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Description of Symbols and Indicators

Safety Notices

The following symbols will help you to assess the risk to yourself, other people and materials should you fail to comply with a safety notice:

⚠️ DANGER

This symbol warns of immediate danger to the life and health of personnel.
Severe injury or death will result.
Follow all instructions indicated by this symbol in order to avoid injury or death.

⚠️ WARNING

This symbol warns of potential danger to the life and health of personnel.
Severe injury or death may result.
Follow all instructions indicated by this symbol in order to avoid injury or death.

⚠️ CAUTION

This symbol warns of possible danger to the health of personnel.
Injury may result.
Follow all instructions indicated by this symbol in order to avoid injury.

NOTE

This heading warns of material damage and indicates additional information.
- This symbol denotes action to be taken to avoid risks.

Other indicators

1., 2., 3. denote work steps to be taken.
(1), (2), (3) etc. indicate item numbers in illustrations.
- This symbol denotes a list.
General Safety Instructions

Maintenance and Repair Instructions

WARNING

Observe the safety notices contained in the maintenance manual, the operator manual and on the truck. Failure to do so could result in serious or even fatal injuries to maintenance and other personnel.

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

Maintenance and Repairs

- Work must be performed in accordance with these service instructions and relevant service bulletins.
- Maintenance and repair work must only be performed by qualified and authorized personnel.
- Keep fire protection equipment at hand and do not use a naked flame to check fluid levels or to test for leaks.
- Use groundwater neutral, non-flammable solvents for cleaning. Always perform cleaning work over an oil separator. Protect the electrical system against damp.
- Keep the work place and battery charging station clean, dry and well ventilated.
- Do not allow oils to penetrate the ground or the drainage system. Used oil must be recycled correctly. Oil filters and dehumidifying inserts must be treated as special waste. Observe the local authority regulations.
- Spilled battery fluid must be neutralized immediately and thoroughly rinsed.
- Keep the truck clean. This will facilitate tracing loose or faulty components.
- Maintain the legibility of the data capacity plate and data plate, warning and instruction decals.
- Truck modifications and additions may only be performed with Crown’s prior written approval.
- The reliability, safety and suitability of Crown trucks can only be ensured by using original Crown parts.

Before Parking the Truck

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

Before Working on the Truck

- Raise the truck so that the drive wheel can turn freely.
- Apply the Emergency Disconnect and disconnect the battery.
- Prevent the truck from rolling away and lowering.
- Allow sufficient room for manoeuvre when testing the truck, to avoid endangering yourself and other people.

Before Starting the Truck

- Test the safety mechanisms.
- Get into the travel position.
- Test the travel direction switch, speed control, steering, warning mechanisms and brakes.
Warning and Instruction Decals on the Truck

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

- Clean any dirty decals.
- Replace any faulty or missing decals.

The spare parts manual gives details of the labelling and arrangement of the warning and instruction decals on the truck.
INTRODUCTION
General

INFORMATION

This manual is intended only for trained, specialist personnel who are authorised to carry out the operations described.

Service Training

Crown offers appropriate truck-related training for service personnel. For more information contact Crown's service department.

Replacement Parts

This manual does not contain a spare parts list. Replacement parts can be found in the spare parts catalog.

Additional Attachments and Modifications

⚠️ WARNUNG

Untested modifications can lead to fatal accidents. Any modification which alters the original condition of the truck requires prior testing and approval in writing by Crown (see contact address).

- The weight and position of attachments can have a significant affect on the capacity and other features of the truck.
- Modifications to the electrical system or the subsequent installation of electric-powered components can damage the truck.

Using the Manual

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<td>Introduction</td>
</tr>
<tr>
<td>Lubrication &amp; Adjustment</td>
</tr>
<tr>
<td>Drive Unit</td>
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<tr>
<td>Electrical System</td>
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<td>Brake System</td>
</tr>
<tr>
<td>Steering</td>
</tr>
<tr>
<td>Platform</td>
</tr>
<tr>
<td>Schematic Diagrams</td>
</tr>
</tbody>
</table>

Contact Address

CROWN Gabelstapler GmbH & Co.KG
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Fax: +49 (0)89 / 93 002 -175 or 133
Models

This manual covers maintenance and repair work for the following model:

TC 3000-3.0
LUBRICATION & ADJUSTMENT
Lifting and Jacking up the Truck

**CAUTION**

*Scalding risk from battery acid!*
- You must remove the battery before transporting the truck.

This will prevent possible battery acid leakage in the truck and resulting material or personal damage.

Lifting the Truck

**WARNING**

*Truck tipovers and falling loads can cause death!*
- Make sure the lifting truck or crane as well as the lifting gear have sufficient capacity.

Information on the capacity required can be found on the truck data plate under “Truck Weight Less Battery” and “Battery Weight”.

Lifting the truck with a crane

1. Remove the battery
2. Attach chains and hooks (2) to the cutouts in the floorboard in front of the battery compartment (see Fig. TC465).
3. Push a thin board on either side between the truck and the chain.
4. Attach lifting slings around the tow hitch (1) (see Fig. TC465).

Lifting the truck with a forklift truck

1. Remove the battery
2. Position the forks (1) of the truck that is doing the lifting under the chassis of the lift truck (see Fig. TC462).
LUBRICATION & ADJUSTMENT
Lifting and Jacking up the Truck

3. Attach the truck securely onto the forks (1) of the truck doing the lifting (e.g. with a tensioning belt).

Jacking up the Truck

**WARNING**

_Truck tipovers and incorrect handling of the equipment can result in fatal injuries._

- Make sure the jack has sufficient capacity.
- Always support a raised truck with wooden blocks or other suitable equipment to relieve the jack.
- Never place your hands or other parts of your body under the truck before it has been supported.

Information on the capacity required can be found on the truck data plate under “Truck Weight Less Battery” and “Battery Weight”.

1. Place the jack in the centre of the left hand side of the skirt (1, Fig. TC463) and raise the truck a maximum of 20 mm.

2. Place hard wooden blocks (2) under the front and rear ends of the chassis and lower the truck onto them.

3. Place the jack in the centre of the right hand side of the skirt (3) and raise the truck a maximum of 20 mm.

4. Place hard wooden blocks (4) underneath and lower the truck.

---

TC 3000

14
Towing the Truck

**WARNING**

*Truck tipovers and falling loads can cause death!*

- Make sure the towing truck has sufficient capacity. Information on the capacity required can be found on the truck data plate under “Truck Weight Less Battery” and “Battery Weight”.

**NOTE**

*Risk of damage to the drive system!*

As the drive wheel is braked on de-energised trucks, the truck must be raised sufficiently when being towed to prevent the drive wheel from contacting the ground.

1. Remove the battery.
2. Place the forks (1) of the towing truck underneath the lift truck (see Fig. TC464).
3. Raise the truck (approx. 20 mm) until the drive wheel has been lifted off the ground.
4. Pull the truck **slowly and only in a forward direction** (as indicated by the arrow in Fig. TC464).
Taking the Truck out of Service

You must carry out the following tasks if you are withdrawing the truck from service for more than 3 months:

1. Disconnect the battery.
2. De-commission the battery in accordance with the manufacturer’s instructions.
3. Clean and then lubricate the truck.

**NOTE**

*Note the following when cleaning the truck:*
- Do not use pressure jets and/or solvents on the truck.
- Do not use metal brushes.
- Do not wet-clean the electrical system.
- Do not use flammable cleaning agents.
- Take measures to protect the environment.

4. If possible store the truck in a dry room with as constant a temperature and air humidity as possible.
   Do not park the truck outdoors or in a humid environment.

5. If the truck has to be stored in hostile conditions (e.g. saline atmosphere) treat the surface of the truck with a suitable preservative to prevent corrosion.

6. If the truck has to be stored in excessively dusty conditions, cover it with a permeable material and not plastic sheets as these can allow condensation water to form.

7. Jack up the truck (see page 15), as otherwise the constant pressure can cause the wheels to flatten.

Restoring the Truck to Service

To restore the truck to service, proceed as follows:

1. Remove the anti-corrosion film.
2. Jack up the truck, remove the wooden blocks and lower the truck.
3. Charge the battery or install a charged battery.
4. Connect the battery.
5. Carry out the daily safety inspection.

Testing Re-Commissioned Trucks

Trucks that have been out of service for a long period of time must be checked at regular intervals. To do this, proceed as follows:

1. Connect the battery and test the truck’s functions.
2. Check the gear unit for leaks.
3. Check any anti-corrosion film that may have been added and replace if necessary.
4. Disconnect the battery.
Recommended Lubricants and Accessories

The tables show typical lubricants used by Crown itself in its facilities. However, you can use any lubricants provided they meet the same technical criteria.

Cold Store Trucks

Special hydraulic oil, lubrication oil and grease must be used for cold store trucks operating in low temperature conditions (see table).

<table>
<thead>
<tr>
<th>Type</th>
<th>Lubricant Type</th>
<th>Product</th>
<th>Manufacturer</th>
<th>Crown Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Transmission oil</td>
<td>Hyp 85W90</td>
<td>Aral</td>
<td>053002-004</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GX-D 85W90</td>
<td>Esso</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobilube HD85W90</td>
<td>Mobil</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spirax MB90</td>
<td>Shell</td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>Low temperature transmission oil</td>
<td>Mobil SHC 624</td>
<td>Mobil</td>
<td>053002-009</td>
</tr>
<tr>
<td>B</td>
<td>Grease (Multi-Purpose)</td>
<td>Aralube HLP2</td>
<td>Aral</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>LM Grease</td>
<td>Castrol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regulus A2</td>
<td>Century</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beacon EP2</td>
<td>Esso</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EP2</td>
<td>Maxol</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mobiluxe EP2</td>
<td>Mobil</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retinax LX</td>
<td>Shell</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALGWMII</td>
<td>SKF</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Renolit MP</td>
<td>Fuchs</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>Low temperature grease</td>
<td>Aralube SKL2</td>
<td>Aral</td>
<td>053002-005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unirex Lotemp EP</td>
<td>Mobil</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duraplex EP2</td>
<td>Fuchs</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Lubrication oil</td>
<td>Essolube HDX+40</td>
<td>Esso</td>
<td>053002-007</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kowal M 40</td>
<td>Aral</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delvac 1240</td>
<td>Mobil</td>
<td></td>
</tr>
<tr>
<td>GG</td>
<td>Low temperature lubrication oil</td>
<td>Mobil SHC 626</td>
<td>Mobil</td>
<td>053002-008</td>
</tr>
<tr>
<td>M</td>
<td>Special grease</td>
<td>Molycote® BR-2 Plus</td>
<td>Dow Corning</td>
<td></td>
</tr>
</tbody>
</table>

An anti-corrosion fluid (Crown no. 805236-004) must be applied to all screws, washers, nuts, pins, retaining rings etc. Carefully protect all electrical connections and components against corrosion. For detailed information, refer to the Electrical System chapter.

Service intervals (see page 19) must be adapted to the conditions of use.
## LUBRICATION & ADJUSTMENT

### Recommended Lubricants and Accessories

<table>
<thead>
<tr>
<th>Lubricants</th>
<th>Product</th>
<th>Application</th>
<th>Crown Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-corrosive agent</td>
<td>Tectyl</td>
<td>Corrosion inhibitor for cold store trucks</td>
<td>805236-004</td>
</tr>
<tr>
<td>Rubber &amp; Vinyl Dress-</td>
<td>Commercial</td>
<td>Rubber Components, Plastic Panels</td>
<td>............</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Way</td>
<td></td>
</tr>
</tbody>
</table>

---

TC 3000
Planned Maintenance

The following inspection and maintenance schedule assumes single-shift operation under normal conditions.

The maintenance intervals must however always be 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.

 Routinely check for wear, corrosion, damage, and test component operation and safety when carrying out maintenance work. If in doubt, replace components.

Planned maintenance must be performed either after a certain number of service hours or a certain period of time (whichever is reached first).

Guide to abbreviations:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Months</td>
</tr>
<tr>
<td>h</td>
<td>Service hours</td>
</tr>
<tr>
<td>X</td>
<td>Perform on standard trucks</td>
</tr>
<tr>
<td>C</td>
<td>Perform on cold store trucks</td>
</tr>
<tr>
<td>X/C</td>
<td>Perform on standard and cold store trucks</td>
</tr>
</tbody>
</table>

### Guide to abbreviations:

Position | Component | Lubricant | Action | 12 M | 24 M | 36 M |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I-1</td>
<td>Truck, general</td>
<td></td>
<td>Clean truck if necessary.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>NOTE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note the following when cleaning the truck:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Do not use pressure jets and/or solvents on the truck.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Do not use metal brushes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Do not wet-clean the electrical system.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Do not use flammable cleaning agents.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Note the environmental safety guidelines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-2</td>
<td>Labels, decals(a)</td>
<td></td>
<td>Check that labels and decals are legible. Replace any illegible or severely damaged decals.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-3</td>
<td>Handles* Backrest grab bar* Work Assist ™</td>
<td></td>
<td>Ensure it is fitted securely and check for damage.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-4</td>
<td>Emergency Disconnect(b)</td>
<td></td>
<td>Test Emergency Disconnect power switch.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-5</td>
<td>Steering(b)</td>
<td></td>
<td>Check operation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-6</td>
<td>Travel functions(b)</td>
<td></td>
<td>Drive the truck in both directions.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TC 3000
<table>
<thead>
<tr>
<th>Position</th>
<th>Component</th>
<th>Lubricant</th>
<th>Action</th>
<th>12 M</th>
<th>24 M</th>
<th>36 M</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-7</td>
<td>Brake (b)</td>
<td>Test by changing the travel direction with the travel switch. Check brake switch.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-8</td>
<td>Hitch Position Control™ (b)</td>
<td>Test in both directions.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-9</td>
<td>Load wheels and castors</td>
<td>Check bearing play. Check tyres for wear.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-10</td>
<td>Drive wheel</td>
<td>Check wheel nut torque (130 Nm). <strong>NOTE</strong> <em>On new trucks or after removing/assemblying the drive wheel, torque the wheel nuts after 100 h to 130 Nm.</em> Check tyres for wear.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-11</td>
<td>Drive motor</td>
<td>Torque drive motor mounting screws to 16 Nm.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check that power cable connections on the drive motor are secure. Torques: Torque the bottom nut to 7.5 Nm. Torque the top nut to 2.5 Nm.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-12</td>
<td>Drive transmission unit</td>
<td>Torque drive transmission unit mounting screws to 70 - 75 Nm.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-13</td>
<td>Battery connector</td>
<td>Check connector housing, contact springs and cables. Clean contacts.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-14</td>
<td>Electrical system</td>
<td>Check insulation of all accessible wires for damage. Make sure switches and connections are fitted securely and check for damage.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-15</td>
<td>Battery cover</td>
<td>Lubricate hinges and lock.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-16</td>
<td>Main contactor</td>
<td>Clean main contactor contacts and check for wear.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-17</td>
<td>Traction controller</td>
<td>Torque the traction controller mounting screws to 8 - 10 Nm. Check the power cable connections on the traction controller are secure. Nut torque: 13 - 15 Nm. Check and analyse error log.</td>
<td>X/C</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## LUBRICATION & ADJUSTMENT

### Planned Maintenance

<table>
<thead>
<tr>
<th>Position</th>
<th>Component</th>
<th>Lubricant</th>
<th>Action</th>
<th>12 M</th>
<th>24 M</th>
<th>36 M</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-18</td>
<td>Electromechanical brake</td>
<td></td>
<td>Check the dust shield ring for damage. Apply weak pressurized air to the abrasion. Measure the air gap (see page 115).</td>
<td>X/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-19</td>
<td>Steering</td>
<td></td>
<td>Test the steering auto-reset. Replace the tiller recuperating spring if required (see page 140).</td>
<td>X/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-20</td>
<td>Steer motor</td>
<td>Z/ZZ</td>
<td>Clean and lubricate the exposed steer motor toothing.</td>
<td>X/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-20</td>
<td></td>
<td>Check that power cable connections on the steer motor are secure. Torques: Torque the bottom nut to 3.75 Nm. Torque the top nut to 1.25 Nm.</td>
<td>X/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-21</td>
<td>Drive transmission unit</td>
<td>K/KK</td>
<td>Check the oil level and replenish as required (see page 29). Replace the oil (see page 29).</td>
<td>X/C</td>
<td></td>
<td>X/C</td>
</tr>
<tr>
<td>I-22</td>
<td>Traction and steering controllers</td>
<td></td>
<td>Carry out a PMT test (see page 110).</td>
<td></td>
<td></td>
<td>Annually</td>
</tr>
<tr>
<td>I-23</td>
<td>Entire truck</td>
<td></td>
<td>Carry out the UVV inspection (Germany only). In other countries: the truck must be inspected at intervals determined by national legislation or regulations.</td>
<td></td>
<td></td>
<td>Annually</td>
</tr>
<tr>
<td>I-24</td>
<td>Tow hitch and hitch plate</td>
<td></td>
<td>Test the operation of the hitch mechanism. Check that the tow hitch and hitch plate are secure. Torque the screws to standard levels and replace if damaged. Lubricate the tow hitch including the drawbar eye and drawbar eye support.</td>
<td>X/C</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L-25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-26</td>
<td>Steering controller</td>
<td></td>
<td>Torque the steering controller mounting screws to 8 - 10 Nm. Check the power cable connections on the steering controller are secure. Nut torque: 2.5 - 3 Nm</td>
<td>X/C</td>
<td>X/C</td>
<td></td>
</tr>
</tbody>
</table>

---

**a.** For items numbers and ordering information refer to the spare parts catalog.

**b.** See operator manual.
LUBRICATION & ADJUSTMENT

Inspection and Lubrication Points

- I-9
- I-10
- I-21
- I-9
- I-24, L-25
### Standard Torques

**NOTE**

The torques listed in the manual always take precedence over standard torques.

<table>
<thead>
<tr>
<th>Standard Screws and Nuts</th>
<th>8 and 8.87</th>
<th>10 and 10.9</th>
<th>12 and 12.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread Size</td>
<td>Torque (Nm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5 x 0.8</td>
<td>5 - 6</td>
<td>7 - 8</td>
<td>8 - 10</td>
</tr>
<tr>
<td>M6 x 1</td>
<td>8 - 10</td>
<td>12 - 14</td>
<td>14 - 16</td>
</tr>
<tr>
<td>M8 x 1.25</td>
<td>20 - 25</td>
<td>30 - 35</td>
<td>34 - 40</td>
</tr>
<tr>
<td>M10 x 1.5</td>
<td>40 - 45</td>
<td>60 - 65</td>
<td>70 - 75</td>
</tr>
<tr>
<td>M12 x 1.75</td>
<td>70 - 80</td>
<td>100 - 110</td>
<td>115 - 130</td>
</tr>
<tr>
<td>M16 x 2</td>
<td>170 - 190</td>
<td>240 - 270</td>
<td>280 - 320</td>
</tr>
<tr>
<td>M20 x 2.5</td>
<td>340 - 380</td>
<td>450 - 500</td>
<td>550 - 600</td>
</tr>
<tr>
<td>M24 x 3</td>
<td>580 - 650</td>
<td>800 - 900</td>
<td>900 - 1050</td>
</tr>
<tr>
<td>M30 x 3.5</td>
<td>1150 - 1300</td>
<td>1600 - 1800</td>
<td>1850 - 2100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Umbrako screws and nuts</th>
<th>10 and 10.9</th>
<th>12 and 12.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread Size</td>
<td>Torque (Nm)</td>
<td></td>
</tr>
<tr>
<td>M5 x 0.8</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>M6 x 1</td>
<td>14</td>
<td>19</td>
</tr>
<tr>
<td>M8 x 1.25</td>
<td>33</td>
<td>45</td>
</tr>
<tr>
<td>M10 x 1.5</td>
<td>63</td>
<td>86</td>
</tr>
<tr>
<td>M12 x 1.75</td>
<td>111</td>
<td>152</td>
</tr>
<tr>
<td>M16 x 2</td>
<td>270</td>
<td>372</td>
</tr>
<tr>
<td>M20 x 2.5</td>
<td>521</td>
<td>717</td>
</tr>
</tbody>
</table>
Castor Wheels and Skids

Frame
Adjusting the Castor Wheels and Skids

The castor wheels (7) and skids (2) must be 5 mm above the ground to prevent the truck from tipping over around corners. The castor wheels and skids are adjusted in the same way.

1. Position the unladen truck on a level surface.
2. Switch the truck off and prevent it from being switched on again.
3. Check the condition of the castor wheels (7) / skids (2) and make sure they are 5 mm above the ground.

Note: Any worn castor wheels or skids must be replaced. If the distance from the castor wheels / skids to the ground is more than 5 mm, they must be re-adjusted.

4. Place a 5 mm thick plate under the castor wheels (7) or skids (2).
5. Loosen the screws (1) on either side and move the castor wheels (7) or skids (2) over the slotted holes so that they are positioned on the plate.
6. Torque the screws (1) on either side to standard levels and remove the plate.
7. Switch on the truck and carry out a test run.
DRIVE UNIT
Changing the Transmission Oil

⚠️ CAUTION

Hazardous chemicals can cause serious injury. Observe the manufacturer's safety instructions when handling solvents and lubricants.

Allow the transmission oil to reach operating temperature before changing it. This ensures that it can drain off quickly and take any contamination with it.

For oil change intervals see “Routine Maintenance”, page 19.

For authorised oil grades see Recommended Lubricants and Accessories, page 17. The approximate capacity is 1.8 litres.

NOTE

The refill plug can only be accessed when the truck is raised. Therefore a crane or another truck with sufficient capacity must be used to raise the truck. Jacking up the truck is prohibited for safety reasons. Alternatively, if the truck can only be raised by a certain amount, the drive motor can be removed (see page 103) in order to add oil via the open gear unit cover.

⚠️ WARNING

Danger of death
A falling truck can kill you!
Always use lifting gear, slings and blocks with sufficient capacity.

Carry out the following tasks before standing underneath a raised truck:

• Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.
• If the truck is raised with a forklift truck, it must be secured on the forks of the truck doing the lifting, to prevent it from slipping and falling off.
• Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.

1. Raise the truck with a crane or forklift truck (see pages 13 and 14) until the drive wheel is clear of the ground.
2. Secure the raised truck to prevent it from lowering accidentally.
3. Power up the truck and apply the steering to turn the drive wheel so that the refill plug (1) and the drain plug (2) are accessible.
4. Switch off the truck and prevent it from being switched on again.
5. Place a flat tray with a minimum capacity of 2 litres underneath to collect the used oil.

For gear units with a refill plug:
   – Unscrew the refill plug (1, see Fig. GPC411).

For gear units without a refill plug:
   – Remove the drive motor (see page 103).
6. Unscrew the drain plug (2, see Fig. GPC411) and collect the oil.
7. Dispose of used oil in accordance with environmental and local regulations.
8. Clean the drain plug (2), screw it on and tighten.

**NOTE**

*Make sure to use the correct oil grade: cold store trucks require a different type of oil than standard trucks.*

9. Add a suitable transmission oil (see Recommended Lubricants and Accessories on page 17).
   - Capacity: approx. 1.8 litres
10. Clean the refill plug (1), screw it on and tighten.
11. Remove the jack from the truck and the device to prevent it from being switched on.
12. Test the steering.
13. Lubricate steering toothing (3, see Fig. GPC411) with type M lubricant (see Recommended Lubricants and Accessories on page 17).
Components

The drive unit consists of a drive assembly and a steering assembly.

The drive assembly comprises the following:

- Brake (1)
- Drive transmission unit (4)
- Drive wheel (5)
- Drive motor (6)

The steering assembly comprises the following:

- Steer motor (2)
- Steering transmission (3)

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

- Brake (see page 115)
- Drive motor (see page 103)
- Steering assembly (see page 105)
- Drive wheel (see page 35)
- Shaft seal of the output shaft on which the drive wheel (5) is seated (see page 32).

**NOTE**

*In the following sections we will first describe operations that can be performed on the drive transmission unit with the drive unit installed. This will be followed by the removal and complete disassembly of the drive transmission unit.*
Replacing the Output Shaft Seal

DRIVE UNIT

Replacing the Output Shaft Seal
Special Tools Required

Tool to press in the shaft seal (part no. 822671).

Preparation

1. Jack up the truck and secure it (see page 13).
2. Drain the transmission oil (see page 29).
3. Disassemble the drive wheel (see page 35).

Shaft Seal Removal

The item numbers refer to Figure GPC412 on page 32.

Output shaft removal

1. Remove the screws (42) and take off the cover (43).

Note: If there is a cover pressed in on the gear unit, it must be damaged in order to remove it. Proceed as follows:
1. Carefully penetrate the cover with a large screwdriver and a hammer.
2. Lever off the cover with the screwdriver.

The cover (43) is now removed. Proceed as follows:
1. Loosen the screw (41) and remove it together with the washer (40).
2. Press off the output shaft (50).
3. Remove the shims (35) and bushing (36).
4. Pull off the bearing (34) and remove the shaft seal (51) from the output shaft.

Output shaft assembly

CAUTION

Hazardous chemicals can cause serious injury. Observe the manufacturer’s safety instructions when handling solvents and lubricants.

1. Grease the sealing lip of the new shaft seal.
2. Place the shaft seal (51) onto the output shaft (50).
3. Press on a new bearing (34).
4. Fit the shims (35) and bushing (36).
5. Push the pre-assembled output shaft (50) into the gear unit.
6. Assemble the washer (40) and screw (41).
7. Torque the screw (41) to 260 Nm.

Note: Check the output shaft friction torque after each assembly.
- It should be 4 - 10 Nm
If the friction torque is out of range, proceed as follows:

Adjusting the output shaft friction torque

1. Remove the output shaft again.
- To reduce the friction torque:
  - Increase the rated size of the shims (35).
- To increase the friction torque:
  - Reduce the rated size of the shims (35).
2. Reassemble the output shaft.
Check the friction torque again and re-adjust if required.
3. Using the special tool press the shaft seal (51) over the holes in the output shaft flange into its correct position.

To assemble the cover (43) with screws:

1. Clean the contact surfaces of the housing (44) and cover (43) with a suitable solvent.
2. Apply a sealing compound to the contact surfaces in accordance with the manufacturer’s instructions. We recommend either Loctite® 518, Loctite® 574 or Terostat® MS935.
3. Place the cover (43) in position and torque the screws (42) to 10 Nm.

NOTE

Check the hardening time of the sealing compound used before adding oil.
4. Add transmission oil (see page 29).
To press on the cover (43):

**NOTE**

*The cover may get damaged during assembly. To fit the cover use a secure washer to place the cover on.*

1. Fit a new cover (43) with the sealed side facing out.
2. Using a plastic hammer and a secure washer (⌀ 148 - 150 mm) underneath, strike the cover evenly without damaging it.
3. Insert and tighten the drain plug (45).

**NOTE**

*Check the hardening time of the sealing compound used before adding oil.*

4. Add transmission oil (see page 29).
Drive Wheel and Wheel Bolt Replacement

Drive Wheel Disassembly

The truck must be raised in order to remove the drive wheel (see page 13).

**WARNING**

*Danger of death*

*A falling truck can kill you!*

*Always use lifting gear, slings and blocks with sufficient capacity to raise the truck.*

*Carry out the following tasks before standing underneath a raised truck:*

- Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.
- If you are raising the truck with another forklift truck, secure it to the forks of the truck doing the lifting so that it cannot slip or fall down.
- Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.

1. Raise the truck with a crane or forklift truck (see page 13) until the drive wheel is clear of the ground.
2. Secure it against accidental lowering.
3. Switch on the truck and turn the steering until the drive wheel nuts can be accessed.
4. Power down the truck.
5. Disconnect the battery and prevent the truck from being switched on again.
6. Unscrew the wheel nuts and remove the drive wheel.

Replacing the Wheel Bolts

If the wheel bolts are damaged, proceed as follows:

1. Remove the wheel bolts with a bolt extractor.
2. Fit new wheel bolts (49, Fig. GPC412, page 32) with Loctite® 243™.

Drive Wheel Assembly

Assembly of the drive wheel is the reverse of disassembly. Torque the wheel nuts crosswise to **130 Nm**.
Replacing the Drive Unit

The truck must be raised in order to replace the drive unit.

**WARNING**

_Danger of death_

A falling truck can kill you!

Always use lifting gear, slings and blocks with sufficient capacity to raise the truck.

Carry out the following tasks before working underneath a raised truck:

- Support the truck raised with a crane in such a way that it cannot fall down even if the lifting gear cracks or the crane fails.
- If you are raising the truck with another forklift truck, secure it to the forks of the truck doing the lifting so that it cannot slip or fall down.
- Physically block the lift mechanism of the truck doing the lifting before you stand underneath the raised load.

**Special Tools Required**

A home-made device for holding the drive unit.

**Drive Unit Removal**

1. Disconnect the battery and prevent the truck from being switched on again.
2. Disconnect all electrical connections to the drive motor, brakes, steer sensor and steer motor.
3. Raise the truck either with another forklift truck or with a crane (see page 13) so that the device for holding the drive unit can be pushed underneath the truck.
4. Drain the oil (see page 29).
5. Push the device for holding the drive unit underneath the truck.
6. Remove the mounting screws (1, Fig. TC415).
7. Raise the truck until the drive unit is free.
8. Pull out the drive unit or move the raised truck.

**Drive Unit Installation**

1. When assembling a new gear unit, remove the steer sensor from the old gear unit and attach it to the new one (see page 141).
2. Assemble the drive unit in the reverse order of disassembly.
3. Torque the mounting screws (1, Fig. TC415) to 70 - 75 Nm.
4. Add transmission oil (see page 29).
Repairing the Drive Transmission Unit

DRIVE UNIT
Repairing the Drive Transmission Unit

TC 3000
37
**NOTE**

Gear unit repair work requires specialist expertise and experience, as well as special tools. Note that all the bearings and seals must be replaced. If you cannot meet these particular requirements, use a new drive transmission unit.

**Preparation**

The item numbers refer to Figure GPC412 on page 37.

1. Remove the drive unit (see page 36).
2. Remove the drive motor (see page 103).
3. Remove screws (57).
4. Lift off the entire steering assembly.
5. Remove screws (58).
6. Extract the live ring bearing (59).
7. Remove the bleeder valve (64).
8. Remove the O-ring (60), shim (61), supporting ring (62) and retaining ring (63).
9. Remove the gear unit cover (88).

**Drive Transmission Unit Disassembly**

**Output shaft removal**

1. Remove the screws (42) and take off the cover (43).

**Note:** If there is a cover pressed in on the gear unit, it will necessarily be damaged if removed. To do this, proceed as follows:

1. Penetrate the cover (43) with a large screwdriver and a hammer.
2. Lever off the cover (43) with the screwdriver.

The cover (43) is now removed. Proceed as follows:

1. Prevent the gear unit from twisting: insert the mandrel (1) see Fig. GPC415_1 in the hole of the pinion (30).

**Bevel gear and bevel pinion removal**

1. Mandrel
2. Loosen the screw (42) and remove it together with the washer (41).
3. Press off the output shaft (50).
4. Remove the shims (35) and bushing (36).
5. Pull off the bearing (34) and remove the shaft seal (51) from the output shaft.
1. Remove the bevel gear (39, see Fig. GPC416_1) together with the bearing (37) and washer (38) from the housing (44).
2. Push the bearing (37) through the two holes of the bevel gear (39) and remove the washers (38).
3. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
4. Remove the groove nut (29).
5. Pull the bevel pinion shaft (48) and conical roller bearing (47) and washers (32) out from underneath the gear unit.
6. Remove the washers (32).
7. Remove the conical roller bearing (47) from the bevel pinion shaft (48).
8. Remove the pinion (30) and the conical roller bearing (31) from the housing (44).
9. Pull the conical roller bearing (31) off the pinion (30).
10. Take the outer rings of the conical roller bearings (31, 47, 37, 34) off the housing (44).
11. Remove the washer (46) from the housing (44).

Drive Transmission Unit Assembly

NOTE
Always use new bearings and seals to assemble the drive transmission unit.

Bevel pinion and drive pinion assembly
1. Insert the washer (46) into the housing (44).
2. Use a press to force the outer rings of the conical roller bearings (31, 47, 37, 34) into the housing (44).
3. Press the conical roller bearing (47) onto the bevel pinion shaft (48).
4. Fit the support ring with a shim (32).

Note: The combined nominal size of both shims is 2.2 mm.
5. Press the conical roller bearing (31) onto the pinion (30).
6. Insert the pinion (30) in the correct position into the housing (44).
7. Insert the bevel pinion shaft (48) into the pinion (30).

The bevel pinion shaft (48) and the pinion (30) must now be installed into the gear unit:
8. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
9. Screw the groove nut (29) onto the bevel pinion shaft (48) and torque to 35 Nm.
10. Remove the mandrel (1).

Note: Check the bevel pinion shaft (48) friction torque after each assembly.

– It should be 0.1 - 0.2 Nm

If the friction torque is not within range, proceed as follows:

Adjusting the bevel pinion shaft friction torque
1. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
2. Remove the groove nut (29).
3. Pull the bevel pinion shaft (48) and conical roller bearing (47), supporting ring and shim (32) out from underneath the gear unit.

• To reduce the friction torque:
  – Add a shim.

• To increase the friction torque:
  – Remove a shim.
4. Insert the bevel pinion shaft (48) back into the pinion (30).
5. Prevent the gear unit from twisting: insert the mandrel (1, see Fig. GPC415_1) in the hole of the pinion (30).
6. Screw the groove nut (29) onto the bevel pinion shaft and torque to 35 Nm.
7. Remove the mandrel (1).
8. Check the bevel pinion shaft friction torque again and re-adjust if required.
DRIVE UNIT
Repairing the Drive Transmission Unit

Bevel gear assembly

1. Place the shim (38) onto the bevel gear (39).

**Note:** The nominal size of the shim is 1.0 mm.

2. Press the conical roller bearing (37) onto the bevel gear (39).

3. Insert the bevel gear (39) in the correct position into the housing (44).

4. Assemble and install the output shaft and adjust the friction torque (see *Output shaft assembly*, page 33).

5. Check the bevel gear toothing on the reference diameter of the pinion (30) (see Fig. GPC417_1):

**Note:** The maximum bevel gear toothing clearance is 0.2 - 0.5 mm.

If there is any deviation, the bevel gear toothing clearance must be adjusted.

**Adjusting the bevel gear toothing clearance**

1. Loosen the screw (42) and remove it together with the washer (41).

2. Press off the output shaft (50).

3. Remove the bevel gear (39), conical roller bearing (37) and washer (38) from the housing (44).

4. Push the bearing (37) through the two holes of the bevel gear (39).

5. Remove the washers (38) and adjust the thickness:
   - To reduce the clearance: Increase the number of shims (38).
   - To increase the clearance: Reduce the number of shims (39).

6. Fit the washers (38) with the adjusted size.
7. Press on the conical roller bearing (37).
8. Fit the pre-assembled bevel gear in the correct position in the housing.
9. Re-fit the output shaft and check the clearance again.
10. Using the special tool (part no. 822671) press the shaft seal (51) over the holes in the output shaft flange as far as the stop of the special tool.

To assemble the cover (43) with screws:

**CAUTION**

*Hazardous chemicals can cause serious injury. Observe the manufacturer’s safety instructions when handling solvents and lubricants.*

1. Clean the contact surfaces of the housing (44) and cover (43) with a suitable solvent.
2. Apply a sealing compound to the contact surfaces in accordance with the manufacturer’s instructions. We recommend either Loctite® 518, Loctite® 574 or Terostat® MS935.
3. Attach the cover (43) with the screws (42). Torque the screws (43) to 10 Nm.

**NOTE**

*Check the hardening time of the sealing compound used before adding oil.*

To press on the cover (43):

1. Fit a new cover (43) with the sealed side facing out.

**NOTE**

*The cover may get damaged during assembly. To fit the cover use a secure washer to place the cover on.*

2. Using a plastic hammer and a secure washer (Ø 148 - 150 mm) underneath, strike the cover evenly without damaging it.

The cover (43) is now installed. To finish assembling the bevel gear proceed as follows:

1. Fit the cover (31) in the correct position.

2. Fit the live ring bearing (59) in the correct position and fasten with the screws (58). Torque the screws to 25 Nm.
3. Install the bleeder valve (64).
4. Insert and tighten the drain plug (45).
5. Remove the O-ring (60), shim (61), supporting ring (62) and retaining ring (63).
6. Attach the steering gear together with the steer motor and intermediate flange (24).

**NOTE**

*Check the hardening time of the sealing compound used before adding oil.*

7. Add oil (see page 29).
8. Assemble the drive motor (see page 103).
9. Assemble the drive unit (see page 36).
ELECTRICAL SYSTEM
Wire Colour Code

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

Third party component wires may pose an exception to this rule:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Colour</th>
<th>Colour number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLK</td>
<td>Black</td>
<td>0 **</td>
<td>Digital signal</td>
</tr>
<tr>
<td>BRN</td>
<td>Brown</td>
<td>1 **</td>
<td>Analog signal</td>
</tr>
<tr>
<td>RED</td>
<td>Red</td>
<td>2 **</td>
<td>Positive not connected</td>
</tr>
<tr>
<td>ORG</td>
<td>Orange</td>
<td>3 **</td>
<td>+12 VDC - transformer</td>
</tr>
<tr>
<td>YEL</td>
<td>Yellow</td>
<td>4 **</td>
<td>Third DC - transformer</td>
</tr>
<tr>
<td>GRN</td>
<td>Green</td>
<td>5 **</td>
<td>Negative not connected</td>
</tr>
<tr>
<td>BLU</td>
<td>Blue</td>
<td>6 **</td>
<td>Negative, insulated</td>
</tr>
<tr>
<td>VIO</td>
<td>Violet</td>
<td>7 **</td>
<td>+5 VDC - transformer</td>
</tr>
<tr>
<td>GREY</td>
<td>Gray</td>
<td>8 **</td>
<td>Fourth DC - transformer</td>
</tr>
<tr>
<td>WHT</td>
<td>White</td>
<td>9 **</td>
<td>Various</td>
</tr>
<tr>
<td>RED/WHT</td>
<td>Red/White</td>
<td>29 **</td>
<td>Positive connected</td>
</tr>
<tr>
<td>GRN/WHT</td>
<td>Green/White</td>
<td>59 **</td>
<td>Negative connected</td>
</tr>
</tbody>
</table>

** Numbers 01 to 99
## Contact Symbol Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K*</td>
<td>Relays</td>
<td>LMS</td>
<td>Limit switch</td>
</tr>
<tr>
<td>ACS</td>
<td>Travel switch</td>
<td>LOS</td>
<td>Lower Switch</td>
</tr>
<tr>
<td>AXS</td>
<td>Auxiliary function switch</td>
<td>ORS</td>
<td>Override switch</td>
</tr>
<tr>
<td>BRS</td>
<td>Brake switch</td>
<td>POT</td>
<td>Potentiometers</td>
</tr>
<tr>
<td>DIS</td>
<td>Travel direction switch</td>
<td>RA</td>
<td>Raise potentiometer</td>
</tr>
<tr>
<td>DRS</td>
<td>Door switch</td>
<td>RAS</td>
<td>Raise switch</td>
</tr>
<tr>
<td>EDS</td>
<td>Emergency power disconnect</td>
<td>REA</td>
<td>Reach potentiometer</td>
</tr>
<tr>
<td>EM</td>
<td>Encoder module</td>
<td>RS</td>
<td>Reverse switch</td>
</tr>
<tr>
<td>ENC</td>
<td>Encoders</td>
<td>SAS</td>
<td>Safety reverse switch</td>
</tr>
<tr>
<td>FS</td>
<td>Forward switch</td>
<td>SDS</td>
<td>Start switch</td>
</tr>
<tr>
<td>HBS</td>
<td>Handbrake switch</td>
<td>SES</td>
<td>Seat switch</td>
</tr>
<tr>
<td>HNS</td>
<td>Horn switch</td>
<td>SSS</td>
<td>Sideshifter switch</td>
</tr>
<tr>
<td>HSS</td>
<td>Rabbit/Turtle toggle switch</td>
<td>THS</td>
<td>Thermo switch</td>
</tr>
<tr>
<td>KYS</td>
<td>Key switch</td>
<td>TLT</td>
<td>Tilt switch</td>
</tr>
<tr>
<td>LGS</td>
<td>Light switch</td>
<td>WAS</td>
<td>Walk-along / pedestrian mode switch</td>
</tr>
<tr>
<td>BV (AK)</td>
<td>Battery voltage after the key switch</td>
<td>M2 (PM)</td>
<td>Pump motor</td>
</tr>
<tr>
<td>BDI</td>
<td>Battery discharge indicator</td>
<td>MRC</td>
<td>Control module</td>
</tr>
<tr>
<td>BR</td>
<td>Brake</td>
<td>OHGD</td>
<td>Overhead guard display</td>
</tr>
<tr>
<td>BWI</td>
<td>Brush wear indicator</td>
<td>P</td>
<td>Pump contactor</td>
</tr>
<tr>
<td>CA</td>
<td>Cable connection</td>
<td>PC</td>
<td>Plug connection</td>
</tr>
<tr>
<td>F</td>
<td>Field coil connection</td>
<td>PCB</td>
<td>Printed circuit board</td>
</tr>
<tr>
<td>FAN</td>
<td>Fan</td>
<td>SF</td>
<td>Shunt field</td>
</tr>
<tr>
<td>FU</td>
<td>Fuse</td>
<td>STI</td>
<td>Steering wheel indicator</td>
</tr>
<tr>
<td>HN</td>
<td>Horn</td>
<td>SV</td>
<td>Solenoid valve</td>
</tr>
<tr>
<td>IFD</td>
<td>Information display</td>
<td>TB</td>
<td>Terminal block</td>
</tr>
<tr>
<td>JC</td>
<td>Socket = counterpart to PC</td>
<td>TMM</td>
<td>Truck management module</td>
</tr>
<tr>
<td>LINE</td>
<td>Main contactor</td>
<td>TT</td>
<td>Hourmeter</td>
</tr>
<tr>
<td>M1 (TM)</td>
<td>Traction Motor</td>
<td>VMN</td>
<td>Motor driver (volt motor negative)</td>
</tr>
<tr>
<td>GPCSR</td>
<td>Safety switch - RH side restraint</td>
<td>GCSL</td>
<td>Safety switch - LH side restraint</td>
</tr>
<tr>
<td>PLS</td>
<td>Platform switch</td>
<td>TCM</td>
<td>Traction Motor</td>
</tr>
<tr>
<td>PS</td>
<td>Pressure switch</td>
<td>HR</td>
<td>Heating</td>
</tr>
<tr>
<td>HCM</td>
<td>Hydraulic control module</td>
<td>ALM</td>
<td>Travel alarm</td>
</tr>
</tbody>
</table>
### ELECTRICAL SYSTEM

#### Contact Symbol Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
<th>Abbreviation</th>
<th>Description (Sheet 2 of 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECEIVER</td>
<td>Receiver</td>
<td>TRANSMITTER</td>
<td>Transmitter</td>
</tr>
<tr>
<td>BDI</td>
<td>Combination instrument</td>
<td>CHARGER</td>
<td>On-board charger</td>
</tr>
<tr>
<td>BRK</td>
<td>Electromagnetic brake</td>
<td>DR</td>
<td>Driver</td>
</tr>
<tr>
<td>SLS</td>
<td>Sideshift left switch</td>
<td>SRS</td>
<td>Sideshift right switch</td>
</tr>
<tr>
<td>ECS</td>
<td>Lift control switch</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

* If one of the above abbreviations is used more than once, a number extension will be used, e.g. SV1, SV2 etc.
# Electrical Wiring Diagrams

<table>
<thead>
<tr>
<th>Europe</th>
<th>USA</th>
<th>Description</th>
<th>Europe</th>
<th>USA</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Wires joining" /></td>
<td><img src="image" alt="Wires joining" /></td>
<td>Wires joining</td>
<td><img src="image" alt="Switch applied manually" /></td>
<td><img src="image" alt="Switch applied manually" /></td>
<td>Switch applied manually</td>
</tr>
<tr>
<td><img src="image" alt="Wires crossing" /></td>
<td><img src="image" alt="Wires crossing" /></td>
<td>Wires crossing</td>
<td><img src="image" alt="Solenoid valve" /></td>
<td><img src="image" alt="Solenoid valve" /></td>
<td>Solenoid valve</td>
</tr>
<tr>
<td><img src="image" alt="Wire connection" /></td>
<td><img src="image" alt="Wire connection" /></td>
<td>Wire connection</td>
<td><img src="image" alt="Throttle / coil" /></td>
<td><img src="image" alt="Throttle / coil" /></td>
<td>Throttle / coil</td>
</tr>
<tr>
<td><img src="image" alt="Plug / socket" /></td>
<td><img src="image" alt="Plug / socket" /></td>
<td>Plug / socket</td>
<td><img src="image" alt="Resistor" /></td>
<td><img src="image" alt="Resistor" /></td>
<td>Resistor</td>
</tr>
<tr>
<td><img src="image" alt="Wire strap" /></td>
<td><img src="image" alt="Wire strap" /></td>
<td>Wire strap</td>
<td><img src="image" alt="Capacitor" /></td>
<td><img src="image" alt="Capacitor" /></td>
<td>Capacitor</td>
</tr>
<tr>
<td><img src="image" alt="Terminal board" /></td>
<td><img src="image" alt="Terminal board" /></td>
<td>Terminal board</td>
<td><img src="image" alt="Potentiometer" /></td>
<td><img src="image" alt="Potentiometer" /></td>
<td>Potentiometer</td>
</tr>
<tr>
<td><img src="image" alt="Fuse" /></td>
<td><img src="image" alt="Fuse" /></td>
<td>Fuse</td>
<td><img src="image" alt="Varistor" /></td>
<td><img src="image" alt="Varistor" /></td>
<td>Varistor</td>
</tr>
<tr>
<td><img src="image" alt="Assembly" /></td>
<td><img src="image" alt="Assembly" /></td>
<td>Assembly</td>
<td><img src="image" alt="Thermal protector" /></td>
<td><img src="image" alt="Thermal protector" /></td>
<td>Thermal protector</td>
</tr>
<tr>
<td><img src="image" alt="Contact, normally open" /></td>
<td><img src="image" alt="Contact, normally open" /></td>
<td>Contact, normally open</td>
<td><img src="image" alt="Lamp" /></td>
<td><img src="image" alt="Lamp" /></td>
<td>Lamp</td>
</tr>
<tr>
<td><img src="image" alt="Contact, normally closed" /></td>
<td><img src="image" alt="Contact, normally closed" /></td>
<td>Contact, normally closed</td>
<td><img src="image" alt="Horn" /></td>
<td><img src="image" alt="Horn" /></td>
<td>Horn</td>
</tr>
<tr>
<td><img src="image" alt="Selective switch" /></td>
<td><img src="image" alt="Selective switch" /></td>
<td>Selective switch</td>
<td><img src="image" alt="Battery" /></td>
<td><img src="image" alt="Battery" /></td>
<td>Battery</td>
</tr>
<tr>
<td><img src="image" alt="Contactors/Relays" /></td>
<td><img src="image" alt="Contactors/Relays" /></td>
<td>Contactors/Relays</td>
<td><img src="image" alt="Diode" /></td>
<td><img src="image" alt="Diode" /></td>
<td>Diode</td>
</tr>
<tr>
<td><img src="image" alt="Slow release contactor / relay" /></td>
<td><img src="image" alt="Slow release contactor / relay" /></td>
<td>Slow release contactor / relay</td>
<td><img src="image" alt="Breakdown diode" /></td>
<td><img src="image" alt="Breakdown diode" /></td>
<td>Breakdown diode</td>
</tr>
<tr>
<td><img src="image" alt="Time delay contactor / relay" /></td>
<td><img src="image" alt="Time delay contactor / relay" /></td>
<td>Time delay contactor / relay</td>
<td><img src="image" alt="LED" /></td>
<td><img src="image" alt="LED" /></td>
<td>LED</td>
</tr>
<tr>
<td><img src="image" alt="Switch, normally open" /></td>
<td><img src="image" alt="Switch, normally open" /></td>
<td>Switch, normally open</td>
<td><img src="image" alt="Transistor" /></td>
<td><img src="image" alt="Transistor" /></td>
<td>Transistor</td>
</tr>
<tr>
<td>Europe</td>
<td>USA</td>
<td>Description</td>
<td>Europe</td>
<td>USA</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>-----</td>
<td>------------------------------</td>
<td>--------</td>
<td>-----</td>
<td>-------------</td>
</tr>
<tr>
<td>![Europe_1]</td>
<td>![USA_1]</td>
<td>Push button, mechanically actuated</td>
<td>![Europe_2]</td>
<td>![USA_2]</td>
<td>MOSFET</td>
</tr>
<tr>
<td>![Europe_5]</td>
<td>![USA_5]</td>
<td>Emergency power disconnect</td>
<td>![Europe_6]</td>
<td>![USA_6]</td>
<td>Comparator</td>
</tr>
<tr>
<td>![Europe_7]</td>
<td>![USA_7]</td>
<td>Motor armature</td>
<td>![Europe_8]</td>
<td>![USA_8]</td>
<td>...</td>
</tr>
</tbody>
</table>
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Operator Menu

From page 54

Events

Service

Level 2

Password

Level 3

Password

Performance

SET P1

SET P2

SET P3
## Analyzer Menu Overview

<table>
<thead>
<tr>
<th>A 1 Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A 1.1 Traction</td>
<td></td>
</tr>
<tr>
<td>A 1.2 Hydraulics</td>
<td></td>
</tr>
<tr>
<td>A 1.3 Steer</td>
<td></td>
</tr>
<tr>
<td>A 1.4 Main C</td>
<td></td>
</tr>
<tr>
<td>A 1.5 CAN Tiller</td>
<td></td>
</tr>
<tr>
<td>A 1.6 CAN Backrest</td>
<td></td>
</tr>
<tr>
<td>A 1.7 Display Module</td>
<td></td>
</tr>
</tbody>
</table>

### A 2 Inputs

| A 2.1 Access 1 Inputs |  |
| A 2.2 Access 2 Inputs |  |
| A 2.2.1 RAS Switch |  |
| A 2.2.2 LOS 1 Switch |  |
| A 2.2.3 RAS 2 + 3 Switch |  |
| A 2.2.4 LOS 2 + 3 Switch |  |
| A 2.2.5 LMS 5 Sensor |  |
| A 2.2.6 LMS 6 Sensor |  |
| A 2.2.7 LMS 8 Switch |  |
| A 2.2.8 LMS 9 Sensor |  |
| A 2.2.9 LMS 10 Sensor |  |
| A 2.2.10 Pressure Transducer |  |
| A 2.2.11 Pump Motor Current |  |
| A 2.2.12 Pump On |  |

### A 2.3 Access 3 Inputs

| A 2.3.1 Temp Access 3 |  |
| A 2.3.2 TS 1 |  |
| A 2.3.3 FWD Switch |  |
| A 2.3.4 REV Switch |  |
| A 2.3.5 POT WPR |  |
| A 2.3.6 HSS Switch |  |
| A 2.3.7 HNS 1 + 2 Switches |  |
| A 2.3.8 BRS Switch |  |
| A 2.3.9 FPS 1 Sensor |  |
| A 2.3.10 FPS 2 Sensor |  |

### A 2.3.11 HPCS 1 Switch |  |
| A 2.3.12 HPCS 2 Switch |  |
| A 2.3.13 HPCS 3 Switch |  |
| A 2.3.14 HPCS 4 Switch |  |
| A 2.3.15 Traction Motor Current |  |
| A 2.3.16 ECR 1 Encoder 64P |  |
| A 2.3.17 LMS 7 + 7.1 Sensors |  |
| A 2.3.18 BLS Switch |  |

### A 2.5 Access Inputs

| A 2.5.1 Temp Access 5 |  |
| A 2.5.2 TS 3 (Temp Motor) |  |
| A 2.5.3 Steer Mot Current |  |
| A 2.5.4 Steer POT 1 |  |
| A 2.5.5 Steer POT 2 |  |
| A 2.5.6 ECR2 (Encoder 32P) |  |
| A 2.5.7 ECR3 (Encoder 48P) |  |
| A 2.5.8 Straight Ahead Sensor |  |

### A 3 Outputs

| A 3.1 Battery % |  |
| A 3.2 Battery Voltage |  |
| A 3.3 Buzzer |  |
| A 3.4 Travel Alarm |  |
| A 3.5 Fan Output |  |
| A 3.6 Travel Light |  |
| A 3.7 Battery Current |  |
| A 3.8 SV 1 |  |
| A 3.9 SV 2 |  |
| A 3.10 PV |  |
| A 3.11 Brake Output |  |
| A 3.12 Horn Output |  |
| A 3.13 Traction Speed |  |
| A 3.14 RPM Traction Motor |  |
| A 3.15 RPM Steer Motor |  |

### A 4 Test Outputs

| A 4.1 FN 1 |  |
Analyzer Menu - Status & Inputs

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No display
See page 60

See page 61

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Analyzer Menu - Outputs

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A3

Outputs

A3.1
BATTERY %
Value

A3.2
BATTERY VOLTAGE
Value

A3.3
BUZZER
Value

A3.4
TRAVEL ALARM
Value

A3.5
FAN OUTPUT
Value

A3.6
TRAVEL LIGHT
Value

A3.7
BATTERY CURRENT
Value

A3.8
SV1
Value

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Analyzer Menu - Outputs

From page 58

A3

From page 58

A3.9

SV2

Value

A3.10

PV

Value

A3.11

BRAKE OUTPUT

Value

A3.12

HORN OUTPUT

Value

A3.13

TRACTION SPEED

Value

A3.14

RPM TRACTION MOTOR

Value

A3.15

RPM STEER MOTOR

Value

Level 3 Only

Test Outputs

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Analyzer Menu - Access 2 Inputs

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Access 2 Inputs

A2.2.1 RAS SWITCH = VALUE

A2.2.2 LOS1 SWITCH= VALUE

A2.2.3 RAS2+3 SWITCH= VALUE

A2.2.4 LOS2+3 SWITCH= VALUE

A2.2.5 LMS 5 SENSOR = VALUE

A2.2.6 LMS 6 SENSOR = VALUE

A2.2.7 LMS 8 SENSOR = VALUE

A2.2.8 LMS 9 SENSOR = VALUE

A2.2.9 LMS 10 SENSOR = VALUE

A2.2.10 PRESSURE TRANSDUCER = VALUE

A2.2.11 PUMP MOTOR CURRENT = VALUE

A2.2.12 PUMP ON= VALUE
Analyzer Menu - Access 3 Inputs

From page 57

Access 3 Inputs

A2.3.1 TEMP ACCESS 3 = VALUE

A2.3.2 TS1 = VALUE

A2.3.3 FWD SWITCH = VALUE

A2.3.4 REV SWITCH = VALUE

A2.3.5 POT WPR = VALUE

A2.3.6 HSS SWITCH = VALUE

A2.3.7 HNS 1 + 2 SWITCH = VALUE

A2.3.8 BRS SWITCH = VALUE

A2.3.9 FPS 1 SENSOR = VALUE

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ELECTRICAL SYSTEM
Service Menu

Analyzer Menu - Access 3 Inputs

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A2.3.10
FPS 2 SENSOR = VALUE

A2.3.11
HPCS1 SWITCH = VALUE

A2.3.12
HPCS2 SWITCH = VALUE

A2.3.13
HPCS3 SWITCH = VALUE

A2.3.14
HPCS4 SWITCH = VALUE

A2.3.15
TRACTION MOTOR CURRENT = VALUE

A2.3.16
ECR1 ENCODER 64P = VALUE (pulses)

A2.3.17
LMS7 & 7.1 SENSOR1 = VALUE

A2.3.18
BLS = VALUE

TC443
Analyzer Menu - Access 5 Inputs

From page 57  Access 5 Inputs

A2.5.1  TEMP ACCESS 5 = VALUE
A2.5.2  TS3 (TEMP MOTOR) = VALUE
A2.5.3  STEER MOT CURRENT = VALUE
A2.5.4  STEER POT1 = VALUE
A2.5.5  STEER POT 2 = VALUE
A2.5.6  ECR2 (ENCODER32P) = VALUE
A2.5.7  ECR3 (ENCODER48P) = VALUE
A2.5.8  STRAIGHT AHEAD SENSOR = VALUE
Analyzer Menu - Test Outputs

From page 59

Test Outputs

A4.1

FN1
Enter to Cancel

A4.2

SV1
Enter to Cancel

A4.3

SV2
Enter to Cancel

A4.4

PV
Enter to Cancel

A4.5

BRK
Enter to Cancel

A4.6

MAIN C
Enter to Cancel

A4.7

HN
Enter to Cancel

A4.8

Flash Light
Enter to Cancel

A4.9

Travel Alarm
Enter to Cancel

Escape

Note:
1. Test outputs can only be reached through service level 3.
2. Currently, only item A4.1 (fan) can be activated.
3. All test outputs are automatically reset after 5 seconds.
Calibration - Rocker & Load Sensor

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Steering calibration (see page 66)

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Features

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Features

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- F1
- F2: TRAVEL ALARM
- F3: BEACON
- F4: TRUCK TYPE
- F5: Message Mode
- F6

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From page 68

**F5**

**F6**

**F7**

**F8**

**F9**

**F10**

**F11**

**F12**

**F12.1**

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View PIN code:
“Entry ##” is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1
Features

From page 70

Modify PIN code:
“Entry ##” is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1

Delete PIN code:
“Entry ##” is displayed for 0.5 seconds. The PIN code and the performance level are then displayed as shown below:
1234 P1

TC452
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Note:
Runtime 2 = Runtime 1 + fixed time in seconds

1) The setting cannot be changed in service level 2. It can be increased but not decreased in service level 3.
Events

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TC 3000

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Events

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Performance

From page 73

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TC456
Performance

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P1

SET P2

P2

P2.1

TRAVEL SPEED FWD = VALUE

EDIT 1 - 9

P2.2

TRAVEL SPEED REV = VALUE

EDIT 1 - 9

P2.3

ACCELERATION = VALUE

EDIT 1 - 9

P2.4

PLUGGING = VALUE

EDIT 1 - 9

P2.5

COASTING = VALUE

EDIT 1 - 9

P2.6

QP & HPC PF = VALUE

EDIT 1 - 9

P2.7

HPC SPEEDS FF = VALUE

EDIT 1 - 9

P2.8

QP COASTING = VALUE

EDIT 1 - 9

P2.9

SPEED CONTROL = VALUE

EDIT 1 - 9

P2.10

AUX SPEED #1

EDIT 1 - 9

Utilities

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P1

SET P2

P2

P2.1

TRAVEL SPEED FWD = VALUE

EDIT 1 - 9

P2.2

TRAVEL SPEED REV = VALUE

EDIT 1 - 9

P2.3

ACCELERATION = VALUE

EDIT 1 - 9

P2.4

PLUGGING = VALUE

EDIT 1 - 9

P2.5

COASTING = VALUE

EDIT 1 - 9

P2.6

QP & HPC PF = VALUE

EDIT 1 - 9

P2.7

HPC SPEEDS FF = VALUE

EDIT 1 - 9

P2.8

QP COASTING = VALUE

EDIT 1 - 9

P2.9

SPEED CONTROL = VALUE

EDIT 1 - 9

P2.10

AUX SPEED #1

EDIT 1 - 9

Utilities

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Performance

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Utilities

P2

Performance

P3

SET P3

P3.1

TRAVEL SPEED FWD = VALUE

EDIT 1 - 9

P3.2

TRAVEL SPEED REV = VALUE

EDIT 1 - 9

P3.3

ACCELERATION = VALUE

EDIT 1 - 9

P3.4

PLUGGING = VALUE

EDIT 1 - 9

P3.5

COASTING = VALUE

EDIT 1 - 9

P3.6

QP & HPC PF = VALUE

EDIT 1 - 9

P3.7

HPC SPEEDS FF = VALUE

EDIT 1 - 9

P3.8

QP COASTING = VALUE

EDIT 1 - 9

P3.9

SPEED CONTROL = VALUE

EDIT 1 - 9

P3.10

AUX SPEED #1

EDIT 1 - 9

TC458

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Re-Key Required

Save? N

Save? Y

TC 3000

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Performance

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Utilities

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Continued on page 57
## Parameter Setting

The travel and braking patterns of the truck can be adapted within limits to suit the customer’s requirements.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
<th>Factory Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Speed FWD</td>
<td>Max. forward speed of the unladen truck (battery first). Speeds can be set from 1-9; from 6.0 km/h to 10 km/h.</td>
<td>Performance level 1: 9  Performance level 2: 9  Performance level 3: 9</td>
</tr>
<tr>
<td>Travel Speed REV</td>
<td>Max. reverse speed of the unladen truck (tow hitch first). Speeds can be set from 1-9; from 6.0 km/h to 10 km/h.</td>
<td>Performance level 1: 6  Performance level 2: 6  Performance level 3: 6</td>
</tr>
<tr>
<td>Acceleration</td>
<td>Time required for the unladen truck to accelerate forward to 8.8 km/h. Settings from 1-9, corresponding to 1.6/1.8/2.0/2.2/2.4/3.0/3.5/4.0/4.5 seconds.</td>
<td>Performance level 1: 8  Performance level 2: 8  Performance level 3: 8</td>
</tr>
<tr>
<td>Plugging</td>
<td>Time required to brake from 8.8 km/h to 0 km/h when the travel direction is changed (plugging). Settings from 1-9, corresponding to 0.7/0.8/0.9/1.0/1.1/1.2/1.3/1.4/1.5/1.6 seconds.</td>
<td>Performance level 1: 2  Performance level 2: 2  Performance level 3: 2</td>
</tr>
<tr>
<td>Coasting</td>
<td>Time required to brake from 8.8 km/h to 0 km/h when the travel switch is released (coasting). Settings from 1-9, corresponding to 1.3/1.4/1.5/1.6/1.7/1.8/2.0/2.2/2.4/2.6 seconds.</td>
<td>Performance level 1: 4  Performance level 2: 4  Performance level 3: 4</td>
</tr>
<tr>
<td>QP speed PF</td>
<td>Max. forward speed of unladen truck in &quot;Quick Pick&quot; mode. Settings from 1-9, corresponding to 2.8/3.2/3.6/4.0/4.4/4.8/5.2/5.6/6.0 km/h.</td>
<td>Performance level 1: 6  Performance level 2: 6  Performance level 3: 6</td>
</tr>
<tr>
<td>QP Time</td>
<td>Length of time the truck remains in &quot;Quick Pick&quot; mode. Settings from 1-9, corresponding to 1/2/3/4/5/6/7/8/9/10 seconds.</td>
<td>Performance level 1: 9  Performance level 2: 9  Performance level 3: 9</td>
</tr>
<tr>
<td>QP Coasting</td>
<td>Time the truck takes to decelerate from the &quot;QP Speed PF&quot; speed to 0 km/h. Settings from 1-9, corresponding to 0.5/0.7/0.9/1.1/1.3/1.5/1.7/1.9/2.1/2.3 seconds.</td>
<td>Performance level 1: 9  Performance level 2: 9  Performance level 3: 9</td>
</tr>
<tr>
<td>QP Acceleration</td>
<td>Time taken in seconds for the unladen truck to accelerate in &quot;Quick Pick&quot; mode to the pre-set forward speed. Settings from 1-9, corresponding to 1.4/1.6/1.8/2.0/2.2/2.4/2.6/2.8/3.0 seconds.</td>
<td>Performance level 1: 1  Performance level 2: 1  Performance level 3: 1</td>
</tr>
</tbody>
</table>
Calibration

Calibration is performed in the “SERVICE” menu under the “CALIBRATION” menu item on the display. To select the “CALIBRATION” menu proceed as follows:

Selecting the CALIBRATION Menu

You can navigate through the menu structures using the cursor keys ( , , , , , ) on the display. An overview of the menu structure can be found in Electrical System, on page 57.

1. Turn the key switch right to the "On" position.
   – The display screen is activated.

Note: On trucks without a key switch, press the  key for one second until the display screen is activated.

2. Press the  key until the “SERVICE” menu appears.

3. Press the  key until “LEVEL 2” appears.

4. Press the  key until you are requested to enter your PIN.

5. Enter the Service PIN using the  and  keys and press .
   – The service menu is now selected and the “ANALYZER” menu is displayed.

6. Press the  key until the “CALIBRATION” menu appears.

7. Using the  key select the first sub-menu.
   – The “C1 FWD/REV ROCKER” menu for calibrating the traction potentiometer is selected.

Calibrating the Traction Potentiometer

- Jack up the truck (see page 14).

- The “CALIBRATION” menu is selected (see “Selecting the CALIBRATION Menu” on page 82).

1. Press the  key until the “C1 FWD/REV ROCKER” menu appears.

2. Press the  key.
   – The security question “SURE YES/NO” for calibrating is displayed.

3. To continue calibrating, press  “Y” (Yes).

4. Press the  key.
   – The prompt “TURN ROCKER MAX FWD & MAX REV. THEN ENTER” appears.

5. Move the travel switch forward as far as the stop, then back as far as the stop.

6. Confirm with  .
   – The prompt for saving the values “SAVE YES/ NO” is displayed.

7. To save the values, press  “Y” (Yes).

8. To quit the menu press  .
   – The “C1 FWD/REV ROCKER” menu is selected.

9. Press  to return to the “CALIBRATION” menu.

10. To activate the new settings, switch the truck off and on again.

11. Carry out a test run.

Steering Calibration

- Select the “CALIBRATION” menu (see “Selecting the CALIBRATION Menu” on page 82).

1. Using the  key, select the “C1 FWD/REV ROCKER” menu.

2. Press the  key until the “C2 STEER SYS” menu appears.
3. Press the ◀ key.
   – The security question “SURE YES/NO” for calibrating is displayed.

4. To continue calibrating, press ◀ “Y” (Yes).

5. Press the ◀ key.
   – The “C2.1 ACQUIRE TILLER CENTER” menu for calibrating the tiller centre position is selected.

**To calibrate the tiller centre position:**
1. Set the tiller to the centre position.

2. To confirm the centre position press the ◀ key to select “CONFIRM” and press ◀.

3. Press the ◀ key.
   – The “C2.2 ADJUST FULL RIGHT COARSE” menu for calibrating the right steering angle is selected.

**To perform a rough calibration of the right steering angle:**
This calibration only provides a basic adjustment of the drive wheel with regard to the required position.
1. Move the tiller to the right as far as the stop and hold it in that position.

2. Press the ◀ key to view the setting (0 to 9).

3. Using keys ◀ and ◀, set the drive wheel roughly to the < 90 degree position.

4. Confirm the drive wheel position with ◀.

5. Press the ◀ key.
   – The “C2.3 ADJUST FULL RIGHT FINE” menu for fine-tuning the right steering angle is selected.

**To fine-tune the right steering angle:**
Fine-tuning is required to adjust the drive wheel exactly to the required position.
1. Move the tiller to the right as far as the stop and hold it in that position.

2. Press the ◀ key to view the setting (0 to 9).

3. Using keys ◀ and ◀, set the drive wheel exactly to the 90 degree position.

4. Confirm the drive wheel position with ◀.

   – The “C2.3 ADJUST FULL RIGHT FINE” menu is selected.

5. Press the ◀ key.
   – The “C2.4 ADJUST FULL LEFT COARSE” menu for calibrating the left steering angle is selected.

**NOTE**
The left steering angle is calibrated in the same way using the “C2.4 ADJUST FULL LEFT COARSE” and “C2.5 ADJUST FULL LEFT FINE” menus.

**Calibrating forward travel:**
1. Select the “C2.6 ADJUST DRIVE TIRE CENTER” menu using the ◀ key.

2. Press the ◀ key to view the setting.
   – The factory default setting for “Adjust Drive Tire Center” is 107.

3. Using keys ◀ and ◀, visually set the drive wheel to forward travel.
   – Carry out a test run to check whether the truck actually travels forward.

4. Confirm the drive wheel position with ◀.
   – The “C2.4 ADJUST FULL LEFT COARSE” menu is selected.

5. Press the ◀ key.
   – The “C2.7 2ND ENCODER” menu is selected.

   **Note:** The “C2.7 2ND ENCODER” menu must not be changed. The encoder setting must be “ON”.

6. Press the ◀ key.
   – The prompt for saving the values “SAVE YES/NO” is displayed.

7. To save the values, press ◀ “Y” (Yes).

8. To quit the menu press ◀
   – The “C2 STEER SYS” menu is selected.

9. Press ◀ to return to the “CALIBRATION” menu.

10. To activate the new settings, switch the truck off and on again.

11. Carry out a test run.
Control Modules

Travel functions and power steering are controlled by modules which communicate with each other via a common CAN-Bus:

- Access 1 (Display)
- Access 3 (Traction Control Module)
- Access 5 (Steering Control Module)
- Access 8 and 8.1 (CAN interface #1 and #2)

The module locations are shown in Components (see page 50).

Power Fuses

The power fuses (2, 4) are mounted directly on the controllers (see Fig. GPC476).

1. Access 3/2
2. FU7 (400 A), power fuse for Access 3/2
3. Access 5
4. FU8 (30 A), power fuse for Access 5

General

Travel functions and power steering are controlled by modules which communicate with each other via a common CAN-Bus:
Servicing and Replacing the Control Modules

**WARNING**

*Short circuits can cause fires!*  
Control modules operate at high currents. Note the following:
- You must be trained to carry out this work.
- Use non-fatigue eye protection.
- Wear close-fitting clothing.
- Do not wear jewelry.
- Always use insulated tools.

**CAUTION**

Incorrect procedures can lead to serious injury!  
Avoid accidents by:
- Switching the truck off  
- Disconnecting the battery.  
- Preventing the truck from being switched on again.  
- Jacking up the truck and preventing it from rolling away (see page 14).

Discharging the Capacitors

The truck must be de-energised and secured, see safety notices. Once this has been done:
1. Short the positive and negative connections of the control module over a resistor (10 - 100 Ohm, min. 5 W) for a few seconds.

Servicing the Control Modules

The truck must be de-energised and secured, see safety notices.
1. Discharge the capacitors.  
2. Dry clean the outside of the control module.  
3. Check that the nuts attaching the power cables are tight (for torques see page 19).  
4. Check the logged events.

Replacing Control Modules

**Removal**

The truck must be de-energised and secured, see safety notices. Once this has been done:
1. Discharge the capacitors.  
2. Remove / disconnect all wires (mark the wires if necessary). Remove the bus bars if present.  
3. Remove the control module mounting screws.  
4. Remove the control module.  
5. Check the tooth pattern left by the back plate of the control module on the assembly plate. The full surface area of the control module must be in contact with the plate. If there are large areas with no contact to the controller, replace the assembly plate to avoid thermal problems.

**NOTE**

*Note that for control modules with radiator fins (e.g. Access 2/3) item 5 does not apply on removal.*

**CAUTION**

Hazardous chemicals can cause serious injury.  
Observe the manufacturer’s safety instructions when handling solvents and lubricants.
6. Remove the heat conducting paste remains on the assembly plate with a lint-free cloth and a commercial silicon removing agent.

**Assembly**

Use a control module with the right software version (see spare parts manual).

**NOTE**

*Note that for control modules with radiator fins (e.g. Access 2/3) item 1 does not apply on assembly. When installing these control modules make sure that they are positioned on the bus bar in such a way that they cannot twist when screwed tightly.*

1. Apply heat conducting paste (Dow Corning® 340, part no. 053051-008) thin and evenly to the base plate of the new control module.  
2. Attach the control module to the assembly plate.  
3. If necessary clean the power cable connections.
4. Refit / connect all wires. Attach the bus bars if applicable (for torques see page 19).

5. Set the control module parameters and carry out a functional test:
   - Leave the truck jacked up.
   - Connect the battery and remove the power-up prevention mechanism.
   - Adjust the parameters (see page 81).
   - Carry out a functional test.
## Event Codes - Access 3

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Tool LED</th>
<th>Operating error LED</th>
<th>Description</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>- Replace controller.</td>
</tr>
<tr>
<td>301</td>
<td>X</td>
<td>-</td>
<td>Memory error. Parameter changes have been cleared or are no longer stored. The truck can operate, but uses the default settings.</td>
<td>- Re-load the default settings (attention - this resets the default settings of all the controllers). - If the error persists after switching the truck off and on again, replace the controller.</td>
</tr>
<tr>
<td>302</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>- Replace controller.</td>
</tr>
<tr>
<td>303</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>- Check the power cables for corrosion. Make sure they are securely attached. - If the cable attachment is ok, replace the controller.</td>
</tr>
<tr>
<td>304</td>
<td>X</td>
<td>-</td>
<td>Overvoltage or low voltage (limits are 45 volts and 9 volts respectively).</td>
<td>If the event occurs when the truck is powered up: - Voltage on PC200-4 drops to below 9 volts. Replace controller. If the error occurs during travel: - Check battery condition. - Check battery cable connections. - Check main contactor contacts.</td>
</tr>
<tr>
<td>305</td>
<td>X</td>
<td>-</td>
<td>Voltage on VMN too low.</td>
<td>If the event occurs when the truck is powered up: - Check power cable connections to motor. - Check internal motor connections. - Check motor insulation resistance to chassis. If no error is found on the motor, the controller is faulty. Replace controller. If the event occurs during travel: - Check motor connections. - Check main contactor contacts. - Check motor insulation resistance to chassis. If no error is found on the motor or main contactor, the controller is faulty. Replace controller.</td>
</tr>
<tr>
<td>Event Code</td>
<td>Tool LED</td>
<td>Operating error LED</td>
<td>Description</td>
<td>Remedy</td>
</tr>
<tr>
<td>------------</td>
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</tbody>
</table>
| 306        | X        | -                   | Voltage on VMN too high. | If the event occurs when the truck is powered up:  
- Check power cable connections to motor.  
- Check internal motor connections.  
If no error is found on the motor, the controller is faulty. Replace controller.  
If the event occurs when the main contactor is closed:  
- Check motor connections.  
- Check motor insulation resistance to chassis.  
If no error is found on the motor, the controller is faulty. Replace controller. |
| 307        | X        | -                   | Main contactor already closed. | - Check freedom of movement of main contactor contacts.  
- Test if main contactor power cable has shorted. |
| 308        | X        | -                   | Main contactor does not close. | - Check main contactor wiring.  
- Measure voltage on coil connections: It should be approx. 24 volts measured between the red/white wires and the battery negative terminal.  
- Check freedom of movement of main contactor contacts. |
<p>| 309        | X        | -                   | Controller internal error. | - Switch the truck off and on again. If the error persists, replace the controller. |
| 310        | X        | -                   | Controller capacitors do not charge. | - Check whether additional electrical consumers have been connected without Crown's permission. If so, disconnect these consumers and start the truck. If the error persists, replace the controller. |
| 314        | X        | -                   | Main contactor driver shorted. | - Check for short circuit or low impedance between CA200-17 and battery negative. If there is no error in the wiring, replace the controller. |</p>
<table>
<thead>
<tr>
<th>Event Code</th>
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<th>Operating error LED</th>
<th>Description</th>
<th>Remedy</th>
</tr>
</thead>
</table>
| 315        | X        | -                   | Main contactor driver | - Measure voltage on the main contactor coil connections: It should be approx. 24 volts measured between the red/white wires and the battery negative terminal. 
- Check main contactor wiring for damage. 
If the main contactor and its wiring are ok, replace the controller. |
| 316        | X        | -                   | Main contactor coil and/or brake coil shorted. | - Check wiring for brake and main contactor. 
- Disconnect the main contactor and measure the coil resistance: It should be $R_{25\,^\circ C}=44\,\Omega$. 
- Disconnect the brake and measure the coil resistance: It should be $R_{25\,^\circ C}=10\,\Omega$. 
If no error is discovered in the wiring, the main contactor or the brake, then the controller is faulty. Replace controller. |
| 317        | X        | -                   | VACC error | - Check if the traction potentiometer resets itself to 0 volt output voltage in neutral: Service Menu > Analyzer > Acess 3 Inputs > A2.3.5 > POT WPR. 
- To calibrate the potentiometer: Service Menu > Calibration Menu > C1 > FWD/REV ROCKER |
| 320        | X        | -                   | No CAN Bus communication between controller and display. | - Switch off the truck and measure the resistance on connector CA200 between pin 1 and pin 2: It should be R=60 $\Omega$. 
- Check connector on display. 
- Check that the display is working correctly. |
| 321        | X        | -                   | Truck model not selected. | **Warning:** The setting *cannot* be reversed. 
- In the service menu display select > Features Menu > F4 > Truck Type TC 3000 and adjust. |
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>322</td>
<td>X</td>
<td>-</td>
<td>Short circuit from positive brake connection after battery+.</td>
<td>Measure voltage from CA200-7 after battery+ if the voltage is 0 V, there is a short circuit between the positive brake connection and PC300-20 on the controller. Remove pin PC300-20 temporarily: If the error still persists, the controller must be faulty. Replace controller.</td>
</tr>
<tr>
<td>324</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>325</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>326</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>328</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
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<td>329</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>330</td>
<td></td>
<td>-</td>
<td>PPCS error</td>
<td>Check switch in Analyzer menu: SERVICE Menu &gt; Analyzer Menu &gt; Access 3 Inputs &gt; A2.3.11 - A2.3.14 If the truck is idle: A2.3.11 = A1, A2.3.12 = A3, A2.3.13 = A5, A2.3.14 = A7</td>
</tr>
<tr>
<td>332</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>333</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>334</td>
<td>X</td>
<td>-</td>
<td>Controller still in system test phase.</td>
<td>The event deletes itself after the system test.</td>
</tr>
<tr>
<td>337</td>
<td>X</td>
<td>-</td>
<td>Controller internal error.</td>
<td>Replace controller.</td>
</tr>
<tr>
<td>338</td>
<td>X</td>
<td>-</td>
<td>Incorrect battery voltage</td>
<td>Check the battery voltage: SERVICE MENU &gt; ANALYZER &gt; A3 &gt; OUTPUTS &gt; A3.2 BATTERY VOLTAGE. Measure the battery voltage directly on the battery terminals. If the voltages differ, replace the controller.</td>
</tr>
<tr>
<td>340</td>
<td>X</td>
<td>-</td>
<td>Unsuitable parameter setting for drive motor.</td>
<td><strong>Attention</strong>: re-loading the default settings will clear all customer-specific settings in all the controllers. To restore the default settings: SERVICE MENU &gt; PERFORMANCE &gt; P20 &gt; LOAD FACTORY DEFAULTS and restart the truck. If the error still persists, the controller must be faulty. Replace controller.</td>
</tr>
</tbody>
</table>