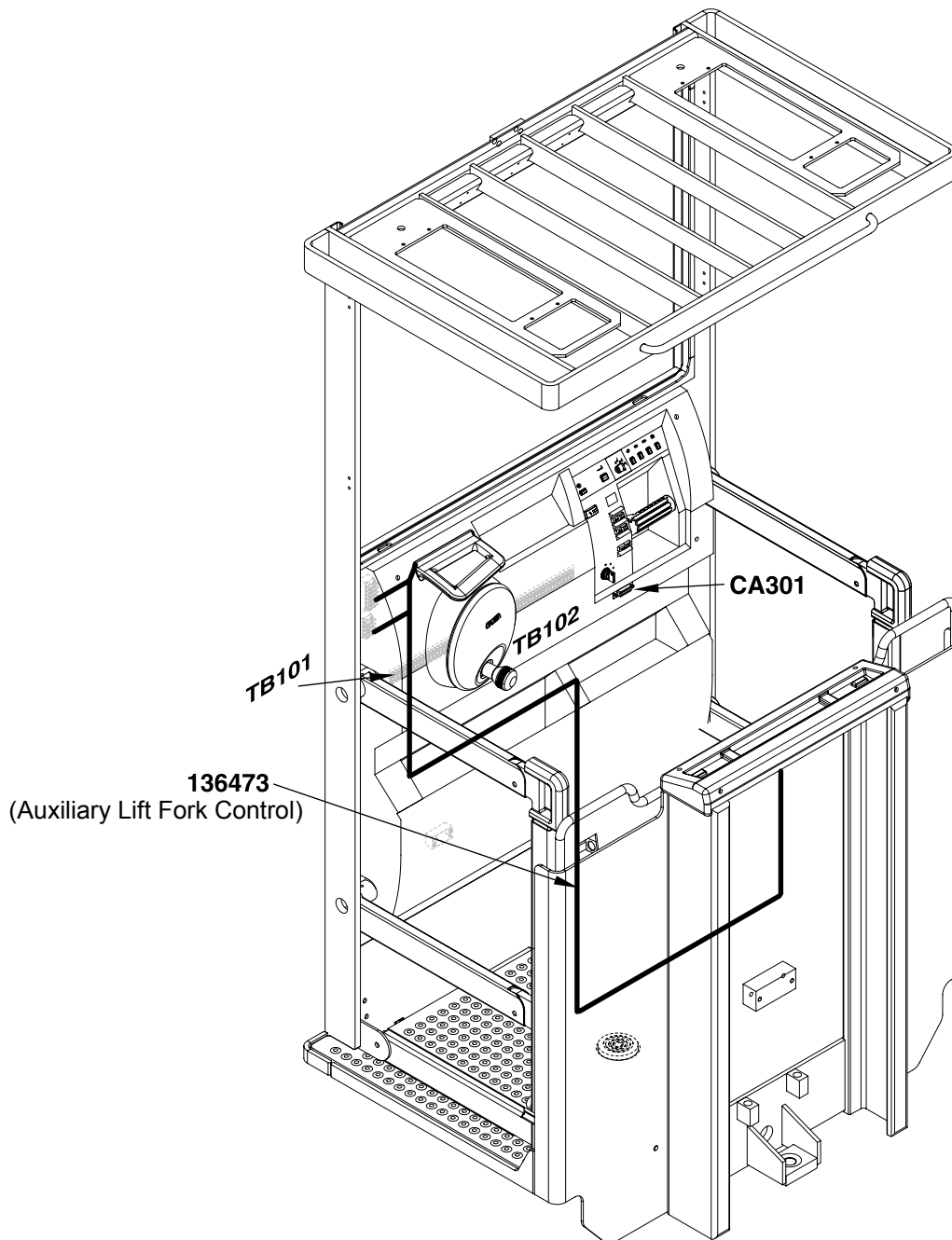
132275

SCHEMATIC DIAGRAMS

PLATFORM WITH AUXILIARY LIFT FORK



Platform with Auxiliary Lift Fork



13307



HYDRAULIC SCHEMATIC

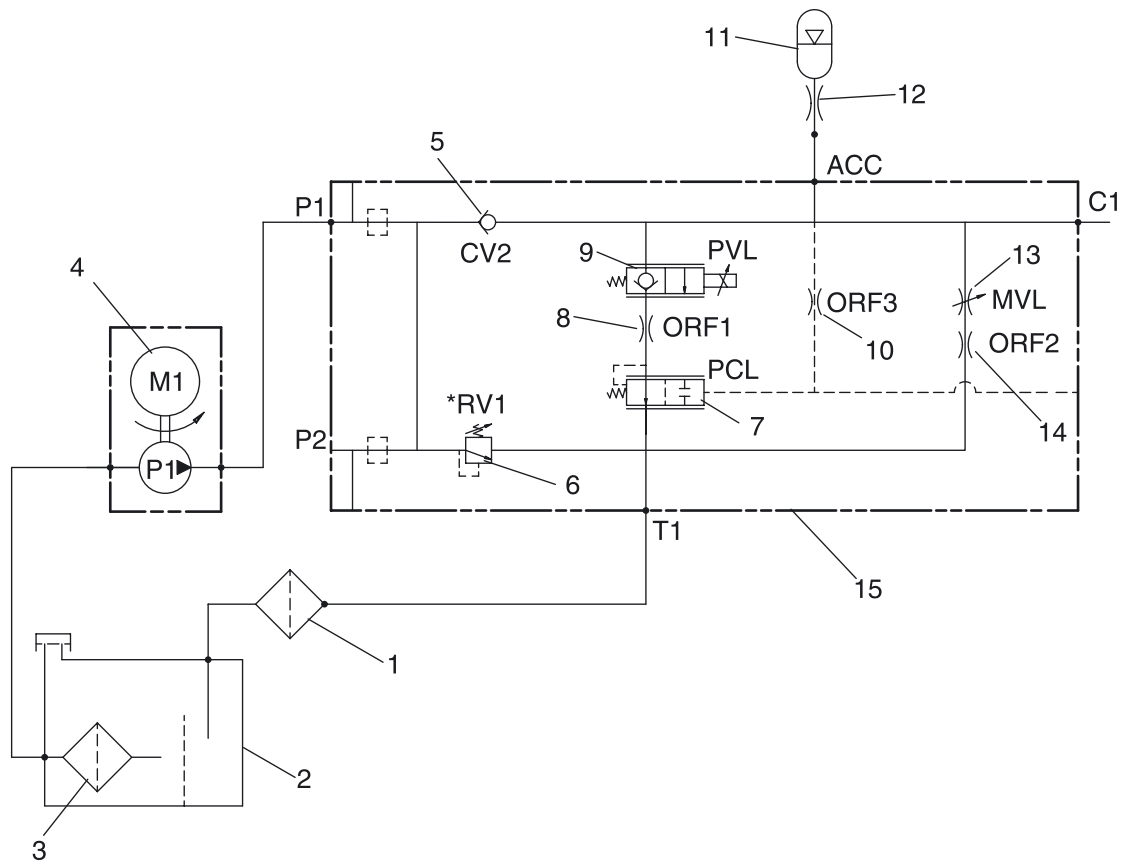


Notes:



HYDRAULIC SCHEMATIC SINGLE SPEED LIFT

Single Speed Lift



13051-1

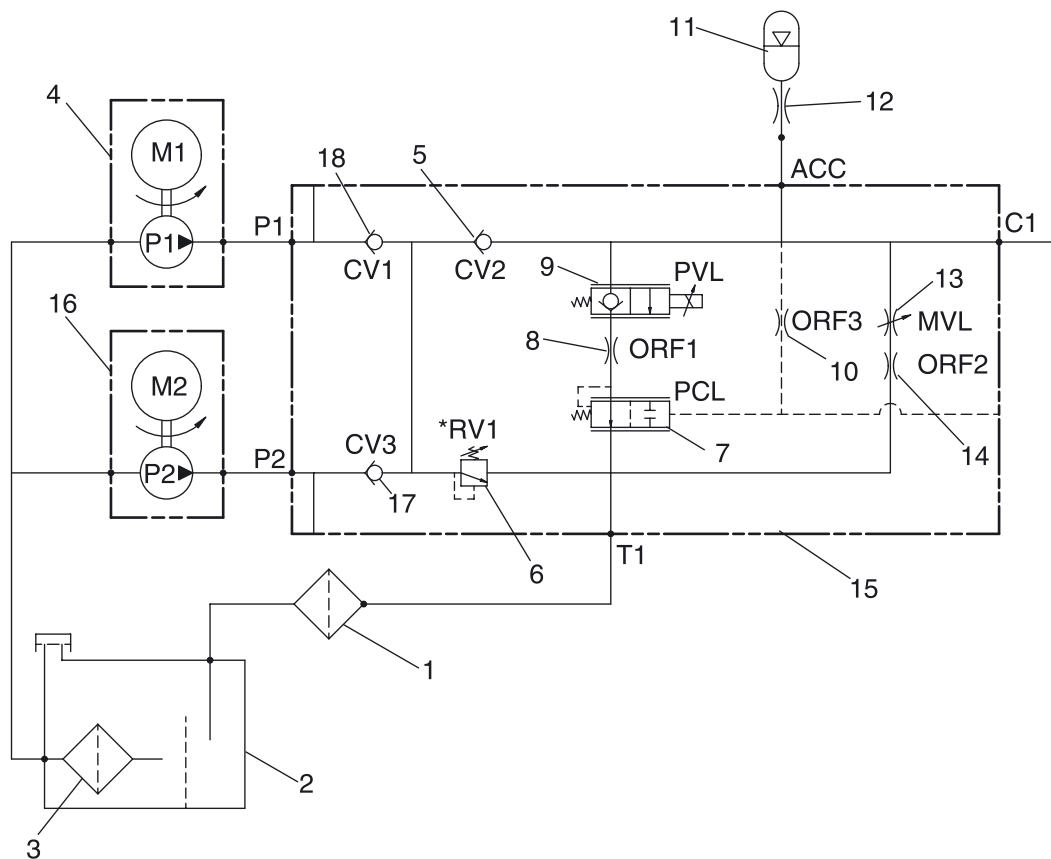
- | | | | |
|----|------------------------------------|----|-------------------------------|
| 1 | Return filter 10 micron | 2 | Reservoir |
| 3 | Suction strainer 100 mesh | 4 | Lift pump (P1) and motor (M1) |
| 5 | Check Valve (CV2). | 6 | Relief Valve (RV1) |
| 7 | Pressure Compensator Valve (PCL) | 8 | Orifice (ORF1) |
| 9 | Proportional Solenoid Valve (PVL). | 10 | Orifice (ORF3). |
| 11 | Accumulator | 12 | Connector Orifice. |
| 13 | Manual Lowering Valve (MVL). | 14 | Orifice (ORF2) |
| 15 | Lift / Lower Manifold Block | 16 | Lift pump (P2) and motor (M2) |
| 17 | Check Valve (CV3). | 18 | Check Valve (CV1). |
| C1 | Output to Lift Cylinders | | |

HYDRAULIC SCHEMATIC

TWO SPEED LIFT



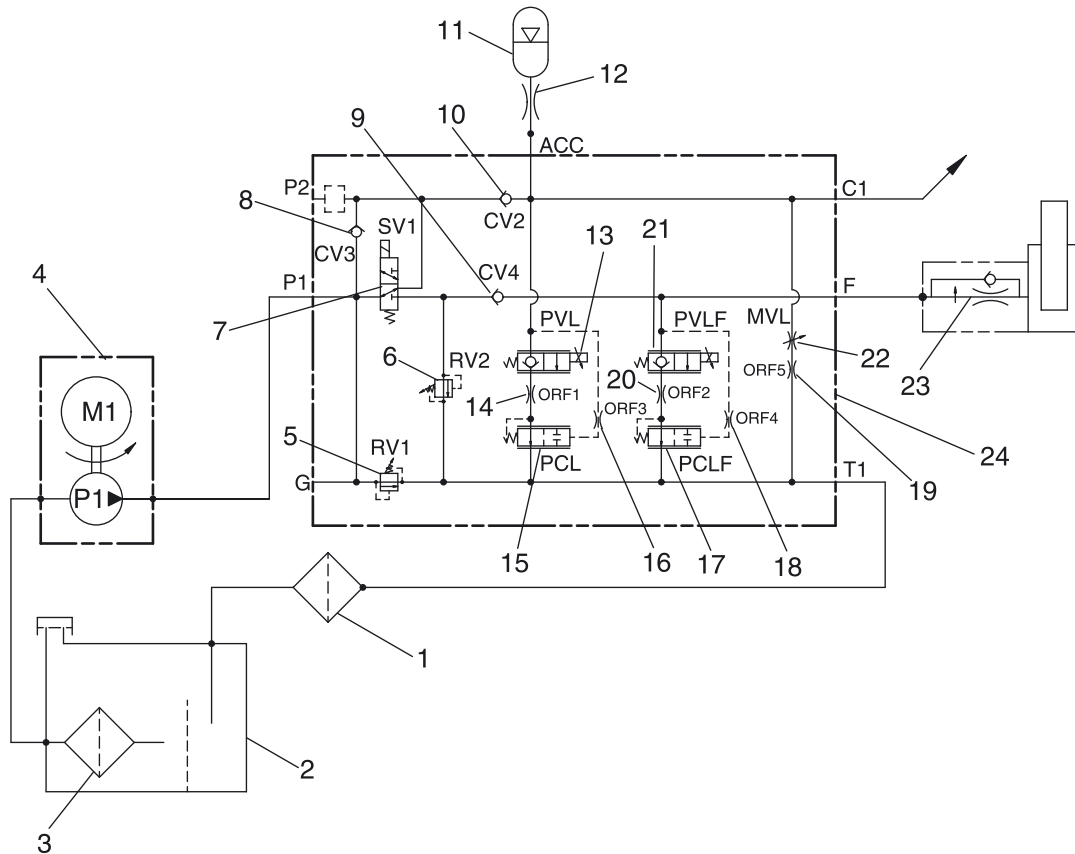
Two Speed Lift



13051-2

- | | | | |
|----|------------------------------------|----|-------------------------------|
| 1 | Return filter 10 micron | 2 | Reservoir |
| 3 | Suction strainer 100 mesh | 4 | Lift pump (P1) and motor (M1) |
| 5 | Check Valve (CV2). | 6 | Relief Valve RV1 |
| 7 | Pressure Compensator Valve (PCL) | 8 | Orifice (ORF1) |
| 9 | Proportional Solenoid Valve (PVL). | 10 | Orifice (ORF3). |
| 11 | Accumulator | 12 | Connector Orifice. |
| 13 | Manual Lowering Valve (MVL). | 14 | Orifice (ORF2) |
| 15 | Lift / Lower Manifold Block | 16 | Lift pump (P2) and motor (M2) |
| 17 | Check Valve (CV3). | 18 | Check Valve (CV1). |
| C1 | Output to Lift Cylinders | | |

Single Speed Lift With Lifting Forks



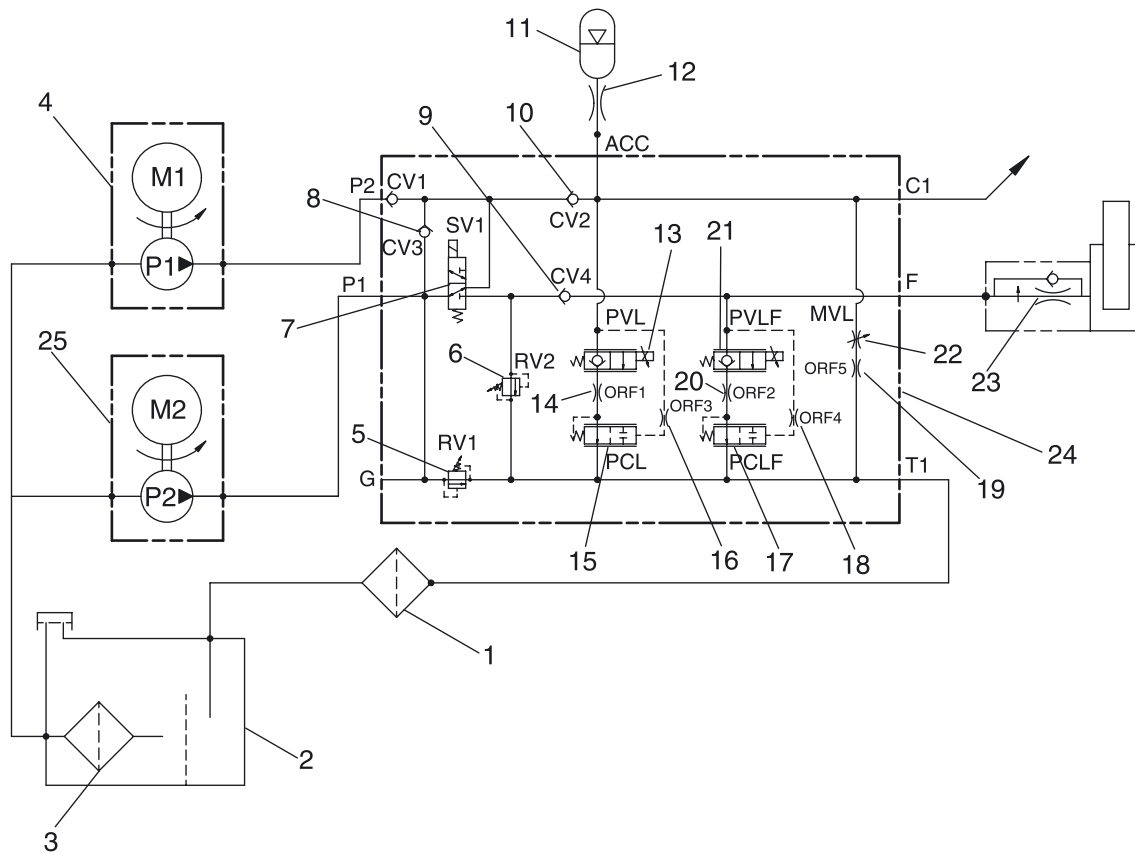
1	Return filter 10 micron	2	Reservoir
3	Suction strainer 100 mesh	4	Lift pump (P1) and motor (M1)
5	Relief Valve (RV1)	6	Relief Valve (RV2)
7	Solenoid Valve (SV1)	8	Check Valve (CV3)
9	Check Valve (CV4).	10	Check Valve (CV5)
11	Accumulator	12	Connector Orifice.
13	Proportional Solenoid Valve (PVL).	14	Orifice (ORF1)
15	Pressure Compensator Valve (PCL)	16	Orifice (ORF3)
17	Pressure Compensator Valve forks(PCLF)	18	Orifice (ORF4)
19	Orifice (ORF5)	20	Orifice (ORF6)
21	Proportional Solenoid Valve Forks (PVLF).	22	Manual Lowering Valve (MVL).
23	Flow Control Valve	24	Lift / Lower Manifold Block
25	Lift pump (P2) and motor (M2)	C1	Output to Lift Cylinders
F	Output to Fork Lift Cylinder		

HYDRAULIC SCHEMATIC

TWO SPEED LIFT WITH LIFTING FORKS

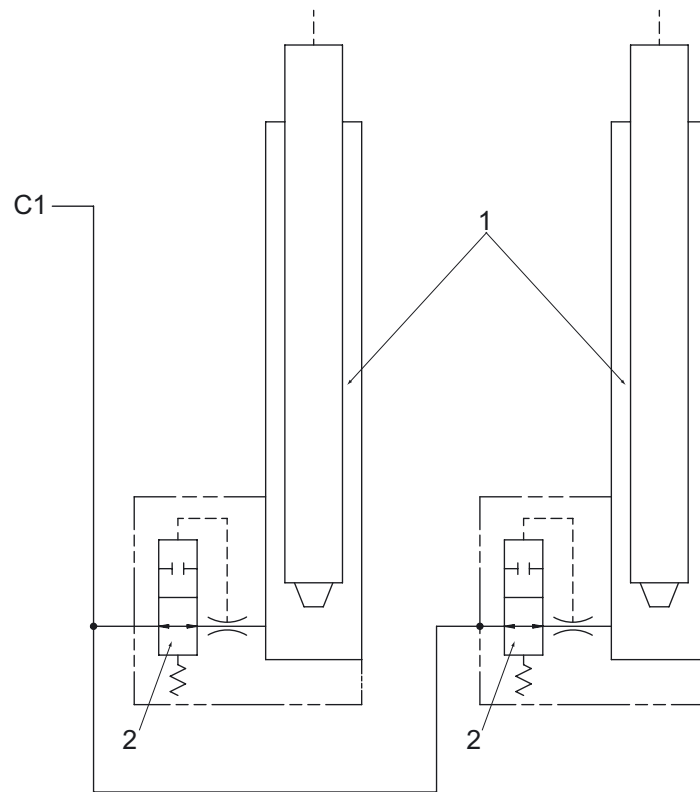


Two Speed Lift With Lifting Forks



13054-1

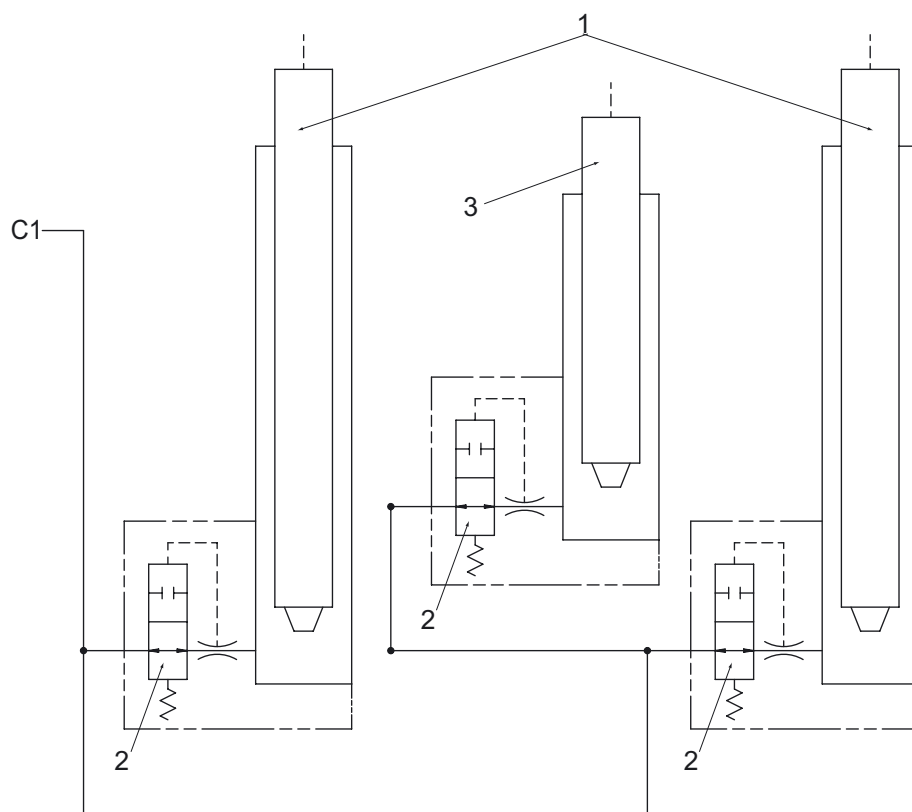
- | | | | |
|----|---|----|-------------------------------|
| 1 | Return filter 10 micron | 2 | Reservoir |
| 3 | Suction strainer 100 mesh | 4 | Lift pump (P1) and motor (M1) |
| 5 | Relief Valve (RV1) | 6 | Relief Valve (RV2) |
| 7 | Solenoid Valve (SV1) | 8 | Check Valve (CV3) |
| 9 | Check Valve (CV4). | 10 | Check Valve (CV5) |
| 11 | Accumulator | 12 | Connector Orifice. |
| 13 | Proportional Solenoid Valve (PVL). | 14 | Orifice (ORF1) |
| 15 | Pressure Compensator Valve (PCL) | 16 | Orifice (ORF3) |
| 17 | Pressure Compensator Valve forks(PCLF) | 18 | Orifice (ORF4) |
| 19 | Orifice (ORF5) | 20 | Orifice (ORF6) |
| 21 | Proportional Solenoid Valve Forks (PVLF). | 22 | Manual Lowering Valve (MVL). |
| 23 | Flow Control Valve | 24 | Lift / Lower Manifold Block |
| 25 | Lift pump (P2) and motor (M2) | C1 | Output to Lift Cylinders |
| F | Output to Fork Lift Cylinder | | |



1 Lift Cylinders
C1 From Lift / Lower Manifold Block

2 Velocity Fuse

TT Mast



13054-1

- | | | | |
|---|--------------------|----|----------------------------------|
| 1 | Lift Cylinders | 2 | Velocity Fuse |
| 3 | Free Lift Cylinder | C1 | From Lift / Lower Manifold Block |