

CROWN



Service Manual

ESR4000 Series

CROWN

TABLE OF CONTENT

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Index

MA – SAFETY	PAGE	SER. NO. SEC.	ISSUE
Symbols Used In The Manual	M/P-MA-0000-001 .		
General Maintenance and Repair Safety Instructions	M/P-MA-0000-001		
- Maintenance and Repair	M/P-MA-0000-002		
- Before Parking the Truck	M/P-MA-0000-002		
- Before Working on the Truck	M/P-MA-0000-002		
- Before Starting the Truck	M/P-MA-0000-002		
Truck Warnings and Labels	M/P-MA-0000-002		
ITD – INTRODUCTION	PAGE	SER. NO. SEC.	ISSUE
General	M/P-ITD-2140-001		
- Operating Instructions	M/P-ITD-2140-001		
- Service Training	M/P-ITD-2140-001		
- Ordering Spare Parts	M/P-ITD-2140-001		
- Using the Manual	M/P-ITD-2140-001		
- Page Numbering in the Manual	M/P-ITD-2140-002		
Model Number	M/P-ITD-2140-003		
M1 – LUBRICATION AND ADJUSTMENT	PAGE	SER. NO. SEC.	ISSUE
Jacking up the Truck	M-1.0-2140-001		
Raising the Truck with a Crane	M-1.0-2140-002		
Towing the Truck	M-1.0-2140-002		
Component Access	M-1.0-2140-003		
- Removing the Floorboard	M-1.0-2140-004		Rev.1 08/00
- Seat Disassembly / Installation	M-1.0-2140-004		
- Plastic Panel Disassembly / Assembly	M-1.0-2140-004		
Maintenance	M-1.1-2140-001		
- Driver Participation	M-1.1-2140-001		
- Daily Maintenance Log	M-1.1-2140-001		
- Recommended Lubricants and Oils	M-1.1-2140-002		
- Lubrication Items and Intervals	M-1.2-2140-001		
- Inspection and Maintenance Schedule	M-1.2-2140-002		Rev.1 08/00
Torques	M-1.9-0000-001		
M2 – HYDRAULICS	PAGE	SER. NO. SEC.	ISSUE
Changing Hydraulic Oil	M-2.0-0000-001		
Hydraulic Pipes and Accessories	M-2.1-2140-001		
- Filter	M-2.2-2140-002		
- Tank	M-2.3-2140-002		
- System Bleeding	M-2.3-2140-002		
- Drift Test	M-2.3-2140-002		
Functional Description	M-2.3-2140-003		
Hydraulic Symbols	M-2.3-2140-013		
Valve Block	M-2.4-2140-001		
- Safety Valve Setting (RV1 and RV2)	M-2.4-2140-001		
- Proportional Valve Setting (PVA and PVH)	M-2.4-2140-001		
M3 – DRIVE UNIT	PAGE	SER. NO. SEC.	ISSUE
Drive Unit	M-3.1-2140-001		
- Removal	M-3.1-2140-001		
- Draining the Oil	M-3.1-2140-001		
- Steering Chain Removal	M-3.1-2140-002		
- Drive Wheel Removal	M-3.1-2140-002		
- Tools	M-3.1-2140-003		

- Measurement Tools	M-3.1-2140-004
- Equipment	M-3.1-2140-005
Gear Unit Maintenance	M-3.1-2140-008
- Disassembly	M-3.1-2140-510
- Pre-Assembly Test	M-3.1-2140-013
- Assembly	M-3.1-2140-013
- Final Assembly	M-3.1-2140-019
- Gear Upper Section Assembly	M-3.1-2140-021
- Live Ring Bearing Maintenance	M-3.1-2140-021
- Gear Unit Assembly	M-3.1-2140-022

M4 – ELECTRICS	PAGE	SER. NO. SEC.	ISSUE
Electrics - General	M-4.0-0000-001		
- Wire Colour Codes	M-4.0-0000-001		
- Abbreviations	M-4.0-0000-002		
- Electrical Symbols	M-4.0-0000-004		
Load Monitor (Display)	M-4.3-2140-200		
- Troubleshooting	M-4.3-2140-203		
Encoder ECR2	M-4.3-2140-300		
ESR4000 Status Codes	M-4.3-2140-400		
- Power-up circuit diagram	M-4.3-2140-401		
- Status codes 200 to 294	M-4.3-2140-402		
- Status codes 311 to 399	M-4.3-2140-427		
- Status codes 813 to 838	M-4.2-2140-403	-----	Rev.1 08/00
Access 1-2-3	M-4.3-2140-600		
- Access 1, Design and Function	M-4.3-2140-600		
- Battery Discharge Indicator	M-4.3-2140-601		
- Power "on"	M-4.3-2140-601		
- Operator Improper Sequence Error	M-4.3-2140-601		
- Service Due Key Display	M-4.3-2140-601		
- Navigation Keys	M-4.3-2140-602		
- Message Display	M-4.3-2140-602		
- Load Monitor	M-4.3-2140-601		
Operator Menu	M-4.3-2140-603		
Service Menu	M-4.3-2140-605		
Analyzer Menu	M-4.3-2140-606		
Calibration Menu	M-4.3-2140-611		
- Accessing the CALIBRATION Menu	M-4.3-2140-613		
- When to calibrate	M-4.3-2140-613		
- Calibration Procedures	M-4.3-2140-613		
- Calibration Complete	M-4.3-2140-613		
Features Menu	M-4.3-2140-621		
Menü HOUR METERS	M-4.3-2140-629	-----	Rev.1 08/00
Log Events Menu	M-4.3-2140-630		
Performance Menu	M-4.3-2140-631		
Utilities Menu	M-4.3-2140-644	-----	Rev.1 08/00
Emergency Disconnect Contactor	M-4.4-2140-001		
Battery Maintenance	M-4.6-2140-001		
- Charging the Battery	M-4.6-2140-001		
- Replacing the Battery	M-4.6-2140-001		
Traction / Pump Motor Maintenance	M-4.35-2140-001		
- Access	M-4.35-2140-001		
- Maintenance	M-4.35-2140-001		

M5 – BRAKE	PAGE	SER. NO. SEC.	ISSUE
Brake System	M-5.0-2140-001		
- Bleeding the Brake System	M-5.0-2140-001		
- Motor Brake	M-5.0-2140-002		

- Operating Brake Adjustment	M-5.0-2140-002
Parking Brake	M-5.0-2140-003
- Parking Brake Adjustment	M-5.0-2140-003
- Brake System Bleeding	M-5.0-2140-004
- Motor Brake Disassembly	M-5.0-2140-004
Load Wheel Brake System	M-5.0-2140-006
- Load Wheel Brake Adjustment	M-5.0-2140-006
- Brake System Bleeding	M-5.0-2140-007

M6 – STEERING	PAGE	SER. NO. SEC.	ISSUE
- Steering	M-6.0-2140-001		
- Steering Unit Disassembly	M-6.0-2140-002		
- Hydraulic Motor Disassembly	M-6.0-2140-003		
- Steering Chain Adjustment	M-6.0-2140-004		
- POT6 (Steer Angle Display) Replacement	M-6.0-2140-005		
- Assembly and Adjustment	M-6.0-2140-005		

M7 – MAST	PAGE	SER. NO. SEC.	ISSUE
Mast	M-7.0-2140-001		
- Torque Requirements	M-7.0-2140-001		
- Fork Adjustments	M-7.0-2140-001		
- Mast Testing (Assembled)	M-7.0-2140-001		
- Flaking	M-7.0-2140-001		
- Shock Absorbers	M-7.0-2140-001		
- Mast Dampening Screws, Adjustment	M-7.0-2140-001		
- Mast Disassembly	M-7.0-2140-003		
- Mast Assembly	M-7.0-2140-003		
- Mast Rollers	M-7.0-2140-004		
- Mast Roller Adjustment	M-7.0-2140-004		
- Mast Play Control	M-7.0-2140-004		
- Fork Carriage	M-7.0-2140-006		
- Disassembly	M-7.0-2140-006		
- Assembly	M-7.0-2140-006		
- Fork Carriage Roller Adjustment	M-7.0-2140-007		
Lift Chains	M-7.5-2140-001		
- General	M-7.5-0000-001		
- Inspection	M-7.5-0000-001		
- Cleaning	M-7.5-0000-001		
- Wear	M-7.5-0000-001		
- Freedom of Movement	M-7.5-0000-002		
- Chain Tension	M-7.5-0000-002		
- Chain Anchor and Pulleys	M-7.5-0000-002		
- Worn or Missing Plates	M-7.5-0000-002		
- Protruding or Turned Chain Pins	M-7.5-0000-002		
- Corrosion	M-7.5-0000-003		
- Chain Lateral Wear	M-7.5-0000-003		
- Uneven Chain Tension	M-7.5-0000-003		
- Misalignment of Lift Components	M-7.5-0000-003		
- Lift Chain Lubrication	M-7.6-0000-001		
Fork Tine Test	M-7.6-0000-002		
- General	M-7.6-0000-002		
- Fork Identification	M-7.6-0000-002		
- Repairs	M-7.6-0000-002		
- Crack Inspection	M-7.6-0000-002		
- Fork Identification	M-7.6-0000-002		
- Fork Blade Warping	M-7.6-0000-003		
- Verticality Test	M-7.6-0000-003		
- Measuring the Fork Tip Width	M-7.6-0000-004		
- Fork Tine Height Difference	M-7.6-0000-004		

- Fork Stop	M-7.6-0000-004
- Wear	M-7.6-0000-005

M8 – CYLINDERS	PAGE	SER. NO. SEC.	ISSUE
General	M-8.0-0000-001		
- Plunger Cylinders	M-8.0-0000-001		
- Piston Cylinder	M-8.0-0000-002		
- Maintenance	M-8.0-0000-003		
- Inspection	M-8.0-0000-003		
Installing the Piston Seals	M-8.0-2340-001		
Cylinder Disassembly	M-8.0-2340-002		
- Free-Lift Cylinder Disassembly and Assembly	M-8.0-2340-002		
- Lift Cylinder Disassembly and Assembly	M-8.6-2340-002		
- Reach Cylinder Disassembly and Assembly	M-8.6-2340-002		
- Sideshifter Cylinder Disassembly and Assembly	M-8.6-2340-003		
- Tilt Cylinder Disassembly and Assembly	M-8.6-2340-003		
- Parking Brake Cylinder Disassembly and Assembly	M-8.6-2340-002		

DIA – WIRING DIAGRAMS	PAGE	SER. NO. SEC.	ISSUE
Standard Layout	M/P-DIA-2140-001		
- Control Circuit	M/P-DIA-2140-001	-----	Rev.2 09/00
- Acces1	M/P-DIA-2140-002	-----	Rev.2 09/00
- Access2	M/P-DIA-2140-003		
- Access3	M/P-DIA-2140-004		
- Switches and Controls	M/P-DIA-2140-005		
- Mast, Hydraulic Components	M/P-DIA-2140-008	-----	Rev.2 09/00
- Fuses, Fans and Contactors	M/P-DIA-2140-008		
- Node points	M/P-DIA-2140-011	-----	Rev.2 09/00
- Power cable	M/P-DIA-2140-013		

HYD – HYDRAULIC DIAGRAM	PAGE	SER. NO. SEC.	ISSUE
Hydraulic Diagram	M/P-HYD-2140-001	-----	Rev.1 09/00

CROWN

SAFETY

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Safety Symbols used in the Manual

To help guide you through the manual and to highlight particular danger areas, we have used graphic illustrations:

DANGER



This symbol indicates life-threatening risks

- *Failure to comply with this notice may result in severe or fatal injuries to yourself or other people.*

WARNING



This symbol indicates the risk of serious injury and/or serious material damage.

- *Failure to comply with this notice may result in severe injuries to yourself or other people and/or serious material damage.*

CAUTION



This symbol indicates the risk of minor injury and/or minor material damage.

- *Failure to comply with this notice may result in minor injuries to yourself or other people and/or minor material damage.*

INFORMATION



Contains additional information with supplementary notes and hints.

OPTION



These items relate to optional features not supplied with the standard version.

General Maintenance and Repair Safety Notes

DANGER



Read the safety notices in the truck Maintenance and Operator's Manuals.

- *Failure to do so could result in severe or fatal injuries to maintenance personnel and/or other persons.*

Motorised vehicles can be dangerous if maintenance and service are neglected. For this reason maintenance and inspections must be carried out at regular short intervals by trained personnel working to approved company guidelines.

DANGER



Follow all national/local safety regulations applicable for maintenance work, e.g. for work on higher levels.

- *Failure to do so could result in severe or fatal injuries to maintenance personnel and/or other persons.*

Maintenance and Repair

1. Maintenance work must only be carried out in accordance with the test and maintenance program contained in the present Maintenance Manual and any applicable service notices.
2. Only qualified and authorised personnel may carry out work on the truck.
3. Always keep fire extinguishers in good working condition. Do not approach fluid levels or leaks with a naked flame.
4. To clean, use a non flammable, non combustible cleaning solution which is groundwater-neutral. Only carry out cleaning with an oil separator. Protect the electrical system from dampness.
5. Keep the service area clean, dry and well-ventilated.
6. Do not allow oil to penetrate the ground or enter the draining system. Used oil must be recycled. Oil filters and desiccants must be treated as special waste products. Relevant applicable regulations must be followed.

7. Neutralise and thoroughly rinse any spilled battery fluid immediately.
8. Keep the truck clean. This will facilitate the location of loose or faulty components.
9. Make sure that capacity and data plates, warnings and labels are legible at all times.
10. Alterations or modifications by the owner or operator are not permitted without the express written authorisation from Crown.
11. Only use original Crown spare parts to ensure the reliability, safety and suitability of the Crown truck.

Before Leaving the Truck

- Stop the truck.
- Lower the fork carriage fully.
- Apply the parking brake.
- Turn off the travel switch and remove the key.
- Block all wheels when parking on an uneven surface.

Before Carrying out Work on the Truck

- Raise the truck to free the drive wheel. Press the emergency Stop button and disconnect the battery.
- Prevent the truck from rolling away.
- Before carrying out work on the hoist frame, the lift mast or on the fork carriage: Block these parts according to maintenance instructions in order to prevent them from dropping.
- Only carry out operational testing when there is sufficient room to manoeuvre, to avoid the risk of injury to yourself and others.

Before Operating the Truck

- Check the safety devices.
- Get into the driver's seat.
- Check the operation of the lifting device, travel direction switch, speed control, steering, warning devices and brakes.

Warnings and Labels on the Truck

During regular maintenance check that the warnings and labels on the truck are complete and legible.

- Clean any illegible labels.
- Replace any faulty or missing labels.

The order and meaning of the warnings and labels on the truck are described in section 10.9 of the parts manual.

CROWN

INTRODUCTION

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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.

This manual therefore contains fewer and less detailed warnings than the Operator's Manual, as the latter is aimed at persons who have very little or no prior experience at all.

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 manual.

Spare parts can be ordered by quoting:

- The truck specification number
- 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

Kronstadter Str. 11

81677 Munich

GERMANY

Tel.: +49 (0)89 / 93 002 -0

Fax: +49 (0)89 / 93 002 -175 oder 133

Using the Manual

The Maintenance Manual is written in three independent language blocks: **English, German and French.**

Each language block in turn is divided into chapters and sections.

The table on the following page shows how the manual is structured.

Sections Maintenance	
Section	Description
IDX	Table of Content
MA	Safety
ITD	Introduction
M1	Lubrication and Adjustment
M2	Hydraulics
M3	Drive Unit
M4	Electrical
M5	Brake
M6	Steering
M7	Mast / Lifting Mechanism
M8	Cylinder
DIA	Electrical Diagrams
HYD	Hydraulic Schematic

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Page Numbering in the Manual

The page numbers are on the left and right-hand sides of the page footer.

If a page has been modified since the last edition, a revision number will be found in the middle of the footer:

02 REV. 2/99 means the second amendment to this page in February 1999.

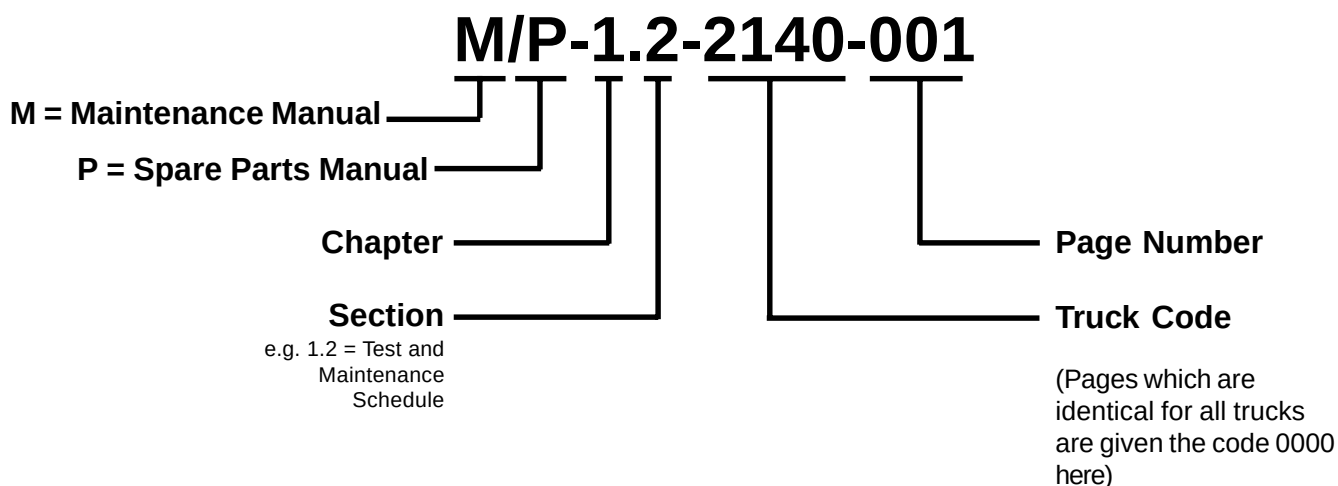
The page numbers are not necessarily consecutive!

The back page of the manual contains a print number in the following form:

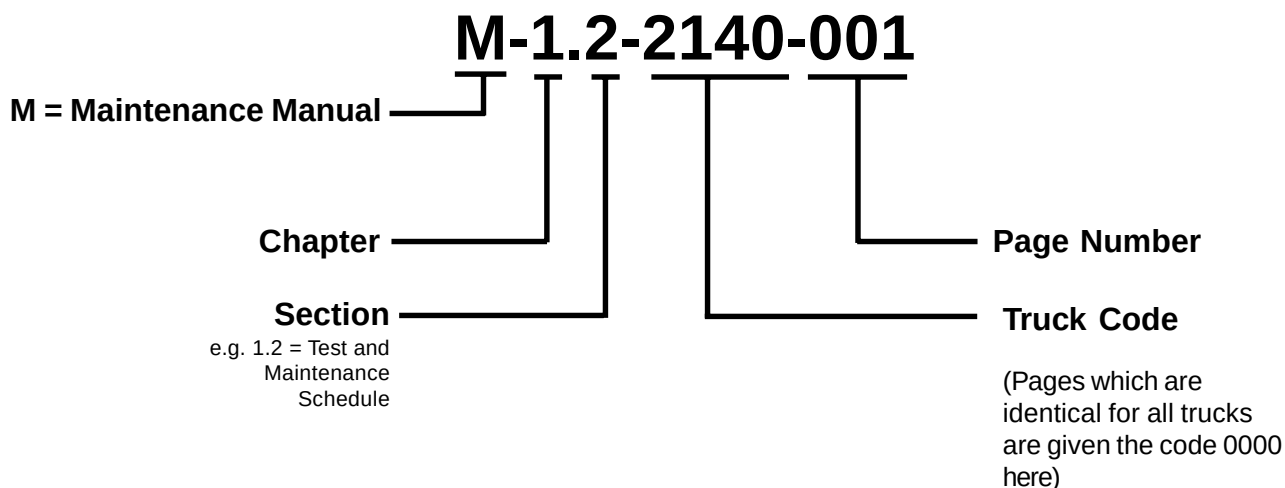
MS-ESR4000-GB-D-F 02/00

In this example, 02/00 is the edition date.

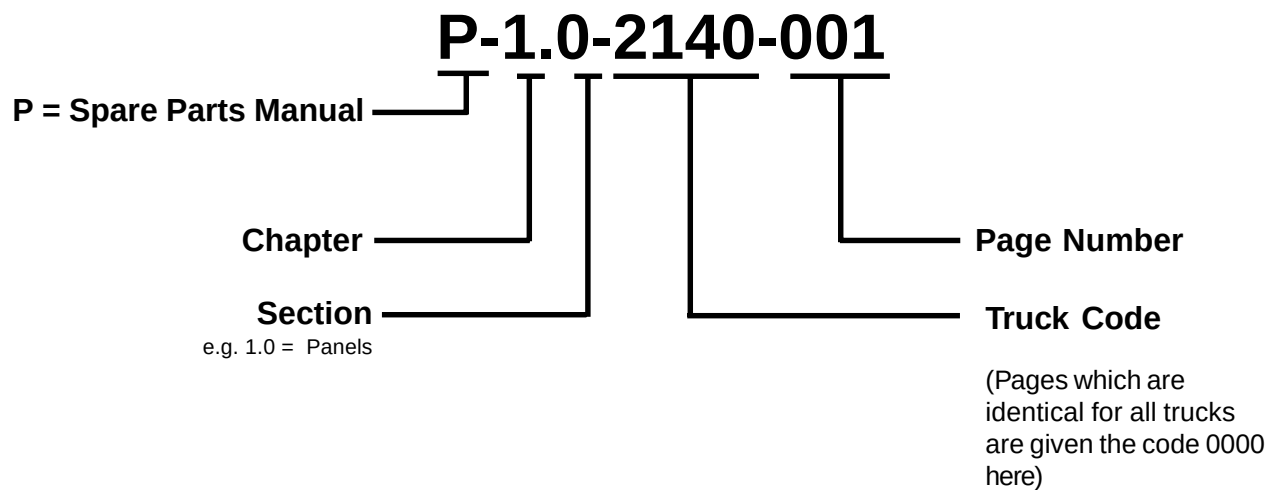
A page beginning with M/P- is *identical* in both the maintenance and spare parts manuals:



A page beginning with M- is *only* contained in the maintenance manual:



A page beginning with P- is *only* contained in the spare parts manual:



Model-Number

Modeldescription	ESR4020	-	1.4	Capacity	
ESR = 3-Wheel Sit-Down Rider Reach Truck				Code	Capacity
				1.4	1.400 kg
				1.6	1.600 kg
				2.0	2.000 kg

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CROWN

LUBRICATION AND ADJUSTMENT

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Jacking up the Truck

Apply a jack with sufficient capacity, hard wooden blocks and wedges as shown in Fig. M1633.

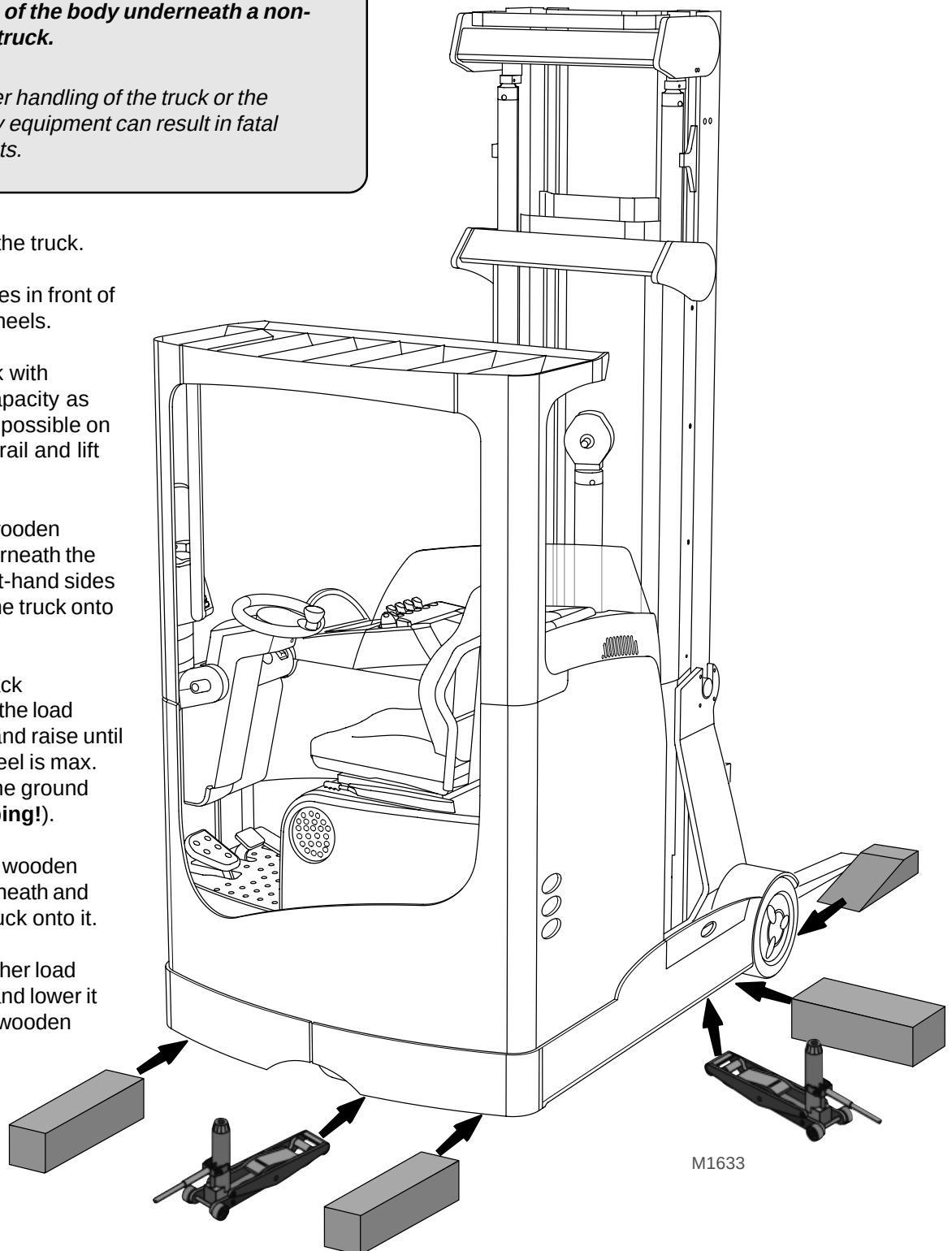
DANGER



Always support the raised truck on square blocks or other appropriate material to relieve the trolley. Never put your hands or other parts of the body underneath a non-supported truck.

- *Improper handling of the truck or the auxiliary equipment can result in fatal accidents.*

- Fully lower the truck.
- Place wedges in front of both load wheels.
- Apply a jack with sufficient capacity as centrally as possible on the skirting rail and lift the truck.
- Slide hard wooden blocks underneath the left and right-hand sides and lower the truck onto them.
- Apply the jack underneath the load wheel arm and raise until the load wheel is max. 10 mm off the ground (**risk of tipping!**).
- Slide a hard wooden block underneath and lower the truck onto it.
- Raise the other load wheel arm and lower it onto a hard wooden block.



M1633

Raising the Truck with a Crane

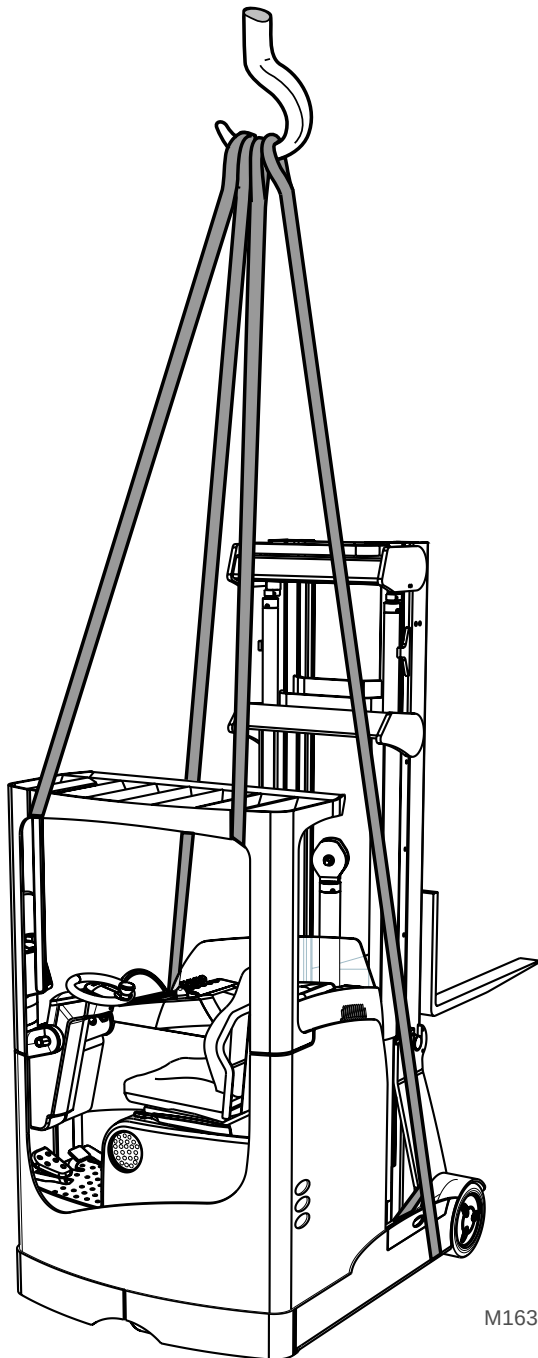
Attach the chains / slings as illustrated in the diagram.

DANGER



Make sure the crane / fork lift and the lifting equipment have sufficient capacity.

- *If the crane / lift truck crash or a load falls, fatal injuries can result.*

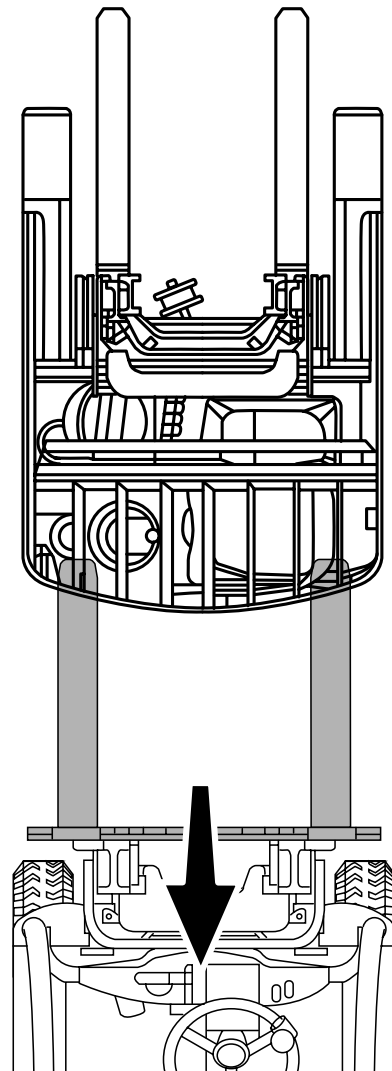


M1630

Towing the Truck

If the truck has been switched off and is idle, it can be towed over short distances without having to release the drive wheel brake. A breakdown truck can be removed from its operating aisle using a fork lift truck with a minimum 2500 kg capacity.

- Position the forks under the chassis as illustrated in the diagram.
- Raise the truck approximately 20 mm off the ground. The drive wheel should not be in contact with the ground.
- Slowly tow the truck in a forward direction only (black arrow).



M1722

Component Access

Access can be gained either by unscrewing the panels (Access etc.) or simply by flipping up and lifting out the driver seat.

Detailed descriptions are contained on the next page.

WARNING



Always remove the battery connector before carrying out maintenance work. This applies especially if the connector and plug connection have to be separate.

Underneath the panel

- Access 1, 2 & 3
- Contactors
- Fuses

Underneath the steering column panel

- Steering gear and sensor

Underneath the floorboard

- Main brake cylinder
- Pedal mechanism
- Hydraulics
- Priority valve

Underneath the driver's seat

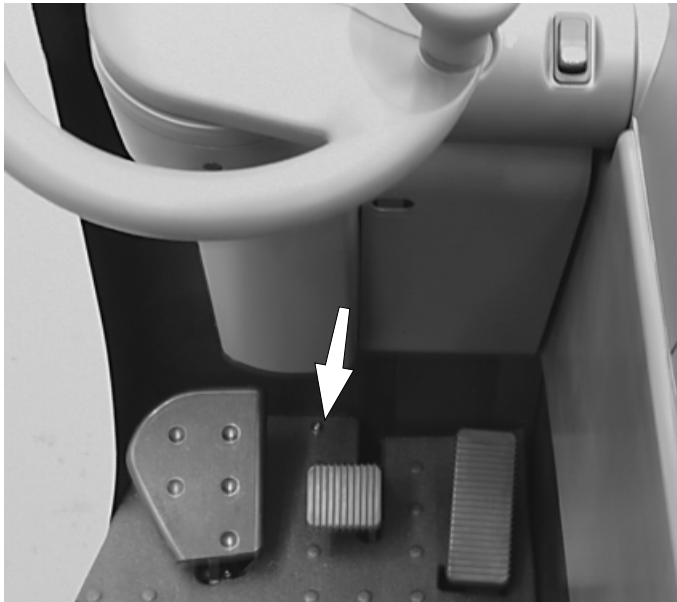
- Drive system
- Hydraulic pump
- Hydraulic tank
- Brake system
- Main hydraulic block
- Proportional valves



M1729

Removing the Floorboard

Remove one screw (see Fig. M1690). Lift the floorboard backwards and up to remove it (seat must be removed first).



M1690

Seat Disassembly / Installation

- Push the seat fully forward.
- Open the quick release mechanism (see Fig. 1670)



M1670

- Flip the seat forward (Fig. M1699)

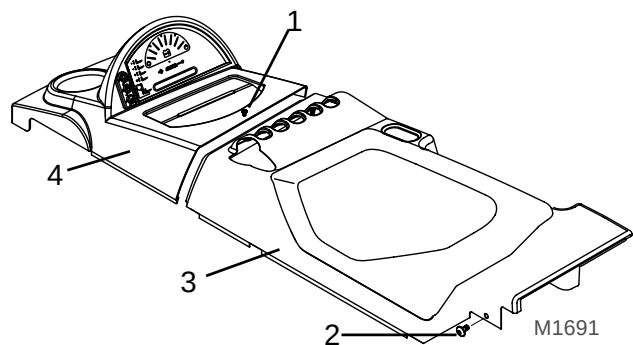


M1699

- Disconnect the cable to the seat switch from the clutch.
- Lift out the seat from the top.
- Installation is the reverse of disassembly. **Do not forget the cable to the seat switch!**

Plastic Panel Disassembly / Assembly

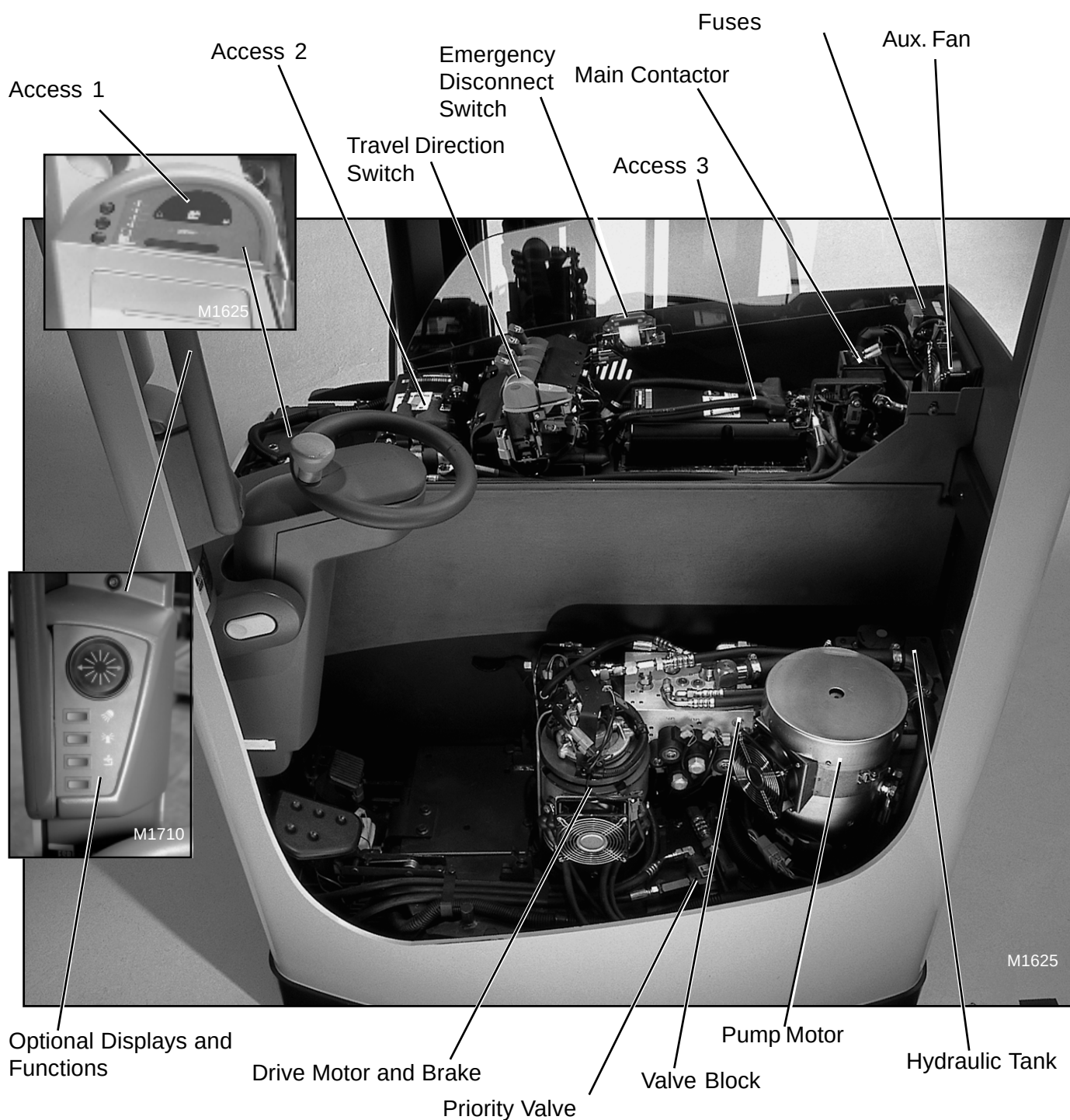
- Remove screws (1 and 2, Fig. M1691).



M1691

- Raise the cover (3) and disconnect the electrical connections to the control levers. Remove the panel.
- Unplug Acces 1 in panel (4).
- Remove panel (4).
- Installation is the reverse order.

Driver Seat, Floorboard and Panel Removed



Maintenance

Driver Participation

By involving the driver in the maintenance schedule, truck downtimes can be substantially reduced. The driver can also contribute to determining the maintenance schedule, thereby saving costs. Crown therefore recommends that the driver carry out the daily maintenance in accordance with the table on page M1.2-1720-002.

Daily Maintenance Log

A maintenance log is provided to keep a record of the extent and time of maintenance performed.

Recommended Lubricants and Oils

Lubricants

Only high grade lubricants and oils should be used. These can be obtained from any oil manufacturer. Those listed in table on page M1.1-1720-002 are typical, and any lubricant of the same grade can be used.

Cold Store Trucks

Special hydraulic oil, lubrication oil and grease must be used for cold store trucks operating in low temperature conditions (see table on page M1.1-1720-002). An anti-corrosion fluid (Crown no. 078882-002) must be applied to all screws, washers, nuts, pins, retaining rings etc.

Maintenance schedules should be kept as short as possible to prevent excessive wear of moving components.

Lubricant Type	Product Description	Manufacturer	CROWN-Part-No.	Type
Grease (multi purpose)	Aralube HLP-2 LM-Grease Regulus A2 Beacon EP2 EP2 Mobiluxe E2 Retinax LX	Aral Castrol Century Esso Maxol Mobil Shell	053002-001	B
Low temperature grease	Aralube SKL2 Unirex Lotemp EP	Aral Mobil	053002-005	BB
Lubrication oil (chain)	Kowal 40 Essolube HDX Plus + 40 Delvac 1240	Aral Esso Mobil	053002-007	G
Low temperature lubrication oil	SHC 626	Mobil	053002-008	GG
Hydraulic oil	Vitam GF 32 Hyspin AWS-32 Nuto H32 DTE 24 Tellus 32	Aral Castrol Esso Mobil Shell	053001-003	D
Low temperature hydraulic oil	Univis J 13 Aero HFA	Aral Mobil	053001-008	DD
Transmission oil	Hyp 85W90 GX - D 85W90 Mobilube HD85/90 Spirax MB 90	Aral Esso Mobil Shell	053002-004	A
Low temperature transmission oil	Mobilube SHC	Mobil	053002-006	AA
Rubber and vinyl dressing				H
Special grease	MOS ₂ Lithium	Dow Corning	063002-022	M
Universal lubrication oil	SAE 40			C

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Grease Items / Grease Intervals

Item	Component	Type	Total	250 hours	500 hours	1000 hours	2000 hours
1	Mast reach frame	B/BB	A/R	X			
2	Hoist frame	B/BB	A/R	X			
3	Lift chains	G/GG	A/R	X			
4	Integrated, tilting side-shifter	B/BB	A/R	X			
5	Tilt mast attachment side-shifter	B/BB	A/R	X			
6	Steering column	B/BB	A/R	X			
7	Gear unit	A/AA	A/R		X		
8	Mast reach carriage rollers	B/BB	A/R		X		
9	Battery unlocking mechanism	B/BB	A/R		X		
10	Drive unit live ring bearing	B/BB	A/R			X	
11	Battery housing rails	B/BB	A/R			X	
12	Seat rails	B/BB	A/R			X	
13	Hydraulics	D/DD	A/R				X

L08-GB

Inspection and Maintenance Schedule

The following inspection and maintenance schedule assumes single-shift operation under normal conditions. The frequency of maintenance intervals must however be constantly adapted to the prevailing operating conditions.

In dusty or otherwise extreme operating conditions including cold store application, the maintenance intervals specified must be reduced. Exact details should be discussed with a Crown service engineer.

When carrying out maintenance routinely check for wear, corrosion, damage, component operation and safety. If in doubt, replace components.

The item numbers in the tables correspond to the numbers in the Component Access section (page M-M1.0-2140-001 ff.)

Battery Maintenance

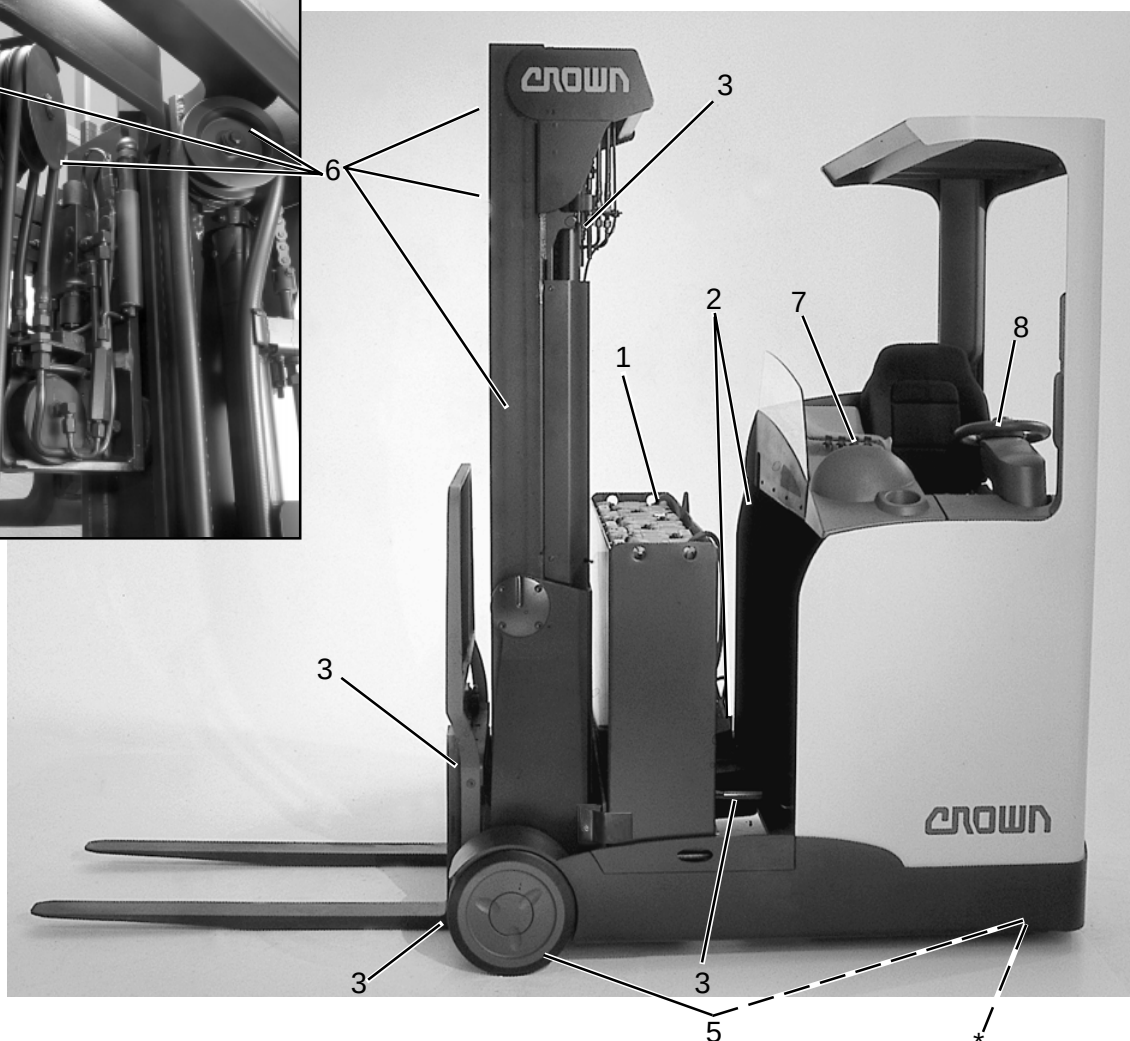
The battery must only be serviced in accordance with the manufacturer's instructions.

Daily or every 8 service hours

Item	Component	Measures
1	Battery	Charge battery. Check electrolyte level, correct if necessary.
2	Battery connector (= EMERGENCY STOP)	Check for damage, check contacts for burning.
3	Leakage	
	- Gear unit	Check for leaks
	- Hydraulic system	Check for leaks
	-Brake system	Check for leaks
4	Hydraulic oil level	Visually check that the oil level in the reservoir is between the min. and max. levels
5	Wheels / Load wheels	Check tyres for wear and foreign bodies. Remove any foreign bodies.
6	Mast, chain and hose rollers	Check for damage and test operation
7	Hydraulic functions	Check all functions
8	Steering	Test operation and check for freedom of movement. Test adjusting mechanism.
#	Drive wheel bolts	For new trucks or when replacing wheels only : Torque wheel bolts once to 180 Nm.



M1692



M1695



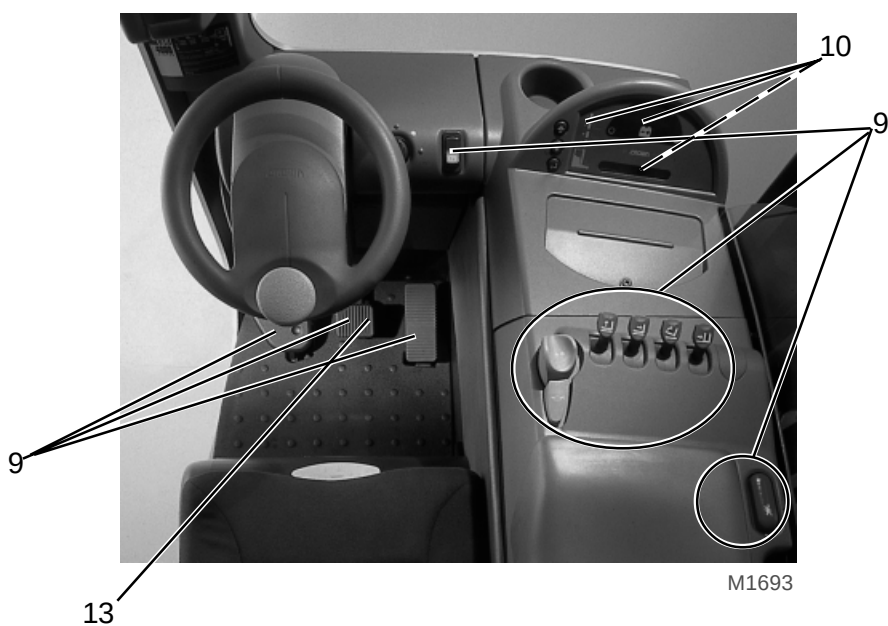
M1625

3*

Daily or every 8 service hours (contd.)

Item	Component	Measures
9	Controls	
	- Accelerator pedal	Ensure absence of jerky movements
	- Deadman pedal	Test operation.
	- Brake pedal	Test operation.
	- Travel direction switch	Test operation and end stop lock-in position.
	- Horn	Test operation.
	- Hydraulic control lever	Test operation and make sure there is freedom of movement
	- Emergency Stop switch	Test operation.
	- Parking brake	Test operation.
10	Displays	Test operation.
11	Battery lock	Visually check that the battery is securely locked.
12	Battery support	Is the battery locked with the side straps?
13	Brake	Test operation and braking distance.

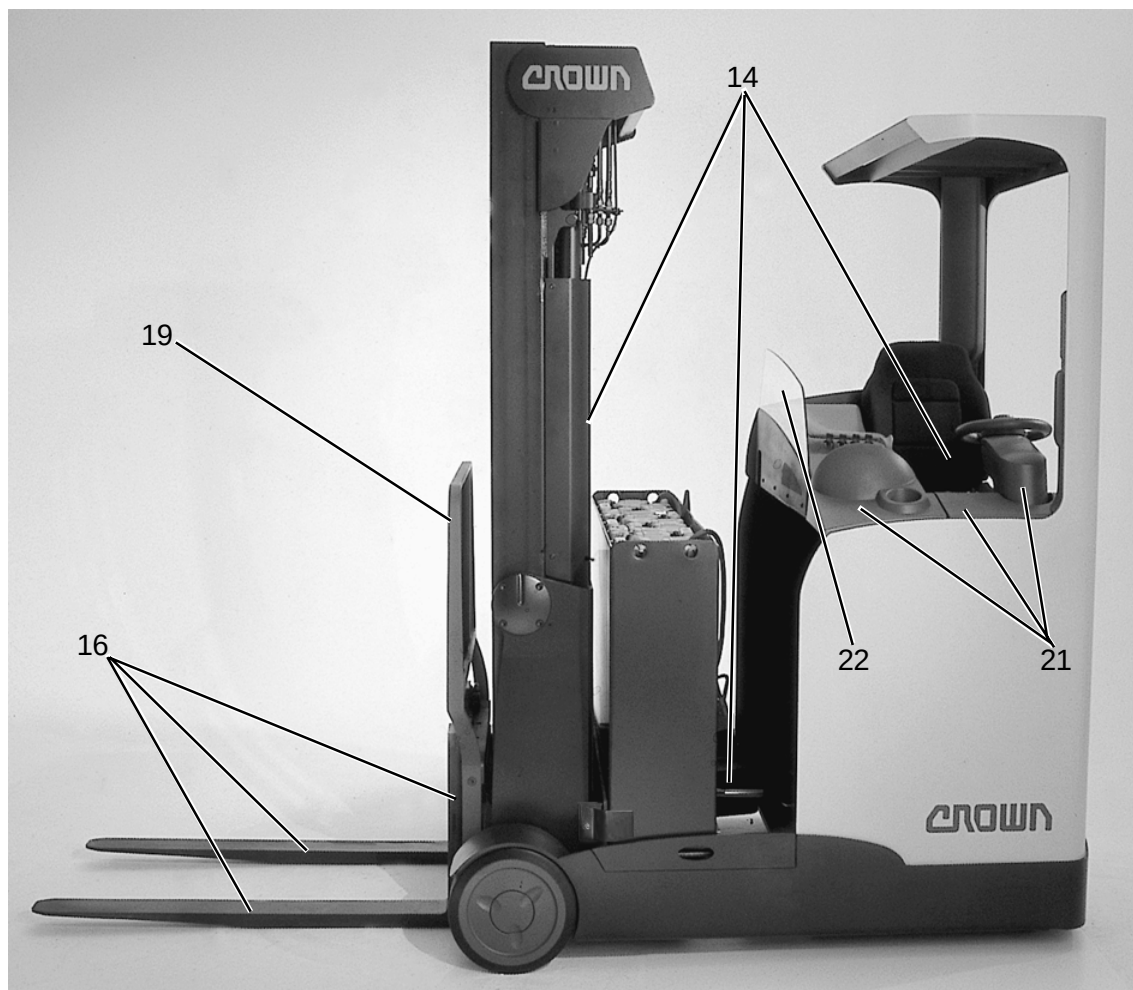
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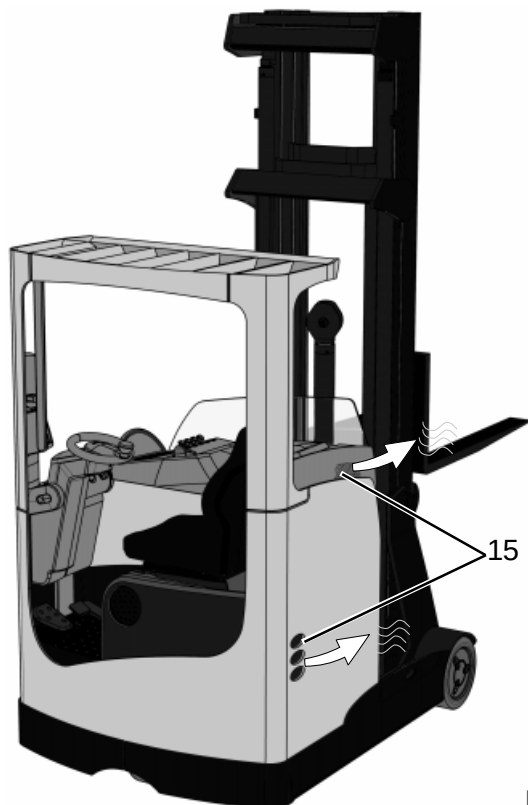
Daily or every 8 service hours (contd.)

Item	Component	Measures
14	Limit Switches	
	- Lift speed reduction	Test operation.
	- Reach limit cutout	Test operation.
	- Seat switch	Test operation.
	- Optional switches	Test operation.
15	Fans	Test operation.
16	Fork and Fork Carriage	Visually inspect for cracks and wear.
17	Lift Chains	Visually inspect for wear and sufficient lubrication.
18	Chain Anchor	Visually inspect for cracks and damage.
19	Load Guard	Visually inspect for damage and to ensure attachments are secure.
20	Attachments	Test operation, check for damage and to ensure attachments are secure.
21	Covers / Panels	All covers / panels present, undamaged and secure?
22	Windscreen	Secure, not cracked and clear?

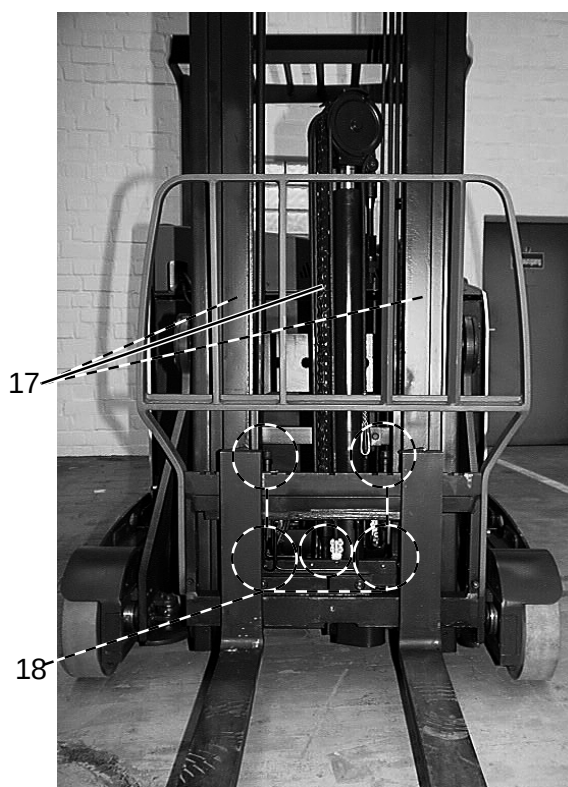
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M1695



M1697

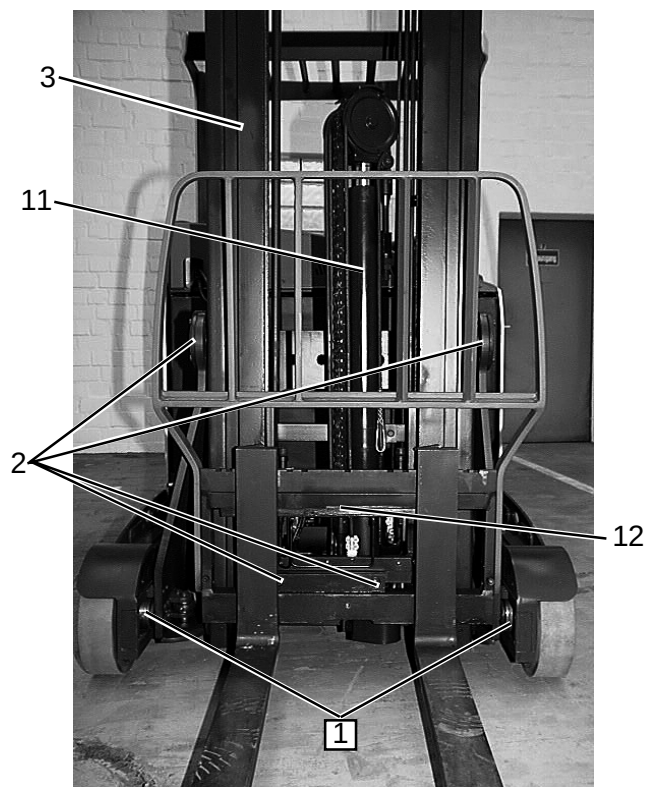


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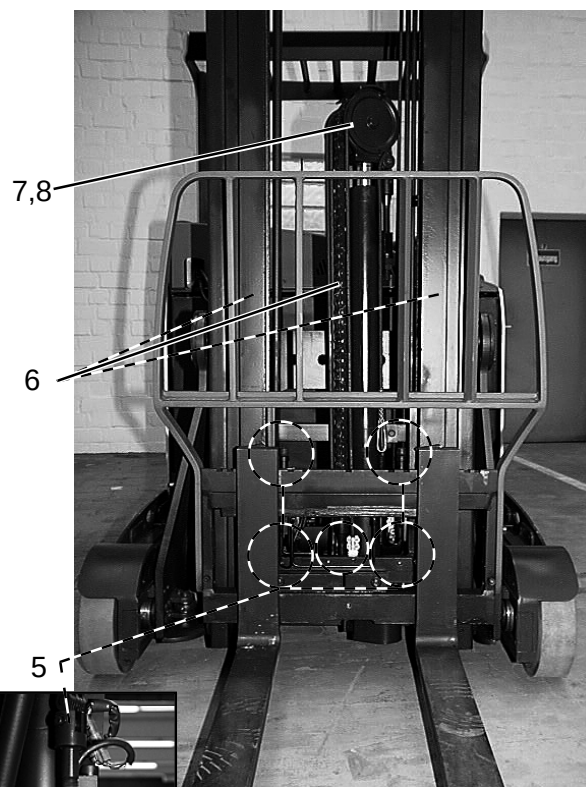
Every 3 months or 250 service hours

Item	Component	Measures
1	Mast reach frame	Clean bearings and contact surface, check for wear, if necessary replace bearings and/or contact surface. Grease.
2	Mast bearing and mast attachment	Clean and check. Check bearing and lower mast attachment torques.
2.1	Mast bearing - tilt mast	Check for damage. Check bearing cap torques.
3	Hoist frame	Clean rollers and contact surfaces. Check for wear and freedom of movement. Grease.
4	Mast and fork carriage stops.	Check for wear. Check stop torques.
5	Chain anchor	Check for wear. Check jam nut torques.
6	Lift chains	Clean. Check for wear / damage and even chain tension. Lubricate chains.
7	Chain pulleys	Check for wear and freedom of movement. Clean.
8	Hose pulleys	Check for wear and freedom of movement. Clean.
9	Cable and cable tension on mast	Check cable for damage. Replace damaged cable. Check cable tension, adjust if necessary.
10	Hydraulic pipes in mast	Check hoses and pipes for damage and replace if necessary.
11	Mast hydraulic cylinder	Visually inspect for leaks. Check piston rod for damage. Check cylinder attachment torque. Check top secondary cylinder attachment and condition of shims.
12	Integrated, tilting side-shifter	Check wheels for wear, clean, grease. Lubricate grease nipple on fork carriage. Check hydraulic components for leaks.
	Tilt mast attachment side-shifter	Make sure the sideshift does not jerk from left to right. If necessary, replace sliding pieces. Grease. Check hydraulic components for leaks.

L03-part1-gb



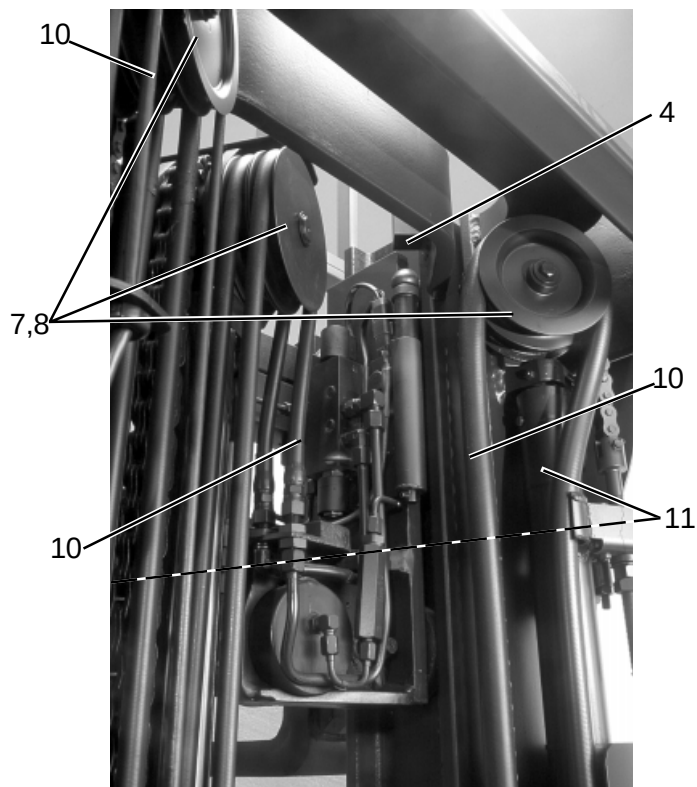
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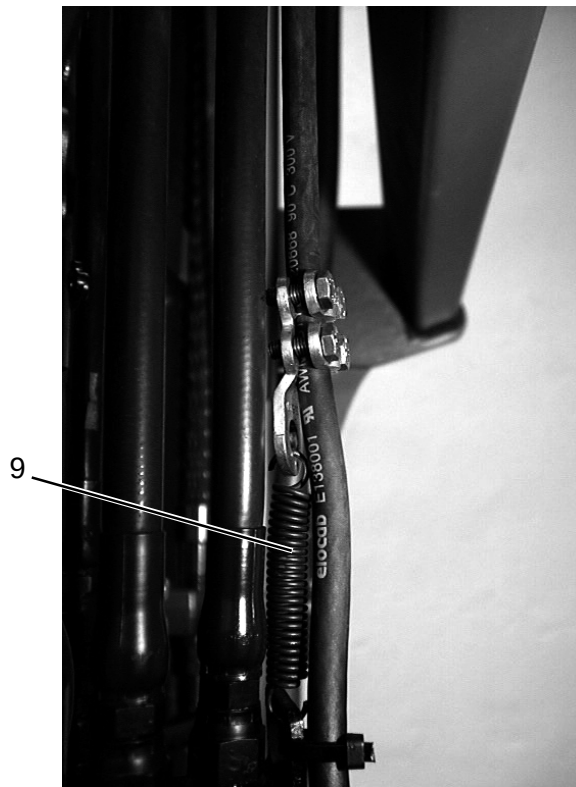
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M1701



M1699



M1700

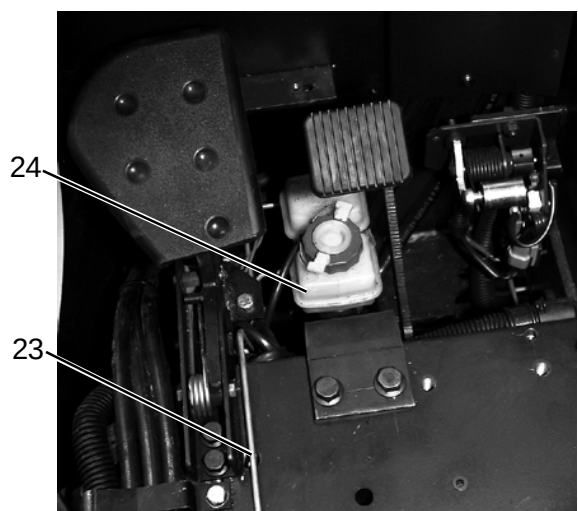
Every three months or 250 service hours, part 2

Item	Component	Measures
15	Drive wheel nuts / bolts	Check for damage, check wheel nut torques.
16	Battery removal / unlocking mechanism	Check rubber bumper on battery housing for wear. Check operation of locking mechanism, if necessary adjust eccentric bolts on reach frame.
17	Battery rollers	Clean. Replace worn rollers.
18	Hydraulic filter	REPLACE ONLY AFTER FIRST 250 h - SERVICE. Other changes either annually or every 500 service hours.
19	Hydraulic valves	Check for leaks. Tighten to appropriate torque.
20	Hydraulic hoses	Check for damage and leaks. If necessary tighten or replace connections.
21	Steering column	Clean and re-grease gear wheels.
22	Parking brake	Check cable for damage and adjust brake. Check brake cylinder for leaks.
23	Brake lines	Check for leaks, damage and corrosion. Replace if necessary.
24	Brake fluid	Check level.
25	Brake mechanism	Check operation and braking distance, test for jerking. Adjust if necessary.

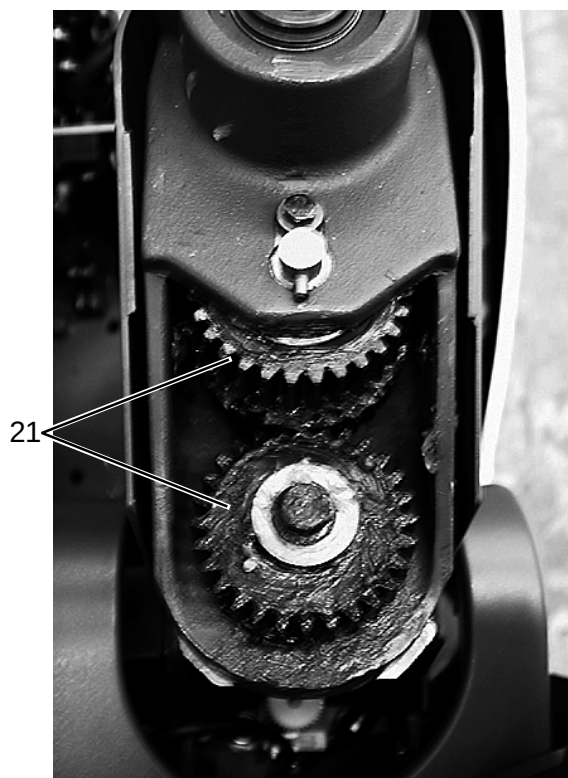
L03-part2-gb



M1702



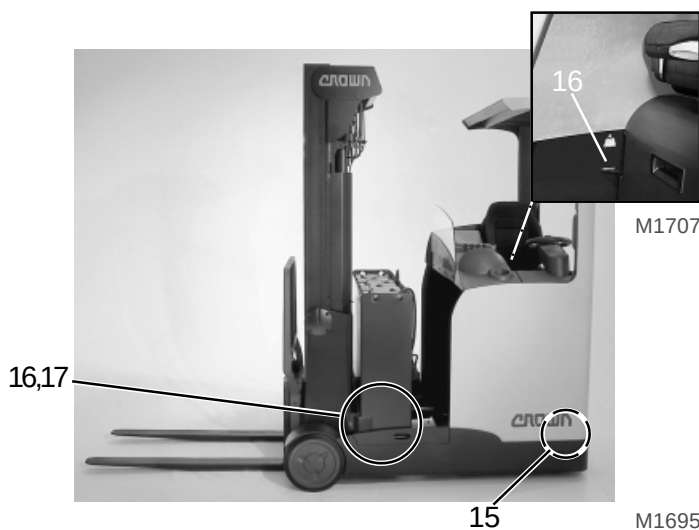
M1704



M1706

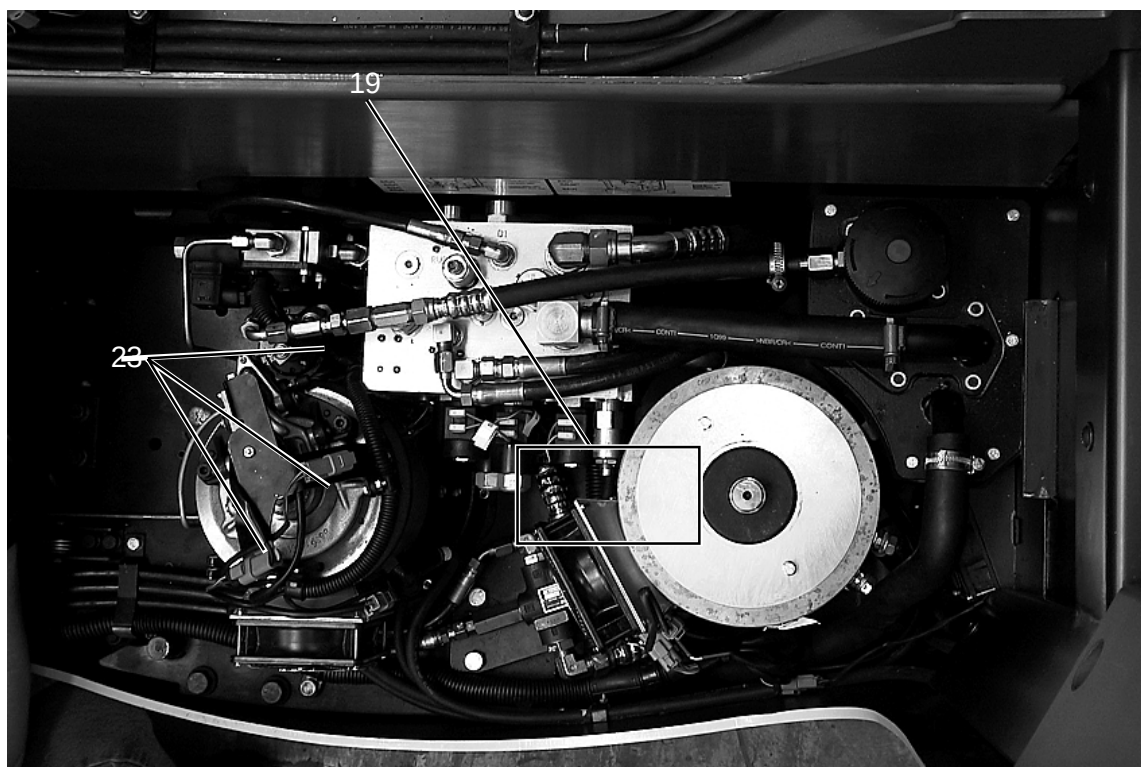


M1705



M1707

M1695

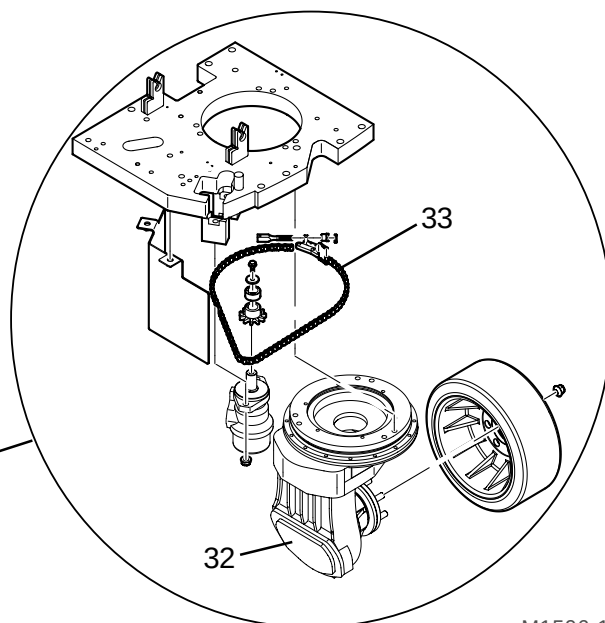
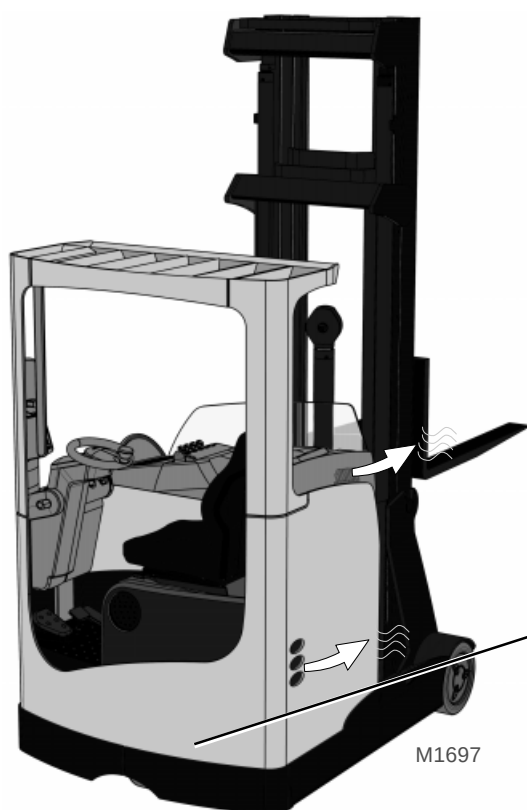


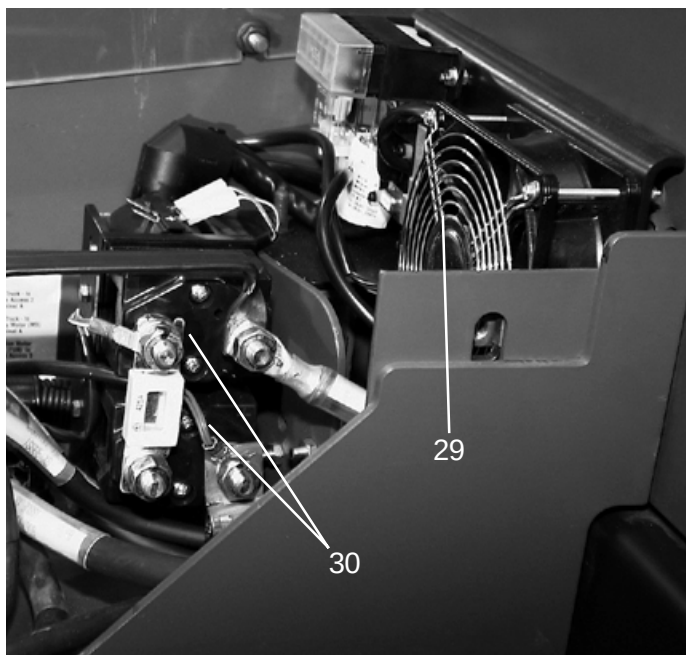
M1703

Every three months or 250 service hours, part 3

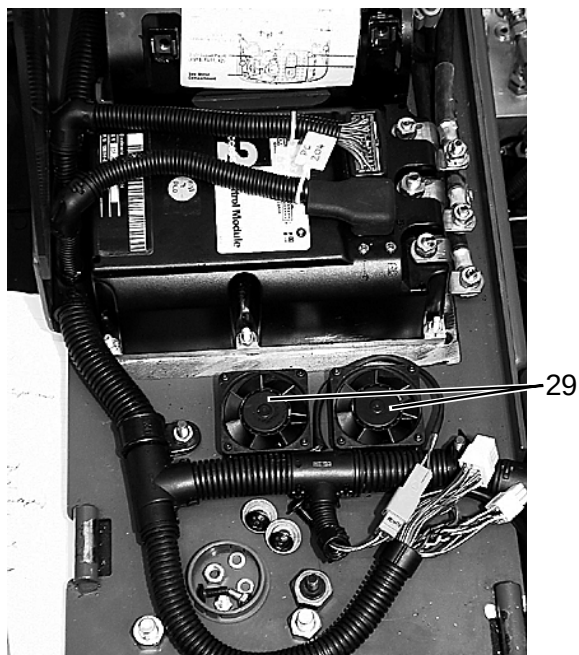
Item	Component	Measures
26	Accelerator pedal mechanism	Check for excessive bearing play
27	Deadman pedal	Check for excessive bearing play
28	Motor carbon brushes / collector	Clean. Check for wear.
29	Electrical aux. vents	Test operation.
30	Emergency Disconnect contactor tips	Clean. Check for wear.
31	Electrical system	Clean and check battery connector contacts. Check all wires for damage and make sure they are routed safely. Check connector contact.
32	Gear unit	Check for leaks.
33	Steering drive chain	Check for freedom of movement. Check chain play, adjust if necessary.

L03-part3-gb

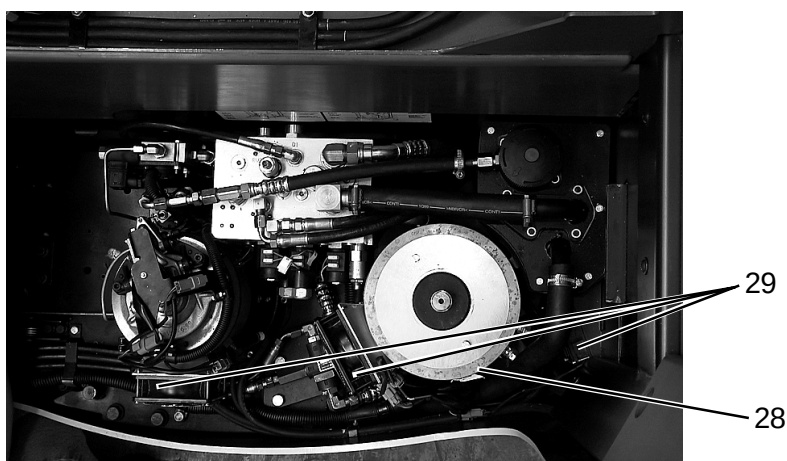




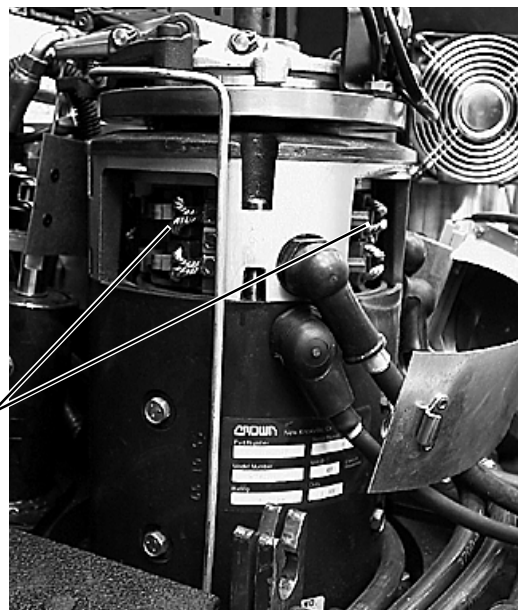
M1709



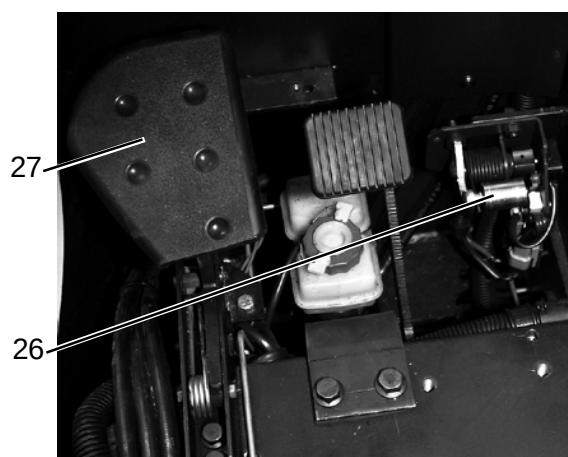
M1708



M1703



M1705

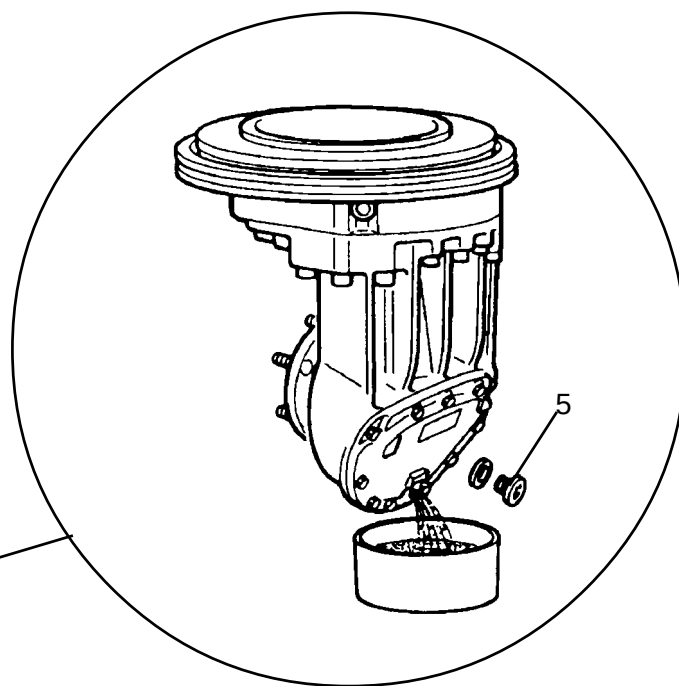
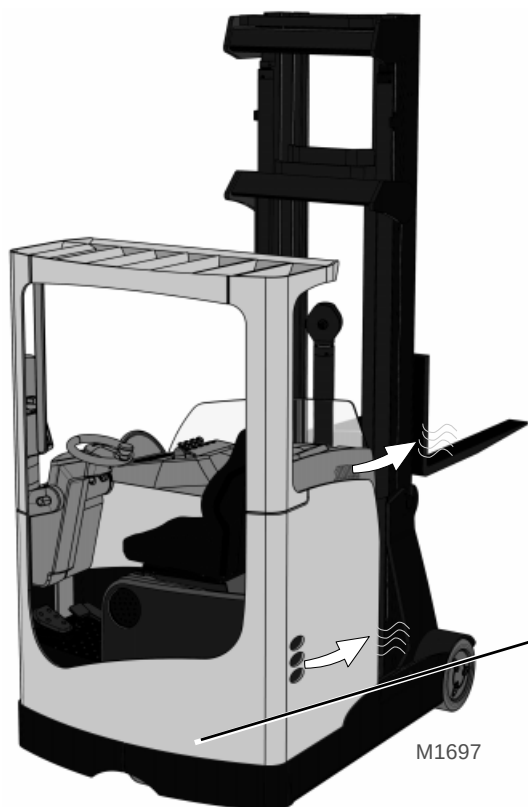


M1704

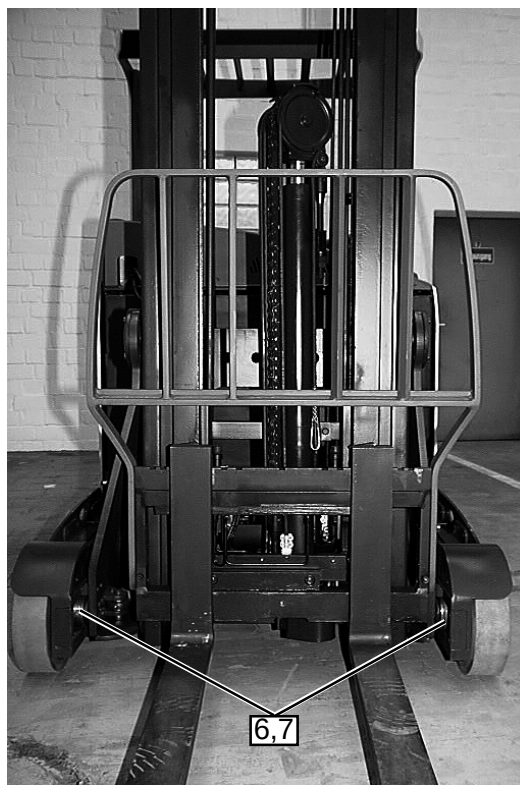
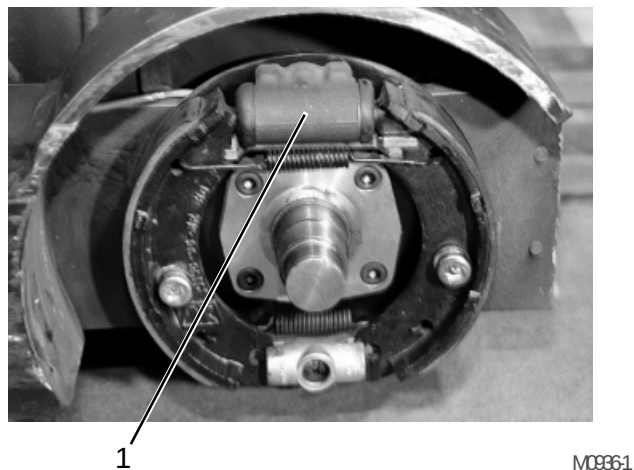
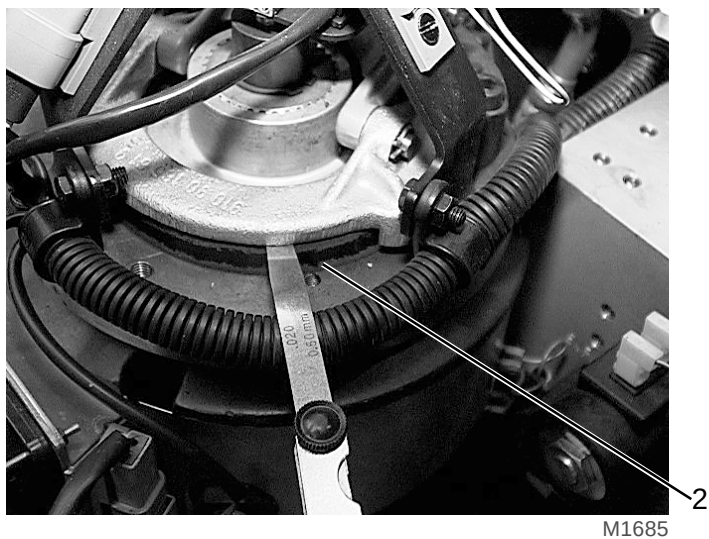
Annually or every 500 service hours

Item	Component	Measures
1	Load wheel brake	Remove abrasion, check brake lining for excessive wear, adjust brake. Check wheel brake cylinder for freedom of movement and for leaks.
2	Motor brake	Remove abrasion, check brake lining and disk for excessive wear
3	Parking brake	Check vent screw passes through.
4	Wheel tyres	Check for wear and damage, replace if necessary.
5	Gear unit	Change gear oil once only after 500 service hours.
6	Mast reach carriage rollers	Lubricate all rollers
7	Mast reach carriage sliding pieces	Check lateral play, set play-free adjustment on both sides.
8	Battery unlocking mechanism	Grease bolt guides
9	Lift height display	Check calibration

L04-part1-gb



M0763-1



Annually or every 1000 service hours

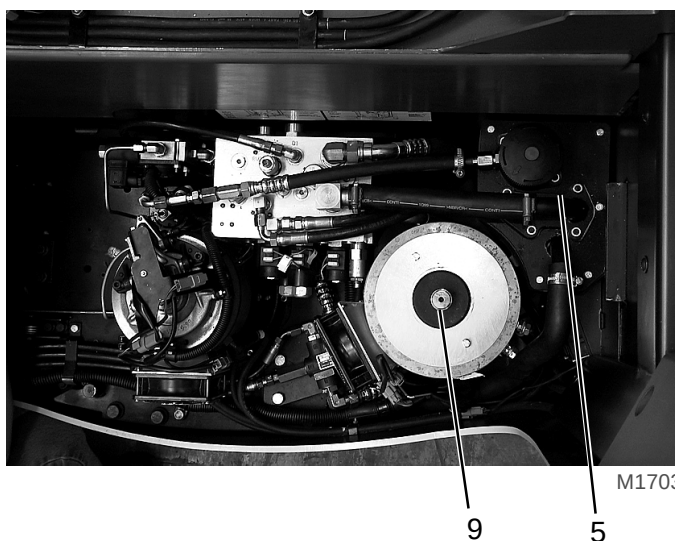
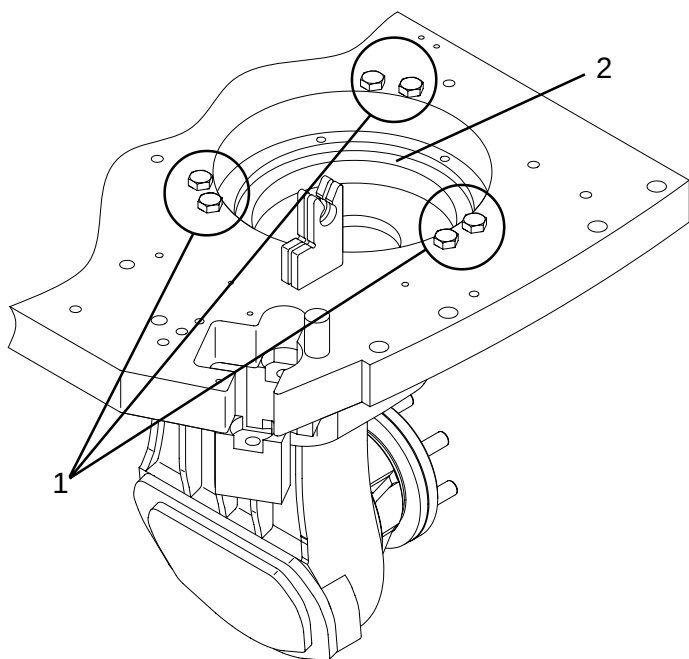
Item	Component	Measures
1	Gear unit	Tighten mounting screws to correct torque.
2	Drive unit live ring bearing	Check play, grease. Replace if there is play.
3	Battery housing rails	Clean, check for wear, grease.
4	Mast reach carriage	Replace rails, set to zero play on both sides.
5	Hydraulic reservoir attachment	Adjust mounting straps if necessary. Tighten mounting screws to correct torque.
6	Control unit attachment	Tighten mounting screws to correct torque.
7	Seat rails	Clean and grease seat rails. Check for freedom of movement. Adjust rails if necessary.
8	Steering column adjustment	Check engagement for wear, replace if necessary.
9	Pump motor bearing	Check for wear, replace if necessary.
10	UVV Test	Carry out UVV test (Germany only, in other countries carry out tests at appropriate intervals in accordance with national regulations).

L05-part1-gb

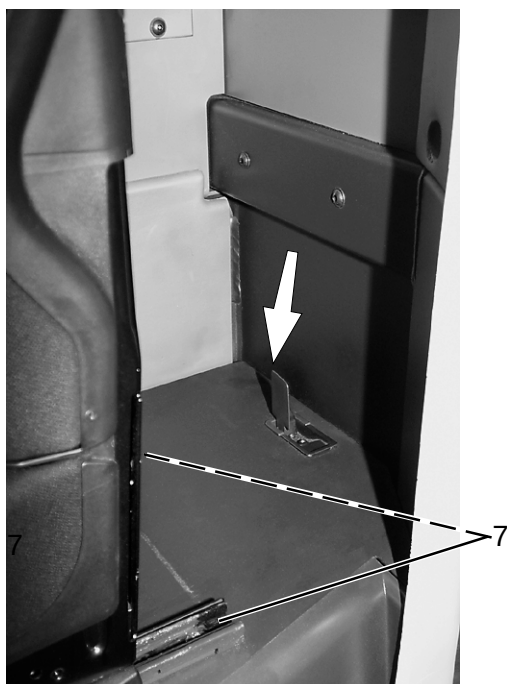
Every 2 years or 2000 service hours

Item	Component	Measures
1	Link chain in mast reach frame	Check for wear and freedom of movement. Replace if necessary.
2	Hydraulics	Change hydraulic oil, replace suction and return flow filter.
3	Battery	Check battery and truck insulation resistance.
4	Motor shaft toothing	Check connection for wear, replace if necessary.
5	PMT test	Check traction control system safety circuit.

L06-part1-gb



M1625



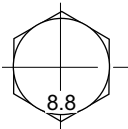
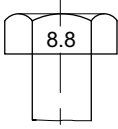
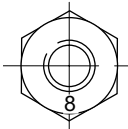
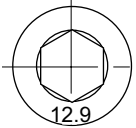
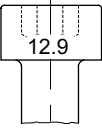
M1670

Torques

The screw and nut strengths shown below are used in the manufacture of Crown trucks. The information on the page is designed to help determine the correct torque for maintenance work.

NOTE

The torques listed in the maintenance section always supersede those shown on next page.

Screw grade marking		Nut grade marking
		
		

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T01-gb

Standard Screws and Nuts

Grade	8 and 8.8	10 and 10.9	12 and 12.9
Thread Size	Torque (Nm)		
M5 x 0.8	5 - 6	7 - 8	8 - 10
M6 x 1	8 - 10	12 - 14	14 - 16
M8 x 1.25	20 - 25	30 - 35	34 - 40
M10 x 1.5	40 - 45	60 - 65	70 - 75
M12 x 1.75	70 - 80	100 - 110	115 - 130
M16 x 2	170 - 190	240 - 270	280 - 320
M20 x 2.5	340 - 380	450 - 500	550 - 600
M24 x 3	580 - 650	800 - 900	900 - 1050
M30 x 3.5	1150 - 1300	1600 - 1800	1850 - 2100

T02-gb

Umbrako Screws and Nuts

Grade	10 and 10.8	12 and 12.9
Thread Size	Torque (Nm)	
M5 x 0.8	8	11
M6 x 1	14	19
M8 x 1.25	33	45
M10 x 1.5	63	86
M12 x 1.75	111	152
M16 x 2	270	372
M20 x 2.5	521	717

T03-gb

CROWN

HYDRAULICS

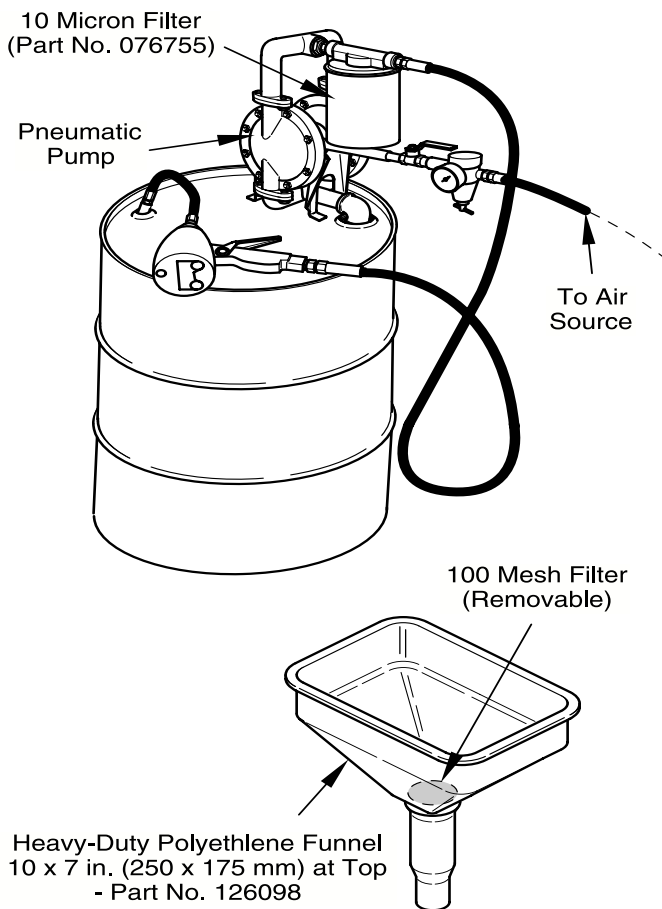
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Changing Hydraulic Oil

All hydraulic systems are extremely sensitive to contamination.

Therefore, the oil must be filtered through a 10 micron filter or strainer 100 before entering the system.

This is especially important if the oil comes from a barrel. The following illustration shows a compressed air pump incorporating a 10 micron filter and funnel with a strainer 100.



6459D

2. Flexible thermoplastic hoses must be replaced if they distort in their normal operating position. Rubber hoses must always be replaced if they leak.

3. Hoses and pipes must not rest loosely against other components. This could result in chafing or cuts. Route lines so that they do not get jammed.

4. All connections must be completely sealed.

5. The elbows on suction connections must be positioned so that the suction hose has the full flow and does not collapse.

WARNING



De-pressurise all components before carrying out maintenance work on the hydraulic system.

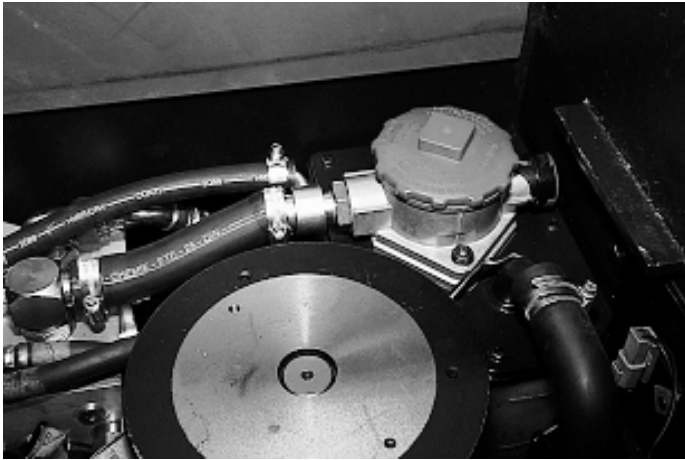
- High pressure hydraulic oil can cause serious injuries.
- Whenever a high pressure fluid enters the skin it must be treated as an emergency, even if the skin initially shows no reaction. Physically effects will set in later.
- Secure all connections before re-applying system pressure. Keep hands and body away from any ports as high pressure hydraulic oil can emerge.
- Use absorbent paper to trace leaks, never use your hands!

Hydraulic Pipes and Accessories

1. Air blast all hoses and pipes to remove any loose dirt prior to installation. Any rubber hoses with interior wiring, thermoplastic hoses and steel tubes which are squashed together or bent are non-serviceable and must be replaced, even if no external damage is visible.

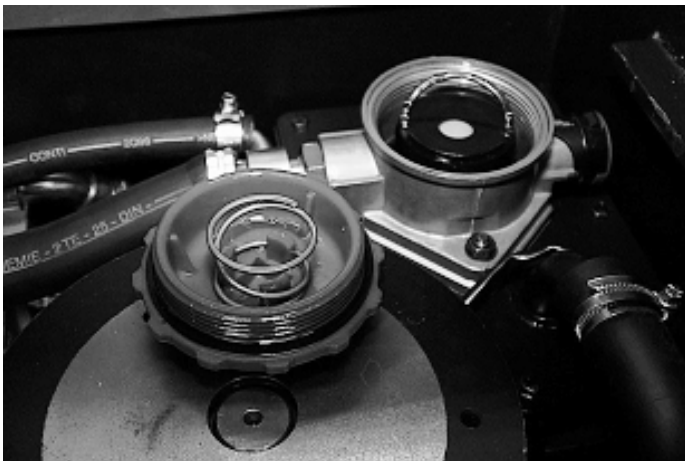
Filter

The internal filter is located in the tank filter / filler neck.



M1731

To access the filter, turn the filter lid to the left and then remove it.

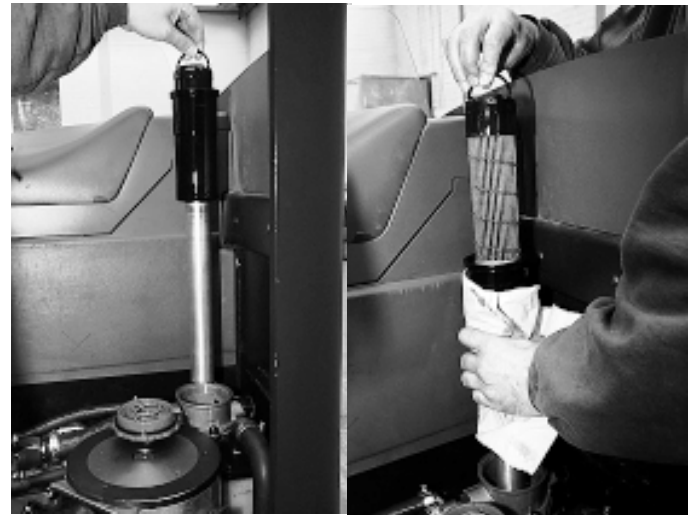


M1732



M1733

Lift up the filter clip and remove the filter element together with the container and the ascending pipe.



M1735

Wipe any spilled hydraulic oil with a clean, lint-free cloth.

Do not remove the filter element from the truck. This will prevent sediment from the container dropping back into the hydraulic reservoir.

Slightly turn and pull the filter element up out of the container. Dispose of it in accordance with environmental regulations.

Clean the filter container and ascending pipe with a clean, lint-free cloth. Insert a new filter element in the filter container, turning it slightly.

Fit the container in the hydraulic reservoir and screw on the lid.

Tank

When all the cylinders are fully retracted and the entire hydraulic system has been bled, fill the tank until the oil reaches the "Max." level.

Drain-Plug



M1634

The tank has a drain plug (see Fig. M1634). This is used only to remove residual oil and deposits from the sump.

Suction off the hydraulic oil via the filler neck before opening the drain plug and place a suitable bowl underneath. System Bleeding

The hydraulic system is self-bleeding.

It is not necessary to remove any connections to bleed the air from the system.

Repeatedly activate all the cylinders as far as their mechanical stop until the hydraulic oil in the bowl is clear. Switch off the truck. After 20 minutes check the oil level and if necessary fill to the "Max." level.

If the tolerances are exceeded the valve seats may be contaminated.

In this case operate the respective function several times from one stop to the other to flush the valve seats.

Drift Test

All drift tests must be carried out with maximum load (the data plate specifies the rated load for your truck). Parts used for test loads must be evenly distributed on a square pallet with a 1.32 m edge length. Attach the pallet to the fork carriage. Extend the forks to their maximum width.

DANGER



Never stand or work under an overhead load.

Drift Test Tilt Function

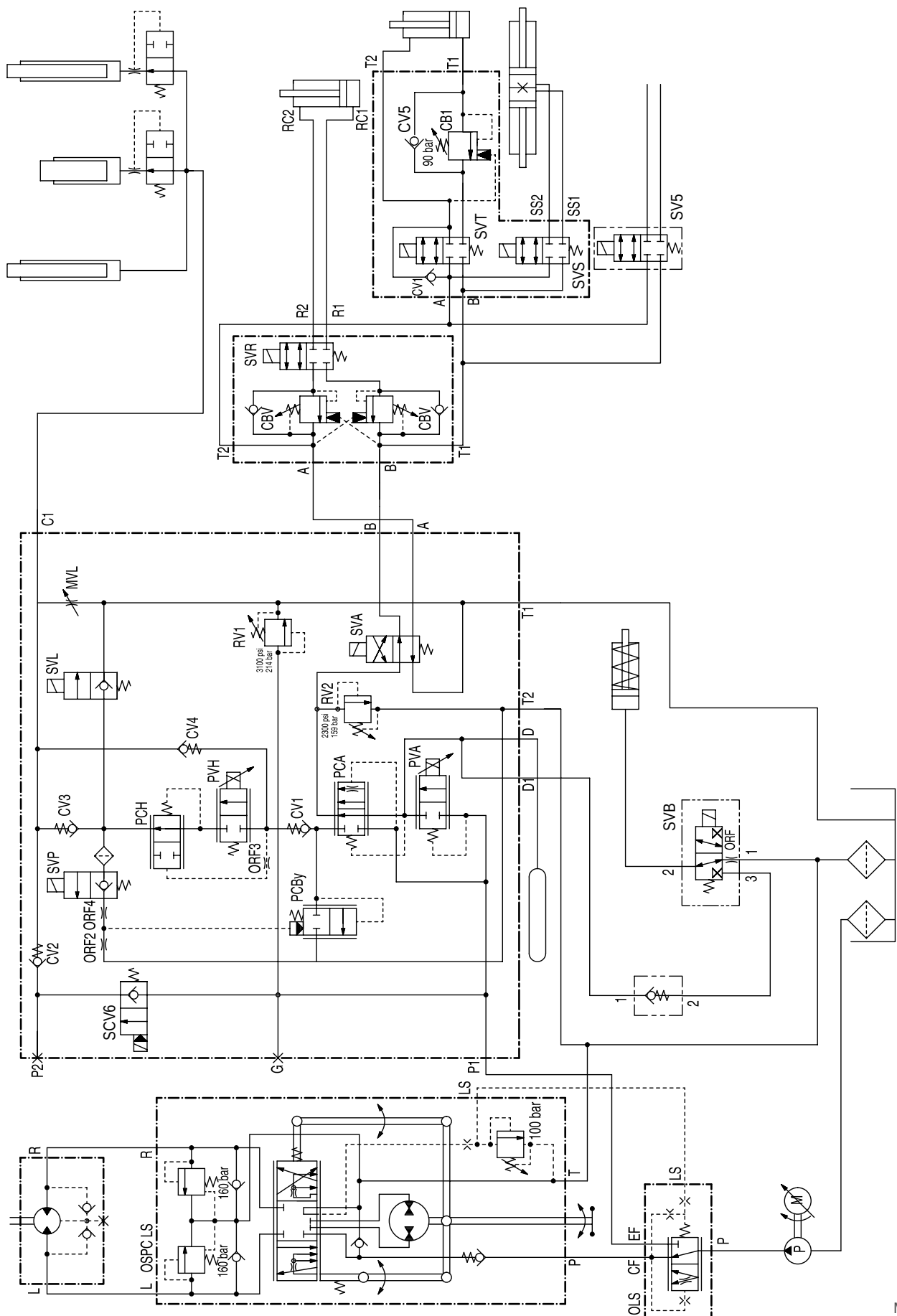
- Tilt the fork carriage several times backwards and forwards.
- Raise the test load 60 cm above the ground with the fork carriage tilted up.
- Power down the truck.
- Measure again after 5 minutes. The load should not lower by more than 15 mm.

Drift Test Lift Function

- Operate the lift several times.
- Raise the test load above the chassis height.
- Tilt the fork carriage down.
- Measure and record the height of one fork tine above the ground.
- Power down the truck.
- Measure the same fork tine again after 5 minutes. The load should not lower by more than 50 mm.

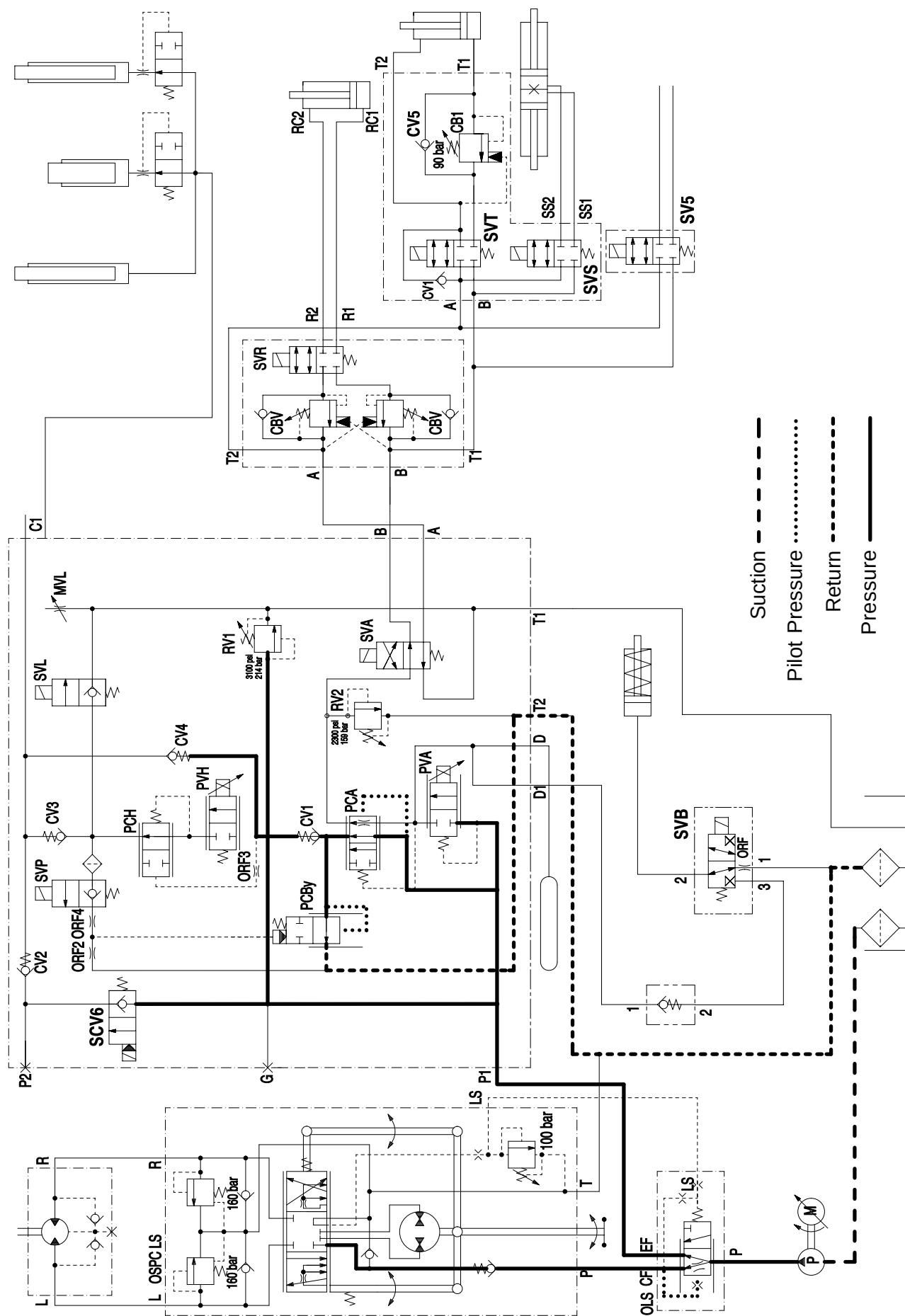
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Hydraulic System



M1586

No Demand for Steering



M1711

Printed in Germany

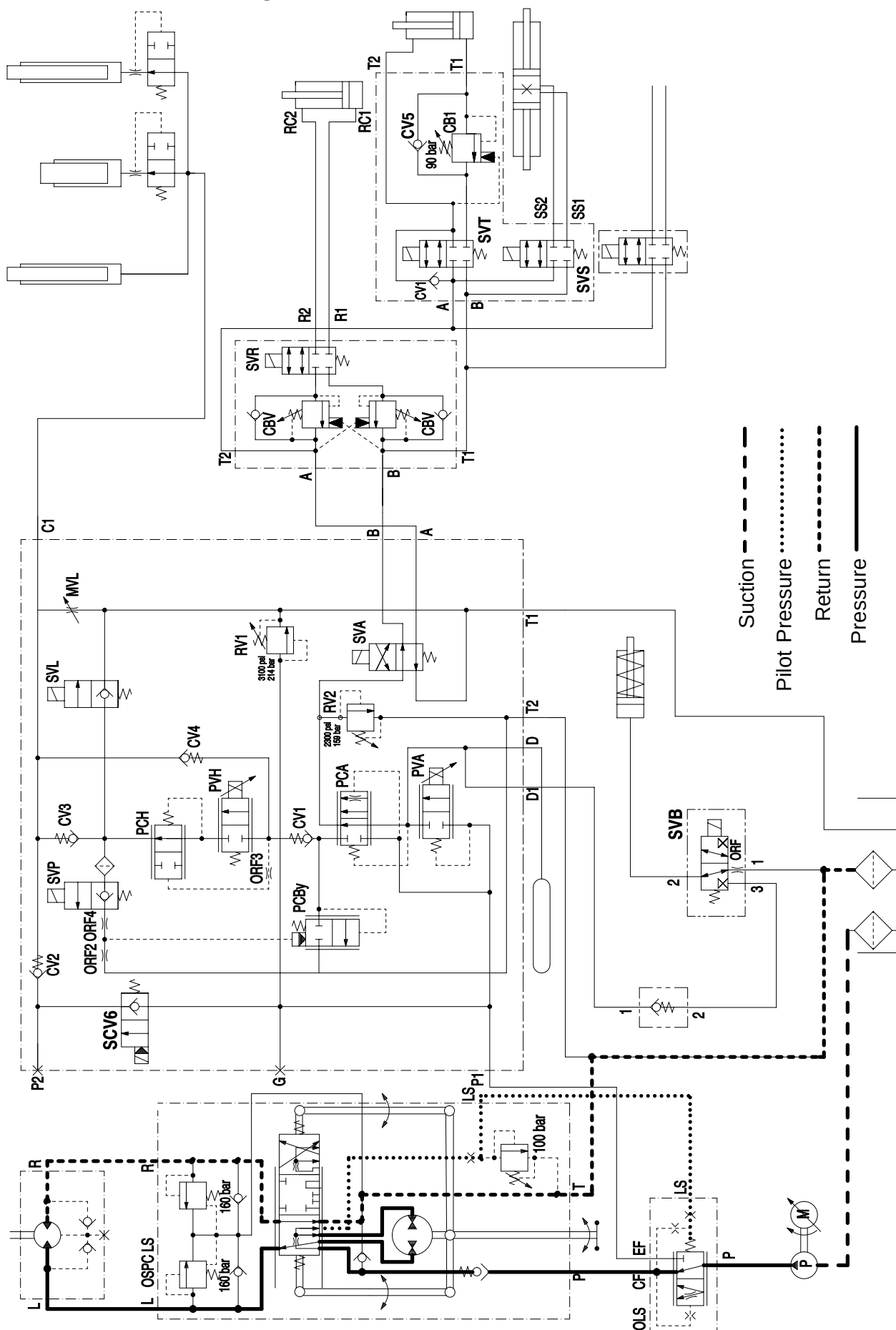
No Demand for Steering

With no demand on steering circuit, pump P will draw oil from the reservoir through the strainer to the external priority valve with flow divider assembly and provide standby flow out port CF to the steering unit (SU). Any excess flow will go out port EF. Static pressure after the check valve at port P with no steering requested will stay in the system.

A small amount of oil will flow from port LS of the pump flow divider to port LS on the SU. The line that connects the two LS ports is the load sense line. Within the flow divider a small amount of pilot oil flow splits, with a portion of the oil routed to the left side of flow divider spool and another portion passing to the right side across a small orifice. Oil that has passed across the orifice continues to the load sense line to pass through the SU and return to tank through port T of the SU.

As oil passes across this control orifice at the priority valve a pressure differential is created that is sensed at both sides of the flow divider spool. When sufficient pressure differential exists, as when no steering flow is demanded, pressure on the left side of flow divider spool is sufficient to overcome the bias spring force on the right side of spool. The spool will shift right, opening the bypass flow path for the main pump flow to SU, providing nearly full flow out port EF to port P1 of the hydraulics manifold assembly for accessory or lift functions.

Full Demand for Steering



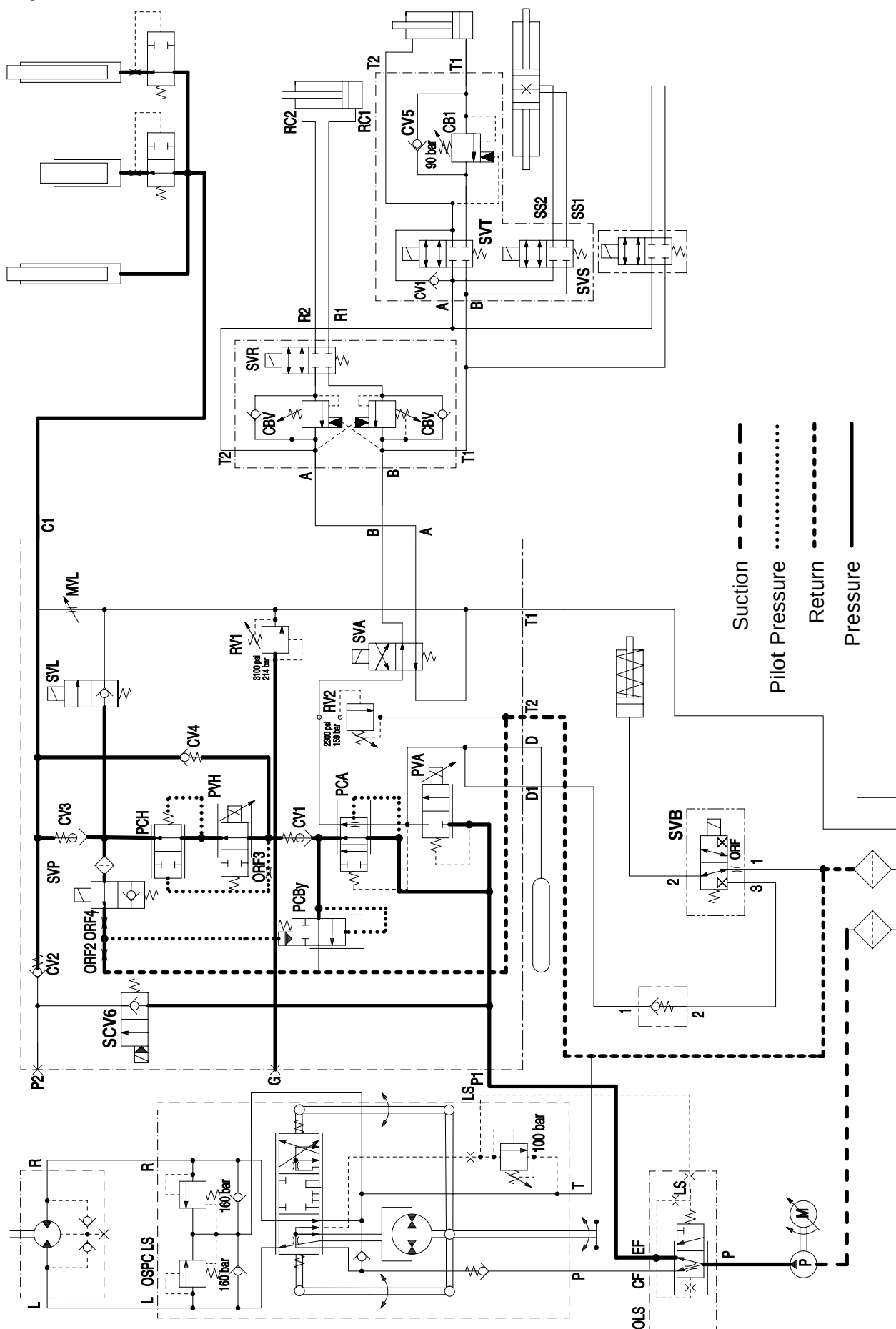
Full Demand for Steering

With the steering tiller turned, oil flow is routed through SU from port P to either port L or R, depending on which direction steering tiller is turned, through the steering motor, back to port L or R of SU, out port T of SU and back to the reservoir.

At the same time, the load sense port is also connected to the pressurized port L or R of SU, causing the load sense line to become pressurized at load pressure. This pressure is transmitted back to priority flow divider section through port LS and is sensed at right side of the flow divider spool. This pressure assists the bias spring to overcome the pressure on the left side of flow divider spool and causes the spool to shift left. This ensures that steering receives priority flow to satisfy steer demand regardless of other hydraulic operations.

Steering wheel movement is monitored by steering sensor STS which is an input to Access 2. When steering is requested, Access 2 increases pump speed to provide enough oil flow in system to meet steering demand. RV in SU protects the steering circuit at a fixed relief pressure of 160 bar.

Low Speed Lift



M1713

Low Speed Lift

PVH is the raise/lower electrical proportional valve which provides proportional control of raise/lower functions. Access 2 controls PVH through pulse width modulation. This means that the wider the pulse from Access 2, the more PVH will open. SVP is a solenoid controlled pilot valve that is used to control PCBy.

Access 2 will energize SVP simultaneously with PVH during lift. Oil will flow from port EF of priority flow divider assembly into port P1 of the hydraulics manifold. Oil flow will exit manifold at port C1 and travel to the base of the mast cylinders via hydraulic hoses and to the base of the free lift cylinder via hose that is connected to the same distribution block and is routed through the mast.

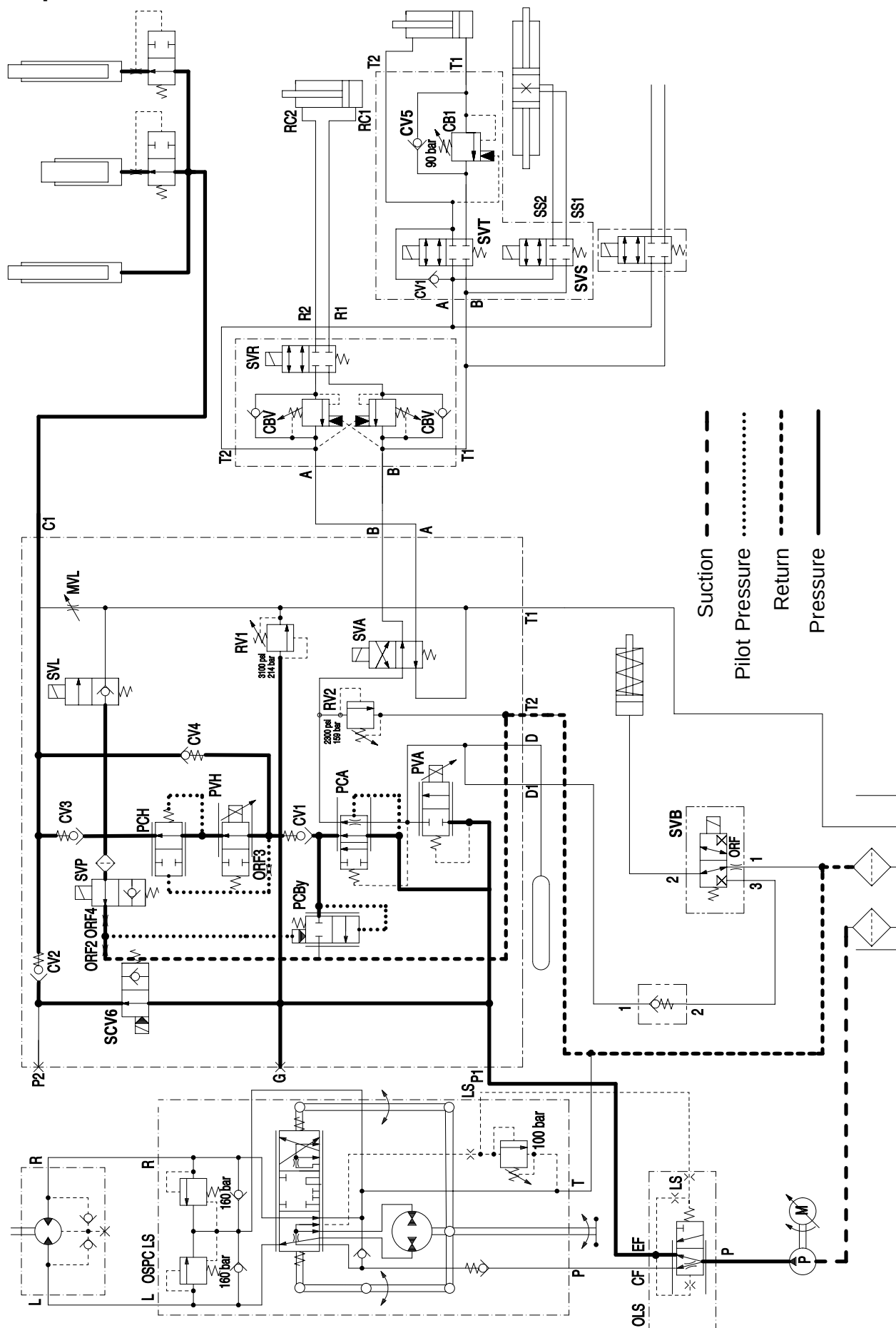
During lift, oil flows from pump P through the priority flow divider valve from EF to P1 to valve PCA. With accessory functions not used, a pilot line delivers oil pressure to the right side of PCA and causes PCA to shift left when that pressure overcomes the bias spring force. With PCA shifted left, oil is permitted to flow through it. Immediately after PCA the oil flow is split: oil will flow to PCBy and also through CV1 to PVH. With PVH closed, pilot passage at PCBy pressurizes the bottom of PCBy and overcomes the bias spring force, allowing oil to be bypassed to tank at a low pressure.

When lift is commanded, PVH is opened proportionally in response to operator command. Simultaneously, SVP is actuated. Oil from PCA passes through CV1, PVH, PCH, CV3 and exits out manifold port C1 and is routed to lift cylinders. With SVP opened, a pilot pressure equal to lift pressure at C1 is delivered to the pilot side of PCBy.

Therefore a pressure differential is created across PVH and PCH which acts in conjunction with spring bias in PCBy to control how much oil is bypassed at PCBy and how much oil is sent to the lift cylinders. This permits full pressure compensation of the lift flow.

With the same operator command to PVH, the same flow will be delivered out port C1 regardless of the system load or pressure. If PVH is just "cracked" open, the pressure differential across PVH and PCH will act against the PCBy bias spring and cause PCBy to be partially shifted open, allowing excess flow to be bypassed to the tank through manifold port T2. In this scenario, the demanded flow delivered to port C1 is for a slow, metered lift.

High Speed Lift



M1714

High Speed Lift

When PVH is fully opened for full speed lift, minimal pressure differential will exist across PVH and PCH causing PCBy to fully close due to spring bias overcoming the pressure differential. This allows full flow to be delivered to port C1 for maximum lift speed.

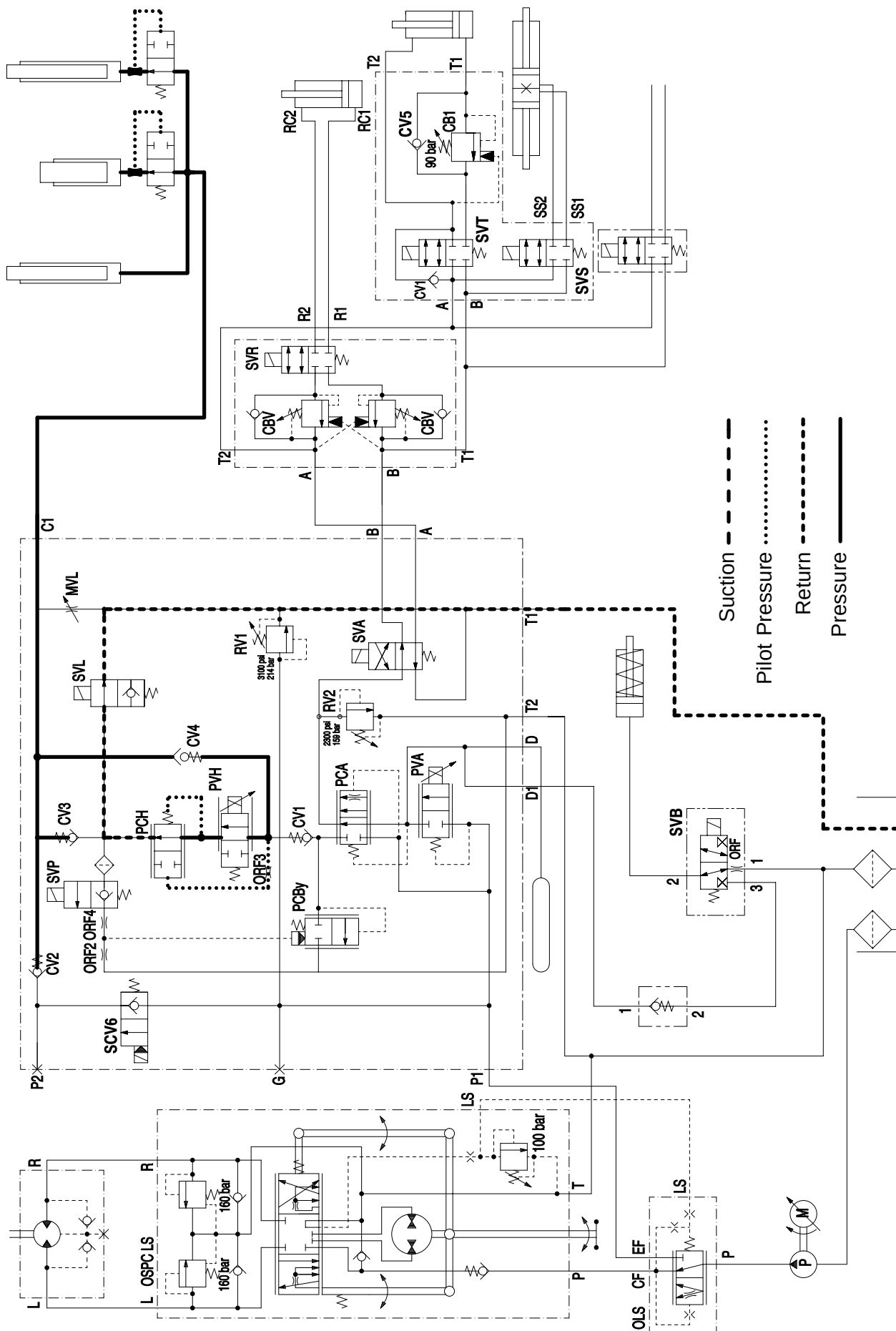
During lift operation ORF4, which is a 1.3 mm orifice, dampers the pilot pressure signal to PCBy to prevent any flutter during low speed metered lift.

When lift is stopped and lift POT2 is centered, PVH and SVP are de-energized. ORF2 is a 0.25 mm orifice that permits pilot pressure signal to PCBy to be bled off to reservoir through port T2. This permits PCBy to bypass oil flow out port T2 to reservoir when truck is at idle.

SCV6 is a solenoid check valve that is energized by Access 2 when the operator pulls POT2 all the way back. Its purpose is to maximize efficiency by bypassing all other valving when maximum lift speed is requested.

RV1 is an adjustable relief valve that protects the lift circuit.

Lower Circuit



M1719

Printed in Germany

Lower Circuit

Lower is requested by the operator pushing forward the raise/lower potentiometer POT2.

This action changes the voltage across the raise/lower potentiometer which signals Access 2 that lower has been requested. Access 2 will energize SVL and pulse PVH, with PVH opening in proportion to the operator command to control lower speed.

During lower, oil flows from lift cylinders to port C1 of the manifold assembly, through CV4, PVH, PCH, SVL, and out port T1 of the manifold assembly. From there it returns to the reservoir.

PCH is the pressure compensator for the lower circuit. Pressure compensated lower control is accomplished in the following manner:

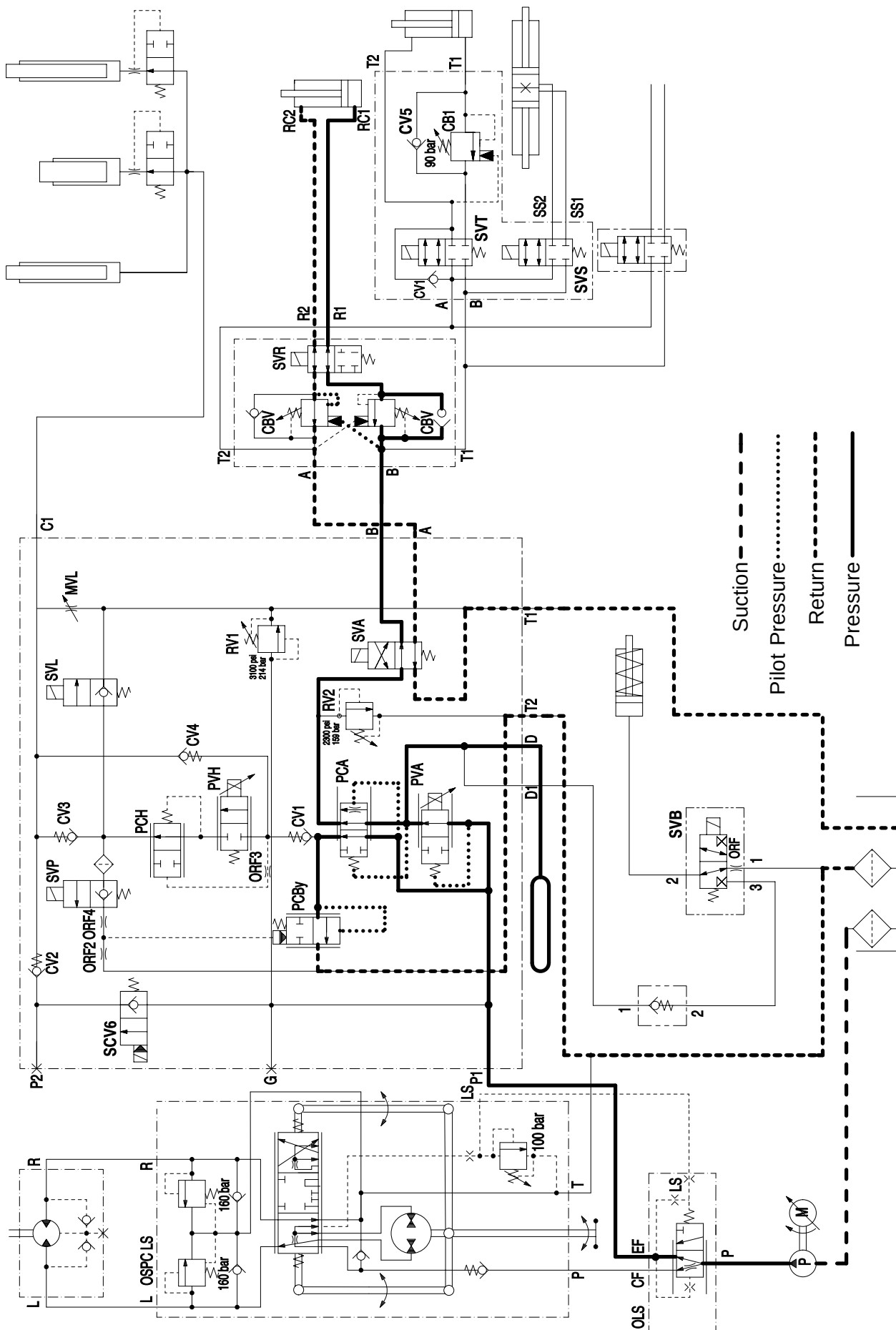
As SVL is opened, any pressure in the circuit after PCH is dropped to tank pressure. With PVH still closed, a pilot pressure is delivered through ORF3, a 0.4 mm orifice, to left side of PCH. ORF3's purpose is to slow PCH's response.

When PVH is opened, the bias spring in PCH holds PCH open to allow lower. If flow across PVH increases to the point that the pressure differential is greater than PCH spring bias force, PCH will be gradually closed in response.

To control lower flow, the maximum pressure drop across PVH is the only pressure needed to overcome 11 bar bias spring in PCH. Because of this, the flow across PVH and PCH will remain constant for a given command regardless of load and pressure at port C1 of the manifold assembly, providing pressure compensated lower control.

Maximum lower speed is controlled by maximum opening of PVH. PVH's position is electronically controlled by Access 2, giving Access 2 electronic control of lower speed. Lower speed, as controlled by Access 2, can be modified in the Performance Menu.

Reach Forward Circuit



Reach Forward Circuit

General information on PVA proportional valve accessory function

Oil will flow from pump P through priority valve, passing out port EF into port P1 of the hydraulics manifold.

Flow then passes to PVA and also to bypass port of PCA. PVA is the proportional valve that determines the amount of oil flow delivered to accessory circuits.

How far PVA will shift open is in direct proportion to how far the operator moves POT3. During accessory idle, when PVA is closed, a pilot line delivers oil pressure to right side of PCA causing PCA to shift left when pressure overcomes the bias spring force.

With PCA shifted left, oil is permitted to flow through PCA. After PCA the flow is split between PCBy and CV1/PVH.

With PVH closed, pilot passage at PCBy pressurizes the bottom of PCBy and overcomes the bias spring, allowing all oil to be bypassed to tank port t2 at low pressure.

When PVA is shifted open, oil flows through PVA to priority port into PCA. A pilot line directs pressure to the left side of PCA and acts with the bias spring to spool PCA right.

A pressure differential is now sensed by PCA, with inlet pressure to PVA sensed by a pilot line to the right of the spool, and downstream pressure, after PVA, acting with the bias spring to provide pressure compensation of accessory flow.

If PVA is shifted open with a high inlet pressure, PCA is shifted more to the left, decreasing accessory circuit flow, allowing more inlet flow to be bypassed to tank port T2. If PVA is shifted open with a low inlet pressure, PCA is shifted more to the right, allowing more inlet flow to be passed to accessory circuit, and less inlet flow to be bypassed to tank port T2.

Reach circuit

Reach is requested by the operator by pushing POT3.

PVA is energized, opening to deliver the desired flow out of the priority port of PCA, with excess flow being bypassed over PCA to CV1 and PCBy.

From PCA's priority port, oil flows to solenoid selector valve SVA. SVA is not energized for reach and oil passes through lower portion of SVA, out port B of hydraulics manifold, and into port B of reach manifold, with solenoid valve SVR being energized. Oil will flow through lower counterbalance valve of double counter-

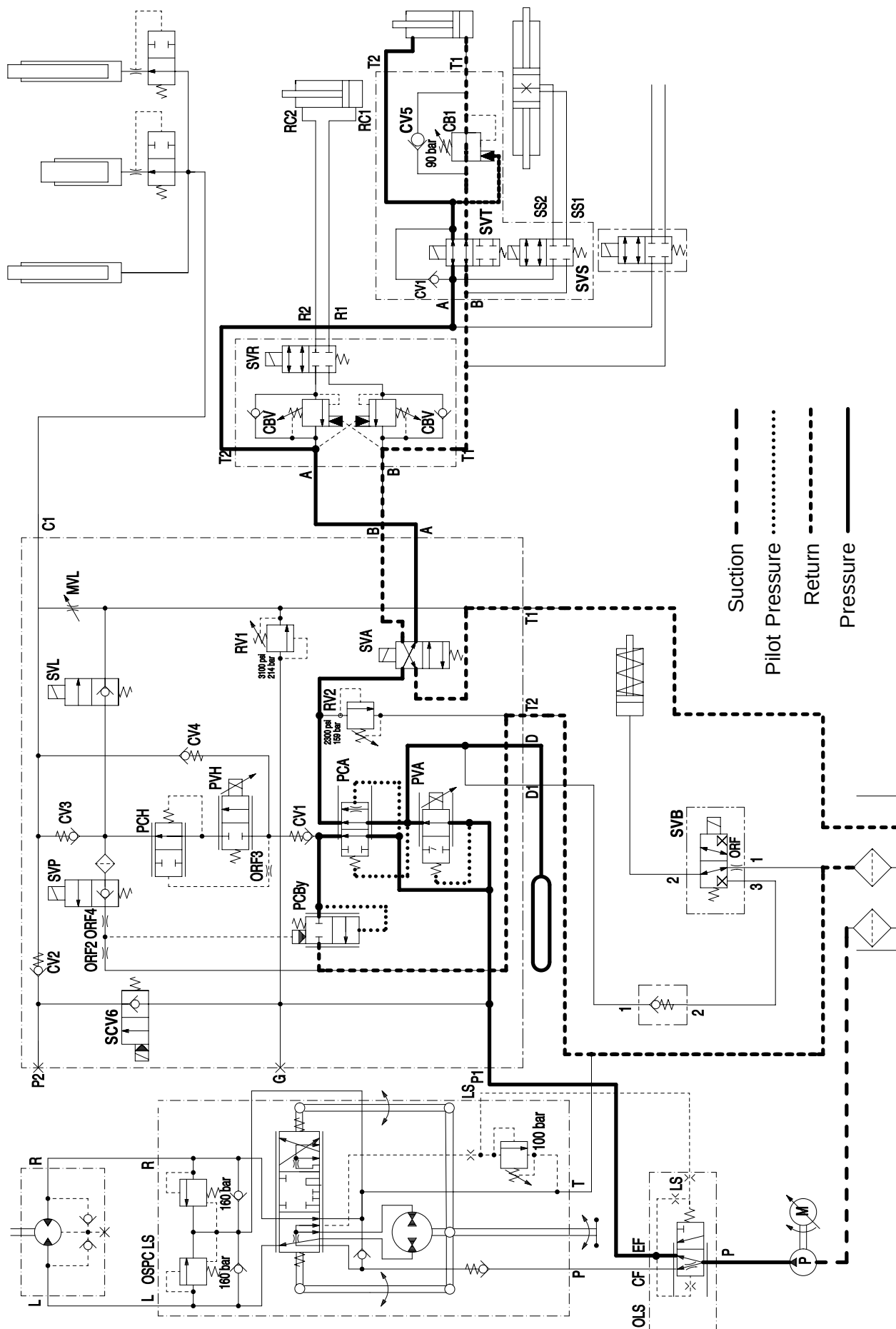
balance valve assembly, through SVR, and exiting reach manifold at port R1. It is routed into rear part of reach cylinder causing it to extend.

Oil in front of reach cylinder will be pushed out of the cylinder and into port R2 on the manifold, through SVR, the other side of dual counterbalance valve, out port A of reach manifold block, into port A of hydraulics manifold block, through SVA, exit hydraulics manifold block at port T1 and return to the reservoir .

When reach is stopped and PVA and SVR is de-energized, oil in carriage circuit is trapped by counterbalance valves and SVR in reach manifold block to prevent reach carriage drift.

Pressurized oil in the mast hose, connected between hydraulics manifold port B and reach manifold port B, is depressurized, energizing SVA for 1 second short time after the operator stops accessory hydraulics demand.

Tilt Down Circuit



M1715

Printed in Germany

Tilt Down Circuit

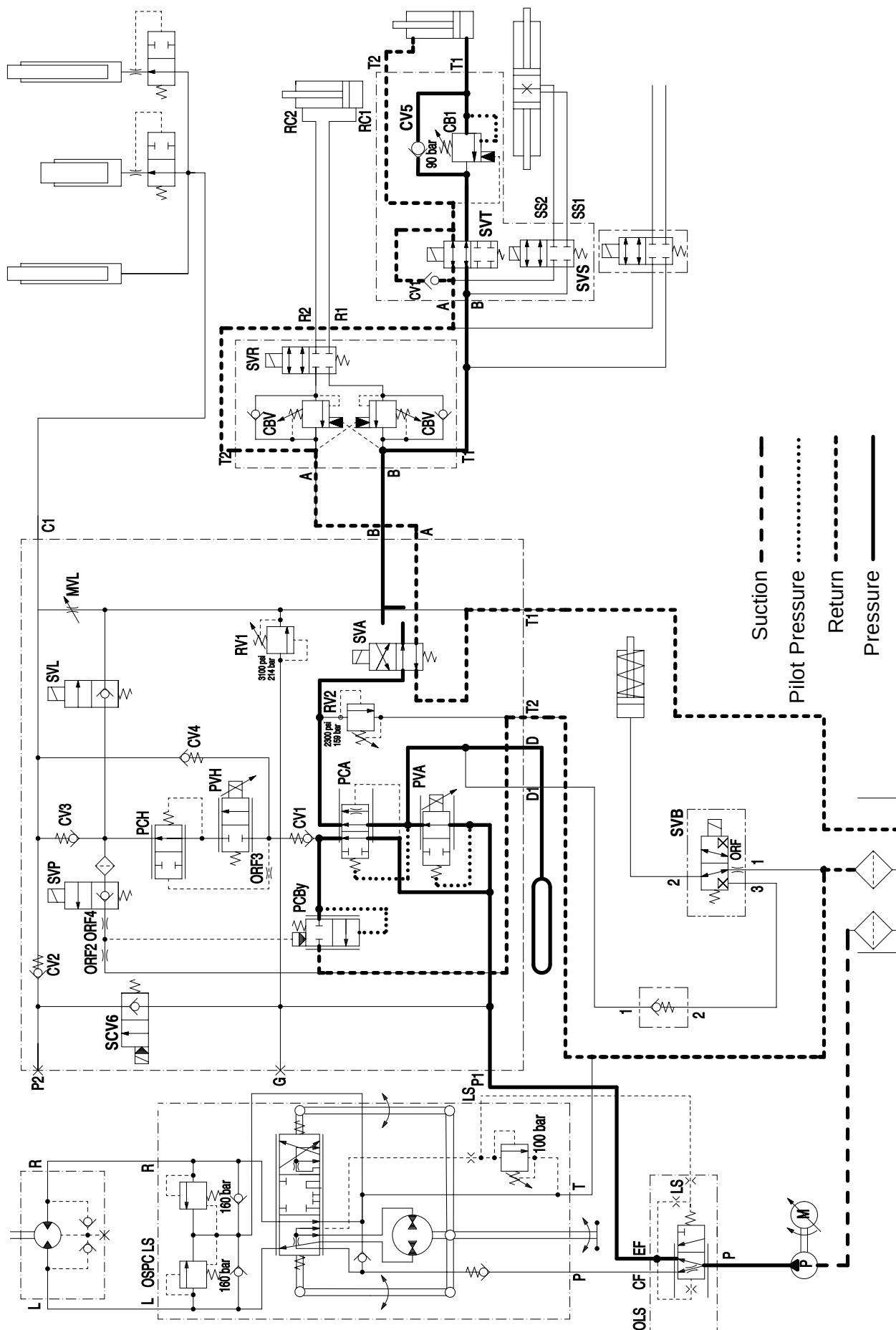
Pushing the tilt POT4 will activate Access 2 to proportionally energize PVA, SVA and SVT.

Oil will flow from pump P through priority valve out through port EF, into port P1 of the hydraulics manifold, through PVA, PCA and upper envelope of SVA. SVA is energized for tilt down.

Oil will exit hydraulics manifold at port A, enter reach manifold at port A, pass through and exit reach manifold at port T2, enter tilt/sideshift manifold at port A, pass through the upper envelope of SVT exit tilt/sideshift manifold at port T2 and enter at front of tilt cylinder.

Return oil will exit rear of the tilt cylinder, enter tilt/sideshift manifold at port T1, pass through counterbalance valve CB1, pass through the upper envelope of SVT, exit tilt/sideshift manifold at port B, enter reach manifold at port T1, exit reach manifold block at port B, enter hydraulics manifold at port B, pass through the upper envelope of SVA, exit hydraulics manifold at port T1 and return to reservoir.

Tilt Back Circuit



M1716

Printed in Germany

Tilt Back Circuit

Pulling the tilt POT4 will activate Access 2 to energize PVA and SVT.

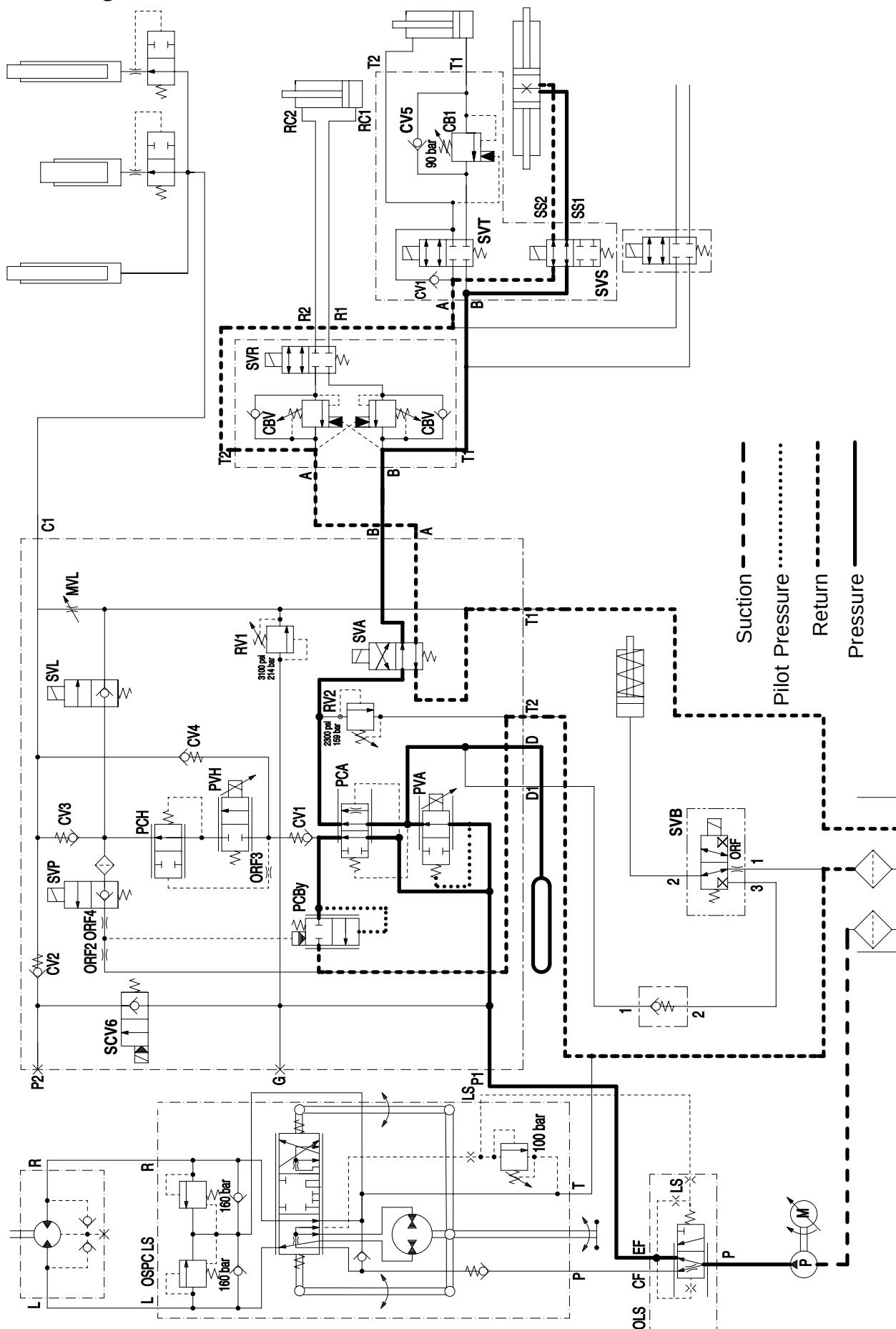
SVA will not be energized for tilt back. Oil will flow from port EF into port P1 of the hydraulics manifold, through PVA, PCA and the lower envelope of SVA.

Oil flow will then exit hydraulics manifold at port B, enter reach manifold at port B, exit reach manifold at port T1, enter tilt/sideshift manifold at port B, pass through the upper envelope of SVT, pass through the check valve bypassing CB1, exit tilt/sideshift manifold at port T1 and enter at rear of tilt cylinder.

Return oil will exit at front of tilt cylinder, enter tilt/sideshift manifold at port T2, pass through the upper envelope of SVT, exit tilt/sideshift manifold at port A, enter reach manifold at port T2, exit reach manifold at port A, enter hydraulics manifold at port A, pass through the lower envelope of SVA, exit hydraulics manifold at port T1 and return to reservoir.

Pressurized oil in the mast hose, connected between hydraulics manifold port B and SVT, is depressurized by energizing SVA for 1 second short time after the operator stops accessory hydraulics demand.

Sideshift Right Circuit



Sideshift Right Circuit

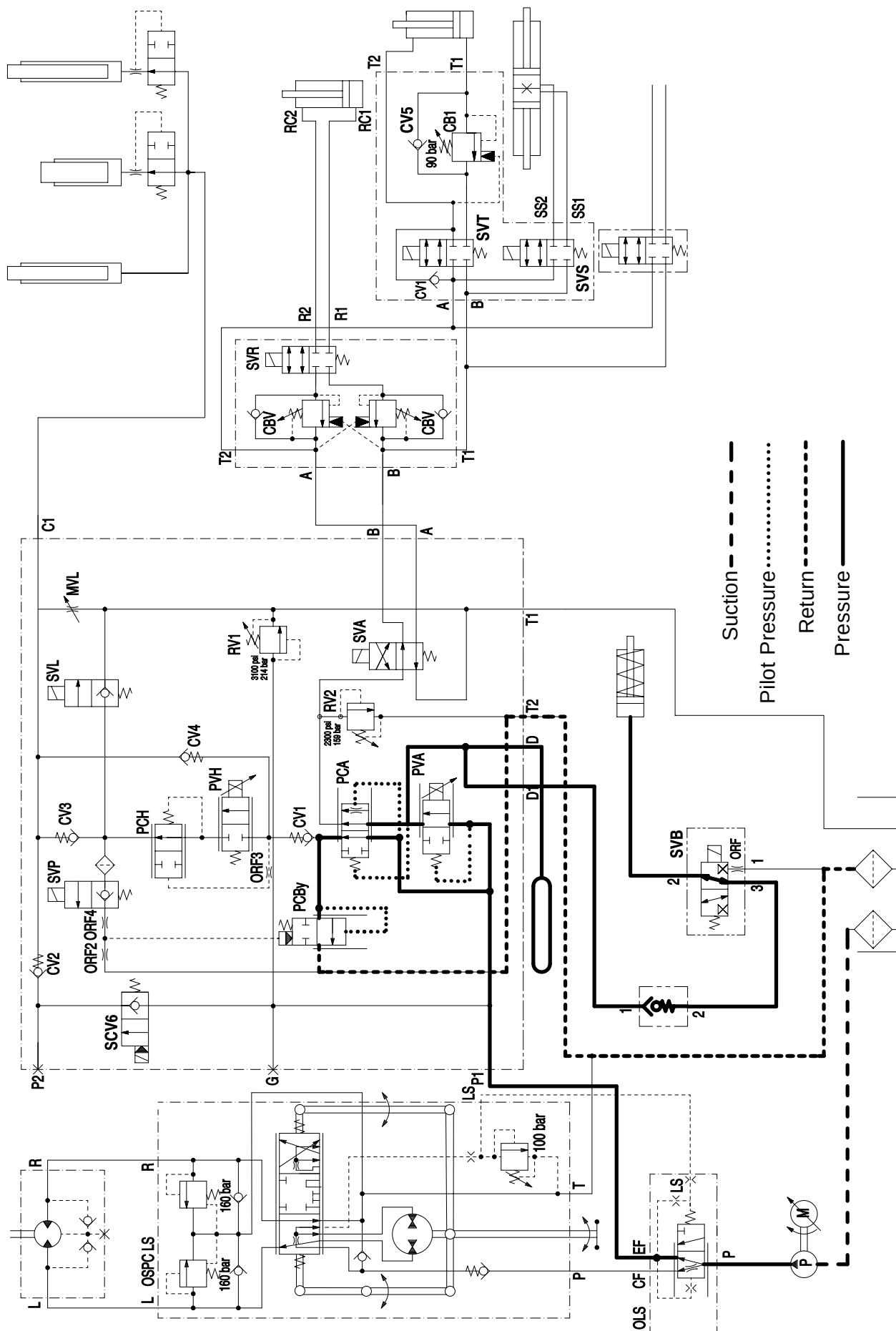
Sideshift switch SLR input to Access 2 will control sideshift function. For sideshift right, the sideshift switch joystick must be pushed. This activates Access 2 to control PVA to a fixed pulse width modulated setting.

Oil flows from pump P through priority valve, out port EF into port P1 of the hydraulics manifold block and through PVA and PCA. SVA will not be energized and oil will flow through its lower envelope, out port B of hydraulics manifold, into port B of reach manifold, out port T1 of reach manifold, into port B of tilt/sideshift manifold, through the upper envelope of SVS, out port SS1 of SS manifold into the sideshift cylinder.

Return oil from sideshift cylinder will enter port SS2 of tilt/sideshift manifold, flow through the upper envelope of SVS, out port A of SS manifold, into port T2 of reach manifold, out port A of reach manifold, into port A of hydraulics manifold, through the lower envelope of SVA and out port T1 of hydraulics manifold where it will return to reservoir.

Pressurized oil in the mast hose, connected between hydraulics manifold port B and tilt/sideshift manifold port B, is depressurized by energizing SVA for 1 second short time after the operator stops accessory hydraulics demand.

Parking Brake Release Circuit



M1717

Parking Brake Release Circuit

The parking brake is active and the truck's traction wheel is blocked when the hydraulic system is depressurized.

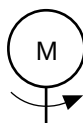
After power up the pump runs on idle speed if the operator is in seated position, the deadman pedal is depressed and a traction command is given. Oil will flow from the pump through priority valve out of port EF, into P1 and through PVA. PVA is pulsed by Access 2 for 1 second after power up to keep the accumulator pressurized on output D of the hydraulics manifold.

After PVA the hydraulic line splits into output D and D1. Oil flow out port D will charge the accumulator. Oil flow through D1 will pass the check valve and the energized solenoid valve SVB, passing through the right envelope of SVB, entering the rear portion of the parking brake cylinder.

Hydraulic Symbols



Vented reservoir
with lines above the fluid level



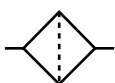
Electric motor
with unidirectional turn and speed



Vented reservoir
with lines below the fluid level



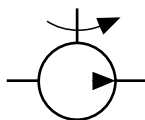
Electric motor
with unidirectional turn
and variable speed



Filter or strainer



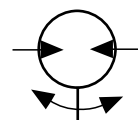
Hydraulic line with full flow
(tubing or hose)



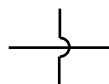
Hydraulic pump
with fixed displacement
and single direction of turn



Pilot or drain line or drainage
with limited flow



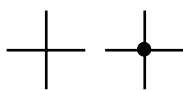
Hydraulic motor,
bi-directional



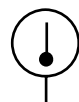
Lines crossing; not connected



Pressure gauge



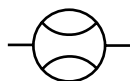
Lines crossing and connected



Thermometer



Plugged port (test port)



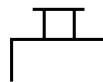
Flow meter



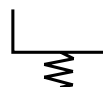
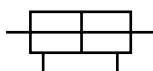
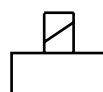
Accumulator gas charged
diaphragm type



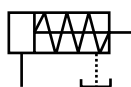
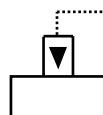
Pressure switch



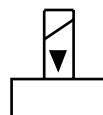
Manual actuator

Double-acting cylinder;
unequal areaSpring, (bias to normal de-
energised position)Double-acting cylinder;
equal area

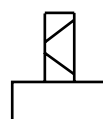
Solenoid single coil or winding

Single-acting cylinder
with spring returned
(rod end vented)

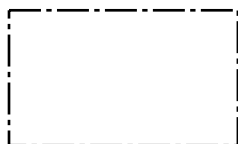
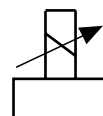
Hydraulic pilot operated

Single-acting cylinder
ram type

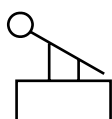
Solenoid valve, pilot operated

Single-acting cylinder,
with cushion

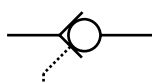
Dual solenoid

Assembly housing,
manifold block

Proportional solenoid



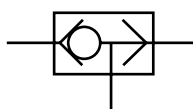
Manual lever actuator



Pilot check valve (pilot to open)



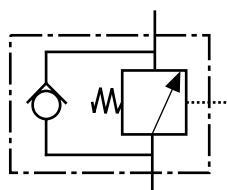
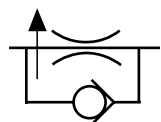
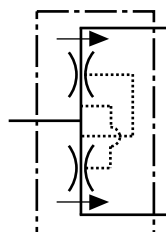
Throttle, fixed



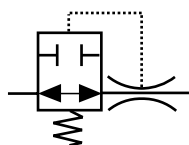
Shuttle valve



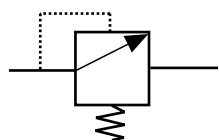
Throttle, adjustable

Pressure-compensated
flow control, fixedSingle counterbalance valve
assembly in manifoldPressure-compensated
flow control with reverse
flow bypass; fixed.

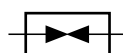
Flow divider/combiner



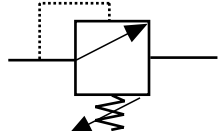
Velocity fuse

Bypass flow control
with controlled flow,
pressure-regulated

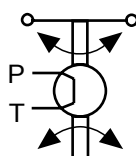
Relief valve, fixed setting



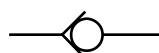
Shut-off valve, manual



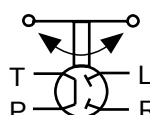
Relief valve, adjustable



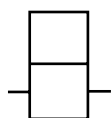
Torque generator



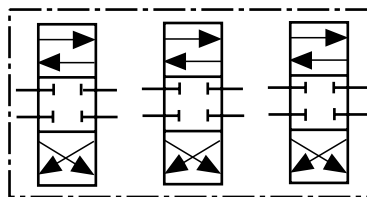
Check valve



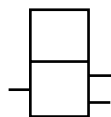
Hydraulic steer unit



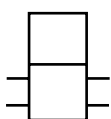
2/2 way valve
(two way, two switch positions)



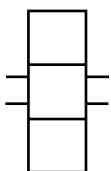
Valve block with
3 operating units



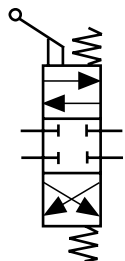
3/2 way valve
(three way, two switch positions)



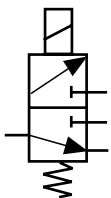
4/2 way valve
(four way, two switch positions)



4/3 way valve
(four way, two switch positions)



4/3 way valve
(four way, two switch positions);
manual activation and spring centered



3/2 way valve
(three way, two switch positions);
Spring bias solenoid control

Valve Bank

Relief Valve #1 & #2 (RV1 & RV2)

Operation

The lift circuit is protected from excessive oil pressure by RV1 and the accessory (reach, tilt, etc.) circuit is protected by RV2. If pressure within the circuit exceeds the relief valve preset level, the valve will open and relieve pressure by directing oil to the reservoir thus maintaining a maximum pressure limit for the circuit.

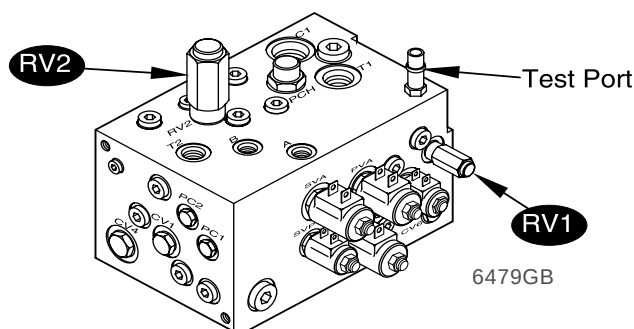
Adjustment

A fully charged battery should be installed in the truck and all truck calibration and feature configuration should be completed before attempting any measurements or adjustments.

RV1

To adjust RV1:

1. Connect a fitting (7/16-20) to the test port. For the



use of the CROWN Mini-Testsystem we suggest an adaptor, e. g. SKK20-7/16UNF-PE from the company Stauff, Germany. Connect a 0 to 350 bar pressure gauge to the test port of the manifold. Insert thermometer in hydraulic oil and note the temperature.

2. Place a load according to table H03-GB on forks. Pull control lever "Lift" in the full raise position and hold while reading gauge. Pressure reading must be taken while passing full flow over relief valve with all pumps operating. Pressure range is:

RV1	
Oiltemperature C°	Pressure Bar
20 bis 32	224 - 227,5
38 bis 60	217 - 225

H01-GB

3. If relief valve setting is not within required range, loosen jam nut on RV1 and adjust valve.
4. Tighten jam nut when adjustment is correct and recheck pressure setting. Readjust if necessary.

RV2

RV2 is not adjustable. To check for proper operation:

1. Connect a fitting (7/16-20) to the test port. For the use of the CROWN Mini-Testsystem we suggest an adaptor, e. g. SKK20-7/16UNF-PE from the company Stauff, Germany. Connect a 0 to 350 bar pressure gauge to the test port of the manifold. Insert thermometer in hydraulic oil and note the temperature.
2. Place a load according to table H03-GB on forks. Depress and hold tilt back switch on multi task handle. Keep forks in full tilt back position while reading gauge. Pressure reading must be taken while passing full flow over relief valve. Pressure range is:

RV2	
Oiltemperature C°	Pressure Bar
20 bis 32	116,5 - 123,5
38 bis 60	114 - 120,5

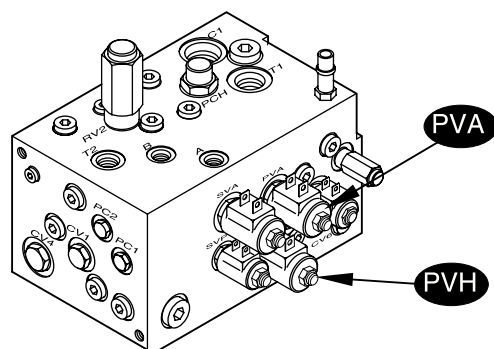
H03-GB

Test-Loads for RV1- / RV2-Adjustment	
Model	Minimum Test-Load (kg)
ESR4020-1.4	3.000
ESR4020-1.6	4.000
ESR4020-2.0	4.000

H02-GB

Proportional Valves PVA & PVH

If PVA and PVH are replaced, valves must be calibrated. To calibrate, refer to section M4.3.



6481

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CROWN

DRIVE UNIT

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General

The drive unit is located in the middle of the truck below the driver's seat. The drive motor is mounted vertically on top of the gear unit.

WARNING



THE GEAR UNIT MUST ONLY BE SERVICED BY TRAINED AND AUTHORISED CROWN PERSONNEL. FAILURE TO COMPLY WILL INVALIDATE THE WARRANTY.

Servicing the gear unit requires years of experience. Incorrect adjustments and settings will result in premature failure of the gear unit. It is therefore generally preferable to replace the whole gear unit.

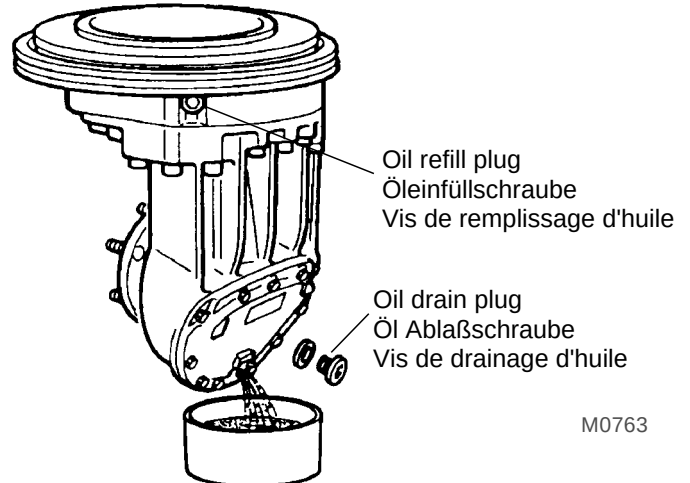
New gear units are always supplied without oil.

Before using the gear unit for the first time, fill oil in accordance with the "Lubricant Table".

- Remove the brake pipe (1).
- Suspend the handbrake cable (3) from the brake (2).

Draining the oil

- Place the oil collector tray underneath the gear unit.



M0763

Gear Unit Removal

DANGER



Disconnect the battery from the truck before carrying out any maintenance work.

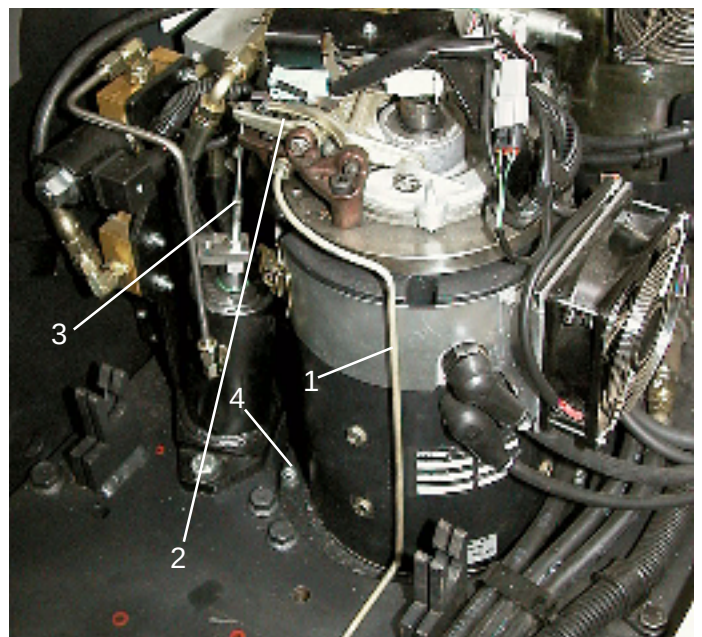
Use a suitable bowl or basin when carrying out maintenance which could result in fluids being spilled.

To ensure a safe working environment and to relieve pressure on the jack, support the raised truck on both sides with wooden blocks or other suitable auxiliary equipment.

- Unscrew the oil refill plug.
- Unscrew the oil drain plug, clean it and replace the seal.
- Screw in the oil drain and refill plugs.

Disassembly

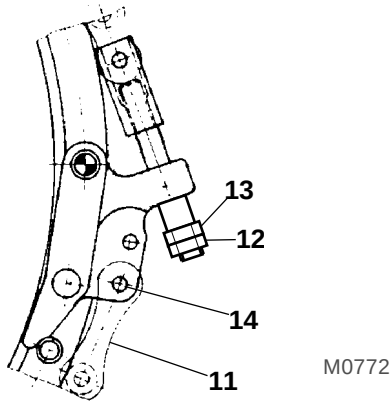
- Power down the truck.
- Disconnect the battery.
- Raise the drive wheel at least 400 mm and support the truck chassis with wooden blocks or other suitable auxiliary equipment (see page M1.0-2130-008)
- Remove the seat and motor panel. (see section M1.0).
- Remove the floorboard.



M1574

- Label and remove all drive motor cable connections / plug connectors.
- Remove the six screws (4), lift out the motor and put it down.

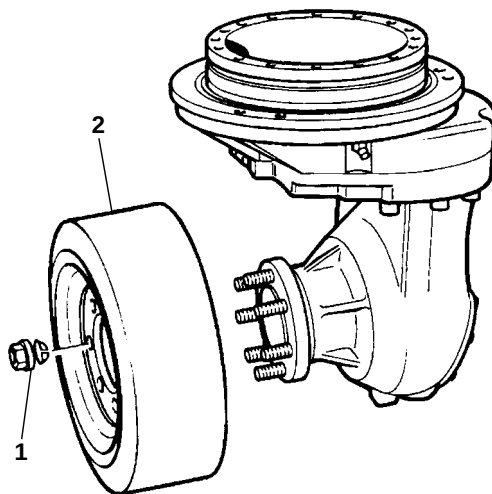
Steering Chain Removal



- Unscrew the jam nut (12) and the adjusting nut (13).
- Drive out the chain adjusting pin (14) and remove the steering chain (11).
- Secure the gear unit by supporting it with wooden blocks or slings. Remove the six screws (item 4, Fig. M1574) and lift out the gear unit from underneath the chassis.

Drive Wheel Removal

- Unscrew the wheel nuts (1) and remove the drive wheel (2).



The following section ("Tools") lists only the tools and equipment which are absolutely essential for gear unit maintenance.

Any maintenance on the gear must be carried out with the proper tools and equipment.

All bearings and seals must be replaced whenever the gear unit is dismantled.

Drive Motor

Maintenance

Before starting the maintenance disconnect the battery from the truck!

Bearing

Both bearings are maintenance free. Never re-grease the bearings, always replace both bearings if one should become worn. Also any sealing components (shaft sealing rings etc. should be replaced.

Carbon Brushes

Blow off dust with dry, clean air at low pressure. Check brushes for cracks and ease of movement in its cavity.

Measure the length of the brushes. They must be replaced if the length is < 16 mm. New brushes are 33 mm long.

Commutator

A slight colored film over the commutator, where the brushes run is normal. If the commutator seems to be worn out in the contact area of the brushes, measure the diameter of the commutator in the worn area. It should be not less than 82.3 mm for reslotting. Replacement diameter is 81.0 mm, replace the commutator.

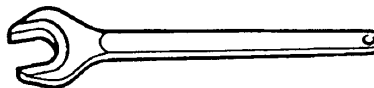
If possible, avoid to reslot a commutator. Spezial equipment is necessary to do so. CROWN suggest to use a sparepart.

If it is absolutely necessary to rework the commutator, you must keep a minimum diameter of 81.0 mm at least. The mica must be resawn to a depth of at least 0,5 mm.

Tools

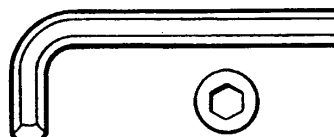
Wrench
Maulschlüssel
Clé à vis

10
 13
 30



Allen wrench
Innensechskantschlüssel
Clé coudée pour vis à six pans creux

6
 10

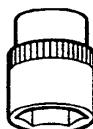


Torque wrench 9.5 - 250 Nm
Drehmomentschlüssel
Clé dynamométrique à déclenchement réglable de 9,5 à 250 Nm



Hex sockets
Steckschlüssel
Clé à douille à six pans

10
 13
 24
 30

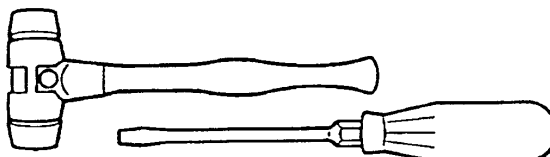


6
 10

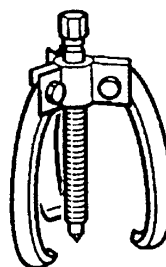


Plastic hammer 1000g
Kunststoffhammer
Maillet en plastique
Steel hammer 250g
Stahlhammer
Marteau en acier

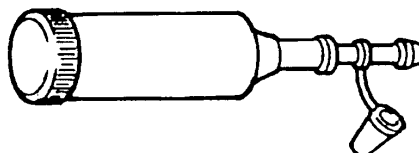
Screwdriver or tyre lever
Schraubendreher oder Montageisen
Tournevis ou levier démonte-pneu



Extractor
Zwei- oder Dreiarm - Abzieher
Extracteur

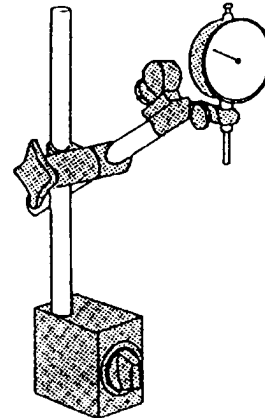


Grease gun with yoke to DIN 71412 - M8x1
Fettpresse für Kegelschmiernippel nach DIN 71412 - M8x1
Pompe de graissage avec embout pour le graissage conique selon la norme DIN 71412 - M8x1

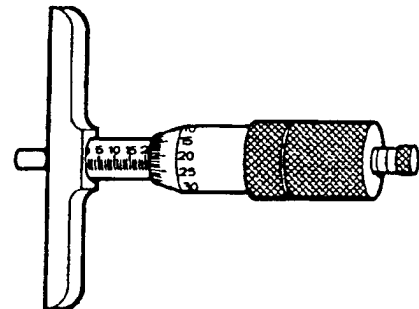


Measurement Tools

Dial gauge with magnet
Meßuhr mit Magnetstand
Jauge à cadran avec aimant

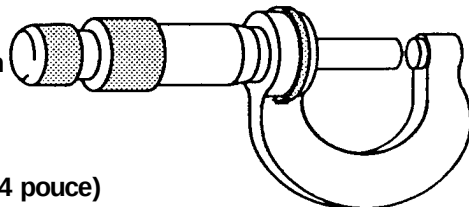


Micrometer depth gauge up to 70mm
Tiefenmikrometer bis 70mm
Micromètre de profondeur mesurant
une profondeur maximale de 70mm

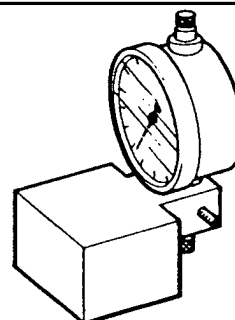


Micrometer up to 25mm
Mikrometer bis 25mm
Micromètre mesurant une profondeur jusqu'à 25mm

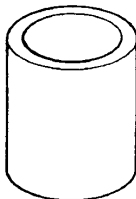
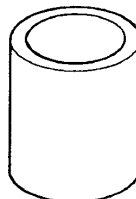
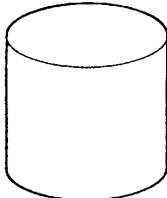
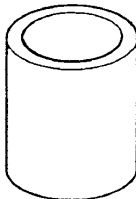
Accuracy 1/100mm (0.0004 in.)
Genauigkeit 1/100mm (0.0004 in.)
Exactitude de lecture 1/100 mm (0,0004 pouce)



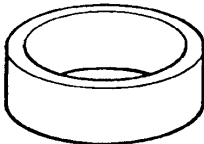
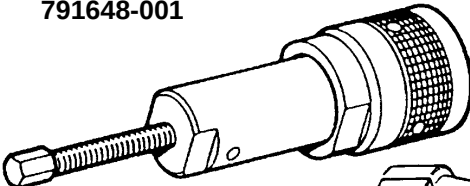
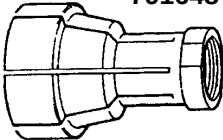
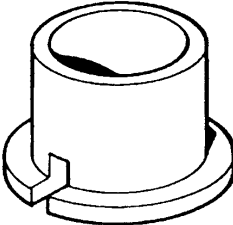
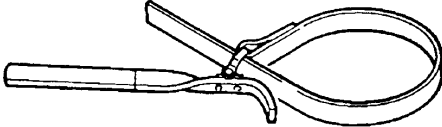
Measuring tool for pinion shaft assembly
Meßvorrichtung für Kegelritzelwellenmontage
Outil de mesure pour l'assemblage de l'arbre du pignon



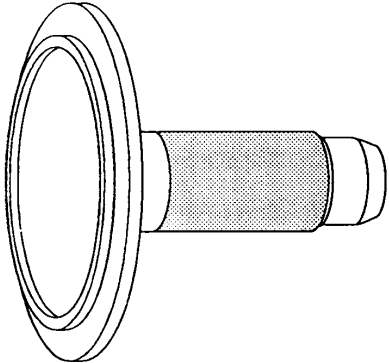
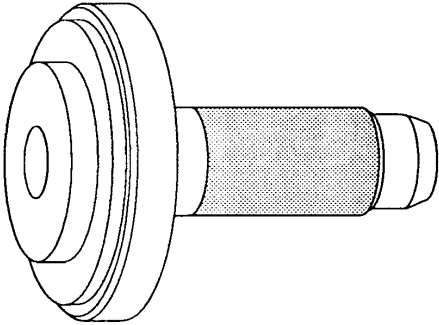
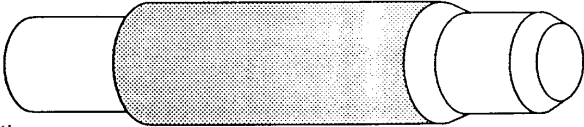
Equipment

B	Bush Buchse Douille Removing bearing inner race, pinion shaft Lagerinnenring abziehen, Kegelritzelwelle Pour démonter la bague intérieure des paliers de l'arbre du pignon	791646-001	
C	Bush Buchse Douille Fitting bearing inner race, pinion shaft Lagerinnenring aufpressen, Kegelritzelwelle Pour monter la bague intérieure des paliers de l'arbre du pignon	791646-002	
D	Measuring bush Meßbuchse Douille de réglage Pinion shaft assembly Kegelritzelwelleneinbau Assemblage de l'arbre du pignon	791646-003	
F	Clamping device Spannvorrichtung Outils de serrage Pinion shaft assembly Kegelritzelwelleneinbau Assemblage de l'arbre du pignon	791647	
G	Bush Buchse Douille Fitting bearing inner race, pinion shaft Lagerinnenring aufpressen, Kegelritzelwelle Pour monter la bague intérieure des paliers de l'arbre du pignon	791646-004	

Equipment

H	Bush Buchse Douille Fitting bearing inner race, wheel shaft Lager - Innenring aufpressen, Radwelle Pour démonter la bague intérieure des paliers de l'essieu	791646-005 
M	Extractor Abzieher Extracteur Remove bearing inner race, wheel shaft and crown wheel Lagerinnenring abziehen, Radwelle und Tellerrad Retirer la bague intérieure des paliers de l'essieu et de la couronne d'entraînement Collet Spannzange Pince de serrage	791648-001  791648-002  Bearing / Lager / Palier 32011
N	Disk Druckstück Disque Remove bearing inner race, crown wheel Lagerinnenring abziehen, Tellerrad Retirer la bague intérieure des paliers de la couronne d'entraînement	791649 
O	Pressure Device Pressvorrichtung Manchon de pression To remove wheel studs Radbolzen entfernen Pour dévisser les boulons de fixation des roues	791650 
P	Strap wrench Bandschlüssel Clé à sangles Spur gear mounting Stirnradmontage Montage de l'engrenage droit	

Equipment

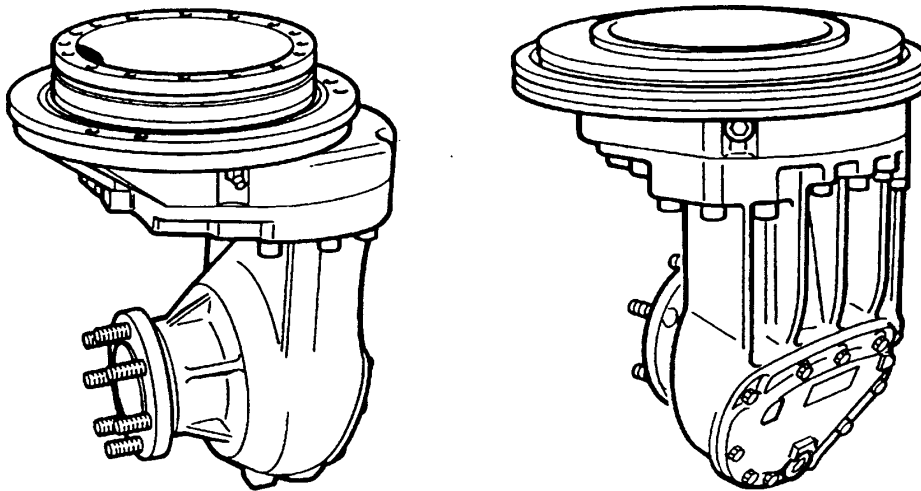
S	Assembly Mandrel Montagedorn Mandrin de montage	791651-001	
Fitting thread protective shield, wheel shaft Fadenschutz montieren, Radwelle Pour monter l'anneau protecteur fileté et l'essieu			
T	Assembly Mandrel Montagedorn Mandrin de montage	791651-002	
Fitting sealing ring, wheel shaft Radialwellendichtring montieren, Radwelle Pour monter l'anneau d'étanchéité de l'essieu			
U	Assembly Mandrel Montagedorn Mandrin de montage	791651-003	
Fitting venting filter Entlüftungsfiter eintreiben Pour enfoncer le filtre d'aération			

Gear Unit Maintenance

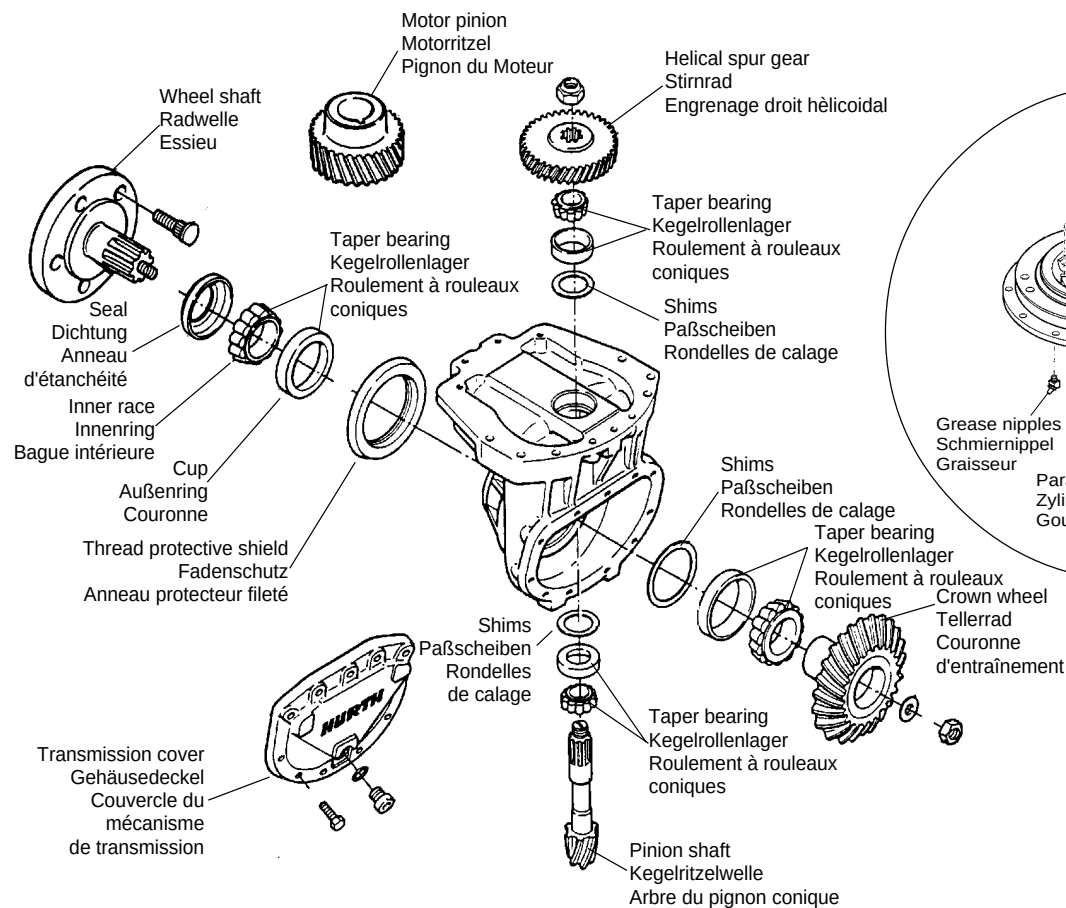
General

Before carrying out repair work on the gear unit it is advisable to read the following section. Some of the processes described are very complex. **Special tools are essential (see pages 3.1-2140-003 through -007).**

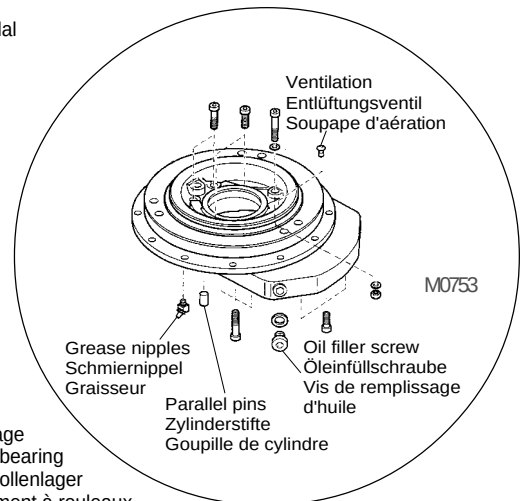
Gear Unit Main Components



M0756



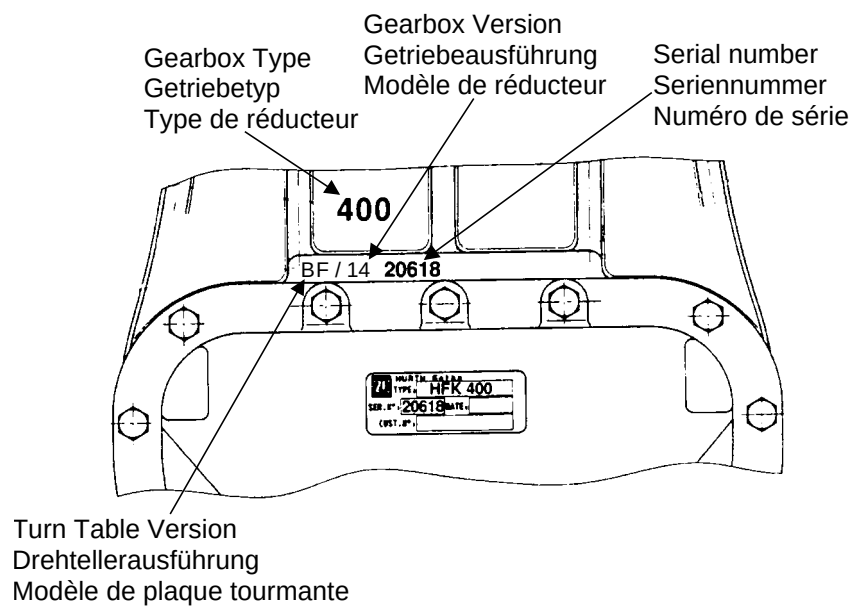
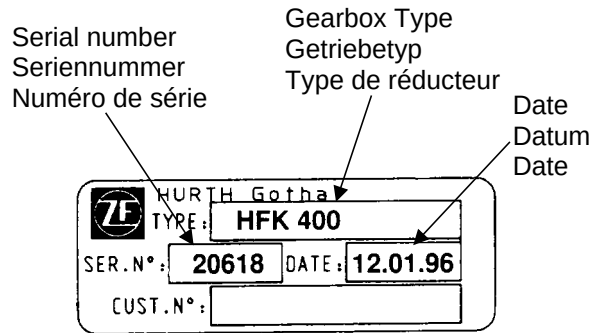
Turntable Drehteller Plaque tournante



M0753

M0754

Gear Unit Labelling



M0771

Setting Data

Bearings

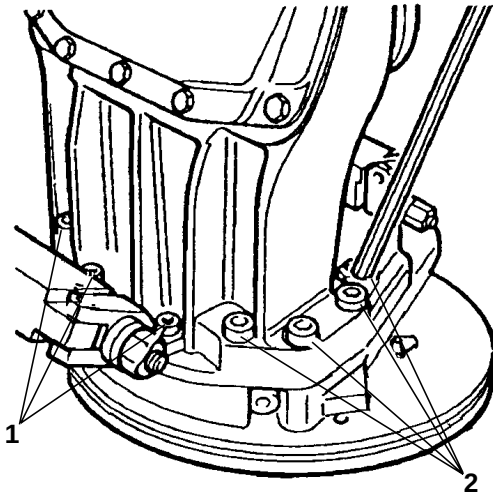
Taper bearing pre-tension, pinion shaft	0.02 - 0.07 mm
Taper bearing pre-tension, wheel shaft	0.05 - 0.10 mm
Torsional flank clearance, spur bevel gear	0.03 - 0.11mm
Max. bearing clearance, live ring bearing	0.03 mm

Screw and Nut Torques

Hex. nut to fasten the helical spur gear	150 Nm
Hex. bolt for wheel shaft	245 Nm
Hex. bolt for gear unit cover	9.5 Nm
Oil drain and refill plug	22 Nm
Allen screw to fasten the upper part	M8: 23 Nm, M10: 46 Nm
Wheel nuts	140 Nm
Grease nipple for lower part	10 Nm

Disassembly

- Remove the upper part of the transmission housing.
- Loosen the nine Allen screws (1,2).
- Using a plastic hammer gently tap underneath the upper part to loosen it from the transmission housing.



INFORMATION

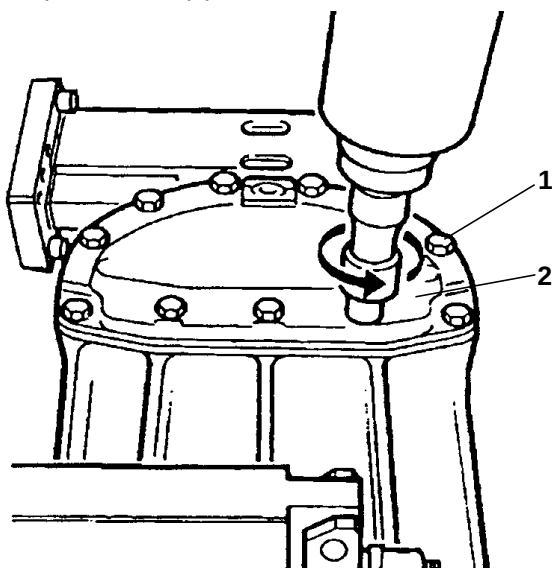


The upper part of the transmission housing can only be replaced as a whole unit.

Replace any damaged components such as cylinder pins, air filter and grease nipple.

Gear Unit Cover Removal

- Remove the twelve Allen screws (1).
- Tap the cover (2) to loosen and lift it out.



M0757

Spur Bevel Gear and Wheel Shaft Removal

- Screw the two wheel nuts (1) onto the wheel bolts and fix the wheel shaft (2) with a lever (3).
- Remove the Allen screw with a wrench SW 24 (4), and carefully remove the spur bevel gear (5) from the wheel shaft.
- Drive the wheel shaft (2) from the housing using a copper mandrel.

WARNING



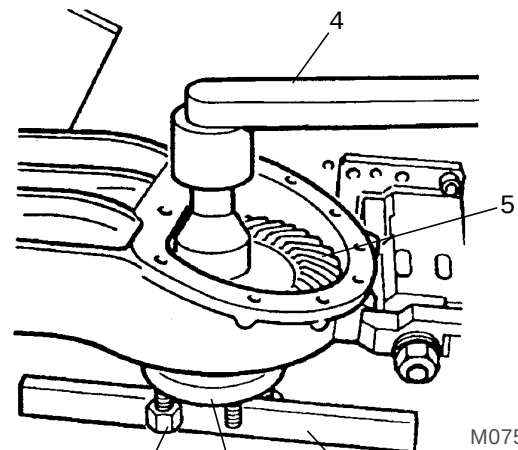
Use breathing apparatus. Heated Loctite sealant releases toxic vapours.

Use protective gloves to remove the hot spur bevel gear.

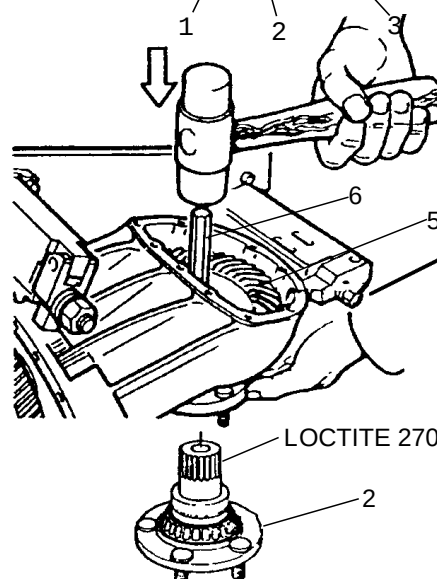
INFORMATION



The spur bevel gear is fixed to the wheel shaft with Loctite 270. To remove, heat the spur bevel gear to 100 °C - 120 °C.



M0758



M0759

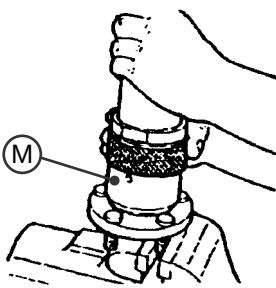
BEARING INNER RING REMOVAL

Wheel Shaft

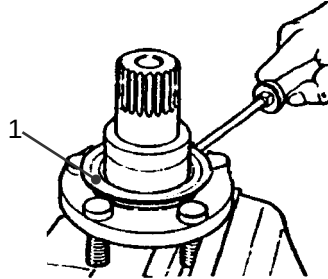
INFORMATION

i Always replace the packing washer (1, Fig.760-2) when removing the wheel shaft.

- Push the collet chuck of the extractor "M" up the bearing rollers.
- Fix the collet chuck to the bearing rollers via the extractor spigot nut.
- Screw the spindle to the wheel shaft. Carefully extract the bearings evenly.
- Carefully remove the seal.



M0760-1



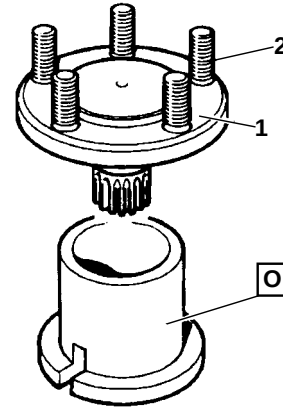
M0760-3

Wheel Bolt Removal

INFORMATION

i The wheel bolts can only be driven out when the wheel shaft has been removed.

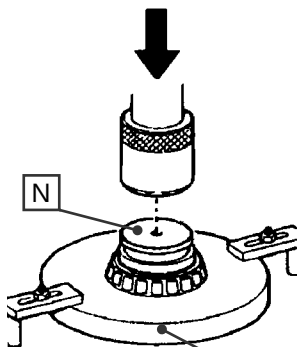
- Place the wheel shaft (1) on the press (O) and push the wheel bolts (2) out.



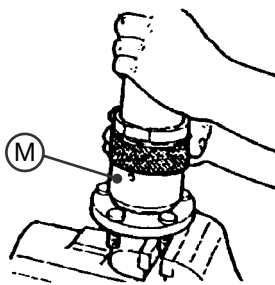
M0761

Spur Bevel Gear

- Insert the pressure plate "N" into the spur bevel gear (2) notch.
- Push the collet chuck of the extractor "M" up the bearing rollers.
- Fix the collet chuck to the bearing rollers via the extractor spigot nut.
- Screw the spindle to the wheel shaft. Carefully extract the bearings evenly.



M0760-2



M0760-1

Pinion Shaft Disassembly

INFORMATION



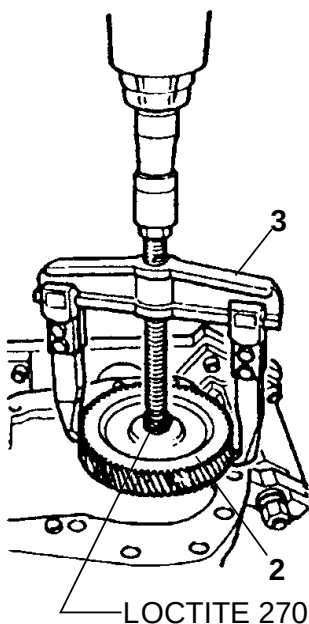
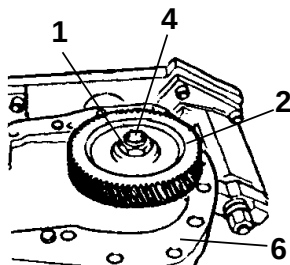
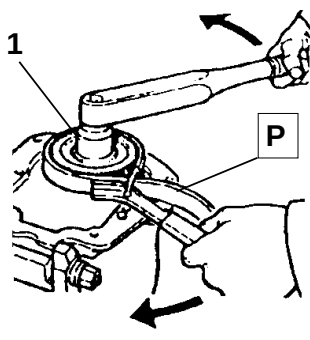
Before removing the pinion shaft first remove the spur bevel gear and the wheel shaft. See previous chapter "Spur Bevel Gear and Wheel Shaft Removal".

Unscrew the Allen nut (1) and fix the gear wheel (2) using a strap wrench "P".

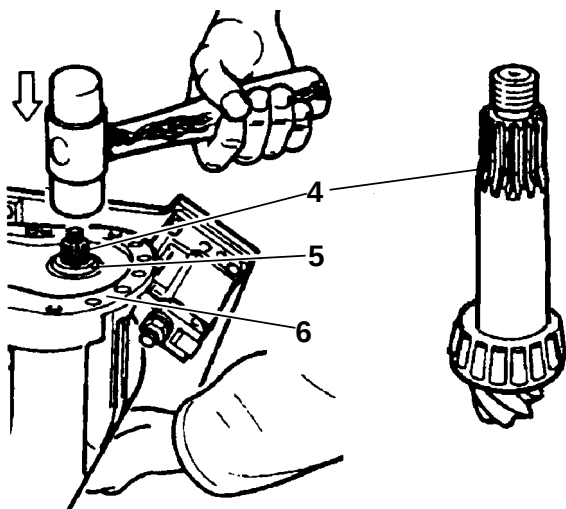
Extract the gear wheel (2) using an extractor (2).

Bring out the pinion shaft (4) while taking care not to damage the thread!

Remove the bearing inner ring (5) from the housing (6).



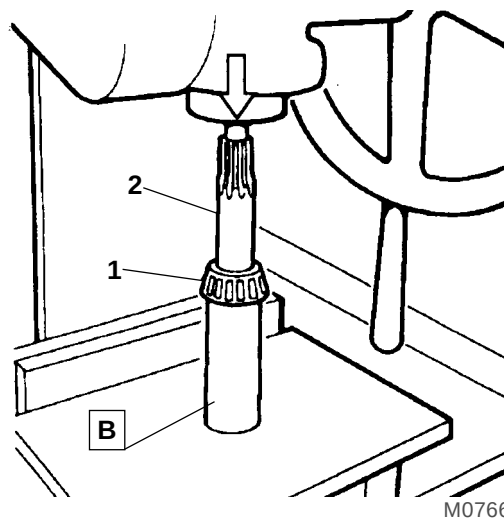
M0764



M0765

Extracting the Taper Bearing Inner Ring from the Pinion Shaft

- Extract the taper bearing inner ring (1) and bushing "B" from the pinion shaft (2).



M0766

Removing the Taper Bearing Cups from the Transmission Housing

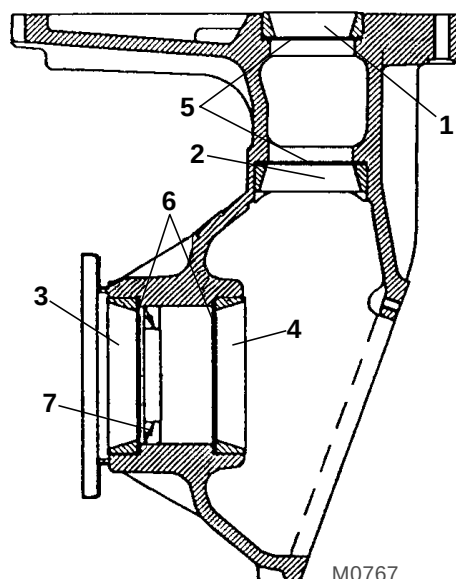
- Carefully drive out the bearing cups (1,2) for the pinion shaft and (3,4) for the wheel shaft with a copper mandrel.

INFORMATION



DO NOT DAMAGE THE SHIMS (5,6) WHEN FORCING OUT THE BEARING CUPS.

KEEP THE BEARING CUPS AND SHIMS.



M0767

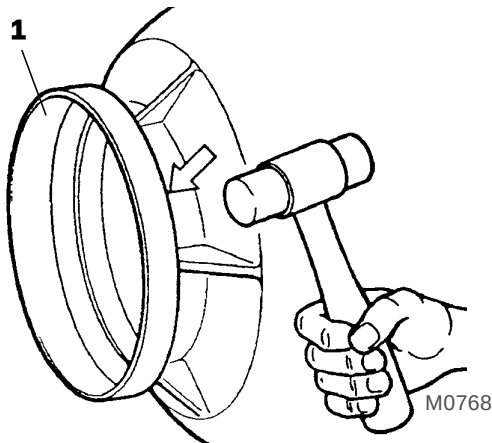
- Using a screwdriver and hammer drive out the conical nipple (7).

Thread Protective Shield Removal

INFORMATION

THE THREAD SHIELD IS GLUED TO THE HOUSING.

- Gently tap on the thread shield (1) to loosen and remove it.



Pre-Assembly Test

General

Thoroughly clean all components and remove any traces of LOCTITE.

CAUTION

YOU MUST FOLLOW THE SOLVANT MANUFACTURER'S INSTRUCTIONS AND WARNINGS.

- Replace all worn and damaged components.
- Always replace gear wheels in sets and fit new taper bearings.
- New gear wheel pairs must always be fitted with new taper bearings.
- Always replace the taper bearings in full (inner ring, cup, conical roller).
- Always apply gear oil to the taper bearings prior to assembly.
- Do not re-use, rather replace shims.

- Check the smoothness of the seal surfaces and grind if necessary.
- Replace all seals.

Assembly

Pinion Shaft Installation Dimensions

- Insert bushing "D" in the housing bearing notch and calculate dimension "F".
- The housing dimension "E" can be calculated using the following equation:

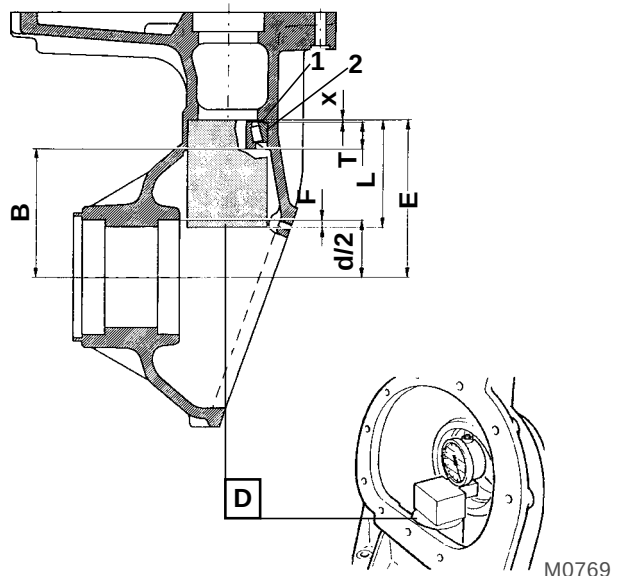
$$E = L - F + d/2,$$
 where
 L = Length of bushing "D",
 F = Measurement from the bearing seat diameter to the face of bushing "D"
 and $d/2 = 45.00 \text{ mm}$.

- Dimension "X" for the shim (1) is calculated as follows:

$$X = E - B - T,$$

whereby

E = Housing dimension, B = Installation dimension of the pinion shaft and T = Bearing width (2).



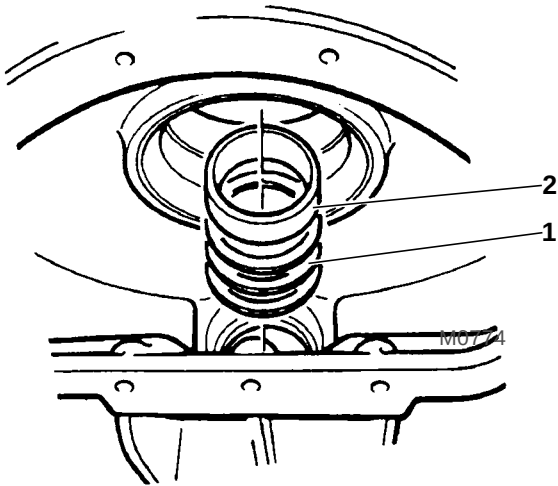
Installing the Pinion Shaft Bearing Cup in the Housing

- Calculate the shim width as described in the above equation and insert the shims (1) in the seat of the bearing cup.
- Press the bearing cup (2) into the bearing seat of the transmission housing.

INFORMATION



The max. tolerance is ± 0.05 mm.



M0774

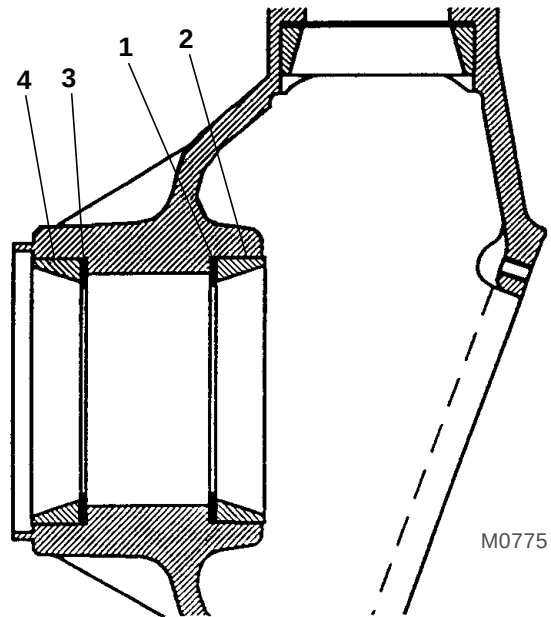
- Press the bearing cup (2) into the bearing seat in the transmission housing.

INFORMATION



Only press in the wheel shaft seal and the thread protective shield during final assembly.

Wheel Shaft Pre-Assembly



M0775

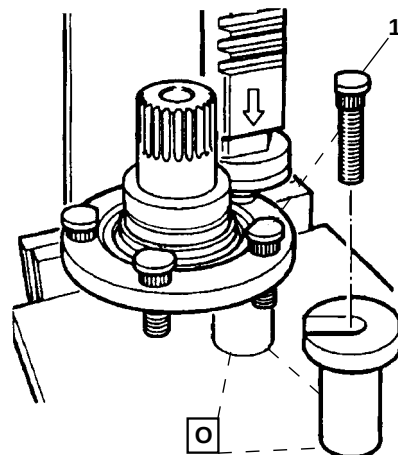
Wheel Bolt Assembly

- Press the wheel bolt (1) into the wheel shaft flange using the press "O".

INFORMATION



Make sure that the flat side of the bolt is pointing towards the centre of the wheel shaft (2).



M0776

Bearing Inner Ring and Cup Installation

Inner Ring

- Insert the shim set (1) which was removed during disassembly in the housing.
- Press the bearing cup (2) into the bearing seat of the transmission housing.

Cup

- Insert the shim set (1) which was removed during disassembly in the housing.

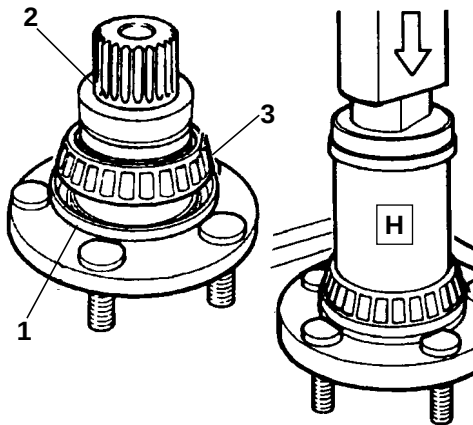
Seal and Taper Bearing Assembly

- Press the packing washer (1) onto the wheel shaft (2).
- Carefully press the taper bearing (3) onto the wheel shaft using bushing "H".

INFORMATION

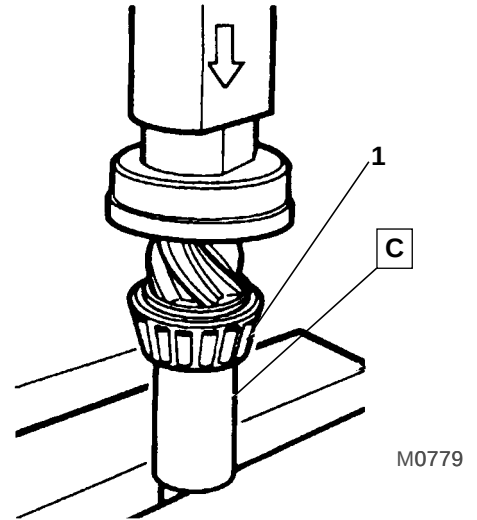


Only grease the packing washer and the taper bearing on final assembly.

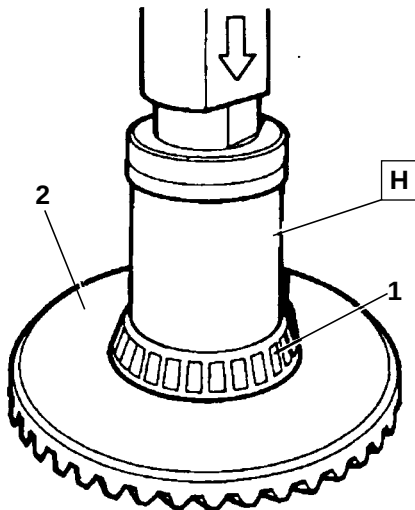


Pinion Shaft Pre-Assembly

- Carefully press the taper bearing (1) onto the pinion shaft up to the shaft shoulder using the bushing "C".



Spur Bevel Gear Pre-Assembly

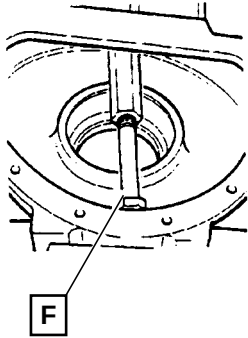


- Carefully press the taper bearing (1) onto the spur bevel shaft (2) using bushing "H".

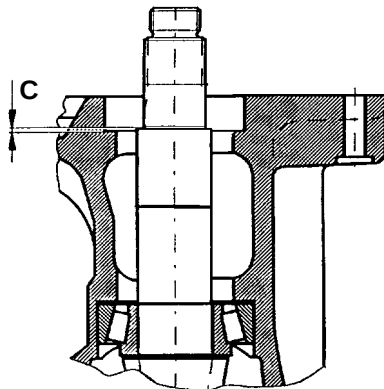
Pinion Shaft Assembly

INFORMATION**GREASE THE BEARING INNER RING.**

- Insert the pre-assembled pinion shaft from underneath the housing and slightly pre-tension the bearing using tensioner "F".
- Calculate dimension "C".

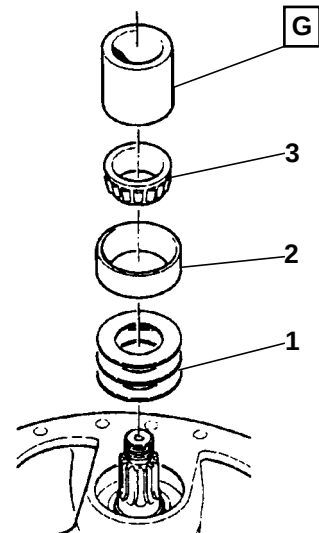


M0780

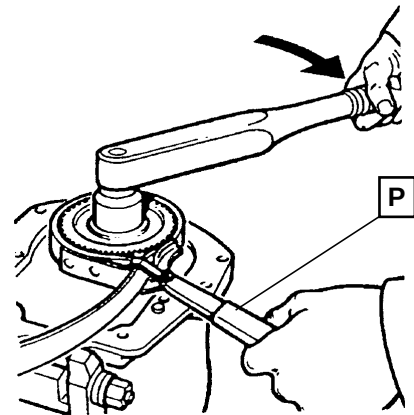


M0781

- Fit the shim set (1); dimension "C" plus 0.02 mm.
- Carefully press the taper bearing cup (2) into the housing.
- Using the bushing "G" press the taper bearing inner ring (3) onto the pinion shaft. Place the helical geared spur pinion onto the pinion shaft and screw in the Allen nut (M0783).
- Fix the spur pinion with strap wrench "P" and torque nut to 150 Nm (M0784).
- Remove tensioner "F".



M0783



M0784

Pinion Shaft Pre-Assembly

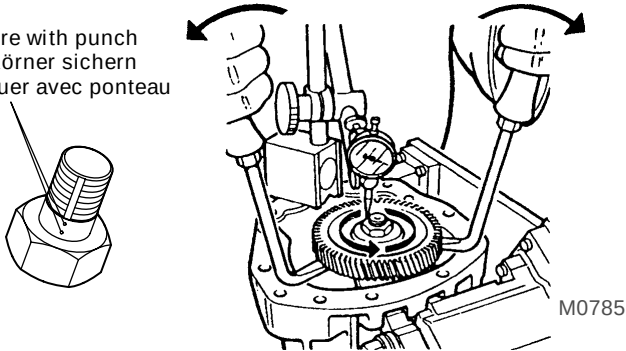
- Manually press the pinion shaft down and turn it several times to align the conical rollers.
- Attach the dial gauge in accordance with diagram no. M0785 and set the dial face to zero.
- Mark the measured point on the helical geared spur pinion.
- Carefully lift the pinion shaft using two screwdrivers or mounting iron.
- Repeat the process several times.
- The pre-tension value should be between 0.02 mm and 0.07 mm.
- The preferred pre-tension value is 0.07 mm.
- Remove the spur pinion and the upper bearing cup from the housing.
- Insert any additionally required shims and refit the pinion shaft.

INFORMATION

- Before re-fitting the helical geared spur pinion apply a thin layer of LOCTITE 270 to the spline toothing.
- Wipe off excess LOCTITE.
- It is not possible to check the pre-tensioned taper bearings directly. If testing is carried out with the above procedure, you must ensure that there is zero play.

- Lock the nuts once they have been correctly torqued.

Secure with punch
Mit Körner sichern
Bloquer avec ponteau

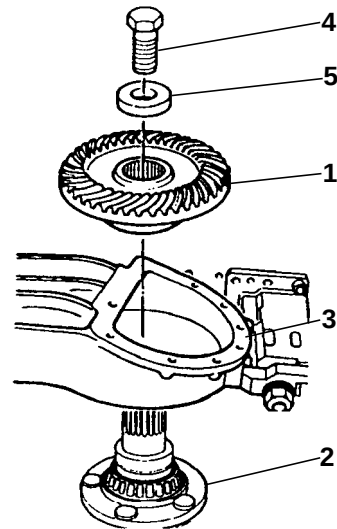


M0785

Wheel Shaft Assembly**INFORMATION**

THE RADIAL SHAFT SEAL MAY ONLY BE RE-ASSEMBLED WHEN THE WHEEL SHAFT PRE-TENSION VALUE BETWEEN THE TAPER BEARINGS HAS BEEN CALCULATED.

- Carefully insert the spur bevel gear (1) in the housing (3).
- Fit the wheel shaft (2) in the transmission housing and push the spline toothing into the spur pinion.
- Lock the spur bevel gear and the wheel shaft with an Allen screw (4) and washer (5) (torque: 245 Nm).



M0786

Spur Bevel Gear Play

INFORMATION

- To measure the torsional flank clearance on the spur bevel gear, make sure that the pinion shaft cannot be turned (with a wooden wedge).
- The torsional flank clearance is created by adding or removing shims (1) (see Fig. no. M0787).

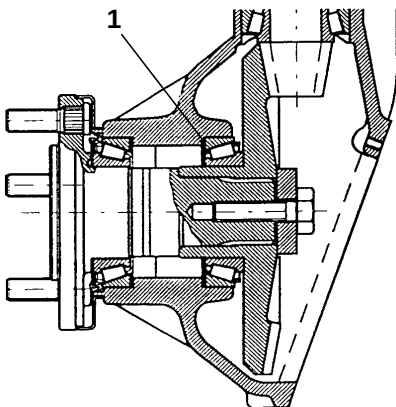
Calculating the Torsional Flank Clearance

- Place the dial gauge (2) - as shown in Fig. no. 0788 - as perpendicular as possible (90°) to the tooth profile.
- Turn the wheel shaft (3) in both directions in order to calculate the torsional flank clearance.

INFORMATION

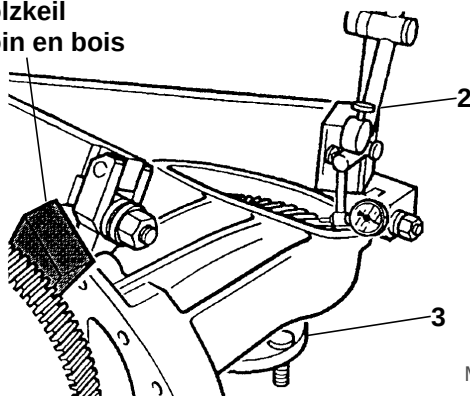


Max. permissible torsional flank clearance:
0.03 - 0.11 mm, preferably 0.07 mm.



M0787

Wooden wedge
Holzkeil
Coin en bois



M0788

Adjusting the Bevel Wheel Set

WARNING



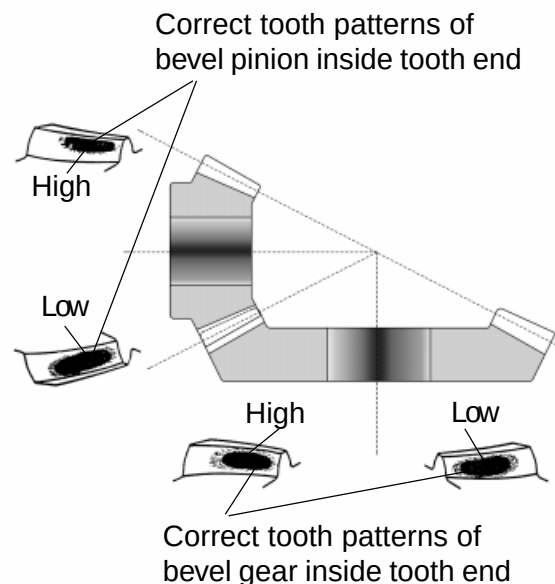
ADJUST WITH CARE. THE BEARING AND SHIM PRE-TENSION AFFECT THE TOOTH PATTERN. DO NOT SET THE PRE-TENSION TOO LOW. IT WILL AUTOMATICALLY REDUCE DURING NORMAL OPERATION.

The correct setting can be calculated via the tooth profile pattern.

Basic Rules:

- Always adjust the bevel wheel set according to the correct flank position. The tooth ends should **not** form a straight line.
- The tooth pattern must always align with the inner tooth end.
- The tooth pattern must range from high (top edge of the tooth) to low (bottom edge of the tooth).

Fig. M1565-1 shows the limits of the permissible tooth patterns on the bevel pinion and bevel gear.



M1565-1

Wheel Shaft Pre-Tension

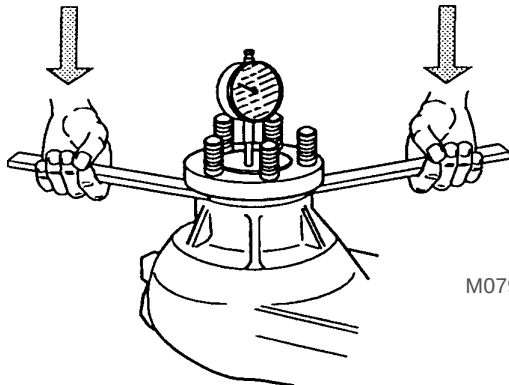
- Manually press down the wheel shaft and turn it several times to align the conical rollers.
- Attach a dial gauge in accordance with diagram no. M0790 and set the dial face to zero.
- Using two screwdrivers or two tyre levers carefully lever the wheel shaft up and record the dial gauge readings (actual bearing clearance).
- Remove the wheel shaft and take the outer bearing ring out of the transmission housing seat.
- Add shims as required and refit the wheel shaft. Take several measurements.

INFORMATION



The bearing clearance should be 0.002 mm.

- Only pre-tension the bearing when the required clearance has been obtained.



M0790

- The pre-tension should be between 0.05 mm - 0.10 mm.
- *The pre-tension cannot be checked, however there should be no bearing clearance and it should be possible to turn the wheel shaft manually.*

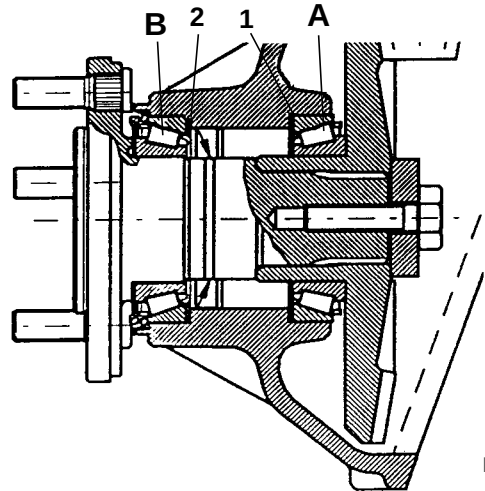
Second Torsional Flank Clearance Check

- After the above process the torsional flank clearance should be checked again (see "Calculating the Torsional Flank Clearance").

INFORMATION



If the torsional flank clearance requires adjustment, shims from bearing 'A' should be added or removed and shims from the shim set at bearing 'B' should also be added or removed.



M0791

Final Assembly

Thread Shield Assembly

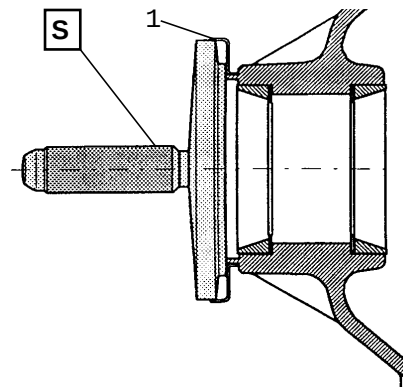
- Spray the seat of the shield with LOCTITE- Rapid Cleaner 706. Leave the Rapid Cleaner to soak and remove any dirt. Spray the surface again and leave to dry.

WARNING



**THESE ARE DANGEROUS SUBSTANCES.
READ THE MANUFACTURER'S
INSTRUCTIONS AND CAUTIONS.**

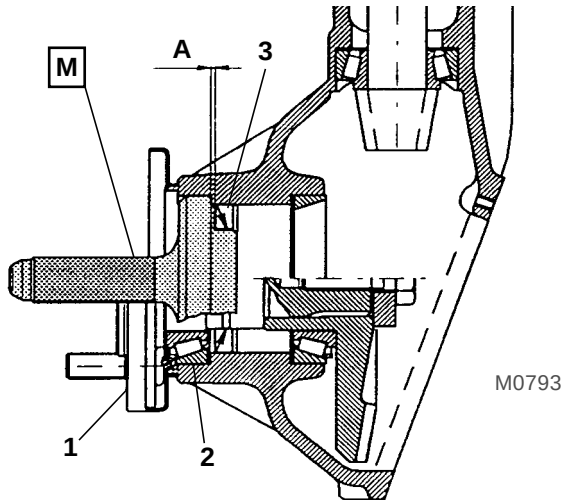
- Coat the seat on the gear with LOCTITE No. 270 before fitting the thread shield (1) with mandrel "S".



M0792

Radial Shaft Packing Washer Assembly

- Remove the wheel shaft (1).
- Extract the bearing outer ring of the outer bearing using a bearing extractor.
- Coat the outer surface with LOCTITE 574 before fitting the packing washer (3) with mandrel "T"; installation $3.0^{+0.5}$ mm.



M0793

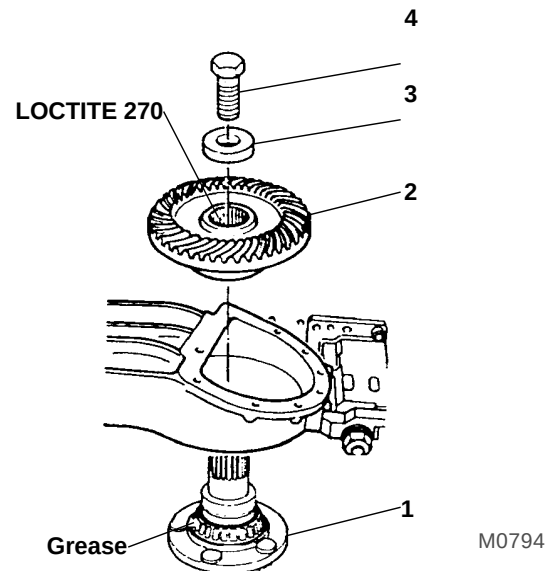
Wheel Shaft Assembly (Fig. M0794)

- Coat the spline toothing of the spur bevel gear with LOCTITE 270 before assembling the wheel shaft (1) and spur bevel gear (2).
- Apply a thick coat of grease no. 053002-001 to the bearing and seal.
- Carefully push the wheel shaft into the spur bevel gear.

INFORMATION

CAREFULLY DISPOSE OF EXCESS LOCTITE.

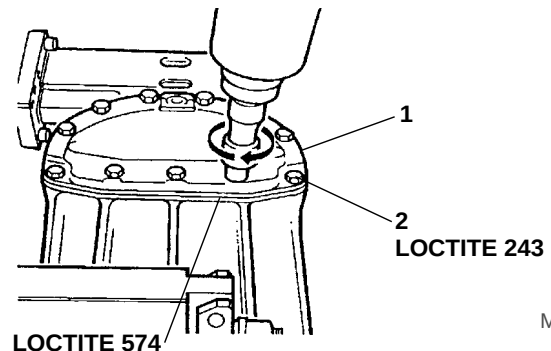
- Secure the assembly with a seal (3) and screw (4).
- Torque the screw to 245 Nm.



M0794

Housing Cover Assembly

- Coat the housing upper surface with LOCTITE upper surface sealing.
- Apply a drop of LOCTITE 243 onto the thread of each hex. bolt.
- Place the housing cover (1) on the transmission housing and fix with screws (2).
- Torque screws to 9.5 Nm.



M0795

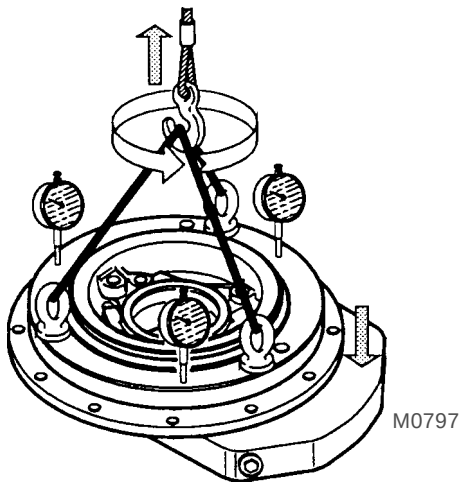
Gear Upper Section Assembly

INFORMATION

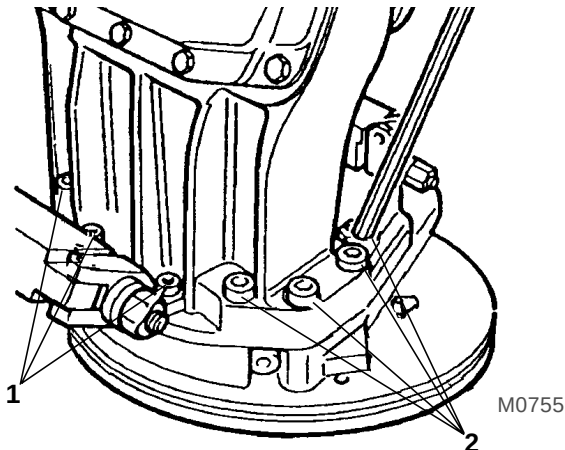


The upper section must be replaced if:

- The cover of the live ring bearing is loose.
 - The live ring bearing is hard to turn and/or jams.
 - The bearing clearance is too large.
- In order to check the bearing clearance the upper section must be fixed, as shown in figure no. M0797.
 - Fit three dial gauges as shown.
 - Apply an axial load of no more than 50 kg to the live ring bearing, and turn it.
 - The bearing clearance should not exceed 0.03 mm.



- Carefully fit the bleed valve and mandrel "U" in the upper section.
- Screw in the two grease nipples in the upper section; and torque to 10 Nm.



Live Ring Bearing Maintenance

INFORMATION



IN NORMAL CONDITIONS THE BEARING SHOULD BE GREASED EVERY 1000 HOURS.

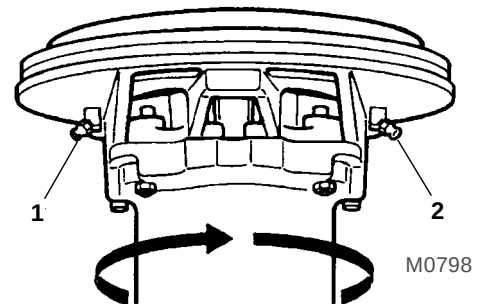
IN DUSTY OR DAMP CONDITIONS THE BEARING SHOULD BE GREASED EVERY 125 HOURS.

Lubrication

Required amount: 55 g approx.

- Use both grease nipples (1,2) to lubricate the live ring bearing, while slowly turning the live ring plate to spread the grease evenly.
- Keep pressing in the grease until only clean, fresh grease emerges.

Remove excess grease with a cloth.



Gear Unit Assembly

Assembly is the reverse of disassembly (see page 3.1-2140-001).

- Check the oil level after a few hours of operation and replenish if necessary.
- Check gear unit for leaks.

DANGER



THE BRAKE SYSTEM MUST BE PARTLY DISASSEMBLED TO INSTALL AND REMOVE THE GEAR UNIT. BEFORE USING THE TRUCK:

- Check the brake fluid visual gauge
- Check the brake setting and adjust if necessary
- Check the brake force
- Adjust the steering chain

Filling the Gear Unit with Oil

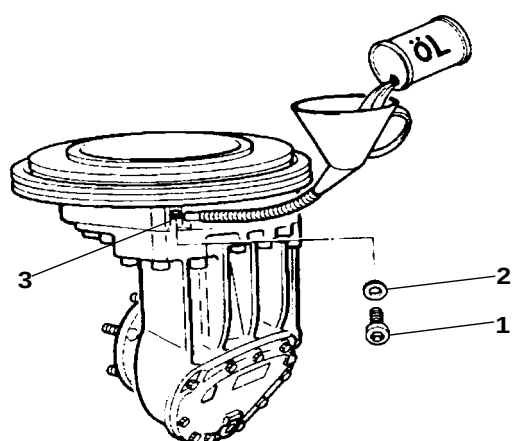
- Before replenishing with oil clean the magnet of the oil drain screw (2) and replace the conical nipple.

INFORMATION



FOR NORMAL OPERATING CONDITIONS USE GEAR OIL NO. 053002-004.

FOR COLD STORE APPLICATIONS USE OIL NO. 053002-006.



M0799

Required oil amount is 3.7 l approx.

- Fill oil up to the lower mark of the oil filler port (3).

CROWN

ELECTRICS

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Electrics - General

Wire Colour Codes

The wires used in the truck are colour-coded and numbered according to their function. The first digit or the first two digits indicate the wire colour while the last two digits are counter numbers.

ABBREVIATION	COLOUR	NUMBER	FUNCTION
BLK	Black	0 **	Digital signal
BRN	Brown	1 **	Analog signal
RED	Red	2 **	Positive not connected
ORG	Orange	3 **	+12 V DC converter
YEL	Yellow	4 **	Third DC converter
GRE	Green	5 **	Negative not connected
BLU	Blue	6 **	Insulated negative
VIO	Violet	7 **	+5 V DC converter
GREY	Grey	8 **	Fourth DC converter
WHT	White	9 **	Various
R/W	Red/White	29 **	Positive connected
G/W	Green/White	59 **	Negative connected

** Numbers 01 to 99

E01-gb

Index of Abbreviations

Index of Abbreviations *			
Abbreviation	Component	Abbreviation	Component
ACS	Travel Switch	FLS	Free Lift Switch
ALM*	Alarm	FS	Forward Travel Switch
BFS	Brake Fluid Level Monitor Switch	FU**	Fuse
BLS	Battery Latch Monitor Switch	HCM	ACCESS 2 (Pump Controller)
BMS	Parking Brake Monitor Switch	HGTRS	Height Reset Switch
BRS	Parking Brake Switch	HGTS	"Lift" Speed Reduction Mast Switch
BW*	Brush Wear Sensor	HN	Horn
DMS	Safety Switch (Left Foot Pedal)	HNS	Horn Switch
DPS*	Display Switch	K*	Relay
ECR*	Encoder	KYS	Key Switch
ED*	Emergency Disconnect Contactor	LCS	Lower Cutout Switch
EDS	Emergency Disconnect Switch	LS	Load Sense Transducer
ED1 / ED2	Emergency Disconnect Contactor Tips	M*	Electric Motor
FAN*	Fan	ORS	Override Switch for Overriding Programmed Lift Cutouts
FKS	Fork Carriage Position Monitor Switch	POT*	Potentiometer

* If one of the above abbreviations is used more than once, a progressive digit is added, e.g. SV1, SV2 etc.

E02a-gb

Index of Abbreviations (contd.)

Index of Abbreviations *			
Abbreviation	Component	Abbreviation	Component
PVA	Accessories Proportional Valve	SV*	Solenoid Valve
PVH	Lift Proportional Valve	SVA	Accessories Solenoid Valve
RES	"Forward / Retract Reach" Slowdown Switch	SVB	Brake Solenoid Valve
RS	Reverse Travel Switch	SVL	"Lower" Solenoid Valve
SAD	Steer Angle Display	SVP	Pilot Circuit Solenoid Valve
SB**	Filter Block (Suppression)	SVR	"Reach" Solenoid Valve
SCV6	Bypass Solenoid for Maximum Lift Speed	SVS	"Sideshift" Solenoid Valve
SES	Seat Switch	SVT	"Tilt" Solenoid Valve
SLS	Sideshift "Left" Switch	SV5	5th Hydraulic Function Solenoid Valve
S.P.**	Main Wiring Loom Star Point	TCM	ACCESS 3 (Traction Controller)
SRS	Sideshift "Right" Switch	THS*	Electric Motor Thermal Sensor
STS	Steer Sensor Module		

* If one of the above abbreviations is used more than once, a progressive digit is added, e.g. SV1, SV2

E02b-gb

Electrical Symbols

EUROPE	USA	DESCRIPTION	EUROPE	USA	DESCRIPTION
		Wires joining			Hand operated maintained contact
		Wires crossing			Solenoid valve
		Wire connection			Inductor
		Plug / socket			Resistor
		Wire strap			Capacitor
		Terminal board			Potentiometer
		Fuse			Varistor
		Assembled unit			Thermal protector
		Contact, normally open			Lamp
		Contact, normally closed			Horn
		Contact double throw			Battery
		Operating device			Diode
		Operating devices, slow releasing			Breakdown diode
		Operating device, slow operating			LED
		Hand operated push button			Transistor
		Mechanically actuated			MOSFET
		Hydraulically actuated			Thyristor
		Emergency disconnect			Comparator
		Motor armature			

M0056-gb

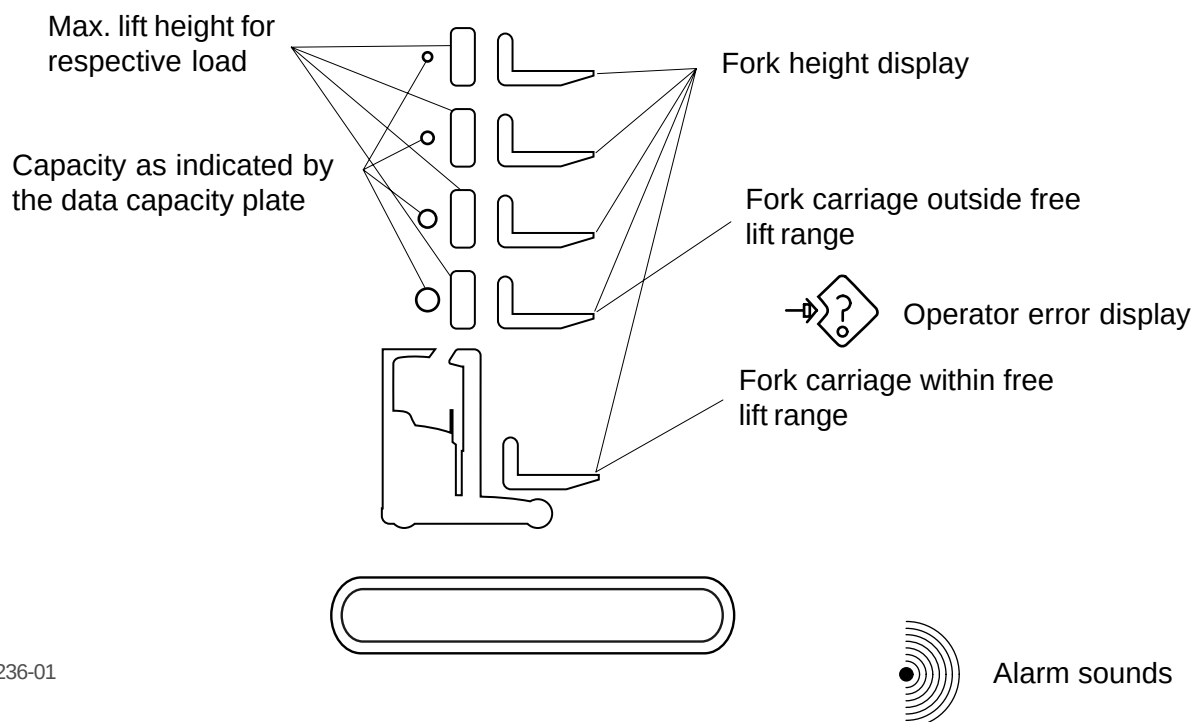
Capacity Data Monitor

The capacity data monitor CDM operates in conjunction with the load sensor LS on the fork carriage to calculate the weight of the load, the monitor switch FKS to calculate the fork carriage position and the height encoder ECR2.

For the CDM to operate correctly, the maximum permissible loads according to the data capacity plate must be entered for the respective lift heights in the FEATURES menu, under F10 "Capacity".

- Information is displayed via the ACCESS 1 operator display.
- The load sensor LS receives a continuous pressure signal from the tilt cylinder via a hydraulic line. This signal is proportional to the load and is transmitted to the truck control system.
- The monitor switch for the fork carriage position FKS cuts out the load signal transmission as soon as the fork carriage reaches one of its two limits. In this position it is impossible to calculate the load due to the additional pressure in the tilt cylinder.
- The encoder ECR2 transmits the signal for the fork carriage height display. To do this, the option "Ht Encoder" must be enabled in the FEATURES menu under item F4.
- The data capacity plate states the residual capacities for the individual lift heights and ranges. This data must be entered in menü F10 "Capacity". In this way the control system calculates the maximum lift height for each load and displays this on the CDM via a LED.

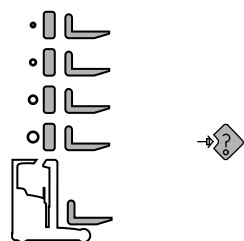
Capacity Data Monitor (on ACCESS 1 operator display)



6236-01

Capacity Data Monitor (continued)

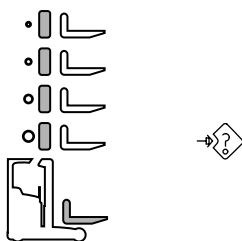
The following are various load monitor displays for varying load, travel speed and lift height situations.



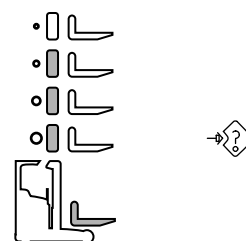
TEST



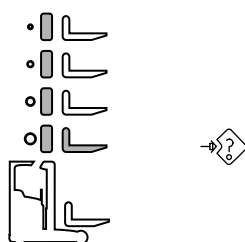
- Self-test during start-up
- Approx. 2 sec. continuous alarm



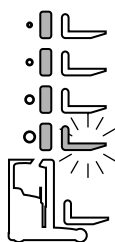
- Fork carriage within free lift range
- Load and load centre of gravity permit max. lift height



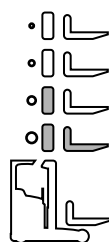
- Fork carriage within free lift range
- Load and load centre of gravity restrict max. lift height



- Fork carriage beyond free lift range
- Load and load centre of gravity permit max. lift height
- Travel speed less than creep speed.



- Fork carriage beyond free lift range
- Load and load centre of gravity permit max. lift height
- Travel speed equal to or greater than creep speed.



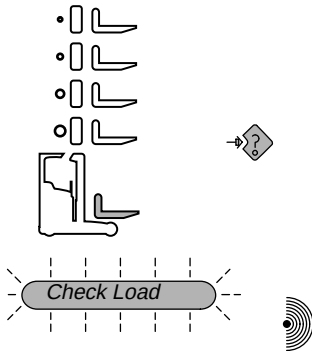
- Fork carriage beyond free lift range
- Load and load centre of gravity restrict max. lift height
- Travel speed less than creep speed.



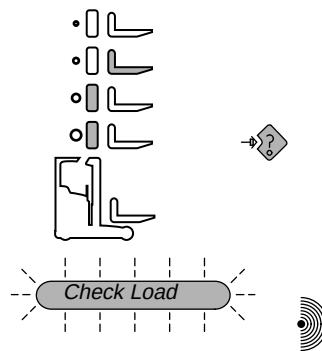
- Fork carriage beyond free lift range
- Load and load centre of gravity restrict max. lift height
- Travel speed equal to or greater than creep speed.

6237_1

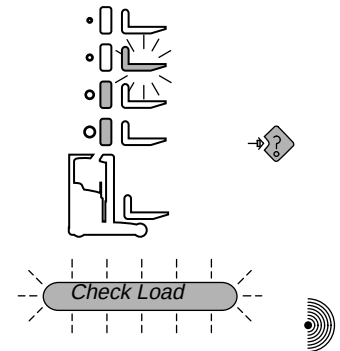
Capacity Data Monitor (continued)



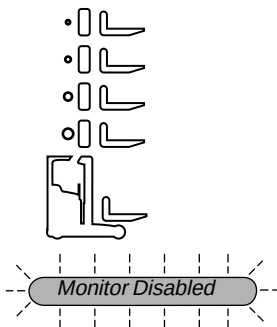
- Fork carriage within free lift range
- Load exceeds truck's maximum capacity (at a 60 cm load centre)



- Fork carriage beyond free lift range
- Load exceeds the maximum capacity for the current lift height (at a 60 cm load centre)
- Travel speed less than creep speed.



- Fork carriage beyond free lift range
- Load exceeds the maximum capacity for the current lift height (at a 60 cm load centre)
- Travel speed equal to or greater than creep speed.



- Fork carriage position switch FKS opened
- Green LEDs for load display not operating
- Fork height display operating normally
- "Monitor Disabled" message is displayed
- No audible alarm

6237_2

Troubleshooting

The status of individual capacity data monitor components can be verified via ACCESS 1.

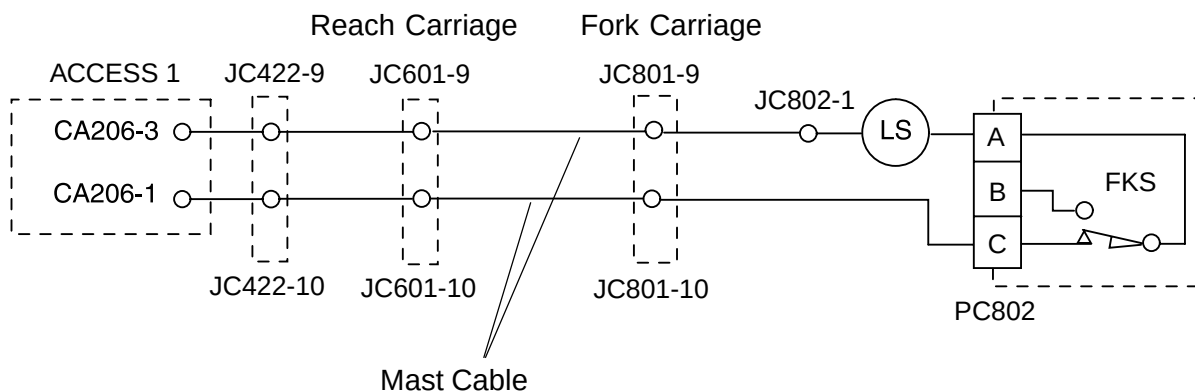
- ECR2 (encoder): Select menu item A2.19 ECR2 and operate the "lift" and "lower" functions in turn. The readings displayed should increase and decrease accordingly.
- Load sensor LS and FKS (fork carriage position): Both items are in series (see circuit diagram). Select A2.36 LS and place several weights on the forks. The readings displayed should increase with additional weight and decrease with a reduction in weight.

No LS/FKS signal displayed:

- Check 12 V supply at output CA206-3 of ACCESS 1. If no 12V present, ACCESS 1 defective.
- Check wiring and connectors between ACCESS 1 and LS/FKS.
- FKS open. The switch opens when the fork carriage or the tilt cylinder is at one of the two limits. Make sure FKS is operating correctly.

No ECR2 signal displayed:

- Check wiring and connectors between ACCESS 3 and ECR2.
- If necessary, replace ECR2.



Height Encoder ECR2

A cable attached to the second stage mast passes through a series of pulleys on the height sensor mounted on the top of the main frame to turn the encoder (ECR2). This supplies the signal to the systems electronics for height calculations.

Troubleshooting

- Check cable for freying.
- Check spring condition.
- Check encoder input to ACCESS 3. Navigate ACCESS 1 to the analyzer input menu (A2) and scroll down to A2.19. The number displayed will increase when raising the forks.

ESR4000 Status Codes

ACCESS 1-2-3

Access 1-2-3 is Crown's Integrated Control System, which electronically monitors operating functions. For certain faults the system automatically generates a service code which can be viewed on the Access 1 operator display.

This maintenance section helps identify the problem when a code is encountered and provides corrective actions to help resolve the cause of the code.

Status Codes

Each of the status codes described on the following pages has a number as well as a brief description of the affected assembly and hints as to the possible causes.

When a Service Code Occurs

Generally speaking, the majority of malfunctions occur in or at output components such as solenoid valves, contactors and motors. The next most error prone components are connectors, wiring and input devices such as switches, potentiometers or encoders.

The least likely to fail are the electronic Access 2 and Access 3 control modules. In all cases, begin troubleshooting with the consumer component. Then move on to the electronic module to which these devices attach. Finally, investigate Access 2 or Access 3 as a possible cause of error.

Truck does not Operate and there is no Status Code

Status codes are the result of tests performed on the outputs of the Access 2 and Access 3 modules. The malfunctions that can occur without providing a service code can fall into one of four categories.

1. Fault during power-up

Malfunctions in the power-up circuit can keep the truck from powering up. Refer to the power up circuit on the following page to troubleshoot this condition.

2. The fault is not electrical

Truck powers up but a code is not present, indicates the fault is a mechanical or hydraulic malfunction rather than an electrical malfunction. Information regarding mechanical and hydraulic troubleshooting is located in the appropriate section of the Service manual.

3. ACCESS 1-2-3 switches the truck off

There are circumstances which cause the Access 1-2-3 system to go into system shut down. In this condition the truck will not power up. The shutdown is required to protect the Access 1-2-3 electronic system when it detects conditions which could be destructive to its internal electronic system. These types of faults could be the direct result of shorted or open circuits which are primary to the systems power source.

During the shutdown sequence, the amber LED on the Access 2 module flashes code 14 (1 x short followed by interval + 4 x short), while the amber LED on the Access 3 module flashes once and then displays code 328 (3 x short followed by an interval + 2 x short followed by an interval + 8 x short).

To extract the fault code, power up the truck while pressing the  and  keys. Select LOG EVENTS and read the last log entry in L1 HISTORY.

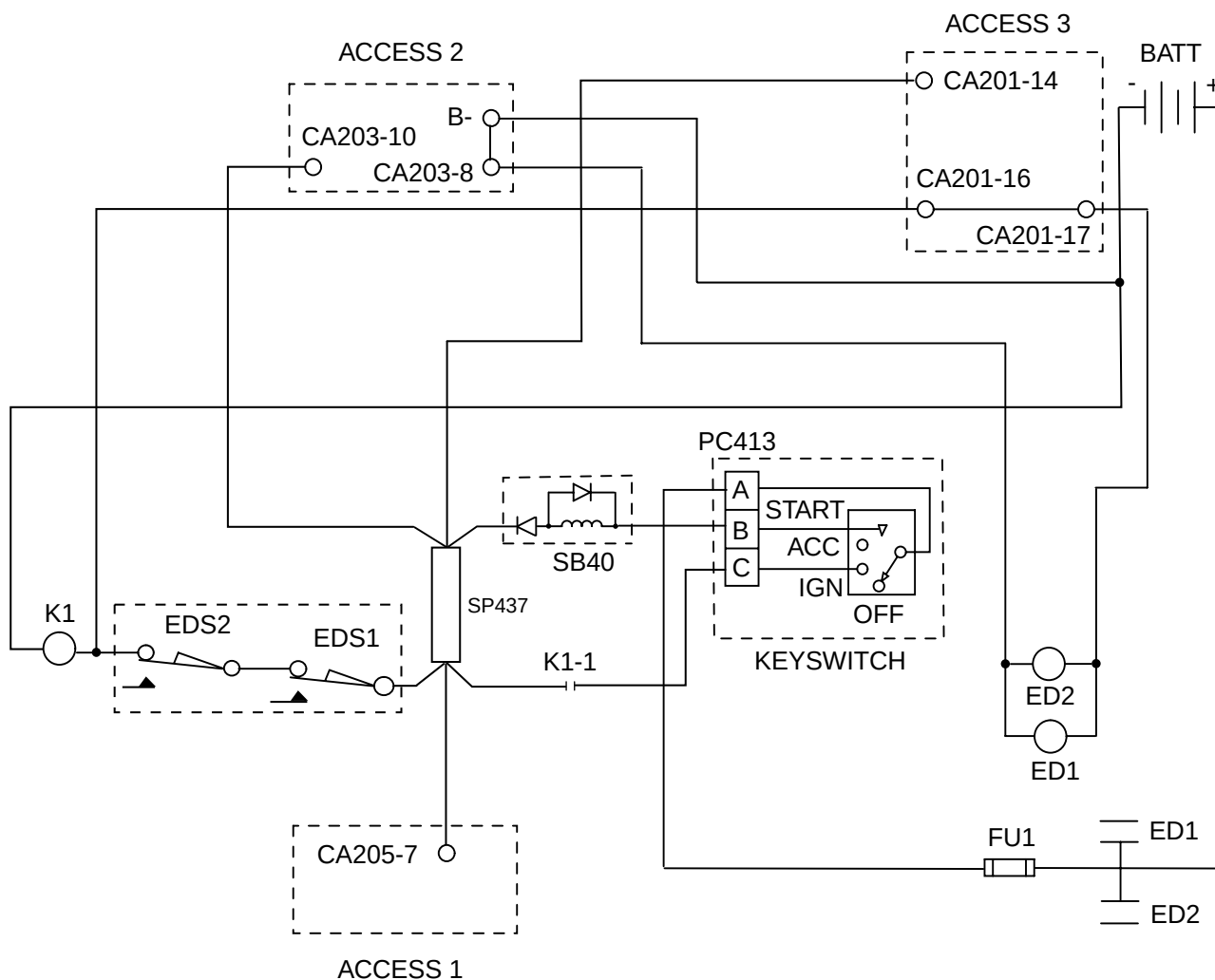
The detailed description of the respective error code provides information on the cause of the fault and how to resolve it.

Operating fault in an unmonitored input

One of a small group of unmonitored inputs has malfunctioned. Following is a list of inputs that are not monitored by the Access 1-2-3 system.

- SLS/SRS: Sideshift left / right switch
- ORS: Lift cutout override switch
- HNS: Horn switch
- HGTS: Switch for "lift" speed reduction
- FKS: Fork tilt switch

Power Up Circuit Diagram



6480-01

Maintenance

WARNING



Due to capacitance voltage present in the ACCESS 2 and ACCESS 3 modules, whenever performing maintenance which may permit contact with the bus bars and associated power cables, discharge the capacitors. Discharge by disconnecting the battery, turning and holding the key switch to the start position until the indicators on the ACCESS 1 face first go dim - then out.

DANGER



Raise drive wheel clear of floor and place hardwood blocks under truck frame.

WARNING



Never keyon truck with any of the ACCESS 1-2-3 connectors disconnected.

Never remove or connect any of the AC-CESS 1-2-3 connectors while the truck is keyed on.

SVA (Accessory Solenoid): Open circuit / Driver Short Circuit**STATUS CODE 211**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVA (A4.4) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

**NOTE**

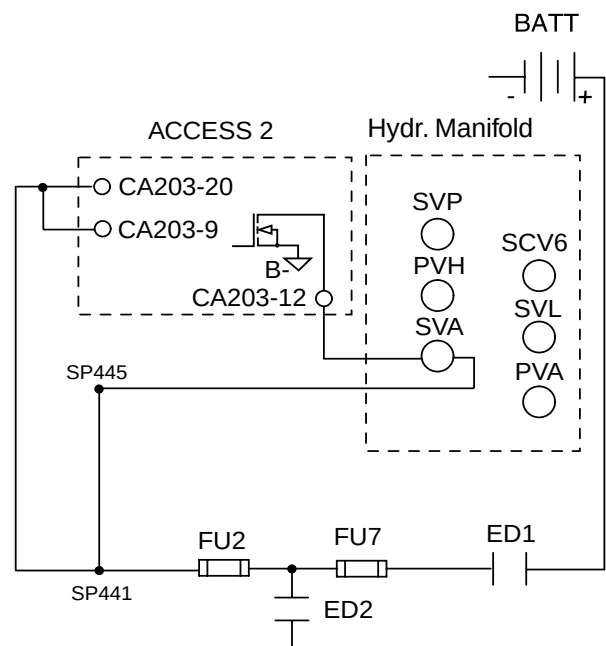
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between SVA and CA203-12 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.4 (SVA).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVA.
 - **0 V:** see note.



6283-01

SVL (Lower Solenoid): Open circuit / Driver Short Circuit**STATUS CODE 212**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVL (A4.5) on display menu. Press and hold ENTER key (drives coil).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

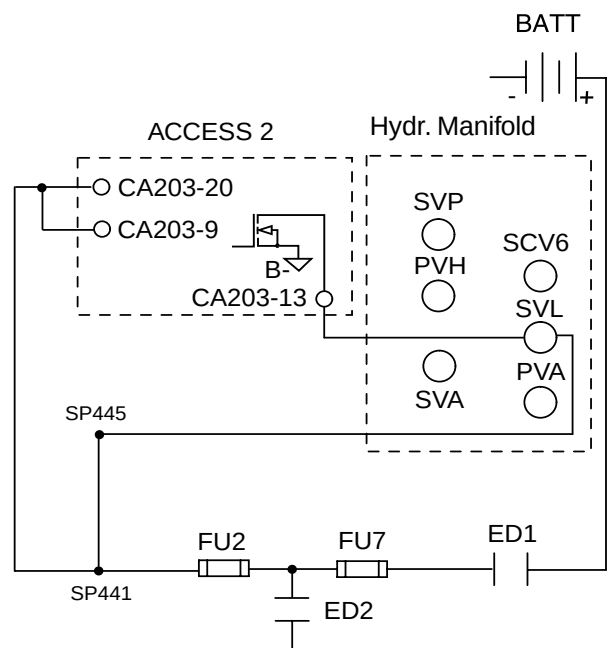
If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between SVL and CA203-13 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.5 (SVL).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVL.
 - **0 V:** see note.



6284-01

SVP (Pilot Solenoid): Open circuit / Driver Short Circuit**STATUS CODE 213**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVP (A4.6) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

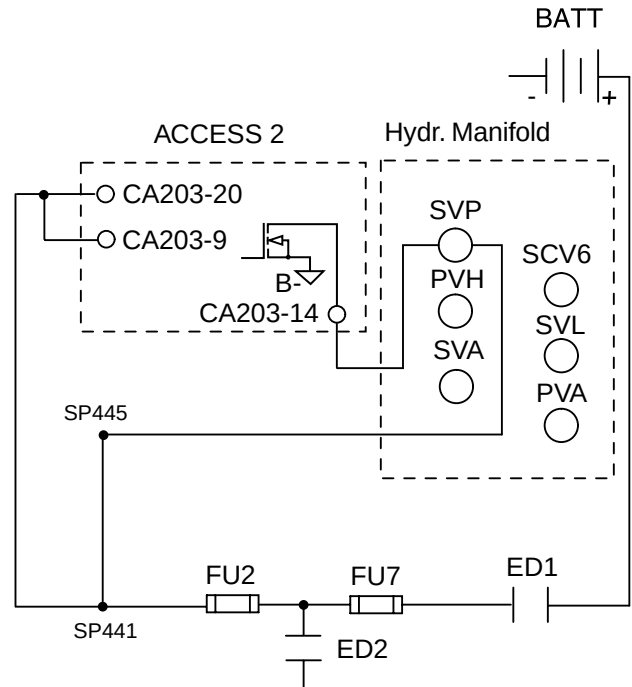
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between SVP and CA203-14 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.6 (SVP).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVP.
 - **0 V:** see note.



6285-01

SVR (Reach Solenoid): Open circuit / Driver Short Circuit**STATUS CODE 214**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVR (A4.7) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

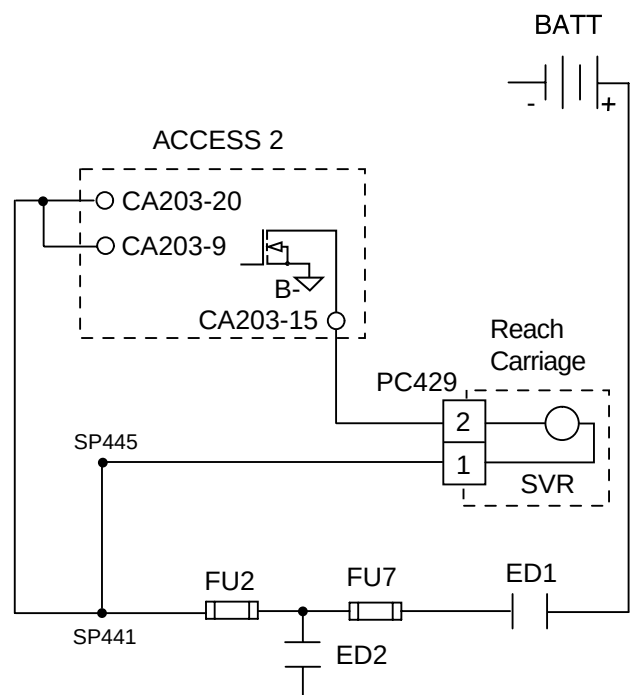
If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Trace positive wiring by referring to the illustration.

Missing Negative Test.

1. Connect meter between SVR and CA203-15 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.7 (SVR).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVR.
 - **0V:** see note.



6286

SVS (Sideshift Solenoid): Open circuit / Driver Short Circuit

STATUS CODE 215

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVS (A4.8) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - If **battery volts** coil open circuit. Then replace solenoid coil.
 - If **0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - If **24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

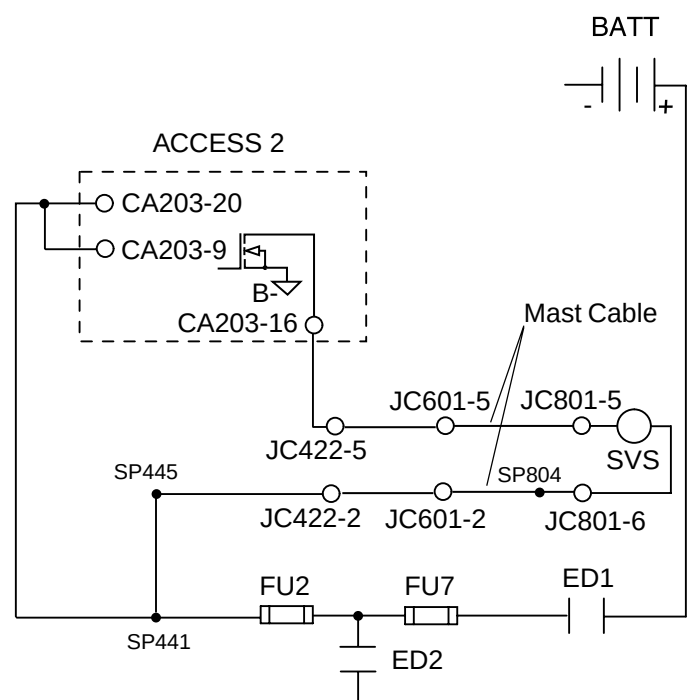
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Trace positive wiring by referring to the illustration.

Missing Negative Test.

1. Connect meter between SVS and CA203-16 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.8 (SVS).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVS.
 - **0 V:** see note.



6287

SVT (Tilt Solenoid): Open circuit / Driver Short Circuit

STATUS CODE 216

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVT (A4.9) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - If **battery volts** coil open circuit. Then replace solenoid coil.
 - If **0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - If **24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

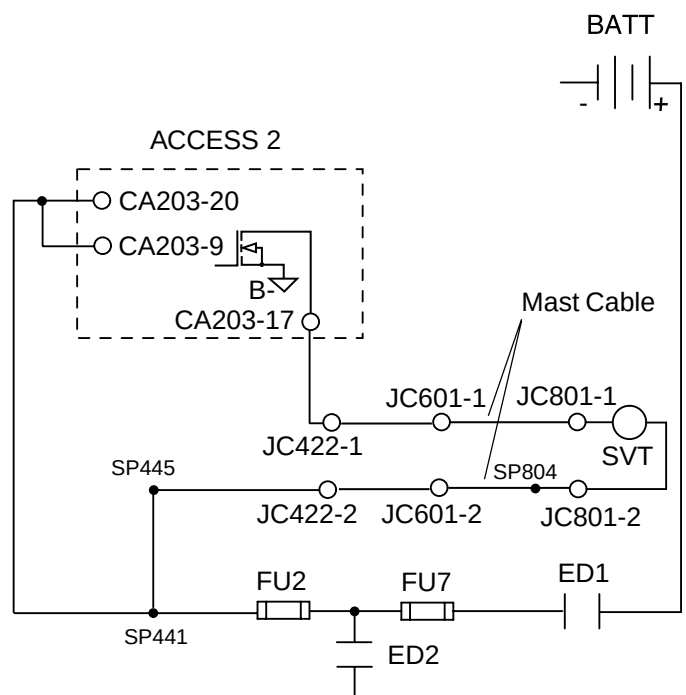
If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Trace positive wiring by referring to the illustration.

Missing Negative Test.

1. Connect meter between SVT and CA203-17 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.9 (SVT).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and SVT.
 - **0V:** see note.



6288

ALM2 (Travel Alarm): Open circuit / Driver Short Circuit**STATUS CODE 217**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select ALM2 (A4.2) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

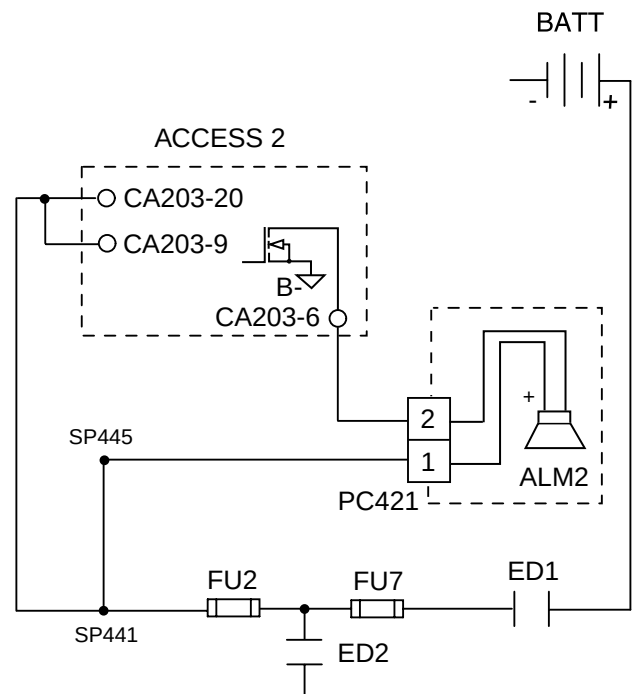
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between ALM2 and CA203-6 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.2 (ALM2).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and ALM2.
 - **0 V:** see note.



6289

PVH (Lift Proportional Valve): Open circuit / Driver Short Circuit**STATUS CODE 219**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select PVH (A4.11) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - **If battery volts** coil open circuit. Then replace solenoid coil.
 - **If 0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - **If 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

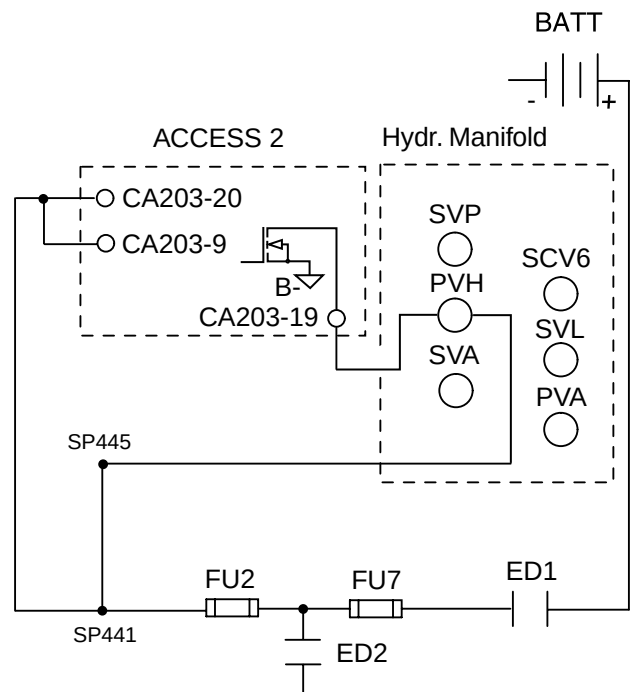
If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between PVH and CA203-19 on Access 2.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.11 (PVH).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 2 and PVH.
 - **0 V:** see note.



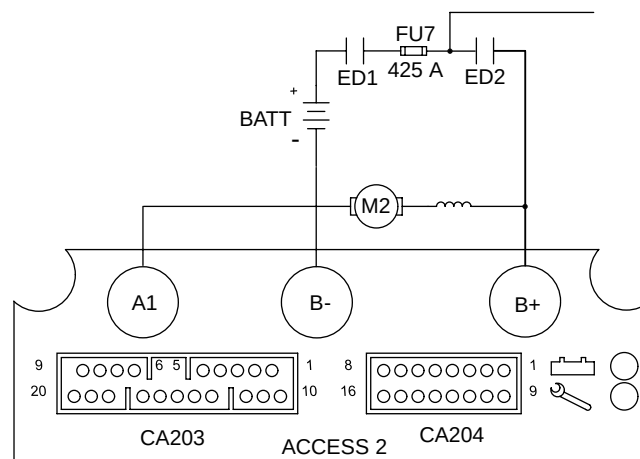
6291-01

M2 (Pump Motor): Open Circuit**STATUS CODE 222**

1. Attach meter across M2 motor terminals (refer to capacitor discharge caution on first page of section).
2. Turn key on while pressing the  and  buttons. Select M2 (A4.16) on display menu. Press and hold ENTER key (drives pump motor).
3. Check meter reading.
 - **If 33 volts on meter and less than 20 amps on display**, then open circuit on pump motor. Check power cables, ED tips and motor terminals. Repair/Replace.
 - **If 0 volts**, repeat test at A1 and B+ terminals at Access 2.
 - **0 volts**, Access 2 defective.
 - **33 volts on meter and less than 20 amps on display**, then open circuit on pump motor. Repair/Replace.
 - **If approx. 48 volts** Access 2 defective. See note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.



6292-02

M2 (Pump Motor): Motor / Driver Short Circuit**STATUS CODE 223**

1. Refer to capacitor discharge caution earlier in this guide. Disconnect and isolate one power cable at pump motor M2, power up truck. Observe the last log event.
 - **Code 222:** Short circuit in motor M2. Repair/Replace.
 - **Code 223:** Disconnect cable on A1 at Access 2 and power up truck.
 - **Code 223** driver short circuit, see note.
 - **Code 222** registered, shorted power cable. Replace.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

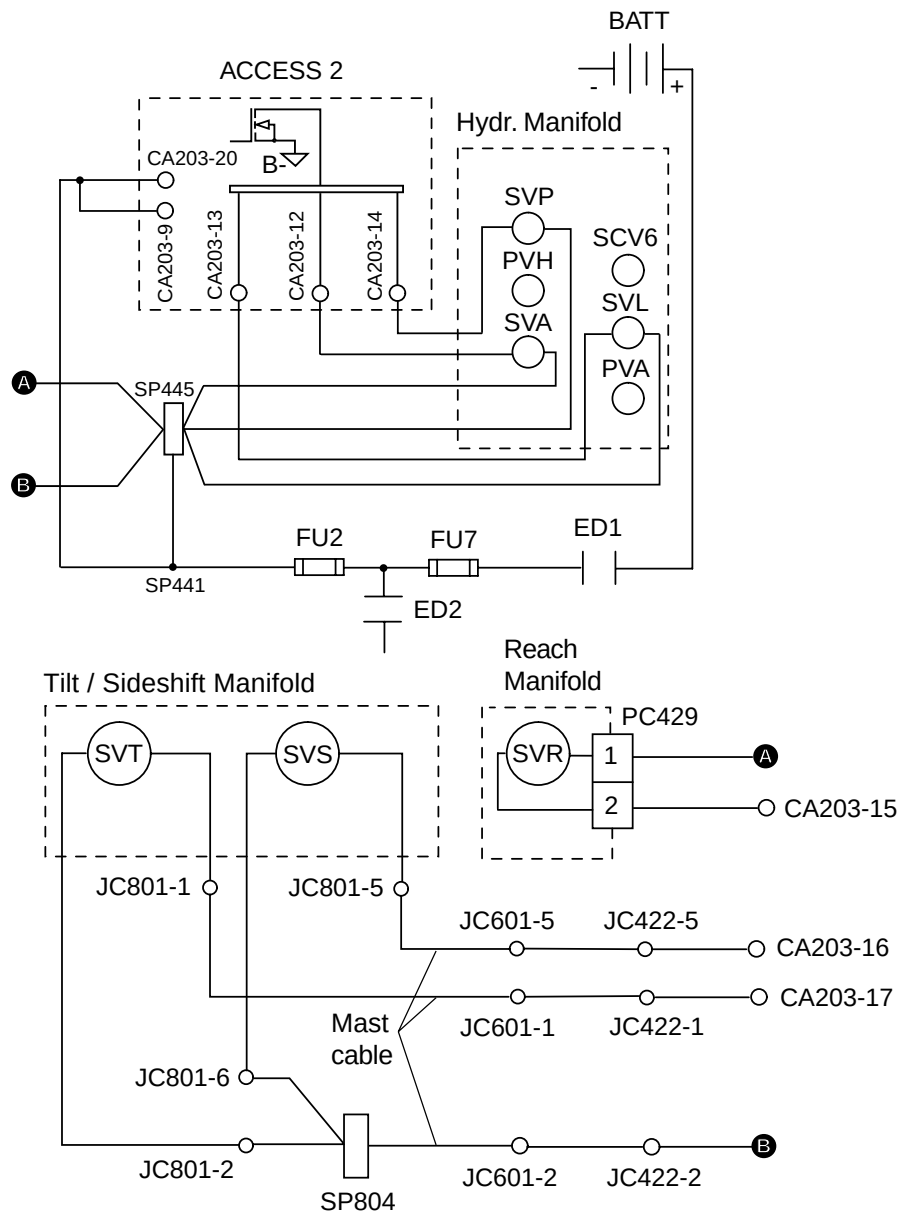
SVA, SVL, SVP, SVR, SVS or SVT: Short Circuit / Driver Open

STATUS CODE 224

1. Re-power the truck. Begin selecting and operating one hydraulic function at a time. Note which function is interrupted by a wrench light.
 2. Once faulted circuit is found, disconnect and isolate the component leads. Re-power the truck and observe fault code.
- **If code 224 remains**, check wiring
 - Wiring okay: Disconnect wires at CA203 in turn and operate the hydraulic functions again. If code remains, Access 2 defective (see note).
 - **If code changes**, short circuit has been found. Replace component or wiring that was isolated prior to this test.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.



6293-02

ALM2, SCV6, ED, PVH, PVA: Short Circuit / Driver Open

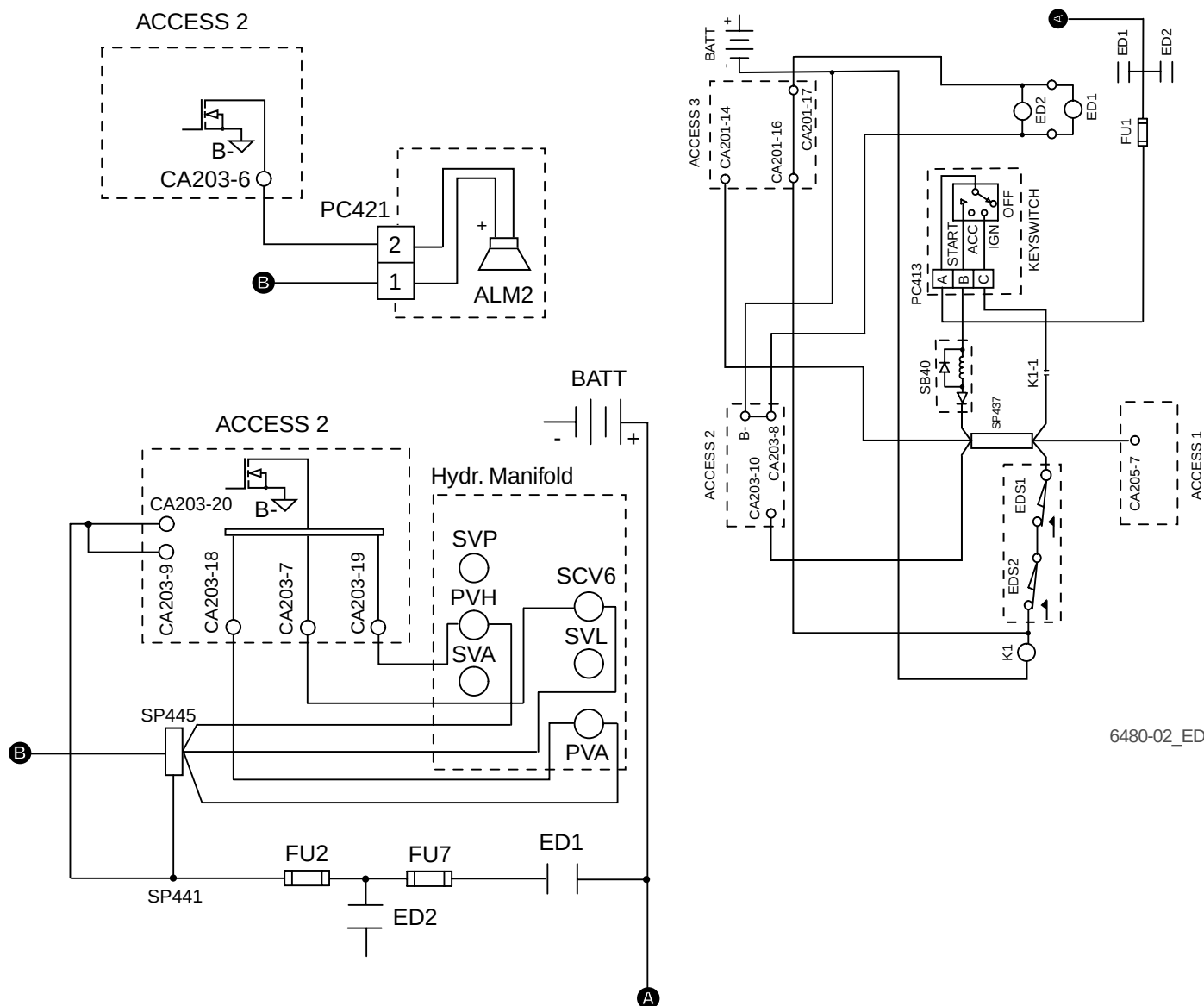
STATUS CODE 225

1. Remove a wire from each component in turn, re-power the truck and drive the corresponding function. After each test check the last log entry. When the status code changes, the defective circuit has been located.
2. Disconnect and isolate the component leads. Re-power the truck and observe fault code

- **If code 225 remains**, check wiring
 - Wiring okay: Disconnect wires at CA203 in turn and operate the functions again. If code remains, Access 2 defective (see note).
- **If code changes**, short circuit has been found. Replace component or wiring that was isolated prior to this test.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.



6294-01

6480-02_ED

PVA (Accessory Solenoid): Open Circuit / Driver Open

STATUS CODE 226

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select PVA (A4.10) on display menu. Press and hold ENTER key (drives coil).
3. Check meter reading.
 - If **battery volts** coil open circuit. Then replace solenoid coil.
 - If **0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 2.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - If **approx. 24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE



If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If frequency gradually increases for no apparent reason, inform Crown Service if necessary.

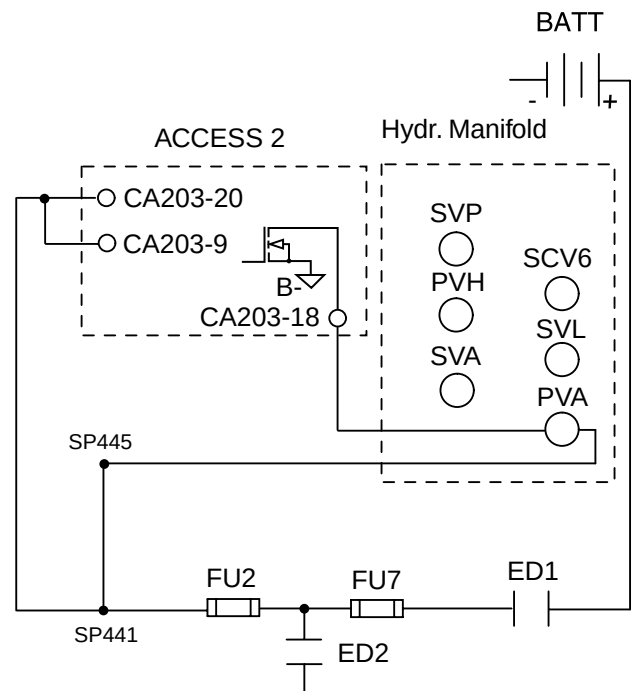
MISSING POSITIVE AND MISSING NEGATIVE TEST.

Missing Positive Test

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA203-20 and B- of Access 2. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA203-20 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between PVA and CA203-18 on Access 2.
 2. Turn the key switch while pressing on the  and  buttons.
 3. Select item A4.10 (PVA).
 4. Press and hold down the ENTER key (drives coil).
- **Battery voltage:** open circuit between Access 2 and PVA.
 - **0V:** see note.



6295-01

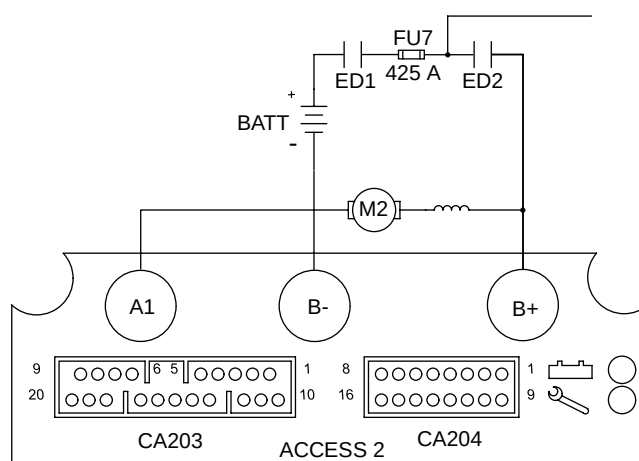
ACCESS 2: Power Circuit Fault

STATUS CODE 227

1. Attach meter across Access 2 A1 and B- terminals. Leave wires connected to terminals.
2. Turn key on while pressing the  and  buttons. Select M2A (A4.16) on display menu. Press and hold ENTER key (drives pump motor).
3. Check meter reading.
 - If **battery volts**, Access 2 faulty (see note).
 - If **0 volts** disconnect cable from A1 terminal. Re-select M2 (A4.16) on display menu. Then press and hold ENTER key and watch response on meter.
 - **0 volts** Access 2 faulty (see note).
 - **Battery volts** check cables for poor connections or corrosion.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.



6292-02

FU7 (Main Fuse): Open Circuit**STATUS CODE 228**

1. Replace FU7. Note: due to the capacitance build up within the module a conclusive in circuit test of the fuse may not be possible.
2. Attach meter leads across Access 2 B+ and B- terminals. Leave wires connected to these terminals.
3. Turn key on while pressing the  and  buttons. Select M2 (A4.16) on display menu. Press and hold ENTER. (drives pump motor).
4. Check meter reading.

- **If approx. 0 volts:** Open power circuit between Access 2 and the battery.

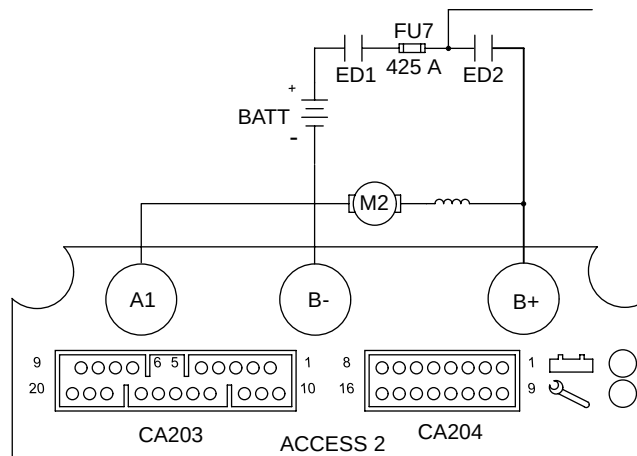
Then check all connections including power cables, ED tips, FU7 and battery connection.

- **If battery volts** power circuit is good.

Access 2 faulty. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.



6292-02

POT3 (Reach): Above Electrical Limit

STATUS CODE 243

1. Turn key on while pressing the  button. Select POT3 (A2.5) on display menu. Operate the reach function.
2. View display readings.

- **If approximately 5 volts** open between potentiometer and Access 2.

Then check plugs and connections to CA204-7 and CA204-6.

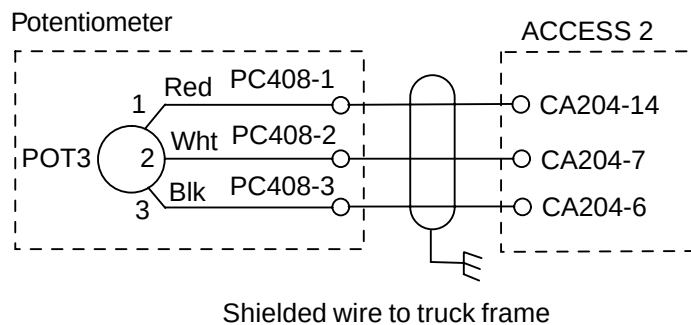
Okay, replace potentiometer.

- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Forward Reach" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Retract Reach" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6296

POT3 (Reach): Above Electrical Limit**STATUS CODE 244**

1. Turn key on while pressing the  button. Select POT3 (A2.5) on display menu. Operate the reach function.
2. View display readings.

- **If approximately 0 volts.** Open between potentiometer and Access 2.

Then check plugs and connection to CA204-14.

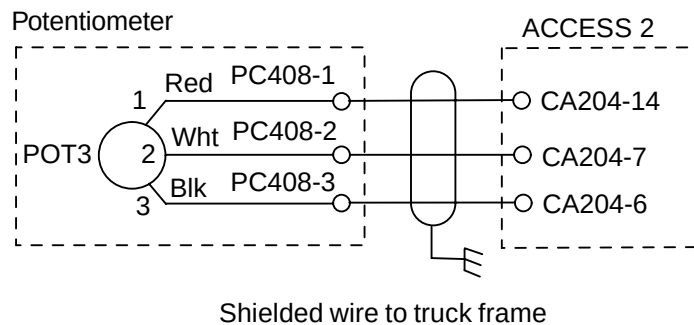
Okay, replace potentiometer.

- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Forward Reach" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Retract Reach" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6296

POT2 (Lift / Lower): Above Electrical Limit**STATUS CODE 245**

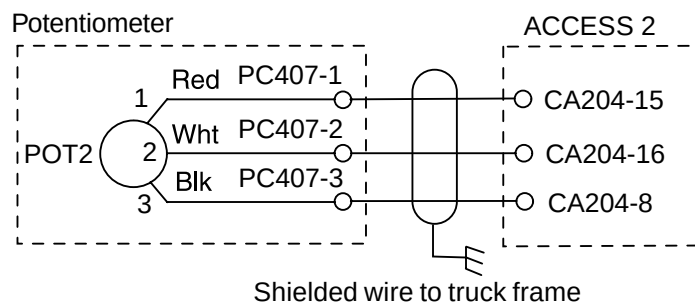
1. Turn key on while pressing the  button. Select POT2 (A2.4) on display menu. Operate the "Lift / Lower" function.
2. View display readings.

- **If approximately 5 volts.** Open between potentiometer and Access 2.
Then check plugs and connections to CA204-16 and CA204-8.
Okay, replace potentiometer.
- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Lower" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Lift" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6297

POT2 (Lift / Lower): Below Electrical Limit**STATUS CODE 246**

1. Turn key on while pressing the  button. Select POT2 (A2.4) on display menu. Operate the reach function.
2. View display readings.

- **If approximately 0 volts.** Open between potentiometer and Access 2.
Then check plugs and connection to CA204-16.
Okay, replace potentiometer.
- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Lower" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Lift" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.

POT3 (Reach): Calibration Error**STATUS CODE 247**

1. Turn key on while pressing the  button. Select POT3 (A2.5) on display menu. Operate the "Reach" function.
2. View display readings.
 - If approximately 0.5 - 1.0 volts lever is at full "Forward Reach" position. Correct reading
 - If approximately 2.5 volts lever is in center position. Correct reading
 - If approximately 4.0 - 4.5 volts lever is in full "Retract Reach" position. Correct reading

NOTE

The voltages should vary by approx. ± 1.5 V from the center position. Check potentiometer activation if the deviation is less or greater than the amount specified. If the activation is correct, replace the potentiometer.

POT2 (Lift/Lower): Calibration Error**STATUS CODE 248**

1. Turn key on while pressing the  button. Select POT2 (A2.4) on display menu. Operate the "Lift/Lower" function.
2. View display readings.
 - If approximately 0.5 - 1.0 volts lever is at full "Lower" position. Correct reading
 - If approximately 2.5 volts lever is in center position. Correct reading
 - If approximately 4.0 - 4.5 volts lever is in full "Lift" position. Correct reading

NOTE

The voltages should vary by approx. ± 1.5 V from the center position. Check potentiometer activation if the deviation is less or greater than the amount specified. If the activation is correct, replace the potentiometer.

POT5 (5th Hydraulic Function): Above Electrical Limit**STATUS CODE 251**

1. Turn key on while pressing the  button. Select POT5 (A2.14) on display menu. Operate the 5th hydraulic function.
2. View display readings.

- **If approximately 5 volts.** Open between potentiometer and Access 3.

Then check plugs and connections to CA201-2 and CA202-8.

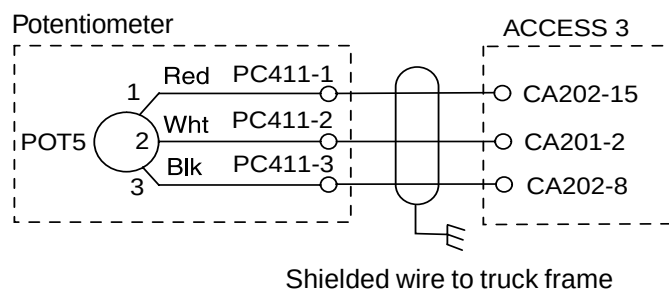
Okay, replace potentiometer.

- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Forward" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Reverse" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6297_5

POT5 (5th Hydraulic Function): Below Electrical Limit**STATUS CODE 252**

1. Turn key on while pressing the  button. Select POT5 (A2.14) on display menu. Operate the 5th hydraulic function.
2. View display readings.

- **If approximately 0 volts.** Open between potentiometer and Access 3.

Then check plug and connection to CA202-15.

Okay, replace potentiometer.

- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Forward" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Reverse" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.

POT5 (5th Hydraulic Function): Calibration Error**STATUS CODE 253**

1. Turn key on while pressing the  button. Select POT5 (A2.14) on display menu. Operate the 5th hydraulic function.
2. View display readings.
 - If approximately 0.5 - 1.0 volts lever is at full "Forward" position. Correct reading
 - If approximately 2.5 volts lever is in center position. Correct reading
 - If approximately 4.0 - 4.5 volts lever is in full "Reverse" position. Correct reading

NOTE

The voltages should vary by approx. ± 1.5 V from the center position. Check potentiometer activation if the deviation is less or greater than the amount specified. If the activation is correct, replace the potentiometer.

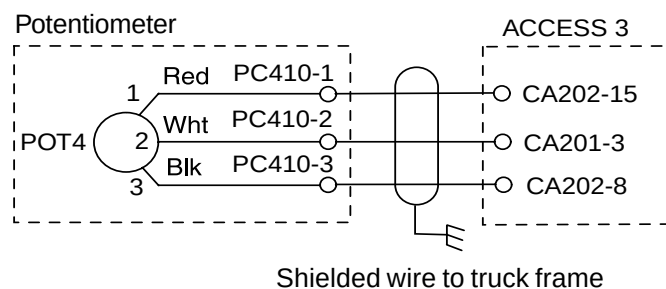
POT4 (Tilt): Above Electrical Limit**STATUS CODE 255**

1. Turn key on while pressing the  button. Select POT4 (A2.6) on display menu. Operate the tilt function.
2. View display readings.
 - If approximately 5 volts. Open between potentiometer and Access 3.
Then check plugs and connections to CA201-3 and CA202-8.
Okay, replace potentiometer.
 - If approximately 2.5 volts lever is in center position. Correct reading
 - If approximately 0.5 - 1.0 volts lever is at full "Tilt Down" position. Correct reading
 - If approximately 4.0 - 4.5 volts lever is in full "Tilt Up" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6297_4

POT4 (Tilt): Below Electrical Limit**STATUS CODE 256**

1. Turn key on while pressing the  button. Select POT4 (A2.6) on display menu. Operate the tilt function.
2. View display readings.

- **If approximately 0 volts.** Open between potentiometer and Access 3.

Then check plugs and connections to CA202-15.

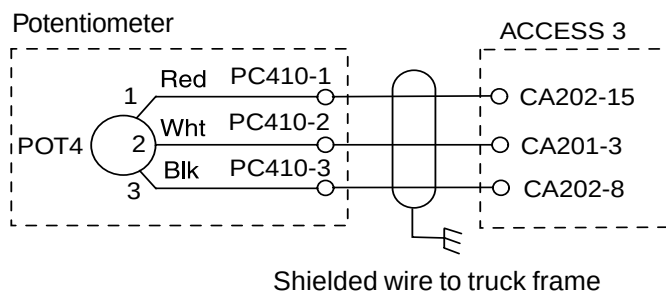
Okay, replace potentiometer.

- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 0.5 - 1.0 volts** lever is at full "Tilt Down" position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Tilt Up" position. Correct reading

Correct readings are confirmed, intermittent connection likely in the potentiometer circuit. Check connections and potentiometer.

NOTE

Recalibrate the potentiometer after repair.



6297_4

POT4 (Tilt): Calibration Error**STATUS CODE 257**

1. Turn key on while pressing the  button. Select POT4 (A2.6) on display menu. Operate the tilt function.
2. View display readings.

- **If approximately 0.5 - 1.0 volts** lever is at full "Forward Tilt" position. Correct reading
- **If approximately 2.5 volts** lever is in center position. Correct reading
- **If approximately 4.0 - 4.5 volts** lever is in full "Reverse Tilt" position. Correct reading

NOTE

The voltages should vary by approx. ± 1.5 V from the center position. Check potentiometer activation if the deviation is less or greater than the amount specified. If the activation is correct, replace the potentiometer.

ACCESS 2: Operating Temperature Beyond Limits**STATUS CODE 261**

1. Check application and operating period of truck.
2. If the application does not appear to be excessive, clean the Access 2 module. Make certain adequate air flow is possible and that the module is clean.
 - Make sure there is sufficient air circulation and heat conduction.
 - Check Access 2 mounting. Make sure sufficient heat transfer grease is between module and mounting surface and that module is tight against mounting surface. Check mounting screw tightness.
 - Make sure ambient temperature is within operating range of control (-40 to +85°C).

Check all terminations and make sure they are secure. Check pump motor for overheating. Make sure correct fuse size is used for FU7 (425A).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ACCESS 2: Operating Temperature too low**STATUS CODE 268**

1. Check application of truck.
2. Make sure ambient temperature is within operating range of control (-40 to +85°C).

Make sure Access 2 is clean. Make sure adequate air circulation is provided. If no fault is found, see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ACCESS 2: Operating Temperature too high**STATUS CODE 269**

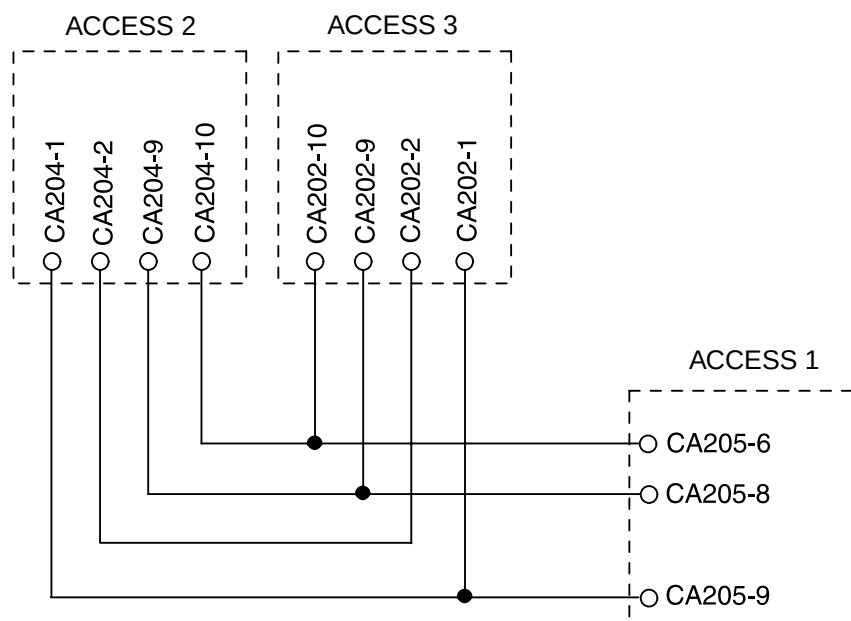
1. Check application and operating period of truck.
2. If the application does not appear to be excessive, clean the Access 2 module.
 - Make sure there is sufficient air circulation and heat conduction.
 - Check Access 2 mounting. Make sure sufficient heat transfer grease is between module and mounting surface and that module is tight against mounting surface. Check mounting screw tightness. Use correct FU7 type fuse (425 A).
 - Check all terminations and make sure they are secure. If no fault is found, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ACCESS 2: Communication Error with ACCESS 3**STATUS CODE 291**

1. Check condition of fuses FU3 and FU4.
2. Ensure the green LED on Access 2 is "on".
 - If light is not "on", check input power source.
3. View amber light on Access 2.
 - If LED is solid "on", Access 2 defective.
 - If flashing a code 14 or amber LED "off", the communications wiring harness or connectors for the CAN network is open or has a bad connection (refer to illustration).



6298

ACCESS 2: Incompatible with ACCESS 3**STATUS CODE 292**

1. Hardware of Access 2 is incompatible with Access 3 software (see note).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ACCESS 2: Invalid Make**STATUS CODE 293**

1. ACCESS 2 invalid (see note).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ED does not close

STATUS CODE 294

1. Attach meter across ED coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select ED (A4.3) on display menu. Press and hold ENTER key (drives contactor).
3. Check meter reading.
 - If **48 volts** magnetic coil faulty. Replace coil.
 - If **approx. 24 volts**. Power up truck and read last log code.
 - **No error code**: Check mechanical operation and wiring of ED contactor.
 - **Code 294 remains**: Access 2 faulty (see note).
 - If **0 volts** positive or negative to ED contactor missing (see box).

NOTE

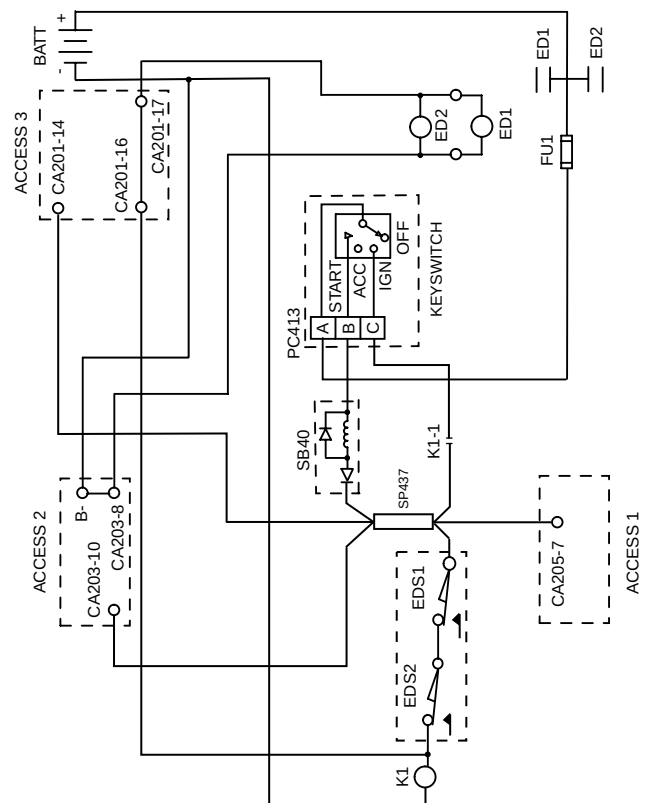
 If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check power path from battery (reference illustration). Power for ED goes through Access 3 (input - CA201-16, output - CA201-17).
 - **Signal at input, none at output**: Access 3 faulty.

Missing Negative Test

1. Check negative output between terminal B+ and CA203-8 using test output (A4.3) and activating the ED contactor.
 - **Signal present**, open circuit, check wiring.
 - **Signal missing**, Access 2 faulty. See note.



6480-02

ACCESS 2: Invalid Calibration

STATUS CODE 295

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency, inform Crown Service if necessary.

ACCESS 3: Faulty 15 V internal power supply**STATUS CODE 311**

1. Connect meter to B- terminal of Access 3 and with positive lead check CA201-2 then CA201-3.
 - **If either of the connections measures battery voltage**, check for miss wiring to ACCESS 2 and ACCESS 3.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Faulty 15 V powerbase supply**STATUS CODE 312**

1. Connect meter to B- terminal of Access 3 and with positive lead check CA201-2 then CA201-3.
 - **If either of the connections measures battery voltage**, check for miss wiring to ACCESS 2 and ACCESS 3.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Faulty -12 V powerbase supply**STATUS CODE 313**

1. Connect meter to B- terminal of Access 3 and with positive lead check CA201-2 then CA201-3.
 - **If either of the connections measures battery voltage**, check for miss wiring to ACCESS 2 and ACCESS 3.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Faulty 5 V CAN data bus supply

STATUS CODE 314

1. Connect meter to B- terminal of Access 3 and with positive lead check CA201-2 then CA201-3.
 - If either of the connections measures battery voltage, check for miss wiring to ACCESS 2 and ACCESS 3.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

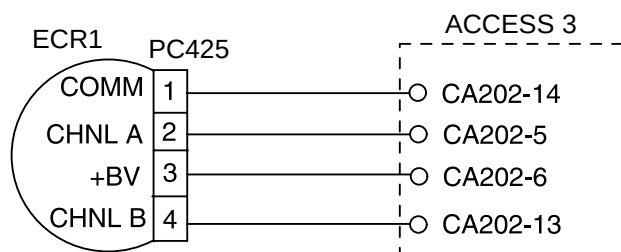
ACCESS 3: Faulty 5V ECR1 supply

STATUS CODE 315

1. Connect meter to B- terminal of Access 3 and with positive lead check CA201-2 then CA201-3.
 - If either of the connections measures battery voltage, check for miss wiring to ACCESS 2 and ACCESS 3.
2. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
3. Disconnect PC425 plug connection at ECR1. Power up truck and attempt travel. Check last log event.
 - **Status code changes:** Error in encoder circuit. Repair or replace encoder.
 - **Code 315 remains:** Check wiring for short circuit. Remove connection CA202-6 to ACCESS 2 and start the truck. Attempt travel.
 - Code changes: short circuit in wiring.
 - Code 315 remains: internal error, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



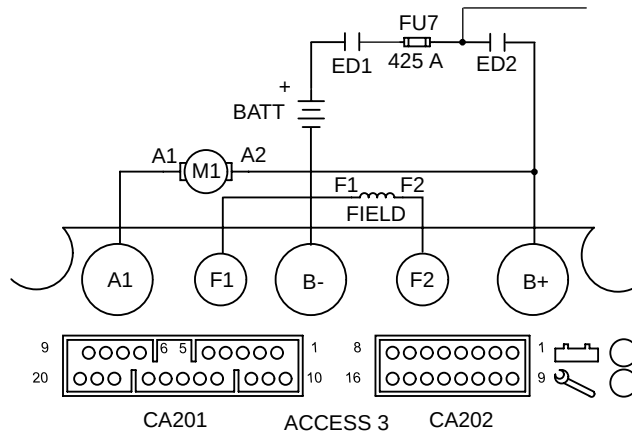
6300

M1 (Traction motor): Overvoltage in traction motor circuit**STATUS CODE 316**

1. A circuit in the traction motor circuit is intermittently or permanently open. Components to check include: ED contactor tips, FU7, cables and connections in path of battery to traction motor

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

M1 (Traction motor): Overcurrent in armature circuit**STATUS CODE 317**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Check wire connections between motor and connection A1 of ACCESS 3.
3. Disconnect and isolate A1 terminal at the drive motor and power up truck. Power up the truck. Depress the left operator pedal. Power down truck and turn key on while pressing the  and  buttons. Check last log event (L1).

- **Code 374:** Check wiring between traction motor M1 and ACCESS 3.

Wiring correct: Drive motor armature faulty. Repair or replace.

- **Code 317 remains:** Check connection A1 to ACCESS 3 and start the truck. Depress the left operator pedal. Power down truck and turn key on while pressing the  and  buttons. Check last log event (L1).

If the symptoms and code 317 remain: Replace ACCESS 3.

SVB (Brake Solenoid): Faulty power supply

STATUS CODE 318

This condition is present when the power supply to SVB is outside the permissible range. The test is performed with the ED contactor closed.

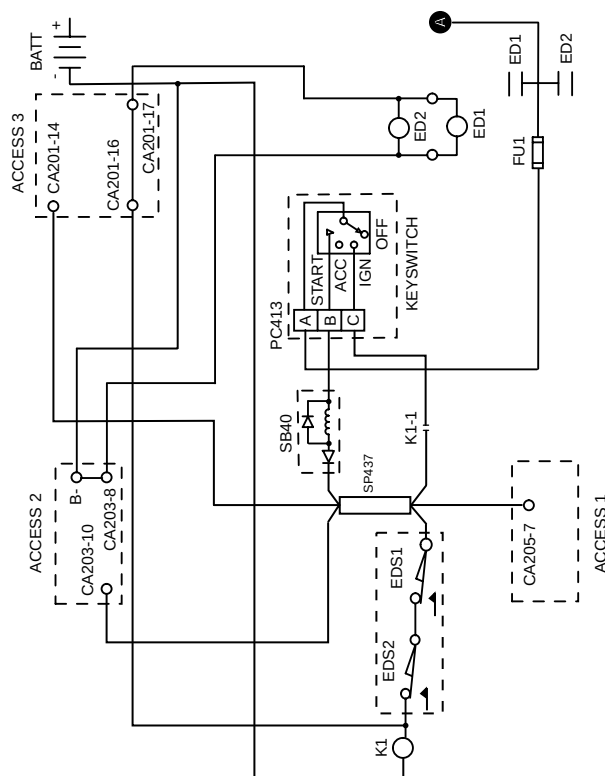
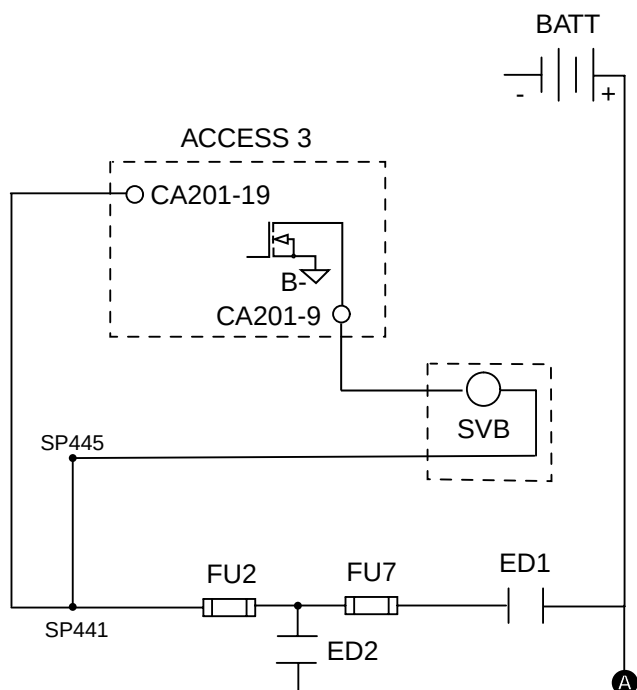
Check the following components: fuses FU7 and FU2, ED contactor, relay K1, wiring between SVB and BATT POS. (see box).

NOTE

i If truck operates, check the connections at ACCESS 3 and wire connections for corrosion or other signs of damage. If all connections are correct, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

BATT POS control

1. Check fuses FU7 and FU2.
2. Fuses correct: power up the truck and measure the voltage between CA201-19 and B- of ACCESS 3. Apply battery current while depressing the left operator pedal.
3. No battery supply: check wiring between CA201-19 and BATT POS. (see wiring diagram).



M1 (Traction motor): Overcurrent in field circuit**STATUS CODE 319**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Check traction motor F1 and F2 power cable connections and cable condition between the motor and Access 3 module. Check that F1 and F2 motor connections are not wired to B-, B+ terminals of Access 3.
3. Refer to capacitor discharge description on first page of section.

Disconnect and isolate drive motor F1, F2 terminals one at a time and power up truck. Depress the left operator pedal. Power down truck and turn key on while pressing the  and  buttons. Check last log event (L1).

- **Code 324:** Motor field faulty. Repair field or replace the traction motor.
- **Code 319 remains:** Disconnect and isolate Access 3 F1, F2 terminals one at a time and power up truck. Depress the left operator pedal.

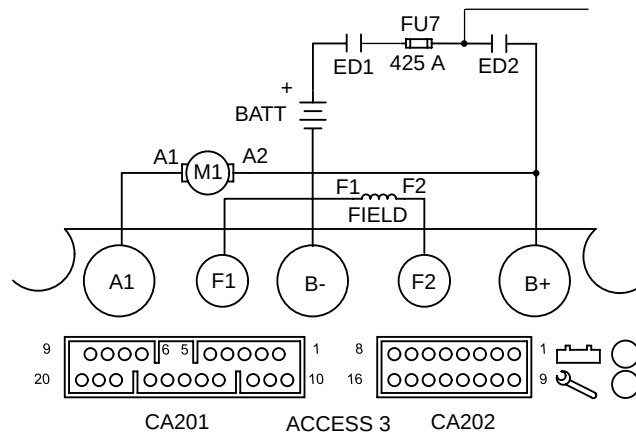
Power down truck and turn key on while pressing the  and  buttons.

Check last log event (L1).

- **If the symptoms and code 317 remain:** Replace ACCESS 3 (see note).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

ACCESS 2 & 3: Incorrect voltage at B+ before start-up

STATUS CODE 321

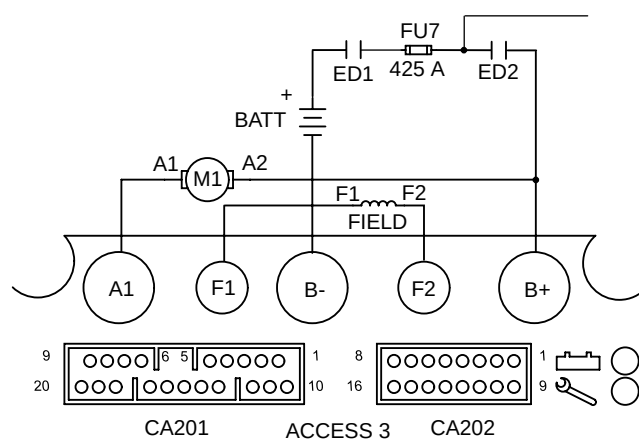
1. Connect meter between B- terminal of Access 3 and CA201-15 and then CA203-11 with battery plugged in. Should be battery volts.
2. Make sure power cables are connected to Access 2, M2 pump motor, Access 3, and traction motor correctly.
3. Refer to capacitor discharge description at beginning of this section.

Unplug truck and disconnect all connections from B+ of Access 3. With key off and battery plugged in, verify battery voltage at B+ terminal of Access 3.

- **0 V:** Access 3 faulty (see note).
- **Battery voltage present:** Measure battery voltage at terminal B+ of Access 2.
 - **0 V:** Access 2 faulty (see note).

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

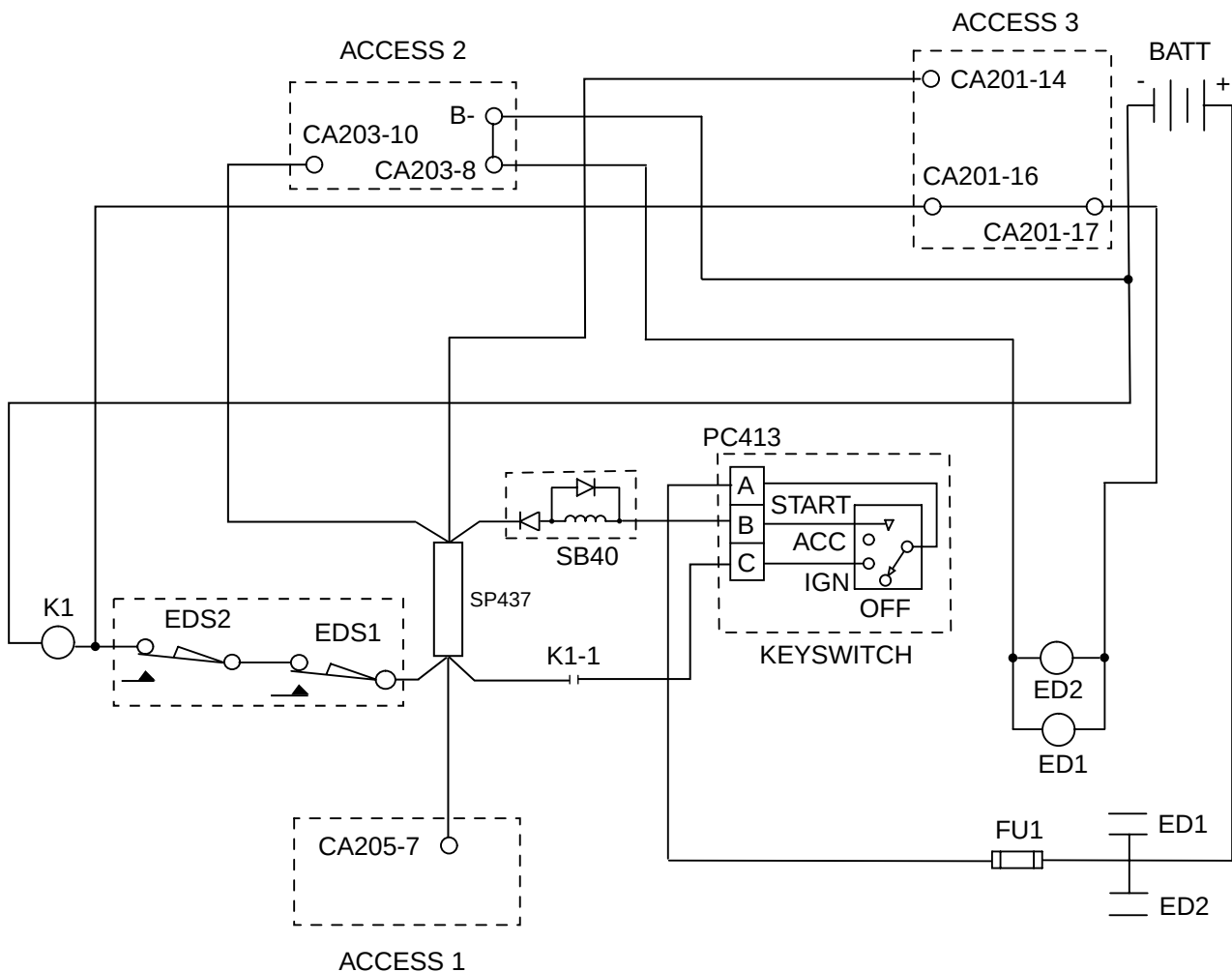
ED contactor: Open circuit / Driver Short Circuit

STATUS CODE 322

- Short circuit exists between battery positive and CA201-17. Battery voltage should only be present at CA201-17 after depressing the left operator pedal when truck is powered up.
 - No short circuit:** see item 2.
- Perform continuity test between connections CA201-17 and CA203-8.
 - Open circuit:** Check wiring and ED magnetic coil. Repair or replace as required.
 - Wiring correct:** ACCESS 3 faulty (see note).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6480-01

M1 (Traction motor): Faulty armature current circuit**STATUS CODE 323**

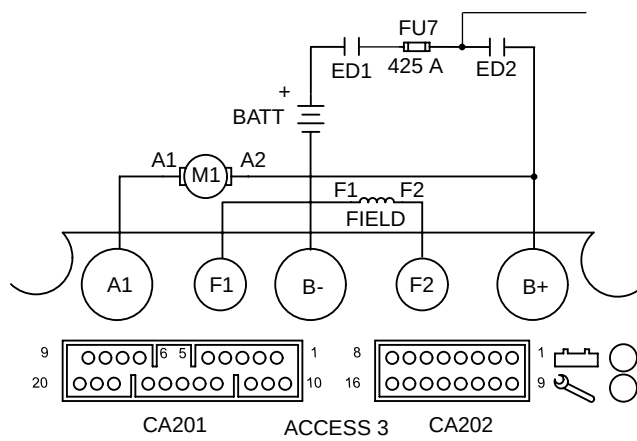
1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Check wiring between traction motor and ACCESS 3 (see circuit diagram).
3. Refer to capacitor discharge description at beginning of this section.

Disconnect wire A1 from ACCESS 3. Start up the truck and attempt travel.

- **Code changes:** Wiring error. Repair or replace.
- **Code 323 remains:** Replace ACCESS 3 (see note).

NOTE

i If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

M1 (Traction motor): Faulty field circuit**STATUS CODE 324**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Attach meter across motor field terminals F1 and F2.
3. Turn key on while pressing the  and  buttons. Select M1-F (A4.14) for forward direction or M1-F (A4.15) for reverse direction on display menu. Press and hold ENTER key (drives motor field).

Observe meter voltage reading and display amperage reading.

- **Battery volts on meter, less than 10 amps on display:** Open circuit exists in drive motor field circuit. Repair/replace.
- **0 volts on meter, less than 10 amps on display:** Then attach meter leads to the F1 and F2 terminals on Access 3.

Turn key on while pressing the  and  buttons.

Select M1-F (A4.14) M1-R (A4.15) on display menu.

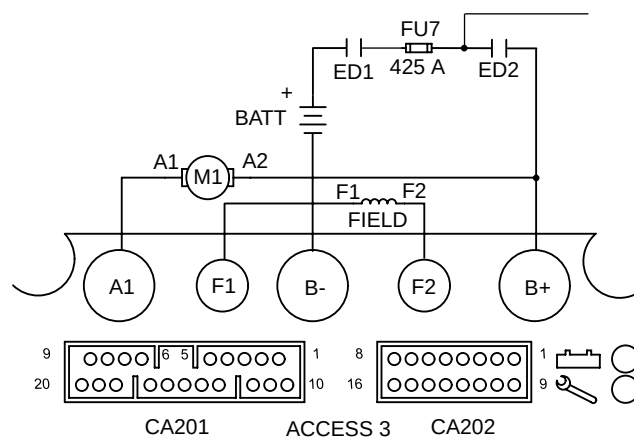
Press and hold ENTER key (drives motor field).

Observe meter voltage reading and display amperage reading.

- **Battery volts, open circuit in power cable circuit.** Check wiring and traction motor. Repair or replace.
- **0 volts on meter and less than 10 amps on display,** replace Access 3. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

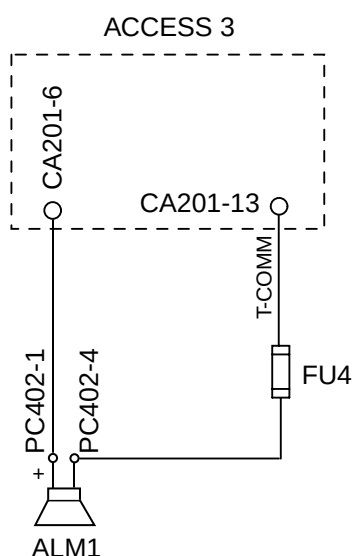


ALM1 (Status Alarm): Short circuit / Driver open**STATUS CODE 325**

1. Power down truck, disconnect wire PC402 from ALM1. Power up the truck again and view last event log (L1).
 - **Code changes or no code displayed:** Short circuit in ALM1 wiring.
 - **Code 325:** Disconnect CA201-6 and power up the truck.
 - Code changes: Short circuit in wiring between ACCESS 3 and ALM1.
 - Code 325 remains: ACCESS 3 faulty (see note).

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6303

ACCESS 3: Internal Error**STATUS CODE 326**

1. If truck operates, check complete wiring of ACCESS 3.
 - **Wiring correct:** ACCESS 3 faulty (see note).

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ED contactor: Contacts welded / Wiring fault

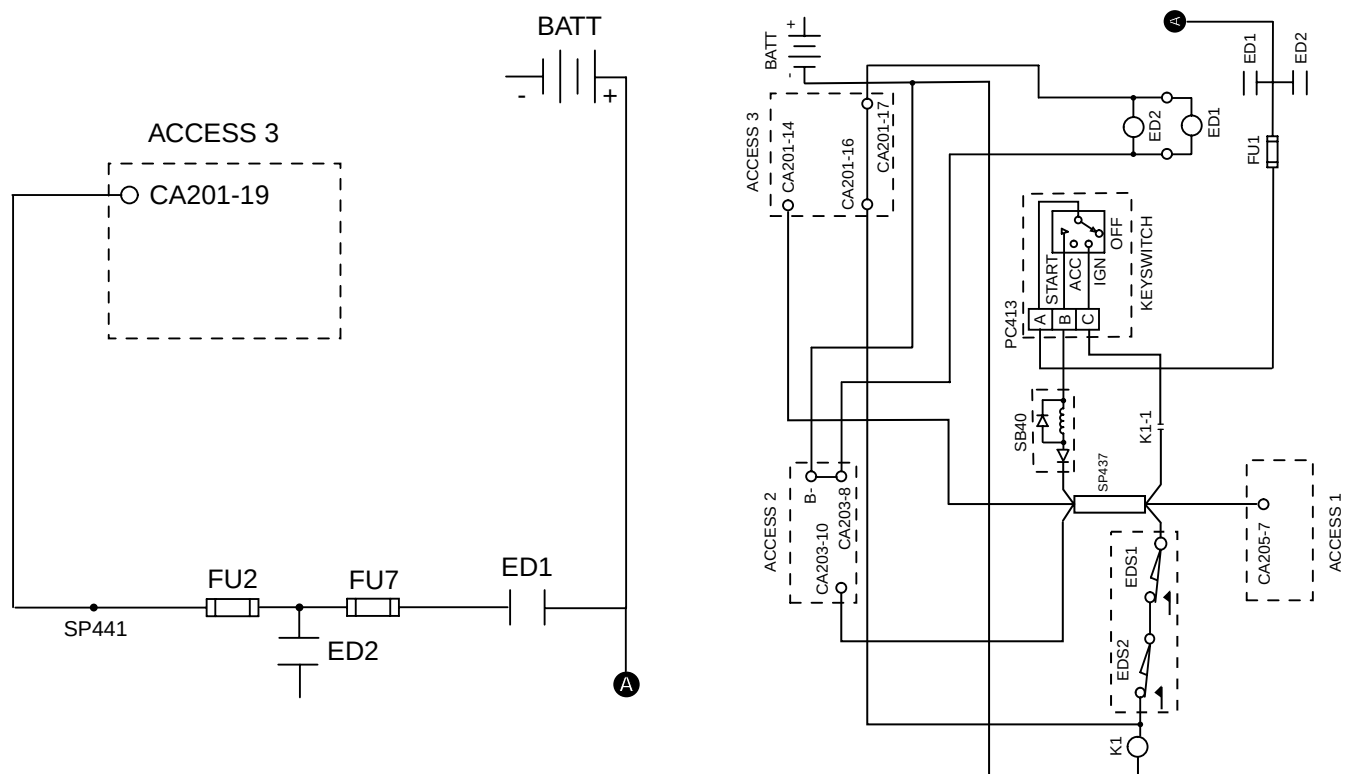
STATUS CODE 327

This error code is generated if voltage is present at CA201-19 when the ED contactor is open.

- Make sure the left operator pedal is **NOT** depressed and take voltage reading at CA201-19.
 - > 0 V (when the ED contactor is open 0 V should be recorded):** Short circuit between CA201-19 and BATT POS.
Clean all the terminals of the ED contactor, replace if necessary. Check control and power cable wiring.
 - 0 V:** correct voltage reading.
ED contactor tips may be corroded or welded. Repair or replace as required.
- Measure voltage at CA201-19. When the ED contactor is closed, battery supply should be present.
 - 0 V:** Check fuses FU7 and FU2 as well as wiring.
- Check battery supply at CA201-15.
 - 0 V:** Check wiring.
 - Battery supply:** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6302

6480-02_ED

ED contactor: Short circuit / Driver open

STATUS CODE 328

NOTE

i Carry out this test only if code 328 is displayed on Access 1. If the Access 3 amber light is flashing a code 328 and Access 1 is inoperable, refer to "When truck does not operate and there is no code" at the beginning of this book.

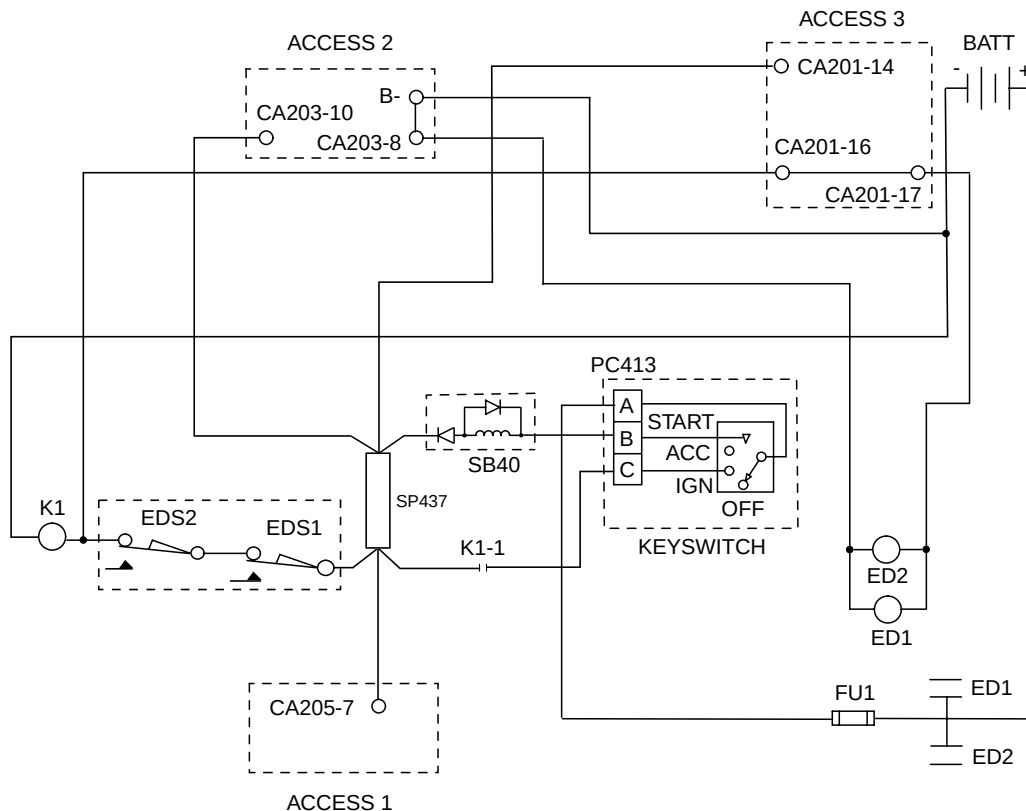
1. Disconnect leads at ED coil. Use continuity check to test for short circuit in ED coil and suppressor circuit. Coil resistance is approx. 140 ohms.
 - **If shorted:** repair or replace.

When corrected, power up truck and verify code is cleared.

If code 328 remains, see item 2.
 - **No short circuit:** see item 2.
2. Power down truck. Re-connect green striped-white lead to ED coil. Power up truck and measure voltage between disconnected wire and battery negative.
 - **Voltage present:** see item 3,
 - **0V:** Short circuit. Check wiring.
 3. If no faults are found in above checks, verify wiring condition
 - Wiring correct, see note.

NOTE

i If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6480-01

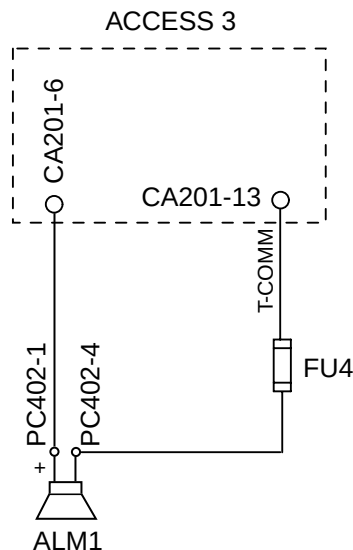
ACCESS 1

ALM1 (Status Alarm): Driver Short Circuit**STATUS CODE 329**

1. Disconnect PC402.
 - **Alarm goes off:** check output signal from CA201-6 of ACCESS 3.
 - **12 V or battery voltage:** see item 2.
2. Disconnect wire CA201-6 on ACCESS 3. Record voltage at CA201-6 of ACCESS 3.
 - **12 V or battery voltage remain:** ACCESS 3 faulty (see note).
 - **0 V:** Record voltage on disconnected wire CA201-6.
 - Voltage present: short circuit in wiring.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



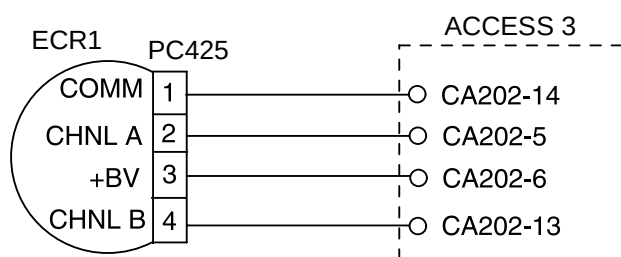
6303

ECR1 (Drive motor encoder): Incorrect counts**STATUS CODE 331**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Turn key on while pressing the button . Select ECR1 (A2.21) on display menu.
3. Move accelerator pedal slightly to provide traction command and observe encoder counts on display when drive wheel is moving.
 - **If count not present**, then check for +5 volts between PC425-3 and PC425-1.
 - **If: 5 volts is present**, check encoder pulsing with digital meter measuring between Access 3 B-terminal and first PC425-2 (Channel A) then PC425-4 (Channel B).
If not pulsing, check wiring and mechanical coupling.
If wiring and coupling okay, replace ECR1.
 - **If: 0 volts**, check for +5 volts between CA202-6 and CA202-14 of ACCESS 3.
 - **If voltage present**, repair/replace wiring.
 - **If 0 volts**, disconnect wires at CA202-6 and CA202-14 and retest ACCESS 3 outputs.
If 0 volts, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6300

ECR1: Counts opposite to traction command**STATUS CODE 332**

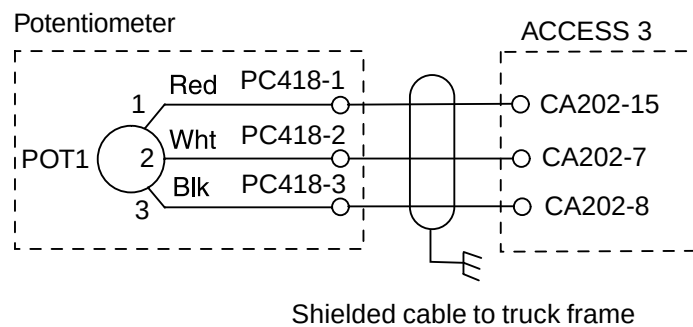
1. Verify wiring of channels A and B between ECR1 and Access 3.
2. Verify wiring of traction motor field and armature cables..
 - **Reversed polarity:** Adjust wiring.
 - **Polarity correct:** Replace ECR1.
 - If checks okay, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

POT1 (Traction command potentiometer): Above voltage limit**STATUS CODE 333**

- Power up the truck while depressing the  button. Select item A2.3 (POT1) and view the display reading.
 - Approx. 5V:** open circuit between potentiometer and ACCESS 3.
Check wires CA202-7, CA202-8 and wire connections.
If wiring is correct, replace potentiometer.
 - 0.5 - 1.0 V:** Potentiometer in zero position.
 - 4.0 - 4.5 V:** Potentiometer in maximum position.
If voltage readings are correct there is probably an intermittent error in the potentiometer circuit. Check wire connections and potentiometer.

NOTE*Calibrate potentiometer after repair.*

6304

POT1 (Traction command potentiometer): Below voltage limit**STATUS CODE 334**

- Power up the truck while depressing the  button. Select item A2.3 (POT1) and view the display reading.
 - Approx. 0V:** open circuit between potentiometer and ACCESS 3.
Check CA202-15 and wire connections.
If wiring is correct, replace potentiometer.
 - 0.5 - 1.0 V:** Potentiometer in zero position.
 - 4.0 - 4.5 V:** Potentiometer in maximum position.
If voltage readings are correct there is probably an intermittent error in the potentiometer circuit. Check wire connections and potentiometer.

NOTE*Calibrate potentiometer after repair.*

POT1 (Traction command potentiometer): Calibration error**STATUS CODE 337**

1. Power up the truck while depressing the  button. Select item A2.3 (POT1) and view the display reading. Apply the forward and reverse direction switches in turn, depress the accelerator and view the voltage readings.
2. Voltage should be 0.5 - 1.0 V in zero position and 4.0 - 4.5 V in maximum position.
 - **Voltage readings greater or less than listed:** Adjust potentiometer or linkage.
 - **Voltage span less than listed:** Re-calibrate POT1.

POT1: Voltage reading incompatible with ACS Status (travel switch)**STATUS CODE 341**

1. Power up the truck while depressing the  button. Select items A2.3 (POT1) and A2.9 (ACS) in turn and check component operation.

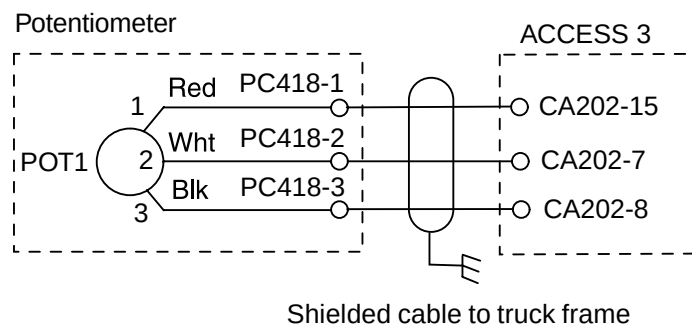
NOTE

If the components have been previously repaired, ensure correct polarity of wiring.

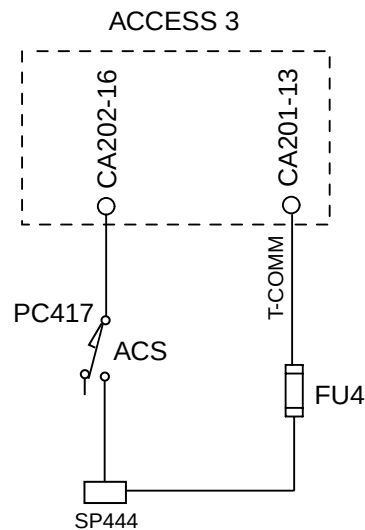
2. At POT1 voltage should be 0.5 - 1.0 V in zero position and 4.0 - 4.5 V in maximum position.

ACS should display "0" (= open) when POT1 is in zero position, and "1" (= closed) when POT1 is not in zero position.

- **Status display different from above:** Adjust, repair or replace affected component.



6304



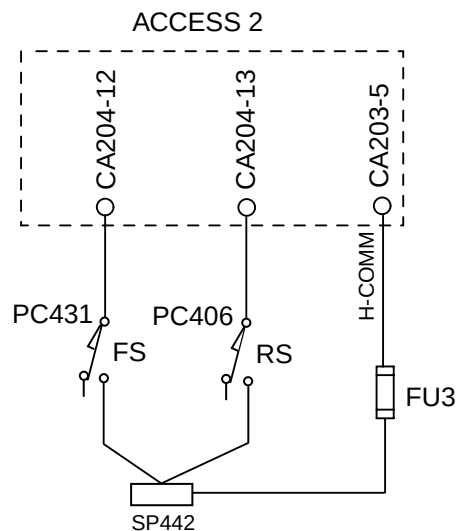
6305_01

FS/RS (Travel direction switch): Simultaneously closed**STATUS CODE 343**

1. Power up the truck while depressing the  button. Select A2.1 (FS) followed by A2.2 (RS) and check switch status.
2. Check FS and RS wiring for short circuits by disconnecting the RS output and observing the display.
 - **Code changes:** Apply travel direction switch and check wiring. If necessary, replace travel direction switch.
 - **Code 343 remains:** Disconnect wire CA204-13 from ACCESS 2 and observe display.
 - Code changes: check wire.
 - Code 343 remains: ACCESS 2 faulty (see note).

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6305

BMS (Brake monitor switch): Brake released instead of applied**STATUS CODE 348**

This error code covers hydraulic and mechanical faults which cause the brake monitor switch (BMS) either to fail or not to work within the specified 1.5 second interval when the brakes are applied.

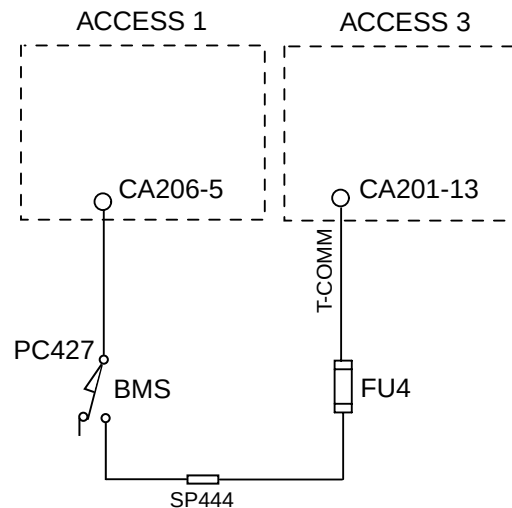
1. Check fuses FU3 and FU4, replace if necessary.
2. Check the operation of the hydraulic/mechanical brake activation at M1 (traction motor).
 - **Faulty brake activation:** Possible causes could be a faulty brake cable, worn brake lining or a faulty SVB solenoid. Check, repair and replace components as required.
 - **Correct brake activation :** see item 3.
3. Check operation of BMS.

Power up the truck while depressing the  button. Select item A2.30 (BMS) and check the switch status. BMS should be display "0" (=open) when the brake is applied and "1" (=closed) when the brake is released.

- **Status display does not change:** Adjust, repair or replace BMS as required.
- **Status display as specified:** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



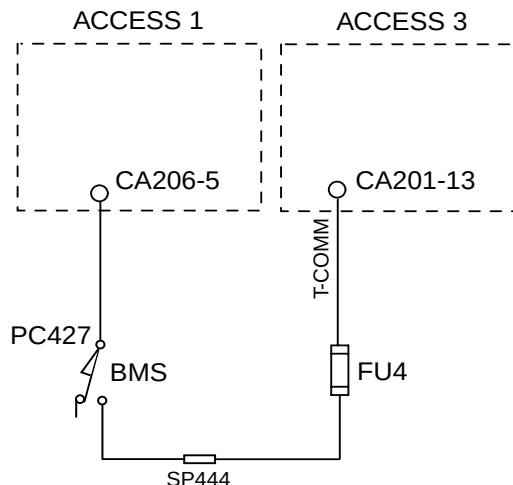
BMS (Brake Monitor Switch): Brake applied instead of released**STATUS CODE 349**

This error code covers hydraulic and mechanical faults which cause the brake monitor switch (BMS) either to fail or not to work within the specified 1.5 second interval when the brakes are applied.

1. Check fuses FU3 and FU4, replace if necessary.
2. Check wiring of SVB.
3. Check the operation of the hydraulic/mechanical brake activation at M1 (traction motor).
 - **Faulty brake activation:** Check hydraulic circuit, in particular non-return valve, SVB solenoid, hydraulic cylinder (internal leakage, faulty seals etc.).
 - **Correct brake activation :** see item 3.
4. Check operation of BMS.

Power up the truck while depressing the  button. Select item A2.30 (BMS) and check the switch status. BMS should be display "0" (=open) when the brake is applied and "1" (=closed) when the brake is released.

- **Status display does not change:** Adjust, repair or replace BMS as required.
- **Status display as specified:** Disconnect CA206-4 and view error code again.
 - **Code changes:** Wiring fault or BMS faulty. Repair or replace.
 - **Code 349 remains:** ACCESS 1 faulty.

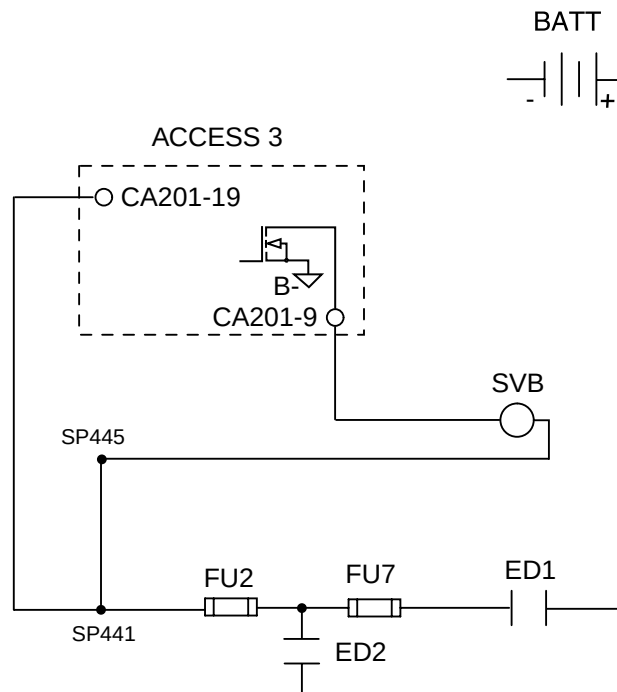


SVB (Brake Magnetic Coil): Magnetic Coil Short Circuit**STATUS CODE 351**

1. Disconnect SVB magnetic coil and isolate wire ends. Power up the truck again and view the last log event.
 - **Error code changes:** Faulty circuit is localised. Replace coil or replace previously isolated wiring.
 - **Code 351 remains:** Check wiring and/or disconnect wire to CA201-9.
 - **Code changes:** Short circuit between SVB and ACCESS 3. Repair or replace.
 - **Code 351 remains:** See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



351

SVB (Brake Magnetic Coil): Driver Short Circuit**STATUS CODE 352**

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SVB (A4.12) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - If **battery volts** coil open circuit. Then replace solenoid coil.
 - If **0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 3.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing, Use missing negative test (see box).
 - If **24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

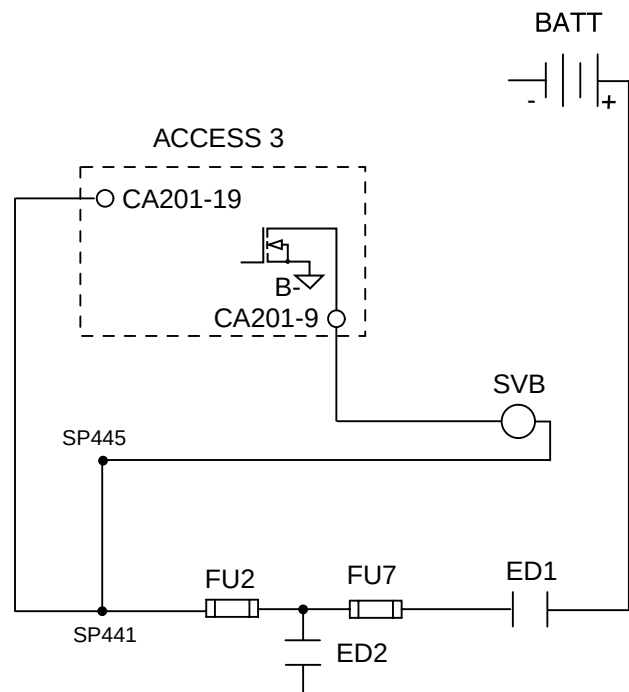
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Check fuses FU7 and FU2.
2. Fuses okay: power up truck and record voltage between CA201-19 and B- of Access 3. Press on the left operator pedal, voltage should be present.
3. No battery voltage: check wiring between CA201-19 and Positive (see diagram).

Missing Negative Test.

1. Connect meter between SVB and CA201-9 on Access 3.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.12 (SVB).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 3 and SVB.
 - **0 V:** see note.



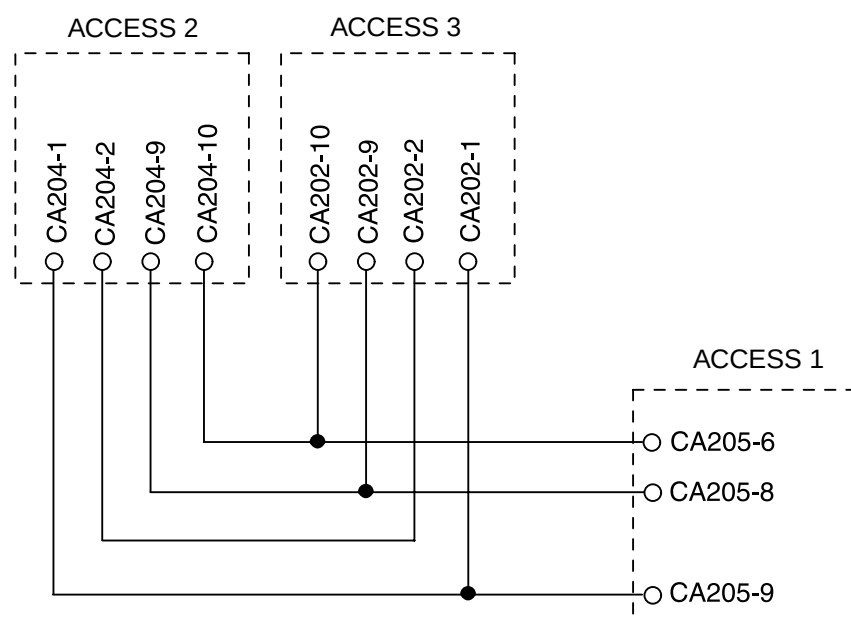
351

ACCESS 3: Unable to read from ACCESS 1 or ACCESS 2**STATUS CODE 353**

This indicates a problem with communications between Access 1-2-3. Access 1 may be locked up in this condition.

Code 328 preceded by a single flash will be blinked on LED of Access 3 (3 short blinks followed by interval + 2 short followed by interval + 8 x short). Code 14 will be blinked on LED of Access 2 (1 x short followed by interval + 4 x short).

1. Check condition of the communications link between Access 1-2-3 (connectors, connector pins, wiring).
2. Check for +5 volts at Access 3 between CA202-2 and CA202-10.
 - **If 5 volts**, then continue with step 3.
 - **If 0 volts** then disconnect CA204-2. Re-measure voltage between CA202-2 and CA202-10.
 - **If voltage is present**, then short circuit exists in Access 2. Repair/ replace.
 - **If voltage is not present**, disconnect CA202-2 and CA202-10 at Access 3 and measure voltage on Access 3 pins.
 - If voltage is present**, short exists in wiring. Repair/replace.
 - If voltage not present**, Access 3 faulty.
3. Check for +5 volts at Access 2 between CA204-2 and CA204-10.
 - **If 5 volts** then continue with step 4.
 - **If 0 volts** then open circuit in communication link exists between modules. Check wiring.
4. Check communication lines voltage level. 2.5 volts should be present between CA204-1 and CA204-9 and between CA202-1 and CA202-9.
 - **If less than 2.2 volts or greater than 2.8 volts**, disconnect CA204-1, CA204-9, CA202-1, CA201-9, CA205-9 and CA205-8 and check voltage between BATT NEG. and the respective connections for ACCESS 1, ACCESS 2 and ACCESS 3. The voltage should be approx. 2.5V.



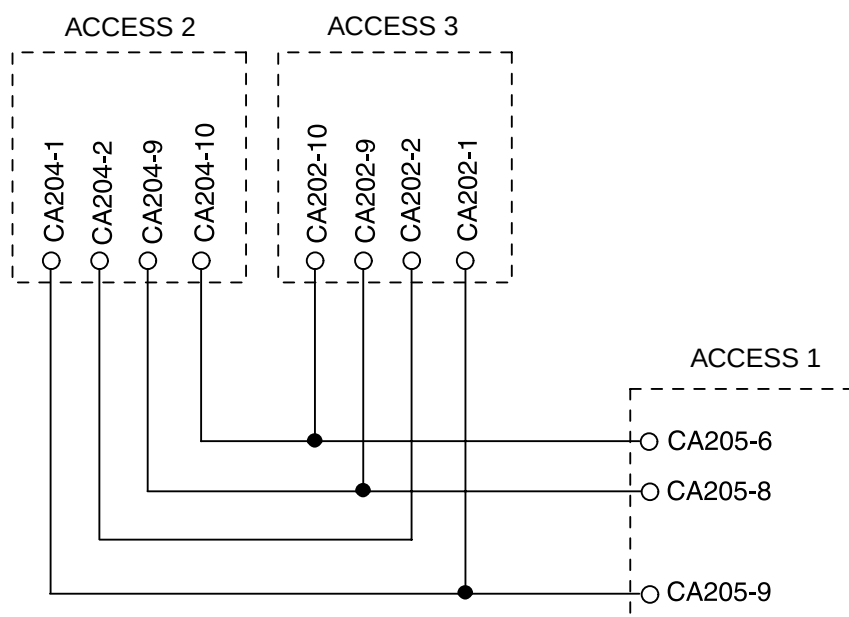
ACCESS 1-2-3: Write Error

STATUS CODE 354

This indicates a problem with communications between Access 1-2-3. Access 1 may be locked up in this condition.

Code 328 preceded by a single flash will be blinked on LED of Access 3 (3 short blinks followed by interval + 2 short followed by interval + 8 x short). Code 14 will be blinked on LED of Access 2 (1 x short followed by interval + 4 x short).

1. Check condition of the communications link between Access 1-2-3 (connectors, connector pins, wiring).
2. Check for +5 volts at Access 3 between CA202-2 and CA202-10.
 - If 5 volts, then continue with step 3.
 - If 0 volts then disconnect CA204-2. Re-measure voltage between CA202-2 and CA202-10.
 - If voltage is present, then short circuit exists in Access 2. Repair/ replace.
 - If voltage is not present, disconnect CA202-2 and CA202-10 at Access 3 and measure voltage on Access 3 pins.
 - If voltage is present, short exists in wiring. Repair/replace.
 - If voltage not present, Access 3 faulty.
3. Check for +5 volts at Access 2 between CA204-2 and CA204-10.
 - If 5 volts then continue with step 4.
 - If 0 volts then open circuit in communication link exists between modules. Check wiring.
4. Check communication lines voltage level. 2.5 volts should be present between CA204-1 and CA204-9 and between CA202-1 and CA202-9.
 - If less than 2.2 volts or greater than 2.8 volts, disconnect CA204-1, CA204-9, CA202-1, CA201-9, CA205-9 and CA205-8 and check voltage between BATT NEG. and the respective connections for ACCESS 1, ACCESS 2 and ACCESS 3. The voltage should be approx. 2.5V.



ACCESS 1: Internal Error**STATUS CODE 355**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 2: Internal Error**STATUS CODE 356**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error**STATUS CODE 357**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error

STATUS CODE 358

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error

STATUS CODE 359

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error

STATUS CODE 361

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

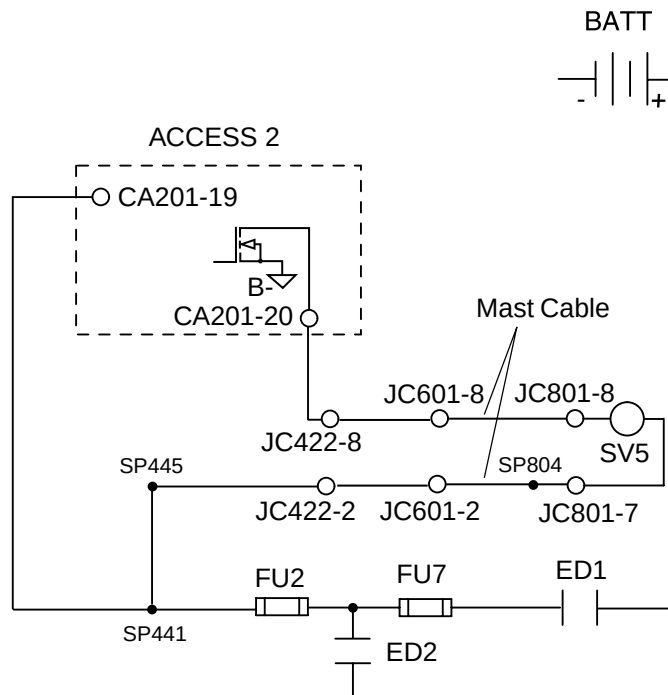
 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

SV5 (5th Hydraulic function solenoid): Short Circuit**STATUS CODE 362**

1. Disconnect and isolate connecting wires from the magnetic coil. Power up the truck and activate the 5th hydraulic function. Now view the last log event.
 - **Code changes:** Short circuit in solenoid or wiring. Repair or replace.
 - **Code 362 remains:** Disconnect wire from connection CA201-20 of ACCESS 3 and repeat test.
 - **Code changes:** Short circuit between SV5 and ACCESS 3. Repair or replace.
 - **Code 362 remains:** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



362

SV5 (5th Hydraulic function solenoid): Driver Short Circuit

STATUS CODE 363

1. Attach meter across coil terminals. Leave wires connected.
2. Turn key on while pressing the  and  buttons. Select SV5 (A4.18) on display menu. Press and hold ENTER key (drives component).
3. Check meter reading.
 - If **battery volts** coil open circuit. Then replace solenoid coil.
 - If **0 volts** positive or negative missing. Then re-power up truck, move one test lead to B- on Access 3.
 - **0 volts** after standing on the left operator pedal. Then positive missing. Use missing positive test (see box).
 - **Battery volts** negative missing. Use missing negative test (see box).
 - If **24 volts** correct functional reading. Then problem likely an intermittent loose connection. Check wiring condition. Wiring checks okay, see note.

NOTE

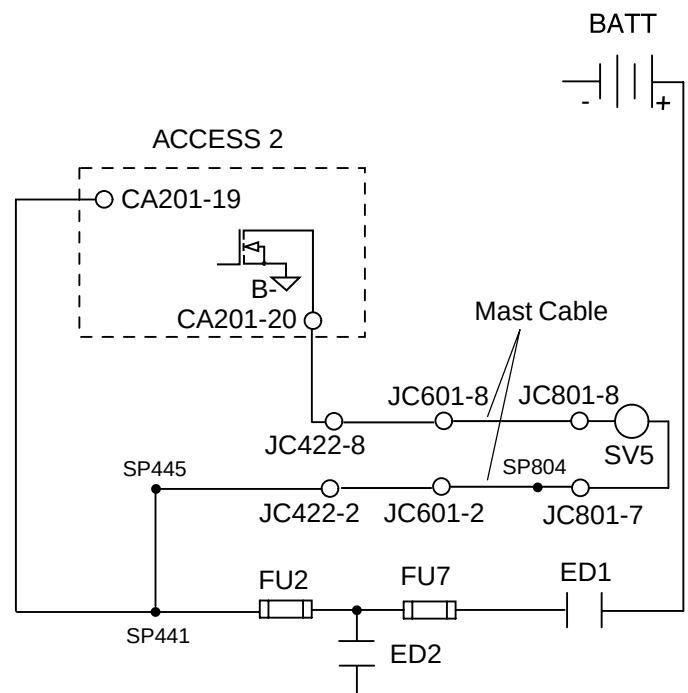
 If truck operates, check connectors at module for corrosion and verify good electrical connections are being made. If connectors are okay this could be a nuisance code. Monitor code frequency. If necessary, inform Crown Service.

MISSING POSITIVE AND MISSING NEGATIVE TEST.**Missing Positive Test**

1. Trace positive wiring by referring to the illustration.

Missing Negative Test.

1. Connect meter between SV5 and CA201-20 on Access 3.
2. Turn the key switch while pressing on the  and  buttons.
3. Select item A4.18 (SV5).
4. Press and hold down the ENTER key (drives coil).
 - **Battery voltage:** open circuit between Access 3 and SV5.
 - **0 V:** see note.



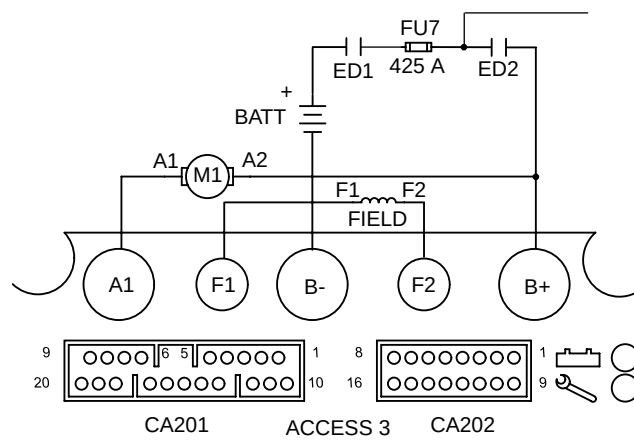
362

M1 (Traction Motor): Short Circuit in Armature Circuit**STATUS CODE 364**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Check drive motor armature connections for looseness or incorrect wiring.
3. Disconnect cable from motor A1 terminal. Power up truck and attempt to travel.
 - **If code changes**, problem in drive motor circuit.
 - **If code 364**, disconnect cable from Access 3 A1 terminal, power up truck and attempt to travel.
 - **If code changes**, short circuit in power cables between Access 3 and drive motor.
 - **If code 364 remains**, see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

ACCESS 3: Internal Error**STATUS CODE 365**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error

STATUS CODE 366

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

i If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

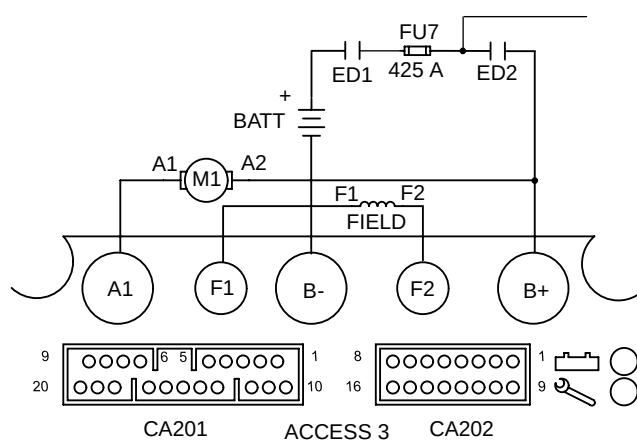
FU7 faulty or open traction motor circuit (M1)

STATUS CODE 367

1. Check fuse FU7 and ED contactor tips. Repair or replace.
2. Check wiring between BATT POS, ED contactor, FU7 and ACCESS 3.

NOTE

i Due to stored capacitance voltage in ACCESS 3, a voltage check of FU7 may be misleading. Replace with known good fuse and retest.



6301

ACCESS 3: Operating temperature too low**STATUS CODE 368**

If truck has been left in the cold store in the off condition for an extended period of time this code may register.

1. If condition cannot be cleared after leaving the truck powered up for a period of time, move truck to warmer location.
 - **Code 368 remains:** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Operating temperature too high**STATUS CODE 369**

1. Make sure drive motor fuse FU7 size is correct (425 amps).
2. Check for loose or corroded connections to power terminals on Access 3.
3. Check installation of Access 3. Make sure full surface contact is being made between Access 3 and the mounting surface with a complete film of thermal transfer grease between mounting surfaces. Check tightness of module mounting screws to ensure module is tightly secured to mounting surface.
4. Check operating conditions and periods of truck.

If the operating conditions are not difficult, either M1 (traction motor) or Access 3 are faulty.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

M1 (Tract. motor): Armature current too high / low during regen. braking STATUS CODE 372

1. Check brake for correct setting and operation. Make sure the brake is not dragging.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

M1 (Traction Motor): Field Circuit Error**STATUS CODE 373**

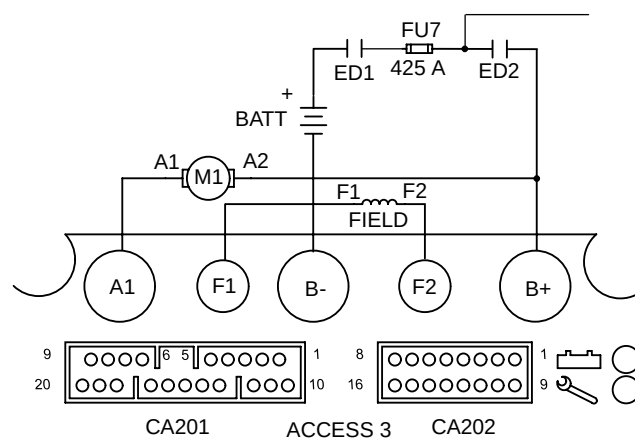
1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame..
2. Power up the truck while pressing the  and  buttons. Select A4.14 (M1-F) for forward travel and A4.15 (M1-F) for reverse travel, press and hold down the ENTER key (drives motor field).

View voltage readings on the display

- **Field current > 50 A:** Short circuit in M1 field circuit. Repair or replace.
- **Field current < 30 A:** M1 field current open. Repair or replace.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

M1 (Traction motor): Armature open circuit**STATUS CODE 374**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Attach meter across A1 and A2 terminals.

Turn key on while pressing the  and  buttons. Select M1-A (A4.13) on display menu. Press and hold . (drives armature).

Observe meter voltage reading and display current reading.

- **If battery volts on meter and less than 50 amps on display:** Open drive motor circuit. Then check power cable connections, motor brushes and holder, and condition to M1. Repair or replace.
- **If 0 volts on meter and less than 50 amps on display:** Then check output of Access 3. Move meter leads to the A1 and A2 terminals of Access 3 and repeat test.
 - **If battery volts**, open circuit in power cables between the drive motor and Access 3.
 - **If 0 volts on meter and less the 50 amps on display**, replace Access 3. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

M1 (Traction motor): Excessive Field Current**STATUS CODE 375**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error**STATUS CODE 376**

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error

STATUS CODE 377

1. If the truck does not operate, check wiring.
 - **Wiring correct** see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

M1 (Traction motor): Short Circuit in Armature Circuit

STATUS CODE 378

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame.
2. Disconnect and isolate the A1 power cable at drive motor. Power up truck and attempt to travel.
 - **If code changes** then short exists in drive motor. Repair/ replace.
 - **If code 378 remains**, power up the truck while pressing the  and  buttons. Select L1 and check the error code.

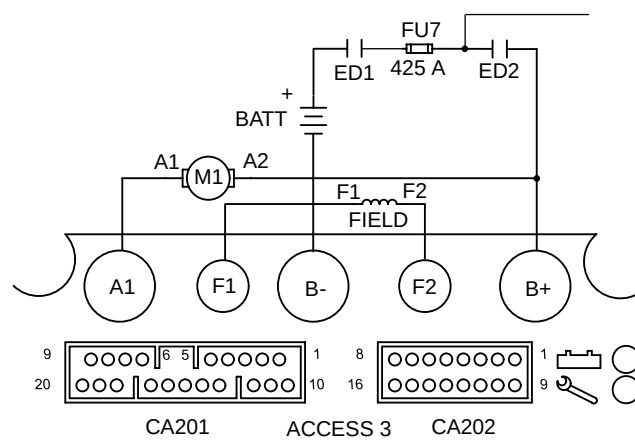
If code 378 remains: refer to capacitor discharge description on first page of section.

Disconnect power cables at the A1 and A2 terminals of Access 3. Power up truck and attempt traction.

- **Code changes**, short in power cables between the drive motor armature and Access 3. Repair/ replace.
- **Code 378 remains**, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



M1 (Traction motor): Short Circuit in Field Circuit**FEHLERCODE 379**

1. Jack up the truck so drive tire is clear of floor and place hardwood blocks under truck frame
2. Refer to capacitor discharge description on first page of section.

Disconnect and isolate the A1 power cable at drive motor. Power up truck and attempt to travel.

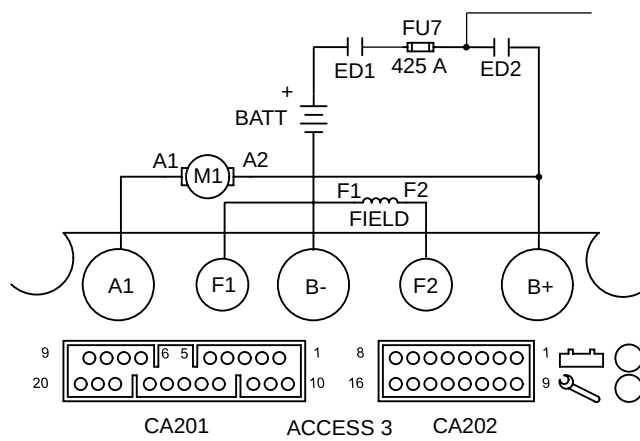
- **If code changes** then short exists in field circuit or wiring. Repair/ replace.
- **If code 379 remains**, refer to capacitor discharge description on first page of section.

Disconnect wire at terminals F1 and F2 of Access 3 and repeat test.

- **Code changes**, short in power cables between the drive motor field and Access 3. Repair/replace.
- **Code 379 remains**, see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



6301

ACCESS 3: Operating Temperature too high**STATUS CODE 385**

1. Check operating conditions and period of truck. Traction may be used much more than normal with respect to the hydraulic functions. Access 3 may need to cool.
2. Verify that drive motor fuse (FU7) is correct size. (425 amps)
3. Check that Access 3 mounting surface is in full contact with mounting surface on truck and that an even layer of heat transfer grease is present.
4. Check tightness of Access 3 mounting screws.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

Incorrect battery voltage**STATUS CODE 386**

This error code is generated if the battery voltage recorded is outside the permissible range of 44.2 - 60 volts.

1. Check that the correct battery is being used.
 - If **battery correct**, replace battery and check error code again.
 - If **code 386 remains**, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error**STATUS CODE 391**

1. If the truck does not operate, check wiring.
 - **Wiring correct**, see note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error**STATUS CODE 392**

1. If the truck does not operate, check wiring.
 - **Wiring correct**, see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal Error**STATUS CODE 393**

1. If the truck does not operate, check wiring.
 - **Wiring correct**, see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 1: Transmission error**STATUS CODE 394**

1. Check serial data connection between ACCESS 1-2-3 (wiring, connections). Make sure the connector pins are clean and not corroded.
2. Check power input to ACCESS 1 on CA205-7.
 - **No voltage**: Check wiring. Repair / replace.
 - **Battery voltage**: see note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 1: Invalid Software**STATUS CODE 395**

1. Use previous software version or upgrade ACCESS 1-2-3 to latest version.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 1: Invalid make**STATUS CODE 396**

1. Installed version is not OEM type or Access 1 is faulty. If necessary, replace Access 1.

ACCESS 3: Internal error**STATUS CODE 397**

1. See note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 2: Internal error**STATUS CODE 398**

1. See note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Internal error**STATUS CODE 399**

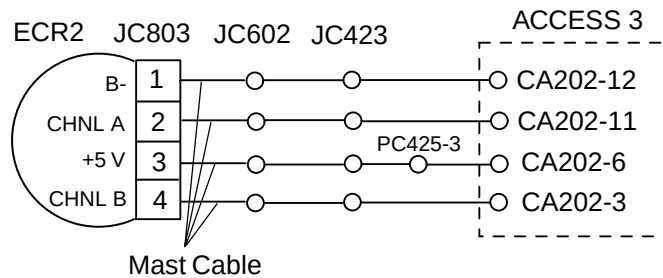
1. See note.

NOTE

 If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ECR2 (Height Encoder): Channel A/B Wire Breakage**STATUS CODE 813**

- Power up the truck while pressing down on the  button. Select item A2.19 (ECR2). Lift and lower the fork carriage while observing the reading on the display.
 - No counts:** open circuit between ECR2 and Access 3 or encoder faulty. Repair / replace.



6307

ECR2 (Height Encoder): No counts for "lift" function**STATUS CODE 814**

This error code could be generated by an incorrect valve calibration (see item 2).

- Power up the truck while pressing down on the  button. Select item A2.19 (ECR2). Lift and lower the fork carriage while observing the reading on the display.
 - No counts:** open circuit between ECR2 and Access 3 or encoder faulty. Repair / replace.
 - Correct counts:** see item 2.
- Select C8.1 "LiftMin" and re-calibrate valve. Store the new value and repeat the test until no error code appears.

ECR2 (Height Encoder): Invalid Configuration**STATUS CODE 815**

- Power up the truck while pressing down on the  button.

Select F4 "Ht Encoder" and enter the correct value. This value must correspond to the truck's features.

ECR2 (Height Encoder): Value exceeds max. lift height**STATUS CODE 816**

1. Check ECR2 for wear or grinding between wheel and wire, replace if necessary.

Power up the truck while pressing down on the  button. Select C6.3 "Encoder" and check that the max. lift height is correctly calibrated. Re-calibrate if necessary.

ECR2 (Height Encoder): No counts for "lower" function**STATUS CODE 818**

1. If this error code appears intermittently, it could indicate an operating error (e.g. fork carriage is resting on the edge of a shelf).

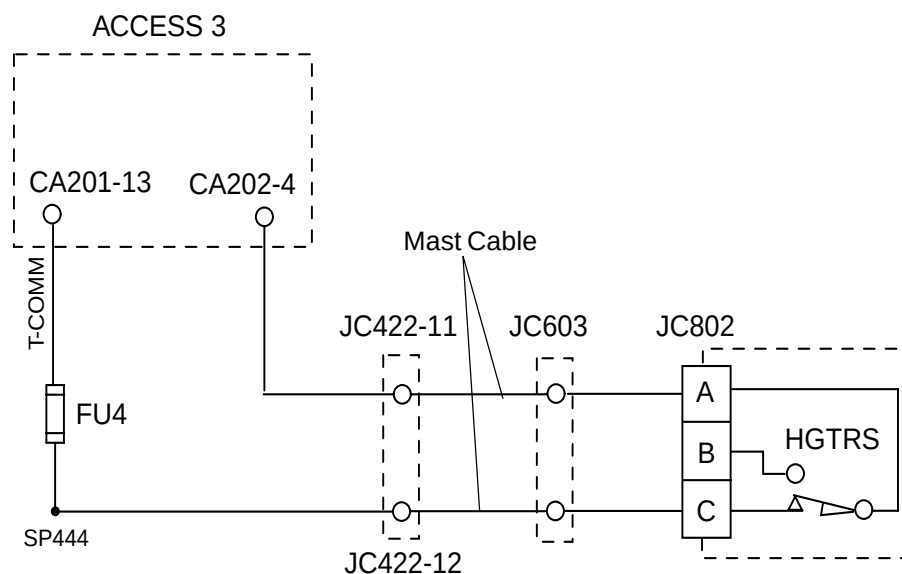
This error code can also occur if a hose burst valve is applied due to excessive oil flow.

2. Power up the truck while pressing down on the  button. Select item A2.19 (ECR2). Lift and lower the fork carriage while observing the reading on the display.

- **No counts:** open circuit between ECR2 and Access 3 or encoder faulty. Repair / replace.

HGTRS (Height Reset Switch): Operating Error**STATUS CODE 819**

1. Check HGTRS setting, re-adjust if necessary.
2. Check HGTRS circuit (wiring, connections). Repair / replace.



6308

ECR2 / HGTRS (Height Encoder / Reset Switch): Operating Error**STATUS CODE 822**

The test compares the number of counts for a lift procedure with the number of counts for a lower procedure. The error code is displayed if the deviation is significant.

1. Check ECR2 for wear or grinding between wheel and wire, replace if necessary.
2. Check adjustment of HGTRS. Out of adjustment, correct.

NOTE

If the adjustment is incorrect, the switch can reset when the mast shifts during travel or while raising or lowering. Ensure there is adequate engagement of the switch after adjustment.

3. With the fork carriage fully lowered, power up the truck while pressing down on the button. Select A2.16 (HGTRS).
 - **Switch status "1" (= open):** When the fork carriage is lowered the switch should be at "0" (height reset = switch closed). Adjust, repair / replace.

NOTE

For easy access, HGTRS should be temporarily bypassed to raise mast.

- **Switch status "0" (= closed):** Attempt to lift and observe display message. HGTRS must remain closed until the first mast level is reached.

If truck operates, then this could be a random nuisance code, e.g. due to mast movements during travel or when lifting / lowering the fork carriage. If necessary, fine-tune the HGTRS.

4. Check fitting of HGTRS to truck, make sure it is secure.
5. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

M2 (Pump motor): Excessive operating temperature**STATUS CODE 825**

1. Check operating conditions and period of truck.
2. Check for loose connections, corroded terminals and brush condition. Correct.
3. Make sure lift motor is clean.
4. Check motor and pump assembly to ensure mechanical binding does not exist.
5. Check lift circuit relief pressure, if necessary reset or replace.

M1 (Traction motor): Excessive operating temperature**STATUS CODE 826**

This error code is generated as soon as the "Travel Hot" message is displayed.

NOTE

 Check operating conditions and period of truck. The error code is normally deleted as the travel speed increases. In certain conditions it is common for this code to appear intermittently.

There is a fault if the "Travel Hot" message is displayed during normal truck operation over an extended period of time.

1. Check for loose connections, corroded terminals and brush condition. Correct.
2. Make sure the engine is clean.
3. Check brake, traction motor, drive unit condition to ensure mechanical binding does not exist.

M2 (Pump motor): Motor brush wear display**STATUS CODE 828**

1. Check engine brushes for wear.
2. Open circuit between Access 1 CA206-9 and pump motor. Repair or replace.
3. Located next to the brush holders are spring taps used to make the brush wear indication. Verify both the brush holder and indicator spring taps are clean, and a good electrical connection exists.

M1 (Traction motor): Motor brush wear display**STATUS CODE 829**

1. Check engine brushes for wear.
2. Open circuit between Access 1 CA206-10 and traction motor. Repair or replace.
3. Located next to the brush holders are spring taps used to make the brush wear indication. Verify both the brush holder and indicator spring taps are clean, and a good electrical connection exists.

Invalid Lift Cutout Zone**STATUS CODE 831**

1. Turn key on while pressing the  button. Select ECR2 (A2.19) on display menu. Raise and lower forks and watch counts.
 - **Irregular counts:** Check ECR2 for wear or other operating faults. Repair / replace.
 - **Regular counts:** Recalibrate lift cutouts (see C6.1 and C6.2).

Low Battery Voltage Lockout**STATUS CODE 832**

1. Battery is discharged. Replace or recharge battery.
2. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 2: Internal Error**STATUS CODE 833**

1. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 2 & ACCESS 3: Setup Mis-match**STATUS CODE 834**

This error code can occur when one of the modules ACCESS 2 or ACCESS 3 has been replaced. Both modules have been configured correctly, but do not tally with each other.

1. Turn key on while pressing the  button.

Copy setup values from the module which was not replaced.

- Select U2.1 to copy from ACCESS 3 to ACCESS 2.
- U2.2 to copy from ACCESS 2 to ACCESS 3.

ACCESS 2 & ACCESS 3: Invalid configuration**STATUS CODE 835**

1. Power up the truck while pressing on the  button.

Run through the FEATURES, CALIBRATION and PERFORMANCE menus fully in turn and reprogram the truck.

ACCESS 3: Hardware and Software not Compatible**STATUS CODE 836**

1. Non OEM hardware or software version installed. Install correct OEM version.
2. Use previous hardware / software versions or upgrade to latest version.

ACCESS 3: Write error**STATUS CODE 837**

1. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

ACCESS 3: Log error**STATUS CODE 838**

1. See note.

NOTE

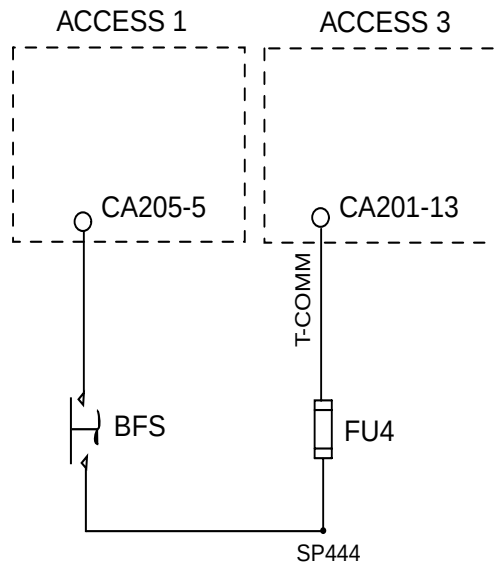
If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

BFS (Brake fluid switch): Brake fluid level too low**STATUS CODE 843**

1. Check brake fluid level.
 - **Brake fluid level too low:** Replenish brake fluid. Bleed brake circuit if necessary.
 - **Brake fluid level correct:** Disconnect wire from CA205-5 at ACCESS 1 and view code again.
 - **Code changes:** Faulty wiring or BFS. Repair / replace.
 - **Code 843 remains:** Error in ACCESS 1 (see note).

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.



843

ACCESS 3: Internal Error**STATUS CODE 851**

1. See note.

NOTE

If truck operates, then this could be a random nuisance code. Monitor code frequency and inform Crown Service if necessary.

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Access 1-2-3

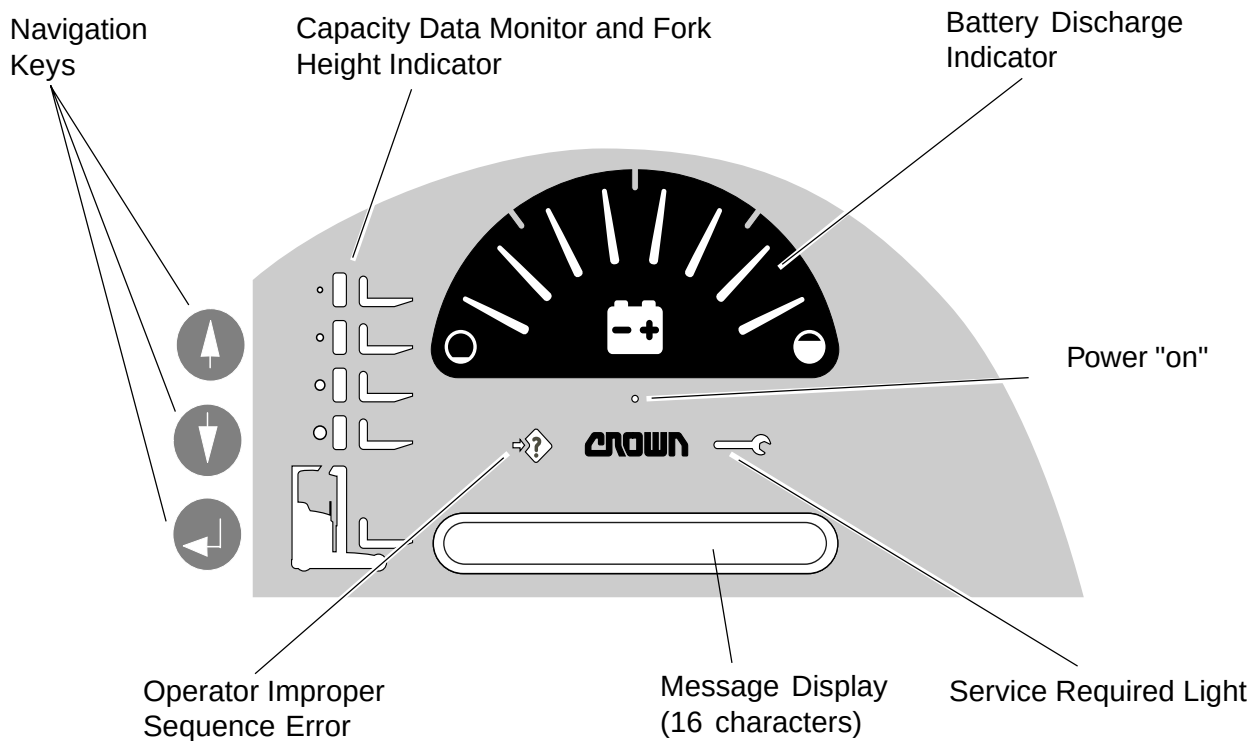
Access 1-2-3 is Crown's integrated truck control system with electronic monitoring of the key operating functions. It consists of the following modules:

- Access 1 = Operator Display
- Access 2 = Pump Controller (HCM)
- Access 3 = Traction Controller (TCM)

Access 1

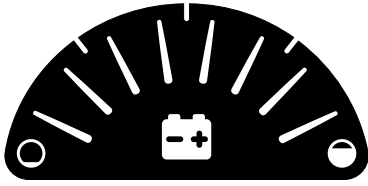
Access 1, the operator display, is the interface between the truck electronic system and the operator or service engineer. For all operating conditions (truck operation, maintenance, troubleshooting) Access 1 provides important data on the status and operation of the individual truck components.

The following section describes the structure and functions of Access 1.



807090 C

Battery Discharge Indicator



6219

- The battery discharge indicator is similar to a fuel gauge and indicates the battery charge.
- The charge is displayed via green indicators which represent a fully charged battery to the right and battery in need of charge to the left.
- The two symbols at the bottom left and right-hand corners of the display represent a charged / discharged battery respectively. When the battery is discharged the symbol in the bottom left-hand corner starts to flash.

Power "on"



6215

- Located in the centre of the operator display. Illuminates when Access 1 is energised.

Operator Improper Sequence Error

Illuminates in the following situations:



6216

- When the truck is powered up.
- Faulty truck operation, e.g. function activated during power-up, lift or travel function activated although safety pedal not depressed.
- The load exceeds the maximum capacity for the current lift height (based on a load centre of 600 mm).

Service Required Light

Illuminates in the following situations:



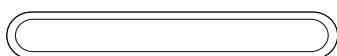
6248

- When the truck is powered up.
- At the end of a scheduled service interval.
- If an operating error occurs, the truck control system generates an error code which can be viewed in the LOG EVENTS menu.

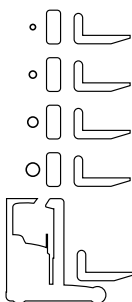


6222

CROWN



6225



6223

Navigation Keys

- The arrow keys  and  are used to scroll through the menus and the individual menu functions. In addition, service modes 2 and 3 can be accessed by pressing the function keys during power-up (see following section).
- The ENTER key is used to select the menus and menu functions as well as to confirm and store new settings.

Message Display

- 16 character, alpha-numerical display.
- Visual interface between the operator / service engineer and the truck electronic system.

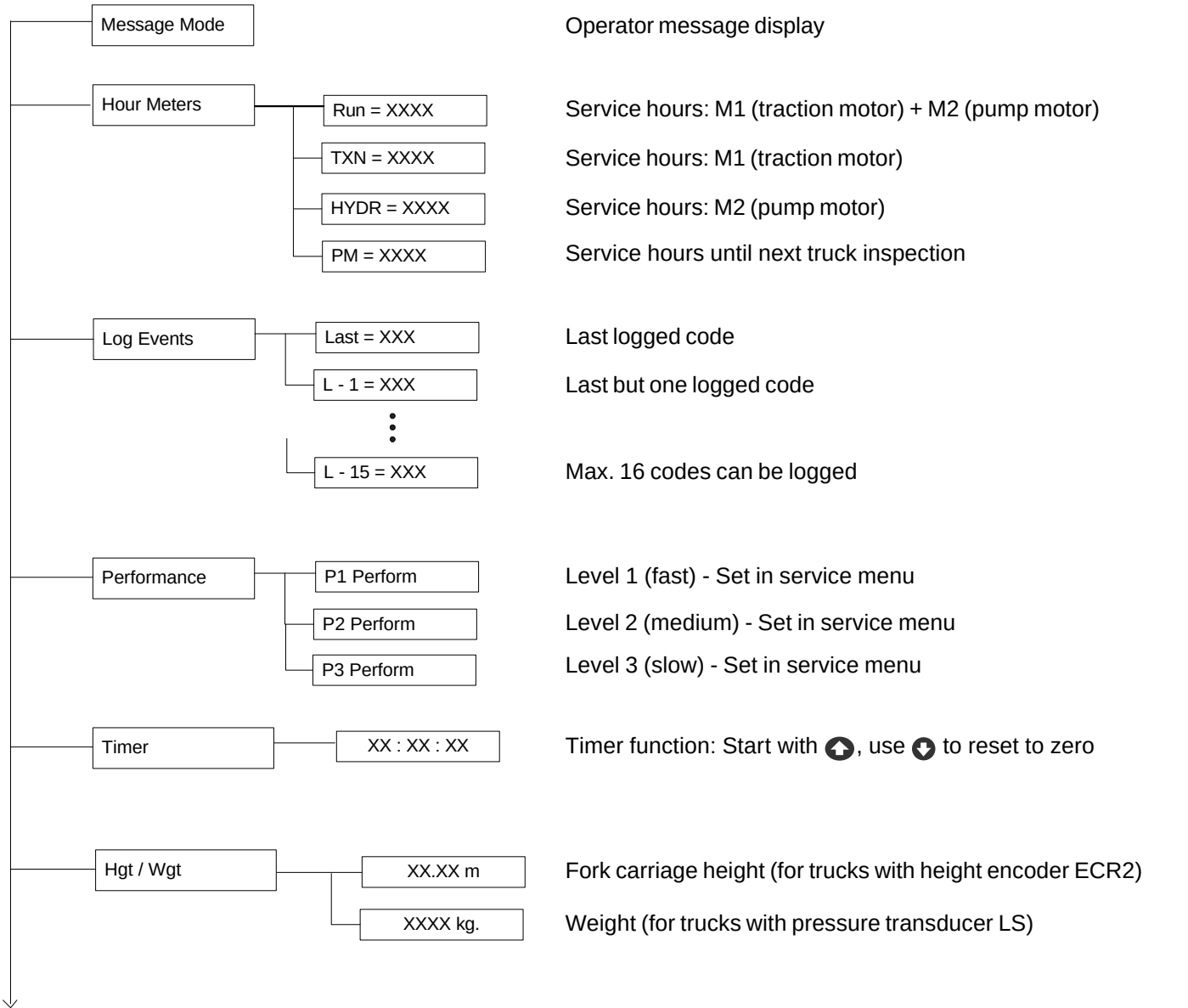
Capacity Data Monitor

- The fork symbol indicates the approximate height of the fork carriage.
- The bar to the left of the fork symbols indicate the maximum lift height for the current load.
- The circles to the left of the bar correspond to the maximum permissible loads for the various lifting heights, according to the capacity data plate.
- For further information see the "Capacity Data Monitor" section at the beginning of this chapter.

Operator Menu

The operator has access - if necessary, on entering the PIN- to the following menu (service level 1).

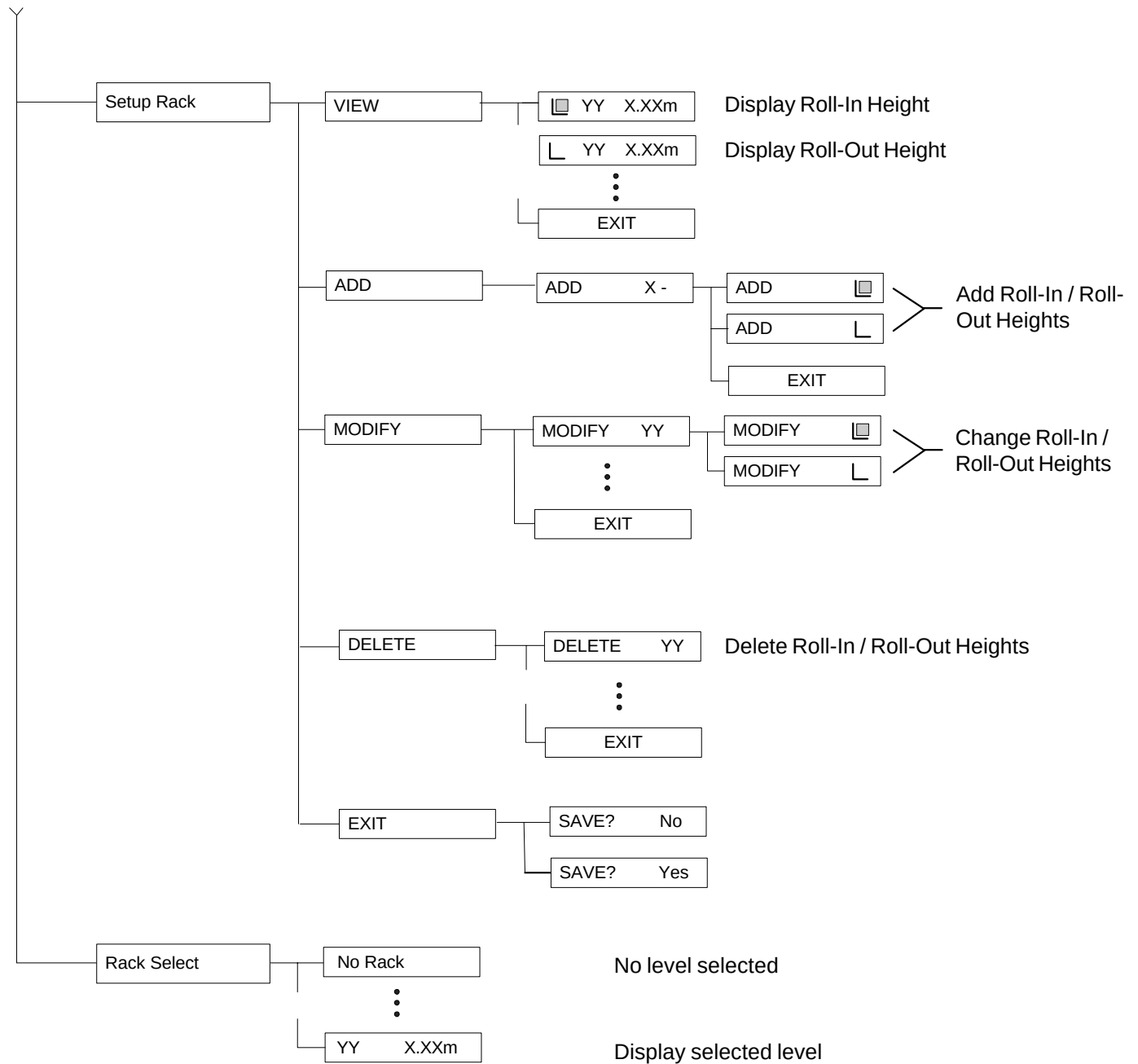
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Menu01

Operator Menu (cont.)

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

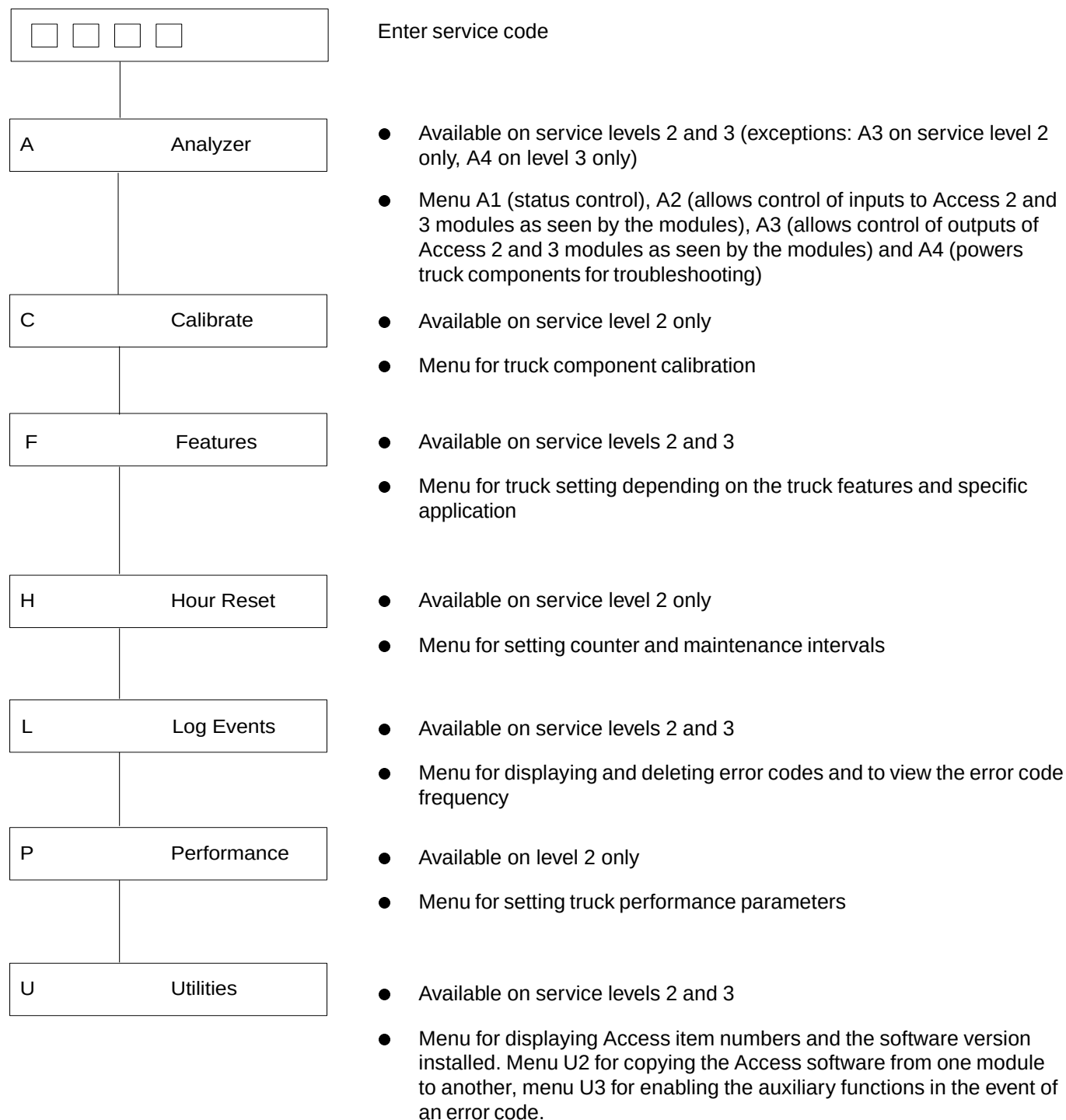


Menu02

Service Menu

By entering the service code the service engineer has access to specific menus, depending on which of the arrow keys  and  were pressed when the truck was started.

- If the  key was pressed when the truck was started and the service code entered, service level 2 is available. The truck can be used in service level 2.
- If the  and  keys were pressed when the truck was started and the service code entered, service level 3 is available. The truck cannot be used in service level 3.



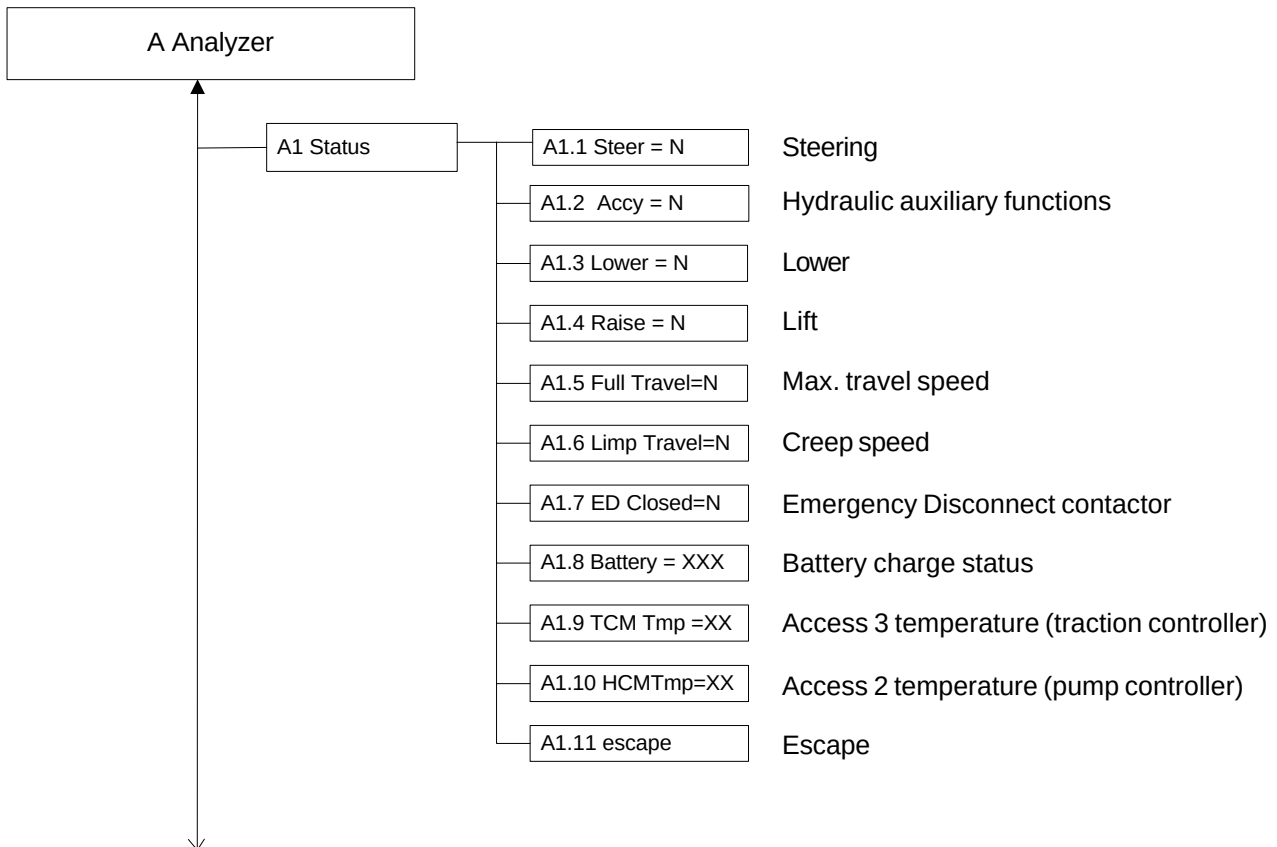
Menu03

ANALYZER Menu

The A1 and A2 sub-menus are available on service levels 2 and 3, A3 sub-menu on service level 2 only and sub-menu A4 on service level 3 only.

Sub-menu A1 provides a status display of various truck functions and components. This allows the engineer to check, in the event of a fault, which functions are inhibited due to certain error codes and which ones are still available.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

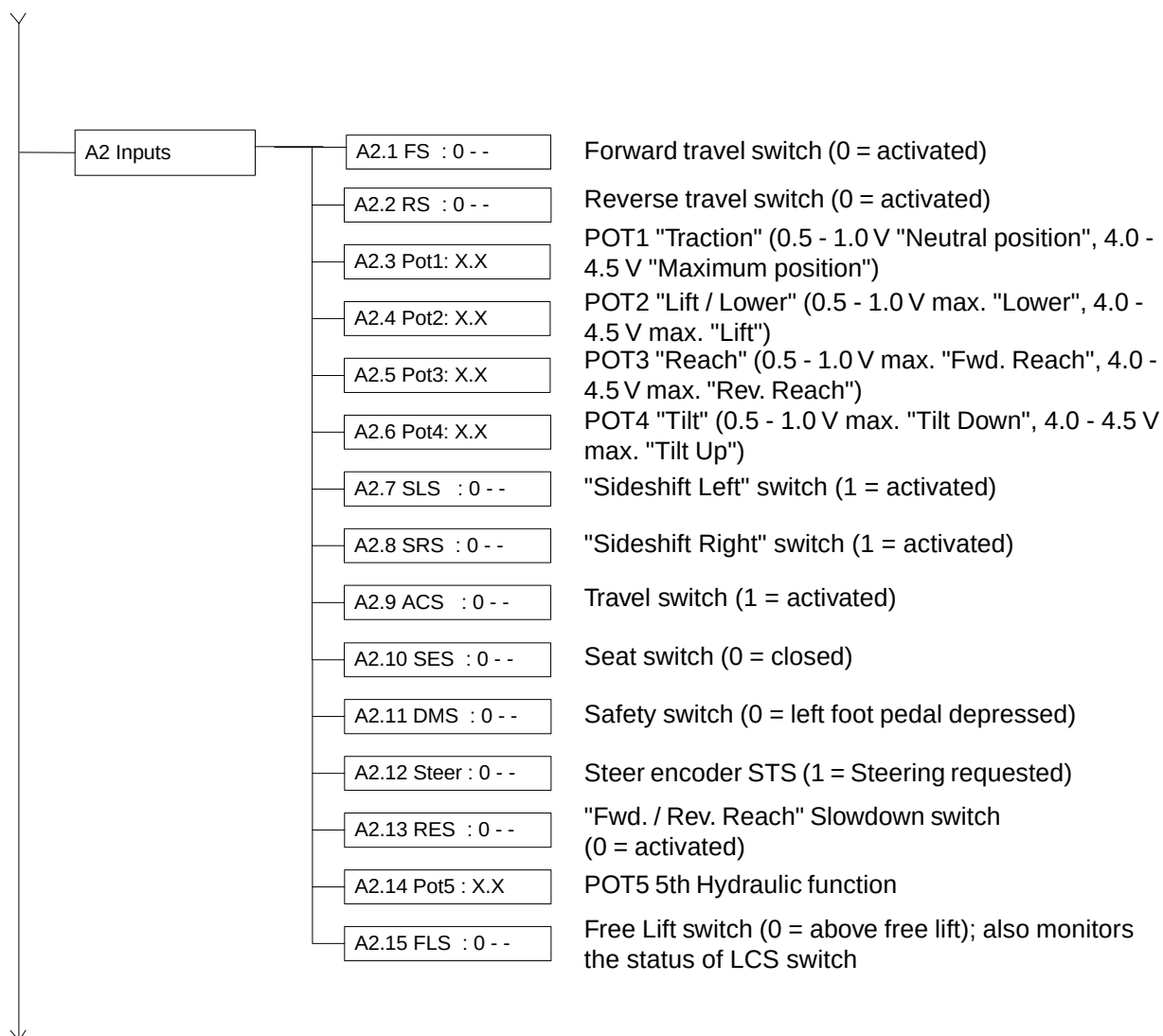


Menu04

ANALYZER Menu (contd.), Inputs

Sub-menu A2 enables the switch inputs to be checked, thereby providing a control for whether the respective switch status or control signal has been correctly read by the Access 2 and 3 modules. The menu is available on service levels 2 and 3.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



ANALYZER Menu (Contd.), Inputs

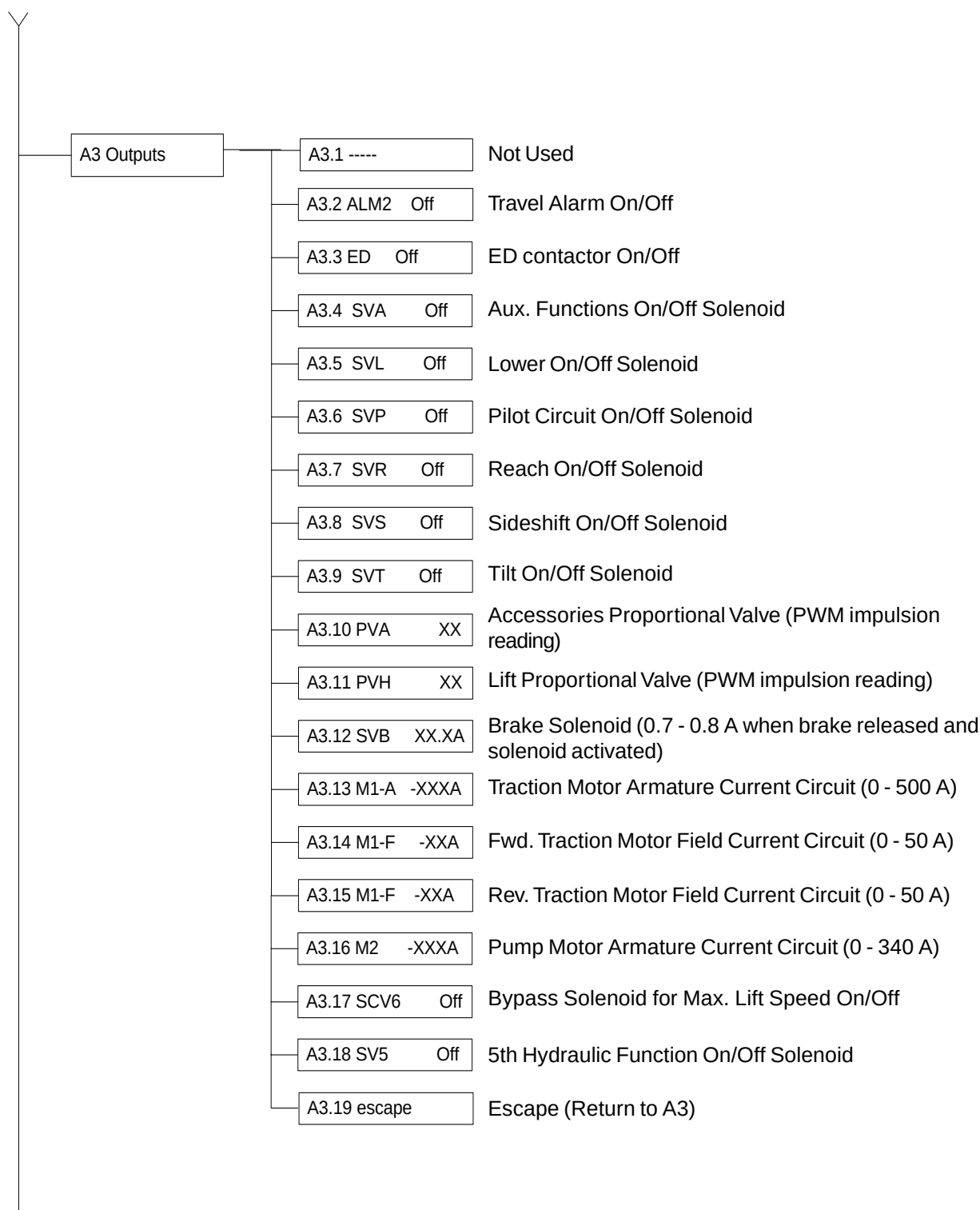
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

A2.16 HGTRS : 0 - -	Height Reset Switch (0 = activated)
A2.17 : 0 - -	Not Used
A2.18 HGTS12: 0 - -	Mast switch for Lift Speed Reduction (0 = Lift Speed Reduced)
A2.19 ECR2: XXX	Height Encoder
A2.20 BFS : 0 - -	Brake Fluid Switch (0 = open, brake fluid level okay)
A2.21 ECR1 : XXX	Traction Encoder
A2.22 BLS : 0 - -	Battery Latch Switch
A2.23 ORS : 0 - -	Raise Cutout Override Switch (1 = activated)
A2.24 Speed : X.X	Travel Speed
A2.25 BW1 : 0 - -	M1 Traction Motor Brush Wear Switch (1 = brushes worn)
A2.26 THS1 : 0 - -	M1 Traction Motor Temp. Gauge (1 = Overtemp.)
A2.27 BW2 : 0 - -	M2 Pump Motor Brush Wear Switch (1 = Brushes worn)
A2.28 THS2 : 0 - -	M2 Pump Motor Temperature Gauge (1 = Overtemp.)
A2.29 BRS : 0 - -	Parking Brake Switch (1 = Brake Switch Applied)
A2.30 BMS : 0 - -	Parking Brake Monitor Switch (1 = Switch Closed, Brake Released)
A2.31 - : 0 - -	Not Used
A2.32 - : 0 - -	Not Used
A2.33 - : 0 - -	Not Used
A2.34 SCS : 0 - -	Not Used
A2.35 : 0 - -	Not Used
A2.36 LS : XXXX	Pressure Transducer / Weight Display
A2.37 - : 0 - -	Not Used

ANALYZER Menu (Contd.), Outputs

Sub-menu A3 allows the signal outputs to be checked, and thereby provides a control for whether the signals to activate and deactivate the components of the Access 2 and 3 modules have been correctly transmitted. The menu is available on service level 2.

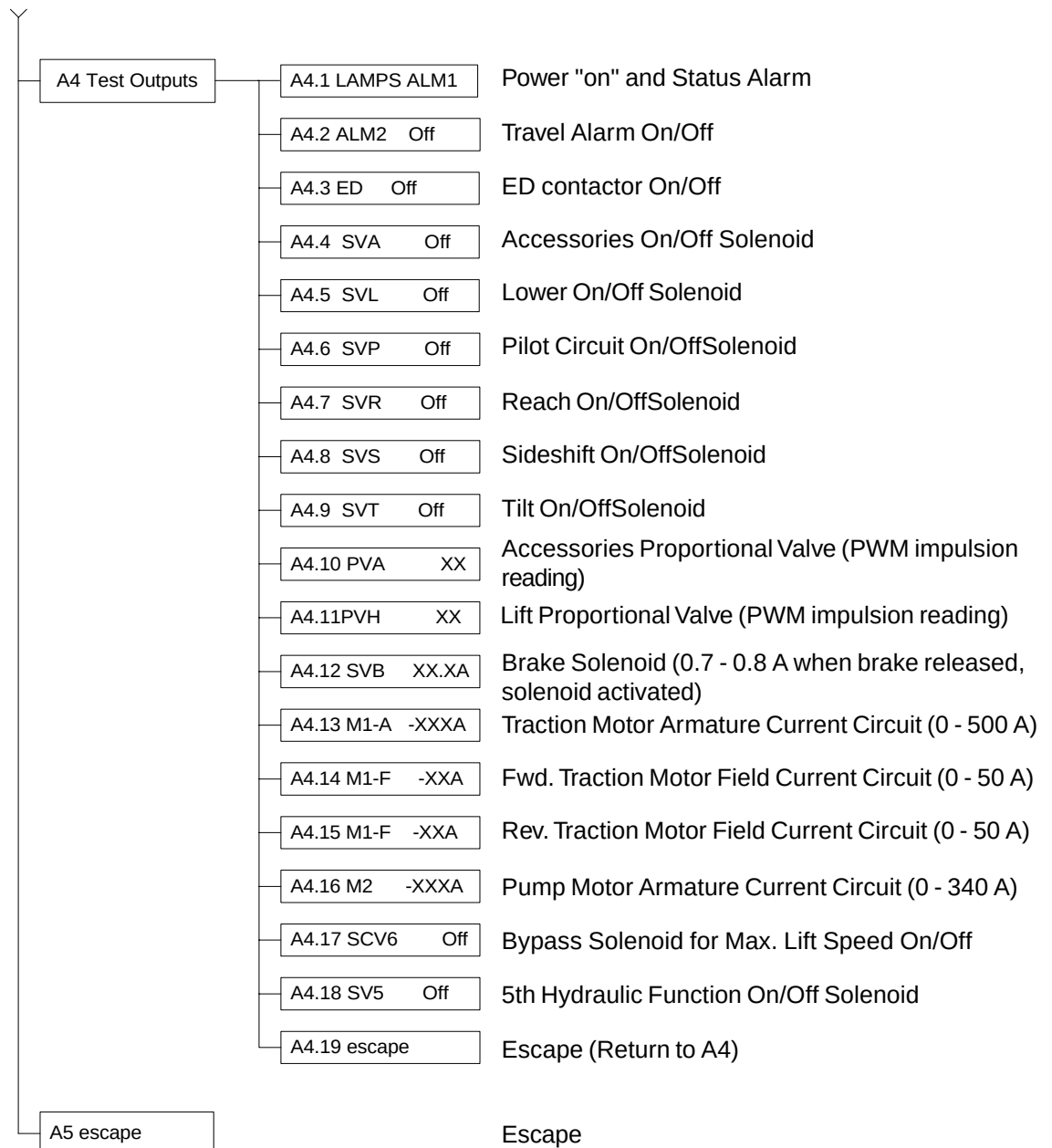
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



ANALYZER Menu (Contd.), Test Outputs

Sub-menu A4 allows the most important truck components to be activated, which enables the cause of error to be located immediately during troubleshooting, e.g. magnetic coil, wiring etc. The menu is only available on service level 3.

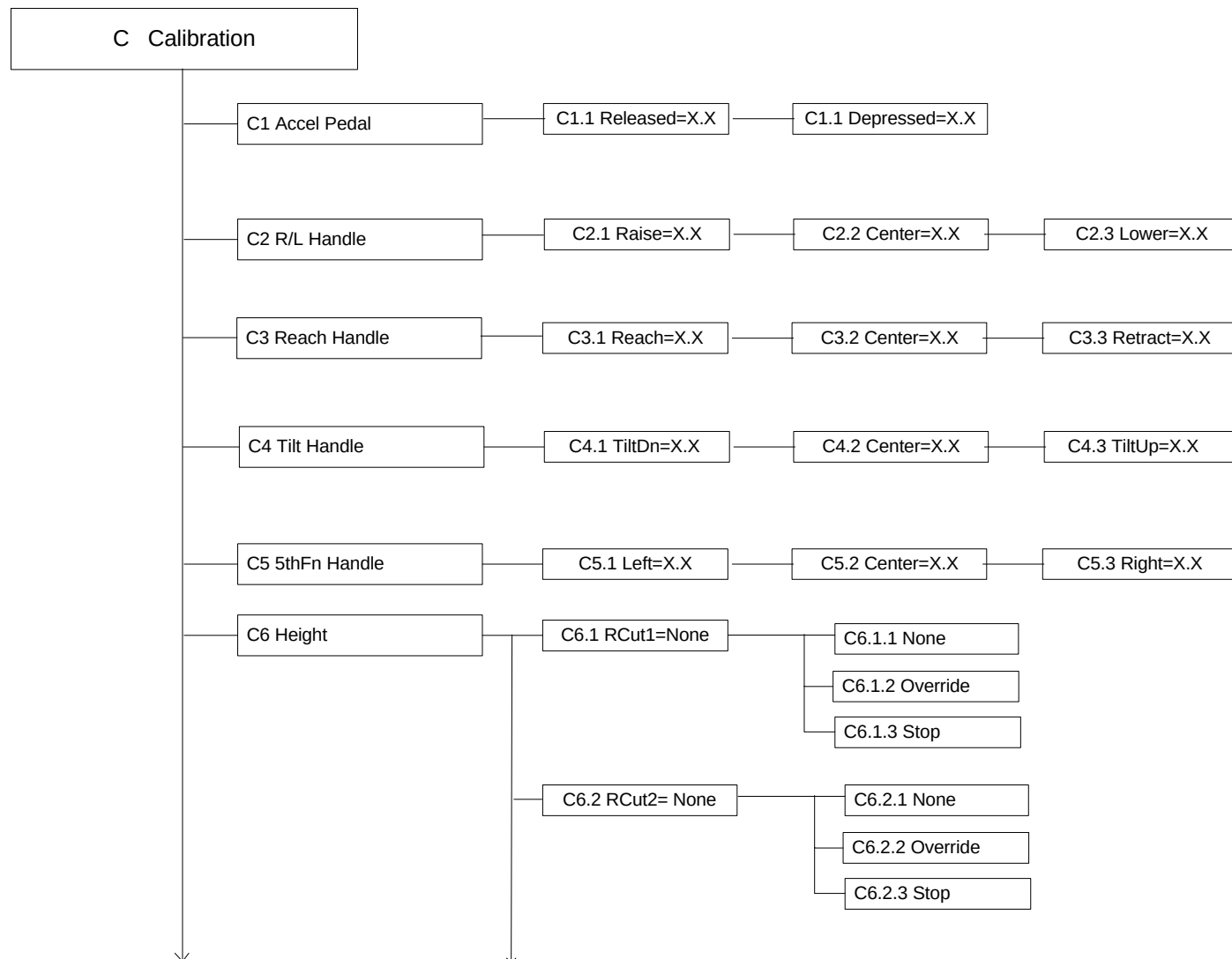
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



CALIBRATION Menu

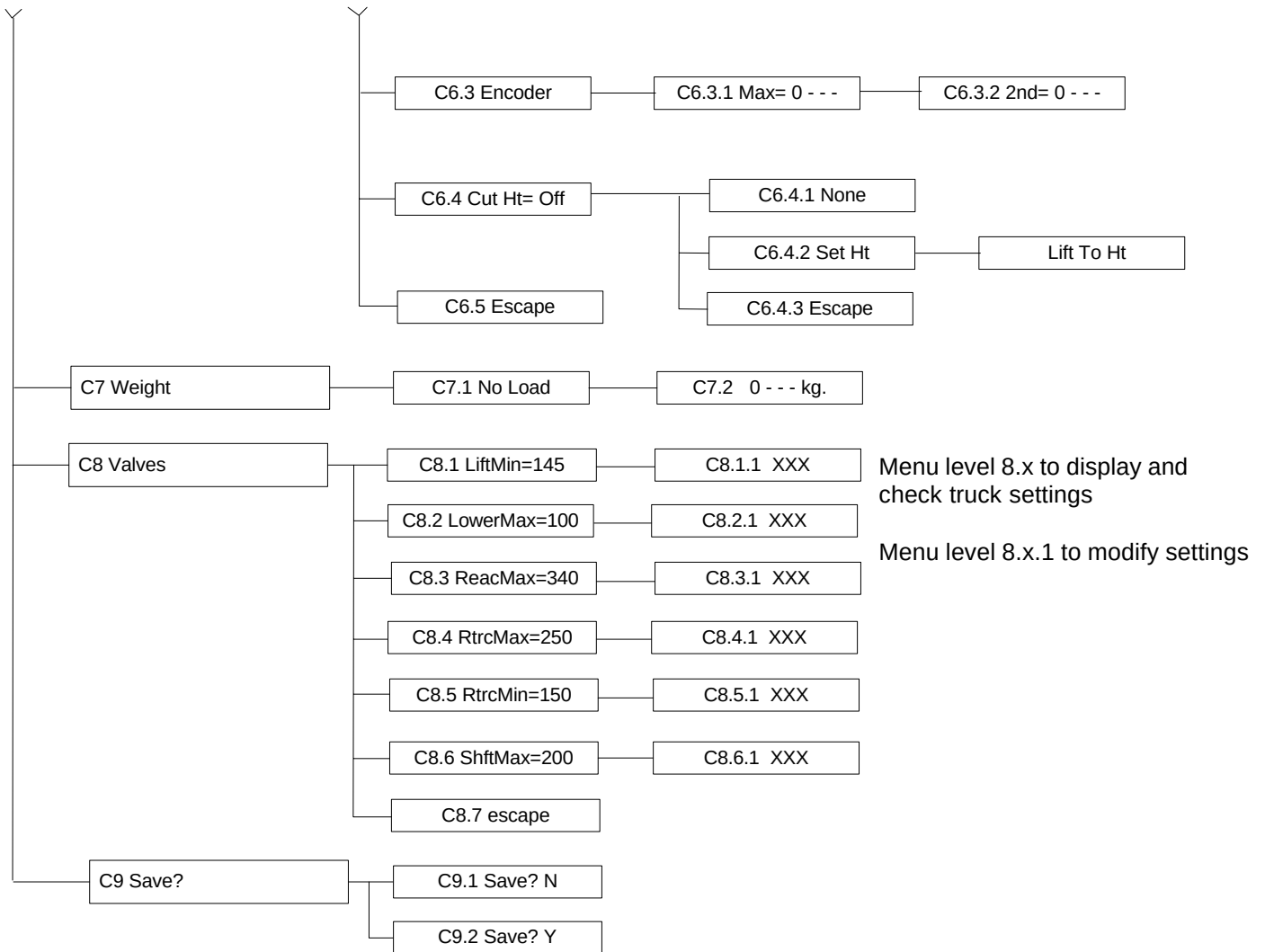
Menu used to calibrate potentiometers, height encoder, capacity data monitor and solenoid valves as well as to set lift cutouts and a user-defined lift height for speed limits. This menu is available only on service level 2.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



CALIBRATION Menu (Contd.)

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Menu08

Accessing the CALIBRATION Menu

Power up the truck while pressing the  key. After inputting the service code select CALIBRATION and press ENTER. C1 ACCEL PEDAL is displayed.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

The first menu shows the truck components which can be calibrated.

- C1 ACCEL PEDAL (Accelerator):
Traction Potentiometer POT1
- C2 R/L HANDLE (Lift / Lower):
Lift / Lower Potentiometer POT2
- C3 REACH HANDLE (Reach):
Reach Potentiometer POT3
- C4 TILT HANDLE (Tilt):
Tilt Potentiometer POT4
- C5 5THFN HANDLE (5th Hydraulic Function):
Potentiometer for 5th Hydraulic Function POT5
- C6 HEIGHT (Height Calibration):
For trucks with height encoder ECR2, calibration of maximum lift height, setting of max. 2 lift cutouts and user-defined lift heights for speed limits.
- C7 WEIGHT (Weight Calibration):
For trucks with pressure transducer LS and height encoder ECR2: Calibration of capacity data monitor (must be activated in Features Menu F10).
- C8 VALVES (Solenoid Valves):
Calibration of proportional valves PVH and PVA for lift and accessory functions.

When to calibrate:

- Access 1 replaced. This will require the pressure transducer (LS) to be calibrated.
- Access 2 or Access 3 replaced. This will require the potentiometers to be calibrated.
- Any of the potentiometers or components used to fix or position potentiometers replaced.

- When solenoid valves have been replaced they must be recalibrated.
- Pressure transducer (LS) replaced.
- Status code instructions recommend recalibration of a specific component.

Calibration Procedures

A full explanation of calibration procedures for each menu level follows.

Calibration Complete

When calibration procedures are complete, scroll down to SAVE (C9) and press ENTER. If the calibration completed has to be saved for future truck operation, select "Save? Y" (C9.2) and press ENTER. This process will require less than a minute to complete.

NOTE



In order not to delete the calibration values, do not operate any truck controls or display keys during this process.

C1 ACCEL PEDAL

Menu used to calibrate traction potentiometer POT1. To calibrate press ENTER, or scroll to C2 with the ⬇ key.

C1.1 Released = _

Calibrates the neutral position of POT1. Set the accelerator pedal to neutral and press ENTER. The display changes to C1.2.

C1.2 Depressed = _

Calibrates the maximum position of POT1. Depress the accelerator pedal fully and then press ENTER. The display returns to C1.

If no more settings are required, go to "C9 Save ?" and save the new values in C9.2. Calibration is complete and the truck can be returned to operation.

C2 R/L HANDLE

Menu used to calibrate lift potentiometer POT2. To calibrate press ENTER, or scroll to C3 using the ⬇ key.

C2.1 Raise = _

Move the lever to the full speed lift position and press ENTER. The menu will then proceed to C2.2.

C2.2 Center = _

With the lever in the neutral position, press ENTER. The menu will then proceed to C2.3.

C2.3 Lower = _

Move the lever to the full speed lower position and press ENTER. The menu will then return to the C2 menu level.

If no further calibration is required, scroll to the "C9 Save?" menu level, press and select the C9.2 menu. Calibration is complete and truck can be returned to operation. If further calibration is required, scroll to the appropriate menu level and continue.

C3 REACH HANDLE

Menu used to calibrate reach potentiometer POT3. To calibrate press ENTER, or scroll to C4 using the ⬇ key.

C3.1 Reach = _

Move the lever to the full speed reach position and press ENTER. The menu will then move to C3.2.

C3.2 Center = _

With the lever in the neutral position, press ENTER. The menu will proceed to C3.3.

C3.3 Retract = _

Move the lever to the full speed retract position and press ENTER. The menu will then return to the C3 menu level.

If no further calibration is required, scroll to "C9 Save?" and store the new values under C9.2. Calibration is complete and truck can be returned to operation.

C4 TILT HANDLE

Menu used to calibrate tilt potentiometer POT4. To calibrate press ENTER, or scroll to C5 using the  key.

C4.1 Tilt Dn = _

Set the lever for tilting to the maximum "Tilt Down" position and press ENTER. The display changes to C4.2.

C4.2 Center = _

Set the lever for tilting to the neutral position and press ENTER. The display changes to C4.3.

C4.3 Tilt Up = _

Set the lever for tilting to the maximum "Tilt Up" position and press ENTER. The display returns to C4.

If no more settings are required, go to C9.2 "C9 Save ?" and save the new values in C9.2. Calibration is complete and the truck can be returned to operation.

C5 5TH FN HANDLE

Menu used to calibrate 5th hydraulic function potentiometer POT5. To calibrate press ENTER, or scroll to C6 using the  key.

C5.1 Left = _

Set the lever for the 5th hydraulic function to the maximum "Attachment Left" position and press ENTER. The display changes to C5.2.

C5.2 Center = _

Set the lever for the 5th hydraulic function to the neutral position and press ENTER. The display changes to C5.3.

C5.3 Right = _

Set the lever for the 5th hydraulic function to the maximum "Attachment Right" position and press ENTER. The display returns to C5.

If no more settings are required, go to C9.2 "C9 Save ?" and save the new values in C9.2. Calibration is complete and the truck can be returned to operation.

C6 HEIGHT

Menu used to calibrate the height encoder as well as for setting the lift cutouts (max. 2) and a user-defined lift height for activating travel, lower and reach speed limits (see PERFORMANCE Menu P8, P9, P10).

When selecting the menu the fork carriage must be within the free lift range. To calibrate press ENTER, or scroll to C7 using the  key.

C6.1 RCut1 = _

Menu for setting a lift cutout. If more than one lift cutout is to be set, the lower of the two lift heights must be defined in menu C6.1.2 "Override". This will allow the first lift cutout to be bypassed by pressing the ORS override switch. To enter the lift height press ENTER and scroll to C6.1.2 or C6.1.3 using the  key.

C6.1.1 None = _

If no raise cutouts are required, select this menu and press ENTER. The display returns to C6.1.

C6.1.2 Override = _

Menu for setting a raise cutout with override. Press ENTER and raise the fork carriage to the required height. Then press ENTER again. The display returns to C6.1.

C6.1.3 Stop = _

Menu for setting a raise cutout without override. Press ENTER and raise the fork carriage to the required height. Then press ENTER again. The display returns to C6.1.

C6.1.4 Escape = _

If no change is to be made to the existing setting, press ENTER to quit the menu. The display returns to C6.1.

C6.2 RCut2 = _

Menu for setting a second raise cutout. A greater lift height must be programmed here than in C6.1. To enter the lift height press ENTER and scroll to C6.2.2 or C6.2.3 using the  key.

C6.2.1 None = _

If no additional raise cutout is to be set, select this menu and press ENTER. The display returns to C6.2.

C6.2.2 Override = _

Menu for setting a second raise cutout with override. Press ENTER and raise the fork carriage to the required height. Then press ENTER again. The display returns to C6.2.

C6.2.3 Stop = _

Menu for setting a second raise cutout without override. Press ENTER and raise the fork carriage to the required height. Then press ENTER again. The display returns to C6.2.

C6.2.4 Escape = _

If no change is to be made to the existing setting, press ENTER to quit the menu. The display returns to C6.2.

C6.3 Encoder = _

Menu for setting the height encoder ECR2. To calibrate press ENTER or scroll with  until you reach C6.4.

C6.3.1 Max = _

This menu is used to enter the maximum lift height. To do so, raise the fork carriage until it reaches the mechanical stop. Now measure the exact height from the ground to the top edge of the forks and enter the measurement in millimeters.

To enter the lift height use the arrow keys  and  to select the first requested figure and confirm with ENTER. Now enter the other figures in the same way. The display changes to C6.3.2.

C6.3.2 2nd = _

Menu used to calibrate the height reset (1st mast stage). To do so, lower the fork carriage until the "Stop" message is displayed. Now measure the exact height from the ground to the top edge of the forks and enter the measurement in millimeters.

To enter the lift height use the arrow keys  and  to select the first requested figure and confirm with

ENTER. Now enter the other figures in the same way. The display changes to C6.3.

C6.4 Custom = _

Menu for setting a user-defined lift height for activating travel, lower and reach speed limits (see PERFORMANCE Menu P8, P9, P10). To calibrate, press ENTER or scroll to C6.5 using the  key.

C6.4.1 None = _

If no user-defined lift height for a speed reduction is to be set, select this menu and press ENTER. The display returns to C6.4.

C6.4.2 Set Ht = _

Menu for setting a user-defined lift height for activating speed limits. Press ENTER and raise the fork carriage to the required height. Now press ENTER again. The display returns to C6.4.

If no more settings are required, go to "C9 Save ?" and store the new values under C9.2. Calibration is complete and the truck can be returned to operation.

C6.4.3 Escape = _

If no more changes are to be made to the existing setting, press ENTER to quit the menu. The display returns to C6.4.

C6.5 Escape = _

Press ENTER to quit the menu. The display returns to C6.

If no more settings are required, go to "C9 Save ?" and store the new values under C9.2. Calibration is complete and the truck can be returned to operation.

C7 WEIGHT

Menu used to calibrate the pressure transducer LS. Calibration is in two stages, first with an unladen fork carriage and then with a test load. Calibration must be performed with:

- a calibrated test load (> 700 kg)
- a load centre of 600 mm
- horizontal fork carriage approx. 300 mm above the ground.

To calibrate, press ENTER or scroll to C8 using the  key.

C7.1 No Load

Position the unladen fork carriage approx. 300 mm horizontally above the ground and press ENTER. The display changes to C7.2.

C7.2 0 - - - kg

Raise the test load and enter the exact weight in kilograms in this menu.

To enter the weight using the  and  keys first select the required figure and confirm with ENTER. Now enter the remaining figures in the same way. The display returns to C7.

If no more settings are required, go to "C9 Save ?" and save the new values in C9.2. Calibration is complete and the truck can be returned to operation.

C8 VALVES

Menu used to calibrate the proportional valves PVA and PVH to set the speed of lift and accessory functions.

- The lift calibration must be performed with the nominal load, whereas the accessory function calibration must be performed with an unladen truck.
- The hydraulic oil must be at operating temperature. To warm the oil flow extend the mast 6 - 8 times to the limit and bring all accessory functions 2 - 3 times to their respective ends of stroke.

CAUTION

Only the specified guideline speeds can be set in this menu because they comply with the flow parameters stored in the software. Setting other values can cause the truck to operate in an uncontrolled manner.

To calibrate, press ENTER or scroll to C9 using the  key.

C8.1 LiftMin

The current setting for the minimum lift speed is displayed. To check the correct setting value operate the lift function and note the operation of the fork carriage.

NOTE

In calibration mode the lift and accessory functions operate at a preset speed, irrespective of the respective lever position.

The lower function however continues to operate in direct proportion to the lever position.

Ideally, the fork carriage will not move. If movement is detected, the value in C8.1.1 must be corrected accordingly by pressing ENTER. If no calibration is required, scroll to C8.2 with the  key.

C8.1.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value if the fork carriage lowered during the previous test.
- Decrease the value if the fork carriage raised during the previous test.

Now confirm the new value with ENTER. The display returns to C8.1.

NOTE

The ENTER key must be pressed (return to C8.1) to save the new setting and then tested on the truck.

Repeat the test until the fork carriage does not move when the lift function is operated. If this proves impossible, the least possible upward movement of the fork carriage should be set.

C8.2 LowrMax

The current setting for the maximum lower speed is displayed. To check the correct setting set the lever to the maximum "Lower" position and record the speed.

- Speed with nominal load: 0.55 m/s

If the recorded speed is greater or less, the setting in C8.2.1 must be corrected accordingly by pressing ENTER. If no calibration is necessary, scroll to C8.3 using the  key.

C8.2.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value to raise the maximum lowering speed.
- Decrease the value to reduce the maximum lowering speed.

Now confirm the new value with ENTER. The display returns to C8.2.

NOTE



The ENTER key must be pressed (return to C8.2) in order for the changed setting to be stored and then tested on the truck.

Repeat the test until the specified lowering speed has been obtained.

C8.3 ReacMax

The current setting for the maximum "Fwd. Reach" speed is displayed. To check the correct setting operate the "Fwd. Reach" function and record the speed.

- Speed (unladen): 0.19 m/s

If the recorded speed is greater or less, the setting in C8.3.1 must be corrected accordingly by pressing ENTER. If no calibration is necessary, scroll to C8.4 using the  key.

C8.3.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value to raise the maximum "Fwd. Reach" speed.
- Decrease the value to reduce the maximum "Fwd. Reach" speed.

Now confirm the new value with ENTER. The display returns to C8.3.

NOTE



The ENTER key must be pressed (return to C8.3) in order for the changed setting to be stored and then tested on the truck.

Repeat the test until the specified "Fwd. Reach" speed has been obtained.

C8.4 RtrcMax

The current setting for the maximum "Retract Reach" speed is displayed. To check the correct setting operate the "Retract Reach" function and record the speed.

- Speed (unladen): 0.19 m/s

If the recorded speed is greater or less, the setting in C8.4.1 must be corrected accordingly by pressing ENTER. If no calibration is necessary, scroll to C8.5 using the  key.

C8.4.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value to raise the maximum "Retract Reach" speed.
- Decrease the value to reduce the maximum "Retract Reach" speed.

Now confirm the new value with ENTER. The display returns to C8.2.

NOTE



The ENTER key must be pressed (return to C8.4) in order for the changed setting to be stored and then tested on the truck.

Repeat the test until the specified speed has been obtained.

C8.5 RtrcMin

The current setting for the minimum "Retract Reach" speed is displayed. To check the correct setting operate the "Retract Reach" function and record the speed.

- Speed (unladen): 0.006 m/s

If the recorded speed is greater or less, the setting in C8.5.1 must be corrected accordingly by pressing ENTER. If no calibration is necessary, scroll to C8.6 using the  key.

C8.5.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value to raise the minimum "Retract Reach" speed.
- Decrease the value to reduce the minimum "Retract Reach" speed.

Now confirm the new value with ENTER. The display returns to C8.5.

NOTE



The ENTER key must be pressed (return to C8.5) in order for the changed setting to be stored and then tested on the truck.

Repeat the test until the specified speed has been obtained.

C8.6 ShftMax

The current setting for the maximum sideshift speed is displayed. To check the correct setting operate the sideshift function and record the speed.

- Speed (unladen): 0.05 m/s

If the recorded speed is greater or less, the setting in C8.6.1 must be corrected accordingly by pressing ENTER. If no calibration is necessary, scroll to C8.7 using the  key.

C8.6.1

Using the arrow keys  and  set the required value in this menu.

- Increase the value to raise the minimum sideshift speed.
- Decrease the value to reduce the minimum sideshift speed.

Now confirm the new value with ENTER. The display returns to C8.6.

NOTE



The ENTER key must be pressed (return to C8.6) in order for the changed setting to be stored and then tested on the truck.

Repeat the test until the specified speed has been obtained.

C8.7 Escape

To exit the menu press ENTER. The display returns to C8.

C9 SAVE ?

The previous settings can be either stored or cancelled.
Pressing ENTER changes to the display to C9.1.

C9.1 Save ? N

Press ENTER to cancel the previous settings and keep the original setup. The display returns to the initial menu.

Scroll to C9.2 using the  key.

C9.2 Save ? Y

Press ENTER to store the new settings.

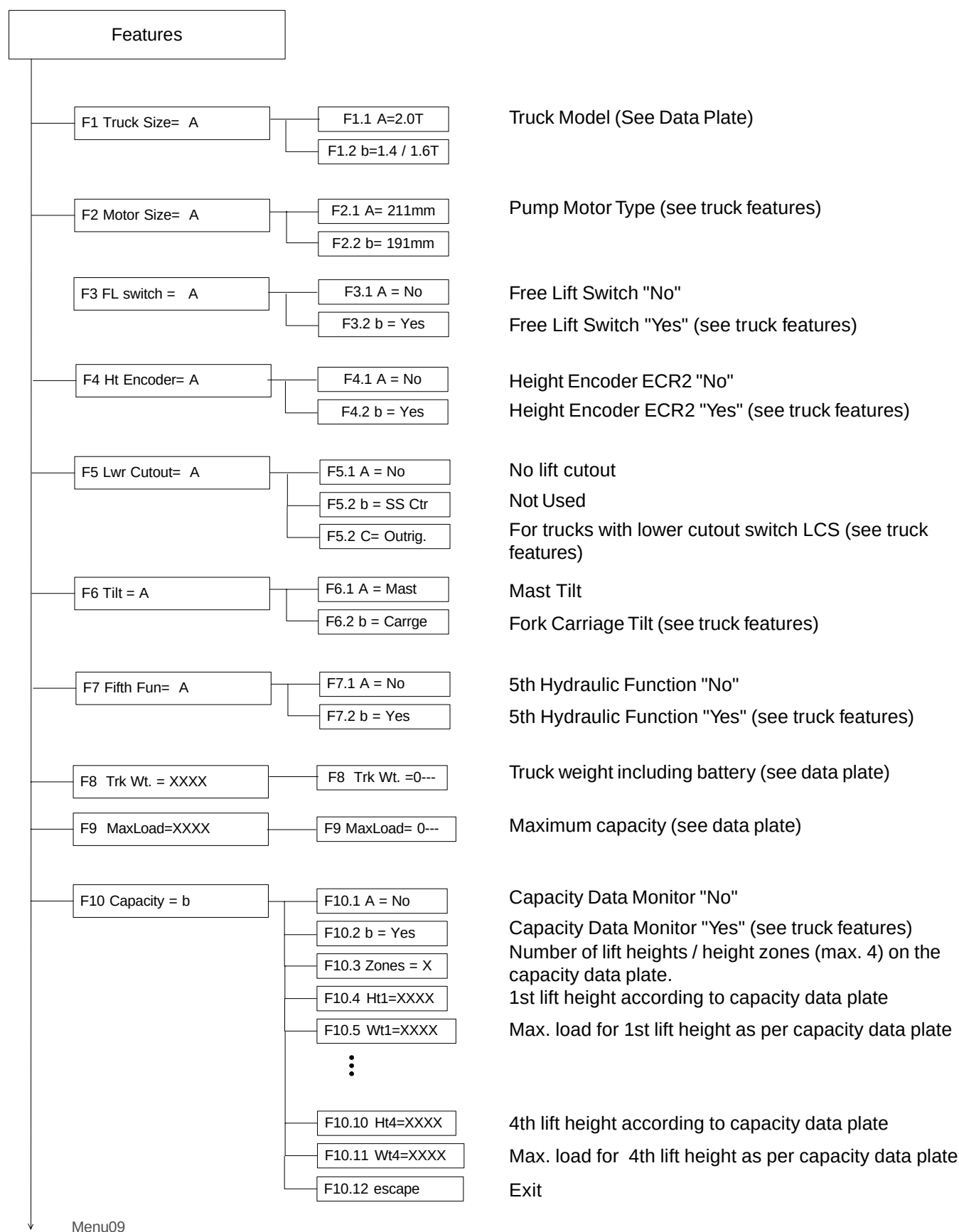
NOTE

In order not to delete the calibration values, do not operate any truck controls or display keys during this process.

After storing, the display returns to the initial menu.

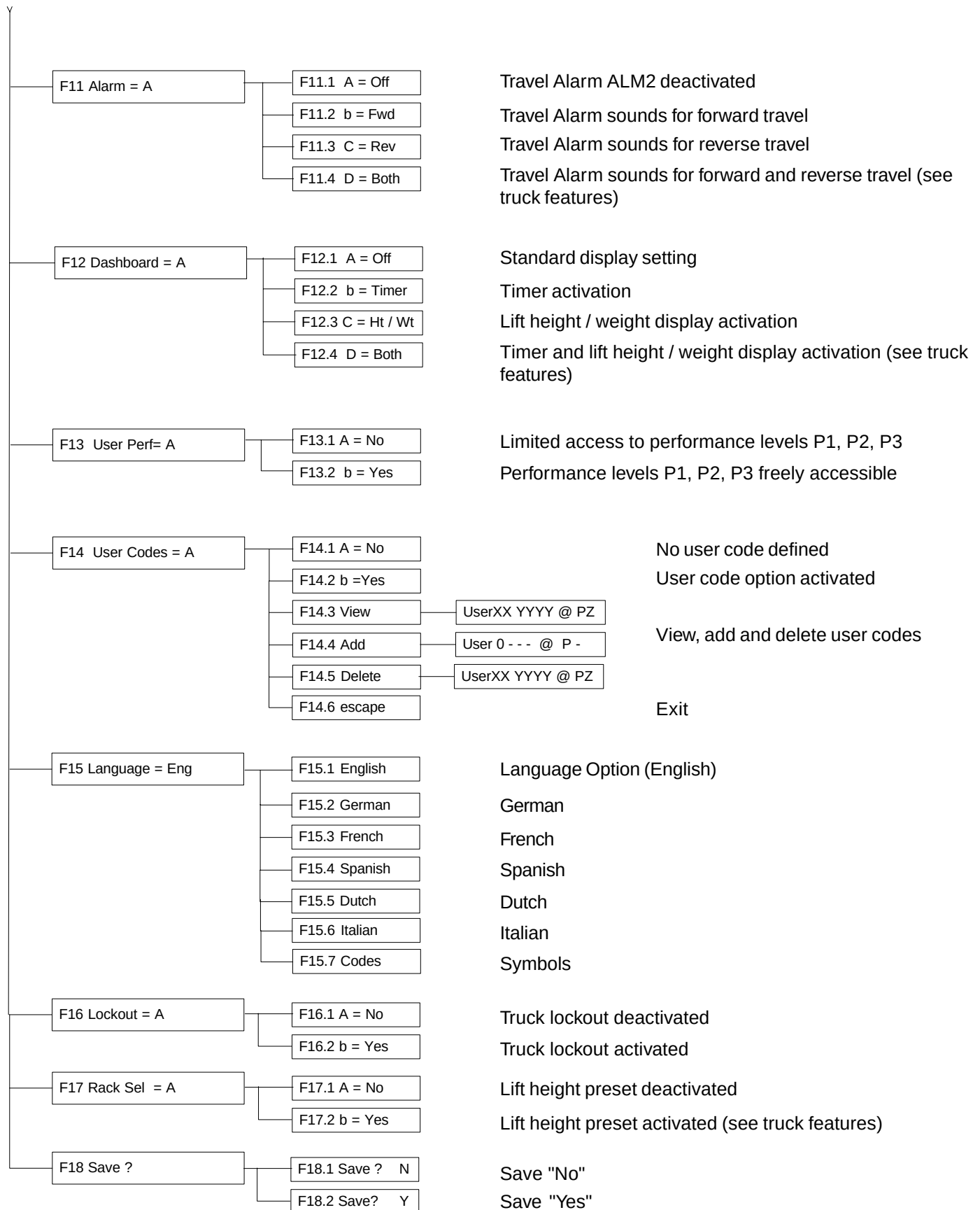
FEATURES Menu

This menu is available on service levels 2 and 3. To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



FEATURES Menu (Contd.)

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Menu10

Access to FEATURES Menu

Power up the truck while pressing the  key. After inputting the service code select the FEATURES menu and confirm with ENTER. F1 TRUCK SIZE is displayed.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

The first menu level shows the various truck components and parameters which can be programmed.

F1 TRUCK SIZE = _

The current setting is displayed. Use  to scroll to F2, pressing ENTER changes the display to F1.1.

F1.1 A = 2.0 t

Setting for truck with 2.0 t maximum load. Use  to scroll to F1.2, pressing ENTER returns the display to F1.

F1.2 b = 1.4 / 1.6 t

Setting for trucks with 1.4 or 1.6 t maximum load. Pressing ENTER returns the display to F1.

F2 MOTOR SIZE = _

The current setting is displayed. Use  to scroll to F3, pressing ENTER changes the display to F2.1.

F2.1 A = ...

Setting for trucks with a large pump motor. Use  to scroll to F2.2, pressing ENTER returns the display to F2.

F2.2 b = ...

Setting for trucks with a small pump motor (special trucks only). Pressing ENTER returns the display to F2.

F3 FL SWITCH = _

The current setting is displayed. Use  to scroll to F4, pressing ENTER changes the display to F3.1.

F3.1 A = No

Setting for trucks without a free lift switch. Use  to scroll to F3.2, pressing ENTER changes the display to F3.

F3.2 b = Yes

Setting for trucks with a free lift switch. The switch status affects for example travel speed and acceleration.

Pressing ENTER changes the display to F3.

F4 HT ENCODER = _

The current setting is displayed. Use  to scroll to F5, pressing ENTER changes the display to F4.1.

F4.1 A = No

Setting for trucks without height encoder. Use  to scroll to F4.2 pressing ENTER returns the display to F4.

F4.2 b = Yes

Setting for trucks with height encoder. The encoder signal affects the travel, lowering and reach speeds of the truck among others.

Pressing ENTER returns the display to F4.

F5 LWR CUTOOUT = _

The current setting is displayed. Use  to scroll to F6, pressing ENTER changes the display to F5.1.

F5.1 A = No

Setting for trucks without lower cutout. Use  to scroll to F5.2, pressing ENTER changes the display to F5.

F5.2 b = xxx

Not used. Use  to scroll to F5.3, pressing ENTER changes the display to F5.

F5.3 c = Outrig.

Setting for trucks with Lowering Cutout switch LCS. Pressing ENTER returns the display to F5.

F6 TILT = _

The current setting is displayed. Use  to scroll to F7, pressing ENTER changes the display to F6.1.

F6.1 A = Mast Tilt

Setting for trucks with mast tilt. Use  to scroll to F6.2, pressing ENTER changes the display to F6.

F6.2 b = Fork Carriage Tilt

Setting for trucks with fork carriage tilt. Pressing ENTER returns the display to F6.

F7 FIFTH FUN = _

The current setting is displayed. Use  to scroll to F8, pressing ENTER changes the display to F7.1.

F7.1 A = No

Setting for trucks without the 5th hydraulic function. Use  to scroll to F7.2, pressing ENTER returns the display to F7.

F7.2 b = Yes

Setting for trucks with the 5th hydraulic function. Pressing ENTER changes the display to F7.

F8 TRK WT. = _

The current setting is displayed. The truck weight must agree with the weight on the data plate (in kilograms, including battery, unladen).

To change the setting press ENTER. Then use the  and  keys to select the first required figure and confirm with ENTER. Then enter the remaining figures in the same way. Pressing ENTER returns the display to F8.

F9 MAX LOAD = _

The current setting is displayed. The maximum load must agree with the value specified on the capacity data plate.

To change the setting press ENTER. Then use the  and  keys to select the first required figure and confirm with ENTER. Then enter the remaining figures in the same way. Pressing ENTER returns the display to F9.

F10 CAPACITY = _

The current setting is displayed. Use  to scroll to F11, pressing ENTER changes the display to F10.1.

F10.1 A = No

Setting for trucks without Capacity Data Monitor. Use  to scroll to F10.2, pressing ENTER returns the display to F10.

F10.2 b = Yes

Setting for trucks with Capacity Data Monitor. Use  to scroll to F10.3, pressing ENTER returns the display to F10.

F10.3 Zones = _

Sets the number of lift heights / lift zones specified on the capacity data plate.

To change the setting press ENTER. Then use the  and  keys to select the required figure and confirm with ENTER. Use the  key to scroll to F10.4.

F10.4 Ht1 = _

The displayed reading must correspond to the first, maximum lift height indicated on the capacity data plate (see Fig. 6223).

To change the value press ENTER. Then use the  and  keys to select the first requested figure and confirm with ENTER. Now enter the remaining figures in the same way. Scroll to F10.5 using the  key.

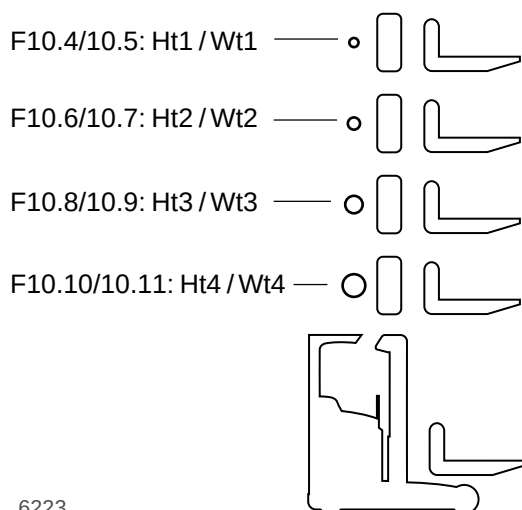
F10.5 Wt1 = _

The displayed reading must correspond to the first, minimum load as indicated on the capacity data plate (see Fig. 6223).

To change the value, see F10.4. Scroll to F10.6 using the  key.

Example:

Truck has 4 lift zones according to the capacity data plate.



6223

F10.6 Ht2 = _

The displayed reading must correspond to the second lift height indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.7 using the  key.

F10.7 Wt2 = _

The displayed reading must correspond to the second load indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.8 using the  key.

F10.8 Ht3 = _

The displayed reading must correspond to the third lift height as indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.9 using the  key.

F10.9 Wt3 = _

The displayed reading must correspond to the third load as indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.10 using the  key.

F10.10 Ht4 = _

The displayed reading must correspond to the fourth, minimum lift height as indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.11 using the  key.

F10.11 Wt4 = _

The displayed reading must correspond to the fourth, maximum load as indicated on the capacity data plate.

To change the value, see F10.4. Scroll to F10.12 using the  key.

F10.12 Escape

Press ENTER to return to F10.

F11 ALARM = _

The current setting is displayed. Use  to scroll to F12, pressing ENTER changes the display to F11.1.

F11.1 A = Deactivated

Setting for trucks without a travel alarm. Use  to scroll to F11.2, pressing ENTER returns the display to F11.

F11.2 b = Forward

Setting for travel alarm activation during forward travel. Use  to scroll to F11.3, pressing ENTER returns the display to F11.

F11.3 C = Reverse

Setting for travel alarm activation while reversing. Use  to scroll to F11.4, pressing ENTER returns the display to F11.

F11.4 D = Both

Setting for travel alarm activation for both forward and reverse travel. Pressing ENTER returns the display to F11.

F12 DASHBOARD = _

The current setting is displayed. Use  to scroll to F13, pressing ENTER changes the display to F12.1.

F12.1 A = Deactivated

Setting to deactivate the timer and height / weight display options in the user menu. Use  to scroll to F12.2, pressing ENTER returns the display to F12.

F12.2 b = Timer

Setting to activate the timer display option in the user menu. Use  to scroll to F12.3, pressing ENTER returns the display to F12.

F12.3 C = Height / Weight Display

Setting to activate the height / weight display option in the user menu. For trucks with height encoder ECR2 and pressure transducer only.

Use  to scroll to F12.4, pressing ENTER returns the display to F12.

F12.4 D = Both

Setting to activate the timer and height / weight display options in the user menu. For trucks with height encoder ECR2 and pressure transducer only. Pressing ENTER returns the display to F12.

F13 USER PERF = _

The current setting is displayed. Use  to scroll to F14, pressing ENTER changes the display to F13.1.

F13.1 A = No

Setting for restricted access to performance levels P1, P2, P3. If no user code is specified (see F14.1), performance level 2 = P2 is entered as the default when the truck is powered up.

Pressing ENTER returns the display to F13.

F13.2 b = Yes

Setting for unrestricted access to performance levels P1, P2, P3. The user has access to all performance levels, regardless of any user codes specified under F14.

Pressing ENTER returns the display to F13.

F14 USER CODES = _

The current setting is displayed. Use  to scroll to F15, pressing ENTER changes the display to F14.1.

F14.1 A = No

Setting to deactivate the user code option. Use  to scroll to F14.2, pressing ENTER returns the display to F14.

F14.2 b = Yes

Setting to activate the user code option. Any number between 1 and 25 user codes can be specified. These must each be allocated a specific performance level.

Use  to scroll to F14.3, pressing ENTER returns the display to F14.

F14.3 View

Menu for viewing all specified user codes and their respective performance levels. Press ENTER and use the arrow keys  and .

After viewing, press ENTER to return to F14.3 and then scroll to F14.4 with the  key.

F14.4 Add

Menu for adding user codes and allocating the required performance level.

To add a user code first press ENTER and then use the arrow keys  and  to select the first required number and confirm with ENTER. Now input the other numbers in the same way.

Then select the required performance level using the arrow keys  and  and confirm with ENTER. The display returns to F14.4. Scroll to F14.5 with the  key.

F14.5 Delete

Menu for deleting user codes.

To delete a user code use the arrow keys  and  to select the user code to be deleted and confirm deletion with ENTER. The display returns to F14.5. Scroll to F14.6 with the  key.

F14.6 Escape

Pressing ENTER returns the display to F14.

F15 LANGUAGES = _

The selected language is displayed. Scroll to F16 using the  key, pressing ENTER changes the display to F15.1.

F15.1 English

Sets English as the menu language. Scroll to F15.2 using the  key, pressing ENTER returns the display to F15.

F15.2 German

Sets German as the menu language. Scroll to F15.3 using the  key, pressing ENTER returns the display to F15.

F15.3 French

Sets French as the menu language. Scroll to F15.4 using the  key, pressing ENTER returns the display to F15.

F15.4 Spanish

Sets Spanish as the menu language. Scroll to F15.5 using the  key, pressing ENTER returns the display to F15.

F15.5 Dutch

Sets Dutch as the menu language. Scroll to F15.6 using the  key, pressing ENTER returns the display to F15.

F15.6 Italian

Sets Italian as the menu language. Scroll to F15.7 using the  key, pressing ENTER returns the display to F15.

F15.7 Codes

Setting to select graphic symbols. Pressing ENTER returns the display to F15.

F16 LOCKOUT = _

The current setting is displayed. Scroll to F17 with the  key, pressing ENTER returns the display to F16.1.

F16.1 A = No

Setting for deactivating the truck lockout system. Scroll to F16.2 with the  key, pressing ENTER returns the display to F16.

F16.2 b = Yes

Setting for activating the truck lockout system. Pressing ENTER returns the display to F16.

F17 RACK SEL = _

The current setting is displayed. Scroll to F18 with the  key, pressing ENTER changes the display to F17.1.

F17.1 A = No

Setting for deactivating the lift height preset. Scroll to F17.2 with the  key, pressing ENTER changes the display to F17.

F17.2 b = Yes

Setting for activating the lift height preset. For trucks with height encoder ECR2 and pressure transducer LS only. Pressing ENTER returns the display to F17.

F18 SAVE ?

The previous settings can be either stored or cancelled. Pressing ENTER changes to the display to F18.1.

C18.1 Save ? N

Press ENTER to cancel the previous settings and keep the original setup. The display returns to F18.

Scroll to F18.2 using the  key.

F18.2 Save ? Y

Press ENTER to store any new settings.

NOTE

In order not to delete the calibration values, do not operate any truck controls or display keys during this process.

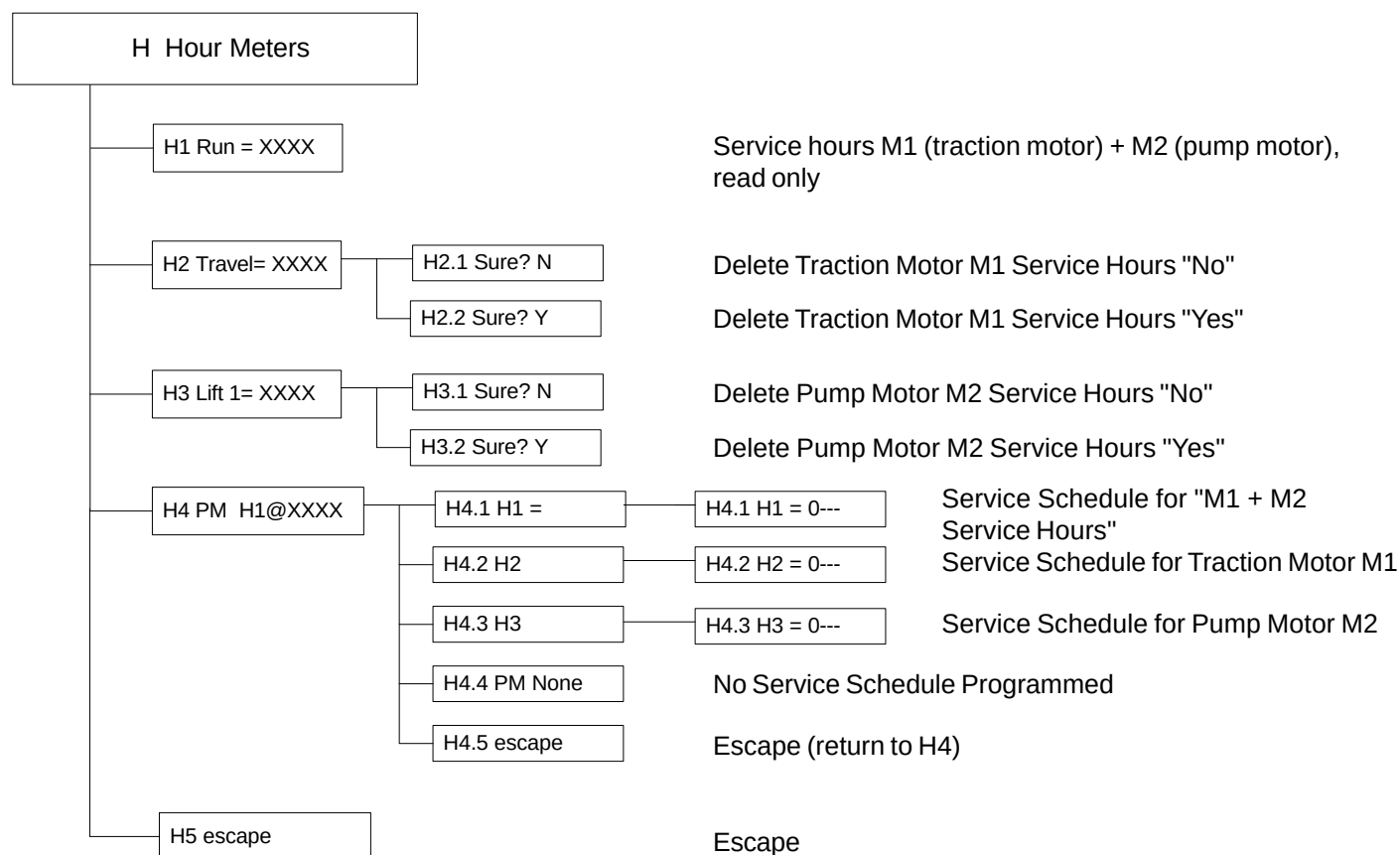
After storing, the display returns to the initial menu.

HOOR METERS Menu

Menu for viewing and processing the truck hourmeter. This menu is only available on service level 2.

Only one Service Schedule can be activated at any one time in H4.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

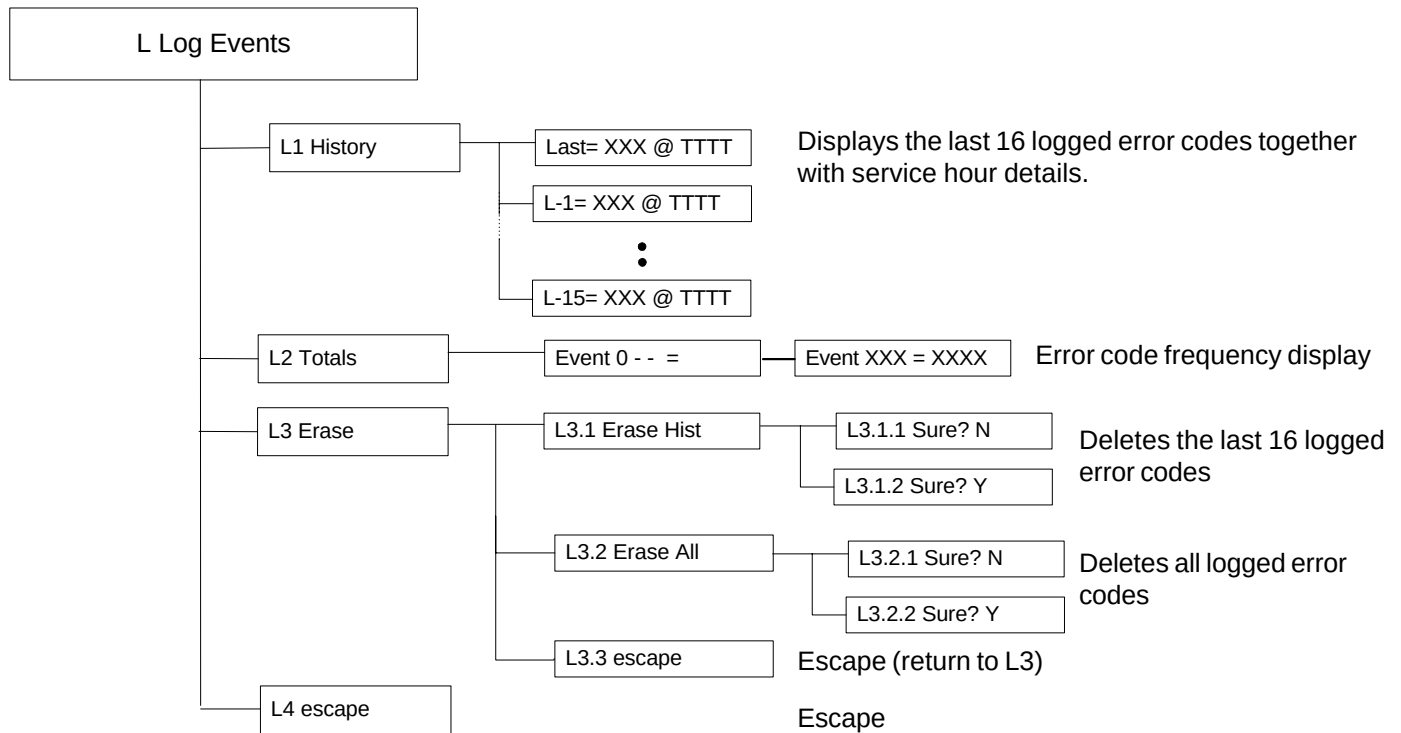


Menu11

LOG EVENTS Menu

Menu for viewing and processing logged error codes. This menu is only available on service levels 2 and 3.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

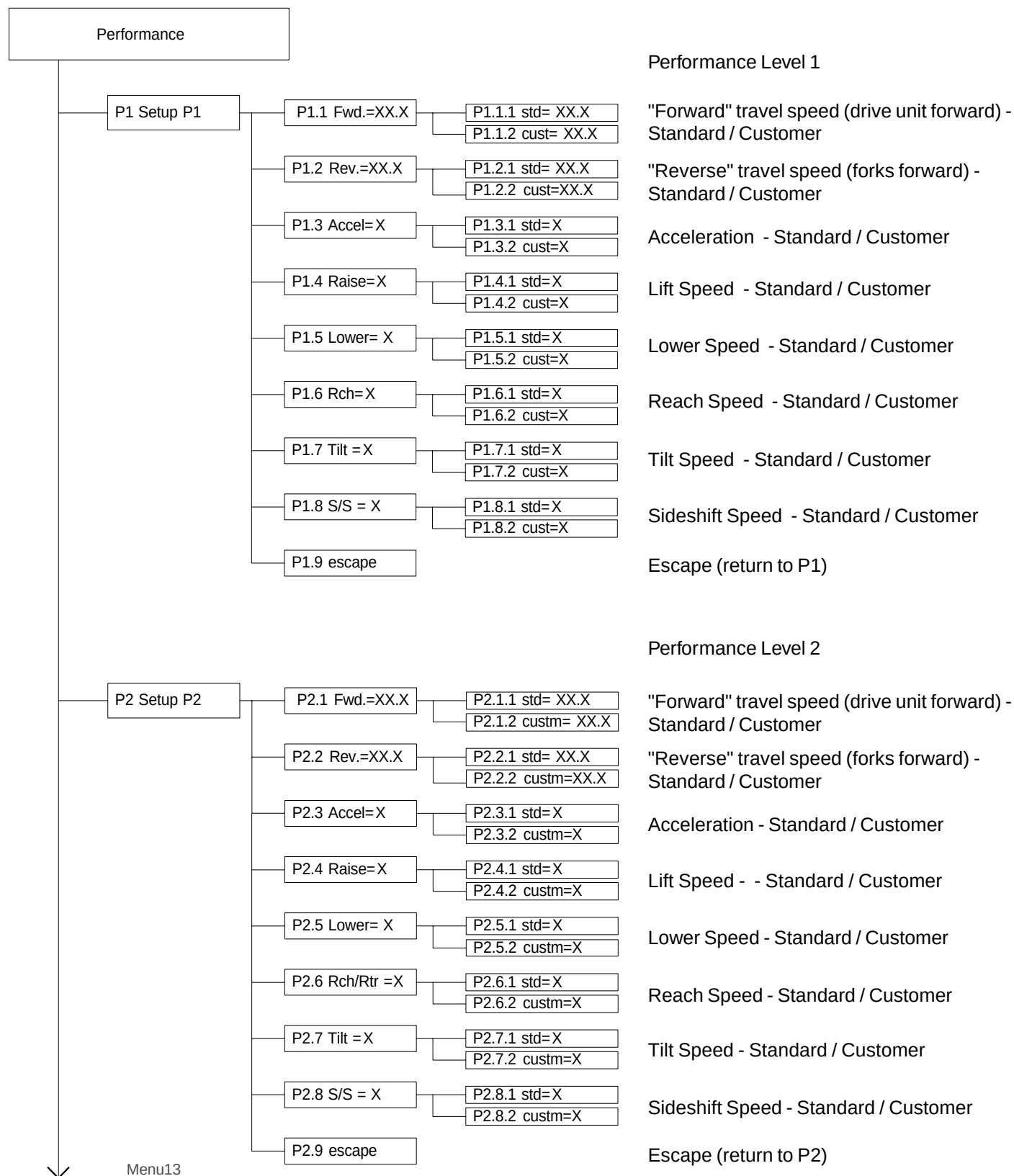


Menu12

PERFORMANCE Menu

Menu for setting truck performance features such as speeds, acceleration and braking patterns. This menu is only available in service level 2.

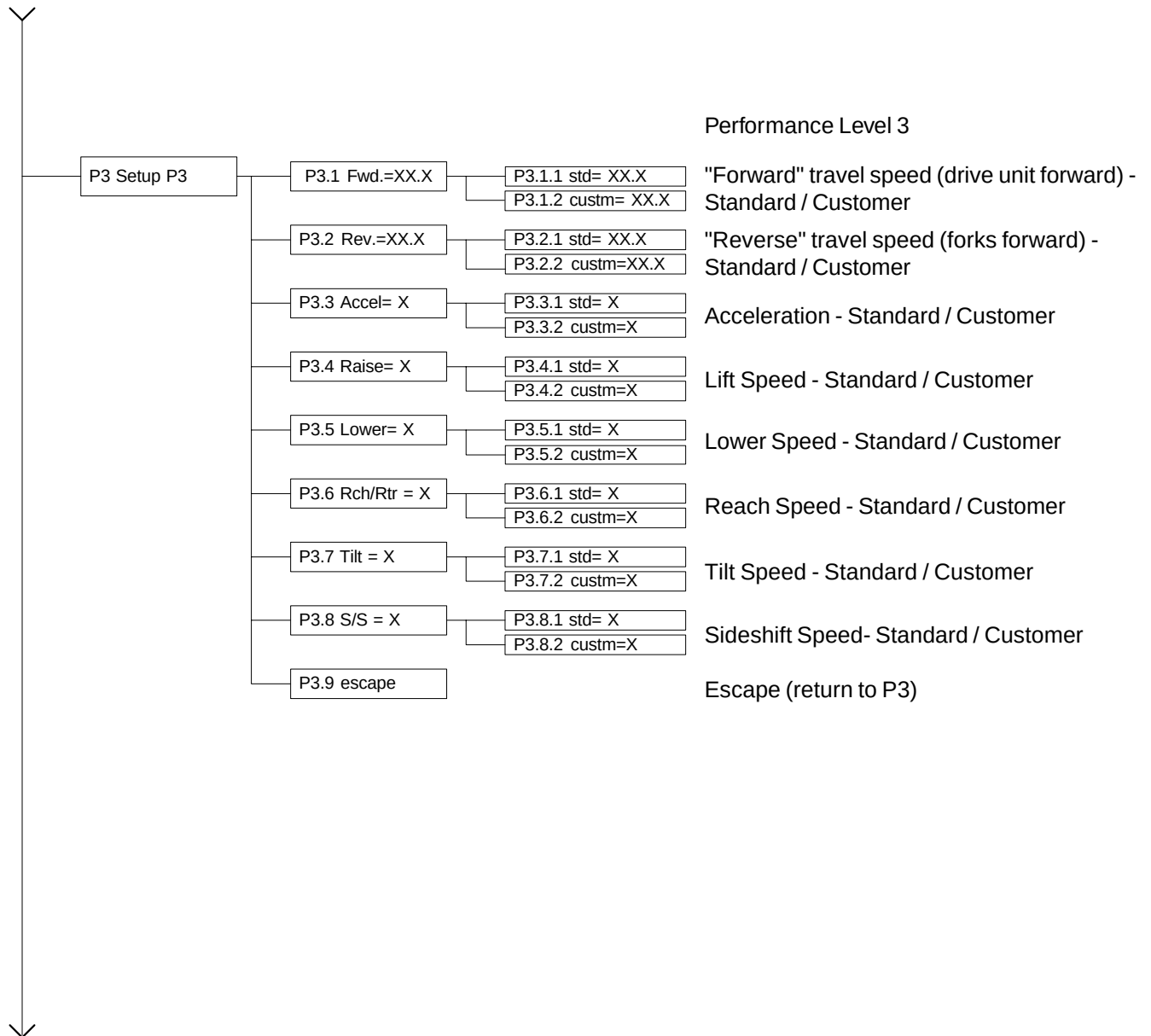
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Menu13

PERFORMANCE Menu (Contd.)

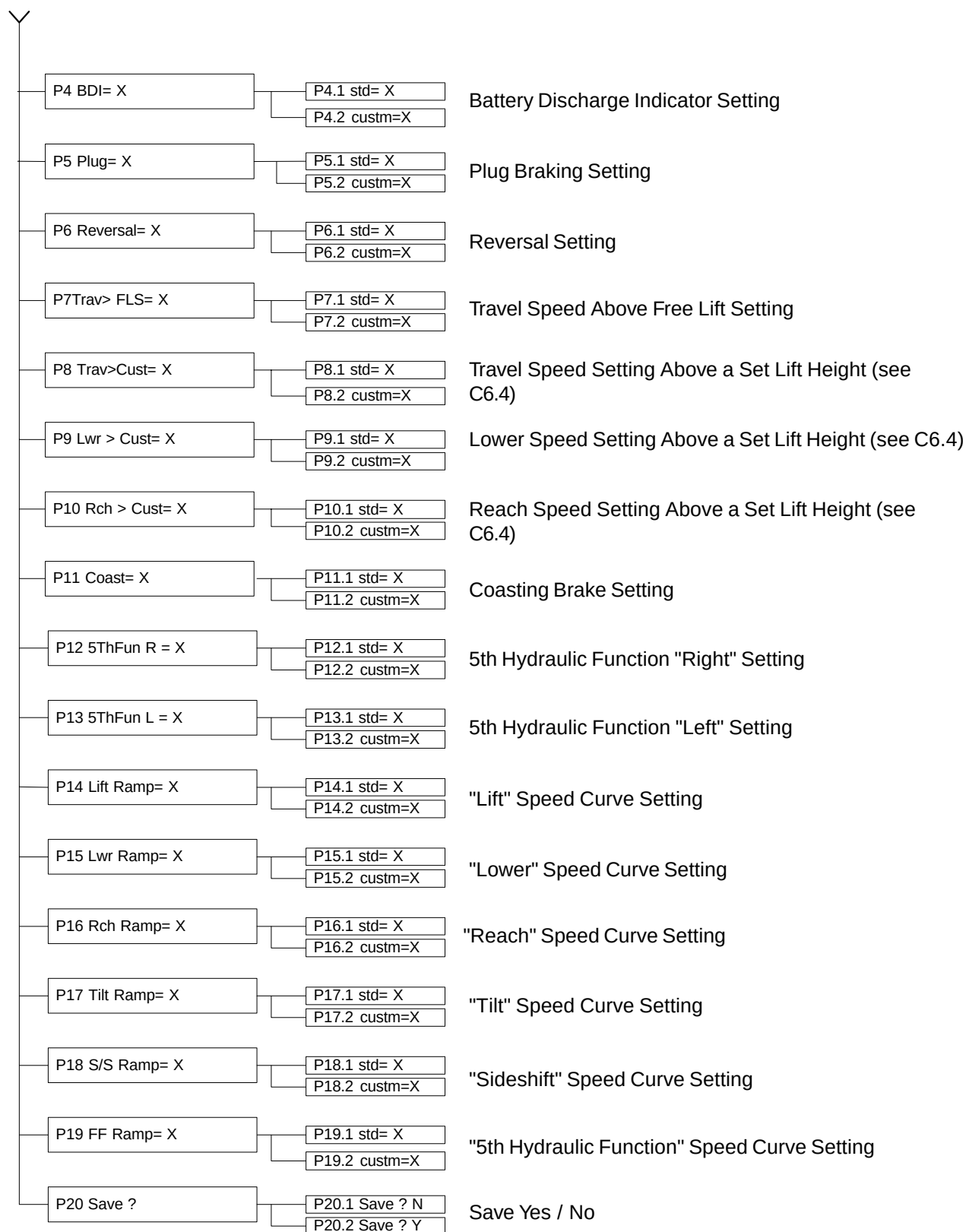
To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Menu14

PERFORMANCE Menu (contd.)

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Access to PERFORMANCE Menu

Power up the truck while pressing the  key. After inputting the service code select the PERFORMANCE menu and confirm with ENTER. P1 SETUP P1 is displayed.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .

The first menu level shows the various truck functions (speed, acceleration, braking) which can be set.

NOTE



Before amending any PERFORMANCE menu settings the truck must be configured in the FEATURES menu. Some PERFORMANCE menu items will be activated or deactivated, depending on the FEATURES settings.

P1, P2, P3

P1, P2, P3 refer to three different performance levels with different truck behaviour in terms of speed, acceleration and braking (P1 = fast, P2 = medium, P3 = slow). Either fixed standard values or customised, user-specific values can be selected to set performance levels.

Depending on the configuration, these performance levels can be either freely accessible to the operator or else restricted (see F13). For restricted access (F13.1 = A) additional user codes in F14 can be defined and which are allocated a specific performance level. The truck handles in a way which is suited to the driver's competence and experience.

The standard settings for performance levels P1, P2 and P3 are as follows:

- P1: Fastest performance level.
- P2: As for P1, but with limited travel speed.
- P3: As for P2, but with limited acceleration.

P1 SETUP P1

To view or change the current setting press ENTER, or scroll to P2 using the .

P1.1 Fwd. = _

Displays the current setting for maximum forward travel speed (drive unit first) for performance level 1.

To change the setting press ENTER, or scroll to P1.2 using the .

P1.1.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.1.2 using the .

P1.1.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.1.

P1.2 Rev. = _

Displays the current setting for maximum reverse travel speed (forks first) for performance level 1.

To change the setting press ENTER, or scroll to P1.3 using the .

P1.2.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.2.2 using the .

1.2.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.2.

P1.3 Accel = _

Displays the current acceleration for performance level 1, i.e. the time taken for the truck to travel from zero to max. speed.

A reading of 1 represents the minimum, 9 the maximum acceleration. To change the setting press ENTER or scroll to P1.4 with the  key.

P1.3.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.3.2 using the  key.

P1.3.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.3.

P1.4 Raise = _

Displays the current setting for the maximum lift speed in performance level 1. To change the setting press ENTER, or scroll to P1.5 with the  key.

P1.4.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.4.2 using the  key.

P1.4.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.4.

P1.5 Lower = _

Displays the current setting for the maximum lower speed in performance level 1. To change the setting press ENTER, or scroll to P1.6 with the  key.

P1.5.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.5.2 using the  key.

P1.5.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.5.

P1.6 Rch/Rtr = _

Displays the current setting for the maximum reach speed in performance level 1. To change the setting press ENTER, or scroll to P1.7 with the  key.

P1.6.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.6.2 using the  key.

P1.6.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.6.

P1.7 Tilt = _

Displays the current setting for the maximum tilt speed in performance level 1. To change the setting press ENTER, or scroll to P1.8 with the  key.

P1.7.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.7.2 using the  key.

P1.7.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.7.

P1.8 S/S = _

Displays the current setting for the maximum sideshift speed in performance level 1. To change the setting press ENTER, or scroll to P1.9 with the  key.

P1.8.1 Std = _

Displays the standard setting for performance level 1. To select the standard setting press ENTER, or scroll to P1.8.2 using the  key.

P1.8.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P1.8.

P1.9 Escape

Press ENTER to quit the menu. The display returns to P1.

P2 SETUP P2

Press ENTER to view or change the current setting, or scroll to P3 with the  key.

P2.1 Fwd. = _

Displays the current setting for the maximum forward travel speed (drive unit first) for performance level 2.

Press ENTER to change the current setting, or scroll to P2.2 with the  key.

P2.1.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.1.2 using the  key.

P2.1.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.1.

P2.2 Rev. = _

Displays the current setting for the maximum "Reverse" speed (forks first) in performance level 2.

To change the setting press ENTER, or scroll to P2.3 with the  key.

P2.2.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.2.2 using the  key.

P2.2.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.2.

P2.3 Accel = _

Displays the current acceleration for performance level 2, i.e. the time taken for the truck to travel from zero to max. speed.

A reading of 1 represents the minimum, 9 the maximum acceleration. Press ENTER to change the current setting, or scroll to P2.4 with the  key.

P2.3.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.3.2 using the  key.

P2.3.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.3.

P2.4 Raise = _

Displays the current setting for the maximum lift speed in performance level 2. Press ENTER to change the current setting, or scroll to P2.5 with the  key.

P2.4.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.4.2 using the  key.

P2.4.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.4.

P2.5 Lower = _

Displays the current setting for the maximum lower speed in performance level 2. Press ENTER to change the current setting, or scroll to P2.6 with the  key.

P2.5.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.5.2 using the  key.

P2.5.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.5.

P2.6 Rch/Rtr = _

Displays the current setting for the maximum reach speed in performance level 2. Press ENTER to change the current setting, or scroll to P2.7 with the  key.

P2.6.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.6.2 using the  key.

P2.6.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.6.

P2.7 Tilt = _

Displays the current setting for the maximum tilt speed in performance level 2. Press ENTER to change the current setting, or scroll to P2.8 with the  key.

P2.7.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.7.2 using the  key.

P2.7.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.7.

P2.8 S/S = _

Displays the current setting for the maximum sideshift speed in performance level 2. Press ENTER to change the current setting, or scroll to P2.9 with the  key.

P2.8.1 Std = _

Displays the standard setting for performance level 2. To select the standard setting press ENTER, or scroll to P2.8.2 using the  key.

P2.8.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P2.8.

P2.9 Escape

Press ENTER to quit the menu. The display returns to P2.

P3 SETUP P3

Press ENTER to view or change the setting, or scroll to P4 with the  key.

P3.1 Fwd. = _

Displays the current setting for the maximum forward travel (drive unit first) in performance level 3.

To change the setting press ENTER, or scroll to P3.2 with the  key.

P3.1.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.1.2 using the  key.

P3.1.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.1.

P3.2 Rev. = _

Displays the current setting for the maximum reverse travel (forks first) in performance level 3.

To change the setting press ENTER, or scroll to P3.3 with the  key.

P3.2.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.2.2 using the  key.

P3.2.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.2.

P3.3 Accel = _

Displays the current acceleration for performance level 3, i.e. the time taken for the truck to travel from zero to maximum speed.

A reading of 1 represents the minimum, 9 the maximum acceleration. Press ENTER to change the setting, or scroll to P3.4 with the  key.

P3.3.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.3.2 using the  key.

P3.3.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.3.

P3.4 Raise = _

Displays the current setting for the maximum lift speed in performance level 3. Press ENTER to change the current setting, or scroll to P3.5 with the  key.

P3.4.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.4.2 using the  key.

P3.4.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.4.

P3.5 Lower = _

Displays the current setting for the maximum lower speed in performance level 3. Press ENTER to change the current setting, or scroll to P3.6 with the  key.

P3.5.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.5.2 using the  key.

P3.5.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.5.

P3.6 Rch/Rtr = _

Displays the current setting for the maximum reach speed in performance level 3. Press ENTER to change the current setting, or scroll to P3.7 with the  key.

P3.6.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.6.2 using the  key.

P3.6.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.6.

P3.7 Tilt = _

Displays the current setting for the maximum tilt speed in performance level 3. Press ENTER to change the current setting, or scroll to P3.8 with the  key.

P3.7.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.7.2 using the  key.

P3.7.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.7.

P3.8 S/S = _

Displays the current setting for the maximum sideshift speed in performance level 3. Press ENTER to change the current setting, or scroll to P3.9 with the  key.

P3.8.1 Std = _

Displays the standard setting for performance level 3. To select the standard setting press ENTER, or scroll to P3.8.2 using the  key.

P3.8.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P3.8.

P3.9 Escape

Press ENTER to quit the menu. The display returns to P3.

P4 BDI = _

Displays the current setting for the battery discharge indicator.

The setting for this parameter changes the reference values for the battery discharge indicator. A low setting will result in a deeper battery discharge, which in turn causes the lift cutout to be activated at a later stage.

Settings can vary from 1 to 9. 1 represents a residual voltage of approx. 1.90 volts per battery cell and 9 for approx. 1.98 / battery cell.

To change the setting press ENTER, or scroll to P5 with the  key.

P4.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P4.2 using the  key.

P4.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P4.

P5 PLUG = _

Displays the current plug braking setting.

The setting for this parameter affects the plug braking pattern (reversing the travel switch).

The settings vary from 1 to 9, with 1 representing the minimum braking force (long braking distance) and 9 the maximum braking force (short braking distance).

To change the setting press ENTER, or scroll to P6 with the  key.

P5.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P5.2 using the  key.

P5.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P5.

P6 REVERSAL = _

Displays the reversal setting during plug braking.

The setting for this parameter affects the travel direction reversal delay for plugging, i.e. the time taken from coasting in the original travel direction to starting in the opposite direction.

The settings vary from 1 to 9, with 1 representing the minimum delay and 9 the maximum delay.

To change the setting press ENTER, or scroll to P7 with the  key.

P6.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P6.2 using the  key.

P6.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P6.

P7 TRAV > FLS = _

Displays the current setting for the maximum speed above the free lift.

This parameter allows trucks with the free lift switch FLS to restrict the maximum travel speed when the fork carriage is above the free lift.

To change the setting press ENTER, or scroll to P8 with the  key.

P7.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P7.2 using the  key.

P7.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P7.

P8 TRAV > CUST = _

Displays the current setting for the maximum speed above a programmed, customised lift height.

This parameter allows trucks with a height encoder ECR2 to restrict the maximum speed when the fork carriage is above a user-defined lift height (above the free lift). This lift height must first be programmed in C6.4.

To change the setting press ENTER, or scroll to P9 with the  key.

P8.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P8.2 using the  key.

P8.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P8.

P9 LWR > CUST = _

Displays the current setting for the maximum lower speed above a programmed, customised lift height.

This parameter allows trucks with a height encoder ECR2 to restrict the maximum lower speed when the fork carriage is above a user-defined lift height (above the free lift). This lift height must first be programmed in C6.4.

To change the setting press ENTER, or scroll to P10 with the  key.

P9.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P9.2 using the  key.

P9.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P9.

P10 RCH > CUST = _

Displays the current setting for the maximum reach speed above a programmed, customised lift height.

This parameter allows trucks with a height encoder ECR2 to restrict the maximum reach speed when the fork carriage is above a user-defined lift height (above the free lift). This lift height must first be programmed in C6.4.

To change the setting press ENTER, or scroll to P11 with the  key.

P10.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P10.2 using the  key.

P10.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P8.

P11 COAST = _

Displays the current setting for coast braking.

The setting for this parameter affects the braking pattern for coasting (accelerator pedal returns to neutral).

The settings vary from 1 to 9, with 1 representing the minimum brake force (long braking distance) and 9 the maximum brake force (short braking distance).

To change the setting press ENTER, or scroll to P12 with the  key.

P11.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P11.2 using the  key.

P11.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P11.

P12 5TH FUN R = _

Displays the current setting for the maximum speed of the "Right" 5th hydraulic function. To change the setting press ENTER, or scroll to P13 with the  key.

P12.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P12.2 using the  key.

P12.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P12.

P13 5TH FUN L = _

Displays the current setting for the maximum speed of the "Left" 5th hydraulic function. To change the setting press ENTER, or scroll to P14 with the  key.

P13.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P13.2 using the  key.

P13.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P13.

P14 LIFT RAMP = _

Displays the current setting for the lift function acceleration curve.

The setting of this parameter affects the response time of the solenoid PVH when the lift function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P15 with the  key.

P14.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P14.2 using the  key.

P14.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P14.

P15 LWR RAMP = _

Displays the current setting for the lower function acceleration curve.

The setting of this parameter affects the response time of the solenoid PVH when the lower function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P16 with the  key.

P15.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P15.2 using the  key.

P15.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P15.

P16 RCH RAMP = _

Displays the current setting for the reach function acceleration curve.

The setting of this parameter affects the response time of the solenoid PVA when the reach function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P17 with the  key.

P16.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P16.2 using the  key.

P16.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P16.

P17 TILT RAMP = _

Displays the current setting for the tilt function acceleration curve.

The setting of this parameter affects the response time of the solenoid PVA when the tilt function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P18 with the  key.

P17.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P17.2 using the  key.

P17.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P17.

P18 S/S RAMP = _

Displays the current setting for the sideshift acceleration curve.

The setting of this parameter affects the response time of the solenoid PVA when the sideshift function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P19 with the  key.

P18.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P18.2 using the  key.

P18.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P18.

P19 FF RAMP = _

Displays the current setting for acceleration curve of the 5th hydraulic function.

The setting of this parameter affects the response time of the solenoid PVA when the 5th hydraulic function is operated. The settings vary from 1 to 9, with 1 representing the minimum and 9 the maximum response time.

To change the setting press ENTER, or scroll to P20 with the  key.

P19.1 Std = _

Displays the standard setting. To select the standard setting press ENTER, or scroll to P19.2 using the  key.

P19.2 Custm = _

To change the setting first press ENTER. Then use the arrow keys  and  to select the required value and confirm with ENTER. The display returns to P19.

P20 SAVE ?

The previous settings can be either stored or cancelled. Pressing ENTER changes to the display to C20.1.

C20.1 Save ? N

Press ENTER to cancel the previous settings and keep the original setup. The display returns to the initial menu.

Scroll to C20.2 using the  key.

P20.2 Save ? Y

Press ENTER to save any settings made.

NOTE

In order not to delete the calibration values, do not operate any truck controls or display keys during this process.

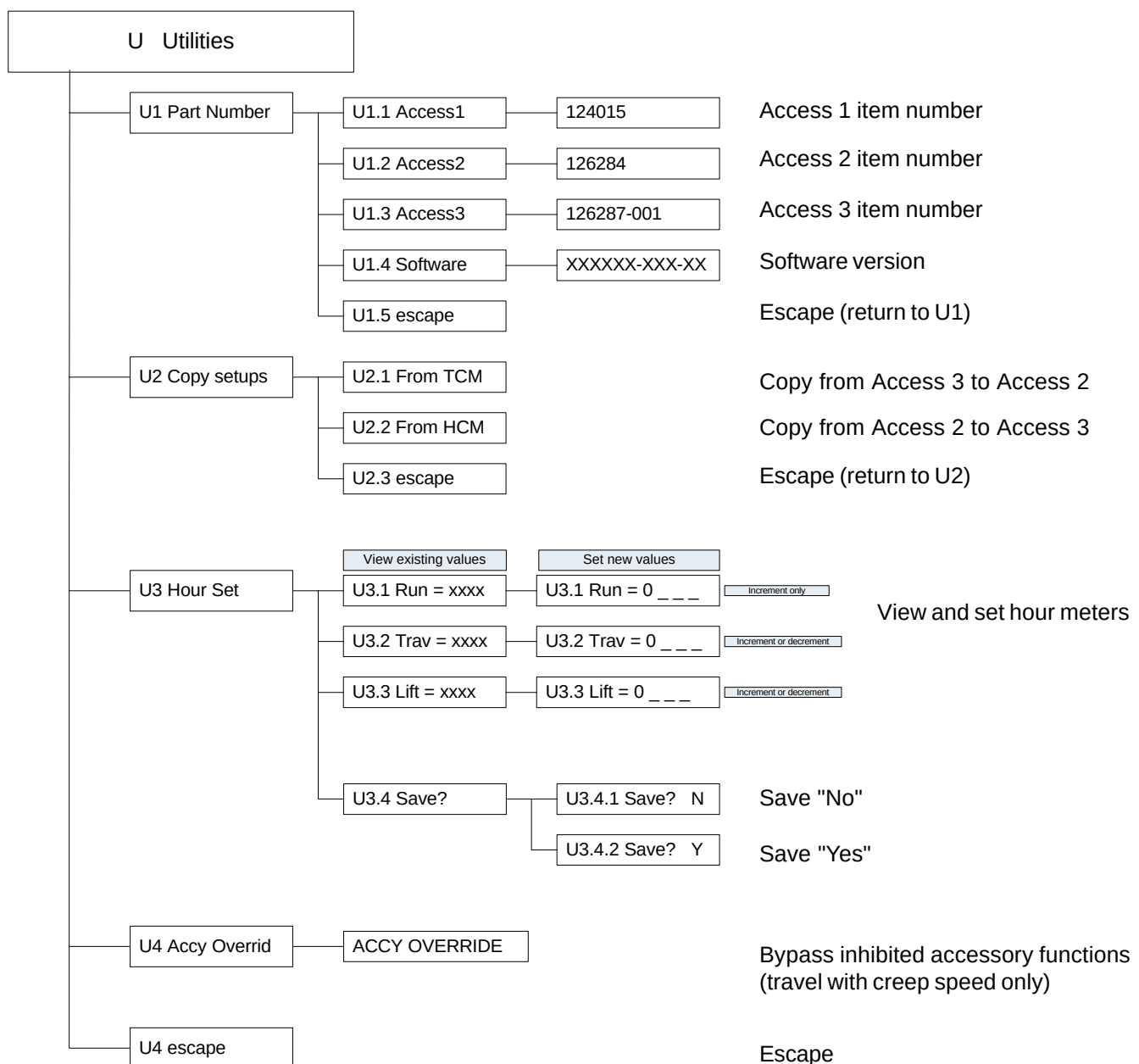
After storing, the display returns to the initial menu.

UTILITIES Menu

This menu is available on service levels 2 and 3.

- U1 shows the item numbers of the Access modules and the number of the installed software version.
- U2 enables truck configuration parameters to be transferred from one module to another.
- U3 enables the hydraulic accessory functions to be operated if they are inhibited by an error code. When this function is activated the truck can travel only at creep speed, regardless of whether there is an error code or not.

To move left and right in the menu use ENTER, to scroll up and down use the arrow keys  and .



Drive Motor

Access

- Disconnect battery.
- Prevent truck from rolling away.



M1699

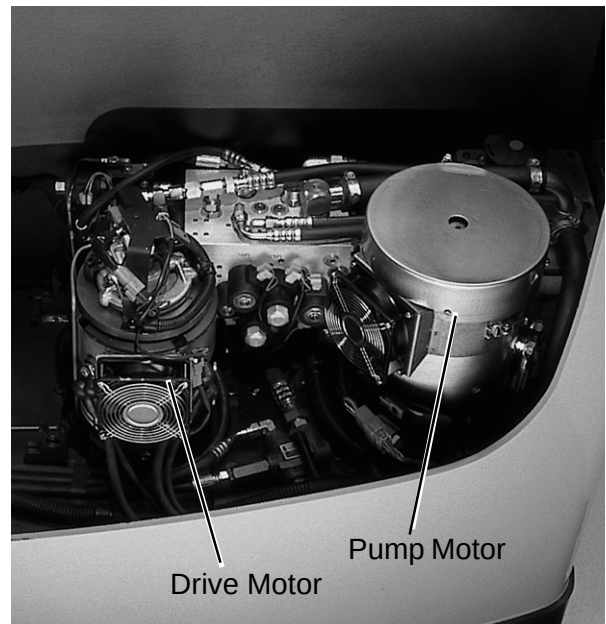
- Lift the seat.
- Disconnect motor-fan and remove it.

Maintenance

- Blast off the dust in the motor with dry air.
- Remove all of the 8 carbon brushes and check for wear. If you need to change one ore more brushes, replace all brushes at the same time. It is recommended to change the brush-springs every time you change the brushes.

New brush: 33,1 mm
 Replacement length (worn) 16 mm
 Spring tension, new brush 1.360 g
 Spring tension, worn brush 900 g

- All brushes should be under the same pressure and moove free in the brush holder.
- Check commutator for wear and damage. An equally distributed film where the brushes are in contact with the commutator is normal. Measure the minimum commutator diameter:



M1625

Diameter new commutator: 85,3 mm
 Min. diameter for reslotting: 82,3 mm
 Worn at: 81,0 mm

According to the result leave the commutator as is, reslot or change.

- Reassembly: Mount the motor cover with the fan. Do not forget to reconnect the fan!

Pump Motor

Access

- Disconnect battery.
- Prevent truck from rolling away.
- Lift the seat.
- Disconnect motor-fan and remove it.

Maintenance

- Blast off the dust in the motor with dry air.
- Remove all of the 8 carbon brushes and check for wear. If you need to change one ore more brushes, replace all brushes at the same time. It is recommended to change the brush-springs every time you change the brushes.

New brush: 32 mm
 Replacement length (worn) 16 mm
 Spring tension, new brush: 570 g

- All brushes should be under the same pressure and moove free in the brush holder.

- Check commutator for wear and damage. An equally distributed film where the brushes are in contact with the commutator is normal. Measure the minimum commutator diameter:

Diameter new commutator: 82 mm

Min. reslotted diameter 78 mm

Replace at diameter: 76 mm

According to the result leave the commutator as is, reslot or change.

- Reassembly: Mount the motor cover with the fan. Do not forget to reconnect the fan!

Emergency Disconnect Contactor

CAUTION



Always disconnect the battery, jack up the truck and secure it with wooden wedges before performing any maintenance or repair work. The drive wheel must not touch the ground.

Contactor Tips

- The contactor tips may fade and become uneven during normal operation. However, this does not affect the operation of the truck and cleaning is not required.
- The contactor tips must be replaced before the contact layer is fully worn.
- Always replace contactor tips in sets.

Contactor Coil Control

- Disconnect the wires.
- Measure the through resistance (approx. 140 Ohm). If a different reading is obtained, replace the contactor coil.

Replacing the Contactor Tips / Coil

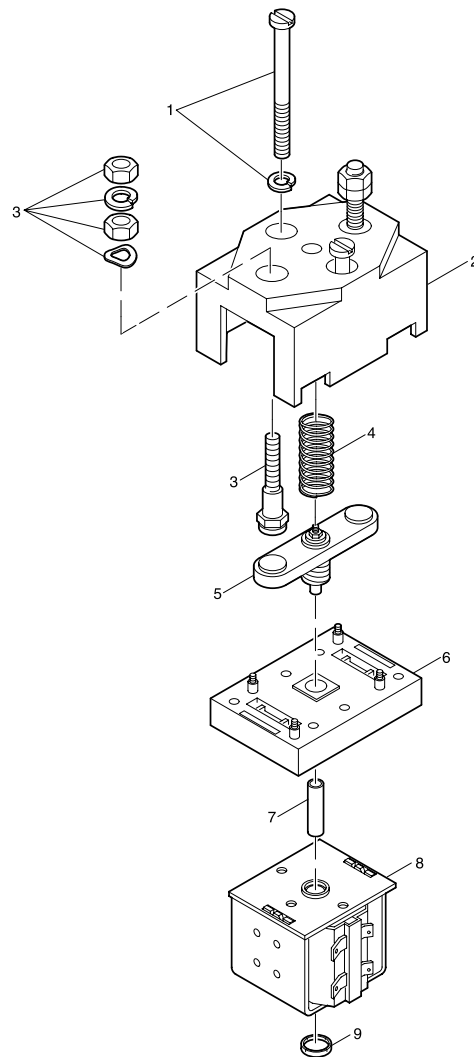
See Fig. M0158. Refer to the Spare Parts Manual, page 4.1-2140-001, for the layout and attachment of the ED contactors in the truck.

Replacing the Contactor Tips

1. Disconnect the wires from the contactor tips.
2. Unscrew the two mounting screws (item 1) and the housing lid (item 2).
3. Disassemble the contact assembly and replace the contactor tips.
4. Re-assemble the contactor assembly, the housing cover (item 2) and fix it with two screws (item 1).
5. Re-connect the wires.

Replacing the Contactor Coil

1. Disconnect all the wires from the ED contactor.
2. Disassemble the contactor housing.
3. Unscrew the two mounting screws (item 1) and remove the housing lid (item 2). Disassemble the contact assembly and re-assemble it with the new coil.
4. Fit the housing lid (item 2) and fix it with two screws (item 1).
5. Re-connect the wires.



M0158

Battery Maintenance

The battery can only be maintained in accordance with the battery manufacturer's instructions.

Charging the Battery

- Remove the ignition key before adding or removing the battery connector.
- Follow the instructions of the battery and charger manufacturers.

DANGER



Danger of explosion! Hydrogen can escape from lead storage batteries and can explode in the presence of sparks or naked flames.

- Only charge the battery in specially designated areas.
- Make sure that the area is well ventilated.
- Keep the battery lid open while charging.
- Keep naked flames away from the battery and avoid sparks.

Replacing the Battery

DANGER



Risk of accidents! Only use batteries of the specified size, weight and performance on this truck.

The wrong weight and size will alter the truck centre of gravity. This can lead to accidents.

Before replacing the battery:

- Maintain the drive wheel in a straight position and lower the forks.

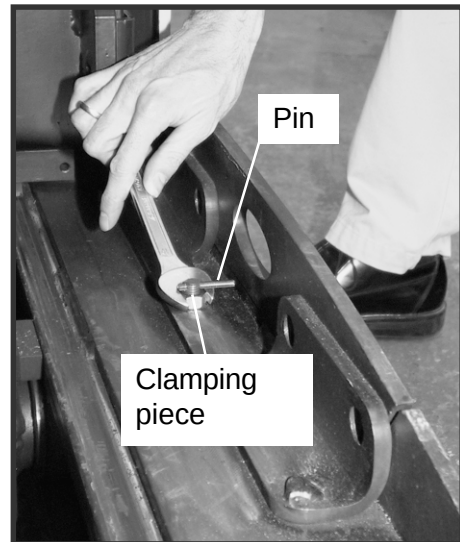
To slide the battery onto a battery trolley, first disassemble the outrigger fin (see Fig. 1 - 3). To do so, the mast must be fully retracted.

- Power down the truck and remove the key.
- Unscrew the lock nut on the clamping piece with a fork wrench (see Fig. 2).
- Turn the clamping piece 90°. The pin faces parallel to the outrigger.

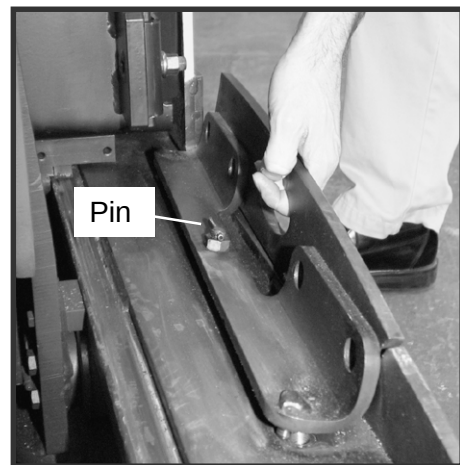
- Lift out the fin (see Fig. 3).
- Power up the truck.



Batt01



Batt02



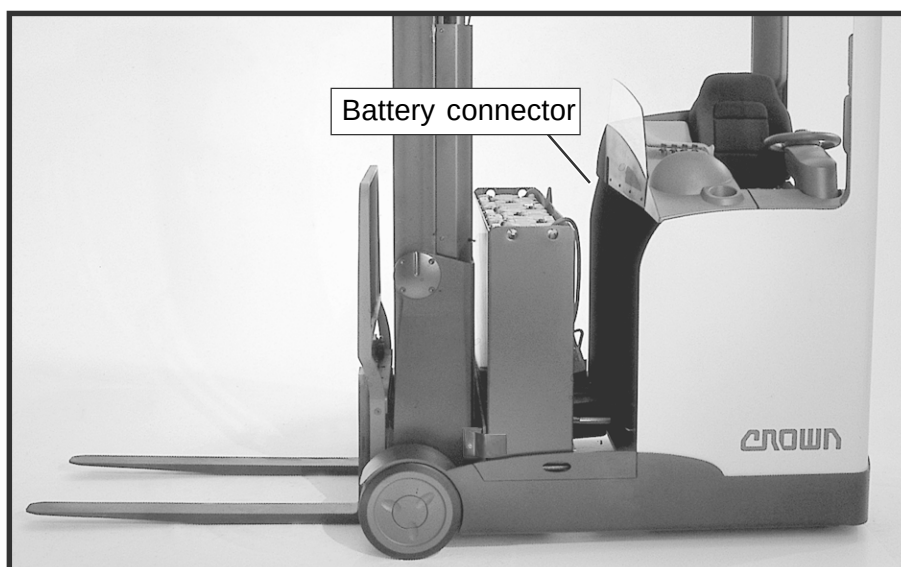
Batt03

Remove the battery in full from its compartment using the "Fwd. Reach" function. Proceed as follows:

- Press down on the battery lever at the front right of the seat (see Fig. 4).
- Operate the "Fwd. Reach" function. The battery moves out of its compartment together with the mast carriage.
- Power down the truck and remove the key.



Batt04



Batt05

- Disconnect the battery (see Fig. 6).
- Place the battery cable on the battery.
- Make sure that all the battery terminals are protected with insulating caps, if necessary insulate accordingly.



Batt06

WARNING

Do not touch or let metal objects fall on top of the battery in order to avoid a short circuit.

The battery compartment is secured with clamps on the left and right-hand sides.

- Release one clamp (see Fig. 7).
- Turn the clamp up (see Fig. 8)
- Lift the battery out of the truck using a crane or suitable lifting equipment.

To replace the battery using a battery trolley see the following section.



Batt07



Batt08

Replacing the Battery with a Battery Trolley

The battery height when installed on the truck is 300 mm (see Fig. 9). The battery trolley should be at the same height.



Batt09

After replacing the battery with the battery trolley:

- Power down the truck and remove the ignition key.
- Fit the outrigger fin (see Fig. 3).
- Turn the clamping piece 90°. The pin faces perpendicularly to the outrigger (see Fig. 2).
- Hold the clamping piece with the pin and tighten the lock nut with a fork wrench.

- Move the trolley up to the truck and prevent it from moving away.
- Push the battery onto the trolley and prevent it from sliding away.
- Fit a new battery. The battery must rest against the rear clamp.
- Re-tighten the front clamp.
- Check that the rear clamp is engaged.
- Connect the battery.
- Fully retract the mast reach. This pushes the battery back into its compartment.
- When it engages the battery tray is separated from the mast carriage.
- Operate the reach function and check that the battery remains in its compartment.

CROWN

BRAKE

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Brake System

The truck is fitted with two brake systems, one brake system applied to the load wheels and the second to the drive motor.

Motor Brake System

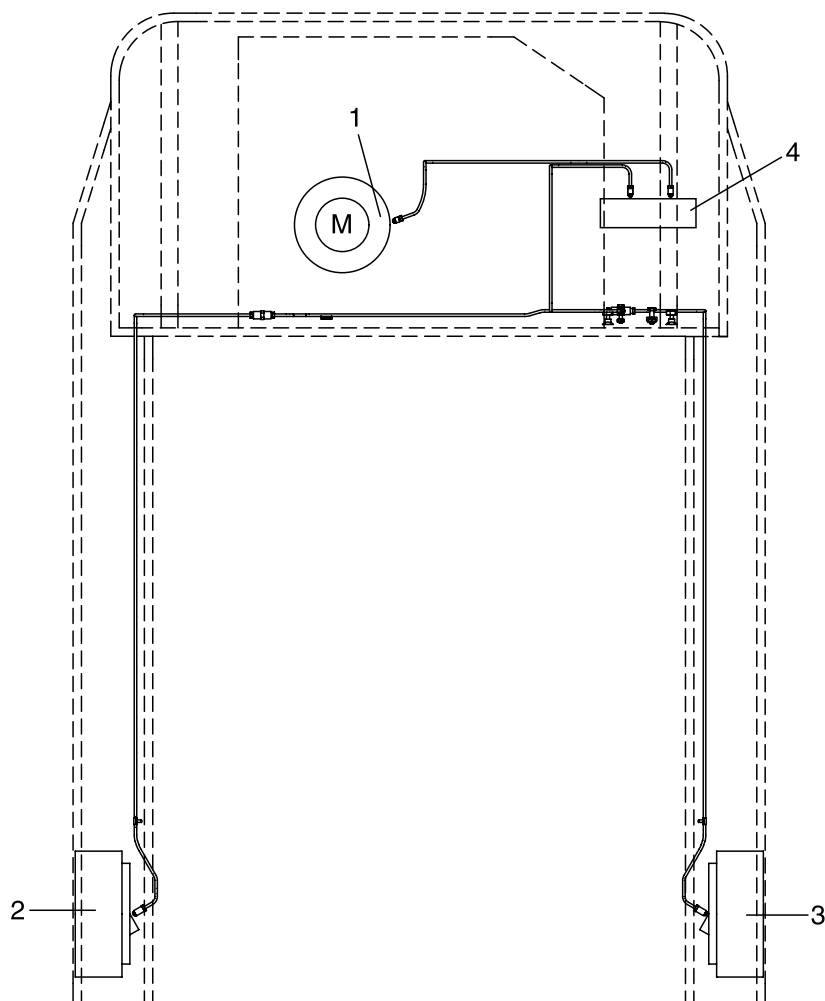
The motor brake is a disk brake, used as an operating and parking brake. It is a single unit together with the drive motor shaft.

Load Wheel Brake System

The load wheel brake system is a drum brake, used as an operating brake. It is applied directly to the load wheels.

Bleeding the Brake System

To bleed the brake system always start with the brake cylinder furthest away from the main brake cylinder (4). First bleed load wheel brake system (2), followed by load wheel brake system (3) and finally the drive motor brake cylinder (1).

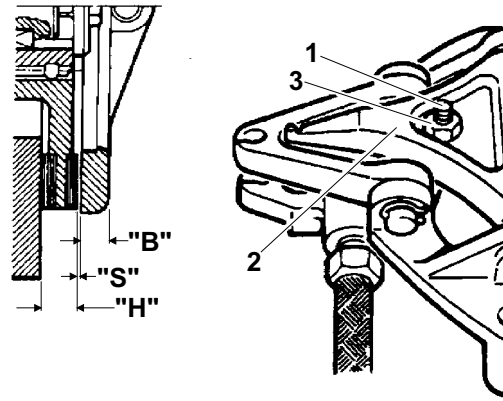


M1689

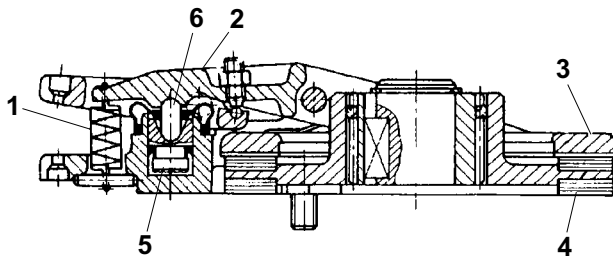
Motor Brake

When the brake is released the tension spring (1) lifts the pressure plate (3) from the brake rotor (4) via the brake lever (2), enabling the truck to travel.

When the operating brake is applied the brake piston (5) is pressurised by the main brake cylinder. This causes the brake piston to press the brake rotor (4) against the drive motor bearing plate via the thrust bolt (6), the brake lever (2) and the pressure plate (3).



M0917



- Loosen the jam nut (3) to adjust the air gap.
- Screw in/out the threaded pin (1) in the brake lever (2).
- After adjustment, tighten the jam nut (3) and check the air gap again. Re-adjust if necessary.

Operating Brake Adjustment

DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Hang the parking brake cable. To do this completely remove the piston rod from the hydraulic cylinder, then turn the brake cable up until the nipple can be suspended from the brake lever.
- Check air gap "S" with a feeler gauge. Adjust if necessary (see Fig. 917).

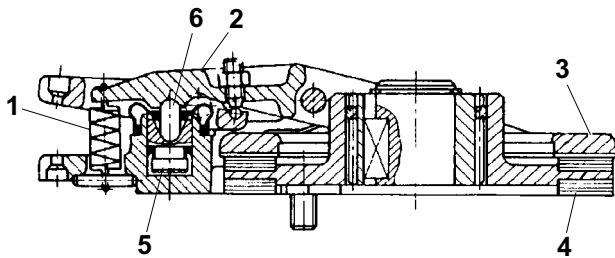
Air gap "S": 0.5 mm

Rotor minimum thickness "H": 7.5 mm

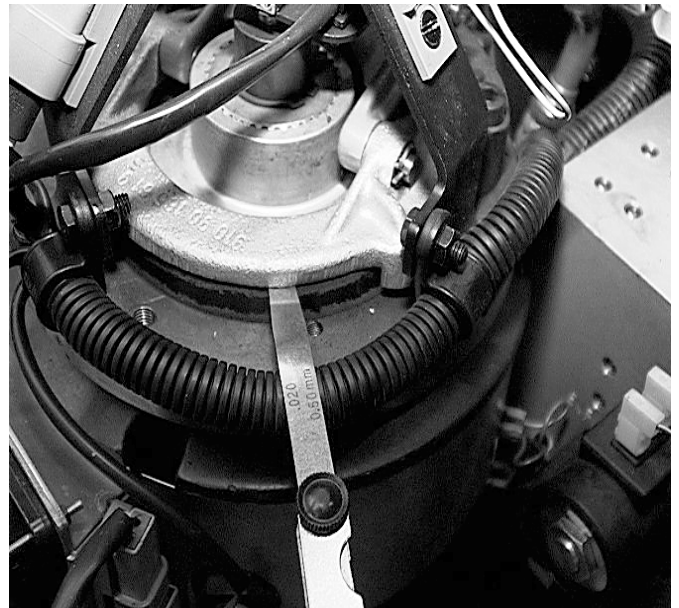
Pressure plate minimum width "B": 6.0 mm

Parking Brake

The parking brake is engaged via a brake cable. The tension applied to the cable via a hydraulic cylinder acts on the brake lever (2) which pushes the brake rotor (4) onto the drive motor bearing plate via the pressure plate (3).



M0916



M1685

Parking Brake Adjustment

DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Using a hex. bolt fully remove the piston rod from the hydraulic cylinder (see Fig. M1687).



Screw to remove the piston rod

M1687

- Insert a 0.5 mm feeler gauge in the brake air gap (see Fig. M1685).
- Screw the brake cable approx. 2 thread turns into the piston rod of the hydraulic cylinder.
- Hang the nipple into the brake lever and screw the brake cable into the piston rod until the nipple in the brake lever is secured in the brake lever support, and the feeler gauge can just be pulled out of the air gap (rated 0.5 mm).
- Fix the brake cable with the jam nut.
- Check the air gap again. If necessary, adjust by screwing the brake cable in or out.
- Remove the hex. bolt to remove the piston rod (see note).

DANGER



The screw to remove the piston rod must be unscrewed to ensure perfect brake operation.

Brake System Bleeding

The brake system must be bled after changing the brake fluid or replacing the brakes.

DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

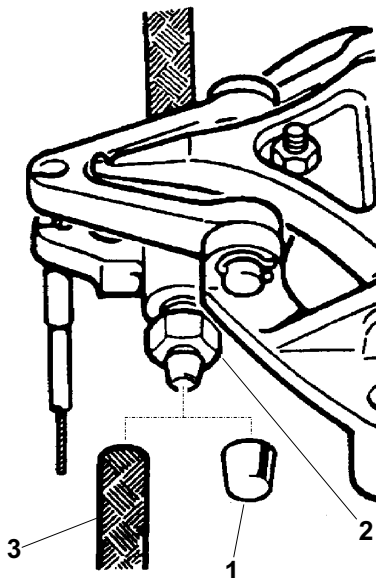
CAUTION



Keep the brake fluid away from the brake components and do not spill it onto the ground or into the drainage system.

Check the brake fluid level in the brake fluid reservoir and refill if necessary.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Remove the cap (1) from the bleed valve (2) (see Fig. M0918).
- Connect the bleed hose (3) onto the valve and use a bowl to collect the brake fluid.
- Apply the brake pedal and unscrew the bleed valve (2) approx. $\frac{1}{2}$ turn to bleed the air.
- When the brake fluid is bubble-free, screw tight the bleed valve (2) and only then release the brake pedal.



M0918

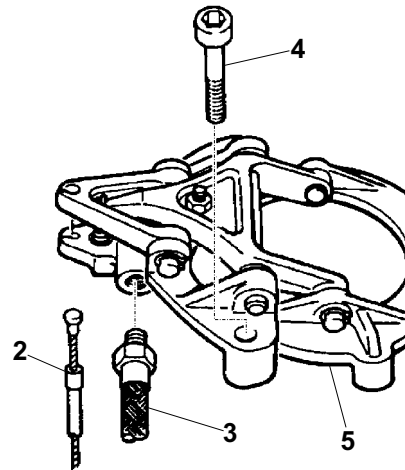
Motor Brake Disassembly

DANGER



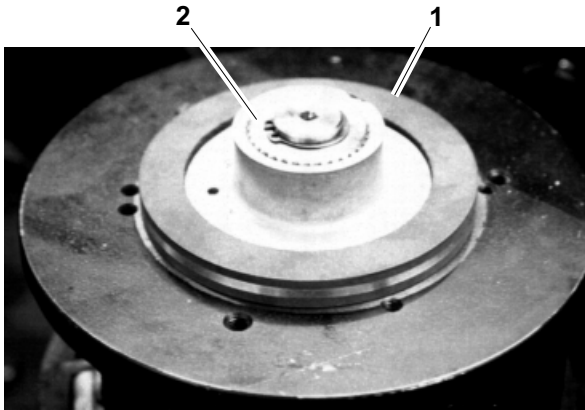
Always secure the truck to prevent it from rolling away when carrying out maintenance.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Hang the parking brake cable. To do this completely remove the piston rod from the hydraulic cylinder (see Fig. M1687, page M5.0-2140-003), then turn the brake cable up out of the piston rod until the nipple can be suspended from the brake lever.
- Disconnect the brake pipe (3). Remove the two screws (4) and remove the brake (5) (see Fig. M0921).



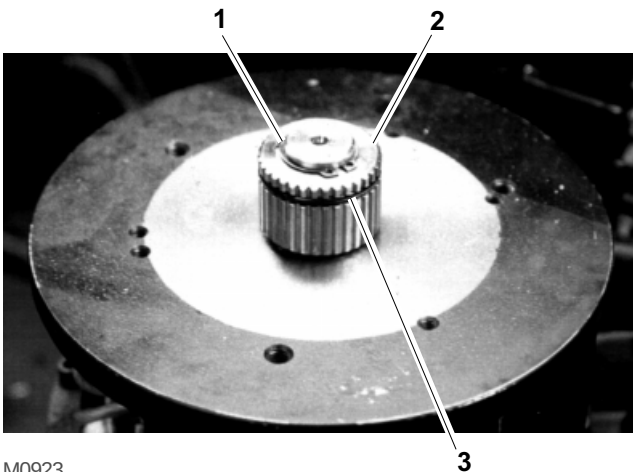
M0921

- Lever out the brake disk (1) using a screw driver and remove it from the motor shaft (2) (see Fig. M0922).



M0922

- Remove the retaining ring (1). Lever up the pinion using a tyre lever and remove it (see Fig. M0923).



M0923

- Replace the O ring (3) if necessary.
- Assembly is the reverse of disassembly.
- After assembling and adjusting the brake, remove the Allen screw to remove the piston rod from the hydraulic cylinder (see note),

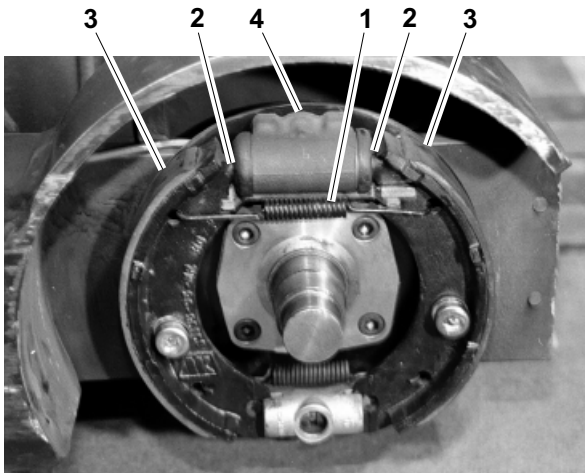
DANGER

The screw to remove the piston rod must be unscrewed to ensure perfect brake operation.

Load Wheel Brake System

When the brake pedal is not applied the tension spring (1) acts on the brake piston (2) and releases the brake pad (3) from the load wheel rim.

When the brake is applied the brake cylinder (4) is pressurised by the brake pedal and main brake cylinder attached to it. The brake piston (2) pushes the brake pads (3) against the load wheel rim in the opposite direction to the spring pressure (see Fig. M0936).



M0936

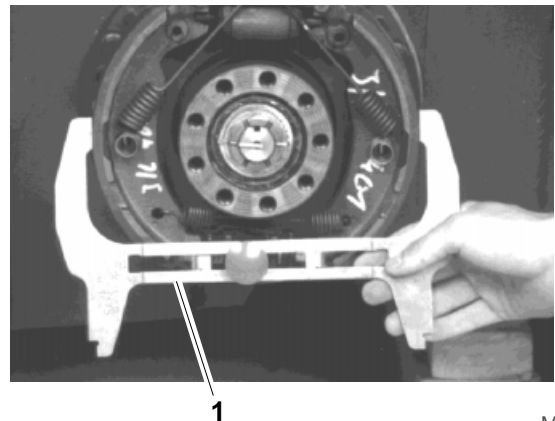


M1686

- Use a gauge to measure the internal diameter of the load wheel rim and the outer diameter of the brake pads. The difference should be approx. 1.0 mm (see Fig. MM0947).

Air gap: 0.5 mm

Min. brake lining thickness: 2.0 mm



M947

Load Wheel Brake Adjustment

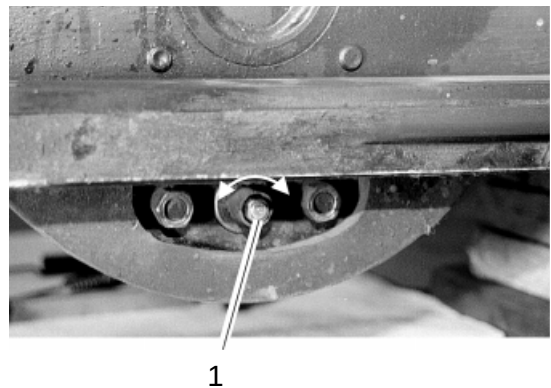
DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Raise the load wheel using a jack and support the outrigger with suitable wooden blocks.
- Remove the wheel cap, disassemble the inside retaining ring and remove the wheel from its hub (see Fig. M1686).

- To adjust the air gap adjust the set screw (1) on the inside of the load wheels (see Fig. M0941).



M941

Brake System Bleeding

The brake system must be bled after changing the brake fluid or replacing the brakes.

DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

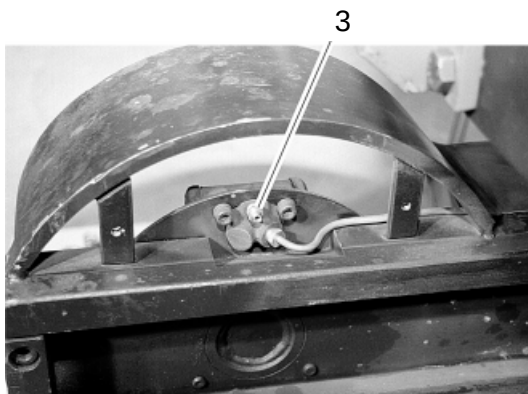
CAUTION



Keep the brake fluid away from the brake components and do not spill it onto the ground or into the drainage system.

Check the brake fluid level in the brake fluid reservoir and refill if necessary.

- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Remove the cap from the bleed valve (3) (see Fig. M0943).
- Connect the bleed hose to the valve and use a bowl to collect the brake fluid.
- Apply the brake pedal and unscrew the bleed valve (3) approx. $\frac{1}{2}$ turn to bleed the air.
- When the brake fluid is bubble-free, screw tight the bleed valve (3) and only then release the brake pedal.
- Remove the bleed hose and fit the cap.



M943

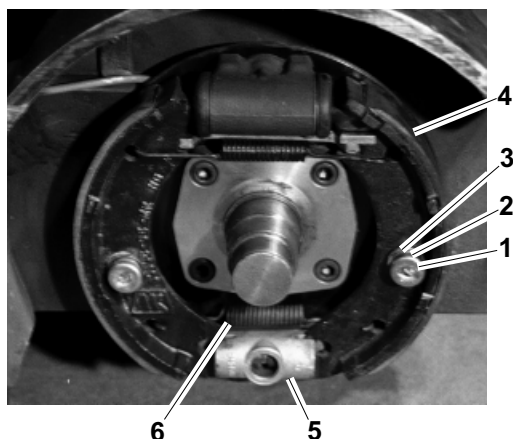
Load Wheel Brake Disassembly

DANGER



Always secure the truck to prevent it from rolling away when carrying out maintenance.

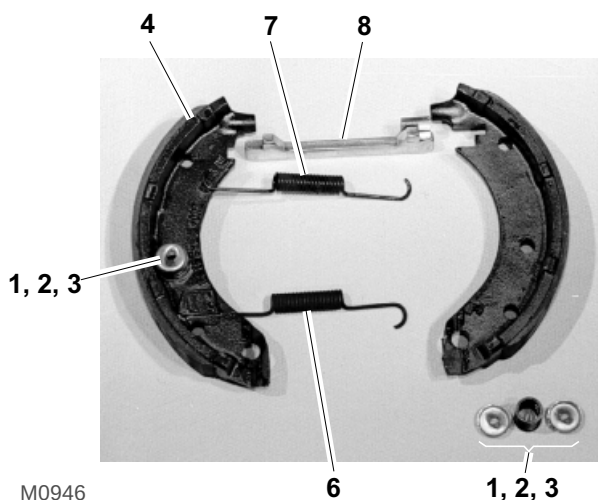
- Power down the truck, disconnect the battery and secure the truck to prevent it from rolling away (see note).
- Disassemble the spring cap (1), spring (2) and rear



M0944

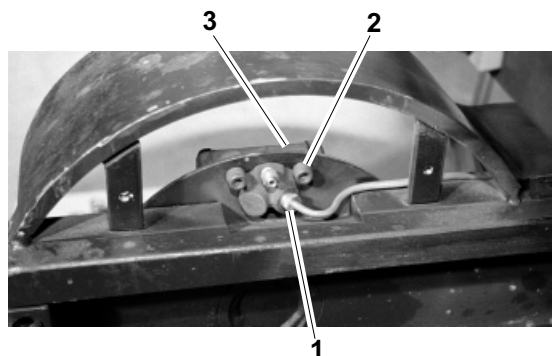
spring cap (3) (see Fig. M0944).

- Using a tyre lever, lever out one brake pad (4) from the adjusting mechanism (5).
- Hang out the lower tension spring (6) from one brake pad and remove the brake (see Fig. M0946).



M0946

- Unscrew the brake pipe (see Fig. M0945).
- Remove the two screws (2) and disassemble the brake cylinder (3).



M0945

- Assembly is the reverse order.

CROWN

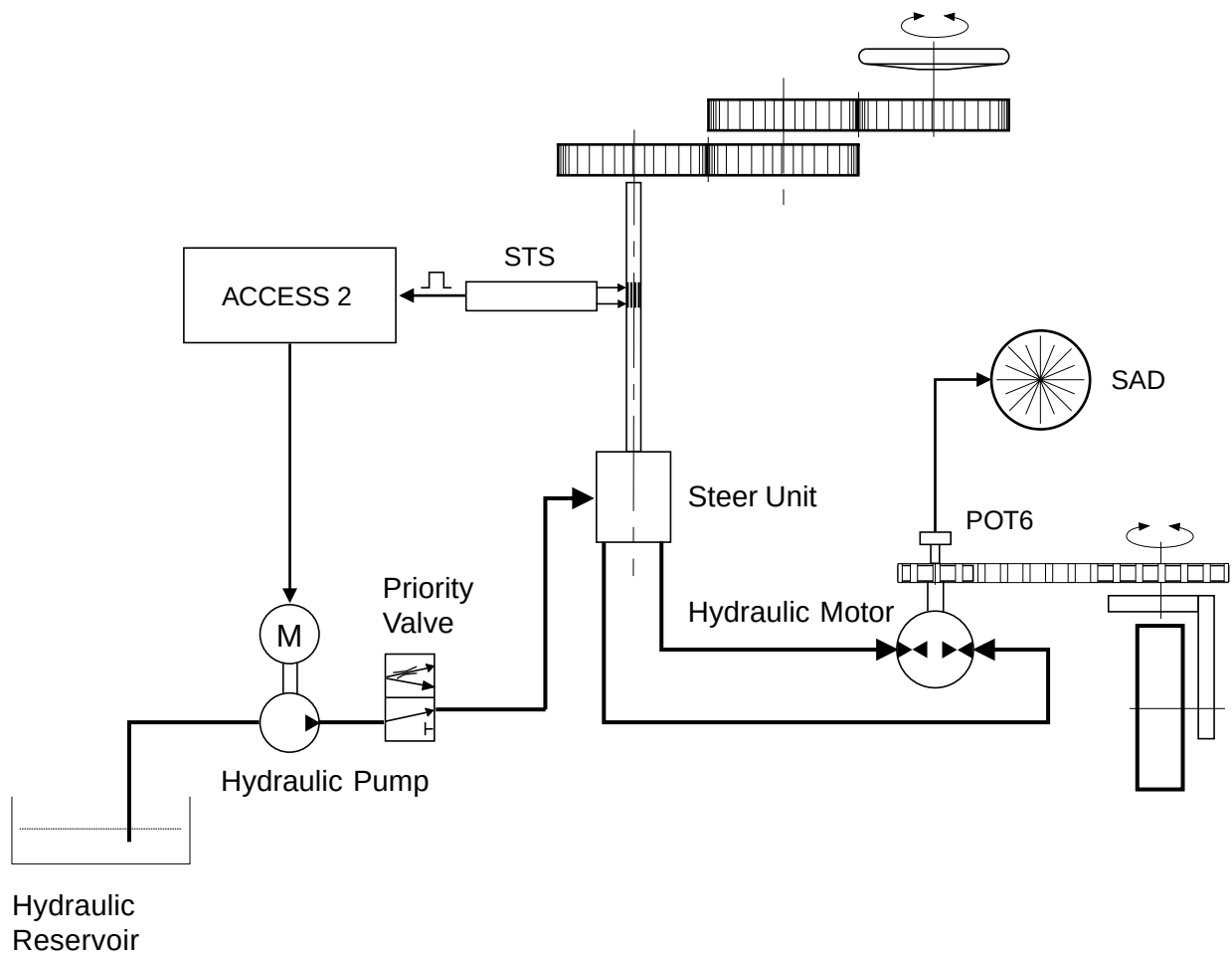
STEERING

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Steering

The truck is fitted with an electrical hydraulic steering system (see Fig. M1108).

- The rotation of the steering column generates an electrical signal at the steering sensor which is transferred to Access 2 via the encoder module STS.
- The pump motor M2 is driven by Access 2. The oil flows from the hydraulic steering unit to the hydraulic motor on the drive unit, which converts the rotary movement to the drive wheel via a chain drive.
- The SAD steer angle display is available as an option. This receives the drive wheel angle data via the potentiometer POT6 attached to the drive unit.



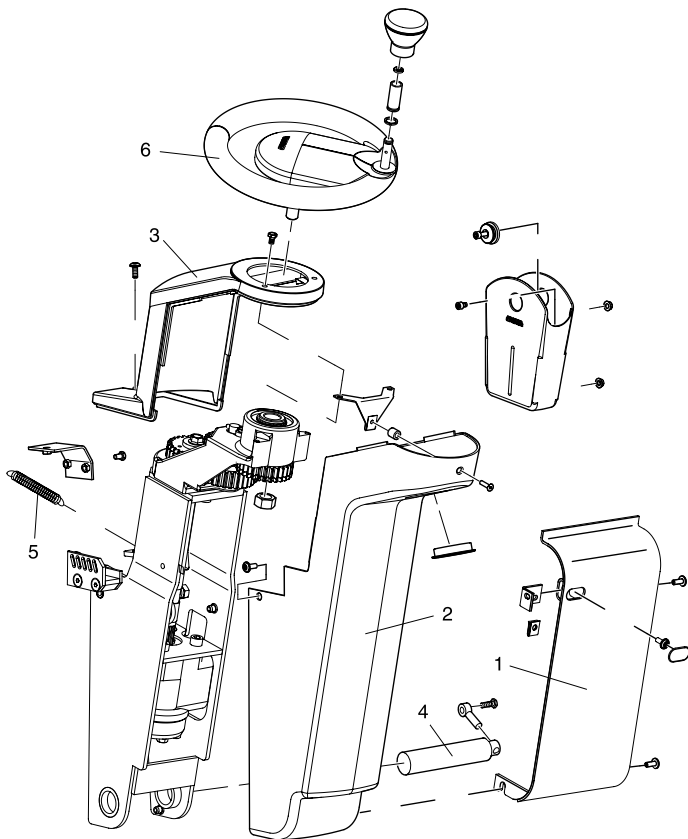
M1108

Steering Unit Disassembly

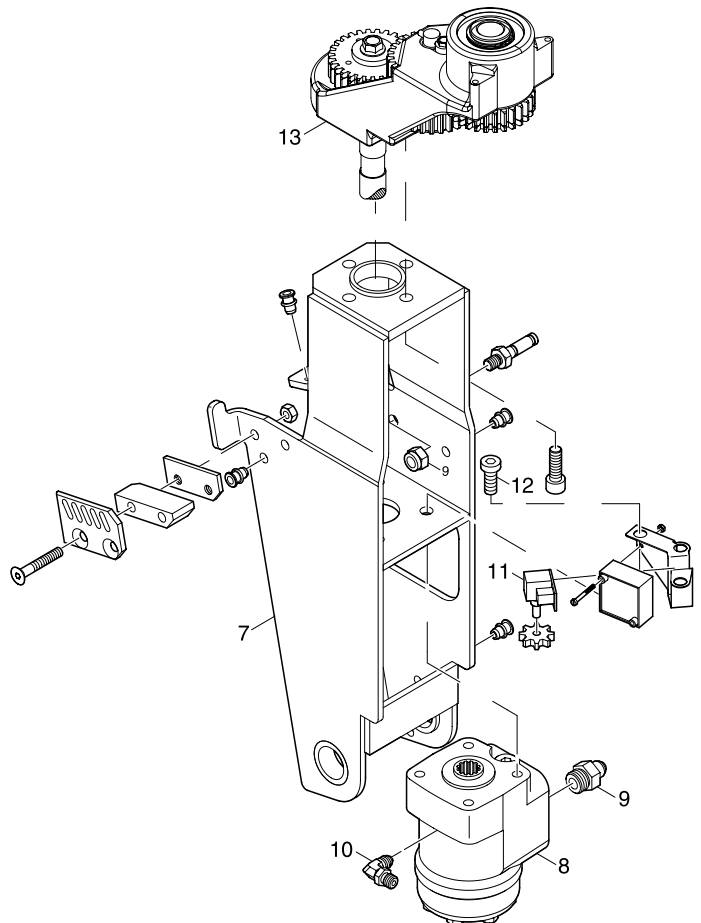
DANGER

Always jack up the truck and support it with suitable wooden blocks when carrying out maintenance work. The drive wheel must not touch the ground.

- Power down the truck, remove the battery connector and jack up the truck (see note).
- Remove the seat, the steering column panels (1 - 3) and the steering wheel (6).
- Use a bowl to collect any spilled hydraulic oil. Remove the hydraulic hoses and the four screw fittings (9) from the steer unit (8) and seal the connections.
- Unhook the two springs (5) and remove the bolt (4) out of its groove to the right.



- Tilt out the steering column (7) and remove the rear hydraulic hose from its screw fitting (10).
- Remove the steering sensor (11) connection.
- Remove the steering column (7) in full, or alternatively just remove the steering unit (8). To do so, remove the four mounting screws (12), disassemble the steering sensor (11) and remove the steer unit from the steering shaft (13).
- Assembly is the reverse of disassembly. When fitting the encoder make sure that the pinion engages exactly in the steering shaft toothing.



M1679

M1680

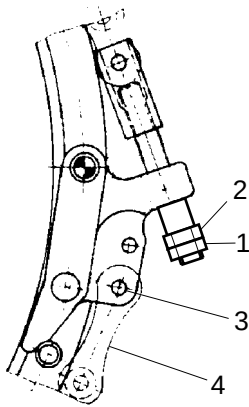
Hydraulic Motor Disassembly

DANGER

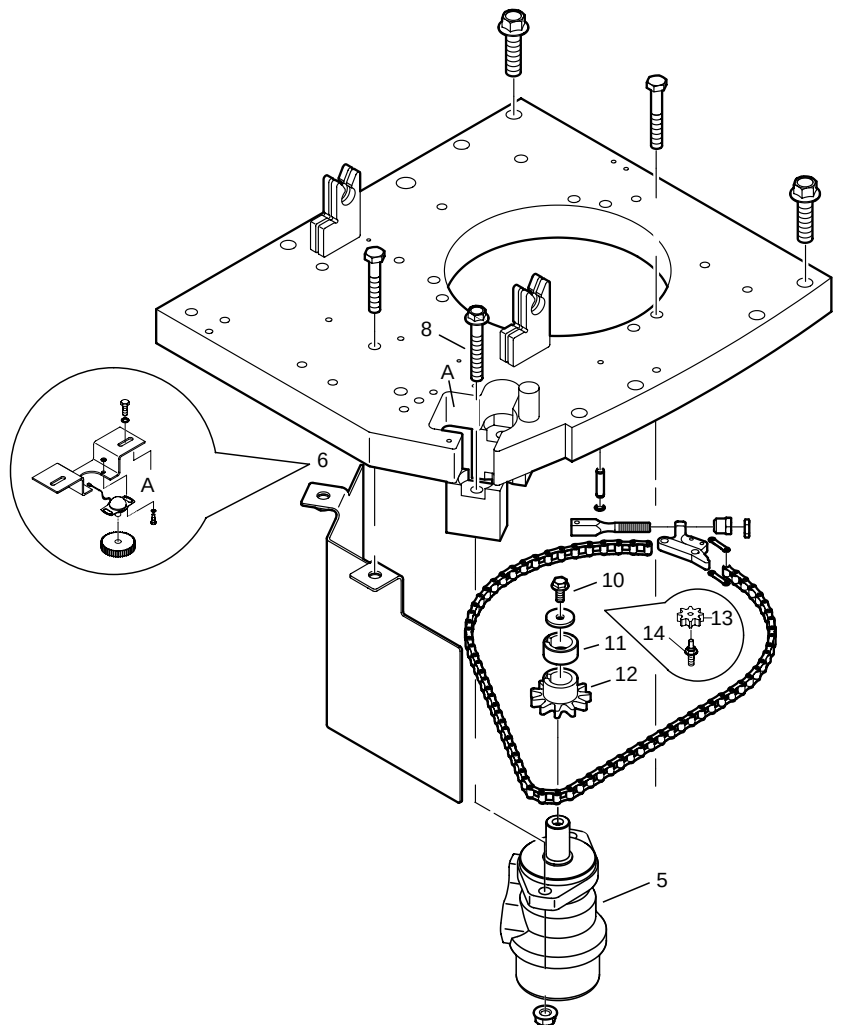


Always jack up the truck and support it with suitable wooden blocks when carrying out maintenance work. The drive wheel must not touch the ground.

- Power down the truck, remove the battery connector and jack up the truck (see note).
- Remove the seat, engine compartment and floorboard.
- Raise the drive wheel at least 400 mm off the ground and make sure the frame is properly secured.
- To remove the steering chain unscrew the jam nut (1) and adjusting nut (2). Remove the lock pin (3) and take out the steering chain (see Fig. M1152).
- If necessary, disassemble the steering angle display potentiometer (option). See item 6, Fig. M1506_2).
- Use a collecting basin for any spilled hydraulic oil. Disconnect the hydraulic hoses from the hydraulic motor and seal the connections.
- Remove the two mounting screws (8) and remove the steer motor (5).
- Remove screw (10), spacer sleeve (11) and chain wheel (12).
- If necessary remove the screw (14) and pinion (13) to activate the potentiometer (option).
- Assembly is the reverse of disassembly.



M1152



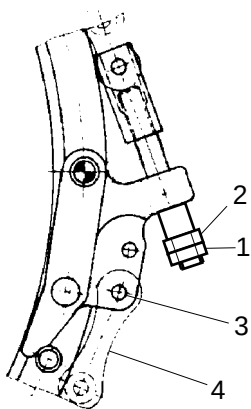
M1506_2

Steering Chain Adjustment

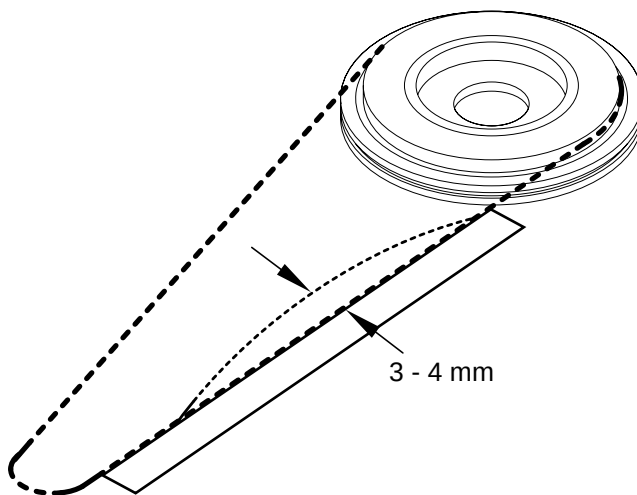
NOTE

i The steering chain slack should be approx. 3 - 4 mm. Check the tension every 250 hours.

- Unscrew the jam nut (1) and tension the chain using the adjusting nut (2) (see Figs. M1152, 1149).
- After adjusting, tighten the jam nut (1).
- Check the tension again, adjust if necessary.



M1152



M1149

POT6 (Steer Angle Display) Replacement

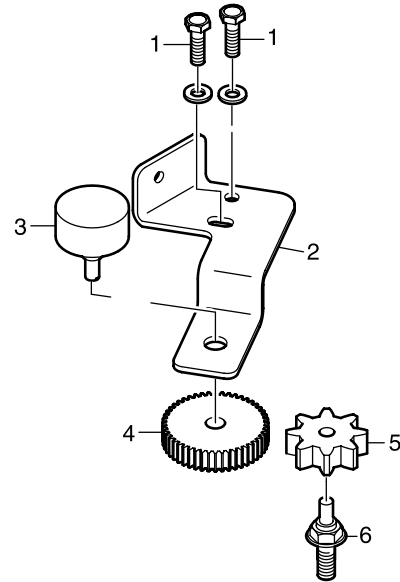
- Remove the potentiometer connector (see Fig. M1681).
- Remove the two screws (1) and disassemble the angle bracket (2).
- Remove the potentiometer (3).
- Remove the gear wheel (4) from the potentiometer shaft.

Assembly and Adjustment

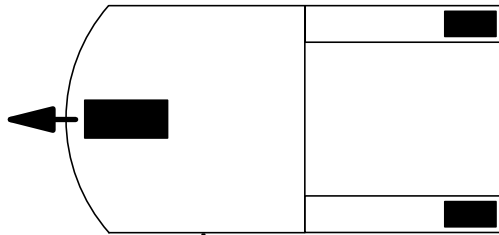
- Assembly of the potentiometer is the reverse of disassembly.
- Before final assembly, check the potentiometer against the steer angle display SAD. To do this, set the drive wheel so that it is facing straight ahead (see Fig. M1129A) and turn the gear wheel

(4) until the SAD is displaying forward travel.

- Finally assemble the potentiometer. Make sure that the gear wheel (4) is snug with the hydraulic motor pinion toothing (5) and that the SAD display does not change.



M1681



M1129A

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CROWN

MAST

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Torque Requirements

All screws and nuts must be tightened to the standard torques specified in the tables on page M-M1.9-2140-001 ff.

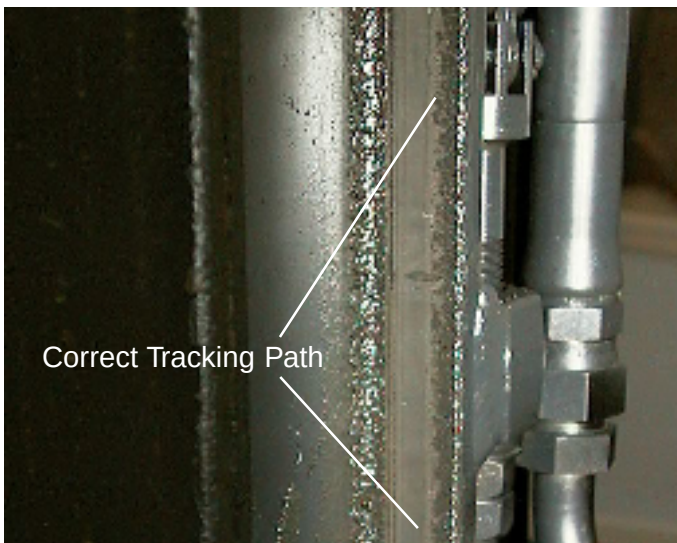
Fork Adjustments

With the forks fully lowered and level, adjust so that the top of the fork tip is a maximum of 65 mm from the floor.

The maximum fork height (raised) is to be within ± 25 mm) of the fork height specified on the truck data plate.

Mast Testing (Assembled)

Inspect the roller tracking path on each channel. The only area that should show wear is the rear section of the I-beam where the roller slides. See Illustration 7-1. The I-beam should not show signs of any cutting or grooving. If grooving or cutting is evident, it will normally take place at the side of the roller; 10 mm from the channel face. If this type of wear is evident, the mast rollers will have to be adjusted accordingly.



M1641

A recheck of the mast channel will be required.

Once the mast meets requirements, lubricate it with grease, Crown No. 063002-024 for standard or 063002-017 for cold store / corrosion application.

When the mast is raised and nearly fully extended, it should not tilt to the right or left but should be even and straight. All mast stages should be aligned. If a tilting condition exists, it is a sign that the shimming is too loose or unbalanced and will need to be adjusted.

All hose guide pulleys should move freely. Check hoses for any signs of chafing.

Flaking

It is not uncommon for a new mast to appear as if it is flaking or peeling. This appearance indicates that the rollers are seating on the mast channel and this is considered normal. Eventually, this condition will disappear. The grease applied to the channel will retain these particles.

Shock Absorbers

For maintenance and repairs of shock absorbers see the "Fork Carriage" section.

Mast Dampening Screws

The mast dampening screws are located at the bottom of the main frame, top and bottom of the second stage mast and at the top of the third stage mast.

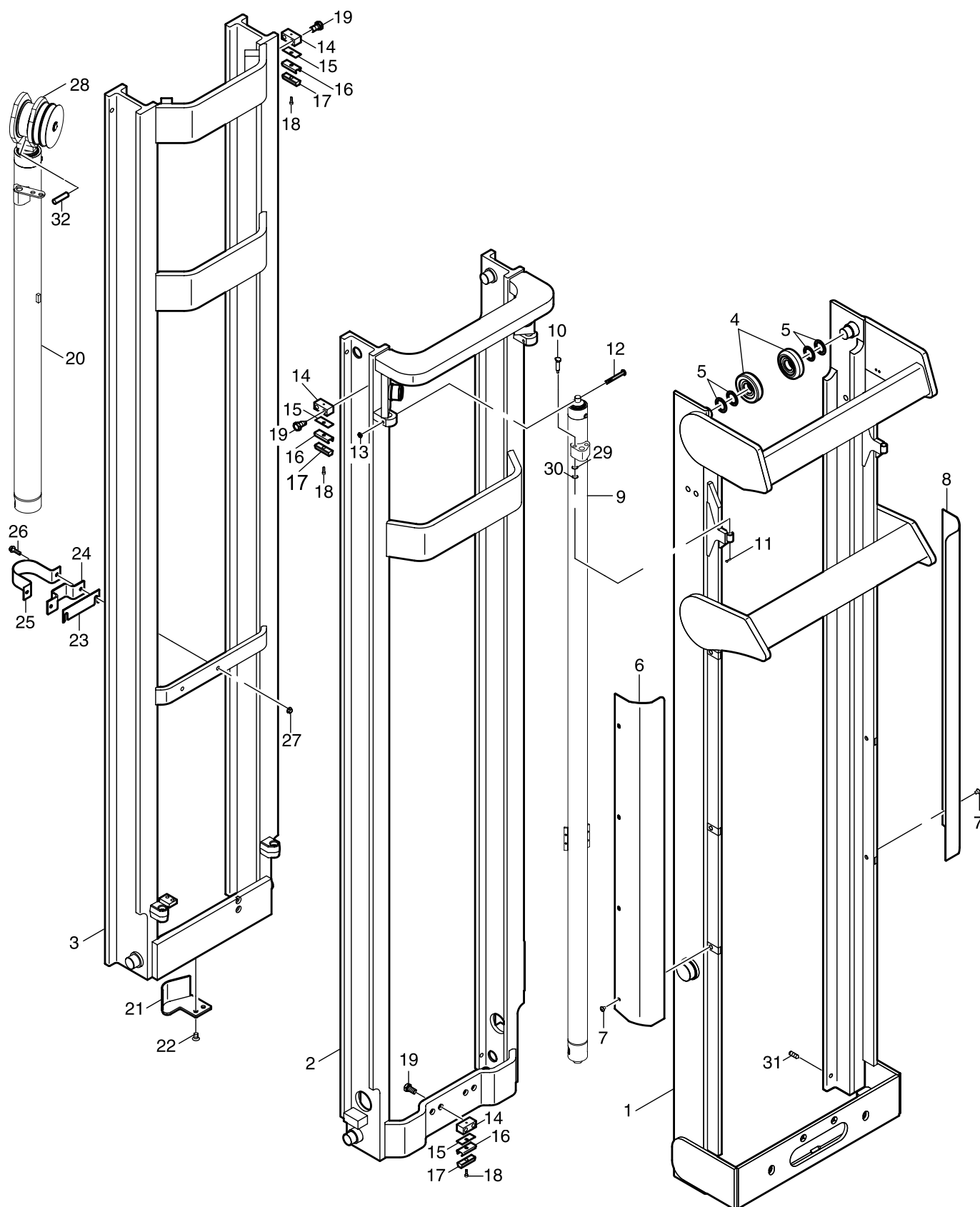
ADJUSTMENT (see Fig. M1650):

- Fully lower the mast.
- Unscrew the mast dampening screws (1) and clean the threads. If the copper layer on the top is no longer present, replace the dampening screw.



M1650

Apply thread lock adhesive to the screws and screw them in until they just come into contact with the mast roller behind each screw.



Mast Disassembly

WARNING

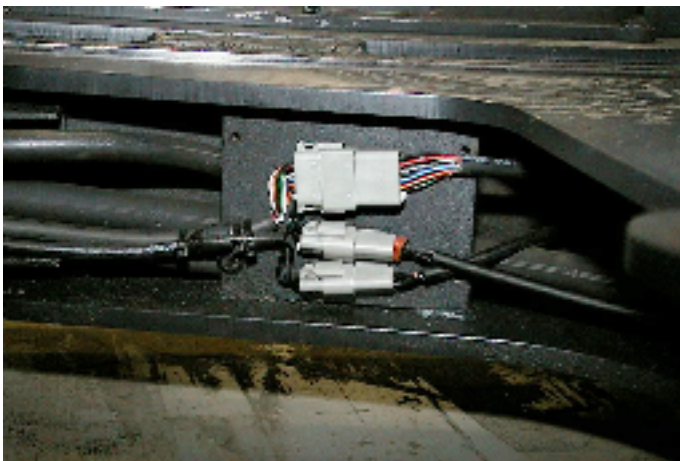


All assembly work on the mast is hazardous

Unsecured stage masts and attachments can sever limbs or even cause fatal injuries. Always block and secure the respective components properly prior to starting assembly.

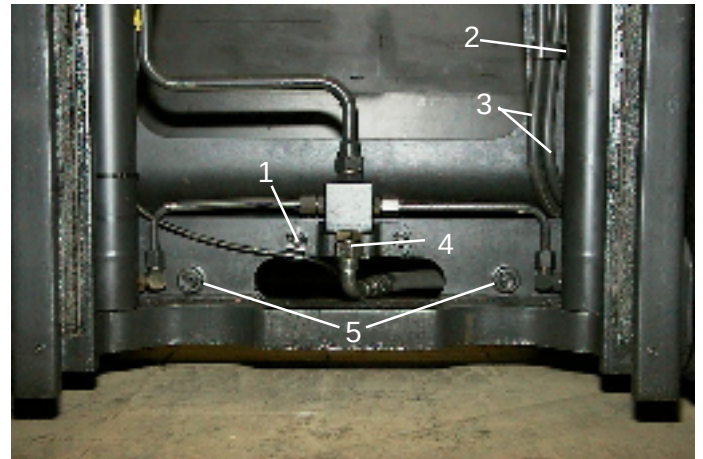
To disassemble the mast proceed as follows:

- Extend the reach assembly fully.
- Disconnect the battery.
- Secure the truck to prevent it from rolling away.
- Prepare a bowl to collect any spilled oil.
- Secure the upper mast section with appropriate devices. **All stage masts must be secured.**
- Loosen the plug connections in the reach assembly frame (Fig. M1655), and remove any cable binders in the mast track.



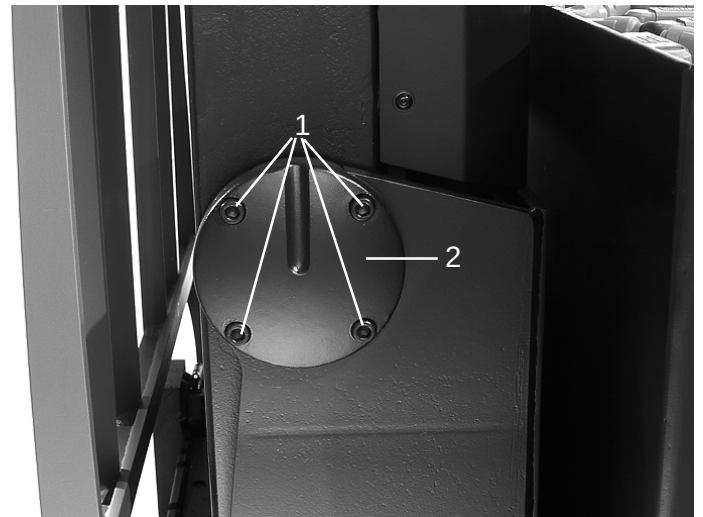
M1655

- Remove clamp (1, Fig. M1651). Thread the wiring through the hole and attach it to the mast with adhesive tape to prevent it from being damaged during assembly and disassembly.
- Remove clamp (2, Fig. M1651). Remove hydraulic lines (3, Fig. M1651) from the screw connection above the mast and seal them. Secure them to prevent them from potential damage.



M1651

- Loosen the hydraulic connection (4, Fig. M1651) and plug the line.



M1662

- Remove the four screws (1, Fig. M1662) from the left and right-hand truck supports. Remove lid (2, Fig. M1662). Remove any shims underneath it and for re-assembly purposes mark the side they were fitted on.
- Remove two nuts (5, Fig. M1651) and their respective screws.
- Carefully lift the mast up out of the supports. Place it on a suitable surface.

Mast Assembly

Assembly is the reverse of disassembly. Bleed the hydraulic system!

Mast Rollers

The mast channels have maximum play when retracted and minimum play when extended. This means that the mast rollers can move freely when the mast is retracted and that they provide maximum stability when the mast is extended. The mast roller play should therefore only be checked when the mast is extended.

The mast roller play retaining shims are fitted underneath the mast rollers (Fig. M0380). To do this, the mast rollers must first be disassembled.

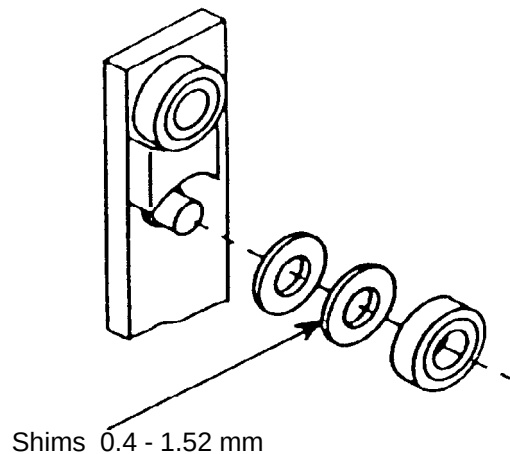
0.4 mm, 0.76 mm and 1.52 mm shims are available. Ideally, each mast roller should contain the same number of shims. However, as this is not always possible, it is essential to ensure that the shims are equally distributed on each side.

An example of this would be 2 shims on each roller of the left mast side and 1 shim on each roller of the right-hand side (Fig. M0381). An uneven distribution of the mast rollers will cause the mast to tilt (Fig. M0382).

Mast Roller Adjustment

A total of 8 mast rollers are fitted on the mast. To adjust the mast rollers, proceed as follows:

- Extend the mast to the mechanical stop and then lower it slightly to prevent the mast from twisting.
- To check the mast roller play push the mast channel to the side using a crowbar. This will push the opposite side against the mast channel, thereby allowing the play between the mast roller and mast channel to be measured exactly.
- After moving the mast channel maintain gentle pressure to keep the channel in position.
- Record the play between the mast roller and the mast channel, approximately 10 mm from the front side of the channel (Fig. M0386). If the rollers are slightly skew, always measure the lesser play.
- The play should be between 0 mm and 0.4 mm. If it exceeds 0.4 mm add another retaining shim behind the roller (Fig. M0385).

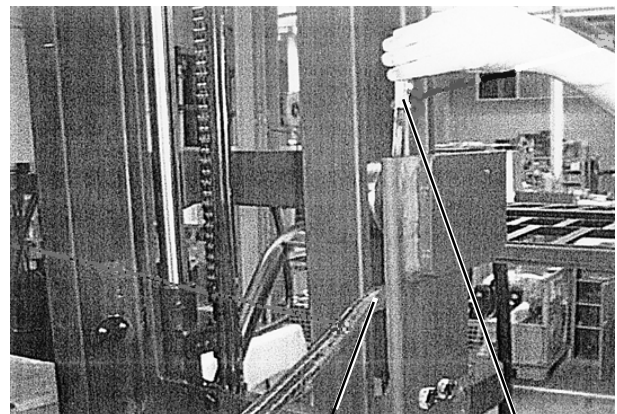


M0380

Mast Play Control

After adjusting the mast roller play, check the operation of the mast rollers:

- De-grease the mast channels with a solvent and dry off with a cloth.
- Spray the mast channels with a thin light-coloured coat. Extend and retract the mast several



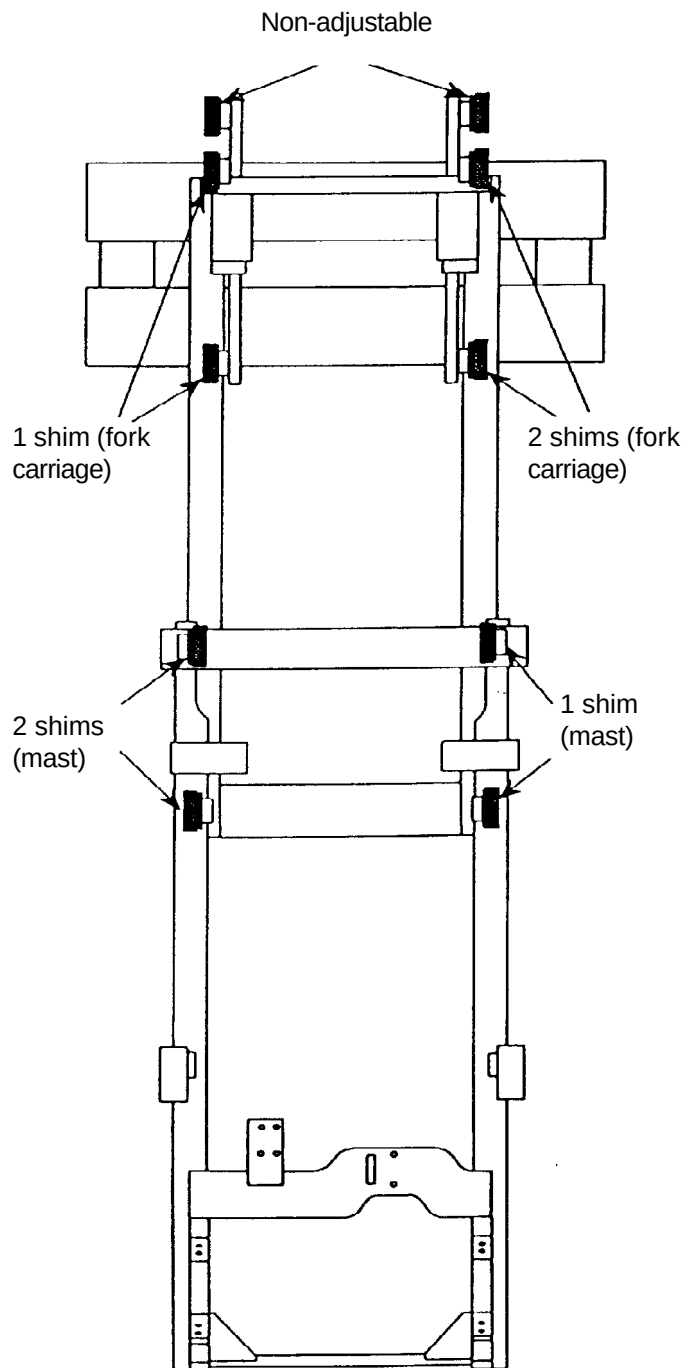
M0386

Crowbar

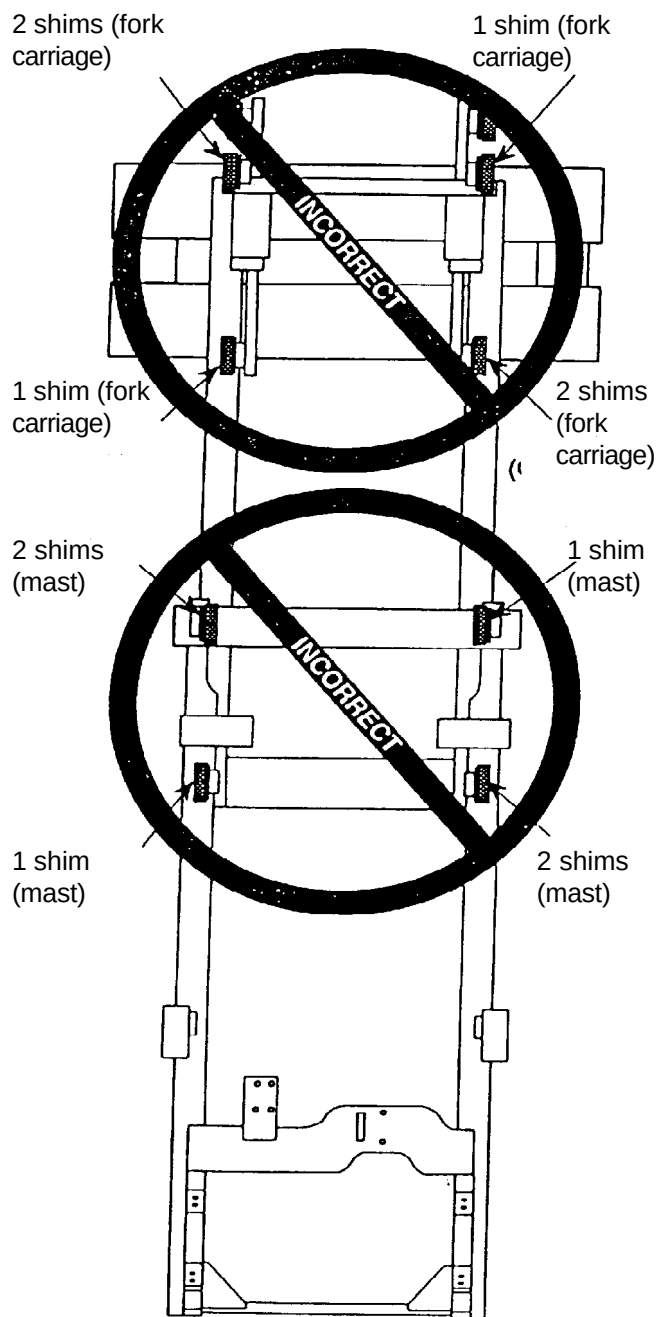
Feeler Gauge

times. The operation of the mast rollers can be verified from the tooth pattern. The tooth pattern should only lie on the running surfaces of the mast rollers in the rear section of the mast channels. The rollers must turn over the entire length of the channel without jamming.

- The mast channels must not contain any grooves or any other kind of damage. Grooves occur on the roller side approx. 10 mm from the front side of the channel if there is insufficient play or the stage masts are not aligned. In this case the play must be adjusted and/or the mast re-aligned.



M0381



M0382

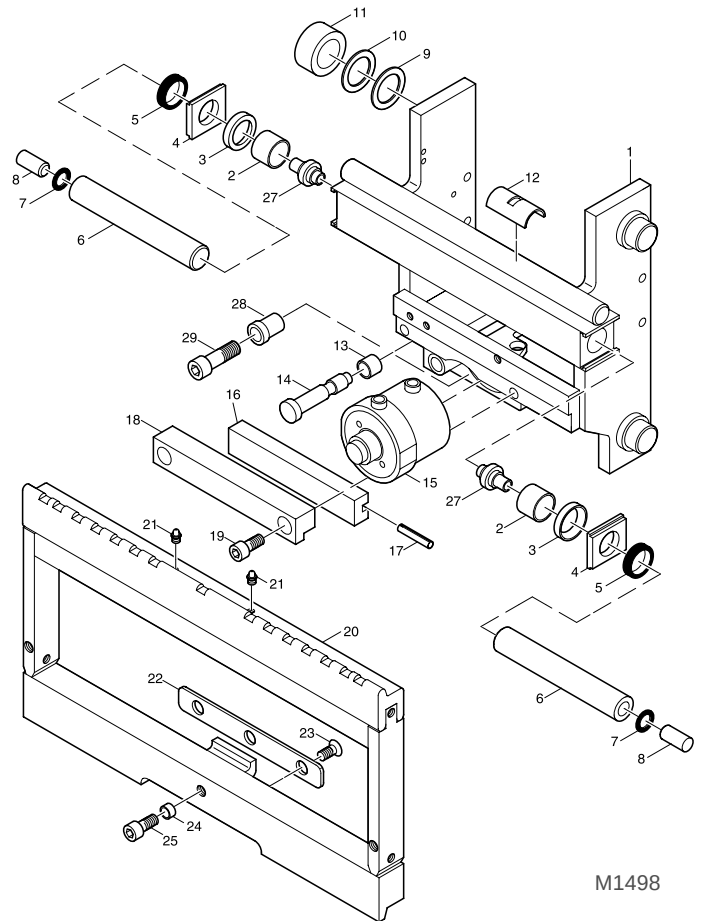
Fork Carriage

Before Disassembly

- Lower the fork carriage.
- Use a bowl to collect any spilled hydraulic oil.
- Power down the truck and disconnect the battery.
- Prepare a lifting mechanism.

Disassembly

- Remove the load guard.
- Unscrew the stop (25, Fig. M1498) and remove the forks.
- Lever off the front frame (20, Fig. M1498). Pay attention to the sliding parts (12).
- Support the carriage with the relevant devices and fix it.



M1498



M1666

- Unscrew both mast dampers (1, Fig. M1666, right side illustrated only).
- Remove the lift chain from the fork carriage. Remove all hydraulic pipes and cables from the fork carriage to the mast or truck. Secure them in such a way that they cannot be damaged when the fork carriage is lifted out.
- Using a lifting device, lift the fork carriage up out of the mast.

Fork Carriage Assembly

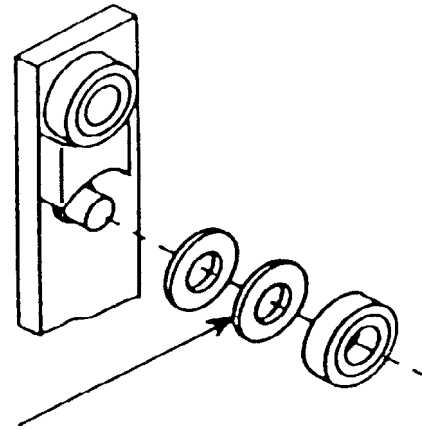
- Assembly is the reverse of disassembly. Clean and re-grease all the contact surfaces.
- Take care not to damage any cables or hoses.
- Bleed the hydraulic system and test it.

Fork Carriage Roller Adjustment

The fork carriage contains a total of 4 casters. The top caster extends over the mast channel when the mast is raised. It is fitted with a retaining ring and does not require adjustment.

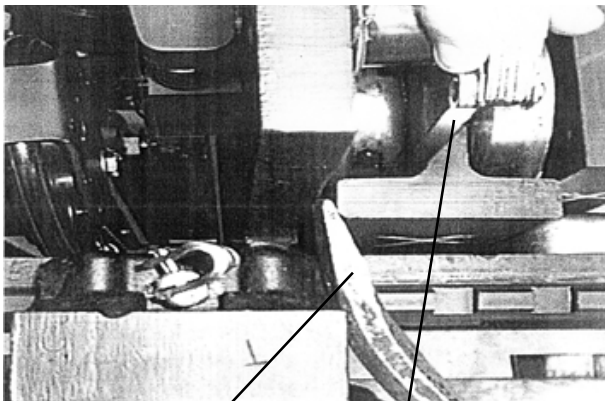
To adjust the remaining casters, proceed as follows:

- Extend the fork carriage as far as the stop and lower it again slightly.
- To check the mast roller play press the mast channel to the side using a crowbar. This will press the opposite side against the mast channel, thereby allowing the play between the mast roller and mast channel to be precisely measured (Fig. M0384).
- After moving the mast channel maintain gentle pressure to keep the channel in position.
- Record the play between the mast roller and the mast channel, approximately 10 mm from the front side of the channel (Fig. M0384). If the rollers are slightly skew, always measure the lesser play.
- The play should be between 0 mm and 0.4 mm. If it exceeds 0.4 mm add another retaining shim behind the roller (Fig. M0385).



M0385

If play > 0.4 mm
add shim



M0384

Crowbar

Feeler
Gauge

Lift Chains

General

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 this cannot be performed on the truck, the lift chains must be removed.

Irrespective of the result of the inspection, the lift chains, detachable chain anchors and anchor bolts must be replaced after max. 6000 service hours or three years, whichever comes first.

The inspection should include the following:

- Wear to the chain and chain 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.

WARNING



Do not use chemical solvents or steam to clean the chains as the lubricant applied at the factory will be removed from the inner plate surfaces.

Cleaning

The chain surface should be cleaned with parafin, a hard bristle brush and lint-free cloth.

After inspection apply another film of chain spray. The oil acts both as a lubricant and as an anti-corrosive protection.

Wear

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.

DANGER

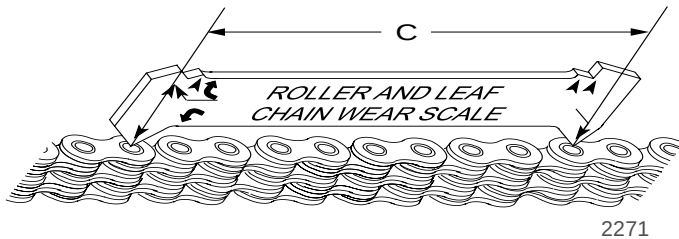


When checking for chain wear be sure to measure a part of the chain which passes over the guide pulleys. Never repair chains by cutting out the worn section and replacing it with a new section. If a chain is worn, always replace both lift chains.

Chain wear can be measured with a wear gauge (Crown No. 106440) or a steel tape measure (see Fig. 2271).

Before testing the chain slack 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.

The chain slack test must cover at least ten links over at least three different points in a section of the chain which always passes over a pulley during operation.



Centre Chain Dimensions (Dimension C in Fig. 2271).

New: 10 links = 254 mm
 Wear limit: 10 links = 262 mm

Outer Chain Dimensions

New: 10 links = 190.5 mm
 Wear limit: 10 links = 196 mm

DANGER

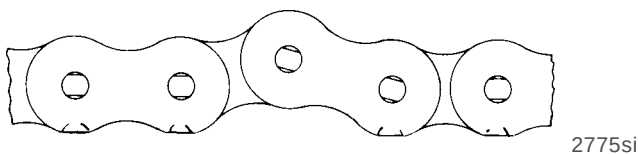


If just one of the faults mentioned in this chapter is detected, both chains together with their chain anchors or bolts must be immediately replaced.

**Never repair damaged chains!
 This can result in fatal accidents!**

Freedom of Movement

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.



Possible causes of stiff joints are as follows:

- Bent pins or plates;
- Rusty joints;
- Peened plate edges.

Chains which are bent or whose edges are worn must be replaced immediately.

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 page M-M1.9-0000-0001, 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.

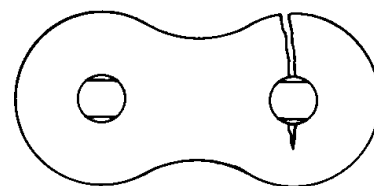
On the chain anchor watch out for wear and cracking of the individual fingers. If one of the above problems occurs replace the chain anchor.

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 or Missing Plates

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.

Replace both chains immediately if cracking shows or plates are missing.

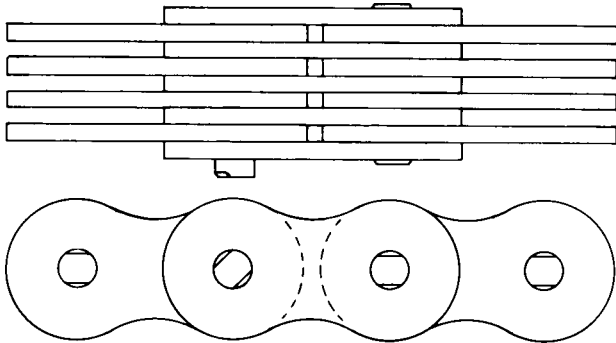


Protruding or Turned Chain Pins

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.



2776si

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.

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.

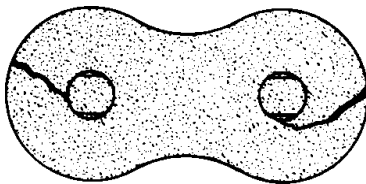
Misalignment of Lift Components

- 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.

Corrosion

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 or roller chain, because corrosion leads to cracking in the side plates.



2773si

It is therefore extremely important to protect lift chains from corrosion, both when operating and in storage. The layer of grease applied at the factory is an excellent protection.

This factory lubrication is applied through a hot dip galvanizing process which ensures full penetration of all joints.

Do not steam clean or degrease new chains. After commissioning the chain supplement the factory lubrication through a regular lubrication schedule.

Further details on the correct lubrication and adjustments are given in the operating instructions for the particular model and at the end of this chapter.

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.

Crown recommends the use of chain oil sprays. These have the advantage of being able to penetrate every crack at the moment of application due to low viscosity, and then to change to a high viscous state and thus resist high pressure and shearing forces. Solid lubricants have not proved as successful.

Furthermore, chain sprays are clean and uncomplicated to use.

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.

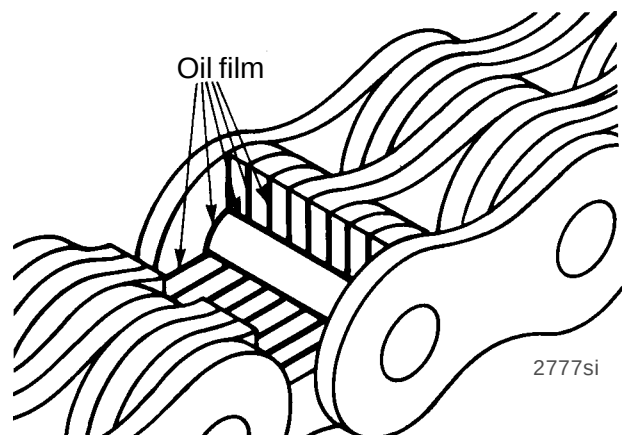
A paste mixture of oil and dirt will gather on the chain joints, but they will not wear as fast as they would if they were left to dry, leaving a metal to metal contact between the pins and plates.

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. 277Si) and allow the oil to penetrate to the bearing surface on the chain bolt, even when the chain is dirty.

In normal operating conditions the chains should be cleaned and *immediately* lubricated every 100 service hours. See page M-M7.5-0000-001 for cleaning details.

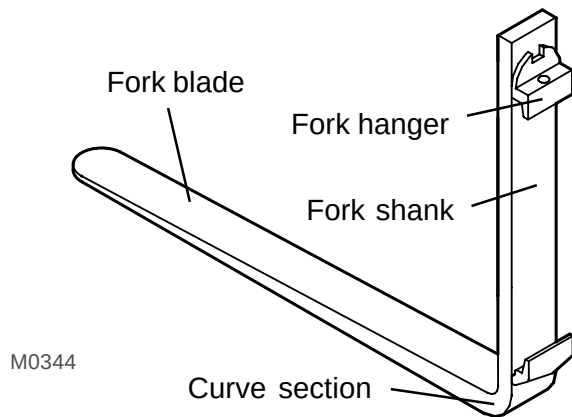


Fork Tine Test

General

The fork tines (Fig. M0344) must be checked by trained personnel at the specified maintenance intervals (see M1.2-2140-009) for cracks, damage and wear.

If the forks are used to transport abrasive loads the inspection must be carried out at shorter intervals.

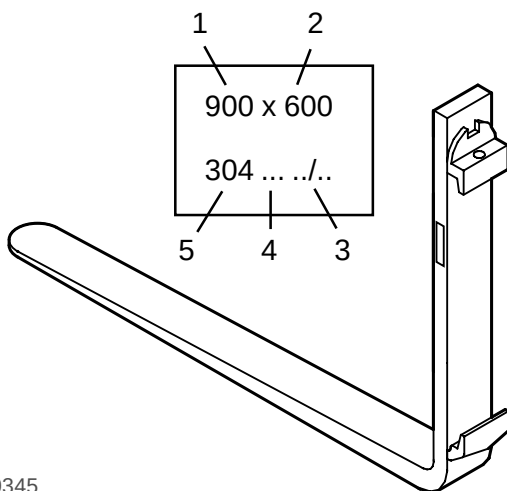


M0344

Fork Identification

The data plate is on the side of the fork back (Fig. M0345) and comprises the following data:

- 1 Capacity
- 2 Load Centre of Gravity
- 3 Manufacturing Data (Month / Year)
- 4 Company Logo
- 5 Manufacturing Site



M0345

DANGER



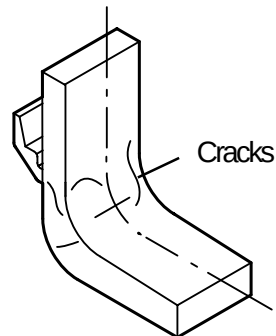
Forks showing signs of cracking, distortion or wear must be de-commissioned. They endanger the life of the operator and other people as well as the general operation of the truck.

Repairs

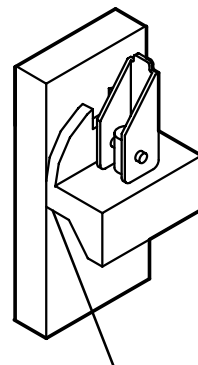
Fork repairs must only be carried out by the **manufacturer / qualified personnel**. When repairing supporting members always carry out a load test and check for signs of cracking.

Crack Inspection

Inspect all fork tine surfaces for signs of cracks (Fig. M0346) and if necessary carry out a non-rupturing crack test (magnetic particle cracking test in accordance with DIN 4113). For upper and lower fork hangers (Fig. M0347) including their fork back attachments check for cracks on the welding seam.



M0346



M0347

Check fork hanger welding seams for any signs of cracking

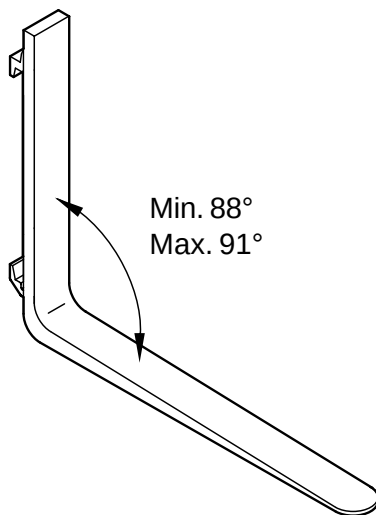
If any cracking is discovered which could affect safety remove the relevant fork.

DANGER

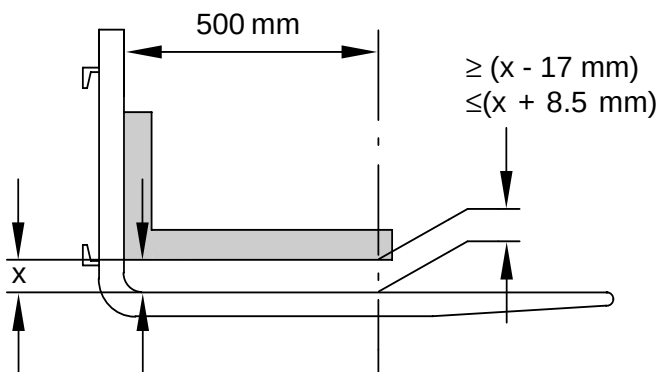
Never carry out repair welding to surface cracks, damaged or worn parts around the heel of the fork.

Fork Blade Warping

Measure the angle deflection between the top of the fork blade and the front of the fork shank. If it is more than 91° or less than 88° (Fig. M0352) the fork must be re-aligned and checked before it can be used again. For measuring procedure see Fig. M0353.



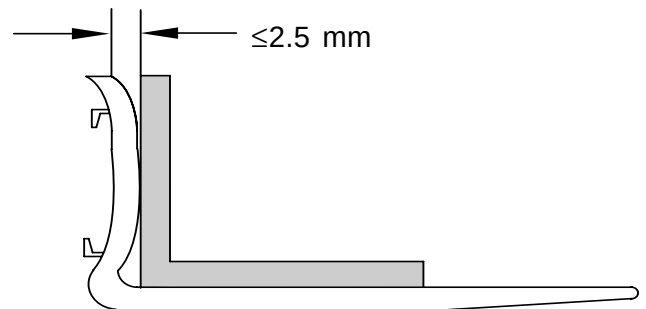
M0352



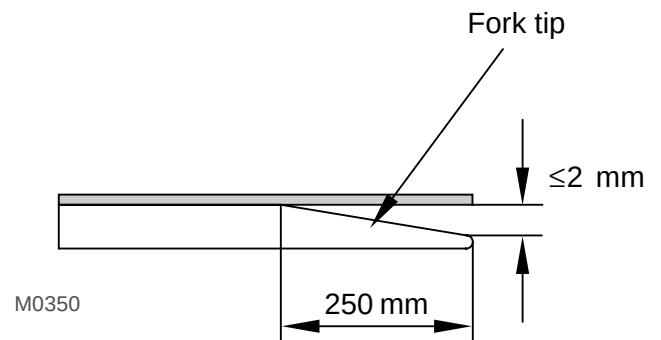
M0353

Verticality Test

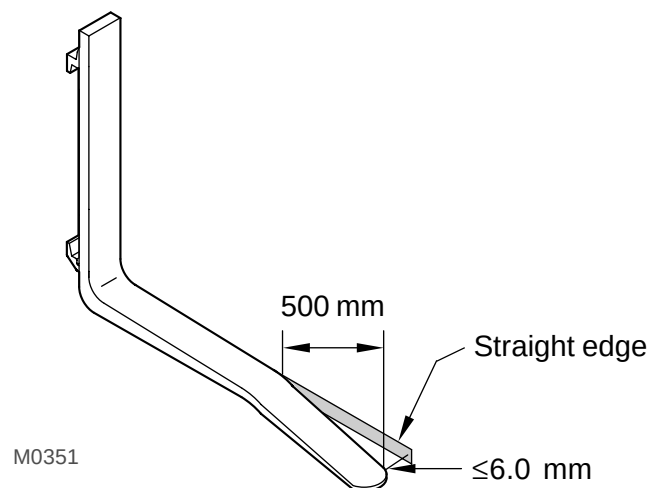
Check verticality of fork shank (Fig. M0349) and fork tip (Fig. M0350/0351). If the readings illustrated below are exceeded the fork must be taken out of service.



M0349



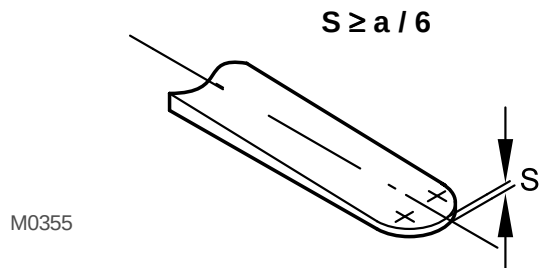
M0350



M0351

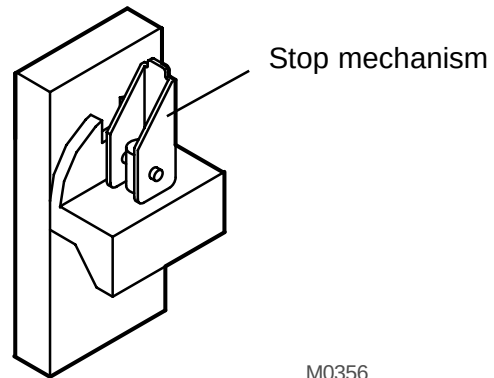
Measuring the Fork Tip Width

If the fork tip width S is less than $1/6$ of a (a = fork back width) do not use the fork (Fig. M0355).



Fork Stop

Check the stop mechanism (Fig. M0356) on both fork tines. If faults or damage are discovered do not use the fork.

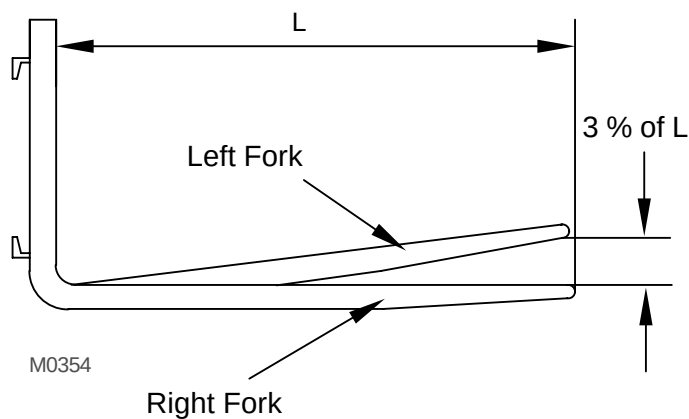


Fork Tine Height Difference

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 1150mm the maximum permissible deviation is approx. 35mm.

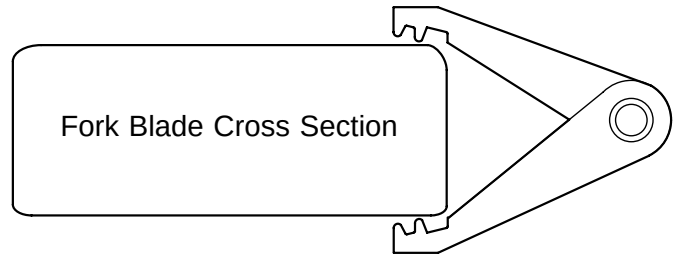
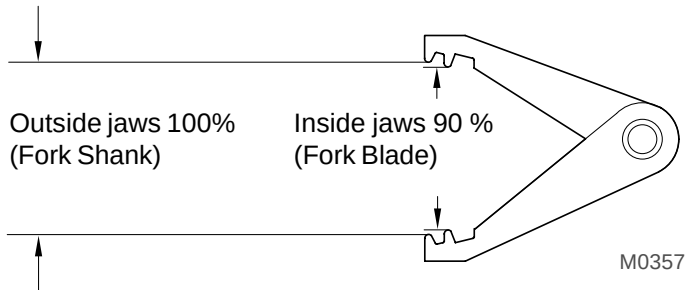
It is however generally advisable to align the forks if the deviation is more than 10mm.



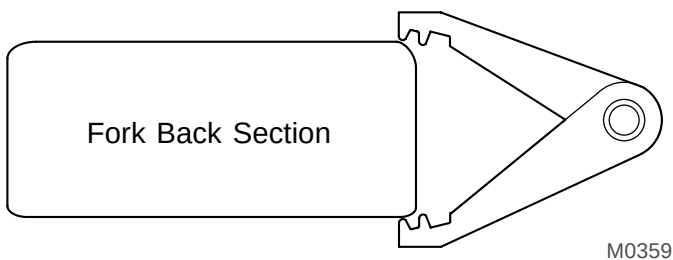
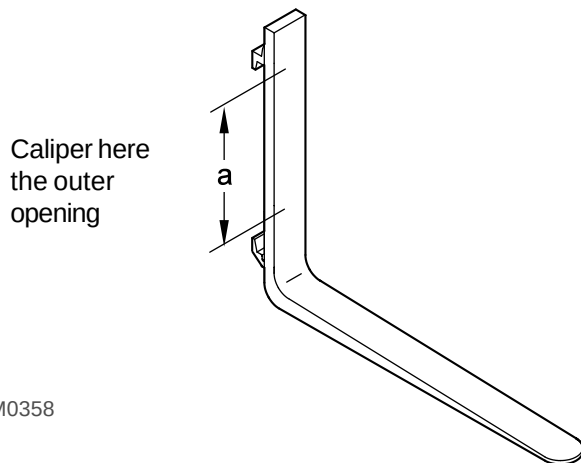
Wear

Check for fork blade wear, in particular at the heel. If the width is 90 % or less than the original value, the fork must be taken out of service. Use a caliper (Crown No. 107330) to check for wear (Fig. M0357).

- Using the caliper, scan the fork blade between the taper and the curved area.
- If the inner scan point fits 90% over the fork blade (Fig. M0360), the fork must not be used.



- First caliper the outer opening 100% in the central area "a" (Figs. M0358, M0359) of the fork shank.



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CROWN

CYLINDERS

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Cylinders

General

There are two main types of hydraulic cylinder:

- Plunger cylinders, and
- Piston cylinders (double-acting cylinders)

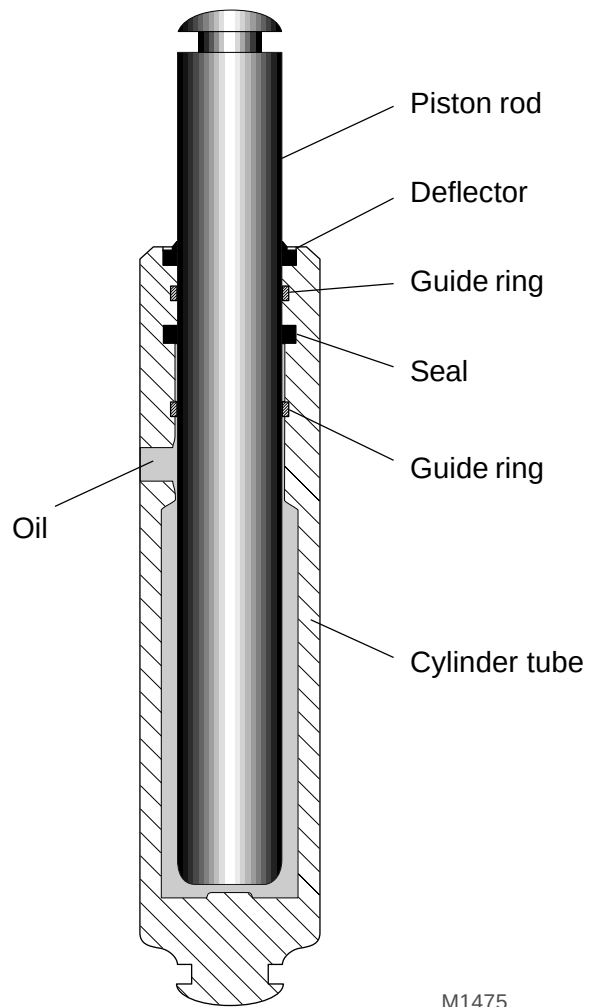
The main difference between the two types of cylinder lies in their operation as well as the sealing material design.

Plunger Cylinders (single-acting)

The plunger cylinder (see Fig. M1475) has only one pressurised rod surface.

The piston rod enters the cylinder via a single or several guide rings. A rod seal in the cylinder head and a dirt deflector protect the inside of the cylinder and the piston rod from external contamination.

The piston rod return movement is actuated either by the net weight of the rod or by the force acting on the piston rod from the load.



M1475

Piston Cylinder (Double-Acting Cylinder)

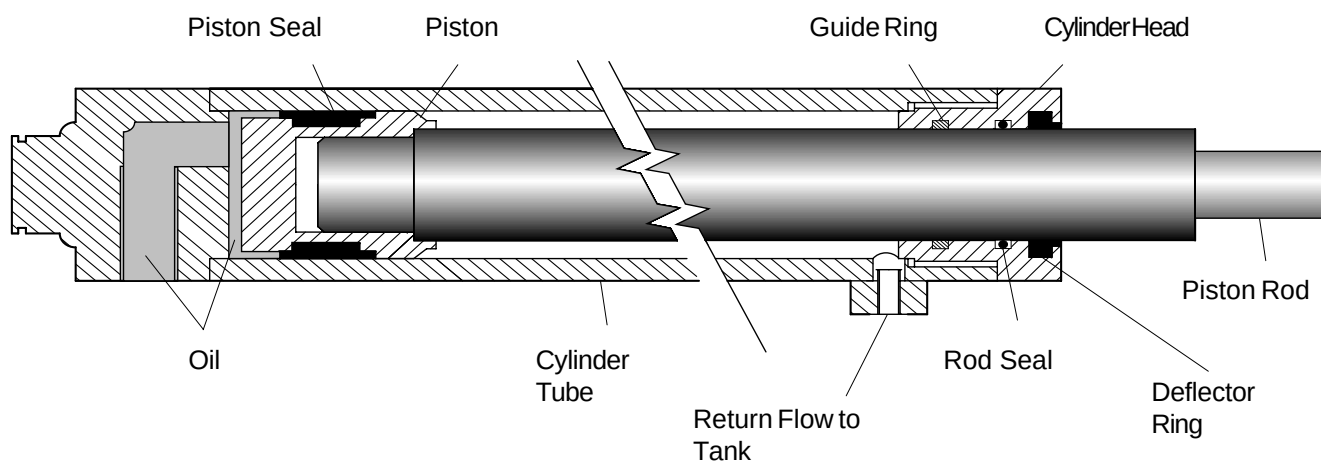
On a piston cylinder both sides of the piston are pressurised. The piston rod can therefore be moved in either direction by the oil flow.

The piston rod can produce different piston areas. This results in different forces and speeds occurring at a constant pressure and flow volume levels.

The rod of the piston cylinder has a piston at one end which enters the cylinder through a guide ring and whose piston seals protect the two oil-filled chambers against each other. The cylinder and piston rod are sealed on the outside by a rod seal in the cylinder head. An additional scraper ring protects the rod seal from external contamination.

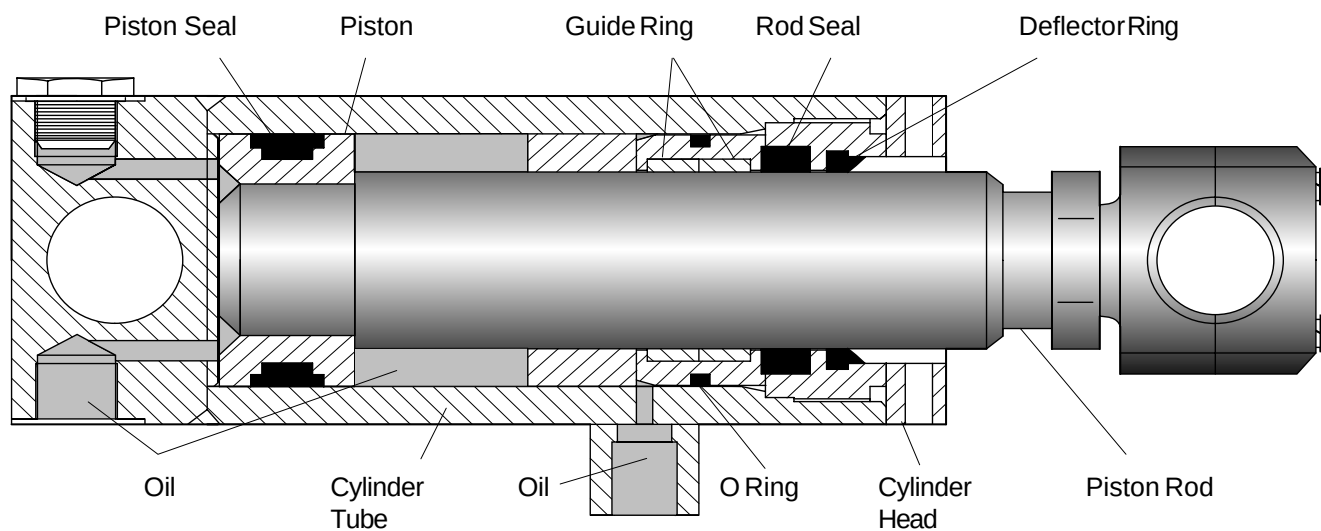
When a piston cylinder is used as a single-acting cylinder it offers reduced operating pressure with the same cylinder tube inside diameter compared with the plunger cylinder, thanks to the larger piston surface. However, the operating speed is reduced at the same flow rate. The de-pressurised side of the cylinder must be bled.

Single-Acting Cylinder



M0822

Double-Acting Cylinder



M0824

Maintenance

WARNING



DE-PRESSURISE ALL HYDRAULIC SYSTEM COMPONENTS BEFORE CARRYING OUT MAINTENANCE WORK.

IF PRESSURISED HYDRAULIC OIL ESCAPES FROM THE SYSTEM IT CAN RESULT IN SERIOUS INJURIES.

High-pressure fluids can penetrate the skin and cause severe injuries. Reduce the pressure before disconnecting the hydraulic lines.

Tighten all connections before re-pressurising the system. Keep hands and feet away from screw holes as high-pressure fluids can emerge at these points.

Use paper or cardboard to trace leaks. Do not use your hands.

If any high-pressure fluid penetrates the skin it should be treated as an emergency even if there are no markings to the skin at first. Pain will set in later. Damage to the tissue may result.

Inspektion and repair of the parking brake cylinder

WARNING!



The cylinder is spring loaded! Wear protective glasses. Unscrew the top cap carefully and slow to decompress the spring before disassembly!

Exept the special precautions to be taken by the compressed spring, disassembly, repair and assembly are to be carried out as described in the following chapters.

Inspection

Before carrying out maintenance closely inspect the cylinder unit by retracting and inserting the cylinder several times.

- Check the piston rod for scratches, nicks and other surface damage.
- Check deflector rings and the entire cylinder head area for individual component wear and abnormal leakage.
- If excess hydraulic oil emerges from the piston rod from at the cylinder head it may be due to a damaged rod seal. Replace the rod seal and make sure that the seal seat is clean and intact.
- Check the pivot for signs of unusual wear or damage. When servicing the cylinder also check the condition of the other parts. Replace any parts showing signs of premature wear as well as parts which are already worn or damaged.
- Minor irregularities on the cylinder tube surface or on the piston rod can be removed with an aluminium oxide cloth or a honing tool.
- When all the parts have been checked clean the cylinder components in a high-grade solvent and dry with low-pressure pressurised air.

Installing the Piston Seal

General

NOTE



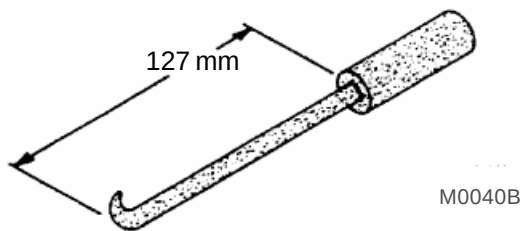
CHECK THE SEAL GROOVE AND THE PISTON ROD (CRITICAL SEAL POSITION) FOR DAMAGE BEFORE FITTING A NEW SEAL.

OTHERWISE, LEAKAGE WILL RE-OCCUR AFTER THE NEW SEAL HAS BEEN FITTED.

When fitting rod seals use assembly equipment and tools made of soft metal or plastic without sharp edges. Do not use a screwdriver or similar tools as these will damage the seal edges.

If the seal has to be pushed over sharp edges, cracks or nicks, use appropriate protective mechanisms.

Rod Seal Disassembly Tool



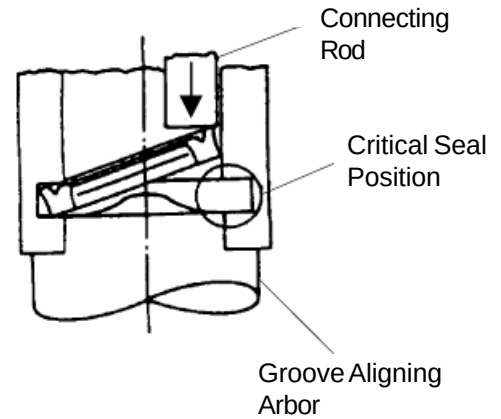
Assembly of Small Rod Seals

Equipment:

- Groove aligning arbor to lock with the cylinder union groove
- Connecting rod

Assembly:

- Apply a thin layer of hydraulic oil to the rod seal and fitting groove;
- Gently squeeze the seal together and place it in the hole;
- Using the connecting rod push the seal into the groove (Fig. M0041B).



M0041B

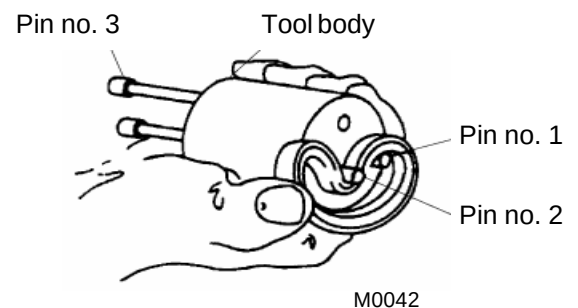
Assembly of Large Rod Seals

Equipment:

- Tool body
- Three pins nos. 1, 2 and 3; pin no. 1 is fixed;

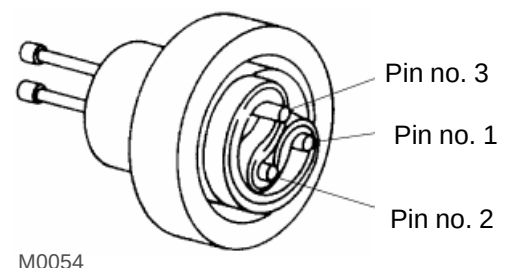
Assembly:

- Apply a thin layer of hydraulic oil to the rod seal and seal position;
- Place the rod seal over fixed pin no. 1 and wrap it around pin no. 2 (Fig. M0042);



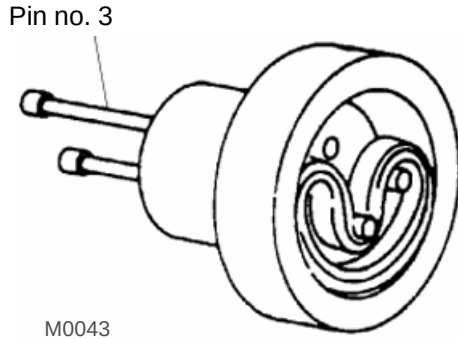
M0042

- Keep bending the rod seal until pin no. 3 can fit in the loop created (Fig. M0054);

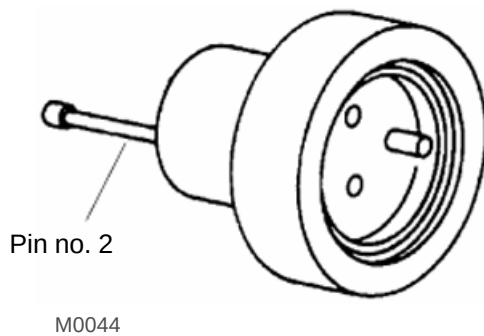


M0054

- Push the tool body and the rod seal into the cylinder union groove.
- Remove pin no. 3 so that the loop of the rod seal can snap into the groove (Fig. M0043);



- Remove pin no. 2 so that the rod seal fits completely into the groove (Fig. M0044);



- Remove the tool body from the cylinder union.

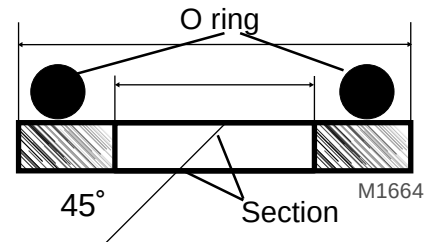
Backup Ring Emergency Assembly

Tools required:

- Sharp blade
- Clean surface

Assembly:

- Using a sharp, thin blade and working on a suitable surface cut a 45° section through the ring.



- Apply a thin layer of hydraulic oil to the backup ring.
- Spread the ring and fit it in the cylinder groove. Make sure that the section is positioned in relation to the O Ring as shown in Fig. M1664. (Otherwise, the backup ring may snap out of the groove.)

Cylinder Disassembly

Free-Lift Cylinder Disassembly and Assembly

The free-lift cylinder (first mast level) is a single-acting cylinder.

Prior to Disassembly

- Retract the mast fully.
- Lower the fork carriage onto wooden blocks.
- Switch off the truck and disconnect the battery.
- Prepare a container to collect any spilled hydraulic oil.

Disassembly

- Unscrew the lift chain nuts on the chain anchor (on the fork carriage).
- Remove the hoses and wires running over the



M1659



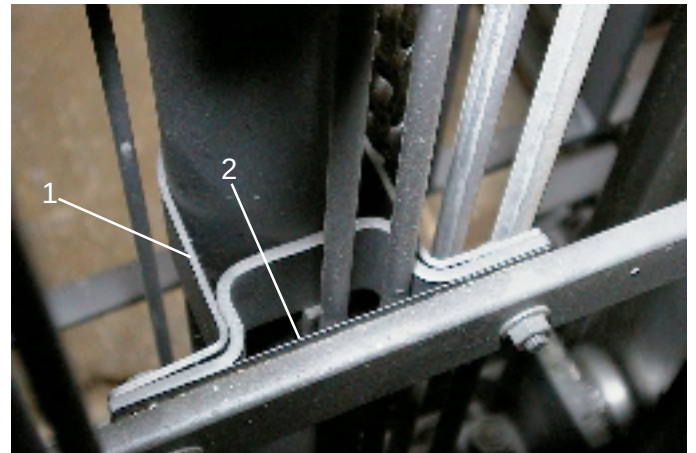
M1648

guide pulley of the free-lift cylinder (1, Fig. M1659). Unhook the tension spring (1, Fig. M1648).

- Remove the guide pulley, drive out the dowel pin on the piston rod and remove the guide pulley support.
- Loosen the cylinder pressure port (2, Fig. M1648) and seal the line.
- Unscrew the clamp (1) and its shim stock (2) (Fig. M1658).
- Lift the cylinder out from the top.

Assembly

- Assembly is the reverse of disassembly. Place the cylinder in the receptacle; the welded plate on the cylinder housing must be facing the cross strut.
- Set the chain tension to the correct value.
- Check the spring tension: Rated spring tension = 450 N (approx. 4,5 kg)
- Bleed the cylinder by opening the bleed screw on top of the cylinder and activating the lift function until no more air escapes. Tighten the screw. Check for leaks and correct operation. If necessary, replenish with hydraulic oil.



M1658

Lift Cylinder Disassembly and Assembly

The lift cylinders are single-acting cylinders.

Prior to Disassembly

- Retract the mast fully.
- Lower the fork carriage to the ground.
- Switch off the truck and disconnect the battery.
- Prepare a container to collect any spilled hydraulic oil.

Disassembly

- Remove side panels on mast where appropriate.



M1651

- Remove any hoses, cables etc. attached to the cylinders.
- Loosen the cylinder pressure ports (1, Fig. M1651) and seal the lines.
- Drive out the dowel pins from the piston rod ends.
- Using a crane, gently lift up the centre mast to release the cylinders.
- Take the cylinders out by lifting them sideways.

Assembly

- Assembly is the reverse of disassembly.
- Check the spring tension of the wire tension springs; rated = 450 N (~ 4.5 kg)
- Bleed the hydraulic cylinder and check operation.

Reach Cylinder Disassembly and Assembly

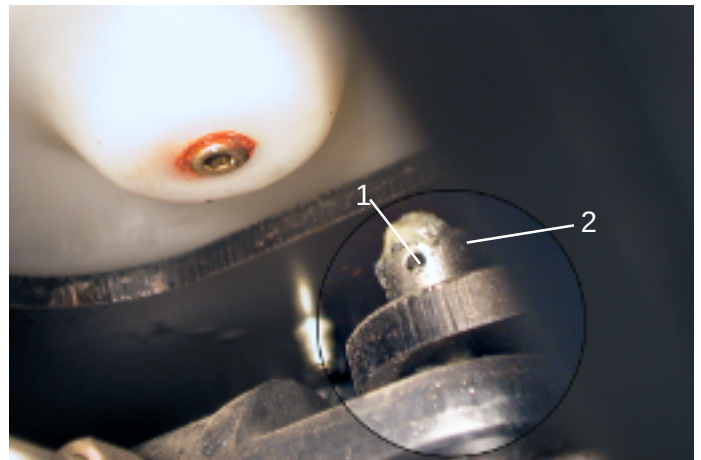
The reach cylinder is a double-acting cylinder. It is installed on the bottom right-hand side of the truck.

Prior to Disassembly

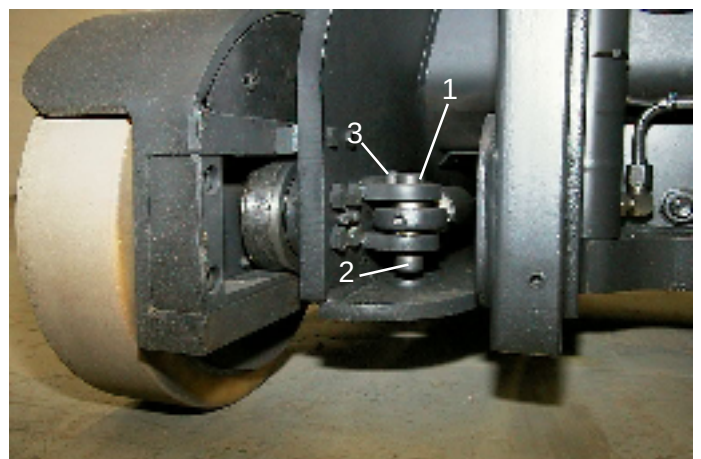
- Extend the reach fully.
- Lower the fork carriage to the ground.
- Prepare a container to collect any spilled hydraulic oil.
- Switch off the truck and disconnect the battery.
- **Jack-up and secure the truck**

Disassembly

- Remove any hoses, cables etc. attached to the cylinders.
- Seal the lines.



M1663



M1656

- Remove the screw (3, Fig. M1663) and retaining pin (1) from the cylinder attachment, turn the screw into the inside thread on the base of the bolt and thus remove the bolts (2).
- At the piston rod end remove the screw which holds the retaining pin. Remove the retaining pin.
- Drive out the bolts (2, Fig. M1656), if necessary, via a neck and remove a screw from the bolt.
- Remove the cylinder.

Assembly

- Assembly is the reverse of disassembly.
- Bleed the hydraulic system and check the operation.

Sideshifter Cylinder Disassembly and Assembly

The sideshifter cylinder consists of two piston rods incorporated within the fork carriage.

Prior to Disassembly

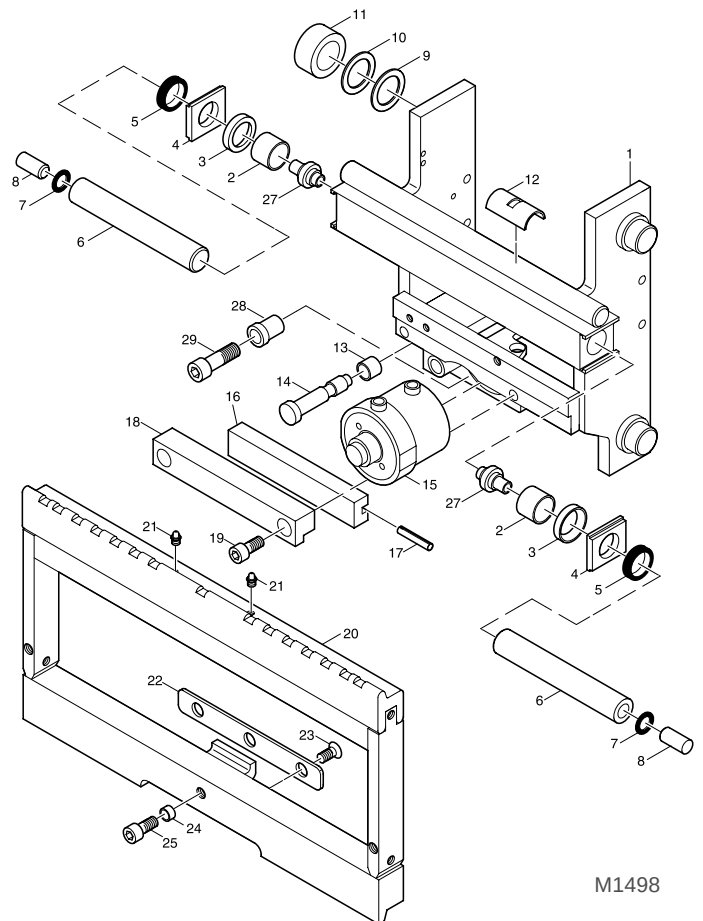
- Lower the fork carriage.
- Switch off the truck and disconnect the battery.
- Prepare a container to collect any spilled hydraulic oil.

Disassembly

- Remove the load guard.
- Unscrew the stopper (25, Fig. M1498) and remove the forks.
- Unscrew the lug (18, Fig. M1498).
- Tilt the frame (20, Fig. M1498) up and slide it from the frame on the side (1). Watch out for the slide pieces (12).
- Remove the sideshifter cylinder components as necessary.

Assembly

- Assembly is the reverse of disassembly. When assembling, clean and re-grease all surfaces.
- To bleed the sideshifter, turn it approx. 20 times to the far left and right (it bleeds itself through an



M1498

internal valve). Bleed the tilt cylinder by gently loosening the hydraulic ports. Tighten again when no more air escapes.

Tilt Cylinder Disassembly and Assembly

The tilt cylinder (15, Fig. M1498) is a double-acting cylinder.

Prior to Disassembly

- Lower the fork carriage.
- Prepare a container to collect any spilled hydraulic oil.
- Switch off the truck and disconnect the battery.

Disassembly

- Remove the load guard.
- Unscrew the stopper (25, Fig. M1498) and remove the fork.
- Unscrew the lug (18, Fig. M1498).

- Tilt the frame (20, Fig. M1498) up and slide it from the frame on the side (1). Watch out for the slide pieces (12).
- Unscrew the hydraulic ports on the cylinder.
- Pull out the dowel pins (21, Fig. M1498) from the tilt limit switch plunger and the piston rod bushing.
- Remove the slide piece (16, Fig. M1498).
- Loosen the screws (29, Fig. M1498) in the eccentric bushing (28) and remove the cylinder.

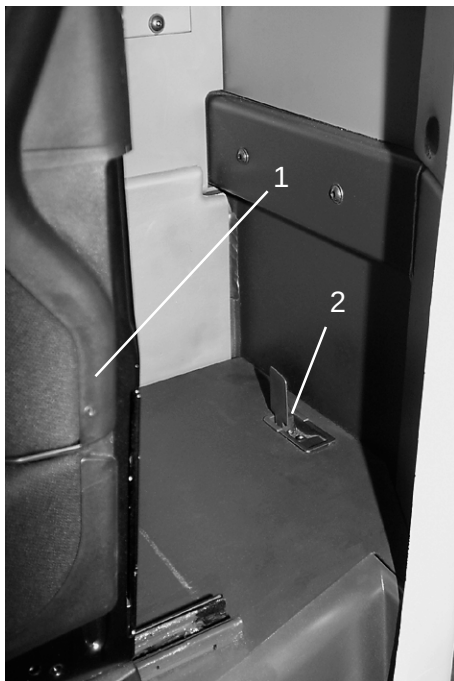
Assembly

- Assembly is the reverse of disassembly. When assembling, clean and re-grease all surfaces.
- Bleed the hydraulic system and check for operation and any signs of leaks.

Parking Brake Cylinder Disassembly and Assembly

Prior to Disassembly

- Switch off the truck and disconnect the battery.



M1670

- **Secure the truck to prevent it from rolling away!**



M1669

Disassembly

WARNING!



The cylinder is spring loaded! Wear protective glasses. Unscrew the top cap carefully and slow to decompress the spring before disassembly!



M1667

- Push the seat up to the front (1, Fig. M1670) and release the lock (2).

- Tilt the seat and the cover forward. (Fig. M1669)
- Loosen the cylinder feed and discharge lines (1, Fig. M1667) and close the lines. Immediately remove any spilled oil.
- Using a screw (2, Fig. M1667) untension the brake cable lever (1) and unhook the brake lever cable.
- Unscrew the cylinder retaining screws on the floorboard and remove the cylinder.

Assembly

- Assembly is the reverse of disassembly.
- **Warning! Turn back the screw (2, Fig. M1667) to the point where the brake is operable again.**
- Bleed the hydraulic system and check for operation and any signs of leaks.

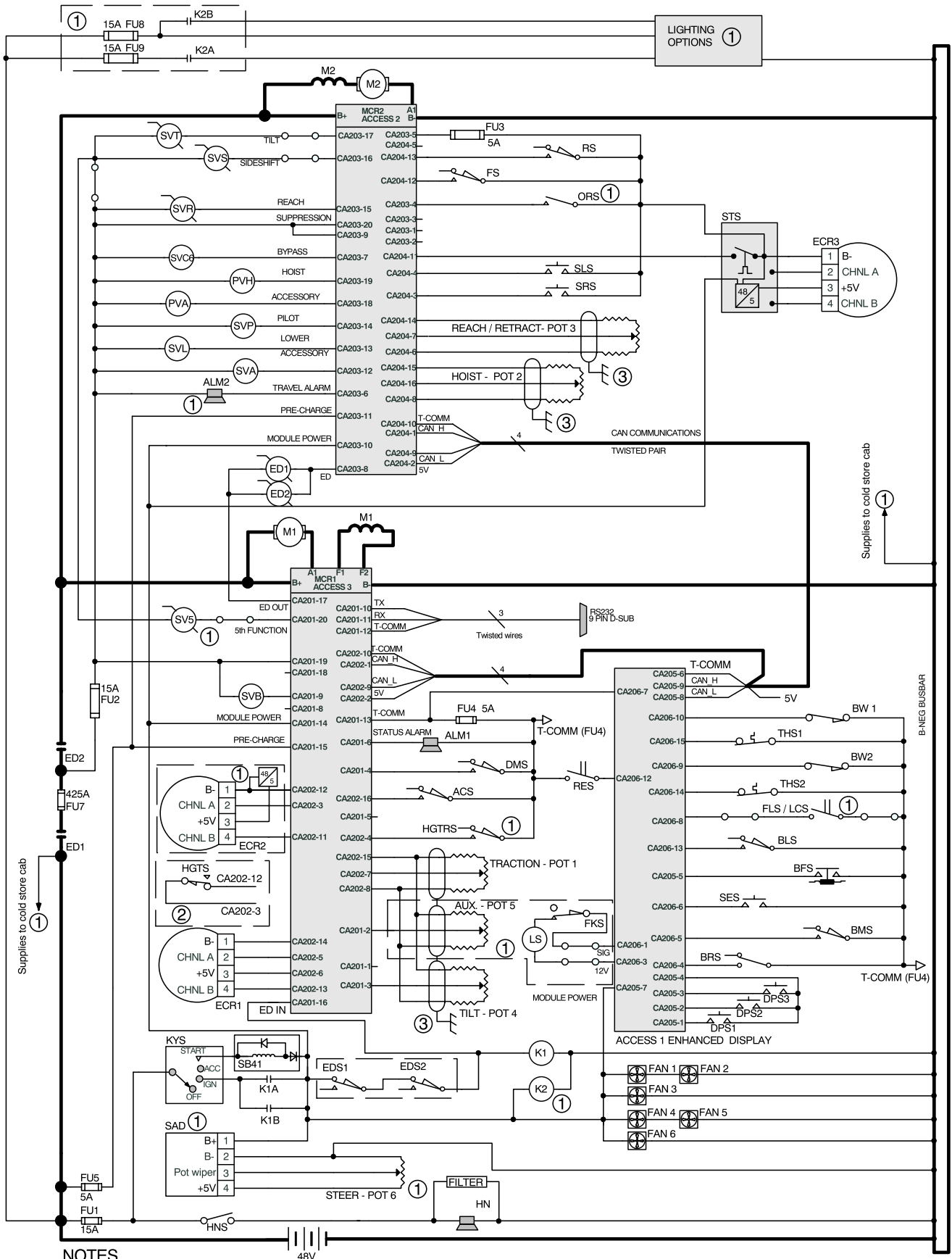
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CROWN

ELECTRICAL DIAGRAMS

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Control Circuit

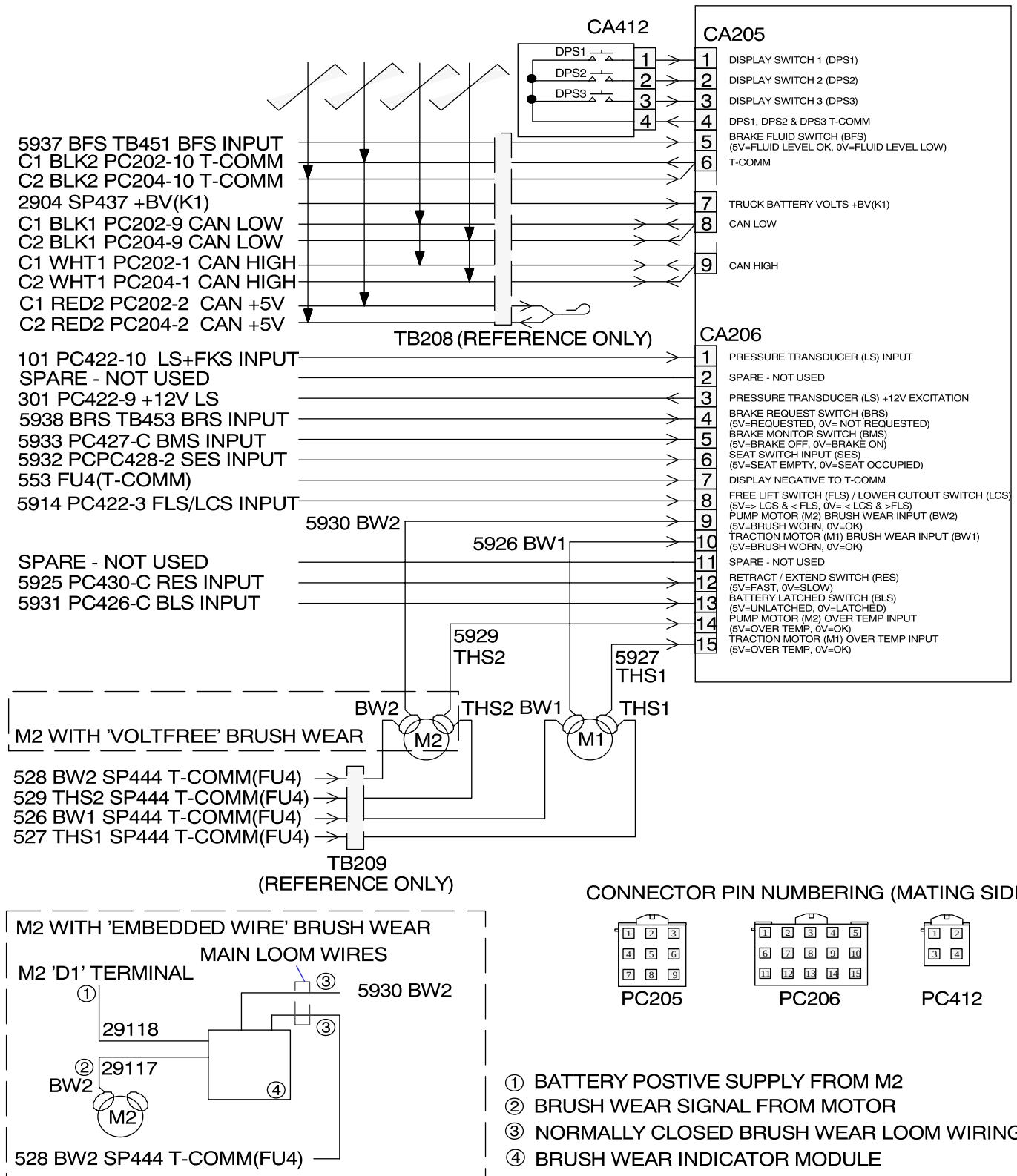


NOTES

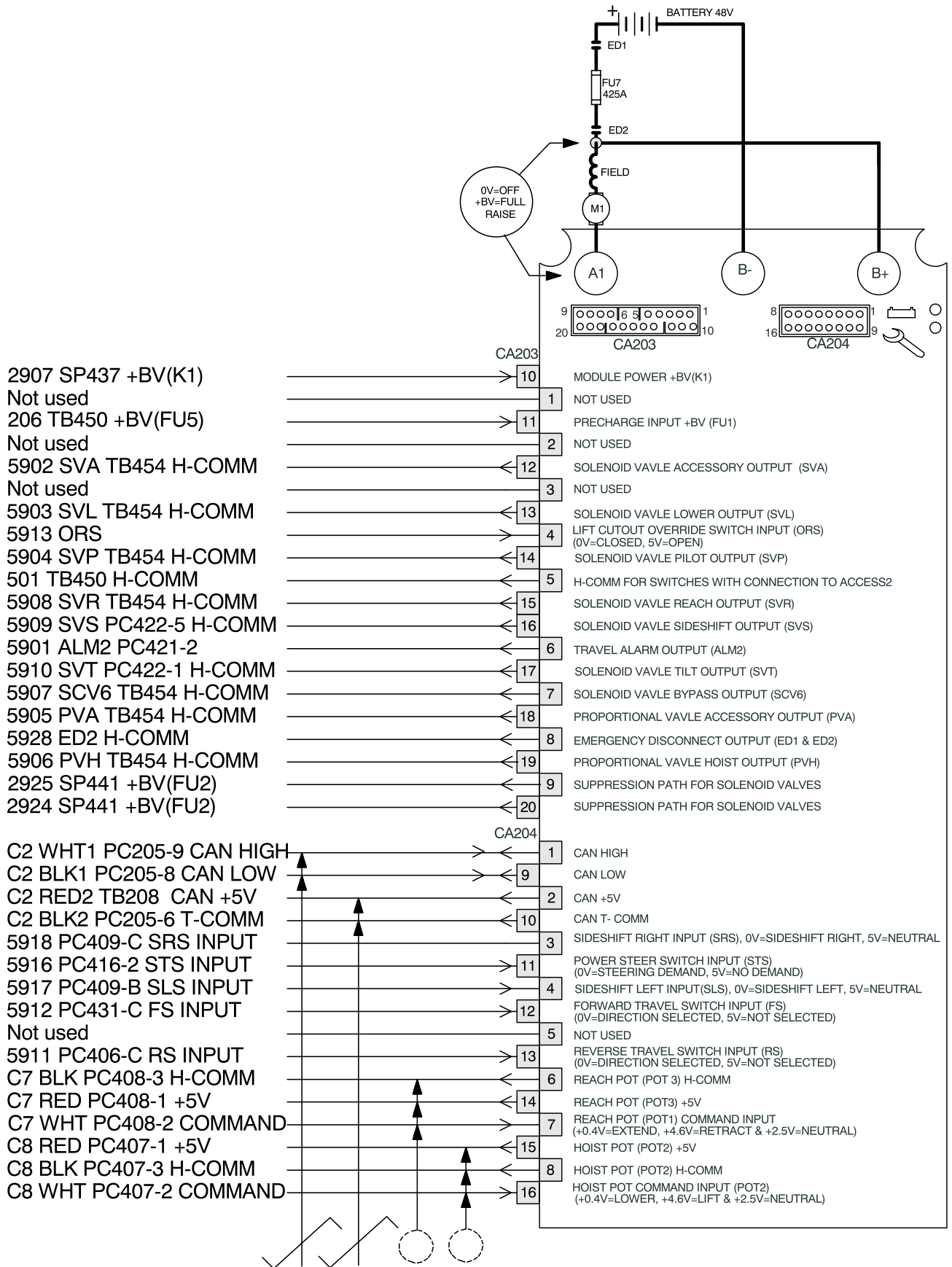
- ① This feature is optional.
- ② HGTS uses same input as ECR2 since both are not present at same time.
- ③ Denotes connection to truck frame.

795400_gb

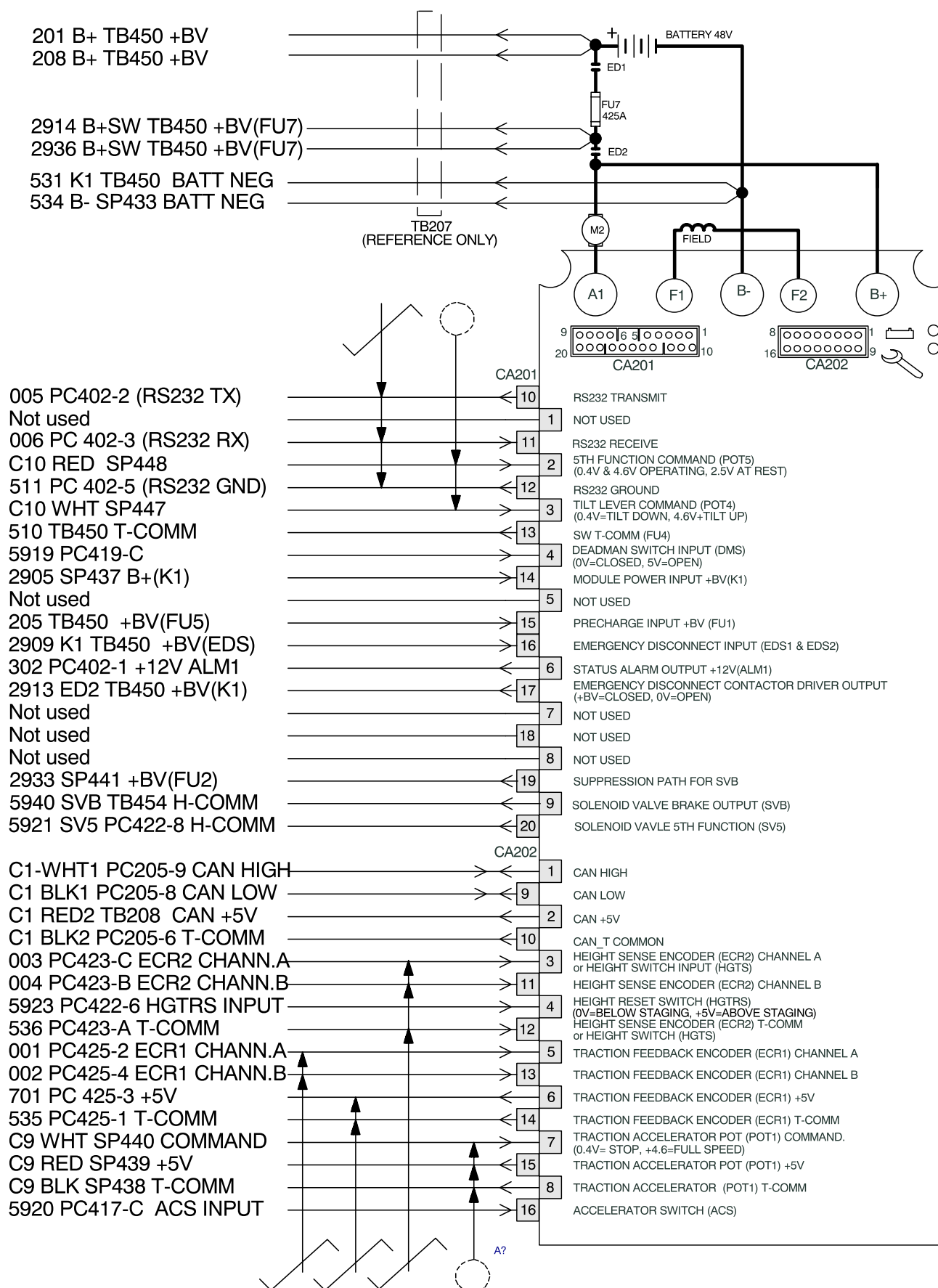
Access1



Access2



Access3

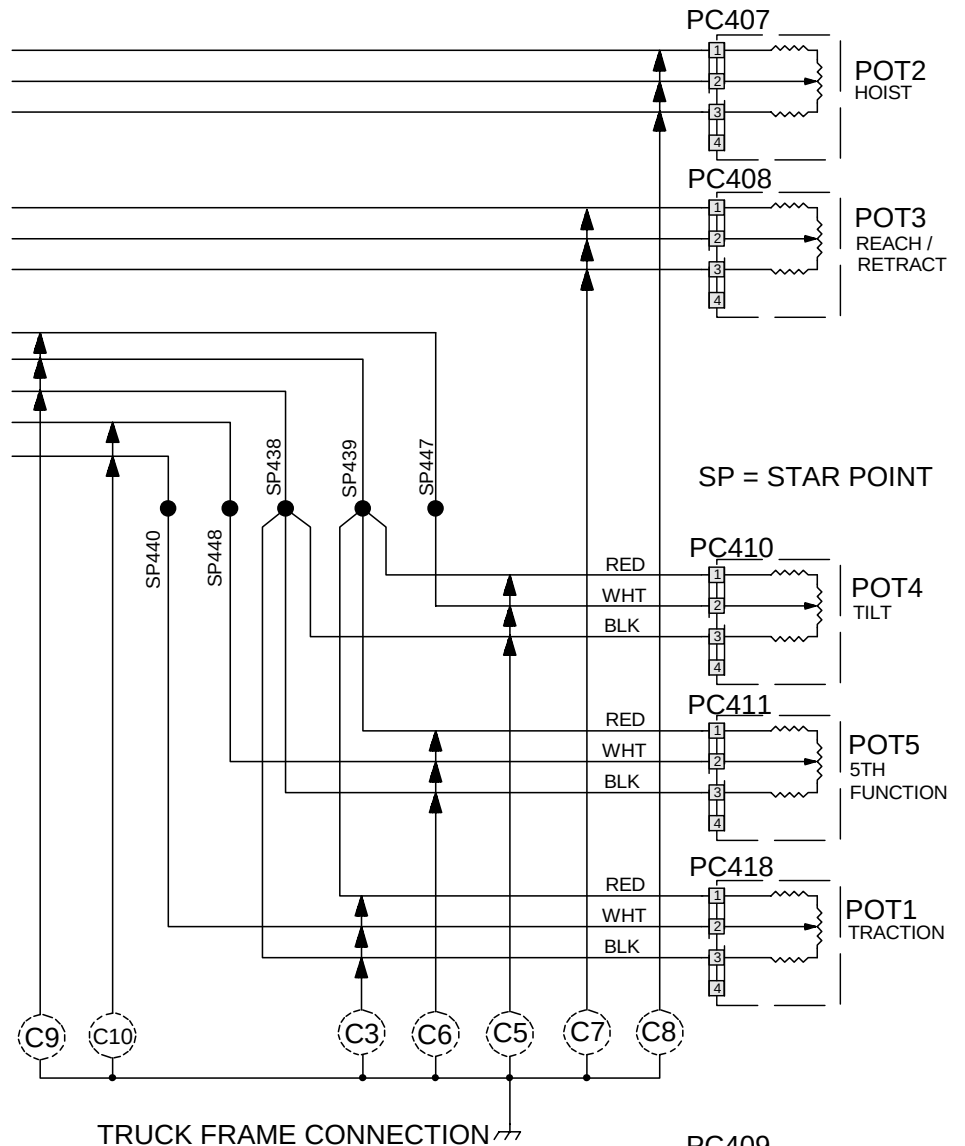


Switches and Operator Controls

C8 RED PC204-15 +5V
C8 WHT PC204-16 COMMAND
C8 BLK PC 204-8 H-COMM

C7 RED PC204-14 +5V
C7 WHT PC204-7 COMMAND
C7 BLK PC204-6 H-COMM

C10 WHT PC201-3 COMMAND
C9 RED PC202-15 +5V
C9 BLK PC202-8 T-COMM
C10 RED PC201-2 COMMAND
C9 WHT PC202-7 COMMAND

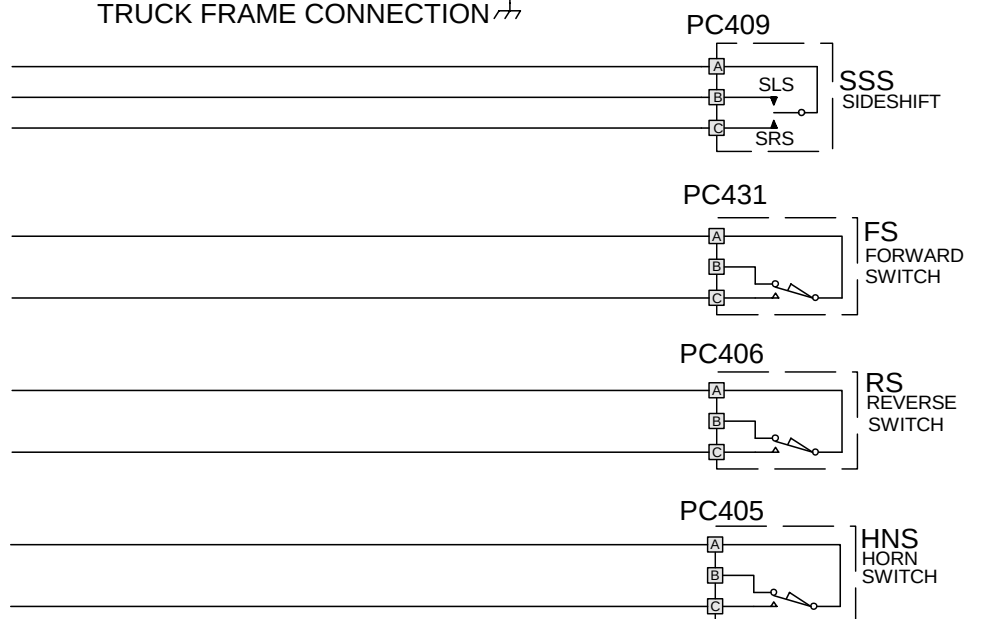


508 SP442 H-COMM(FU3)
5917 PC204-4 SLS INPUT
5918 PC204-3 SRS INPUT

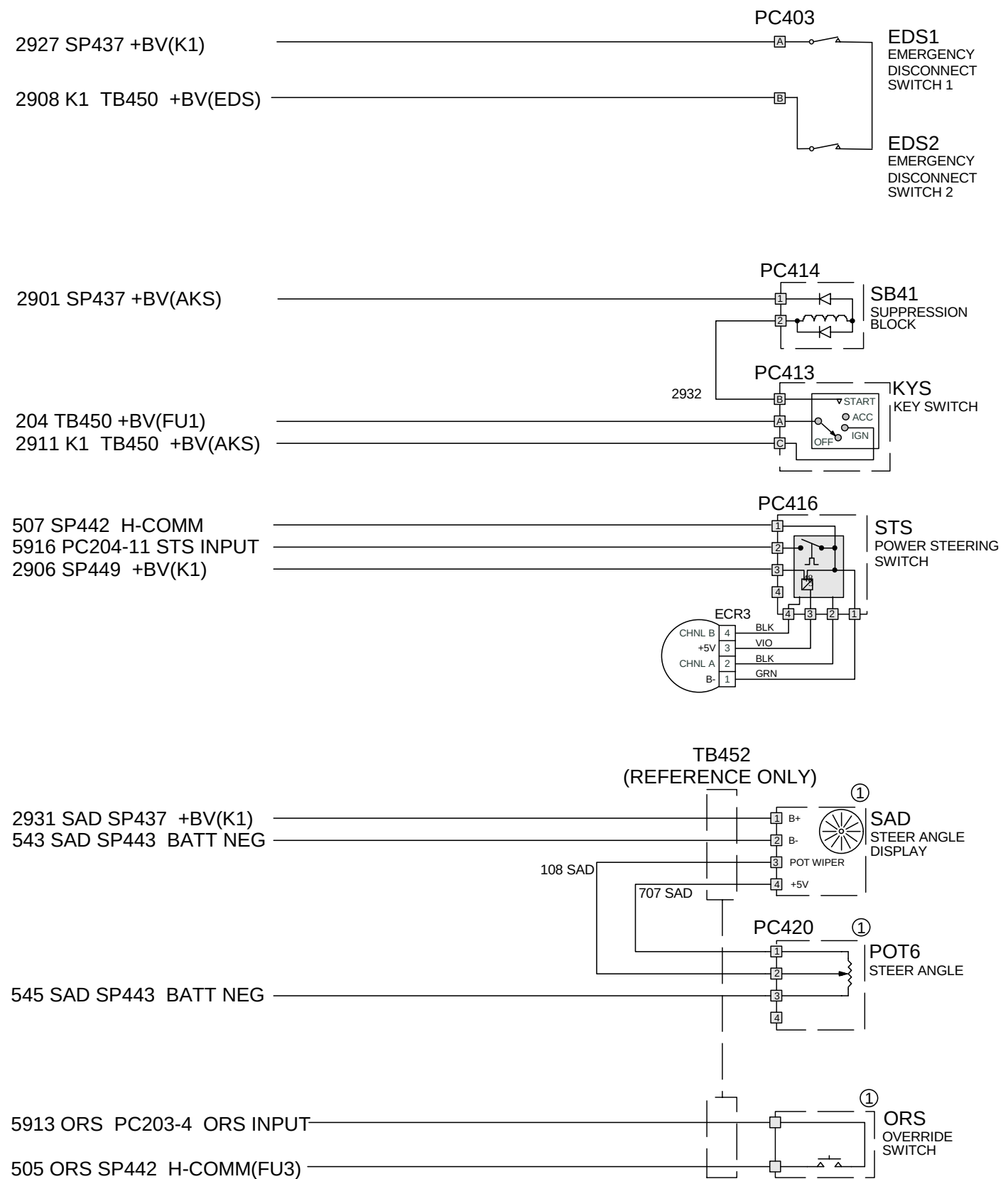
504 SP442 H-COMM(FU3)
5912 PC204-12 FS INPUT

503 SP442 H-COMM(FU3)
5911 PC 204-13 RS INPUT

203 FU1 TB450 +BV(FU1)
2912 HN TB451 +BV(HNS)

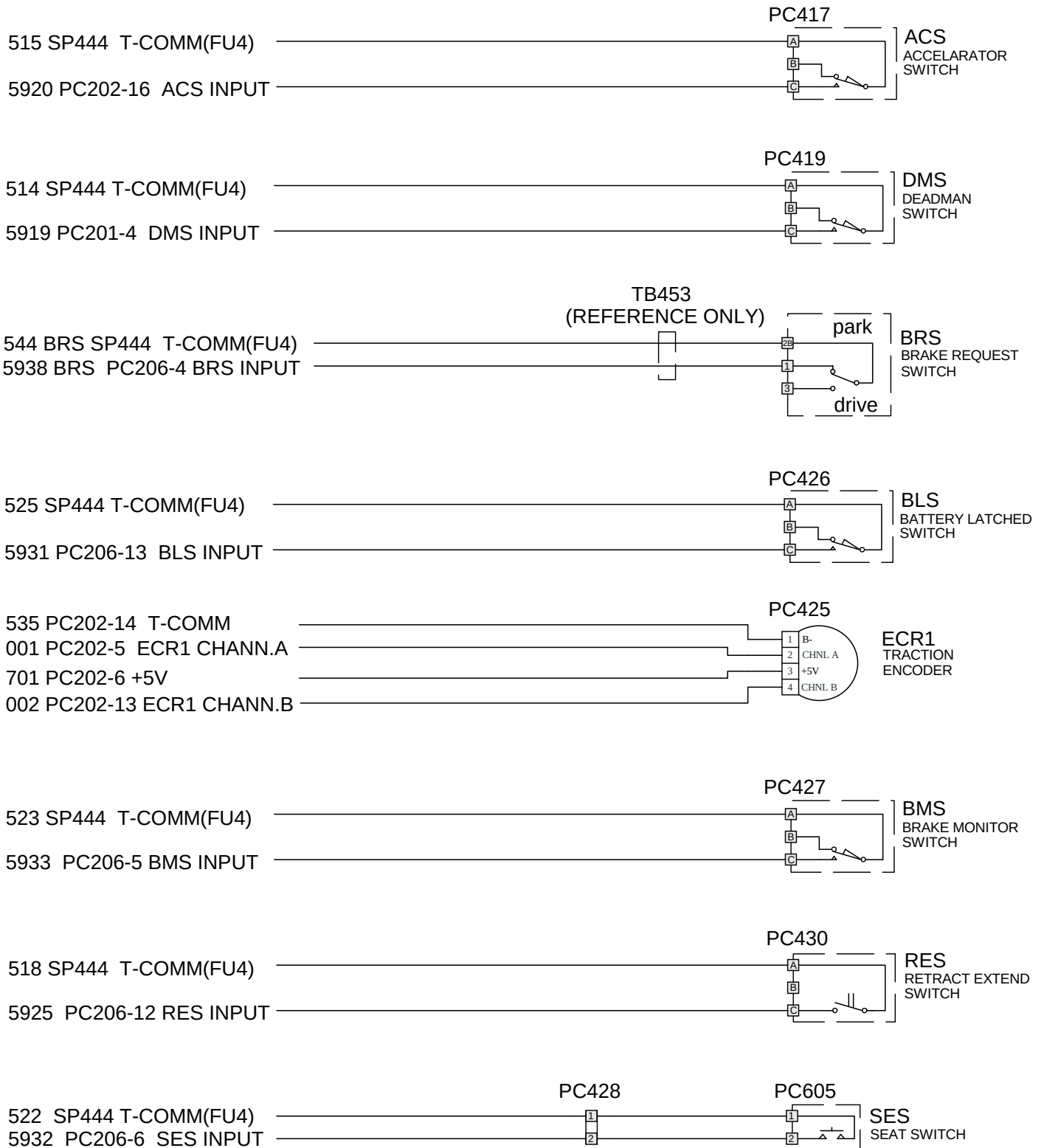


Switches and Operator Controls

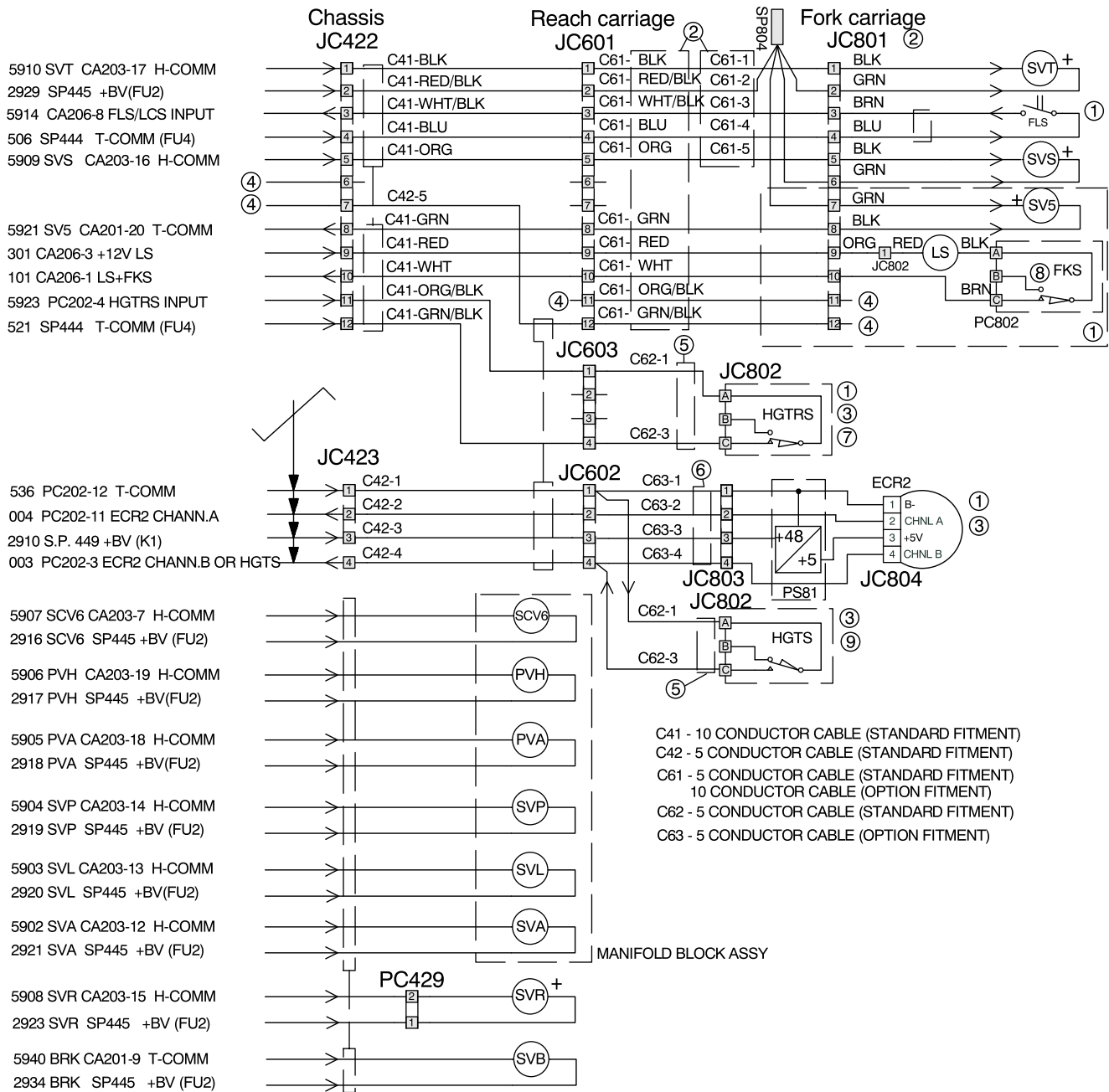


① Optional fitment

Switches and Operator Controls

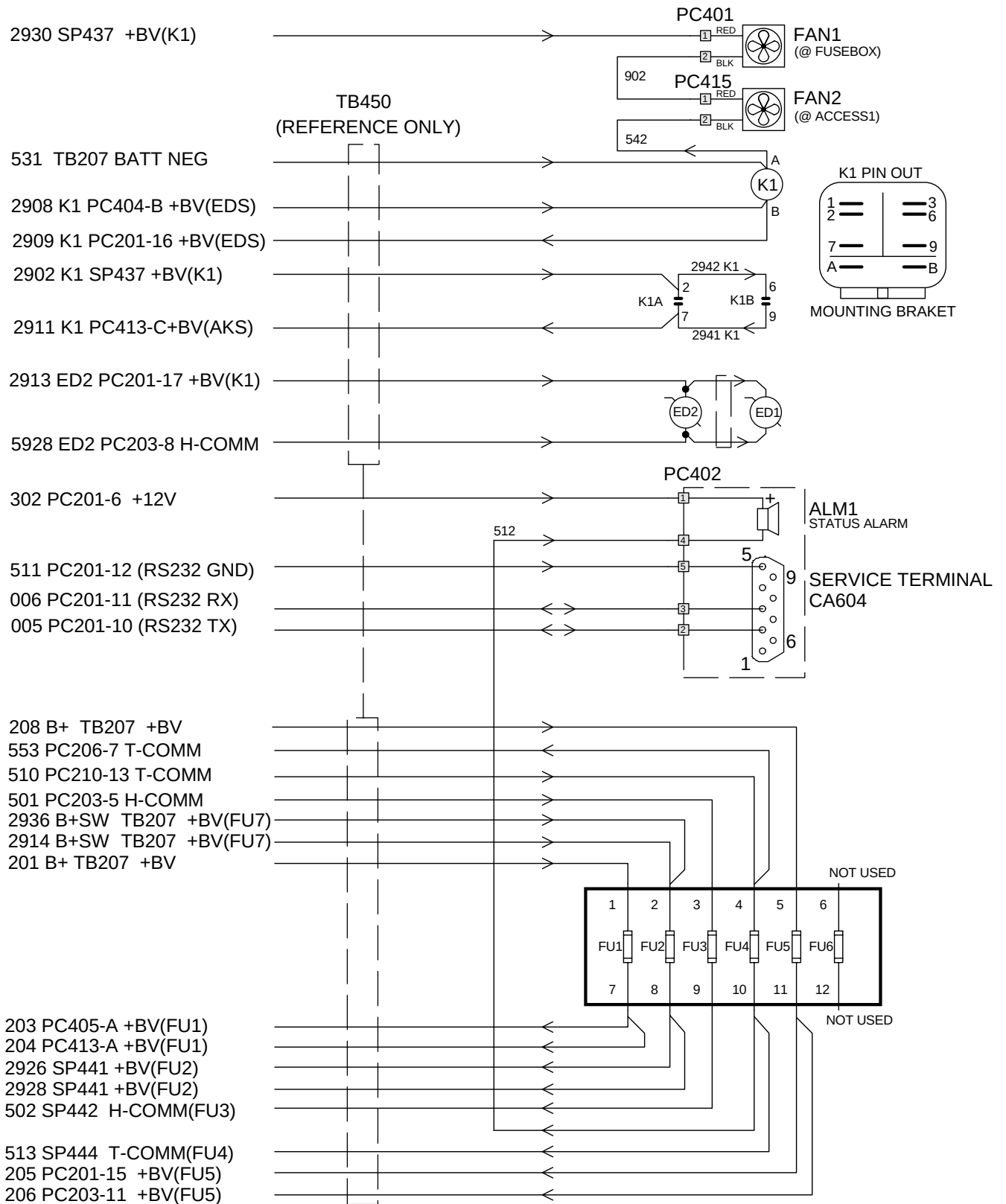


Mast, Hydraulic Components

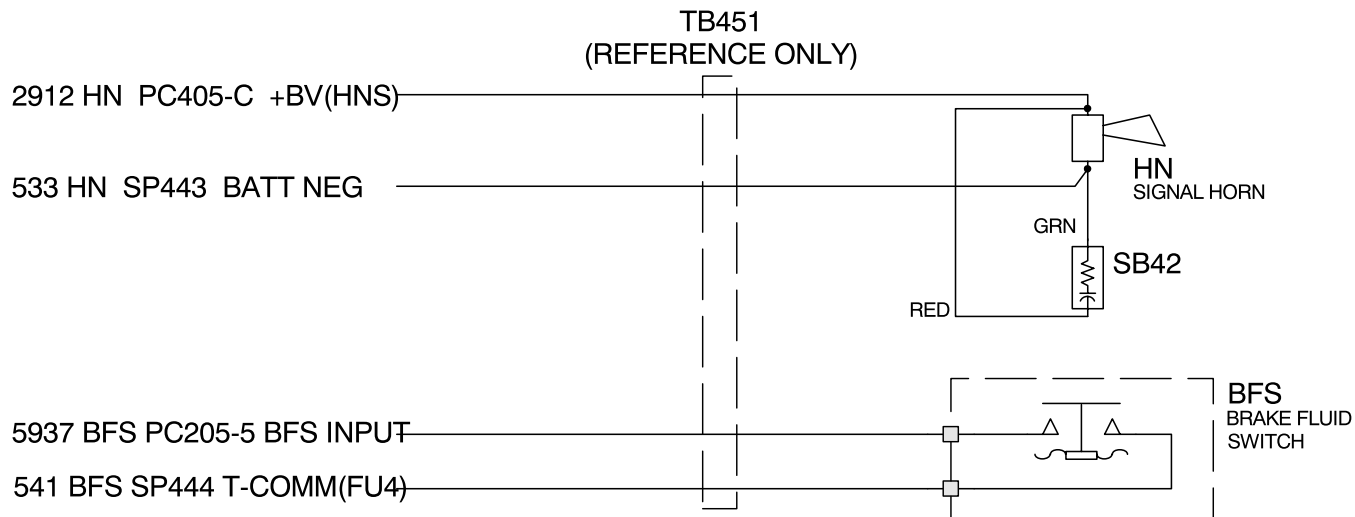
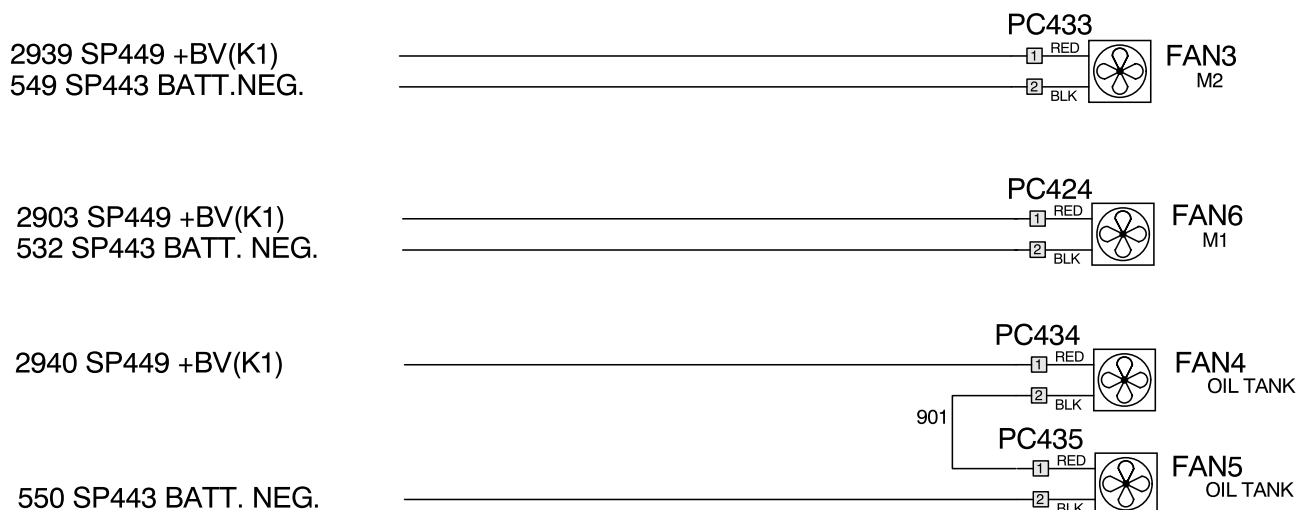


TB454 (REFERENCE ONLY)

Fuses, Fans and Contactors



Fuses, Fans and Contactors



Star Point Loom Connections

STAR POINT 437

2901 PC414-1 +BV(AKS)
2902 K1 TB450 +BV(K1)
2904 PC205-7 +BV(K1)
2905 PC201-14 +BV(K1)
2907 PC203-10 +BV(K1)
2927 PC403-A +BV(K1)
2930 PC401-1 +BV(K1)
2931 SAD TB452 +BV(K1)
2938 SP449 +BV(K1)



STAR POINT 441

2915 SP445 +BV(FU2)
2924 PC203-20 +BV(FU2)
2925 PC203-9 +BV(FU2)
2926 TB450 +BV(FU2)
2928 TB450 +BV(FU2)
2933 PC201-19 +BV(FU2)
2935 SP445 +BV(FU2)



STAR POINT 442

502 TB450 H-COMM(FU3)
503 PC406-A H-COMM(FU3)
504 PC431-A H-COMM (FU3)
505 ORS TB452 H-COMM(FU3)
507 PC416-1 H-COMM(FU3)
508 PC409-A H-COMM(FU3)



STAR POINT 443

532 PC424-2 BATT NEG
533 HN TB451 BATT NEG
534 B- TB207 BATT NEG
543 SAD TB452 BATT NEG
545 SAD TB452 BATT NEG
549 PC433-2 BATT NEG
550 PC435-2 BATT NEG



Star Point Loom Connections

STAR POINT 444

506 PC422-4 H-COMM(FU4)
513 TB450 T-COMM(FU4)
514 PC419-A T-COMM(FU4)
515 PC417-A T-COMM(FU4)
518 PC430-A T-COMM(FU4)
521 PC422-7 T-COMM(FU4)
522 PC428-1 T-COMM(FU4)
523 PC427-A T-COMM(FU4)
525 PC426-A T-COMM(FU4)
526 BW1 TB209 T-COMM(FU4)
527 THS1 TB209 T-COMM(FU4)
528 BW2 TB209 T-COMM(FU4)
529 THS2 TB209 T-COMM(FU4)
541 BFS TB451 T-COMM(FU4)
544 BRS TB453 T-COMM(FU4)

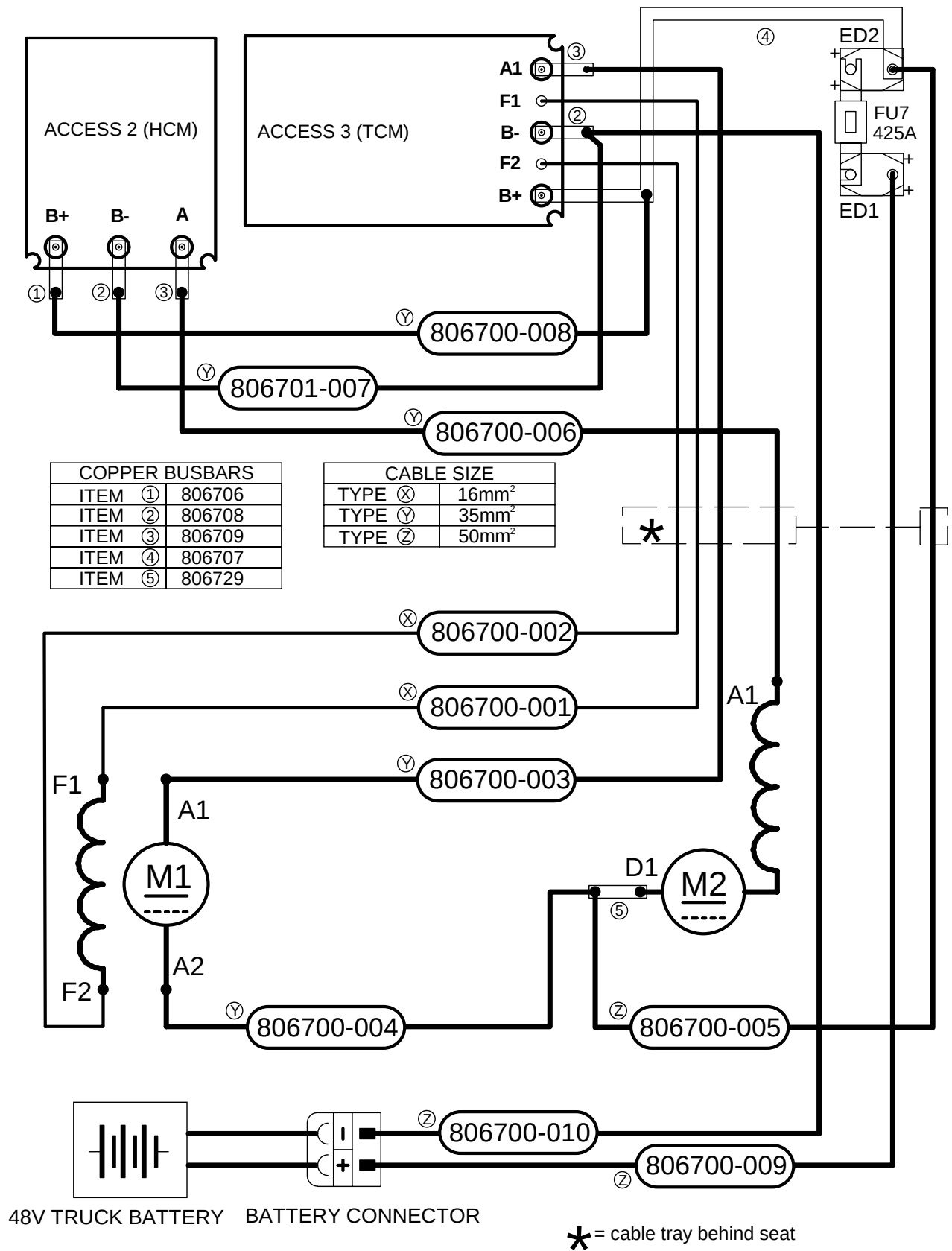
STAR POINT 445

2915 SP441 +BV(FU2)
2916 SCV6 TB454 +BV(FU2)
2917 PVH TB454 +BV(FU2)
2918 PVA TB454 +BV(FU2)
2919 SVP TB454 +BV(FU2)
2920 SVL TB454 +BV(FU2)
2921 SVA TB454 +BV(FU2)
2922 ALM2 PC421-1 +BV(FU2)
2923 SVR PC429-1 +BV(FU2)
2929 PC422-2 +BV(FU2)
2934 BRK TB454 +BV(FU2)
2935 SP441 +BV(FU2)

STAR POINT 449

2903 PC424-1 +BV(K1)
2906 PC416-3 +BV(K1)
2938 SP437 +BV(K1)
2939 PC433-1 +BV(K1)
2910 PC423-3 +BV(K1)

Power Cables



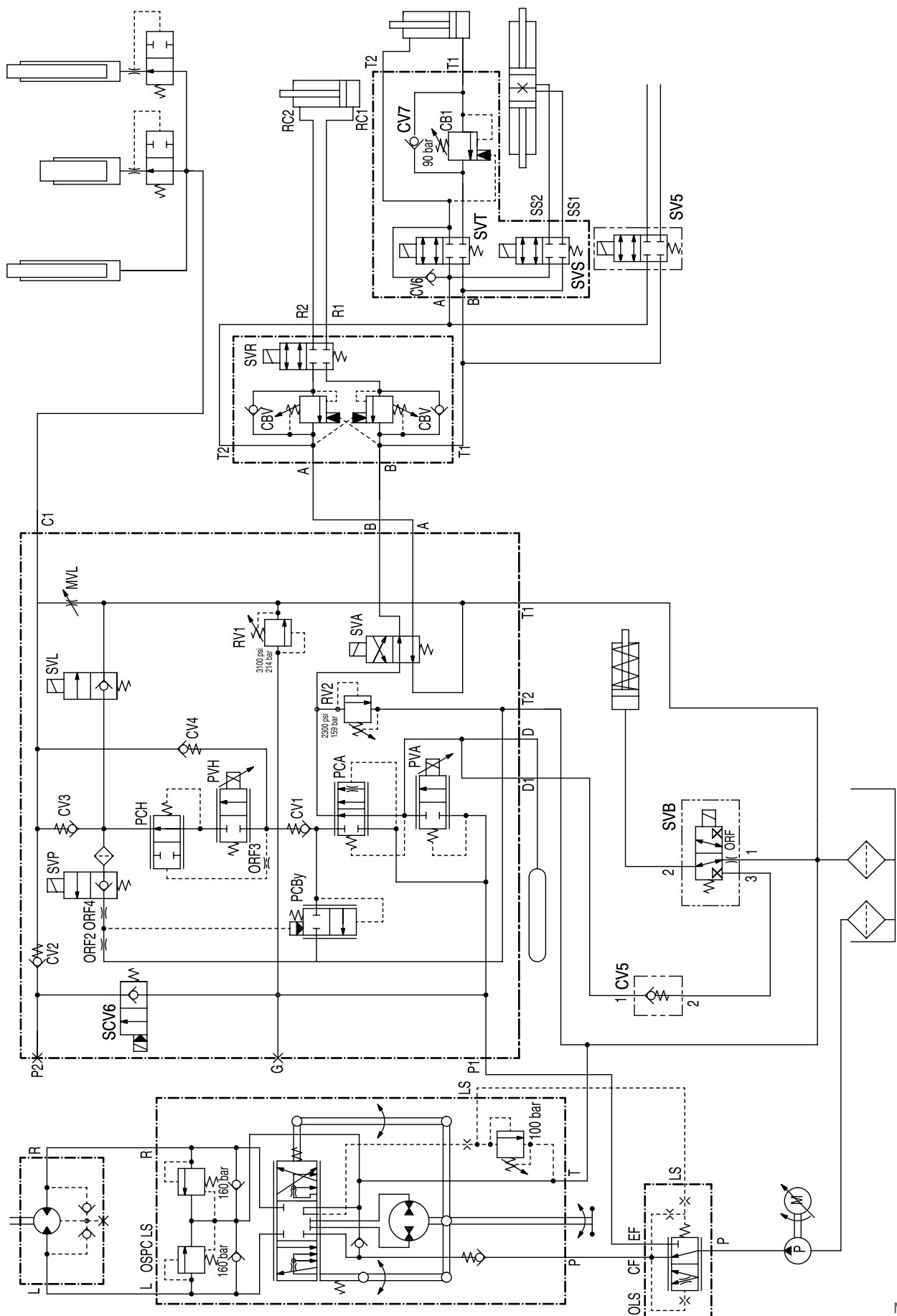
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CROWN

HYDRAULIC SCHEMATIC

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Hydraulic System



M1586

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Printed in Germany • Revision Level C
Order Number: 812550-006