

# ***CLAAS***



## **SCORPION**

**9040 (404-03)**

**7045 (403-03)**

**7040 (402-03)**

**7030 (401-03)**

**6030 (400-01)**

## **Repair Manual**

# ***SERVICE & PARTS***

# Table of Contents

## 1 Machine, applications, operation (overview)

1.1	Machine outside view .....	1-2
1.2	Inside of cab (overview) .....	1-3
1.3	Instrument panel, multifunctional lever, switch consoles (overview) .....	1-4
1.4	Fields of application and using a telehandler with an attachment .....	1-5
1.5	Legal regulations regarding telehandler operation .....	1-8
1.6	Type labels and component numbers .....	1-11

## 2 Specifications

2.1	Model and trade names (overview) .....	2-2
2.2	Frame .....	2-2
2.3	Engine .....	2-2
2.4	Oil/water fan .....	2-3
2.5	Drive .....	2-3
2.6	Axles .....	2-4
2.7	Service and parking brake .....	2-4
2.8	Steering system .....	2-5
2.9	Work hydraulics .....	2-6
2.10	Electrical system .....	2-8
2.11	Tyres for models 401-03/402-03/403-03 .....	2-12
2.12	Tyres for model 404-03 .....	2-12
2.13	Machine weights, axle loads .....	2-13
2.14	Noise levels .....	2-13
2.15	Vibrations, oscillation and acceleration value .....	2-14
2.16	Coolant compound table .....	2-14
2.17	Tightening torques .....	2-15
2.18	Trailer couplings: trailer weight/drawbar load .....	2-15
2.19	Pallet forks model 400-01 .....	2-16
2.20	Load on pallet forks model 401-03 (without counterweight) .....	2-17
2.21	Load on pallet forks model 401-03 (with counterweight 2 x 150 kg) .....	2-18
2.22	Pallet forks model 402-03 (with counterweight 2 x 150 kg) .....	2-19
2.23	Pallet forks model 402-03 (with counterweight 2 x 300 kg) .....	2-20
2.24	Load on pallet forks model 403-03 .....	2-21
2.25	Payloads model 404-03 .....	2-22
2.26	Dimensions with bucket .....	2-26
2.27	Dimensions with bucket .....	2-27
2.28	Dimensions with pallet forks .....	2-28
2.29	Dimensions with pallet forks .....	2-29

## 3 Maintenance and servicing work

3.1	Explanation of symbols on the maintenance label .....	3-2
3.2	Maintenance label .....	3-3
3.3	Fluids and lubricants (overview) .....	3-4
3.4	Maintenance plan .....	3-5
3.5	Introduction .....	3-9
3.6	Safety prop for telescopic boom .....	3-9
3.7	Fuel system .....	3-10
3.8	Maintenance of engine lubrication system .....	3-14
3.9	Maintenance of the engine and hydraulics cooling system .....	3-18
3.10	Cleaning the radiator with the reversing fan (option) .....	3-23
3.11	Air filter maintenance .....	3-24
3.12	Maintenance: V-belts .....	3-26
3.13	Gearbox and axle maintenance .....	3-27

3.14	Safety instructions regarding the hydraulic system .....	3-32
3.15	Monitoring the hydraulic oil and the return filter .....	3-33
3.16	Checking the hydraulic oil level .....	3-33
3.17	Filling up hydraulic oil .....	3-34
3.18	Replacing the return filter of the hydraulic system .....	3-34
3.19	Replacing the microfilter of the hydraulic system .....	3-34
3.20	Replacing the microfilter in the LS line .....	3-35
3.21	Replacing hydraulic oil .....	3-36
3.22	Important notices on the use of biodegradable oil .....	3-37
3.23	Checking hydraulic pressure lines .....	3-38
3.24	Lubrication work .....	3-39
3.25	Maintenance of the brake system .....	3-42
3.26	Replacing/bleeding the service brake fluid with bleed equipment .....	3-43
3.27	Maintenance of compressed-air brake system (option) .....	3-46
3.28	Tyre maintenance .....	3-47
3.29	Heating and ventilation maintenance .....	3-49
3.30	Maintenance of air conditioning (option) .....	3-50
3.31	Maintenance of the electrical system .....	3-55
3.32	Maintenance of trailer coupling .....	3-59
3.33	General maintenance work on the machine .....	3-60
3.34	Cleaning inside the cab .....	3-61
3.35	Cleaning the seat belt .....	3-61
3.36	Cleaning the exterior of the machine .....	3-61
3.37	Checking screw connections .....	3-61
3.38	Checking pivots and hinges .....	3-61
3.39	Cleaning the engine compartment .....	3-62
3.40	Maintenance and servicing work "Aggressive Media" .....	3-63
3.41	Maintenance and servicing of attachments on the quickhitch .....	3-65
<b>4</b>	<b>Engine</b>	
4.1	Electrical system/hydraulics – fan (electrical diagram) .....	4-2
4.2	Fan (functional description) .....	4-6
4.3	Fan connector assignment for models 402, 403, 404 .....	4-7
4.4	Diesel engine connector assignment (88 kW) .....	4-8
4.5	Diesel engine connector assignment (103 kW) .....	4-9
4.6	Fuel preheater connector assignment .....	4-10
4.7	Diagnosis connector assignment .....	4-11
4.8	88 kW diesel engine electrical system (electrical diagram) .....	4-14
4.9	103 kW diesel engine electrical system (electrical diagram) .....	4-18
4.10	Fuel preheater (electrical diagram) .....	4-22
4.11	Engine diagnosis (electrical diagram) .....	4-24
4.12	Engine oil cooler side (88 kW) (overview) .....	4-25
4.13	Engine drive side (88 kW) (overview) .....	4-26
4.14	Engine turbocharger side (88 kW) (overview) .....	4-27
4.15	Engine oil cooler side (103 kW) (overview) .....	4-28
4.16	Fuel: high-pressure unit .....	4-29
4.17	Engine drive side (103 kW) (overview) .....	4-30
4.18	Engine turbocharger side (103 kW) (overview) .....	4-31
4.19	Electronics overview (103 kW) .....	4-32
4.20	Electronic engine speed setting (103 kW) (overview) .....	4-35
4.21	Function: warning indicator light in tip switch (103 kW diesel engine) .....	4-36
4.22	Engine drive – clutch (88/103 kW) (overview) .....	4-41
4.23	Installing the fan pump .....	4-42
4.24	Fuel system (88/103 kW) (overview) .....	4-43
4.25	Bleeding the fuel system (88/103 kW) .....	4-44
4.26	Fan circuit (not in reversing operation) .....	4-45
4.27	Fan circuit with reversing fan .....	4-46

4.28	Reversing valve block .....	4-47
4.29	Setting maximum fan speed (reversing fan) .....	4-48
4.30	Setting maximum fan speed (without reversing fan) .....	4-48
4.31	Cleaning the radiator with the reversing fan (option) .....	4-49
4.32	Function: reversing fan operation .....	4-50

## 5 Power train

5.1	40 kph drive hydraulic diagram for models 400, 401, 402 .....	5-2
5.1	30 – 40 kph drive hydraulic diagram for models 402, 403, 404 .....	5-4
5.2	40 kph drive hydraulic diagram for models 402 – 404 .....	5-6
5.3	Drive hydraulic diagram (designations) .....	5-7
5.4	40 kph drive electrics diagram for models 402, 403, 404 .....	5-10
5.5	30 – 40 kph drive electrics diagram for models 400 – 404 .....	5-12
5.6	Electrical diagram (designations) .....	5-13
5.7	Functional description of drive hydraulics and electrical system .....	5-15
5.8	Drive electrics connector assignment for models 400 – 404 .....	5-18
5.9	Towing and transporting the machine .....	5-19
5.10	Hydraulic pump TMP 89 (models 402, 403, 404) .....	5-21
5.11	Hydraulic pump H1 P078 (models 400, 401, 402) .....	5-22
5.12	High speed gearbox (0 – 40 kph) .....	5-23
5.13	High-speed gearbox with auxiliary motor (0 – 40 kph) .....	5-23
5.14	Function without auxiliary motor (0 – 40 kph) .....	5-24
5.15	Function with auxiliary motor (0 – 40 kph) .....	5-24
5.16	Gearbox overview (0 – 40 kph) .....	5-25
5.17	Overview of control cover and diagram up to serial no. (0 – 40 kph) .....	5-26
5.18	Overview of control cover and diagram from serial no. (0 – 40 kph) .....	5-27
5.19	Control cover component parts for gearbox (0 – 40 kph) .....	5-28
5.20	Hydraulic drive circuit (0 – 40 kph) .....	5-29
5.21	Legend for gearbox circuit diagram (0 – 40 kph) .....	5-30
5.22	Gearbox circuit diagram (0 – 40 kph) .....	5-31
5.23	Legend for gearbox circuit diagram with auxiliary motor (0 – 40 kph) .....	5-32
5.24	Gearbox circuit diagram with auxiliary motor (0 – 40 kph) .....	5-33
5.25	Measurement reports .....	5-34
5.26	Test report for model 400/401/402 with H1 pump without auxiliary motor (0 – 40 kph) 5-36	
5.27	Test report for model 403/404/402 with TMP89 pump and auxiliary motor (fixed displacement motor) (0 – 40 kph) 5-37	
5.28	Test report for model 403/404 diesel engine 103 kW and TMP89 pump and auxiliary motor (variable displacement motor) (0 – 40 kph) 5-38	
5.29	Test report for model 402/403/404 (30 kph) .....	5-39
5.30	Error description for test report .....	5-40
5.31	Checking and setting boost pressure (0 – 40 kph gearbox) .....	5-41
5.32	Checking high pressure (0 – 40 kph) .....	5-42
5.33	Checking engine droop (pump) (0 – 40 kph) .....	5-43
5.34	Checking driving direction identification (0 – 40 kph) .....	5-44
5.35	Setting engine droop on the gearbox with/without auxiliary motor (fixed displacement motor 0 – 40 kph) .....	5-45
5.36	Control initiation set screw (0 – 40 kph gearbox) .....	5-46
5.37	Checking the cardan shaft speed (0 – 40 kph gearbox) .....	5-47
5.38	Troubleshooting work on drive .....	5-48
5.39	Hydraulic pump report .....	5-49
5.40	Report for measurement 1 of hydraulic pump (engine speed and boost pressure) .....	5-50
5.41	Report for forward/reverse measurement 2 of hydraulic pump .....	5-51
5.42	Report for measurement of forward driving direction of hydraulic pump: .....	5-52
5.43	Report for forward measurement 3 of hydraulic pump: .....	5-53
5.44	Variable displacement pump test for models 400/401 and 402 .....	5-54
5.45	Variable displacement pump test for models 402/403/404 .....	5-56
5.46	Checking the high-speed gearbox .....	5-58

5.47	Measurement 1 (driving direction identification) .....	5-59
5.48	Measurement 2 (M4 pressure at shuttle throttle) .....	5-59
5.49	Measurements 3 and 4 (proportional solenoid and proportional regulator) .....	5-60
5.50	Measurement 5 (pressure relief valve M3, PCOR valve) .....	5-60
5.51	High-speed gearbox report: measurement 1 (driving direction identification) .....	5-61
5.52	High-speed gearbox report: measurement 2 (M4 shuttle pressure) .....	5-62
5.53	High-speed gearbox report: measurements 3 and 4 (proportional solenoid and proportional regulator) .....	5-63
5.54	Report: measurement 5 (pressure relief valve M3, PCOR valve) .....	5-64
5.55	Repair work on the high-speed gearbox .....	5-65
5.56	Repair work on the high-speed gearbox .....	5-68
5.57	Repair work on the high-speed gearbox .....	5-69
5.58	Checking or replacing the shuttle throttle .....	5-72
5.59	Removing the shuttle throttle .....	5-73
5.60	Installing the shuttle throttle .....	5-76
5.61	Checking the auxiliary motor .....	5-77
5.62	Switching off rear axle/4 wheel drive .....	5-78
5.63	Disabling 4 wheel drive (overview) .....	5-79
5.64	Installation position .....	5-80
5.65	Drive electronics Operator's Manual (SUSMIC) .....	5-81
5.66	Error table .....	5-82
5.67	Checking the proportional valves by means of current measurement .....	5-83
5.68	Removing the consumers circuit from the hydraulic drive .....	5-84
5.69	Sealing work on the drive shaft (0 – 40 kph gearbox) .....	5-85
5.70	Mounting the rotary shaft seal (0 – 40 kph gearbox) .....	5-86
5.71	Mounting the drive flange (0 – 40 kph gearbox) .....	5-87
5.72	Sealing the Ecospeed gearbox .....	5-88
5.73	Removing the control cover (old) from the Ecospeed gearbox .....	5-89
5.74	Travelling drive with reduced engine speed .....	5-98
5.75	Overview: auxiliary motor (variable displacement motor) .....	5-99
5.76	Overview: auxiliary motor (variable displacement motor) .....	5-100
5.77	Checking control initiation/engine droop of auxiliary motor (variable displacement motor) .....	5-101
5.78	Drive (electrical diagram) .....	5-104
5.79	20 kph hydraulic drive diagram for models 400 – 404 .....	5-106
5.80	Drive hydraulic diagram (descriptions) .....	5-107
5.81	Functional description of drive hydraulics and electrical system .....	5-109
5.82	Drive electrics connector assignment for models 400 – 404 .....	5-112
5.83	Variable displacement motor 110 cm <sup>3</sup> /rev (20 kph) .....	5-113
5.84	Variable displacement motor 110 cm <sup>3</sup> /rev (20 kph, seen from the side) .....	5-114
5.85	Variable displacement motor 160 cm <sup>3</sup> /rev (20 kph) .....	5-115
5.86	Test report for model 400 – 404 (20 kph) .....	5-116
5.87	Error description for test report models 400/401 (20 kph) .....	5-117
5.88	Hydraulic circuit: drive with hydraulic pump H1 P078 (20 kph) .....	5-118
5.89	Hydraulic circuit: drive with hydraulic pump TMP 89 (20 kph) .....	5-119
5.90	Setting boost pressure (20 kph) .....	5-120
5.91	Checking high pressure (20 kph) .....	5-121
5.92	Checking engine droop – variable displacement pump (20 kph) .....	5-122
5.93	Setting engine droop – hydraulic motor (20 kph) .....	5-123
5.94	Setting final speed (20 kph) .....	5-124
<b>6</b>	<b>Axles/differential lock</b>	
6.1	Differential lock diagrams (serial no.) .....	6-2
6.2	Designations: differential lock electrical diagram .....	6-3
6.3	Differential lock diagrams .....	6-6
6.4	Functional description of differential lock .....	6-7
6.5	Differential lock connector assignment .....	6-8
6.6	20 kph gearbox (overview) .....	6-9

6.7	Removing the 20 kph gearbox .....	6-10
6.8	Installing the 20 kph gearbox .....	6-17
6.9	Front and rear axle flanges .....	6-25
6.10	Type label and oil filler neck (overview) .....	6-26
6.11	Conversion table and tightening torques .....	6-27
6.12	Removing the joint housing .....	6-28
6.13	Installing the joint housing .....	6-30
6.14	Removing the double cardan shaft .....	6-31
6.15	Mounting the double cardan shaft .....	6-33
6.16	Remove the planetary drive .....	6-35
6.17	Replacing the seals of the planetary drive .....	6-37
6.18	Installing the planetary drive .....	6-38
6.19	Installing the planetary drive .....	6-40
6.20	Sealing the front axle differential .....	6-42
6.21	Removing the front axle differential lock .....	6-44
6.22	Installing the front axle differential lock .....	6-47
6.23	Differential lock: hydraulic circuit .....	6-50
6.24	Special tools (overview) .....	6-51

## 7 Brakes

7.1	Brake (20 kph) diagrams (electric/hydraulic) .....	7-2
7.2	Brake (40 kph) diagrams (electric/hydraulic) .....	7-4
7.3	Hydraulic diagram – trailer brake valve .....	7-6
7.4	Designations: hydraulic brake diagram .....	7-7
7.5	Designations: electric brake diagram .....	7-8
7.6	Functional description of brakes .....	7-9
7.7	Brakes connector assignment .....	7-10
7.8	40 kph brake circuit (overview) .....	7-11
7.9	20 kph brake circuit (overview) .....	7-12
7.10	Disabling (releasing) the parking brake in the front axle .....	7-13
7.11	Enabling (adjusting) the parking brake in the front axle .....	7-13
7.12	Wear check: service brake discs .....	7-14
7.13	Setting the brake linkage – master brake cylinder .....	7-14
7.14	Service and parking brake (overview) .....	7-15
7.15	Removing the brake discs .....	7-16
7.16	Brake discs (overview) .....	7-19
7.17	Installing the brake pistons of the service and parking brake .....	7-20
7.18	Installing the belleville spring washers and the brake cylinder housing .....	7-21
7.19	Installing the service brake .....	7-23
7.20	Towing and transporting the machine .....	7-26
7.21	Hydraulic trailer brake circuit (option) .....	7-28
7.22	Air compressor .....	7-29
7.23	Air compressor overview .....	7-30
7.24	Air compressor components .....	7-31
7.25	Valves (air compressor) .....	7-32
7.26	Circuit (air compressor) .....	7-33

## 8 Steering system

8.1	Electrical/hydraulic diagrams for steering system up to serial no. 400 01 0167, 401 03 0195, 402 03 0176, 403 03 0145, 404 03 0146	8-2
8.2	Electrical/hydraulic diagrams for steering system from serial no. 400 01 0168, 401 03 0196, 402 03 0177, 403 03 0146, 404 03 0147,	8-4
8.3	Designations: electric steering diagram .....	8-5
8.4	Designations: hydraulic steering diagram .....	8-6
8.5	Functional description of steering system .....	8-7
8.6	Steering system connector assignment .....	8-8

8.7	Steering circuit with variable displacement pump (LS = load sensing) .....	8-9
8.8	Hydraulic steering diagram: priority valve – variable displacement pump (LS = load sensing) 8-10	
8.9	Steering circuit with gear pump .....	8-11
8.10	Hydraulic steering diagram: priority valve – gear pump .....	8-12
8.11	Hydraulic steering diagram: 4 wheel steering/front axle steering .....	8-13
8.12	Diagonal steering circuit (crab steering) .....	8-14
8.13	Hydraulic steering diagram: front axle steering with diagonal steering valve (crab steering) .....	8-15
8.14	Hydraulic steering diagram: diagonal steering with diagonal steering valve (crab steering) .....	8-16
8.15	Hydraulic steering diagram: 4 wheel steering with diagonal steering valve (crab steering) 8-17	
8.16	Steering system goes out of line (20/40 kph) .....	8-18
8.17	Steering valve (overview) .....	8-19
8.18	Pressure relief valve – servostat: settings .....	8-20
8.19	Front and rear axle steering sensor (magnetic sensor) .....	8-21
8.20	Removing the steering rams .....	8-22
8.21	Installing the steering rams .....	8-26
8.22	Adjusting the steering angle .....	8-30
<b>9</b>	<b>Work hydraulics</b>	
9.1	Work hydraulics fixed displacement pump (diagram) – raising/lowering the telescopic boom (HUSCO) .....	9-2
9.2	Work hydraulics fixed displacement pump (diagram) – raising/lowering the telescopic boom (Bucher) .....	9-4
9.3	Work hydraulics variable displacement pump (diagram) – raising/lowering the telescopic boom (HUSCO) .....	9-6
9.4	Work hydraulics variable displacement pump (diagram) – raising/lowering the telescopic boom (Bucher) .....	9-8
9.5	Raising/lowering the telescopic boom (electrical diagram) .....	9-10
9.6	Load stabiliser (electrical diagram) .....	9-12
9.7	Work hydraulics (diagram) – extending/retracting the telescopic boom, fixed displacement pump (HUSCO) .....	9-14
9.8	Work hydraulics fixed displacement pump (diagram) – extending/retracting the telescopic boom .....	9-16
9.9	Work hydraulics variable displacement pump (diagram) – extending/retracting the telescopic boom (HUSCO) .....	9-18
9.10	Work hydraulics variable displacement pump (diagram) – extending/retracting the telescopic boom (Bucher) .....	9-20
9.11	Work hydraulics variable displacement pump (diagram) – extending/retracting the telescopic boom .....	9-22
9.12	Extending/retracting the telescopic boom (electrical diagram) .....	9-24
9.13	Retracting/extending the telescopic boom (designations) .....	9-25
9.14	Work hydraulics fixed displacement pump (diagram) – dumping in/out (HUSCO) .....	9-28
9.15	Work hydraulics fixed displacement pump – dumping in/out (diagram) .....	9-30
9.16	Work hydraulics variable displacement pump (diagram), dumping in/out (HUSCO) .....	9-32
9.17	Work hydraulics variable displacement pump (diagram) – dumping in/out (Bucher) .....	9-34
9.18	Dumping in/out (electrical diagram) .....	9-36
9.19	4 wheel drive OFF (electrical diagram) .....	9-38
9.20	Dumping in/out (electrical diagram) .....	9-40
9.21	Bucket repositioning (electrical diagram) .....	9-42
9.22	Work hydraulics fixed displacement pump (diagram) – locking/unlocking (HUSCO) .....	9-44
9.23	Work hydraulics fixed displacement pump (diagram) – locking/unlocking (Bucher) .....	9-46
9.24	Work hydraulics variable displacement pump (diagram) – locking/unlocking (HUSCO) .....	9-48
9.25	Work hydraulics variable displacement pump (diagram) – locking/unlocking (Bucher) .....	9-50
9.26	Locking/unlocking (electrical diagram) .....	9-52
9.27	Work hydraulics fixed displacement pump (diagram) – rear additional control circuit (HUSCO) .....	9-54
9.28	Work hydraulics fixed displacement pump (diagram) – additional control circuit (Bucher) .....	9-56
9.29	Work hydraulics variable displacement pump (diagram) – rear additional control circuit (HUSCO) .....	9-58
9.30	Work hydraulics variable displacement pump (diagram) – additional control circuit (Bucher) .....	9-60
9.31	Work hydraulics fixed displacement pump (diagram) – rear additional control circuit, Autohitch (HUSCO) .....	9-62
9.32	Work hydraulics fixed displacement pump (diagram) – additional control circuit, Autohitch (Bucher) .....	9-64
9.33	Work hydraulics variable displacement pump (diagram) – rear additional control circuit, Autohitch (HUSCO) .....	9-66
9.34	Work hydraulics variable displacement pump (diagram) – additional control circuit, Autohitch (Bucher) .....	9-68
9.35	Work hydraulics fixed displacement pump (diagram) – rear additional control circuit, Autohitch, tipping trailer (HUSCO) .....	9-70
9.36	Work hydraulics fixed displacement pump (diagram) – additional control circuit, Autohitch, tipping trailer (Bucher) ....	9-72
9.37	Work hydraulics variable displacement pump (diagram) – rear additional control circuit, Autohitch, tipping trailer (HUSCO)	

9-74	
9.38	Work hydraulics variable displacement pump (diagram) – additional control circuit, Autohitch, tipping trailer (Bucher) 9-76
9.39	Work hydraulics fixed displacement pump (diagram) – rear additional control circuit, tipping trailer (HUSCO) ..... 9-78
9.40	Work hydraulics fixed displacement pump (diagram) – additional control circuit, tipping trailer (Bucher) ..... 9-80
9.41	Work hydraulics variable displacement pump (diagram) – rear additional control circuit, tipping trailer (HUSCO) ..... 9-82
9.42	Work hydraulics variable displacement pump (diagram) – additional control circuit, tipping trailer (Bucher) ..... 9-84
9.43	Work hydraulics fixed displacement pump (diagram) – Autohitch (HUSCO) ..... 9-86
9.44	Work hydraulics fixed displacement pump (diagram) – Autohitch (Bucher) ..... 9-88
9.45	Work hydraulics variable displacement pump (diagram) – Autohitch (HUSCO) ..... 9-90
9.46	Work hydraulics variable displacement pump (diagram) – Autohitch (Bucher) ..... 9-92
9.47	Work hydraulics fixed displacement pump (diagram) – Autohitch, tipping trailer (HUSCO) ..... 9-94
9.48	Work hydraulics fixed displacement pump (diagram) – Autohitch, tipping trailer (Bucher) ..... 9-96
9.49	Work hydraulics variable displacement pump (diagram) – Autohitch, tipping trailer (HUSCO) ..... 9-98
9.50	Work hydraulics variable displacement pump (diagram) – Autohitch, tipping trailer (Bucher) ..... 9-100
9.51	Work hydraulics fixed displacement pump (diagram) – tipping trailer (HUSCO) ..... 9-102
9.52	Work hydraulics fixed displacement pump (diagram) – tipping trailer (Bucher) ..... 9-104
9.53	Work hydraulics variable displacement pump (diagram) – tipping trailer (HUSCO) ..... 9-106
9.54	Work hydraulics variable displacement pump (diagram) – tipping trailer (Bucher) ..... 9-108
9.55	Work hydraulics variable displacement pump (diagram) – additional control circuit for quick couplers on telescopic boom (HUSCO) 9-110
9.56	Work hydraulics fixed displacement pump (diagram) – additional control circuit for quick couplers on telescopic boom 9-112
9.57	Work hydraulics (diagram) – safe load indicator ..... 9-114
9.58	Work hydraulics (diagram) – safe load indicator (HUSCO) ..... 9-116
9.59	Front/rear additional control circuit for quick couplers, Autohitch, tipping trailer (electrical diagram) ..... 9-118
9.60	Front socket, safe load indicator (electrical diagram) ..... 9-120
9.61	Front socket, safe load indicator (electrical diagram) ..... 9-122
9.62	Work hydraulics variable displacement pump (diagram) – additional control circuit for quick couplers on quickhitch (HUSCO) 9-124
9.63	Work hydraulics variable displacement pump (diagram) – work platform with radio control ..... 9-126
9.64	Work hydraulics variable displacement pump (diagram) – work platform with radio control ..... 9-128
9.65	Work platform with radio control: electrical diagram ..... 9-130
9.66	Remote radio controls (diagram designations) ..... 9-131
9.67	Work platform with radio control (electrical diagram) with common rail ..... 9-134
9.68	Work platform with radio control (electrical diagram) without common rail ..... 9-136
9.69	Tilt ram lock (electrical diagram) ..... 9-138
9.70	Tilt ram lock (electrical diagram) ..... 9-140
9.71	Work hydraulics variable displacement pump (diagram) – frame levelling, oscillating axle interlock ..... 9-142
9.72	Frame levelling, oscillating axle interlock (electrical diagram) ..... 9-144
9.73	Frame levelling, oscillating axle interlock (electrical diagram) ..... 9-146
9.74	Oscillating axle interlock (electrical diagram) ..... 9-148
9.75	Work hydraulic diagram (designations) ..... 9-149
9.76	Functional description of work hydraulics ..... 9-153
9.77	Work hydraulics connector assignment ..... 9-157
9.78	Test report: models 400/401 Husco control valve ..... 9-158
9.79	Test report: models 400/401 Bucher control valve ..... 9-159
9.80	Test report: models 402/403/404 Husco control valve ..... 9-160
9.81	Test report: models 402/403/404 Bucher control valve ..... 9-161
9.82	Work hydraulics test ports ..... 9-162
9.83	Variable displacement pump (hydraulic pump) ..... 9-163
9.84	Checking and setting the work hydraulics ..... 9-165
9.85	Work hydraulics circuit (gear pump) ..... 9-167
9.86	Work hydraulics circuit (variable displacement pump LS) ..... 9-168
9.87	Control valve connections (4-fold) HUSCO ..... 9-169
9.88	Control valve (4-fold) (overview) HUSCO ..... 9-170
9.89	Control valve connections (5-fold) HUSCO ..... 9-171
9.90	Control valve (5-fold) (overview) HUSCO ..... 9-172
9.91	Control valve connections (5-fold) Bucher ..... 9-173



9.92	Control valve (5-fold) (overview) Bucher .....	9-174
9.93	Lift ram circuit .....	9-175
9.94	Tilt ram circuit .....	9-176
9.95	Compensating ram circuit .....	9-177
9.96	Push-out ram circuit .....	9-178
9.97	3rd control circuit .....	9-179
9.98	Control valve (4-fold) pilot control circuit .....	9-180
9.99	Valve block connections (overview) .....	9-181
9.100	Pilot control unit, pilot valve .....	9-182
9.101	Load stabiliser .....	9-183
9.102	Load stabiliser circuit .....	9-185
9.103	Changeover valve: Autohitch/tipping trailer connection/additional control circuit 9-186	
9.104	Autohitch, rear additional control circuit .....	9-187
9.105	Tipping trailer connection circuit .....	9-188
9.106	Front additional control circuit .....	9-189
9.107	Frame levelling with oscillating axle interlock (option) telehandler 404 (overview) .....	9-190
9.108	Bleeding the hydraulic ram of the oscillating axle interlock .....	9-193
9.109	Frame levelling circuit .....	9-194
9.110	Frame levelling valve overview .....	9-195
9.111	Lift ram with hose burst valve (overview) .....	9-196
9.112	Tilt ram (overview) .....	9-197
9.113	Push-out ram with final position damping (overview) .....	9-198
9.114	Compensating ram (overview) .....	9-198
9.115	Quickhitch .....	9-199
9.116	Installing the telescopic boom .....	9-200
9.117	Replacing the flexible line in the telescopic boom .....	9-209
9.118	Replacing the control valve .....	9-212
9.119	Replacing the priority valve .....	9-212
9.120	Replacing the fan pump .....	9-213
9.121	Replacing the A 10 work hydraulics pump .....	9-214
9.122	Replacing the pilot valve .....	9-214

## 10 Electrical systems

10.1	Machine lights (electrical diagram) .....	10-2
10.2	Machine lights (electrical diagram) .....	10-4
10.3	Turn indicators/horn/rotating beacon (electrical diagram) .....	10-6
10.4	Turn indicators, horn, rotating beacon (electrical diagram) .....	10-8
10.5	Mirror adjustment/heating (electrical diagram) .....	10-10
10.6	Mirror adjustment/heating (electrical diagram) .....	10-12
10.7	Wiper/washer diagram .....	10-14
10.8	Hydraulics monitoring diagram .....	10-16
10.9	Hydraulics monitoring (electrical diagram) .....	10-18
10.10	Wiper/washer diagram .....	10-20
10.11	Washer system (electrical diagram) .....	10-22
10.12	Heating – air conditioning system/air-suspension seat (electrical diagram) .....	10-24
10.13	Multimedia/cigarette lighter (electrical diagram) .....	10-28
10.14	Multimedia/cigarette lighter (electrical diagram) .....	10-30
10.15	Cab legend (SLP II) .....	10-33
10.16	Cab wiring diagram (SLP II) .....	10-34
10.17	Cab legend (SLP II) .....	10-35
10.18	Cab wiring diagram (SLP III) .....	10-36
10.19	Cab legend (SLP III) .....	10-37
10.15	Cab wiring harness .....	10-41
10.16	Cab option wiring harness .....	10-42
10.17	Armrest wiring harness .....	10-44
10.18	Mirror adjustment wiring harness .....	10-45

10.19	Engine vat signals wiring diagram (SLP IV) .....	10-46
10.20	Engine vat wiring harness .....	10-47
10.21	Engine compartment legend .....	10-48
10.22	Frame signal wiring diagram (SLP V) .....	10-49
10.23	Frame wiring harness .....	10-51
10.24	Frame legend .....	10-52
10.25	Options signals wiring diagram (SLP VI) .....	10-53
10.26	Socket wiring harness X3 .....	10-54
10.27	Additional valves wiring harness .....	10-55
10.28	Mirror/preheating option wiring harness .....	10-56
10.29	Overall diagrams legend .....	10-57
10.30	Electric machine components (overview) .....	10-59
10.31	Electrical diagram designations and positions .....	10-61
10.32	Connector positions on machine .....	10-62
10.33	Functional description of hydraulics monitoring .....	10-65
10.34	Hydraulics monitoring connector assignment .....	10-65
10.35	Lights connector assignment .....	10-66
10.36	Turn indicator/horn connector assignment .....	10-67
10.37	Rotating beacon connector assignment .....	10-68
10.38	Mirror adjustment connector assignment .....	10-68
10.39	Mirror heating connector assignment .....	10-68
10.40	Window wiper/wash connector assignment .....	10-69
10.41	Heating/air conditioning connector assignment .....	10-69
10.42	Air-suspension seat connector assignment .....	10-70
10.43	Multimedia connector assignment .....	10-70
10.44	Cigarette lighter connector assignment .....	10-70
10.45	Ohm's Law (current, voltage, resistance); power .....	10-71
10.46	Multifunction measuring device .....	10-71
10.47	Terminal description .....	10-72
10.48	Cable colour coding .....	10-76
10.49	Electric components .....	10-78
10.50	Fuses (overview) .....	10-79
10.51	Electronic components (overview) .....	10-83
10.52	Functional description of the steering electronics .....	10-85
10.53	Proportional controls (overview and connections) .....	10-88
10.54	Proportional electronics .....	10-89
10.55	Hold electronics .....	10-90
10.56	Retrofitting the front right and rear right working lights .....	10-91
10.57	Retrofitting a rotating beacon .....	10-92
10.58	Retrofitting a radio .....	10-93
10.59	Retrofitting the low-speed control .....	10-93
10.60	Retrofitting the air conditioning system .....	10-94
10.61	Retrofitting a front or rear socket .....	10-95
10.62	Retrofitting a load stabiliser .....	10-95
10.63	Wiring harness disconnect (cab – machine frame) .....	10-96
10.64	Radio control system (transmitter) operation .....	10-97
10.65	Overview of transmitter and receiver system control elements .....	10-98
10.66	"STOP switch" safety feature on the transmitter .....	10-100
10.67	Indications regarding the transmitter battery .....	10-100
10.68	Taking the transmitter into service .....	10-101
10.69	Emergency lowering of the telescopic boom .....	10-102
10.70	Removing the work platform from the quickhitch .....	10-103
10.71	Maintenance work on the work platform .....	10-104
10.72	Maintenance work on the transmitter and receiver system .....	10-105
10.73	Charging the transmitter battery .....	10-106
10.74	Troubleshooting the transmitter and receiver system .....	10-107
10.75	Transmitter and receiver system specifications .....	10-107

10.76	List of frequencies for radio control system .....	10-108
10.77	Specifications – work platform .....	10-109
10.78	Inspection and maintenance work report .....	10-110
10.79	Remote radio control (hydraulic circuit) .....	10-111
10.80	Relays (overview) .....	10-112
10.81	Remote radio control valves (overview) .....	10-113
10.82	Safe load indicator .....	10-114
10.83	Safety instructions regarding the safe load indicator .....	10-115
10.84	Overview of displays .....	10-117
10.85	Safe load indicator for telescopic boom (version A) .....	10-118
10.86	Safe load indicator for telescopic boom (version B) .....	10-119
10.87	Safe load indicator for telescopic boom (version C) .....	10-121
10.88	Setting the safe load indicator (version C) .....	10-122
10.89	Safe load indicator settings for telescopic boom (version B) .....	10-125
10.90	Setting the safe load indicator (100 % point stability) .....	10-126
10.91	Removing the load sensor .....	10-128
10.92	Overload control in bucket mode .....	10-129
10.93	Overload control in fork lift mode .....	10-130
10.94	Disabling the overload control manually .....	10-131
10.95	Adjustment work on the overload control .....	10-132
10.96	Circuit diagram: overload control enabled .....	10-136
10.97	Circuit diagram: overload control disabled .....	10-137
10.98	Overview of valves .....	10-138
10.99	Overview of valve connections and ports .....	10-139
10.100	Circuit diagram: raising/lowering, switch S116 actuated (bucket operation) .....	10-140
10.101	Circuit diagram: raising/lowering under 36° and at 80 – 100 % load .....	10-141
10.102	Circuit diagram: raising/lowering over 100 % load and angle detection under 36° .....	10-142
10.103	Circuit diagram: raising/lowering, switch S84 actuated (overload control OFF) .....	10-143
10.104	Circuit diagram: raising/lowering, switch S125 retract (pallet forks operation) .....	10-144
10.105	Circuit diagram: raising/lowering, switch S125 ON (bucket operation) .....	10-145
10.106	Circuit diagram: extend telescopic boom, load less than 100 % .....	10-146
10.107	Circuit diagram: extend telescopic boom, load over 100 % .....	10-147
10.108	Circuit diagram: retract telescopic boom .....	10-148
10.109	Circuit diagram: retraction/extension switch S84 (telescopic boom extension) .....	10-149
10.110	Cab wiring harness (overload control) .....	10-150
10.111	Legend: cab wiring harness (overload control) .....	10-151
10.112	Frame wiring harness (overload control) .....	10-152
10.113	Relay wiring harness (overload control) .....	10-153
10.114	Legend: relays (overload control) .....	10-154
10.115	Electric components (overload control) .....	10-155

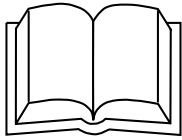
## A Appendix

A.1	4-fold control valve (Bucher), fixed displacement pump (overall hydraulic diagram) .....	A-2
A.1	4-fold control valve (Bucher), variable displacement pump (overall hydraulic diagram) .....	A-4
A.2	4-fold control valve (HUSCO) (overall hydraulic diagram) .....	A-6
A.3	Hydraulics – 4-fold control valve: overall diagram .....	A-8
A.4	Fixed displacement pump – 5-fold control valve (Bucher) (overall hydraulic diagram) .....	A-10
A.5	Fixed displacement pump – 5-fold control valve (HUSCO) (overall hydraulic diagram) .....	A-12
A.6	Variable displacement pump – 5-fold control valve (Bucher) (overall hydraulic diagram) .....	A-14
A.7	Variable displacement pump – 5-fold control valve (HUSCO) (overall hydraulic diagram) .....	A-16

### 3.9 Maintenance of the engine and hydraulics cooling system

The combined engine/hydraulic oil cooler is located in the engine compartment. It cools the diesel engine, and the hydraulic oil of the drive and work hydraulics.

#### Specific safety instructions



#### **Danger!**

All work involving antifreeze carries an increased

#### **Danger of poisoning and causticisation!**

- ☞ *Seek medical attention immediately if antifreeze has been swallowed*
- ☞ *Wear protective clothing and gloves*
- ☞ *Keep antifreeze out of reach of children*

- Dirt on the radiator fins reduces the radiator's heat dissipation capacity! To avoid this:
  - Clean the outside of the radiator at regular intervals. Refer to the maintenance plans for the cleaning intervals
  - In dusty or dirty work conditions, clean more frequently than indicated in the maintenance plans
- An insufficient coolant level reduces the heat dissipation capacity as well and can lead to engine damage! Therefore:
  - Check the coolant level at regular intervals. Refer to the maintenance plans in the appendix for the intervals
  - If the coolant must be replaced frequently, have the cooling system checked for leaks by an authorised workshop!
  - Never fill in cold water/coolant if the engine is warm!
  - After filling the expansion tank, make a test run with the engine and check the coolant level again after stopping the engine
- The use of the wrong coolant can destroy the engine and the radiator. Therefore:
  - Add enough antifreeze to the coolant.
  - Use brand-name antifreeze compounds with anticorrosion additives – [see Fluids and lubricants \(overview\)](#) on page 3-4
  - Do not use radiator cleaning compounds if an antifreeze compound has been added to the coolant – otherwise this causes sludge to form that can damage the engine



#### **Environment!**

Use a suitable container to collect the coolant as it drains and dispose of it in an environmentally friendly manner!

## Checking the coolant level and quality



### Notice!

Check the coolant level every **10 s/h (service hours)** or once a day.  
We recommend checking it before starting the engine.  
Check the antifreeze at regular intervals, especially at temperatures below 4 °C!  
Replace the coolant every 2 years!

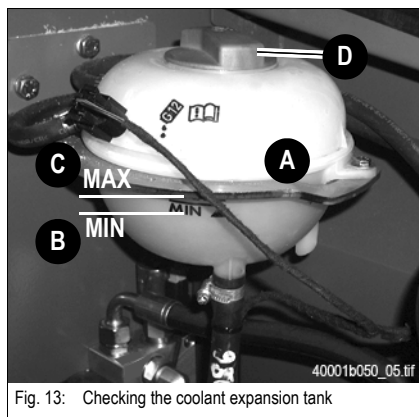


Fig. 13: Checking the coolant expansion tank

#### Check the coolant level as follows

- Park the machine on level ground
- Lower the telescopic boom fully
- Apply the parking brake with the switch
- Stop the engine
- Switch off ignition and remove the ignition key
- Open the engine cover
- Check the coolant level in the expansion tank **A**

If the coolant level is below the **MIN** mark **B** of the expansion tank:

- Fill up coolant to the **MAX** mark **C**

#### Check the coolant quality (antifreeze) with suitable testing equipment (antifreeze tester)

- ➔ – see [Fluids and lubricants \(overview\)](#) on page 3-4 and
- see [chapter 2 "Coolant compound table"](#) on page 2-14

## Filling up coolant

**Danger!**

Never open the coolant tank and never drain coolant if the warm engine is running since the cooling system is under high pressure

**Danger of burns!**

- ☞ Wait at least 10 minutes after stopping the engine!
- ☞ Wear protective gloves and clothing
- ☞ Always actuate the safety valve in the filler cap of the expansion tank first.  
To do this:  
Unscrew the filler cap to the first notch and release the pressure

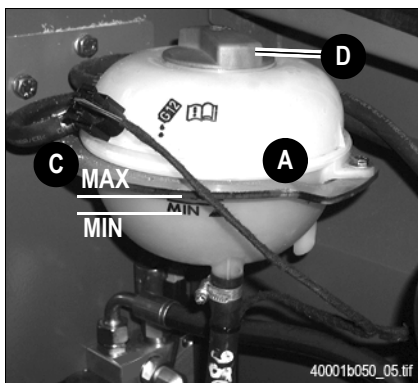


Fig. 14: Filling up coolant in the expansion tank

## ☞ Fill up coolant as follows

- Park the machine on level ground
- Lower the telescopic boom fully
- Apply the parking brake with the switch
- Switch off ignition and remove the ignition key
- Allow the engine/cooling system to cool down

Release the overpressure in the coolant expansion tank **A**. To do this:

- Open cap **D** to the first notch and release the pressure
- Open filler cap **D** fully
- Fill up coolant to the **MAX** mark **C**
- Use brand-name antifreeze compounds with anticorrosion additives – see *Fluids and lubricants (overview)* on page 3-4 and – see *chapter 2 “Coolant compound table”* on page 2-14
- Close filler cap **D**
- Start and warm up the engine, as you do so:
  - Open the heating circuit fully (see Operator's Manual)
  - Stop the engine
  - Check the cooling system and the heating water circuit for leaks
  - If necessary, have leaks immediately repaired by qualified and trained staff
  - Check the coolant level again
  - If necessary, fill in coolant and repeat the procedure until reaching the correct coolant level



Our support email:

[ebooklibonline@outlook.com](mailto:ebooklibonline@outlook.com)