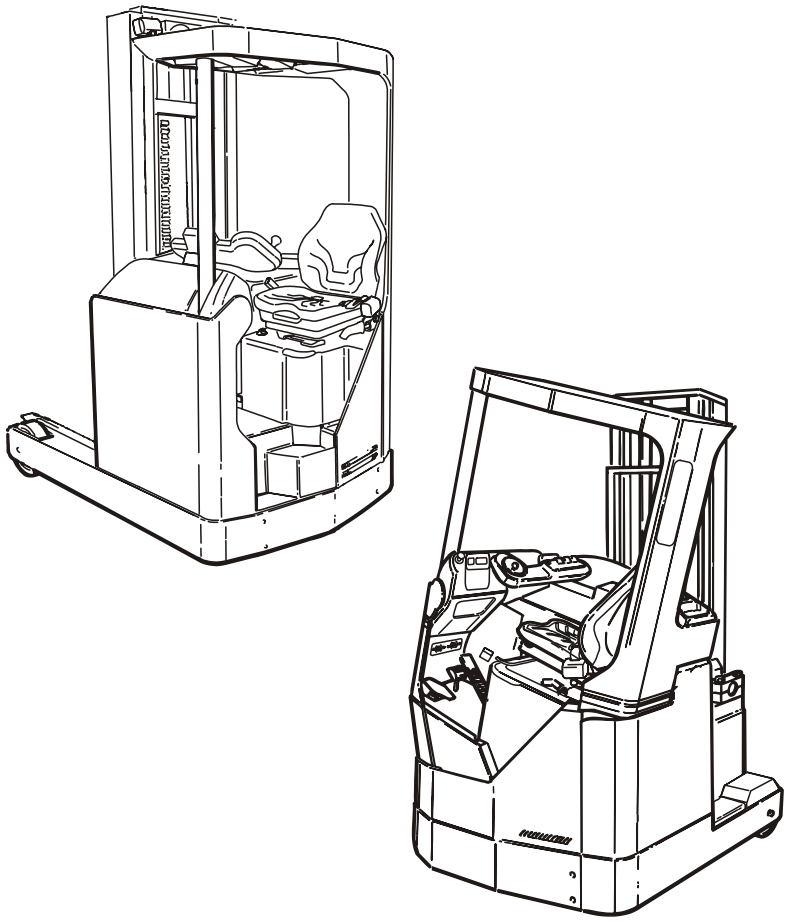


Service Manual en

REFLEX RR B,E RR B,E CC

Valid from serial number: 713962-

Order number: 218920-040
Issued: 2005-09-09 ITS

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Document revisions

Issue date	Resp.	Changes
2004-09-01	ITS	Brand new version.
2005-06-01	ITS	Updating: M4, P1, P2, P3, P4, 0840, 3550, 5000 (wiring diagram + component list), 5110, 5710, 6000, 6620, 7100, 7400, 9390, 9420, 9500
2005-09-09	ITS	Updating: M4, P2, P4, 3550.2 (new)

This manual covers following truck models:

T-code	Model	Serial number
403	RR B1-3	713962-
404	RR B1-3C	713962-
405	RR B4-6	713962-
406	RR B4-6C	713962-
407	RR B7-8	713962-
408	RR B7-8C	713962-
409	RR E 1-3	713962-
410	RR E1-3C	713962-
411	RR E4-6	713962-
412	RR E4-6C	713962-
413	RR E7-8	713962-
414	RR E7-8C	713962-
669	RR E2-3CC	713962-
670	RR E4-6CC	713962-
671	RR E7-8CC	713962-
716	RR B2-3CC	713962-
717	RR B4-5CC	713962-
718	RR B7-8CC	713968-

Some chapters in this manual covers only certain of the T-codes above.

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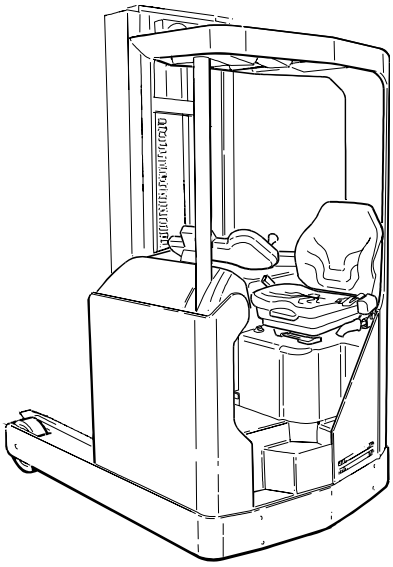
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2-General product information – M2

2.1 Presentation of the reach trucks



The reach truck program is intended for handling pallets indoors or alternatively other types of loads using other load carriers. The trucks are operated seated in a protected and ergonomic operator position. The reach trucks are available in different size classes and have as standard a lifting capacity of up to 2500 kg and a lifting height of up to 11,5 m.

The trucks are equipped with a 48 V electrical system. The travel and lifting speeds are transistor controlled to provide smooth operations. In addition, the travel function and the different hydraulic functions have additional controls which further enhance these features. Different speeds, steering and cab tilt (optional) can be set using parameters to give the best possible individual setting for the functions.

2.1.1 Application areas for the reach trucks

The reach trucks are solely designed and manufactured to handle goods. The trucks should be fitted with the appropriate accessories relevant to the application.

2.1.2 Prohibited applications for the reach trucks

The reach trucks are designed for handling goods indoors. Unless the truck is specially equipped, it is not permitted to use the truck for other purposes including the following applications:

- In areas that contain dust or gases which can cause fires or explosions
- As a tow-truck for trailers
- To tow other trucks
- To transport/lift passengers
- To drive on gravel or grass

2.2 Truck data

The table provides information regarding some technical data, which is of value with daily use of the truck.

Truck type	B/E1-3 B/E1-3CC	B/E4 B/E4CC	B/E5-6 B/E5-6CC	B/E7-8 B/E7-8CC
Rated lifting capacity, kg	1600	1600	2000	2500
Travel speed without load and without support arm brake, km/h	11,2	10,4	10,4	-
Travel speed with rated load and without support arm brake, km/h	10,1	9,7	9,7	-
Travel speed without load and with support arm brake, km/h	12,0	12,0	12,0	12,0
Travel speed with rated load and with support arm brake, km/h	12,0	12,0	12,0	12,0
Hill-climbing ability with rated load, %	10	10	10	7
Lift speed without load, m/s	0,54	0,54	0,54	0,52
Lift speed with rated load, m/s	0.33	0.30	0.30	0.27
Lowering speed without load, m/s	0,47	0,47	0,47	0,46
Lowering speed with rated load, m/s	0,50	0,50	0,49	0,47
Weight excluding battery, kg [5]	2315 [1]	3631 [4]	2995 [2]	3885 [3]
Battery (5 h discharged)	360/480	600/750	480/600	600/800
Battery weight (min.), kg	700/865	1075	865/1075	1075/1270
Continuous noise level, dB A	< 70	< 70	< 70	< 70
Vibration value, m/s^2	0,5	0,5	0,5	0,5

[1] h_3 = 5700 mm

[2] h_3 = 7000 mm

[3] h_3 = 9000 mm

[4] h_3 = 11000 mm

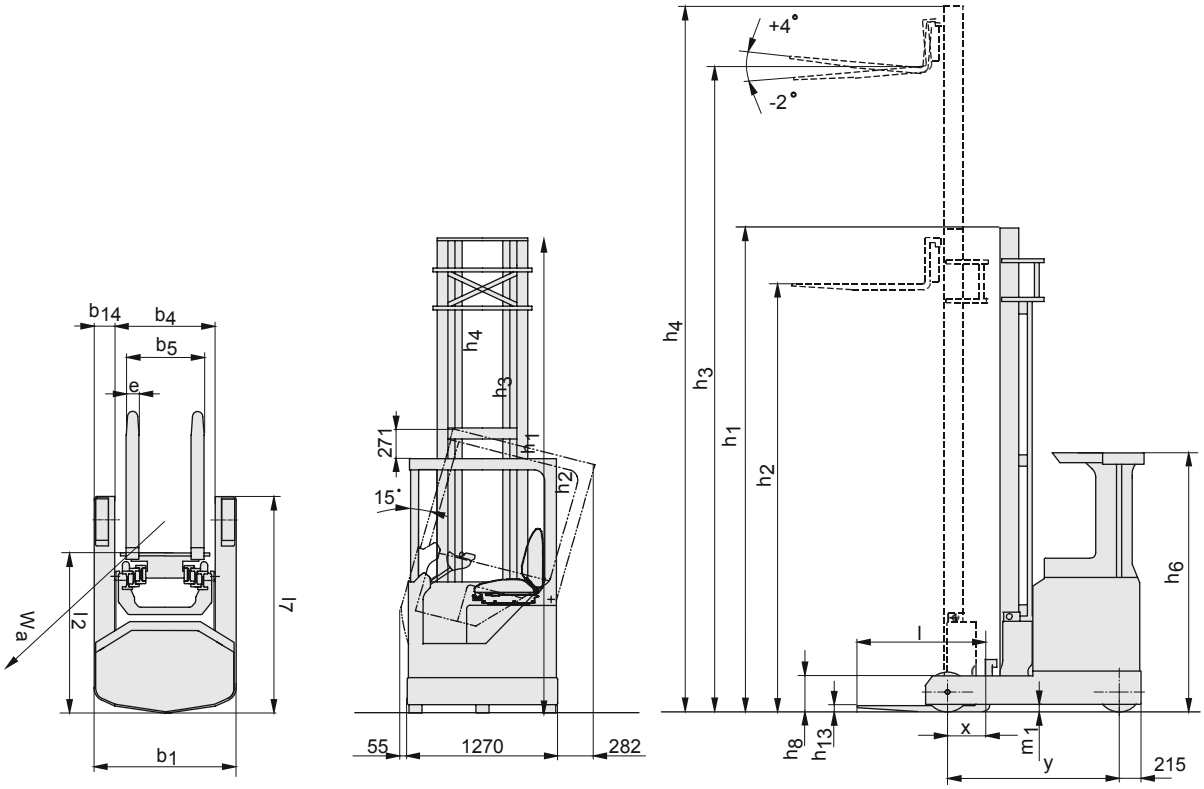
The lifting capacity, lift height and weight are indicated on the identification plate of the truck.

[5] For the RR B/E CC, please add 240 kg for the cold-store cabin.

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2.3 Truck dimensions

The diagrams show external dimensions for RR B1-8 and E1-E8.



Dimensions (mm)	B/E1-3 B/E1-3CC	B/E4 B/E4CC	B/E5-6 B/E5-6CC	B/E7-8 B/E7-8CC
b_1 Chassis width	1270/1470/ 1670	1270/ 1470/1670	1270/1470/ 1670	1270/1470/ 1670
b_4 Width between support arms, min./max.	900/1100/ 1300	900/1100/ 1300	900/1100/ 1300	900/1100/ 1300
b_5 Width across fork, min./max.	250-738	250-738	250-738	250-738
e Fork width	100	100	120	125
h_1 Mast height, min	2057-3898	4457- 4790	2165-3898	2271-4504
h_2 Free lift	1416-3257	3816- 4149	1524-3257	1691-3923
h_3 Lift hight	4400-9500	10000- 11000	4400-9500	4800-11500
h_4 Mast height, max	5040-10140	10140- 11640	5240-10140	5381-12081

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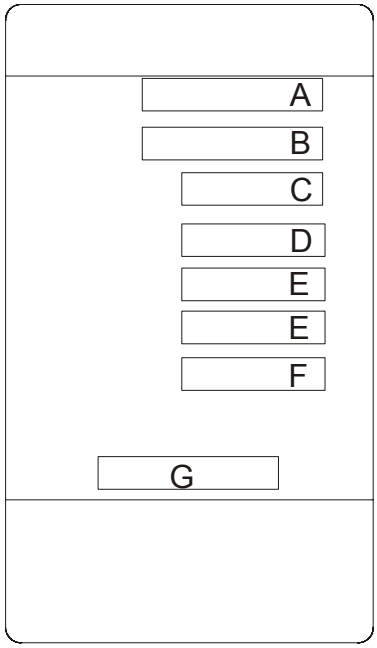
Dimensions (mm)	B/E1-3 B/E1-3CC	B/E4 B/E4CC	B/E5-6 B/E5-6CC	B/E7-8 B/E7-8CC
h_6 Height above overhead guard [1]	2166	2216	2266	2266
l Fork length	1150	1150	1150	1150
l_7 Truck length excl. forks [2]	1811	1886	1887	2011
m_1 Floor clearance	70	70	70	70
Wa Turning radius	1640	1690	1690	1815

[1)] For the RR B/E CC, please add 20 mm for the cold-store cabin.

[2)] For the RR B/E CC, please add 51 mm for the cold-store cabin.

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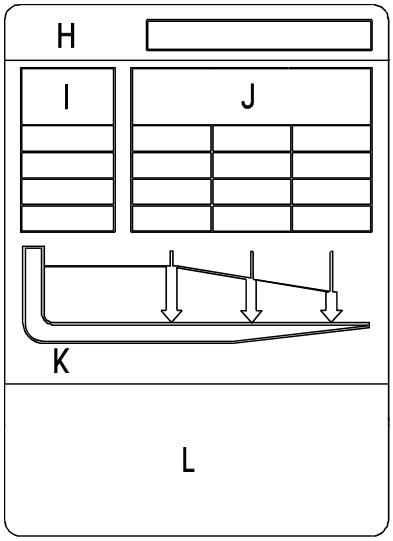
2.4 Identification plate, truck



The illustration shows the identification plate for the truck.

Item	Text		Unit
A	TYPE		
B	SERIAL NO.		
C	RATED CAPACITY		kg
D	WEIGHT WITHOUT BATTERY		kg
E	BATTERY WEIGHT	MAX MIN	kg kg
F	BATTERY VOLTAGE		V
G	BATTERY TYPE ACCORDING TO ASME UL583 NORM (ONLY ASME)		

2.4.1 Capacity plate

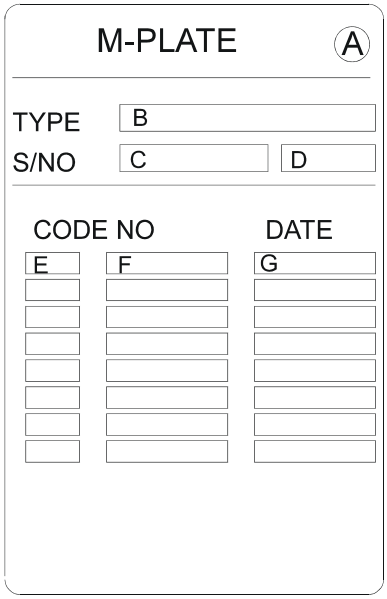


The diagram shows the capacity plate used on the truck.

Item	Text	Unit
H	NO	
I	LIFT HEIGHT	mm
J	ACTUAL CAPACITY	kg
K	LOAD CENTRE	mm
L	THE TRUCK MUST ALWAYS BE DRIVEN WITH LOWERED FORKS AND RETRACTED MAST EXCEPT WHEN PLACING OR REMOVING LOAD.	

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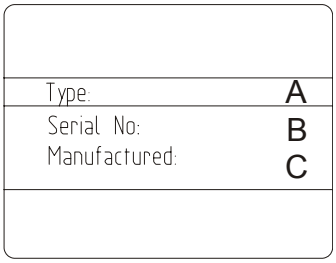
2.4.2 Modification plate



The picture shows the modification plate, which must be attached to the truck if the truck has been supplied as non-standard or has been modified after delivery from the factory. The plate includes the information presented in the table below.

Item	Text
A	Modification plate
B	Type
C	Serial number
D	Place of manufacture
E	Place of manufacture
F	Modification number
G	Date

2.4.3 Identification plate, mast



The illustration shows the mast identification plate which can be found on the side of the mast. The plate shows information according to the table below.

Item	Text
A	Type
B	Serial number
C	Date

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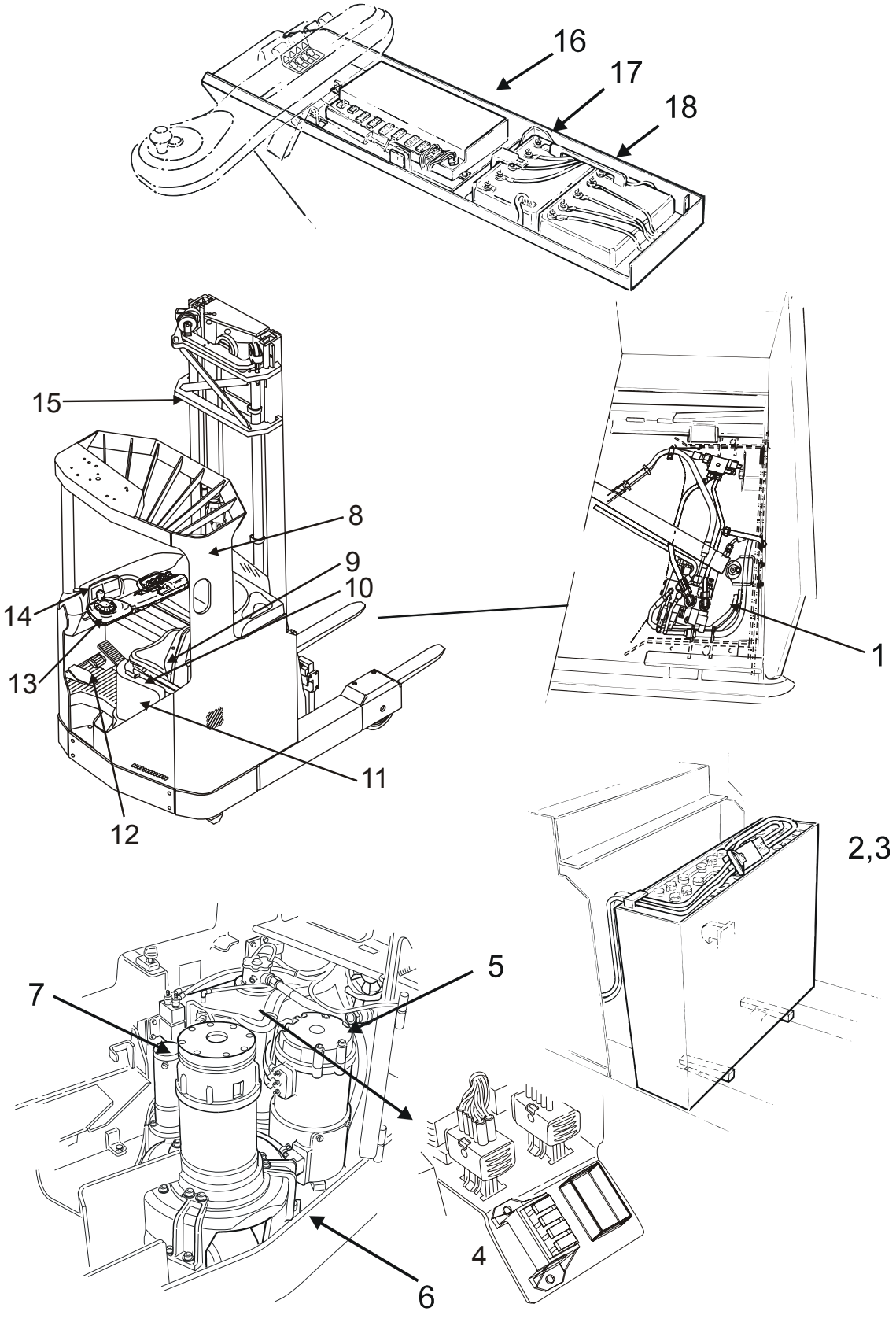
2.5 Main components RR B/E 1-8

1. **Hydraulic valves:**
   The valves are located to provide easy access.
2. **Battery:**
   48 V with different Ah values.
3. **Recharging connector:**
   The battery is recharged via this permanently attached recharging connector.
4. **Control circuit fuse:**
   10A, part no. 161640-100.
   Fuse for electrical steering wheel:
   30 A, part no. 161640-300.
5. **Hydraulic unit:**
   Pump motor, pump and oil tank integrated in a compact unit.
6. **Drive unit with brake:**
   Drive motor, gears and drive wheel combined into a compact unit. Steering bearings between motor and gears as well as a 360° steering angle which facilitates the handling of loads.
7. **Electrical steering motor:**
   Mounted with the drive gear to provide a compact design.
8. **Identification plate, truck:**
   With model designation, serial number, year of manufacture, weight without battery, battery weight, rated capacity, battery voltage and manufacturer.
9. **Operator's seat:**
   The seat is fully adjustable to provide optimal operator comfort.
10. **Serial number:**
    The manufacturing number plate fitted to the chassis.
11. **Cover:**
    Easily swivelled to provide good access for servicing.
12. **Pedals:**
    Accelerator with optional direction selector, travel brake and safety pedal.
13. **Control console:**
    The control console can be adjusted to a suitable height and angle to obtain a comfortable working position. The steering, hydraulic functions, horn, height indication, travel direction and any extra hydraulic functions are all controlled from this console.
14. **Instrument panel:**
    This provides information on the truck's running time, time indication, error codes, travel direction, parking brake, steering angle, driver identification and battery status. The instrument panel also houses the emergency switch off, keypad and switches for accessories.
15. **Mast:**
    The mast is a clear-view model and is equipped with an identification plate with type designation, serial number and date of manufacture.
16. **Electronics:**
    All the electronics collected in a protected compartment.
17. **Drive motor fuse:**
    RR B1-3, E1-3:
    125 A, part no. 29584.
    RR B4-8 and E4-8
    160 A part no. 29223.
18. **Pump motor fuse:**
    RR B1-3, E1-3:
    200 A, part no. 29673.
    RR B4-6 and E4-6:
    250 A, part no. 29221.
    RR B7-8 and E7-8:
    300 A, part no. 29674.

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Main components RR B/E 1-8

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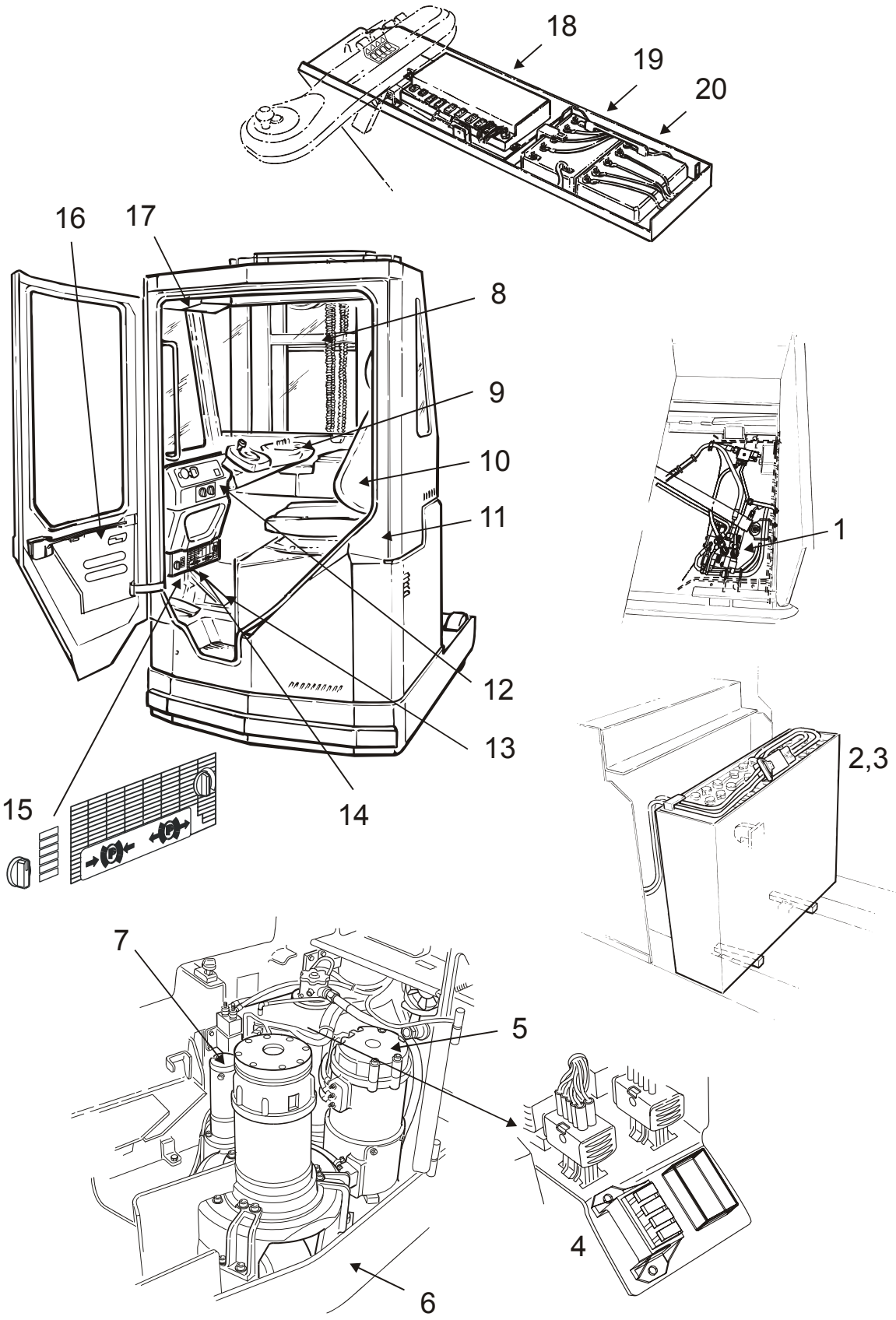
2.6 Main components RR B/E 2-8 CC

1. **Hydraulic valves:**
   The valves are located to provide easy access.
2. **Battery:**
   48 V with different Ah values.
3. **Recharging connector:**
   The battery is recharged via this permanently attached recharging connector.
4. **Control circuit fuse:**
   10A, part no. 161640-100.
   Fuse for electrical steering wheel:
   30 A, part no. 161640-300.
5. **Hydraulic unit:**
   Pump motor, pump and oil tank integrated in a compact unit.
6. **Drive unit with brake:**
   Drive motor, gears and drive wheel combined into a compact unit. Steering bearings between motor and gears as well as a 360° steering angle which facilitates the handling of loads.
7. **Electrical steering motor:**
   Mounted with the drive gear to provide a compact design.
8. **Mast:**
   The mast is a clear-view model and is equipped with an identification plate with type designation, serial number and date of manufacture.
9. **Control console:**
   The control console can be adjusted to a suitable height and angle to obtain a comfortable working position. The steering, hydraulic functions, horn, parking brake, height indication, travel direction and any extra hydraulic functions are all controlled from this console.
10. **Operator's seat:**
    The seat is fully adjustable to provide optimal operator comfort.
11. **Serial number:**
    The manufacturing number plate fitted to the chassis.
12. **Instrument panel:**
    This provides information on the truck's running time, time indication, error codes, travel direction, parking brake, steering angle, operator identification and battery status. The instrument panel also houses the emergency switch off, key and switches for accessories.
13. **Pedals:**
    Accelerator with optional direction selector, travel brake and safety pedal.
14. **Heater:**
    The main heater for the driver's cab enables setting of the temperature and operating the auxiliary heater.
15. **Control circuit fuse:**
    5A, part no. 161640-005.
    Fuse for main heater.
    30 A, part no. 161640-030.
    Fuse for auxiliary heater
    30 A, part no. 161640-030.
16. **Identification plate, truck:**
    With model designation, serial number, year of manufacture, weight without battery, battery weight, rated capacity, battery voltage and manufacturer.
17. **Height indication**
18. **Electronics:**
    All the electronics collected in a protected compartment.
19. **Drive motor fuse:**
    RR E2CC-E3CC:
    125 A, order no. 29584.
    RR E4CC-E8CC:
    160 A, order no. 29223.
20. **Pump motor fuse:**
    RR E2CC-E3CC:
    200 A, order no. 29673.
    RR E4CC-E6CC:
    250 A, order no. 29221.
    RR E7CC-E8CC:
    300 A, order no. 29674.

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Main components RR B/E 2-8 CC

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2.7 Warning and information plates and symbols RR B/E 1-8

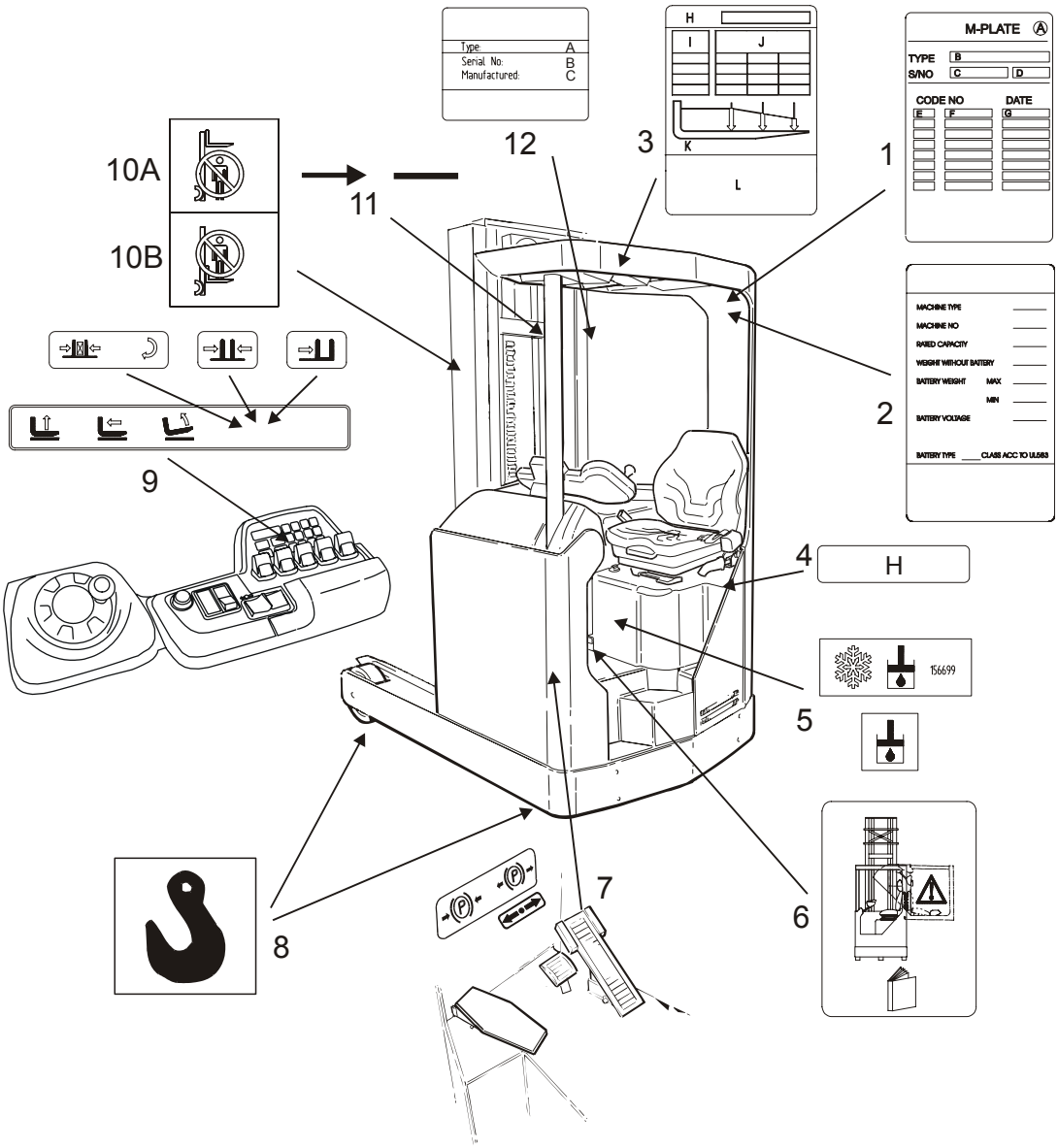
The figure shows the position and significance of the plates and symbols located on RR B/E 1-8.

1. **Modification plate**
2. **Identification plate, truck**
3. **Capacity plate**
4. **Serial number**
5. **Hydraulic oil filler neck**
6. **Cab tilt lock**
7. **Parking brake and travel direction (accessories)**
8. **Lifting points**
9. **Hydraulic switches: Lift/lower, retract/extend mast, fork tilting, side shifting and any optional hydraulic functions**
10. **A) Do not walk under a suspended load**
    B) Do not stand on the forks
11. **Max. height with rated lifting capacity**
12. **Identification plate, mast**

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Warning and information plates and symbols RR B/E 1-8

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2.8 Warning and information plates and symbols RR B/E 2-8 CC

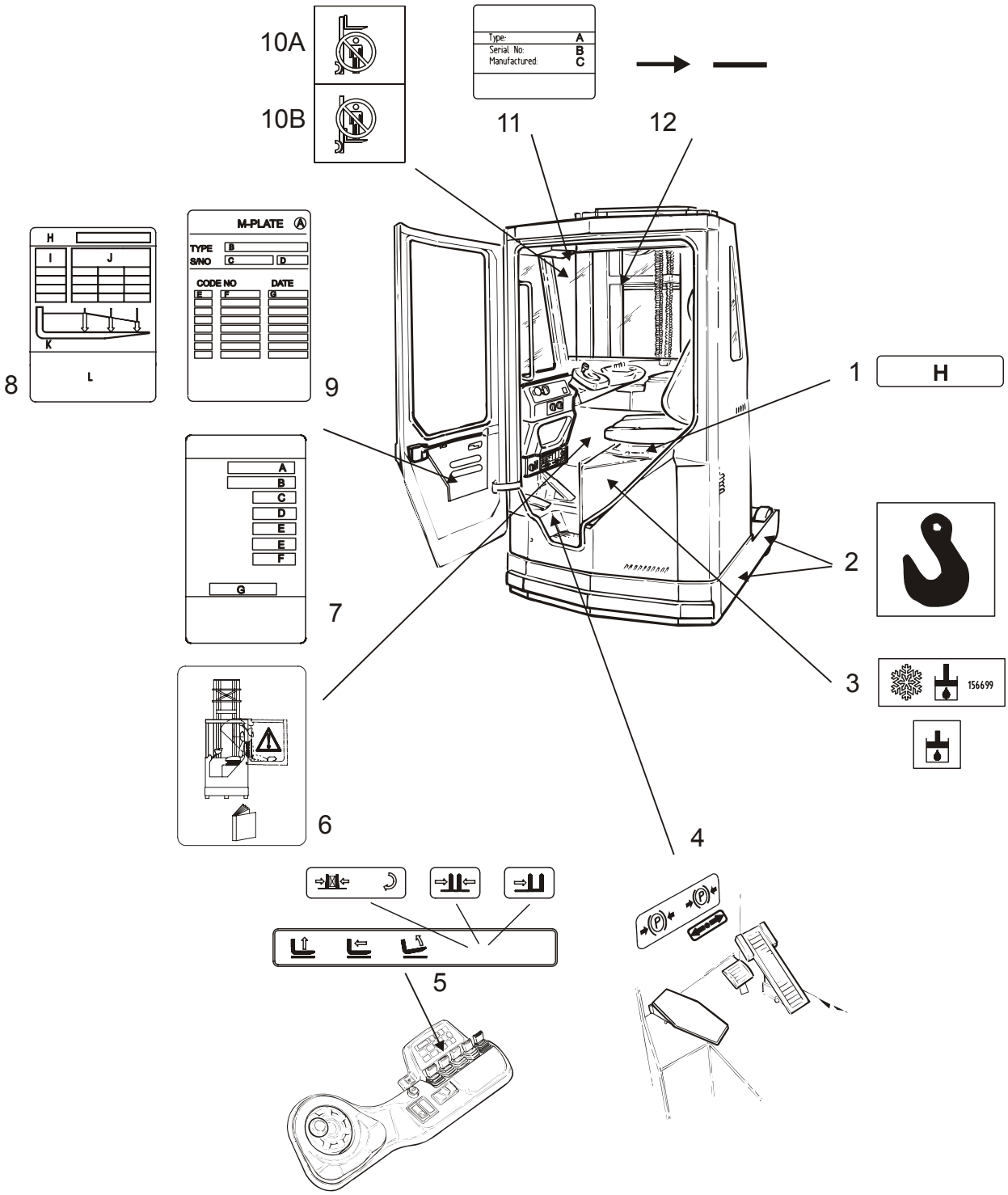
The figure shows the position and significance of the plates and symbols located on RR B/E 2-8 CC.

1. **Serialnumber**
2. **Lifting points**
3. **Hydraulic oil filler neck**
4. **Parking brake and travel direction (accessories)**
5. **Hydraulic switches: Lift/lower, retract/extend mast, fork tilting, side shifting and any optional hydraulic functions**
6. **Cab tilt lock**
7. **Identification plate, truck**
8. **Capacity plate**
9. **Modification plate**
10. **A) Do not walk under a suspended load**
    B) Do not stand on the forks
11. **Identification plate, mast**
12. **Max. height with rated lifting capacity**

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Warning and information plates and symbols RR B/E 2-8 CC

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3-Technical data – M4

Table 1: Technical data

Model	RR B/E1-3 RR B/E1-3CC	RR B/E4-6 RRB/E4-6CC	RR B/E7-8 RR B/E7-8CC
Drive motor			
Type	TSP 112/4-130-T	TSP 112/4-4-165-T	TSP 112/4-165-T
Output, kW	5.5	7.5	7.5
Duty cycle, %	60	60	60
Insulation class	F	F	F
Transmission/drive gear			
Type	2-stage angle transmission	2-stage angle transmission	2-stage angle transmission
Gear ratio	19.2:1	20.89:1	20.89:1
Oil volume, Litres	2.8	3.3	3.3
Oil type	Hypoid oil	Hypoid oil	Hypoid oil
Normal temperature	SAE 80W90	SAE 80W90	SAE 80W90
< -15° C:	SAE 75W	SAE 75W	SAE 75W
Wheels			
Drive wheel	diameter 310x120	diameter 310x120	diameter 350x130
Support arm wheels	diameter 265x108 diameter 300x100	diameter 350x108	diameter 350x108
Max. weight on support arm wheels without load/with load (kg)	1835/4350	2820/5400 (B4) 2240/5470 (B5-6)	3225/7045
Max. weight on drive wheel without load/with load (kg)	1785/1480	2605/2225 (B4) 2200/1910 (B5-6)	2725/2150
Max. support arm wheel pressure (MPa)	4,5	4,6 (B4, B5-6)	5,3
Max. drive wheel pressure (Mpa)	3,3	3,8 (B4) 3,4 (B5-6)	3,9

Technical data – M4

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Table 1: Technical data

Model	RR B/E1-3 RR B/E1-3CC	RR B/E4-6 RRB/E4-6CC	RR B/E7-8 RR B/E7-8CC
Hydraulic system			
Pump motor, Type	TSP 112/4-150-T	TSP 112/4-150-T	TSP 112/4-195-T
Output, kW	10.0	10.0	14.0
Duty cycle, %	15	15	15
Insulation class	F	F	F
Pump flow, Litres/minute	30	26	35
Tank volume, Litres	30/38	38	38
Oil type:			
Normal temperature	ISO-L-HM32	ISO-L-HM32	ISO-L-HM32
<-15°	ISO-L-HV32	ISO-L-HV32	ISO-L-HV32
Hydraulic pressure			
Pressure at rated load, bar	150	180	185
Overflow pressure, bar	165	195	200
Steering motor			
Type	36-4830312J	36-4830312J	36-4830312J
Output	0.20	0.20	0.20
Duty cycle, %	100	100	100
Minimum carbon brush length, mm	9	9	9
Minimum commutator diameter, mm	22.9	22.9	22.9
Insulation class	B	B	B
Fuses			
F1, Drive motor	125 A/29584	160 A/29223	160 A/29223
F3, Pump motor	200 A/29673	250 A/29221	300 A/29674
F60, Control voltage A5	10 A/122308-100	10 A/122308-100	10 A/122308-100
F61, Steering servo	30 A/122308-300	30 A/122308-300	30 A/122308-300
F62, Input from main contactors	10 A/122308-100	10 A/122308-100	10 A/122308-100
F63, Extra equipment	10 A/122308-100	10 A/122308-100	10 A/122308-100

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Technical data – M4

Valid from serial number	T-code
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Table 1: Technical data

Model	RR B/E1-3 RR B/E1-3CC	RR B/E4-6 RRB/E4-6CC	RR B/E7-8 RR B/E7-8CC
Batteries			
Dimension WxLxH	See C-code 5110	See C-code 5110	See C-code 5110
Capacity			
Weight			
Driving speed			
Without load, without support arm brakes,km/h	11.2	10.4	---
With rated load, without support arm brakes, km/h	10.1	9.7	---
Without load, with support arm brakes,km/h	12.0	12.0	12.0
With rated load, with support arm brakes,km/h	12.0	12.0	12.0
Lift/lowering speed			
Lifting without load, m/s	0.50	0.50	0.50
Lifting with 1000 kg load, m/s	0.37	0.35	0.37
Lifting with rated load, m/s	0.33	0.30	0.27
Lowering without load, m/s	0.46	0.46	0.44
Lifting with 1000 kg load, m/s	0.53	0.53	0.50
Lowering with rated load, m/s	0.50	0.49	0.47
Power consumption, Driving			
Driving without load, Ampere	68	80	107
Driving with rated load, Ampere	68	86	116
Power consumption, Free lift			
Lifting without load, Ampere	115	111	168
Lifting with rated load, Ampere	251	285	263

Technical data – M4

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Model	RR B/E1-3 RR B/E1-3CC		RR B/E5-6 RR B/E5-6CC		RR B/E7-8 RR B/E7-8CC	
Power consumption, Free lift						
	Ampere	Bar	Ampere	Bar	Ampere	Bar
Lifting without load	115	36	111	40	168	42
Lifting with rated load	251	135	285	158	263	140
Power consumption, Main lift						
	Ampere	Bar	Ampere	Bar	Ampere	Bar
Lifting without load	140	54	145	64	211	75
Lifting with rated load	269	153	290	170	300	175
Tilting without load						
Tilting with rated load						
Mast in/out without load	198/155	103/65	180/145	93/62	170/133	73/52
Mast in/out with rated load	211/160	110/60	190/150	111/69	170/135	80/64
Side shift forks without load	120/100	46/30	118/97	50/32	180/162	51/67
Side shift forks with rated load	233/195	130/100	200/252	142/107	330/274	187/172

NOTE!

The above values are recommended values. Variations may occur between different trucks.

Some data may be missing in the table because corresponding tests have not been carried out or the data is not available at the present time.

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3.1 General tightening torque

Millimetre threads.
The following applies under ideal conditions, e.g. steel against steel.

3.1.1 Galvanised, non-oiled bolts

Table 2: General tightening torque in Newton metres NM							
Thread	**A**	**M3**	**M4**	**M5**	**M6**	**M8**	**M10**
Tightening torque	8.8	1.15	2.8	5.5	9.5	23.0	45
Tightening torque	12.9	2.0	4.7	9.3	16.3	38.5	75.8
Thread	**A**	**M12**	**M14**	**M16**	**M20**	**M24**	
Tightening torque	8.8	77.7	123	189	369.6	638.5	
Tightening torque	12.9	130.5	208	319.7	623	1075	

A=Strength class

3.1.2 Untreated, oiled bolts

Table 3: General tightening torque in Newton metres NM							
Thread	**A**	**M3**	**M4**	**M5**	**M6**	**M8**	**M10**
Tightening torque	8.8	1.2	2.9	5.7	9.8	24.0	47
Tightening torque	12.9	2.1	4.9	9.7	17.0	40.0	79.0
Thread	**A**	**M12**	**M14**	**M16**	**M20**	**M24**	
Tightening torque f	8.8	81	128	197	385	665	
Tightening torque	12.9	136	217	333	649	1120	

A=Strength class

NOTE!

Experience has shown that if you adjust the torque wrench to the values for untreated bolts, you will achieve the correct torque value for galvanised bolts.
Do not tighten more than the values set out in the table otherwise the bolts may be destroyed

Technical data – M4

General tightening torque

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4-Introduction, maintenance – P1

All points in the service program shall be included to attain the highest level of safety and minimum possible truck downtime. The service intervals are for guidance only and do not need to be followed strictly. The truck driver can adapt these to local conditions, but it is important that the intervals meet the truck manufacturer's minimum requirements.

The service intervals are based on the operating times and can be adapted to most normal 8 hour shifts. The service interval may be shortened if the truck is used more frequently or in more demanding situations, e.g. cold store, dusty or corrosive environments. The following operating hours have been used when calculating the interval:

Day time: 08.00-17.00 (20 hours/week)

2-shifts: 06.00-14.00, 14.00-22.00 (40 hours/week)

3-shifts: 06.00-14.00, 14.00-22.00, 22.00-06.00 (60 hours/week)

Ensure the truck receives a regular maintenance service after every 500 driving hours. The truck's safety, efficiency and service life is dependent on the service and maintenance it receives.

Only use spare parts approved by the truck manufacturer for servicing and repairs.

4.1 Safety regulations during maintenance work

Only persons trained in servicing and repairing this type of truck are qualified to carry out service and repair work.

- Do not carry out any maintenance work on the truck unless you have the correct training and knowledge to do so.
- Keep the area where servicing work is done clean. Oil or water makes the floor slippery
- Never wear loose objects or jewellery when working on the truck.



WARNING !

Short circuit/Burns
Short-circuiting and burn injuries can occur if metal objects come into contact with live electrical connections when working on the truck's electrical system.
Remove watches, rings and other metal jewellery.

- Always remove the battery plug when carrying out maintenance work on the truck unless otherwise stated in this Service Manual.
- Always switch off the truck's power supply before opening the covers on the drive unit or electrical system.

- Discharge the system pressure slowly before starting work on the truck's hydraulic system.
- Use paper or rigid cardboard when checking a possible oil leakage. **Never** use your hands.
- Bear in mind that the oil in the transmission and the hydraulic system may be hot.

WARNING !
Risk of burn injuries
Hot transmission and hydraulic oil.
Let the truck cool before changing the oil.

- Only fill the hydraulic system with new, clean oil.

WARNING !
The hydraulic system can be damaged.
Hydraulic components can be damaged, if the oil is contaminated.
Always use new, clean oil in the hydraulic system.

- Store and dispose of changed oil in accordance with local directives.
- Do not flush solvents and the like used for cleaning down drains that are not intended for this purpose. Follow the local directives that apply for disposal.
- Disconnect the battery when welding on the truck.

NOTE!
The battery can be damaged.
When using electric welding equipment, the welding current can enter the battery.
The battery must be disconnected.

- Remove at least 100 mm of paint around the welding/grinding area by sand-blasting or the use of a paint stripper when welding or grinding on painted surfaces.

CAUTION!
Unhealthy gases.
Heated paint gives off unhealthy gases.
Remove 100 mm of paint from around the working area.

4.2 Cleaning and washing

Cleaning and washing the truck is important for the reliability of the truck.

- Carry out general cleaning and washing weekly.

NOTE!
Risk of short-circuiting.
The electrical system can be damaged.
Disconnect the battery before washing by pulling out the battery plug.

4.2.1 Cleaning the exterior

- Remove rubbish, etc. from the wheels daily.
- Use a well-known degreasing agent, diluted to a suitable concentration.
- Rinse off loose grime using tepid water.

NOTE!

Jamming, corrosion
Mechanical parts can be damaged.
After washing the truck it should be lubricated as set out in the chapter Maintenance and the lubrication chart C-code P2.

4.2.2 Cleaning the motor compartment

- Cover the electric motors, connections and valves before washing.

NOTE!

Risk of short-circuiting.
The electrical system can be damaged.
Electrical components must not be washed with high-pressure cleaners.

- Clean the motor compartment using a well-known degreasing agent, diluted to a suitable concentration.
- Rinse off loose grime using tepid water.

4.2.3 Electrical components

- Blow electric motors clean using compressed air.
- Clean electrical panels, electronic boards, contactors, contacts, solenoid valves, etc. using a damp cloth and a cleaning agent.

NOTE!

Risk of short-circuiting.
The electrical components can be damaged.
Do not break the warranty seal on the electronic card.

4.3 Safe lifting

All lifting must be carried out on a flat, anti-slip and firm surface. Avoid newly-laid asphalt or asphalt on a hot summer’s day.

- Activate the parking brake to prevent the truck from moving during lifting. If the lift applies to the brake wheel, chock the other wheels so that the truck remains still.
- Select the lifting points so that the lift is as easy as possible (one corner at a time). If the truck has marked lifting points on the under side of the chassis these can be used to achieve well-balanced lifting.

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- Ensure that the surface under the jack is clean and free of oil and grease.
- Ensure that your hands and the jack's lever are free of oil and grease.
- Use the lever belonging to the jack. If the lever is too short, it will require more effort than is necessary. If the lever is too long, there is a risk of the jack being overloaded.
- Support the truck:
  - as close to the raised part of the chassis as possible to reduce the falling height if the truck tips over.
  - so that the truck cannot roll.
- **Never** block up the jack to lift higher.
- **Never** work under a lifted truck without well adapted blocking.



WARNING !
Risk of being crushed.
Bad blocking under a truck can collapse
Never work under a truck that is not blocked with pallets and secured by a lifting device.

4.4 Opening motor compartment

4.4.1 RR B 1-8

To open the motor compartment.

- Loosen the handle beside the driver's seat and swing the door outwards.

To close the motor compartment.

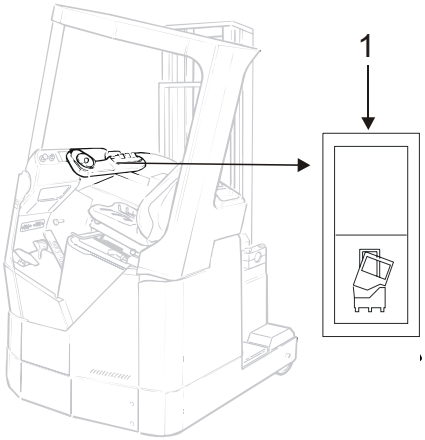
- Close the door and tighten the handle.

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4.5 Cab tilting

4.5.1 RR E 1-8

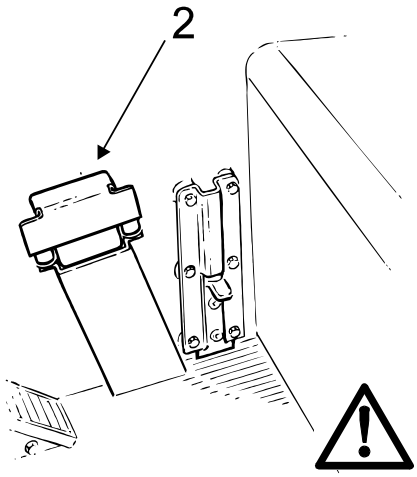


Make sure there is sufficient room for the tilted cab before you start servicing work. Also make sure there is no risk of the cab accidentally being tilted back during servicing.

On trucks with low lifting heights – extend the mast so that finger protection and panel are accessible when tilting up. Also check that the cab does not catch the mast, hose reel or other parts on the truck.

WARNING!

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
Ensure no one is in the motor compartment when tilting the cab.

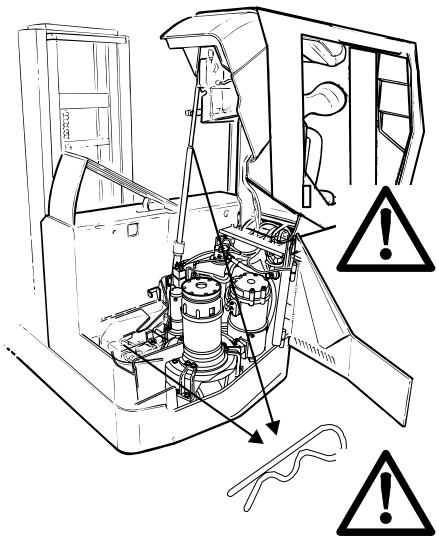


When you carry out a service in the motor compartment you should tilt the cab fully. Only the lift/lower function is operational and then only at crawl speed during tilting.

- Press the switch to lower the cab while starting the truck. The display shows 6 lines.
- Move the hydraulic lever for fork lift backwards.
- When the cab stops (at 15°), loosen the catch that releases the cab.
- Continue to move the lever backwards until the cab stops (at 45°).

WARNING!

Falling cab!
The cab can fall without dampening when tilted over 45°.
The cab is heavy so make sure the person catching it has the situation under control. If possible, use an overhead crane.



- Take hold of the protective roof and tilt the cab fully.
- Insert the safety pin into the cylinder.

WARNING!

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
The safety pin must always be inserted.

Ensure nobody is present in the motor compartment when tilting the cab back.

WARNING!

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
Ensure no one is in the motor compartment when tilting the cab.

- Take hold of the protective roof and tilt the cab back to the 45° position.
- Move the hydraulic lever for fork lift forwards until the cab comes to rest in the lowered position.

WARNING!

Risk of tipping.
The truck can tip if the battery is removed when the truck is tilted to the service position.
Never remove the battery from the truck.

NOTE!

Risk of being crushed.
The plastic guard can be damaged when tilting the cab down.
Always have the doorplate swung out when lowering the cab.

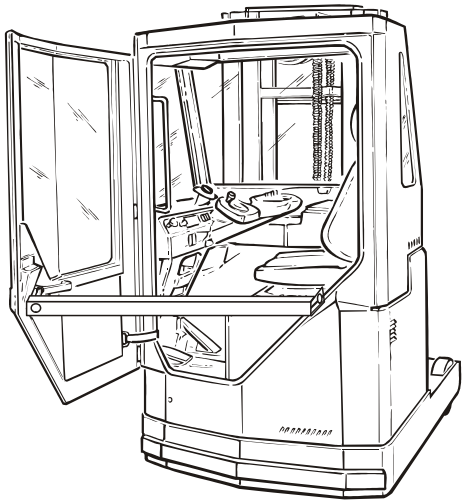
- Close the doorplate and tighten the screw for door locking.

4.5.2 RR E 2-8 CC

Make sure there is sufficient room for the tilted cab before you start servicing work. Also make sure there is no risk of the cab accidentally being tilted back during servicing.

WARNING!

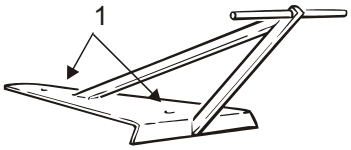
Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
Ensure no one is in the motor compartment when tilting the cab.



When you carry out a service in the motor compartment you should tilt the cab fully. Only the lift/lower function is operational and then only at crawl speed during tilting.

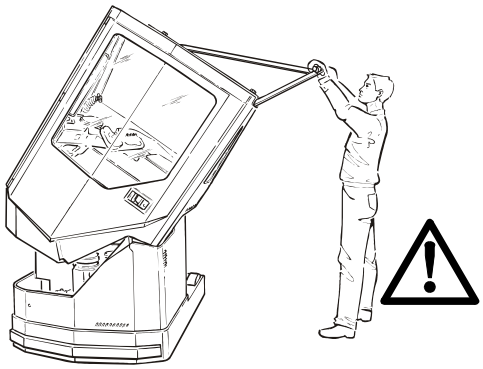
- Fit the tool 08-15912 between the lock function in the door and the wall; this will keep the door open while tilting the cab.
- Press the switch for cab lowering while turning the key. The display shows 6 lines.
- Move the hydraulic lever for fork lift backwards.
- When the cab stops (at 15°), loosen the catch that releases the cab.
- Continue to move the lever backwards until the cab stops (at 45°).

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WARNING!

Falling cab!
The cab can fall without dampening when tilted over 45°.
The cab is heavy so make sure the person catching it has the situation under control. If possible, use an overhead crane.

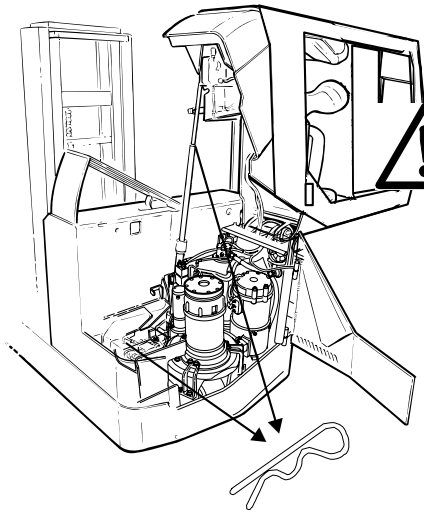


- Remove the two screws on the roof, position tool 31-150030 over these and secure it using the screws
- Take hold of the handle and tilt the cab up fully.
- Insert the safety pin into the cylinder.

WARNING!

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
The safety pin must always be inserted.

Ensure nobody is present in the motor compartment when tilting the cab back.



WARNING!

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
Ensure no one is in the motor compartment when tilting the cab.

- Take hold of the tool and tilt the cab back to the 45° position.
- Remove the tilt tool from the roof and replace the screws.
- Move the hydraulic lever for fork lift forwards until the cab comes to rest in the lowered position.

NOTE!

Risk of being crushed.
The plastic guard can be damaged when tilting the cab down.
Always have the doorplate swung out when lowering the cab.

- Close the doorplate and tighten the screw for door locking.
- Dismantle the tool from the door.

WARNING!

Risk of tipping.
The truck can tip if the battery is removed when the truck is tilted to the service position.
Never remove the battery from the truck.

Introduction, maintenance – P1

Cab tilting

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5-Preventive maintenance – P2

5.1 Maintenance Schedule

5.1.1 RR B/E 1-8

Table 4: Maintenance schedule RR B/E 1-8

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
0000	**Chassis**						
0000.1	Check for cracks or damage				X		
0340.1	Check door locking and lubricate door hinges				A		
0350.1	Lubricate the runners in the reach carriage				F		
0390.1	Check the battery mounting and wear to the battery lock.	U			X		
0390.2	Check the locking of the roller bed				X		
0510.1	Tighten hinges and guides on the cab					A	
0620.1	Check the mounting of the seat and adjustment functions.					X	
0640.1	Check the operation of the driver's controls	U			X		
0640.2	Check the wheel function	U			X		
0640.3	Check the brakes	U			X		
0640.4	Check pedal function	U			X		
0640.5	Check the horn	U			X		
0810.1	Check the attachment of the machine housing and the protective roof.					X	
0820.1	Check the pinch guard					X	
0840.1	Check the emergency switch	U			X		

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Table 4: Maintenance schedule RR B/E 1-8

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
1700	**Motors**						
1700.1	Check for any loose connections					X	
1700.2	Check and tighten mounting bolts					X	
1700.3	Check for noise in the bearings					X	
1730.1	Check steering motor's carbon brushes					X	
2550	**Drive assembly**						
2550.1	Check oil levels				X		
2550.2	Change the oil				C		C
2550.3	Check for noise and leakage	U			X		
2550.4	Check and tighten mounting of the support arm					X	
2550.5	Lubricate the gear ring					H	
3180	**Brakes**						
3180.1	Check the brake discs for wear						X
3180.2	Check for play in released position					X	
3180.3	Check the braking torque					X	
3370.1	Check the brake discs for wear						X
3370.2	Check for play in released position					X	
3370.3	Check the braking torque					X	
3500	**Wheels**						
3530.1	Remove string and other detritus	U			X		
3530.2	Check for drive wheel wear and related bolts	U				X	
3550.1	Remove string and other detritus	U			X		
3550.2	Check the support arm wheels' rotation and mounting	U			X		
3550.3	Check for wear on the support arm wheels	U			X		

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Table 4: Maintenance schedule RR B/E 1-8

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
4100	**Steering console**						
4100.1	Check the mounting and locking of the control console	U			X		
4100.2	Check the strength and locking of the gas damper	U			X		
5000	**Electrical Panel**						
5000.1	Clean and check the mountings						X
5000.2	Tighten cable connections					X	
5000.3	Check the emergency driving functions					X	
5000.4	Check error code log and operation times	U			X		
5190.1	Check contactor points						X
5190.2	Check movement in the contactor						X
5280.1	Check electrical limiting functions					X	
5110	**Battery**						
5110.1	Check electrolyte levels (10-15 mm over cell plates)		U		X		
5110.2	Check connections on the battery, truck and charger		U		X		
5110.3	Check the cell and pole guards		U		X		
5110.4	Check fluid density		U		X		
5110.5	Check temperature				X		
5110.6	Remove overflow fluid from the battery trough				X		
5110.7	Check for wear to the locking catch	U			X		

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Table 4: Maintenance schedule RR B/E 1-8

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
6000	**Hydraulic system**						
6110.1	Check the tank, mounting and leakage					X	
6110.2	Check oil levels				X		
6110.3	Clean or replace the oil						B
6120.1	Check the hoses, pipes and couplings	U			X		
6120.2	Check for wear to hoses on the mast and reach carriage			X			
6130.1	Change air and oil filters					X	
6170.1	Check overflow pressure					X	
6600	**Cylinders**						
6600.1	Check for leakage	U			X		
6600.2	Check the mountings					X	
7100	**Mast and reach carriage**						
7100.1	Check the lowering speed					X	
7100.2	Check for cracks or damage					X	
7110.1	Lubricate mast beams by the runners			F			
7120.1	Check for wear on lifting chains and sprockets			X			
7120.2	Check adjustment of lifting chains Check chain bolts and chain mountings. Check and tighten the lock nuts and inspect the safety pins on all chains			X			
7120.3	Lubricate lifting chains				D		
7150.1	Check for play on rollers					X	
7190.1	Check and tighten mast mounting					X	
7200.1	Check the function of accessories	U			X		
7400.1	Check for wear to the forks and other lifting devices	U				X	
7400.2	Check for damage and deflection on the forks and other lifting devices	U				X	

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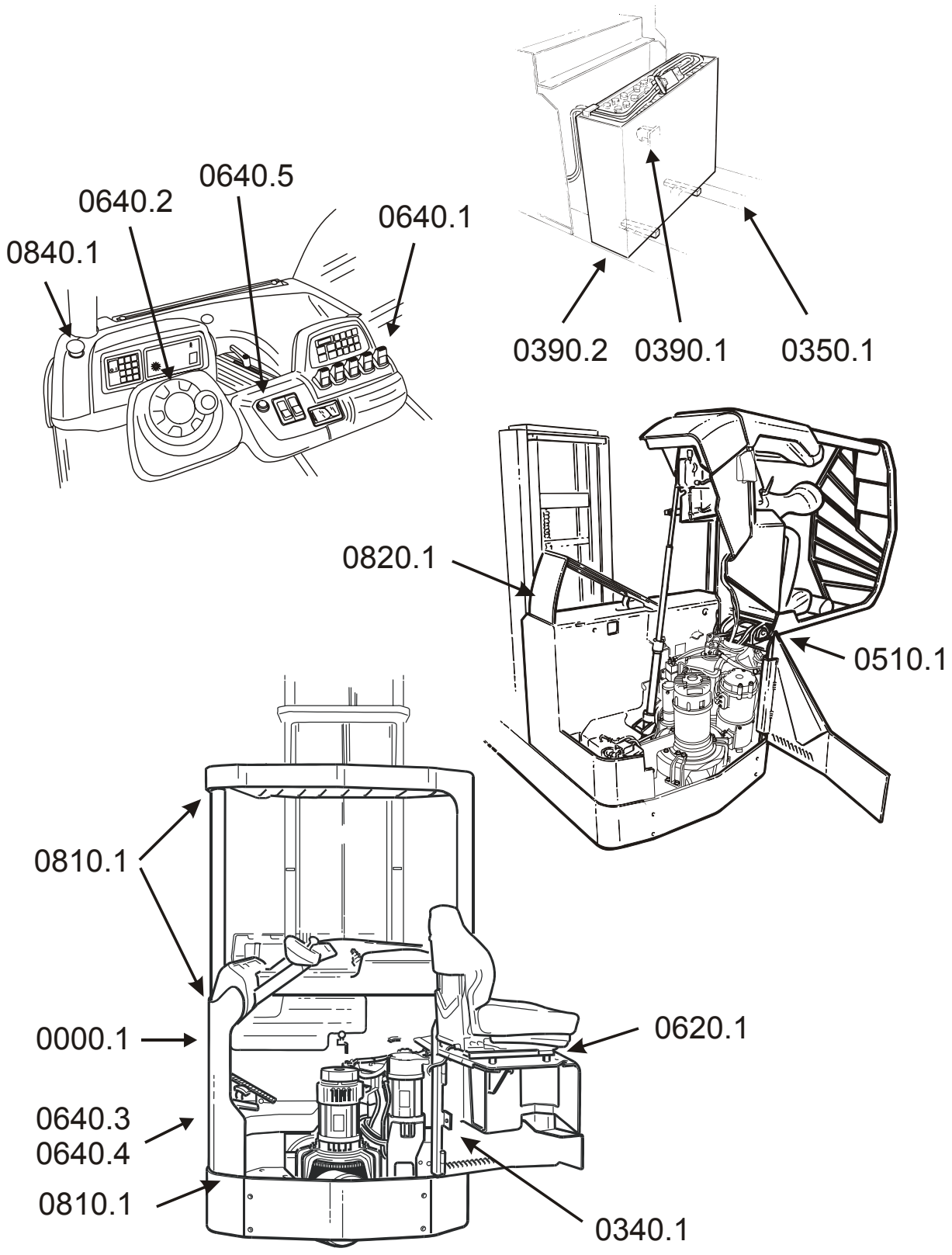
Table 4: Maintenance schedule RR B/E 1-8

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
7400.3	Check wearing strips and tilt angle on the fork carriage.					X	
9500	**Extra equipment**						
9500.1	Check the fire extinguisher					X	

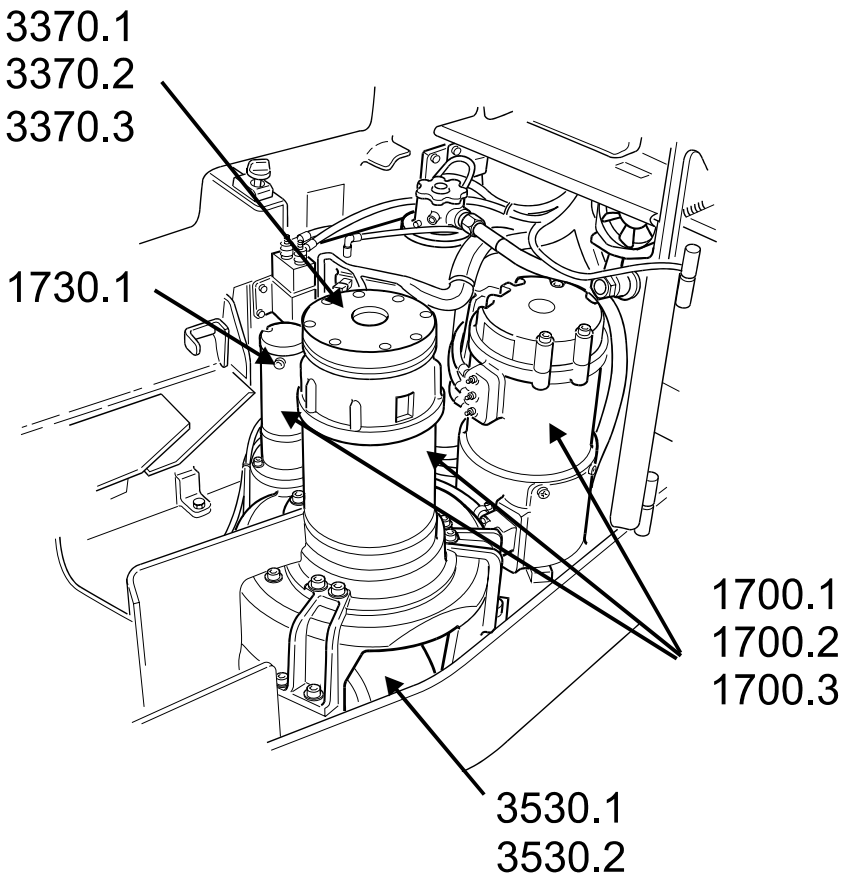
U indicates what appears in the *Daily Care and Function Checking* chapter and must be carried out by the driver.

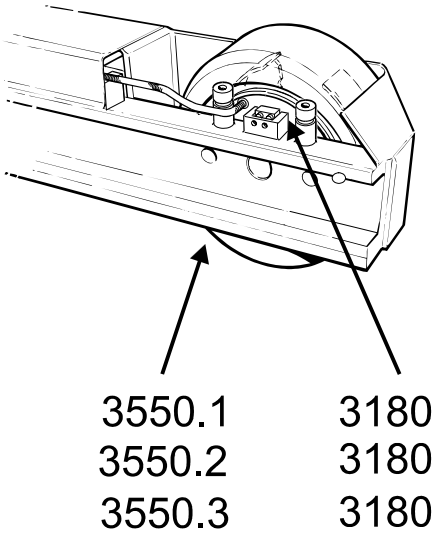
X indicates what should be done during the various services. Other letters indicate oil and grease quality

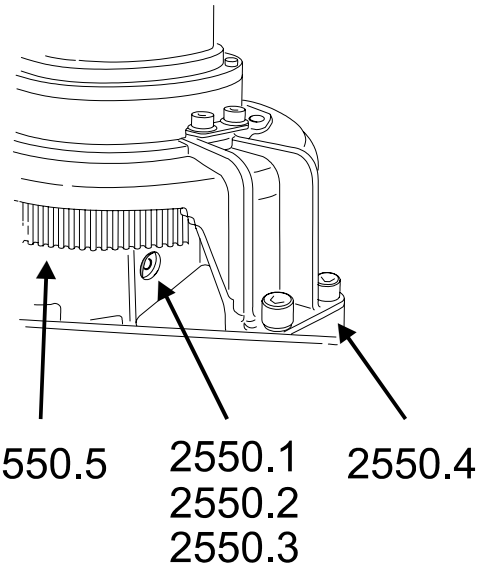
When points with longer time intervals are addressed, the points with shorter time intervals should also be addressed unless otherwise stated above.


0640.5
0640.2
0640.1
0840.1
0390.2
0390.1
0350.1
0820.1
0510.1
0810.1
0000.1
0620.1
0640.3
0640.4
0810.1
0340.1

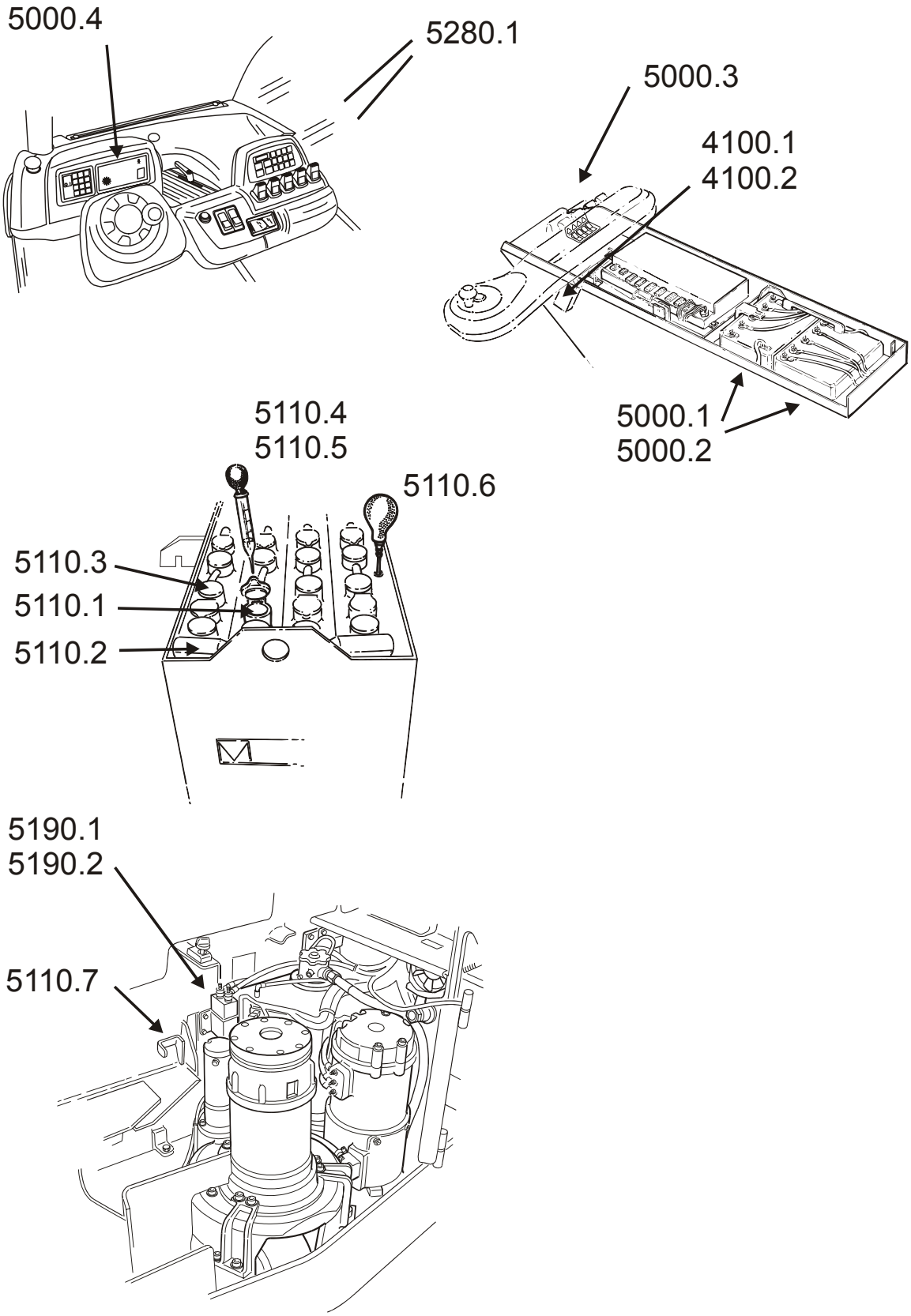
Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09







T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-09-09	218920-040

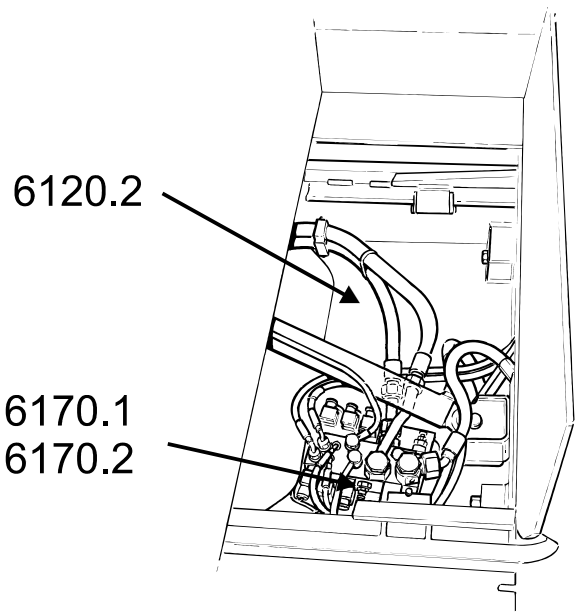


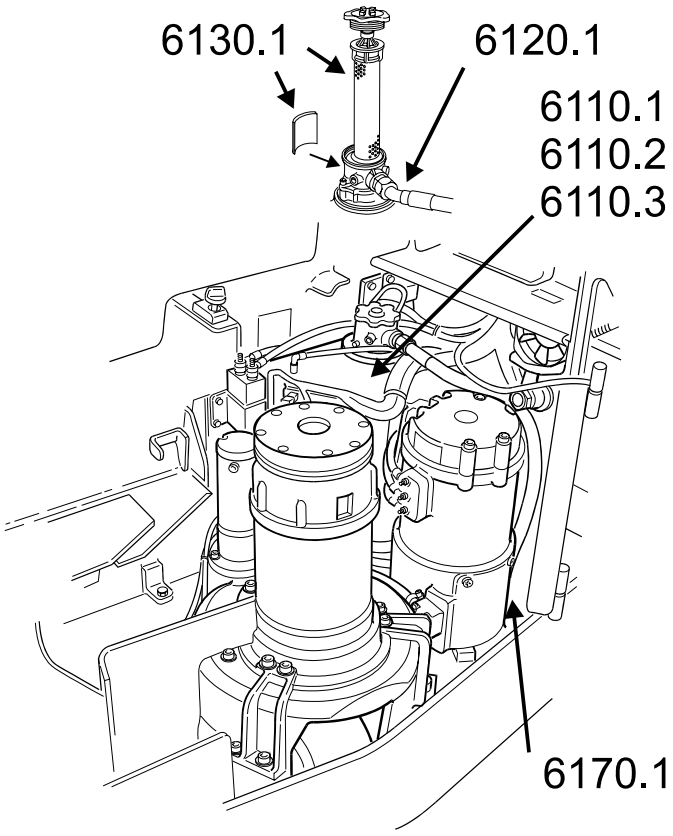
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Preventive maintenance – P2

Maintenance Schedule

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09

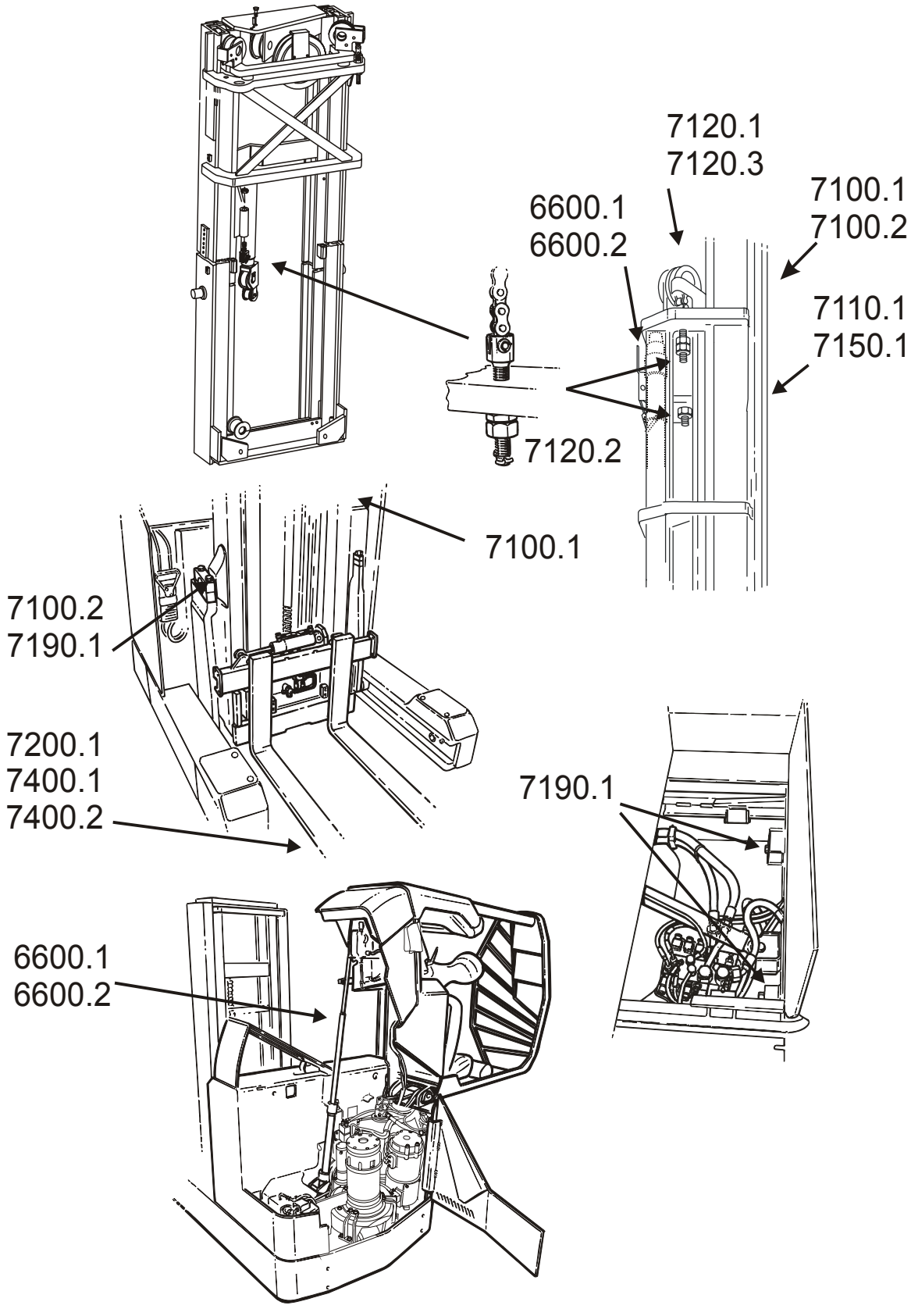




Preventive maintenance – P2

Maintenance Schedule

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-09-09	218920-040



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Valid from serial number	**T-code**
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09

5.1.2 RR B/E 2-8 CC

Table 5: Maintenance schedule RR B/E 2-8 CC

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
0000	**Chassis**						
0000.1	Check for cracks or damage				X		
0340.1	Check door locking and lubricate door hinges				A		
0350.1	Lubricate the runners in the reach carriage				F		
0390.1	Check the battery mounting and wear to the battery lock.	U			X		
0390.2	Check the locking of the roller bed				X		
0510.1	Tighten hinges and guides on the cab					A	
0620.1	Check the mounting of the seat and adjustment functions.					X	
0640.1	Check the operation of the driver's controls	U			X		
0640.2	Check the wheel function	U			X		
0640.3	Check the brakes	U			X		
0640.4	Check pedal function	U			X		
0640.5	Check the horn	U			X		
0810.1	Check and tighten the machine housing attachment					X	
0820.1	Check the pinch guard					X	
0840.1	Check the emergency switch	U			X		
1700	**Motors**						
1700.1	Check for any loose connections					X	
1700.2	Check and tighten mounting bolts					X	
1700.3	Check for noise in the bearings					X	
1730.1	Check steering motor’s carbon brushes					X	

Table 5: Maintenance schedule RR B/E 2-8 CC

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
2550	**Drive assembly**						
2550.1	Check oil levels				X		
2550.2	Change the oil				C		C
2550.3	Check for noise and leakage	U			X		
2550.4	Check and tighten mounting of the support arm					X	
2550.5	Lubricate the gear ring					H	
3180	**Brakes**						
3180.1	Check the brake discs for wear						X
3180.2	Check for play in released position					X	
3180.3	Check the braking torque					X	
3370.1	Check the brake discs for wear						X
3370.2	Check for play in released position					X	
3370.3	Check the braking torque					X	
3500	**Wheels**						
3530.1	Remove string and other detritus	U			X		
3530.2	Check for drive wheel wear and related bolts	U				X	
3550.1	Remove string and other detritus	U			X		
3550.2	Check the support arm wheels' rotation and mounting	U			X		
3550.3	Check for wear on the support arm wheels	U			X		
4100	**Steering console**						
4100.1	Check the mounting and locking of the control console	U			X		
4100.2	Check the strength and locking of the gas damper	U			X		

Table 5: Maintenance schedule RR B/E 2-8 CC

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
5000	**Electrical Panel**						
5000.1	Clean and check the mountings						X
5000.2	Tighten cable connections					X	
5000.3	Check the emergency driving functions					X	
5000.4	Check error code log and operation times	U			X		
5190.1	Check contactor points						X
5190.2	Check movement in the contactor						X
5280.1	Check electrical limiting functions					X	
5110	**Battery**						
5110.1	Check electrolyte levels (10-15 mm over cell plates)		U		X		
5110.2	Check connections on the battery, truck and charger		U		X		
5110.3	Check the cell and pole guards		U		X		
5110.4	Check fluid density		U		X		
5110.5	Check temperature				X		
5110.6	Remove overflow fluid from the battery trough				X		
5110.7	Check for wear to the locking catch	U			X		
6000	**Hydraulic system**						
6110.1	Check the tank, mounting and leakage					X	
6110.2	Check oil levels				X		
6110.3	Clean or replace the oil						B
6120.1	Check the hoses, pipes and couplings	U			X		
6120.2	Check for wear to hoses on the mast and reach carriage			X			
6130.1	Change air and oil filters					X	
6170.1	Check overflow pressure					X	
6600	**Cylinders**						
6600.1	Check for leakage	U			X		

Table 5: Maintenance schedule RR B/E 2-8 CC

Pos. no.	Work to carry out						
	Interval in hours	**5**	**20**	**250**	**500**	**1000**	**3000**
	Interval in days/weeks/months	**1 d**	**1 wk**	**3 m**	**6 m**	**12 m**	**36 m**
6600.2	Check the mountings					X	
7100	**Mast and reach carriage**						
7100.1	Check the lowering speed					X	
7100.2	Check for cracks or damage					X	
7110.1	Lubricate mast beams by the runners			F			
7120.1	Check for wear on lifting chains and sprockets.			X			
7120.2	Check adjustment of lifting chains. Check chain bolts and chain mountings. Check and tighten the lock nuts and inspect the safety pins on all chains.			X			
7120.3	Lubricate lifting chains				D		
7150.1	Check for play on rollers.					X	
7190.1	Check and tighten mast mountings.					X	
7200.1	Check the function of accessories.	U			X		
7400	**Lifting devices**						
7400.1	Check for wear to the forks and other lifting devices.	U			X		
7400.2	Check for damage and deflection on the forks and other lifting devices.	U			X		
7400.3	Check wearing strips and tilt angle on the fork carriage.						
7400.4	Lubrication (see C-code 7400)					X	
9500	**Extra equipment**						
9500.1	Check the fire extinguisher					X	

U indicates what appears in the *Daily Care and Function Checking* chapter and must be carried out by the driver.

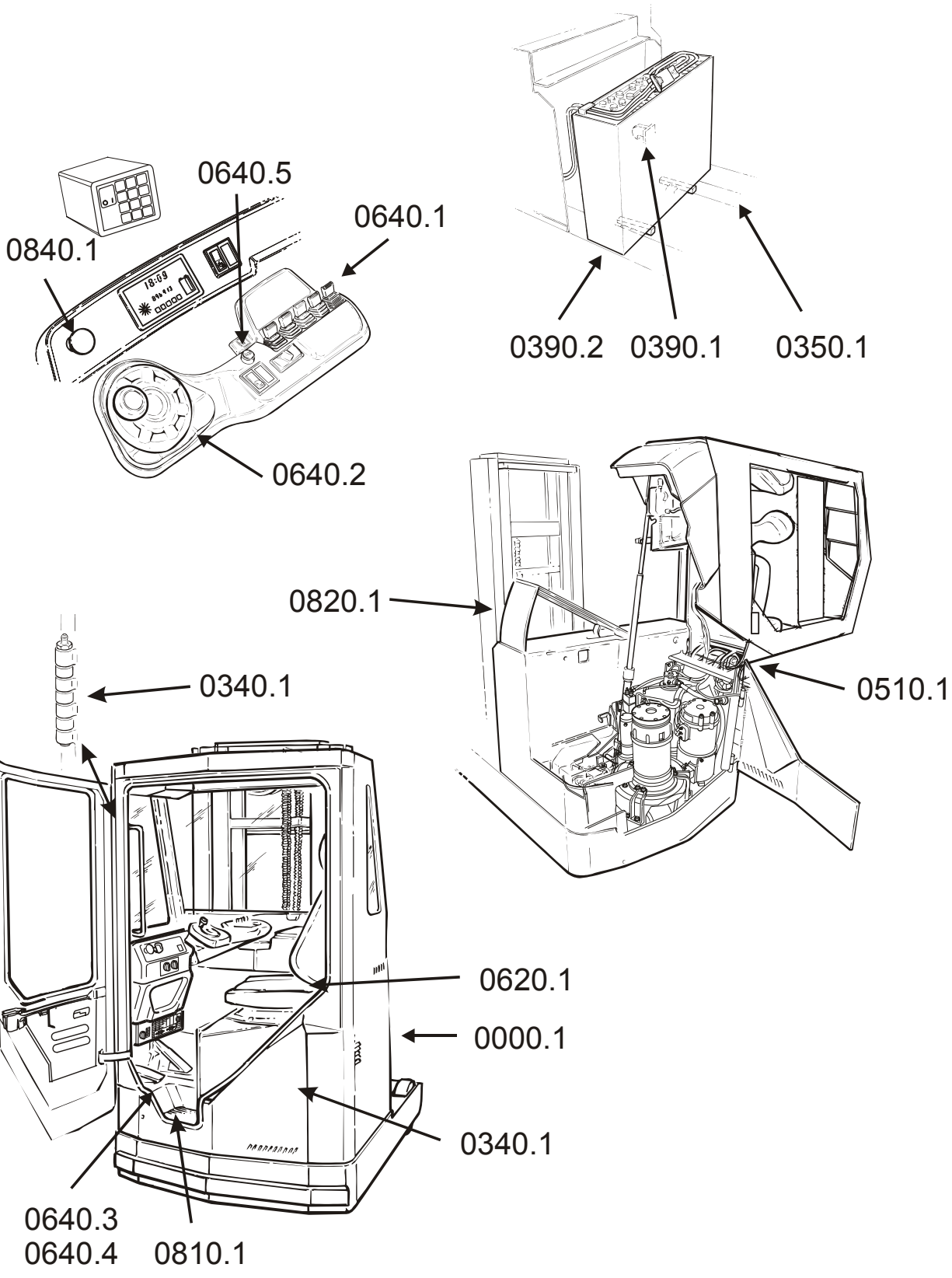
X indicates what should be done during the various services. Other letters indicate oil and grease quality.

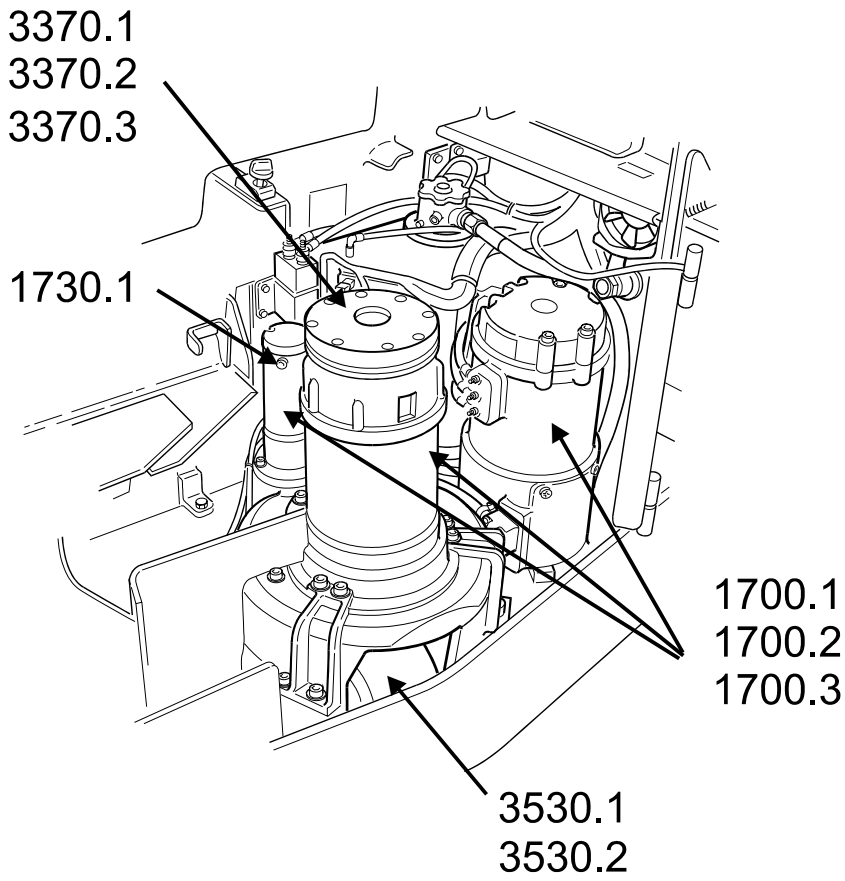
When points with longer time intervals are addressed, the points with shorter time intervals should also be addressed unless otherwise stated above.

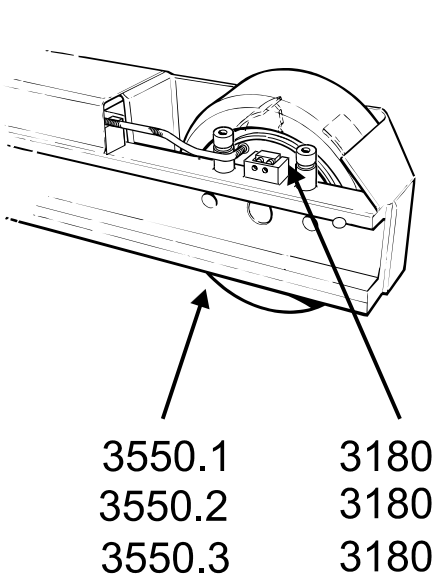
Preventive maintenance – P2

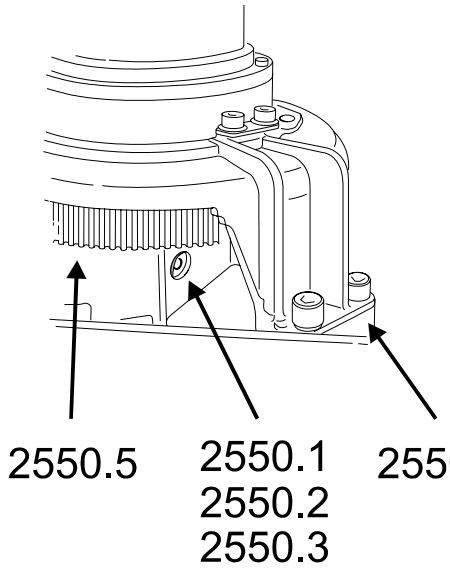
Maintenance Schedule

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09




3370.1
3370.2
3370.3
1730.1
1700.1
1700.2
1700.3
3530.1
3530.2


3550.1
3550.2
3550.3
3180.1
3180.2
3180.3

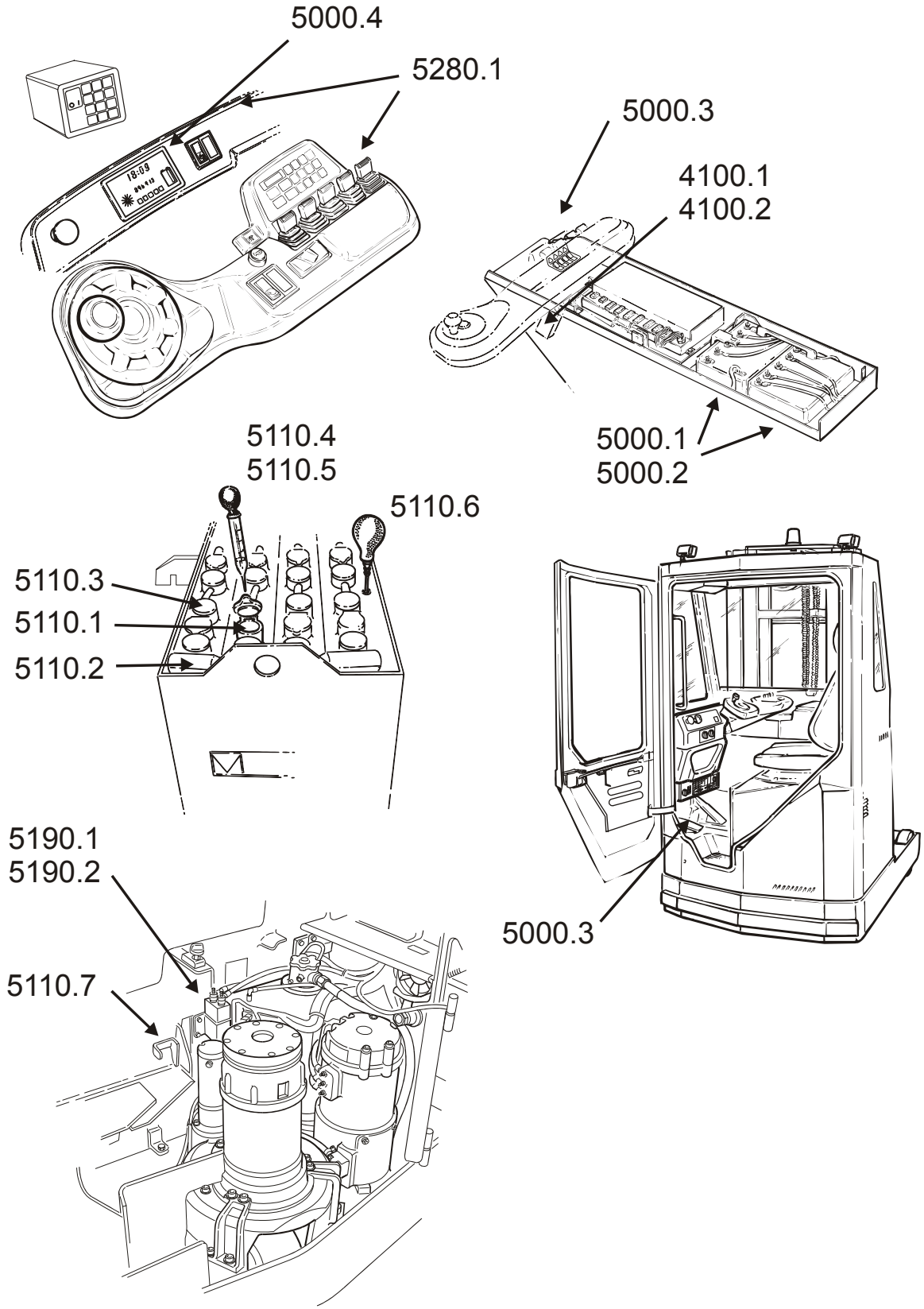

2550.5
2550.1
2550.2
2550.3
2550.4

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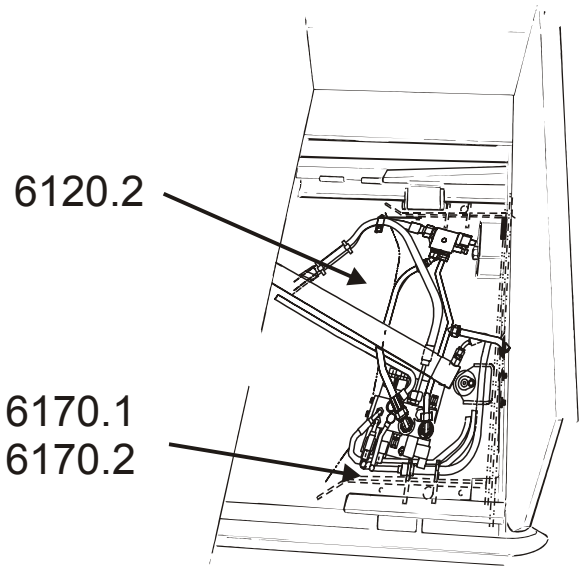
Preventive maintenance – P2

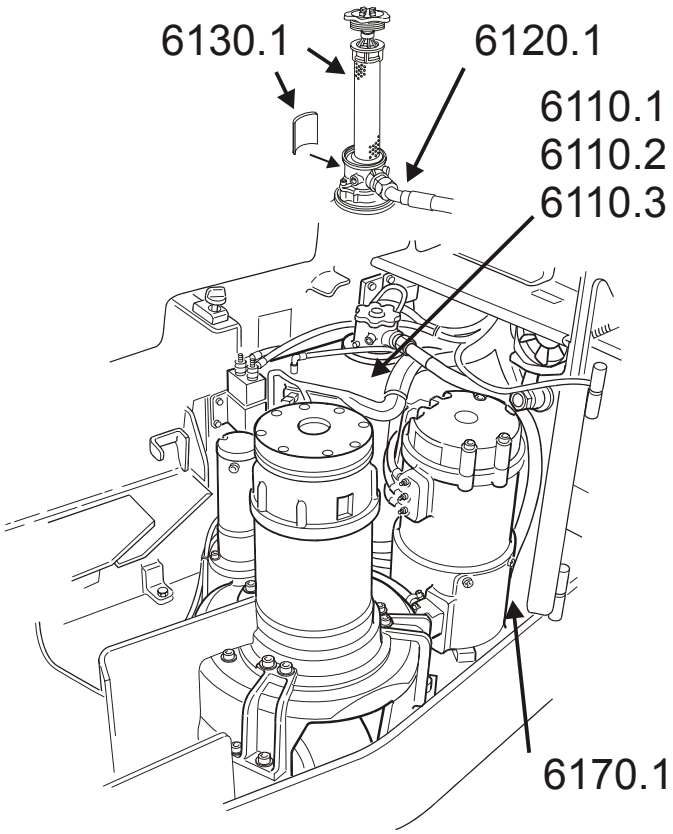
Maintenance Schedule

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09



T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-09-09	218920-040



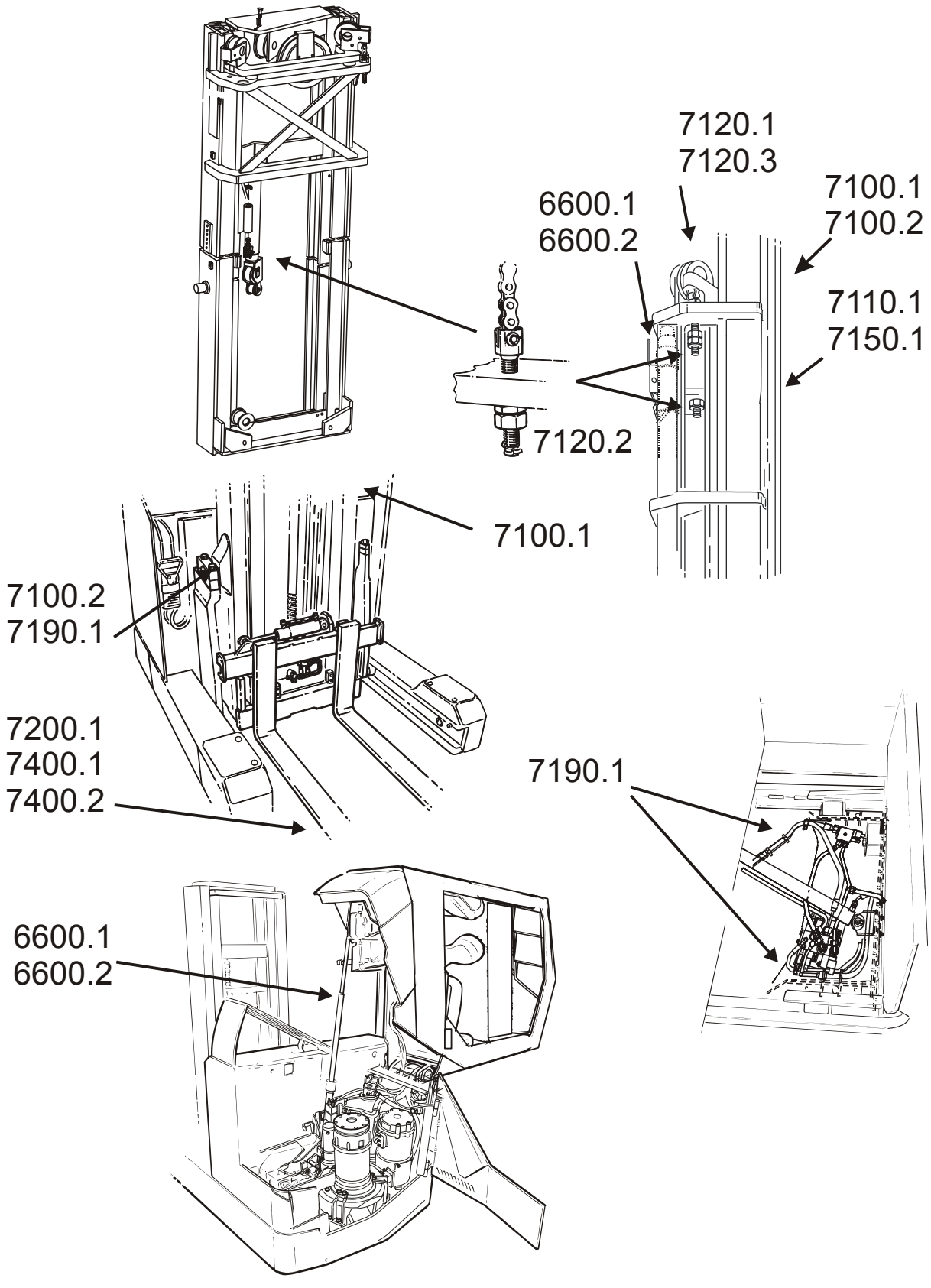


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Preventive maintenance – P2

Maintenance Schedule

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
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Preventive maintenance – P2

Maintenance Schedule

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-09-09	218920-040

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Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

6-Oil and grease specification – P3

Pos.	Lubrication type	Specification		Use
		> - 15°C	< - 15°C	
A	Grease	BT 26777 (Spray)	BT 26777 (Spray)	Bearings and bushings
B	Hydraulic oil	ISO-L-HM32	ISO-L-HV32	Hydraulic System
C	Transmission oil	Hypoid oil SAE 80W/90	Hypoid oil SAE 75W	Gears
D	See table below			Chains and wires
F	Grease	BT 055-70111	BT 055-74320	Side shift forks
G	Grease	Topas NB 52	Topas NB 52	Steering motor gears
H	Grease	Grafloscan A-G1 (Klüber)	Grafloscan A-G1 (Klüber)	Gear ring
I	Graphite-type grease	Q8 Rembrandt EP2 (223690)	Q8 Rembrandt EP2 (223690)	See C-code 7400
J	Calcium-based grease	Q8 Ruysdael WR2	Q8 Ruysdael WR2	See C-code 7400
K	Copper paste			See C-code 7400

Pos	Ambient temperature	Viscosity class	Recommended products*
D	> - 40°C < - 30°C	VG 15	Klüberoil 4UH 1-15, Klüber Lubrication
D	> - 30°C < + 5°C	VG 68	Klüberoil 4UH 1-68N, Klüber Lubrication Anticorit LBO 160 TT, Fuchs DEA
D	> + 5°C < +45°C	VG 150	Klüberoil 4UH 1-150N, Klüber Lubrication Anticorit LBO 160, Fuchs DEA Rexoil, Rexnord Kette
D	>+ 45°C <+ 80°C	VG 220	Klüberoil 4UH 1-220N, Klüber Lubrication

* Similar products from other manufacturers may be used.

Oil and grease specification – P3

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

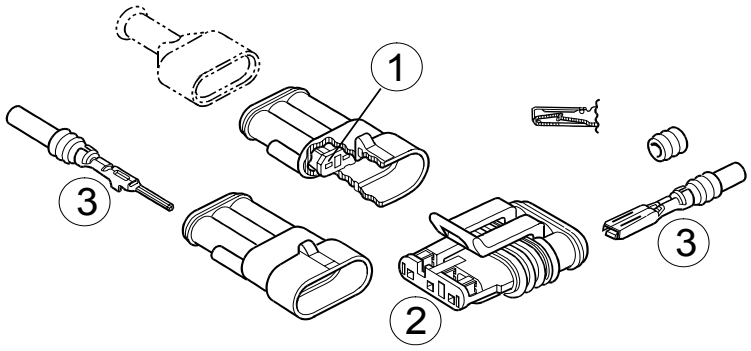
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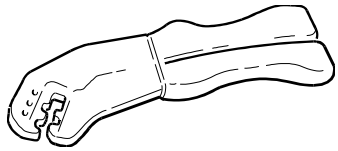
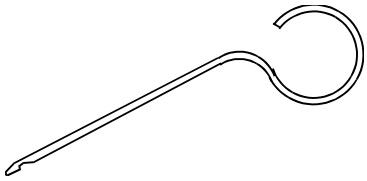
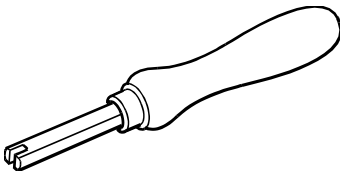
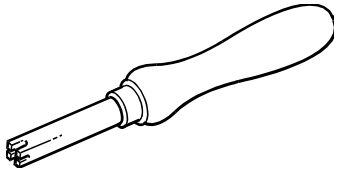
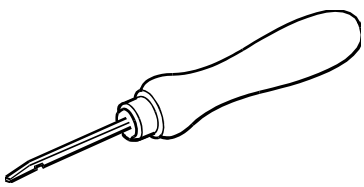
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Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-09-09

7-Tools – P4

7.1 Super Seal connector



Tool	Number	Use
	159232	Tool for fitting pins/sleeves
	159229	Tools for loosening locks (1)
	159230	Tool for fitting secondary locks 2 pole (2)
	159231	Tool for fitting secondary locks 4 pole (2)
	159228	Tool for removing pins/sleeves (3)

Tools – P4

Super Seal connector

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-09-09	218920-040

7.1.1 AMP connector

PT = Power Timer (4.8, 5.8, 6.3 mm)

JPT = Junior Power Timer (2.8 mm)

MPT = Micro Power Timer (1.5 mm)

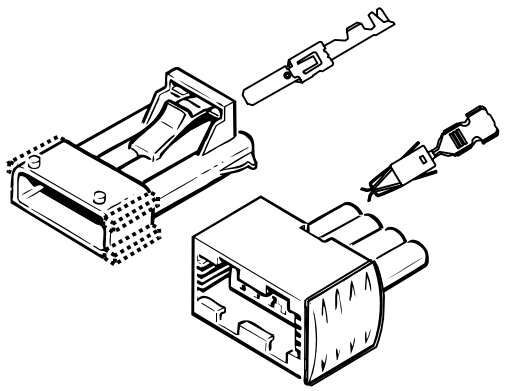
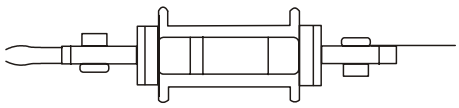
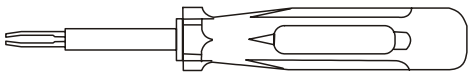
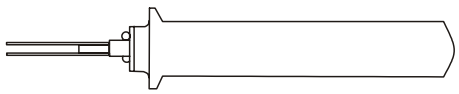
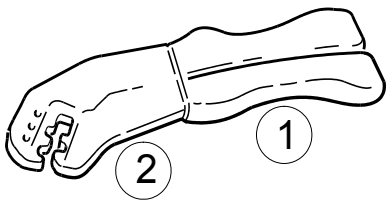
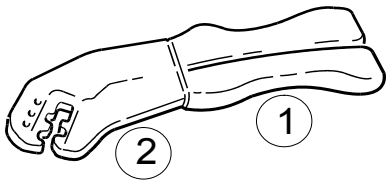
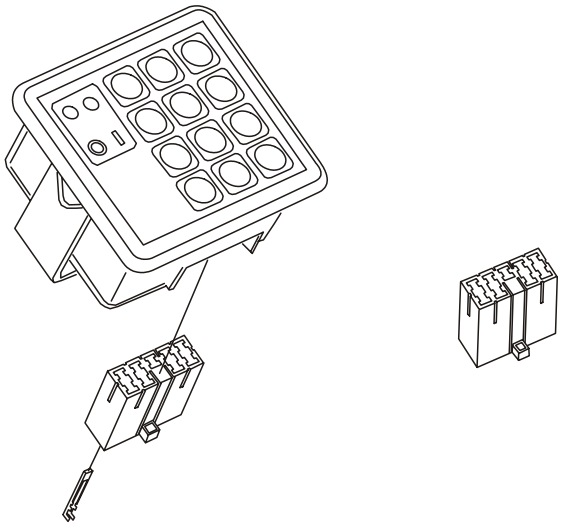
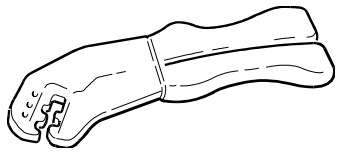
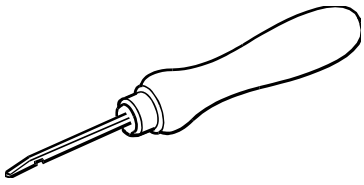


Figure	Number	Use
	151080 (PT)	Tool for removing pins/sleeves
	213296 (JPT)	Tool for removing pins/sleeves
	213298 (MPT)	Tool for removing pins/sleeves
	1=163787 (JPT) 2=163788 (JPT) 1=213336 (MPT) 2=213337 (MPT)	Tool for fitting sleeves
	1=213336 (JPT) 2=213549 (JPT)	Tool for fitting pins For 1.5-2.5 mm^2

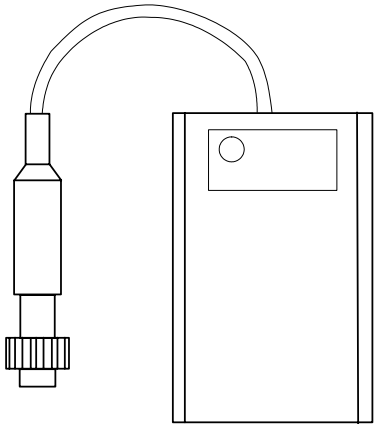
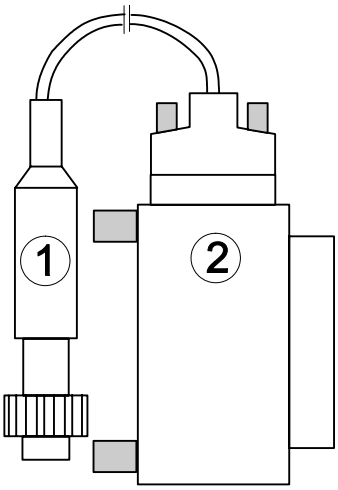
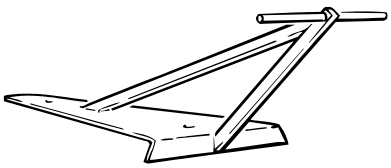
Valid from serial number	T-code
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7.1.2 AMP microtimer



Tool	Number	Use
	141199	Tool for fitting pins/sleeves
	650006	Tool for removing pins/sleeves

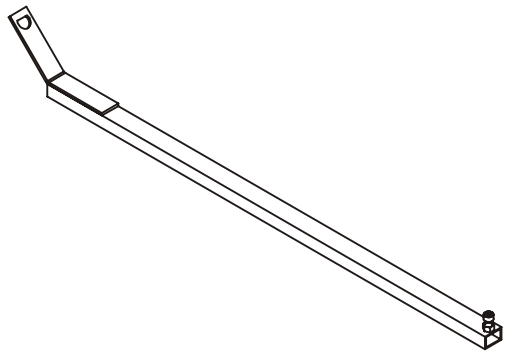
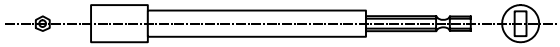
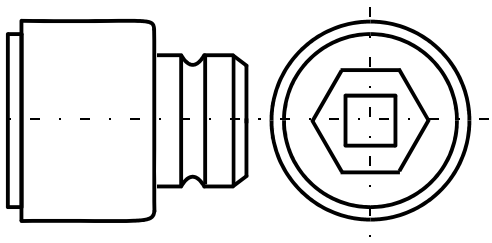
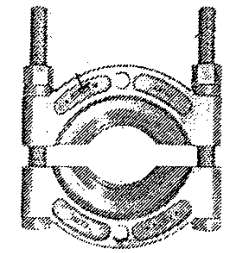
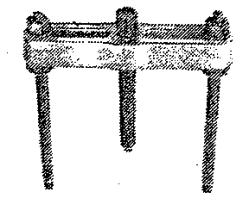
7.1.3 Diverse tools

Tool	Number	Use
	156263	Service instrument (CAN)
	1=163793 2=163792	Service instrument for program changes
	182145-008	TruckCom program
	31-150030	Cab tilt tool

Tools – P4

Super Seal connector

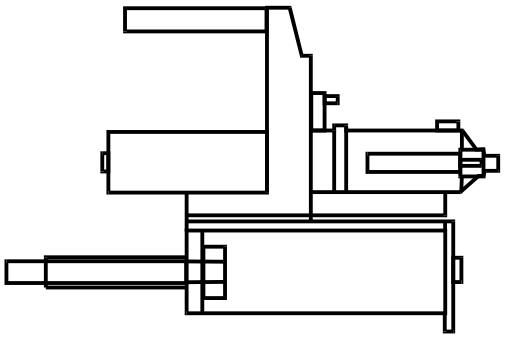
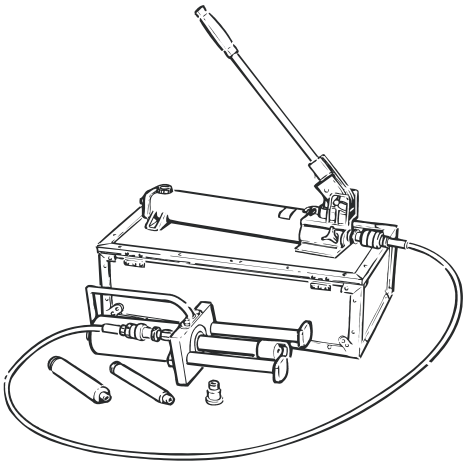
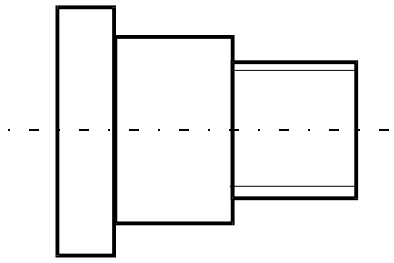
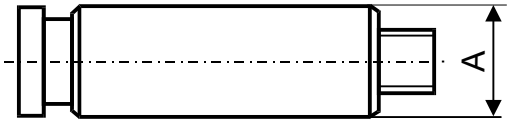
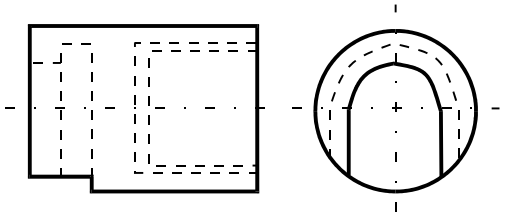
Valid from serial number	T-code
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Tool	Number	Use
	V08-15912	Doorstop tool
	08-15444	Drive motor/Pump motor
	10-15639	Socket for transmission nuts
 	08-13022	Puller, transmission

Tools – P4

Super Seal connector

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Tool	Number	Use
	08-13585	Press tool for support arm wheel
	08-13585-1	Manual press tool for support arm wheel
	08-13585-2	Tool for wheel axle
	08-13585-1/5.1 08-13585-1/5.2	Tool for wheel axle A=30 A=40
	08-13585-1/4	Tool for wheel axle

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Tools – P4

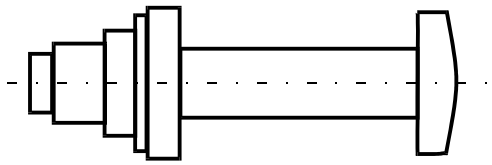
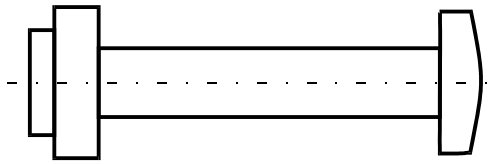
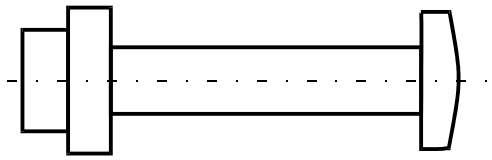
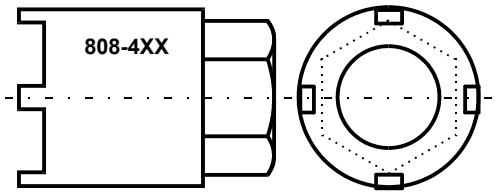
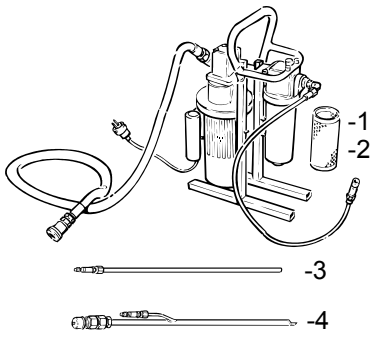
Super Seal connector

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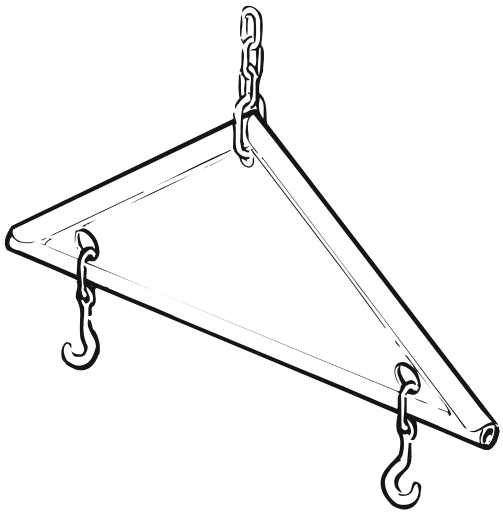
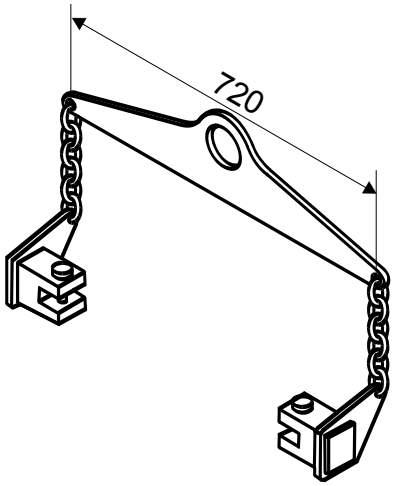
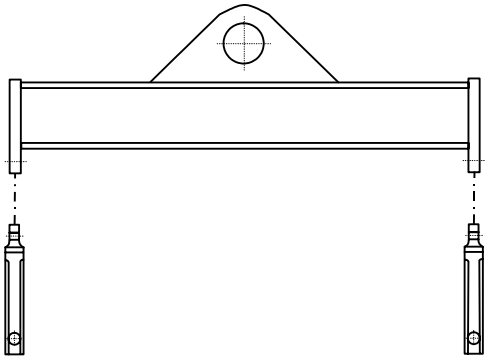
Date
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Tool	Number	Use
	V08-14044	Pressing tool for the support arm wheels
	V08-14044/1	Pressing tool for the support arm wheel bearings
	V08-14044/2	Socket for support arm wheel
	808-413	Socket for support arm wheel
	Compl=V1015191 1=V10-15191-1 2=V10-15191-2 3=V10-15191-3 4=V10-15191-4	Oil cleaning 1=Filter for cleaning 2=Filter for removing water 3=Pipe 4=Pipe
	219730	Pressure measurement for hydraulics

Tools – P4

Super Seal connector

T-code	Valid from serial number
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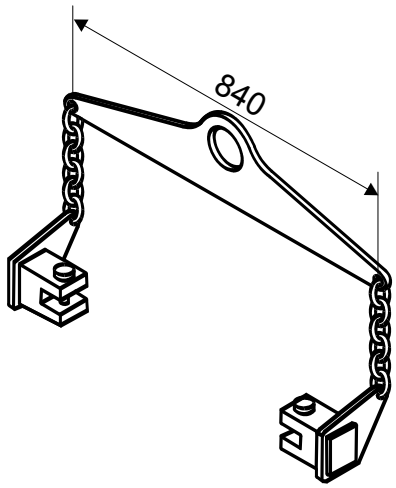
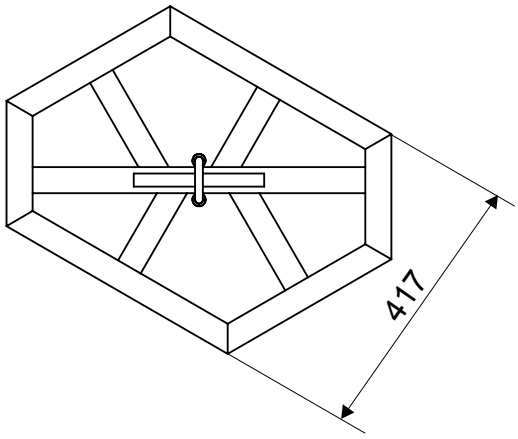
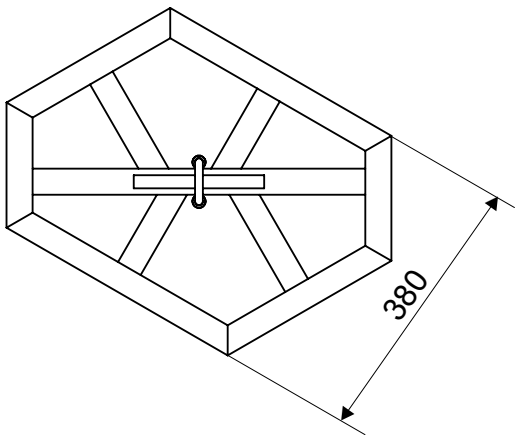
Tool	Number	Use
	11-999-8	Lifting tool for battery Max. 1,500 kg
	11-1242	Lifting tool for mast
	11-1091	Lifting tool for mast

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Tools – P4

Super Seal connector

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Tool	Number	Use
	11-1133/2	Lifting tool for mast
	11-1020	Lifting tool for mast runner
	11-1021	Lifting tool for mast runner

Tools – P4

Super Seal connector

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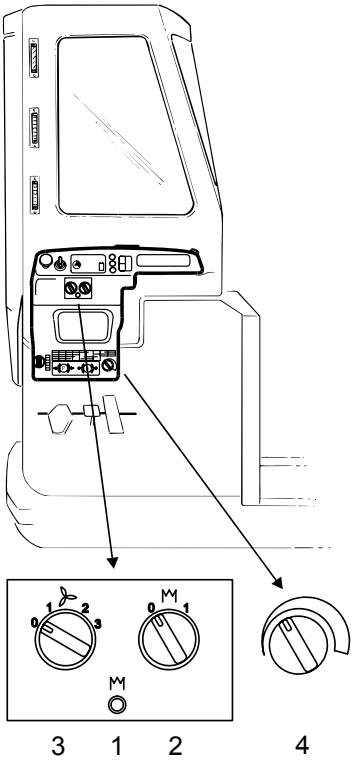
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8-Cab heating/ventilation – 0630

8.1 General

8.2 Air conditioning unit



In order to achieve the greatest possible operator comfort the ventilation and heat can be adjusted to suit your requirements.

8.2.1 Ventilation

The fan can be set to three different speeds.

- Turn the control knob (3) to the required position.

8.2.2 Main heater

- Turn the control knob (2) to **1** to start the heater.

8.2.3 Auxiliary heater

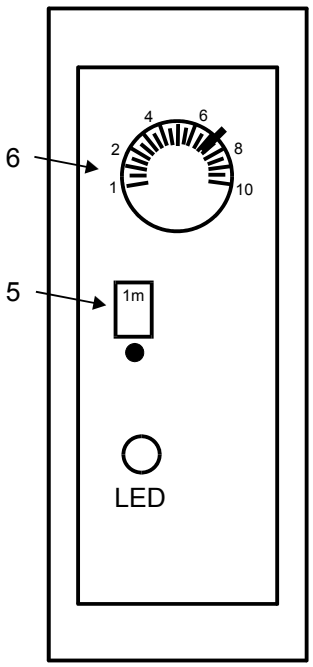
Extra heat may be required when starting a cold truck and when driving between cold and warm areas.

- Press the button (1) and the heater will give off heat under approx. 7 minutes, after which the heater will be turned off. Press once again if you wish to restart the heater. The LED on the pushbutton/time relay is lit when the extra heater is connected.

The time can be adjusted on the time relay inside the heater.

- The interval is adjusted using switch 5.
- The time is adjusted using knob 6.

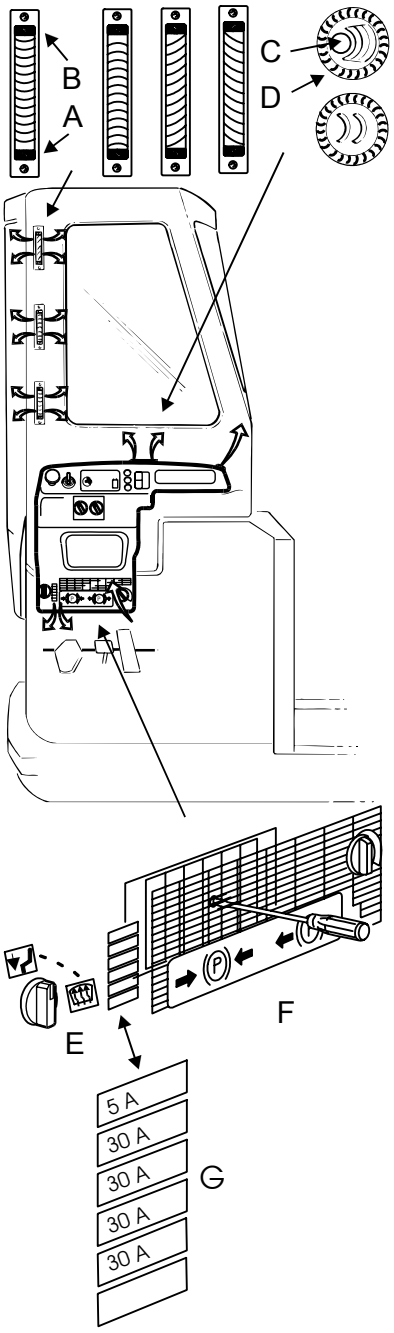
The higher the fan speed, the greater the amount of hot air provided in the cab.



8.2.4 Temperature

The temperature can be set from approximately 5 to 30 degrees, using the thermostat (4).

- Set desired temperature in the cabin using the thermostat (4).



8.2.5 Air direction

There are four different air vents that can be used to direct the air flow to avoid fogging the windows and to provide maximum operator comfort.

- Turn control (A) to open/close the vent and (B) to direct the air flow.
- Press button (C) to open/close the vents and (D) to direct the air flow.

The air vent in the elbow pad cannot be adjusted but can receive increased airflow by increasing the fan speed and closing vents A, C and E to some degree.

- Turn control E to increase/decrease airflow to the floor.

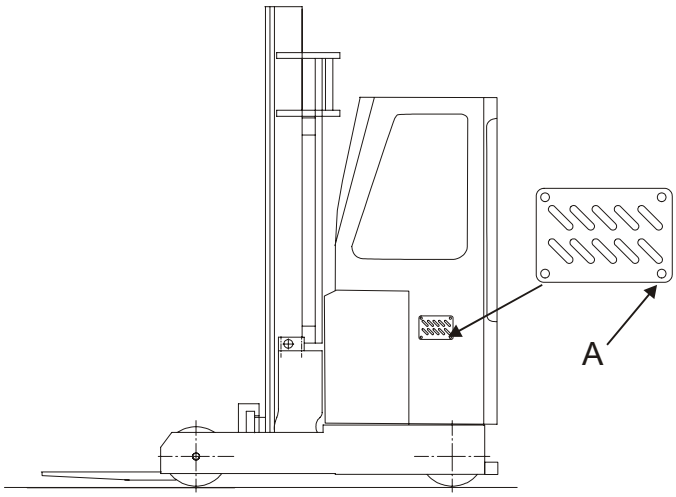
The quantity of outside air mixing with the air inside the cabin can be adjusted by loosening screw F and sliding the plate behind it from side to side.

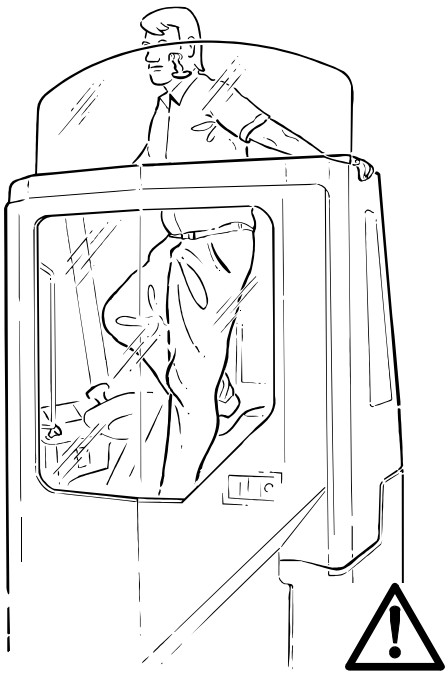
8.2.6 Fuses

There are five fuses in the heater. 1 x 5 ampere for the fan and electronics and 4 x 30 amperes for the heating element.

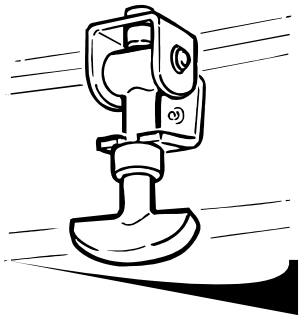
8.2.7 Air filter

Loosen the four screws (A) and remove the cover plate.
Replace the filter with a new one and reinstall the cover plate.





8.2.8 Emergency exit (12)



If the truck breaks down with the door blocked and cannot be moved, you can evacuate the cab through the roof.

- Loosen the catches in the roof and lift up the hatch.
- Climb on the seat and arm rests to reach the roof.

WARNING!
Control panel as a step.
The control panel can move.
Never climb on the control panel.

- Call for help to get down from the roof.

WARNING!
Risk of slipping.
The roof can be slippery.
Get down from the roof in a safe manner. Make sure you get help.

8.2.9 Lighting

In the light fitting there are two 24 volts tubes.

- Switch on the roof light by using the switch to the side of the lamp.

For further information see electric diagram C-code 5000

Cab heating/ventilation – 0630

Air conditioning unit

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9-Driver protection – 0840

9.1 General

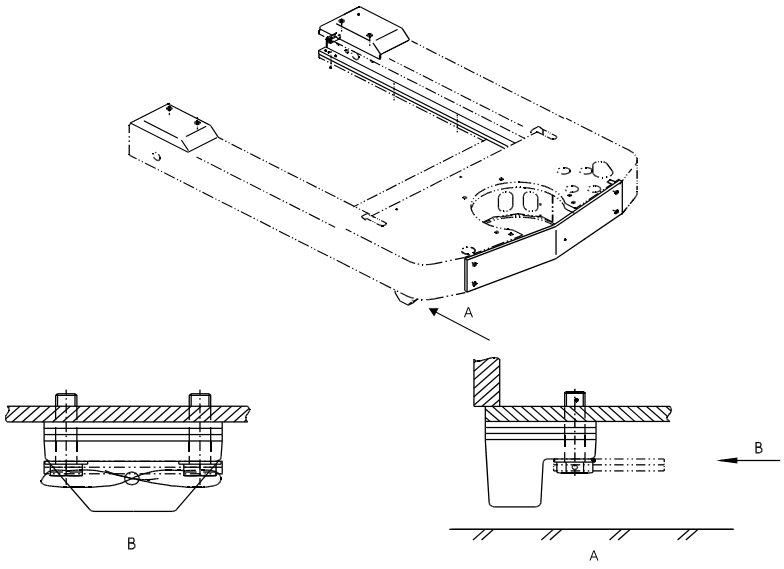
To increase the truck's capacity, tilt stops are fitted to some trucks. Tilt stops are also available as an option on other trucks.

It is, however, permissible to temporarily remove tilt stops during transport of the truck, for instance, between different warehouses, but the truck may not then be used to transport loads.

WARNING !

Reduced stability.
Trucks without tilt stops can tip over, if used to transport loads.
Ensure that tilt stops are refitted with proper distance to the floor if they have been temporarily removed.

The tilt stops are located on the rear corners of each support arm and consist of lugs, shims, bolts and washers.



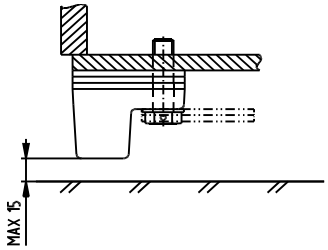
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9.2 Tilt Stops

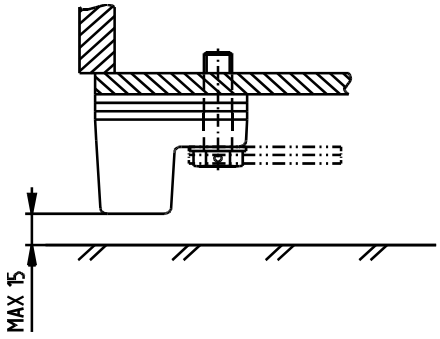
9.2.1 Inspection and Adjustment

To ensure safe operation of the truck, it is important to check the space between the tilt stops and the floor regularly.

- Park the truck on a flat surface.
- Measure the distance between the tilt stop and the floor (max. 15 mm).



- If the tilt stop scrapes the floor or if the distance is too great, the lugs must be adjusted.
- Lift up the rear edge of the support arm using a jack and place a wooden block under the support arm to prevent the truck from toppling over.
- Break the seal.
- Remove the bolts and washers.
- Re-shim the stop so that the distance between it and the floor is as close to 15 mm as possible. However, the distance must not exceed 15 mm. Each shim is 4 mm.
- Fit the remaining shims between the tilt stop and the bolt's washer.



- Refit the bolts and washers.
- Using a torque wrench, tighten bolts to 77.7 Nm.
- Seal

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9.2.2 Removing the tilt stops

Some tilt stops can be removed. Carefully follow the observations in the table below.

The table relates to 900 mm support arm width. Trucks with a greater support arm width normally have no tilt stops.

Truck	Lift height	Comments
RR B/E 1-2		Not equipped with tilt stops
RR B/E3	-max lift height	The tilt stops must not be removed
RR B/E4	-max lift height	The tilt stops must not be removed
RR B/E5-6	-7,000 mm Over 7,000 mm	The tilt stops can be removed The tilt stops must not be removed
RR B/E7	-7,000 mm Over 7,000 mm	The tilt stops can be removed The tilt stops must not be removed
RR B/E8	-8,000 mm Over 8,000 mm	The tilt stops can be removed The tilt stops must not be removed

Driver protection – 0840

Tilt Stops

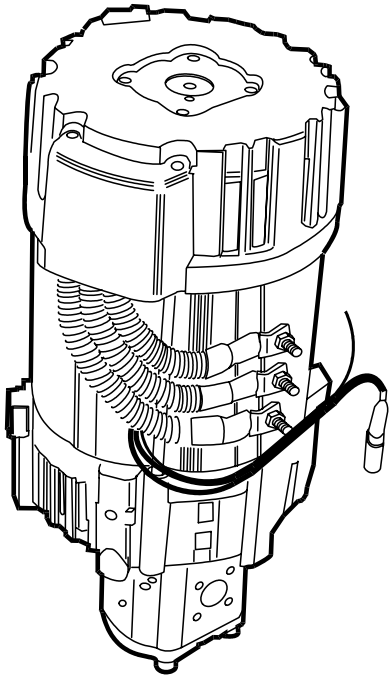
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10-Electric pump motor –1710



10.1 General

The pump motor is a three-phase AC motor. In the motor, there is a thermoelement measuring the motor temperature, as well as a bearing with an integrated measuring unit for measuring rotational speed and direction.

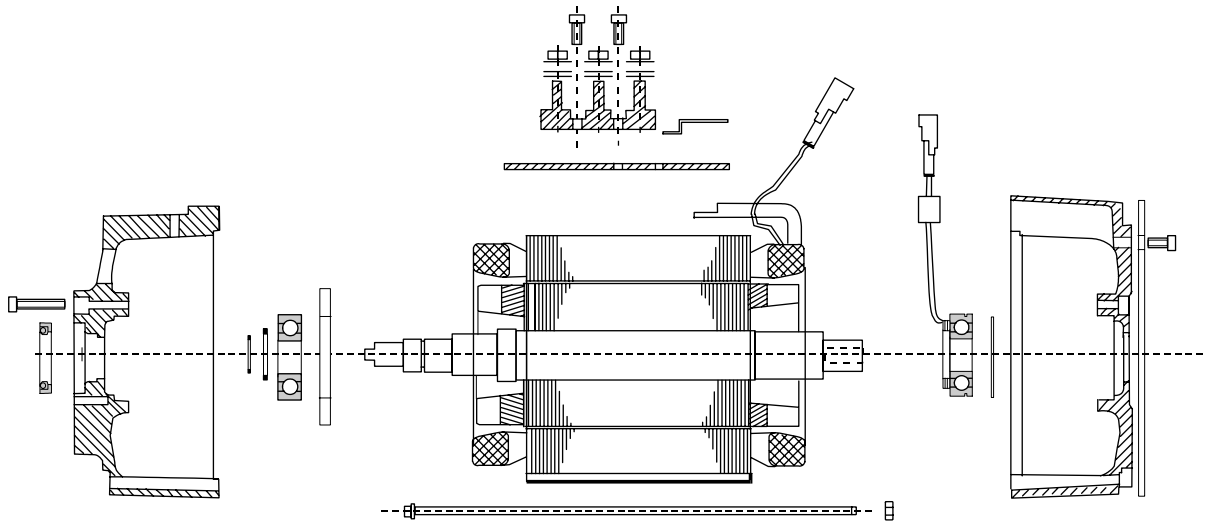
The pump motor is available in two sizes on the trucks.

On the B/E1—B/E6, P112—150 is used.

On the B/E7—B/E8, P112—195 is used.

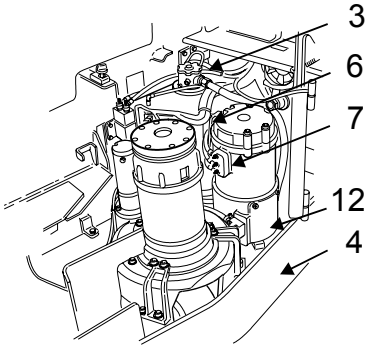
This service manual includes instructions for replacing bearings, axle seals and the temperature sensor.

10.2 Dismantling the pump motor



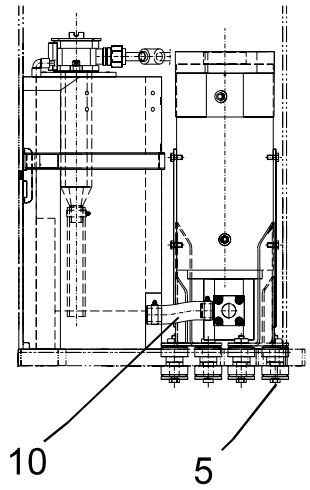
10.3 Dismantling and assembling the pump motor

To open and close the motor compartment, see section P1 in this manual.



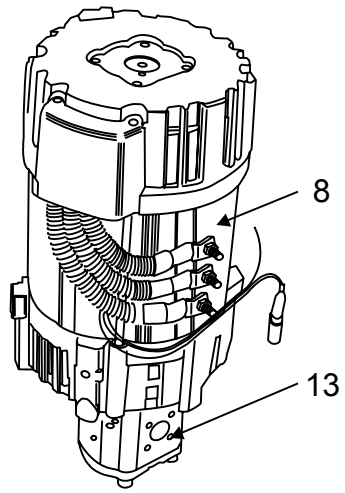
10.3.1 Dismantling

- Lower the forks to the lowest position to reduce pressure in the hoses and pump.
- Disconnect the battery plug.
- Pump the oil out of the hydraulic tank (3) with filter pump V10-15191.
- Remove the support (4) so that the bolts (5) for the pump mounting (12) are accessible.
- Remove the temperature/speed measuring contacts (6) and power cables (7) from the motor (8).
- Remove the hydraulic hose (9) and loosen the hose clamp for the hydraulic hose (10) which is attached to the tank.
- Fasten a lifting eye in the motor axle.
- Remove the bolts (5) holding the pump mounting (12) to the chassis.
- Lift out the hydraulic pump and place it on a clean surface.
- Remove both mounting attachments (12) from the pump motor (8).
- Remove the screws and dismount the pump (13).
- Remove the carrier.



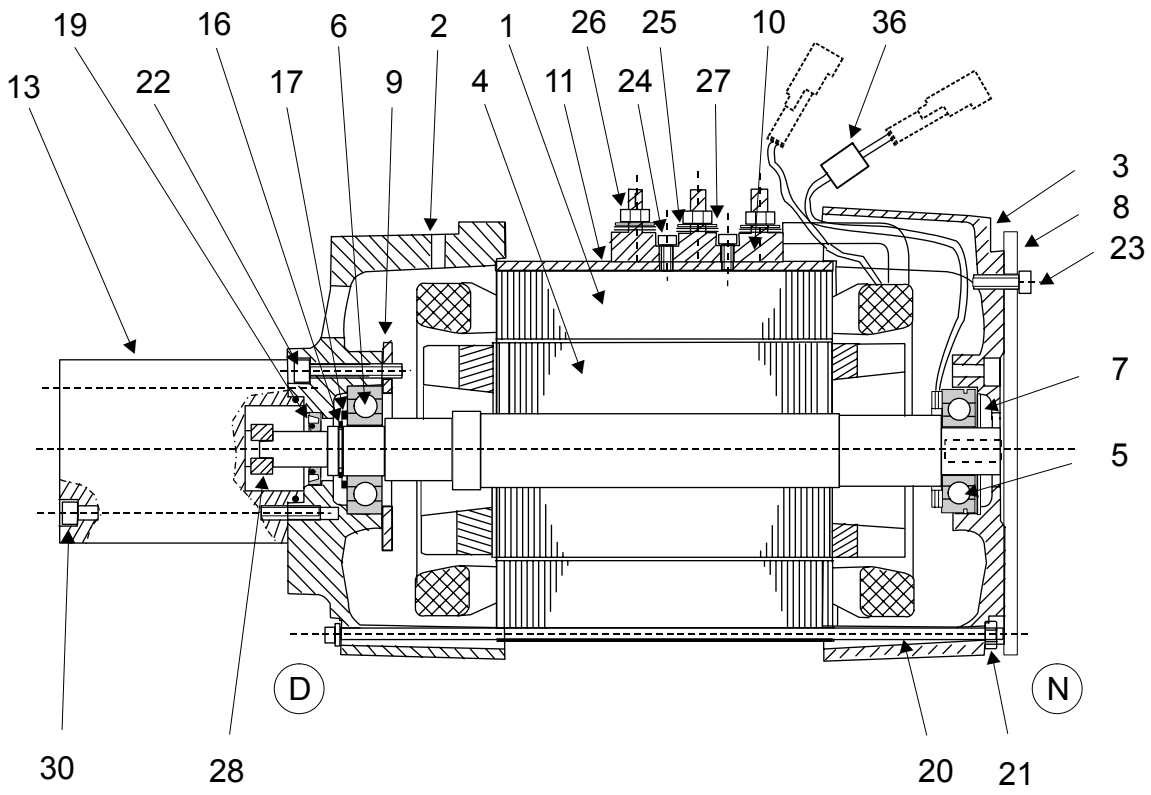
10.3.2 Assembling

- If the O-ring on the pump is damaged, it should be replaced.
- Replace the carrier between the pump and the pump motor (8).
- Replace the pump unit (13) on the pump motor (8).
- Replace both mounting (12) attachments on the pump motor (8).
- Screw a lifting eye into the end of the motor axle and connect it to an overhead crane.
- Lift the hydraulic pump into the truck while at the same time refitting the hydraulic hose (10) on the tank (3).
- Tighten the hose clamp.
- Fasten the two pump mountings (12) to the chassis using the bolts (5).
- Unscrew the lifting eye.
- Refit the hydraulic hose (9) and the temperature/speed metering contacts (6) and the power cables (7).
- Fill the hydraulic tank (3) with new oil.



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10.4 Bearing replacement



10.4.1 Dismantling

Motors without pumps.

- Loosen the screws (23) and remove the protective plate (8).
- Loosen the stud screws (20) using tool 08-15444.
- Remove the shield (3) and washer (7).

If both bearings are to be replaced follow the points below. When only replacing the pulse sensor bearing continue with **A**.

- Remove the screws (22).
- Lift the rotor (4) out of the stator (1).
- Dismount the shield (2) radial seal (19).
- Remove the circlip (16) and support ring (17).
- Pull off the bearing with a puller.

A)

- Pull off bearing (5) with a puller.

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10.4.2 Assembling

Ensure all parts are intact and clean before assembly.

Follow all instructions if both bearings have been replaced

- Place the bearing cap (9) on the rotor axle's D-side.
- Press the bearing (6) on the rotor axle.
- Press the bearing (5) on the rotor axle's N-side.
- Mount the support ring (17) and circlip (16) on the axle's D-side.
- Fit the gasket (19) with the assembly device.

NOTE
Always use a new gasket when fitting the rotor axle.

- Install the rotor in the end shield (2).
- Tighten the bearing cap (9) using the screws (22) to a torque of 6 Nm.
- Fit the rotor (4) in the stator (1).
- Put the washer (7) on the bearing (5).

Ensure that the terminal block assembly 11 is in position

- Install the end shield (3).
- Tighten the stud screws (20) and nuts (21) to a torque of 5 Nm.
- Fit the ferrite block on the sensor cable.
- Fit the protective plate (8) on the N-side.
- Secure the cables from the thermocontact and the sensor bearing to one of the power cables.

If only the pulse sensor bearing is replaced:

- Press the bearing (5) on the rotor axle's N-side.
- Put the washer (7) on the bearing (5).

Ensure that the terminal block assembly 11 is in position

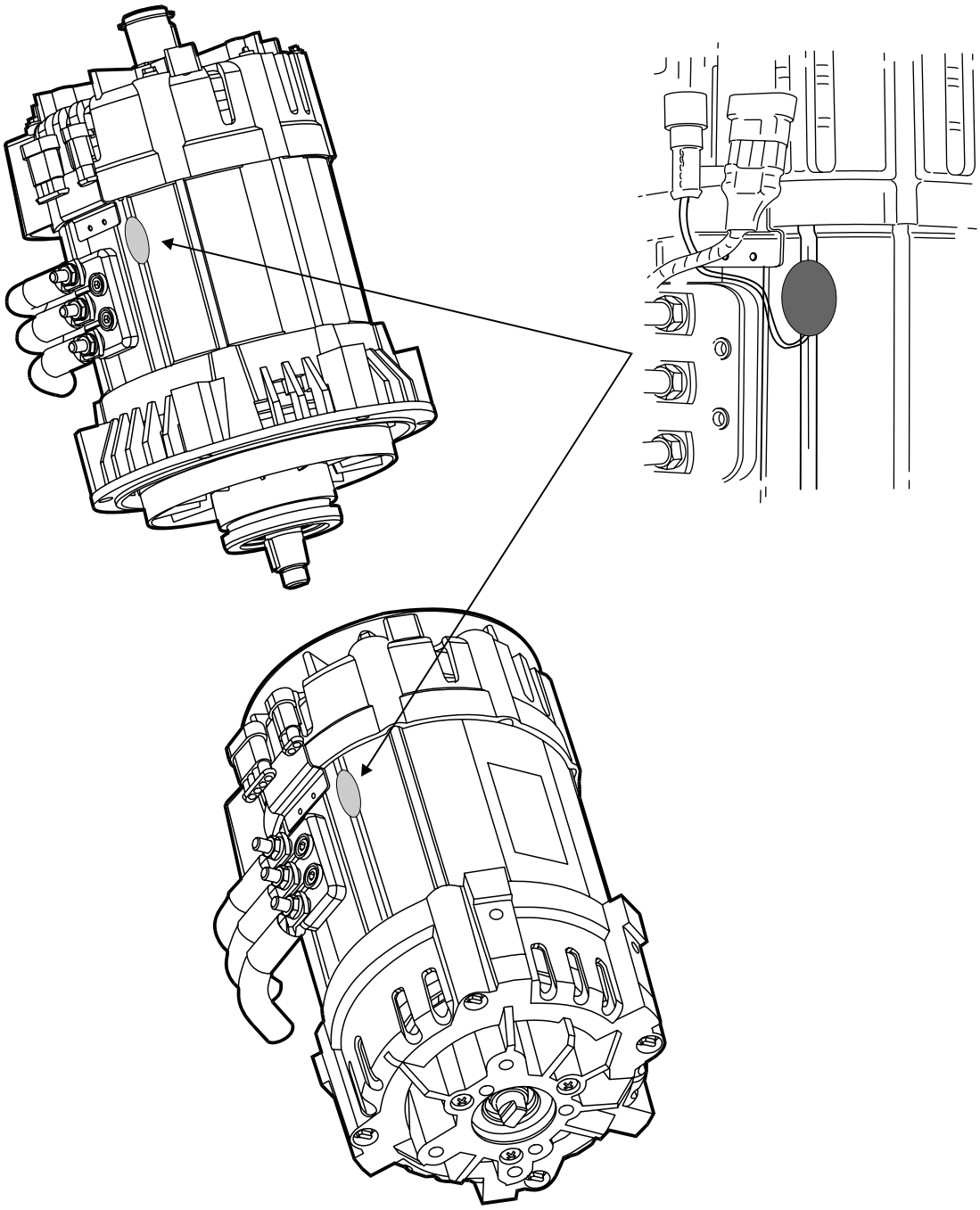
- Install the end shield (3).
- Tighten the stud screws (20) and nuts (21). With a torque wrench, tighten the nuts to 5 Nm.
- Fit the ferrite block on the sensor cable.
- Fit the protective plate (8) on the N-side.
- Secure the cables from the thermocontact and the sensor bearing to one of the power cables.

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10.5 Installation instructions for external temperature sensor

Number 170384



Electric pump motor –1710

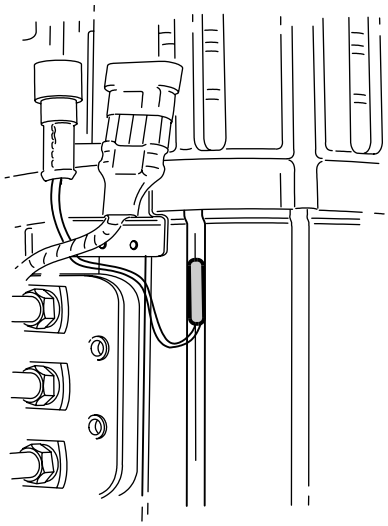
Installation instructions for external temperature sensor

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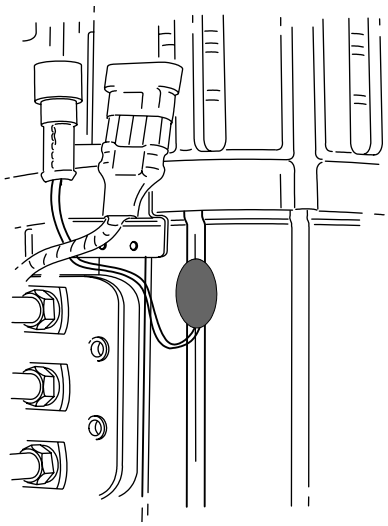
A fully functional temperature sensor mounted inside the motor should have a resistance value of approx. 550 ohm at a temperature of 20 degrees.

The temperature sensor mounted on the outside has a resistance value of approx. 670 ohm at a temperature of 20 degrees.

- The temperature sensor can be mounted to the right or left of the terminal block, depending on which side is easiest to access.
- Scrape the surface clean where the new temperature sensor is to be mounted.
- Place the temperature sensor as shown in the picture.



- Apply metallic lacquer over the sensor. Ensure that the entire sensor is covered by the metallic lacquer.

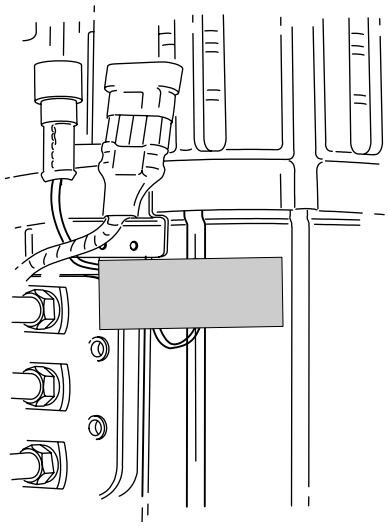


Electric pump motor –1710

Installation instructions for external temperature sensor

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- Fasten the metallic lacquer and the sensor with masking tape and allow it to harden.



- Remove the masking tape. The temperature sensor should now be fixed in place and covered entirely by metallic lacquer.
- Remove the ferrite block from the old sensor and mount it on the cable to the new sensor.
- Remove the contact from the broken sensor, which is attached to the motor.
- Place the new sensor contact in the old bracket and connect it to the cables.
- Fasten the old contact and its cables using a cable tie so it cannot damage anything.

Electric pump motor –1710

Installation instructions for external temperature sensor

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11-Electric steering motor – 1730

11.1 General

The steering motor is located on the drive assembly cowling. It receives signals from the steering generator located in the drive panel. The steering motor is equipped with a gear working directly upon the gear ring on the drive axle. It is also equipped with two carbon brushes.

11.2 Replacing the steering motor

To open and close the motor compartment, see section P1 in this manual.

11.2.1 Dismantling

- Switch off the truck by press the **0** key on the keypad.
- Disconnect the steering motor electrical contact from the tank console.
- Unscrew the screws holding the gear wheel.
- Lift away the steering motor.
- Unscrew the screws holding the gear wheel.
- Pull off the gear with a gear puller.

11.2.2 Assembling

- Replace the O-rings if required.
- Tap the gear wheel onto the steering motor.
- Apply Loctite 243 on the thread.
- Tighten the nut to a torque of 180 Nm.
- Close up the nut in the axle.
- Install the steering motor in the truck.
- Tighten the steering motor to a torque of 40 Nm.
- Connect the connector.

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11.3 Dismantling and assembling the carbon brushes

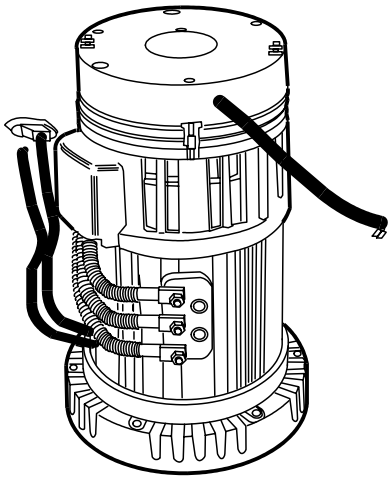
- Unscrew the two plastic plugs on the upper surface of the steering motor.
- Take out the carbon and examine for wear.
- Replace the carbon if necessary.
- Insert the carbon and screw in the plastic plugs.

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12-Electric drive motor – 1760

12.1 General



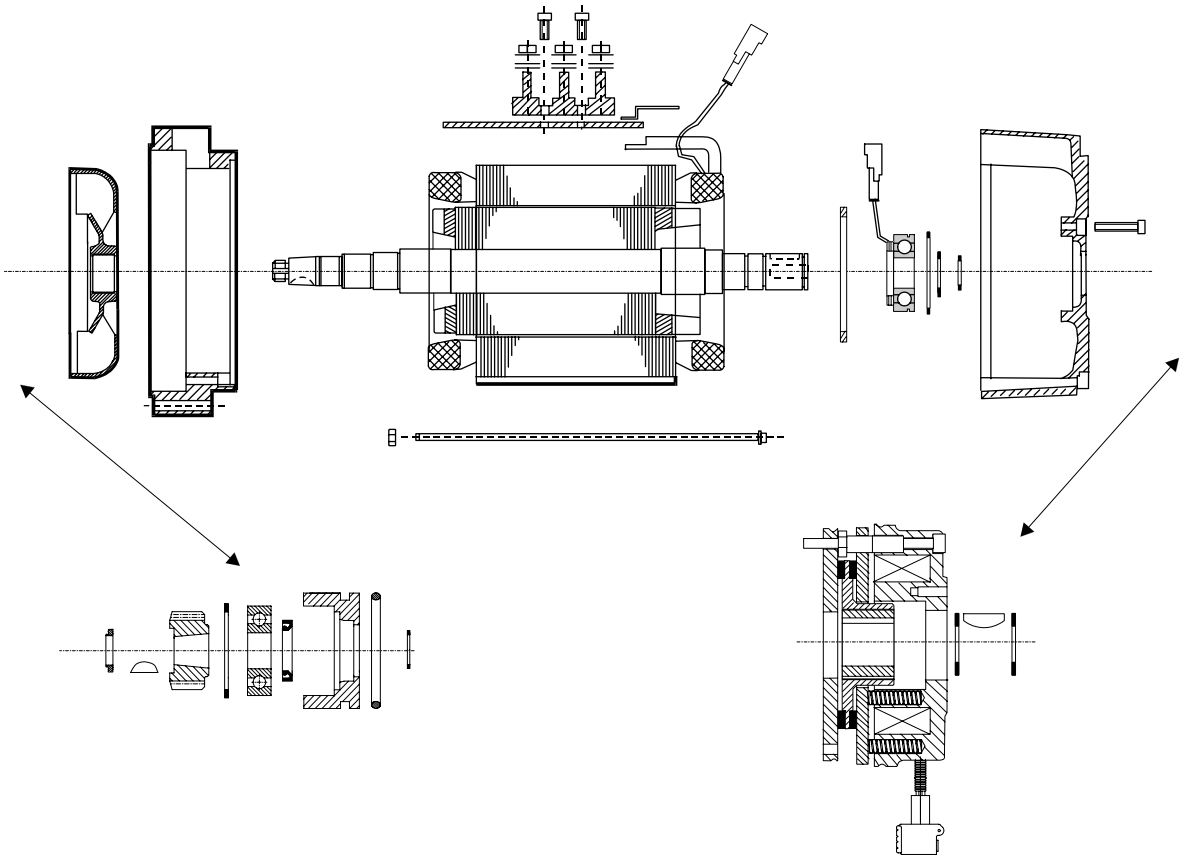
The drive motor is a three-phase AC motor. In the motor, there is a thermoelement measuring the motor temperature, as well as a bearing with an integrated sensor for measuring rotational speed and direction.

The drive motor is available in two sizes on the truck.

On the B/E 1–3, model D112–130 is used.
On the B/E 4–8, model D112–165 is used.

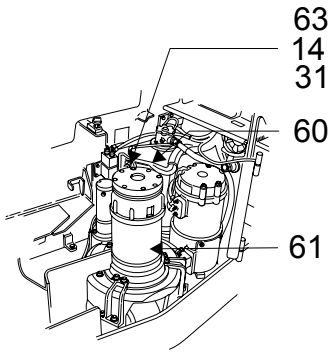
This service manual includes instructions for replacing bearings, axle seals and the temperature sensor.

12.2 Dismantling the drive motor



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12.3 Dismantling and assembling the drive motor



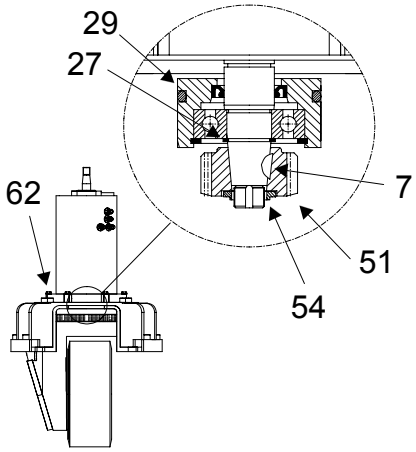
To open and close the motor compartment, see section P1 in this manual.

12.3.1 Dismantling the drive motor

- Cut the power by turning off the key and removing the battery plug.
- Remove the temperature, braking and speed measurement contacts (14, 31, 63) and power cables (60) from the motor (61).
- Fasten a lifting eye to the motor axle.
- Loosen and remove the motor mounting bolts (62).
- Lift out the motor using an overhead crane and place it on a clean surface.

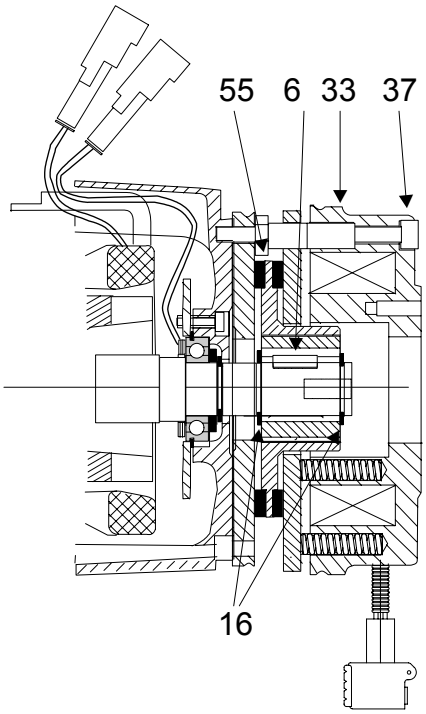
NOTE:
Risk of damage to the gear wheel (51).
The gear wheel on the end of the motor is easily damaged.
Lift out the motor with care.

- Cover the hole to the transmission when the motor is removed to prevent anything from falling inside the transmission housing.



Removing the gear wheel

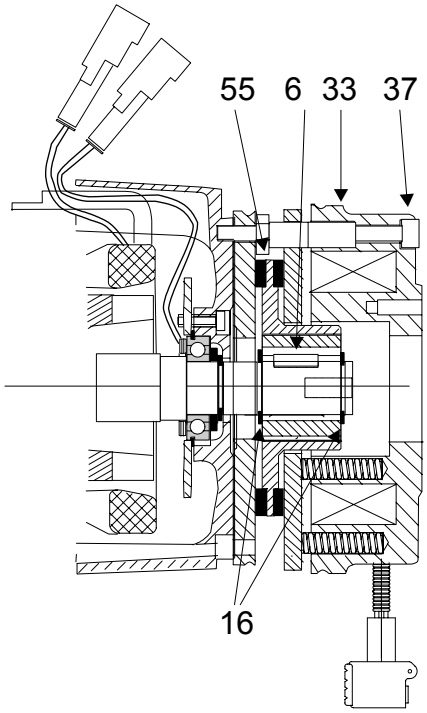
- Tap loose the nut (54) and unscrew it using tool 10-15639.
- Pull off the gear wheel (51) using a gear puller.
- Remove the key (7) holding the gear wheel (51) in place.
- Remove the circlip (27) holding the bearing bracket (29) in place.
- Pull off the bearing bracket (29) using a gear puller.

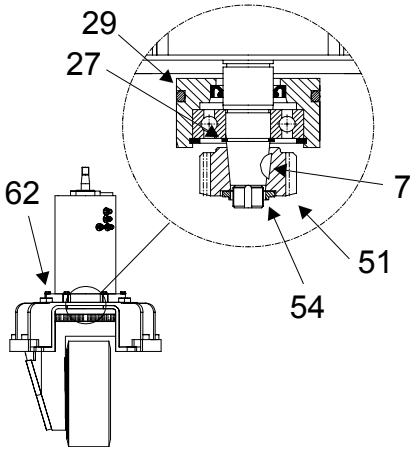


Removing the brakes

- Loosen the screws (37) so that the brakes (33) can be removed.
- Remove the outer circlip (16) from the motor axle.
- Remove the brake hub, key (6), plate and inner circlip (16).

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12.3.2 Assembling the drive motor

Assembling the brakes

- Refit the inner circlip (16) and key (6).
- Check that the friction disc (55) is centred in relation to the magnet housing before you try to install the brakes It may be necessary to charge the magnet coils with 48 V DC to position the brake disc.
- Fit the brake assembly onto the motor. Check that the splines on the friction disc were not damaged during installation.
- Tighten the mounting screws (38) for the brake assembly.
- Refit the outer circlip (16).

Assembling the gear wheel

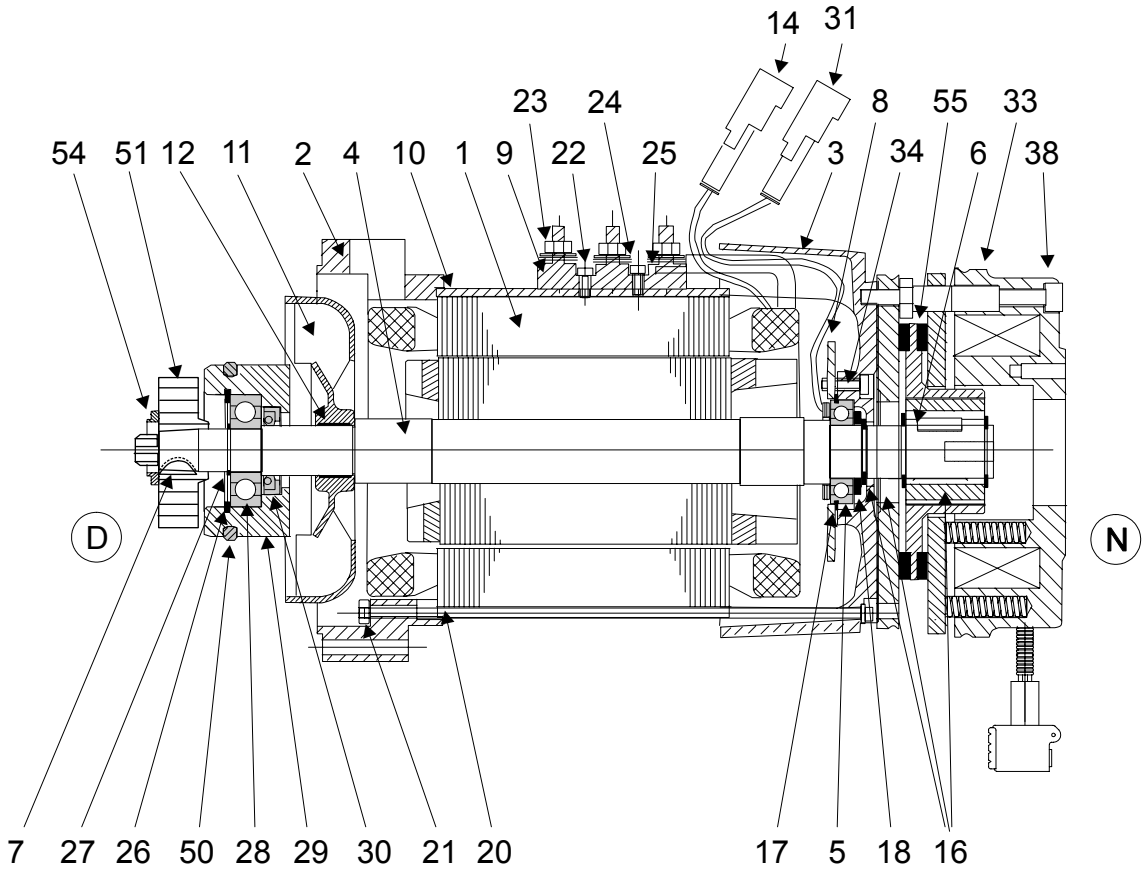
- Refit the bearing cage (29) on the motor axle.
- Fit the circlip (27).
- Fit the key (7).
- Fit the gear wheel (51).
- Fit a new nut (54).
- Use tool 10-15639 and tighten to a torque of 60 Nm.
- Lock the nut with a centre punch in the key track.
- Attach a lifting eye to the motor axle and lift the motor axle into the transmission using an overhead crane.

NOTE:

Risk of damage to the gear wheel (51).
The gear wheel on the end of the motor is easily damaged.
Lift the motor in carefully.

- Tighten the motor (61) into the transmission to a torque of 20 Nm.
- Reconnect the temperature, braking, and the speed measurement contacts (14, 31) and power cables (60) to the motor.
- Remove the lifting eye bolt.
- For brake adjustment, see C-code 3100.

12.4 Bearing replacement



12.4.1 Dismantling

12.4.2 N-side

- Loosen the stud screws (20) using tool 08-15444.
- Remove the screws (34).
- Remove the shield (3).
- Remove the circlip (16) and support ring (18).
- Pull off the bearing (5) with a gear puller.

D-side

- Remove the circlip (26) from the bearing housing.
- Pull off the bearing housing (29) with a gear puller.
- Pull the bearing (28) off from the bearing housing with a Kukko ball bearing puller.
- Remove the seal (30) if it leaks.

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12.4.3 Assembling

Ensure all parts are intact and clean before re-assembly.

N-side

- Press the bearing (5) on the rotor axle.
- Replace the bearing cap (8) on the motor axle.
- Install the flange ring (17).
- Refit the washer (18) and circlip (16).
- Screw the bearing cap (8) and shield (3) together using the screws (34) to a torque of 6 Nm.
- Fit the insulation hose on the sensor bearing cable.
- Place the terminal block (10) between the shields.
- Tighten the stud bolts (20) to a torque of 5 Nm.
- Tie the cables for the thermocontact and the sensor bearing to the middle power cable.

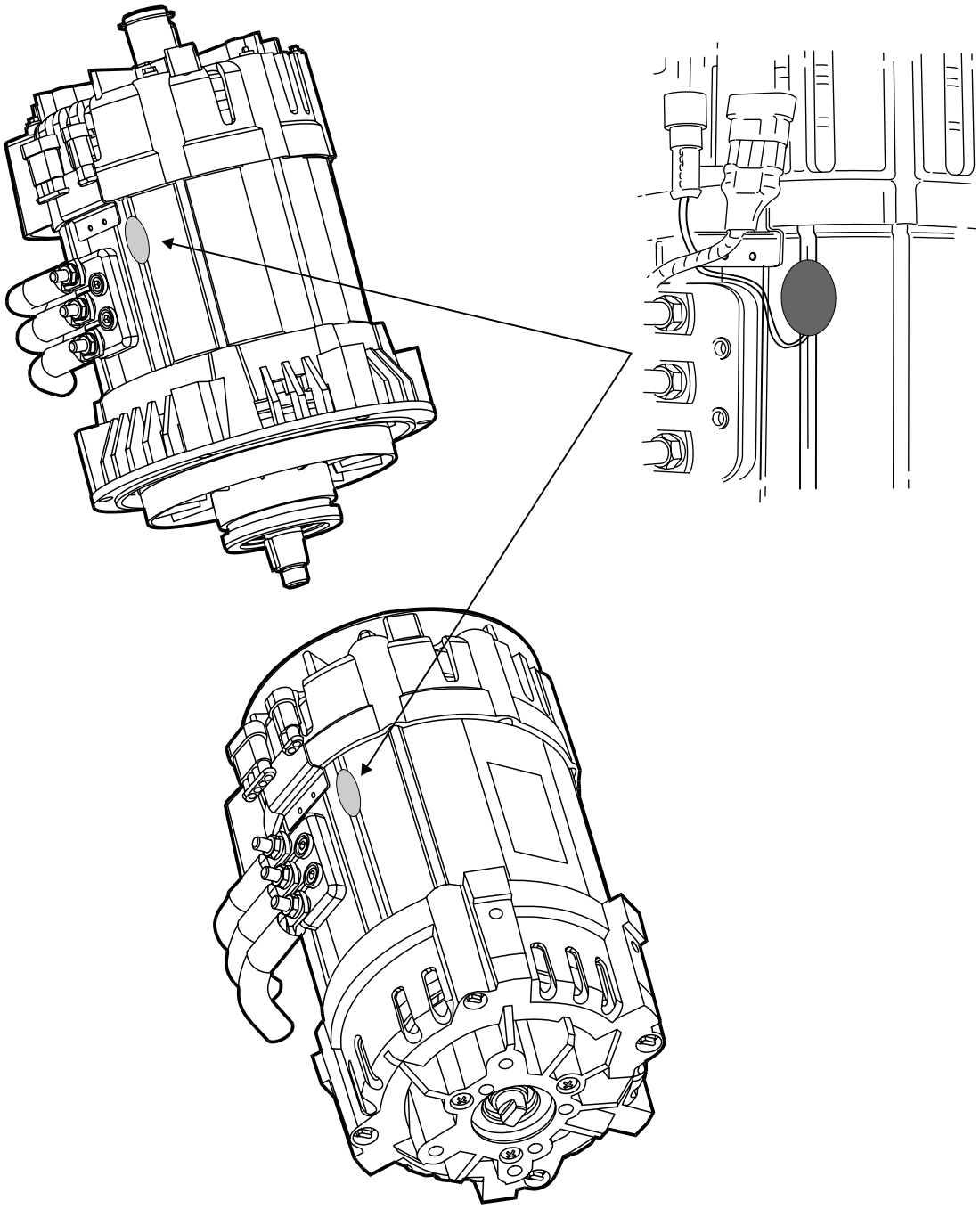
D-side

- Install a gasket (30) on the bearing housing (29).
- Press the bearing (28) into the bearing housing.
- Fit the circlip (26).

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12.5 Installation instructions for external temperature sensor

Number 170384



Electric drive motor – 1760

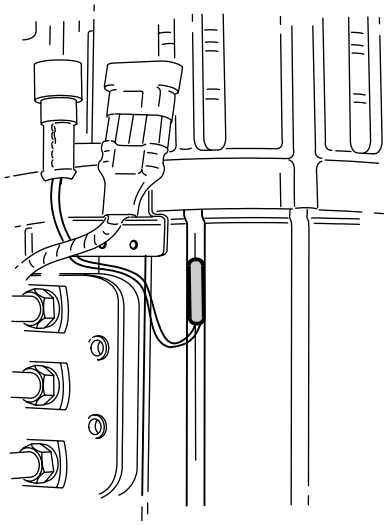
Installation instructions for external temperature sensor

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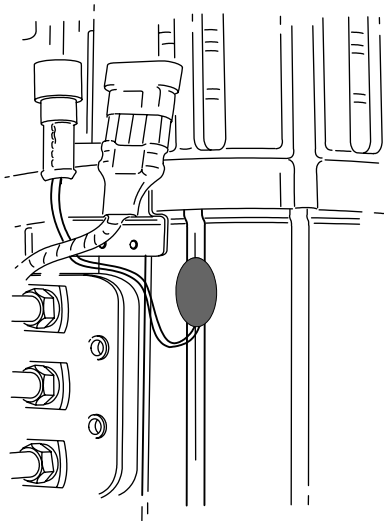
A fully functional temperature sensor mounted inside the motor should have a resistance value of approx. 550 ohm at a temperature of 20 degrees.

The temperature sensor mounted on the outside has a resistance value of approx. 670 ohm at a temperature of 20 degrees.

- The temperature sensor can be mounted to the right or left of the connection terminal block, depending on which side is easiest to access.
- Scrape the surface clean where the new temperature sensor is to be mounted.
- Place the temperature sensor as shown in the picture.

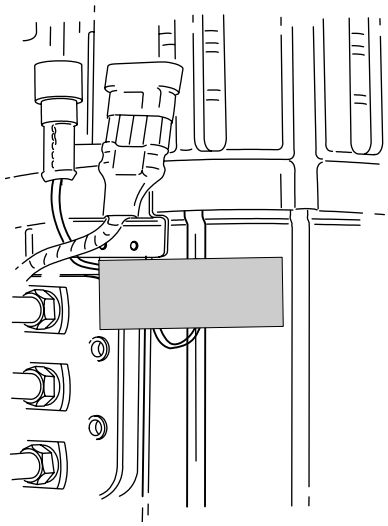


- Apply metallic lacquer over the sensor. Ensure that the entire sensor is covered by the metallic lacquer.



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- Fasten the metallic lacquer and the sensor with masking tape and allow it to harden.



- Remove the masking tape. The temperature sensor should now be fixed in place and covered entirely by metallic lacquer.
- Remove the ferrite block from the old sensor and mount it on the cable to the new sensor.
- Remove the contact from the broken sensor, which is attached to the motor.
- Place the new sensor contact in the old bracket and connect it to the cabling.
- Fasten the old contact and its cabling using a cable tie so it cannot damage anything.

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13- Mechanical drive gear unit – 2550

13.1 General

This type of truck is equipped with a drive gear unit mounted on the chassis with 6 bolts.

The transmission is integrated with the motor, brakes, and sensor measuring speed, steering wheel direction and direction of travel, as a complete drive assembly. The drive assembly is equipped with 360° steering.

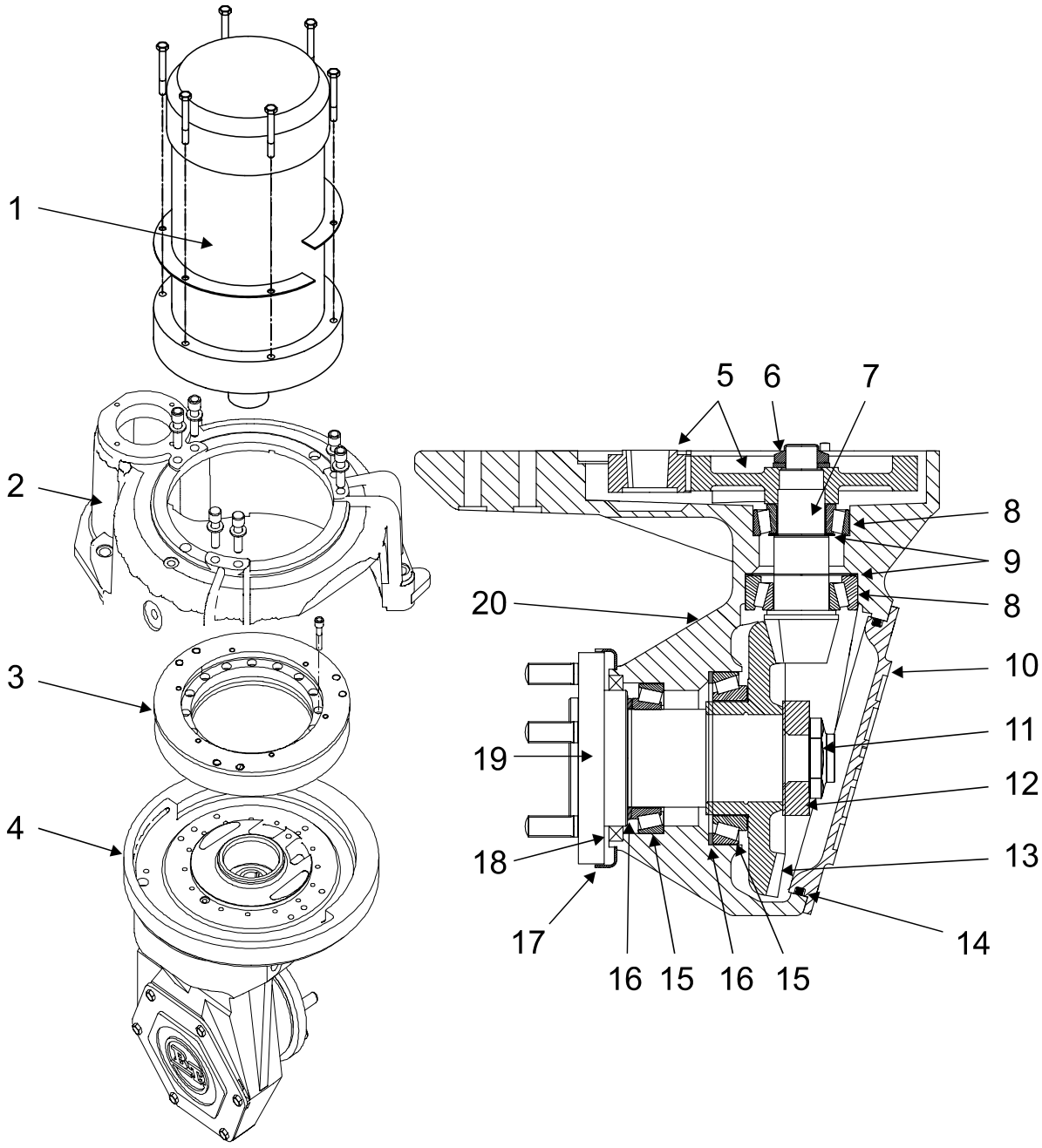
The transmission in this truck is a two-stage angle transmission with conical roller bearings on the drive shaft and pinion. The bearings are pre-tensioned approximately 5/100ths of a mm to minimise the risk of play in the bearings.

This service instruction includes directions for dismantling and assembling the drive transmission, filling and changing the oil and measures in the event of leakage. A complete renovation of the drive transmission is so extensive that specially trained personnel must do this in the workshop.

13.2 Components/data for the drive assembly/transmission

The drive transmission's main components and data are shown in the following diagram and table.

13.2.1 Component placement



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Mechanical drive gear unit – 2550

Components/data for the drive assembly/transmission

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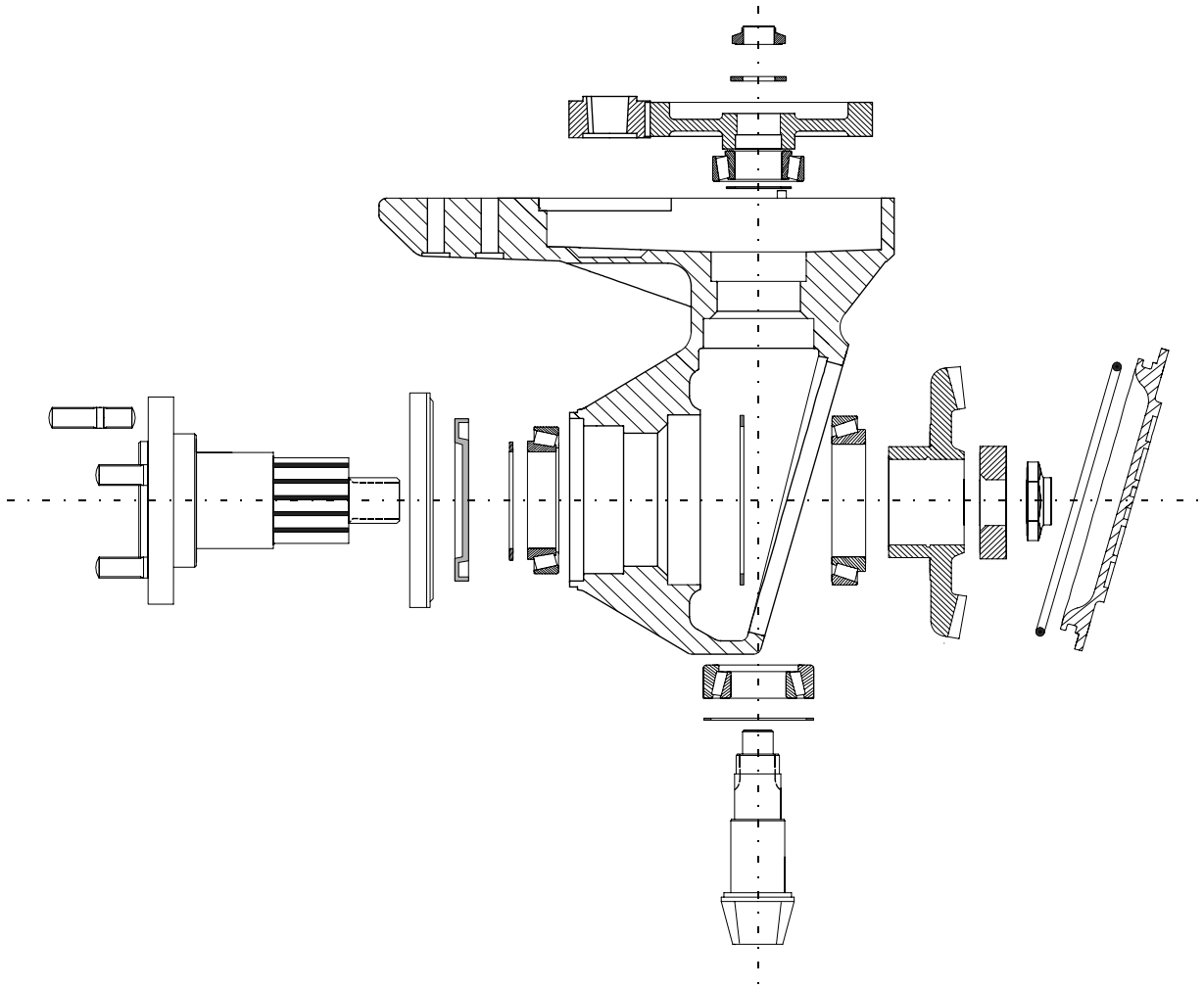
Date
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Pos. No.	Component
1	Drive motor
2	Drive assembly cowl
3	Steering bearings
4	Upper transmission cover with gear ring
5	Gear wheel, primary step
6	Pinion nut
7	Pinion
8	Pinion bearing
9	Shims, pinion bearing
10	Lower transmission cover
11	Drive shaft nut
12	Nut washer
13	Crown wheel
14	O-ring
15	Drive shaft bearings
16	Shims, drive shaft bearings
17	Sealing ring protection
18	Drive shaft sealing ring
19	Drive shaft
20	Transmission housing

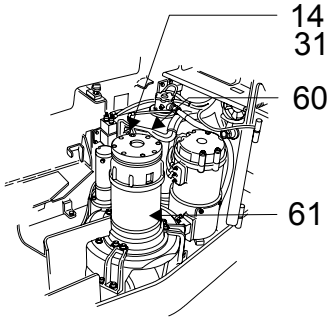
13.2.2 Technical data

Type of truck	RR B/E 1-3	RR B/E 4-8
Transmission	2-stage angle transmission	2-stage angle transmission
Gear ratio	19,20:1	20,89:1
Oil volume, litre	2.8	3,3
Oil type	Hypoid oil	Hypoid oil
Viscosity, normal temperature	SAE 80W/90	SAE 80W/90
Viscosity, < -15° C	SAE 75W	SAE 75W

13.2.3 Dismantling the transmission



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13.3 Replacing the drive motor/drive transmission

To open and close the motor compartment, see section P1 in this manual.

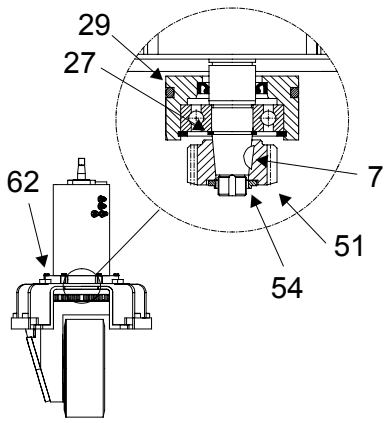
13.3.1 Dismantling the drive motor

- Cut the power by turning off the key and removing the battery plug.
- Remove the temperature, braking and speed measurement contacts (14, 31, 63) and power cables (60) from the motor (61).
- Fasten a lifting eye in the motor axle.
- Dismantle the motor's mounting bolts (62).
- Lift out the motor using an overhead crane and place it on a clean surface.

NOTE!

Risk of damage to the gear wheel (A).
The gear wheel on the end of the motor is easily damaged.
Carefully lift out the motor.

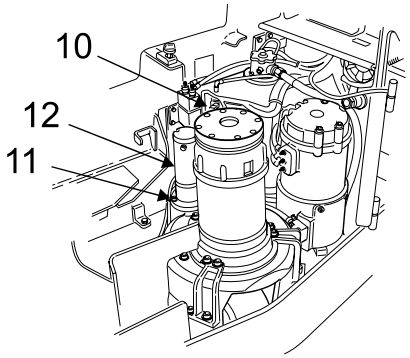
- Cover the hole in the transmission when the motor has been removed to prevent anything from falling inside the transmission housing.



13.3.2 Dismantling the gear wheel

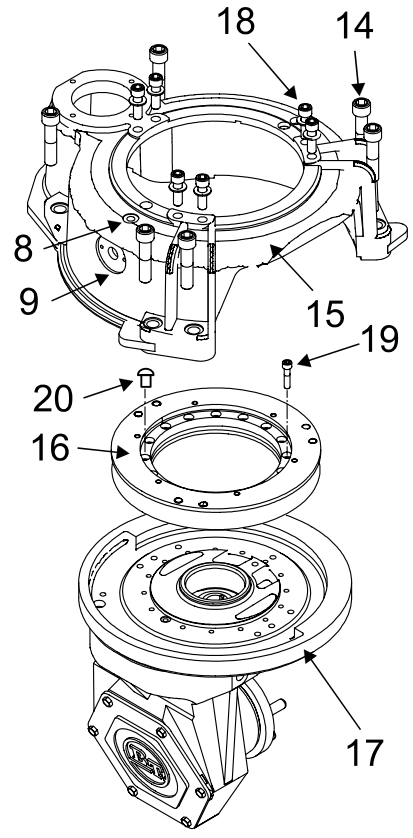
- Tap out the nut (54) lock and unscrew the nut using tool 10-1515639.
- Pull off the gear wheel (51) using a puller.
- Remove the key (7) holding the gear wheel (51) in place.
- Remove the circlip (27) holding the bearing bracket (29) in place.
- Pull off the bearing cage (29) using a puller.

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13.3.3 Dismantling the drive transmission

- Unscrew the four screws holding the support and lift it out of the way.
- Hoist the machine using a pneumatic jack and put it on blocks.
- If the truck is equipped with a steering wheel indicator: Disconnect the indicator for centred steering (8) and steering wheel direction (9).
- Disconnect the contact to the steering motor and loosen the contact (10) from its bracket on the tank plate.
- Unscrew the screws (11) for the steering motor (12) and remove it from the drive transmission.
- Remove the bolts (14) holding the transmission cowl (15) on the chassis.
- Remove the transmission (17) with its cowl (15) from the truck.
- Unscrew the drive wheel.
- Remove the bolts (18) holding the drive transmission (17) to its cowl (15) and lift off the cowl (15).
- **Dismantling the steering bearing (16)**: Unscrew the hexagon socket bolts (19) and remove the steering bearing (16) from the transmission (17).



13.3.4 Assembling the transmission

- **Assembling the steering bearing (16):** Fit the steering bearing (16) using the 15 hexagon socket bolts (19) on the drive transmission (17) with LOCTITE 242, to a torque of 25 Nm.
- Always replace the lift valve (20) when the steering bearing has been removed or when fitting a new bearing.
- Attach the new drive transmission (17) to the cowl (15). Oil the bolts (18) and tighten them to a torque of 80 Nm.
- Secure the drive wheel, torque 130 Nm.
- Insert the drive transmission (17) into position on the truck.
- Fasten the drive transmission (17) with its cowl (15) to the chassis with the 6 bolts (14), torque 222 Nm.
- Fit new O-rings and, if necessary, new plastic seals on the steering motor.
- Fit the steering motor (12) on the drive transmission cowl; the tightening torque on the screws (11) should be 40 Nm.
- Connect the contacts to the steering motor (10).
- **If the truck is equipped with a steering wheel indicator:** Turn the steering wheel until an edge is visible through the hole for the centred steering indicator (8).

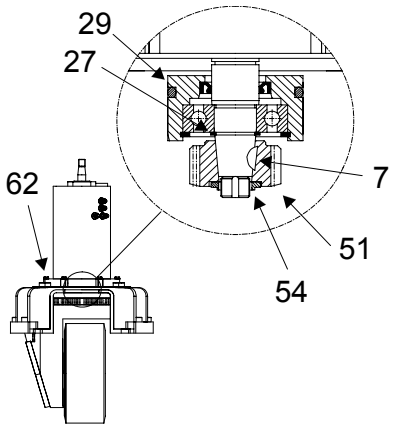
- Screw in the centred steering indicator (8) so that it bottoms on the edge. Then turn it back 1 1/2 turns and lock it in place with a lock nut.
- Screw in the steering wheel direction indicator (9) (red indicator diodes towards the battery compartment) until it stops, then turn it back 1 1/4 turns and lock it in place with a lock nut.

13.3.5 Installing the drive motor

If you replaced the drive transmission (17), also replace the gear wheel (51) on the drive motor.

If you replaced the drive motor, use the old gear wheel on the new motor.

13.3.6 Assembling the gear wheel



- Replace the bearing cage (29) on the motor axle.
- Fit the circlip (27).
- Fit the key (7).
- Replace the gear wheel (51).
- Fit a new nut (54).
- Use tool 10-15639 and tighten to a torque of 60 Nm.
- Lock the nut with a centre punch in the keyway.
- Attach a lifting eye to the motor axle and lift into the transmission using an overhead crane.

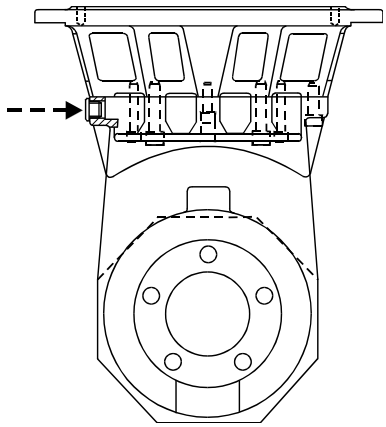
NOTE!

Risk of damaging the gear wheel (A).
The gear wheel on the end of the motor is easily damaged.
Carefully lift in the motor.

- Secure the motor (61) in the transmission with a torque of 20 Nm.
- Reconnect the temperature, braking, and the speed measurement contacts (14, 31) and power cables (60) to the motor.
- Remove the lifting eye bolt.
- Brake adjustment, see C-code 3100.

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13.4 Checking/replacing the oil

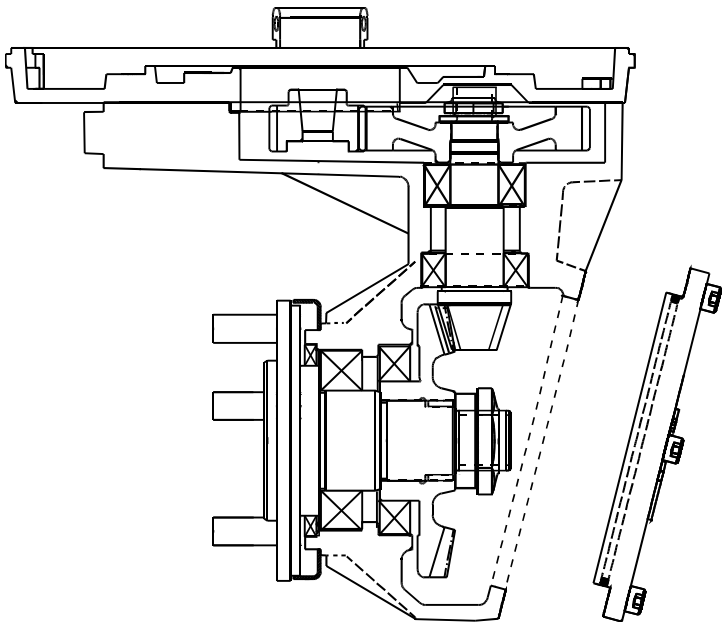


13.4.1 Checking/refilling the oil

- The oil level in the transmission should be checked after every 250 operating hours.
- Check the oil level in the transmission by removing the oil-refill plug on the upper part of the transmission housing.
- Fill the oil right up to the opening to reach the correct level. Hypoid oil MP in the drive transmission.
- SAE 80W/90 for operations in normal temperature.
  SAE 75W for operations in cold stores, < -15° C.
- Oil volume:
  Small gear: Approx.2.8 litres
  Large gear: Approx. 3.3 litres

13.4.2 Changing the Oil

Replace the oil in the transmission for the first time after 50-100 operating hours and then every 3000 operating hours.



- To drain the old oil, remove the lower transmission cowl completely.
- Replace the O-ring seal with every oil change. Make sure the new O-ring is not damaged when fitted.
- Fit the cover and tighten the bolts to a torque of 25 Nm. The bolts should be greased before assembly.
- Fill with oil as instructed in the chapter "Checking/refilling the oil."

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13.5 Repairs

13.5.1 Replacing the drive shaft sealing ring

Replacing the drive shaft sealing ring is easiest when the drive assembly is removed from the truck.

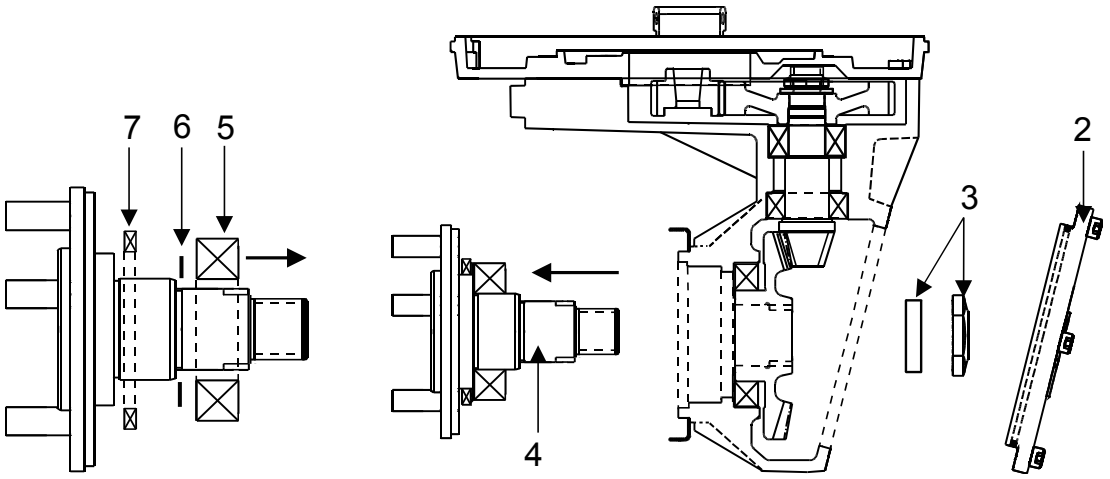
Follow the instructions below if oil leaks from the drive shaft.

Dismantling

- Remove the drive assembly from the truck as described in the section "Replacing the drive motor/drive transmission".
- Remove the lower transmission cowl (2) and drain the oil.
- Loosen the drive shaft nut.
  Remove the nut and spacer ring.
- Carefully tap out the drive shaft using a hammer and brass drift.
- Pull off the bearing from the drive shaft using tool 08-13022.

NOTE!
A standard claw puller cannot be used to remove the bearing. Use a puller such as a KUKKO bearing puller.

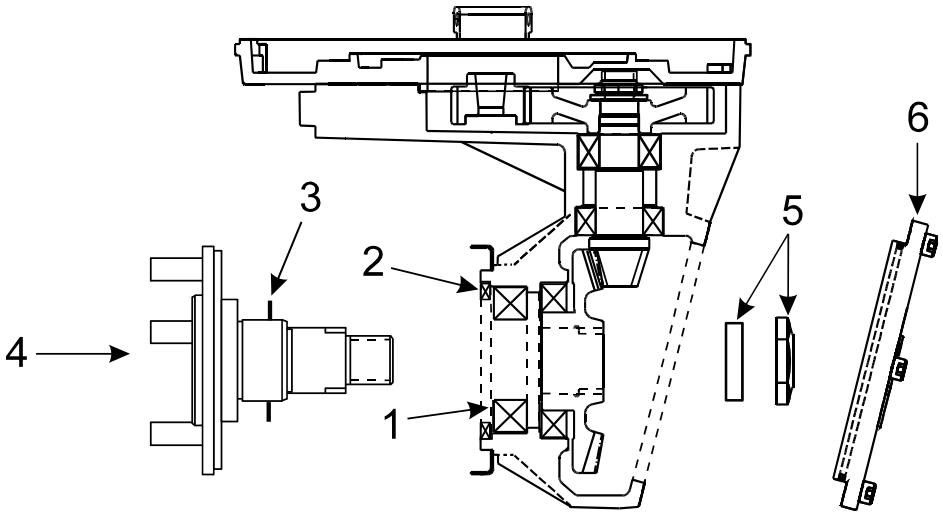
- Check whether the spacer washers (6) on the bearing are damaged. If the puller damaged them, measure the spacer washers' combined thickness and replace them before assembling.
- Remove the sealing ring (7) from the drive shaft.



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Assembling

Follow the instructions below when assembling after replacing the drive shaft sealing ring.

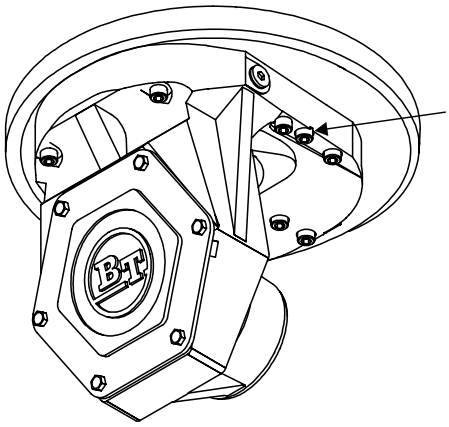


- Insert the drive shaft's outer bearing (1) into place in the transmission housing.
- Push the new sealing ring into the transmission housing. Be careful when pushing in the sealing ring to seat it properly in position.
- Place the axle bearing’s spacer washers on the drive shaft, building the same total thickness as the original ones. Ensure only undamaged spacer washers are used.
- Press the drive shaft , with the spacer washers, into the transmission.
  Check that the drive shaft splines correspond with the splines in the crown wheel.
- Place the distance ring on the end of the drive shaft, and put the shaft nut into position.
  Always use a new nut. The drive shaft nut should be oiled before it is placed on the shaft.
  Tighten the nut to a torque of 700 Nm and lock it in place by centre punching the keyway in the shaft.
- Replace the O-ring before installing the lower cowl. Make sure it is not damaged. Fit the cowl and tighten the bolts to a torque of 25 Nm. The bolts should be greased before assembly.
- Fill with oil as set out in the instructions for refilling.

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13.5.2 Leakage from the upper cover

Follow instructions below in the event of leakage from the transmission's upper cowl:



- Remove the transmission from the truck as described in the section "Replacing the drive motor/drive transmission"
- Loosen all bolts holding the upper cowl on the transmission housing.
- Remove the cover from the transmission housing and clean the sealant surfaces carefully, both on the cowl and the transmission housing.
- Apply sealant such as **Curil K2** to the surfaces. Follow the instructions on the package.
- Fit the cover and tighten the bolts to a torque of 46 Nm.
  The bolts should be greased prior to assembly.
- Fill with oil as set out in the instructions for refilling.
- Assemble the drive transmission/drive motor and fit the drive assembly in the truck as described in the section "Replacing the drive motor/drive transmission."

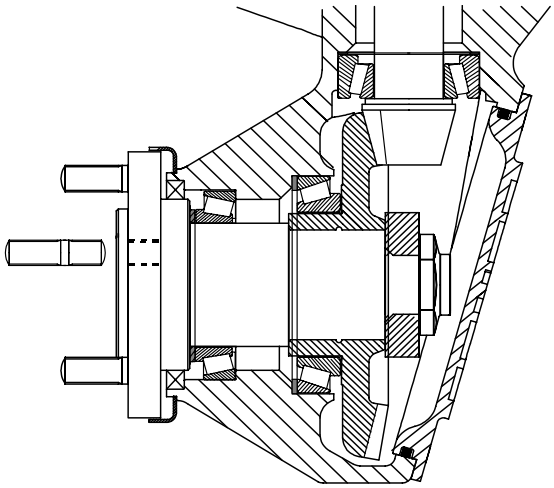
13.5.3 Leakage from the lower cover

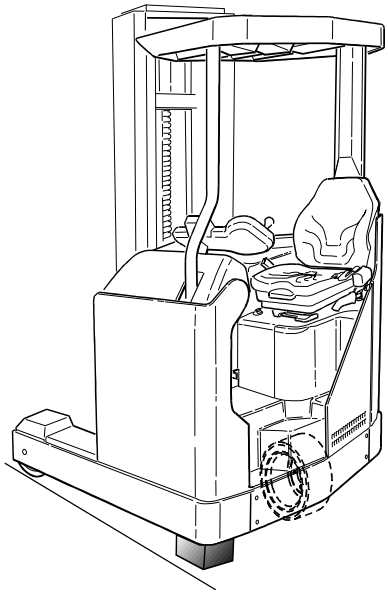
- Drain the remaining oil from the transmission.
- Dismantle the cover from the transmission.
- Replace the sealing ring on the drainage plug and the O-ring on the cover.
- Mount the cover and tighten the bolts to a torque of 25 Nm. Make sure the O-ring is not damaged. The bolts should be greased before assembly.

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13.5.4 Replacing wheel bolts

The wheel bolts on the transmission are stud bolts. To replace the wheel bolts, proceed as follows:





- Pull out the battery's emergency disconnector.
- Remove the bumper by the drive wheel from the chassis.
- Lift the machine using a jack and put it on blocks.
- Dismantle the drive wheel.
- Wheel bolts with damaged threads are removed using the stud bolt tool.
- Broken wheel bolts:
- **Method 1:** Drill a hole in the centre of the bolt and screw out the bolt using a screw extractor for M14 bolts.
- **Method 2:** If the bolt will not come loose with a screw extractor, the bolt must be drilled out.
  - Centre punch the centre of the bolt, be precise when centring the punch.
  - Drill a pilot hole through the bolt using a 5 mm bit.
    Drill out the bolt using an 11.5 mm bit.
  - Try to remove the remains of the bolt with pliers or the like. If that does not work, remove the remains by clearing the threads with a screw tap M14x1.5.
- Apply LOCTITE 270 on the threads of the wheel bolts.
  Mount the new wheel bolt with a stud bolt tool.
  Tightening torque: 80 Nm
- Fit the drive wheel. Tighten the wheel nuts to 130 Nm.
- Remove the blocks and lower the truck.
- Fit the bumper.
- Connect the emergency battery disconnector.

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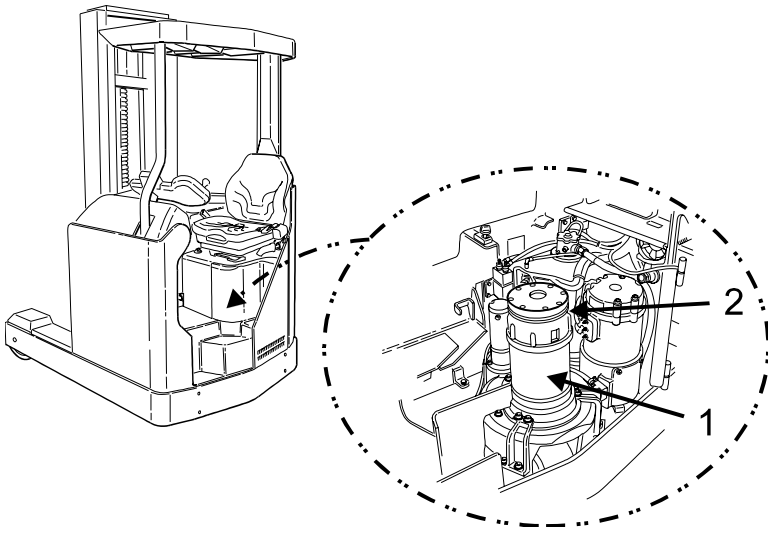
14-Travel brake system – 3100.1

Without support arm brakes

14.1 General

The truck's travel brake system consists of two separate subsystems.

- Regenerative motor braking using the drive motor.
- A single stage electromechanical disc brake fitted on the motor. This is also the truck's parking brake.



14.2 Operating description

The travel brake system's primary braking function is the regenerative motor brake from the drive motor. Braking can be actuated in three different ways:

- When the accelerator is released
- By switching the travel direction using the travel direction selector, normal motor braking.
- By pushing down the brake pedal.

14.2.1 Releasing the accelerator

The regenerative motor brake is automatically engaged when the accelerator is released.

The braking force can be set via a parameter by the driver, see C-code 5710.

The motor braking force is regulated progressively in relation to the speed and the amount the accelerator is released. This functions as follows:

- Braking at a high speed, the accelerator is released completely, gives a high braking force.
- Braking at a low speed, the accelerator is released completely, gives a low braking force.
- Braking at a high speed, the accelerator is released halfway, gives medium braking force.

14.2.2 Travel direction selector

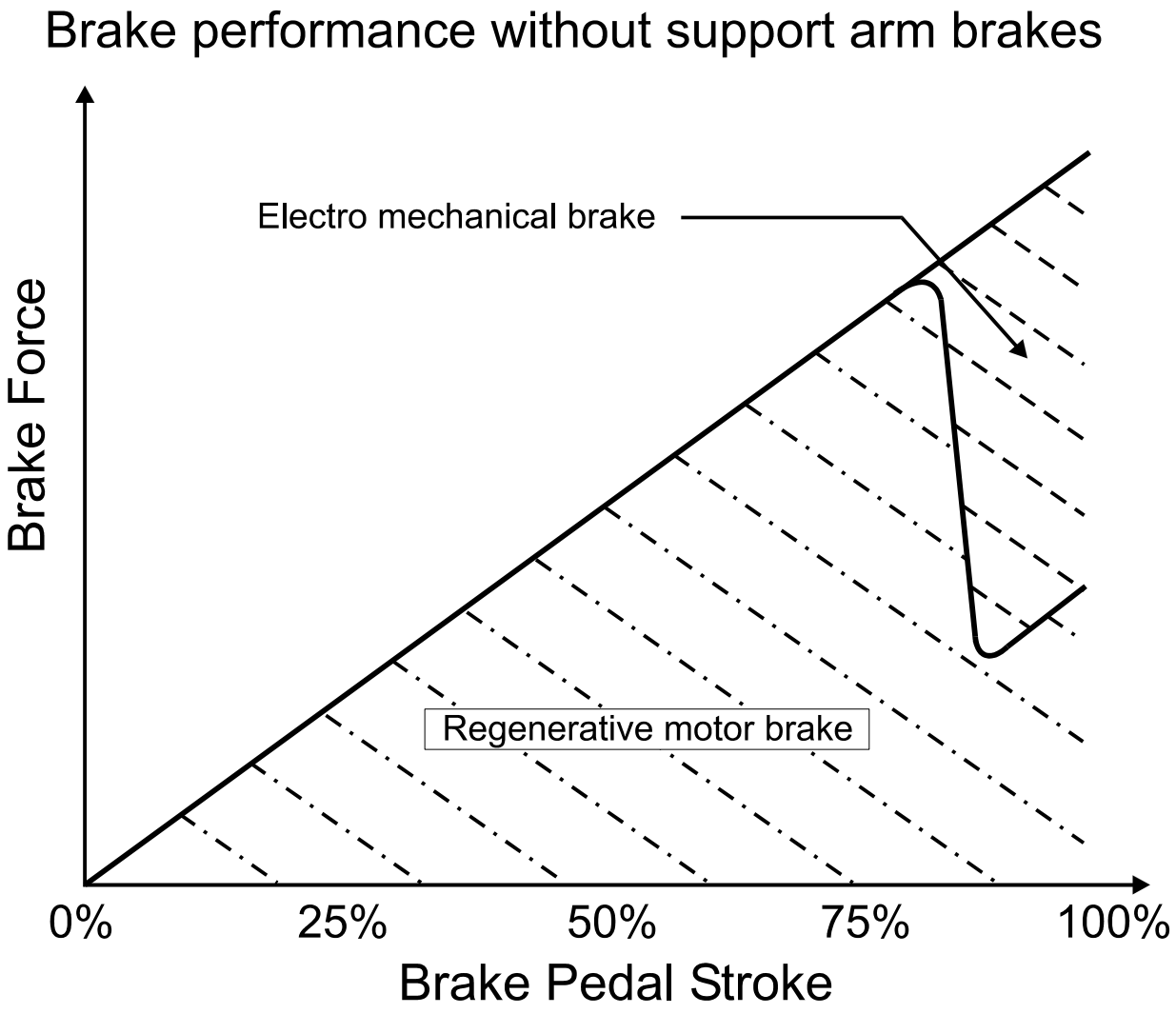
The braking force is regulated by the position of the accelerator, i.e. the more the pedal is pressed down the greater the braking effect.

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14.2.3 Pressing down the brake pedal

Full regenerative motor braking is obtained when the brake pedal is pressed down 80% of its stroke length.

If the brake pedal is pressed down between 80-100%, further braking force is obtained as the electromechanical disc brake on the drive motor is activated.
In the limit area, at 80%, the motor brake reduces corresponding to the braking torque to avoid heavy jerking or wheel locking, see fig.



14.2.4 Parking brake

The parking brake is activated/is active as follows:

- The parking brake is activated automatically when the truck is stopped when driving and the truck brakes to a stop with the help of the brake pedal. The brakes are released when the accelerator is pressed down.
- The parking brake is activated automatically with a few seconds of delay when the driver leaves the truck.
- The parking brake remains active after the ignition switch is switched on.

14.2.5 Emergency brake

Emergency braking of the truck takes place in the event of a fault with the control system or a serious fault in the electrical systems.

- The electromechanical disc brake on the drive motor is the primary emergency brake.
- The motor brake can act with emergency braking under the condition that the voltage supply works.

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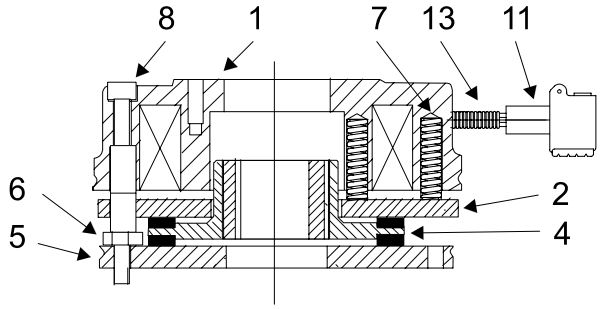
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14.3 Electromechanical disc brake, drive motor

The brake is a single stage electromechanical spring force brake that releases when the magnetic coil is energised. The brake acts as a parking brake, emergency and secondary travel brake at the end of the brake pedal's stroke.

The resistance in the coil is approx. 32 ohm at 20 degree Celcius.

14.3.1 Assembling



- Fit the brake on the motor axle.
- Ensure that the friction disc (4) is centred in relation to the magnet housing before you try to install the brakes.
  It may be necessary to energise the magnet coil with 48 V DC to position the brake disc.
- Fit the brake assembly onto the motor. Check that the splines on the friction disc were not damaged during installation.
- Fit and tighten the brake unit's three securing bolts.
- Check the play between the magnet housing and the pressure plate with the brake applied, should be 0.25-0.40 mm.
  The play may need to be adjusted, see section adjustment.
- Connect the brake cable (11) to the truck's electrical system.
- Switch on the ignition switch and release the parking brake.
  Check that the friction disc rotates freely.
  Cut the voltage and check that the pressure plate locks the friction disc and that the play (0.25-0.40 mm) is correct.

NOTE!

The seat switch must be made.
Use the strap contact 159747 to strap the switch so that you can work without the need of sitting on the seat.
Bear in mind safety, the system is energised.

14.3.2 Dismantling

- Dismantle the brake in the reverse order.
- Place the brake on a clean and dry workbench with the magnet housing (1) facing upward.
- Unscrew the 3 adjuster screws (8) gradually to reduce the spring tension equally.
- The brake unit can now be dismantled fully for inspection of the component parts.

14.3.3 Inspection

Investigate the parts regarding damage and/or wear.

- Check the brake disc (4) and the wear surfaces on the pressure plates (2) and (5) extra carefully.
- Check the springs (7) and the spacers (6) with regard to damage.

NOTE!
Bear in mind the spacer nut is made of brass.

- Check for signs of damage to the splines on the hub (3) and friction disc (4).
- Check for signs of swelling/deformation or damage to the magnet (1) and pressure plate (2).

14.3.4 Assembling

- Clean the parts carefully.
- Assemble the brake in the reverse order to dismantling.
- Bear in mind the following:
  - That the hole in the pressure plate (2) aligns with the corresponding hole in the magnet housing.
  - That the right number of springs have been fitted.
  - That the play 0.25-0.40 mm is set correctly, some adjustment may be necessary.

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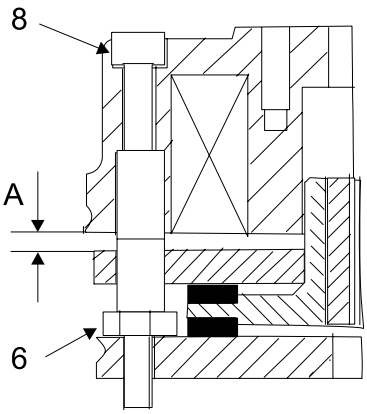
14.4 Maintenance

The brake is included as a checkpoint in the truck's maintenance chart, for intervals see the maintenance chart C-code P2.

Maintenance comprises inspection and adjustment of the play between the pressure plate and magnet housing, wear, braking force and cleaning.

NOTE!

The friction surfaces must not come into to contact with oil or grease as this will seriously reduce the brake's braking force.

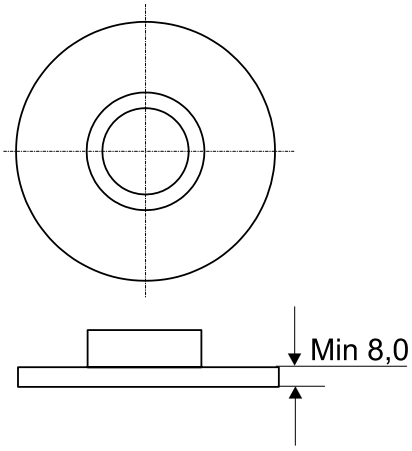


14.4.1 Adjusting the play

- The play must be checked every 1000 operating hours.
- The play (A) is measured between the magnet housing and the pressure plate in three positions, by the adjuster sleeves (6) with the brakes actuated.
- Nominal play with correct adjustment is 0.25-0.40 mm.
- Maximum permitted play is 0.50 mm before adjustment is necessary.

Tools

- Feeler gauges, 14 mm box spanner and 6 mm allen key
- Loosen the three bolts (8).
- Adjust the play using the three adjuster sleeves (6) to 0.25-0.40 mm. Measure, using the feeler gauges, by the side of the adjuster sleeve when adjusting.
  Turning anticlockwise reduces and clockwise increases the play.
- Tighten the bolts to 20 Nm.
- Recheck the play after tightening the bolts.
  Repeat the adjustment if necessary until the play is correct.
- Check the play all the way around the pressure plate. Maximum permitted deviation from the set play is 0.075 mm.



14.4.2 Wear

- Check the friction disc for wear every 3000 operating hours.
- Strip the brake as set out in the section "Dismantling".
- Measure the thickness of the friction disc. Minimum thickness = 8.0 mm.

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14.4.3 Check the braking force

The braking force must be checked at least every 1000 operating hours.

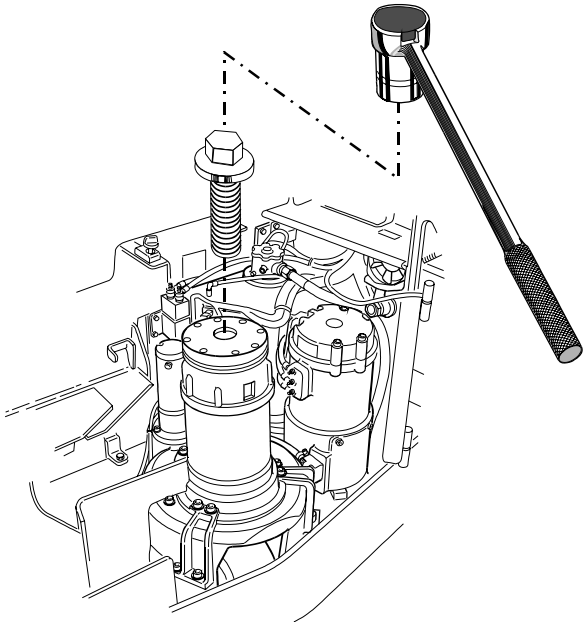
- Lift up the truck so that the drive wheel is free of the ground
- Open the motor compartment covers.

Tools

- Torque wrench set to**90 Nm** and a M12 flange bolt, or a normal bolt and flat washer

NOTE!

The bolt quality shall be at least 10.9.



- Screw in the M12 bolt in the hole (for the lifting hole) in the motor axle.
- Turn the motor axle using the torque wrench until the brakes release.
- If the brake releases before 90 Nm is reached the braking force is too low.
- Adjust the brake play to the right value, see adjusting the play.
- Check the braking force again using the torque wrench.

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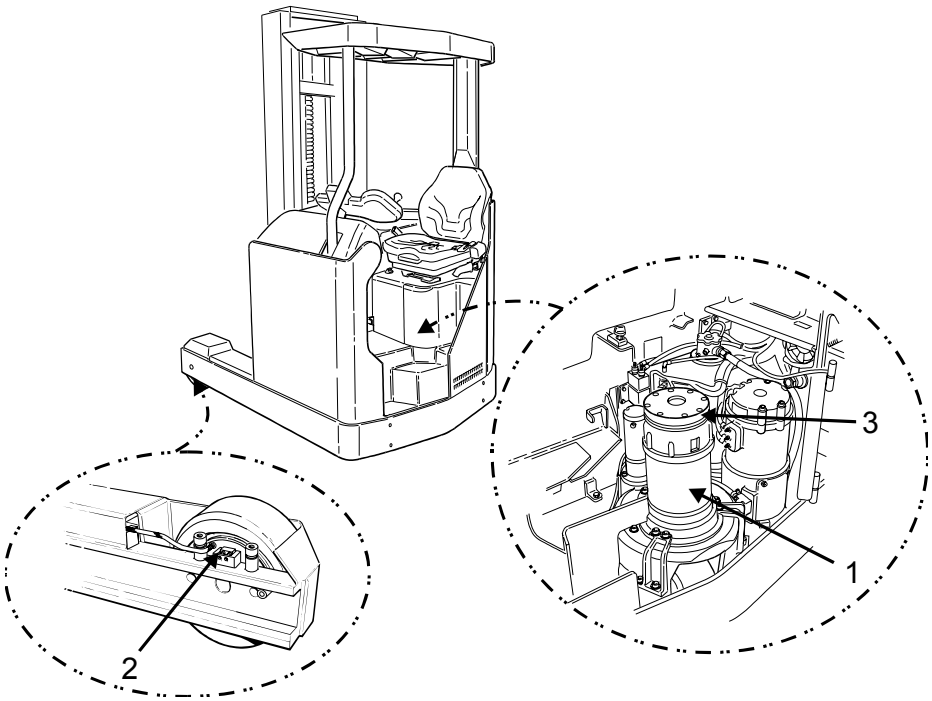
15-Travel brake system – 3100.2

With support arm brake

15.1 General

The truck's travel brake system consists of three separate subsystems.

- Regenerative motor braking using the drive motor.
- Two analogue electromechanical multiple disc brakes fitted in the support arm wheels.
- A single stage electromechanical disc brake fitted on the motor.



15.2 Operating description

The travel brake system's primary braking function is the regenerative motor brake from the drive motor. Braking can be actuated in three different ways:

- When the accelerator is released
- By switching the travel direction using the travel direction selector, normal motor braking.
- By pushing down the brake pedal.

15.2.1 Releasing the accelerator

The regenerative motor brake is automatically engaged when the accelerator is released.

The braking force can be set via a parameter by the driver, see C-code 5710.

The motor braking force is regulated progressively in relation to the speed and the amount the accelerator is released. This functions as follows:

- Braking at a high speed, the accelerator is released completely, gives a high braking force.
- Braking at a low speed, the accelerator is released completely, gives a low braking force.
- Braking at a high speed, the accelerator is released halfway, gives medium braking force.

15.2.2 Travel direction selector

The braking force is regulated by the position of the accelerator, i.e. the more the pedal is pressed down the greater the braking effect.

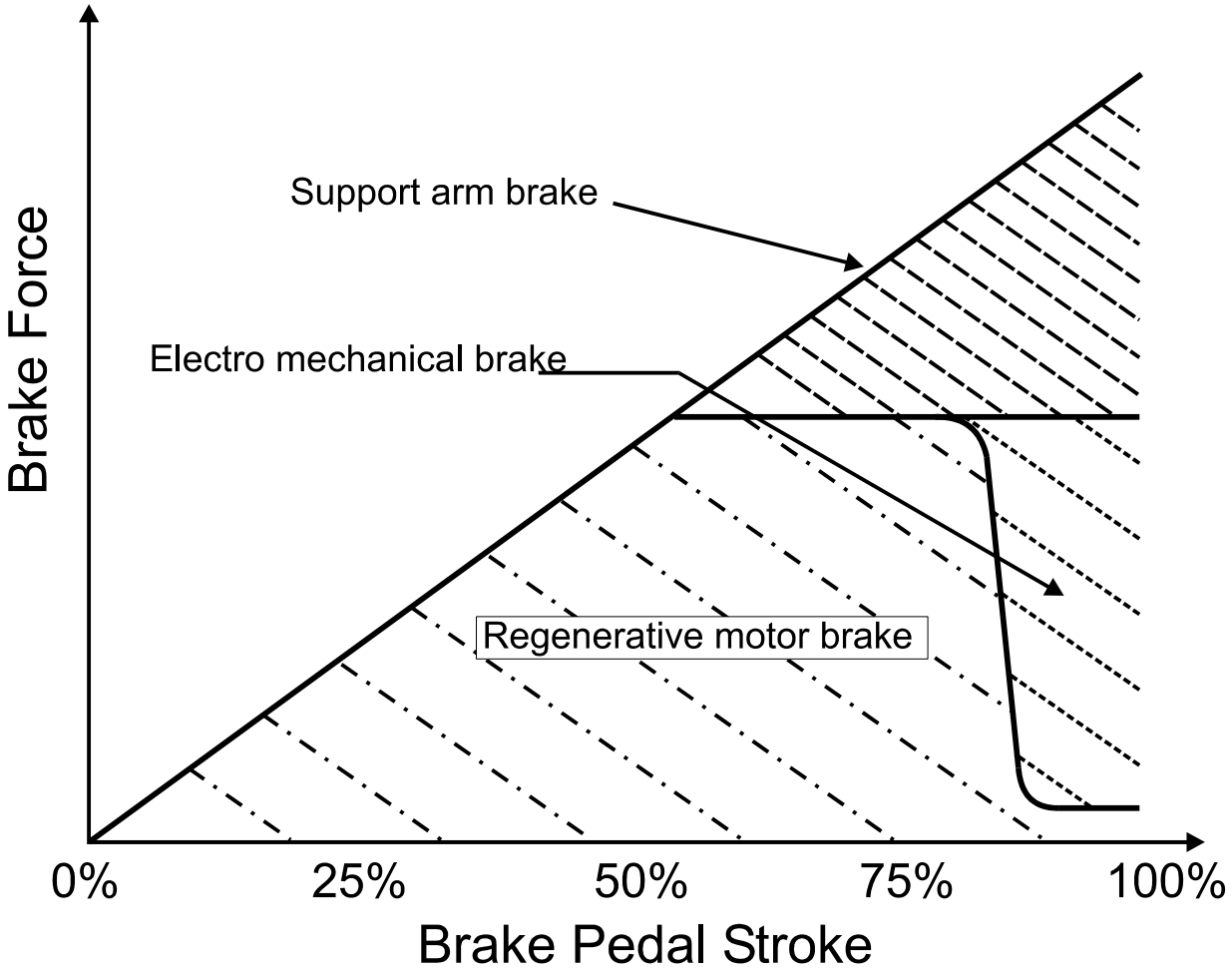
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15.2.3 Pressing down the brake pedal

Full regenerative motor braking is obtained when the brake pedal is pressed down 50% of its stroke length.

If the brake pedal is pressed down more than 50%, further braking force is obtained as the multiple disc brakes in the support arm wheels are activated.
When the brake pedal is pressed down between 85-90%, the electro-mechanical disc brake is also activated on the drive motor at the same time as the motor brake is reduced corresponding to the disc brake's braking force to avoid heavy jerking or wheel locking, see fig.

Brake performance with support arm brakes



15.2.4 Parking brake

The parking brake is activated/is active when:

- The parking brake is activated automatically when the truck is stopped when driving and the truck brakes to a stop with the help of the brake pedal.
  The brakes are released when the accelerator is pressed down.
- The parking brake is activated automatically with a few seconds of delay when the driver leaves the truck.
- The parking brake remains active after the ignition switch is switched on.

15.2.5 Emergency braking

Emergency braking of the truck takes place in the event of a fault with the control system or a serious fault in the electrical systems.

- The electromechanical disc brake on the drive motor is the primary emergency brake.
- The motor brake can act with emergency braking under the condition that the voltage supply works.

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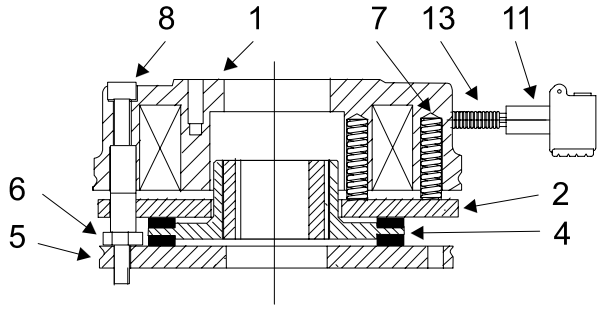
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15.3 Electromechanical disc brake, drive motor

The brake is a single stage electromechanical spring force brake that releases when the magnetic coil is energised.
The brake acts as a parking brake, emergency and a third travel brake at the end of the brake pedal's stroke.

The resistance in the coil is approx. 32 ohm at 20 degree Celcius.

15.3.1 Assembling



- Fit the brake on the motor shaft.
- Fit the O-ring (10) in the groove on the hub
- Ensure that the friction disc (4) is centred in relation to the magnet housing before you try to install the brakes.
  It may be necessary to energise the magnet coil with 48 V DC to position the brake disc.
- Fit the brake assembly onto the motor. Check that the splines on the friction disc were not damaged during installation.
- Fit and tighten the brake unit's three securing bolts.
- Check the play between the magnet housing and the pressure plate with the brake applied, should be 0.25-0.40 mm.
  The play may need to be adjusted, see section adjustment.
- Connect the brake cable (11) to the truck's electrical system.
- Switch on the ignition switch and release the parking brake.
  Check that the friction disc rotates freely.
  Cut the voltage and check that the pressure plate locks the friction disc and that the play (0.25-0.40 mm) is correct.

NOTE!

The seat switch must be made.
Use the strap contact 159747 to strap the switch so that you can work without the need of sitting on the seat.
Bear in mind safety, the system is energised.

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15.3.2 Dismantling

- Dismantle the brake in the reverse order.
- Place the brake on a clean and dry workbench with the magnet housing (1) facing upward.
- Unscrew the 3 adjuster screws (8) gradually to reduce the spring tension equally.
- The brake unit can now be dismantled fully for inspection of the component parts.

15.3.3 Inspection

Investigate the parts regarding damage and/or wear.

- Check the brake disc (4) and the wear surfaces on the pressure plates (2) and (5) extra carefully.
- Check the springs (7) and the spacers (6) with regard to damage.

NOTE!
Bear in mind the spacer nut is made of brass.

- Check for signs of damage to the splines on the hub (3) and friction disc (4).
- Check for signs of swelling or damage to the magnet (1) and pressure plate (2).

15.3.4 Assembling

- Clean the parts carefully.
- Assemble the brake in the reverse order to dismantling.
- Bear in mind the following:
  - That the hole in the pressure plate (2) aligns with the corresponding hole in the magnet housing.
  - That the right number of springs have been fitted.
  - That the play 0.25-0.40 mm is set correctly, some adjustment may be necessary.

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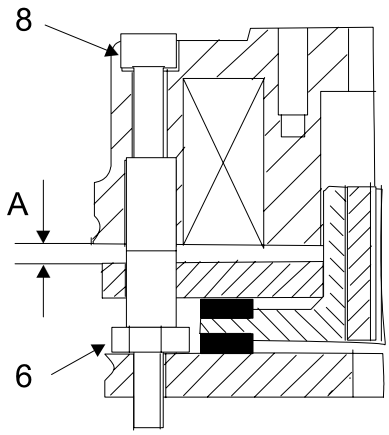
15.4 Maintenance

The brake is included as a checkpoint in the truck's maintenance chart, for intervals see the maintenance chart section P2.

Maintenance comprises inspection and adjustment of the play between the pressure plate and magnet housing, wear, braking force and cleaning.

NOTE!

The friction surfaces must not come into to contact with oil or grease as this will seriously reduce the brake's braking force.

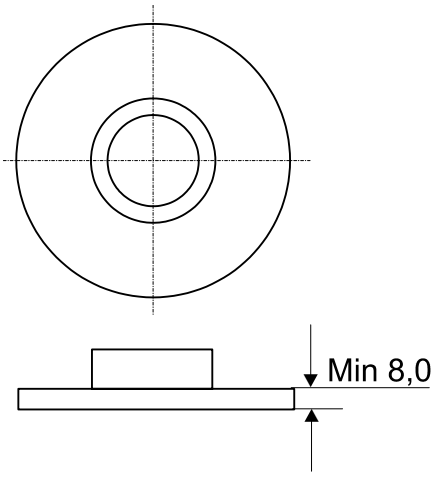


15.4.1 Adjusting the play

- The play must be checked every 1000 operating hours.
- The play (A) is measured between the magnet housing and the pressure plate in three positions, by the adjuster sleeves (6) with the brakes actuated.
- Nominal play with correct adjustment is 0.25-0.40 mm.
- Maximum permitted play is 0.50 mm before adjustment is necessary.

Tools

- Feeler gauges, 14 mm box spanner and 6 mm allen key
- Loosen the three bolts (8).
- Adjust the play using the three adjuster sleeves (6) to 0.25-0.40 mm. Measure, using the feeler gauges, by the side of the adjuster sleeve when adjusting.
  Turning anticlockwise reduces and clockwise increases the play.
- Tighten the bolts to 20 Nm.
- Recheck the play after tightening the bolts.
  Repeat the adjustment if necessary until the play is correct.
- Check the play all the way around the pressure plate. Maximum permitted deviation from the set play is 0.075 mm.



15.4.2 Wear

- Check the friction disc for wear every 3000 operating hours.
- Strip the brake as set out in the section "Dismantling".
- Measure the thickness of the friction disc. Minimum thickness = 8.0 mm.

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15.4.3 Check the braking force

The braking force must be checked at least every 1000 operating hours.

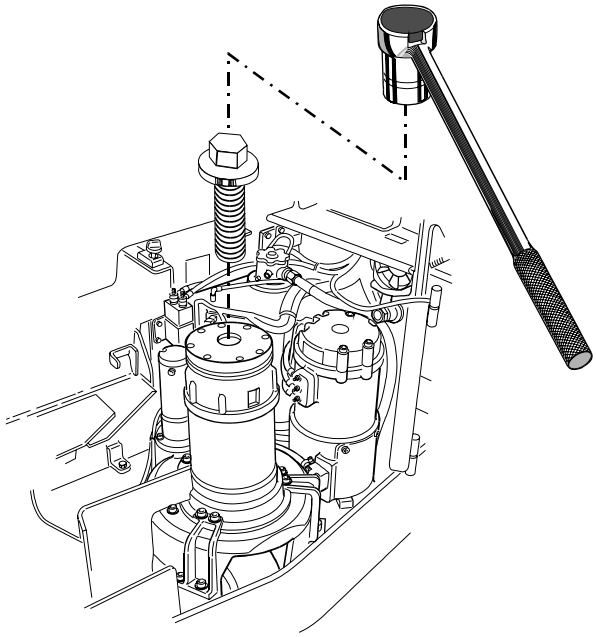
- Lift up the truck so that the drive wheel is free of the ground
- Open the motor compartment covers.

Tools

- Torque wrench set to**90 Nm** and a M12 flange bolt, or a normal bolt and flat washer

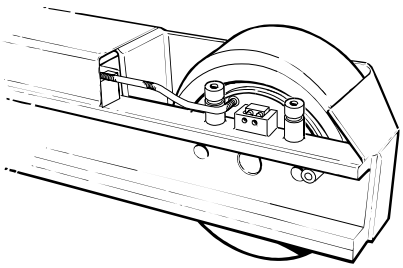
NOTE!

The bolt quality shall be at least 10.9.



- Screw in the M12 bolt in the hole (for the lifting hole) in the motor axle.
- Turn the motor axle using the torque wrench until the brakes release.
- If the brake releases before the torque wrench trips the braking force is too low.
- Adjust the brake play to the right value, see adjusting the play.
- Check the braking force again using the torque wrench.

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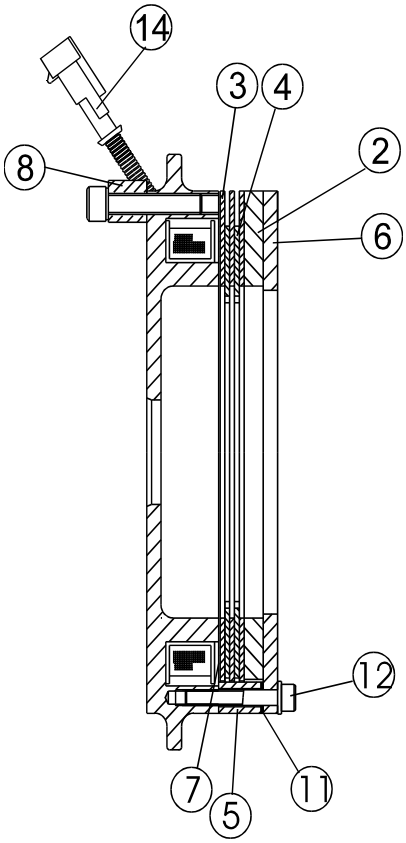


15.5 Multiple disc brake, support arm

The brake is an analogue electromagnetic multiple disc brake, that is the brake is applied by energising the magnet coil. The current in the magnet coil is regulated by a potentiometer in the brake pedal and thereby regulates the braking force. The multiple discs are of steel. The brake acts as a secondary travel brake and is applied when the driver needs to brake heavily, >50% of the available braking force.

The brake is assembled inside the support arm wheel on a hub with splines and a locking heel that takes up the braking force.

The support arm wheel must be dismantled from the truck to check and maintain the brake, see C-code 3550, except when inspecting the actual magnet coil, which can be done with the wheel fitted. All instructions given below assume that the wheel has been dismantled.



15.5.1 Assembling

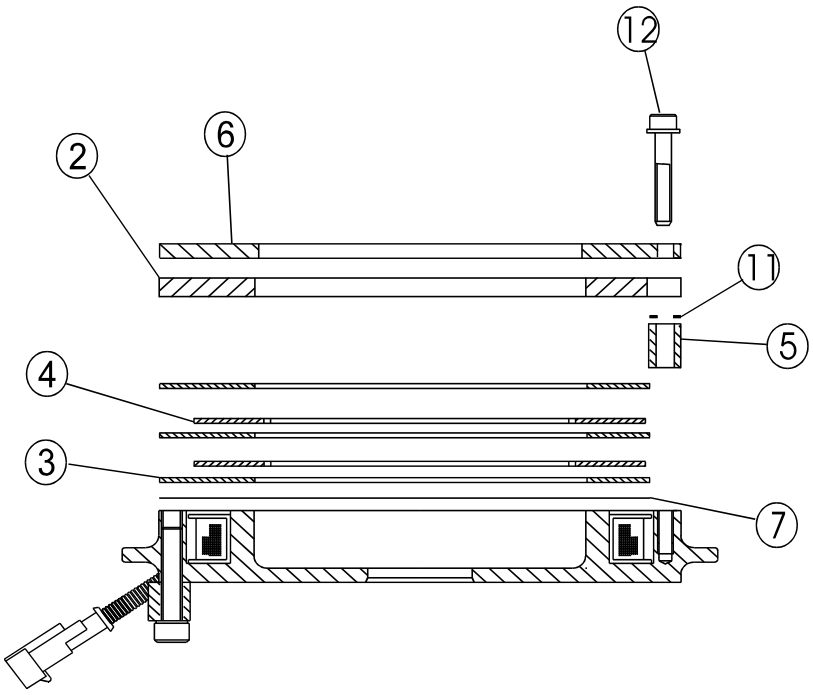
- Check that the brakes apply and releases as they should. Connect the brakes to 48 V D.C. Switch the current on and off.
- Check that the play between the end plate (6) and pressure plate (2) is 1.0-1.25 mm with the current switched on (brakes applied). The play may need to be adjusted, see section adjustment.

NOTE!

Check the play at the same time in two positions at 180 degree spacing.

- Fit the brake in the support arm wheel. Make sure that the inner disc splines are aligned correctly so that they go on the splines on the wheel hub without resistance.
- Assemble the wheel in the support arm according to instruction C-code 3550.
  Ensure the locking heel (8) is positioned in it cut-out in the support arm.
- Connect the brake cable (14) and check the brake function by pressing down the brake pedal fully.

15.5.2 Dismantling



- Lift the brake out of the support arm wheel.
- Place the brake on a clean and dry work bench with the magnet housing (6) facing upward.

NOTE!

Exercise care so that the components and cables are not damaged during this and the following work.

- Loosen and remove the sex M6x40 socket head screws (12) and their washers
- Remove the aluminium end plate (6).

NOTE!

Note the number of shim washers (11) on each spacer (5).

- Lift off the pressure plate (2) and the disc assembly that consists of 3 outer discs (3) and 2 inner discs (4).
- Remove the brass disc (7).

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15.5.3 Inspection

- Check the thickness of the discs.
  The nominal thickness of a new disc = 2.0 mm
  Wear limit = 1.4 mm
- When replacing discs. Replace all inner and outer discs at the same time. **Not** individually.
- Also check that the discs are flat and that the splines or cut-outs are not damaged.
- Check the magnet coil's electrical resistance. Nominal 47.7 Ohm at 20° C

NOTE!
The resistance measurement can be performed with the brake/wheel in the truck.

15.5.4 Assembling

- Clean the parts carefully.

NOTE!
Clean only with a wire brush and dry cloth.

- Assemble the brake in the reverse order.
- Connect the brake to 48 V D.C.
- Check the play between the end plate and pressure plate (brake applied). Adjust the play if necessary.

15.6 Maintenance

The brake is included as a checkpoint in the truck's maintenance chart, for intervals see the maintenance chart section P2.

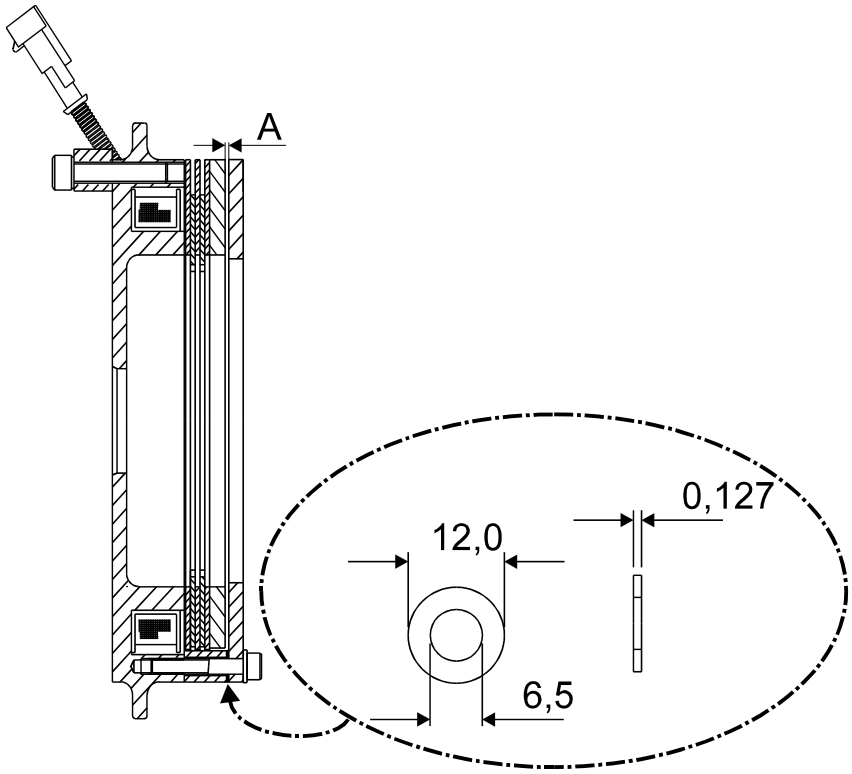
Maintenance comprises inspection and adjustment of the play between the pressure plate and end plate, wear and the magnet coil's resistance and cleaning.

- Cleaning and inspection/adjusting of the play shall be carried out every 1000 operating hours.
- Check for wear and the magnet coil's resistance shall be carried out every 3000 operating hours.

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15.6.1 Adjusting the play

- Dismantle the support arm wheel from the truck and remove the brake.
- Connect the brake to 48 V D.C.



- Check the play, measurement A, with the brake applied.

NOTE!

Check the play at the same time in two positions at 180 degree spacing.

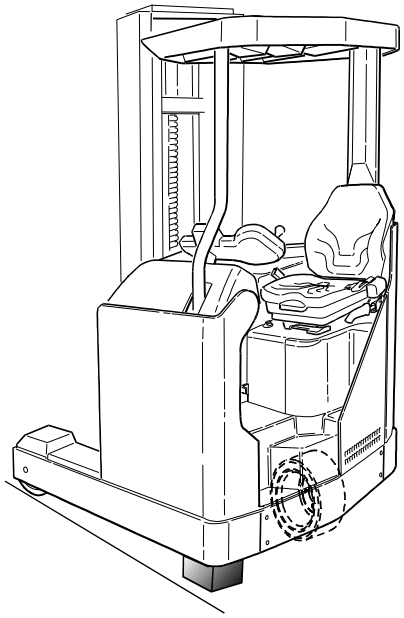
- Maximum permitted play = 2.25 mm
- Nominal play of newly adjusted brakes shall be 1.0-1.25 mm.
- Before adjusting, dismantle the aluminium end plate.
- Remove the shim washers, when adjusting due to wear, or add shim washers when fitting new discs.
  Each shim washer is 0.127 mm thick.
- Fit the aluminium end plate, connect to 48 V D.C. and check the play.
- When the play lies within the nominal permitted value, fit the brake in the wheel and the wheel on the truck.

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16-Drive wheel – 3530

16.1 General

The drive wheel consists of a cast rim with a vulcanised tread. When changing the drive wheel you must ensure that you tighten the wheel nuts to the correct torque.

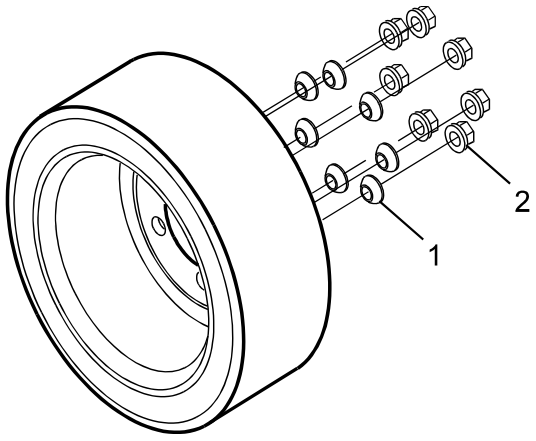


On the Reflex truck two different sizes of wheel have been used.
One with the dimensions diameter 310x12 mm and one 350x130 mm.
The smaller wheel (310 mm) is used on B/E1- B/E3.
The larger wheel (350 mm) is used on B/E4 - B/E8.

16.2 Dismantling the drive wheel

- Lift up the truck on blocks so that the drive wheel is off the ground.
- Unscrew the four bolts holding the guard plate.
- Remove the guard plate.
- Unscrew the nuts holding the drive wheel in position.
- Lift off the drive wheel.

16.3 Assembling the drive wheel



- Lift on the new drive wheel.
- Apply MOLYKOTE grease BT number 055-73040 on the wheel bolts.
- Position the spherical washers (1) on the wheel bolts.
- Tighten the wheel nuts (2) to 130 Nm.
- Fit the guard plate.
- Remove the blocks.

Drive wheel – 3530

Assembling the drive wheel

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17-Fork/support arm wheel – 3550.1

17.1 General

On the Reflex trucks, five different kinds of support arm wheels are used. The wheel is fitted to the support arm with a through axle and clamping sleeve. The axle has a threaded hole for use when dismantling and assembling.

Type of truck	Wheel diameter, mm	Brake/No brake
B1-3, E1-3	265	No
B1-3, E1-3	300	No
B1-3, E1-3	300	Yes
B4-6, E4-6	350	No
B4-6, E4-6, B7-8, E7-8	350	Yes

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17.2 Dismantling the wheel

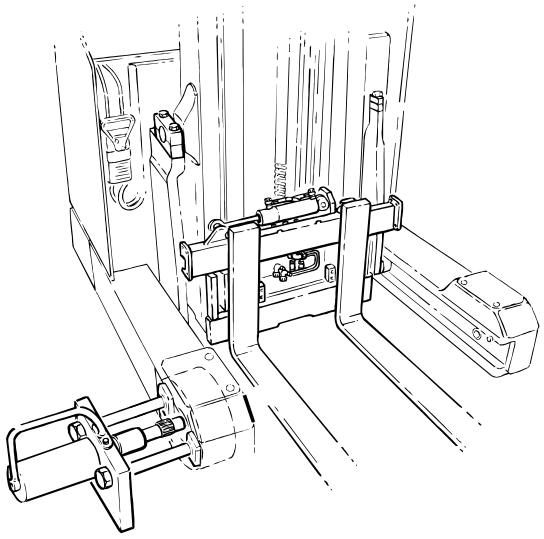
- Lift up the truck and support using blocks so that the support arm wheel runs free of the ground.
- Unscrew the two bolts holding the guard plate above the wheel.
- Remove the guard plate.

For wheels without brakes

- Pull out the wheel axle using tool 08-13585. Use the short punch.
- Lift out the wheel.

For wheels with brakes

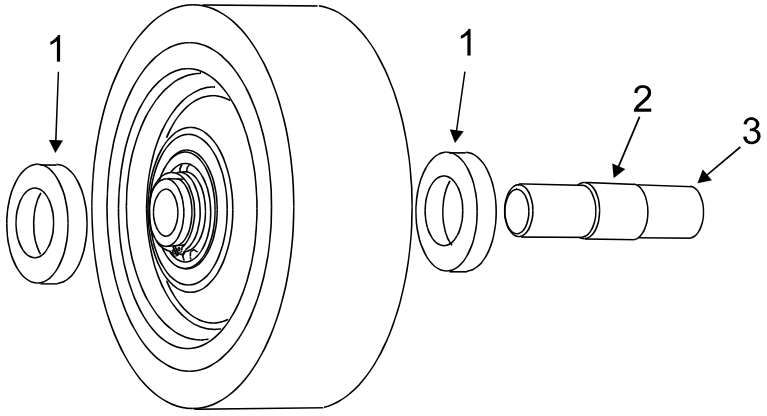
- Loosen the connector/cable to the support arm brake.
- Loosen the locking bolt for the brake shoe.
- Pull out the wheel axle using tool 08-13585. Use the short punch.
- Lift out the wheel.
- Take the brake unit out of the wheel.



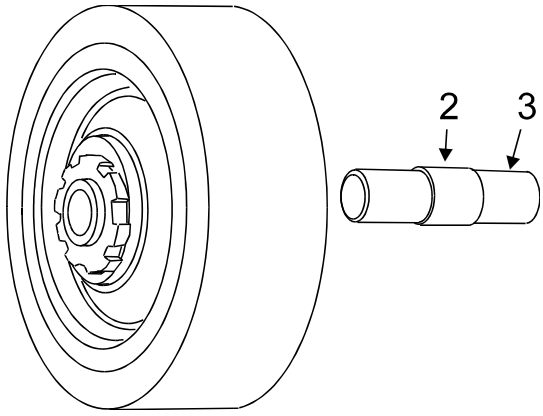
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17.3 Assembling the wheel

265 mm and 300 mm wheels without brakes



300 mm wheel with brake and 350 mm wheel



For wheels with brakes:

- Place the brake unit in position in the wheel.
- 265 mm wheel and 300 mm wheels without brakes.
  Place the spacers (1) in position on the hub.
- Lift the wheel into position in the support arm.

NOTE!

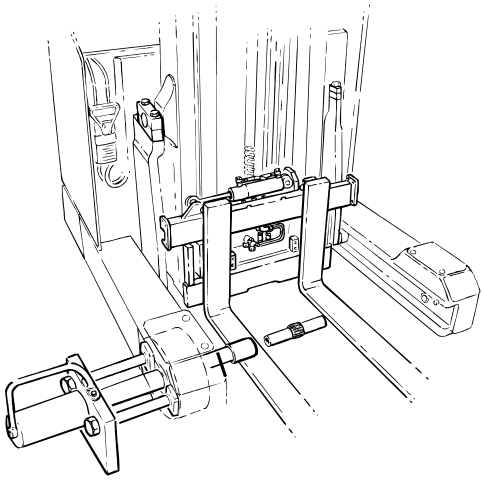
On wheels with brakes, guide the brake's locking shoe into its cut-out in the support arm.

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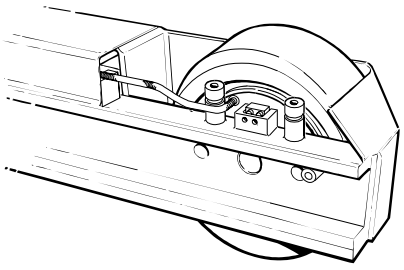
- To centre the wheel vertically, use a jack to adjust the height of the support arm.
- Check that the wheel axle (3) is not damaged. Minor longitudinal scratches can be tolerated.
  If the axle ends have been damaged, the axle should be ground or replaced.
- Fit a new clamping ring (2) on the wheel axle (3).

WARNING !
Loose wheel.
If the wheel is refitted using the old clamping ring, the wheel can become loose while driving.
Always fit the wheel with a new clamping ring on the wheel axle.

- Fit the extension punch on tool 08-13585 and insert it through the wheel hub and support arm.



- Secure the wheel axle using the punch and carefully insert the axle. Make sure the axle is not inserted too far. When the axle is correctly positioned it should be centred in the support arm's wheel bracket.
- Lower the truck.



For wheels with brakes

- Tighten the locking bolt for the brake's locking shoe and connect the brake cable. Secure the cable with a tie on the guard plate bracket so that it does not rub against the wheel.
- Fit the cover plate.

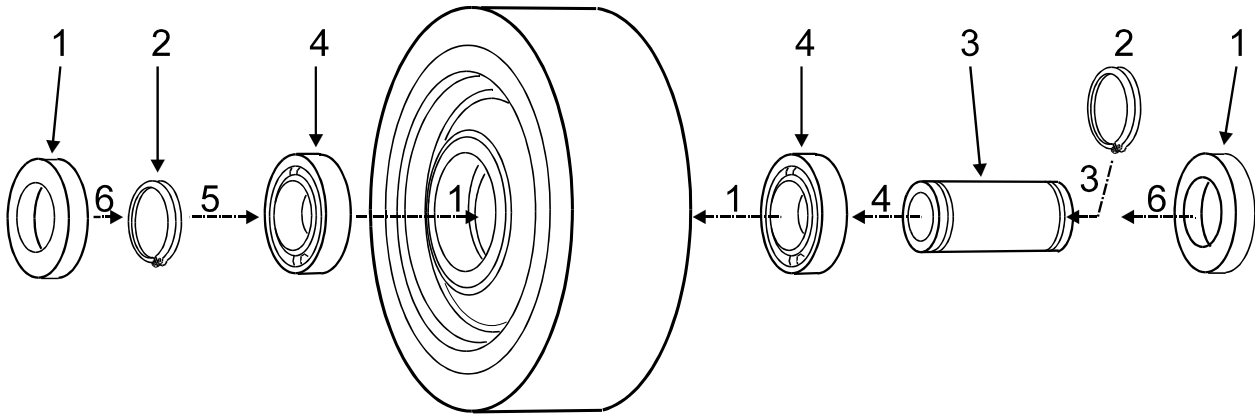
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17.4 Dismantling/assembling the wheel bearings

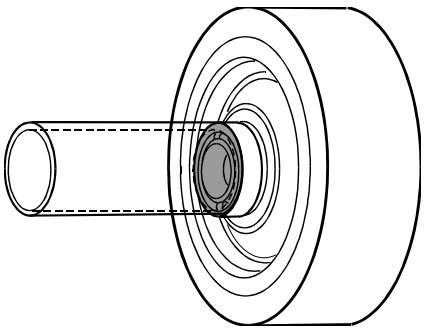
17.4.1 265 mm wheel and 300 mm wheel without brakes.

Dismantling the bearing

- Remove the spacers (1).
- Remove the retainer rings (2).
- Press out the sleeve (3).
- Use a “soft” brass punch or similar to knock out the bearings (4).

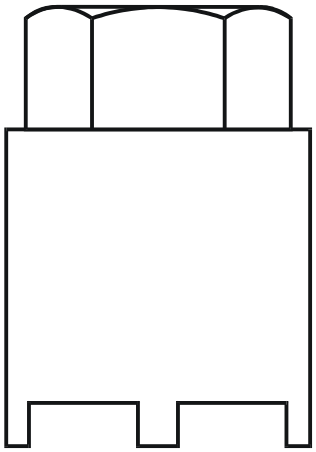


Assembling bearings



- Press in the bearings (4). Use an assembly sleeve of the same outside diameter as the bearing’s outer ring, 90 mm.
- Check that the sleeve (3) is not damaged.
- Fit one of the retainer rings (2) on the sleeve.
- Press in the sleeve until the retainer ring stops against the bearing.
- Fit the other retainer ring.
- Place the spacers (1) in position on the hub.

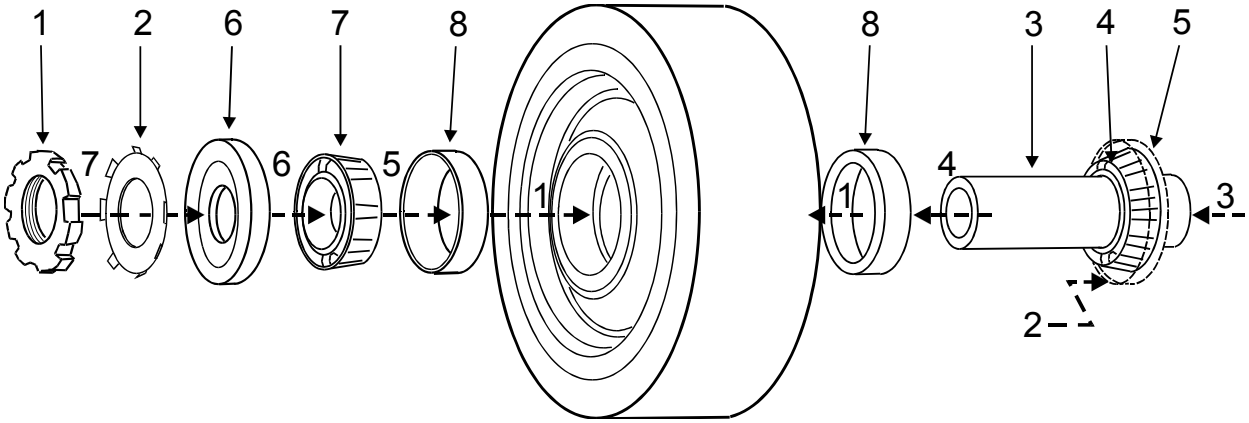
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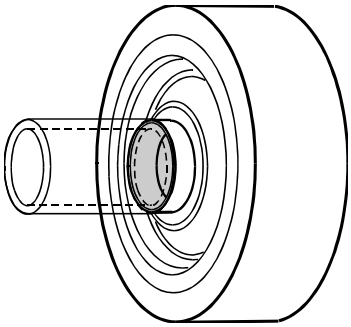


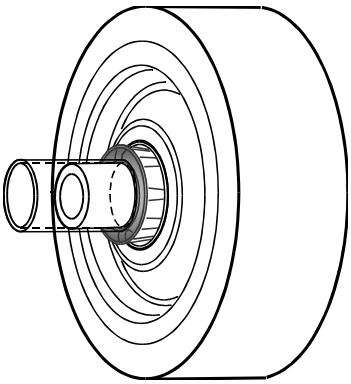
17.4.2 300 mm wheel with brake and 350 mm wheel

Dismantling the bearing

- Loosen the sleeve nut (1). Tools: Sleeve no. 808-413.
- Remove the lock washer (2).
- Press out the sleeve (3).
- Pull the bearing off the sleeve (4) and remove the seal (5).
- Remove the seal (6) and bearing (7).
- Use a “soft” brass punch or similar to tap out the bearing cups (8) from the hub.







Assembling bearings

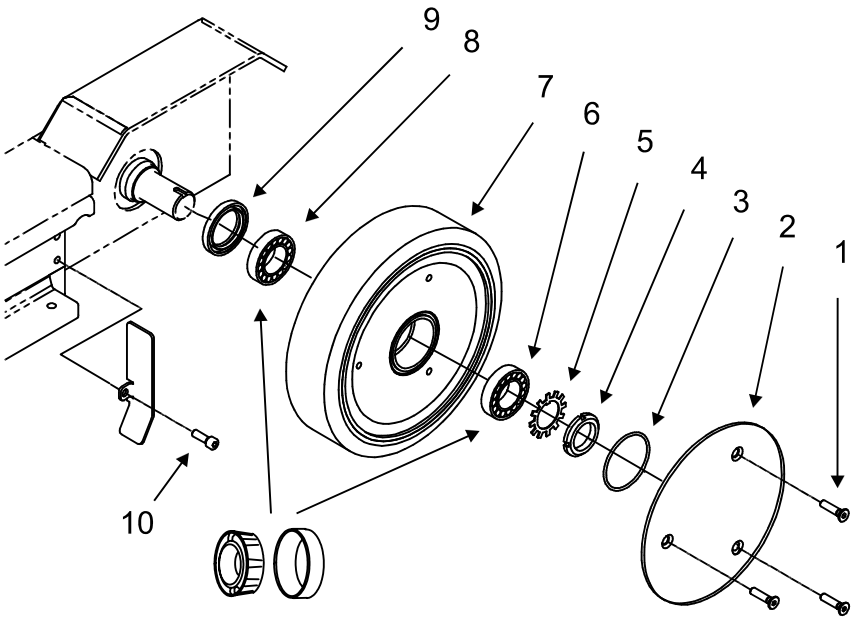
- Fit the bearing cups in the hub.
  Use an assembly sleeve of the same outside diameter as the bearing cup’s diameter, 80 mm.
- Place the sealing ring (5) on the sleeve.
- Press the sleeve into the bearing (4).
- Grease the bearing using bearing grease and place the sleeve with bearing in the wheel. Guide the sealing ring into position on the hub.
- Press on the bearing (7) on the other side of the wheel.
- Fit the sealing ring (6) on the hub.
- Fit the lock washer (2) and sleeve nut (1).
- Tighten the nuts to 50 Nm.
  Tool 808-413 and a torque wrench.
  The threads should be greased prior to assembly.
- Lock the nut by folding at least one of the washer’s tabs down into the nut’s cut-out.

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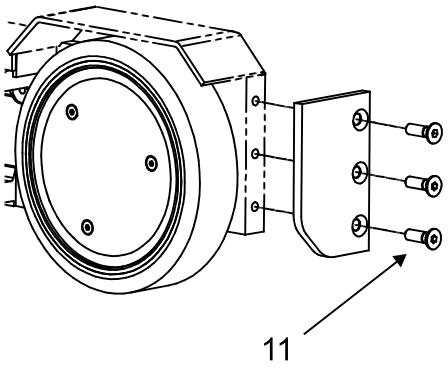
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18-Fork/support arm wheel – 3550.2

18.1 General



18.2 Dismantling the wheel



- Lift up the truck and support using blocks so that the support arm wheel runs free of the ground.
- Unscrew the bolts (1) holding the guard plate (2).
- Remove the guard plate.
- Remove the O-ring (3).
- Fold up the locking tabs on the washer (5) and remove the nut (4).

Carefully remove the wheel (7) so that the axle is not damaged.
If necessary the front and rear plates (10, 11) can be removed.

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18.3 Assembling the drive wheel

- Press the wheel on axle using tool 08-14044.
- Fit the lock washer (5) and nut (4).
- Tighten the nut (4) so that the bearing rotates without any play. The threads should be greased prior to assembly.
- Lock the nut by folding down one of the washer's tabs into the nut's cut-outs.
- Fit the O-ring (3).
- Fit the guard plate (2) and secure in position with the bolts (1).

18.4 Dismantling the wheel bearing

- Remove the sealing ring (9) and the inner part of the bearing (6, 8).
- Use a "soft" punch of brass or the like to knock out the bearing cups (6, 8).

18.5 Assembling the wheel bearing

- Fit the bearing cups in the hub using assembly tool 08-14044-2.
- Grease the bearing with bearing grease and fit the wheel.
- Fit the sealing rings in the hub using assembly tool 08-14044-1.

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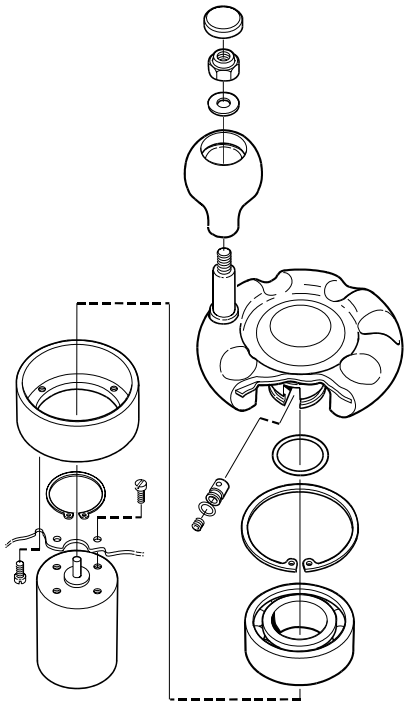
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19-Mechanical steering system – 4100

19.1 General

The steering generatoris fitted in the steering panel and has direct contact with the steering wheel. When you turn the steering wheel the steering generator sends voltage to the steering motor via the electronic card.

19.2 Replacing the steering generator



19.2.1 Dismantling

- Loosen the bolts on the lower panel and remove it.
- Disconnect the connector on the steering generator.
- Dismantle the steering wheel by unscrewing the bolts around the steering generator.
- Loosen the bolts in the driving disc and remove it from the steering generator.
- Unscrew the bolts holding the steering generator on the steel bracket.

19.2.2 Assembling

- Bolt the steering generator onto the steel bracket.
- Secure the driving disc on the steering generator’s shaft.
- Replace the O-ring on the driving disc if necessary.
- Bolt the steering wheel onto the steel bracket.
- Connect the steering generator’s electrical connector.
- Bolt on the lower panel.

Mechanical steering system – 4100

Replacing the steering generator

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20-Steering angle sensor – 4350

20.1 General

These instructions apply to adjustment of the steering angle sensor mounted on the driving gear.

20.2 Procedure

The information supplied by the two directional arrows in the display changes as the sensor detects a change between the high and low level in the driving gear.

The two-way sensor uses the gear wheel to calculate the steering angle and displays the value in the display's compass rose.

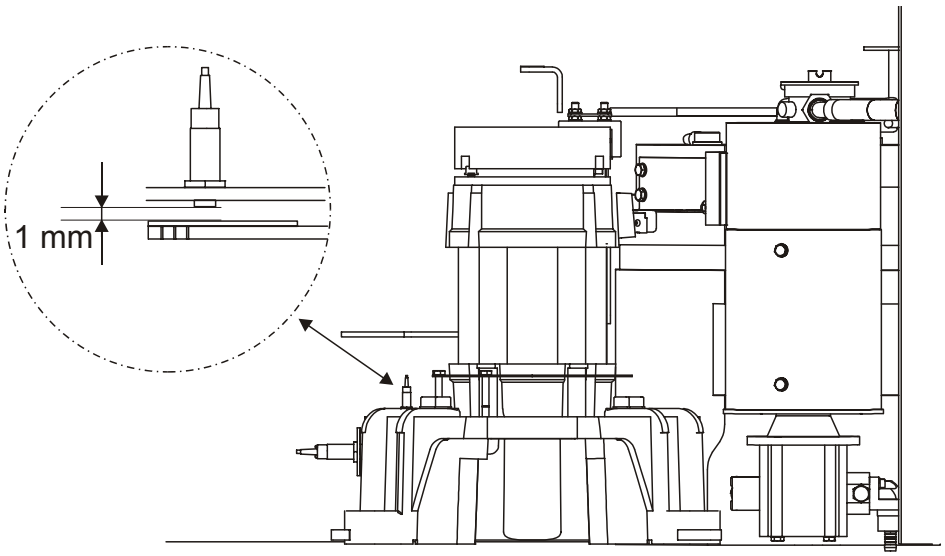
NOTE:

The sensor may be damaged if it is adjusted against an incorrect surface.
Always adjust the sensor against the upper surface.

20.1 Adjustment of directional sensor

Adjust the sensor to a detection range of 1 mm.

- Screw the sensor onto the machined surface until the two touch each other.
- Then unscrew one full rotation.
- Verify that the LED on the sensor/electronic card lights when it is in front of the machined surface.



Steering angle sensor – 4350

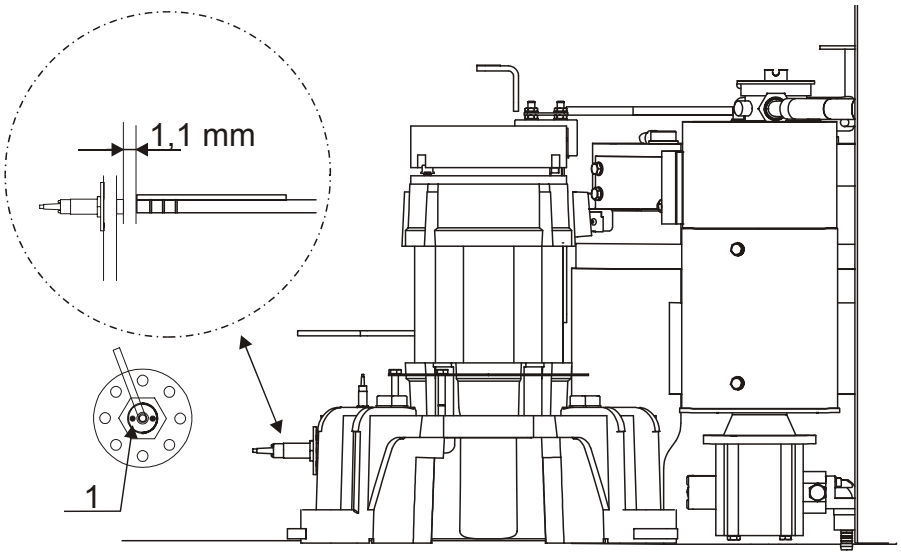
Procedure

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20.1.1 Adjustment of the steering angle sensor

Roughly adjust the sensor to a detection range of ~1.1 mm.

- Measure the supply voltage to the sensor, i.e. connector 810 on the A5 electronic card.
- Screw the sensor onto the large plate until it touches the right part of the cog.
- Then unscrew one full rotation.
- Make sure the sensor is mounted with the LEDs set horizontal and the red LED facing the fork direction.
- Fine-adjust by turning the outer, large plate.
- Measure the voltage on both sensor outputs while the steering wheel is turning and the gear rotating.
- To achieve a correct on/off switching pulse, the voltage on the sensor outputs, or connectors 210 and 211 on the A5 electronic card, should be half that of the supply voltage.
- Finally tighten the large nut and the sensor mounting screws.



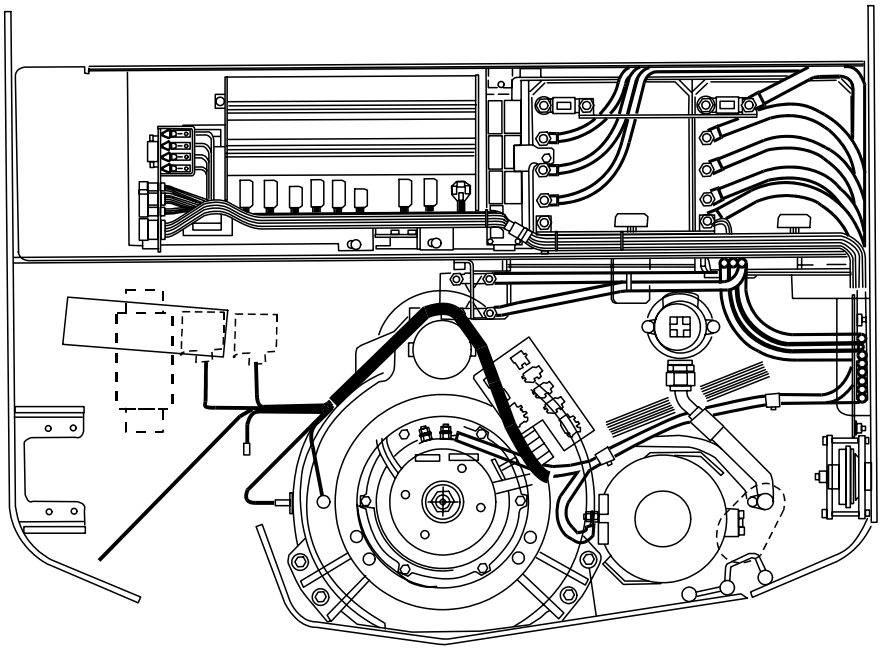
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21-Electrical system – 5000

21.1 General

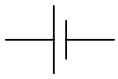
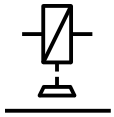
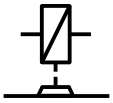
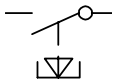
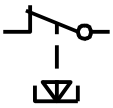
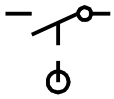
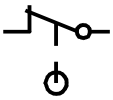
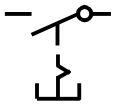
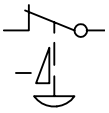
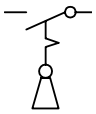
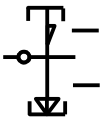
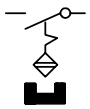
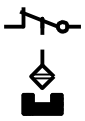
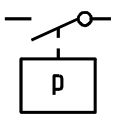
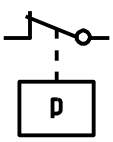
21.1.1 Electrical panel



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21.2 Symbol list and wiring diagrams

21.2.1 List of symbols

Symbol	Description	Symbol	Description
	Battery		
	Brake coil, normally released		Brake coil, normally applied
	Switch, normally open		Switch, normally closed
	Push-button switch, normally open		Push-button switch, normally closed
	Momentary switch, normally open		Momentary switch, normally closed
	Push-button switch, latching, normally open		Emergency switch
	Key switch, normally open		Push-button switch, latching and momentary
	Electro-magnetic switch, normally open		Electro-magnetic switch, nor- mally closed
	Pressure-sensitive switch, normally open		Pressure-sensitive switch, normally closed

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Electrical system – 5000

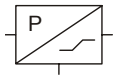
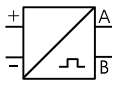
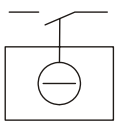
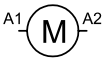
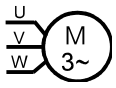
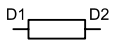
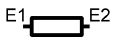
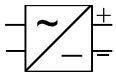
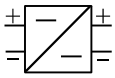
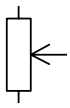
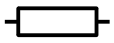
Symbol list and wiring diagrams

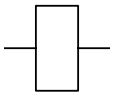
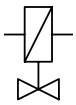
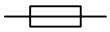
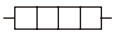
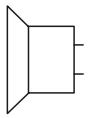
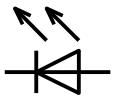
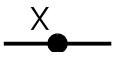
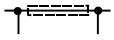
Valid from serial number
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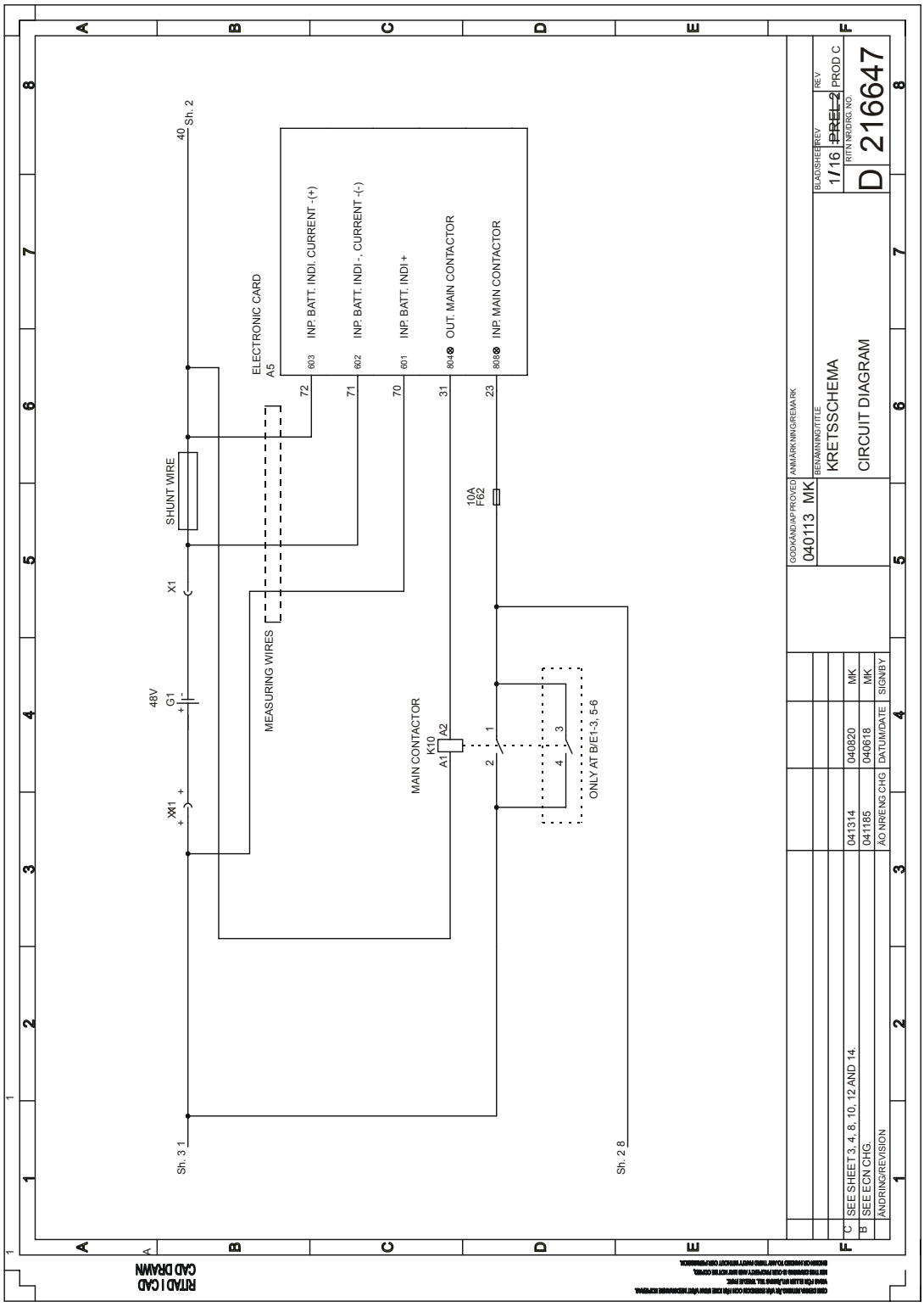
Date
2005-06-01

Symbol	Description	Symbol	Description
	Pressure sensor		
	Capacitive switch, normally open		Capacitive switch, normally closed
	Inductive sensor, normally open		Inductive sensor, normally closed
	Pulse sensor		Thermostat, adjustable
	Seat heater with thermostat		Thermoelectric sensor
	Motor, general		Series motor, armature coil, DC
	Series motor, DC		Motor, permanent magnet
	Three-phase motor, AC		
	Series winding		Shunt winding
	Converter, AC/DC		Converter, DC/DC
	Variable resistor (potentiometer)		Resistor

Symbol	Description	Symbol	Description
	Contactor		Horn
	Lamp		Valve
	Fuse		Diode
	Antenna		Heater element
	Speakers		
	Zener diode		Light emitting diode (LED)
	Contact		Contact, multiple-poles
	Capacitor		Feed cable

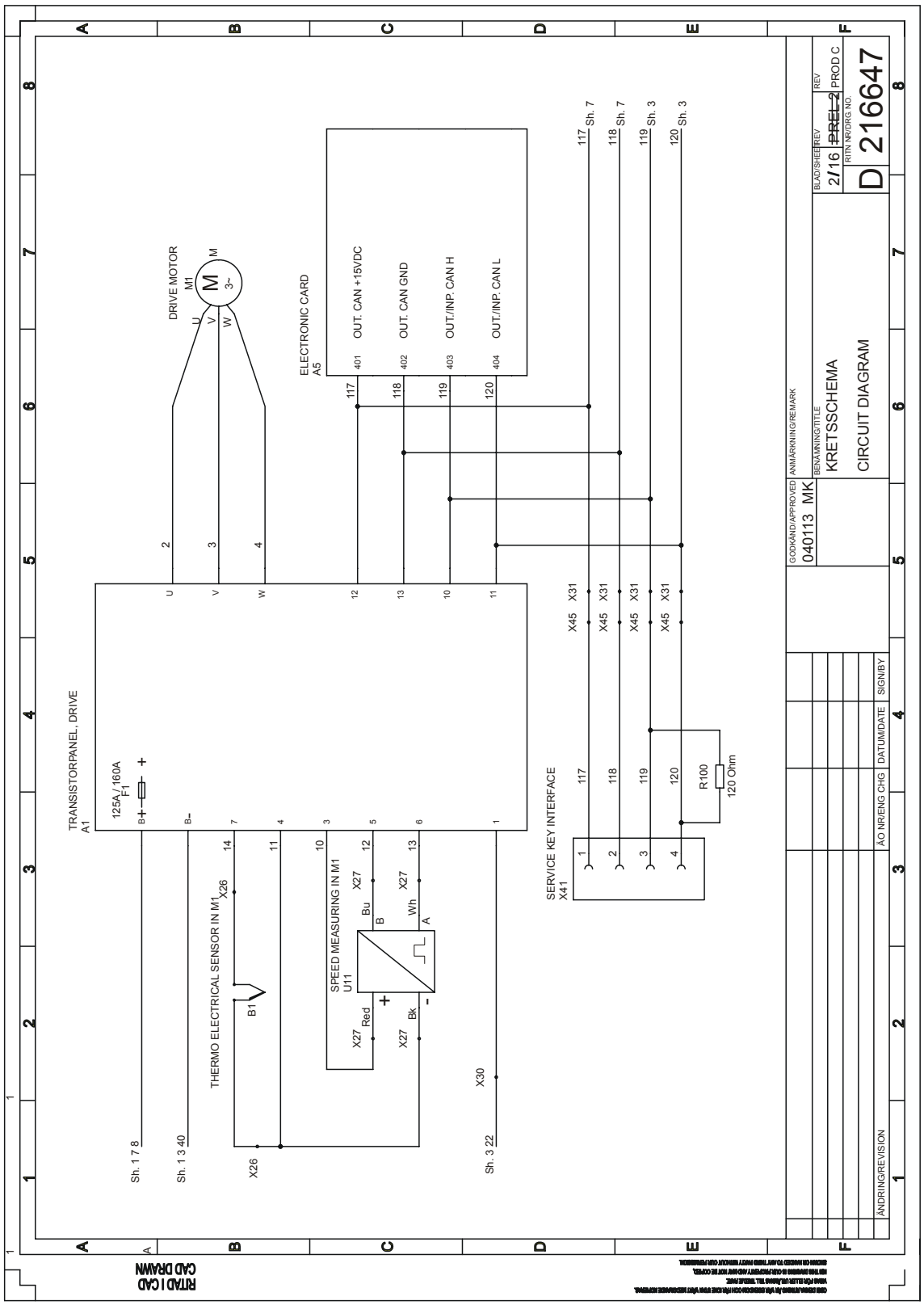
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21.2.2 Wiring diagram (1/16)

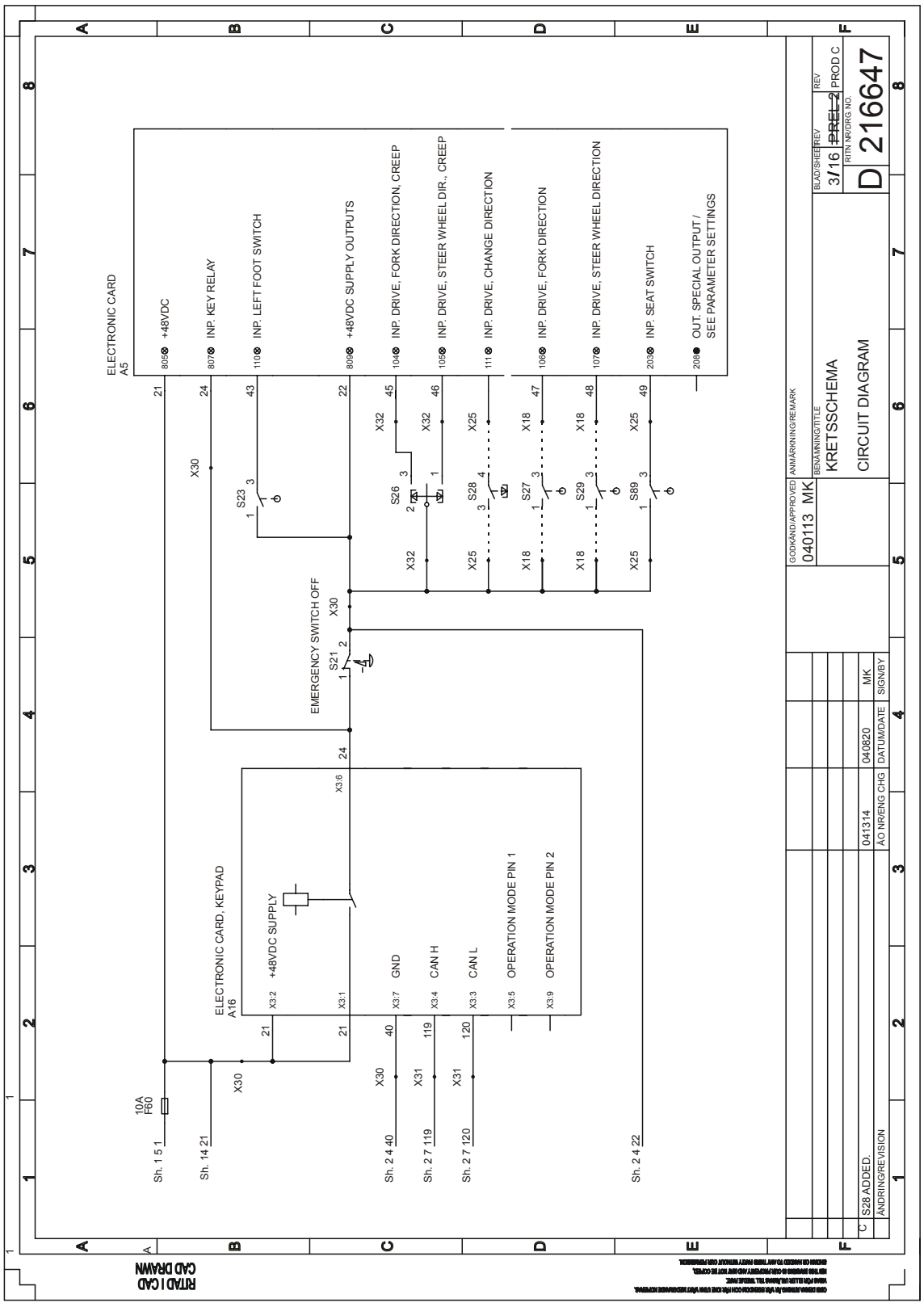


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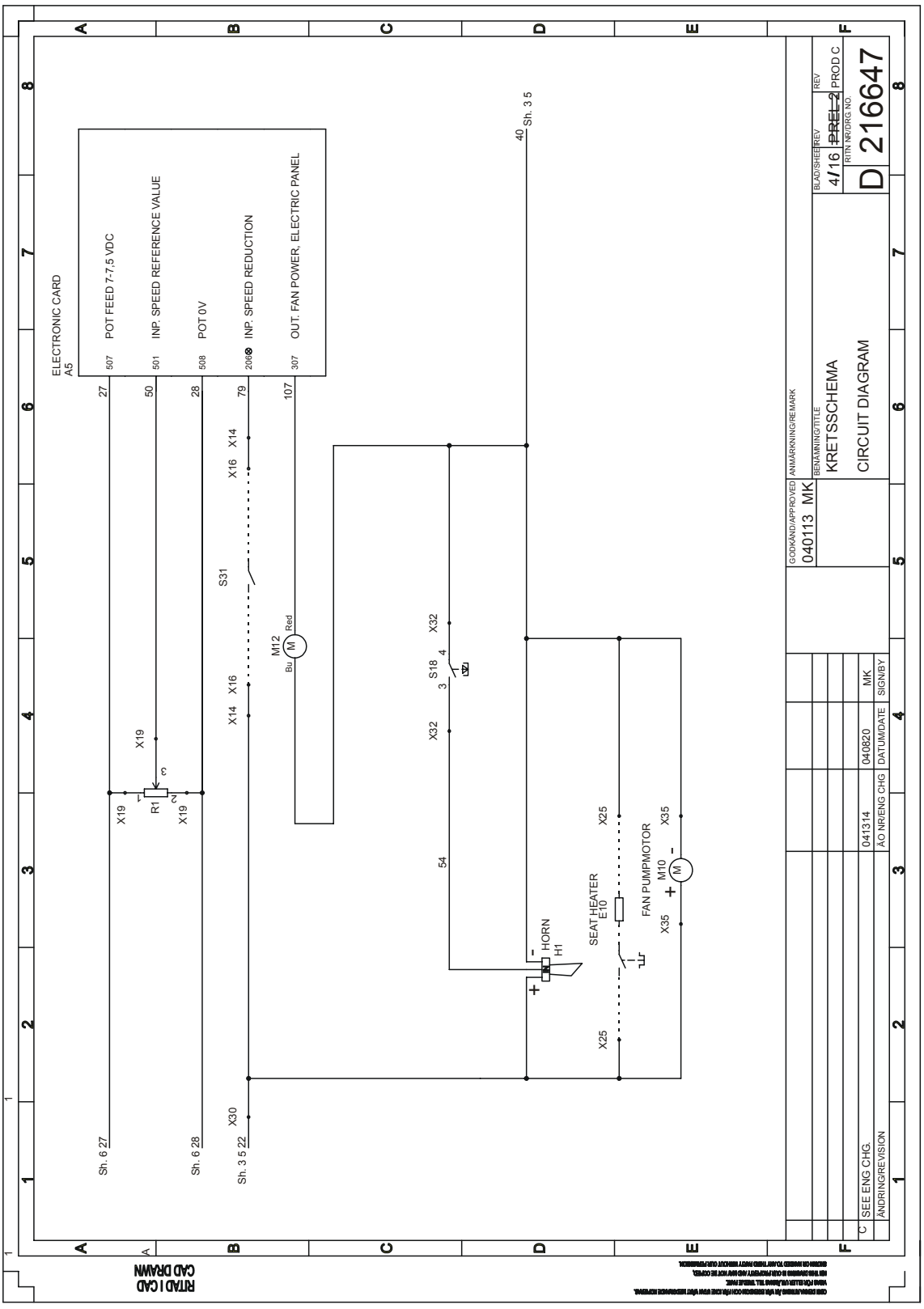
21.2.3 Wiring diagram (2/16)



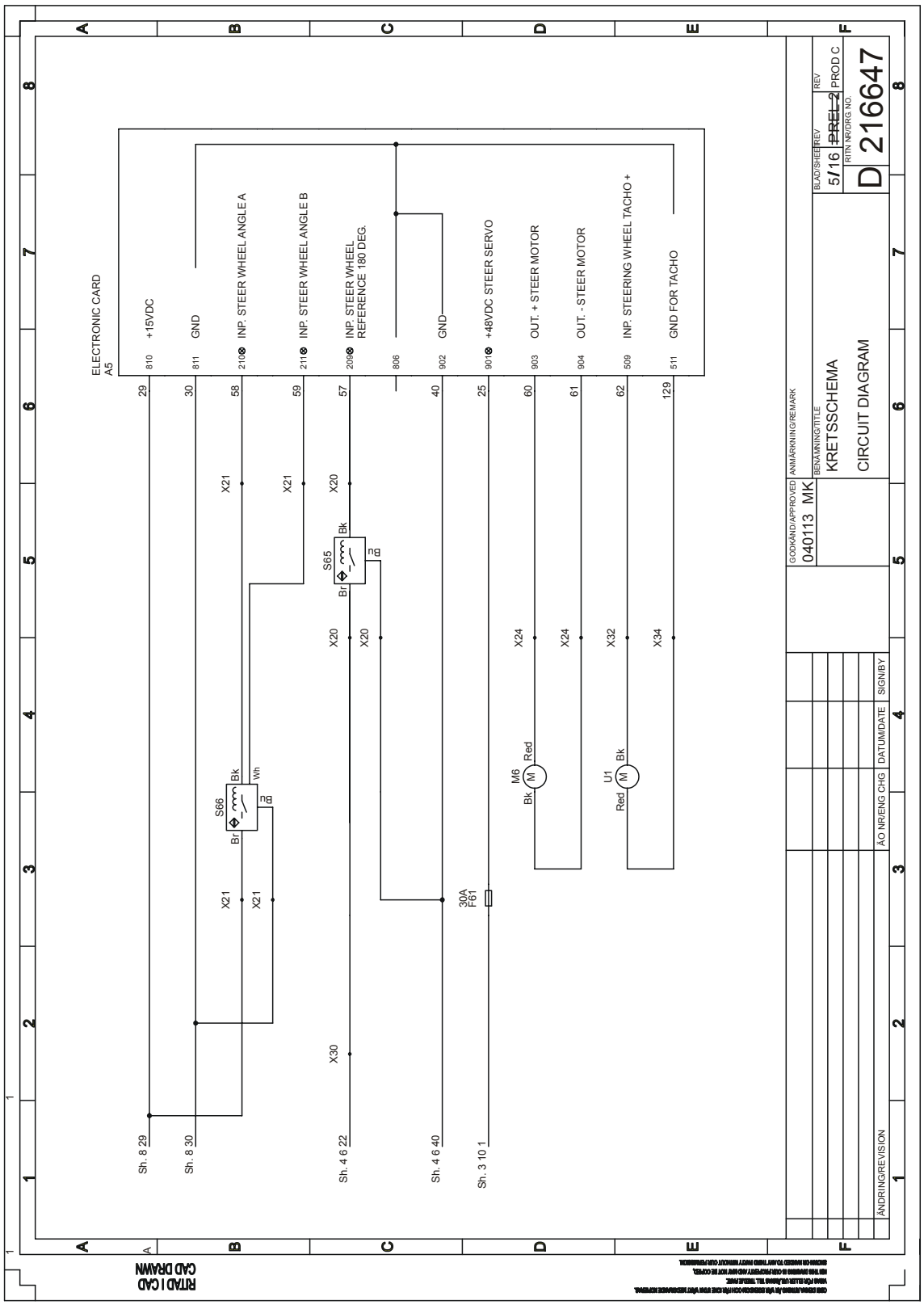
21.2.4 Wiring diagram (3/16)



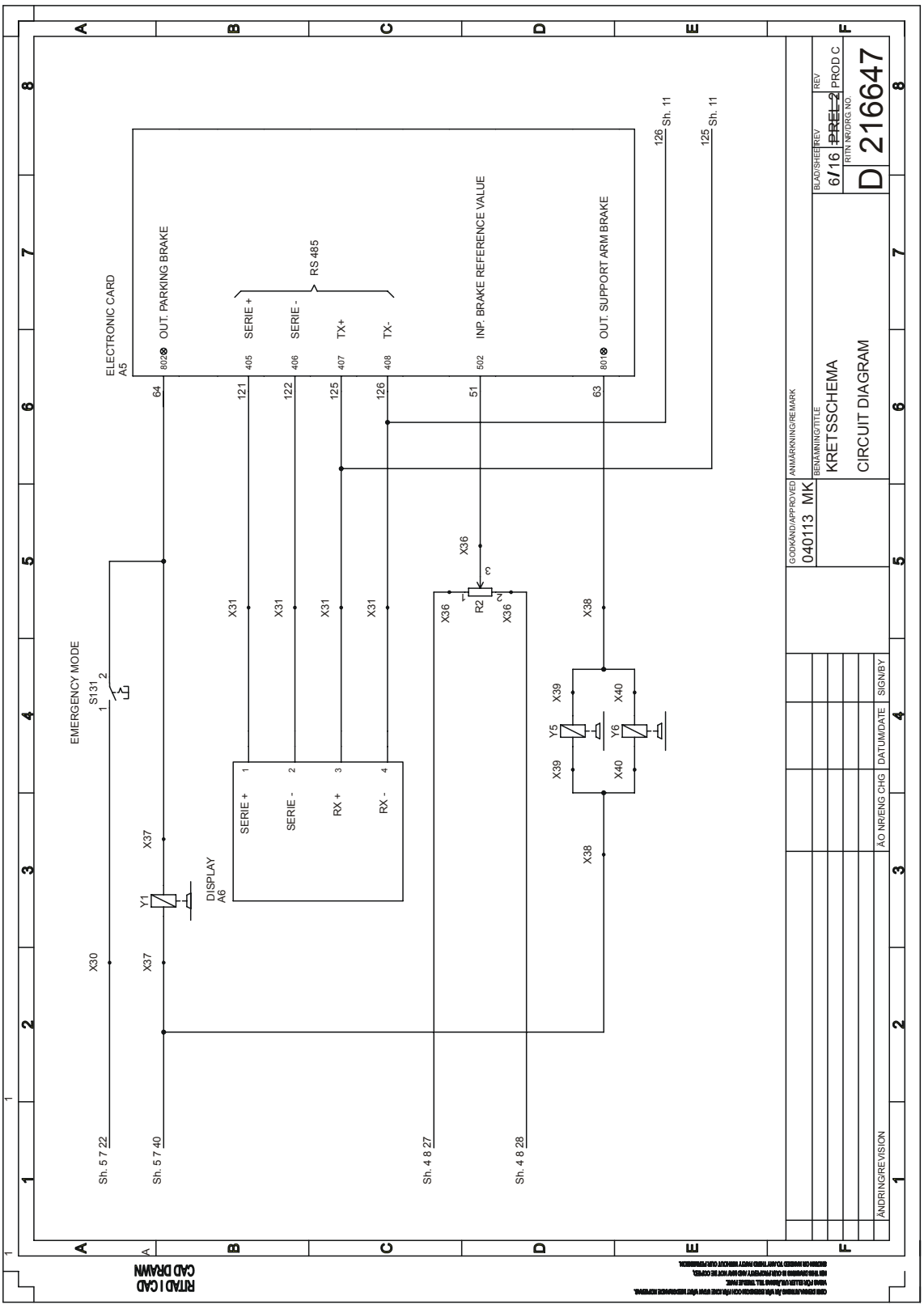
21.2.5 Wiring diagram (4/16)



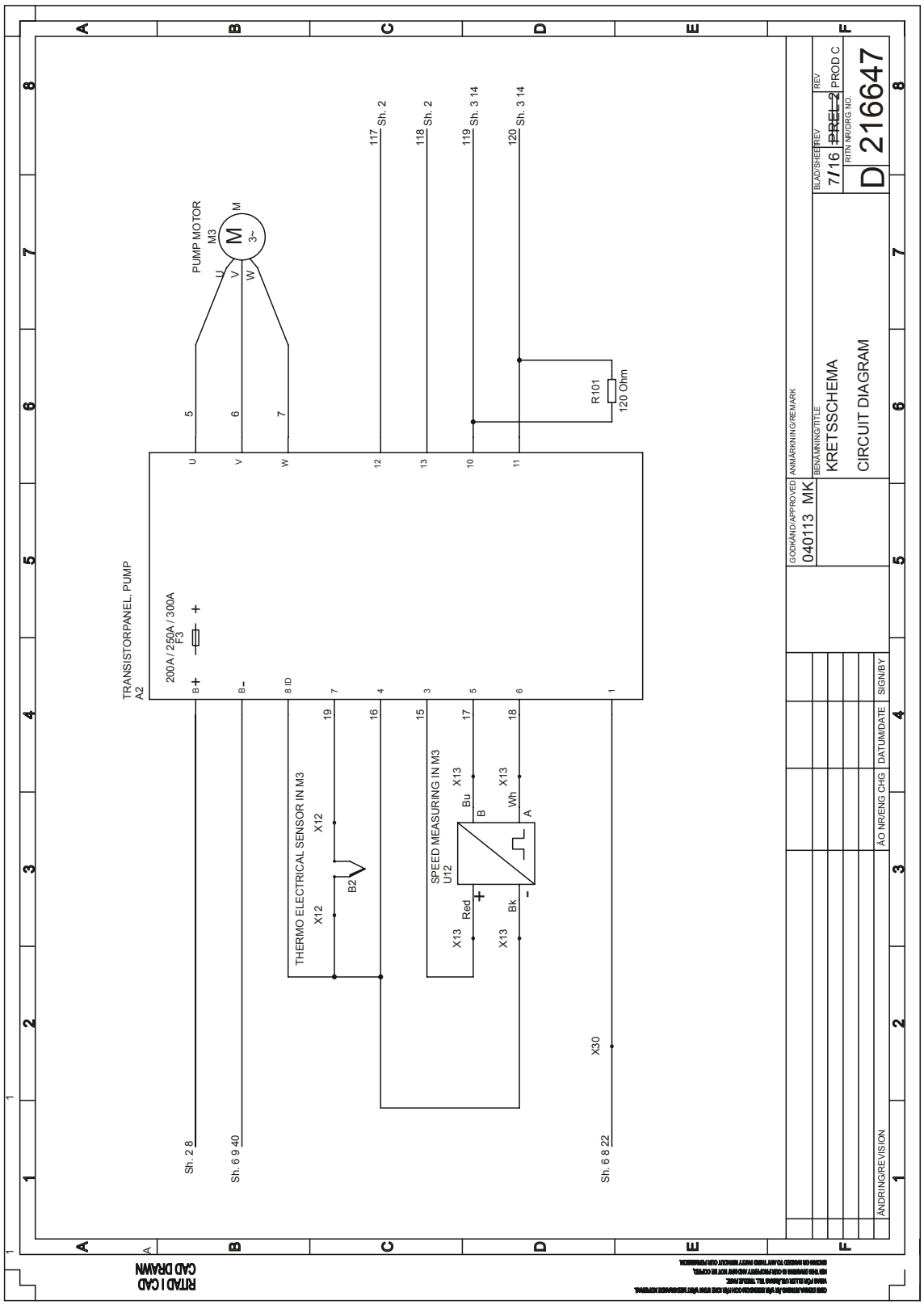
21.2.6 Wiring diagram (5/16)



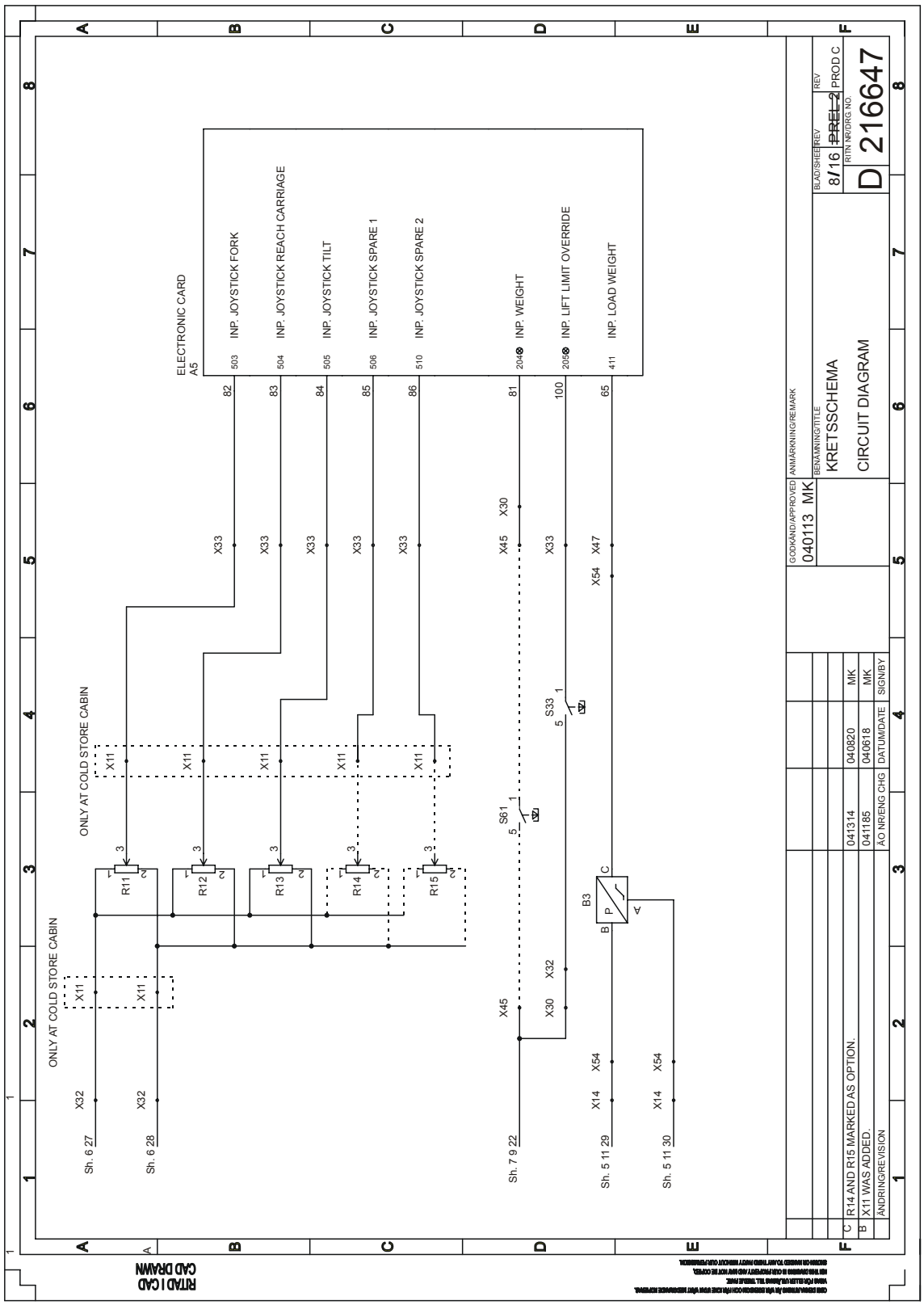
21.2.7 Wiring diagram (6/16)



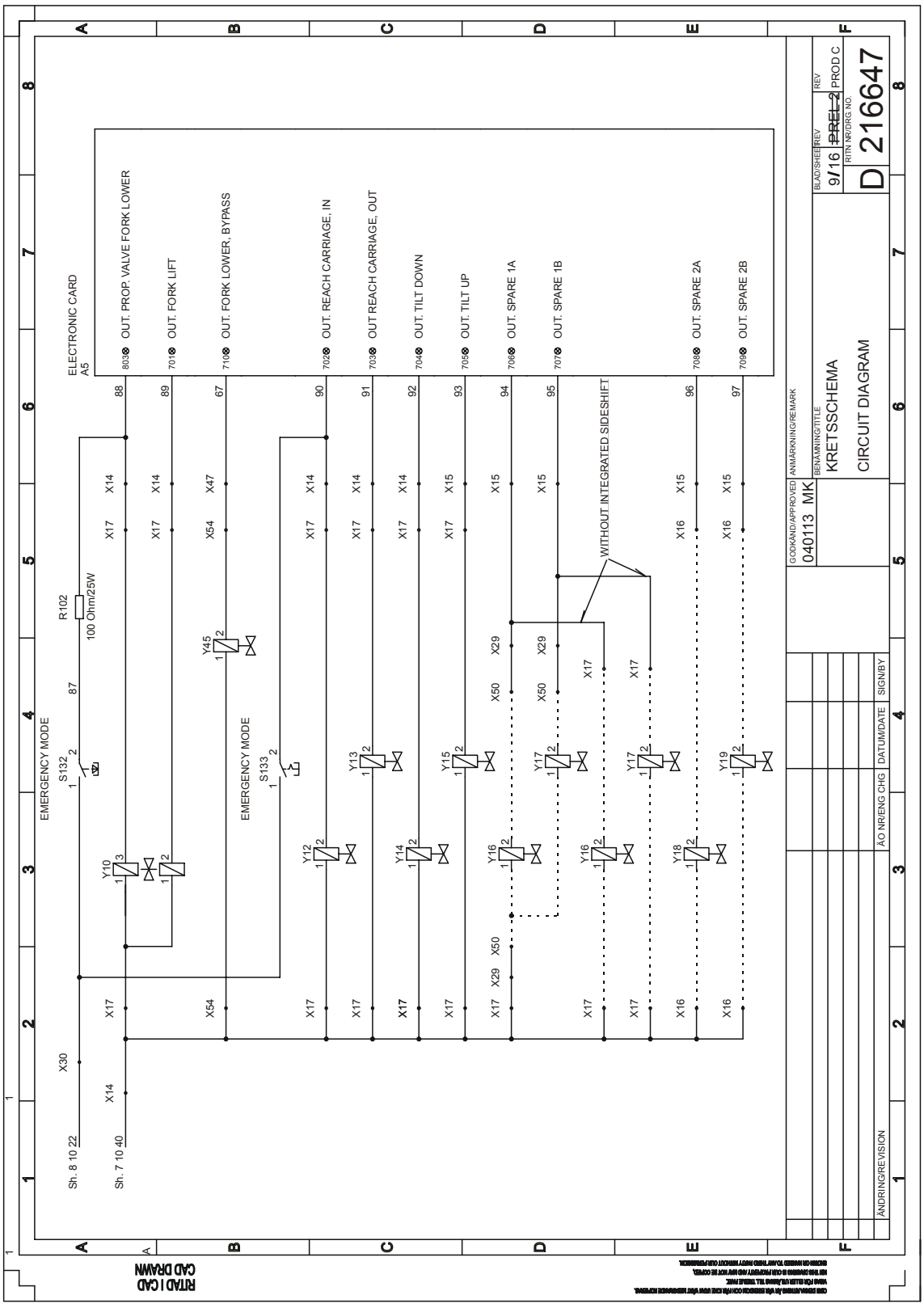
21.2.8 Wiring diagram (7/16)



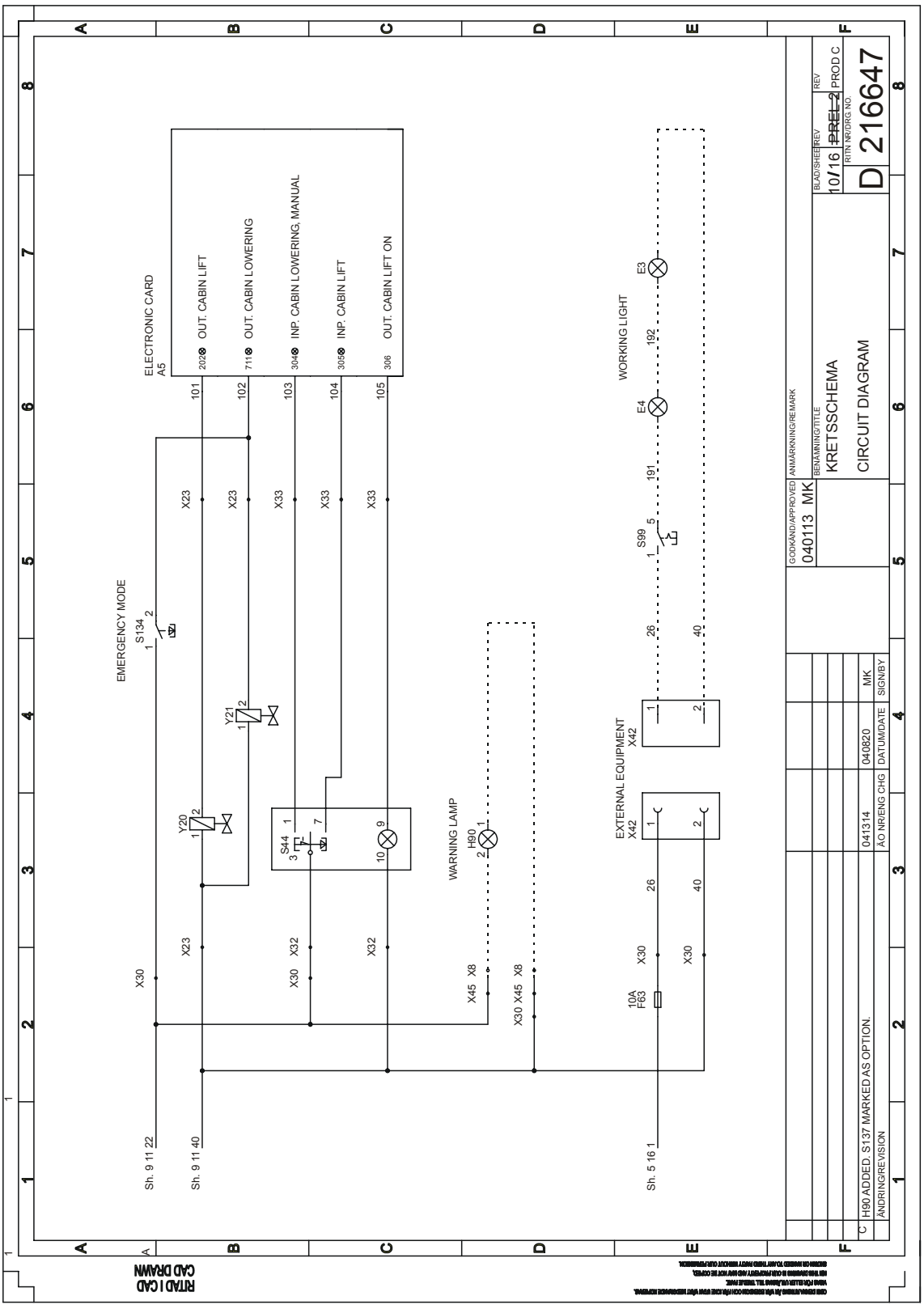
21.2.9 Wiring diagram (8/16)



21.2.10 Wiring diagram (9/16)

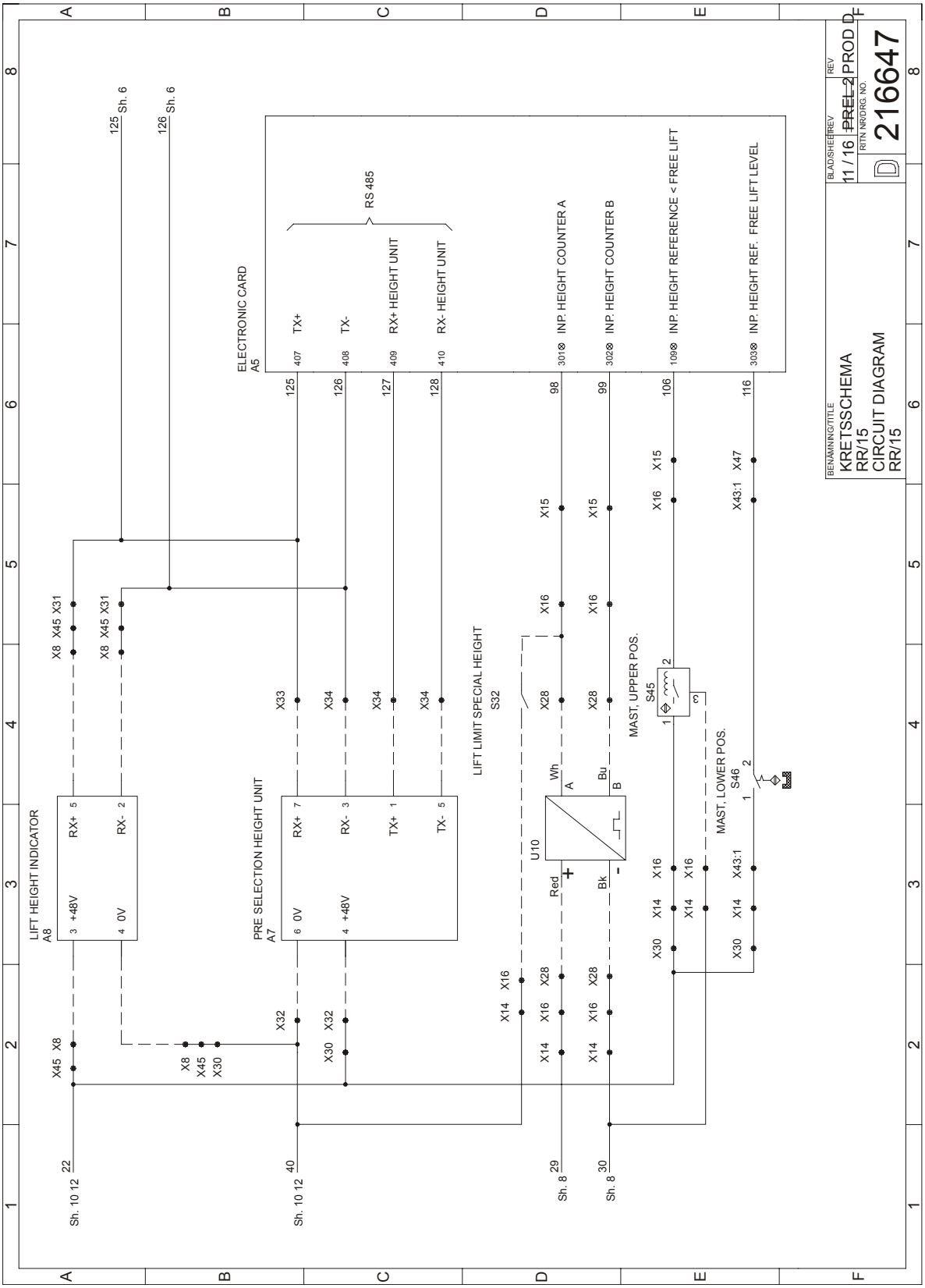


21.2.11 Wiring diagram (10/16)

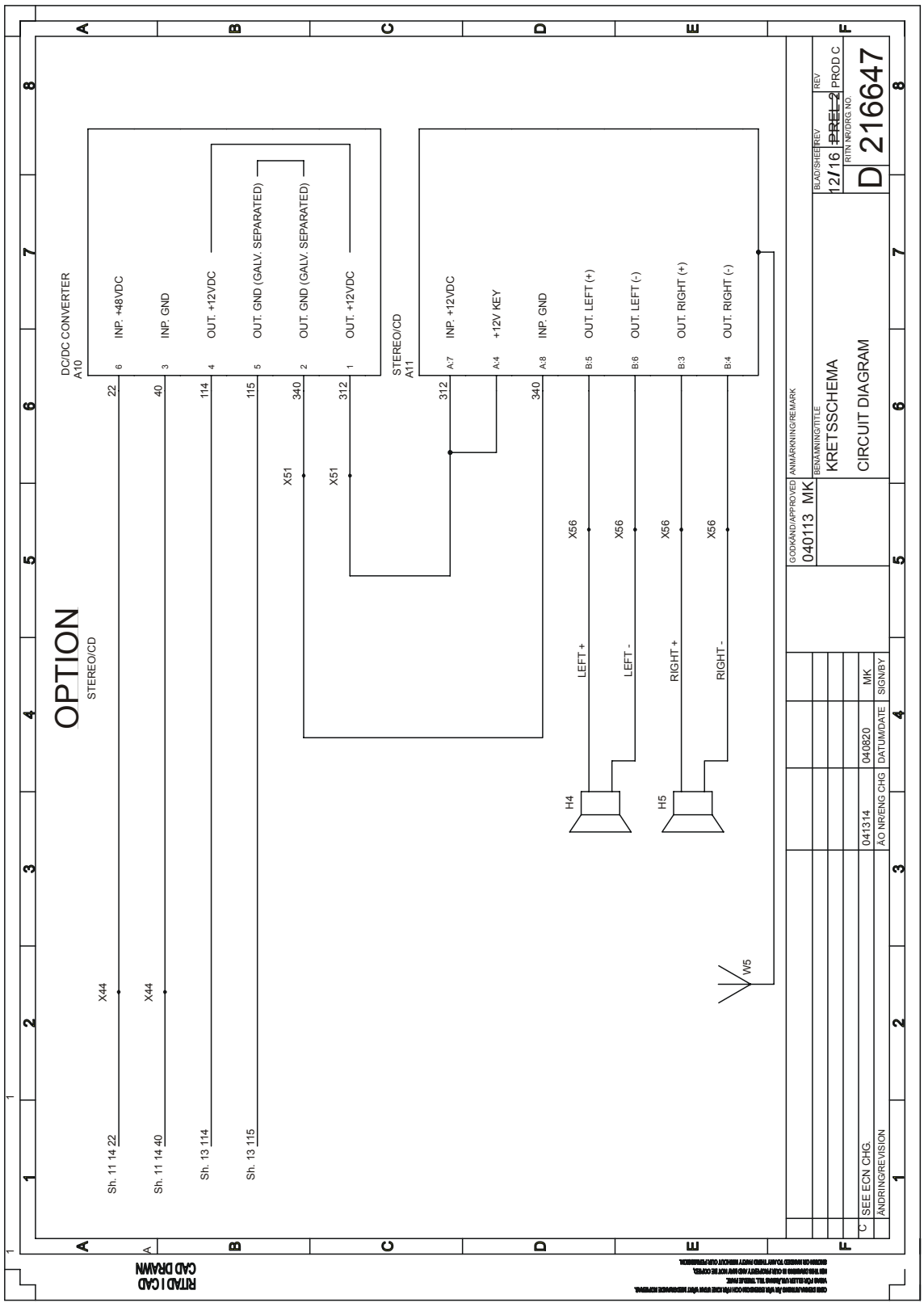


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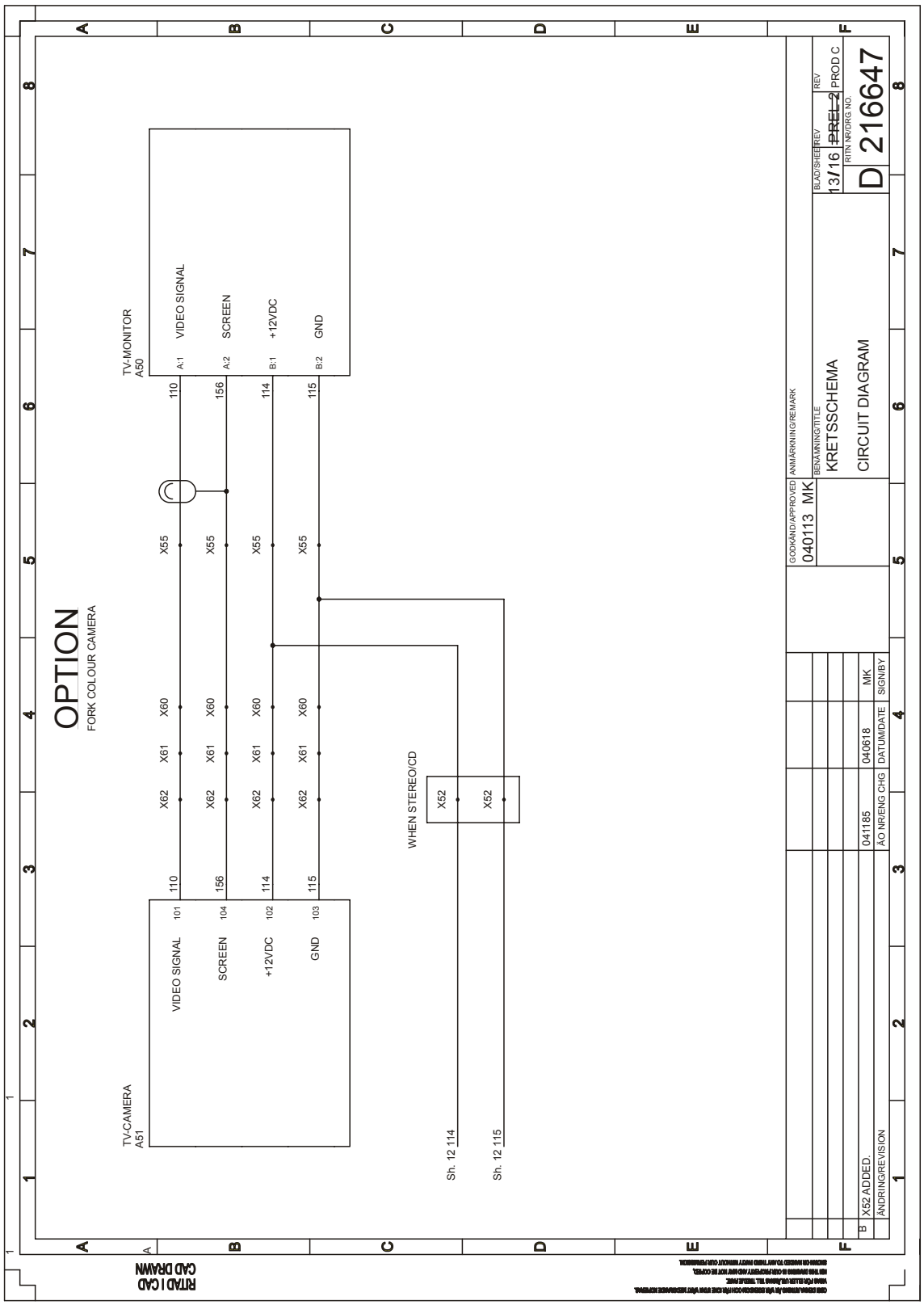
21.2.12 Wiring diagram (11/16)



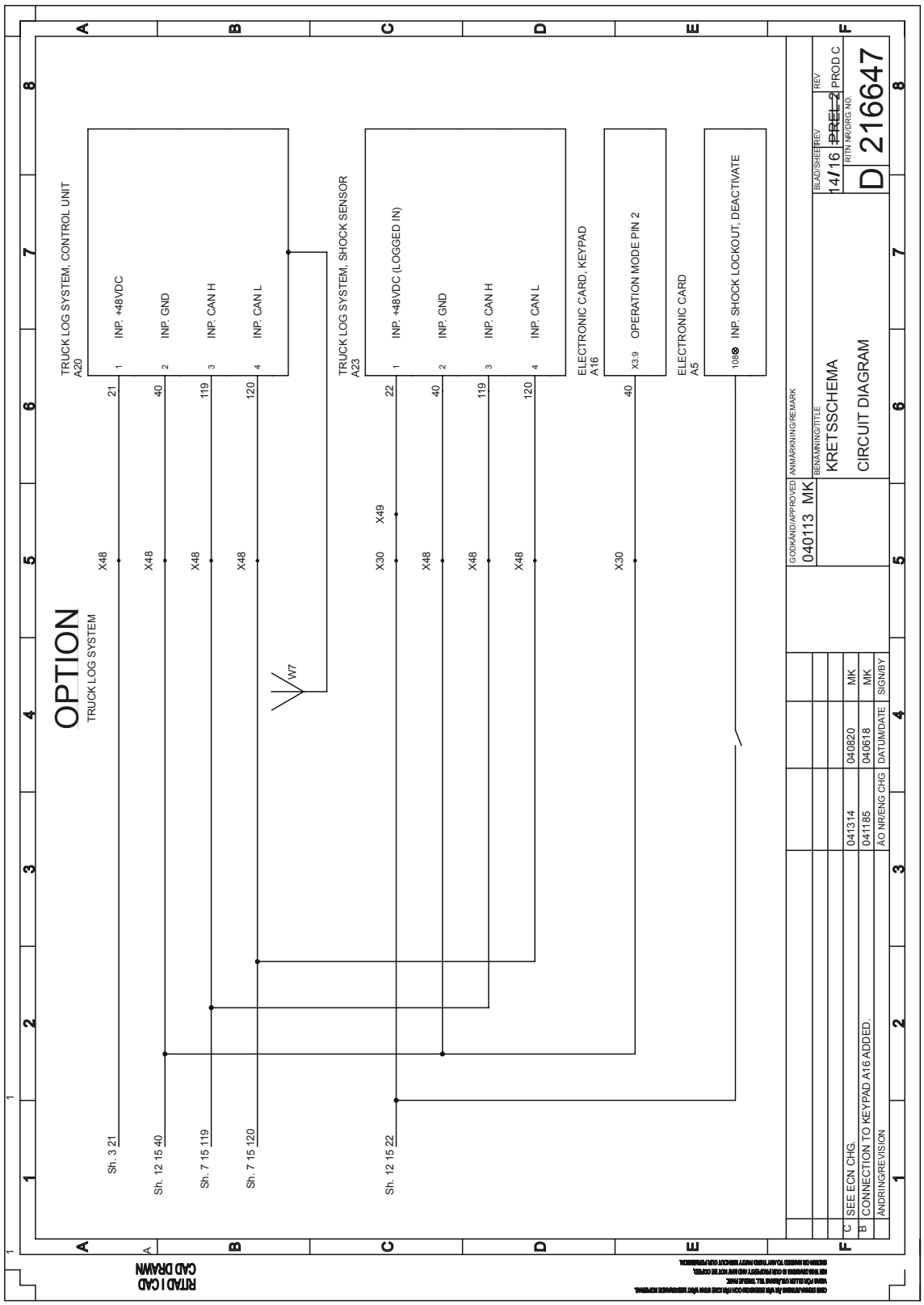
21.2.13 Wiring diagram (12/16)



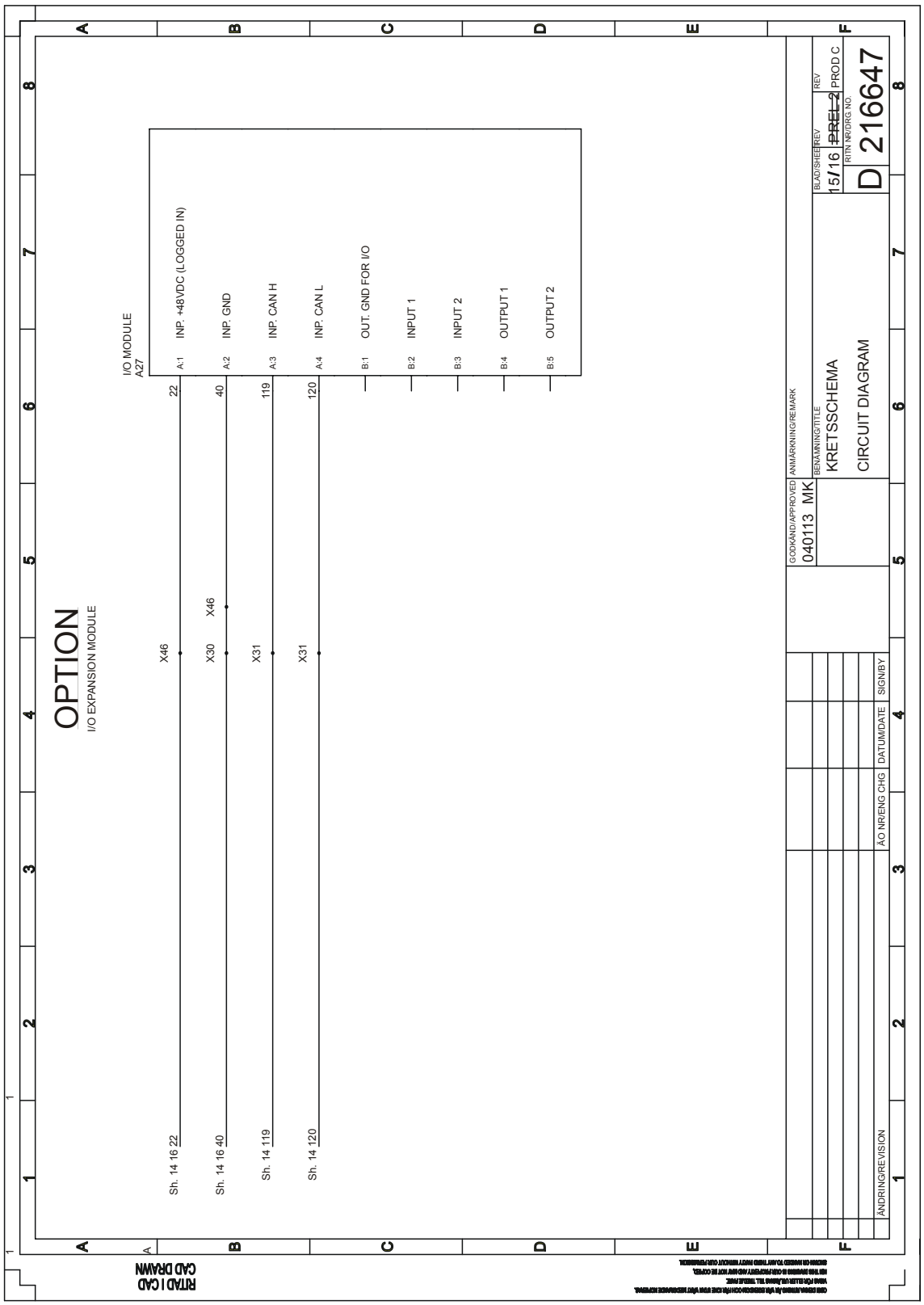
21.2.14 Wiring diagram (13/16)



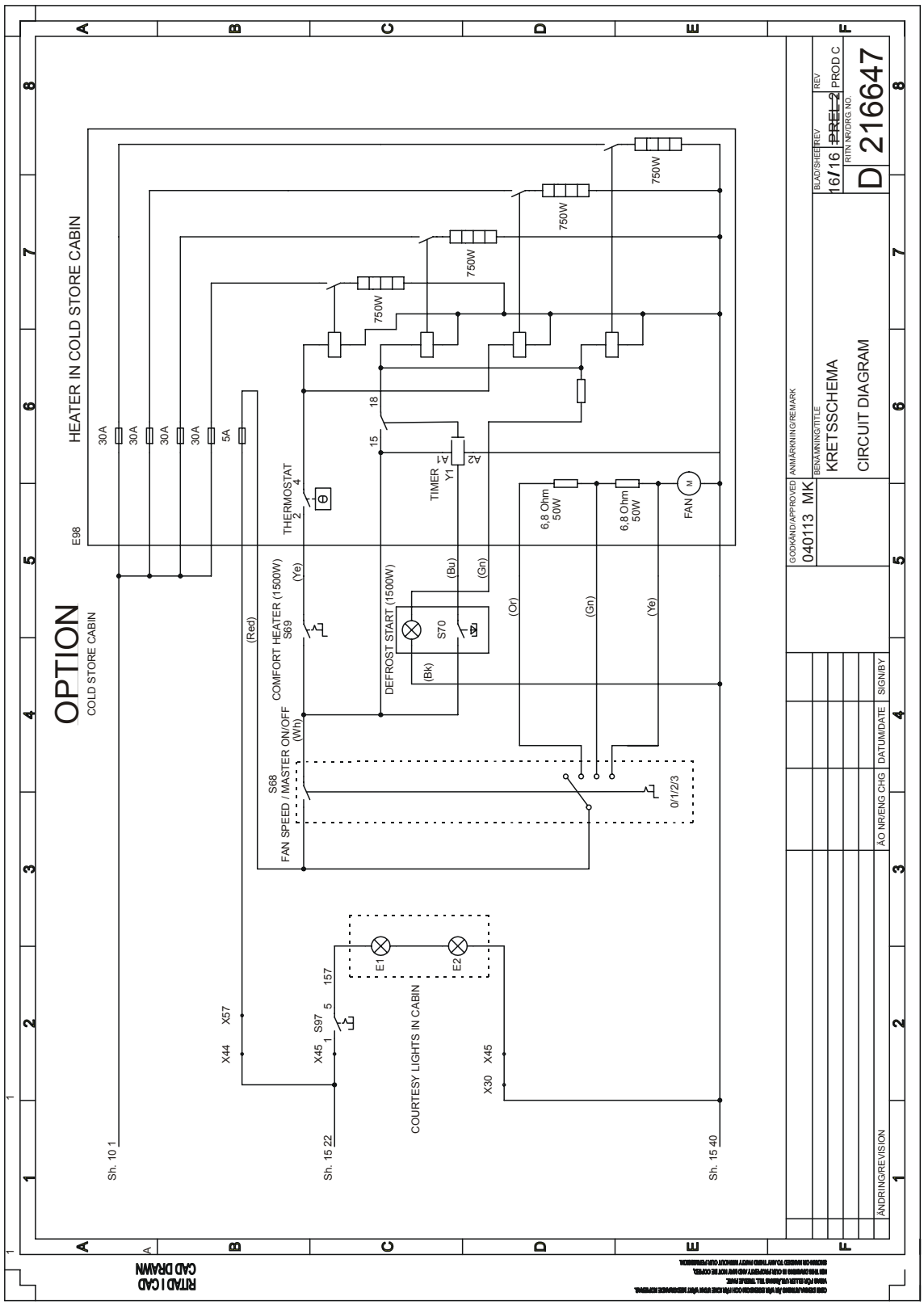
21.2.15 Wiring diagram (14/16)



21.2.16 Wiring diagram (15/16)



21.2.17 Wiring diagram (16/16)



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21.3 Component list

Table 6: Component list

Symbol	Designation/function	Pic-ture
A1	Frequency converter, M1	5
A2	Frequency converter, M3	5
A5	Electronic card	5
A6	Display	1
A7	Height pre-set	2
A8	Height indication display	8
A10	DC/DC converter	10
A11	Stereo/CD	10
[A1]	Electronic card, keyboard	1
A20	TLS, CU	12
A23	TLS, Shock sensor	12
A2	I/O Module	
A50	TV monitor	11
A51	TV camera	11
B1	Thermoelectric sensor, M1	5
B2	Thermoelectric sensor, M3	5
B3	Pressure sensor, hydraulics	6
E10	Seat heater	4
E1, E2	Cab lighting	9
E3, E4	Worklights	8
E98	Cab heating	9
F1	Drive motor fuse, 125/160 A	5
F3	Pump motor fuse, 200/250/300 A	5
F60	Operating fuse for A5 card, 10 A	5

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Table 6: Component list

Symbol	Designation/function	Picture
F61	Steering motor fuse, 30 A	5
F62	Operating fuse for K10, 10 A	5
F63	Operating fuse for extra equipment, 10/16 A	5
G1	Battery, 48 V	8
H1	Horn	5
H4	Speakers	10
H5	Speakers	10
H90	Warning light	8
K10	Main contactor	5
M1	Drive motor	5
M3	Pump motor	5
M6	Steering motor	5
M10	Fan for pump motor	5
M12	Fan for electrical panel	5
R1	Potentiometer, driving	5
R2	Potentiometer, brake	5
R11	Potentiometer, fork lift/lower	2
R12	Potentiometer, reach carriage	2
R13	Potentiometer, tilt	2
R14	Potentiometer, extra hydraulic function	2
R15	Potentiometer, extra hydraulic function	2
R100	Resistor, CAN, service key	8
R101	Resistor, CAN	5

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Table 6: Component list

Symbol	Designation/function	Picture
R102	Resistor, emergency lowering of forks	5
S1	Microswitch, driver number/programming	
S2	Microswitch, driver number/step up	
S3	Microswitch, driver number/step down	
S17	Key switch	
S18	Microswitch, horn	2
S21	Emergency switch	1
S23	Safety switch, left foot-pedal	3
S26	Microswitch, travel direction selector at crawl speed	2
S27	Microswitch travel direction (foot), fork direction	3
S28	Microswitch, travel direction selector, hand	4
S29	Microswitch travel direction (foot), steering wheel direction	3
S31	Microswitch, speed reduction	8
S32	Microswitch, max. lift height	8
S33	Microswitch, by-pass max. lift height	2
S44	Microswitch, cab tilt	8
S45	Microswitch, height indication	7
S46	Magnetic switch, lowering between free lift and main lift	7
S61	Microswitch, load weighing	2
S65	Pulse sensor, steering wheel centre	5
S66	Pulse sensor, steering wheel direction	5
S68	Switch, fan speed	9
S69	Switch, cab heating	9
S70	Switch, extra cab heating	9
S89	Microswitch, seat	4

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Table 6: Component list

Symbol	Designation/function	Pic-ture
S97	Switch, cab lighting	9
S99	Microswitch, work spotlight	1
S131	Microswitch, parking brake release	5
S132	Microswitch, emergency lowering of forks	5
S133	Microswitch, emergency retraction of mast	5
S134	Microswitch, emergency lowering of driver cabin	5
U1	Tachometer, steering	2
U10	Pulse sensor, height meter	7
U11	Pulse sensor, drive motor	5
U12	Pulse sensor, pump motor	5
X1	Contact	8
X8	Contact	8
X11	Contact	2
X12	Contact	5
X13	Contact	5
X14	Contact	5
X15	Contact	5
X16	Contact	6
X17	Contact	6
X18	Contact	5
X19	Contact	5
X20	Contact	5
X21	Contact	5
X23	Contact	5
X24	Contact	5
X25	Contact	4

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Table 6: Component list

Symbol	Designation/function	Pic-ture
X26	Contact	5
X27	Contact	5
X28	Contact	7
X29	Contact	6
X30	Contact	5
X31	Contact	5
X32	Contact	5
X33	Contact	5
X34	Contact	5
X35	Contact	5
X36	Contact	5
X37	Contact	5
X38	Contact	5
X39	Contact	8
X40	Contact	8
X41	Contact	8
X42	Contact	5
X43:1	Contact	6
X44	Contact	10
X45	Contact	1
X46	Contact	5
X47	Contact	5
X48	Contact	5
X49	Contact	5
X50	Contact	8
X51	Contact	10
X52	Contact	6
X54	Contact	6
X55	Contact	5

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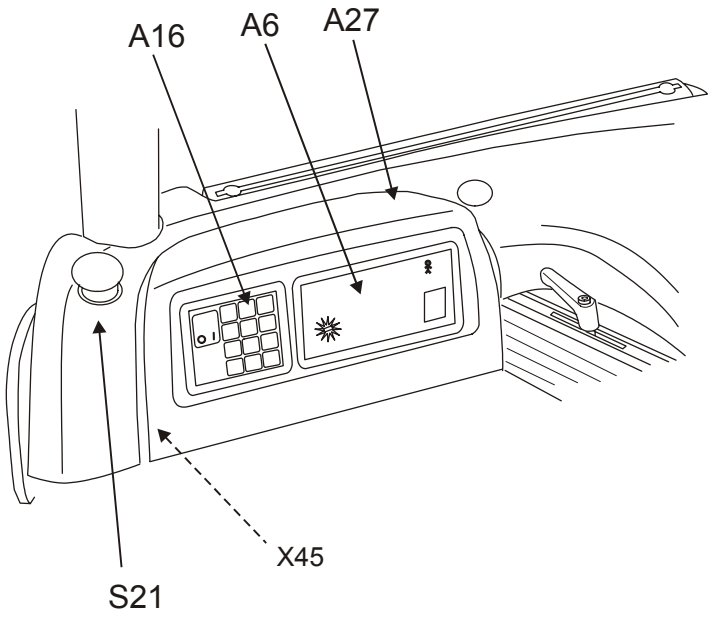
Table 6: Component list

Symbol	Designation/function	Pic-ture
X56	Contact	10
X57	Contact	9
X60	Contact	11
X61	Contact	11
X62	Contact	11
W5	Antenna, radio	10
W7	Antenna, TLS	12
Y1	Magnet, parking brake	5
Y5	Magnet, support arm brake	8
Y6	Magnet, support arm brake	8
Y10	Solenoid valve, lift/lower	6
Y12	Solenoid valve, reach carriage in	6
Y13	Solenoid valve, reach carriage out	6
Y14	Solenoid valve, tilt down	6
Y15	Solenoid valve, tilt up	6
Y16	Solenoid valve, extra hydraulic function 1A	6
Y17	Solenoid valve, extra hydraulic function 1B	6
Y18	Solenoid valve, extra hydraulic function 2A	6
Y19	Solenoid valve, extra hydraulic function 2B	6
Y20	Solenoid valve, cab tilt up	5
Y21	Solenoid valve, cab tilt down	5
Y45	Solenoid valve, fork lower	6

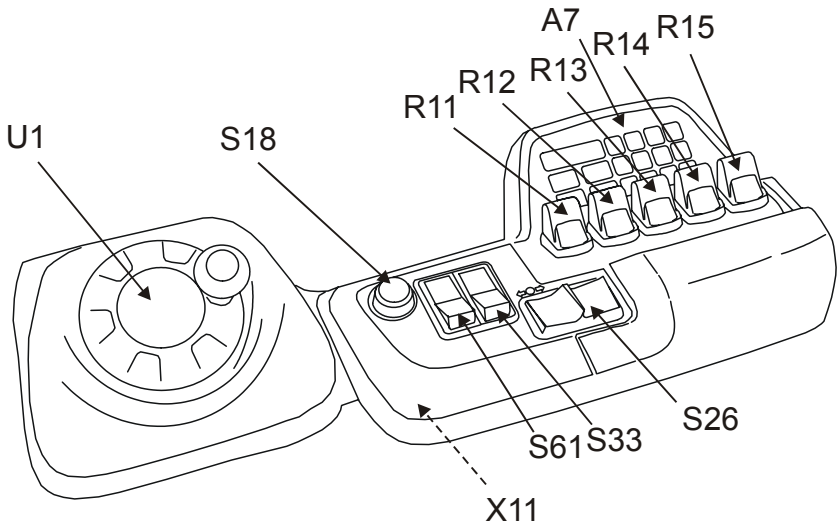
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21.3.1 Figure 1

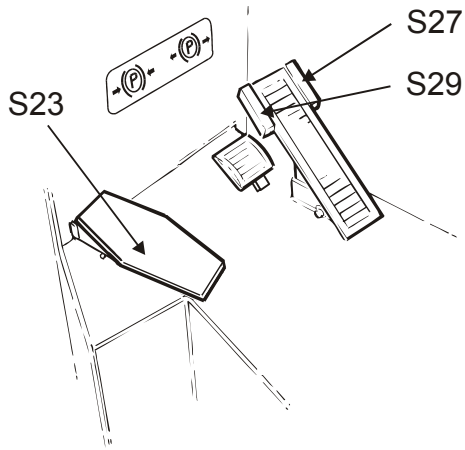


21.3.2 Figure 2

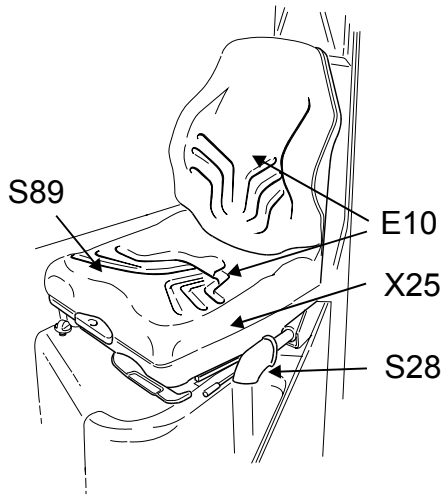


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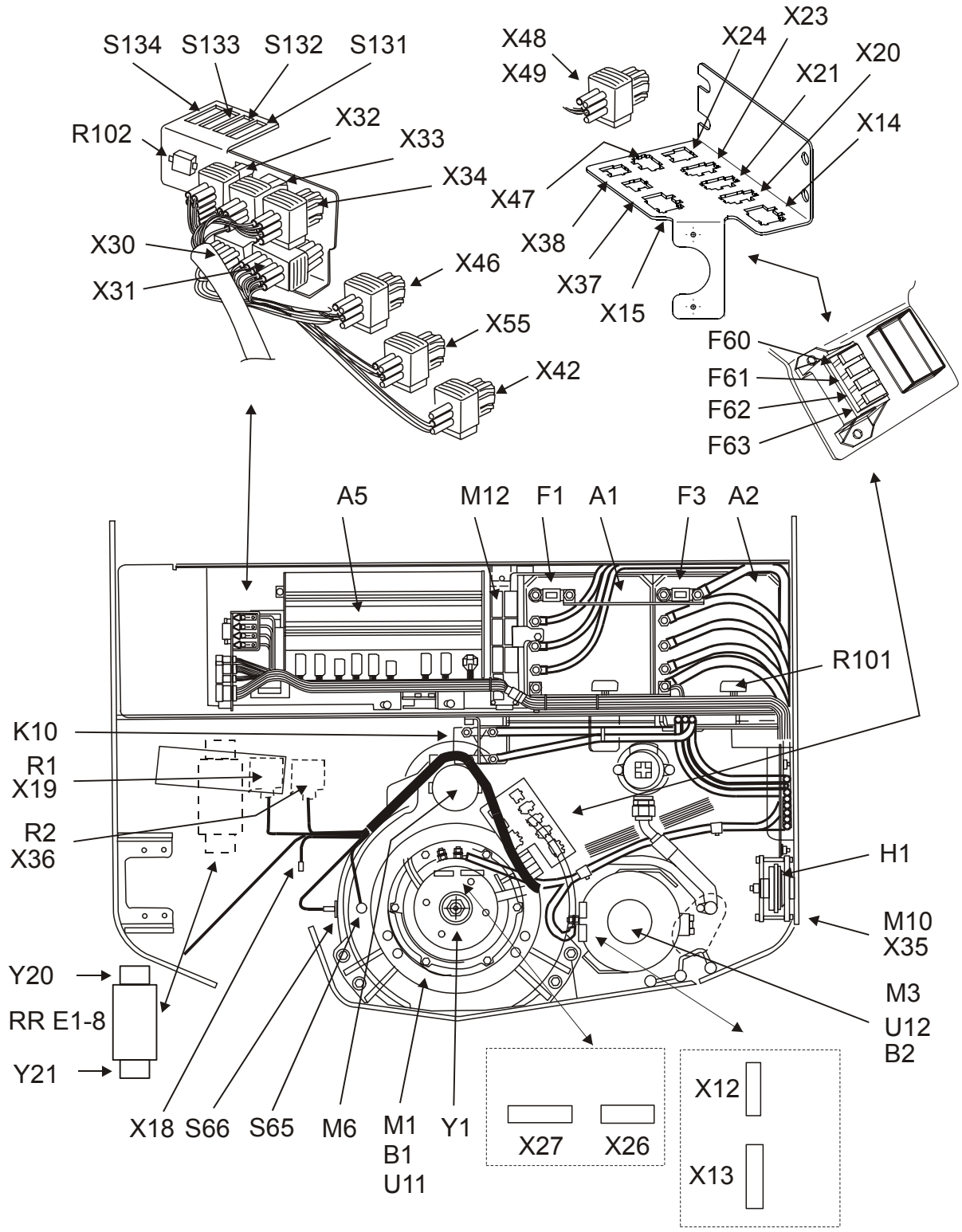
21.3.3 Figure 3



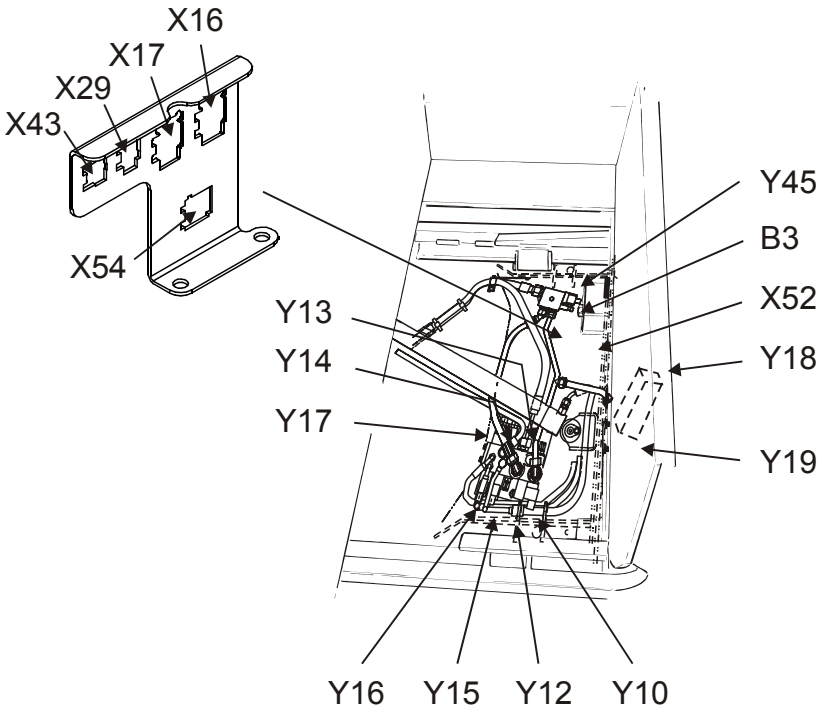
21.3.4 Figure 4



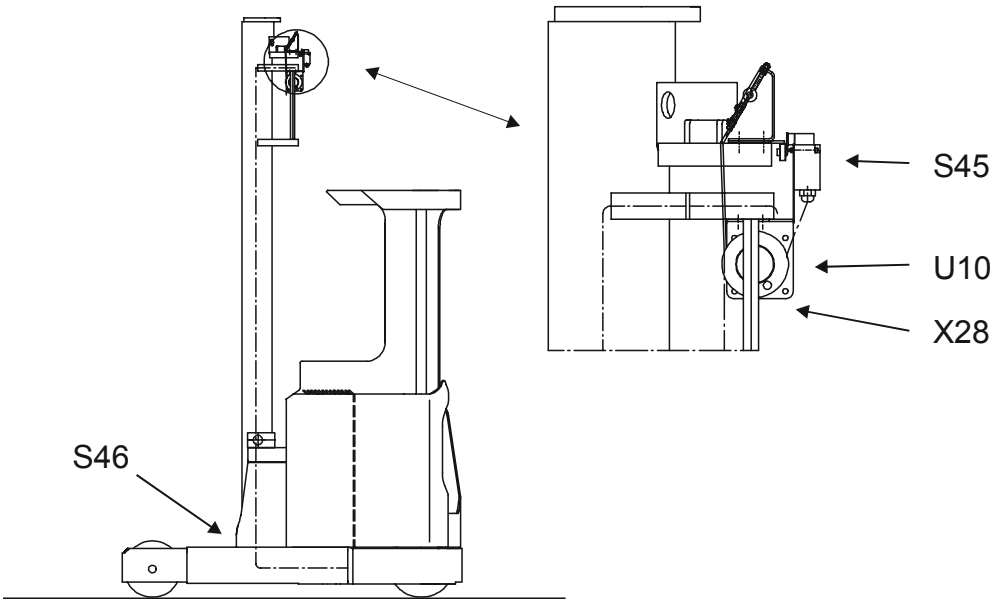
21.3.5 Figure 5



21.3.6 Figure 6

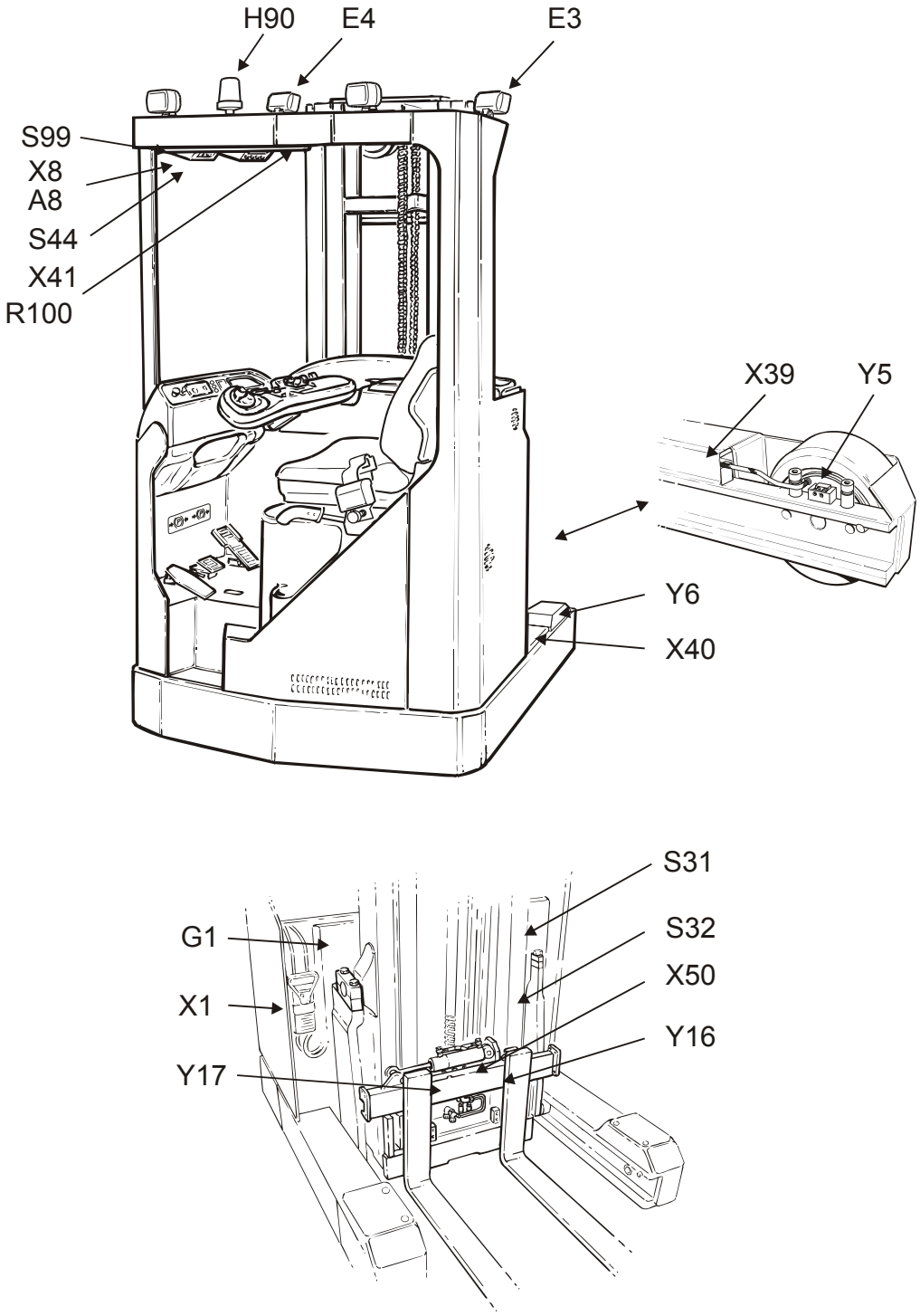


21.3.7 Figure 7



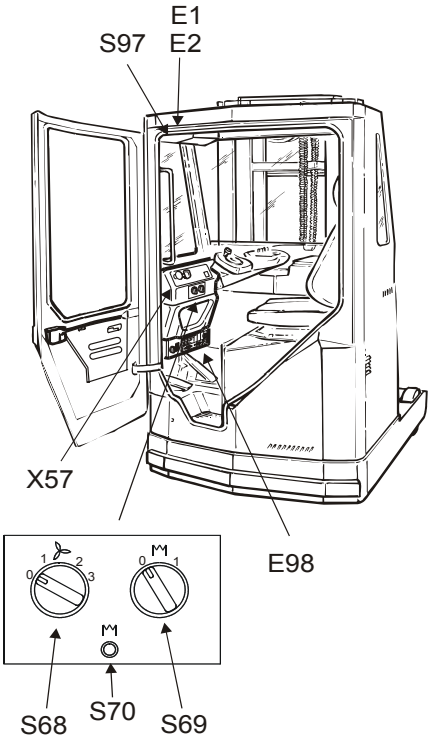
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21.3.8 Figure 8



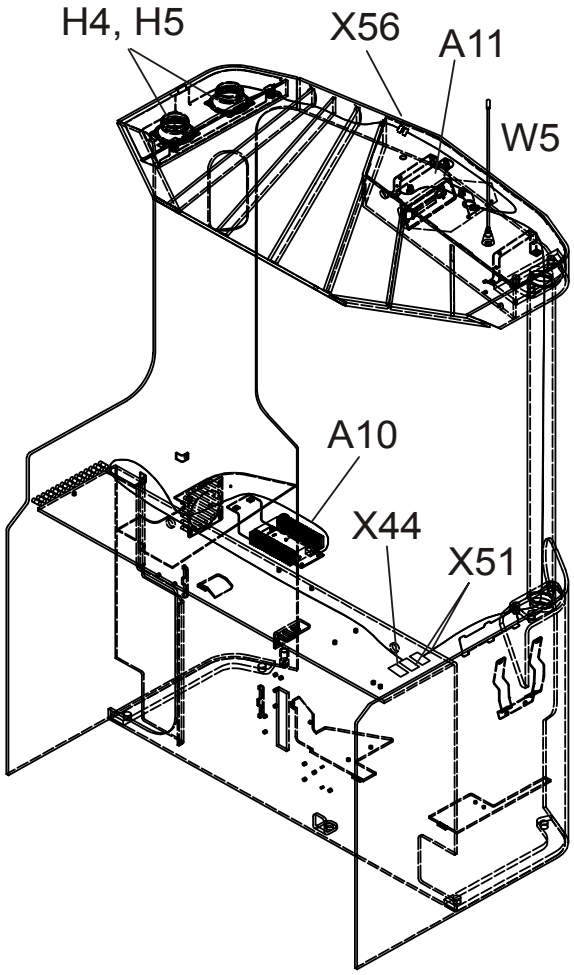
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21.3.9 Figure 9

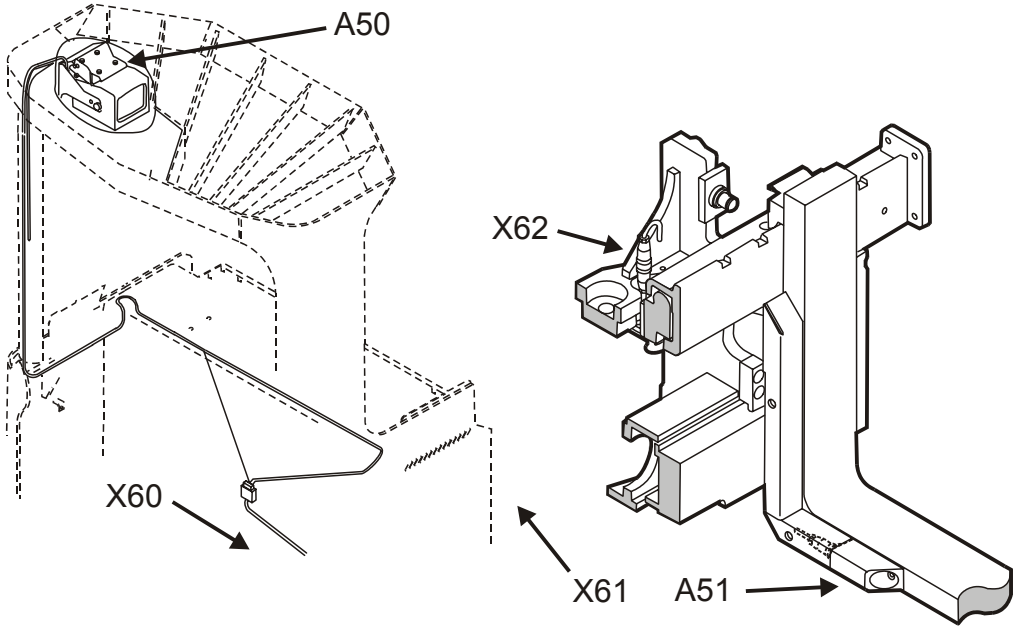


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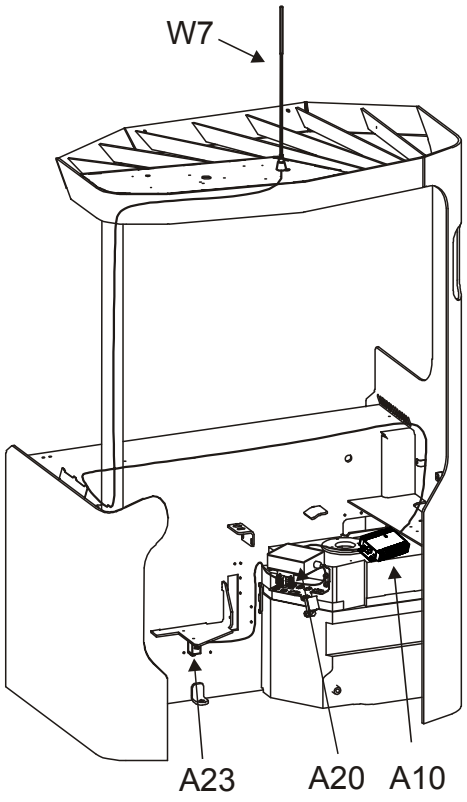
21.3.10 Figure 10



21.3.11 Figure 11



21.3.12 Figure 12



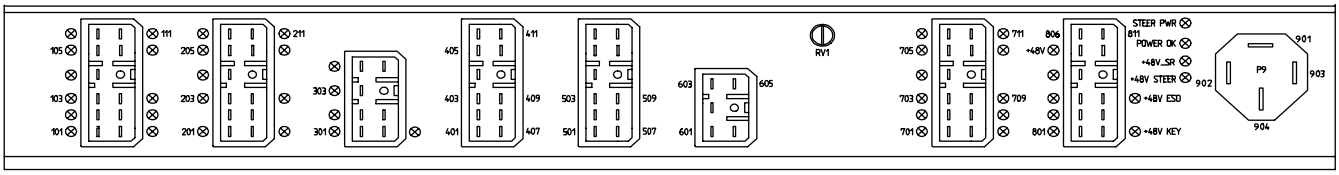
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21.4 Functional description

The electronic card has a microprocessor that monitors switch status, control voltages, etc., and provides instructions for external electronics, contactors, and valves, etc.

The module is equipped with an internal battery so that pre-set information remains in the electronics module once battery power has been switched off. Any errors registered by the micro-processor are shown on the display. Error codes are explained in conjunction with the electronic card. The electronic card's inputs and outputs are marked with connection numbers and can be easily connected and disconnected using the connectors. The inputs and outputs, which have two fixed positions, have LED indicators: **green is used** for **inputs**, **red** for **outputs** and **yellow for others**.

Designation	Diode number
Designations for card inputs/outputs, in accordance with wiring diagram.	Diode name indicating the card's active input/output



21.4.1 Truck not started up

When the battery is connected to the truck via the charging plug, the electronic card A5 receives +48 V voltage and the LEDs (shown in the table) light up. LEDs 210, 211, 301 and 302 light depending on whether the respective sensor has been activated or not. A voltage of +7.35 V is supplied by A5 to potentiometer R1 in the speed control, the brake control R2 and the hydraulic controls R11–R15.

Designation	Diode number
STEER WHEEL ANGLE	210, 211
HEIGHT COUNTER	301, 302
+48 V	805
	STEER PWR
	POWER OK
	+48 V STEER

21.4.2 Truck started up

Truck power is switched on when the driver logs in using his code and presses the green button **I** on the keyboard. In order to use the travel direction selector and hydraulics, the driver must sit in the truck so that switch S89 is on. The voltage is fed through the control fuse F60, the keyboard relay and the emergency switch S21 to the electronic card A5, frequency converters A1 and A2, height electronics A7 and A8, and the fan M10, which starts. The A5 electronic card checks that the internal safety function is functioning and closes the main contactor K10, which provides power to the drive and pump motors. The A5 electronic card starts communications with the height electronics A7 and A8, and provides +32 V to the fan M12, which begins to rotate at half-speed.

A5 checks that the voltage from the potentiometers is +3.65 V and sends control pulses to tachometer U1 and steering motor M6. If the seat has built-in heating, a voltage of +48 V is also supplied to the thermostat and the seat heater E10.

The display turns on and the computer software version number is shown before the display switches to normal mode: time of day, operating time, battery status, load weight and any error codes.

The length of time that the truck is in use is monitored and stored in the electronic module.

The LEDs in the following table will light up:

- No. 706–711 light up if the valves are not installed on the truck.
- No 110, 203 and 305 light up if the switches are actuated.

The LEDs on the frequency converters light up.

Designation	Diode number
LEFT FOOT SWITCH	110
SEAT SWITCH	203
CABIN LIFT	305
SPARE 1A, 1B	706, 707
SPARE 2A, 2B	708, 709
CABIN LIFT	710
CABIN LOWER	711
SUPPORT ARM BRAKE	801 (lights dimly)
FORK LOWER	803 (lights dimly)
MAIN CONTACTOR	804
	+48 V KEY
	+48 V ESO
	+48 V_SR

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21.4.3 Choice of travel direction

The travel direction can be selected in three ways.

On the control console

When the S26 control is pressed down, voltage is fed from the switch to A5. If the control is held down for at least three seconds, the truck runs at crawl speed.

Designation	Diode number
DRIVE, FORK DIRECTION	104
DRIVE, STEER WHEEL DIRECTION	105

On the left-hand handle

When control S28 is pressed, voltage is fed from the switch to A5, causing the truck to change direction of travel. This control can only be used to change direction of travel after the choice has been made on the steering wheel console. It does not allow the crawl speed function to be selected either.

Designation	Diode number
DRIVE, CHANGE DIRECTION	111

On the accelerator

When the pedal is pressed down on the right-hand side (fork direction) voltage is fed from switch S27 to A5. To switch the truck's travel direction, press down on the left-hand side. The pedal does not allow the crawl speed function to be selected.

Designation	Diode number
DRIVE, FORK DIRECTION	106
DRIVE, STEER WHEEL DIRECTION	107

The display shows the direction of travel.

21.4.4 Driving

When the speed control R1 is activated, the drive motor brakes are released. If the safety switch S23 is not actuated when the parking brake is released, the truck cannot be driven and a buzzer sounds from the display.

If the driver presses the accelerator pedal as the green button **I** is pressed on the keyboard, the pedal must be returned to the neutral position before the truck can be driven.

When the accelerator pedal is pressed down, the potentiometer R1 is actuated and the more the accelerator is pressed down the lower the voltage that is fed from R1 to A5. The voltage drops from 3.7 V to 1.7 V, giving a speed of 0-100%. A1 controls the drive motor's speed using information from A5. Current passes through A1's fuse F1 and is converted into 3-phase AC, which goes to M1.

If the switch for speed reduction S31 is actuated so that there is voltage on A5's input, the pre-programmed max. speed will apply. Drive motor speed is measured by sensor U11.

If the direction of travel selector on the control console is held down for at least three seconds, the truck runs at crawl speed.

If the driver leaves his seat for more than three seconds, A5 cuts the current to Y1, causing the parking brake to be applied.

The drive motor's running time is monitored and stored in the electronic module.

Designation	Diode number
PARKING BRAKE	802

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21.4.5 Steering

When the wheel is turned, voltage is supplied by tachometer U1 to A5, which provides progressive power to steering motor M6. This means that the faster the steering motion, the faster the steering motor runs. Progression also means that the higher the driving speed, the lower the steering speed. Drive motor speed is measured by sensor U11.

When the steering wheel is turned, steering wheel sensor S65 is actuated and voltage is fed to A5. The opposite travel direction is shown on the display. The electronics automatically indicate the correct travel direction in that switch S65 transmits signals for 180° of the possible 360. Sensor S65 must pass one of the reference points in order for the electronics to determine the direction of the steering wheel and indicate the travel direction. The function is initiated by a turn of the wheel. This must be done at the initial start and after servicing.

LEDs 209, 210 and 211 light up depending on whether the respective sensors are actuated or not.

Designation	Diode number
STEERING WHEEL REF. 180°	209
STEERING WHEEL ANGLE A	210
STEERING WHEEL ANGLE B	211

21.4.6 Steering wheel indicator

When the wheel is turned, sensor S66 sends signals to A5, which indicates the travel direction on the display. Sensor S65 must pass one of the reference points in order for the electronics to determine the direction of the steering wheel and indicate the travel direction. The function is initiated by a turn of the wheel. This must be done at the initial start and after servicing. When the travel direction is changed using the lever, the arrows switch on the display.

LEDs 209, 210 and 211 light up depending on whether the respective sensors are actuated or not.

Designation	Diode number
STEERING WHEEL REF. 180°	209
STEERING WHEEL ANGLE A	210
STEERING WHEEL ANGLE B	211

21.4.7 Braking

The truck employs various braking systems:

Auto-brakes

When the driver releases the accelerator pedal, the drive motor automatically brakes the truck to the desired speed. The auto-brake function and braking power can be set with parameters.

Motor brakes (electric)

When the driver changes direction using the lever, the drive motor functions as a generator/brake and feeds current back to the battery. Braking force is determined by the accelerator pedal. The A5 electronic card receives information from A1 that motor braking is under way and changes regulation of A1.

Foot brake

When the driver depresses the brake pedal, potentiometer R2 is actuated. The voltage rises from 1.7 V to 4.1 V, which gives a braking force of 0-100%. Down to half of the pedal action, the truck is braked by reversing the drive motor. If the truck has support arm brakes, they will begin to brake the truck in the event of continued downward pressure on the pedal. When the pedal is pressed down fully, this also activates the parking brake. LED 801 shines progressively brighter as braking power increases.

Designation	Diode number
SUPPORT ARM BRAKE	801

Parking brake

When the truck is standing still and the brake pedal is depressed, the parking brake is activated.

If the driver leaves his seat for more than three seconds, A5 cuts the current to Y1, causing the parking brake to be applied.

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21.4.8 Fork lift

When the driver actuates the hydraulic control R11, a voltage of 3.7-6.6 V is fed to the input on A5 and direction valve Y10 opens and sends a signal to transistor regulator A2. The pump motor M3 starts and pumps oil to the lifting cylinders.

If the battery monitor has detected 20% or lower battery capacity, lifting speed will be reduced.

The lifting speed is reduced with the transition from free lift to main lift. The speed of M3 is measured by sensor U12.

Designation	Diode number
FORKLIFT	701

21.4.9 Maximum height

Truck with maximum height switch.

When the forks reach the height switch S32 and A5 receives a signal, the fork lift will be stopped. If the forks are to be lifted above this height, switch S33 must be depressed, which sends a signal to A5 and movement continues. Start must occur within fifteen seconds.

Designation	Diode number
LIFT LIMIT SPECIAL HEIGHT	301
OVERRIDE	205

21.4.10 Maximum height

Truck with pulse counter.

Once the forks reach the main lifting range, A5 receives information from switch S45 to begin counting the pulses from sensor U10. The forks stop when the pre-programmed maximum heights (there are two) have been reached. If the forks are to be lifted above these heights, switch S33 must be depressed, which sends a signal to A5 and movement continues. Start must occur within fifteen seconds.

LEDs 301, 302 and 303 light up depending on whether the respective sensors are actuated or not.

Designation	Diode number
HEIGHT COUNTER	301
HEIGHT COUNTER	302
HEIGHT REFERENCE	303

21.4.11 Fork lowering

When the driver actuates the hydraulic lever R11, a voltage of 3.7-0.66 V is fed to A5, which opens the proportional valve Y10 and Valve Y45, and the driver can lower the forks at variable speed.

If the truck is equipped with a pulse counter, the lowering speed is reduced at the transition from main lift to free lift. The LEDs shine dimly in the neutral position and brightly when lowering begins.

Without a pulse sensor, the lowering speed is reduced when switch S46 is actuated.

Designation	Diode number
FORK LOWER	803
FORK LOWER BYPASS	710

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21.4.12 Mast out/in

When the driver actuates the hydraulic lever R12, voltage (out = 3.7-0.77 V or in =3.7-6.6 V) is fed to A5, which opens the direction valves Y12/Y13 and sends a signal to the frequency inverter A2. Pump motor M3 starts and pumps oil to the reach cylinder. Before the mast reaches the end positions, pump motor speed is reduced.

Designation	Diode number
REACH CARRIAGE IN	702
REACH CARRIAGE OUT	703

21.4.13 Fork tilt up/down

When the driver actuates the hydraulic lever R13, voltage (up = 3.7-6.6 V or in =3.7-0.66 V) is fed to A5, which opens the direction valves Y14/Y15 and sends a signal to the frequency inverter A2. Pump motor M3 starts and pumps oil to the tilt cylinder.

Designation	Diode number
TILT DOWN	704
TILT UP	705

21.4.14 Hydraulic function 4

When the driver actuates the hydraulic lever R14, voltage (3.7-6.7 V or 3.7-0.66 V) is fed to A5, which opens the direction valves Y16/Y17 and sends a signal to the frequency inverter A2. Pump motor M3 starts and pumps oil to the extra function.

Designation	Diode number
SPARE 1A	706
SPARE 1B	707

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21.4.15 Hydraulic function 5

When the driver actuates the hydraulic lever R15, voltage (3.7-6.7 V or 3.7-0.66 V) is fed to A5, which opens the direction valves Y16/Y17 and sends a signal to the frequency inverter A2. Pump motor M3 starts and pumps oil to the extra function.

Designation	Diode number
SPARE 2A	708
SPARE 2B	709

21.4.16 Cab tilt

The driver selects the function by pressing switch S44, which sends a signal to A5 and lamp 44 lights up. When the forks rise to the main lift range, switch S45 closes and a signal is sent to A5. Directional valve Y20 is fed voltage by A5 when cab tilting is to take place. However, the hydraulic lever must be activated more than 50%. Tilting is by around 15 degrees.

If the truck has pulse counter U10, A5 receives information on the position of the forks. At the programmed height, the cab will begin to tilt.

When the forks are lowered and reach the pre-programmed height again or come down to the free lift range, the cab tilts back as A5 sends a signal to direction valve Y21 to open. When lowering too, the hydraulic lever must be activated more than 50%.

As soon as the driver releases the hydraulic levers, the tilting and the forks' lifting/lowering movement stops.

The cab can be lowered manually if the driver presses switch S44 for momentary mode. A5 is fed voltage and keeps direction valve Y21 open as long as the button is depressed.

Designation	Diode number
HEIGHT COUNTER	301
HEIGHT REFERENCE	302
CABIN LOWERING MANUAL	304
CABIN LIFT	305
CABIN LIFT	710
CABIN LOWERING	711

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21.4.17 Height indication

Measuring starts in the main lifting zone when the reference switch S45 is activated and sends a signal to A5. Pulse sensor U10 sends pulses to A5, which starts by displaying the programmed free lift height on the display A8.

Designation	Diode number
HEIGHT COUNTER	301
HEIGHT COUNTER	302
HEIGHT REFERENCE	303

21.4.18 Height pre-set

Measuring starts in the main lifting zone when the reference switch S45 is activated and sends a signal to A5. Pulse sensor U10 sends pulses to A5, which starts by displaying the programmed free lift height on the displays A7 and A8. The forks stop at the first pre-programmed height when A5, via pulse generator U10, reaches the correct height. The halt is initiated by A5 regulating the pump motor speed using A2 and valves for fork lifting and lowering. The driver picks up or deposits the load manually. When the driver again presses the hydraulic control for lifting/lowering, the forks continue to the next pre-programmed level. See C code 9000.

Designation	Diode number
HEIGHT COUNTER	301
HEIGHT COUNTER	302
HEIGHT REFERENCE	303

21.4.19 Weighing

- Collect load on forks.
- Lift the fork off the floor and the weight will be shown on the display.

The load's weight will be shown in the display window at intervals of 50 kg, with a tolerance of ± 25 kg. Display automatically reverts to time measurement after 10 seconds. For calibration, see C code 5710.

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21.4.20 Driver identification

Login can be performed in two different ways:

Without pin code

- Press 1, 2, 3 to select driver and then the green button **I** on the keyboard.

With pin code

- Enter the pin code and then press the green button **I** on the keyboard to select driver 1 to 10.

For programming of the driver combination, see C code 5710.

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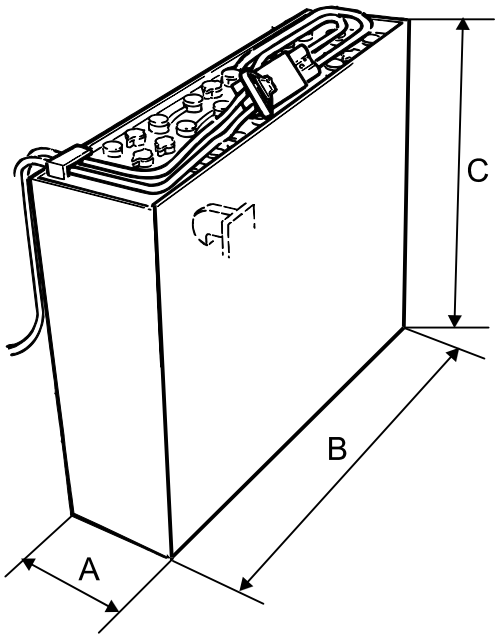
Valid from serial number	T-code
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22-Battery – 5110

22.1 Battery dimensions

Model	Battery size (Ah)	Min. weight (kg)	Depth (A) mm	Width (B) mm	(1 Height (C) mm	(1 Drawing number
B/E1	360-450	700	273	1208	778 783	148200 145066
B/E2-5	480-600	865	344	1208	778 783	148204 145067
B/E6-7	600-750	1075	419	1208	778 783	148216 145068
B/E8	876-900	1270	491	1208	778 783	148221 146987

(1 Lower measurement is the roller table battery.



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22.2 Setting the battery parameters on RR trucks fitted with Hawker Evolution gel batteries

22.2.1 General

Following completed evaluation and testing, recommendations for the setting of parameter 21 on RRs fitted with Hawker Evolution gel battery have been prepared. There are also instructions for verifying and adjusting the set values.

22.2.2 Battery recommendation

Exide gel batteries (e.g. Sonnenschein)

In our tests of Exide gel batteries, we have not been able to make any recommendations for setting the parameters on any of our products. As a result, we do not recommend using this type of batteries.

Hawker Evolution batteries

For Hawker Evolution gel batteries, clear guidelines regarding their use exist. This is why we are able to recommend these batteries.

-The Evolution batteries have been designed for use in low-intensity applications.

-The recommended use is one shift per day (max. 8 hours).

-Max. 6 days of use per week with an expected service life of 1,000 cycles.

-Max. discharge level 70%

-The ambient temperature should be from +5°C to +35°C

-The battery must be charged using a Hawker battery charger with an EZ controller. Charging must be done according to the instructions supplied with the Hawker battery.

-Typical charging time 12 hours

-Equalising charging is required after 6 charge cycles

-Discharged batteries must not be stored away. The maximum allowed storage time is 2 month, however, charging once a month is required.

22.2.3 Battery installation

NOTE
Parameter 21 must always be checked and adapted to the battery, which is installed in the truck. The parameter setting depends on the battery type, machine type and battery size.

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22.2.4 Recommended parameter setting for ventilation regulated batteries

When setting parameter 21 in a Reflex truck fitted with Hawker Evolution batteries, we advise that the recommended value for wet-type batteries should be reduced by six (6) units

Example:

Parameter 21 with a 520 Ah wet battery: 14

Parameter 21 with a Hawker Evolution battery: 8

WARNING!

Battery service life will be reduced if the value of parameter 21 is set too high. Please always check that the parameter setting is correct by referring to the instructions below.

To verify the charging state of a discharged 48 V battery, measure the open circuit voltage (i.e. voltage at no load) following a period of inactivity. The zero indication should appear at an open circuit voltage that must not fall below 2.02 V/cell or 48.48 V.

See the instructions below.

22.2.5 Instructions for verifying the parameter setting

- Charge the battery.
- Operate the truck in its normal application until the battery indicator indicates a discharged battery (0% in the display).
- Disconnect the battery from the truck and allow it to rest for at least two hours. NOTE! Do not allow any charging or discharging during this time.
- Measure the voltage in the battery at room temperature. If the voltage is less than U_{end}, (see the table below), the parameter value **must** be reduced. If the value considerably exceeds U_{end}, the risk of causing damage to the battery is reduced. At the same time, however, the operating time of the truck decreases. If an extended operating time is desired, slightly increase the parameter value.
- Each change should be followed up by a new verification of the parameter setting.

Battery type	Battery voltage when idle, U_{end}
Hawker Evolution	48.48 V

Battery – 5110

Setting the battery parameters on RR trucks fitted with Hawker

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23-Transistor panel – 5460

23.1 Frequency converter

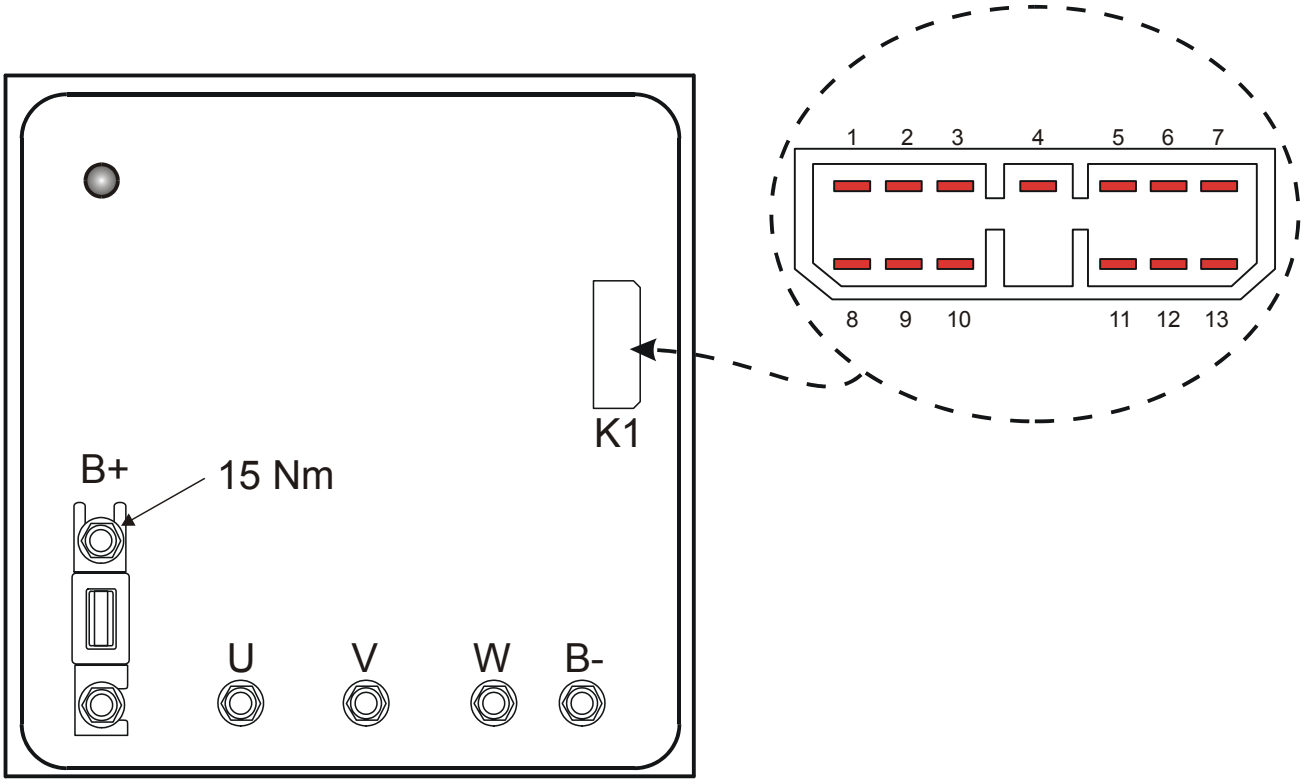
23.1 General description

The frequency converter is equipped with a green LED that indicates OK status.
On start-up, it flashes twice and then remains on.
Basic software to control the motor is stored in the frequency converter.

The frequency converter has internal monitoring of CAN communications DC voltage levels, intrinsic temperature and motor temperature.

Any detected function errors are registered by the frequency converter and the information sent via CAN to the main card A5, which registers the error code and presents the corresponding code on the instrument panel display.

The frequency converter can be reprogrammed via CAN.



Transistor panel – 5460

Frequency converter

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23.1.1 Terminal connections and pole bolts

I: Input, O: Output

Term.	Cable A1/A2	Description	Active	Input/Output
1	22	Ignition Start/Stop	+48 VDC	I
2	NC			
3	10/15	Sensor, + voltage	+12 VDC, 50mA	O
4	11/16	Sensor, - voltage	0 V	O
5	12/17	Pulse generator, phase 1	+12 V, 1kOhm	I
6	13/18	Pulse generator, phase 2	+12 V, 1kOhm	I
7	14/19	Motor temp.		I
8	-/16	CAN ID0 (Not connected when used as A1)	1: Open 0: Sensor, -	I
9	NC			I
10	119	CAN H	0-5 V	I/O
11	120	CAN L	0-5 V	I/O
12	117	CAN + voltage, external	+15 VDC	I
13	118	CAN – voltage, external	0 V	I
B+	8	Battery +	+48 VDC	I
B-	40	Battery -	0 V	I
U	2/5	Motor winding U	0-33 V	O
V	3/6	Motor winding V	0-33 V	O
W	4/7	Motor winding W	0-33 V	O

23.1.2 Technical Data

Parameter	Setting ACS 4808	Setting ACS 4811	Unit	Description
Operating voltage	48	48	Volt	
Maximum voltage	65	65	Volt	Over-voltage point
Minimum operating voltage	30	30	Volt	Under-voltage point
Frequency	13	8/13	kHz	
Contactor voltage	48	48	Volt	
Ambient operating temperature	-35 - +55	-35 - +55	°C	
Current limit, down-regulation with overheating of the heatsink	85	85	°C	0 A at 125°C
Current limit, down-regulation at excessively low cooling block temperatures	-20	-20	°C	50% current limiting at start
Current limiting	250	350	Amp	2 minutes
Speed	100	100	%	Modulation

23.1.3 Installation of new frequency converter on truck

Frequency converters from BT Parts can be delivered in different configurations:

1. **Ready programmed with complete number**
   = part number for frequency converter including program.
2. **Non-programmed at part number**
   = only part number for frequency converter.

When installing a new card, certain parameters must be reprogrammed so that the truck can be safely operated.

23.1.4 Programming

For downloading new programs to the electronics card, the Truck Com service program is used.

See the Truck Com user manual for a description of the procedure.

Transistor panel – 5460

Frequency converter

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24-Electronic card – 5710

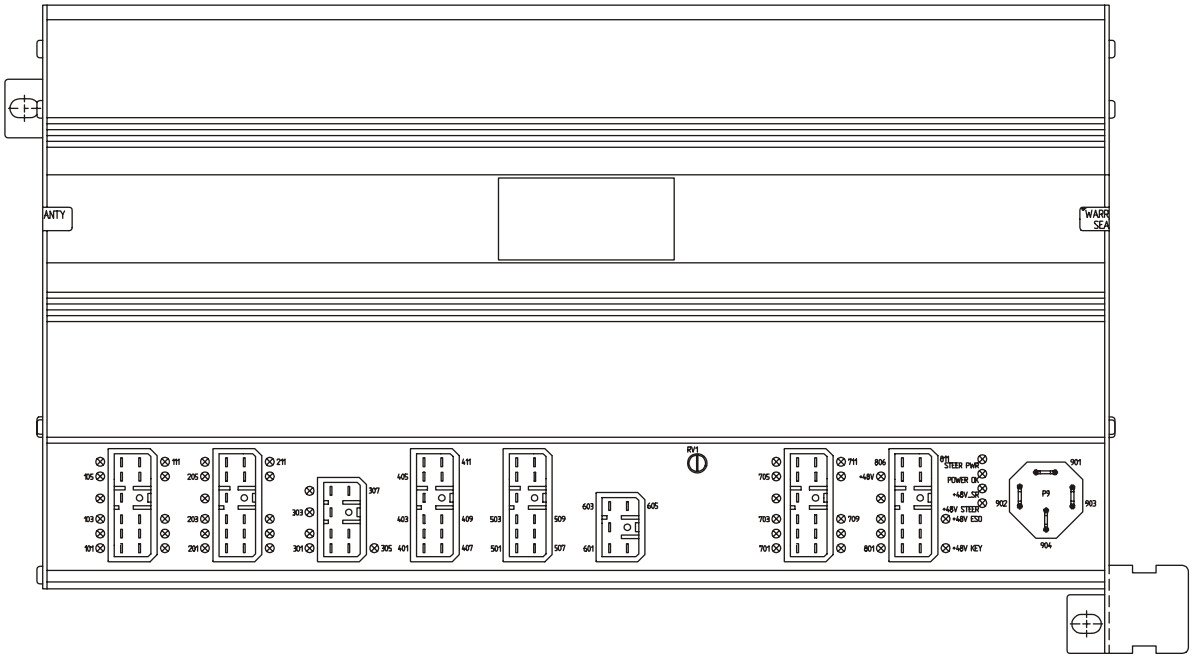
24.1 General description

This description is valid from electronic card 169937-002 and software 217797-001.

The A5 electronic card is equipped with green LEDs on the inputs from the microswitches and sensors, red LEDs on the outputs to the contactors and valves, and yellow for voltages. This card is also equipped with a potentiometer for adjusting the hydraulic control for fork lowering.

The truck's programmable parameters settings are stored on the electronic card.

The main card monitors the truck's steering, driving and hydraulic functions. Any errors are registered and the corresponding error code is displayed on the instrument panel's display.



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24.2 Terminal connections and voltages on A5

The LEDs on the connection terminals are designated in the tables as follows:

I	= Input, green light emitting diode (LED)
O	= Output, red light emitting diode (LED)
Other	= Yellow light emitting diode (LED)

24.2.1 10X

Term.	Cable	Description	Active (V)	LED
101	34	Selection of driver/parameter settings	+48	I
102	35	Selection of driver/step up	+48	I
103	36	Selection of driver/step down	+48	I
104	45	Travel direction selection for fork direction at crawl speed	+48	I
105	46	Travel direction selection for steering wheel direction at crawl speed	+48	I
106	47	Travel direction selection for fork direction	+48	I
107	48	Travel direction selection for steering wheel direction	+48	I
108	-	TLS shock sensor temporarily deactivated		I
109	106	Reference height sensor, forks above free-lift range	+48	I
110	43	Safety pedal (left foot-switch)	+48	I
111	39	Travel direction selector	+48	I

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24.2.2 20X

Term.	Cable	Description	Active (V)	LED
201	-	Reserve		I
202	101	Valve, cab tilting up	+48	O
203	49	Seat switch	+48	I
204	81	Weight indication	+48	I
205	100	Lift height limitation, by-pass	+48	I
206	79	Speed reduction, driving	+48	I
207	-	Reserve		I
208	-	Indicator signal, See parameter settings	+48	O
209	57	Steering wheel sensor, 180°	+48	I
210	58	Steering wheel sensor, channel A	+15	I
211	59	Steering wheel sensor, channel B	+15	I

24.2.3 30X

Term.	Cable	Description	Active (V)	LED
301	98	Lifting height limit/height meter, channel A	0 –(+)15	I
302	99	Height meter, channel B	0 –(+)15	I
303	106	Reference height sensor, at changeover between free lift and main lift.	+48	I
304	103	Cab lowering, manual	+48	I
305	104	Cab tilt, selected	+48	I
306	105	Cab tilt, selected	+48	
307	107	Electronic fan	+32/48	

24.2.4 40X

Term.	Cable	Description	Active (V)	LED
401	117	CAN – Serial (+)	+15	
402	118	CAN – Serial (-)	0	
403	119	CAN H	0-5	
404	120	CAN L	0-5	
405	121	RS485 - Serial (+)		
406	122	RS485 - Serial (-)		
407	125	RS485 - TX (+), transmits data		
408	126	RS485 - TX (-), transmits data		
409	127	RS485 - RX (+), receives data		
410	128	RS485 - RX (-), receives data		
411	65	Pressure transducer, load weighing	0,5-4,5	

24.2.5 50X

Term.	Cable	Description	Active (V)	LED
501	50	Potentiometer acceleration, set point	+3,7–1,7	
502	51	Potentiometer braking, set point	+1,7–4,1	
503	82	Potentiometer acceleration, set point	+0,66–3,7–6,6	
504	83	Potentiometer extension/retraction of mast, set point	+0,66–3,7–6,6	
505	84	Potentiometer tilting of forks, set point	+0,66–3,7–6,6	
506	85	Potentiometer extra (1) hydraulic function, set point	+0,66–3,7–6,6	
507	27	Potentiometer feed	+7,35	
508	28	Minus to 501-506, 510	0	
509	62	Steering tachometer (+)	Max. ±3	
510	86	Potentiometer extra (2) hydraulic function, set point	+0,66–3,7–6,6	
511	129	Steering tachometer (-)	0	

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24.2.6 60X

Term.	Cable	Description	Active (V)	LED
601	70	Battery monitor, voltage measurement (+)	+48	
602	71	Battery monitor, voltage/current measurement (-)	0	
603	72	Battery monitor, current measurement (+)		
604	-	Reserve		
605	-	Reserve		

24.2.7 70X

Term.	Cable	Description	Active (V)	LED
701	89	Valve, lifting the forks	+0,5–48	O
702	90	Valve, mast retraction	+0,5–48	O
703	91	Valve, mast reach	+0,5–48	O
704	92	Valve, downward tilting of forks	+0,5–48	O
705	93	Valve, upward tilting of forks	+0,5–48	O
706	94	Valve, extra hydraulic function 1 A	+0,5–48	O
707	95	Valve, extra hydraulic function 1 B	+0,5–48	O
708	96	Valve, extra hydraulic function 2 A	+0,5–48	O
709	97	Valve, extra hydraulic function 2 B	+0,5–48	O
710	67	Valve, bypass of fork lowering	+0,5–48	O
711	102	Valve, downward cab tilt	+0,5–48	O

24.2.8 80X

Term.	Cable	Description	Active (V)	LED
801	63	Support arm brake, active	0,2 – (+)48	O
802	64	Motor brake, released	1,5–(+)48	O
803	88	Valve, lowering the forks	0,2–(+)24	O
804	31	Main contactor	+48	O
805	21	Battery voltage, (+) 48 V	+48	+48 V
806		Battery voltage, minus	0	
807	24	Battery voltage, (+) 48 V after keypad relay	+48	+48 V KEY
808	23	Battery voltage, (+) 48 V after main contact on	+48	
809	22	Battery voltage, (+) 48 V after emergency stop	+48	+48 V ESO
810	29	Voltage feed, (+) 15 V	+15	
811	30	Battery voltage, minus	0	

24.2.9 90X

Term.	Cable	Description	Active (V)	LED
901	25	Battery voltage, (+) 48 V	+48	
902	40	Battery voltage, minus	0	
903	60	Steering motor, (+)	+48	
904	61	Steering motor, (-)	+48	

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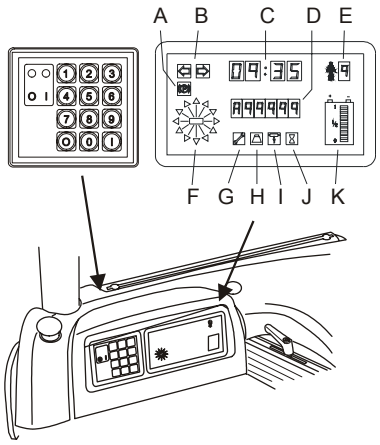
LED	Colour	Function
+48 V STEER	Yellow	Voltage at steering electronics
+ 48V_SR	Yellow	Steering OK
STEER PWR	Yellow	Steering OK
POWER OK	Yellow	Indicates all voltages available on electronic card

Potentiometer	Function
RV 1	Trimming of the proportional valve's opening position

24.3 Adjusting the lowering speed

To set the lowering speed, see C-code 6000.

24.4 Displaying and programming



It is possible to look up items in the machine-specific register, but not to reprogram it. It is possible, however, to program driver-specific parameters and set the clock. The parameters are indicated in the table.

If the driver has not logged out with the **0** key, the truck will automatically perform the log-out operation after a specified time.

24.4.1 Keypad

Do as follows to check the driver and machine-specific register settings:

- Enter the driver PIN-code and then depress the green **I** key on the keypad so that the electronic card will recieve positive feed, at the same time push the travel direction selector in the fork direction.

The following functions will scroll across the display:

- Time of day CL
- Parameters P
- Serial number of software Pn
- Operating hours H
- Error codes E

Release the travel direction selector at the desired item.

Use the lift/lowering lever to increase/decrease the value.

The travel direction selector is used for the different adjustment modes.

The display shows the following functions:

- (C) Time of day
- (D) parameters, serial number of software, operating hours and error codes

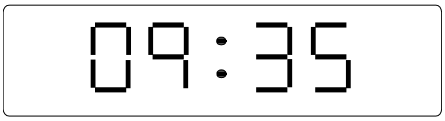
The "No." of the address register is displayed on the left side, while the "value" is displayed on the right side.

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Clock

When the clock can be set, the hours will blink in the display, and after depressing the travel direction selector, the minutes will blink.

- Use the lift/lowering lever to increase/decrease the value.
- Use the travel direction selector to switch between hours and minutes.



Function	Value
hours	09 = 9h
minutes	35 = 35 min

Complete programming and store the set value by depressing the red **0** key.

NOTE:

Altered truck characteristics.
If you alter truck-specific parameters, truck handling will change.
Do not change any parameters unless you have the necessary skills to do so.

Driver parameters 1-7

Do as follows to reprogram the driver parameters if this is permitted:

- Enter the driver PIN-code and then depress the green **I** key on the keypad so that the electronic card will recieve positive feed, at the same time push the travel direction selector in the fork direction.
- Release the travel direction selector when “P” is displayed. The driver number will be shown in the display (E).
- Use the lift/lowering lever to scroll to the parameter to be changed.
- Depress the travel direction selector (the parameter number blinks).
- Use the lift/lowering lever to increase/decrease the value.
- Depress the travel direction selector to confirm the value. (The parameter number stops blinking.)

To change other parameters, scroll to the desired parameter with the lift/lowering lever and then repeat the operation “Depress switch I (the parameter number blinks)”.

Complete programming and store the set value by depressing the red **0** key.

Common driver parameters can only be reprogrammed using a service instrument.

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24.5 Parameter setting of all parameters

Keypad

- Connect the service key to the truck.
  Alternatively, a PC running the TruckCom application can be used.
- Enter the driver PIN-code and then depress the green **I** key on the keypad so that the electronic card will recieve positive feed, at the same time push the travel direction selector in the fork direction.

The following functions will scroll across the display:

- Time of day CL
- Parameters P
- Serial number of softwaresoftwarePn
- Operating hours H
- Error codes E

Release the travel direction selector at the desired item.

Use the lift/lowering lever to increase/decrease the value.

The travel direction selector is used for the different adjustment modes.

The display shows the following functions:

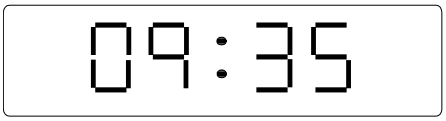
- (C) Time of day
- (D) parameters, serial number of software, operating hours and error codes

The "No." of the address register is displayed on the left side, while the "value" is displayed on the right side.

Clock

When clock setting is selected, the hours will blink in the display, and after depressing the travel direction selector, the minutes will blink.

- Use the lift/lowering lever to increase/decrease the value.
- Use the travel direction selector to switch between hours and minutes.



Function	Value
hours	09 = 9h
minutes	35 = 35 min

Complete programming and store the set value by depressing the red **0** key.

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Electronic card – 5710

Parameter setting of all parameters

Valid from serial number	T-code
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NOTE:

Altered truck characteristics.
If you alter truck-specific parameters, truck handling will change.
Do not change any parameters unless you have the necessary skills to do so.

Parameters

- Release the travel direction selector when “P” is displayed. The driver number will be shown in the display (E).
- Use the lift/lowering lever to scroll to the parameter to be changed.
- Depress the travel direction selector (the parameter number blinks).
- Use the lift/lowering lever to increase/decrease the value.
- Depress the travel direction selector to confirm the value. (The parameter number stops blinking.)

To change other parameters, scroll to the desired parameter with the lift/lowering lever and then repeat the operation “Depress the travel direction selector (the parameter number blinks)”.

Complete programming and store the set value by depressing the red 0 key.

Table 7: List of parameters

No.	Parameter type	Unit	Min./max.	Std. value	Comments
01	Steering sensitivity		1–6	3	1 = Several wheel turns 5 = Few wheel turns 6 = No progressivity In steps of 1
02	Drive motor, max. speed	%	10–100	100	Percentage of max. speed In steps of 5
03	Drive motor, acceleration	%	10–100	100	Percentage of max. speed In steps of 5
04	Drive motor, speed retardation	%	0–100	50	Percentage of speed retardation > 0 = no retardation In steps of 5
05	Drive motor, retardation when reversing	%	35–100	80	Percentage of max. retardation In steps of 5
06	Cab tilt start	m	0,5–7	1	Distance above the reference height where the cab tilt lift starts in steps of 0.5
07	Cab lowering start	m	0,5–7	1	Distance above the reference height where the cab tilt lowering starts in steps of 0.5
11	Drive motor, speed reduction	%	10–100	100	Percentage of max. speed In steps of 5
12	Masts out/in movement, speed	%	10–100	80	Percentage of max. speed In steps of 5
13	Extra function 1 speed	%	10–100	10 20	B/E 1-6 mast with integrated side shift B/E7-B/E8
14	Extra function 2 speed	%	10–100	20	In percent of max. oil flow in steps of 5
15	Engaging hydraulic extra function 1, current limit	%	0–100	100	0 = not connected > 0 = connected In steps of 5
16	Engaging extra function 2, current limit	%	0–100	0	0 = not connected > 0 = connected In steps of 5
17	Lift height limitation level 1	m	0–13,5	13,5	0 = not connected > 0 = connected In steps of 0.05

Table 7: List of parameters

No.	Parameter type	Unit	Min./max.	Std. value	Comments
18	Lift height limitation level 2	m	0–13,5	13,5	0 = not connected > 0 = connected In steps of 0.05. Set greater or equal to L.h. limitation 1.
19	Forks' free lift height	m	1,0–4,5	2,2 See table	Top side of fork to floor when inner guide is at top. In steps of 0.01
20	Time indication		1–6	6	1 = Ignition time (A) 2 = Total movement time (b) 3 = Drive motor time (c) 4 = Pump motor time (d) 5 = Service time (S) 6= Weight indication, (b) shown during 5 seconds.
21	Battery size		1–20	12 See table	See table
22	Type of Truck		1–5	2	1 = B/E1-3 with support arm brakes 2 = B/E1-3 without support arm brakes 3 = B/E4-6 with support arm brakes 4 = B/E4-6 without support arm brakes 5 = B/E7-8
23	Type of Mast		0/1	1	0 = Old mast 1 = With valve in fork yoke
24	Left foot-switch		1/0	0	0 = Activates buzzer 1 = Also cuts drive motor
25	Service interval	h	0–2000	100	0 = No service counter In steps of 50h
26	Cab tilt		0/1	1	0 = B1-8 1 = E1-8
27	Lift priority		0/1	1	0 = Fork lift prioritised 1 = Fork lift not prioritised
28	Indication signal on output 208		0-4	0	0= Hydraulics 1= Driving 2= Driving in drive wheel direction 3= Driving in fork direction 4= Shock sensor active

Table 7: List of parameters

No.	Parameter type	Unit	Min./max.	Std. value	Comments
29	Maximum lift height	m	0-13,5	13,5	0 = not connected > 0 = connected In steps of 0.05
30	I/O box	1	0-2	0	0 = No I/O module connected 1 = Output 1 hydraulics Output 2 driving 2 = Output 1 driving in drive wheel direction Output 2 driving in fork direction
37	Calibration weight for weighing	kg	100–5000	1000	In steps of 10
38	Calibration of accel-eration/brake pedal/ reach carriage and weight.	1	0-4	0	1 =Calibration of speed- brake potentiometer and reach carriage distance 2 = Not used 3 =Not used 4 = Weight calibration
39	Driver access		1–4	3	1 = Key, open 2 = Key, locked 3 = Keypad, open 4 = Keypad, locked
40	Time, year	Year	0–99		In steps of 1
41	Time, day	Day	1–31		In steps of 1
42	Time, month	Month	1–12		In steps of 1

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24.5.1 Parameter 1

The higher the value entered, the less the steering wheel needs to be turned to turn the drive wheel. The value 6 provides steering with no progressive steering, i.e. reduced sensitivity at higher speeds.

24.5.2 Parameter 2

Use this parameter to set the maximum allowed travel speed.

24.5.3 Parameter 3

The lower the value entered, the longer it will take for the truck to reach maximum speed.

24.5.4 Parameter 4

Use this parameter to set the force applied when the truck brakes, i.e. when the accelerator pedal is released.

24.5.5 Parameter 5

Use this parameter to set the force applied when the truck brakes when switching the travel direction and the drive motor is used to brake the truck.

24.5.6 Parameters 6 and 7

Use these parameters to set the height to which the cab (RR E1–8) should be tilted up and down to. Both values use the reference height in the initial setting.

24.5.7 Parameter 11

Use this parameter to set the maximum allowed travel speed when switch S31 is actuated.

24.5.8 Parameter 12

Use this parameter to adjust the extension and retraction speed of the mast.

24.5.9 Parameters 13 and 14

Use these parameters to adjust the oil flow to the two optional hydraulic functions.

24.5.10 Parameters 15 and 16

When these parameters are set to a value >0, monitoring of the potentiometers and valves for the two optional hydraulic functions is activated. The magnitude of the value determines the pressure applied for these functions.

24.5.11 Parameters 17 and 18

If the truck is equipped with height measurement, these two parameters can be used to set the maximum lift heights. The second maximum height value must be equal to or larger than the first maximum height value. The maximum lift height is set using parameter 29.

If the truck is not equipped with height measurement U10, set this parameter to 0.

The parameter should be set to 0 if the truck is not equipped with height measurement, otherwise when using the switch for maximum lift height S32, the bypass of height measurement does not work.

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24.5.12 Parameter 19

Lift height:	Rough setting B/E 1-6 mast with integrated side shift	Rough setting B/E7-8
4400	1,42	
4600	1,50	
4800	1,56	1,65
5400	1,75	1,84
5700	1,85	
6300	2,07	2,14
6750	2,22	2,38
7000	2,42	2,48
7500	2,56	
8000	2,74	2,83
8500	2,93	3,01
9000	3,09	3,14
9500	3,19	3,27
10000		3,43
10500		3,58
10800		3,70

24.5.13 Parameter 20

Use this parameter to set whether operating hours, A-d, S or weight measurement shall be displayed when the truck is operated.

24.5.14 Parameter 21

Use this parameter to set the type of battery installed on the truck. This parameter can also be used to compensate for different driving styles.

For additional information about battery installation and setting the battery parameters, please see section 5110.

When setting the battery guard check-point, perform measurement as follows:

- Specific gravity with fully charged battery. Use to inspect the battery quality.

When the battery indicator shows 80% discharge, minimum specific gravity is 1.14.)

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Parameter setting of all parameters

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The specific gravity may vary depending on the type of battery used.

Value	Function	Battery (Ah)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11	Slightly discharged	900
12		730, 700, 580 CSM
13	More discharged	600
14		
15		480, 450
16		
17		360
18		
19		
20		

WARNING!!

Correct parameter setting.
The battery could suffer permanent damage.
If parameters are set higher than recommended, this will cause over-discharge of the batteries resulting in battery destruction.

24.5.15 Parameter 22

Use this parameter to activate the brake coil function and monitoring, and thus achieve higher maximum travel speed.

If the machine type is changed, next time the key is switched on new parameters will be loaded in the frequency converters. In order for the new parameters to take effect, the truck must be switched off and on once again with the key.

24.5.16 Parameter 23

When this parameter is set to 1, this informs the truck controller that the fork unit is equipped with a switching valve operating two different functions. The oil flow is controlled by a valve in the large valve plate.

24.5.17 Parameter 24

When this parameter is set to 1, it is possible to stop the truck using the drive motor but impossible to continue driving unless the safety pedal is depressed.

24.5.18 Parameter 25

Use this parameter to determine the service interval of the truck. The buzzer sounds and code C029 is displayed when the service counter reaches zero. The counter shows the time that has passed since the last service intervention.

If an earlier service intervention is required, simply activate this parameter without adjusting the time.

24.5.19 Parameter 26

When this parameter is set to 1, the cab tilt function (E 1-8) and monitoring are activated.

24.5.20 Parameter 27

When this parameter is set to 1, priority of the lifting function is cancelled, i.e. the hydraulic function currently in use will continue to operate even if lifting is activated.

24.5.21 Parameter 28

Using this parameter, it is possible to switch the information on output 208 during truck operation. Use an intermediary relay if the connected component draws much current.

24.5.22 Parameter 29

If the truck is equipped with height measurement, use this parameter to set the maximum lift height. Bypassing this lift height is not possible. For more information, see parameters 17 and 18.

24.5.23 Parameter 30

Using this parameter, it is possible to switch the information on the I/O box outputs during truck operation. Use an intermediary relay if the connected component is draws much current.

24.5.24 Parameter 37

- Set this parameter to the weight with which the truck is calibrated.

Complete programming in the usual manner.

24.5.25 Parameter 38

- Set this parameter to 1.
- Switch off the truck and then switch it on.

Calibration of the travel speed and brake potentiometers will take place.

This parameter is automatically reset to 0.

NOTE:
Incorrect calibration.
Incorrect calibration value.
Do not operate the controls once calibration has started.

- Fully retract the reach carriage to the inner stop against the battery wall.
- Fully extend the reach carriage to the outer stop.

The end position of the reach carriage cylinder and the slowdown distance have now been calibrated. During calibration, the reach carriage speed is reduced.

- Set this parameter to 4.
- Switch off the truck and then switch it on.

Calibration of weight measurement is now possible.

- Set the forks in the free lift area and do not move them. (--- 1) is displayed
- To confirm the selection, keep the travel direction selector pushed in the fork direction for two seconds and proceed to the next step.
- Now set the forks to the main lift area and do not move them. (--- 2) is displayed
- To confirm, keep the travel direction pressed for two seconds.
- Lift the load (with the programmed weight) with the forks off the ground in the free lift area. (-- weight) is displayed.
- Confirm by pressing the travel direction selector for two seconds.

Weight calibration is now complete and the weight symbol lights with a steady light, while the weight is indicated in the display.

If an error occurs during programming, (Error) is displayed and programming must be repeated.

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24.5.26 Parameter 39

Set this parameter to 1 or 2 if only three drivers/truck travel characteristics will be programmed and the key is used to start the truck.
If the keypad is used and up to ten drivers/truck travel characteristics will be programmed, set the parameter to 3 or 4. In the latter case, this value must be programmed for each driver. See the section “Keypad”.

24.5.27 Parameters 40 to 42

Use these parameters to set the year, day and month. This setting is used by the error code log.

24.5.28 Miscellaneous parameters

The other parameters between 10 and 42 are shown on the display and can be programmed, however, this will not cause any change in the software. Other parameters are fixed and cannot be reprogrammed.

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24.6 Operating hours

When the hour meter setting is displayed, the **symbol E** lights up. The time is displayed as follows:

Letter	Time
	Key time
	Total travel time
	Drive motor time
	Pump motor time
	Time until next service intervention

24.6.1 Installing a new electronic card in the truck

The A5 electronic card supplied by BT can be ordered in different modes:

1. **Completely programmed for the specific truck with the default values preset.**
   =P/N for the card includingsoftware.
2. **Not programmed**
   = only P/N for the card.

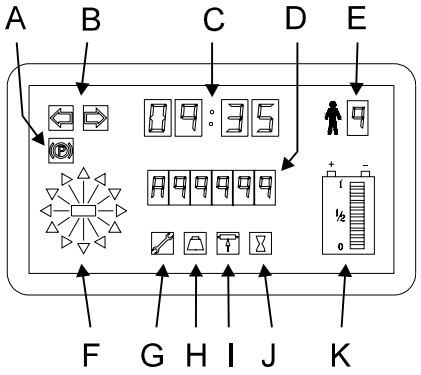
When installing a new electronic card in the truck, some parameters must be programmed to ensure safe operation of the truck.

Use the TruckCom application to download new software to the electronic card.

For details, see the TruckCom user guide.

Adjust the R1 potentiometer on the electronic card according to C code 6000.

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24.7 Warning codes

Character	Error
[	Warning

When an error occurs a buzzer sounds and a code is displayed, for 10 seconds, in the right-hand section of the text window D. The error is also displayed in the text box (G). If the error is still present after one minute, the buzzer will sound again for two seconds.

This will be repeated until the error is corrected, however the truck can be driven with all functions, as set out in the following table

WARNING

Ignoring error indication
Jeopardises truck safety.
Always check truck functions before operation.

Code	
Description	Only two dots on the screen
Error type	Truck does not start
Error causes	1. Short circuit, sensor
	2. Short circuit, cabling
	3. Defect electronic card
Note	

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24.8 Error Codes

The last 50 errors are stored in the error log with the date and time.

24.8.1 Error mode

Error mode	Explanations/corrective actions
Start error	The truck starts, no driving or hydraulic functions
Critical error	Steering safety relay makes Main contactor opens Parking brakes are activated
General error	Current function stops
Height error	Fork lift at low speed
Emergency switch on	Main contactor opens Parking brakes are activated
Steering error	Steering safety relay makes Drive motor reverses to stop
Drive regulator error	Main contactor opens Lift regulator error Steering enabled Parking brake activated when braking
Lift regulator error	Hydraulics stop Valves closed

Warning codes 3 –99 give a warning signal of 2 Hz.
Error codes 100– give a warning signal of 4 Hz.

T-code	Valid from serial number
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24.8.2 Safety logic

This applies to the following functions:

X = Action-- = Function disabled

Action: Function	K10 opens	Y1 activated	Reversing with M1	Steering disabled	Function at A2 halted
Emergency switch	X	X	--		--
Key	X	X	--	X	--
Steering error			X	X	
Error at A1	X		--		--
Error at A2					X (and el. valves off)
Error at A5	X	X	--	X	--

24.9 Warning Codes without registration

Code	**3**
Description	Shock sensor activated by TLS
Error type	Travel speed reduced to inching speed
Error causes	1. Truck collision
	2.
	3.
	4.
Note	Enter the reset code (11111) using the keypad
Code	**4**
Description	Truck has been immobilised via programming of the TLS
Error type	Travel speed reduced to inching speed
Error causes	1. Stop code entered in the TLS.
	2.
	3.
	4.
Note	Enter the reset code via the TLS or the service code

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Warning Codes without registration

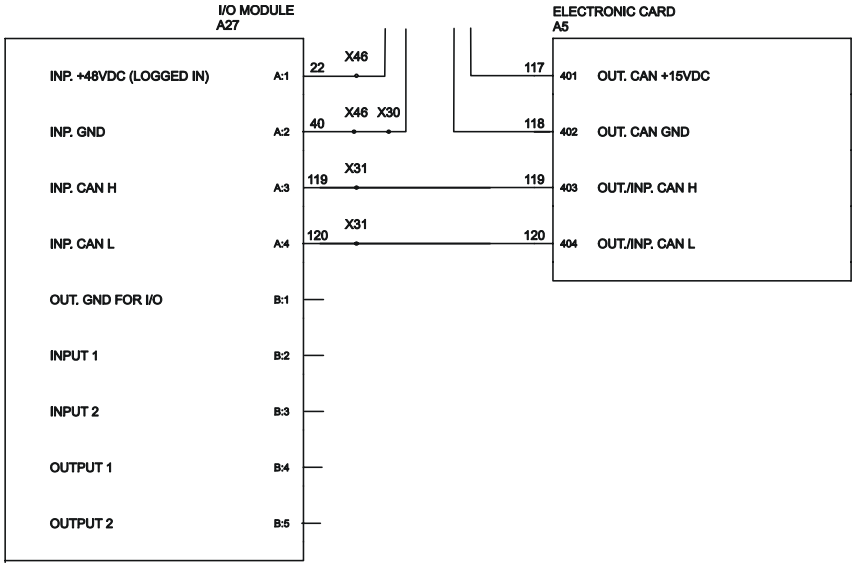
Valid from serial number
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Code	5
Description	No communication with the I/O unit
Error type	No measure
Error causes	1. Defective I/O unit
	2. Defective CAN cable
	3.
	4.
Note	



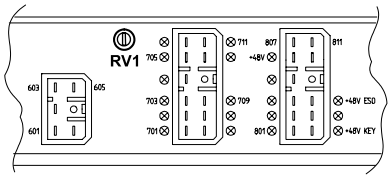
Code	11
Description	Overheating of cooling flange on electronic card
Error mode	Maximum current to steering motor drops and the driving speed is reduced to crawl speed.
Error cause	1. Seized steering/gear Cool and check motor/gear
	3. Seized steering bearings
	4. Defective steering motor
	Defective electronic card A5
Comments	

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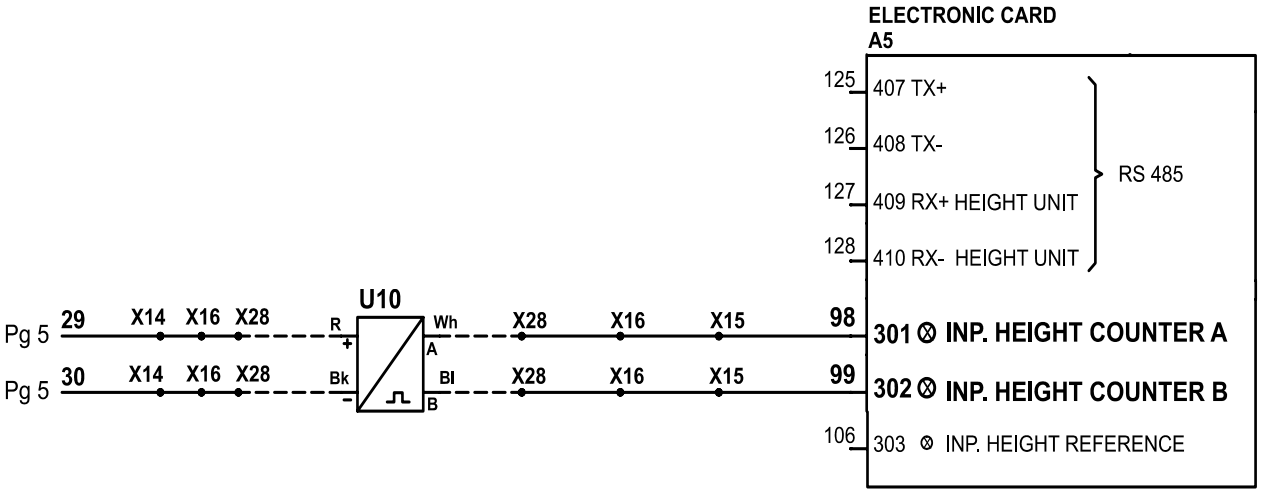
Warning Codes without registration

T-code	Valid from serial number
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Code	13
Description	No/too few pulses from the height measurement sensor when raising or lowering the forks
Error mode	No corrective action
Error cause	1. Incorrectly adjusted RV1 potentiometer on A5 electronic card
	2. Defective height sensor U10/cables.
	3. Incorrect oil quality
	4. Fork carriage too light (forks missing)
	5. Defective electronic card A5
Comments	



1. **Turn the potentiometer RV1, on the A5 electronic card, anti-clockwise and increase the flow on the valve until the correct lowering speed is obtained.**
2. **Height sensor U10.**



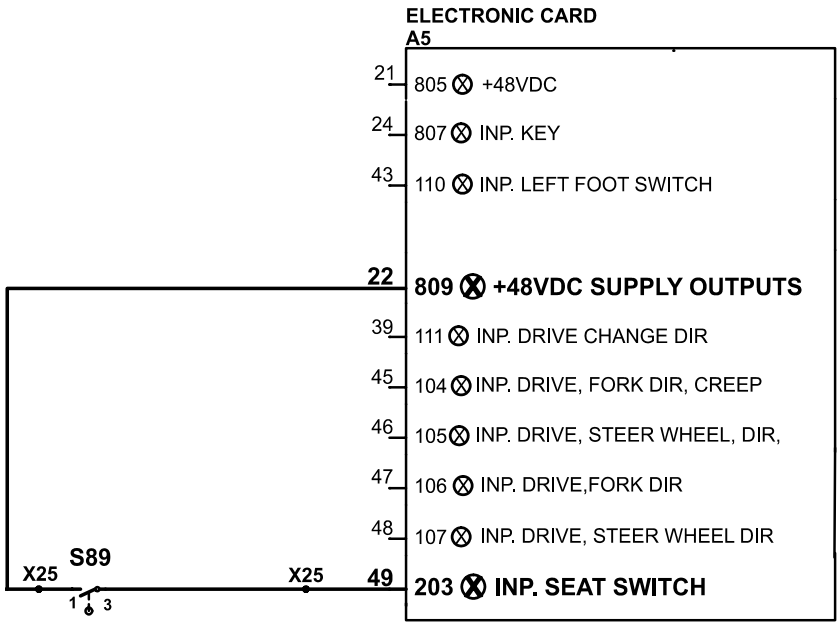
- Check whether the LeDs LD301 and LD302 flash when the forks are raised or lowered. Flashing is irregular, as the pulses are phase displacement by 90 degrees.
- If LD301 and LD302 are switched off the entire time, check that the +15 V supply voltage is on U10. The red cable is positive and the black cable is 0 V. If there is no voltage: check that the cables are intact and that there is no play or oxidisation on the connector pins on terminals X28, X16 and X14.
- If flashing only occurs sporadically, check that the wire does not slip on the height sensor's roller.

- If the mechanics are okay, check that the cables from U10, white cable 98 to input 301 and black cable 99 to input 302 are not broken. Check that there is no play or oxidisation on the connector pins on terminals X28, X16 and X15.
- If the cables and connector are okay, replace the height sensor U10.

3. **Is the oil too thick, standard oil in a coldstore truck. Is it especially fork lowering that runs too slowly?**
4. **Fork lowering will be too slow, if the forks are missing.**
5. **If nothing helps, replace the A5 card.**

Code	14
Description	Seat switch activated more than 20 minutes without moving the truck
Error mode	No corrective action
Error cause	1. Strapped switch
	2. Faulty switch/wiring
	3. Defective electronic card A5
Comments	

Seat switch S89



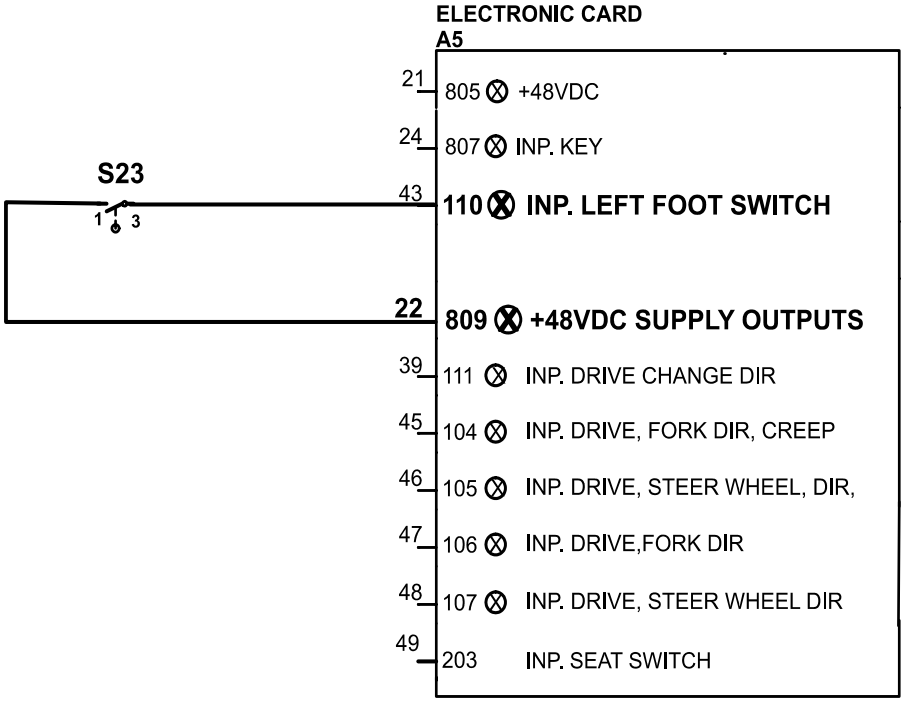
1. **If LD203 is on the entire time.**
   - Check that the seat switch has not been strapped.
   - Remove cable 49 on switch S89, terminal 3. If LD203 goes out, check the functionality of S89.

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2. **If LD203 does not go out, check the cable by also removing it from terminal 203.**
3. **If LD203 does not go out, replace the A5 electronic card.**

Code	15
Description	Safety switch activated more than 20 minutes without moving the truck
Error mode	No corrective action
Error cause	1. Strapped switch
	2. Faulty switch/wiring
	3. Defective electronic card A5
Comments	

Safety switch (left-foot switch), S23



1. **If LD110 is on the entire time.**
   - Check that the safety switch has not been strapped.
   - Remove cable 43 on the switch S23, terminal 3. If LD110 goes out, check the functionality of S23.
2. **If LD110 does not go out, check the cable by also removing it from terminal 110.**
3. **If LD110 does not go out, replace the A5 electronic card.**

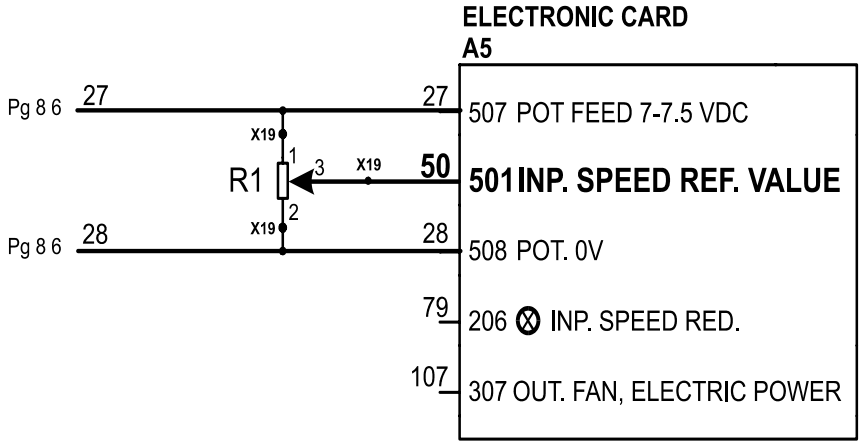
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Warning Codes without registration

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Code	16
Description	Voltage from accelerator pedal's potentiometer R1 is outside the calibrated value at start up. (+/-0.2V).
Error mode	Start up error
Error cause	1. Activated pedal at start up
	2. Faulty potentiometer/bracket/wiring
	3. Calibration error.
	4. Defective electronic card A5
Comments	Manoeuvre to neutral position

Accelerator, R1



1. **Check that the accelerator has not stuck in the actuated position.**
2. **Check that R1 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X19. The voltage on input 501 should be 3.7 +/- 0.2 VDC when R1 is correctly mechanically adjusted.
3. **For calibration of the speed control, see the section "Parameter setting" in this manual.**
   (Deactuated position).
4. **If the voltage on input 501 is correct and calibration does not rectify the problem, then replace the A5 electronic card.**

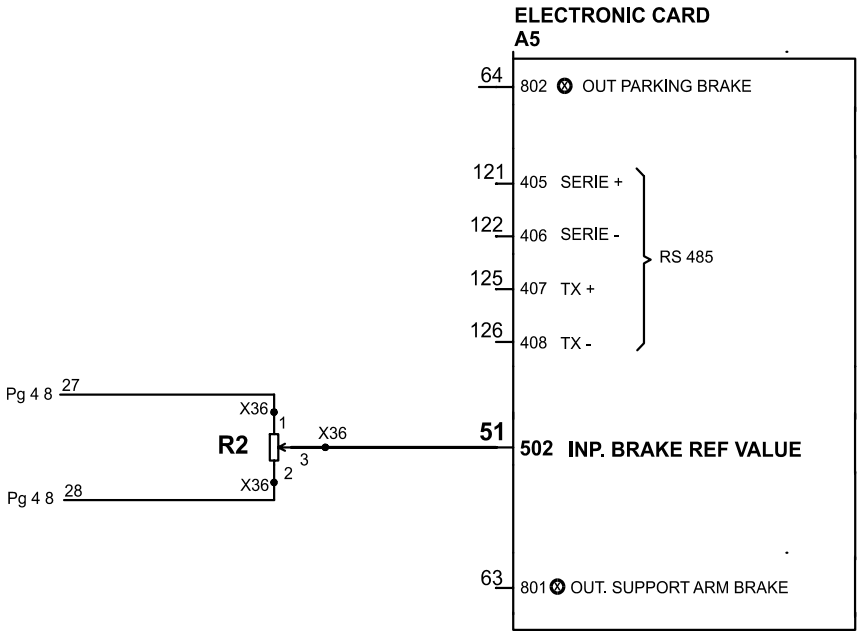
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Warning Codes without registration

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Code	17
Description	Voltage from the brake pedal potentiometer R2 is outside of the calibrated value at start up (+/-0.2 V).
Error mode	Start up error
Error cause	1. Activated brake pedal at start up
	2. Faulty potentiometer/bracket/wiring
	3. Calibration error.
	4. Defective electronic card A5
Comments	Manoeuvre to neutral position

Brakes, R2



1. **Check that the brake pedal has not stuck in the actuated position.**
2. **Check that R2 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X36. The voltage on input 502 should be 1.7 +/- 0.2 VDC when R2 is correctly mechanically adjusted.
3. **For calibration of the brake control, see the section "Parameter setting" in this manual.**
   (Deactuated position).
4. **If the voltage on input 502 is correct and calibration does not rectify the problem, then replace the A5 electronic card.**

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Code	**18**
Description	Battery on the electronic card has reached the lowest voltage
Error mode	Internal clock stops
Error cause	1.Battery voltage too low
Comments	
Code	**19**
Description	Previously programmed values missing
Error mode	Standard values have been loaded
Error cause	Displaced A5 electronic card 1. Program A5 card
Comments	

1. See section “Parameter Settings” in this manual.

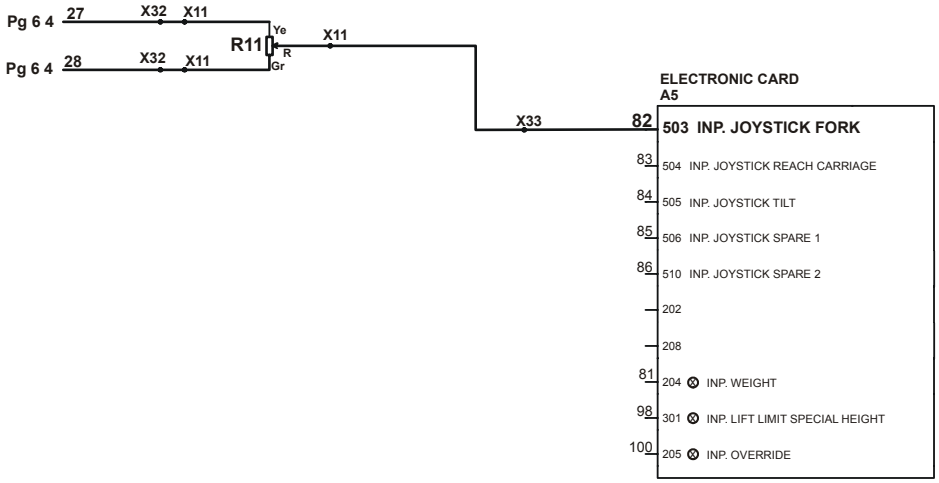
Electronic card – 5710

Warning Codes without registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	21
Description	Potentiometer R11 for fork lift/lower gives incorrect voltage when ignition is switched on (+/-0.6 V).
Error mode	Start up error
Error cause	1. Activated joystick at start up
	2. Faulty potentiometer/wiring
	3. Calibration error.
	4. Defective electronic card A5
Comments	Manoeuvre to neutral position

Fork control, joystick R11



1. **Check that the joystick for the fork operations has not stuck in an actuated position.**
2. **Check that R11 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X11. The voltage on input 503 should be 3,7 +/ -0,6 VDC when R11 is correctly adjusted.
3. **Calibration of fork joystick.**
   - Check that the joystick is not actuated and is in its neutral position.
   - Restart the truck.
4. **Calibration of the joystick takes place. If the correct voltage is on input 503 and calibration does not help, replace the A5 electronic card.**

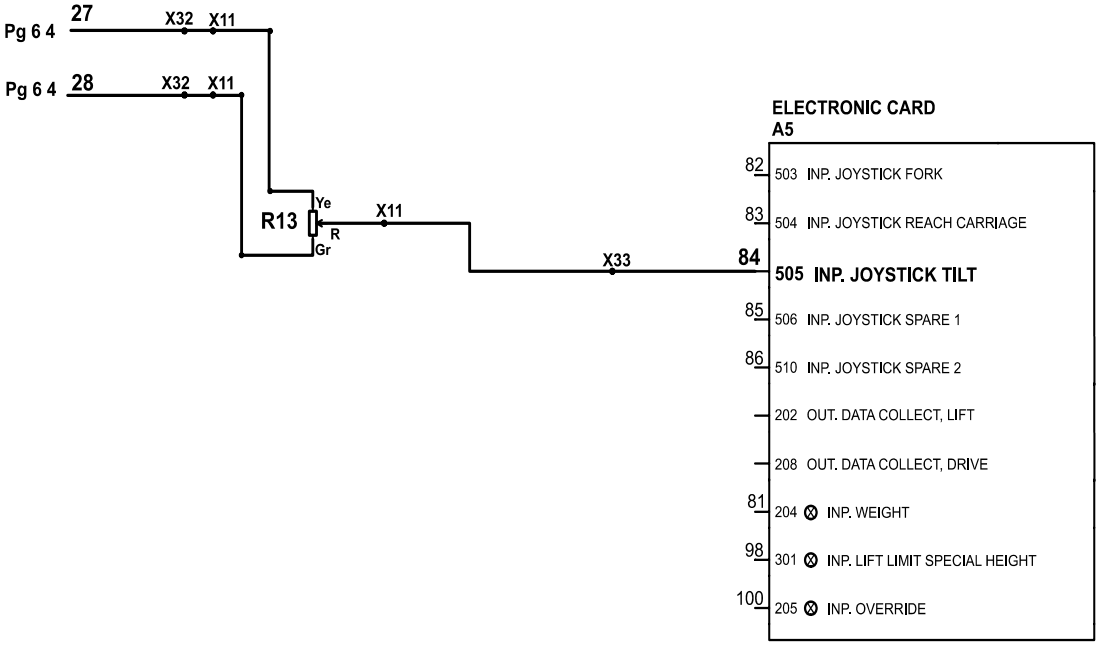
Electronic card – 5710

Warning Codes without registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	22
Description	Potentiometer R13 for tilting gives incorrect voltage when ignition is switched on (+/-0.6 V).
Error mode	Start up error
Error cause	1. Activated joystick at start up
	2. Faulty potentiometer/wiring
	3. Calibration error
	4. Defective electronic card A5
Comments	

Tilt control, joystick R13



1. **Check that the joystick for the tilt operation has not stuck in an actuated position.**
2. **Check that R13 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X11. The voltage on input 505 should be 3.7 +/ -0.6 VDC when R13 is correctly adjusted.
3. **Calibration of the tilt control.**
   - Check that the joystick is not actuated and is in its neutral position.
   - Restart the truck
4. **Calibration of the joystick now takes place. If the correct voltage is on input 505 and calibration does not help, replace the A5 electronic card.**

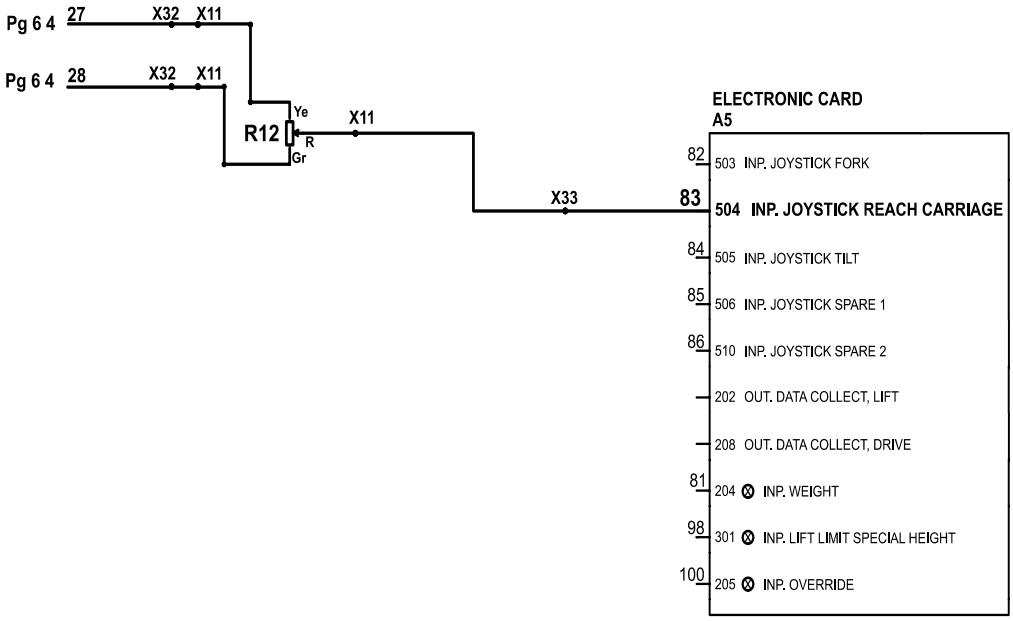
Electronic card – 5710

Warning Codes without registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	23
Description	Potentiometer R12 for the mast reach in/out gives incorrect voltage when ignition is switched on (+/-0.6 V).
Error mode	Start up error
Error cause	1. Activated joystick at start up
	2. Faulty potentiometer/wiring
	3. Calibration error
	4. Defective electronic card A5
Comments	

Mast reach/retraction control, joystick R12

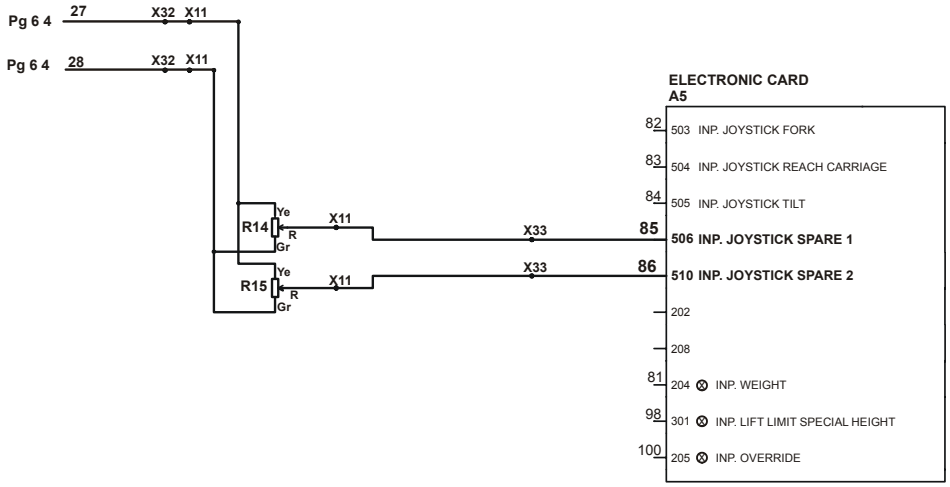


1. **Check that the joystick for the mast's reach/retraction operations has not stuck in an actuated position.**
2. **Check that R12 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X11. The voltage on input 504 should be 3,7 +/ -0,6 VDC when R12 is correctly adjusted.
3. **Calibration of the mast's reach/retraction control.**
   - Check that the joystick is not actuated and is in its neutral position.
   - Restart the truck.

4. **Calibration of the joystick now takes place. If the correct voltage is on input 504 and calibration does not help, replace the A5 electronic card.**

Code	24
Description	Potentiometer R14 or R15 for extra functions “1“ and “2“ give incorrect voltage when the ignition key is switched on (+/-06 V).
Error mode	Start up error
Error cause	1. Activated joystick at start up
	2. Faulty potentiometer/wiring
	3. Calibration error
	4. Defective electronic card A5
Comments	Manoeuvre to neutral position

Extra hydraulic functions, joystick R14 and joystick R15



1. **Check that both of the joysticks for the extra hydraulic functions have not stuck in actuated positions.**
2. **Check that R14 and R15 are located in their brackets. Check that there is no play or oxidisation on the connector pins on terminal X11. The voltage on input 506 and 510 should be 3.7 +/-0.6 VDC when R14 and R15 are correctly adjusted.**
3. **Calibration of the control for extra hydraulic functions**
   - Check that both the joysticks are not actuated and are in their neutral positions.
   - Restart the truck.
4. **Calibration of the joysticks now takes place. If the correct voltage is on inputs 506 and 510 and calibration does not help, replace the A5 electronic card.**

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	25
Description	Output stage error
Error mode	General error
Error cause	1. Emergency switch S133 for Y12 (retracted mast) activated
	2. See codes 50-62 for more information
Comments	

1. **Check S133, which is located under the arm panel.**
2. **To view the registers with recorded warning codes, see the section “Display and programming”:**

The number of the address register is displayed on the left side, while the value is displayed on the right side.

Code	26
Description	Input stage error
Error mode	General error
Error cause	1. See codes 90-94 for more information
Comments	

1. **Proceed as follows when you wish to look in the register for warning codes when registering, see the section “Display and programming”.**

The number of the address register is displayed on the left side, while the value is displayed on the right side.

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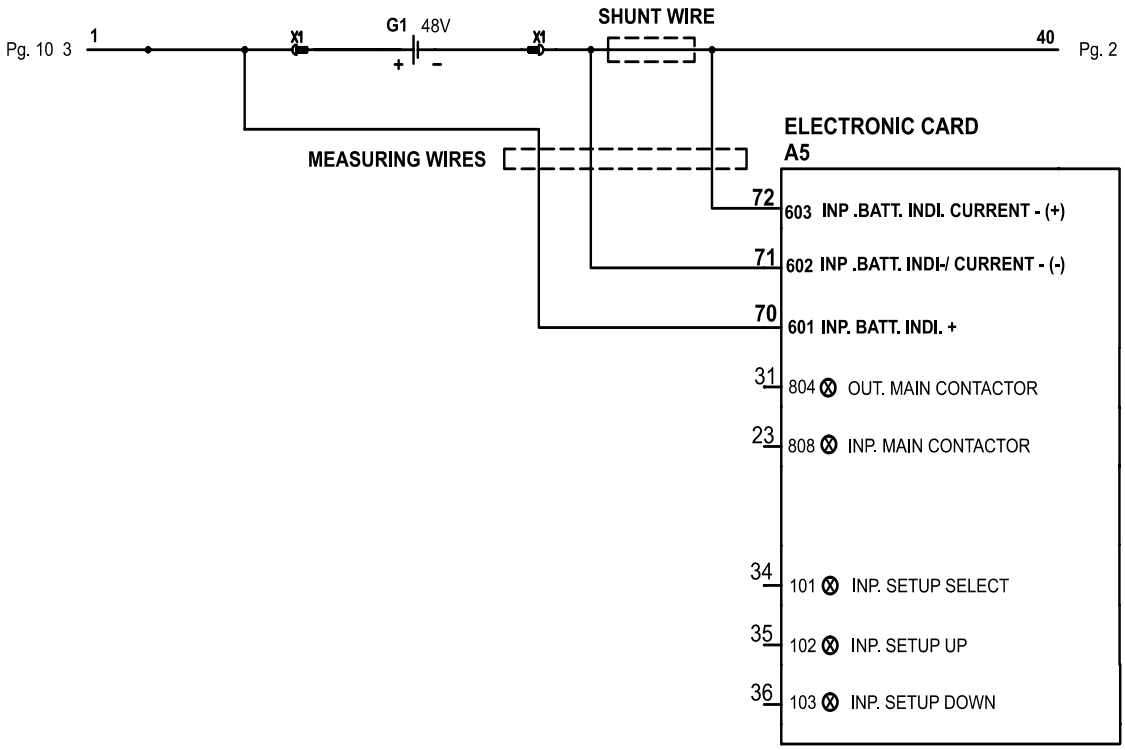
Electronic card – 5710

Warning Codes without registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	27
Description	Incorrect battery measurement
Error mode	Battery display flashes
Error cause	1. No voltage to the battery indicator
	2. Poor contact on battery measurement cables
	3. Defective electronic card A5
	4. Defective battery
Comments	

Battery measurement



1. **Check the voltage supply (+48 VDC) to the battery indicator, cable 70 feeds positive to terminal 601 and cable 71 feeds terminal 602 with negative.**
2. **Check that cable 72 and its connector are intact and make good contact from the shunt to terminal 603. Also check that cable 71 makes good contact with the shunt.**
3. **If there is no error as set out in points 1 and 2, try a new A5 card.**
4. **Contact the battery manufacturer for assistance in determining whether the battery is OK.**

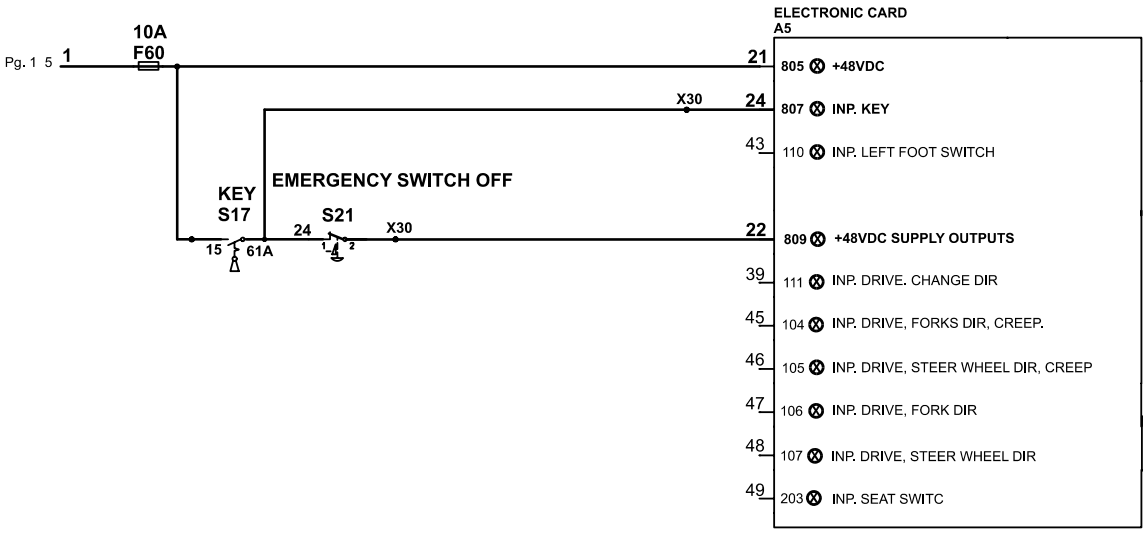
Electronic card – 5710

Warning Codes without registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	28
Description	Emergency switch is activated
Error mode	Emergency switch on
Error cause	1. Driver action
	2. Faulty switch/wiring
	3. Defective electronic card A16
	4. Defective electronic card A5
Comments	Reset S21 and restart the truck

Emergency switch



1. **Check that S21 is not actuated.**
2. **If LeD 809 does not come there is a break in the circuit. If Led 809 comes on the error code could be due to a loose connector in the circuit. Check cable 22 by removing it from terminal 809 and measure using an ohmmeter to terminal 2 on S21. Also check the connector pins for play and oxidisation. If the cable is intact, continue to measure with the ohmmeter through S21 to terminal 1. If S21 is not depressed there should be no breakage. If everything is OK, check that the connection between S16 and S21 is intact.**
3. **If S21 and its cables are okay, replace the A5 card.**

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

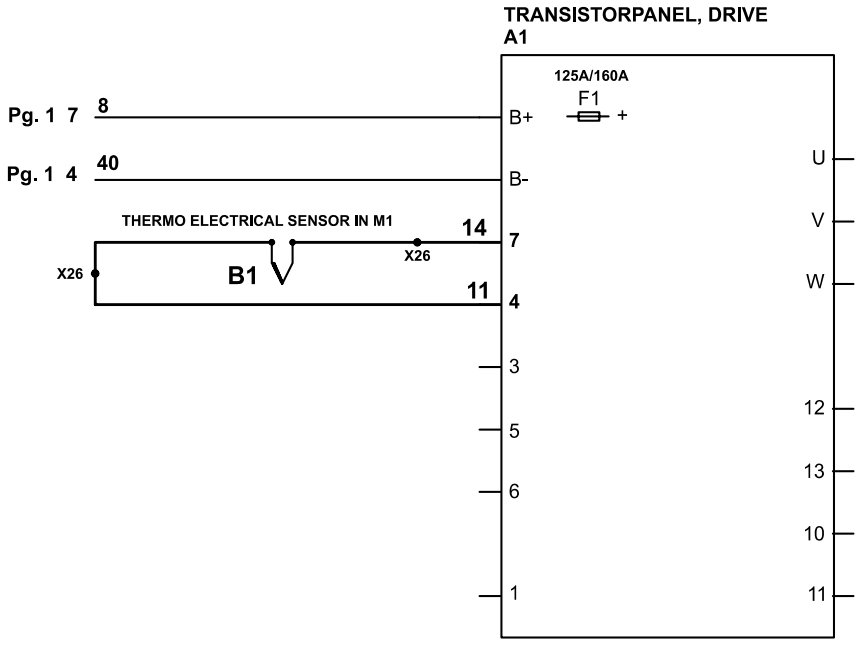
Code	29
Description	Service time (S) is zero
Error mode	No corrective action
Error cause	1. Time for servicing
Comments	Reset with parameter 25

1. Resetting parameter 25:

- See the section “Programming” in this document.
- The service intervals can be checked in the section Preventive maintenance.

Code	40
Description	Warning temperature for drive motor
Error mode	Maximum current reduced
Error cause	1. Overheated drive motor M1
	2. Faulty temperature sensor/wiring
	3 Defective drive regulator, A1
Comments	

Temperature sensor B1 in drive motor M1



1. Check that the ventilation is okay, especially the fan M10 in the motor compartment.

2. Check B1.

- Remove connection X26. Measure B1 in X26 with the ohmmeter, approx. 570 ohm at 20°C.
- Check that cable 11 is intact between X26 and terminal 4 on A1.
- Check that cable 14 is intact between X26 and terminal 7 on A1.
- Also check the connector pins on the terminals for play and oxidisation.

3. If B1 and its cables are okay, replace A1.

Code	**41**
Description	Warning temperature on the drive regulator
Error mode	Maximum current reduced
Error cause	1. Overheated drive regulator
	2. Defective fan
	3.Defective drive regulator, A1
Comments	

1. Check that the ventilation is okay.
2. Check the fan M12, by the motor regulators.
3. If the ventilation okay, replace A1.

Code	**42**
Description	Current calibration error on the drive regulator
Error mode	No corrective action
Error cause	Defective drive regulator, A1
Comments	

1. Replace the drive regulator, A1.

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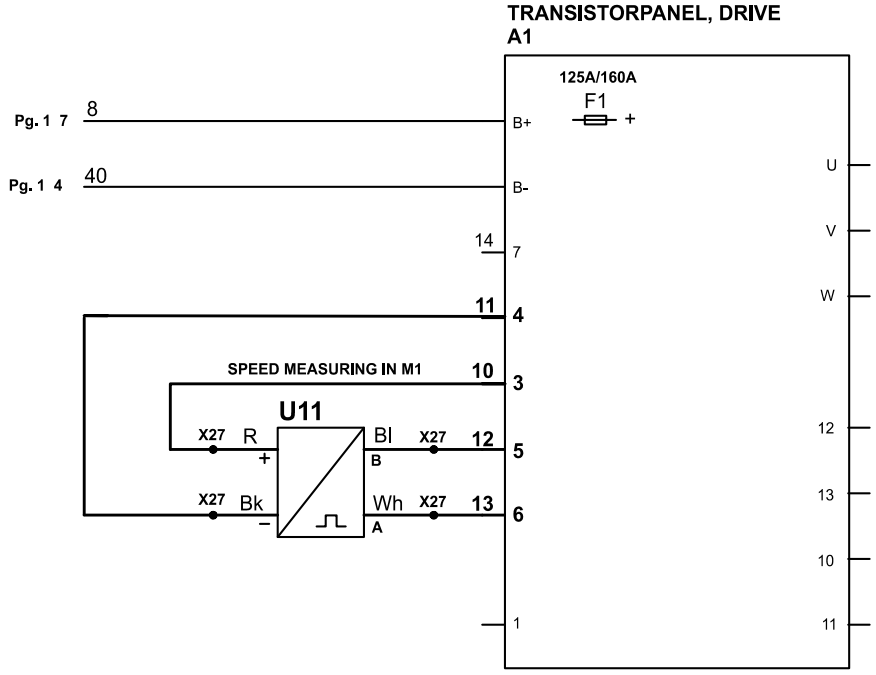
Electronic card – 5710

Warning Codes without registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	43
Description	Incorrect number of pulses from the drive motor's pulse transducer bearing
Error mode	General error
Error cause	1. Faulty sensor/wiring.
	2. Defective drive regulator.
Comments	

Drive motor's pulse transducer bearing, U11



1. Check the cables to U11.

- Remove connection X27.
- Check that cable 11 is intact between X27 and terminal 4 on A1.
- Check that cable 10 is intact between X27 and terminal 3 on A1.
- Check that cable 12 is intact between X27 and terminal 5 on A1.
- Check that cable 13 is intact between X27 and terminal 6 on A1.
- Also check the connector pins on the terminals for play and oxidisation.
- If the cables are okay, replace the transducer bearing U11.

2. If the fault remains, replace A1

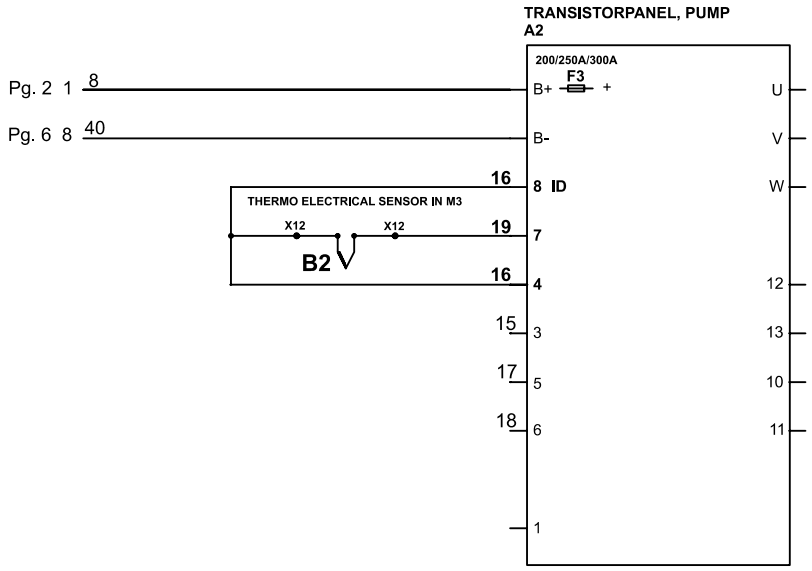
Electronic card – 5710

Warning Codes without registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	45
Description	Warning temperature for pump motor
Error mode	Maximum current reduced
Error cause	1. Overheated pump motor
	2. Faulty temperature sensor/wiring
	3. Defekta lyftregulatorer, A2
Comments	

Temperature sensor B2 in the pump motor M3



1. **Check that the ventilation is okay, especially the fan M10 in the motor compartment.**
2. **Check B2.**
   - Remove connection X12. Measure B2 in X12 with the ohmmeter, approx. 570 ohm at 20°C.
   - Check that cable 16 is intact between X12 and terminal 4 on A1.
   - Check that cable 19 is intact between X12 and terminal 7 on A1.
   - Also check the connector pins on the terminals for play and oxidisation.
3. **If B2 and its cables are okay, replace A2.**

Valid from serial number
713962-

T-code
403-414, 669-671, 716-718

Order number
218920-040

Date
2005-06-01

Code	46
Description	Warning temperature in the lift regulator
Error mode	Maximum current reduced
Error cause	1.Overheated lift converter
	2. Defective fan
	3.Defective lift regulator, A2
Comments	

1. **Check that the ventilation is okay.**
2. **Check the fan M12, by the motor regulators.**
3. **If the ventilation okay, replace A2.**

Code	47
Description	Current calibration error in the lift regulator
Error mode	No corrective action
Error cause	1. Defective frequency converter
Comments	

1. **Replace the lift regulator A2.**

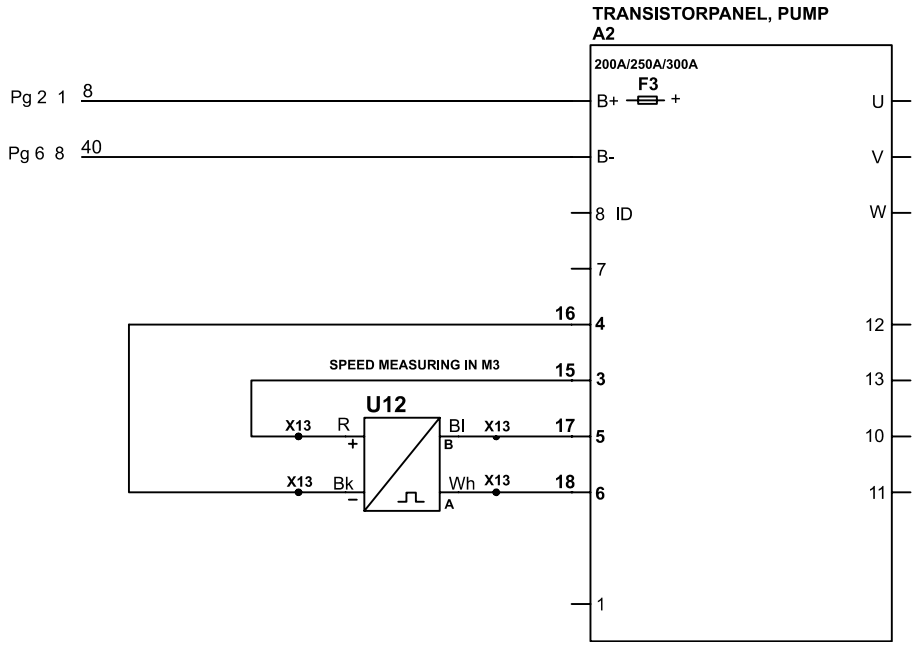
Electronic card – 5710

Warning Codes without registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	48
Description	Incorrect number of pulses from the pump motor's pulse transducer bearing
Error mode	General error
Error cause	1. Faulty sensor/wiring
	2. Defective drive regulator
Comments	

Pump motor's pulse transducer bearing, U12



1. **Check the cables to U12.**
   - Remove connection X13.
   - Check that cable 16 is intact between X13 and terminal 4 on A1.
   - Check that cable 15 is intact between X13 and terminal 3 on A1.
   - Check that cable 17 is intact between X13 and terminal 5 on A1.
   - Check that cable 18 is intact between X13 and terminal 6 on A1.
   - Also check the connector pins on the terminals for play and oxidisation.
   - If the cables are okay, replace the transducer bearing U12.
2. **If the fault remains, replace A2.**

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

24.10 Warning codes with registration

When a warning code is registered, it is automatically displayed. Registration is made in the first of the 50 possible locations and moves previous errors one step down.

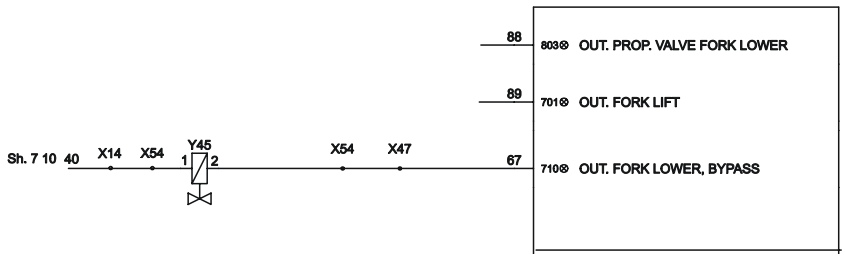
Warning codes 50–64 are either for valve, support arm brake or cable breakage or short circuits.

Warning codes 90-94 are either for potentiometer or cable breakage.

Only the actual function is disabled; other functions are unaffected.

Code	50
Description	Output 710 short circuit/breakage
Error mode	General error
Error cause	1. Faulty wiring/valve Y45
	2. Defective electronic card A5
Comments	

Hydraulic valve Y45 engages the cab lift



1. **Disconnect the cable 67 from output 710.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 67 is intact between terminal 701 and the terminals in X47/X54.
   - Measure the coil resistance of Y45 between the blue and black cables. The resistance should be approx. 90 Ohms.
   - Check whether cable 40 is intact from X54 to battery minus.
2. **If the fault remains, replace A5.**

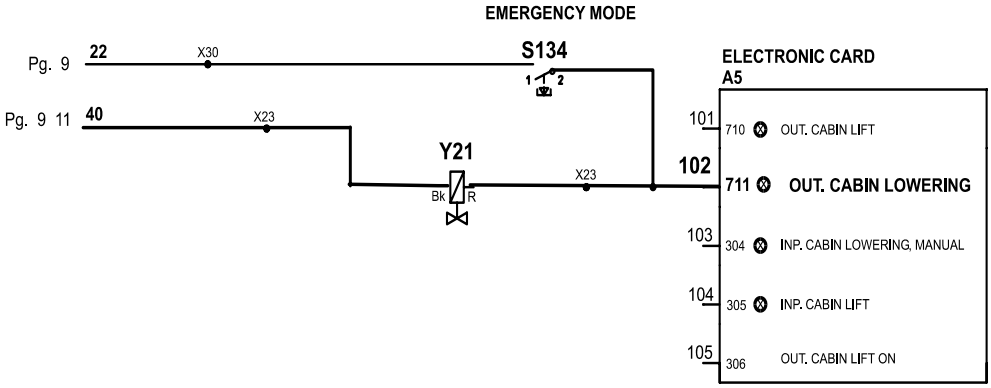
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	51
Description	Output 711 short circuit/breakage
Error mode	General error
Error cause	1. Emergency switch for Y1 activated
	2. Faulty wiring/valve Y21
	3. Defective electronic card A5
Comments	

Hydraulic valve Y21 engages cab lowering



1. **Check that the switch S134 is open.**
2. **Disconnect the cable 102 from output 711.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 102 is intact between terminal 711 and the terminals in X30.
   - Measure the coil on Y21 between the blue and black cables in X30 with an ohmmeter. Resistance approx. 70 ohm.
   - Check that cable 40 is intact from X30 to the battery negative.
3. **If the fault remains, replace A5.**

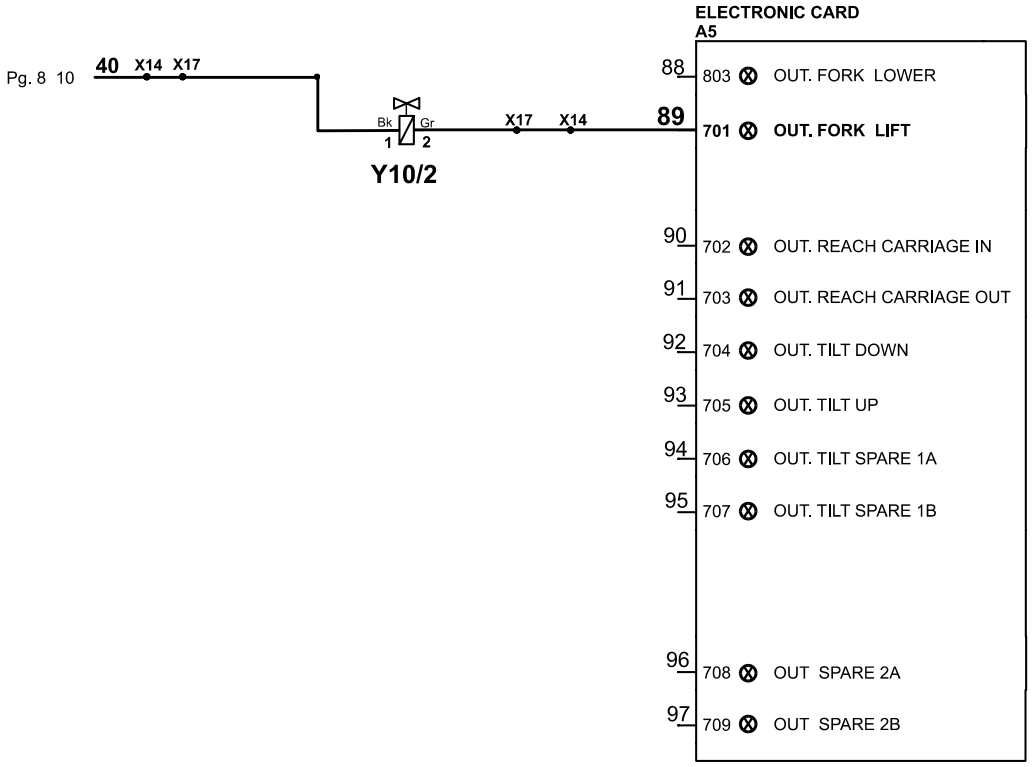
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	52
Description	Output 701 short circuit/breakage
Error mode	General error
Error cause	1. Faulty wiring/valve Y10/2
	2. Defective electronic card A5
Comments	

Hydraulic valve Y10/2 engages fork lift



1. **Disconnect the cable 89 from output 701.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 89 is intact between terminal 701 and the terminals in X17 via X14.
   - Measure the coil on Y10/2 between the grey and black cables in X17 with an ohmmeter. Resistance approx. 105 ohm.
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
2. **If the fault remains, replace A5.**

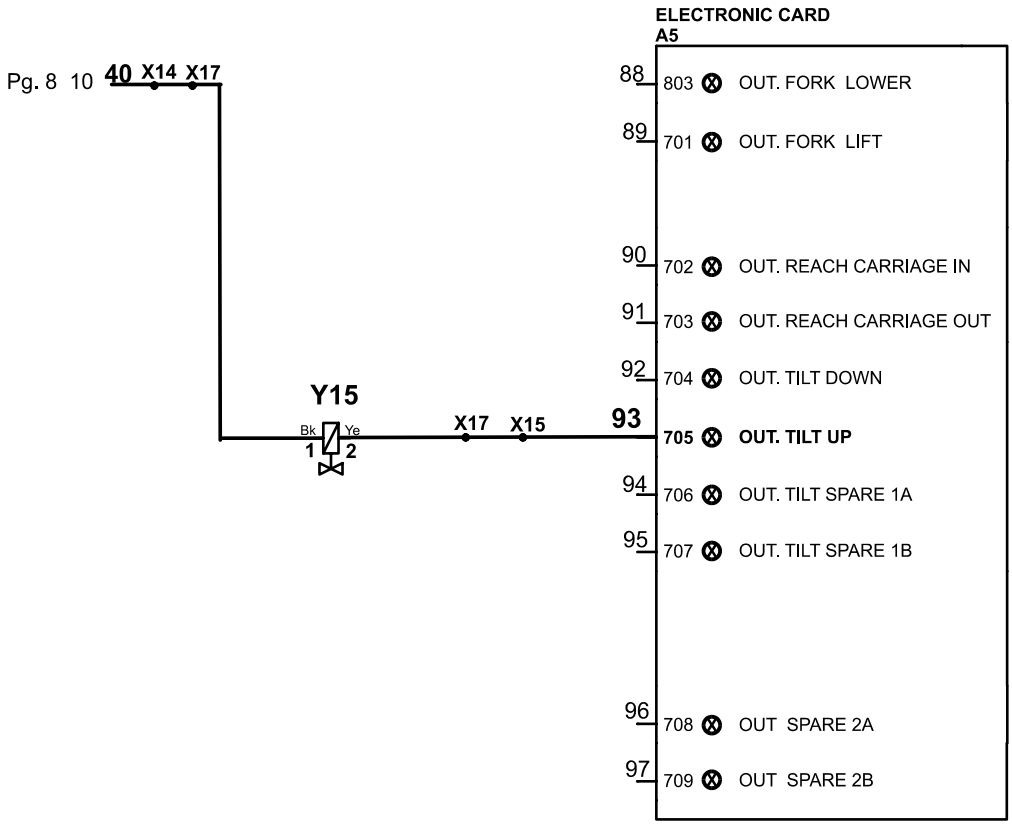
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	53
Description	Output 705 short circuit/breakage
Error mode	General error
Error cause	1. Faulty wiring/valve Y15
	2. Defective electronic card A5
Comments	

Hydraulic valve Y15 engages fork tilt up



1. **Disconnect the cable 93 from output 705.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 93 is intact between terminal 705 and the terminals in X17 via X15.
   - Measure the coil on Y15 between the yellow and black cables in X17 with an ohmmeter. Resistance approx. 90 ohm.
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
2. **If the fault remains, replace A5.**

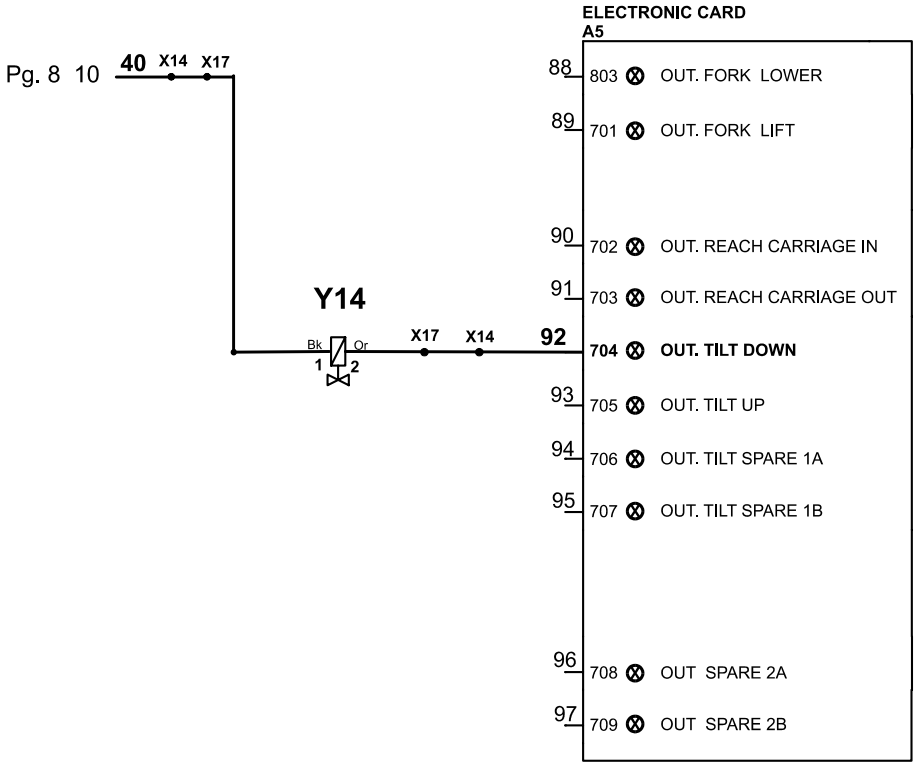
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	54
Description	Output 704 short circuit/breakage
Error mode	General error
Error cause	1. Faulty wiring/valve Y14
	2. Defective electronic card A5
Comments	

Hydraulic valve Y14 engages fork tilt down



1. **Disconnect the cable 92 from output 704.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 92 is intact between terminal 704 and the terminals in X17 via X14.
   - Measure the coil on Y14 between the orange and black cables in X17 with an ohmmeter. Resistance approx. 90 ohm.
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
2. **If the fault remains, replace A5.**

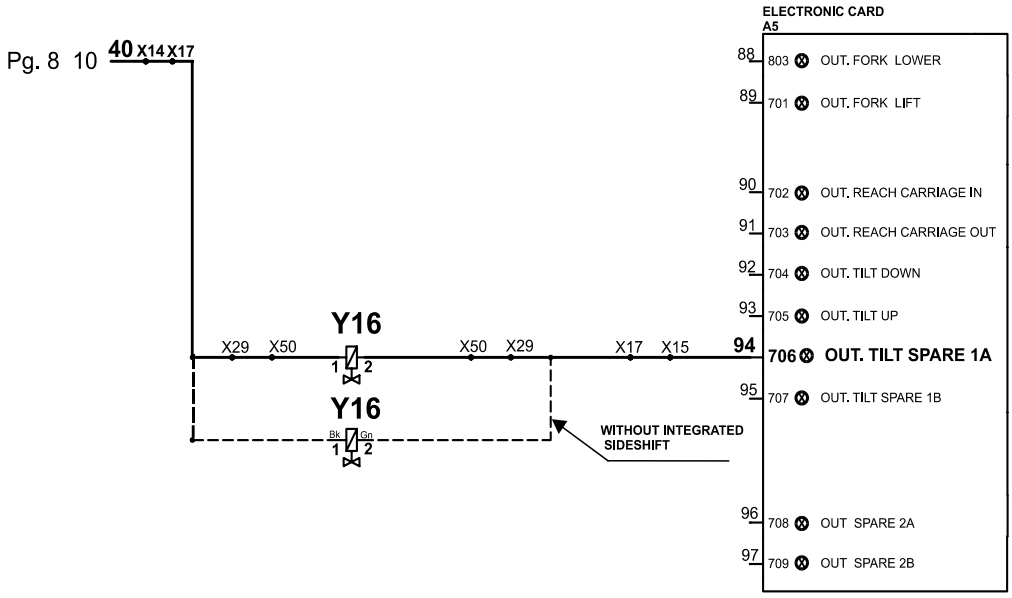
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	55
Description	Output 706 short circuit/breakage
Error mode	General error
Error cause	1. Parameter 15 >0, no valve connected
	2. Faulty wiring/valve Y16
	3. Defective electronic card A5
Comments	

Hydraulic valve Y16 engages a extra hydraulic function, e.g. side shift or fork spread.



1. **If a valve is not connected, parameter 15 must be set to 0. Check parameter 15. See the section “Parameter setting” in this manual.**
2. **Disconnect cable 94 from output 706.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 94 is intact between terminal 706 and the terminals in X50 via X15, X17 and X29.
   - Measure the coil on Y16 between the green and black cables in X50 with an ohmmeter. Resistance approx. 150 ohm.
   - Check that cable 40 is intact from X50, via X29, X17 and X14 to the battery negative.
3. **If the fault remains, replace A5.**

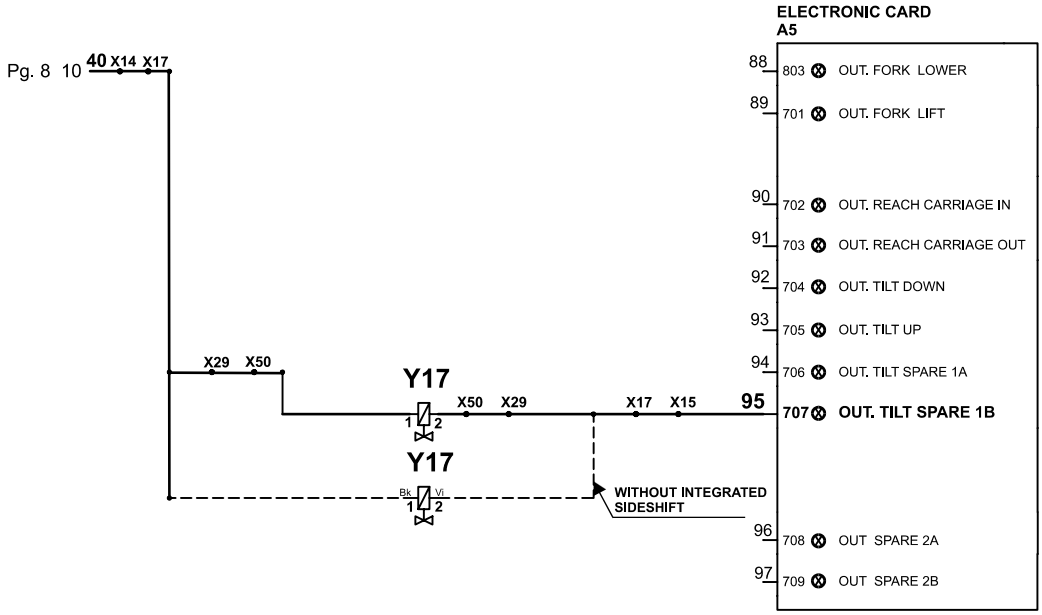
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	56
Description	Output 707 short circuit/breakage
Error mode	General error
Error cause	1. Parameter 15 >0, no valve connected
	2. Faulty wiring/valve Y17
	3. Defective electronic card A5
Comments	

Hydraulic valve Y17 engages a extra hydraulic function, e.g. side shift or fork spread.



1. **If a valve is not connected, parameter 15 must be set to 0. Check parameter 15 as follows. See the section “Parameter setting” in this manual.**
2. **Disconnect cable 95 from output 707.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 95 is intact between terminal 707 and the terminals in X50 via X15, X17 and X29.
   - Measure the coil on Y17 between the green and black cables in X50 with an ohmmeter. Resistance approx. 150 ohm.
   - Check that cable 40 is intact from X50, via X29, X17 and X14 to the battery negative.
3. **If the fault remains, replace A5.**

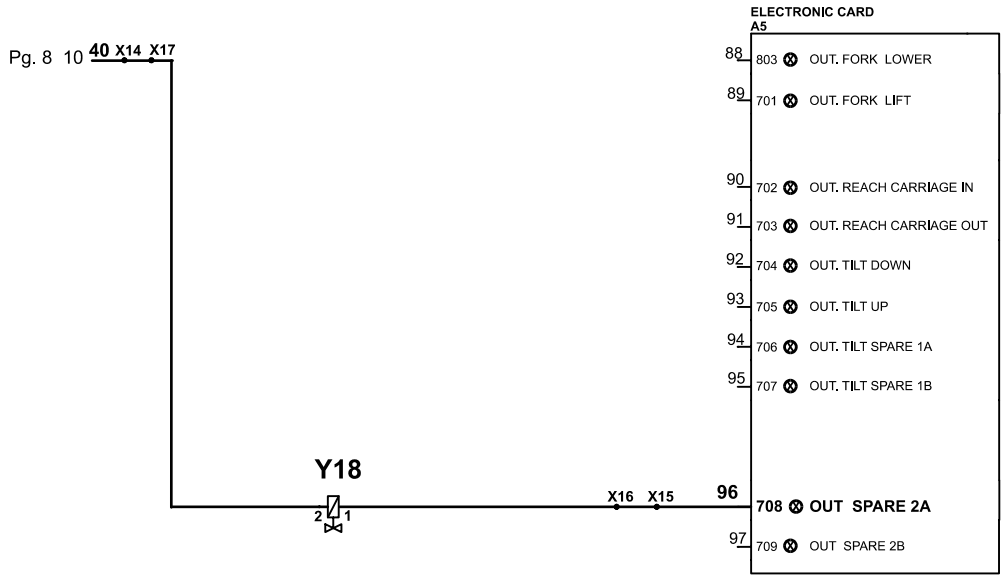
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	57
Description	Output 708 short circuit/breakage
Error mode	General error
Error cause	1. Parameter 16 >0, no valve connected
	2. Defective electronic card A5
Comments	

Hydraulic valve Y18 engages a extra hydraulic function, e.g. side shift or fork spread.



1. **If a valve is not connected, parameter 15 must be set to 0. Check parameter 15 as follows. See the section “Parameter setting” in this manual.**
2. **Disconnect cable 95 from output 707.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 96 is intact between terminal 708 and the terminals in X16 via X15.
   - Measure the coil on Y18 between the cable in X16 and the cable in X17 with an ohmmeter. Resistance approx. 150 ohm. (Not standard)
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
3. **If the fault remains, replace A5.**

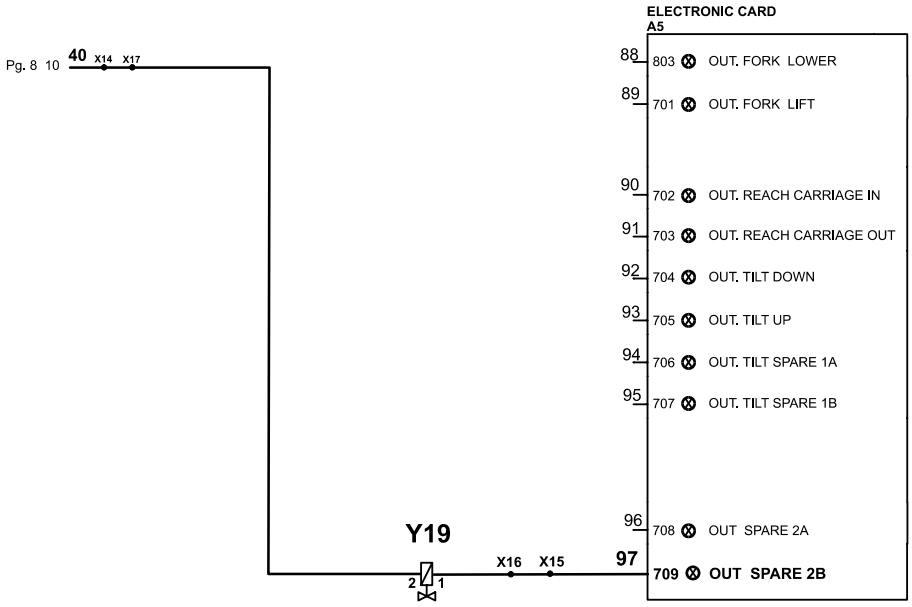
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	58
Description	Output 709 short circuit/breakage
Error mode	General error
Error cause	1. Parameter 16 >0, no valve connected
	2. Faulty wiring/valve Y19
	3. Defective electronic card A5
Comments	Non standard, accessory

Hydraulic valve Y19 engages a extra hydraulic function, e.g. side shift or fork spread.



1. **If a valve is not connected, parameter 16 must be set to 0. Check parameter 16 as follows. See the section "Parameter setting" in this manual.**
2. **Disconnect cable 96 from output 708.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 97 is intact between terminal 709 and the terminals in X16 via X15.
   - Measure the coil on Y18 between the cable in X16 and the cable in X17 with an ohmmeter. Resistance approx. 150 ohm. (Not standard)
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
3. **If the fault remains, replace A5.**

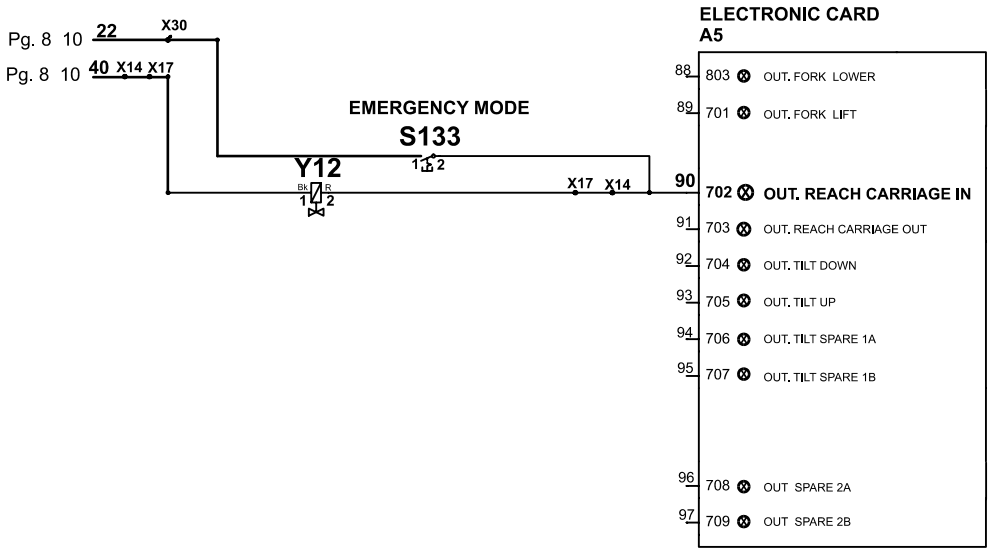
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	59
Description	Output 702 short circuit/breakage
Error mode	General error
Error cause	1. Emergency switch for Y12 activated
	2. Faulty wiring/valve Y12
	3. Defective electronic card A5
Comments	

Hydraulic valve Y12 operates the retraction of the fork carriage.



1. **Check that the switch S133 is open.**
2. **Disconnect the cable 90 from output 702.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 90 is intact between terminal 702 and the terminals in X17 via X14.
   - Measure the coil on Y12 between the red and black cables in X17 with an ohmmeter. Resistance approx. 90 ohm.
   - Check that cable 40 is intact from X17 via X14 to the battery negative.
3. **If the fault remains, replace A5.**

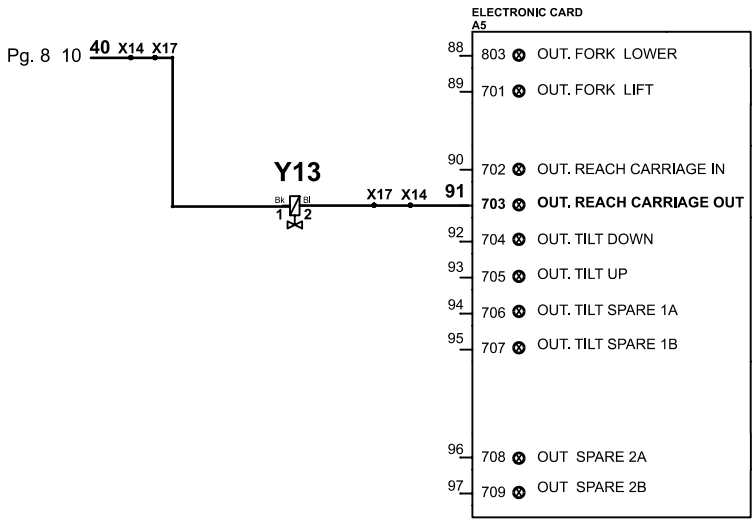
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	60
Description	Output 703 short circuit/breakage
Error mode	General error
Error cause	1. Faulty wiring/valve Y13
	2. Defective electronic card A5
Comments	

Hydraulic valve Y13 operates the extension of the fork carriage.



1. **Disconnect the cable 91 from output 703.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 91 is intact between terminal 703 and the terminals in X17 via X14.
   - Measure the coil on Y13 between the blue and black cables in X17 with an ohmmeter. Resistance approx. 90 ohm.
   - Check that cable 40 is intact from X17 via X14 to the battery negative.
2. **If the fault remains, replace A5.**

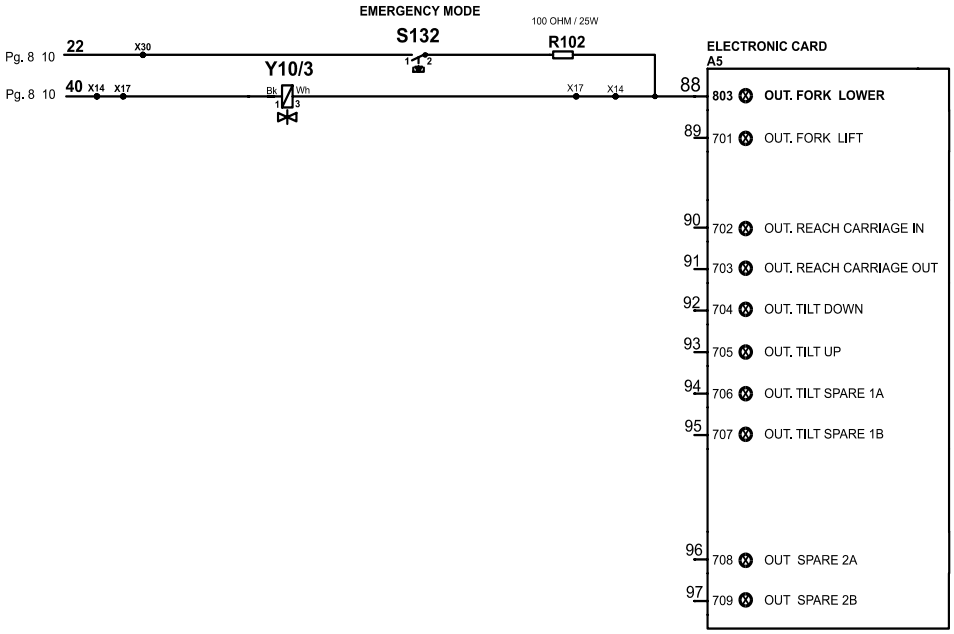
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	61
Description	Output 803 short circuit/breakage
Error mode	General error
Error cause	1. Emergency switch Y10/3 activated
	2. Faulty wiring/valve Y10/3
	3. Defective electronic card A5
Comments	

Hydraulic valve Y10/3 engages fork lowering.



1. **Check that the switch S132 is open.**
2. **Disconnect the cable 88 from output 803.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 88 is intact between terminal 803 and the terminals in X17 via X14.
   - Measure the coil on Y10/3 between the white and black cables in X17 with an ohmmeter. Resistance approx. 27 ohm.
   - Check that cable 40 is intact from X17, via X14 to the battery negative.
3. **If the fault remains, replace A5.**

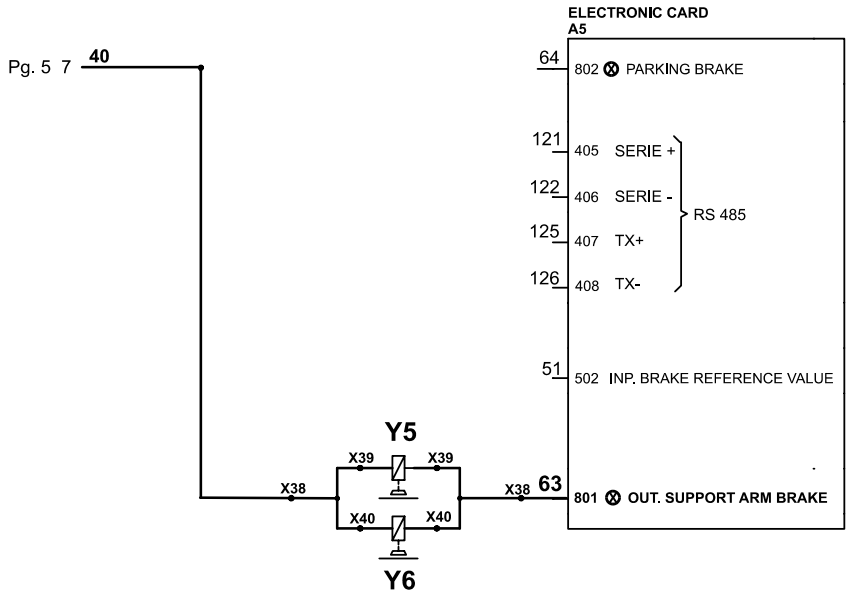
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	62
Description	Output 801 short circuit/breakage
Error mode	If both support arm brakes are defective, the maximum travel speed will be limited to 9 km/h
Error cause	1. Faulty wiring/valve Y5/Y6
	2. Defective electronic card A5
Comments	

Y5/Y6 are the coils in the support arm brakes



1. **Disconnect the cable 63 from output 801.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 63 is intact between terminal 801 and the terminals in X38.
   - Check that the cable 63 is intact between terminal X38 and the terminals in X39/X40.
   - Disconnect connector X39. Measure the coil on Y5 using an ohmmeter. Resistance approx. 50 ohm. If the coils are measured when connected in parallel from X38, the resistance is approx. 25 ohm.
   - Disconnect connector X40. Measure the coil on Y6 using an ohmmeter. Resistance = 50 ohm.
   - Check that the cable 40 is intact between terminals X39/40 and the terminals in X38.
   - Check that cable 40 is intact from X38 to the battery negative.
2. **If the fault remains, replace A5.**

Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	64
Description	Pressure sensor short-circuited/interrupted
Error type	If the pressure sensor is defective, the maximum travel speed will be limited to 9 km/h
Error causes	1. Defective cabling/B3 sensor B3
	2. Defective A5 electronic card
Note	

1. **Measure the voltage on input 411 on the A5 electronic card A5. It must be between >0.3 and <6 volts.**
2. **Measure the voltage to the sensor on cable 29/30. It must be 15 volts.**
3. **Disconnect cable 65 from output 411.**
   - Check whether the connector terminals have contact, are loose or oxidised.
   - Check whether cable 65 is intact between the 411 connector and the X47 connector.
   - Check whether cable 65 is intact between the X47 connector and the X54 connector.
   - Check whether cable 29/30 is intact between B3 and X54 and the connector in X14.
   - Check whether the cable 29/30 is intact from X14 to the A5 electronic card.
4. **Replace A5 if the error remains.**

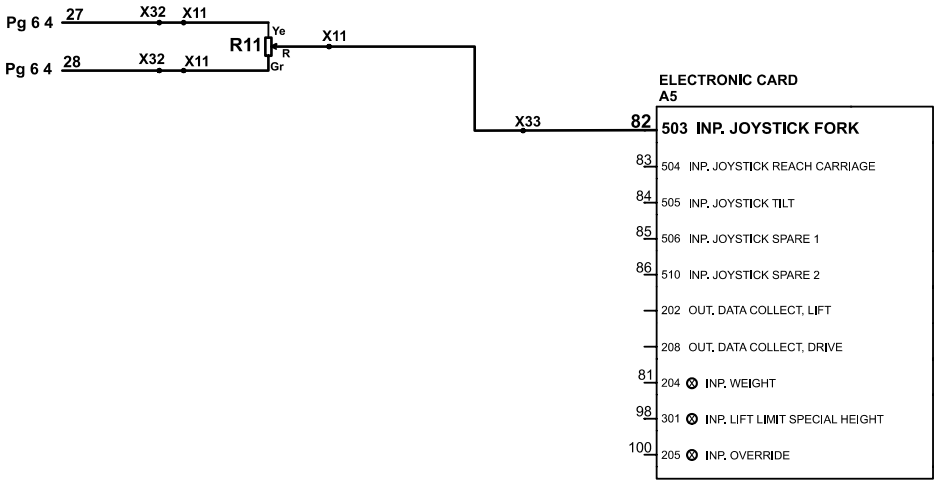
Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	90
Description	Potentiometer R11 for fork lift/fork lower gives incorrect voltage (<0.3 or >7.0 V).
Error mode	General error
Error cause	1. Faulty potentiometer/wiring or activated input without connected potentiometer
	2. Defective electronic card A5
Comments	

Fork control, joystick R11



1. **Check that R11 is located in its bracket.**
   - Check that the voltage across R11 (yellow and grey cable) is 7-7.5 VDC.
   - Check that there is no play or oxidisation on the connector pins on terminal X11.
   - The voltage on input 503 should be 3.7 +/-0.6 VDC when R11 is correctly adjusted.
2. **If the correct voltage is on input 503 and the fault remains, replace the A5 electronic card.**

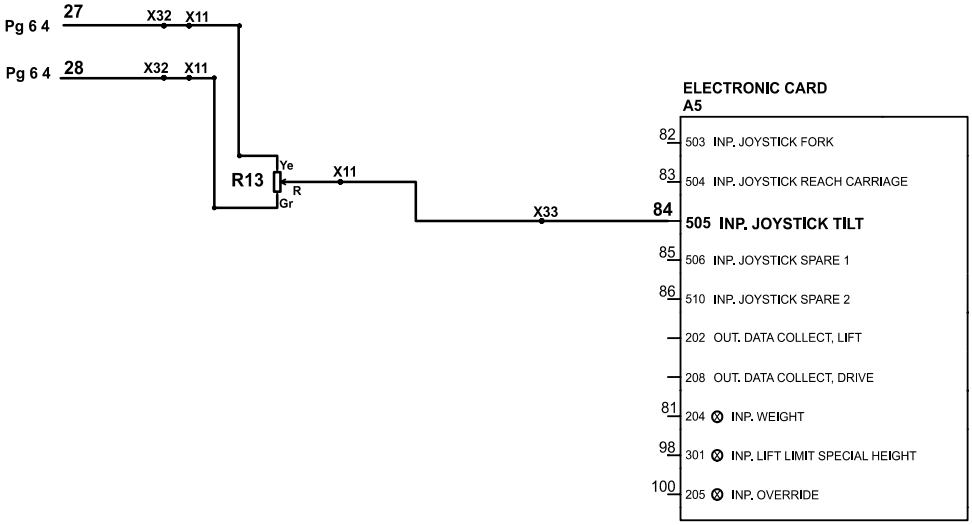
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	91
Description	Potentiometer R13 for tilt gives incorrect voltage (<0.3 or >7.0 V).
Error mode	General error
Error cause	1. Faulty potentiometer/wiring or activated input without connected potentiometer
	2. Defective electronic card A5
Comments	

Tilt control, joystick R13



1. **Check that R13 is located in its bracket.**
   - Check that the voltage across R13 (yellow and grey cable) is 7-7.5 VDC.
   - Check that there is no play or oxidisation on the connector pins on terminal X11.
   - The voltage on input 505 should be 3.7 +/-0.6 VDC when R11 is correctly adjusted.
2. **If the correct voltage is on input 505 and the fault remains, replace the A5 electronic card.**

Electronic card – 5710

Warning codes with registration

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	92
Description	Potentiometer R12 for mast reach in/out movement gives incorrect voltage (<0.3 or >7.0 V)
Error mode	General error
Error cause	1. Faulty potentiometer/wiring or activated input without connected potentiometer
	2. Defective electronic card A5
Comments	

Mast reach/retraction control, joystick R12



1. **Check that R12 is located in its bracket.**
   - Check that the voltage across R12 (yellow and grey cable) is 7-7.5 VDC.
   - Check that there is no play or oxidisation on the connector pins on terminal X11.
   - The voltage on input 504 should be 3.7 +/-0.6 VDC when R11 is correctly adjusted.
2. **If the correct voltage is on input 504 and the fault remains, replace the A5 electronic card.**

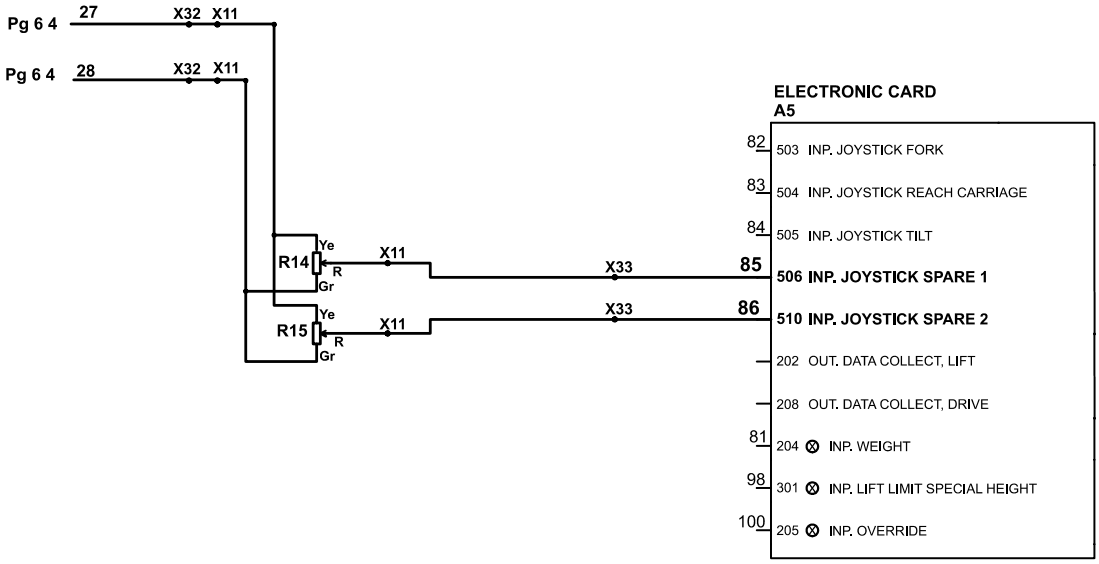
Electronic card – 5710

Warning codes with registration

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	93
Description	Potentiometer R14 or R15 for extra function “1“ and “2“ gives incorrect voltage (<0.3 or >7.0 V).
Error mode	General error
Error cause	1. Parameters 15/16 >0, no potentiometer connected
	2. Faulty potentiometer/wiring
	3. Defective electronic card A5
Comments	

Extra hydraulic functions, joystick R14 and R15



1. **If a valve is not connected, parameter 15/16 must be set to 0. Check parameter 16 as follows. See the section “Parameter setting” in this manual.**
2. **Check whether the two joysticks used for the optional hydraulic function have become stuck in the actuated position.**
3. **Check that R14 and R15 are located in their brackets. Check that there is no play or oxidisation on the connector pins on terminal X11. The voltage on input 506 and 510 should be 3.7 +/-0.6 VDC when R14 and R15 are correctly adjusted.**
4. **If the correct voltage is on inputs 506 and 510, replace the A5 electronic card.**

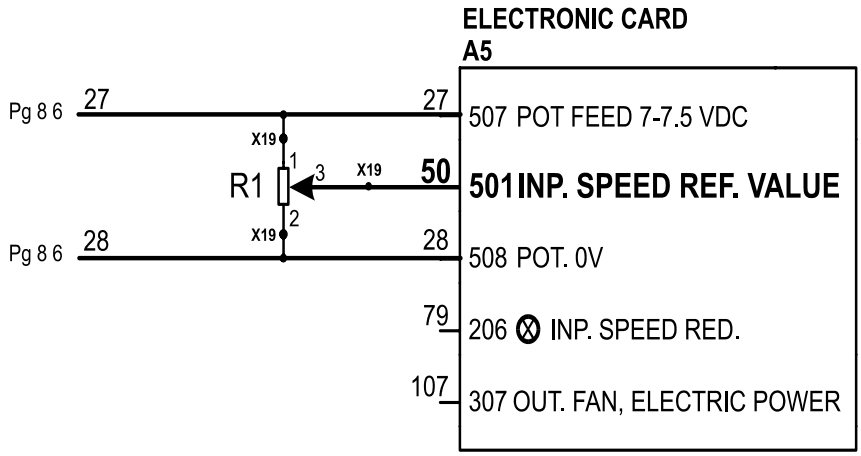
Electronic card – 5710

Warning codes with registration

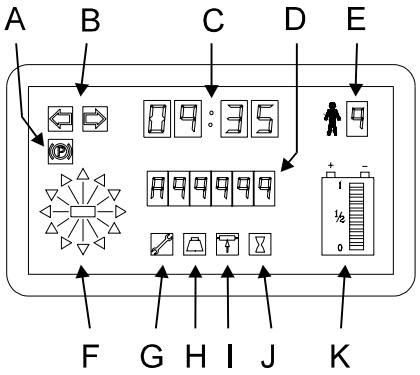
Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	94
Description	Potentiometer R1 for accelerator pedal gives incorrect voltage (<0.4 or >4.6 V).
Error mode	General error
Error cause	1. Faulty potentiometer/wiring
	2. Defective electronic card A5
Comments	

Accelerator R1



1. **Check that R1 is located in its bracket.**
   Check that there is no play or oxidisation on the connector pins on terminal X19. The voltage on input 501 should be 3,7 +/ - 0.2 VDC when R1 is correctly mechanically adjusted.
2. **If the correct voltage is on input 501 and the fault remains, replace the A5 electronic card.**



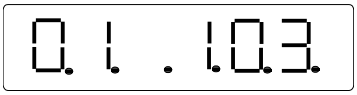
24.11 Error Codes

Character	Error
E	Error

When an error occurs, a buzzer is sounded at the same time as an error code is shown in the right-hand section of the text window D. The error is also indicated in text window G. The buzzer sounds until the ignition is switched off, cutting power to the truck.

If the error remains when the truck is restarted, the code will be shown again and the buzzer will sound.

The truck's hydraulic functions shown in the table will be inoperable.



The code is automatically registered in the error register when it's displayed, the significance of the code is evident from the table. Registration is made in the first of the 50 possible locations and moves previous errors one step down.



When the registry is shown in the text window, the most recent error will be shown first, along with the error code.



To see the date when the error occurred, depress the travel direction selector once, and to see the time, depress once more.
To see more recorded errors, use the lifting/lowering lever to scroll through the display.

WARNING

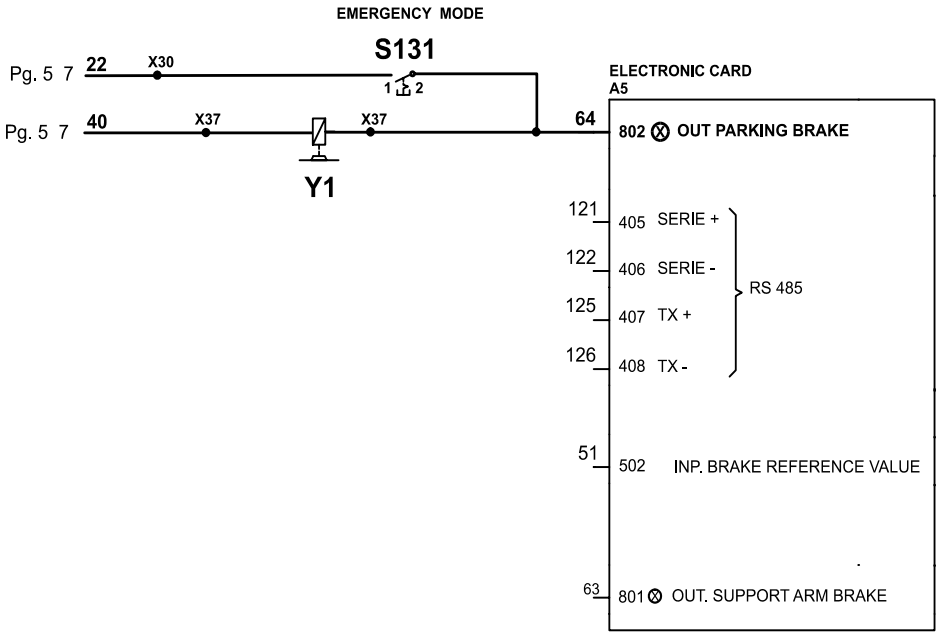
Ignoring error indication
Jeopardises truck safety.
Always check truck functions before operation.

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

24.11.1 Error codes with registration

Code	104
Description	Output 802 short circuit/breakage
Error mode	Critical error
Error cause	1. Emergency switch for Y1 activated
	2. Faulty wiring/valve Y1
	3. Defective electronic card A5
Comments	

Parking brake Y1



1. **Check that the switch S131 is open.**
2. **Disconnect the cable 64 from output 802.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that the cable 64 is intact between terminal 802 and the terminals in X37.
   - Measure the coil on Y1 between the terminals in X37 with an ohmmeter. Resistance approx. 33 ohm.
   - Check that cable 40 is intact from X37 to the battery negative.
3. **If the fault remains, replace A5.**

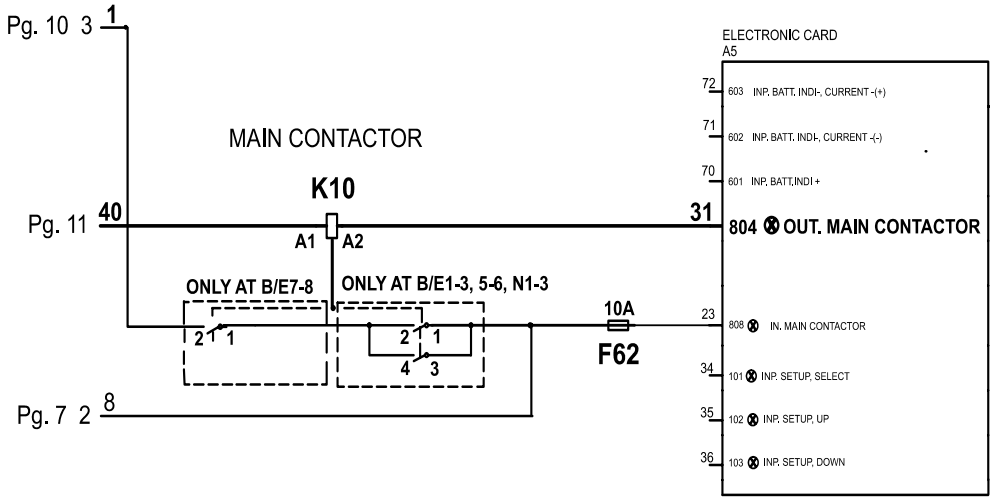
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	106
Description	Output 804 short circuit/breakage
Error mode	Critical error
Error cause	1. Faulty wiring/contactor K10
	2. Defective electronic card A5
Comments	

Main contactor, K10, coil



1. **Disconnect the cable 31 from output 804.**
   - Check that the connector pins make contact, no play and no oxidisation.
   - Check that cable 31 is intact up until contactor K10:A2.
   - Measure the coil on Y10 between A1 and A2.
     Resistance approx. 150 ohm.
   - Check that cable 40 is intact between contactor K10: A1 and the battery negative and terminals in X38.
2. **If the correct voltage is on input 501 and the fault remains, replace the A5 electronic card.**

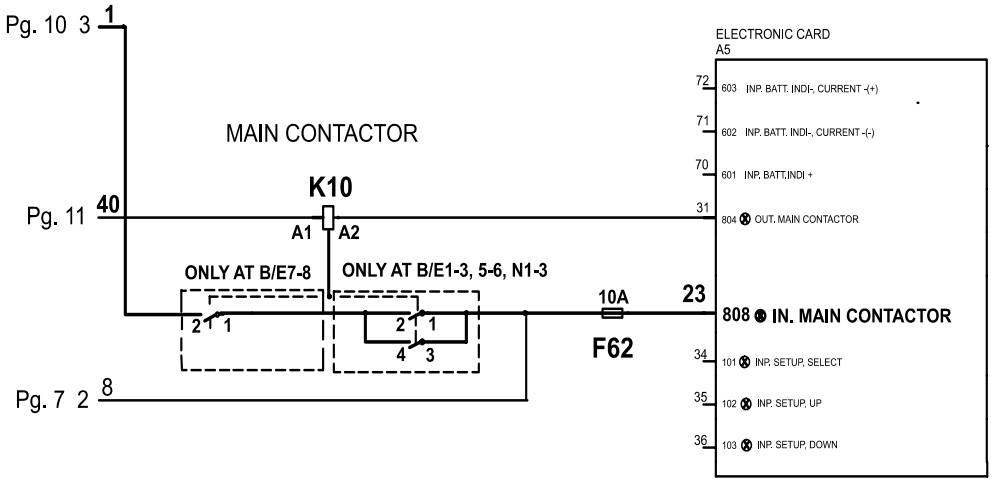
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	107
Description	The main contactor K10 does not close during truck start-up and the emergency stop switch does not operate
Error mode	Critical error
Error cause	1. Defective contactor K10
	2. Defective electronic card A5
Comments	

Main contactor, K10, contactor points



1. **Check the voltage on terminal 808. It must be nominal battery plus, i.e. + 48 VDC, when the truck is stated.**
   - If there is no voltage, check fuse F62 (10 A).
   - If the fuse has not blown, check that cable 23 is intact.
   - If cable 23 is okay, check the contactor points on K10.
   - If the contactor points are okay, check that cable 1 is okay.
2. **If there is a voltage of +48 VDC on the card's terminal 808 and the fault remains, replace the A5 card.**

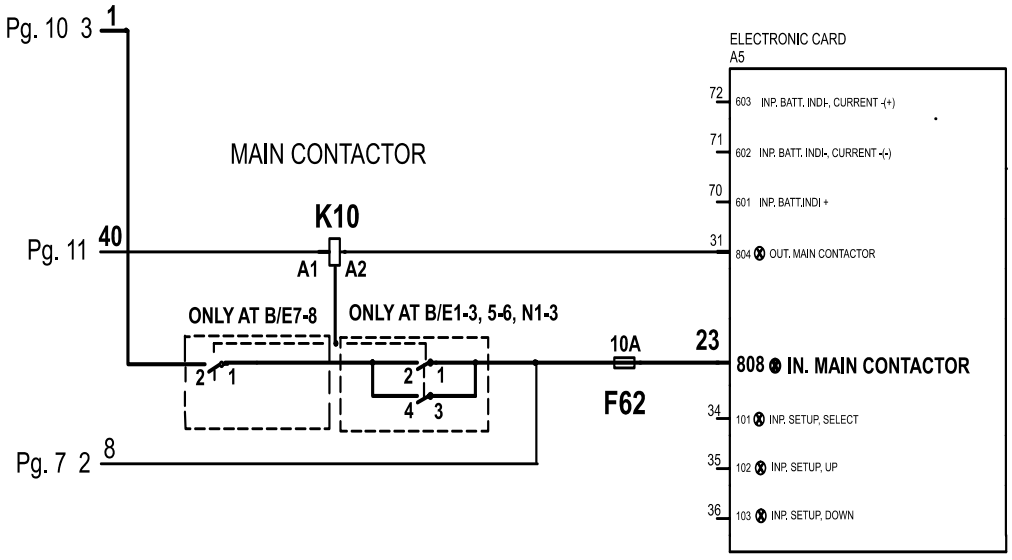
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	108
Description	The main contactor does not open when the red pushbutton on the keypad is depressed and the emergency stop switch does not operate
Error mode	Critical error
Error cause	1. Defective contactor K10
	2. Defective electronic card A5
Comments	

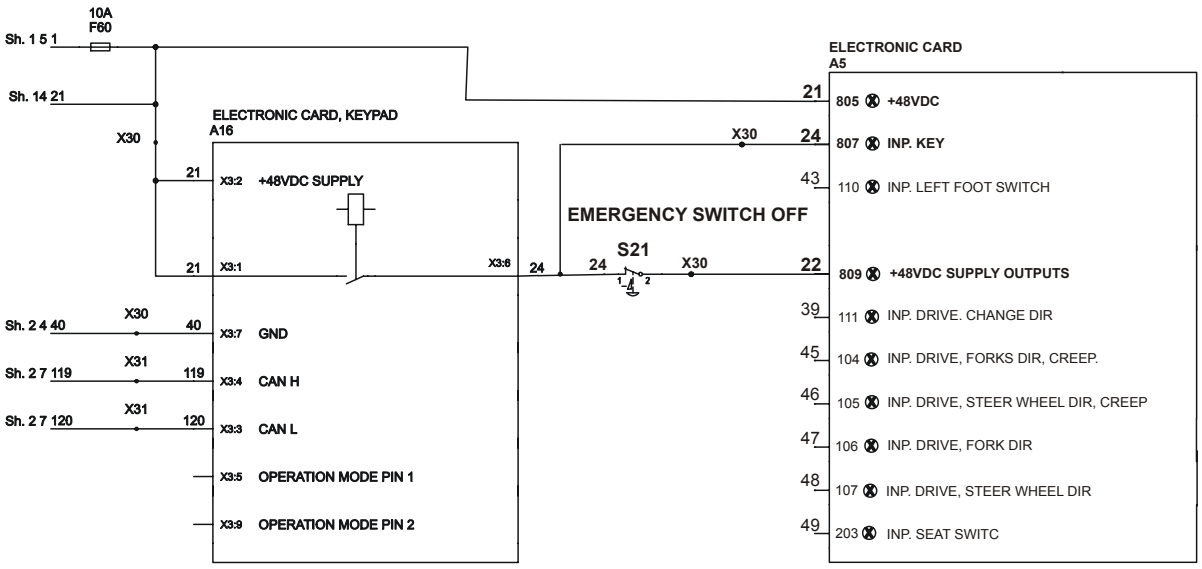
Main contactor, K10, contactor points



1. **Check the voltage on terminal 808. It must be 0 VDC when the red pushbutton on the keypad is depressed.**
   - If there is voltage, check whether the contactor points on K10 are welded together.
   - If the contactor points are okay, check that cable 23 is not short-circuited to any live parts.
2. **If the voltage is 0 VDC on the card's terminal 808 and the fault remains, replace the A5 card.**

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	109
Description	Keypad relay does not open.
Error type	Travel speed reduced to inching speed
Error causes	1. Short-circuited cable
	2. Defective keypad
Note	



1. **Check the voltage in cable 24. It must be 0 VDC when the red pushbutton on the keypad is depressed.**

If the voltage is correct, disconnect cable 24. If the voltage is still correct, then replace the A16 keypad.

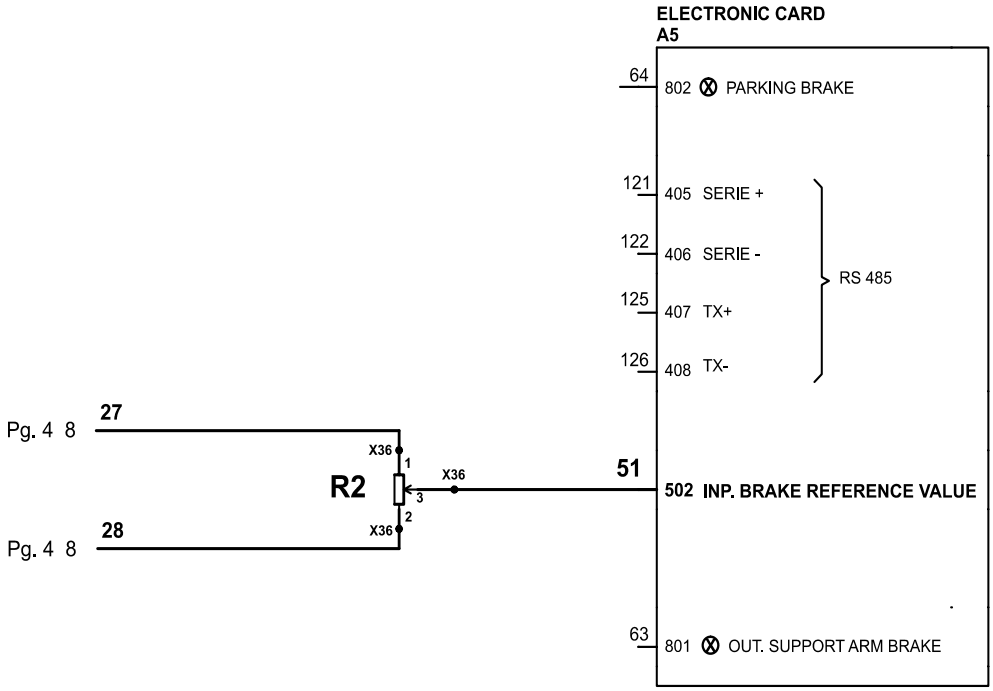
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	111
Description	Potentiometer R2 for brake pedal gives incorrect voltage (<0.4 or >4.6 V)
Error mode	Critical error
Error cause	1. Faulty potentiometer/wiring
	2. Defective electronic card A5
Comments	

Potentiometer R2, brake



1. **Check that R2 is located in its bracket.**
   - Check that the voltage across R2 (1 and 2) is 7-7.5 VDC.
   - Check that there is no play or oxidisation on the connector pins on terminal X36.
   - The voltage on input 502 should be 1.7 VDC when R2 is in the neutral position and 4.1 VDC with the brake pedal is fully actuated.
   - If the voltage is < 0.4 VDC the 7-7.5 V voltage is missing, if the voltage is > 46 VDC, 0 V is missing. If the cables are intact, replace potentiometer R2.
2. **If the correct voltage is on input 505 and the fault remains, re-**

place the A5 electronic card.

Code	**112**
Description	Error on brake input test
Error mode	Critical error
Error cause	1. Defective electronic card A5
Comments	The computer on the card has found a fault during the internal test.

Code	**120**
Description	Memory cell for steering set point value, incorrect value
Error mode	Steering error
Error cause	1. Displaced A5 electronic card
	2. Defective electronic card A5
Comments	Restart can reset error

1. **A temporary disturbance can have affected the card.**
   Try to restart the truck.

Code	**121**
Description	Steering safety relay deactivated due to incorrect voltage in drive stage or communications error with master processor
Error mode	Steering error
Error cause	1. Displaced A5 electronic card
	2. Defective electronic card A5
Comments	Restart can reset error

1. **A temporary disturbance can have affected the card.**
   Try to restart the truck.

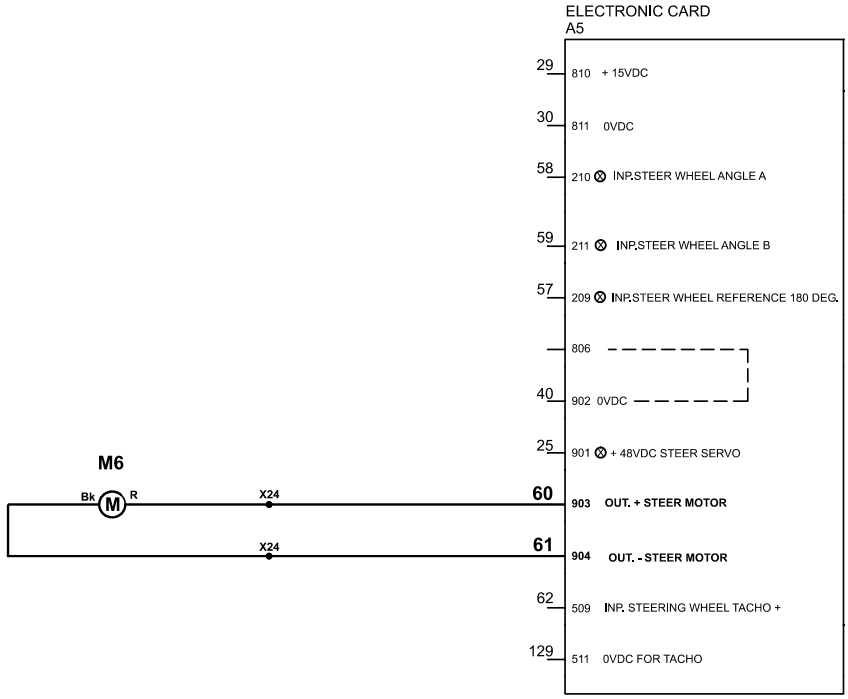
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	122
Description	Warning temperature in steering servo
Error mode	Steering error
Error cause	1. High ambient temperature
	2. Steering jams
	3. Faulty wiring to steering motor
	4. Defective steering motor
	5. Defective electronic card A5
Comments	

Steering motor, M6



1. **Check the ventilation by the A5 card.**
2. **Lift up the truck.**
   - Check that the steering does not jam mechanically.
   - Check the current on the steering, approx. 5A.
3. **Check the cables 60 and 61, terminal X24 and terminals 903 and 904.**
4. **Check the steering motor.**
   - Regarding the carbons and carbon holders, see C-code 1730.
   - Armature windings.
5. **If the fault remains, replace the A5 card.**

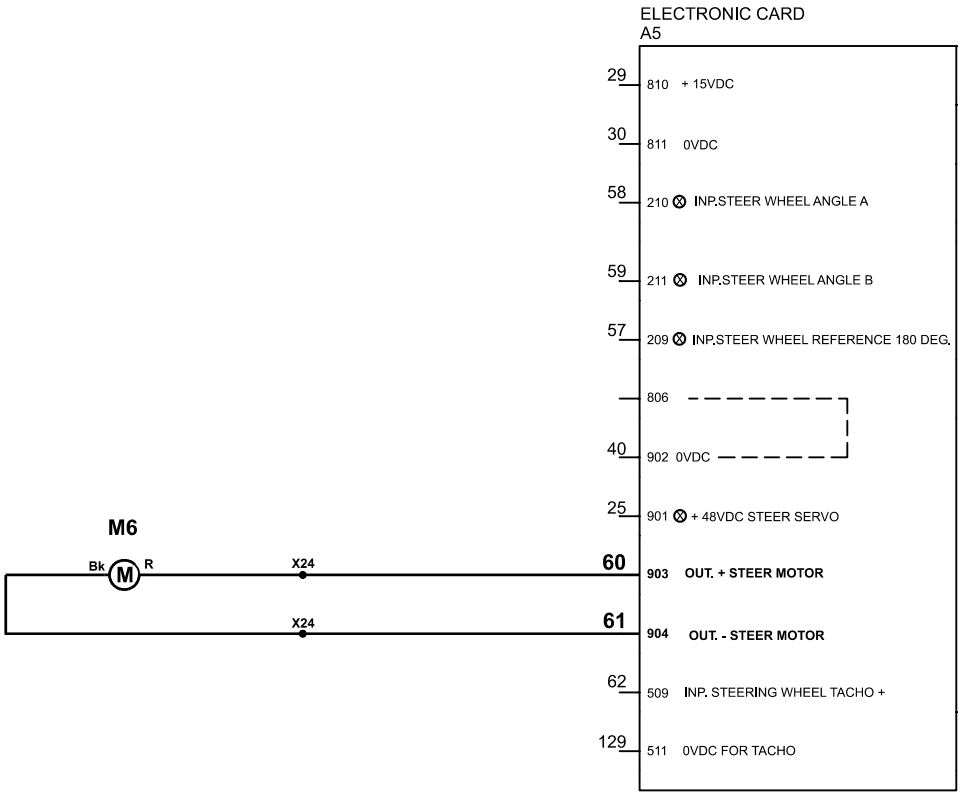
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	123
Description	Output voltage to steering motor differs from requested steering
Error mode	Steering error
Error cause	1. Faulty wiring to steering motor
	2. Defective steering motor
	3. Defective electronic card A5
Comments	

Steering motor, M6



1. **Check the cables 60 and 61, terminal X24 and terminals 903 and 904.**
2. **Check the steering motor.**
   - Regarding the carbons and carbon holders, see C-code 1730 “Electric steering motor”.
   - Armature windings.
3. **If the fault remains, replace the A5 card.**

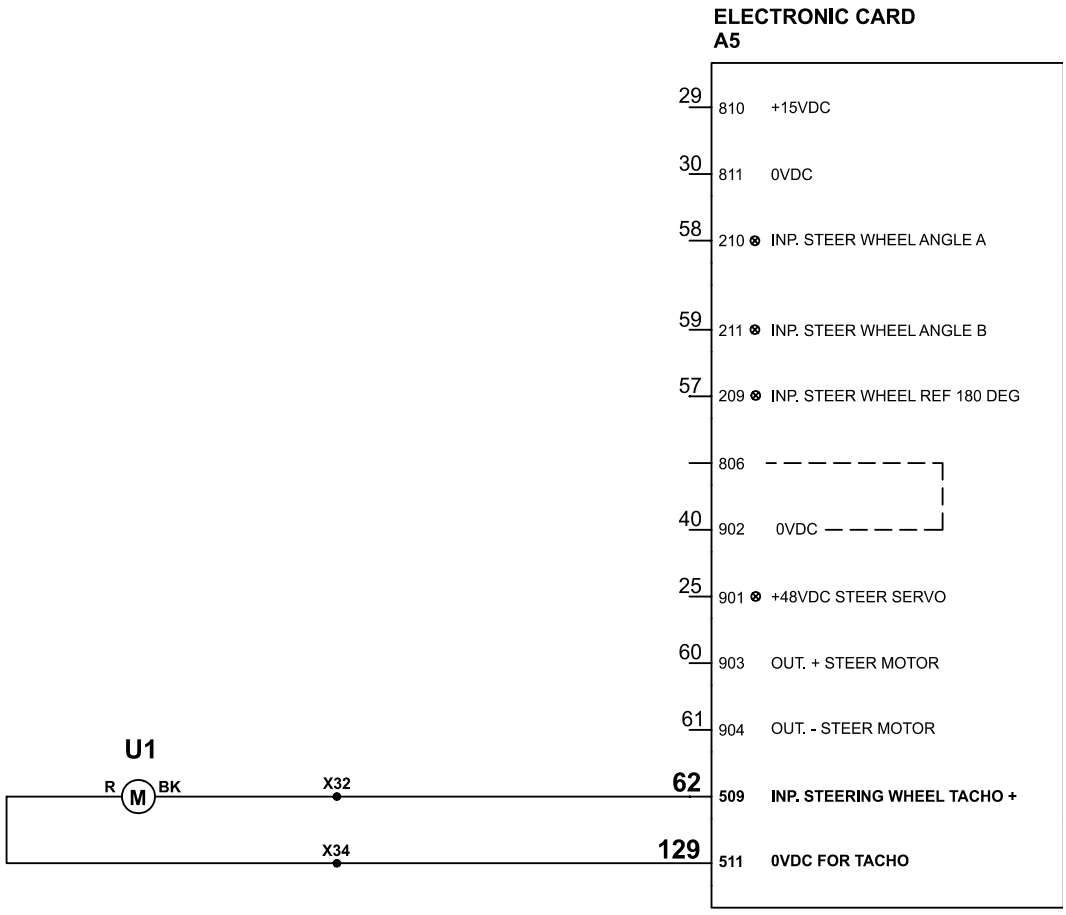
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	125
Description	Steering generator error on test
Error mode	Steering error
Error cause	1. Defective wiring
	2. Faulty generator/carbon brushes
	3. Defective electronic card A5
Comments	

Steering generator, U1



1. **Check the cables 62 and 129, terminals in X32 and X34 and the terminals 509 and 511.**
2. **Check the steering generator.**
   - Regarding the carbons and carbon holders, see C-code 4100 “Mechanical steering system”.
   - Armature windings.
3. **If the fault remains, replace the A5 card.**

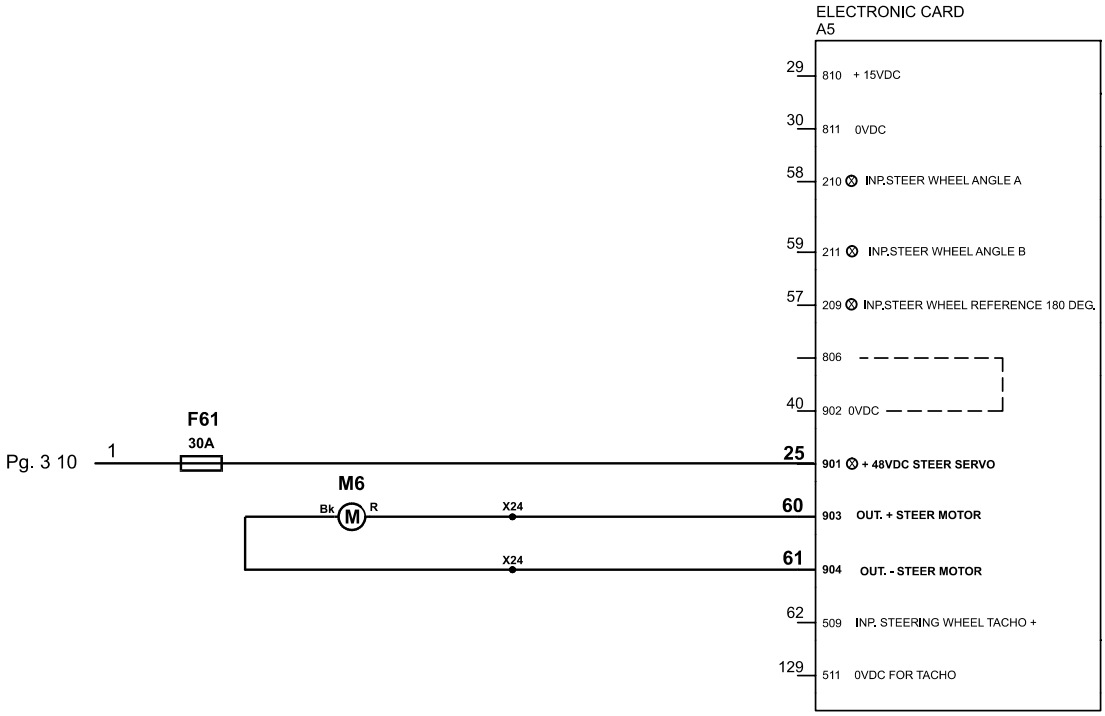
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	126
Description	Steering motor error on test
Error mode	Steering error
Error cause	1. Defective fuse F61
	2. Defective wiring
	3. Faulty steering motor/carbon brushes
	4. Defective electronic card A5
Comments	

Steering motor, M6



1. **Check the fuse F61, 30 A, and the cables 1 and 25 as well as terminal 901.**
2. **Check the cables 60 and 61, terminals X24, 903 and 904.**
3. **Check the steering motor.**
   - Regarding the carbons and carbon holders, see C-code 1730.
   - Armature windings.
4. **If the fault remains, replace the A5 card.**

T-code
403-414, 669-671, 716-718
Valid from serial number
713962-
Date
2005-06-01
Order number
218920-040

Code	127
Description	Communications error between steering processor and master processor
Error mode	Steering error
Error cause	1. External interference (static electricity)
	2. Defective electronic card A5
Comments	Restart can reset error

1. A temporary disturbance can have affected the card. Try to restart the truck.

Code	128
Description	Memory cell for steering set point value contains incorrect value
Error mode	Critical error
Error cause	1. External interference (static electricity)
	2. Defective electronic card A5
Comments	Restart can reset error

1. A temporary disturbance can have affected the card. Try to restart the truck.

Code	130
Description	Communications error between I/O processor and master processor
Error mode	Critical error
Error cause	1. External interference (static electricity)
	2. Defective electronic card A5
Comments	Restart can reset error

1. A temporary disturbance can have affected the card. Try to restart the truck.

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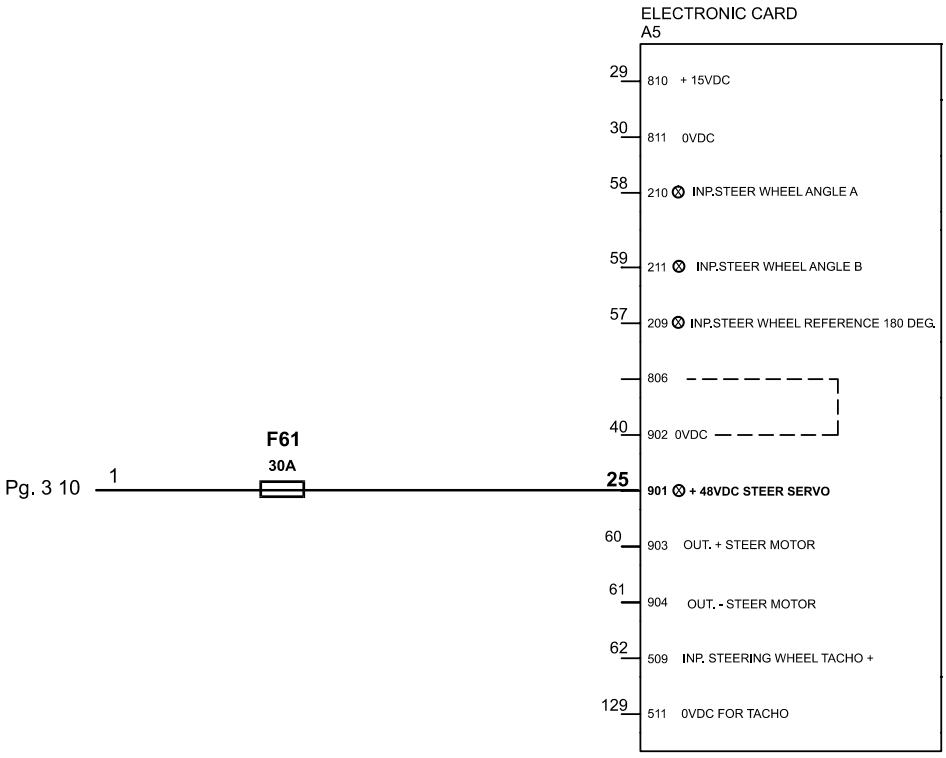
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	131
Description	Error testing safety relay (steering) at start-up
Error mode	Steering error
Error cause	1. Defective fuse F61
	2. Defective wiring for F61
	3. Defective electronic card A5
Comments	

Fuse F61, 30 A



1. **Check the fuse F61, 30 A.**
2. **Check the cables 1 and 25 and terminal 901.**
3. **If the fault remains, replace the A5 card.**

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	133
Description	Error testing safety relay (steering) at start-up
Error mode	Steering error
Error cause	1. Temporary fault during test
	2. Defective electronic card A5
Comments	

1. **A temporary disturbance can have affected the card. Try to restart the truck.**
2. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

Code	134
Description	Safety relay (steering) has opened
Error mode	Steering error
Error cause	1. Electronic card A5 displaced/jarred
	2. Defective electronic card A5
Comments	

1. **The relay can have opened if the truck has driven on very uneven ground or driven on something that has heavily affected the truck. Try to restart the truck.**
2. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

Code	135
Description	Error testing safety relay (main circuit) at start-up
Error mode	Critical error
Error cause	1. Temporary fault during test.
	2. Defective electronic card A5
Comments	

1. **A temporary disturbance can have affected the card. Try to restart the truck.**
2. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

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Valid from serial number
713962-
T-code
403-414, 669-671, 716-718
Order number
218920-040
Date
2005-06-01

Code	136
Description	Error testing safety relay (main circuit) at start-up
Error mode	Critical error
Error cause	1. Temporary fault during test
	2. Defective electronic card A5
Comments	

1. **A temporary disturbance can have affected the card.**
   Try to restart the truck.
2. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

Code	137
Description	Safety relay (main circuit) has opened
Error mode	Critical error
Error cause	1. Electronic card A5 displaced/jarred
	2. Defective electronic card A5
Comments	Restart can reset

1. **The relay can have opened if the truck has driven on very uneven ground or driven on something that has heavily affected the truck.**
   Try to restart the truck.
2. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	140
Description	Incorrect checksum in parameter memory on start-up
Error mode	Critical error
Error cause	1. Displaced A5 electronic card
	2. Defective electronic card A5
Comments	

1. **A temporary disturbance can have affected the card.**
   - Try to restart the truck.
   - Change a parameter and restart.
   - Download new program.
2. **If the fault remains, replace A5 card.**

Code	141
Description	Incorrect checksum for current program
Error mode	Critical error
Error cause	1. Bad download of program from PC
	2. Defective electronic card A5
Comments	

1. **A temporary disturbance can have affected the card. Download new program.**
2. **If the fault remains, replace A5 card.**

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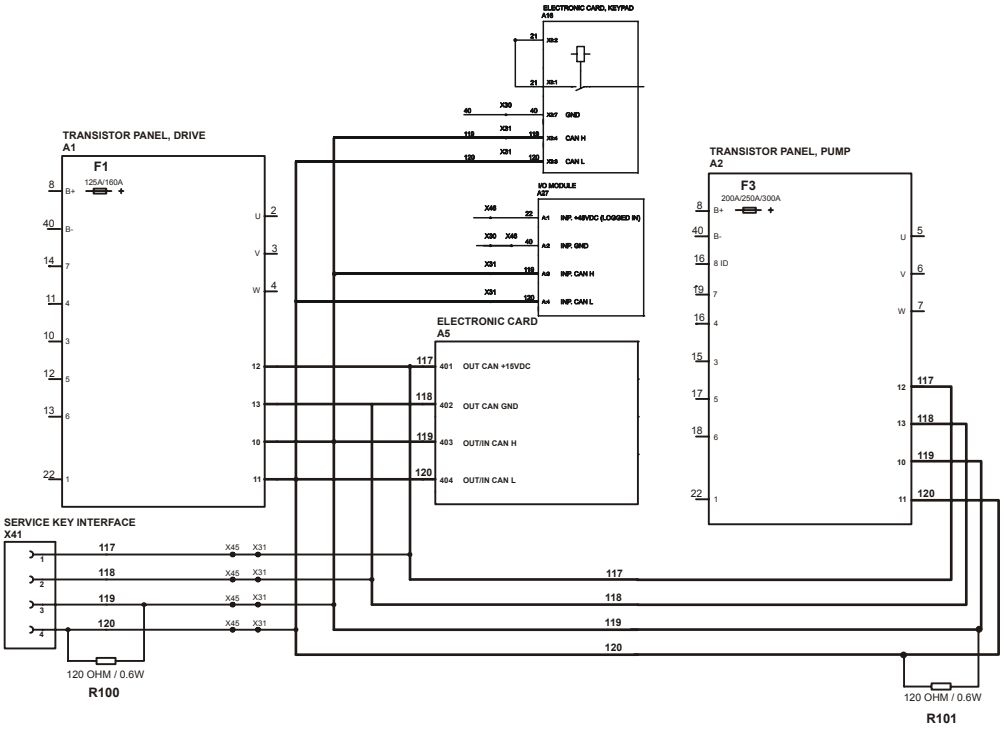
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	150
Description	No communication with the motor regulators on start-up
Error mode	Drive regulator error and lift regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. 15 no V
	3. Defective drive regulator A1
	4. Defective lift regulator A2
	5. Defective electronic card A5
Comments	

CAN communication



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistors R100 and R101.**
2. **Check that output 401 on the A5 card has +15 VDC.**
3. **Try using a new drive regulator A1.**
4. **Try using a new lift regulator A2.**
5. **Try using a new A5 card.**

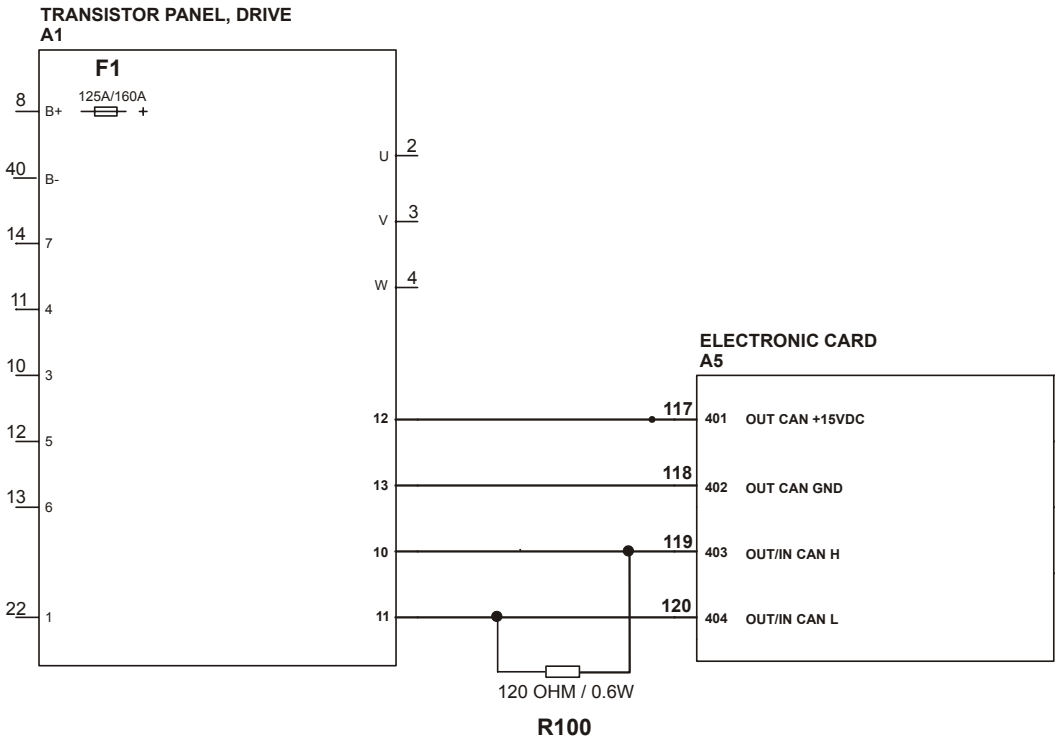
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	151
Description	No communication with the drive regulator on start-up
Error mode	Drive regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. Defekt körregulator
Comments	

CAN – communication between A5 and A1



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistor R101.**
2. **Try using a new drive regulator A1.**

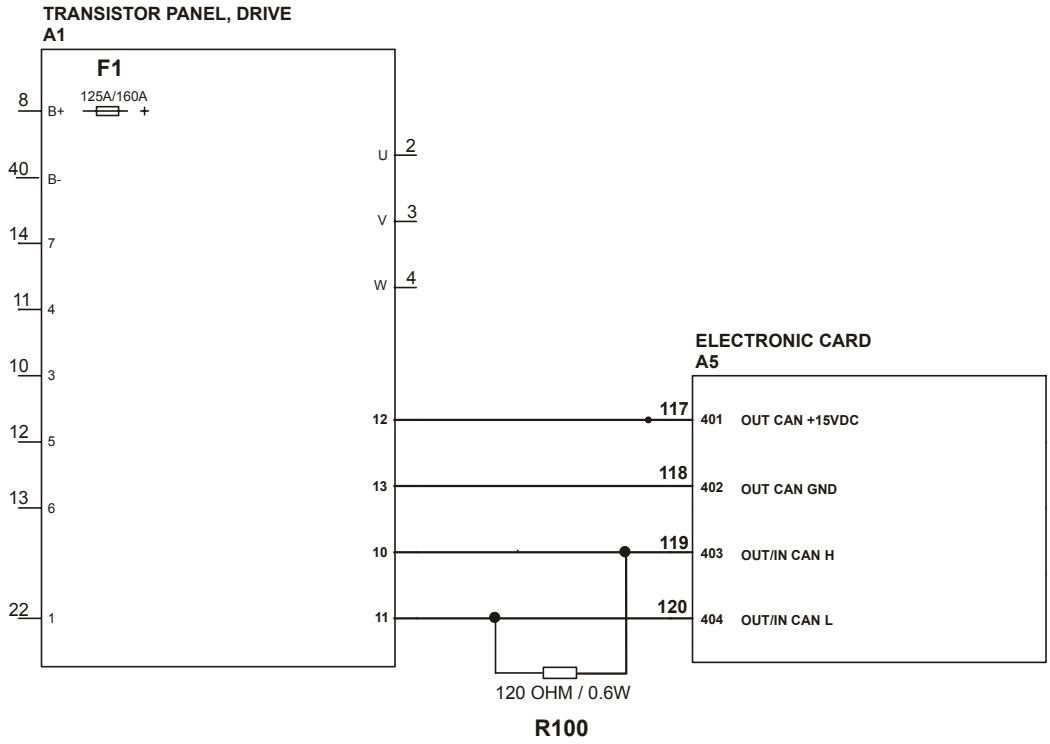
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	152
Description	No communication with drive motor's frequency converter during operation
Error mode	Drive regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. Defective drive regulator
Comments	

CAN – communication between A5 and A1



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistor R101.**
2. **Try using a new drive regulator A1.**

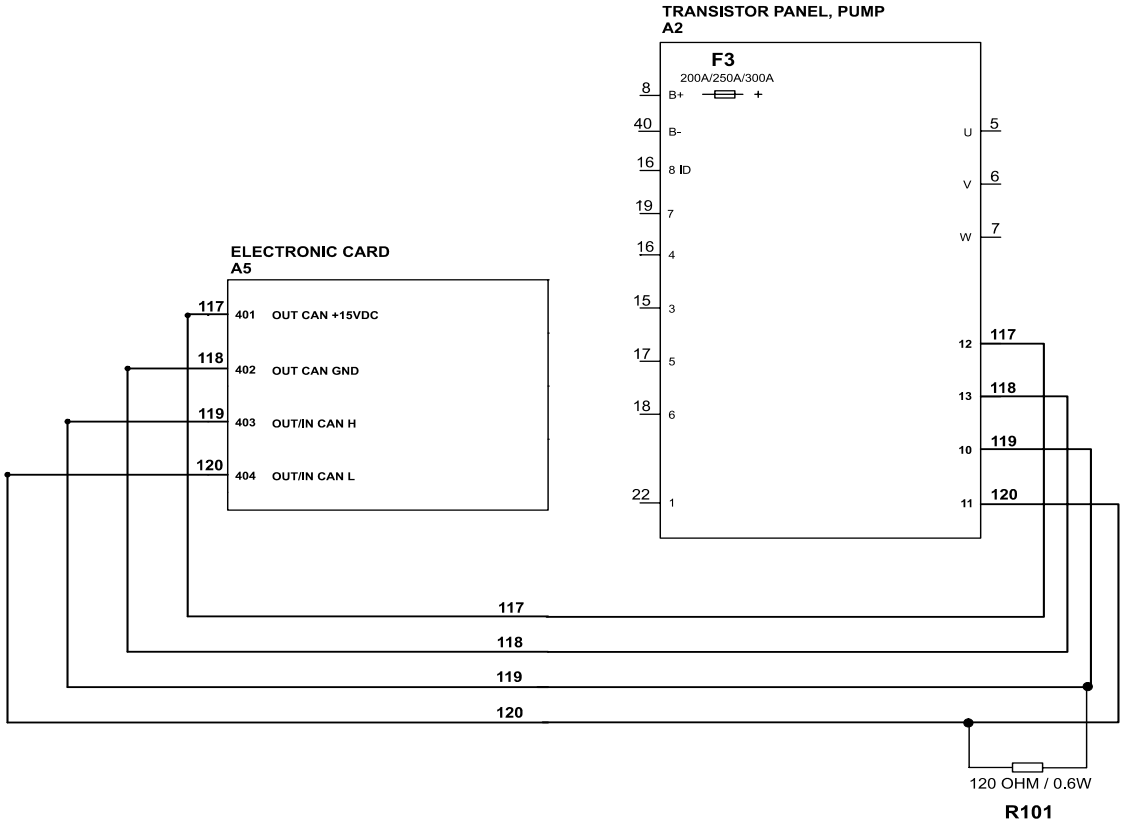
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	153
Description	No communication with the lift regulator on start-up
Error mode	Lift regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. Defective lift regulator
Comments	

CAN – communication between A5 and A2



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistor R101.**
2. **Try using a new lift regulator A2.**

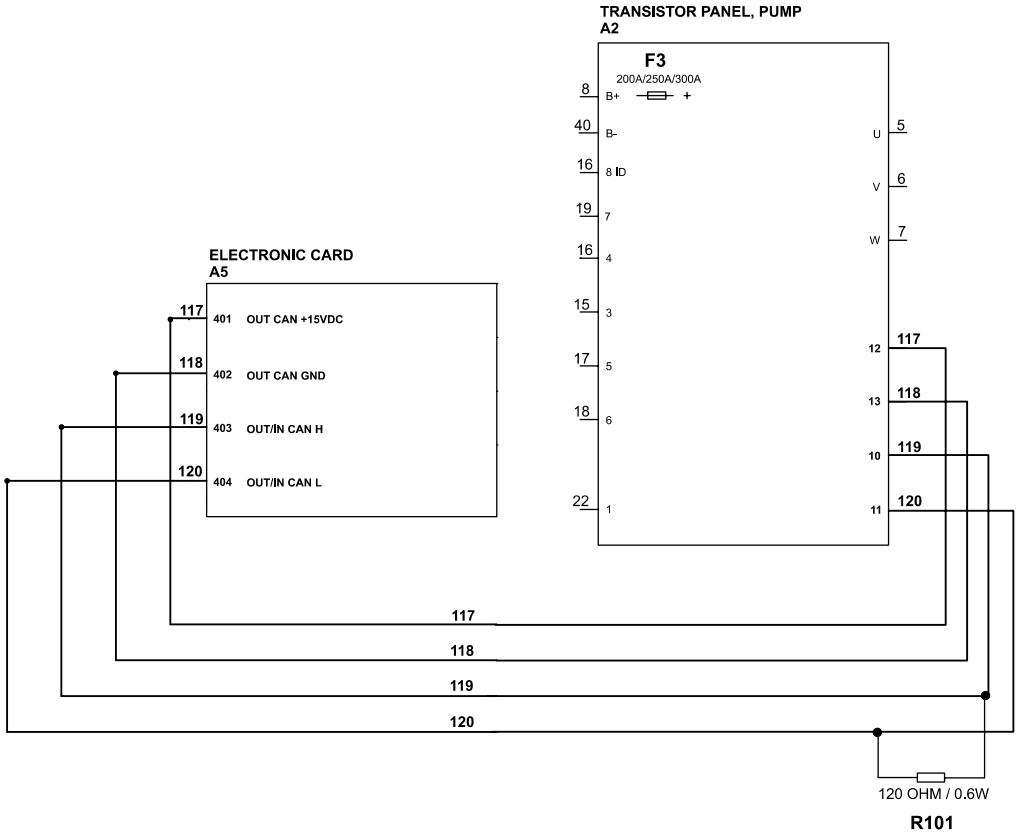
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	154
Description	No communication with the lift regulator while running
Error mode	Lift regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. Faulty lift regulator
Comments	

CAN – communication between A5 and A2



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistor R101.**
2. **Try using a new lift regulator A2.**

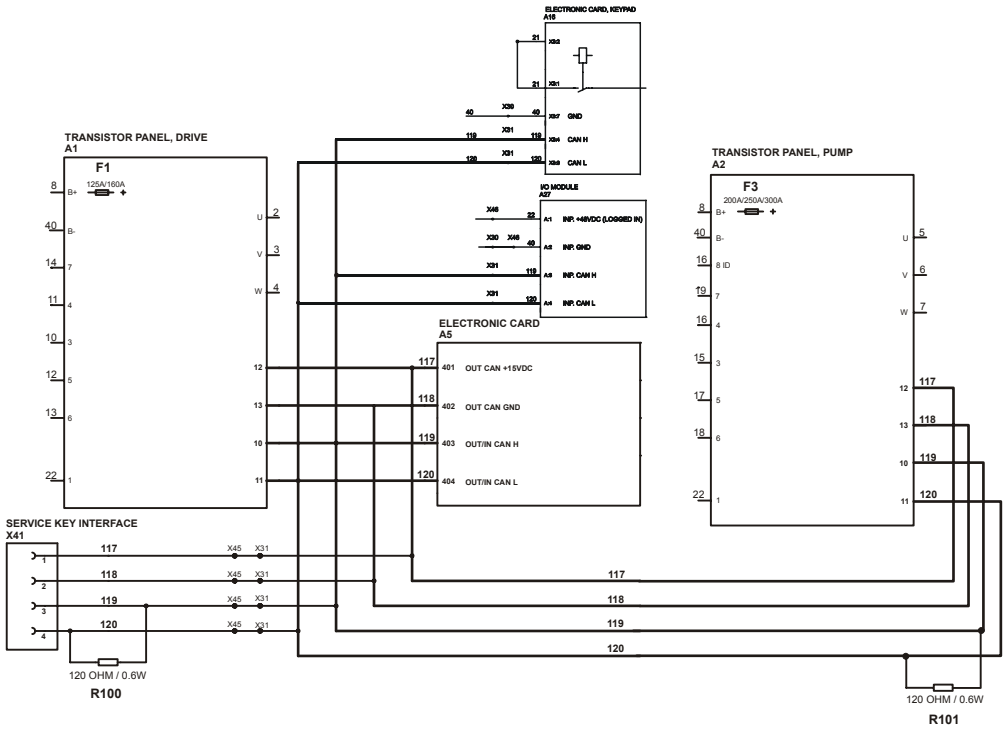
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	155 - 163
Description	General communications error
Error mode	Drive regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. External CAN unit incorrectly connected
	3. Displaced A5 electronic card
	4. Defective electronic card A5
Comments	

CAN communication



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistors R100 and R101.**
2. **Check that the CAN bus is connected correctly to all units.**
3. **A temporary disturbance can have affected the card. Try to restart the truck.**
4. **If the fault remains, despite repeated attempts to start, replace the A5 card.**

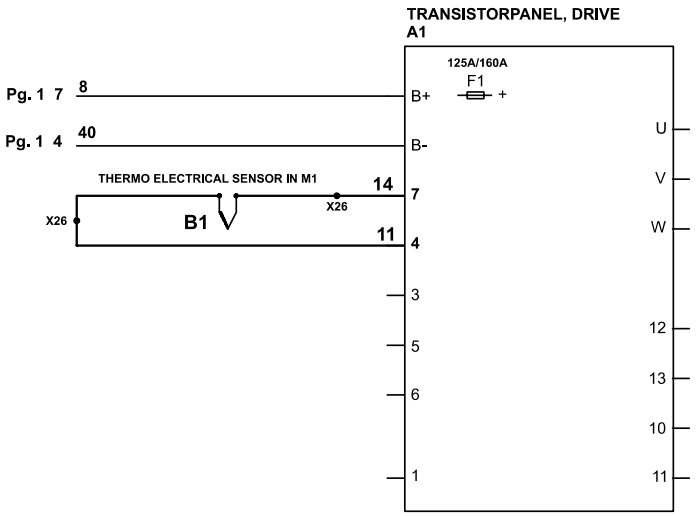
Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	203
Description	CPU or memory fault on the drive regulator
Error mode	Drive regulator error
Error cause	1. Defective drive regulator
Comments	

1. Replace the drive regulator, A1..

Code	205
Description	Overheated drive motor
Error mode	Drive regulator error
Error cause	1. Motor overloaded
	2. Defective cabling/temperature sensor
Comments	Restart possible

Temperature sensor B1 in drive motor M1



1. Check that the ventilation is okay, especially the fan M10 in the motor compartment.

2. Check B1.

- Remove connection X26. Measure B1 in X26 with the ohmmeter, approx. 570 ohm at 20°C.
- Check that cable 11 is intact between X26 and terminal 4 on A1.
- Check that cable 14 is intact between X26 and terminal 7 on A1.
- Also check the connector pins on the terminals for play and oxidisation.

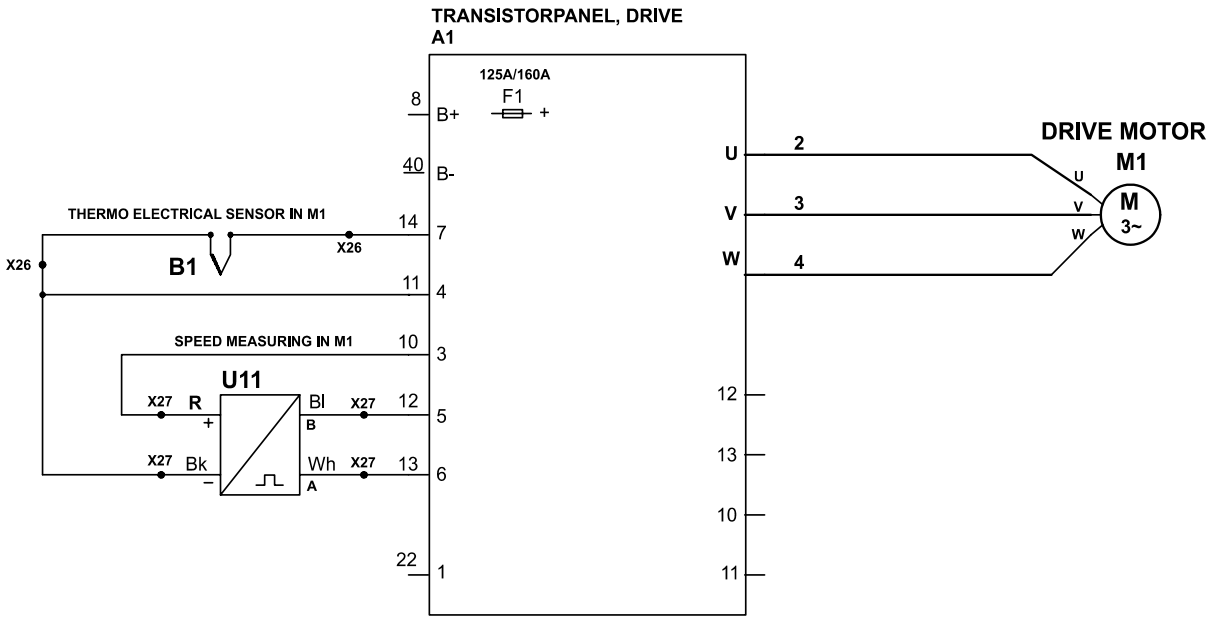
T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	206 - 207
Description	Overheated drive regulator
Error mode	Drive regulator error
Error cause	1. Defective cooling fan
	2. Defective motor, M1
	3. Defective drive regulator, A1
Comments	Restart possible

1. **Check the fan M12, by the frequency converters.**
2. **Check the drive motor and its cables.**
3. **If everything else is okay, replace A1.**

Code	208
Description	Too high current on drive regulator
Error mode	Drive regulator error
Error cause	1. Motor cables incorrectly connected
	2. Defective driving regulator, A1
Comments	

Drive motor circuit



1. **Check that the motor cables are intact and connected correctly.**
2. **Replace the drive regulator, A1.**

Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	209 - 210
Description	Too high voltage on drive regulator
Error mode	Drive regulator error
Error cause	1. Defective battery
	2. Defective motor
	3. Defective drive regulator, A1
Comments	

1. **Check that the battery is okay, sufficiently charged and of the right model.**
2. **Check that the drive motor is okay.**
3. **If everything else is okay, replace A1.**

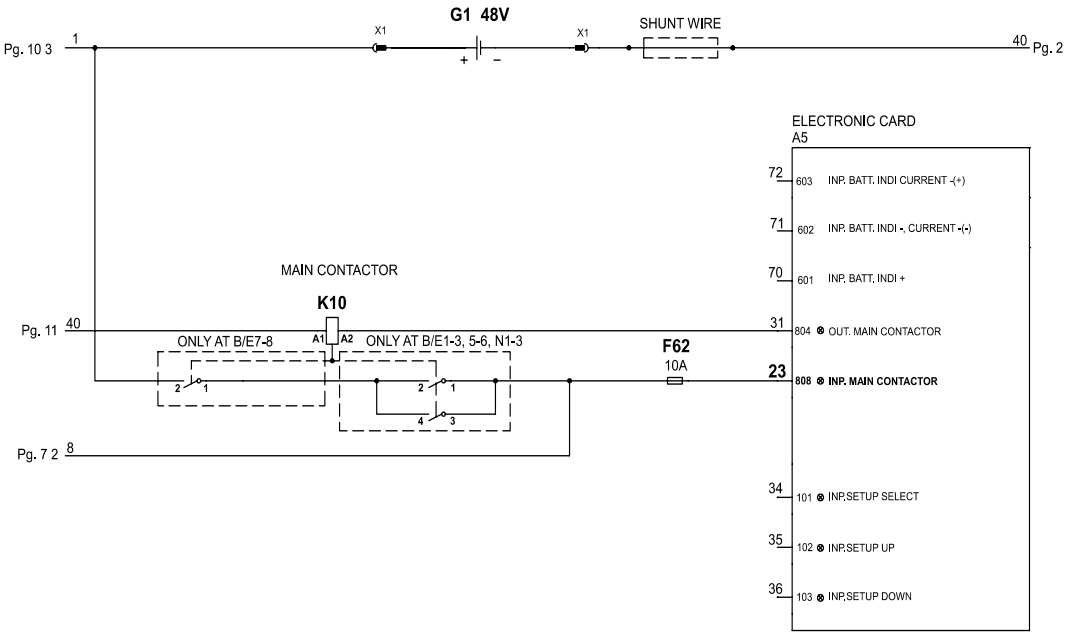
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	211 - 212
Description	Too low voltage on drive regulator
Error mode	Drive regulator error
Error cause	1. Charger plug removed with ignition key S17 switched on
	2. External current load incorrectly connected
	3. Faulty wiring/fuse F62
	4. Defective drive regulator, A1
	5. Defective electronic card, A5
Comments	

Main contactor, K10



1. **If you forget to switch off the truck and pull out the charging plug an error code is given.**
2. **Check that no extra equipment overloads the electrical system.**
3. **Check that there is 48 VDC on input 808, cable 23 when K10 is activated. If not, check the fuse F62 (10 A), contactor points on K10 and the cables 1, 8 and 23.**
4. **If this does not help, replace A1.**
5. **Replace A5.**

Valid from serial number
713962-

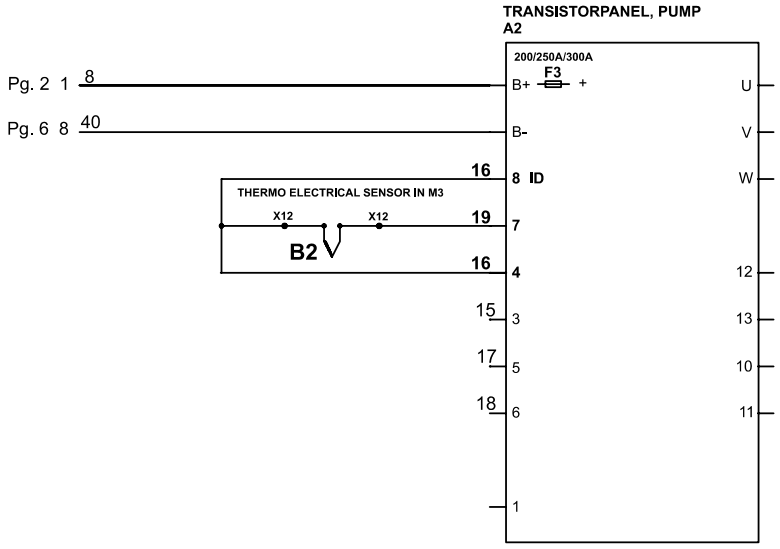
T-code
403-414, 669-671, 716-718

Order number
218920-040

Date
2005-06-01

Code	**213 - 214**
Description	CAN fault on the drive regulator
Error mode	Drive regulator error
Error cause	1. Defective drive regulator, A1
Comments	
Code	**223**
Description	CPU or memory fault on the lift regulator
Error mode	Lift regulator error
Error cause	1. Defective lift regulator, A2
Comments	
Code	**225**
Description	Overheated pump motor
Error mode	Lift regulator error
Error cause	1. Motor heavily loaded
	2. Faulty wiring/temperature sensor
Comments	Restart possible

Temperature sensor B2 in the pump motor



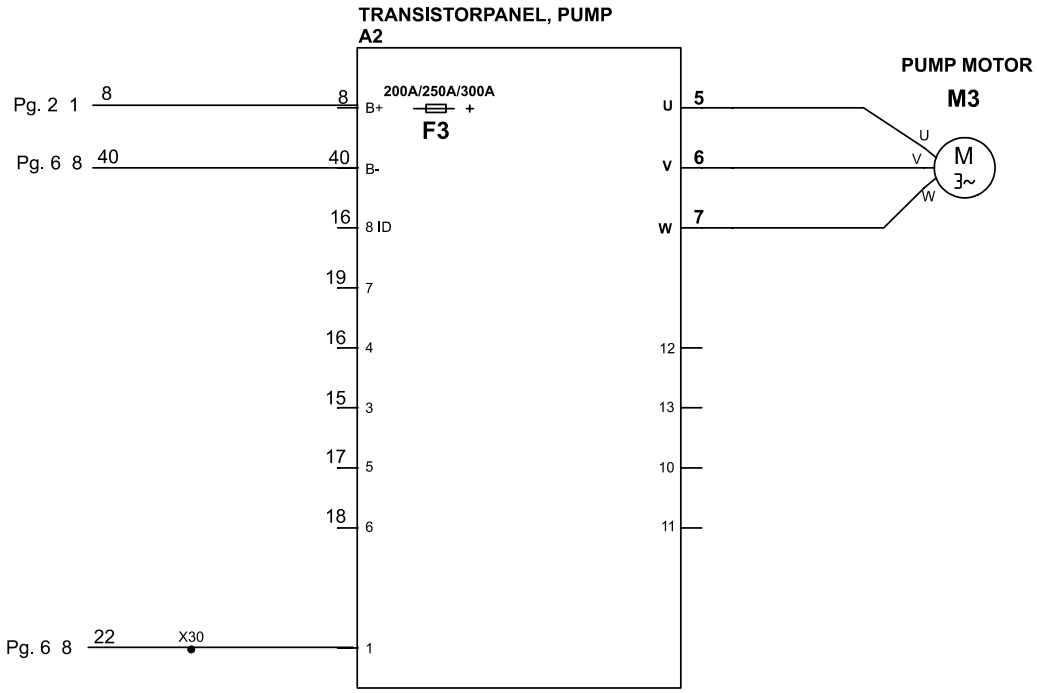
1. **Check that the ventilation is okay, especially the fan M10 in the motor compartment.**

2. Check B2.

- Remove connection X12. Measure B2 in X12 with the ohmmeter, approx. 570 ohm at 20°C.
- Check that cable 16 is intact between X12 and terminal 4 on A1.
- Check that cable 19 is intact between X12 and terminal 7 on A1.
- Also check the connector pins on the terminals for play and oxidisation.

Code	226 - 227
Description	Overheated lift regulator
Error mode	Lift regulator error
Error cause	1. Defective cooling fan
	2. Defective motor cable/motor
	3. Defective lift regulator
Comments	Restart possible

Pump motor circuits



1. Check the fan M12 by the regulators.
2. Check the motor cables 5, 6 and 7 and the pump motor M3.
3. If everything is okay, replace A2.

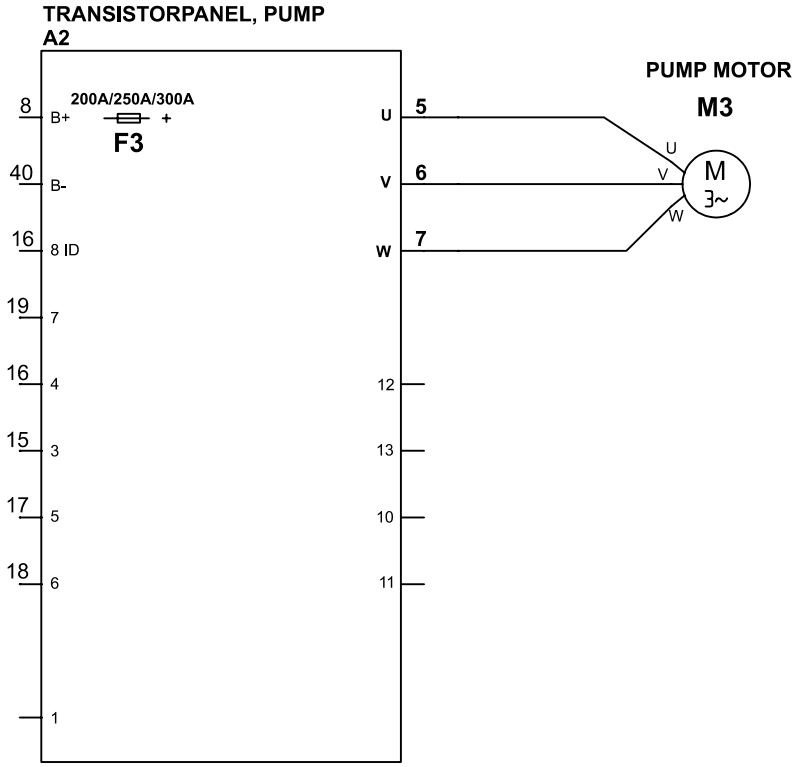
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	228
Description	Too high current on lift regulator
Error mode	Lift regulator error
Error cause	1. Motor cables incorrectly connected
	2. Defective lift regulator, A2
Comments	

Pump motor, M3



1. **Check that the motor cables 5, 6 and 7 are intact and connected correctly.**
2. **If the cables are okay, replace A2.**

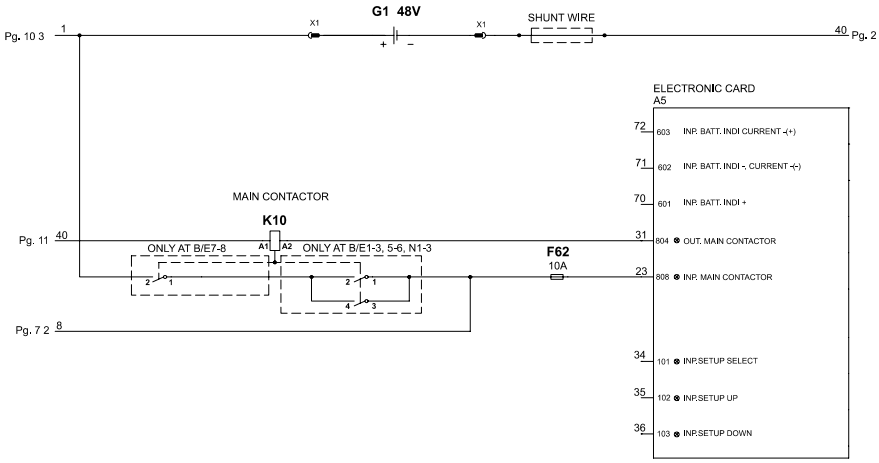
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	229 - 230
Description	Too high voltage on lift regulator
Error mode	Lift regulator error
Error cause	1. Defective battery
	2. Poor contact at K10's contactor points
	3. Defective lift regulator, A2
Comments	

Battery circuit



1. **Check that the battery is okay, sufficiently charged and of the right model.**
2. **Check the contactor points on K10.**
3. **If everything is okay, replace A2.**

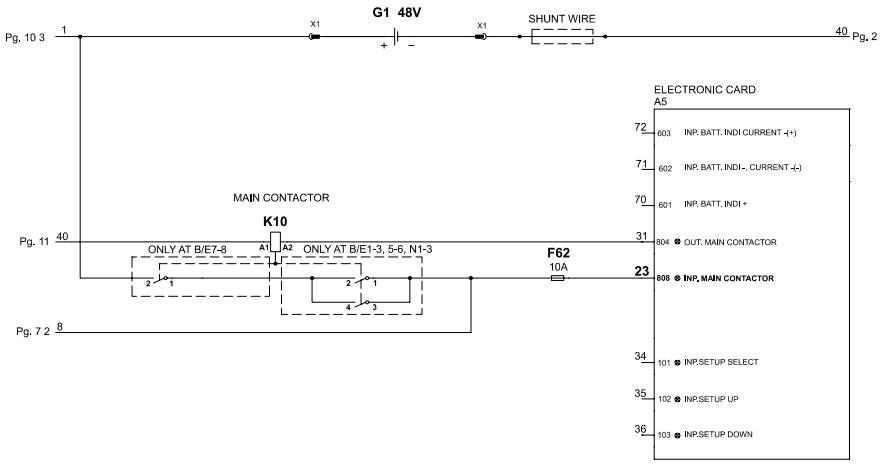
Electronic card – 5710

Error Codes

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

Code	231 - 232
Description	Too low voltage on lift regulator
Error mode	Lift regulator error
Error cause	1. Faulty wiring/fuse F62
	2. External current load incorrectly connected
	3. Charger plug removed with ignition key switched on
	4. Defective electronic card A5
	5. Defective lift regulator, A2
Comments	

Main contactor, K10



1. **If you forget to switch off the truck and pull out the charging plug an error code is given.**
2. **Check that no extra equipment overloads the electrical system.**
3. **Check that there is 48 VDC on input 808, cable 23 when K10 is activated. If not, check the fuse F62 (10 A), contactor points on K10 and the cables 1, 8 and 23.**
4. **If this does not help, replace A2.**
5. **Replace A5.**

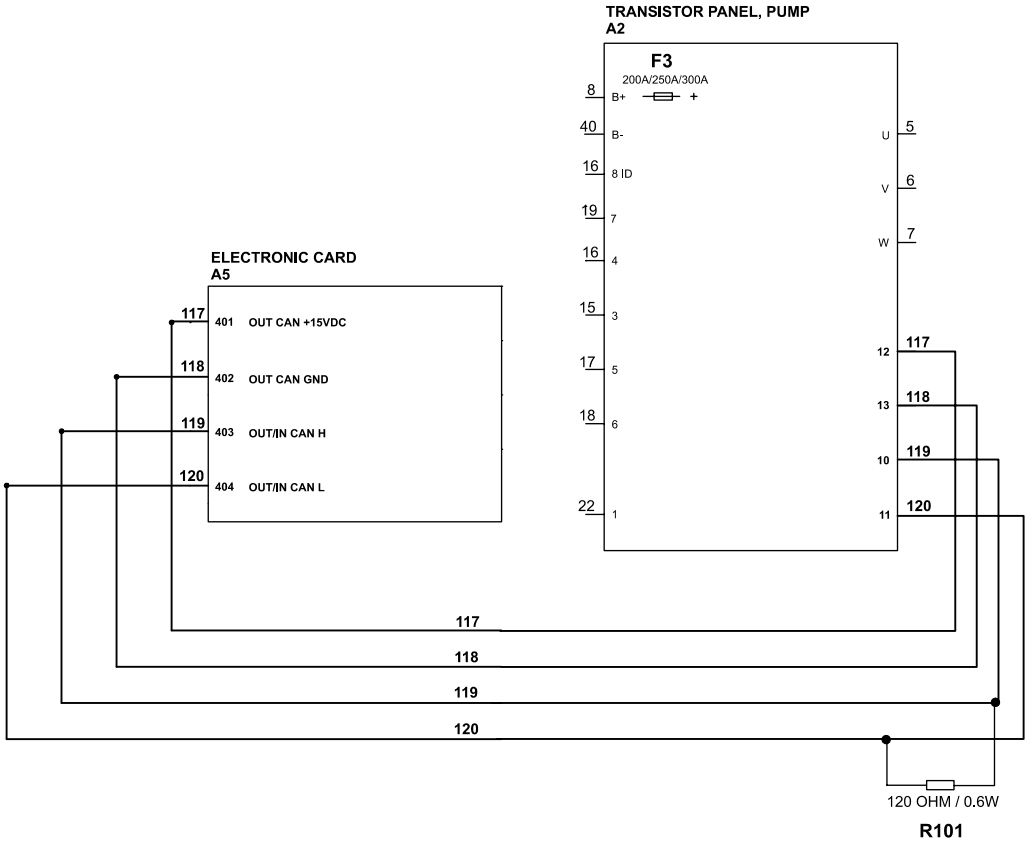
Electronic card – 5710

Error Codes

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Code	233 - 234
Description	CAN fault on the lift regulator
Error mode	Lift regulator error
Error cause	1. Faulty CAN wiring/resistance
	2. Defective lift regulator
Comments	

CAN – communication between A5 and A2



1. **Check that the cables 117, 118, 119 and 120 are not short-circuited or are broken. Also check the resistor R101.**
2. **Try using a new lift regulator A2.**

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

25-Keypad

25.1 General

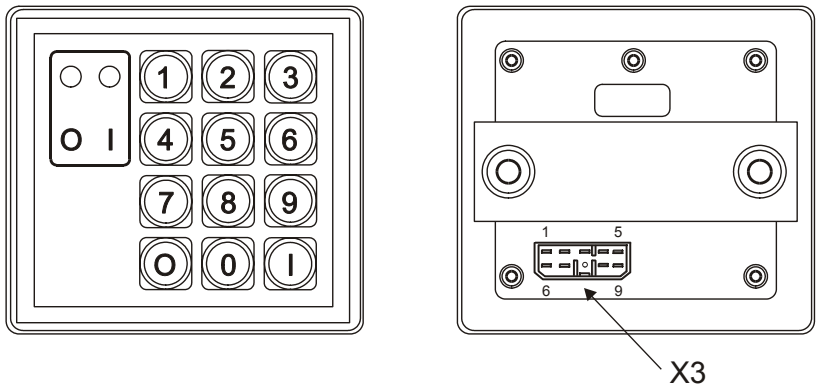
This chapter is about the keypad on which you can designate and change the PIN-codes along with starting the truck.

In the memory of the keypad there are 10 blocks with 10 different driver PIN-codes which are stored as a standard. The 10 different driver PIN-codes has different driver profiles. All 100 driver PIN-codes can be reprogrammed and changed in the driver profiles.

The driver PIN-codes in the keypad or the TLS can be used for log-in depending how the kaypad is programmed.

25.2 Display

The picture to the left indicates the front of the keypad and the picture to the right indicates the back. The table describes the terminalnumber and function of the contact.



Connection	Function	Active (V)
X3:1	Relay in	48
X3:2	Battery +	48
X3:3	CAN L	0-5
X3:4	CAN H	0-5
X3:5	Coding PIN 1	0
X3:6	Relay out	48
X3:7	Battery -	0
X3:8	Not used	
X3:9	Coding PIN 2	0

The relay can be charged with maximum 10A resistive.

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

25.2.1 Description of the keypad symboles

Symbole	Function
	LED that shows truck activated/stopped
	Numeric buttons to designate driver PIN-code and to program.
	Log-out (red pushbutton)
	Log-in (green pushbutton)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

25.3 Function

Five different log-in functions can be set for the keypad. Through connection X3:5 and X3:9 the system negative is connected in different ways.

After changing the function you should leave the keypad dead during approx. 1 minute for the new function to start working.

The zeros that exists in the beginning of the driver PIN-code does not need to be designated.

25.3.1 Function 0

- Connection 1 and 2 (X3:5, X3:9) **not** connected to the system negative.
- Driver PIN-code in keypad is used.
- Log-in with 1-4 digits and green pushbutton. Not 1.
- Driver profiles i A5 card are used.
- Log-out with red pushbutton.

25.3.2 Function 1

- Connection 1 (X3:5) connected to system negative.
- Parameter 39 must be set to 1 or 2 (key). See chapter “Displaying and programming”.
- Driver PIN-codes in keypad is used.
- Log-in with 1-4 digits and green pushbutton.
- Driver profiles i A5 card are used.
- Log-out with red pushbutton.

25.3.3 Function 2

- Connection 2 (X3:9) connected to system negative.
- Driver PIN-codes in keypad are **not** used without verification in the TLS. The TLS sends back that the driver is approved. Not. 1.
- Log-in with 1-5 digits and green pushbutton.
- Driver profiles i A5 card are used.
- Log-out with red pushbutton.

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

25.3.4 Function 3

- Connection 1 and 2 (X3:5, X3:9) is connected to system negative.
- Test function for relay
  Designate the code 1234567890 and green pushbutton to close the relay in the keypad.
- Open the relay with red pushbutton

Not. 1 If the service CAN-key is used at log-in no driver PIN-code is necessary to designate.

25.4 Programming

25.4.1 LED status

Log-in

Function	Green LED	Red LED
Pushbutton 0-9 is used	Illuminate when pushbutton is depressed.	
Log-out		Illuminates ~0,8 sek
Relay in keypad is closed	Illuminates with brightness.	
Incorrect driver PIN-code designated		Illuminates ~0,8 sek

At programming

Function	Green LED	Red LED
Keypad in programming mode	Illuminates for ~0,8 seconds and then flashes with interval of 2 seconds.	
Pushbutton 0-9 is used	Illuminates when pushbutton is depressed.	
Correct value designated	Illuminates ~0,8 sek	
Incorrect value designated		Illuminates ~0,8 sek

 © BT Europe AB

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

25.4.2 Driver PIN-codes

The table shows the driver PIN-codes that is programmed as standard. Theese can be activated for usage or changed according to the driver's whishes.

One or more of theese block can be activated.

One driver profile is guilty for all blocks in the same column and can be programmed according to the chapter "Displaying and programming" in chapter "Electronic card". See parameters 1-7.

	Pro-file 0	Pro-file 1	Pro-file 2	Pro-file 3	Pro-file 4	Pro-file 5	Pro-file 6	Pro-file 7	Pro-file 8	Pro-file 9
Block 0	0000	0001	0002	0003	0000	0000	0000	0000	0000	0000
Block 1	5421	7901	1437	3731	1049	9439	7265	1322	2869	1574
Block 2	1787	4854	2907	9175	5799	1490	3031	7392	5622	5023
Block 3	4659	3174	1026	3815	6703	1179	5152	7514	5668	3215
Block 4	9197	7110	5477	3846	9491	5918	8222	6923	8139	7025
Block 5	2549	6276	9879	9658	1690	4042	5201	9807	4332	9715
Block 6	7474	4142	8620	3754	8432	8788	7430	1948	2595	8527
Block 7	1930	1482	7135	2395	7365	7092	4611	2831	4185	6067
Block 8	2876	4731	1022	5377	3257	7334	9009	7881	8843	7436
Block 9	3242	3162	5878	2828	1910	6907	2136	5730	2957	7691

To enter programming mode:

- Connect the service CAN-key
- Designate 341671 and depress the green pushbutton.

Programming	Function	Remark
1 + green pushbutton	Return to factory settings	
2 + block nr + green pushbutton	Driver parameters in the block can be used	
3 + block nr + green pushbutton	Driver parameters in the block can not be used	
4 + block nr + profile nr + NNNN + green pushbutton	Programming of new driver PIN-code	NNNN = Driver PIN-code
5 + TT + green pushbutton	Programming the close-down time for the truck, after last usage.	TT = 01-20 minutes. 00 = 4 timmar Standard = 20 min-utes

Keypad

Programming

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

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Valid from serial number	**T-code**
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

26-Hydraulics – 6000

26.1 General

The hydraulics on the truck consist of a pump that sucks oil from the tank and transports this to the main valve located in the reach carriage.

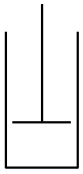
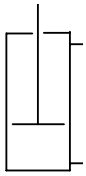
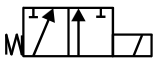
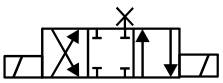
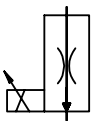
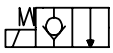
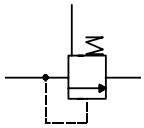
The main valve distributes oil to the reach cylinder and the mast.

The return oil from the reach cylinder and mast is transported via the main valve through the filter to the tank.

The return oil from the reach carriage goes directly through the filter to the tank.

26.2 Symbols

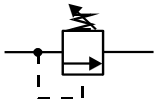
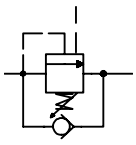
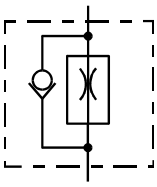
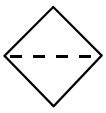
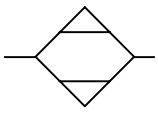
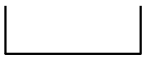
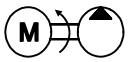
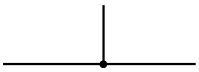
The table explains the symbols used in the hydraulics diagram.

Symbol	Description	Symbol	Description
	Single-acting hydraulic cylinder		Double-acting hydraulic cylinder
	Directional valve 3/2, three ports, two distinct positions, electromagnetically controlled		Directional valve 3/4, four ports, three distinct positions, electromagnetically controlled
	Proportional valve		Valve, two ports, two distinct positions, electromagnetically controlled
	Counter pressure valve		Solenoid valve

Hydraulics – 6000

Symbols

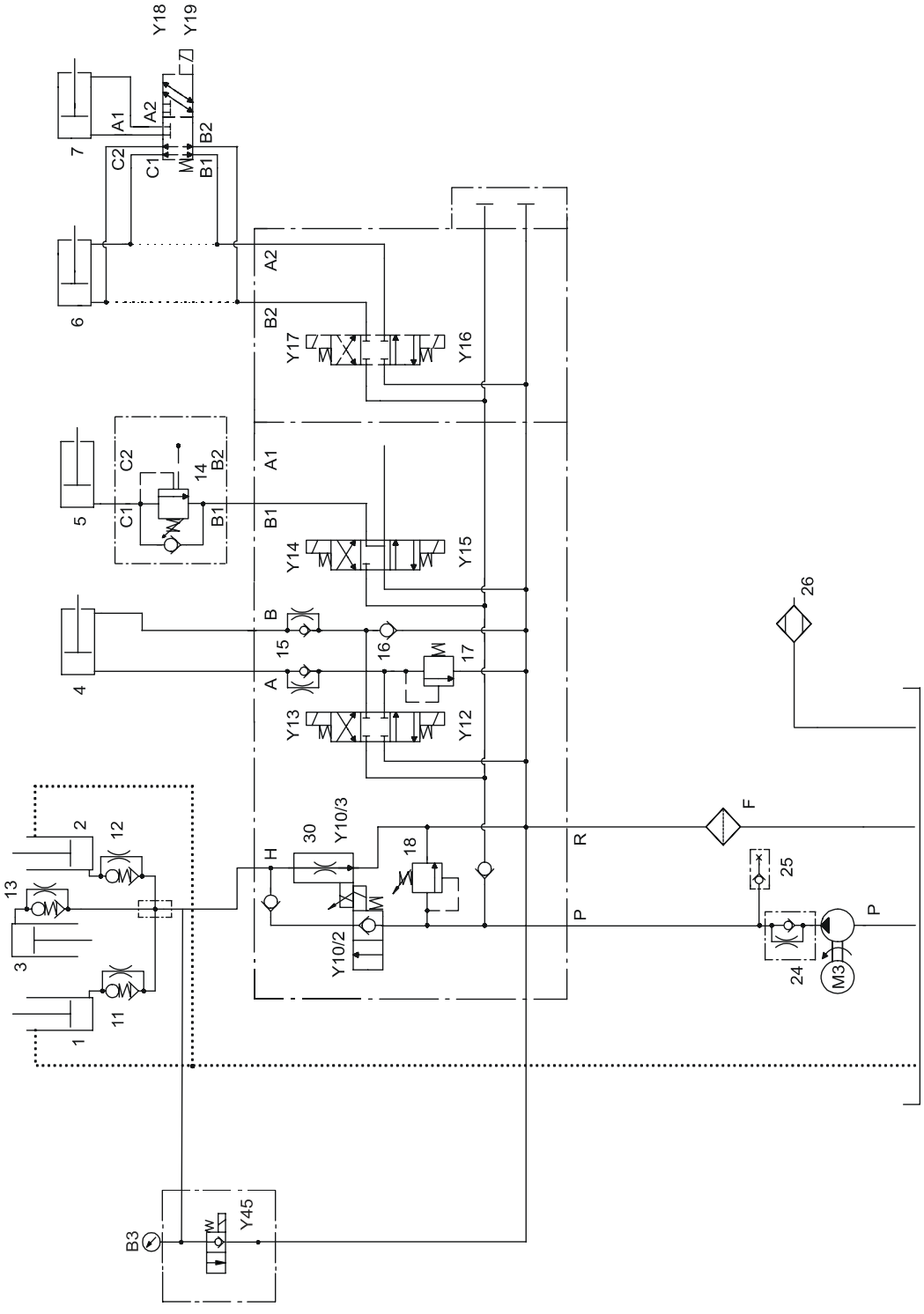
T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Symbol	Description	Symbol	Description
	Pressure limit valve		Load holding valve
	Non-return valve		Non-return valve, spring-loaded (hose rupture valve)
	One-way throttle valve (lowering brake valve)		Metering socket
	Filter		Wiper
	Tank		Electric motor and pump
	Pressure pipe		Pressure pipe with coupling
	Drainage pipe		Pilot pipe
	Pressure sensor		Limit for units containing two or more functions

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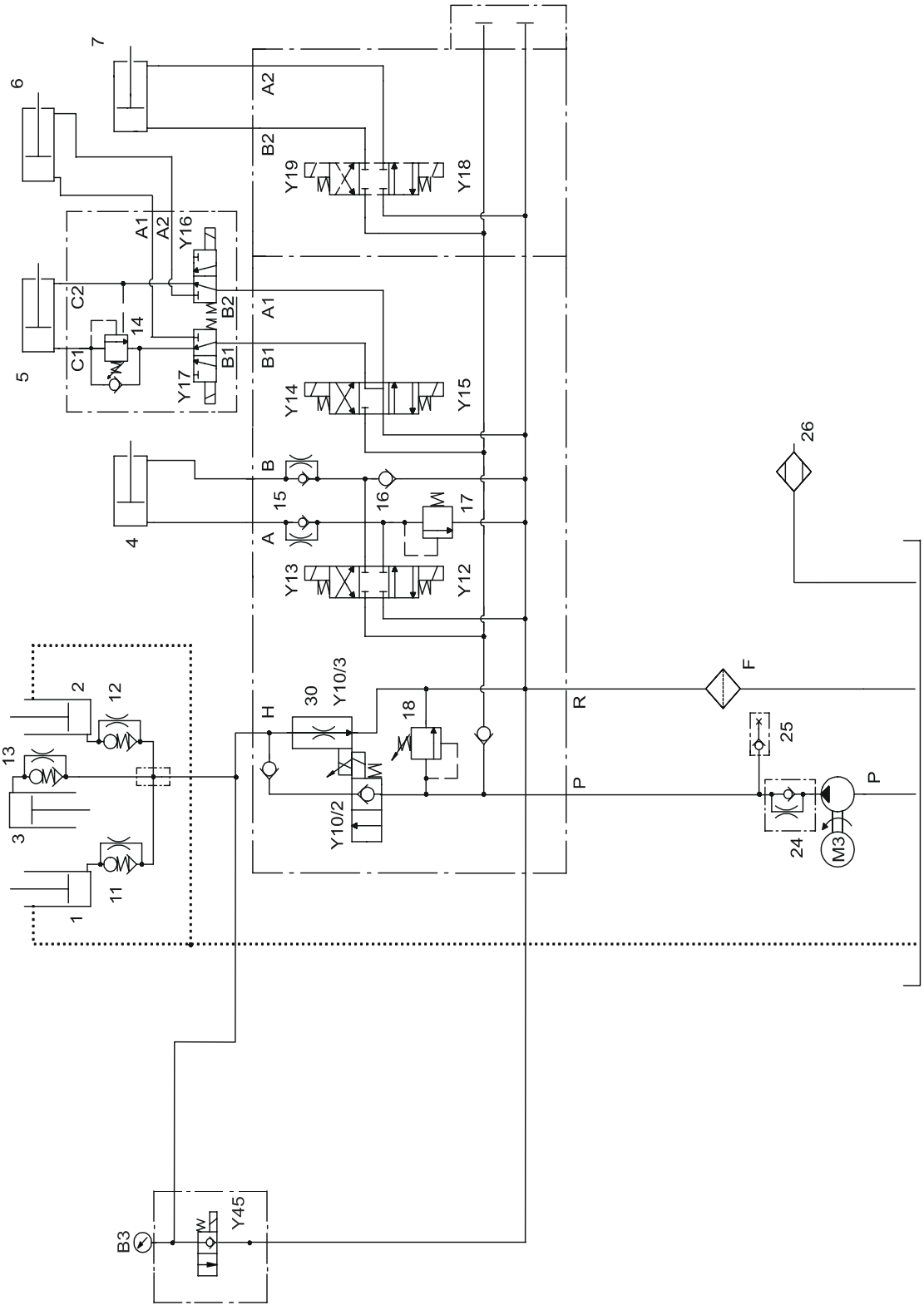
26.2.1 Hydraulics diagram 1 (4)

RR B1-8, RR B1-8C



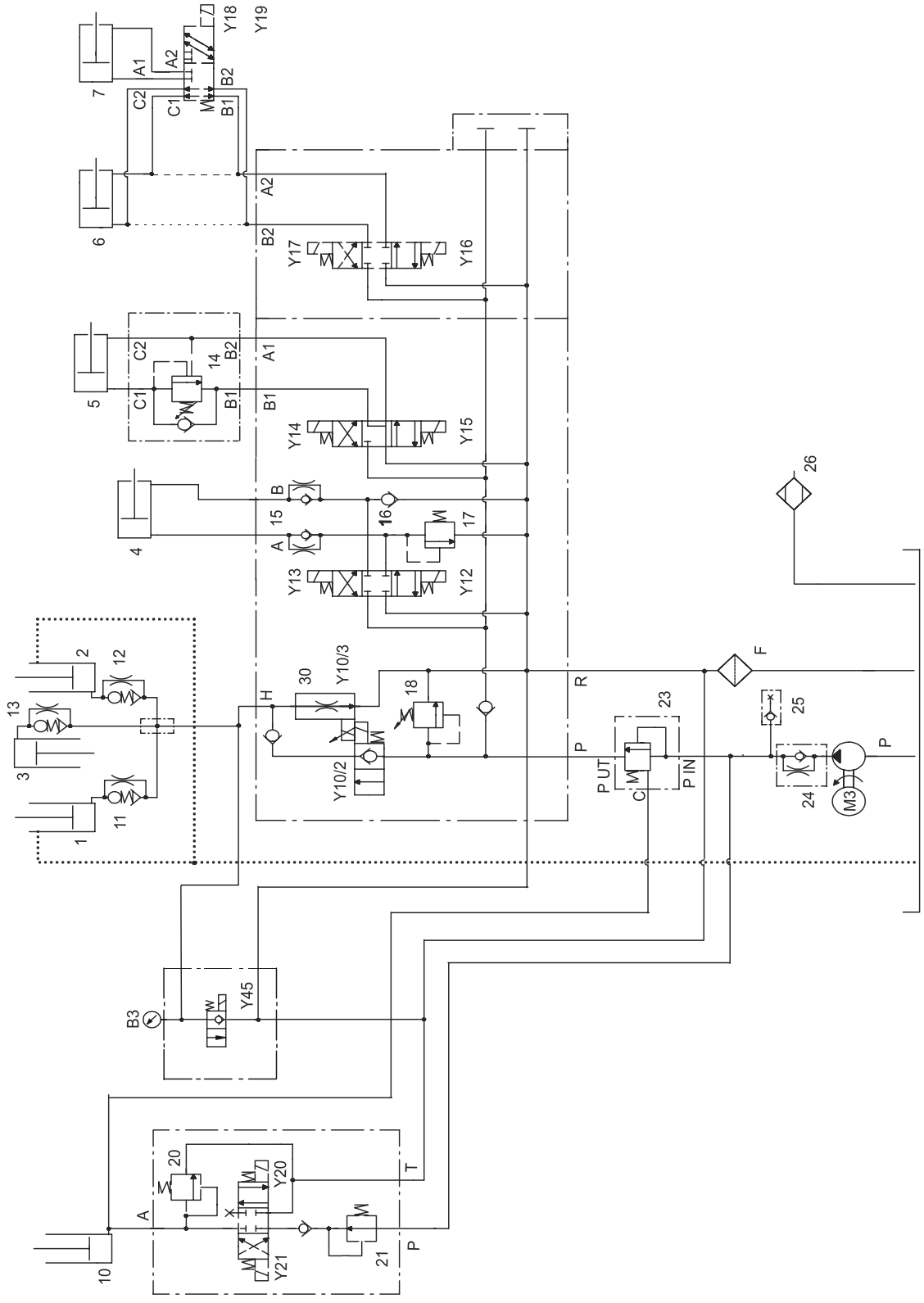
26.2.2 Hydraulics diagram 2 (4)

RR B1-8, RR B1-8C, Integrated side shift



26.2.3 Hydraulics diagram 3 (4)

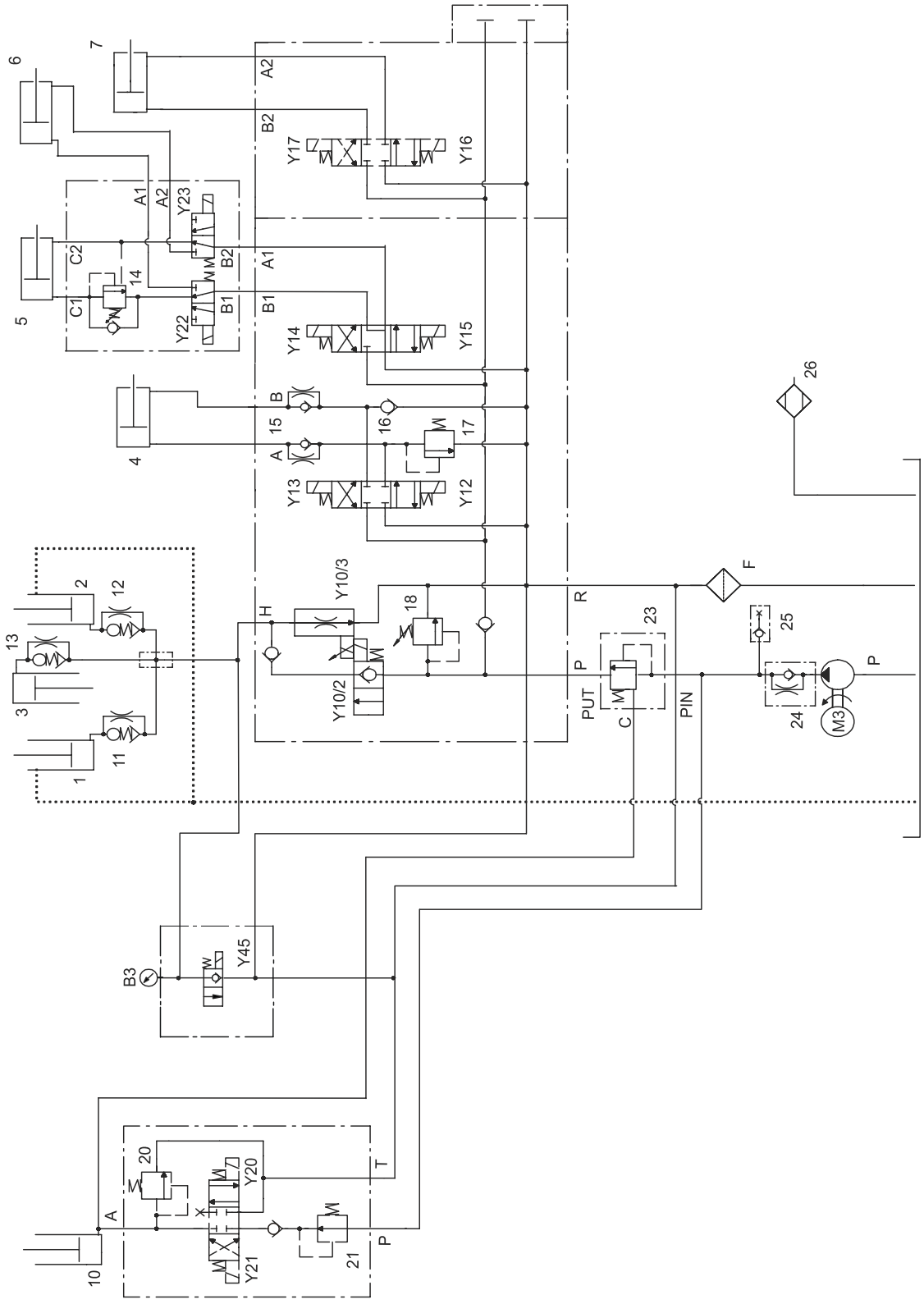
RR E1-8, RR E1-8C



T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

26.2.4 Hydraulics diagram 4 (4)

RR E1-8, RR E1-8C, Integrated side shift



Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

26.3 List of symbols

Symbol	Designation	Function	Comments
1-2	Cylinder	Main lift, forks	
3	Cylinder	Free lift, forks	
4	Cylinder	Extension/retraction, reach carriage	
5	Cylinder	Tilting, forks	
6	Cylinder	Extra function 1	
7	Cylinder	Extra function 2	
10	Cylinder	Cab tilting	Only E1-E8
11-12	Valve	Hose rupture valve, main cylinder	
13	Valve	Hose rupture valve, free lift cylinder	
14	Valve	Load holding valve	14a RR1-8 14b RR1-8 Int SS
15	Valve	Throttle/non-return valve, reach cylinder	
16	Valve	Non-return valve	
17	Valve	Shock valve, reach cylinder	
18	Valve	Pressure limit valve, overflow pressure	
20	Valve	Shock valve, cab tilt	Only E1-E8
21	Valve	Pressure-reducing valve, cab tilt	Only E1-E8
23	Valve	Counter pressure valve, cab tilt	See note 1
24	Valve	Throttle non-return valve, M3	
25	Socket	Socket for pressure measuring	
26	Wiper	Silica gel filter	Only 1C-8C
B3	Pressure sensor		
F	Filter	Oil filter for return flow	

T-code
403-414, 669-671, 716-718
Valid from serial number
713962-
Date
2005-06-01
Order number
218920-040

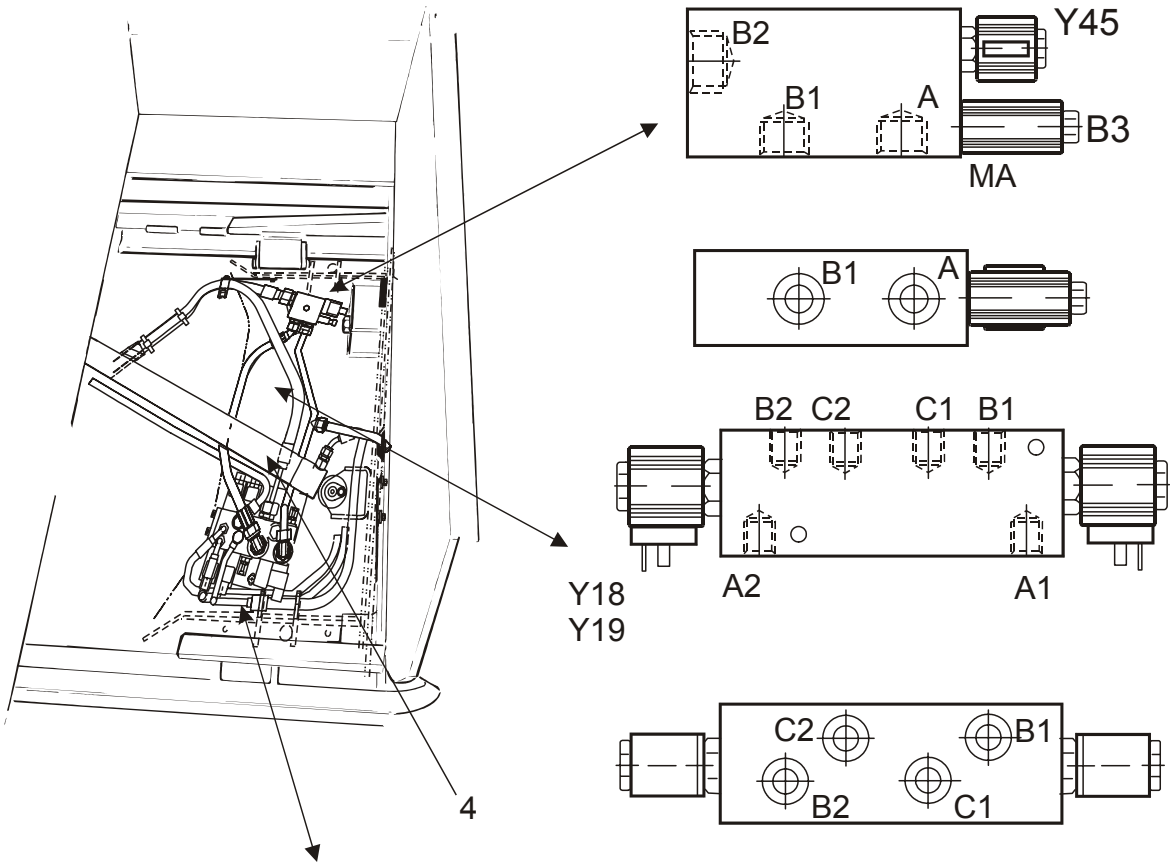
Symbol	Designation	Function	Comments
M	Motor	Pump motor	
P	Pump	Hydraulic pump	
Y10/2	Valve	Lifting, forks	
Y10/3	Valve	Proportional valve lowering, forks	
Y12	Valve	Retraction, mast	
Y13	Valve	Extension, mast	
Y14	Valve	Tilting down, forks	
Y15	Valve	Tilting up, forks	
Y16	Valve	Extra function 1	
Y17	Valve	Extra function 1	
Y18	Valve	Extra function 2	
Y19	Valve	Extra function 2	
Y20	Valve	Cab tilt up	Only E1-E8
Y21	Valve	Cab tilt down	Only E1-E8
Y22	Valve	Switching tilt/side shift	
Y23	Valve	Switching tilt/side shift	
Y45	Valve	Solenoid valve, fork lowering	

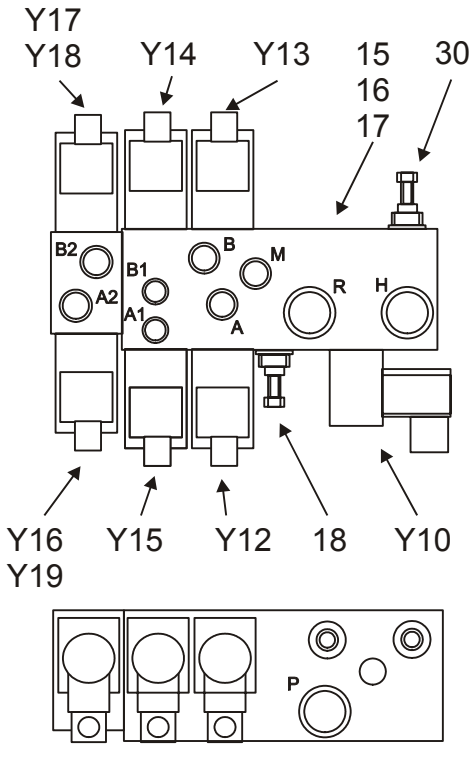
Note 1.

E1-E8
E1C-E8C
Lh < 7 m, No. 23 fitted.
Lh > 7 m, No. 23 not fitted

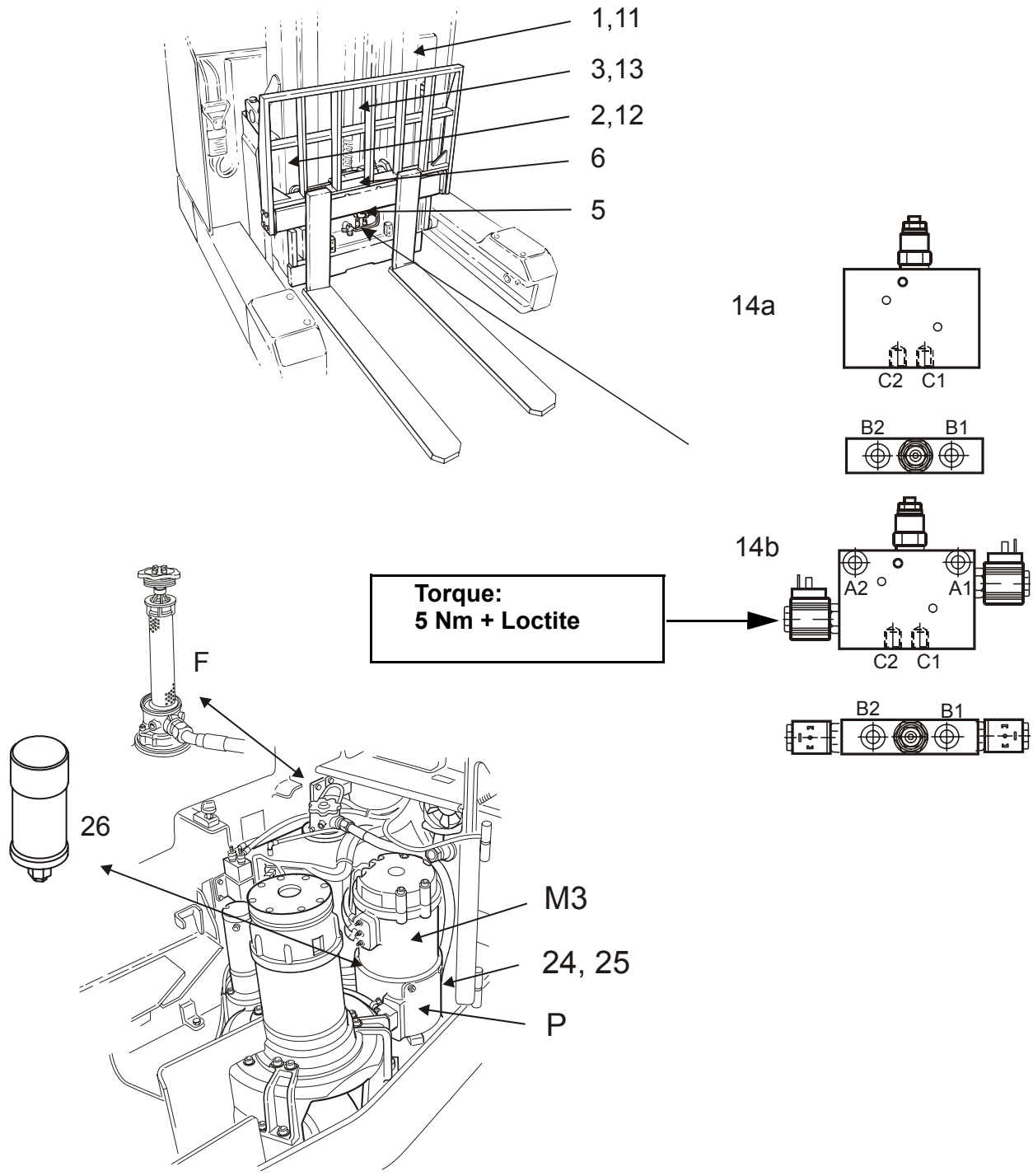
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26.3.1 Component placement 1 (3)





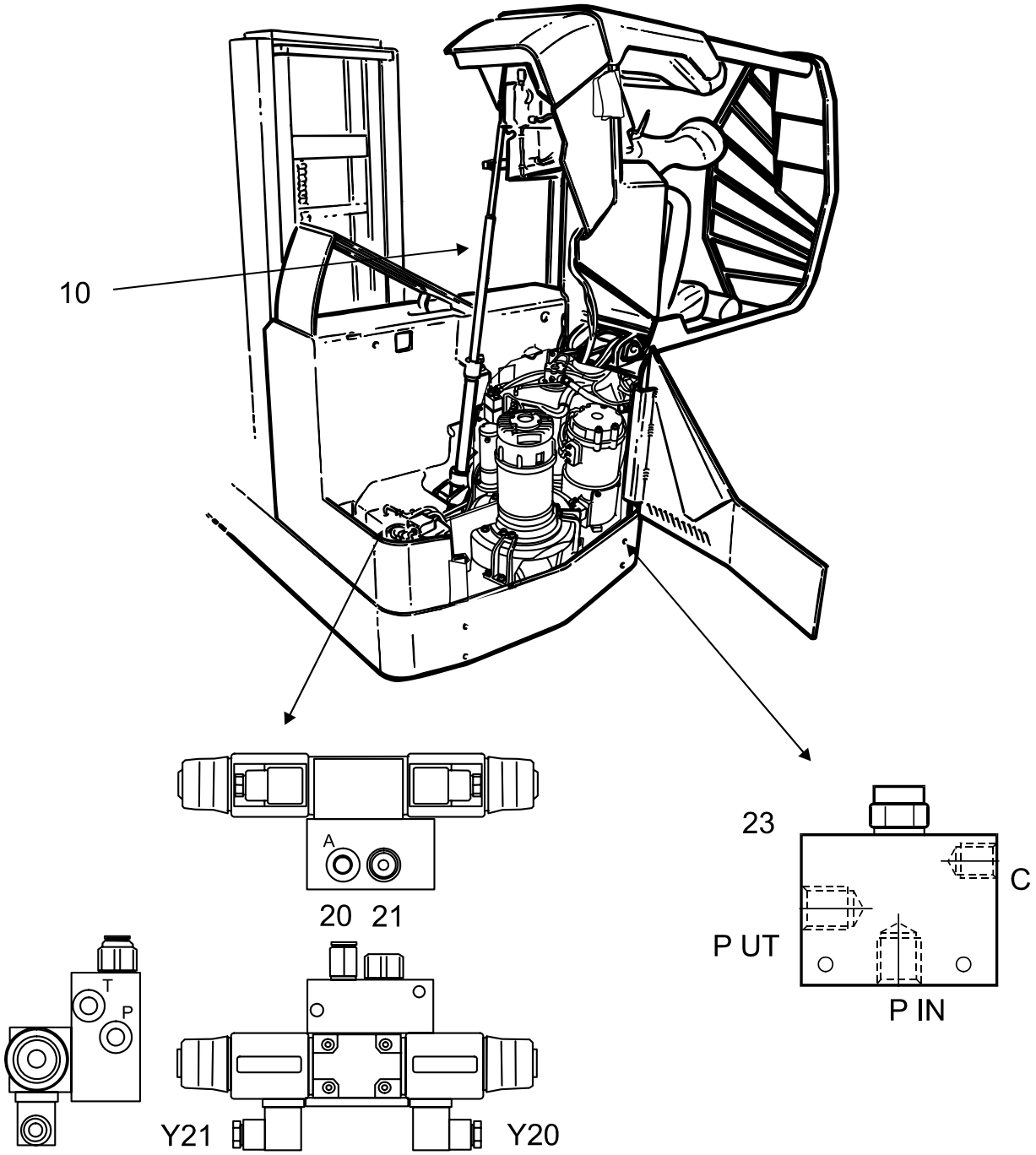
26.3.2 Component placement 2 (3)



Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

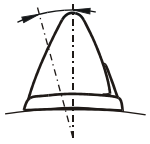
26.3.3 Component placement 3 (3)

RR E1-8



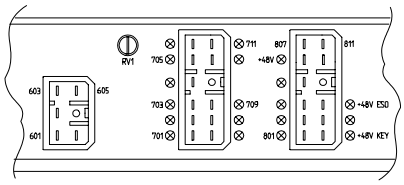
T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

26.4 Adjusting fork lowering

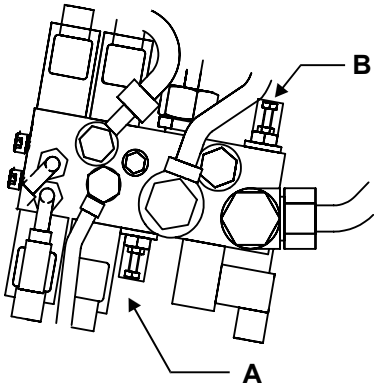


The hydraulic system must be run warm for approx. 10 minutes when adjusting fork lowering so that the correct value is obtained.

- Lift the forks, without a load, to eye-level.
- Actuate the potentiometer for lowering 2-2.5 mm forwards. The LED 803 on the electronic card will come on slightly weaker than with full potentiometer movement.



- Adjust using potentiometer RV 1 on the electronic card A5, so that the forks start to lower very slowly.
- Lift the forks, without a load, to the maximum lifting height.
- Adjust valve B so that the right lowering speed is attained.
- Check that slowing from free lift to main lift functions.
- Seal valve and potentiometer.



A = Flow regulation for fork lifting.

B = Flow regulation for fork lowering.

Lowering speed above free lift without load (m/s).

Model	Min.	Nom.	Max.
RR B/E1-B/E3	0.49	0.52	0.55
RR B/E4-B/E6	0.49	0.52	0.55
RR B/E7-B/E8	0.53	0.56	0.59

Error code 0 13

If error code 0 13 arises, turn the Lower potentiometer, on the electronic card A5, anticlockwise and increase the flow on the valve until the correct lowering speed is achieved.

NOTE!

If error code 0 13 arises on a truck that does not have height indication:
Check that parameter 11 is set to 0.
See 5710 parameter setting.

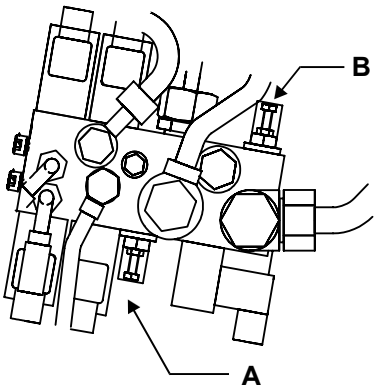
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26.5 Adjusting the maximum lifting capacity

The hydraulic system must be run warm for approx. 10 minutes when adjusting the maximum lift capacity so that the correct value is obtained.

- Extend the reach carriage.
- Lower the forks to floor level.
- Remove the seal on the adjuster screw (A).
- Load the forks with the maximum weight.

Model	Min. (kg)	Max. (kg)
RR B/E1-B/E3	1600	1920
RR B/E1-B/E2	1475	1770
RR B/E3 (Side shift standard)	1475	1770
RR B/E4-B/E6	2000	2400
RR B/E4-B/E6 Side shift	1875	2250
RR B7-B8 (side shift standard)	2500	3000



The right lift capacity is achieved when the inner guide stops just above free lift, approx. 10 mm.

- Lower the forks to floor level.

Adjust to the right lift capacity using the adjuster screw (A) on the main valve.

A = Flow regulation for fork lifting.

B = Flow regulation for fork lowering.

- Loosen the locking nut.
- Screw the adjuster screw (A) outwards to increase the flow.
- Screw the adjuster screw (A) inwards to reduce the flow.
- Lock the locking nut.

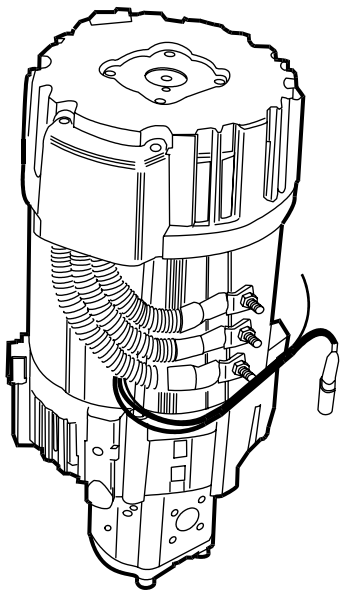
Seal the adjuster screw (A).

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27-Hydraulic pump – 6140

27.1 General

There is one pump size in the truck that has a max flow of 60 litres per minute.

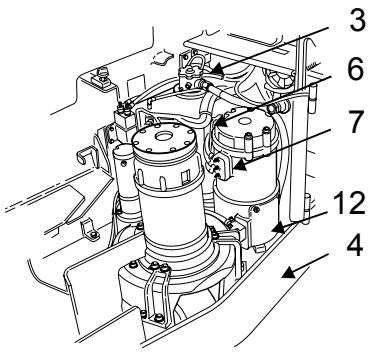
The pump motor is available in two sizes on the trucks.

P150 is used on B/E1-B/E6.

P195 is used on B/E7-B/E8

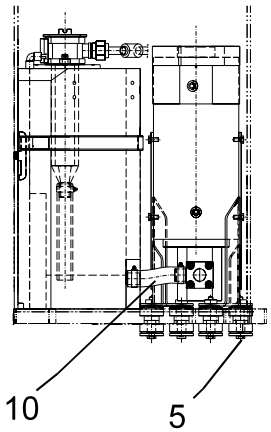
These service instructions contain a description on how to replace the hydraulic pump.

27.2 Replacing the hydraulic pump

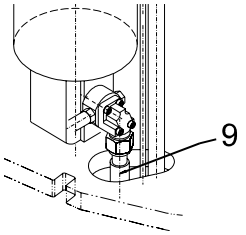


To open and close the motor compartment, see section P1 in this manual.

27.2.1 Dismantling



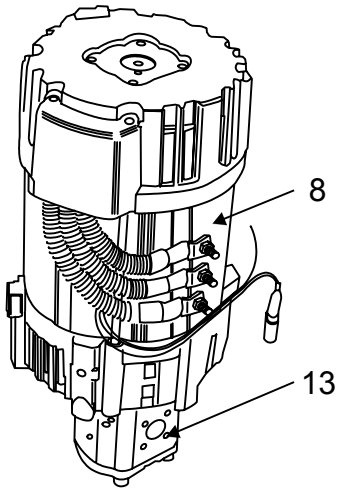
- Disconnect the battery plug.
- Drop the forks to the lowest position to reduce pressure in the hoses and pump.
- Pump the oil out of the hydraulic tank 3 with filter pump V10-15191.
- Remove the support (4) so that the bolts (5) for the pump mounting (12) are accessible.
- Remove the temperature/speed measuring contacts (6) and power cables (7) from the pump motor (8).
- Remove the hydraulic hose (9) and loosen the hose clamp for the hydraulic hose (10) attached to the tank.
- Fasten a lifting eye in the motor axle.
- Remove the bolts (5) holding the pump mounting (12) to the chassis.
- Lift out the hydraulic pump and place it on a clean surface.
- Remove both mountings (12) from the pump motor (8).
- Remove the hose coupling from the pump unit (13).
- Remove the screws and dismount the pump (13).
- Remove the carrier.



Hydraulic pump – 6140

Replacing the hydraulic pump

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27.2.2 Assembling

- Fit the hose coupling on the pump unit (13).
- Replace the carrier between the pump and the pump motor (8).
- Replace the pump unit (13) on the pump motor (8).
- Replace both mounting (12) attachments on the pump motor (8).
- Screw a lifting eye into the end of the motor axle and connect it to an overhead crane.
- Lift the hydraulic pump into the truck while at the same time refitting the hydraulic hose (10) on the tank (3).
- Tighten the hose clamp.
- Fasten the two pump mountings (12) to the chassis using the bolts (5).
- Unscrew the lifting eye.
- Refit the hydraulic hose (9) and the temperature/speed measuring contacts (6) and power cables (7).
- Fill the hydraulic tank (3) with 48 litres of new oil.

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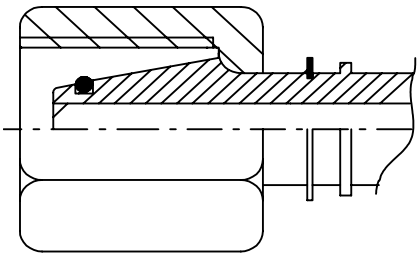
28-Hydraulic connections – 6230

28.1 General

It is important that hydraulic connections are tightened correctly to give a sealed and durable connection.

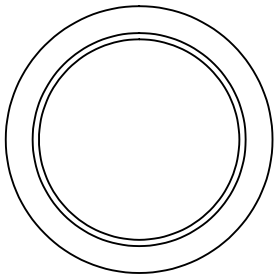
28.2 Tightening torque for hydraulic connections

28.2.1 Conical connection with O-ring



The nut is screwed by hand down until it stops and is then tightened either to a torque or to a number of degrees as set out in the table below. Usually used on the majority of hydraulic hoses on trucks,

Dimension ø [mm]	Tightening torque [Nm]	Tightening angle [°]
6	23	30-45
10	30	30-45
12	50	30-45
15	60	30-45
18	70	30-45
20	80	30-45





28.2.2 Tredo seal

The nut/connection is screwed by hand until it stops and is then tightened to a torque as set out in the table below.

Dimension	Tightening torque [Nm]
R 1/8	12-18
R 1/4	25-45
R 3/8	50-70
R 1/2	70-100
R 5/8	100-140
R 3/4	150-200
R 1	195-250
R 1 1/4	250-310
R 1 1/2	310-400
M 18	50-70
M 22	100-140
M 26	150-200

28.2.3 Pipe coupling

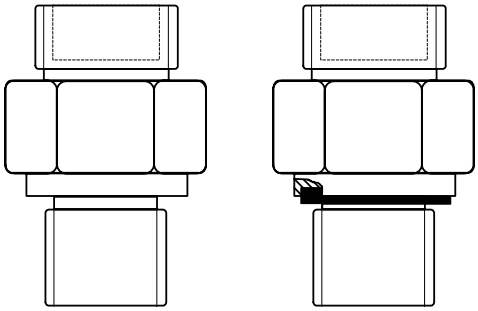
Tighten the coupling by hand and then tighten a half turn to give the correct torque.

28.2.4 Connection screwed into aluminium

Designation with cutting edge	Dimension	Torque [Nm]
G 1/8	R 1/8	~7
G 1/4	R 1/4	~12
G 3/8	R 3/8	~20
G 1/2	R 1/2	~30
G 3/4	R 3/4	~80
G 1	R 1	~100

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28.2.5 Connection screwed into steel



Pressure class L

Designation with cutting edge	Dimen-sion	Torque [Nm]	Designation with EOLASTIC sealing ring	Dimen-sion	Torque [Nm]
GE 6-LM	M 10x1	~20	GE 6-LM-ed	M 10x1	~10
GE 6-LR	R 1/8	~20	GE 6-LR-ed	R 1/8	~10
GE 8-LM	M 12x1.5	~29	GE 8-LM-ed	M 12x1.5	~20
GE 8-LR	R 1/4	~39	GE 8-LR-ed	R 1/4	~20
GE 10-LM	M 14x1.5	~39	GE 10-LM-ed	M 14x1.5	~29
GE 10-LR	R 1/4	~39	GE 10-LR-ed	R 1/4	~20
GE 12-LM	M 16x1.5	~59	GE 12-LM-ed	M 16x1.5	~29
GE 12-LR	R 3/8	~59	GE 12-LR-ed	R 3/8	~39
GE 15-LM	M 18x1.5	~69	GE 15-LM-ed	M 18x1.5	~39
GE 15-LR	R 1/2	~108	GE 15-LR-ed	R 1/2	~59
GE 18-LM	M 22x1.5	~108	GE 18-LM-ed	M 18x1.5	~59
GE 18-LR	R 1/2	~108	GE 18-LR-ed	R 1/2	~59
GE 22-LM	M 26x1.5	~128	GE 22-LM-ed	M 22x1.5	~69
GE 22-LR	R 3/4	~157	GE 22-LR-ed	R 3/4	~88
GE 28-LM	M 33x2	~216	GE 28-LM-ed	M 33x2	~118
GE 28-LR	R 1	~265	GE 28-LR-ed	M 33x2	~137
GE 35-LM	M 42x2	~353	GE 35-LM-ed	M 42x2	~196
GE 35-LR	R 1 1/4	~392	GE 35-LR-ed	R 1 1/4	~235
GE 42-LM	M 48x2	~491	GE 42-LM-ed	M 48x2	~294
GE 42-LR	R 1 1/2	~491	GE 42-LR-ed	R 1 1/2	~294

Hydraulic connections – 6230

Tightening torque for hydraulic connections

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29-Mast mounted hose reel – 6370

29.1 General

These assembly instructions contain requisite information to give trouble-free installation and operation. The enclosed operating instructions contain besides instructions also information regarding inspection and maintenance.

29.2 Assembling

Assemble the hose reel or spring according to the drawing.

Turn the hose drum, with a fully wound hose, in the direction of extraction to preload the spring.

Preloading the hose drum:

- Right extraction clockwise.
- Left extraction anti-clockwise.



WARNING
Loaded spring.
The hose can cause injury.
Always exercise caution when working with the hose reel.

The number of turns depends on the hose length and hose diameter, see the table. The stated values apply as guideline values.

Spring preload (turns)

Hose diameter (mm)	Hose length (m)						
	2.7	3	3.3	5	6	7	8.5
6.3	-	-	4	3	3	3	1.5-2
8	4	4	-	3	3	-	-

The hose is pulled out from the drum once the correct preloading value has been reached.

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29.3 Check after assembly

When the hose reel is first used lift the forks to the maximum lift height. Check that the hose and hose drum work correctly and count the number of turns that the hose drum rotates.

The total of the number of turns made by hand when preloading and the number of turns for maximum extract must be 10 at most.

Turns with preloading + operating turns = max 10

NOTE:

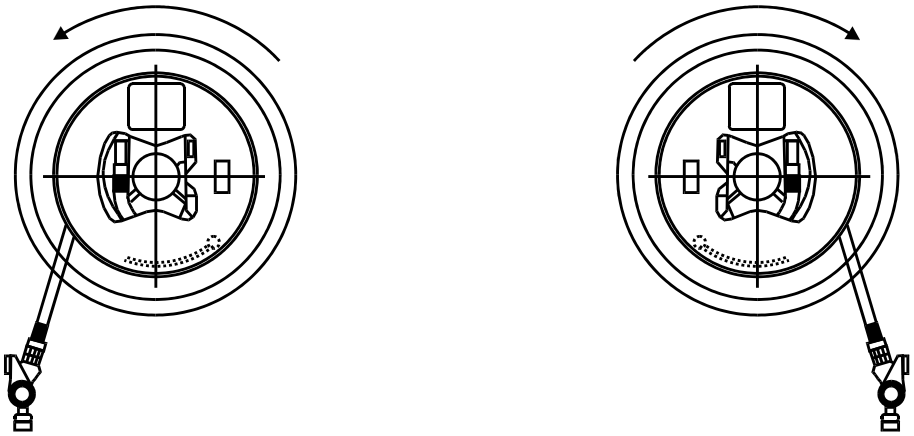
The hose must not be fully unwound from the hose drum at maximum lifting height. At least ¼ turn of hose must remain on the hose drum.

Make sure that the hose drum can still be turned by hand with the hose fully extracted. The hose drum must not lock up.

Check that the hose rewinds correctly when the forks are lowered. The hose must always be loaded otherwise there is a risk of the hose sliding over the side plates. If this is the case adjust the preloading tension.

NOTE:

The spring-loaded eye must face the hose's direction of unwinding.



Spare parts must correspond with the manufacturer's defined technical specifications. This demand is always met when using original spare parts.

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30-Main lift cylinder – 6610

30.1 General

This instruction describes the main lift cylinders in the Newton mast.

There are two lifting cylinders on each mast. A hose rupture valve is located on each cylinder that prevents the forks from falling in the event of a hose rupturing.

We recommend that all masts, irrespective of the lifting height, are raised before the cylinders are dismantled. Applies to 1600 and 2000 kg masts.

30.2 Tools

For lift cylinders on the mast and valve in the fork yoke.
(1600 and 2000 kg masts).

Tool number	Comments
08-15364	To protect the rod seals from damage against the cylinder threads.
08-15366	Assembling the rod seal on 08-15367
08-15367	Assembling the rod seal on the ram
08-15368	Assembling the stop ring on 08-15369
08-15369	Assembling the stop ring on 08-15370
08-15370	Assembling the stop ring on the rod
08-15391	Hook spanner 60-90 with 5 mm pin
08-15393	Pipe wrench
08-15400	Assembling the hose rupture valve

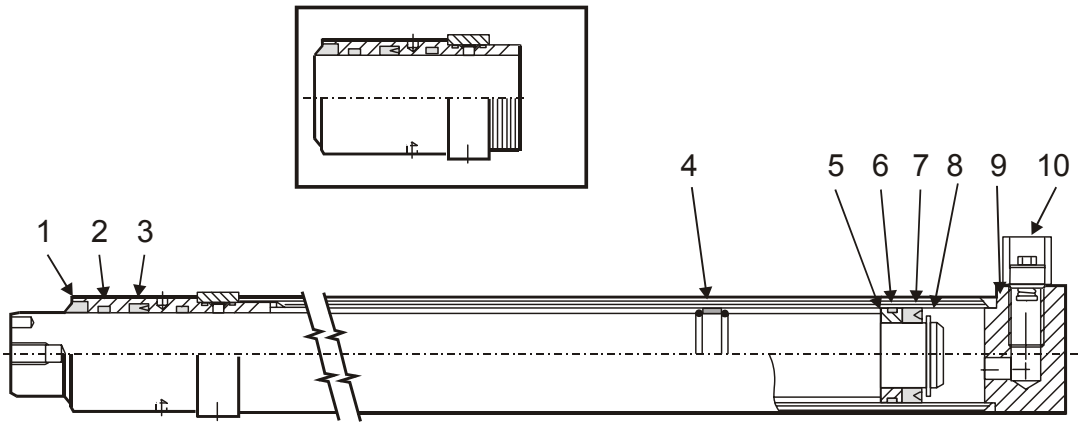
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30.3 Dismantling the lift cylinders from the mast

- Loosen the lift chain from the top on the lift cylinder to be dismantled and place it on the floor over the reach carriage.
- Remove the lifting chain sprocket.
- Block both inner runners approximately 50 cm above the floor with blocks.
- Lower the free liftcylinder to the bottom.
- Loosen the connection pipe in the lift cylinder and manifold. The cylinder can now be removed.
- Plug the manifold connections.
- Check that the remaining lift chains are not damaged.
- Check that the lift chains are not damaged or damage anything while you raise the mast to the top.
- Loosen the lift cylinder by the bottom stud.
- Loosen the cylinder support at the top.
- Remove the cylinder from the mast.

30.4 Dismantling the cylinder

- Dismantle the cylinder from the mast.



- Place the bottom stud (9) in a vice and let the top section rest against e.g. a pipe stand so that the cylinder lies in the horizontal position.
- Carefully knock the top sleeve and the cylinder with a rubber mallet, carefully heat if necessary.
- Loosen the top sleeve (1) using tool 08-15393.
- Carefully pull the rod out of the cylinder so that the threads are not damaged. Place the rod on a soft and clean surface so that it is not damaged.
- Knock off the top sleeve (1) using a rubber mallet.

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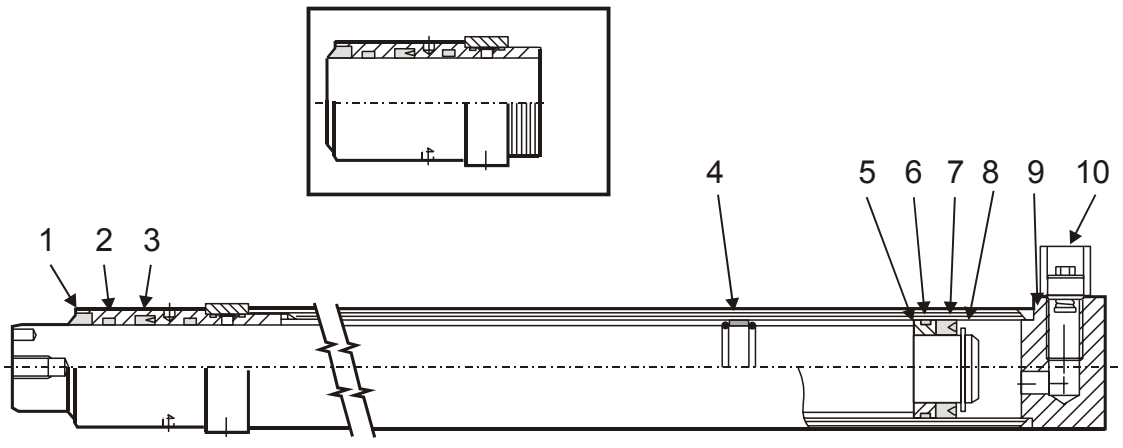
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30.4.1 Dismantling the rod seal, guide ring, guide ring holder and locking ring in lift cylinder

- Remove the clamping ring (8).
- Remove the rod seal (7).
- Dismantle the guide ring holder (5).
- Remove the guide ring (6) from the guide ring holder (5).
- Remove the retainer rings (4).

30.4.2 Fit the locking ring, rod seal, guide ring and guide ring holder in the lift cylinder

- Fit the locking ring (4) on the rod using tool 08-15368, 08-15369 and 08-15370.
- Assemble the guide ring (6) on guide ring holder (5).
- Assemble the guide ring holder (5) on the rod.
- Place the assembly tool 08-15367 on the rod.
- Place the rod seal (7) on the assembly tool 08-15366.
- Assemble the rod seal (7) on the rod.
- Fit the clamping ring (8).



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30.4.3 Dismantling and assembling the hose rupture valve

Cylinder for a 2,500 kg mast

- Disassembly and assembly of the hose rupture valve (10) are both done using the tool 08-15400.

Cylinder for a 1,600 kg and 2,000 kg mast.

- The hose rupture valve (10) is joined with the hose coupling.

30.5 Assembling the cylinder

- Use assembly tool 08-15364 when inserting the rod in the cylinder.
- Remove the assembly sleeve 08-15364.
- Assemble the top sleeve (1) on the rod using a rubber mallet.
- Screw the top sleeve (1) in the cylinder a few turns.
- Apply flange sealant **FD 1042** on the thread.
- Tighten using tool 08-15391.
- On 1350 -2.000 kg lift cylinders the venting hole and the hole for the lower brake valve should be placed on either side.
- Assemble the cylinder on the mast.

NOTE!

The curing time for the flange sealant is 4 hours and the cylinders must not be used before this.

30.5.1 Assembling the cylinder in the mast

- Lift the cylinder in the mast.
- Bolt the cylinder on the bottom stud.
- Assemble the cylinder support.
- Block up the inner runner approximately 50 cm above the floor using blocks.
- Lower the mast.
- Remove the plugs from the manifold.
- Assemble the connection pipe in the cylinder and manifold.
- Lift up the forks until the lift cylinder rests against the top beam.
- Bolt the cylinder on top beam.
- Lower the forks fully.
- Assemble the chain sprocket and lift chain.
- Adjust the chain so that the mast does not pull to one side at the top.

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31-Free lift cylinder – 6620

31.1 General

The free lift cylinder is the cylinder located in the centre of the cylinders in the mast.

There is a hose rupture valve fitted in the free lift cylinder that prevents the load from falling in the event of a ruptured hose.

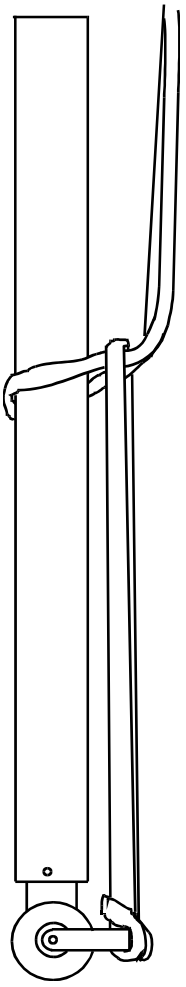
31.2 Tools

For free lift cylinders on the mast with valve in the fork yoke.
(1600 and 2000 kg masts).

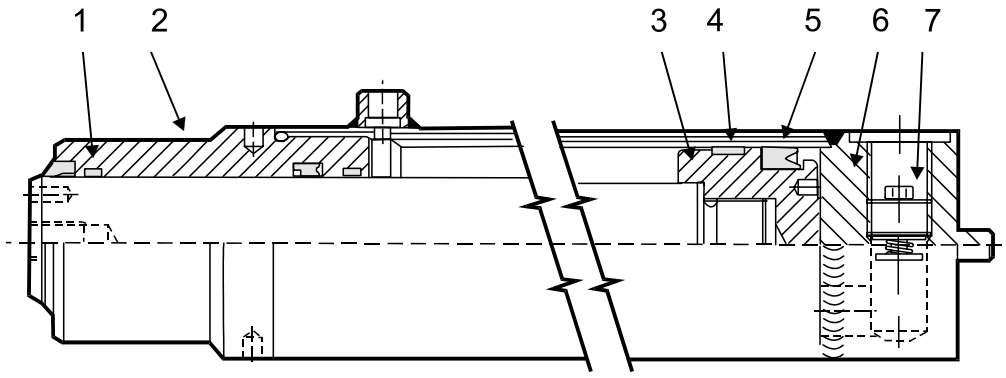
Tool number	Comments
08-15365	To protect the rod seals from damage against the cylinder threads.
08-15418	The assembly punch is used together with tool 08-15419
08-15419	Fitting the rod seal on the piston
08-15391	Hook spanner 60-90 with 5 mm pin
08-15393	Pipe wrench
08-15417	Assembling the hose rupture valve

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31.3 Dismantling



- Remove the feeder pipe on the free lift cylinder.
- Plug the free lift cylinder.
- Remove the venting hose.
- Loosen the mounting bolts on the top side of the free lift cylinder.
- Lift up the intermediate runner using an overhead crane so that the twin hose and cable slacken off.
- Remove the twin hose and cable from the hose reels on the free lift cylinder.
- Block up under the fork yoke.
- Lower the overhead crane so that the fork yoke rests on the block and the free lift chain slackens off.
- Strap together the chains so that they do not slide out of the upper chain sprockets.
- If there is a chain guard, this should be removed from the bracket.
- Remove the inner split pin on the free lift chain pin.
- Remove the free lift chain pin.
- Lift off the free lift chain from the free lift cylinder.
- Remove the chain adjuster from the free lift cylinder.
- Secure a lifting strap around the free lift chain bracket by the end of the free lift piston and a lifting strap around the free lift cylinder (see diagram).
- Secure the lifting strap in an overhead crane.
- Remove the mounting bolts on the top side of the free lift cylinder.
- Lower the free lift cylinder.



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31.3.1 Dismantling the cylinder

- Place the bottom stud (6) in a vice and allow the top section of the cylinder to rest against a pipe stand or similar so that the cylinder lies in the horizontal position.
- Carefully knock the top sleeve (2) with a rubber mallet. Carefully heat a little, if necessary.
- Loosen the top sleeve (2) using pipe wrench 08-15393.
- Carefully pull the rod out of the cylinder so that the threads are not damaged. Place the rod on a soft and clean surface to prevent damage.
- Knock off the top sleeve (2) using a rubber mallet.

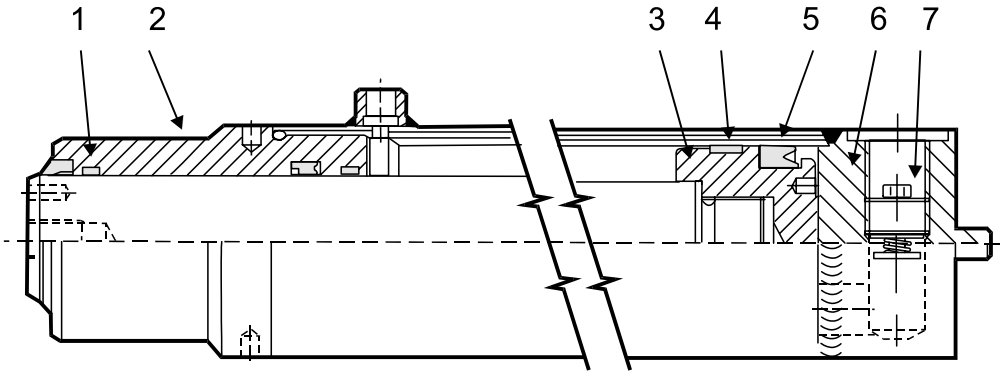
31.4 Dismantle the rod seal and support ring

- Carefully tap a screwdriver into the rod seal (5) without making any marks whatsoever on the piston (3).

NOTE!

If the piston is scratched, it must be replaced to prevent leakage from occurring.

- Very carefully lift up the rod seal (5).
- Carefully cut off the rod seal (5) using a knife so that no damage is caused to the piston (3).
- Remove the support ring (4).



31.4.1 Assembling the rod seal and support ring

- Fit the support ring (4) on the piston (3).
- Fit the rod seal (5) on the piston (3) using assembly tools 08-15418 and 08-15419.

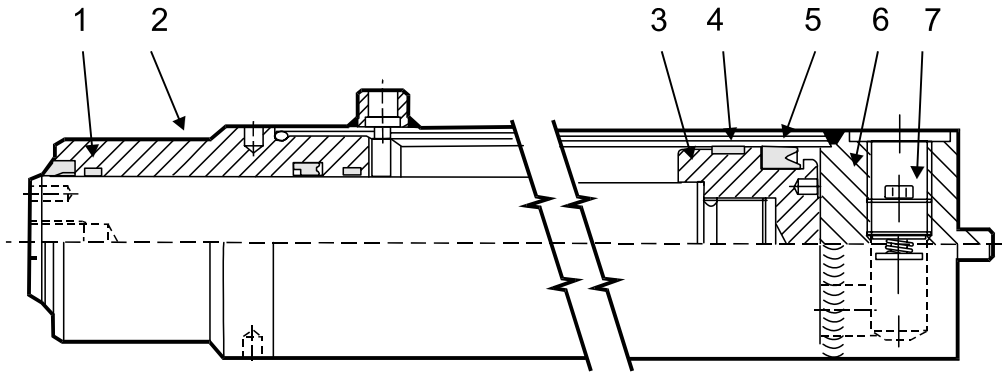
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31.5 Dismantling the piston

- Remove the rod seal (5) and support ring (4).
- Knock and heat the piston a little (3), if necessary.
- Unscrew the piston (3) using pipe wrench 08-15393.
- Brush off any old flange sealant.

31.5.1 Fitting the piston in the free lift cylinder

- Apply **OMNI 230** on the thread.
- Screw in the piston (3) using assembly tool 08-15390.
- Take care to wipe off all surplus sealant.



31.6 Dismantling and assembling the hose rupture valve

- Dismantle the lowering brake valve (7) using tool 08-15417
- Assemble the lowering brake valve (7) using tool 08-15417

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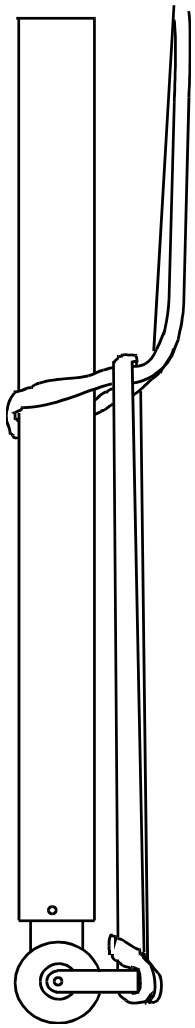
31.7 Assembling the cylinder

- Position the assembly sleeve 08-15365 on the cylinder.
- Insert the rod in the cylinder.
- Remove the assembly sleeve.
- Knock the top sleeve (2) into position on the rod using a rubber mallet.
- Screw the top sleeve (2) in the cylinder a few turns.
- Apply flange sealant **FD 1042** on the thread.
- Tighten using hook spanner 08-15391.

NOTE!

The curing time for the flange sealant is 4 hours and the cylinders must not be used before this.

31.8 Assembly



- Secure a lifting strap around the free lift chain bracket by the end of the free lift piston and a lifting strap around the free lift cylinder (see diagram).
- Lift up the free lift cylinder into its correct position.
- Fit the free lift cylinder using its mounting bolts.
- Take away the overhead crane.
- Fit the chain adjuster.
- Fit the free lift chain with its pin.
- Fit the split pin.
- Fit chain guard, if applicable.
- Remove the straps from around the free lift chain.
- Lift up the inner guide using an overhead crane.
- Place the twin hose and the cable on the free lift cylinder’s hose reels.
- Take away the overhead crane.
- Remove the plugs on the free lift cylinder.
- Fit the feeder pipe on the free lift cylinder.
- Fit the venting hose

Free lift cylinder – 6620

Assembly

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32-Reach cylinder – 6650

32.1 General

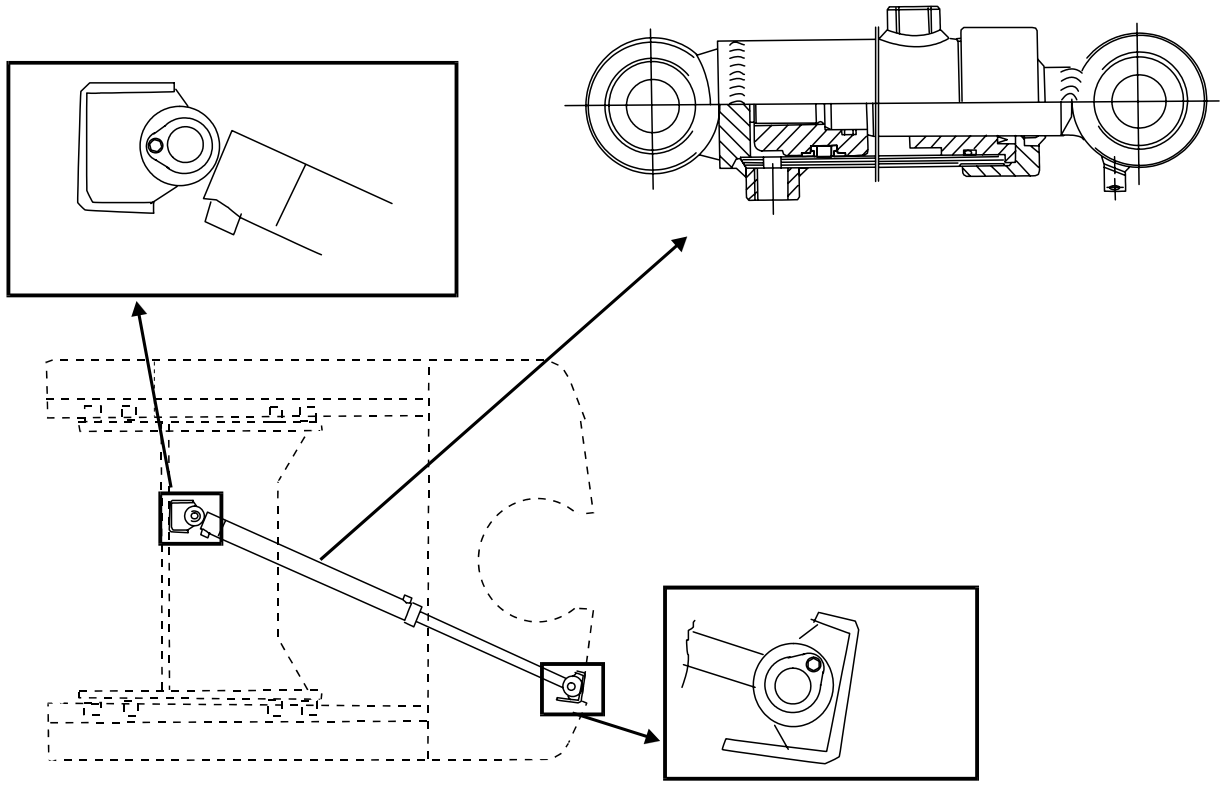
The reach cylinder is located in the reach carriage.

The reach cylinder is a double acting cylinder.
The direction of the cylinder is governed by the main valve.

32.2 Assembling and dismantling the reach cylinder

To open and close the motor compartment, see section P1 in this manual.

32.3 Dismantling



- Swing out door.
- Loosen the footboard from the footboard cylinder.
- Unscrew the return hose from the tank.
- Plug the return hose by the tank.

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- Unscrew the hoses from the reach cylinder.
- Unscrew the upper left bolt on the protective plate.
- Unscrew the mounting bolts for the pins.
- Screw in a lifting eye of the like in the pins.
- Pull out the pins.
- Lift out the reach cylinder

32.3.1 Dismantling the cylinder

- Place the bottom stud in a vice and let the top section rest against e.g. a pipe stand so that the cylinder lies in the horizontal position.
- Carefully knock the rod housing with a rubber mallet.
- Unscrew the rod housing using a pipe wrench.
- Carefully pull the rod out of the cylinder so that the threads are not damaged. Place the rod on a soft and clean surface to prevent damaged.
- Knock off the top sleeve using a rubber mallet.

32.3.2 Dismantle the rod seal and the support ring.

- Knock a screwdriver in the rod seal without making any marks whatsoever on the ram.

NOTE!

If a ram is scratched it must be replaced to prevent leakage from occurring.

- Very carefully lift up the rod seal.
- Carefully cut off the rod seal using a knife so that not damage is caused to the ram.
- Remove the support ring.

32.3.3 Assembling the rod seal and the support ring.

- Assemble the support ring and rod seal on the piston.

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32.3.4 Dismantling the ram

- Remove the rod seal and the support ring.
- Knock and heat the ram a little, if necessary.
- Unscrew the ram using a pipe wrench.
- Brush off any old flange sealant.

32.3.5 Assembling the ram

- Apply **OMNI 230** on the thread.
- Screw in the ram using a hook spanner.
- Take care to wipe off all surplus sealant.

32.3.6 Assembling the cylinder

- Insert the rod in the cylinder.
- Knock the top sleeve in position on the rod using a rubber mallet.
- Screw the top sleeve in the cylinder a few turns.
- Apply flange sealant **FD 1042** on the thread.
- Tighten using a hook spanner.
- Assemble the cylinder in the truck.

NOTE!

The curing time for the flange sealant is 4 hours and the cylinders must not be used before this.

32.4 Assembling

- Fit the reach cylinder.
- Knock in the pins.
- Screw in the mounting bolts for the pins.
- Bolt the protective plate in position.
- Fit the connectors X18 and X19 in the connector plate.
- Assemble the hoses on the cylinder.
- Fit the return hose on the tank.

Reach cylinder – 6650

Assembling

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33-Tilt cylinder – 6660.1

33.1 General

The fork tilt cylinder is located on the mast behind the lower edge of the fork yoke.

The cylinder is double acting, which means it is the oil pressure that moves the ram backwards and forwards in the cylinder. When the ram is pressed out, the lower edge of the fork yoke is moved outwards and in doing so the forks are tilted upwards.

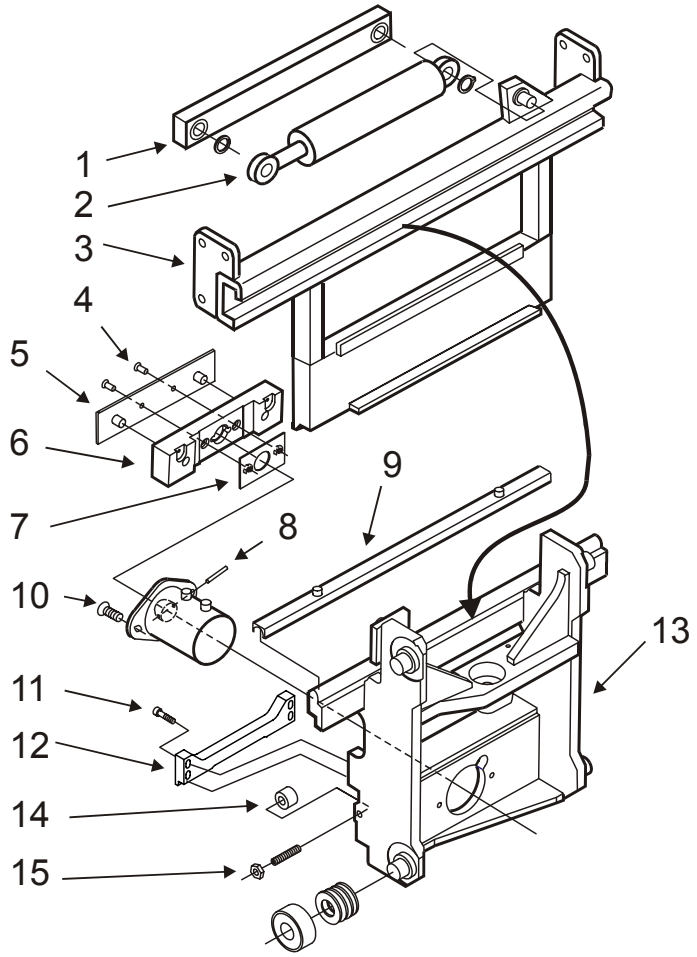
This document is divided into two chapters:

- Mast **with** valve on the fork carriage.
- Mast **without** valve on the fork carriage.

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33.2 Mast with valve on the fork carriage

33.2.1 Dismantling the fork carriage

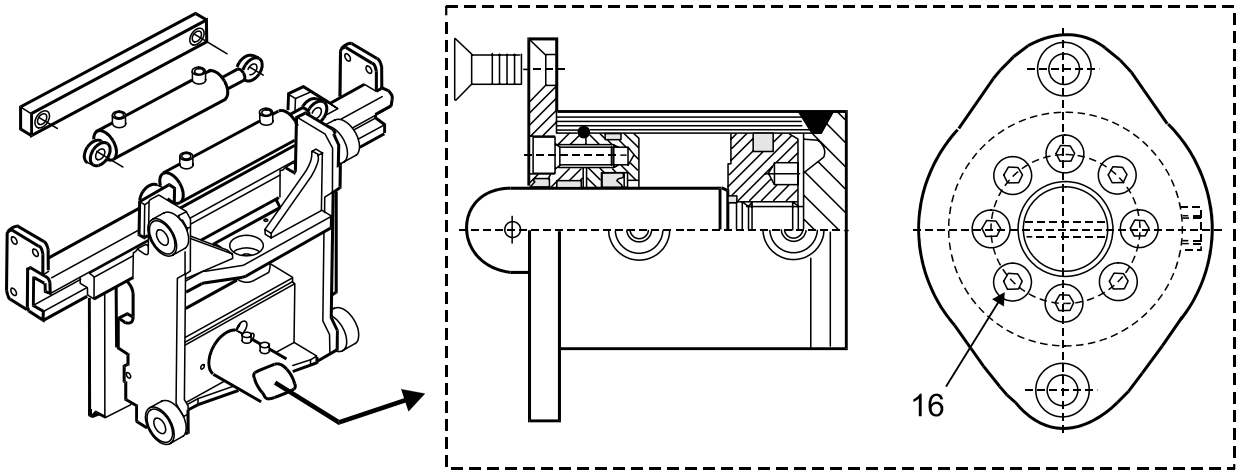


- Lift up the fork carriage to the right working height.
- Remove the forks.
- Remove the clamping ring to dismantle the side shift (2) or the stay (1).
- Loosen the bolts (11) and remove the stop lug (12).
- Secure a lifting strap around the fork yoke (3) and lift out using an overhead crane.
- Unscrew the bolts (4) and remove the plate (5) and the sliding block (6).
- Loosen the nut/bolt (15) and unbolt the bolts (10) from the fork carriage (13).
- Remove the tilt cylinder.
- Knock out the spiral pin (8) and remove the plate (7).

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33.2.2 Dismantling the cylinder

- Unscrew the bolts (16).
- Carefully pull the rod out of the cylinder so that the threads are not damaged. Place the rod on a soft and clean surface to prevent damaged.



33.2.3 Dismantling the rod seal

- Knock a screwdriver in the rod seal without making any marks whatsoever on the ram.

NOTE!

If a ram is scratched it must be replaced to prevent leakage from occurring.

- Very carefully lift up the rod seal.
- Carefully cut off the rod seal using a knife so that not damage is caused to the ram.

33.2.4 Dismantling the ram

- Remove the rod seal.
- Knock and heat the ram a little, if necessary.
- Unscrew the ram (3) using pipe wrench 08-15393.
- Brush off any old flange sealant.

33.2.5 Assembling the ram

- Apply **OMNI 230** on the thread.
- Screw in the ram using a hook spanner.
- Take care to wipe off all surplus sealant.

33.2.6 Assembling the rod seal

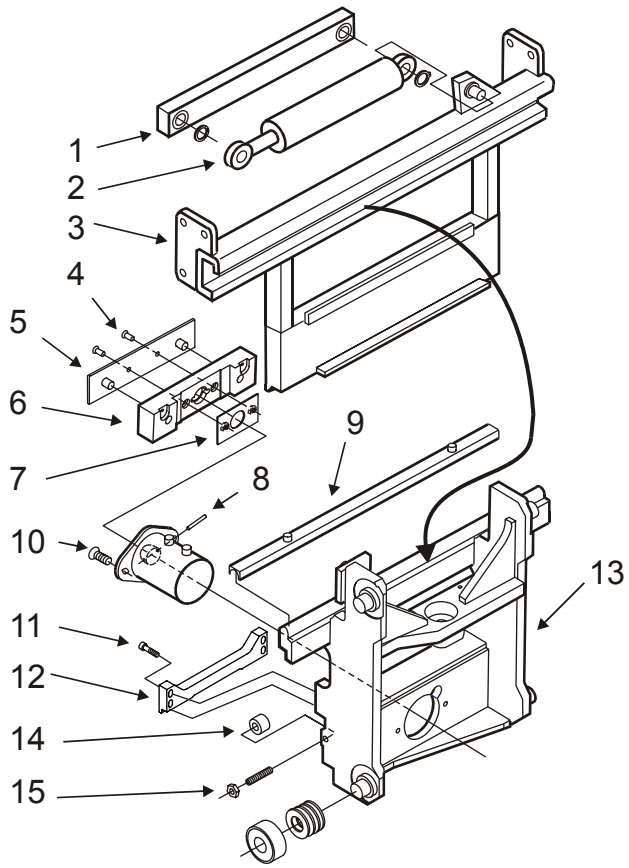
- Press on the rod seal carefully.

33.2.7 Assembling the cylinder

- Insert the rod in the cylinder.
- Tighten with the 8 bolts.

33.2.8 Assembling the fork carriage

- Fit plate (7) and lock in position with the spiral pin (8).
- Fit the tilt cylinder using bolts (10).
- Fit the sliding block (6) and the plate (5) using the bolts (4).
- Lock the sliding block with the bolt/nut (15) so tight that the insert (14) rotates with difficulty.
- Lift the fork yoke (3) in position using an overhead crane.
- Fit the stop lug (12) using bolts (11).
- Fit the side-shift (2).
- Fit the forks.

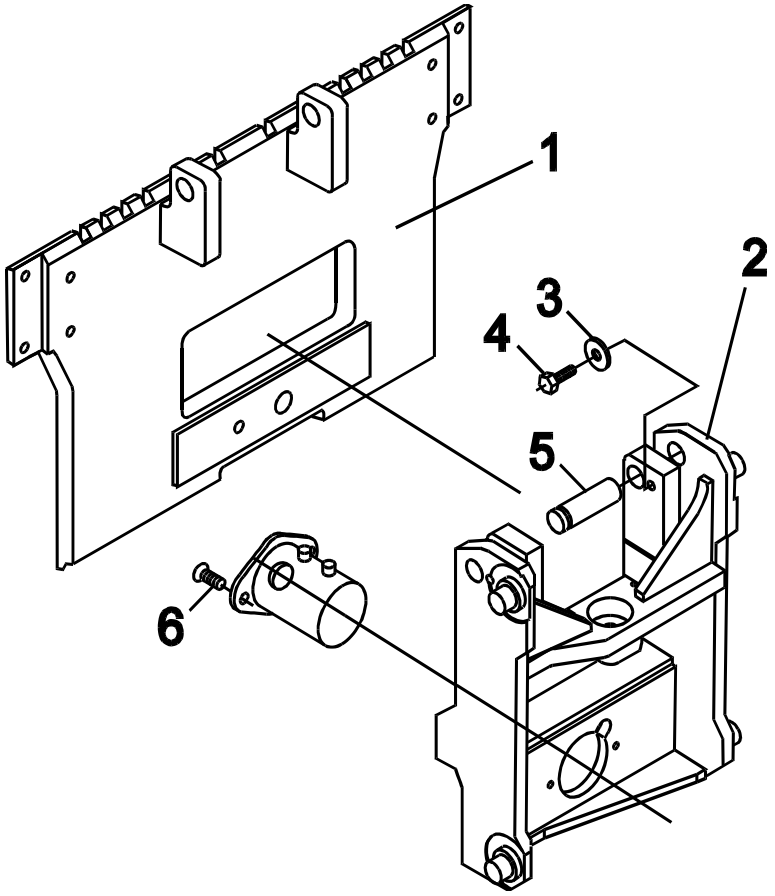


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33.3 Mast without valve on the fork carriage

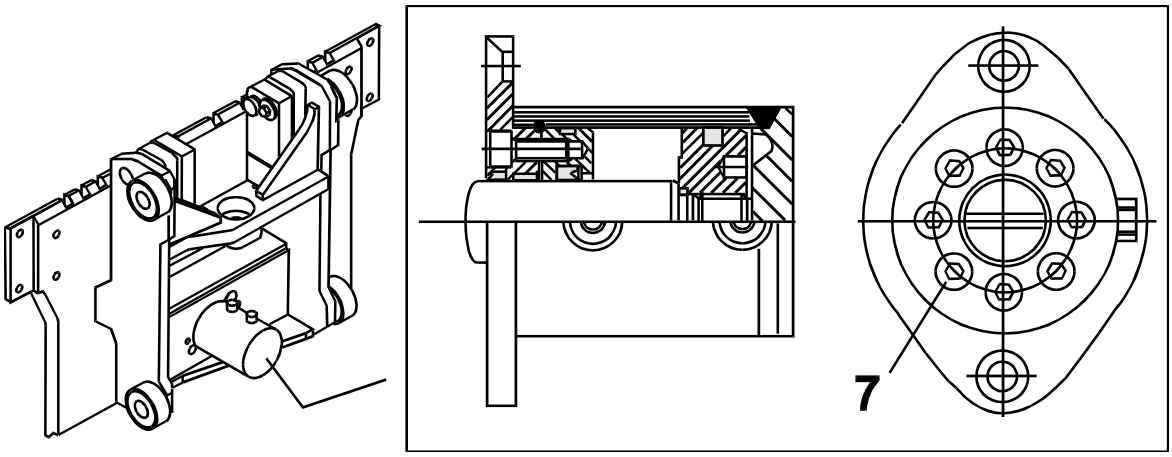
33.3.1 Dismantling the fork carriage

- Lift up the fork carriage to the right working height.
- Remove the forks.
- Lift up the fork yoke in an overhead crane.
- Unscrew the bolts (4) and washers (3).
- Knock out the axles (5).
- Remove the fork yoke.
- Unscrew the bolts (6) and remove the tilt cylinder.



33.3.2 Dismantling the cylinder

- Unscrew the eight bolts (7).
- Carefully pull the rod out of the cylinder so that the threads are not damaged. Place the rod on a soft and clean surface so that it is not damaged.



33.3.3 Dismantling the rod seal

- Knock a screwdriver in the rod seal without making any marks whatsoever on the ram.

NOTE!

If a ram is scratched it must be replaced to prevent leakage from occurring.

- Very carefully lift up the rod seal.
- Carefully cut off the rod seal using a knife so that not damage is caused to the ram.

33.3.4 Dismantling the ram

- Remove the rod seal.
- Knock and heat the ram a little, if necessary.
- Unscrew the ram using pipe wrench 08-15393.
- Brush off any old flange sealant.

33.3.5 Assembling the ram

- Apply **OMNI 230** on the thread.
- Screw in the ram using a hook spanner.
- Take care to wipe off all surplus sealant.

33.3.6 Assembling the rod seal

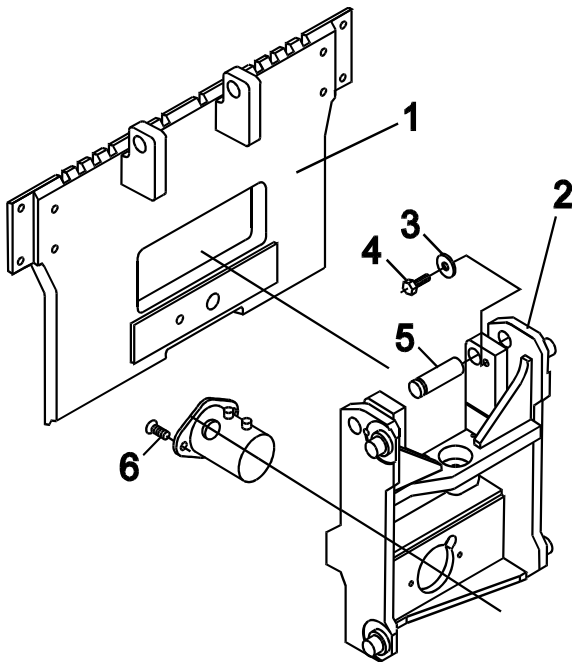
- Press on the rod seal carefully.

33.3.7 Assembling the cylinder

- Insert the rod in the cylinder.
- Tighten with the 8 bolts.

33.3.8 Assembling the fork carriage

- Fit the tilt cylinder using bolts (6).
- Lift the fork yoke in position.
- Knock the axles (5) in position.
- Bolt the axles in position using the bolts (4) and washers (3).
- Fit the forks.



Tilt cylinder – 6660.1

Mast without valve on the fork carriage

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34-Tilt cylinder – 6660.2

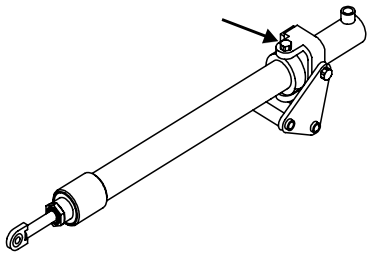
34.1 General

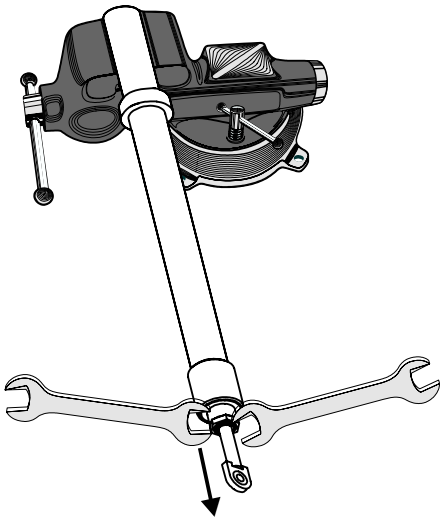
The cab tilt cylinder is fitted in trucks with tilting driver cabs. It is located behind the drive unit and mounted on the battery compartment wall and on the underside of the top section.

34.2 Dismantling the cylinder from the truck

To open and close the motor compartment, see section P1 in this manual.

- Loosen the door lock and open the door.
- Unscrew the return hose from the tank and plug the return hose by the tank.
- Support the top of the cab with pallets or an overhead crane, so that it is not suspended in the cab tilt cylinder.
- Loosen the nuts the hold the top of the cylinder.
- Unscrew the cylinder bracket from the battery compartment wall.
- Pull out the cylinder so the you can access the hose coupling. Loosen the hose and plug the hose and coupling on the cylinder.
- Dismantle the bracket from the cylinder.





34.3 Dismantling and assembling the cylinder

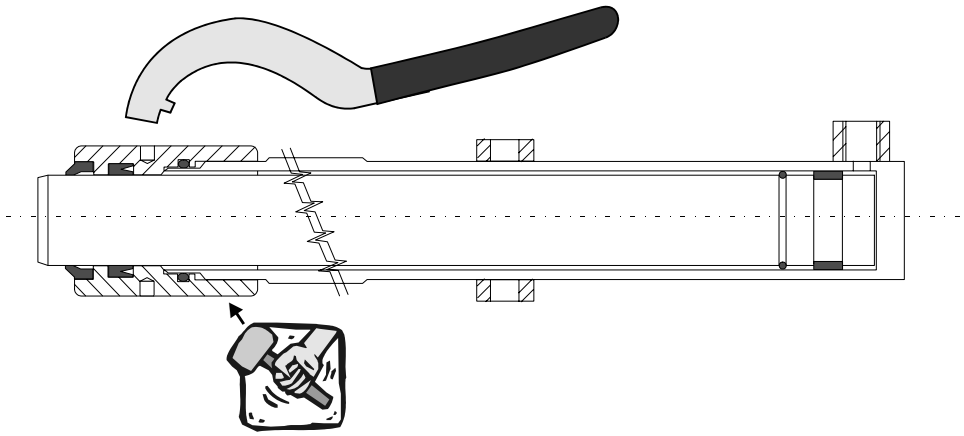
34.3.1 Dismantling the cylinder

- Place the bottom stud in a vice and let the top section of the cylinder tube rest against a support so that the cylinder lies in the horizontal position.

NOTE!

The cylinder only needs to be locked so that it does not rotate during subsequent work.
If you tighten too hard the cylinder tube can be deformed.

- Dismantle the link rod from the cylinder ram.
- Carefully knock the top sleeve with a rubber mallet.
- Unscrew the top sleeve using a hook spanner.



- Pull off the top sleeve from the rod and carefully remove the ram from the cylinder tube. Place the rod on a soft and clean surface so that it is not damaged.
- Brush off any old flange sealant from the cylinder tube and the top sleeve.

34.3.2 Dismantle the seals and the support ring

- Dismantle the wiper from the top sleeve.
- Use a screwdriver to dismantle the rod seal from the top sleeve.
- Remove the O-ring from the top sleeve.
- Remove the support ring from the rod.

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34.3.3 Assembling the rod seal and the support ring

- Check that the ram is not damaged.

NOTE!

If the piston is scratched or in any other way damaged it should be replaced to avoid leakage after assembly.

- Position the support ring on the ram.
- Position the rod seal on the ram.

34.3.4 Dismantling the ram

- Remove the rod seal and the support ring.
- Knock and heat the ram a little, if necessary.
- Unscrew the ram using a pipe wrench.
- Brush off any old flange sealant.

34.3.5 Assembling the ram

- Apply **OMNI 230** on the threads.
- Screw in the ram using a hook spanner.
- Take care to wipe off all surplus sealant.

34.3.6 Assembling the cylinder

- Insert the rod in the cylinder tube.
- Fit the top sleeve on the rod. Use a rubber mallet to knock it on if necessary.
- Screw in the top sleeve a few turns in the cylinder tube.
- Apply flange sealant **FD 1042** on the threads.
- Tighten using a hook spanner.

NOTE!

Long curing time.
Too early usage can cause leakage.
The curing time for the flange sealant is 4 hours. The cylinder must not be used before this.

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34.4 Refitting the cylinder in the truck

- Assemble the bracket on the cylinder.
- Fit the hydraulic hose.
- Screw the cylinder bracket to the battery compartment wall.
- Remove the plug on the return hose and secure the return hose on the tank.
- Press the switch (1) to lower the cab while at the same time turning the key. The display shows 6 lines.
- Move the hydraulic lever for raising the forks back until the cylinder is fully extended.
- Fit the safety pin in the cylinder piston.
- Secure the cylinder to the top of the cab.
- Move back the top section (45 degrees).

WARNING

Risk of being crushed.
There is a great risk of injury if the cab tilt cylinder has full oil pressure when the top section is tipped back.
Ensure that the cab tilt cylinder is pressurised.

- Close the door and lock the door.
- Shift the fork lifting hydraulic lever forwards until the cab stops in its lowest position.

WARNING

Risk of being crushed.
There is a great risk of injury if anyone is present in the motor compartment when tilting the cab back.
Ensure nobody is present in the motor compartment when tilting.

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35-Main mast –7100

35.1 General

These are assembly and dismantling instructions for the mast. The document also contains a list of tools and instructions for how to transport the truck without the battery installed.

These instructions also describe how to rectify mast play.

There are three runners in a mast: the inner, intermediate and outer runner. The inner and intermediate runners have four rollers each. The fork carriage also has four rollers.

It is these rollers that are shimmed so that the play is as little as possible.

35.2 List of tools

- Overhead crane with a capacity of at least 2500 kg.
- 1/2" ratchet handle
- 13 mm socket
- 24 mm socket
- 30 mm socket
- 4 mm Allen key
- 5 mm Allen key
- 1/2" torque wrench 0 -270 Nm.
- 3/4" torque wrench 0 -500 Nm.
- Crowbar
- Large screwdriver
- 17 mm combination spanner
- 19 mm combination spanner
- 27 mm combination spanner
- 32 mm combination spanner
- 36 mm combination spanner
- Cloth
- Absorbent
- Cable ties

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35.3 Transporting the truck

There are two ways to transport the truck when the battery is not installed.

Method 1

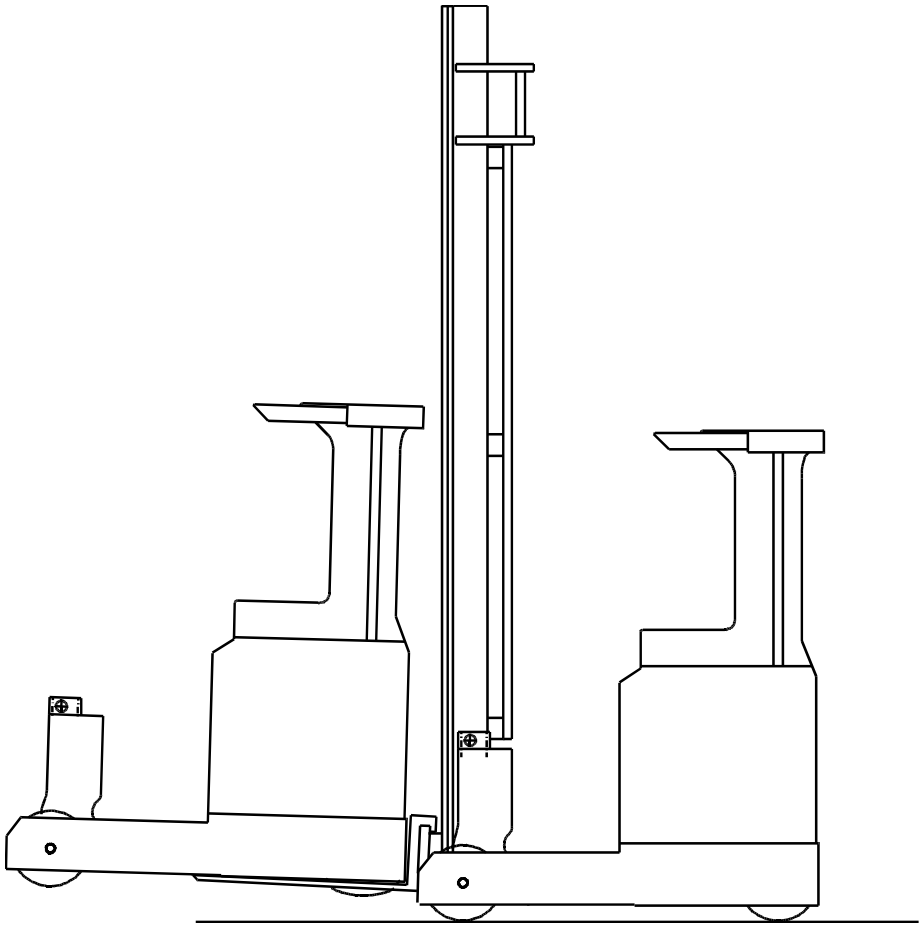
When the truck is to be transported over long distances you should use a fork lift truck with the following lifting capacity.

Load	B/E1-B/E3	B/E4-B/E6	B/E7-B/E8
Load centre distance (Tp)	950	1000	1000
Weight without battery	1800	2250	2850

- Insert the forks under the support arms and lift as illustrated in the diagram.

Method 2

To move the truck over short distances, you can use an extension cable from an adjacent battery.

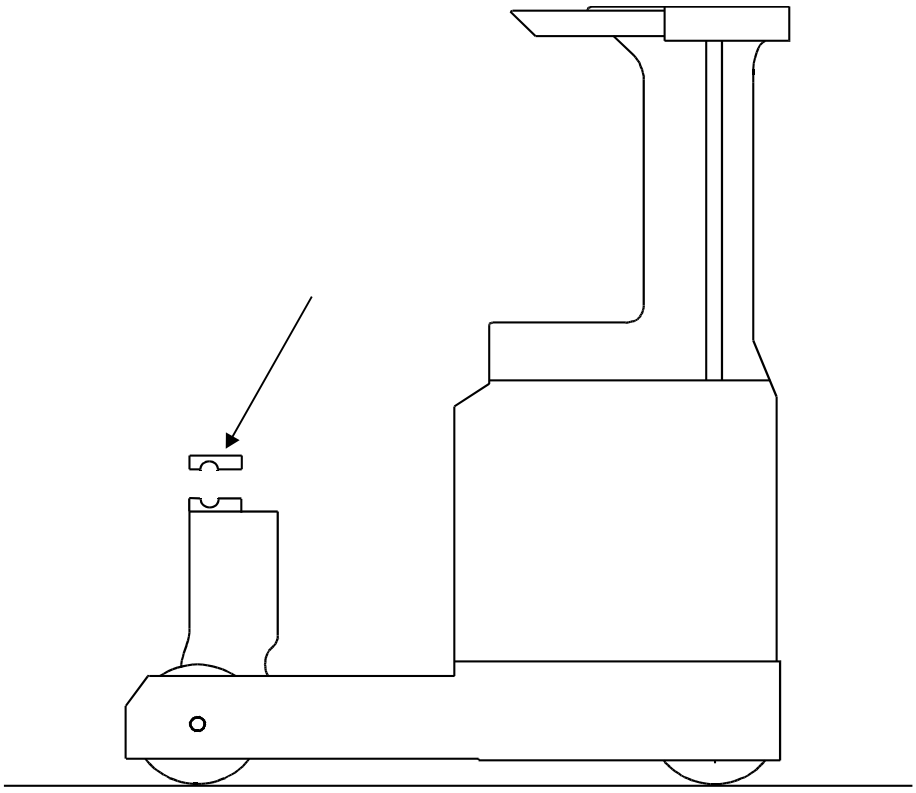


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35.4 Assembling the mast

- Transport the truck to an assembly area with an overhead crane.
- Cut off the steel band around the support arms.
- Lift off the forks.
- Connect 48 V DC to the truck.
- Extend the reach carriage approximately 200 mm.
- Lift off the load support.
- Extend the reach carriage fully.
- Switch off the current using the ignition and disconnect the 48 V DC.
- Remove the protective plate on the reach carriage.
- Loosen the four M16 bolts and remove the upper part of the stud bracket (see diagram). Allow any shims under the stud brackets to remain.
- Using 0 - 2 shims under the stud brackets, the mast incline can be adjusted laterally. The mast should be 90° ± 6'.

NOTE!
Damage may be caused to the mast studs.
The stud holders are manufactured in pairs.
Do not confuse the right and left stud holders.

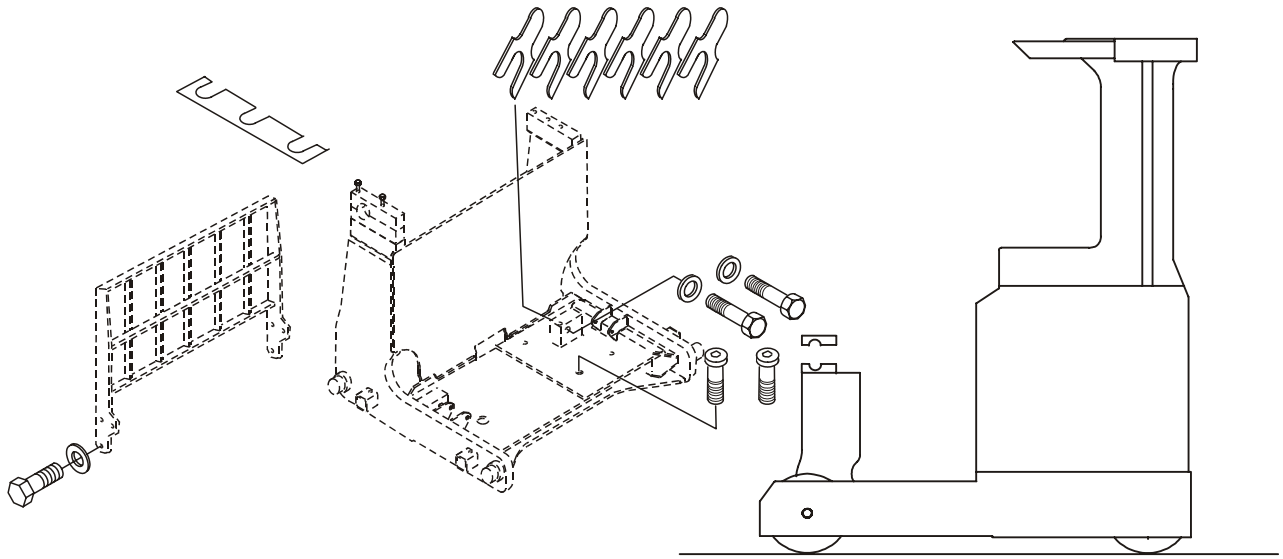


Main mast –7100

Assembling the mast

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- Use the Mast assembly kit that contains the following:

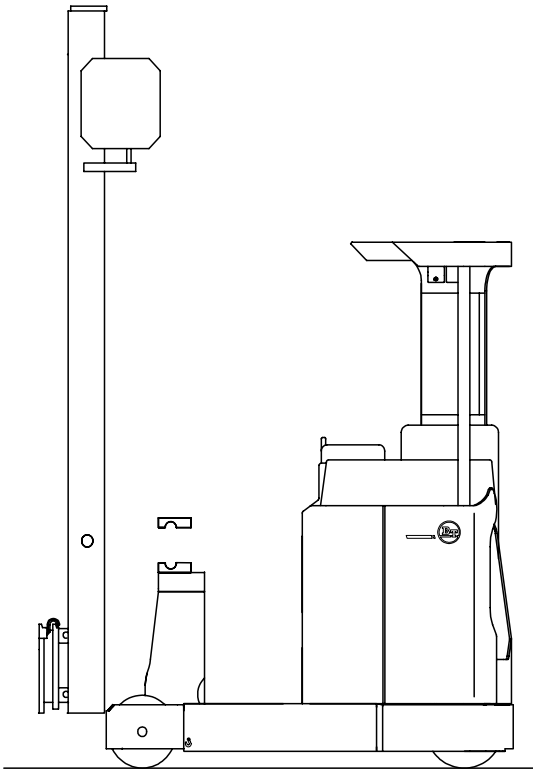


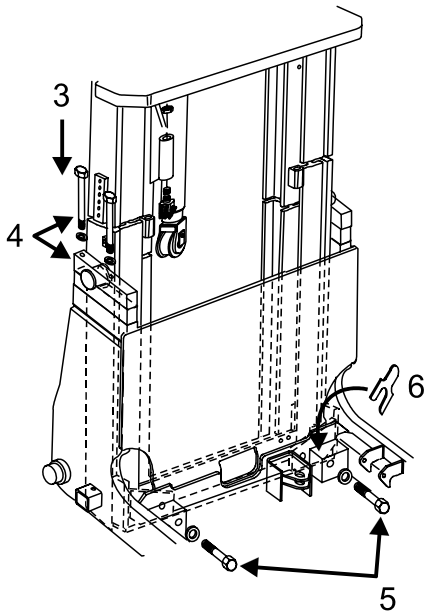
  - 2 bolts and 2 washers to secure the mast in the reach carriage at the bottom of the mast.
  - 6 bolts for securing the load support.
  - 0 – 6 shims for aligning the mast angle forwards and backwards. The mast should be 90° ± 10’.
  - 1 two-part hose clip for the feeder hose on the mast.
- Cut off the steel band on the mast, except the top band.
- Lift up the mast using an overhead crane and tool
  11-1091 for B/E1-B/E3, B/E4-B/E6 and
  11-1133 for B/E7-B/E8

Main mast –7100

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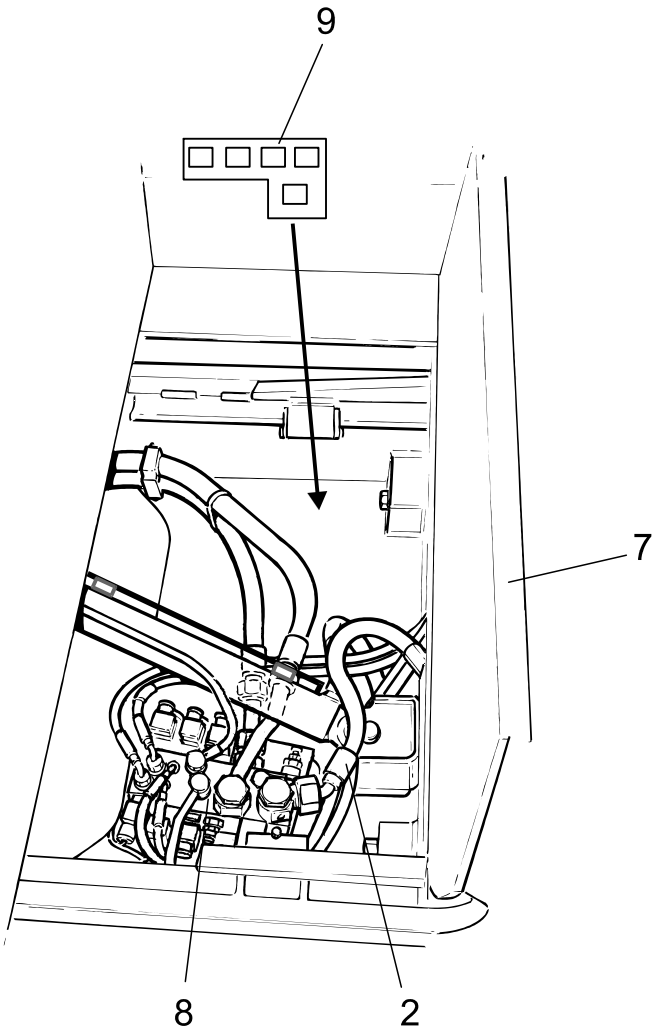




- Guide the mast slowly to the reach carriage (1).
- Stop approximately 100 mm from the reach carriage (1).
- Insert the feeder hose (2) into the reach carriage.
- Guide in the mast fully and lower it so it rests on the pins (3).
- Position the top section of the pin holder and secure loosely with the four bolts (4).
- Screw in the bolts (5) that hold the mast in the bottom of the reach carriage, just far enough so that the shims still have space.
- Position the shims (6) and move the overhead crane in the direction of the forks so that they fasten with the mast.
- Tighten the bolts (4 and 5) with the following torque:

	B/E1-B/E8
Stud bracket bolt (4)	197 Nm
Bottom bolt (5)	385 Nm

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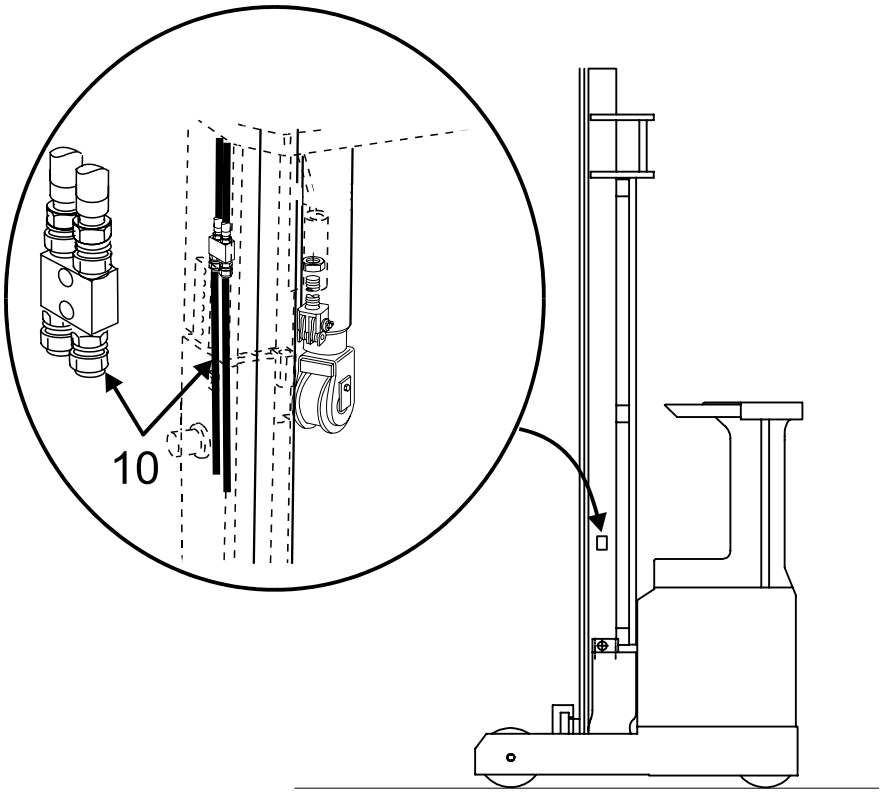
- Bolt the manifold block on the reach carriage wall.
- Fit the mast feeder hose with the hose clip on the reach carriage wall (7).
- Remove the plugs on the feeder hose (2) and on the main valve (8).
- Fit the feeder hose (2) on the valve (8).
- Connect the side-shift cable in the terminal connection (9) on the reach carriage.
- Connect the height indication cable in the terminal connection (9) on the reach carriage.
- Remove the plugs on the tilt hoses.
- Fit the tilt hoses on the side of the mast (10).
- Cut off the upper steel band on the mast.
- Connect 48 V DC to the truck and lift the forks approx. 1,000 mm.
- Fit the forks on the fork yoke.

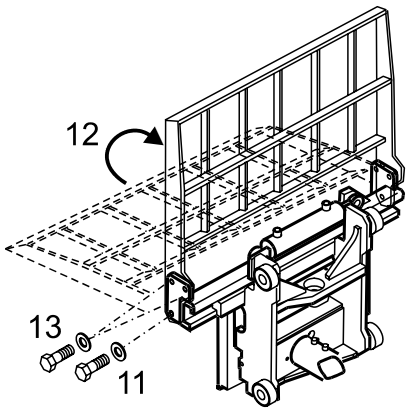
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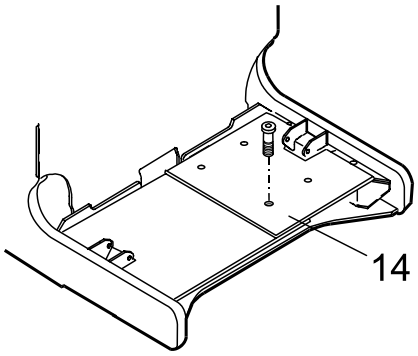
Main mast –7100

Assembling the mast

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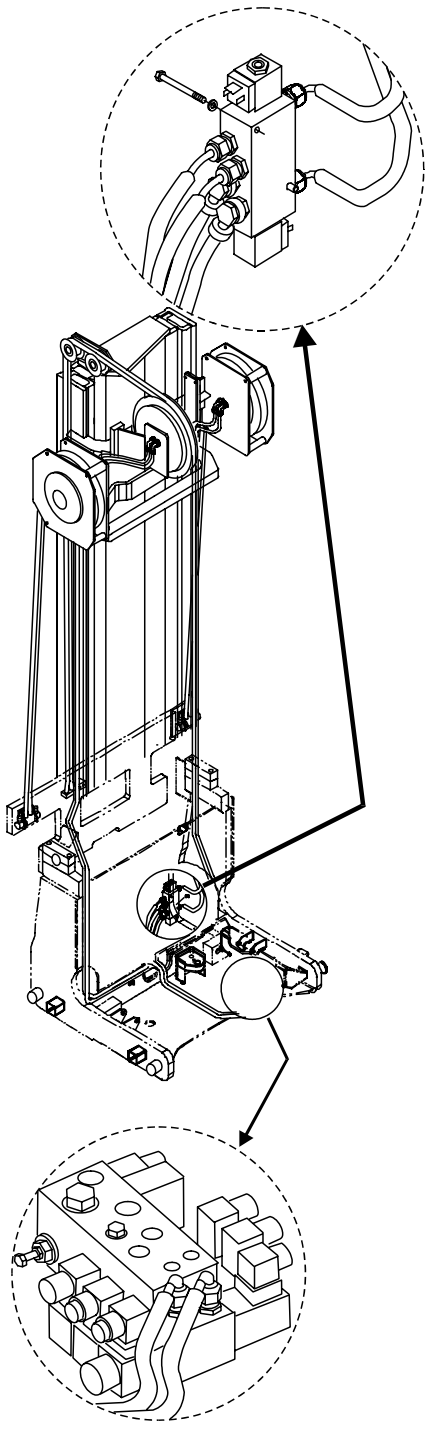






- Place the load support on the forks and secure the lower bolts (11).
- Fold up the load support (12) and secure the remaining bolts (13).
- Tighten the load support to a torque of 45 Nm.
- Bolt on the protective plate (14) above the main valve on the reach carriage.
- Gather together the cables and hoses so they are not damaged.
- Dry or wipe off any oil spillage on the truck.

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35.5 Dismantling the mast

For illustrated references, see section **Assembling the mast**.

- Always use a collection vessel for escaping hydraulic oil and have cloths to hand when couplings on hydraulic hoses are disconnected.
- Extend the reach carriage fully.
- Set all hydraulic functions on the mast in the offload position, fork carriage fully lowered, tilt and side-shift in the centre positions.

WARNING!

Risk of spurting oil
Some parts of the hydraulic system may still hold residual pressure despite the system being discharged.
Make sure there are no other persons in the vicinity of the truck and that you are standing to the side of the coupling you are about to disconnect.
Loosen the hydraulic couplings carefully so that any residual pressure can trickle out.

- Switch off the current and disconnect the battery by pulling out the battery plug.
- Dismantle, if deemed necessary, the load support and the forks.
- Remove the protective plate above the main valve on the reach carriage.
- Secure the mast using an overhead crane and tools 11-1091 for B/E1-3, B/E4-6 and 11-1133 for B/E7-8
- Remove the tilt hoses (10) from the mast.
- Fit protective plugs on the tilt hoses and nipples on the mast.
- Disconnect the height indication cable (connector X16) and the side-shift cable (connector X29) in the terminal connection (9).
- Remove the feeder hose (2) from the main valve (8).
- Fit protection plugs on the main valve and feeder hose.
- Remove the feeder hose's hose clip from the reach carriage wall (7) and loosen the manifold block.
- If the truck is fitted with extra hydraulic functions, loosen the hydraulic hoses from the valve block on the reach carriage. Fit protective plugs on hoses and valve block.
- Loosen the mast bolts (5) on the reach carriage and on the cap to the pin holders (4) slightly. Remove the mast shims (6).

NOTE!

Mark the shims from right and left sides so that the correct mast angle is achieved when reassembling.

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- Carefully lift the mast out of the pin holders, at the same time as the feeder hose (2) is eased out of the reach carriage.
- Carefully lower the mast to the floor.
- Place the mast on a pallet on the floor or, for a more comfortable working height, on a pair of trestles.

CAUTION!

Unexpected/uncontrolled movement
When the mast is laid down, shifting of the centre of gravity may cause the mast to slide to the ground.
Ensure no one is within the area in which the mast can move: mast length + 2 metres safety distance. Always stand to the side of the mast at a safe distance, as far away as the controls of the overhead crane will allow.

- Dry or wipe off any oil spillage on the truck.

35.6 Adjusting the play

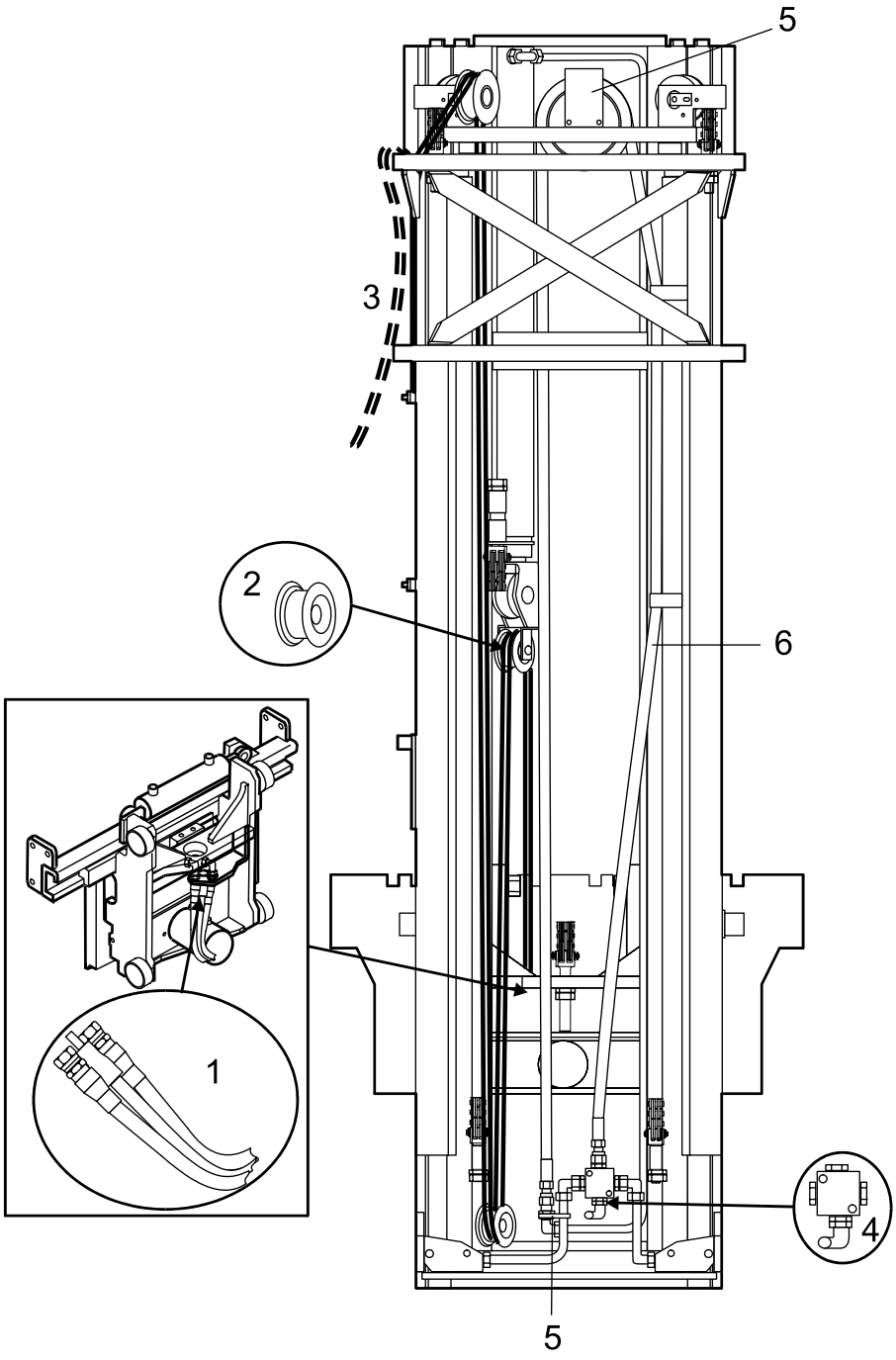
- Dismantle the mast from the truck

NOTE!

Oil leakage.
Risk of valve or cylinder failure if dirt enters the hydraulic connections.
Plug all hydraulic connections.

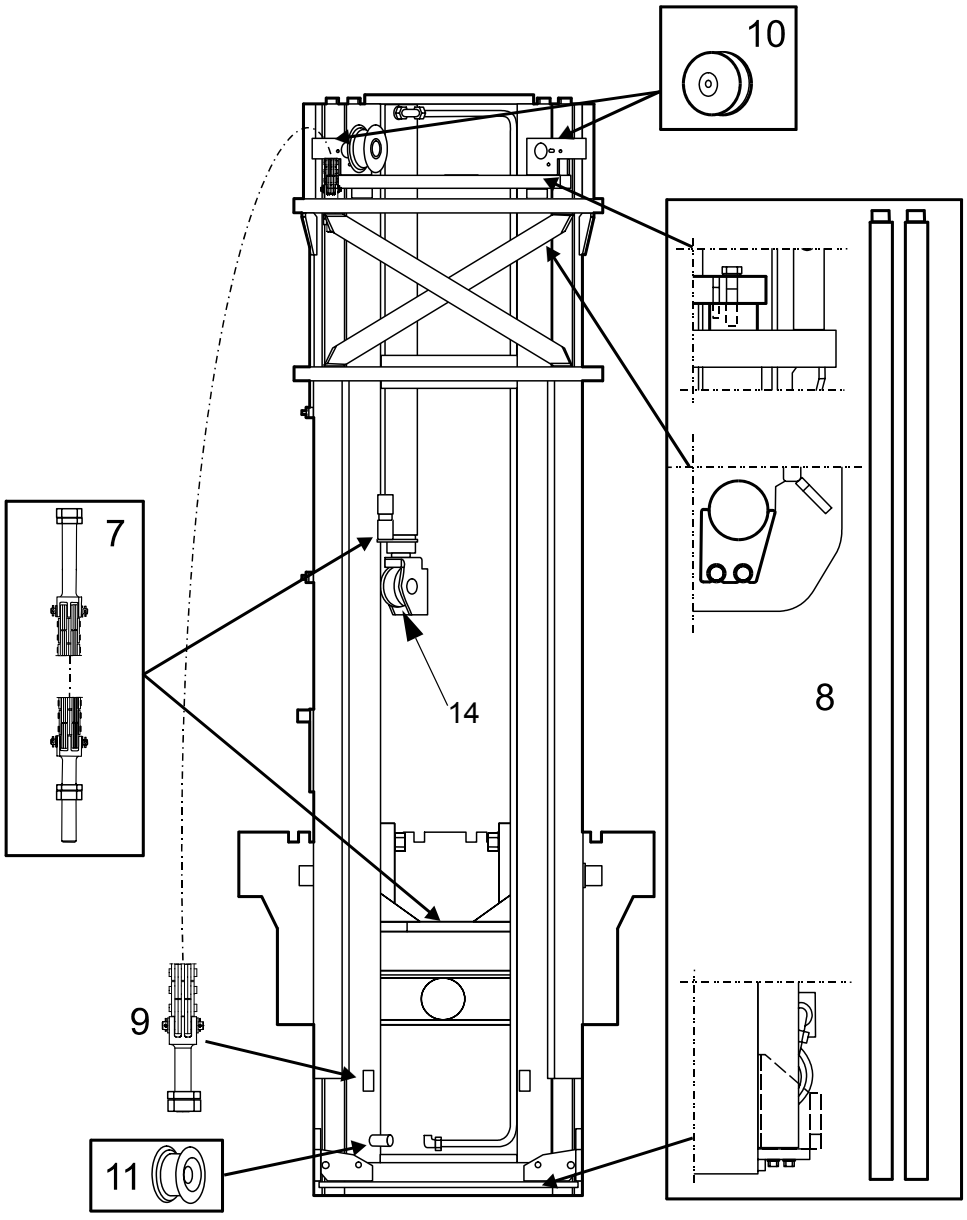
- Place the mast horizontally on a number of pallets or the like.

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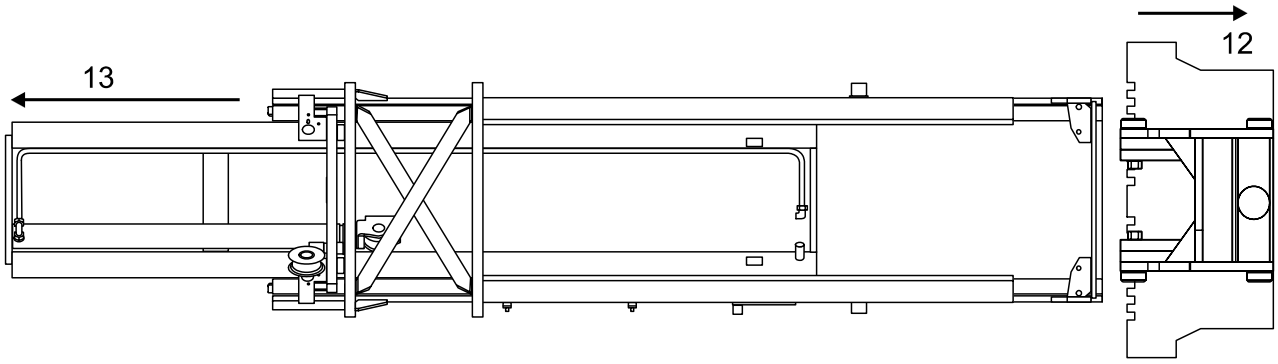
- Dismantle:
  - The twin hose and contact X50 (1) from the fork carriage.
  - The twin hose reel (2) from the free lift cylinder.
  - The twin hose (3) from the mast, but leave it in the outer runner.
  - The manifold block with feeder hose (4) from the feeder pipe to the main lift cylinders.
  - The feeder hose bracket (5) and the feeder hose (6) from the inner runner.

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- Remove:
  - Any chain guard from the bracket
  - The free lift chain (7) from the fork carriage and the free lift cylinder.
  - The main lift cylinders (8).
  - The main lift chains (9), but leave them in the outer runners.
  - The main chain sprockets (10) and the twin hose reel (11) at the bottom of the mast.

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- Remove:
  - The fork carriage (12) from the mast.
  - The inner runner (13) from the mast using the following lifting yoke:
    1,600 kg mast, use lifting yoke BT 11-1020
    2,000 kg mast, use lifting yoke BT 11-1021
    Pull out the inner runner, full stroke length and lift out the runner.
- Clean the mast's component runners and rollers as well as the fork carriage rollers.

35.6.1 Adjusting the mast play.

The mast's rollers are mounted on angled pins. When adjusting the mast with regard to play, adjust as follows:

Lateral play

- By shimming the mast rollers, lateral mast play can be adjusted.
  - Use an indicator gauge and a crowbar to measure the play.
  - Measure the retracted and extended mast.

NOTE!

Max. play on the lower edge is 1 mm.
Max. play on the upper edge is 0.4 mm.

  - Remove the runner from the mast.
  - Dismantle the rollers that need to be shimmed.
- Fit:
  - The shims on the roller pins.
  - The rollers.
  - The runner on the mast.
- Control measure.
- Secure the intermediate and outer runners next to each other
- Fit the inner runner on the mast.

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- Measure and shim as set out in the instructions above.
- Fit the fork carriage on the mast.
- Measure and shim as set out in the instructions above.

35.6.2 Radial play

- The play between roller and contact surface on respective beams must not exceed 0.4 mm. Check using feeler gauges. If the play is greater, the rollers must be replaced with oversized rollers. Oversized rollers (classified) are available in increments of 0.4 mm.
- When fitting oversized rollers, the play may be <0, provided that the mast can be pushed together/drawn apart by hand, even if difficult. After a short period of use, the rollers will give an imprint of the contact surface as play > 0.

35.7 Assembly

- Fit:
  - Free lift chain.
  - Any chain guard.
  - The main lift cylinders.
  - The main lift chain sprockets.
  - The main lift chains.
  - Twin hose, cable and connector X50 in the fork carriage.
  - Twin hose reel on the free lift cylinder.
  - Manifold block with feeder hose on the feeder pipe to the main lift cylinders.
  - Feeder hose bracket on inner guide.

NOTE!
The triple hose can separate.
Risk that the triple hose may break.
Make sure the triple hose rollers are in line.

- Fit the mast in the truck.

Main mast –7100

Assembly

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36-Main lift chain system – 7120

36.1 General

Applies to all machines with a mast.

36.2 Checking the chain setting

The lift chains must be adjusted at regular periods due to stretching, see below. The chain setting is checked during servicing as set out in the maintenance schedule.

Any adjustment is made with the chain mounting bolts.

Adjust the fork height according to C code 7100, 7420, 7700 and 7800 as applicable.

36.3 Chain inspection

The chains are exposed to two types of wear, outline wear and stretching. Wear to the bolts and disc holes is caused by stretching. The chains are also affected by the environment they are used in.

36.3.1 Noise

If lubrication has been insufficient there will be metallic friction on the chain and this will result in noise.

The chain should be replaced.

36.3.2 Surface rust

Surface rust is easy to recognize as the chain will be reddish brown. Deep-seated rust has generally started and the chain has impaired strength.

The chain should be replaced

36.3.3 Rusty links

Fretting corrosion results in a reddish brown powder being visible by the outer discs. It can also appear as if the chain is bleeding when lubricated.

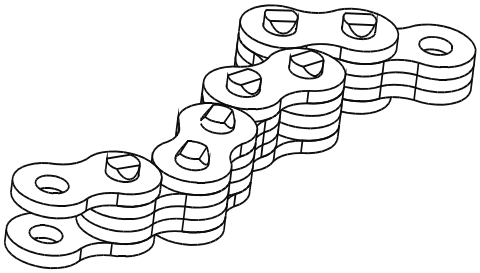
The chain should be replaced.

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36.3.4 Stiff links

If it is not possible to pull out the chain to its normal position this can be because of link rust or seizing.

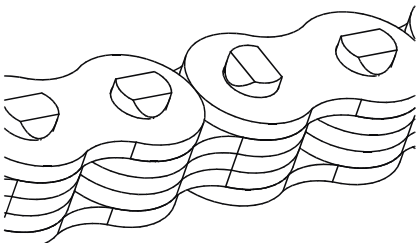
The chain should be replaced.



36.3.5 Bolt rotation

Bolt rotation can be a phenomenon of stiff links. The fault is easy to see when comparing with a new chain.

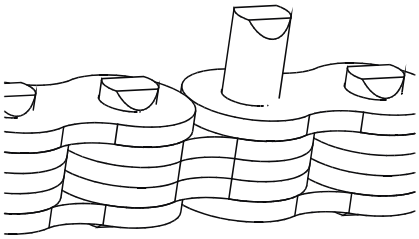
The chain should be replaced



36.3.6 Loose bolts

If a bolt is loose it will protrude from the side of the chain, which is due to a stiff link or bolt rotation.

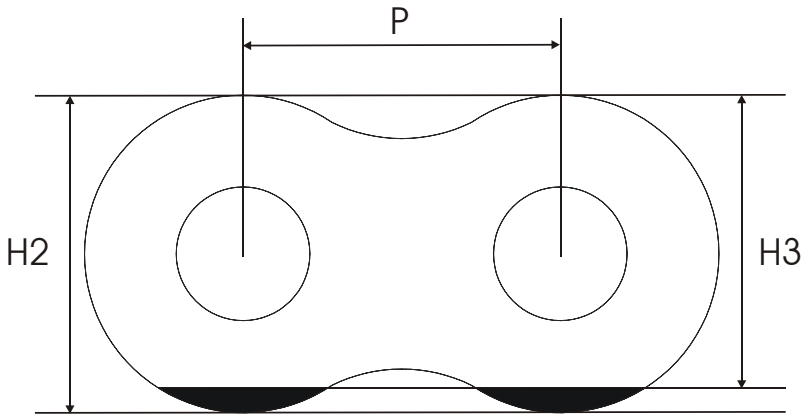
The chain should be replaced.



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36.3.7 Outline wear



P = Pitch

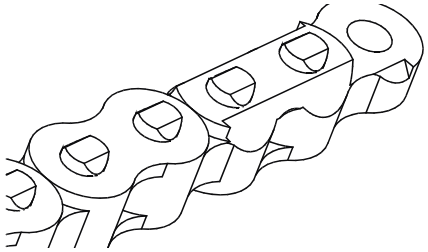
H2 = Nominal disc height.

H3 = Minimum disc height.

A new lift chain has a specific nominal disc height, defined as H2 in the figure. As the truck is used the lift chain wears radically, on the side that runs over the chain sprocket. The minimum disc height is define as H3 in the figure and denotes the minimum permitted value of the disc height.

Maximal permitted outline wear is 5% of the height H2. If a lift chain reaches the maximum level of wear, the chain should be replaced.

The nominal and minimum disc heights for respective lift chains are stated in the table in the chapter “Stretching”.



36.3.8 Stretching

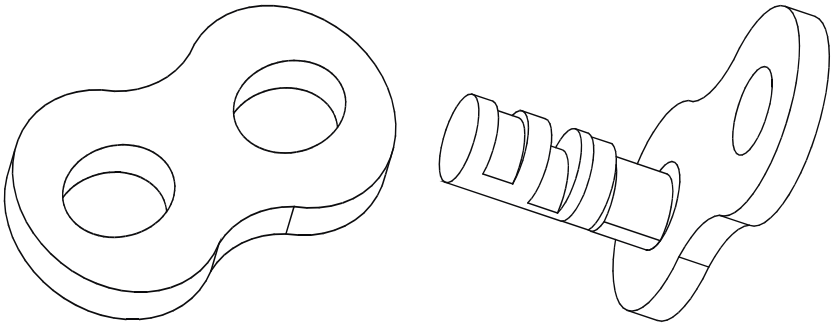
The amount of stretch on a lift chain is measured on the part of the chain that runs over the chain sprocket. The amount of stretch may, at the most, be 2% on the most worn section of the chain. Measurement is suitably made over 300-1000 mm of the chain.

The nominal and maximum permitted chain lengths for lift chains are stated in the table below.

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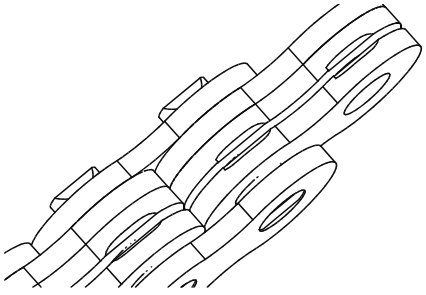
Type of chain	Nominal disc height H2 (mm)	Minimum disc height H3 (mm)	Pitch P (mm)	Nominal chain length for 20/30/ 50 discs (mm)	Maximum permitted chain length for 20/ 30/50 discs (mm)
3/4”, 2x3	17.8	16.9	19.05	381/572/953	389/583/972
3/4”, 3x4	17.8	16.9	19.05	381/572/953	389/583/972
3/4”, 4x6	17.8	16.9	19.05	381/572/953	389/583/972
1”, 4x4	23,6	22,4	25,4	508/762/1270	518/777/1295
1”, 6x6	23,6	22,4	25,4	508/762/1270	518/777/1295

Wear to the bolts and around the holes on the discs are a reason why the chain stretches. The chain should be replaced if stretching is more than 2%.



36.3.9 Damage

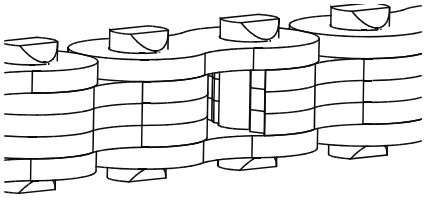
The chain should be replaced if damaged in any way.



36.3.10 Damaged discs

If a disc has broken on the chain, this can be due to overloading or corrosion.

The chain should be replaced.

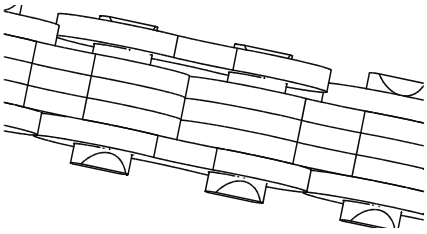


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36.3.11 Damaged bolts

It can be difficult to discover whether a bolt has broken. It can appear as bolt rotation and/or that the outer disc is loose.

The chain should be replaced.



36.3.12 Dirty chain

If a chain is very dirty it is first and foremost recommended that it is replaced. It can also be dismantled and cleaned as set out in the chapter “Cleaning”.

36.4 Cleaning

If a chain is very dirty it is recommended that it is replaced.

Dirty chains should be cleaned before they are lubricated, e.g. by washing with solvent such as diesel or petrol.

The chain should be blown dry using compressed air and lubricated directly after cleaning

NOTE!

Exercise care with degreasing agent as these can contain abrasives.

36.5 Lubrication

Mineral and synthetic oils can be used to relubricate Rexnord chains.

NOTE!

Lubricant must not contain substances such as molybdenum disulphide, PTFE or the like.

A lift chain should be offloaded from the weight of the fork carriage (hanging free) when lubricated.

- **Lubrication intervals:**
  - 500 hours with normal operations
  - 100 hours when driving in rugged environments such as cold stores and corrosive environments.

The chains are sprayed with lubricant. Note the entire chain must be lubricated, even the fastening bolts. It is especially important that the part of the chain which runs over the chain sprocket is well lubricated.

Main lift chain system – 7120

Lubrication

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The lubricate must comply with the viscosity demands at respective temperatures as set out in the table below. The following lubricants are recommended:

Ambient temperature	Viscosity class	Recommended Products*
> - 40°C < - 30°C	VG 15	Klüberoil 4UH 1-15, Klüber Lubrication
> - 30°C < + 5°C	VG 68	Klüberoil 4UH 1-68N, Klüber Lubrication Anticorit LBO 160 TT, Fuchs DEA
> + 5°C < + 45°C	VG 150	Klüberoil 4UH 1-150N, Klüber Lubrication Anticorit LBO 160, Fuchs DEA Rexoil, Rexnord Kette
>+ 45°C <+ 80°C	VG 220	Klüberoil 4UH 1-220N, Klüber Lubrication

* Equivalent products from another manufacturer may be used.

NOTE!

Do not use a special rust protective agent to prevent rust on the lift chains.
These agents impair the lubrication of the chains. Regular lubrication is the best method to prevent rust attack.

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37-Lifting devices – 7400

37.1 General

Chapter 1.1 and 1.2 refer to ISO standard 5057.

37.1.1 Inspection intervals

Fork arms in service shall be inspected in accordance with clause 1.2 at intervals of no more than 12 months and whenever any defect or permanent deformation is detected. If subjected to heavy use, more frequent inspections may be required.

37.1.2 Inspection

The inspection of a fork arm shall be carried out carefully by trained personnel with the aim of detecting any damage, failure, deformation, etc. which may impair safe use. Any fork arm that shows such a defect shall be withdrawn from service, and not be returned to service unless it has been satisfactorily repaired and tested in accordance with 1.5.2, if applicable

37.1.3 Surface cracks

The fork arm shall be thoroughly examined visually for cracks and, if considered necessary, subjected to a non-destructive crack detection process. Special attention shall be paid to the heel and the top and bottom hooks including their attachment to the shank. The fork arm shall be withdrawn from service if surface cracks are detected.

37.1.4 Difference in height of fork tips

A set of fork arms shall be checked for any difference in height when mounted on the fork carrier. If the difference in tip heights exceeds 3 % of the blade length or that recommended by the truck manufacturer, the set of fork arms shall be withdrawn from service. The set of fork arms shall not be returned to service until they have been re-set as necessary (see 1.5.1) and tested in accordance with 1.5.2.

37.1.5 Positioning lock

It shall be confirmed that the positioning lock, where originally provided, is in good repair and correct working order. If any fault is found, the fork arm shall be withdrawn from service until satisfactory repairs have been effected.

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37.1.6 Legibility of marking

If the fork arm marking in accordance with ISO 2330 is not clearly legible, the fork arm shall be removed from service.

37.1.7 Fork arm blade and shank

The fork arm blade and shank shall be thoroughly checked for wear, special attention being paid to the vicinity of the heel. If the thickness of the blade or shank is reduced to 90 % of the original thickness, or to the minimum thickness specified by the fork arm or truck manufacturer, the fork arm shall be withdrawn from service.

37.1.8 Fork arm mountings

The support face of the top hook and the retaining faces of both hooks shall be checked for wear, crushing and other local deformations. If these defects are apparent to such an extent that the clearance between the fork arm and the fork carrier becomes excessive, the fork arm shall be withdrawn from service. For other types of mounting, similar checks shall be carried out.

37.1.9 Repair and testing

Repair

Only the manufacturer of the fork arm or an expert of equal competence shall decide if a fork arm may be repaired for return to service. The repairs shall only be carried out in accordance with the recommendations of the fork arm manufacturer. It is not recommended that surface cracks or wear be repaired by welding. When repairs necessitating resetting are required, the fork arm shall subsequently be subjected to appropriate heat treatment, as necessary.

Yield test

A fork arm that has undergone repairs other than repair or replacement of the positioning lock and/or the marking shall only be returned to service after being submitted to, and passing, the yield test described in ISO 2330, with test load in accordance with the table.

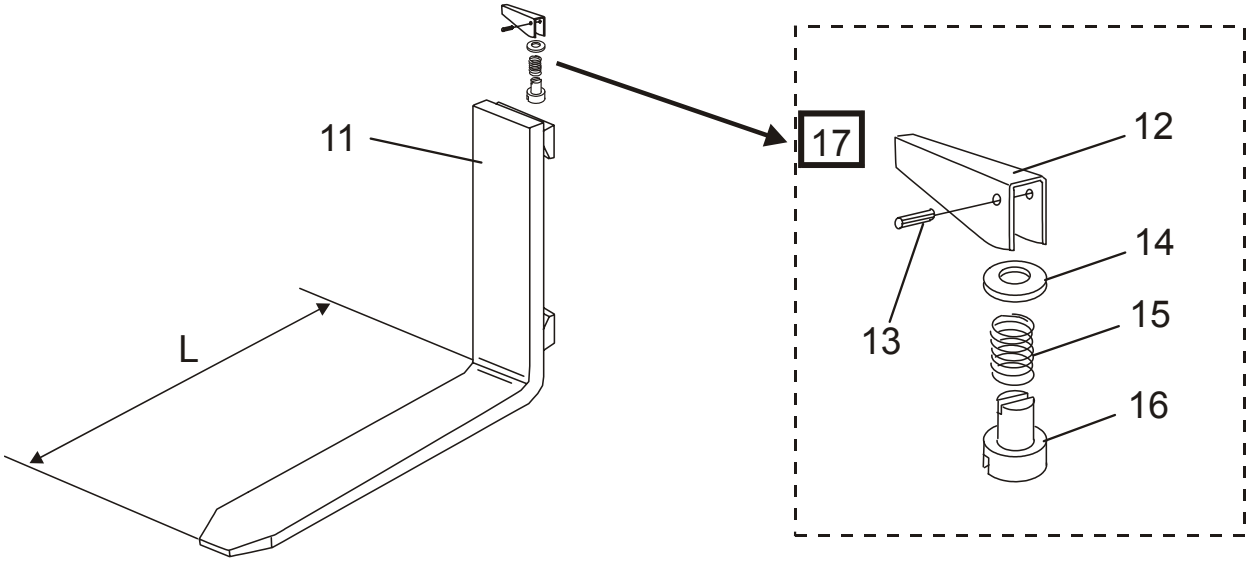
Table 8:

Fork arm specified capacity, m	Test load F_t
m</=5000	2,5 m
m>5000	2,1 m

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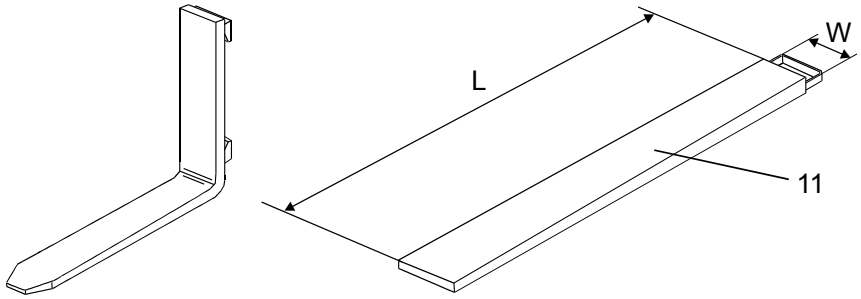
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Fork



11) Fork
12) Clip
13) Spiral pin
14) Washer
15) Spring
16) Catch
17) Catch set

Extended fork



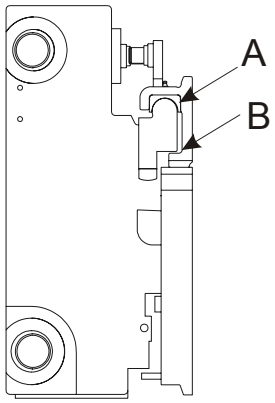
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37.2 Checking the fork carriage's wearing strips

The wearing strip (A) between the yoke and ball beam on the fork carriage is exposed to wear and must be checked every year. Measure the space (B) between the yoke and the ball beam.

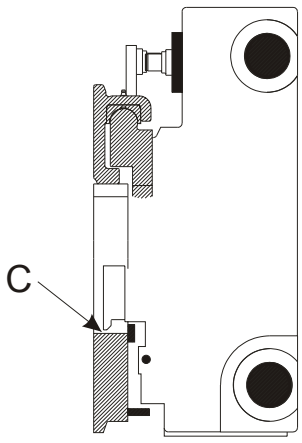
When the wearing strip is new, the space is 2 mm.

If the space is 4 mm or more, the wearing strip must be replaced.



Check the space (C) between the stop lug and the fork yoke on the fork carriage as well.

Max. tilt angle up to 1 mm.

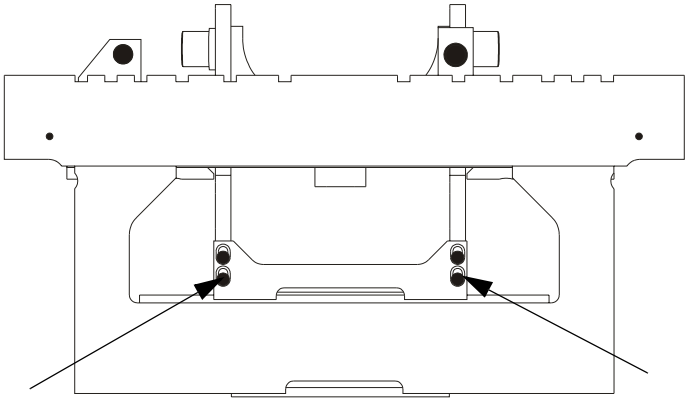


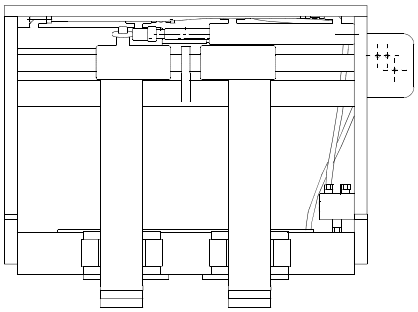
The space can be adjusted using the screws on the stop lug.

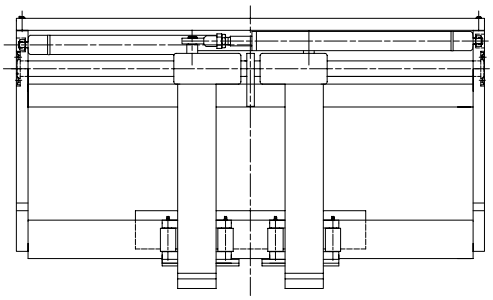
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The image below shows the screws on the stop lug.





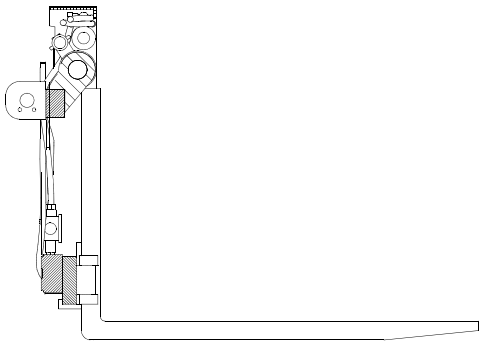


37.3 Fork spread unit

37.3.1 Servicing of fork spread unit

For ordinary servicing of the truck, the following points must be checked/implemented:

- Lubrication of friction plates against fork and ball beam
- Force grease into grease nipples when servicing the truck. The brass bushings in the fork sleeve and in the support rollers provide some degree of lubrication, as they are equipped with graphite inlay.
- Use graphite-type grease, Q8 Rembrandt EP2, for lubrication.
- Check bearings and axles. Replace worn parts with substantial play in the fork sleeve. If the upper chromed axle has been damaged, this must be replaced immediately. Wear on lower support rollers is the result of the forks being used a lot for lateral conveyance. In very dirty environments, these should be checked more often than in normal environments.
- Check forks. Wear must not exceed 10% of nominal thickness as per ISO 5057
- Check screws and nuts. Tighten as normal, if required.



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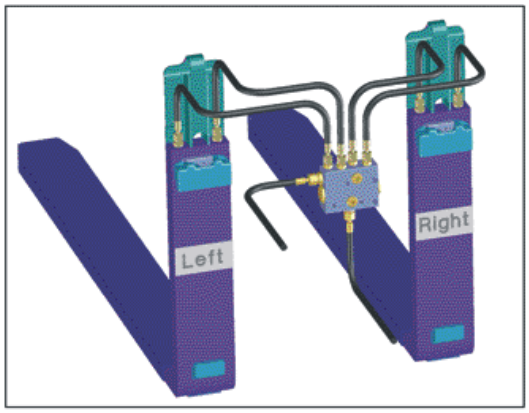
37.4 Telescopic forks

37.4.1 Telescopic forks

The KOOI forks, manufactured by Meijer Special Equipment Company in Holland *(BT has the right to use original text from Meijer Special Equipment in the Netherlands, which is the manufacturer of KOOI Reachforks.)*, are a specially-designed fork with a thickness of 56 mm. This flatter fork can be used for load bearers with lower tunnel heights. The telescopic forks are fitted just like conventional lifting truck forks and can be moved on the carriage in the same way. Each fork has an identification plate on the top. The plates contain important information about the technical specifications of the fork, for example, the maximum load capacity per fork.

Operation of the telescopic forks is by means of a closed and self-lubricating oil circuit. The telescopic forks are delivered with oil that complies with cleanliness standard ISO 4406 17/12.

The telescopic forks should be re-tested every year according to the ISO 5057 requirement (See chapter 1.1). The international standard has to be applied for checking the forks except for the chapters regarding “Fork arm blade and shank” because the inner fork must not be exposed to wear



An L or R is added to the identification plates of the telescopic forks . The forks are mounted on the fork carrier corresponding to left and right as viewed from the driver’s seat. The forks slide onto the fork carrier so that the locking catch fits into the carrier recess.

The flow divider is mounted on the back of the fork carrier.

The flow divider is mounted in a horizontal position.

The hydraulic hoses included for the telescopic forks and the hoses for the forklift truck are connected according to the figure.

Every fitting must be carefully tightened and secured.

The maximum fluid pressure of the telescopic forks is 200 bar.

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37.4.2 Putting the telescopic forks into operation:

- Before using the forks you must bleed the system.
- Extend and retract the forks ten times.
- Move the mast from the front to the back position several times
- Extend and retract the forks ten times.
- Check that the hoses are not restricted
- Check the system for oil leakage

37.5 Maintenance

NOTE!
During any service work on the telescopic forks, the forklift truck must be switched off, the battery disconnected and the ignition key removed.
During maintenance, the pressure should be released from the hydraulic system.
If the telescopic forks are being disconnected , the couplings of the forks should be sealed to prevent dirt getting into the hydraulic system.

How to remove the outer fork

1. **Level the forks to hip height, tilt the mast to its forward position and remove the ignition key from the contact The battery plug must also be removed.**
2. **Take the outer fork off by removing the special M10 bolt from the piston rod on the underside of the fork nose.**
3. **Unscrew the couplings on top of the back of the fork, so the piston rods will not create a vacuum while disassembling.**
4. **Remove the Loctite from the thread of the coupling.**
5. **Unscrew the fixing screw in between the two cylinder heads.**

How to mount the outer fork

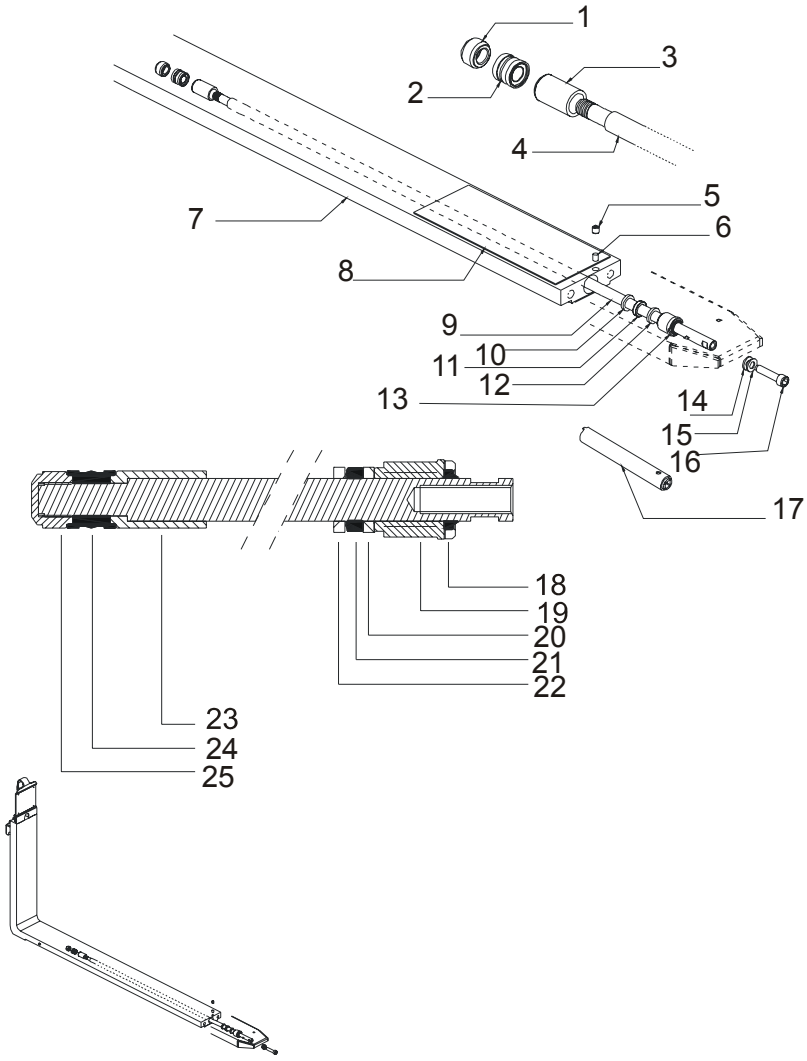
1. **Clean the thread of the special M10 bolt. Put the first washer between the piston rod and the hole in the vertical plate on the outer fork. Then put the second washer on the other side of the vertical plate. Apply Loctite 542 to the special M10 bolt and then insert it first through the second washer, then the vertical plate and then the first washer. Then screw the bolt tight on the piston rod. Put the washers either side of the plate on the outer fork and do not attempt to eliminate any clearance that remains once the bolt is fastened. The remaining clearance**

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will prevent the piston rod from being damaged.

2. **The slide forks have to be extended and retracted several times in order to get the air out of the system.**



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1. **Piston part 2**
2. **Piston seal**
3. **Piston part 1**
4. **Piston rod dia. 15**
5. **Fixing screw**
6. **Plastic plug**
7. **serial number on inner fork**
8. **Fill strip inner fork**
9. **Piston rod dia. 15**
10. **Support ring**
11. **Rod seal**
12. **Support ring**
13. **Complete cylinder head**
14. **Washer**
15. **Washer**
16. **Special bolt M10**

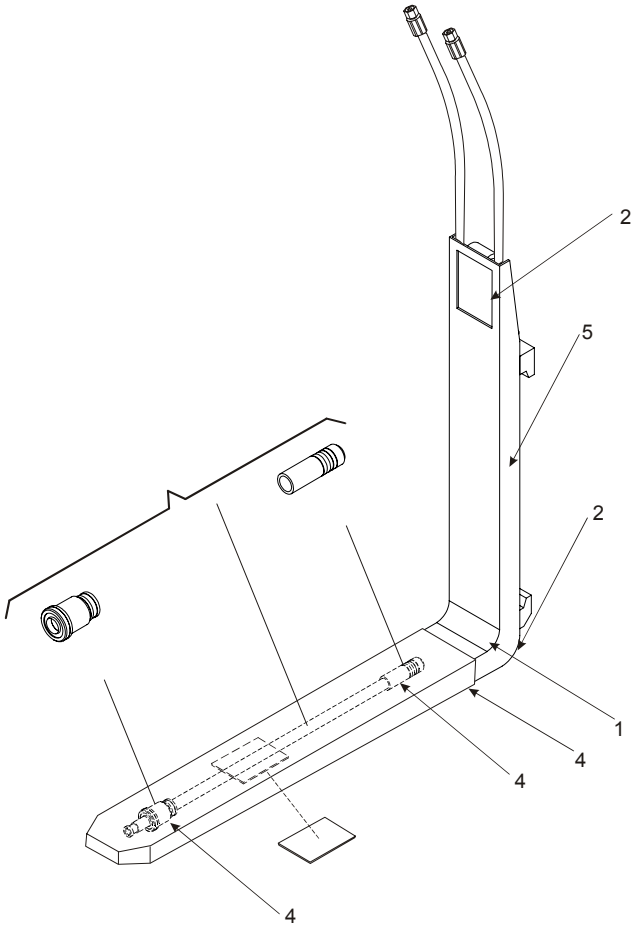
    Cylinder head with seals:
17. **Cylinder head spanner**
18. **Wiper ring**
19. **Cylinder head**
20. **Support ring**
21. **Rod seal**
22. **Support ring**

    Piston with seals:
23. **Piston part 1**
24. **Piston seal**
25. **Piston part 2**

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37.5.1 Maintenance

- Lubricate the top side of the inner fork as required. Lubricate using calcium grease (e.g. Q8 Ruvsdael WR2). (1)
- Check the wear on the forks' underside and wear plate, particularly on the back. Check inner fork according to ISO 5057, except for "Fork arm blade and shank" because the inner fork must not be exposed to wear. (Chapter 1.1). (5)
- Check for hydraulic leaks/damage. Examine the cylinder head for leakage. (This is easy to see if you remove the outer fork)
- If there is any leakage at the heel of the telescopic forks, they must be removed immediately. If the couplings are leaking, they should be tightened or replaced. (2)
- When the wear plate on the underside of the forks is completely worn down or the outer fork sleeves begin to wear, the wear plate should be replaced with a new one to prevent damage to the outer fork sleeves and inner fork.
- Once the outer fork is removed, you can easily check the cylinder head. (4)



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37.6 Troubleshooting

Table 9:

Table 10: Troubleshooting

Symptom	Possible Cause	Possible Solution
Forks extend and retract unevenly	• Hydraulic hoses connected incorrectly • Dirt between inner and outer fork • Leakage at piston seal • Length of the 4 hoses unequal • Damaged flow divider	• Connect hydraulic hoses • Remove dirt • Replace piston seal • Replace flow divider
Forks move without using the lever	Leakage from the control valve	Check below
Forks leak oil	• Leaking couplings • Cylinder head seal damaged • Fork is worn	• Correct mounting or replace couplings • Replace cylinder head seal • Immediately remove forks from forklift truck
Forks move jerkily when extended or retracted	• The control valve/ pump is worn • Insufficient flow	Check below
One outer fork is not retracting	Bolt is broken or loose	Replace or fasten bolt with Loctite 542
The tips of the forks are no longer at the same height	One of the forks has been overloaded and is permanently deformed	Remove forks from truck. Check below.

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Table 9:

Table 10: Troubleshooting

Symptom	Possible Cause	Possible Solution
Too much tolerance between the inner and outer fork	Outer forks are worn or have been over-loaded which caused the underside of the outer forks to be per-manently deformed	Replace outer forks.

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37.6.1 Instructions for replacing hydraulic parts

1. **Level the forks to hip height, tilt the mast to its forward position and remove the ignition key from the contact The battery plug must also be removed.**
2. **Take the outer fork off by removing the special M10 bolt from the piston rod on the underside of the fork nose.**
3. **Unscrew the couplings on top of the back of the fork, so the piston rods will not create a vacuum while disassembling.**
4. **Remove the Loctite from the thread of the coupling.**
5. **Unscrew the fixing screw in between the two cylinder heads.**
6. **Place a reservoir under the forks. Use the cylinder head spanner to unscrew the cylinder head. The right cylinder head (as seen from the position of the driver) must always be unscrewed first because of the plastic plug under the fixing screw.**
7. **Pull the piston rods out carefully. Note that there are two loose support rings, with a piston rod seal on the piston rod in between. They must be replaced before the piston rod is inserted back into the fork.**
8. **The piston can be unscrewed now. To prevent damage to the piston rod while unscrewing the piston, it must be fixed at the clamp.**
9. **The cylinder head can be removed from the piston rod.**
10. **Replace parts.**
11. **Remove the Loctite from the thread of the piston rod.**
12. **Clean the piston rod and the thread with Loctite 7063.**
13. **The cylinder head can be replaced on the piston rod.**
14. **When screwing the pistons on the piston rod, the pistons must be locked with Loctite 542.**
15. **Keep the piston rod (together with the piston and cylinder head) in line with the cylinders and tap it in carefully.**
16. **Put copper paste on the thread of the cylinder head.**
17. **Insert the cylinder head again using the cylinder head spanner.**
18. **Once all piston rods are in, the fixing screw has to be tightened again.**
19. **Now the couplings have to be tightened (lock with Loctite 542).**
20. **Extend the forks about 150 mm.**
21. **The outer forks can now be mounted. Clean the thread of the special M10 bolt. Put the first washer between the piston rod and the hole in the vertical plate on the outer fork. Then put the second washer on the other side of the vertical plate. Apply Loctite 542 to the special M10 bolt and then insert it first**

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through the second washer, then the vertical plate and then the first washer. Then screw the bolt tight on the piston rod. Put the washers either side of the plate on the outer fork and do not attempt to eliminate any clearance that remains once the bolt is fastened. The remaining clearance will prevent the piston rod from being damaged.

22. **The slide forks have to be extended and retracted several times in order to get the air out of the system.**

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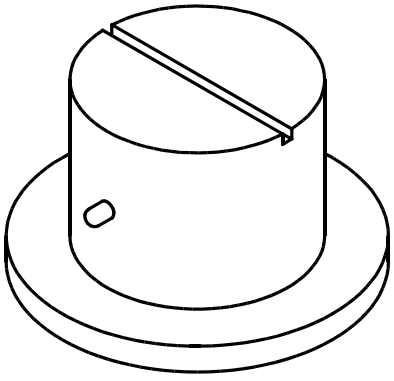
37.7 Extended forks

The standard fork can be extended using extended forks, allowing you to transport bulkier items. When fitting the extended fork, check that it has been adapted for mounting on a standard truck fork (see information on identification plate). Use only in pairs when the specified fork dimensions correspond and the truck fork's length is greater than or equal to the minimum permitted truck fork length.

NOTE!
Please note that load capacity is reduced once the extended forks are attached.
NOTE!
The extended fork must not be used if the mounting is not secure, if it is damaged, dirty or icy. The chamfered underside must face downwards. Daily visual inspection is recommended.

- The extended fork must be regularly maintained, and inspected once a year.
- If the extended fork's plate thickness at any spot is less than 3 mm, it must immediately be replaced.
- If the extended fork shows signs of distortion, cracks or other damage, it must immediately be taken out of service.
- A crack-indication check must be performed using the dye penetration method.
- Check the function and safety of the locking pin.

To fit the forks, use the following locking pin:

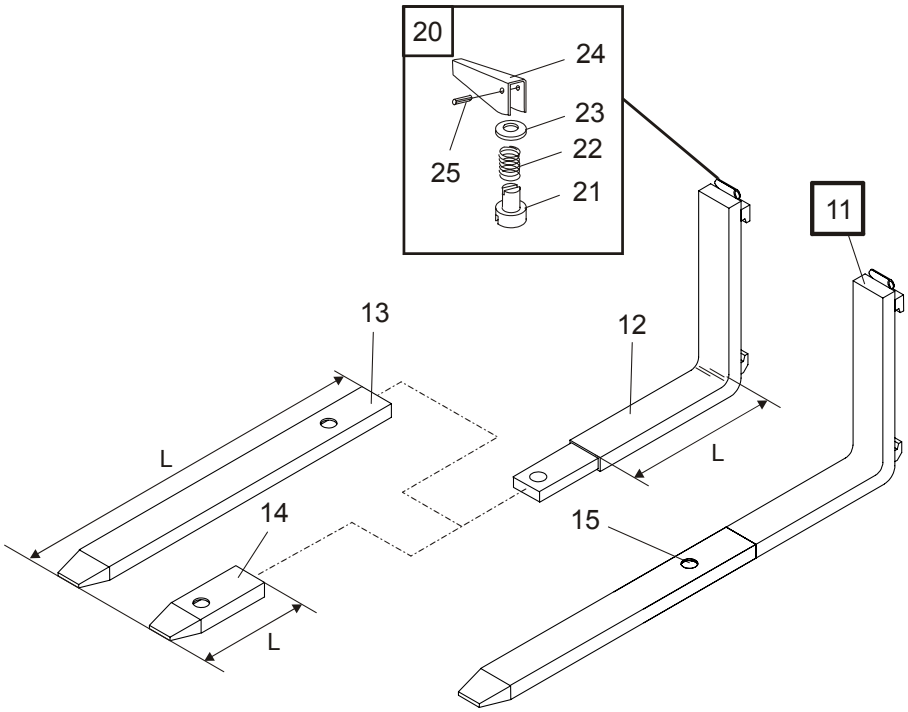


Check that the extended fork is firmly attached, pull on the fork to check it is secure.

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Extended forks

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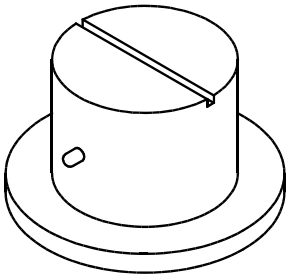
11) Extended fork

12) Fork, main segment (L=825 mm)

13) Fork, extension (L=1175 mm)

14) Fork, extension (L=375 mm)

15) Pin



20) Catch, set

21) Catch

22) Spring

23) Washer

24) Clip

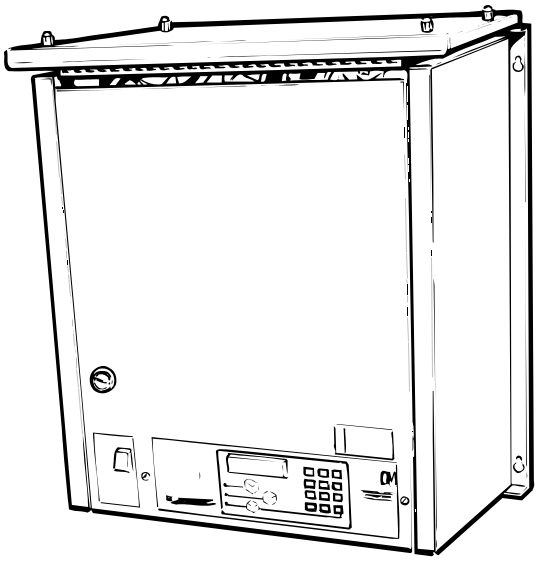
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38-Battery charger – 8340

38.1 General

This is a technical description of the battery charger **BTM**. BTM is a microprocessor controlled Wa charger intended for open lead acid batteries. Wa-charger means that the charging current is high when charging begins to then drop as the battery voltage increases. The microprocessor monitors the charging process and ensures the battery receives the right charge irrespective of the depth of discharge, temperature and age. The computer registers the charging output and limits it if necessary through temporarily shutting down. The display shows the voltage, current, charged Ah, ampere-hours, charging time, etc. The statistics from the charging process are saved.



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38.2 Installation

- Make sure the charger is placed in a dry area.
- Make sure the charger's ventilation holes are not covered.
- Hang small chargers on the wall.
- Place large chargers on the floor.
- Check the charger's rating plate to see the mains voltage it is intended for.

NOTE:
The charger's transformer has a relatively high starting current, which is why slow burn fuses must be used.

There is a switching option inside the enclosure for high or low mains voltage and high or low charging current. This may only be adjusted by qualified personnel. The battery and mains voltage should then be disconnected.

38.3 Functional description

38.3.1 Display functions

Program versions 1.20-1F, 1.20-2F and 1.20-3F contain functions to show information in plain text. Only a few languages are available. Consequently, the program also contains functions to simulate a numerical display with codes. If the display show plain text in a language you do not understand, make sure the program version is 1.20-xF or later, the last letter is the edition. The program's version is shown when the charger is started.

To switch to the numerical display proceed as follows:

- Press the # key until the display shows the text "language". Now press 2 followed by # and *. Wait a few seconds. Switch off and restart the charger. The display now acts as a numerical display.

38.3.2 Charging process

- Connect the charger to the battery.
- Set the mains switch in position 1.

The display now briefly shows the program version, e.g. 1.21. During this time the computer checks the counter-voltage, mains voltage, the charger's temperature, etc. Charging starts and the charger's status is shown using three LEDs. The display shows the charging current and an orange LED lights. At some times the computer stops the charging and gathers measurement data, which is used to calculate correct recharging. The fan starts and stops depending on the temperature.

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Abnormal events during charging are registered, one or more LEDs flash and an error message is displayed. Important information about the charging process is stored, if a power failure occurs. Charging takes place from the right level when the mains power is restored.

When the computer has calculated the correct recharge level based on the collected measurement data the yellow LED lights until the battery is fully charged. Charging is switched off and the green LED lights.

When the battery voltage has fallen to the set value (normally 2.17 V/ cell) a maintenance charging pulse is started and runs for two minutes. The time between two pulses is never less than 30 minutes irrespective of the battery voltage.

Gathered measurement data is stored in a non volatile memory. This data can be read off on the display at any time by using the keyboard.

NOTE:
Old values are written over during a new charging process.

38.3.3 Shutdown conditions

The most important demand on the charger's function is that shutdown takes place when the battery has received the correct charge. BTM has parallel running shutdown programs. The program monitors that the correct ampere-hours are charged.

38.3.4 Delayed power on and charging

There are two functions to delay the start of the charger.

The first can be programmed from 0–31 seconds and is activated each time the charger starts. Some program versions show the remaining time on the display. This function prevents several chargers restarting, if a power failure occurs during charging, simultaneously resulting is a fuse blowing.

The other can be programmed between 0–7 hours and is activated only with a new charging process. Some program versions show the remaining time on the display. This function makes it possible to charge the battery during off peak periods.

38.3.5 Extra charging

The function is only available in program version 1.19 or later.
The function restarts the charger after a programmable number of hours, at least six hours after the start of a new charging process. Extra charging acts as if a battery change has taken place and is intended to give a fresher battery after a weekend.

Example: The battery is put on charge on Friday at 5.00 p.m. and the extra charge starts after 56 hours, default value, at 1.00 a.m. on Monday morning. The function shuts down automatically when the battery is fully charged.

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38.3.6 Equalised charging

The function is only available in program version 1.19 or later.
The function charges 20% of the programmed battery capacity at the earliest six hours after the end of the normal charge. The equalising charge can only continue for five hours and only takes place once per programming session. The function is erased after the equalising charge is complete, and must be reprogrammed when the equalising charge is required. The equalising charge is only used a few times per year to counteract unequal cell voltage and sulphating.

38.3.7 Current and voltage characteristics

The charger's direct voltage varies with the load and is 2.0 – 2.1 V/cell at 100% current and 2.55 – 2.65 V/cell at 25% current. The voltage varies with the mains voltage and temperature.

38.3.8 Safety shutdowns

The computer switches off the main contactor if anything abnormal occurs to prevent damage to the battery and other components.

Temporary shutdowns occur with:

- Incorrect mains voltage.
- Too high charging output.
- Too high temperatures.

Definite shutdown takes place and maintenance charging is connected if the following occurs:

- Recharging capacity is too high.
- Charging with voltage over 2.37 V/cell, more than 6 hours, without approved measurement values. The function "cold storage charging" (charging of cold batteries) permits 8 hours.

Shutdown takes place and maintenance charging is disconnected if:

- The battery is faulty.
- The charging current's momentary value is higher than double the rated current.
- The battery is disconnected without the mains switch being switched off.

If the computer fails, charging is cut by a separate total time circuit after 12 hours without contactor connection.

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38.3.9 Display and keyboard

The charger's panel contains, among others, a display, keyboard and three LEDs.

- The LEDs show the current charging phase and any errors.
- The display shows different measurement values and the gathered data. During charging the display shows the normal charging current and during measurement and resting the battery voltage.
- You can control the displayed information and program the computer from the keyboard.

Reading of analogue measurement values

You can read off the analogue measurement values during the current charge on the display. The significance of the codes is shown in the following table:

- Press * code *.

Code	The display shows
10	The voltage on the charger's output (V)
11	Total charging time during the main and post charging (hh.mm)
12	Recharged ampere-hours (Ah)
13	Charging time with voltage under 2.37 V/cell (hh.mm)
14	Charging time with voltage over 2.37 V/cell (hh.mm)
15	Charging current (A)
16	Mains voltage (VAC)
17	Air temperature around the mother board (°C)
18	Temperature on one of the wound units (transformer in V2-V3, choke in others) (°C)
19	Temperature on one of the diode heatsinks (°C)

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Error indication and error messages

When one or more LEDs flash an error has occurred, after which the display automatically, or after pressing the # key, shows the error codes. Older program versions demand the # key to be pressed once per error code.

Code	Error messages
E01	Error code has been entered
E02	Entered value is too large
E03	Error in EE-prom
E10	Mains error
E11	Direct voltage error
E12	Interrupted secondary fuse
E13	Safety shutdown
E14	High temperature
E17	Error in EE-prom
E20	Great need of maintenance charging
E21	High counter-voltage, across 2.4 V/cell
E22	Low counter-voltage, across 1.8 V/cell
E23	Overcurrent, more than double the rated current
E25	Too low current, less than 1% of the rated current
E26	Tripped secondary fuse
E30	High temperature, on transformer or choke
E31	High temperature on the diode heatsink
E32	High ambient temperature
E36	Fan fault
E40	Too low current, less than 1% of the rated current
E43	Charged capacity> programmed capacity × recharging factor
E44	Long charging time with voltage over 2.37 V/cell
E52	Phase missing on 3 phase charger
E60	Checksum error in EE-prom
E61	Keyboard error. Key pressed > 20 seconds
E62	Communication error with printer

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Code	Error messages
E63	Error in EE-prom
E67	Battery acknowledgement error
E70	Data in the mother board's EE-prom is not valid
E72	Error in the mother board's EE-prom
E76	Error in EE-prom
E77	The content in the computer board's and the mother board's EE-prom is not the same.

Reading statistics from the previous charge

The statistics remain in the system until a new charging process is started or the battery is replaced. The statistics are stored in a register with a three-digit number in the range 290–500. The most important are shown in the following table.

- Press * register number *.

Register	Function (resolution, unit)
290	Voltage before start, 10 mV/cell.
291	Start current, % of the charger's rated current.
320	Final voltage, 10 mV/cell.
321	Final current, % of the charger's rated current.
340	Calculated withdrawn capacity, Ah
360	Total recharged capacity, non maintenance charge, including recharging factor, Ah

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Reading of long term statistics

BTM saves statistics of how the battery and charger have been utilised from a long term perspective. The recharging factor is discarded in these statistics.

Battery utilisation can be read from five registers. Depending on the depth of discharge, each charge is stored in one of these registers.

The limits shown in the following table are delivery settings, but can be changed.

- Press * register number *.

Register	Number of cycles with utilised capacity
610	0-30% of the programmed battery capacity
620	31-50% of the programmed battery capacity
630	51-70% of the programmed battery capacity
640	71-90% of the programmed battery capacity
650	over 90 % of the programmed battery capacity

Register	Function
660	Total recharged Ah
670	Total recharged Ah × 65535
760	Number of charges shutdown due to too long time over 2.37 V/cell

Storing parameters

Parameters used by the program and that can be changed are stored in a parameter memory (EE-prom). This type of memory holds information when switched off, yet permits the contents to be changed.

Chargers with program version 1.19 or later contain two EE-proms for secure data storage. Important data is stored in both and is monitored by a special program function that warns of non conformity. If an error should occur in one of the memories, the program automatically copies data from the other memory.

If an intentional change is made, e.g. while programming, the program approves this, but warns that the change has only be written to one of the memories (E77).

Older chargers with only one EE-prom store information in two separate areas of the memory. If the contents of these memory areas are not the same the program gives a warning through the error code E.60.

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Once all the changes have been made a copy-over can be made with code 22.

- Press * 22 * 2451 *.

2451 is a safety code to avoid data being changed unintentionally. If charging is in progress the contactors release during the actual copying process.

Reading parameters

The program and component circuit boards have the same design irrespective of the charger's rated voltage or current. Values are set by storing parameters concerning the battery and charger in the parameter memory (EE-prom). These values are written during final testing of the device.

NOTE:

There are other parameters that are set at the factory and are not described here. Default values are values written during the functions basic programming. The significance of the register is shown in the following table:

- Press * register *.

Battery specific parameters

Register	Function (resolution, unit)	Default value
200	Battery capacity, Ah	0
210	Recharging factor, %	15
230	No. of cells	0
220	Current that loads the battery during charging, 100 mA	0
224	Cold storage operations, 0 = no, 1 = yes	0
215[1)]	Start voltage for maintenance charging pulse, 10 mV/cell.	217
204[1)]	Lower statistic level ((25 + (y×5))%) y=at value between 1 and 15, e.g. ((25 + (2×5))%)=35%	1
205[1)]	Statistic range ((z×2)%) z=optional value for the required range, e.g. ((10×2)%)=20%	10

[1)] Only applies to program version 1.19 or later.

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Charger specific parameters

Register	Function	Default value
232	Charger's rated current, A	0
240	Mains voltage code, see separate table	9
213[1)]	Extra charging, 0 = no, 1 = yes	1
225[1)]	Time for extra charging, hours	56
217[1)]	Equalising charge , 0 = no, 1 = yes	0
216[1)]	Pause in equalising charge, hours	10
221[1)]	Delayed start, seconds	0
226[1)]	Delayed charging, hours	0
242	Fan installed, 0 = no, 1 = yes	1

Mains voltage codes

Main voltage	Design of the charger	
	1-phase	3-phase
220	0	8
380	1	9
500	2	10
127	3	11
346	4	12

Other functions

Register	Function	Default value
233[1)]	Automatic hardcopy of statistics, 0 = no, 1 = yes	0
234[1)]	Hardcopy of charging, 0 = no, 1 = yes	0
235[1)]	Hardcopy range, hours	5
203[1)]	Hardcopy language, dependent on program version	0

[1)] Only applies to program version 1.19 or later.

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Changing parameters

The parameter values can be changed if necessary.

Example: The charger is programmed for battery 2500 Ah, and you require 300 Ah.

- Press * 200 *, the display shows 250.
- Press, * 2451 * 300 * within 10 seconds.
- Do not forget to copy-over, * 22 * 2451 *, when all the changes have been made.

38.3.10 Acid circulation

General

Under normal charging the recharging factor is 1.15–1.20, i.e. when the recharged amount is equal to that withdrawn from the battery a further 15–20% Ah will be charged. This “over charging“ is necessary, firstly to avoid sulphating, and secondly through gassing to mix the electrolyte so that electrolyte of a greater density does not collect at the bottom of the cells resulting in corrosion.

If it possible to mechanically mix the electrolyte, the recharging factor can be lowered to 1.05–1.07. This makes it possible to save charging time, maintenance and reduce liquid consumption due to gassing.

One way to achieve this is to blow air into the battery cells and in doing so cause the electrolyte to circulate.

To charge acid circulation batteries either requires a charger or battery equipped with an air pump, a.k.a. acid circulation pump.

BTM with acid circulation

There are two systems for acid circulation available for BTM.

Pump type APE or VPM, which is a surface mounted system available in different sizes depending on the number of battery cells. The smallest model gives 200l/h and is used for up to 12 cells. Use the next size up for a greater number of cells, this gives 350l/h. Both types are compatible with all BTM models irrespective of the enclosure.

Some batteries require a higher volume of air. Accordingly, there are two other models of which the largest gives 600l air per hour.

There is also an integrated model API, which is solely used in a floor cabinet.

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Pump type APE, VPM

The pump is mounted in a separate enclosure, which is bolted to the top of the charger with spacers. The connection of the pump takes place across the charger's contactors, possibly via the terminal close to the charger's mains connection.

The pump is equipped with pressure monitoring. Indication is via LEDs and an acoustic signal. The underpressure alarm, under 30 mbar, is indicated by a red flashing LED and a buzzer signal and is delayed by a few seconds. Overpressure, over 120 mbar, is indicated by red/green flashing LEDs and a buzzer. Normal pressure is indicated by a green LED.

The APE pump can be used by all program versions. However, it is important to reduce the recharging factor, normally 15-20%, by 5% for Varta batteries and 7% for Tudor batteries. Other makes of battery, please contact the battery supplier.

Pump type API

The pump is fitted inside the charger and is equipped with a pressure sensor connected to the charger's electronic card. This allows the pressure to be monitored. In the event of an error the charging factor is automatically reset so that the battery always receives the correct recharge.

This type of pump only works with program version 1.24. This program version is fully compatible with program version 1.20, except for the addition of API pump support. The charging factor should be set to 5-7% depending on the make of battery.

38.4 Service and maintenance

38.4.1 Basic programming, code 30

The function is only available in program version 1.19 or later.
The function automatically resets all parameters to default values.

- Press * 30 * 2451 *.

After basic programming the battery capacity, number of cells and the charger's rated current need to be programmed. The mains voltage code is adjusted if necessary.

38.4.2 Resetting the statistics, code 31

The function is only available in program version 1.19 or later.
The function resets the long term statistics.

- Press * 31 * 2451 *.

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38.4.3 Calibrating the measurement value

The electronic components in BTM have a specific margin of error. Instead of calibrating the error margins using a trimming resistance or potentiometers, the computer in BTM stores trimming constants in the parameter memory, EE-prom. These trimming constants are calculated using trimming functions and are activated via the keyboard.

Calibration takes place by first measuring the values to be calibrated with an accurate instrument. Using the calibration function you enter the true values into the computer. The computer calculates a trimming constant, which is stored in the parameter memory and used to compensate the entered values.

The trimming constants are stored in the same way as the parameters. Calibration therefore gives the error message E.77 or E.60. When calibration is complete you use the copy-over function to copy the data to the other memory.

Calibrating the current's zero value and temperatures, code 21

NOTE:
The battery must not be connected. The charger shall be cold.

- Ensure the charger and its components have the same temperature as the ambient temperature.
- Measure the ambient temperature
- Press *21 * 2451 * temperature °C*.

Example: If the ambient temperature is 19°C,
press * 21 * 2451 * 19 *).

The current display is reset when calibrating. The temperature of the transformer, choke and diodes is set to that of the ambient temperature.

Calibrating the battery voltage's measurement value, code 20

- Connect the charger to the battery.
- Measure the voltage across the charger's terminals.
- Wait until the battery voltage has stabilised.
- Press * 20 * 2451 * voltage and the first decimal *.

Example: If the voltage is measured to 56.4 V.
Press * 20 * 2451 * 564 *).

Calibrating the charging current, code 25

- Ensure that the charger delivers at least 50% of the rated current.
- Measure the current using a clamp-on ammeter intended for direct current.
- Press * 25 * 2451 * current and the first decimal *.

Example: If the current is measured to 68.5 A.
Press * 25 * 2451 * 685 *).

Calibrating the mains voltage display, code 26

- Measure the voltage between two phases. With single phase, between the phase and negative.
- Press * 26 * 2451 * voltage *.

Example: If the voltage is measured to 396 V.
Press * 26 * 2451 * 396 *).

38.4.4 Calibrating and programming API

Calibrating zero pressure

- Loosen the air hose from the charger's air nipple. Start the charger with a battery connected.
- When the charger and pump start, press * 35 * 2451 *. The measurement system is now set to the pumps zero pressure.

Calibrating the pressure

- Connect a pressure meter with adjuster screw to the charger's air nipple. Turn the adjuster screw so that a counter pressure equivalent to 90-110 mbar is obtained.

Press * 35 * 2451 * enter the mbar to one decimal *.

All calibration is completed by calculating a new checksum with * 22 * 2451 *.

Programming the alarm limits

Register 246 contains the limits for the underpressure. Each unit corresponds to 10 mbar The charger is usually programmed for 30 mbar, i.e. register 246 contains the value 3.

Register 247 contains the limits for the overpressure. Exactly as for the underpressure each unit corresponds to 10 mbar. The charger is usually programmed for 120 mbar overpressure, i.e. register 247 contains the value 12.

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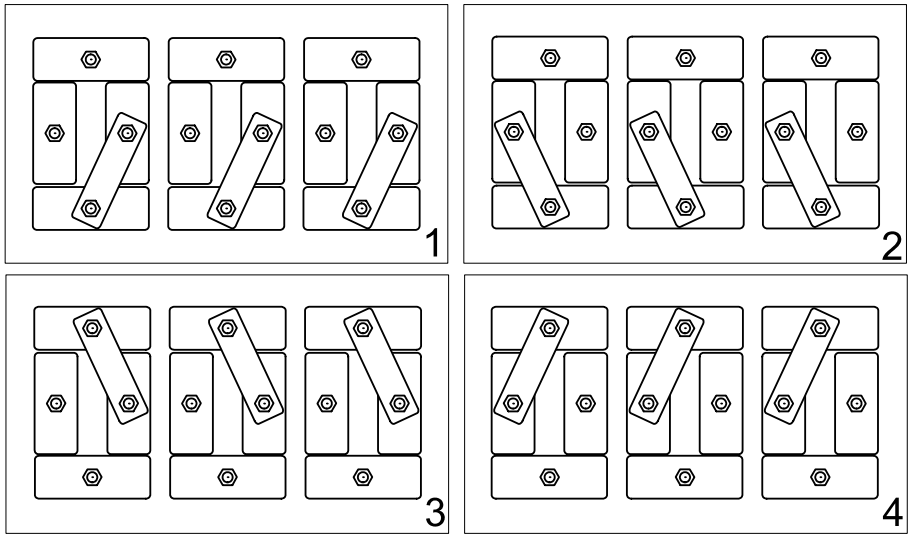
Programming the API function

The register 245 shall contain the value 1 for the program to activate the pressure monitoring function. Press * 245 * to check the content of the register. Use the same programming procedure as for other registers.

All calibration is completed by calculating a new checksum with * 22 * 2451 *.

38.4.5 Adjusting the charging characteristics

The charging characteristics can be adjusted by moving a strap if the charger delivers too high or too low current at the start of charging. The strap is located to the right of the transformer. There is one or three straps depending on the type of charger. Next to the strap is a sign describing how strapping shall take place.



1. **Low mains voltage and high charging current.**
2. **Low mains voltage and low charging current.**
3. **Normal mains voltage and high charging current.**
4. **Normal mains voltage and low charging current.**

38.4.6 Trouble shooting

If an error occurs during charging this normally results in one or more error messages. Some errors are such that the computer does not display the error, e.g. a fault on the electronic card. Here follows a compilation of errors and appropriate actions

Error message, analysis and action

E.22 = low counter-voltage.

The connected battery has too low counter-voltage.

- Check the battery and its connections.

E.30 - E.36 = high temperature on component parts.

- Check the fan
- Check that the ventilation openings are not covered.
- Check that the mains voltage adaptation is correct.
- Check that the ambient temperature is not too high.

E.25 = low current.

- Check that there is no play on the battery plug or battery poles.
- Check that the battery is not sulphated.
- Check the contactors.
- Check the temperature fuses.
- Check for a possible error on the mother board.

E.52 = phase fault.

- Check the fuses on the mains.
- Check that all phases are present.
- Check for play on the mains terminal.
- Check for any diode failure.
- Check that the right mains voltage code has been programmed.

E.60, E.70 = incorrect information in the mother board's EE-prom.

- Reprogram and calibrate if necessary.
- Copy over the data.
- Switch off the charger and then restart.
- Check that the error message has disappeared.

E.72 = error in the mother board's EE-prom

- Check the EE-prom.
- Check the computer board.

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E.76 = error in the computer board's EE-prom.

- Check that the computer board's EE-prom is not missing or faulty.
- Check that an older type of display or printer has not been connected.

E.77 = data in the computer board and mother board EE-prom is valid but not the same.

- Check that copy-over of data has been performed.
- Check that the computer board does not come from another device.

Errors without indication

- If the charger does not work, check that the computer board and display board are fitted correctly and are connected.
- If the mains fuse blows during power up, compare the fuse value with the charger's rated data.
- Check the fuses and connections.
- Check the diodes.
- Check the insulation between phases and the charger's casing.

38.4.7 Trouble shooting acid circulation

- With underpressure, check the hose system, nipples and couples for leakage. If the charging plug with air connection is used, the O-rings in the plug may be damaged.
- Also check that the pump is voltage fed.
- With overpressure, check the hose system for pinched hoses.

38.4.8 Service measures

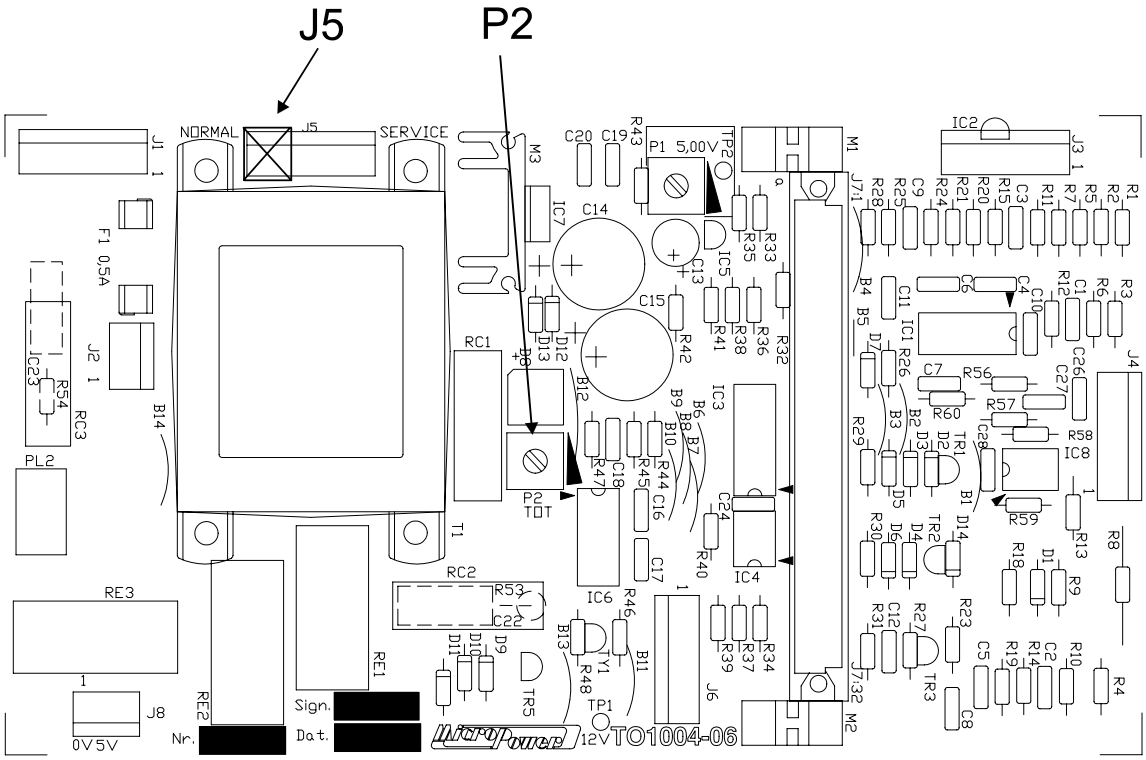
NOTE

Servicing may only be carried out by qualified and authorised personnel.

- Disconnect the charger from the mains and battery when servicing an open charger.
- Check that all cover plates are refitted and that the charger's door is closed and lock once serving is complete.

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Switching to the timer charger



In the event of an error so that computer controlled charging is not possible, you can temporarily switch to timer charging.

- Switch the service plug, J5, located above the mother board's control transformer.
- Set J5 to its right-hand position.
- Set the mains switch in position 1.

Charging starts immediately and continues for the set time, normally 12 hours. The time can be adjusted between 5 and 13 hours using potentiometer, P2. There are settings for 6 and 12 hours. The fan runs continuously in service mode.

- When the fault has been rectified, return J5 to its "normal position" and P2 is set to 12 hours.

Replacing the display card

- Align the LEDs in the corresponding holes before screwing down the board.

Replacing the computer board

- Loosen the mother board's catches on the upper and lower guides.
- Pull out the computer board.
- Check that the new computer board is of the right design and program version.
- Install the new computer board.

If the computer board's EE-prom has not been written to, this will be updated when the charger is started. If it has been written to, the error message E.77 is shown. Perform copy-over using code 22. (* 22 * 2451 *).

Replacing the mother board

- Remove the computer board.
- Remove the bottom grille, applies to the wall mounted model.
- Disconnect all connections.

NOTE:
Exercise care with the thermal wires.

- Loosen the five nuts and lift the mother board out of the charger.
- Install the new mother board.
- Connect the computer board.
- Perform full basic programming, calibration and resetting of statistics.

Replacing the diodes

There are two types of diode: 40HF40 with red connectors, which are used in charger's positive cooler and 40HFR40 with blue connections used in the charger's negative cooler. Some types have mixed connections, i.e. both types are mounted in the same cooler. If these types are not available you can use another diode that withstands at least 40 A, 400 V, and has ¼" threads.

- Secure the diode so that the body lies against the heatsink, check using feeler gauges.
- Only tighten by hand.
  Recommended tightening torque, 2.5 Nm.

38.4.9 Preventive maintenance

In normal environments the charger requires no maintenance. In dusty premises we recommend regular cleaning to ensure cooling and thereby the efficiency of the charger. Cleaning may only be carried out by qualified personnel.

Battery charger – 8340

Service and maintenance

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39-Control/computer equipment – 8700

User manual for TruckCom 3.5 - for “Rider Trucks”

This manual is valid for TruckCom 3.5, program number 182145-008.

39.1 General

TruckCom is a communications program that communicates with trucks equipped with CAN (Controller Area Network) communication.

The program allows the following functions:

- Downloading the software.
- Displaying and adjusting driver and truck parameters and measurement data. You can also save the parameter values (including values for measurement data) for later reloading.
- Displaying data for various digital inputs/outputs and analogue data including voltage, current strength and specific temperatures.

The program is a Windows program run under Windows® 95/98, Windows® XP/2000 and Windows® NT.

39.2 Connection

In order to connect to the truck, a CAN interface of the CPC-PP type with associated cable is required. The interface is connected to the printer port on a PC, and the cable must be connected between the interface and the truck’s CAN connection.

The CAN interface is supplied with current from the truck’s electronics and is protected from any high currents in the truck in the event of a fault arising.

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39.3 Layout

39.3.1 Main window

When the program starts, the main window, consisting of a menu row, tool buttons, work area, log window and status window, opens.

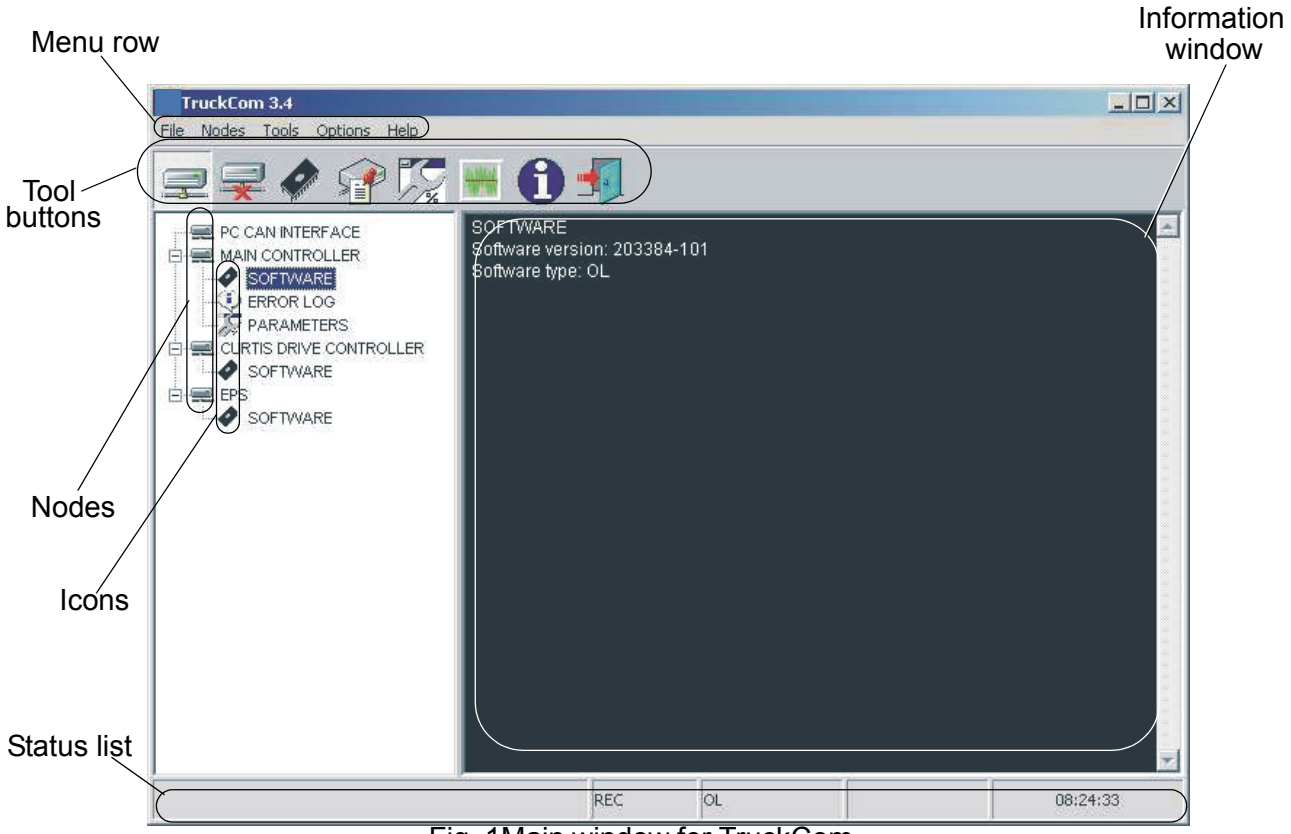
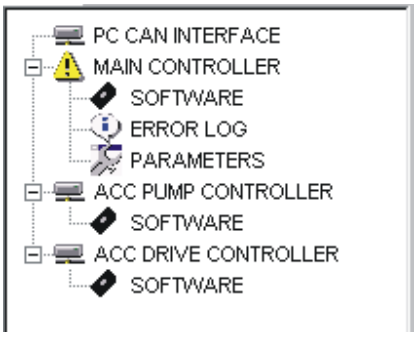


Fig. 1Main window for TruckCom

39.3.2 Nodes

The units connected to and communicating via the CAN interface are called nodes. The nodes detected on the bus are shown in the node window. The current node status and incorporated components/information are displayed using various icons.

Fig. 2A typical screen of the node window



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39.3.3 Icons

Icon	Description
	**Node OK** is displayed when contact is established with a node and no fault has been reported.
	**Node not connected** is displayed when there is no contact with a node in the network.
	**Node not OK** is displayed when a fault has been reported by a node. Click on the node for more information.
	**Program version** is shown when there is information regarding which software is installed. Click for more information.
	**Information** is displayed when a node has information on, for example, fault codes.
	Truck report
	**Parameters** is displayed when a node has information on a parameter.
	Diagnostics
	Conclude

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39.3.4 Tool buttons and menu list

The tool buttons provide direct access to the program's most common functions. The menu list provides access to all program functions. An explanation of each menu button is provided for each section.

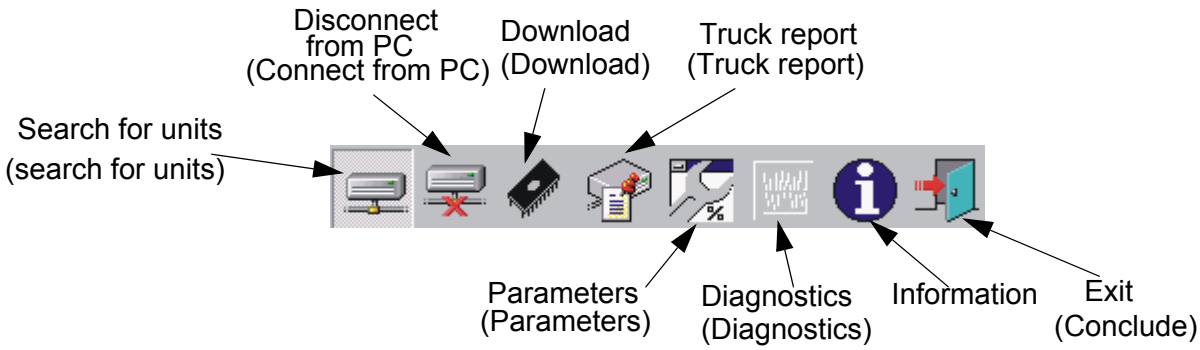


Fig. 3Tool buttons and menu list

39.3.5 Information window

The right section of the main window contains a status window where various messages are displayed.
In order to see previous messages, use the scroll arrows in the right-hand corner.

39.3.6 Status row

There is a status row at the bottom of the main window that shows various statuses when the program is run.



The following are displayed from the left:

Help text "pop-up" via the mouse cursor, connected/not connected to the network, truck type connected, initiation result of the CAN interface and current time.

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39.4 Function for connection

In order to connect the PC to the network, select the "Scan units" function. This can be done using the <Nodes | Scan units> menu or using tool button [Scan nodes].
This must be done when the truck is energised and in normal drive mode. The program now carries out a check and sets CAN interface. A diagnosis is also carried out to check which units are connected to the system. The results of this diagnosis are shown in the “Node” window.

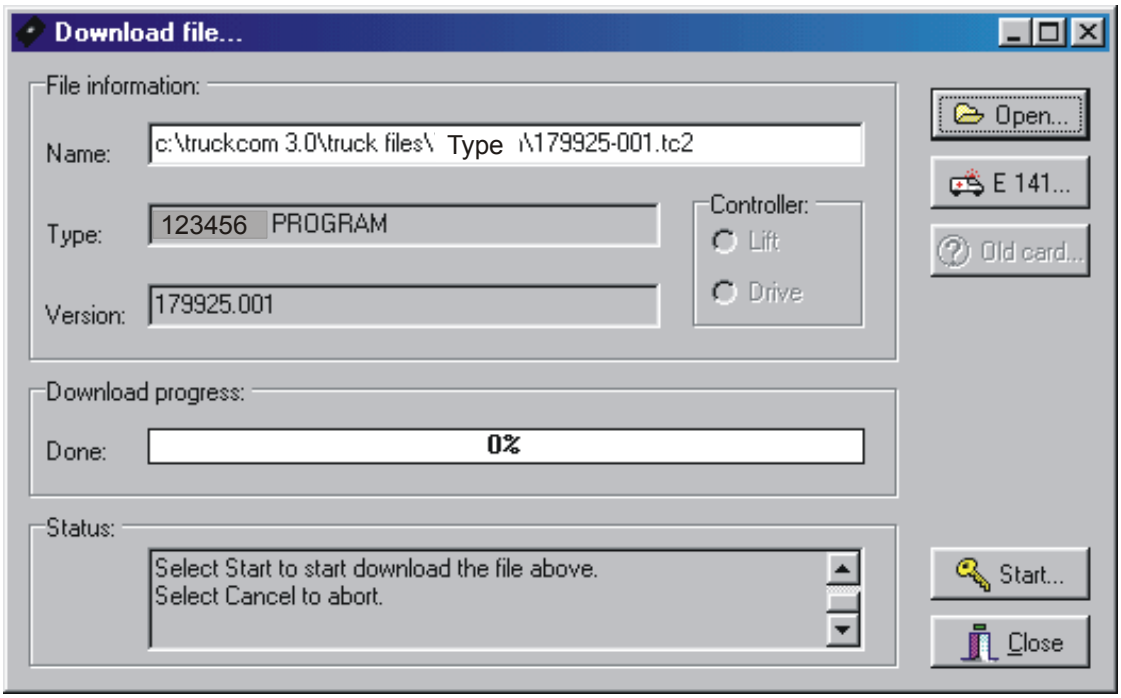
39.5 Function for disconnecting

In order to disconnect from the network, select the “Disconnect” function. This can be done using the <Nodes | Set PC off-Line > menu or with the tool button [Set PC off-Line].

The CAN interface then resets and it is possible to disconnect the CAN cable if required. The aim is to be able to connect to another truck without needing to close the program.

39.6 Function for program downloading

In order to download a new program to one of the nodes, select the "Download" function. This can be done using the <Tools | Download software... > menu or using tool button [Download].



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39.6.1 Normal loading

Select Open.. to open the file to be downloaded to a node. File name, file type and version number are shown in the " file information" box. If it is a file for checks, specify the type of checks that are to receive the file. Start loading by selecting Start... and restart the truck by entering the driver PIN-code and then pressing the green button on the keypad. Restart must take place within 20 of the Start button being activated.

Close the loading box once loading is intact and then disconnect the PC from the network. A new connection can now be made to verify the new program.

39.6.2 Loading in old versions of the electronic card

If loading is to take place to an older type of electronics card which does not support restart with a key, the Old card button... must be used instead of Start...
Loading takes place in the same way, except restart takes place by using the battery plug instead of the key.

39.6.3 Emergency loading

If for any reason there is no program in the electronics card (interrupted loading) E141 will be displayed on the truck display at start. The communication with the truck via the PC will then be minimised. Use "E141" to download the program to the card.

On certain trucks, there is a counter on the display which continuously counts up.

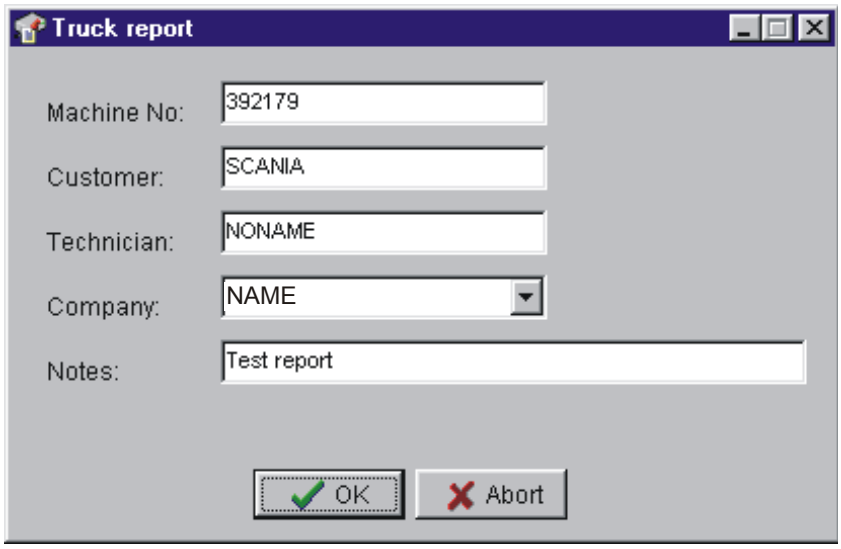
NOTE!

The electronic cards for certain trucks can only be upgraded with the same basic program once they have been programmed. It is therefore not possible to change the basic program (other machine type).

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39.7 Function for truck report

It is possible to generate a report to a file or disk using the truck's configuration and status. Select the <Tools | Generate truck report... menu > or using the Truck report tool button. Save the report in the Report.file.



Example of information generated in the truck report:

```
[GENERAL]
REPORT DATE-TIME=1999-12-09 07:42:14
CPC-PP SERIAL No=8002008
MACHINE NUMBER=392179
CUSTOMER=CUSTOMER 1
TECHNICIAN=NONAME
COMPANY=COMPANY 1
NOTES=Test report

[CAN NODES]
MAIN CARD=125
FORK CARD=-1
TRUCK TRACKER=-1
ACC LIFT CONTROLLER=0
ACC DRIVE CONTROLLER=0
CURTIS LIFT CONTROLLER=-1

[MAIN CARD CONFIGURATION]
SOFTWARE=169942-001
HARDWARE=169937-001
SERIAL NO=12112

[HOUR METERS]
A IGNITION TIME=1
B TOTAL MOVEMENT=0
C DRIVE MOTOR TIME=0
D PUMP MOTOR TIME=0
S SERVICE TIME=9

[ERROR LOG]
01=55 99-12-09 06:11
02=55 99-12-08 20:54
03=55 99-12-08 14:26
04=231 99-12-08 14:16
05=55 99-12-08 14:11
.
.
.
50=55 99-12-08 14:40

[DRIVER PARAMETERS]
1=3
2=100
3=100
.
.
.
100=0

[TRUCK PARAMETERS]
11=100
12=80
13=10
```

The content of certain rows can vary depending on the truck type.

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39.8 Function for parameters

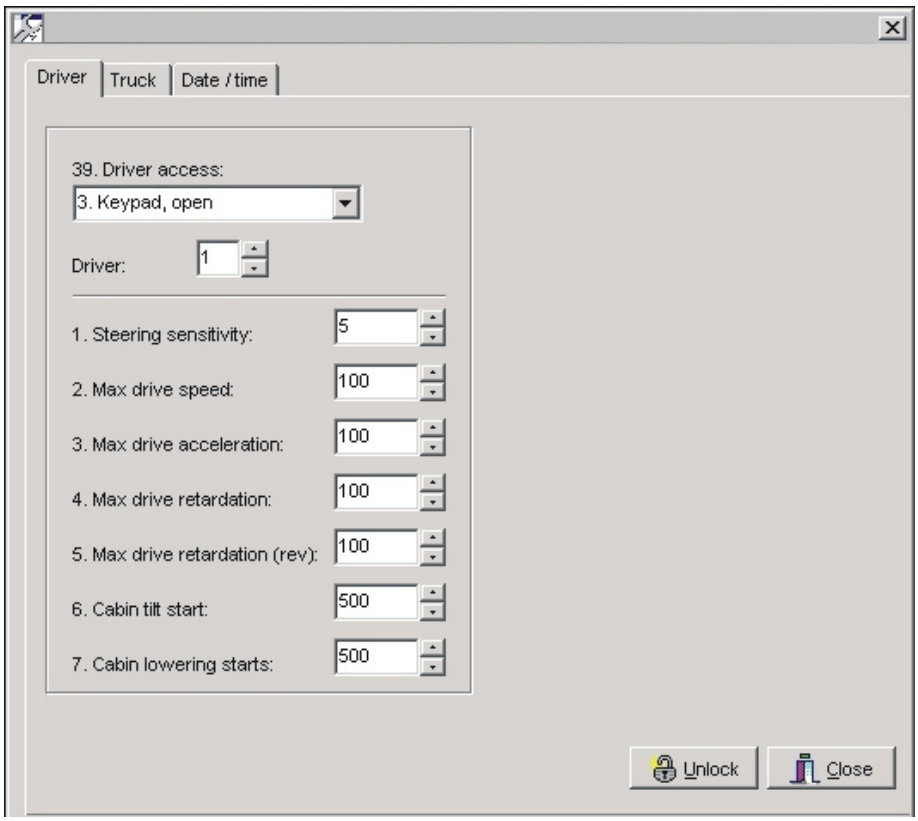
In order to change the truck's parameters, select the "Parameter" function. This can be done using the <Tools | Change parameters > menu or using tool button [Parameters].

NOTE:

The truck must be in normal mode (i.e. not in parameter mode) when connected to TruckCom. Otherwise TruckCom will display "Unable to determine truck brand".

The parameter numbers follow the description in each truck's service manual.

Fig. 4, fig 5 and fig 6 show the RR truck.



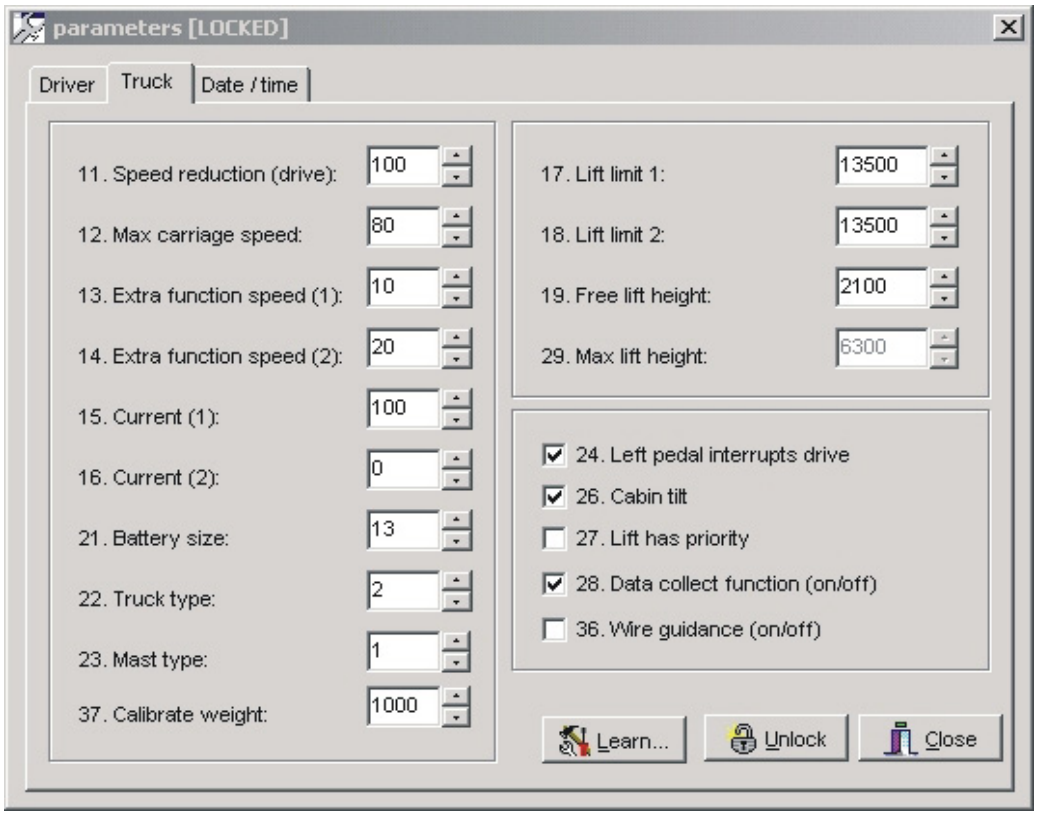


Fig. 4 *Truck* file

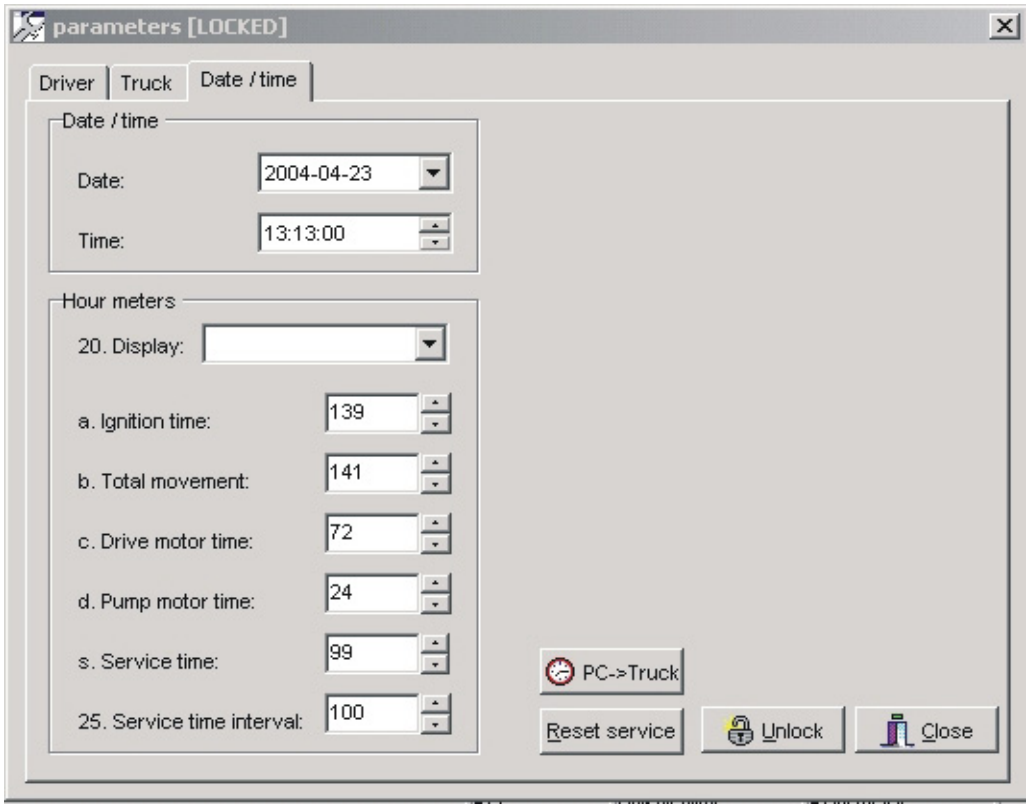


Fig. 5 *Time* file

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39.9 Function for diagnostics

In order to access diagnostics, select the “Diagnostic” function. This can be done using the <Tools | Diagnostic... menu > or using the [Diagnostic] tool button.

NOTE!

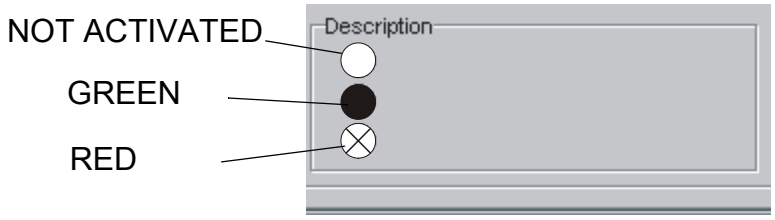
If the value “---” is displayed in a field or the status LED lights up red, communication has been interrupted for some reason and incorrect data may then be displayed.

NOTE:

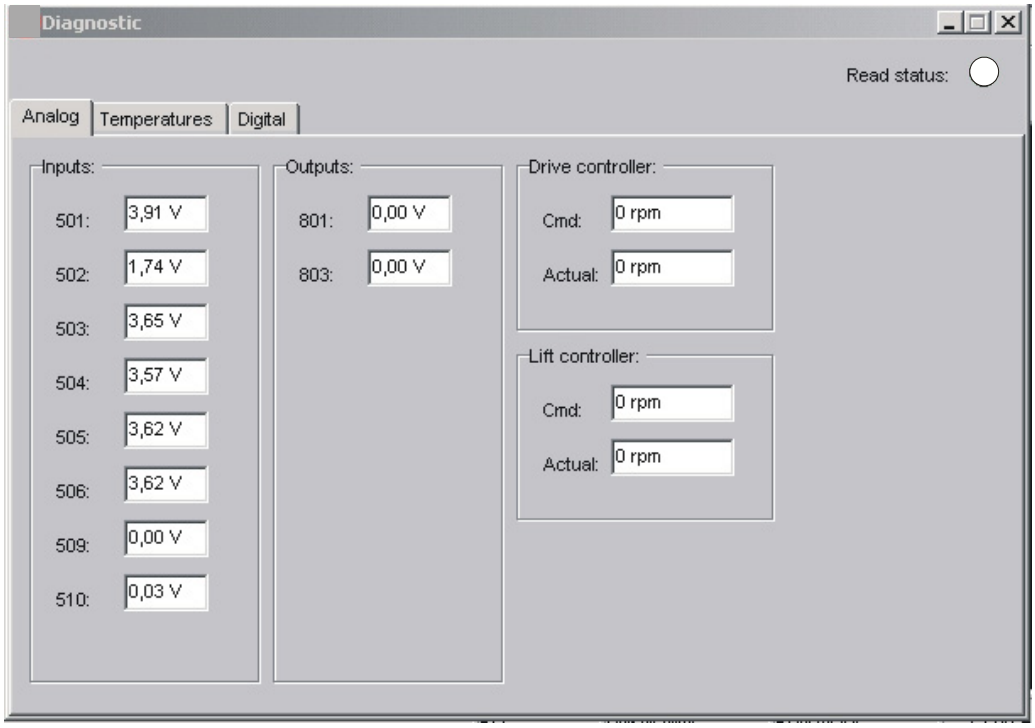
The information on the tabs in diagnostics mode depends on which truck is connected.

39.9.1 Signal colours

The following screenshots have been adapted for improved readability for printout in black and white.



39.9.2 Tab for “Analogue”

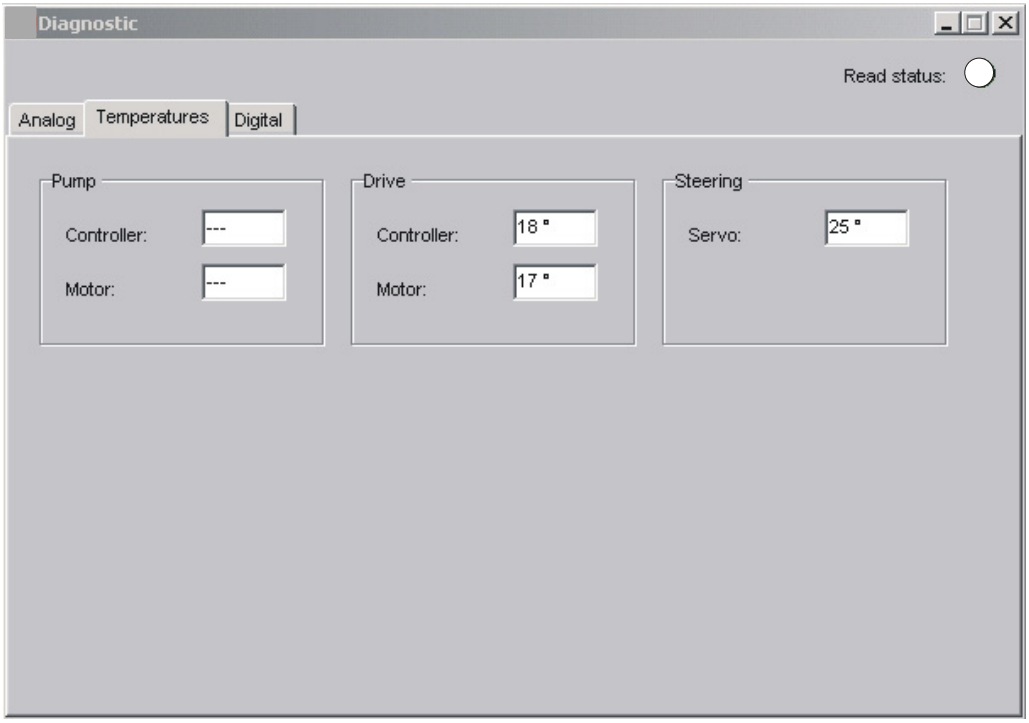


When you click on the *Analogue* tab, the following dialog box is displayed:

- Read status – Shows that the measurement function is activated and functioning.
- *Inputs* - the measured voltage on each potentiometer is displayed. The number refers to the input on the main card and which is specified on the circuit diagram.
- *Outputs* - the voltage sent out to each component. The number refers to the output on the main card and which is specified on the circuit diagram.
- *Driver controller* - Cmd shows the required Ac-figure and the actual speed for each engine.

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39.9.3 Tab for “Temperature”

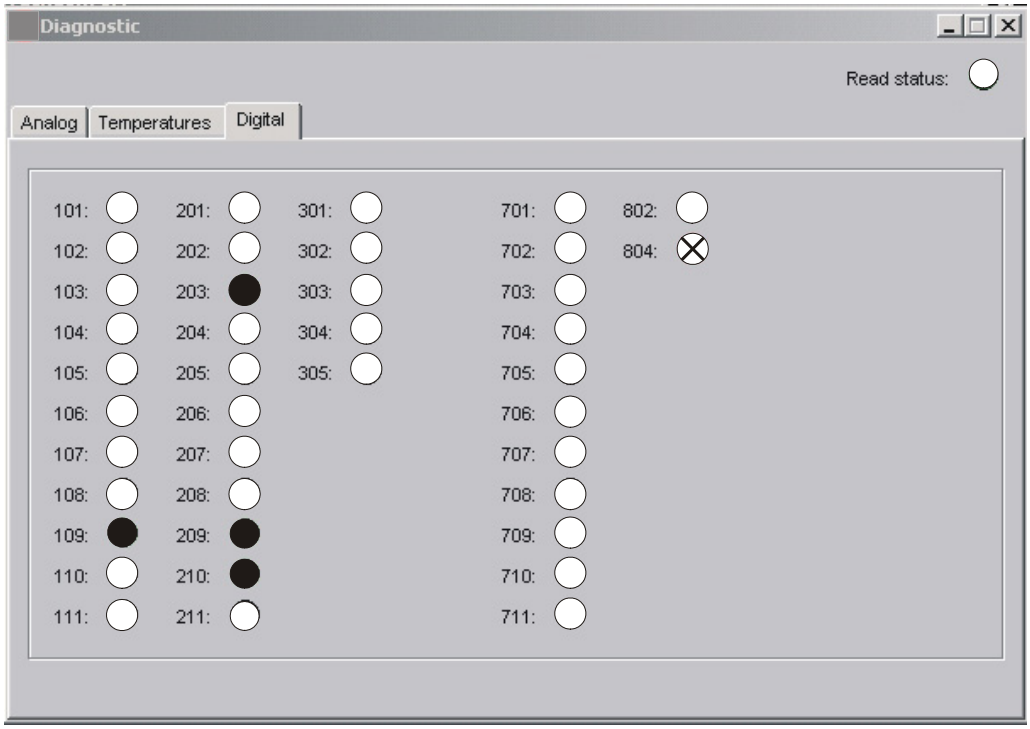


When you click on the *Temperature* tab, the following dialog box is displayed:

- *Pump/Drive* - The current temperatures of the electronics units and the engines expressed in °C .
- *Steering* - The steering regulator’s final-stage temperature expressed in °C.

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39.9.4 Tab for “Digital”



When you click on the *“Digital”* tab, the following dialog box is displayed:

- Status for digital inputs and outputs for the main card. The number refers to the outputs and inputs on the main card specified on the circuit diagram.

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39.10 Other menu functions

39.10.1 Save to file

The truck parameters can be saved in the PC for loading at a later date. Select <*File* | *Save to file* | *Parameters* >. All parameters in the nodes that are connected to the bus will be read and saved in a file.
If only the hour meters are required, select <*File* | *Save to file* | *Hour meters* >.

39.10.2 Loading from a file

A set of parameters can be loaded from the PC to the truck. Select <*File* | *Load from file* | *Parameters* >. The parameters in the file will be copied to the nodes connected to the bus. If only the hour meter settings are required, select <*File* | *Load from file* | *Hour meters* >.

39.10.3 Resetting the CAN adapter

If problems arise when resetting the CAN adapter connected to the PC, this can be done manually by confirming there is voltage to the adapter and then selecting <*Nodes* | *Reset CPC-PP* >.

39.10.4 Deleting the fault code log

In order to delete the truck's fault code log, start the truck in parameter mode and then select < *Tools* | *Erase error log* >.

39.10.5 Resetting the hour meter

In order to zero the truck’s hour meter, start the truck in drive mode and then select < *Tools* | *Reset hour meters* >.

39.10.6 Reading the fault code log

In order to display the truck’s fault code log, select < *Tools* | *Read error log* >.

39.10.7 Adjusting the date/time

In order to rapidly adjust the truck’s date and time, select < *Tools* | *Adjust date & time* >. The time specified on the PC will now be downloaded into the truck.

NOTE!
NOT trucks without a real time clock.

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39.10.8 Adjusting the hour meter on older cards

In order to adjust the hour meter on trucks with older cards, select < *Tools* | *Adjust Hour meters* >. The time on the PC is then downloaded to the truck.

39.10.9 Help

About TruckCom

In order to view the program information, select <*Help* | *About Truck-Com...* > or the [About] tool button.

39.10.10 Conclude

In order to close the program, select <*File* | *Exit* > or the [Exit]´tool button.

39.11 Specifications

Table 11: CAN interface

Description	Value	Unit
Current consumption	40-120	mA
Supply voltage	11-28	V
Speed of transfer	125	kbit/s
Storage temperature	-20-80	^{0}C
Operating temperature	0-60	^{0}C

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39.12 Installation

NOTE!

Installation of the program must take place from the hard disk. You must also be administrator with full privilege.

NOTE!

The software may be damaged in the computer and therefore installation on the PC must be implemented by a person with the necessary knowledge.
BT is exempt from all responsibility for any faults resulting from installation.

NOTE!

All references to the PC operating system functions, menus and commands are based on the English Windows® version.

39.12.1 Installation on a PC with Windows XP/ 2000/NT

The software application is supplied on a CD or via a network in ZIP-format.

Extract the file and put it on the computer's harddrive.

Start the installation by running X:\SETUP.EXE, where X:\ is the drive on which the installation application can be found.

Then follow the on-screen instructions.

39.12.2 IInstallation on a PC with Windows 95/ 98

If truckCom has been previously installed on the PC, changes must be made in the *System. ini* file.
Start the *Msconfig.exe Start* | *Run msconfig* program.
Click on *System.ini* and open the folder (386Enh).
Click away the tick for Device=C:WINDOS\Cpcppvd.vxd
Save and close the program.

Now start the installation

The program is supplied on CD or over the network and the installation is started by running X:\SETUP.EXE, X = the program location.

Then follow the on-screen instructions.

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39.12.3 In the event of any problems with communication with CAN

Ensure that the computer settings for the printer port in setup (BIOS) are as follows:

Port address: 0378

IRQ: 7

Mode: Output only

For information on how the setup is changed, see the user manual from the computer manufacturer.

39.12.4 Uninstallation

TruckCom can be uninstalled from the Windows® start menu < *Settings* | *Control panel* | *add/remove programs* > . Highlight TruckCom and then <*Add/remove program*>.

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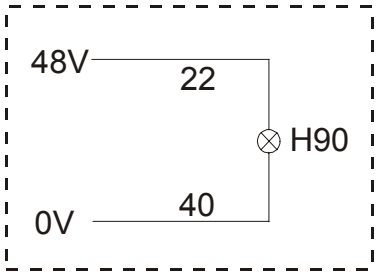
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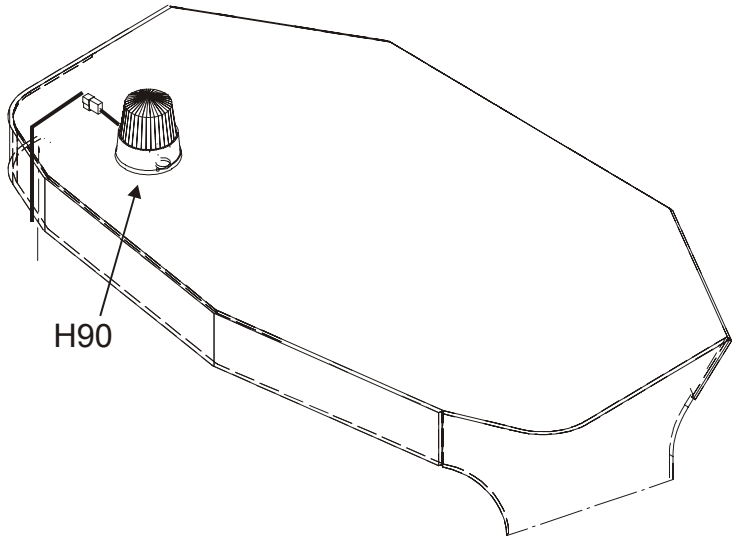
Valid from serial number	T-code
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40- Extra warning lights/alarm – 9370

40.1 General

The truck can be equipped with warning lights in order to attract attention when the driver is operating the truck.





Extra warning lights/alarm – 9370

General

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41-Positioning equipment – 9390

41.1 General

This chapter is about height indication and height pre-set.

The height indication system comprises a tachometer that measures impulses on a wire and relays them to the control card.
The control card then relays the signals to a display panel showing the height of the forks.

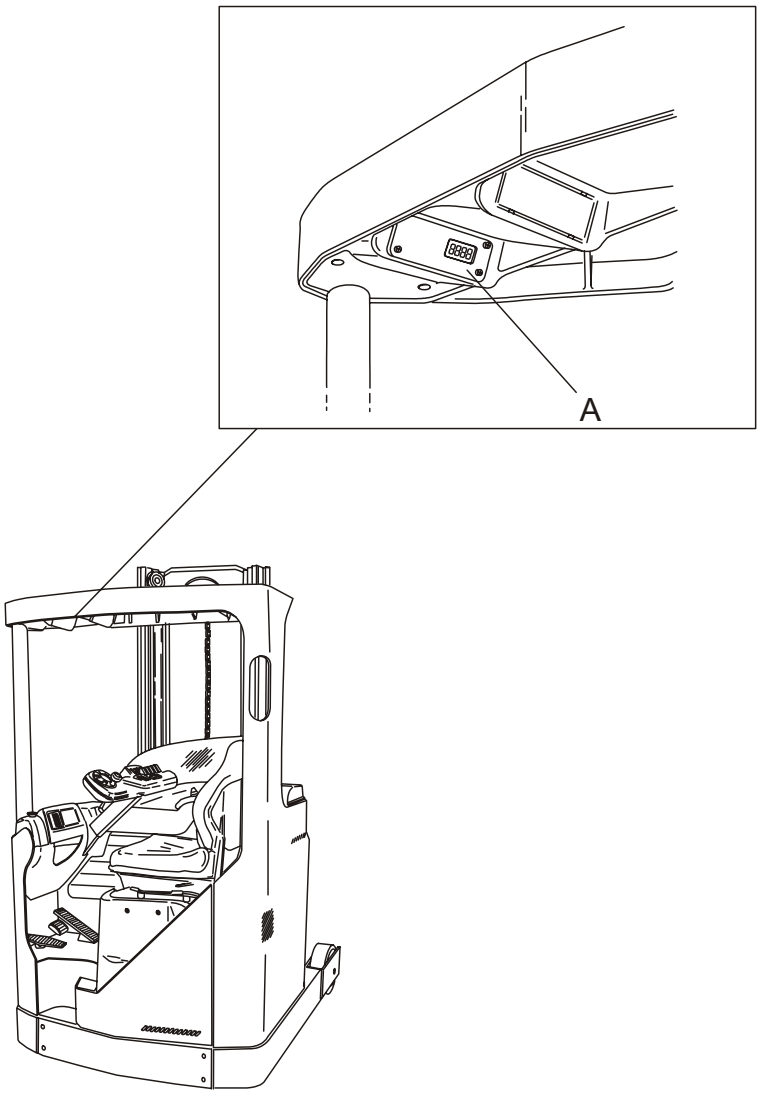
The height pre-set receives impulses from the height indication system. On the height pre-set, you can program the height at which the forks will stop to pick up and deposit loads.

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41.2 Height indication

A height indicator, which shows the current height of the forks within the main lift range, is fitted to trucks with high lifting heights.

The display window (A) shows the fork height based on information from the height meter.



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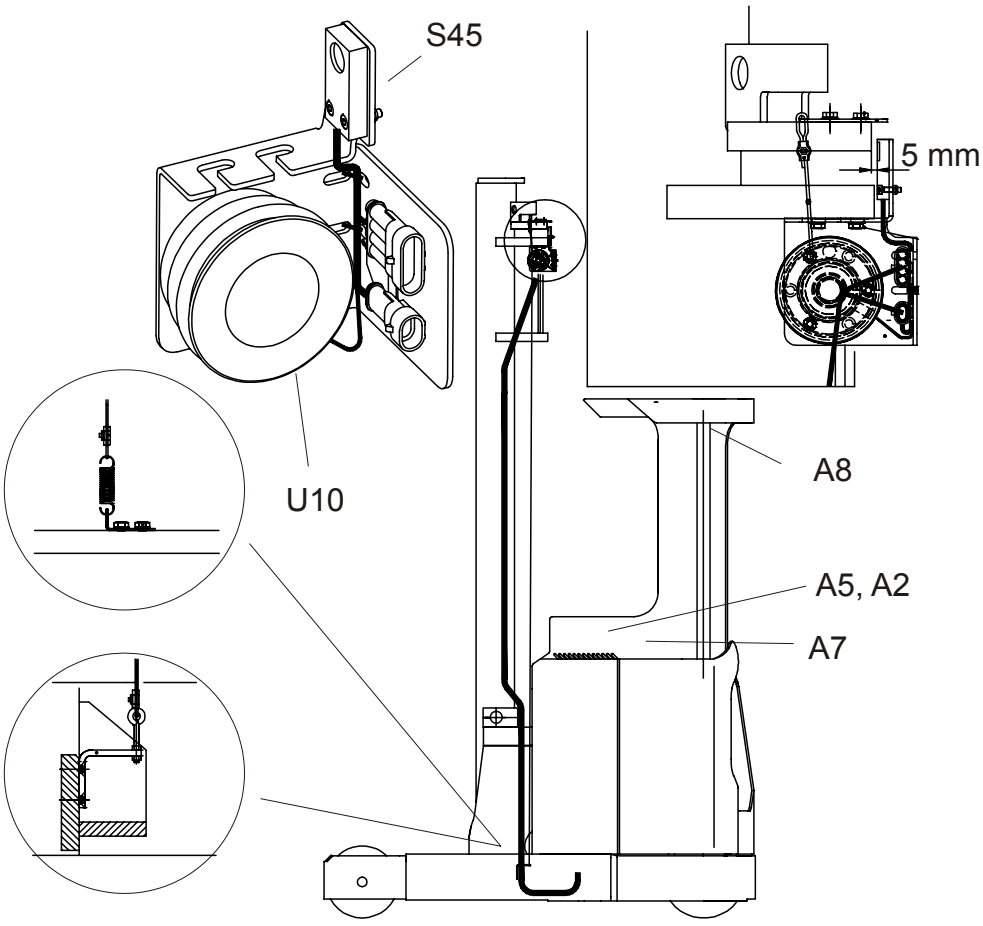
Valid from serial number	T-code
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41.3 Function

Measuring starts in the main lifting zone when the reference switch (S45) is activated and sends a signal to the electronic card (A5). The pulse sensor (U10) sends pulses to A5, which starts by displaying the programmed free lift height on the display (A8). The pulse sensor has two channels, A and B, which relay signals with 90° reciprocal ratio. This gives A5 information on whether the forks are moving up or down. For connection, see Wiring Diagram, chapter 5000.

For programming the free lift height, see Setting Parameters, chapter 5710.

The steel wire should be wrapped one turn around the measuring wheel and stretched taut so it does not slip.



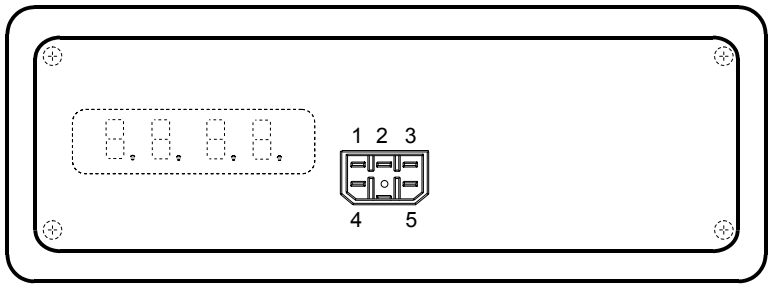
41.4 Display

The picture shows the rear side of the height indication display, and the table explains the terminal numbers for contacts where **I means input**.

Positioning equipment – 9390

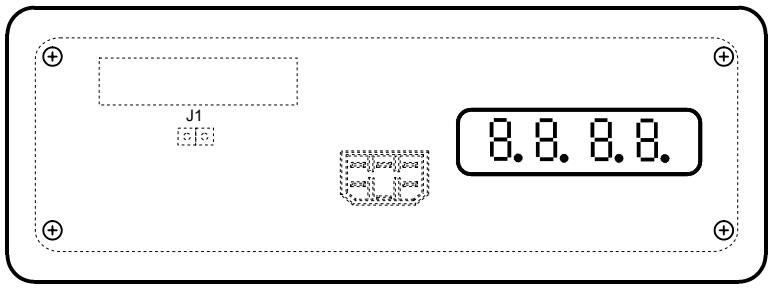
Display

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Terminal number	Connection	Function
1	I	Switching to length display
2	I	RX (-) receives data
3	I	+48 V
4	I	Negative
5	I	RX (+) receives data

When supply voltage is connected to terminal 1, the display can be used for length display.



Unscrew the four screws and strap across clamp J1 to switch the display from metres to inches.

Display	Remarks
Permanently-lit decimal points	The forks are below the reference height
Flashing decimal points	The forks are above the reference height with the ignition on
Four straight lines	Communication error with the truck computer

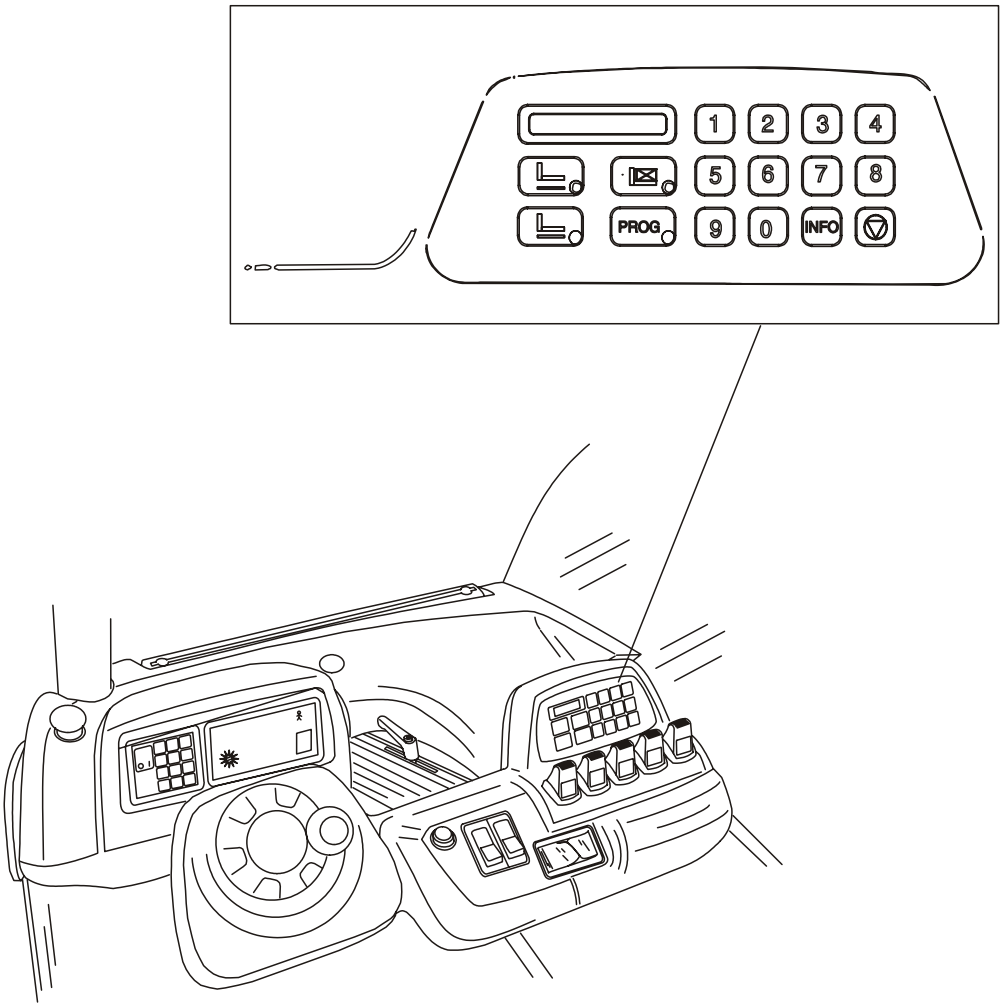
Valid from serial number	T-code
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41.5 Height pre-set

Using the height pre-set, you can lift and lower the forks to up to 99 different pre-programmed levels within the main lift zone.

Lifting and lowering movements are stopped at the desired level based on information from the height meter. Depositing and pick-up of loads takes place manually.

Program the right level for loading and unloading on the keypad. The display window shows the chosen level and any error codes.



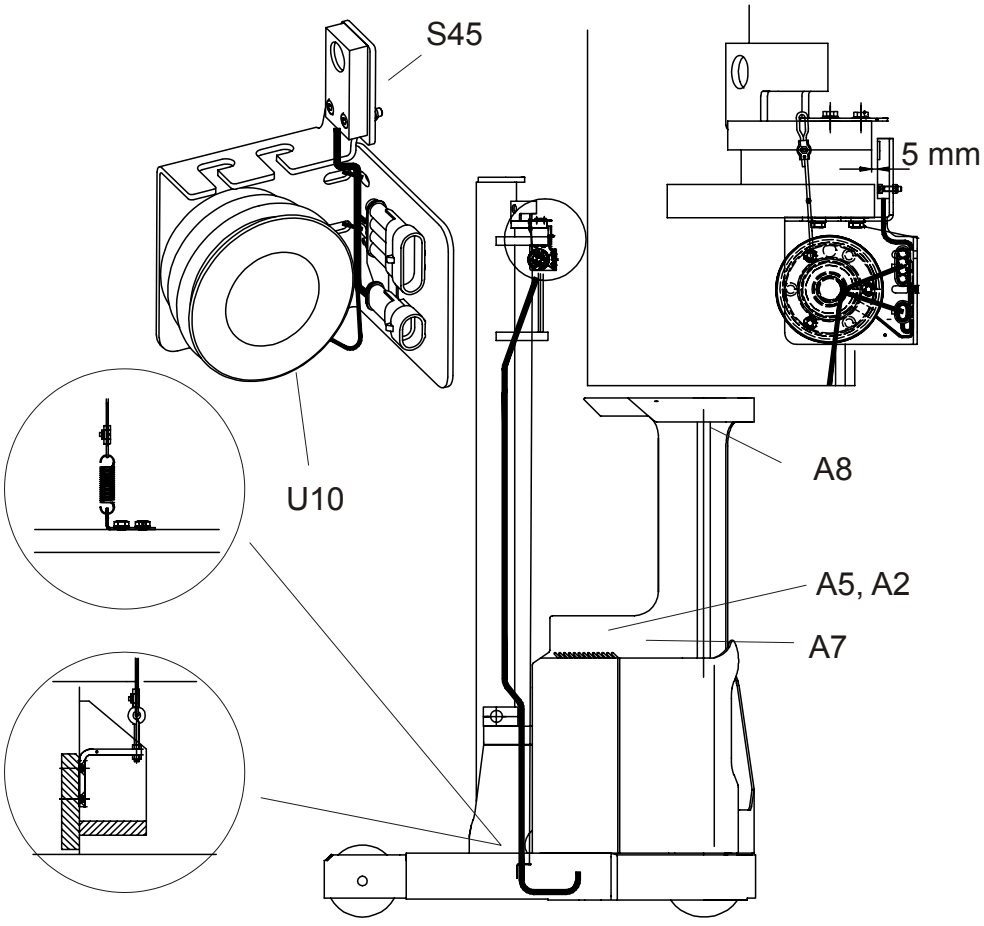
T-code	Valid from serial number
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41.6 Function

Measuring starts in the main lifting zone when the reference switch (S45) is activated and sends a signal to the electronic card (A5). The pulse sensor (U10) sends pulses to A5, which starts by displaying the programmed free lift height on the displays (A7 and A8). The forks stop at the first pre-programmed height when A5, via pulse sensor U10, reaches the correct height. The halt is initiated by A5 regulating the pump motor speed using A2 and valves for fork lifting and lowering. The driver picks up or deposits the load manually. When the driver again presses the hydraulic control for lifting/lowering, the forks continue to the next pre-programmed level. The pulse sensor has two channels, A and B, which relay signals with 90° reciprocal ratio. This gives A5 information on whether the forks are moving up or down. For connection, see Wiring Diagram, chapter 5000.

For programming the free lift height, see Setting Parameters, chapter 5710.

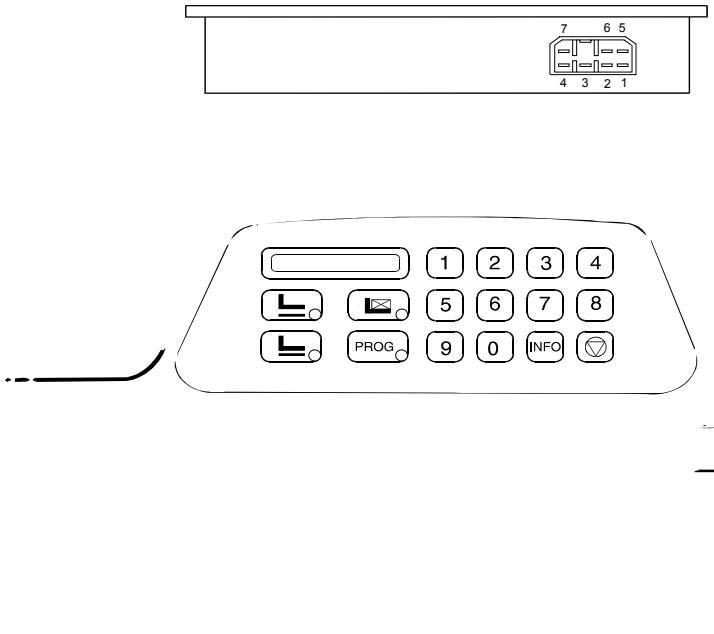
The steel wire should be wrapped one turn around the measuring wheel and stretched taut so it does not slip.



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41.7 Display

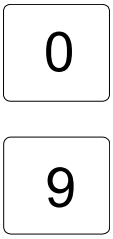
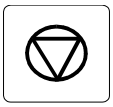
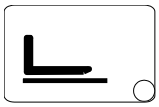
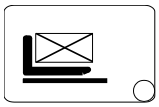
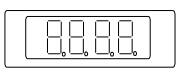
The diagram shows the display and the underside of the display for pre-set height, and the table describes the contactor's terminal number where **I stands for Input** and **O stands for output.**



Terminal number	Connection	Function
1	U	TX (+) transmits data
2		
3	I	RX (+) receives data
4	I	+48 V
5	U	TX (-) transmits data
6	I	Negative
7	I	RX (+) receives data

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41.7.1 Description of the display symbols

Symbol	Function
	Numerical push-buttons for setting height levels
	To control the required height level while driving
	STOP Deletes incorrectly entered height levels in automatic mode, stops programming and removes stops due to error
	Save “LEAVE level” when programming
	Save “COLLECT level” when programming
	LOAD Push-button to indicate that there is a load on the forks when starting
	Push-button to access programming routines
	Display window to indicate height levels and error codes

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41.8 Assembly of height pre-set

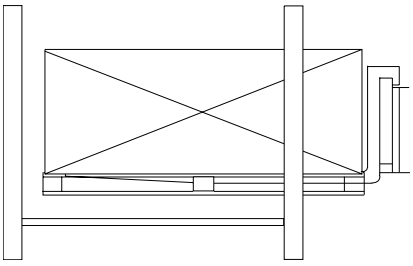
- Undo the 11 screws holding the lower panel in place and remove it.
- Undo the plastic rivets and remove the plastic console from the cavity for height pre-set.
- Screw the height pre-set into place.
- Reconnect the connector.
- Screw the lower panel back into place with the 11 screws.

41.9 Programming

- Press the PROG button briefly to enter programming mode. The LED in the button comes on and the display shows PL00 when the programming routine has been started. You can now program new lifting heights, modify or delete programmed values.

41.9.1 Programming a level

You can only program lifting heights in the main lift range.

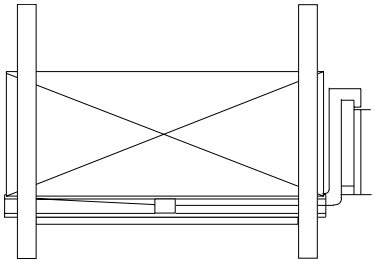


NOTE!

Forks not horizontal.
The load may slide off the forks or catch on the rack.
The forks must always be horizontal, particularly when the load is being deposited on or collected from the rack.

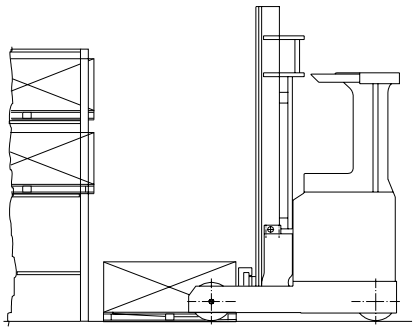
Collect level

- Enter programming mode and state the required level (e.g. 1+5= level 15). The numbers are shown on the display.
- Lift the forks to the required level and press the button COLLECT. The LED flashes.



Leave level

- Pick up the load and wait three seconds. Lift the forks just enough so that the load can be removed from the rack. Ensure that there is sufficient space for safe handling.
- Now press the LEAVE button and both LEDs for collecting and leaving will start to flash
- Press the PROG button until both LEDs go out and the display indicates PL00, to save the information.
- Repeat from “LEAVE “ level to program more levels.
- Press the STOP button to return to display mode.



41.9.2 Deleting programmed levels

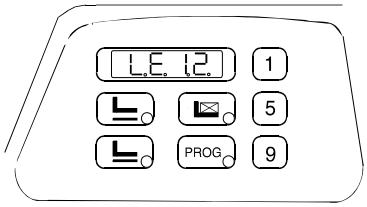
Lower the forks to free lift level when deleting programmed lifting heights.

- Enter programming mode and state the required level (e.g. 1+5= level 15). The numbers are shown on the display.
- Press the COLLECT button (the LED flashes) and then press the LEAVE button (both LEDs start to flash).
- Press the PROG button until both LEDs (COLLECT and LEAVE) stop flashing and the display shows PL00 to erase the memory.
- Press the STOP button to return to display mode.

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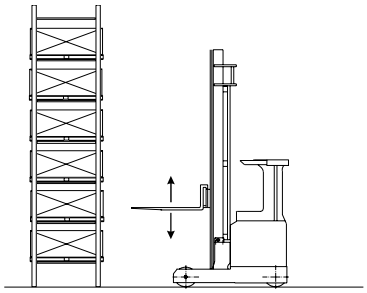
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41.10 Automatic driving



There are two different automatic operating modes. One where the forks are raised/lowered to the required level without a load and the other, with a load.

41.10.1 Collect load



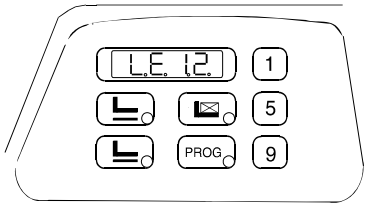
- State the required height level using buttons 0-9 (e.g. 1+2=level 12). The display shows LE12.
- Raise/lower the forks until they are automatically stopped by the electronics. If the wrong direction is chosen, no “lift/lower movement” will take place. The electronics expect the correct direction to be selected.
- When the forks stop and the COLLECT LED comes on, the forks can be manoeuvred under the load.

NOTE!

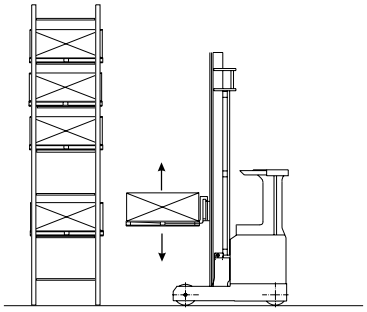
Forks not horizontal.
The load may slide off the forks or catch on the rack.
The forks must always be horizontal, particularly when the load is being deposited on or collected from the rack.

- Raise the forks until they are automatically stopped by the electronics and the LEAVE LED comes on.
- Move the load from the rack. When the work cycle has been completed, the LEDs will go out.

41.10.2 Depositing a load



- Press the LOAD button (the LED now comes on).
- State the required height level using buttons 0--9 (e.g. 5=level 5). The display shows LE05.
- Raise/lower the forks until they are automatically stopped by the electronics. If the wrong direction is chosen, no “lift/lower movement” will take place. The electronics expect the correct direction to be selected.
- When the forks stop and the LEAVE LED comes on, the forks can be slid out from under the load.



NOTE!

Forks not horizontal.
The load may slide off the forks or catch on the rack.
The forks must always be horizontal, particularly when the load is being deposited on or collected from the rack.

- Lower the forks until they are automatically stopped by the electronics and the COLLECT LED comes on.
- Withdraw the forks from the rack. When the work cycle has been completed, the LEDs will go out.

41.10.3 Inspection

- Press the button INFO to check the required “collect/leave level”. The value will be shown for three seconds on the display.

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41.11 Parameters

There are a number of parameters that can be modified in the pre-set height program.

- Press the button PROG for three seconds to start programming routines. The LED comes on and the display shows P_ _ _ .
- Enter code 852 using the numerical keys and the display will now show P_.
- State the required parameter 1 - 9 and then press the LOAD button. The display shows the factory settings. These can be changed to any of the max/min. values shown in the table “Programming parameters”.

NOTE!
If a value outside the max/min. range is programmed in, this will be replaced by the max/min. factory setting.

- Press the STOP button to terminate programming.

41.11.1 Parameter 1

Select the unit of measurement you wish to use (metres or inches).

- Press the PROG button to save the unit you selected. The display shows P_.

41.11.2 Parameter 2

If the distance between lifting heights is equal on all levels, you can make a common program:

- State parameter 2 and press the LOAD button. The display shows P 00 and you now enter the number of levels. Press the LOAD button and the display shows P000.
- Specify the collect height for the first level in increments of 10 mm. Press the LOAD button and the display shows P000.
- The next value you need to enter is the distance between collect/deposit level in increments of 10 mm. Press the LOAD button and the display shows P000.
- The next value you need to enter is the distance between each deposit level in increments of 10 mm. Press the PROG button to save programmed values. The display shows P_.

41.11.3 Parameter 3

Programming the crawling speed for braking distances:

- State parameter 3 and press the LOAD button. The display shows the previous programmed value for crawling speed **lower**. Enter the new value using the numerical keys. The permitted max/min. values are shown in table “Programming parameters”.
- Press the LOAD button to change the crawling speed **lift**. The display shows the value for crawling speed. Enter the new value using the numerical keys.
- Press the PROG button to save the new values. The display shows P_.

41.11.4 Parameter 4

Programming the crawling distance when lifting and lowering.

- State parameter 4 and press the LOAD button. The display shows the previous programmed value for crawling speed **lower**. Enter the new value using the numerical keys. The permitted max/min. values are shown in table “Programming parameters”.
- Press the LOAD button to change the crawling speed **lift**. The display shows the value for crawling distance. Enter the new value using the numerical keys.
- Press the PROG button to save the new values. The display shows P_.

41.11.5 Parameter 5

Programming the tolerance for the stop levels.

- State parameter 5 and press the LOAD button. The display shows the previous programmed value for tolerance. Enter the new value using the numerical keys. The permitted max/min. values are shown in table “Programming parameters”.
- Press the PROG button to save. The display shows P_.

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41.11.6 Parameter 7

Programming the largest and smallest permitted programming distance between the levels collect and leave.

- State parameter 7 and press the LOAD button. The display shows the previous programmed value for **min.** distance. Enter the new value using the numerical keys, (e.g. 030 = 30 mm). The permitted max/min. values are shown in table “Programming parameters”.
- Press the LOAD button. The display shows the previous programmed value for **max.** distance. Enter the new value using the numerical keys, (e.g. 150 = 150 mm).
- Press the PROG button to save. The display shows P_.

41.11.7 Parameter 8

Resets all the parameters to the factory settings.

NOTE!
Reset to factory settings after upgrading to later program version.

- State parameter 8 and press the LOAD button. The display shows no value.
- Press the PROG button until the display stops showing PP. Turn the ignition key on and off to start the new program.

41.11.8 Parameter 9

- Programming the leave/collect levels’ braking distances.
- State parameter 9 and press the LOAD button. The display shows the braking distance for **lower**. Enter the new value using the numerical keys, (e.g. 050 = 500 mm).
- Press the LOAD button. The display shows the crawl speed for **lift**. Enter the new value using the numerical keys, (e.g. 030 = 300 mm).
- Press the PROG button to save. The display shows P_.

41.12 Programming parameters

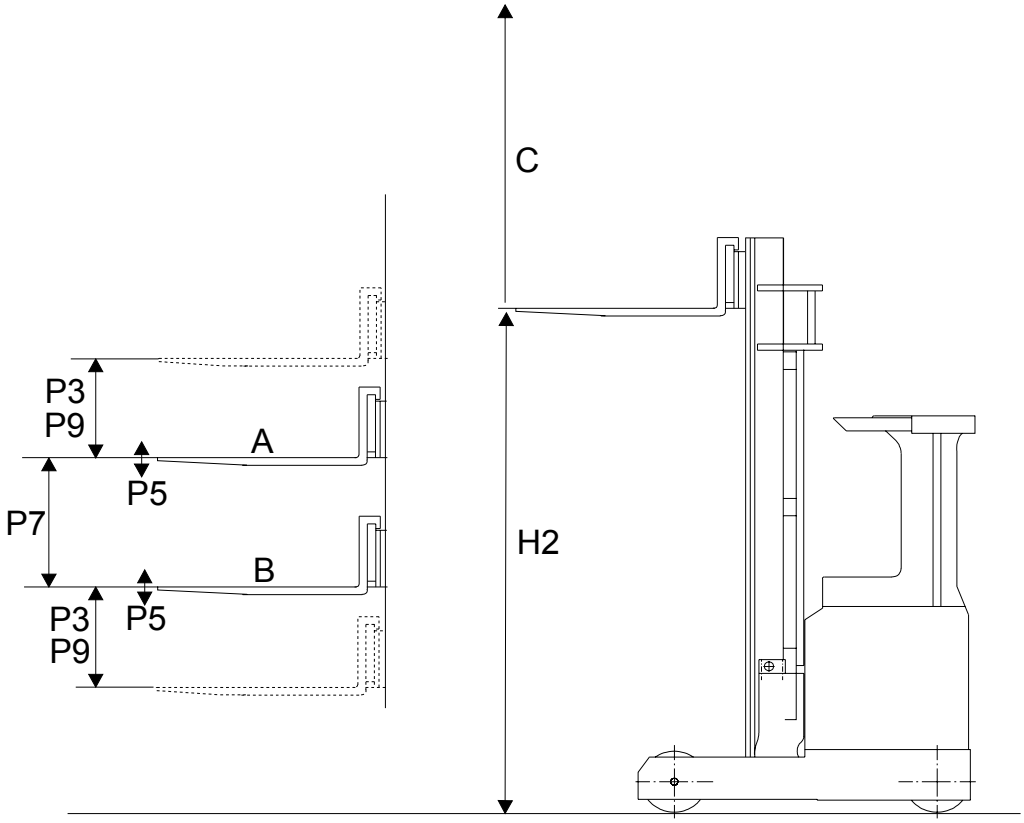
Parameter number	Max./min. value	Factory setting	Unit	Function
P1	001 002	001	m - 10 mminch - 10ths of an inch	Unit of measurement
P2	1 - 99 0 - 999 0 - 255 0 - 999		st 10 mm 10 mm 10 mm	Programming of several levels at equal collect/leave distances. Number of levels Distance first “collect height” Distance collect-leave Distance between “leave levels”
P3	0 - 127 0 - 127	030 010	% of max speed	Crawling speed before stop Lower Lift
P4		010 005	mm	Crawling distance before stop Lower Lift
P5	0 - 255	010	mm	Permitted error tolerance in stop position
P7	0 - 255 0 - 255	030 150	mm	Min./max. distance between leave - collect
P8				Resetting of all parameters to factory settings
P9	 0 - 255 0 - 255	 050 030	 10 mm 10 mm	Braking distance before stop Lower Lift

Positioning equipment – 9390

Programming parameters

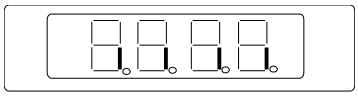
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Position	Function
A	Leave level
B	Collect level
C	Main lifting zone
H2	Free lifting zone

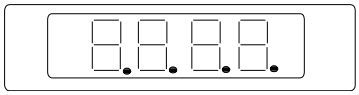


41.13 Error codes

Error code	Remarks
Err 1	Requested height level not programmed or incorrect
Err 2	Forks have stopped outside the tolerance zone (P5)
Err 9	Incorrect value entered when programming
Err flashing	Fault in communication between height pre-set and truck computer



- Four lines appear at start-up. This shows that there has been no communication between height pre-set and the main electronics. The lines will disappear when communication is restored between the units.
- Four dots appear on the display when the forks are in the free lift zone.



- If the dots are flashing, this is an indication that the reference switch was activated when the truck was started (e.g. the forks were above the free lift zone). If the dots continue to flash after the forks have been lowered, a fault may have occurred in the wiring or the height reference switch.

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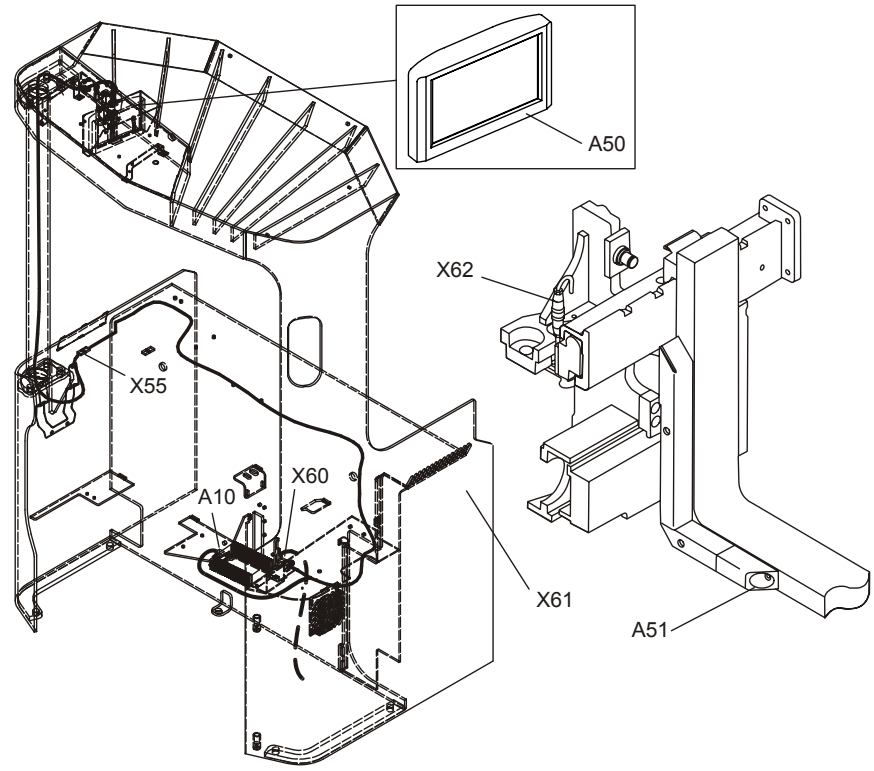
42-TV equipment – 9390

42.1 General

The truck can be equipped with one or more cameras and various monitors. We use a 7” colour monitor that can also be used on trucks with a black & white monitor. This 3chapter describes the various TV equipment options.

42.2 Camera mounted on fork

The equipment consists of a camera mounted on the side of one fork and a colour monitor in front of the driver.

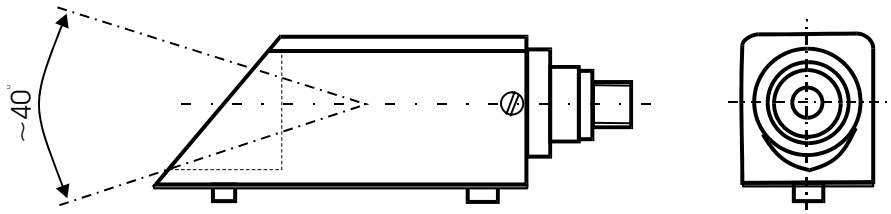


Symbol	Designation/function
A10	Voltage converter
A50	Colour monitor
A51	Camera
X55	Contact
X60	Contact
X61	Contact
X62	Contact

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42.2.1 Colour camera A51

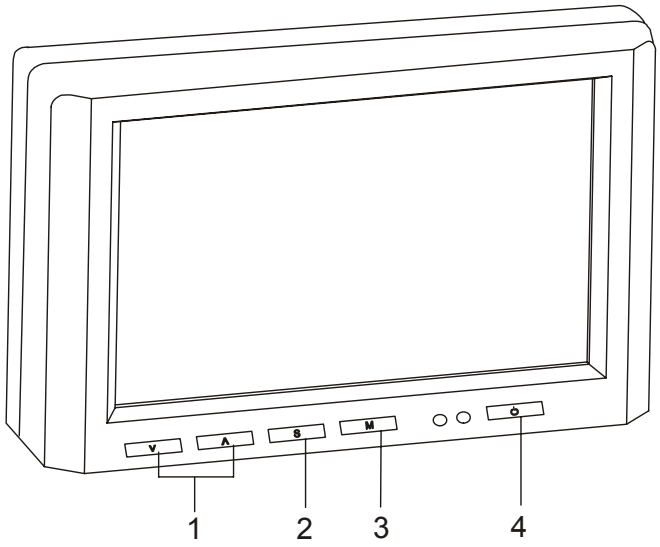
The camera's electronics and lens system are installed in an aluminium case. The lens system cannot be exchanged for a different focal distance. The generation of heat from the electronics is such that no extra heating is required when it is used in cold stores. The camera can also be used on trucks equipped with a black/white monitor.



42.2.2 Colour monitor A50

The monitor has a colour picture and is fed with 12 V voltage.

Ambient temperature from 0° to +60°C



Number	Designation/function
1	Switch, changes settings for monitor
2	Switch, AV1/AV2
3	Switch, menu of settings for monitor
4	Switch, power supply

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- The monitor can be turned on and off using a switch (4)
- Use the switch (2) to shift mode between inputs AV1 and AV2.
- In order to change the monitor's settings, use the switch (3). Pressing this switch accesses a menu for changing settings for the monitor's features. The menu includes the following selection of settings:

Menu choice	Alters
Bright	Brightness from 1-100
Contrast	Contrast from 1-100
Colour	Colour intensity from 1-100
Default	Resets to basic settings
Backlight	Backlighting from 1-100
AV2	AV1 or AV2 when turning on monitor

- To change any setting, the menu option must be selected. Then use the switch (1) up and down to adjust the setting.
- To move between different menu options, press the switch (2).
- To save new settings, hold switch (3) in or turn on and off with switch (4).
- For further information, see Wiring diagram C code 5000.

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42.2.3 Voltage converter A10

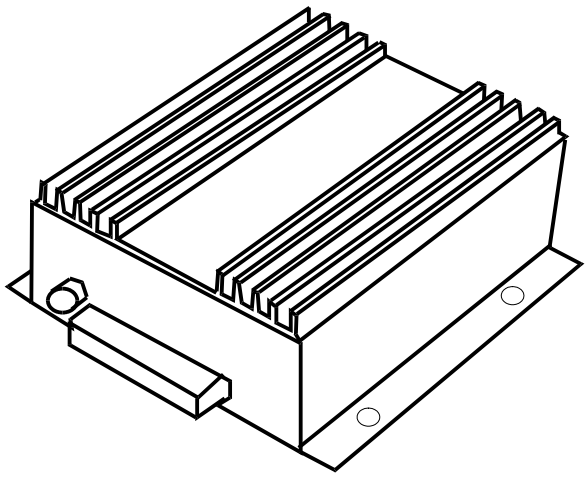
A10 converts incoming voltage 48 V into 12 V, which is fed to the TV monitor and camera.

Parameter	Setting	Unit	Description
Input voltage	48	Volt	
Output voltage	13.2	Volt	
Max. operating voltage	64	Volt	
Min. operating voltage	40	Volt	
Max. continuous current	6	Amp	
Max. intermittent current	8	Amp	
Fuse on input	6.3	Amp	

The converter is protected on the input side against polarity variation, short circuits and thermal overload.

The chassis is not live, and the in/outputs are galvanically separated.

For further information, see Wiring diagram C code 5000.



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43-Truck log system, code lock – 9420

43.1 General

BT TLS truck logging system

The truck can be equipped with various models and combinations of code lock called TLS.

The TLS truck logging system is designed to allow only trained truck drivers to start the truck. Depending on the system used, you start the truck by entering your personal code on the keyboard or using the personal code card.

When you have entered the right code, the truck can be driven. Once the correct code has been used, this is confirmed by the display lighting up or is indicated by other visual means.

The time the truck has been used is registered in the truck log on SD 16.

43.2 SD 16

43.2.1 Login with code (5-digit)

Each time you start the truck, you must enter your personal five-digit code.

- Enter your personal code on the keyboard, 00001, 00002 or 00003 and press the green button (standard code for the first log-in) to start the truck.

If you enter the wrong code, the red LED will light up. Once it goes out, you can start again.

To change the login code, see Davis Derby information.

43.2.2 Logout

You must always log out when leaving the truck.

- Press the red button on the keyboard to log out and to prevent the truck from being driven.

If you have not logged out, the TLS will log out automatically after a preset length of time.

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43.3 Components

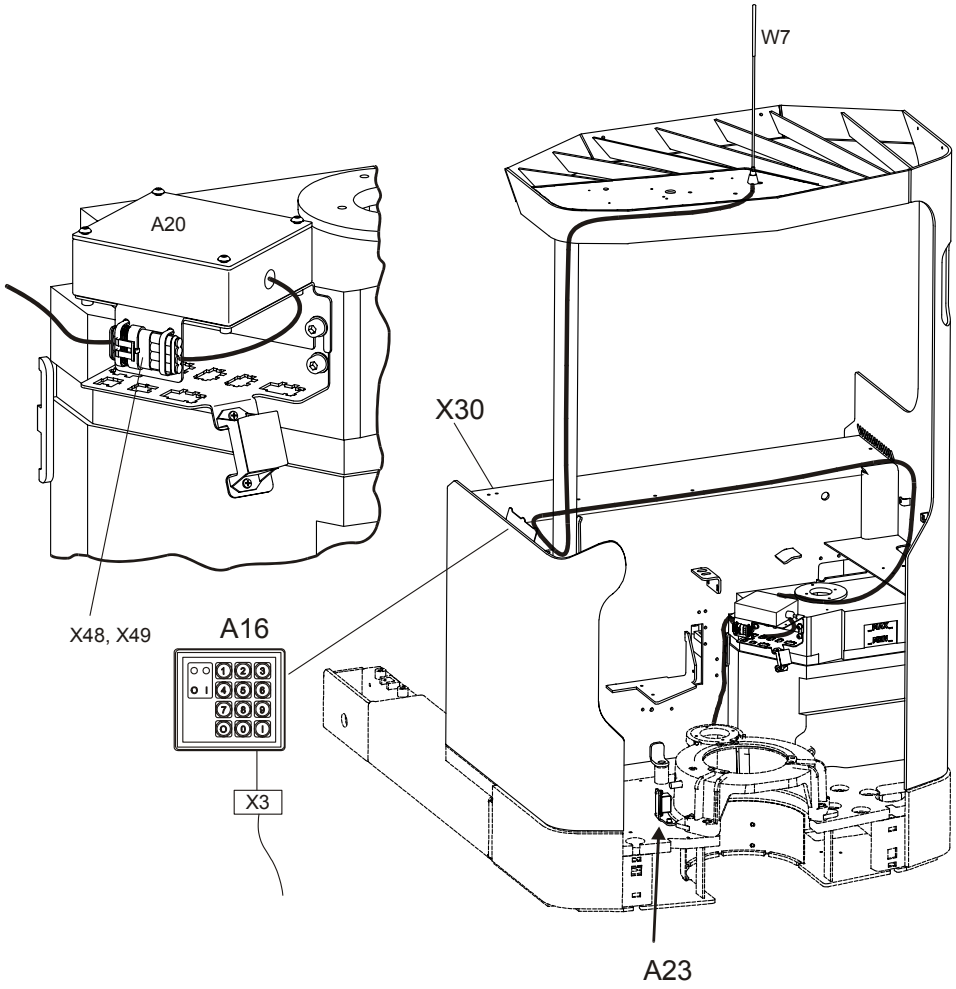
Symbol	Designation/function	Pic-ture
A16	Keyboard	
A20	TLS, CU	
A23	TLS, Shock sensor	
X3	Contact	
X30	Contact	
X48	Contact	
X49	Contact	
W7	Antenna	

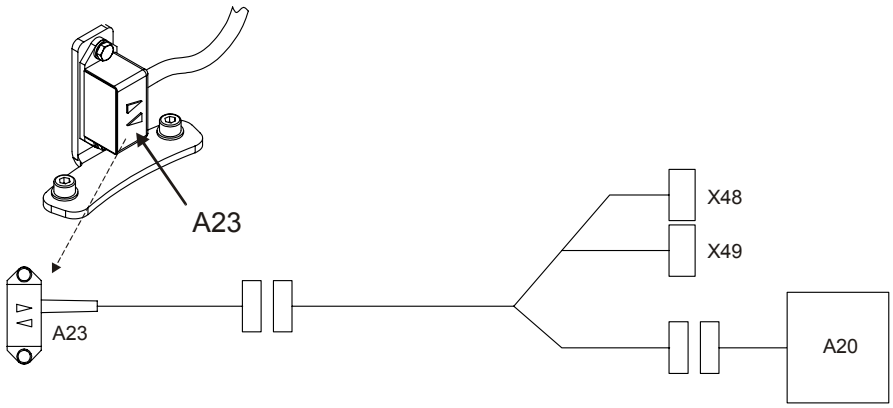
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Truck log system, code lock – 9420

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For further information, see Wiring diagram C code 5000.

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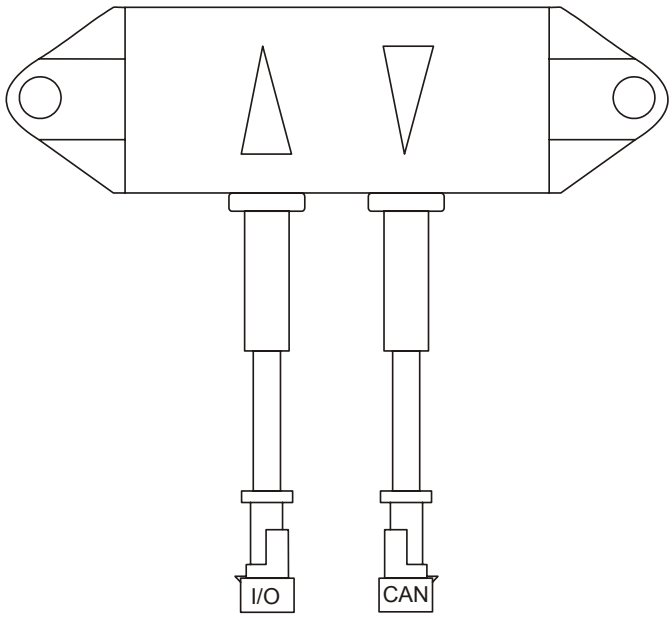
If the truck does not start:

- Check there is 48 V on cable 21 measured with a minus on cable 40.
- Check that there is a minus on contact X3:9. This activates the TLS function
- In the event of error code 3 (shock sensor activated) and 4 (truck disabled), see chapter “Warning codes without registration” C code 5710 in this manual.

For further information, see Davis Derby information.

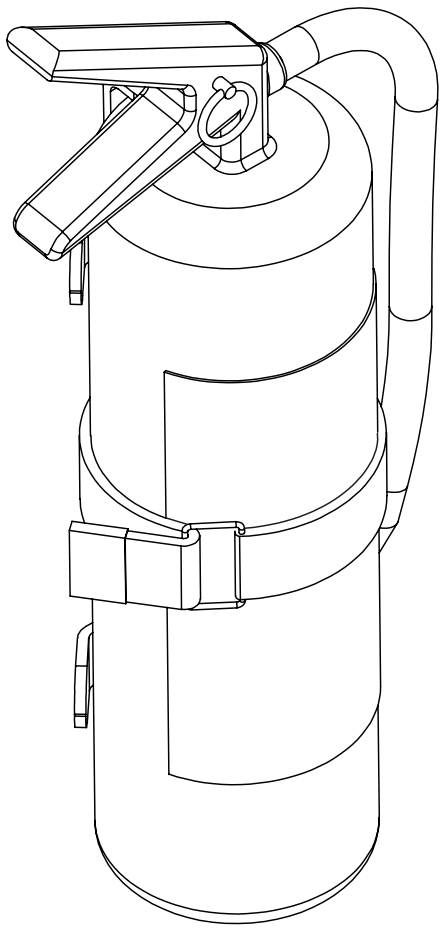
43.4 I/O Module

The I/O module is used to communicate with the electronic card [A5]. The module has 2 outputs that can be loaded with a maximum of 100mA, producing an output voltage of 48V. Communication with the I/O module is via the CAN bus. The inputs are not used.



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44-Extra equipment – 9500

44.1 Dry powder extinguisher

The truck is equipped with a fire extinguisher/powder extinguisher. The following information and instructions can be read on the extinguisher — follow the instructions carefully.

2 kg ABC Powder

13A 89BC

The letters signify:

A: Wood, paper, textiles

B: Liquids, oils

C: Gases

Extinguishing agent: Prestolit Ultra
Propellant:Nitrogen 15 bar
Functional range: -30° C to +60° C

CE-0409

The digits 13 and 89 represent the fire extinguisher's capacity for fires involving the specified materials.

In the event of fire, the powder extinguisher should be employed as follows:

1. **Remove the safety catch.**
2. **Aim the nozzle at the base of the flames**
3. **Press the handle down**

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44.1.1 Regular checks of the powder extinguisher – truck driver

The following points can be found on the powder extinguisher and these can also be found in the driver's manual for the truck.

- Check regularly that the pressure gauge indicator is in the green field. If the indicator is in the red field, the apparatus is useless and must be recharged.
- Recharge the extinguisher immediately after use. Contact an authorised service company.
- Make sure that the extinguisher is checked once a year by a qualified service engineer (from an authorised service company for fire protection) and that a workshop review is carried out every 10 years.

Only material/parts approved by the manufacturer may be used.

44.1.2 Inspection of powder extinguisher in service inspection of the truck

The powder extinguisher must be checked once a year in connection with servicing of the truck.

- Check that the pressure gauge indicator is in the green field. If the indicator is in the red field, the apparatus is useless and must be recharged.
- Check that the powder extinguisher is intact and in working order and is in the correct location in the truck.
- If the extinguisher does not appear to function satisfactorily, make sure that an authorised service company is contacted.

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45-Instructions for destruction

45.1 General

These instructions have been drawn up as a part of BT's environment management program. An important motive is, by taking nature into consideration, to economize with resources. In other words, you should try to recycle material as far as possible, thus minimising the discharge of environmentally ha-zardous substances.

Dismantling instructions are designed for an F code (truck family) and then divided into different C codes. These C codes are:

- 0000 Chassis
- 1000 Motors
- 2000 Transmission/drive transmission
- 3000 Brakes/belt/wheel system
- 4000 Steering system
- 5000 Electrical system
- 6000 Hydraulics/pneumatics
- 7000 Working function - lift mast
- 8000 Auxiliary/installation equipment
- 9000 Accessories/optional equipment

The instructions do not tell you the type of material the parts are made of, but refer you to different material containers where the parts should be collected. Some plastics are marked, which means the instructions refer to the marking to determine the collection container to use.

45.2 Procedure

When sorting a component part you must know what plastic parts, liq-uids, environmentally hazardous substances and metals that it includes.

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45.3 Abbreviations

The following abbreviations for Service Manuals and plastic materials are used in the dismantling instructions. Abbreviations used are:

SM = Service Manual

PE = Polyethene

PP = Polypropylene

PUR = Polyurethane

PVC = Polyvinyl chloride

PC = Polycarbonate

PMMA = Plexiglass

ABS = Acrylonitrile-butadiene-styrene

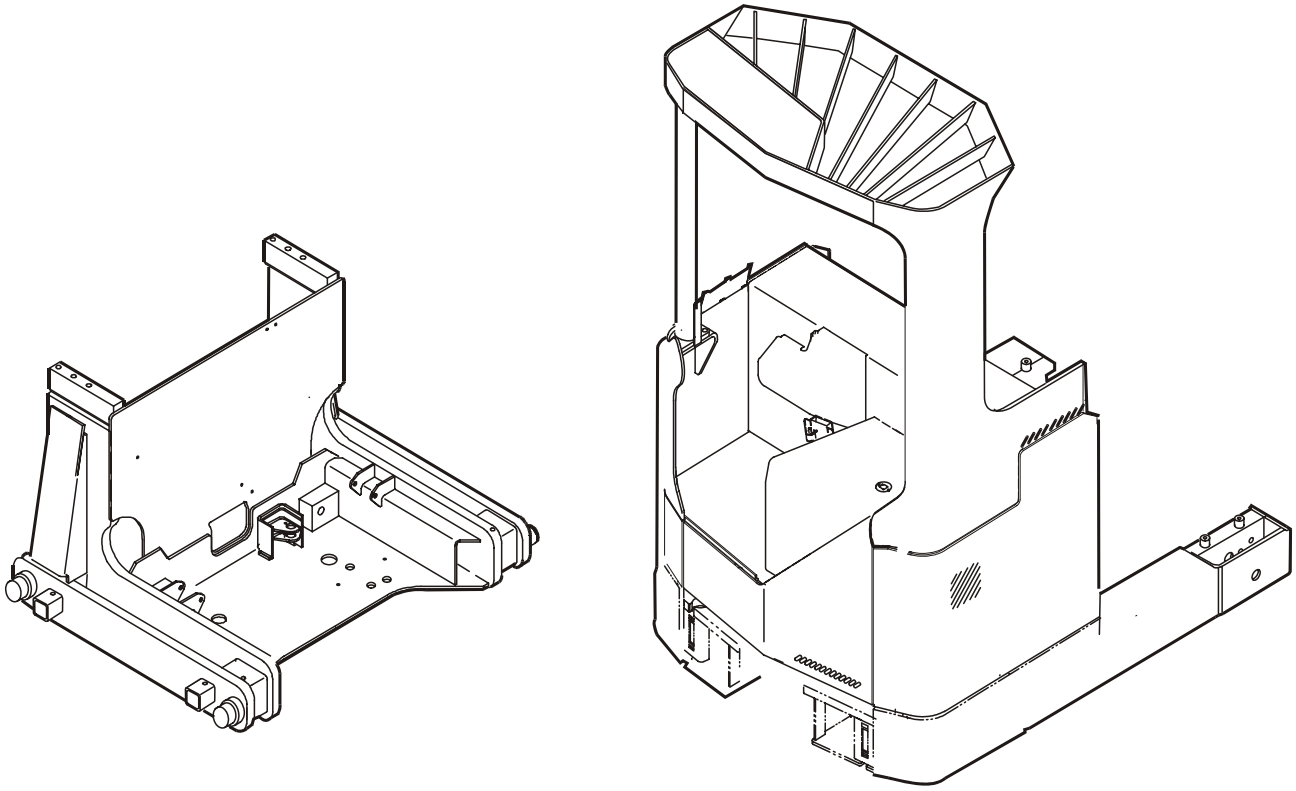
45.4 Sorting

The sorting method for component parts is based on how you can recycle the parts and whether they must be taken care of in a special way.

- Plastics must first and foremost be sorted into recyclable and **non**-recyclable plastics. Plastics that can be recycled must be subdivided to differentiate between the different types of plastics. Instructions either denote in which container the plastic should be placed or there is a reference to the material marking on the plastic component. In those cases where it is stated in which container the plastic part should be placed, this is done by stating the abbreviation for the plastic in question.
  Sorting is not necessary for non-recyclable plastics. These are placed in the container intended for combustible material.
- Iron and steel scrap is sorted separately.
- Composite scrap that is difficult to dismantle and which contains different metals such as steel, aluminium, copper and other materials, e.g. plastics, should be sorted separately.
- Oil is collected in the intended container.
- Oil filters are collected in the intended container.
- Parts contaminated by oil, such as hydraulic hoses and tanks, should be sorted separately.
- Batteries should be returned to the manufacturer, either directly to the manufacturer or through BT.
- Electronic scrap should be sorted from other scrap.
- Cables should be removed and collected separately.
- Small parts such as screws, bolts, nuts, washers, etc. are not included in the dismantling instructions. These should be placed in the container intended for iron and steel scrap.

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45.5 Frame/chassis (0300)



Main mast mounting (to the left) and cab with support arm (to the right).

45.5.1 Dismantling

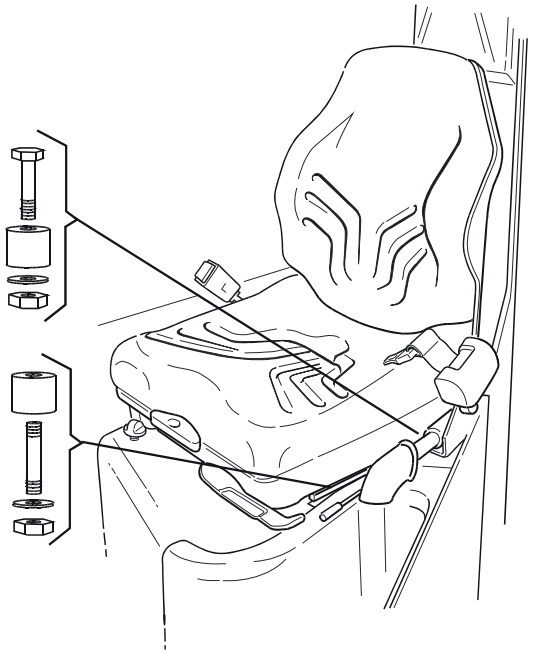
- For the disassembly procedure see C-code 0300.

Material handling

The main mast mounting, cab and support arm should be treated as iron and steel scrap.

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45.6 Operator's seat, cushion (0620)



Operator’s seat for RR-B.

45.6.1 Dismantling

- Remove the seat.
- Dismantle the back rest cushion, seat cushion and head rest from the seat frame.
- If fitted, cut loose the seat belt.

Material handling

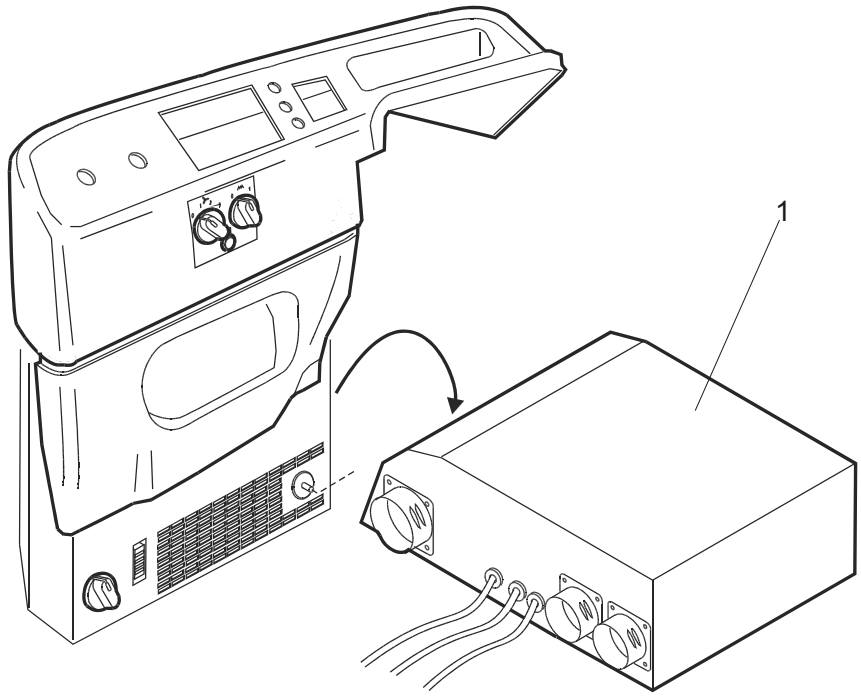
Place the seat frame in a container intended for iron and steel scrap.

Place the seat cushion, back rest cushion, headrest and seat belt in a container intended for combustible material.

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45.7 Cab heating/ventilation (0630)



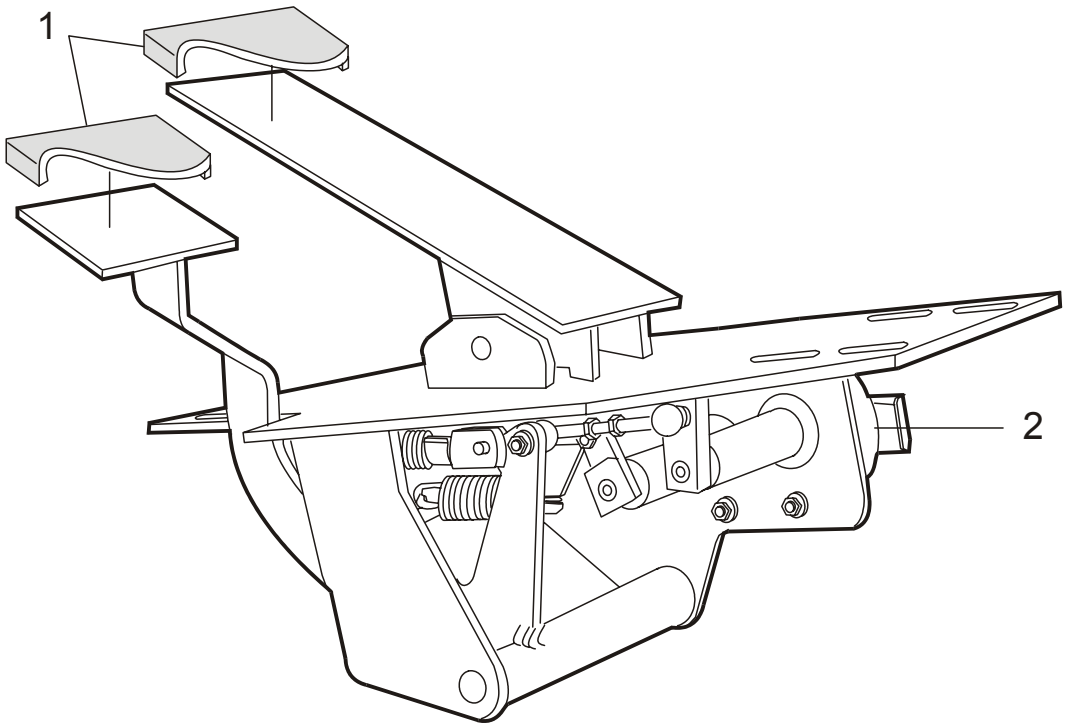
45.7.1 Dismantling

- Remove the ventilation equipment (1).

Material handling

Place the ventilation equipment in the container intended for electronic scrap.

45.8 Driver controls (0640)



45.8.1 Dismantling

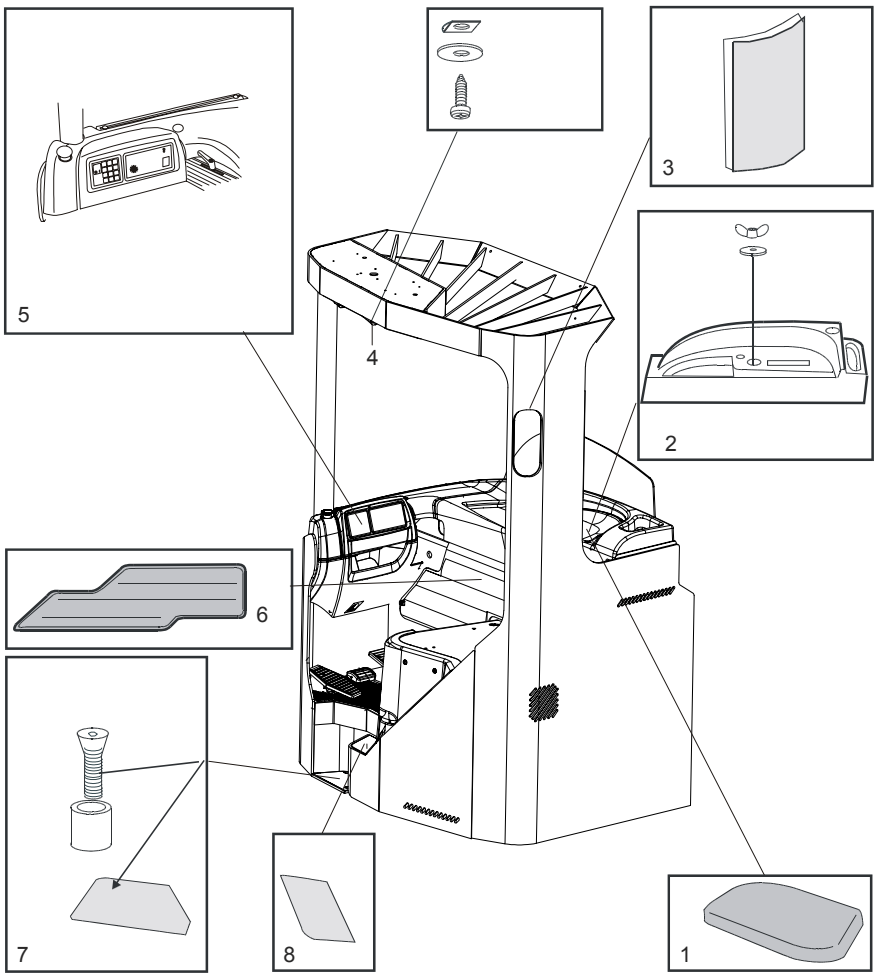
- Remove the pedal rack.
- Remove the rubber surface (1) from the pedals.
- Remove the potentiometer (2).

Material handling

Place the pedal rack in a container intended for iron and steel scrap.
Place the pedal rubber in a container intended for combustible material.
Place the potentiometer in a container intended for electronic scrap.

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45.9 Interior fittings RR-B (0680)



Interior fittings for RR-B.

45.9.1 Dismantling

- Remove the elbow cushion (1).
- Remove the elbow panel (2).
- Remove the headrest cushion (3).
- Remove the ceiling panel (4).
- Remove the instrument panel (5).
- Remove the side panel (6).
- Remove the rubber anti-skid pads (7, 8).

Instructions for destruction

Interior fittings RR-B (0680)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Material handling

Place the armrest cushion in the container intended for combustible material.

The armrest panel has been material coded and must be placed in the container intended for that material.

Place the headrest cushion in the container intended for combustible material.

Place the ceiling panel in the container intended ABS material.

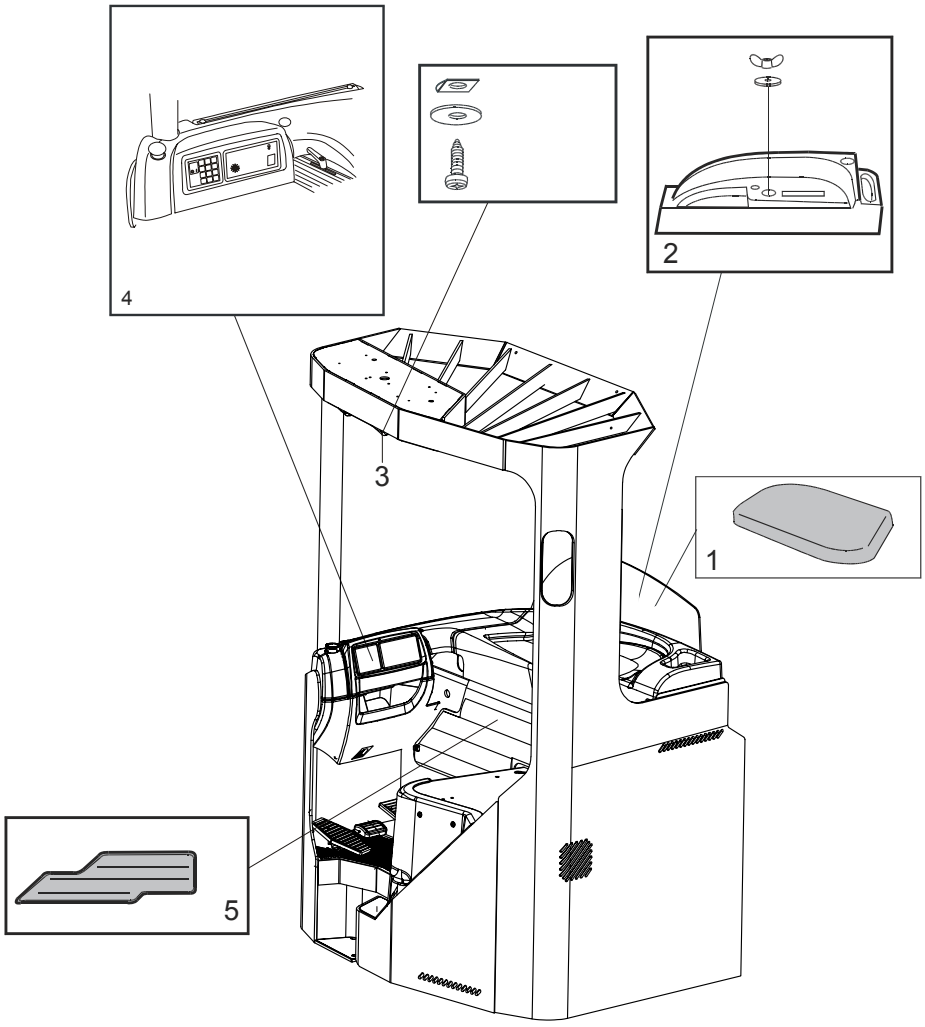
The instrument panel has been material coded and must be placed in the container intended for that material.

Place the side panel in the container intended for combustible material.

Place the rubber anti-skid pads in the container intended for combustible material.

 © BT Europe AB

45.10 Interior fittings RR-E (0680)



Interior fittings for RR-E.

45.10.1 Dismantling

- Remove the armrest cushion (1) and the armrest panel (2).
- Remove the ceiling panel (3).
- Remove the instrument panel (4).
- Remove the side panel (5).

Instructions for destruction

Interior fittings RR-E (0680)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Material handling

Place the armrest cushion in the container intended for combustible material.

The armrest panel has been material coded and must be placed in the container intended for that material.

Place the ceiling panel in the container intended ABS material.

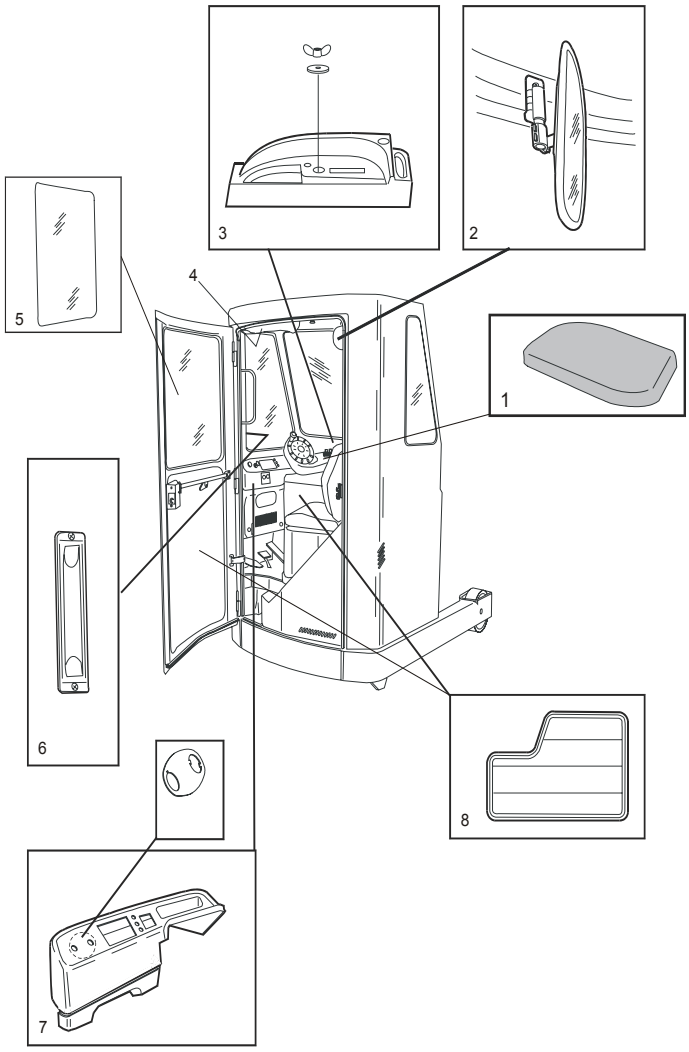
The instrument panel has been material coded and must be placed in the container intended for that material.

Place the side panel in the container intended for combustible material.

 © BT Europe AB

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.11 Interior fittings RR-B-CC (0680)



Interior fittings for RR-B-CC.

45.11.1 Dismantling

- Remove the elbow cushion (1).
- Remove the rearview mirror (2).
- Remove the elbow panel (3).
- Remove the ceiling panel (4).
- Remove all Plexiglas windows (5).
- Remove the ventilation unit (6).
- Remove the instrument panel (7).
- Remove the side panel (8).

Instructions for destruction

Interior fittings RR-B-CC (0680)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Material handling

Place the armrest cushion in the container intended for combustible material.

Place the rearview mirror in the container intended for complex scrap.

The armrest panel has been material coded and must be placed in the container intended for that material.

Place the ceiling panel in the container intended ABS material.

Place the Plexiglas in the container intended for PMMA.

The ventilation unit has been material coded and must be placed in the container intended for that material.

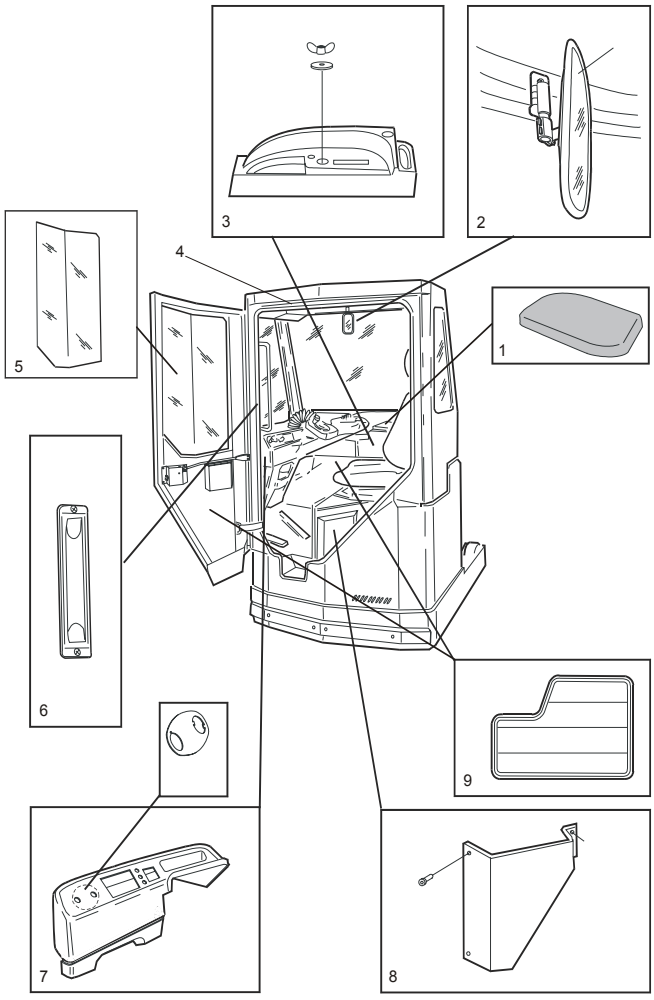
The instrument panel has been material coded and must be placed in the container intended for that material.

Place the side panel in the container intended for combustible material.

 © BT Europe AB

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.12 Interior fittings RR-E-CC (0680)



Interior fittings for RR-E-CC.

45.12.1 Dismantling

- Remove the elbow cushion (1).
- Remove the rearview mirror (2).
- Remove the elbow panel (3).
- Remove the ceiling panel (4).
- Remove the Plexiglas window (5).
- Remove the ventilation unit (6).
- Remove the instrument panel (7).
- Remove the cover panel (8).
- Remove the side panel (9).

Instructions for destruction

Interior fittings RR-E-CC (0680)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

Material handling

Place the armrest cushion in the container intended for combustible material.

Place the rearview mirror in the container intended for complex scrap.

The armrest panel has been material coded and must be placed in the container intended for that material.

Place the ceiling panel in the container intended ABS material.

Place the Plexiglas in the container intended for PMMA.

The ventilation unit has been material coded and must be placed in the container intended for that material.

The instrument panel has been material coded and must be placed in the container intended for that material.

The cover panel has been material coded and must be placed in the container intended for that material.

Place the side panel in the container intended for combustible material.

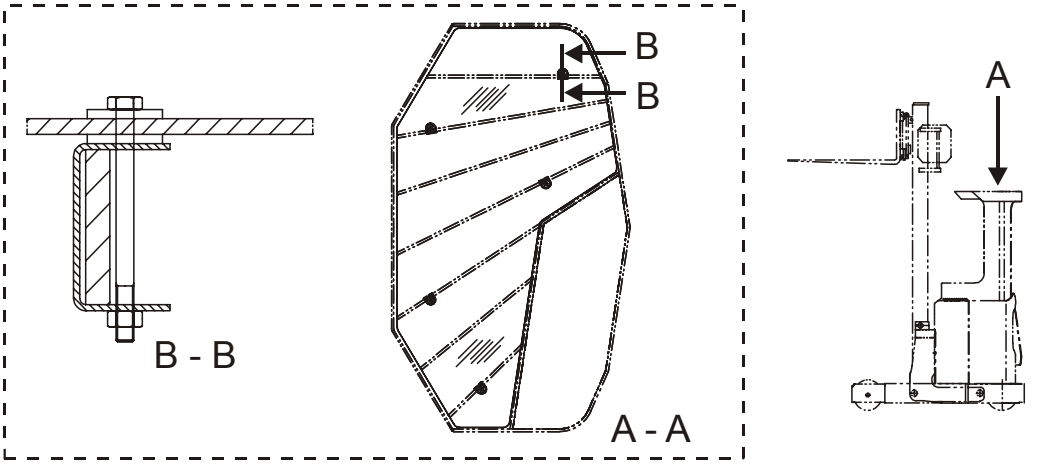
 © BT Europe AB

Instructions for destruction

Rollover guard/head guard (0810)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.13 Rollover guard/head guard (0810)



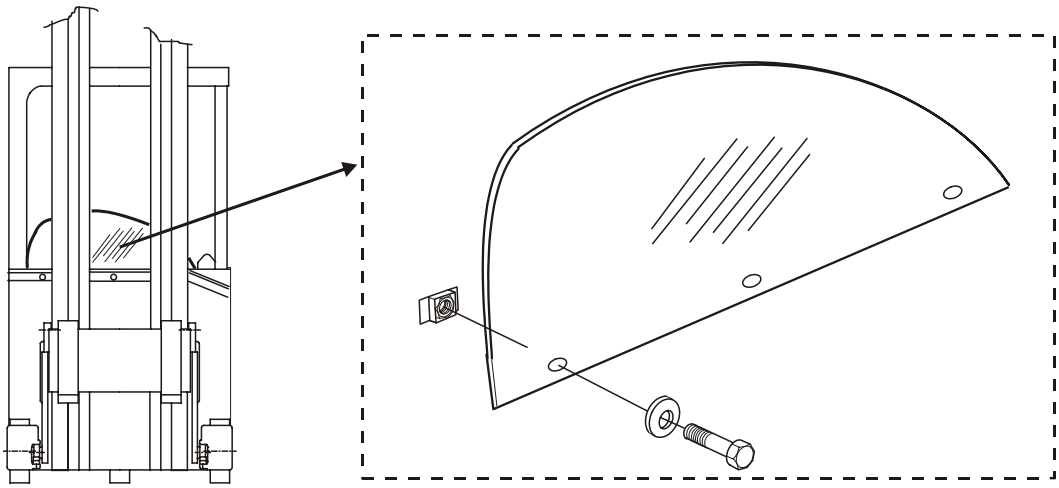
45.13.1 Dismantling

- Remove the protection plate.

Material handling

Place the protection plate in the container intended for PC.

45.14 Finger protectors (0820)



45.14.1 Dismantling

- Remove the finger protector.

Material handling

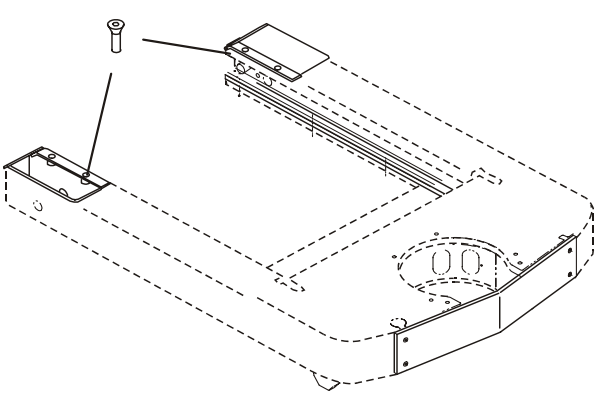
Place the finger protector in a container intended for PMMA.

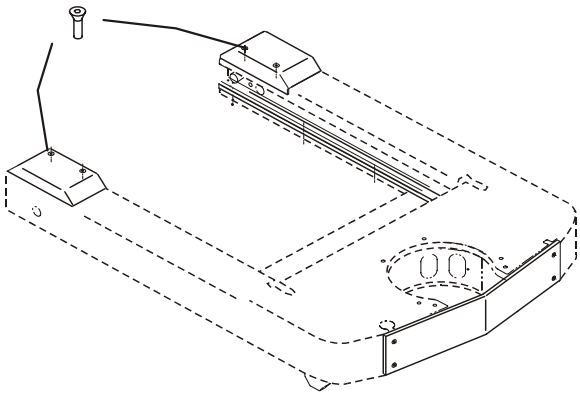
Instructions for destruction

Finger/foot protectors (0820)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.15 Finger/foot protectors (0820)





45.15.1 Dismantling

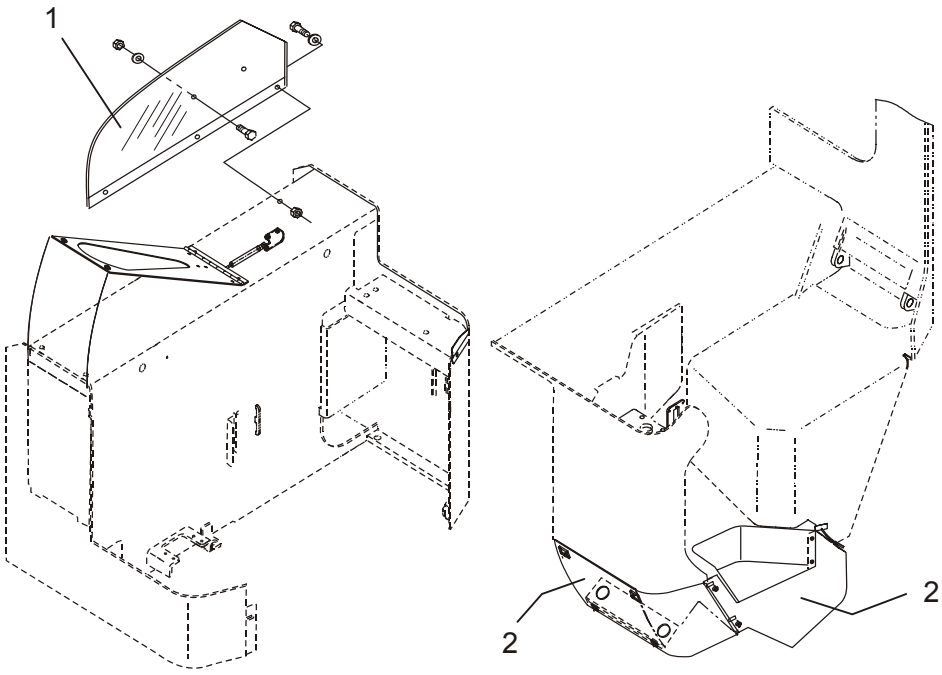
- Remove the foot protector.

Material handling

Place the foot protector in the container intended for iron and steel scrap.

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.16 Finger/foot protectors (0820)



Finger and foot protectors for the RR-E.

45.16.1 Dismantling

- Remove the finger protector (1).
- Remove the foot protector (2).

Material handling

Place the finger protector (1) in the container intended for PMMA.

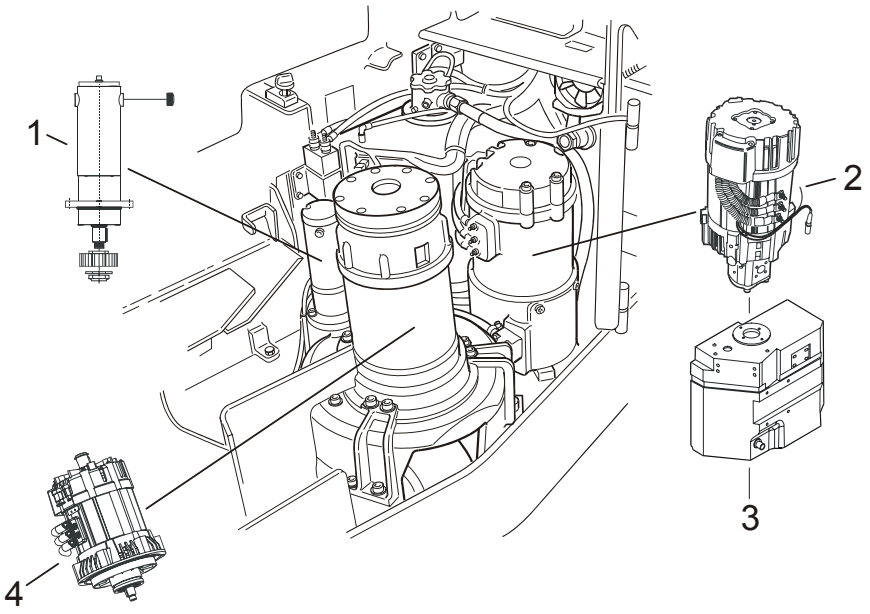
Place the foot protector (2) in the container intended for PE.

Instructions for destruction

Electric motors (1700)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.17 Electric motors (1700)



Steering motor (1), pump motor (2) and travel drive motor (3).

45.17.1 Dismantling

- Remove the cables.
- Remove the steering motor.
- Remove the pump motor including the pump (see 6100).
- Remove the travel drive motor from the transmission.

Material handling

Cables are placed in a container intended for cables.

Place the motors in the container intended for complex scrap.

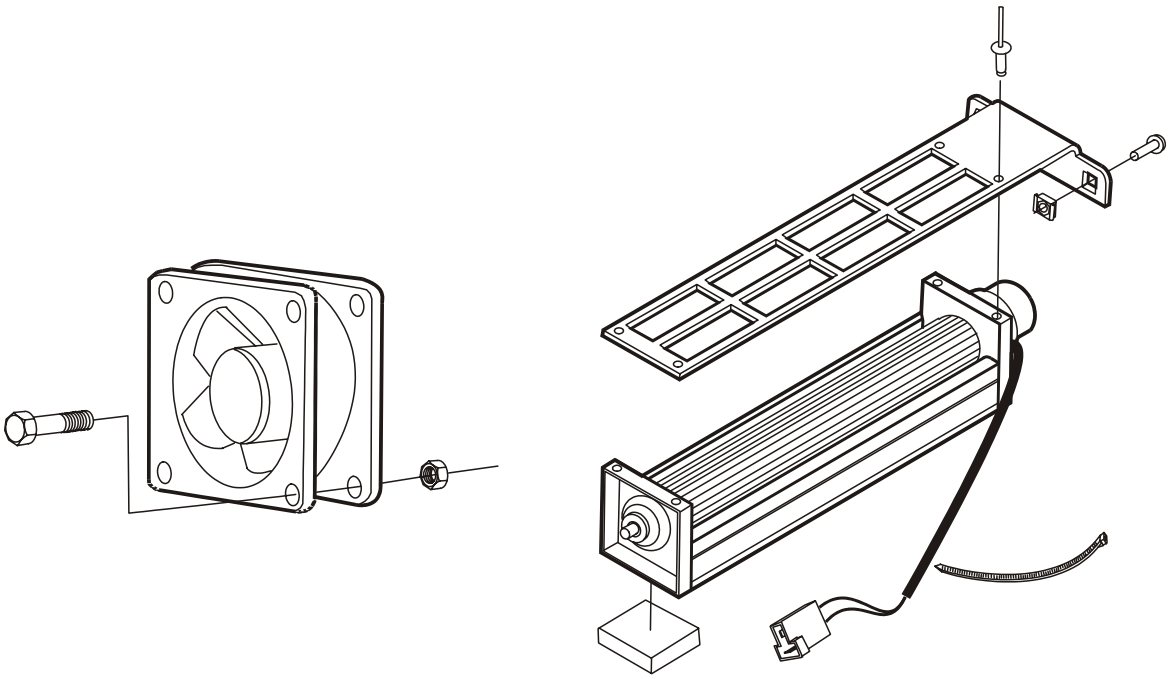
 © BT Europe AB

Instructions for destruction

Electric fan motor (1740)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.18 Electric fan motor (1740)



45.18.1 Dismantling

- Remove the cables.
- Remove the fans.

Material handling

Cables are placed in a container intended for cables.

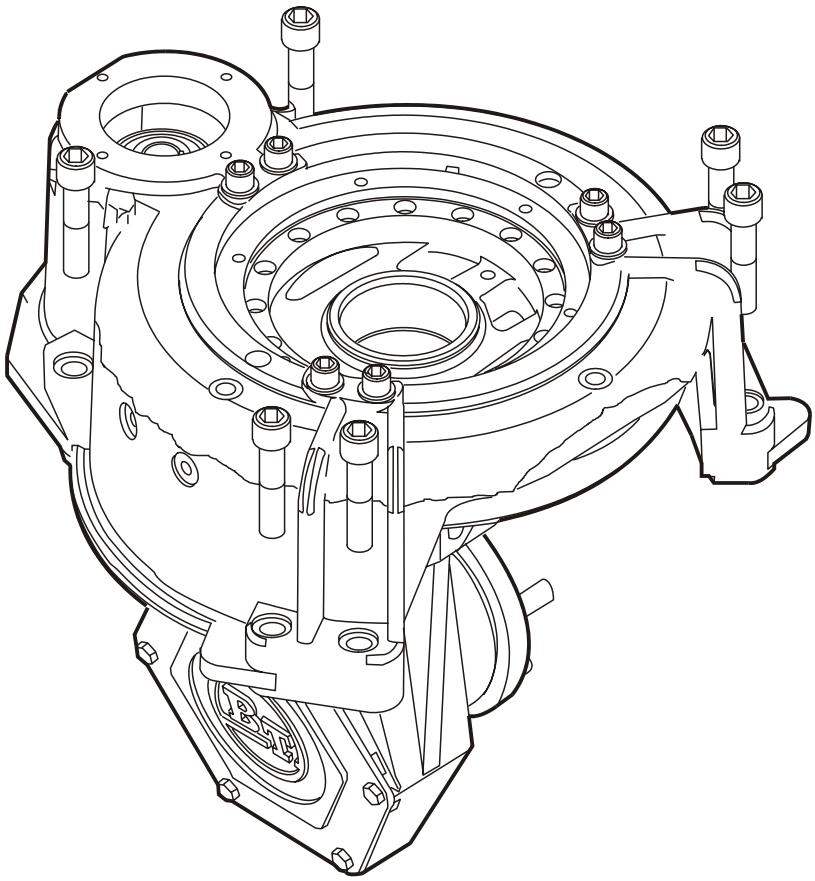
Place the fan in the container intended for complex scrap. The fan wings of the left fan must be placed in the container intended for combustible material.

Instructions for destruction

Drive unit, final gear (2500)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.19 Drive unit, final gear (2500)



45.19.1 Dismantling

- Drain the oil from the gearbox.
- Remove the gearbox from the drive motor.
- Remove the drive wheel.

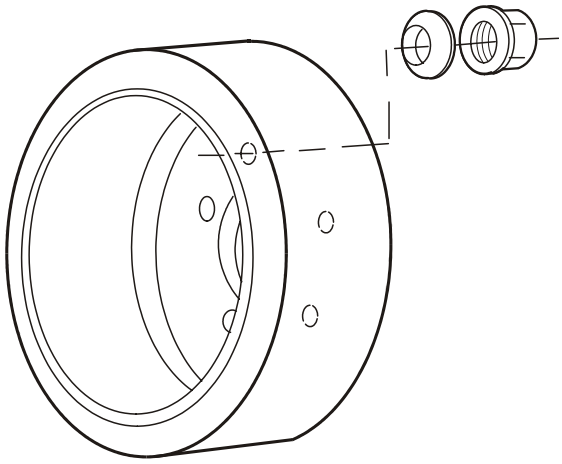
Material handling

The oil is poured into a container intended for oil (classified as hazardous waste within the EU).

The gearbox is placed in a container intended for iron and steel scrap.

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
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45.20 Wheels (3500)



Drive wheel.

45.20.1 Dismantling

- Remove the drive wheel and support arm wheels.

Material handling

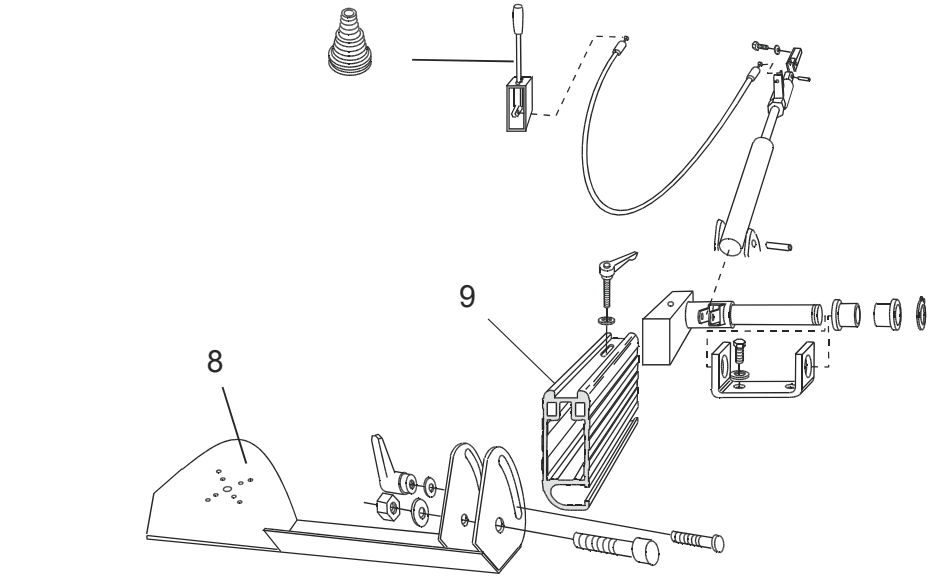
If possible, remove the vulcanization from the rims. Place the vulcanization in a container intended for combustible material and the rims in a container intended for iron and steel scrap. Otherwise place the wheels in a container intended for complex scrap.

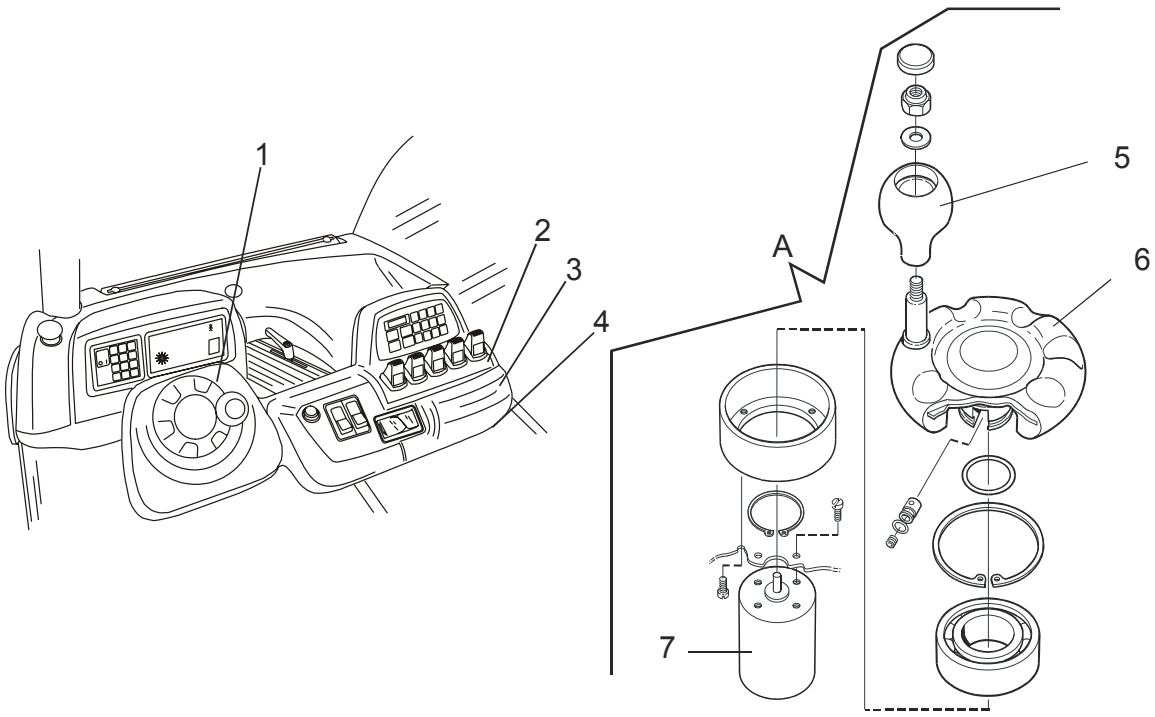
Instructions for destruction

Electric steering system (4300)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.21 Electric steering system (4300)





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Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.21.1 Dismantling

- Remove the wrist support (1).
- Remove the arm cushion (2).
- Remove the upper (3) and lower (4) steering panels.
- Remove the knob on the steering wheel (5), the steering wheel (6) and the motor (7).
- Remove the console (8) and the arm (9).

Material handling

Place the wrist guard, the control cushion and knob from the steering wheel in a container intended for combustible material.

The upper and lower steering panels have been material coded and must be placed in the container intended for that material.

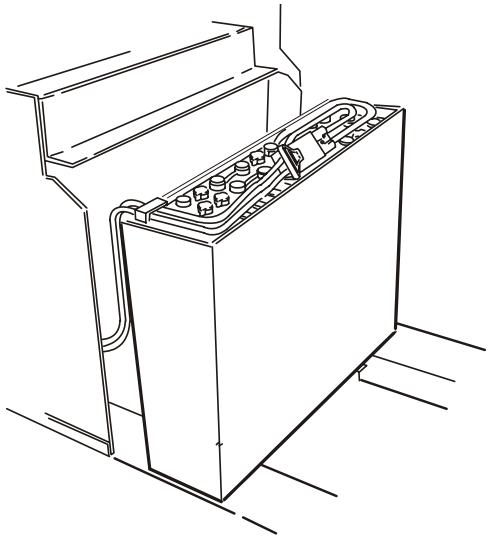
Place the motor, steering wheel and arm in a container intended for complex scrap.

Place the console in a container intended for iron and steel scrap.

Place the other fittings in a container intended for combustible material or complex scrap.

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.22 General electric equipment (5100)



Truck battery.

45.22.1 Dismantling

- Remove the cables.
- Remove the battery.

Material handling

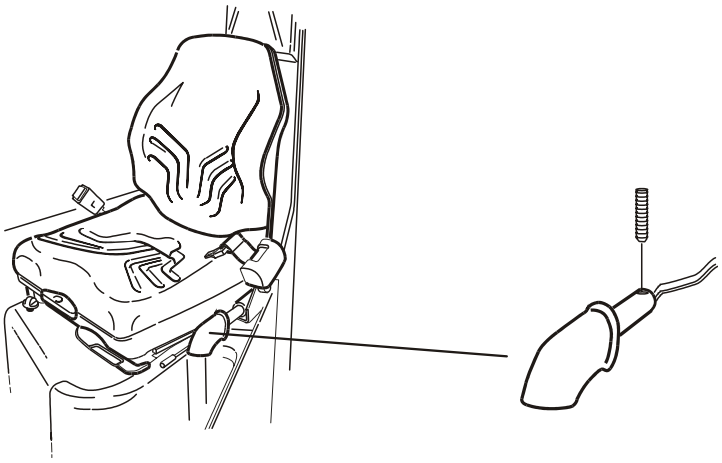
Cables are placed in a container intended for cables.

The battery (classified as hazardous waste within the EU) should be returned to the battery manufacturer or the manufacturer's representative (see the rating plate on the battery). The battery can also be handed in to a BT representative, who bears responsibility for returning the battery to the manufacturer.

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Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.23 Manöversystem, körfunktion (5300)



Travel direction selector.

45.23.1 Dismantling

- Remove the handle.
- Remove the cables from inside the handle.

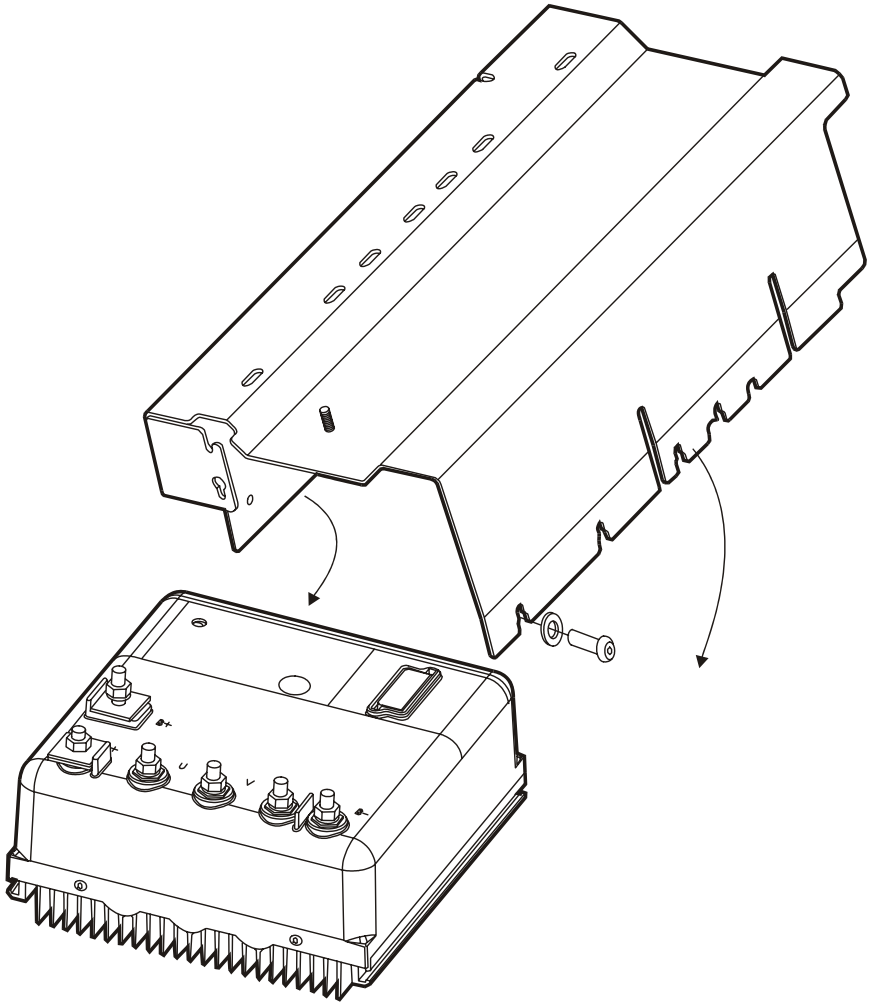
Material handling

Place the cables in the container intended for cables.

Place the handle in the container intended for complex scrap.

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.24 Power system, drive function (5400)



Frequency converter.

45.24.1 Dismantling

- Remove the guard.
- Remove the cables.
- Remove the frequency converter.

Material handling

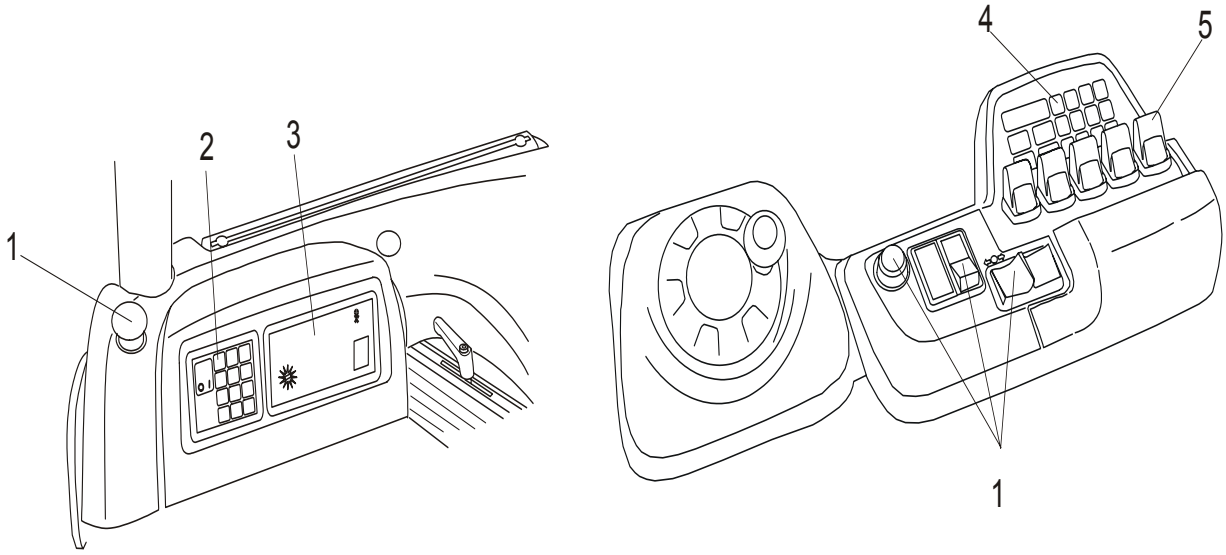
Place the guard in a container intended for iron and steel scrap.

Cables are placed in a container intended for cables.

Place the frequency converter in a container intended for electronic scrap.

 © BT Europe AB

45.25 Control system, operation function (5500)



Control panel (left) and instrument panel (right).

45.25.1 Dismantling

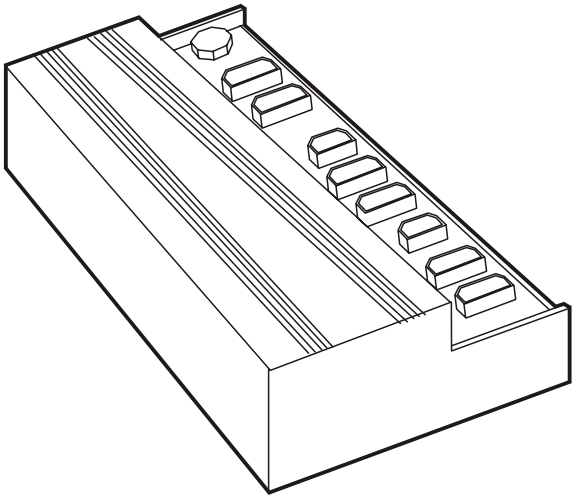
- Remove the switches (1), keypad (2), display (3), height indicator (4), potentiometer (5) and associated cables.

Material handling

Place the component parts in the container intended for electronic scrap.

Place the cables in the container intended for cables.

45.26 Steering/protective electronics (5700)



Electronic circuit board.

45.26.1 Dismantling

- Remove the cables.
- Remove the electronic circuit board.

Material handling

Place the cables in the container intended for cables.

Place the electronic circuit board in the container intended for electronic scrap.

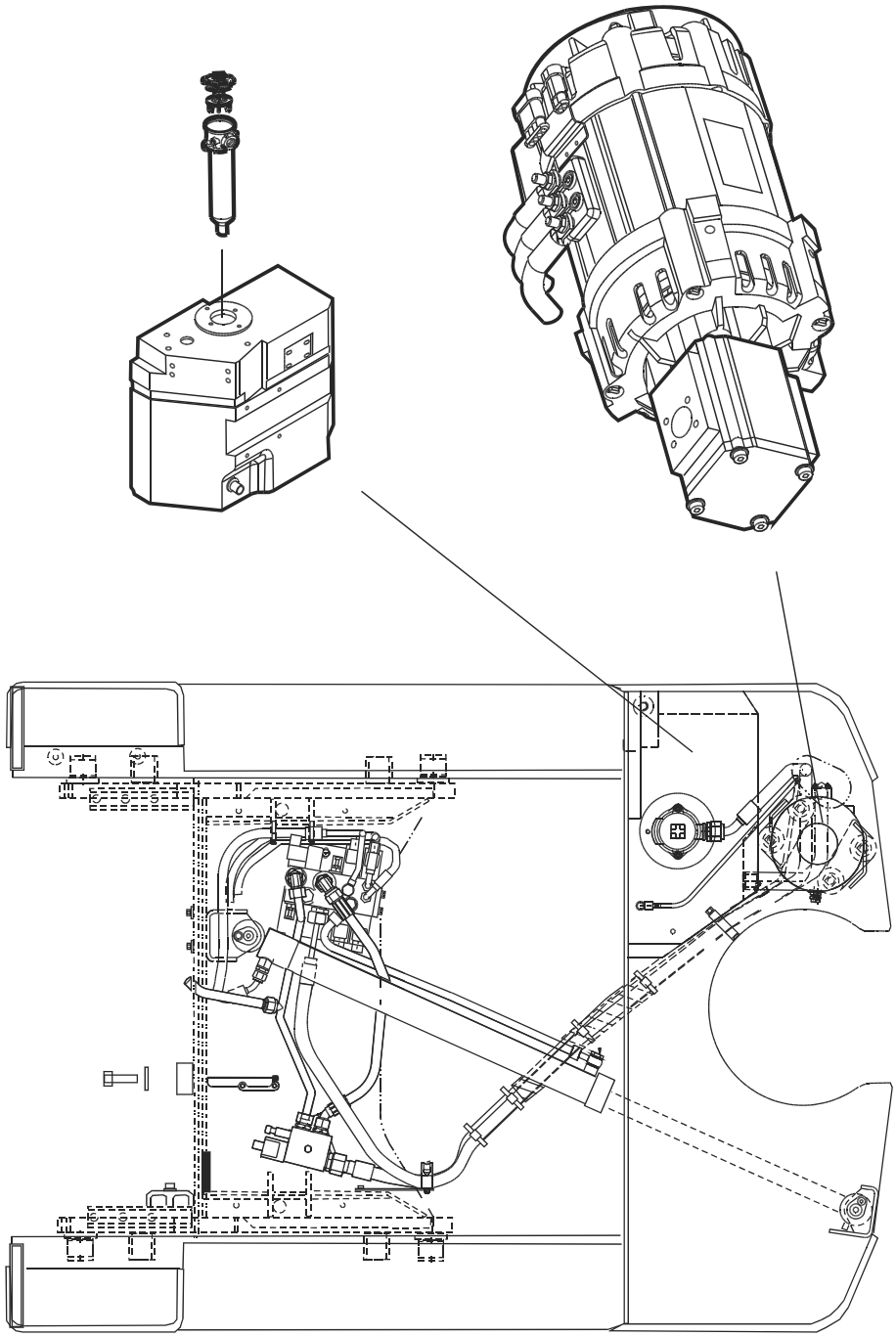
 © BT Europe AB

Instructions for destruction

Hydraulic unit (6100)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.27 Hydraulic unit (6100)



Hydraulic tank (at top left), hydraulic unit (at top right) and hydraulic pipes to the reservoir (bottom).

Instructions for destruction

Hydraulic unit (6100)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040

45.27.1 Dismantling

- Drain all oil from the hydraulic oil reservoir.
- Remove the oil filter from the oil reservoir.
- Remove the hydraulic lines.
- Remove the oil reservoir.
- Remove the hydraulic unit (motor + pump).

Material handling

Pour the oil into a container intended for oil (classified as hazardous waste within the EU).

Place the oil filter in the container intended for oil filters.

Place the hydraulic hoses in the container intended for oil-contaminated material.

Place the reservoir in the container intended PE.

Place the motor together with the pump in the container intended for complex scrap.

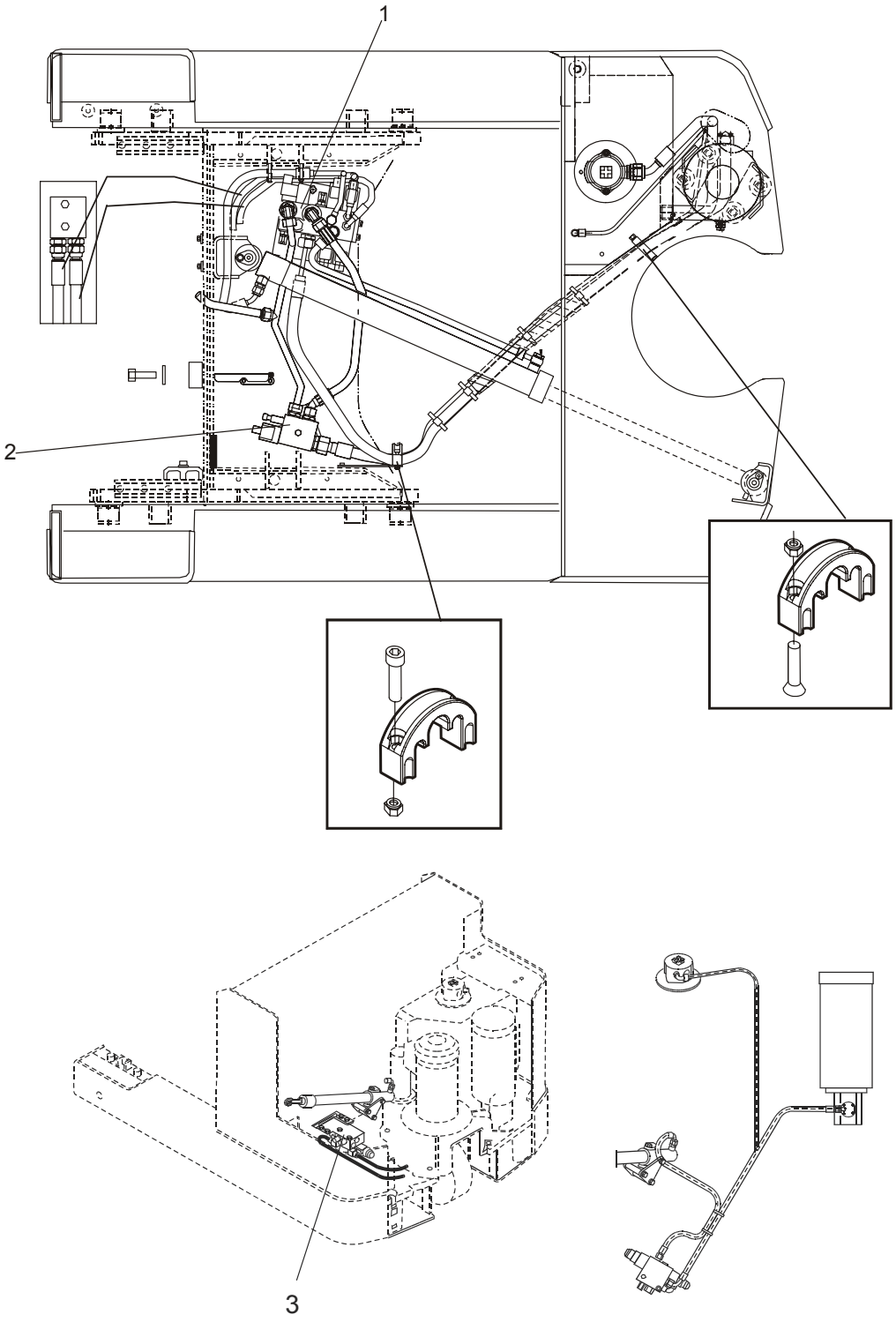
 © BT Europe AB

Instructions for destruction

Hydraulic system, fitted on the chassis (6200)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
Order number	**Date**
218920-040	2005-06-01

45.28 Hydraulic system, fitted on the chassis (6200)

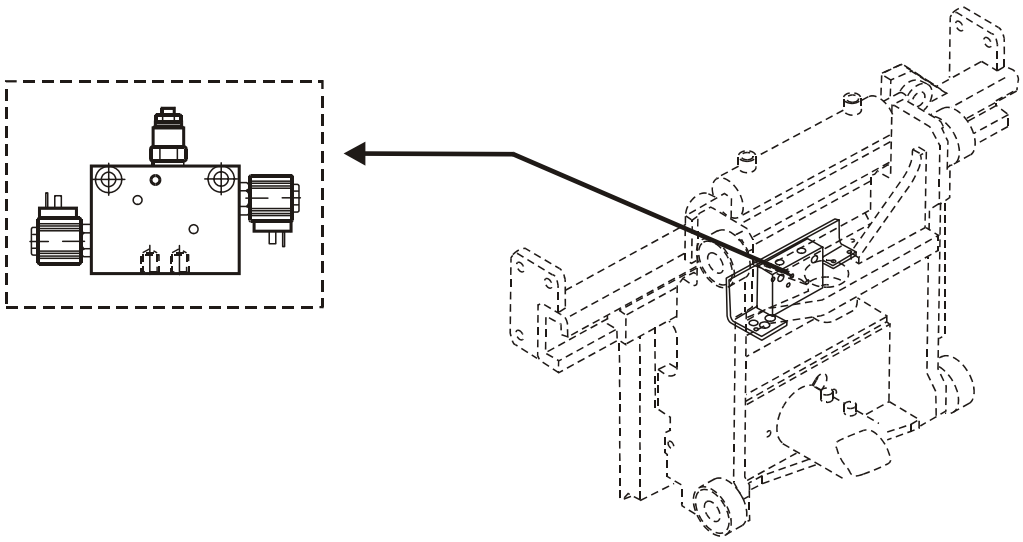


Main valve (1), valve (2) and hydraulic lines on top and the main valve (3) and hydraulic lines for cab tilting on the RR-E under.

Instructions for destruction

Hydraulic system, fitted on the chassis (6200)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
Date	**Order number**
2005-06-01	218920-040



Routing valve.

45.28.1 Dismantling

- Remove the hydraulic lines.
- Remove the valve plate.

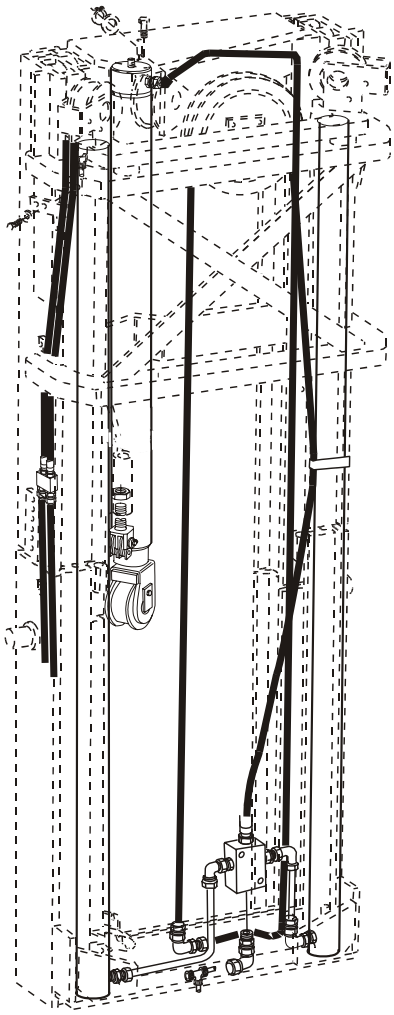
Material handling

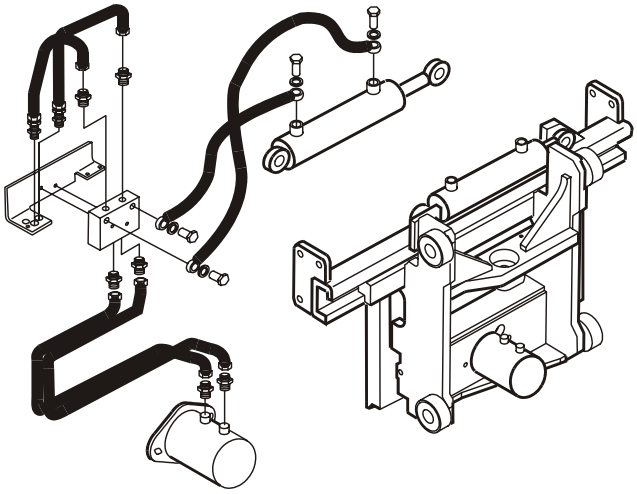
Place the hydraulic hoses in the container intended for oil-contaminated material.

Place the valve plate in the container intended for complex scrap.

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
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45.29 Hydraulic system, fitted on the mast (6300)





Hydraulic lines on mast (to the left) and fork carriage (to the right).

45.29.1 Dismantling

- Remove the hydraulic lines.

Material handling

Place the hydraulic hoses in the container intended for oil-contaminated material.

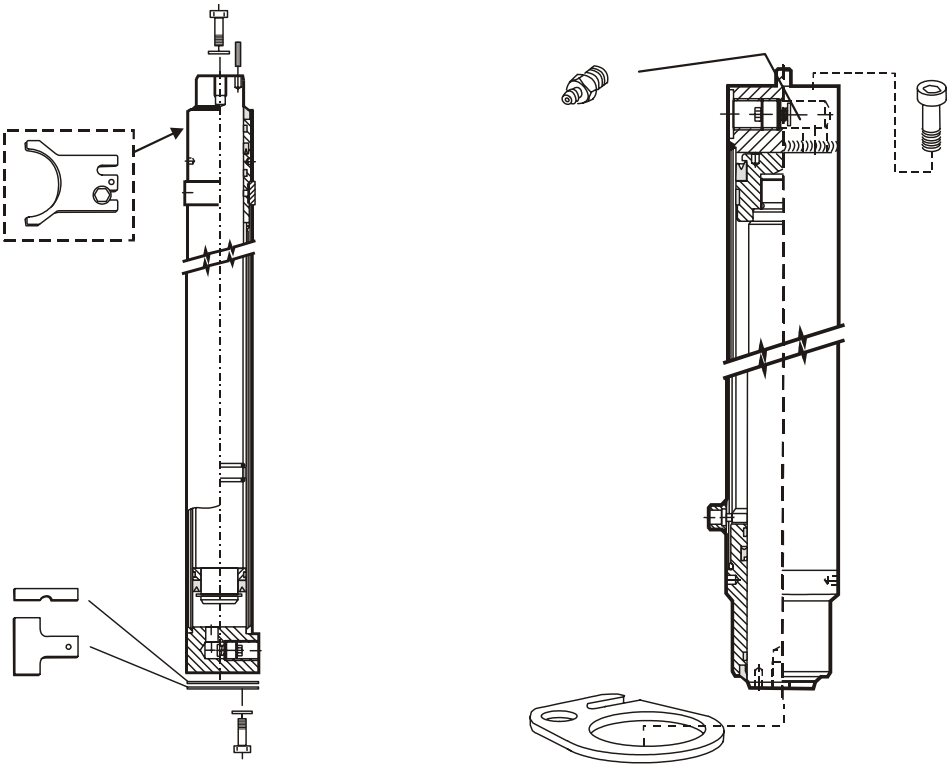
Place the hydraulic pipes in the container intended for iron and steel scrap.

Instructions for destruction

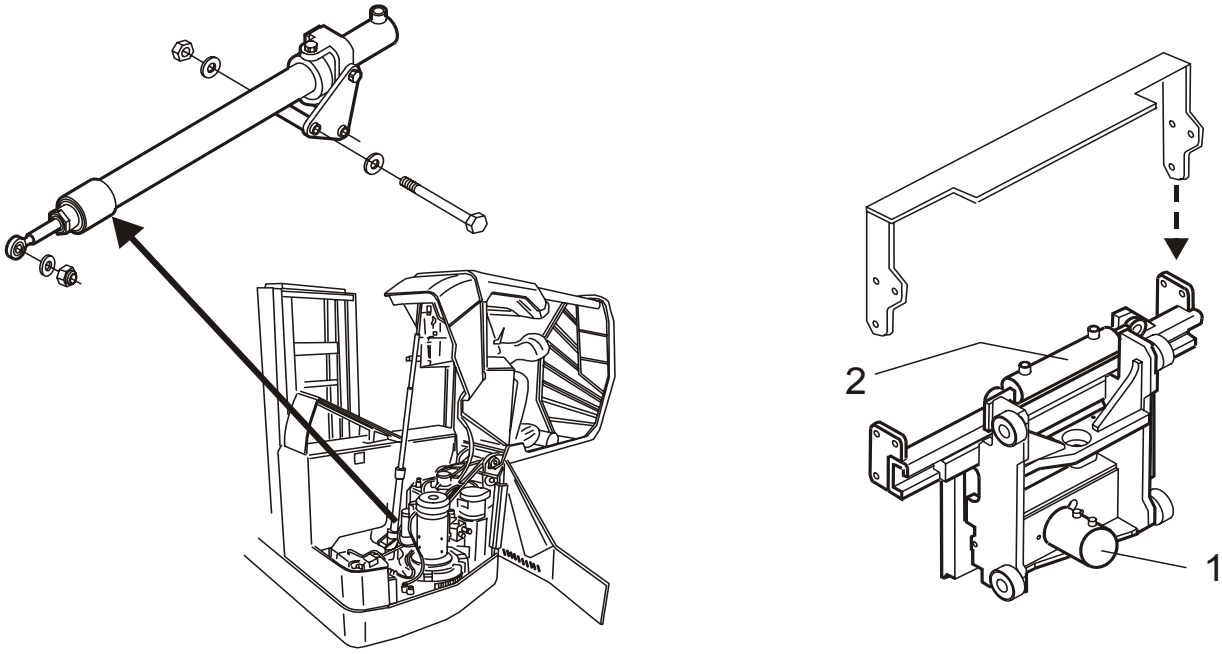
Hydraulcylindrar (6600)

T-code	Valid from serial number
403-414, 669-671, 716-718	713962-
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2005-06-01	218920-040

45.30 Hydraulcylindrar (6600)



Main lift cylinder (to the left) and free lift cylinder (to the right)

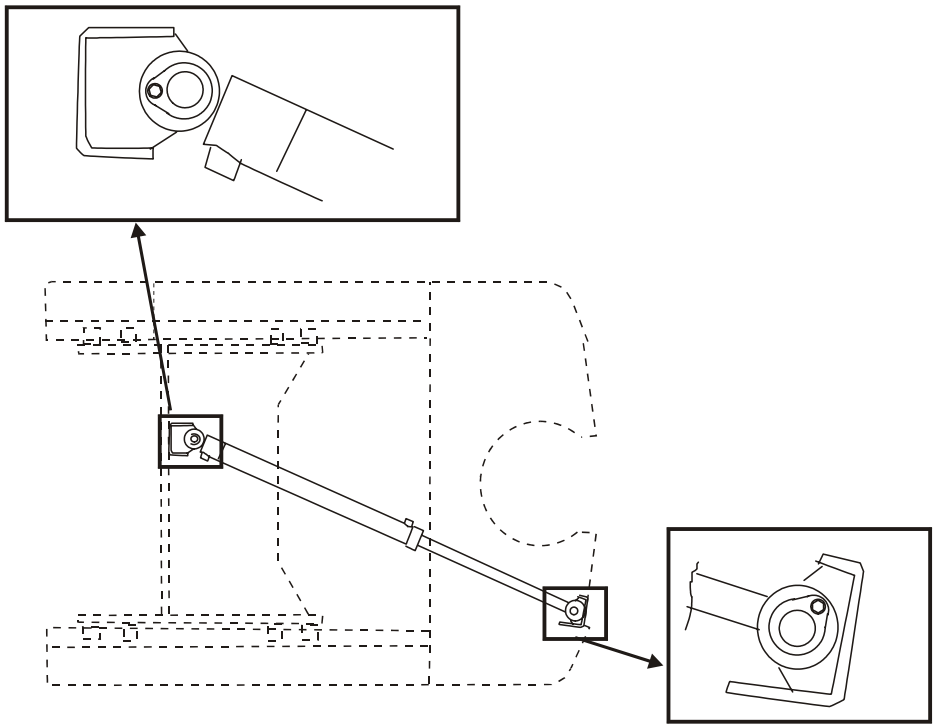


The cab cylinder for RR-E (to the right) and the tilt cylinder (1) and side-shift cylinder (2) to the right.

Instructions for destruction

Hydraulcylindrar (6600)

Valid from serial number	T-code
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Reach cylinder.

45.30.1 Dismantling

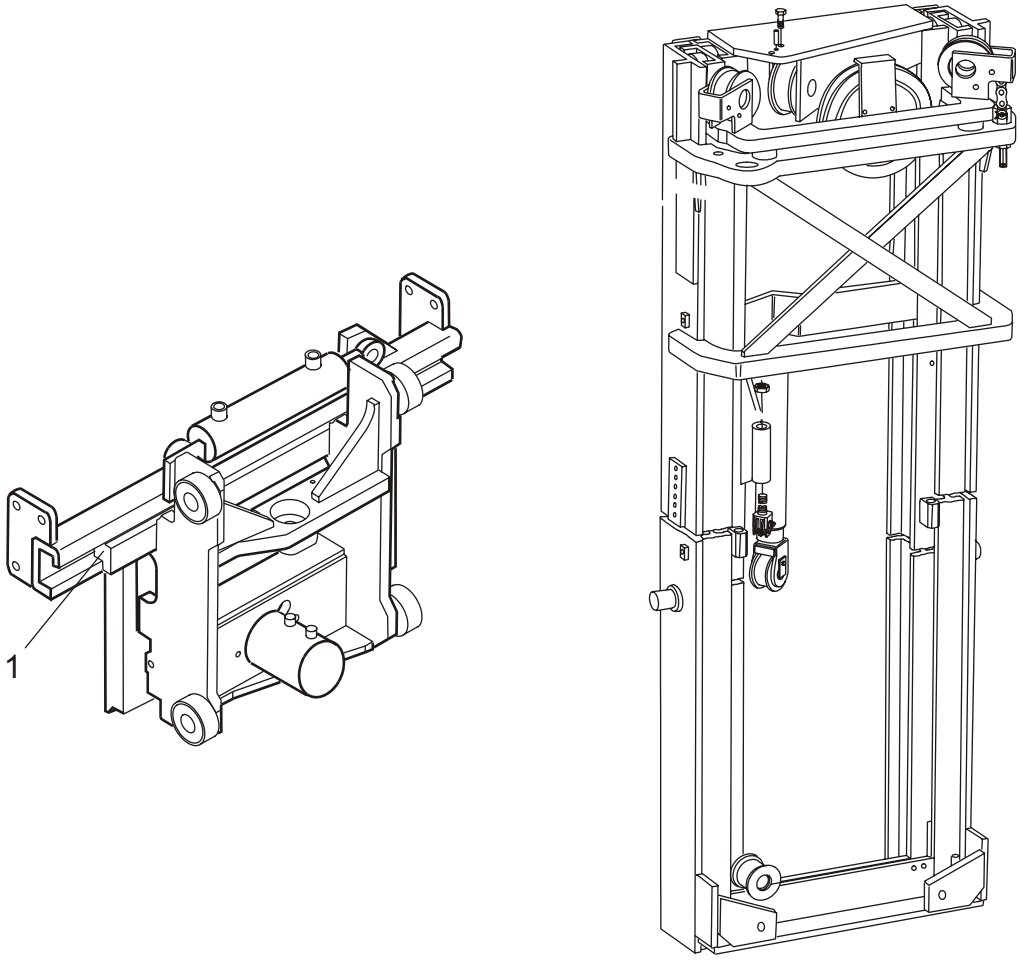
- Remove the cylinders.
- Drain all oil from the cylinders.
- Destroy the cylinders by cutting.

Material handling

Place the cylinders a container intended for iron and steel scrap.

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Date	**Order number**
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45.31 Main mast (7100)



Main mast fork carriage (to the left) and main mast (to the right).

45.31.1 Dismantling

- Refer to C-code 7100 regarding removal of the main mast fork carriage and the main mast itself.
- Remove the plastic components from the main mast.

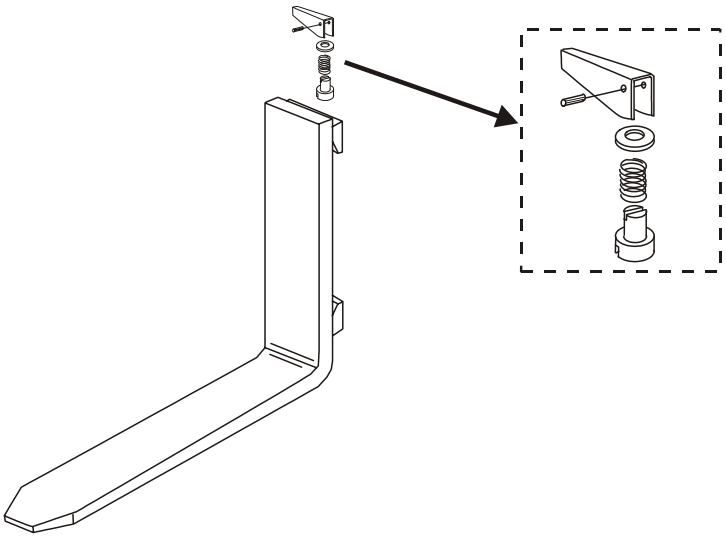
Material handling

The main mast fork carriage and the main mast itself should be treated as iron and steel scrap.

Place the sliding plate (1) of the fork carriage in the container intended for combustible material.

Place the plastic components in the container intended for combustible material.

45.32 Lift fork (7410)



45.32.1 Dismantling

- Remove the forks.

Material handling

The forks should be treated as iron and steel scrap.

45.33 Optional electric equipment (9300)

45.33.1 Dismantling

- Remove any optional equipment, such as tape recorders, work lights, warnings lights, cameras and TV monitors.
- Remove the cables.

Material handling

Place the cables in the container intended for cables.

Place tape recorders, cameras and TV monitors in the container intended for electronic scrap.

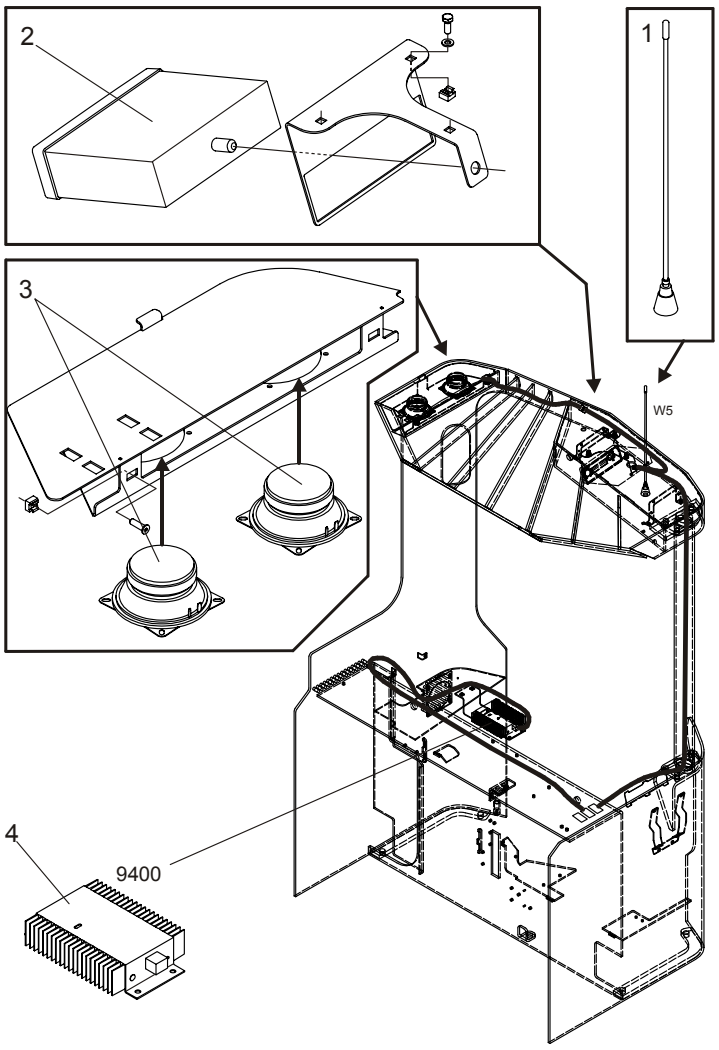
Place the other fittings in the container intended for complex scrap.

Instructions for destruction

Radio/CD player (9330)

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45.34 Radio/CD player (9330)



Radio/CD player for the truck.

45.34.1 Dismantling

- Remove the antenna (1).
- Remove the CD player (2).
- Remove the speaker (3).
- Remove the amplifier (4).

Material handling

Place the antenna in the container intended for complex scrap.

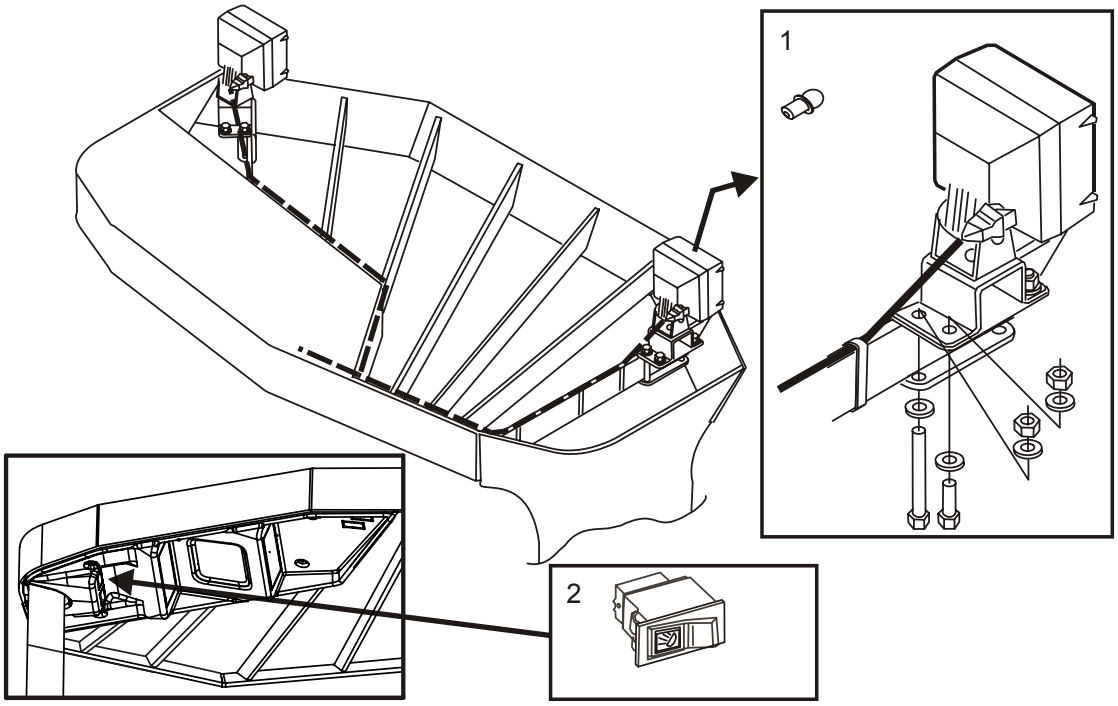
Place the CD player, speaker and amplifier in the container intended for electronic scrap.

Instructions for destruction

Extra work light (9360)

Valid from serial number	T-code
713962-	403-414, 669-671, 716-718
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45.35 Extra work light (9360)



Work light on the truck.

45.35.1 Dismantling

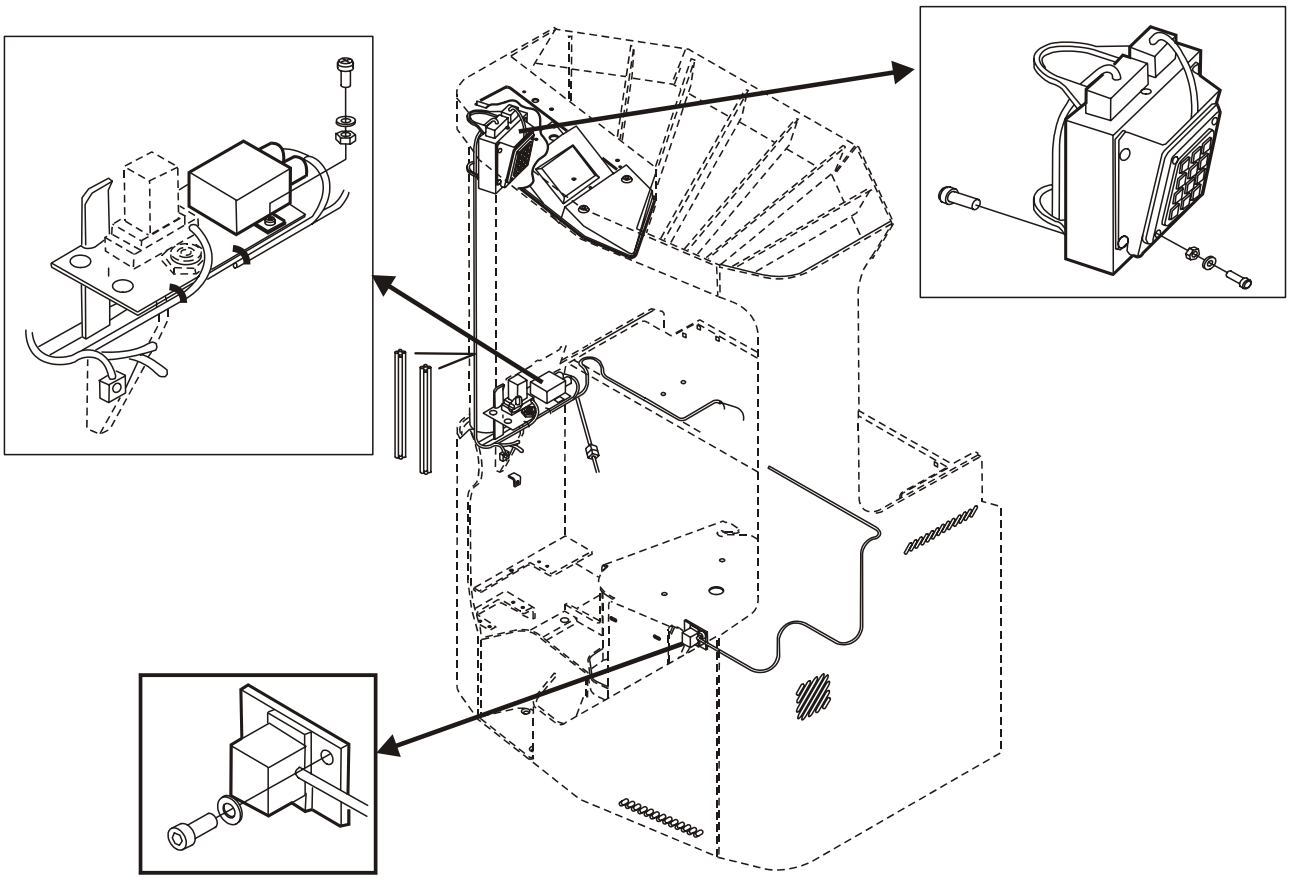
- Remove the work light.
- Remove the switch.

Material handling

Place the work light in the container intended for complex scrap.

Place the switch in the container intended for electronic scrap.

45.36 Optional electric equipment (9400)



Log equipment, code lock of truck.

45.36.1 Dismantling

- Remove the cables.
- Remove the log-on terminal and the relays.

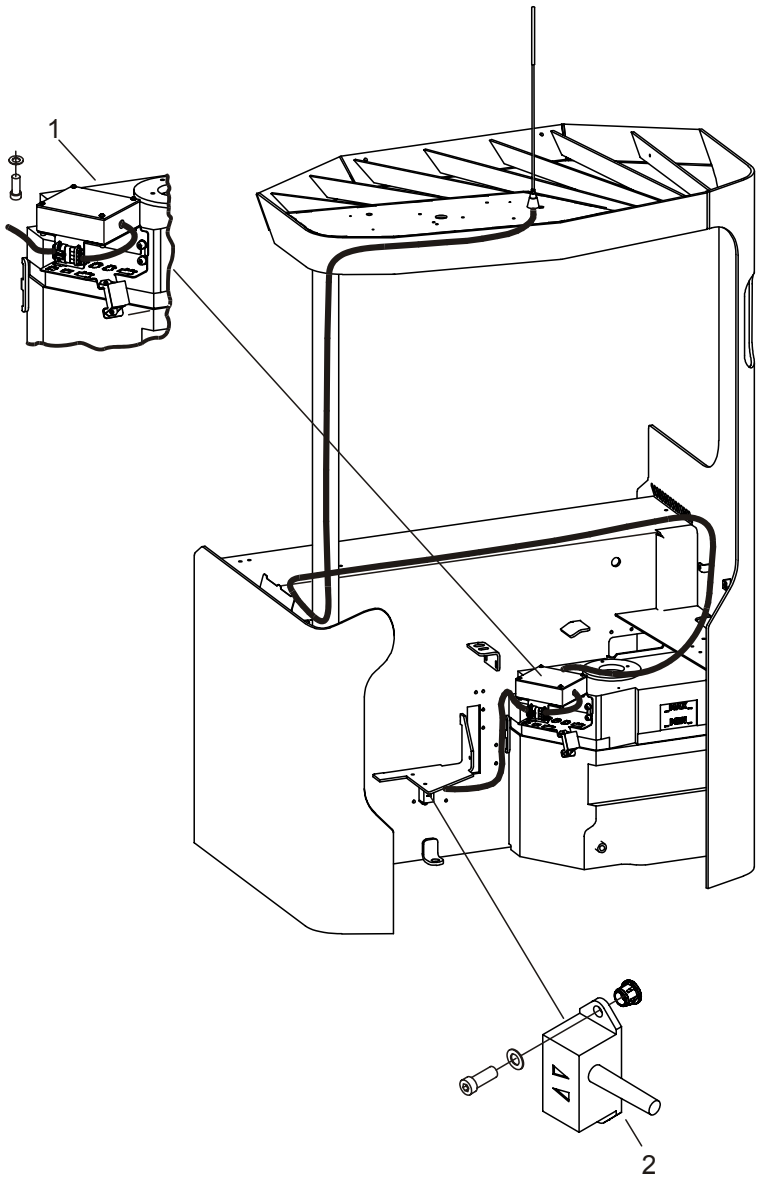
Material handling

Place the cables in the container intended for cables.

Place the log-on terminal and relays in the container intended for electronic scrap.

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45.37 Optional electric equipment (9400)



Code lock of truck.

45.37.1 Dismantling

- Remove the electronics unit (1).
- Remove the shock sensor (2).

Instructions for destruction

Optional electric equipment (9400)

T-code	Valid from serial number
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Material handling

Place the electronics unit and the shock sensor in the container intended for electronic scrap.

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