LIEBHERR

Service Manual

Pipe Layers SERIES 2 Litronic

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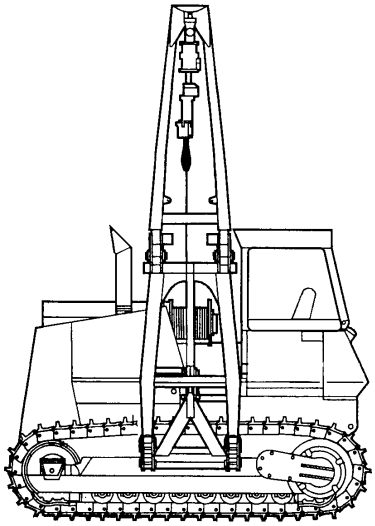
Issue 01/2009



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2.4 FIRE AND EXPLOSION PREVENTION

- Always shut off the engine before refueling.
  - In addition, the heater must also be turned off before refueling.
- Never smoke or allow an open flame in refueling areas and / or where batteries or flammable material are being charged or stored.
- Always use the proper engine starting procedure, as described in the Operation and Maintenance Manual.
- Check the electrical system frequently. Correct any defects, such as loose connections, chafed wiring, or burnt out fuses and bulbs immediately.
- Never store or carry any flammable fluids on the machine, except in the storage tank intended for machine operation.
- Regularly check all components, lines, tubes, and hoses for oil and fuel leaks and/ or damage. Replace or repair damaged components immediately. Oil and fuel leaks can cause fires!
- Be certain that all clamps, guards and heat shields are installed. These components prevent vibration, rubbing and heat build up. Install tie wraps to fasten hoses and wires as required.
- Cold start ether is extremely flammable! Never use cold start ether near heat sources, open flames, or near anyone who is smoking cigarettes! Use only in well ventilated areas and as directed!
- Never use the flame glow plug or preheat system when you use an ether cold start aid. Danger of explosion!
- Know the location of the fire extinguishers, make sure you know how to use them properly. Check out the location of where to report a fire and inform yourself about fire fighting capabilities on the job site before you start to work.

2.5 MACHINE START UP SAFETY

- Before starting the machine, perform a thorough walk around inspection.
- Visually check the machine for loose bolts, cracks, wear, leaks and any evidence of vandalism.
- Never start or operation an unsafe or damaged machine.
- Be certain that all defects are taken care of immediately.
- Make sure that all covers and doors are closed and locked. Check if all warning and safety decals are on the machine and make sure that all of them are legible.
- Clean all windows and mirrors, secure doors and windows to prevent any inadvertent movement.
- Always enter and leave the cab through from the left over the chain. Always use the appropriate handles.

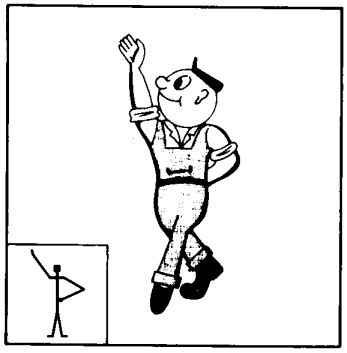
Hand signals are used when the operator of construction equipment has a restricted field of vision in the working area or in the direction of travel. The signals are designed for instant recognition to enable equipment operators to quickly follow operating instructions from spotters, flagmen, or other designated persons to improve safety.

Signals should be given by one person only. This person should face the operator when giving signals and should be outside the danger zone.
In Germany, standard (DIN 2408) specifies clear hand signals which, if used throughout the industry, are designed to avoid misunderstandings between the signal person and the operator. Those standards do not apply if other signals are agreed upon or if other safety signal requirements exist. In any case, all hand signals should be agreed upon between the signalman and the operator.

1. Hand signals (Excerpt from DIN Norm 24 081)

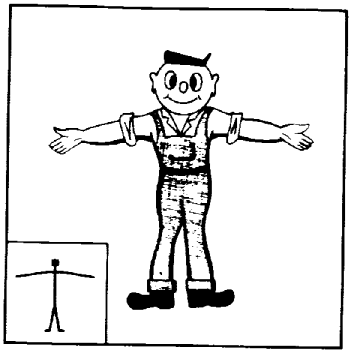
1.1 General Signals

Caution



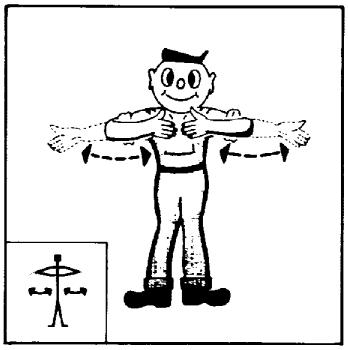
Raise one arm with open palm.

Stop



Extend both arms horizontally.

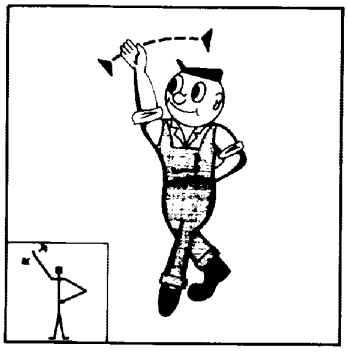
Stop! Danger



Extend both arms horizontally and move forearms in and out.

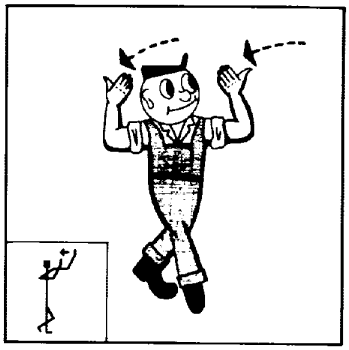
1.2 Travel signals

Start to travel



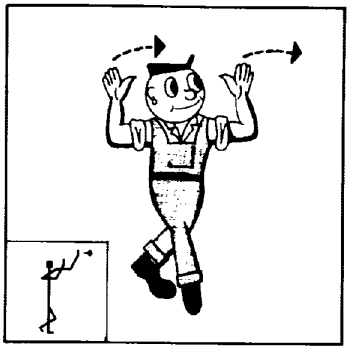
Move the raised hand with the palm pointing outward back and forth.

Travel slowly forward



Both arms raised and bent at elbow with palms pointing inward.

Travel slowly reverse



Both arms raised and bent at elbow with palms pointing outward.

2. Oil for hydraulic system

In the hydraulic system, use only Diesel engine lube oils or special approved oils.

2.1. Oil quality

2.1.1 Approved engine oil classifications

API - classification : CF-4, CG-4, CH-4, CI-4,
(American Petroleum Institute)

ACEA (CCMC) - classification : E2 (D4), E3 (D5), E4, E5,
(Association des Constructeurs Européens de l´Automobile)

Note: The API classifications CC, CD, CE and CF are now obsolete, however, in quality, they had been approved for use in the hydraulic system.

2.1.2 Special oils

Approval is given for each machine type separately. Special guidelines are issued with the release.

The following product presently considered to be an environmentally friendly hydraulic fluid:

Panolin - HLP Synth - VG 46

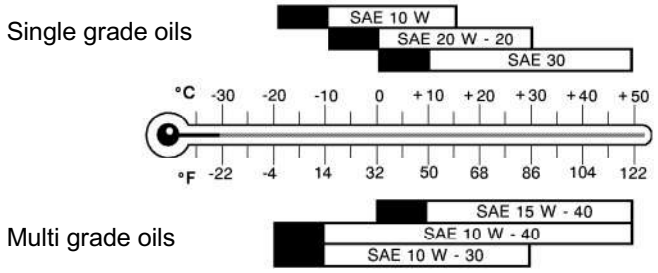
2.2. Oil viscosity

In addition to the quality, the oil must also provide a certain viscosity, the selection is made according to the SAE classification (Society of Automotive Engineers).

The determining factor for the correct selection of SAE classification is the ambient temperature, single grade oils are preferred.

If the viscosity is too high, it can cause cavitations, if it is too low, the lubrication efficiency may be endangered. Both can cause failure of hydraulic components.

The temperature ranges shown in the following chart are guidelines. When operating the machine within the black temperature range, the following warm up procedure should be carried out.



Viscosity for environmentally friendly hydraulic fluids according to ISO: VG 46
(covers SAE 10W and SAE 20W-20 or SAE 10W-30)

For operation in extreme climate zones, such as arctic regions, special guidelines are available from the manufacturer.

Warm up procedure:

a) In temperatures up to 10° C below the given limit (black range)

After starting, run the Diesel engine at medium speed. Warm up the hydraulic system by carefully actuating the hydraulic cylinders. Extend and retract the hydraulic cylinders fully for short periods. After 5 minutes, carefully engage the travel hydraulic as well. Total warm up period is approximately 10 minutes.

b) At even lower temperatures:

Before starting the Diesel engine, preheat the oil in the hydraulic tank, then proceed as described in paragraph a).

1. **Hole diameter for tapping ISO standard Metric (internal) thread**

Thread size	Hole diameter limits		Drill bit Ø
	max.	min.	
M 1	0,785	0,729	0,75
M 1,1	0,885	0,829	0,85
M 1,2	0,985	0,929	0,95
M 1,4	1,160	1,075	1,1
M 1,6	1,321	1,221	1,25
M 1,7	1,346	1,258	1,30
M 1,8	1,521	1,421	1,45
M 2	1,679	1,567	1,6
M 2,2	1,838	1,713	1,75
M 2,3	1,920	1,795	1,9
M 2,5	2,138	2,013	2,05
M 2,6	2,176	2,036	2,10
M 3	2,599	2,459	2,5
M 3,5	3,010	2,850	2,9
M 4	3,422	3,242	3,3
M 4,5	3,878	3,688	3,7
M 5	4,334	4,134	4,2
M 6	5,153	4,917	5
M 7	6,153	5,917	6
M 8	6,912	6,647	6,8
M 9	7,912	7,647	7,8
M 10	8,676	8,376	8,5
M 11	9,676	9,376	9,6
M 12	10,441	10,106	10,2
M 14	12,210	11,835	12
M 16	14,210	13,835	14
M 18	15,744	15,294	15,5
M 20	17,744	17,294	17,5
M 22	19,744	19,294	19,5
M 24	21,252	20,752	21
M 27	24,252	23,752	24
M 30	26,771	26,211	26,5
M 33	29,771	29,211	29,5
M 36	32,270	31,650	32
M 39	35,270	34,670	35
M 42	37,799	39,129	37,5
M 45	40,799	40,129	40,5
M 48	43,297	42,587	43,0
M 52	47,297	46,587	47,0
M 56	50,796	50,046	50,5
M 60	54,796	54,046	54,1
M 64	58,305	57,505	57,6
M 68	62,305	61,505	61,6

Dimensions are in mm
mm x 0,03937 = inches

Standard bore

Diameter range in mm	Bore		Running fit		Shaft							
					Sliding fit	Plain sliding fit	Rough fit	Push fit	Driving fit	Tight fit	Press fit	Forced press fit
	H7	H8	f7	f6	h6	h8	h11	j6	k6	m6	n6	p6
from 1,6	+ 10	+ 14	- 7	- 3	0	0	0	+ 6	+ 6	+ 8	+ 13	+ 16
to 3	0	0	- 16	- 8	- 6	- 14	- 60	- 1	0	+ 2	+ 4	+ 9
from 3	+ 12	+ 18	- 10	- 4	0	0	0	+ 7	+ 9	+ 12	+ 16	+ 20
to 6	0	0	- 22	- 12	- 8	- 18	- 75	- 1	+ 1	+ 4	+ 8	+ 12
from 6	+ 15	+ 22	- 13	- 5	0	0	0	+ 7	+ 10	+ 15	+ 19	+ 24
to 10	0	0	- 28	- 14	- 9	- 22	- 90	- 2	+ 1	+ 6	+ 10	+ 15
from 10	+ 18	+ 27	- 16	- 6	0	0	0	+ 8	+ 12	+ 18	+ 23	+ 29
to 18	0	0	- 34	- 17	- 11	- 27	- 110	- 3	+ 1	+ 7	+ 12	+ 18
from 18	+ 21	+ 33	- 20	- 7	0	0	0	+ 9	+ 15	+ 21	+ 28	+ 35
to 30	0	0	- 41	- 20	- 13	- 33	- 130	- 4	+ 2	+ 8	+ 15	+ 22
from 30	+ 25	+ 39	- 25	- 9	0	0	0	+ 11	+ 18	+ 25	+ 33	+ 42
to 50	0	0	- 50	- 25	- 16	- 39	- 160	- 5	+ 2	+ 9	+ 17	+ 26
from 50	+ 30	+ 46	- 30	- 10	0	0	0	+ 12	+ 21	+ 30	+ 39	+ 51
to 80	0	0	- 60	- 29	- 19	- 46	- 190	- 7	+ 2	+ 11	+ 20	+ 32
from 80	+ 35	+ 54	- 36	- 12	0	0	0	+ 13	+ 25	+ 35	+ 45	+ 59
to 120	0	0	- 71	- 34	- 22	- 54	- 220	- 9	+ 3	+ 13	+ 23	+ 37
from 120	+ 40	+ 63	- 43	- 14	0	0	0	+ 14	+ 28	+ 40	+ 52	+ 68
to 180	0	0	- 83	- 39	- 25	- 63	- 250	- 11	+ 3	+ 15	+ 27	+ 43
from 180	+ 46	+ 72	- 50	- 15	0	0	0	+ 16	+ 33	+ 46	+ 60	+ 79
to 250	0	0	- 96	- 44	- 29	- 72	- 290	- 13	+ 4	+ 17	+ 31	+ 50
from 250	+ 52	+ 81	- 56	- 17	0	0	0	+ 16	+ 36	+ 52	+ 66	+ 88
to 315	0	0	- 108	- 49	- 32	- 81	- 320	- 16	+ 4	+ 20	+ 34	+ 56

Dimensions in µm (1µm = 0,001 mm)

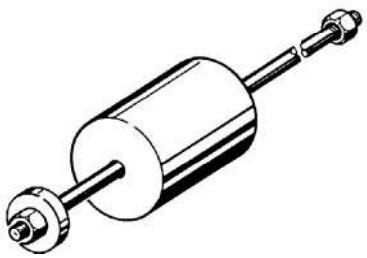
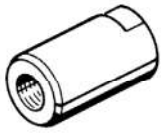
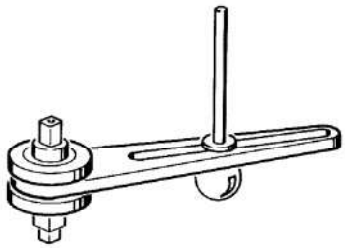
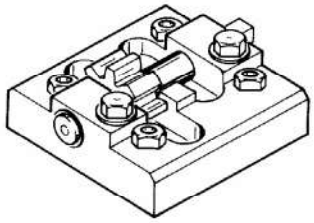
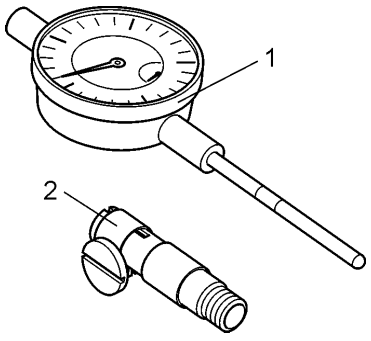
Fit descriptions are in reference to standard bore (Tolerance field H)

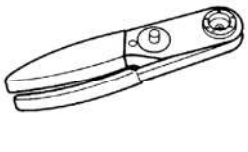
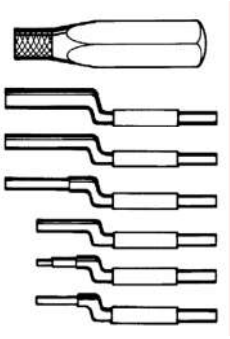
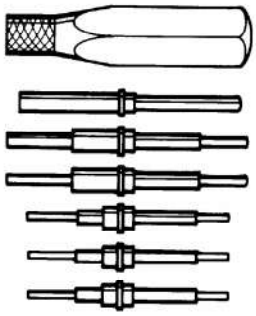
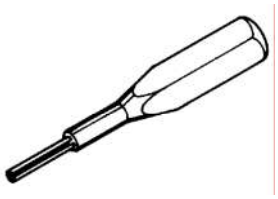
Standard shaft

Diameter range in mm	Shaft			Bore								
	h5	h6	h9	D10	H7	H8	H11	J6	K6	M6	M7	P9
from 1,6	0	0	0	+ 60	+ 9	+ 14	+ 60	+ 3	0	- 2	- 2	- 9
to 3	- 4	- 6	- 25	+ 20	0	0	0	- 4	- 6	- 8	- 12	- 34
from 3	0	0	0	+ 78	+ 12	+ 18	+ 75	+ 4	+ 2	- 1	0	- 12
to 6	- 5	- 8	- 30	+ 30	0	0	0	- 4	- 6	- 9	- 12	- 42
from 6	0	0	0	+ 98	+ 15	+ 22	+ 90	+ 5	+ 2	- 3	0	- 15
to 10	- 6	- 9	- 36	+ 40	0	0	0	- 4	- 7	- 12	- 15	- 51
from 10	0	0	0	+ 120	+ 18	+ 27	+ 110	+ 6	+ 2	- 4	0	- 18
to 18	- 8	- 11	- 43	+ 50	0	0	0	- 5	- 9	- 15	- 18	- 61
from 18	0	0	0	+ 149	+ 21	+ 33	+ 130	+ 8	+ 2	- 4	0	- 22
to 30	- 9	- 13	- 52	+ 65	0	0	0	- 5	- 11	- 17	- 21	- 74
from 30	0	0	0	+ 180	+ 25	+ 39	+ 160	+ 10	+ 3	- 4	0	- 26
to 50	- 11	- 16	- 62	+ 80	0	0	0	- 6	- 13	- 20	- 25	- 88
from 50	0	0	0	+ 220	+ 30	+ 46	- 190	+ 13	+ 4	- 5	0	- 32
to 80	- 13	- 19	- 74	+ 100	0	0	0	- 6	- 15	- 24	- 30	- 106
from 80	0	0	0	+ 260	+ 35	+ 54	+ 220	+ 16	+ 4	- 6	0	- 37
to 100	- 15	- 22	- 87	+ 120	0	0	0	- 6	- 18	- 28	- 35	- 124
from 100	0	0	0	+ 260	+ 35	+ 54	+ 220	+ 16	+ 4	- 8	0	-
to 120	- 15	- 22	- 87	+ 120	0	0	0	- 6	- 18	- 33	- 40	-
from 120	0	0	0	+ 305	+ 40	+ 63	+ 250	+ 18	+ 4	- 8	0	-
to 180	- 18	- 25	- 100	+ 145	0	0	0	- 7	- 21	- 37	- 46	-
from 180	0	0	0	+ 355	+ 46	+ 72	+ 290	+ 22	+ 5	- 9	0	-
to 250	- 20	- 29	- 115	+ 170	0	0	0	- 7	- 24	- 41	52	-
from 250	0	0	0	+ 400	+ 52	+ 81	+ 320	+ 25	+ 5	-	-	-
to 315	- 23	- 32	- 130	+ 190	0	0	0	- 7	- 27	-	-	-

Dimensions in µm (1µm = 0,001 mm)

Fit descriptions are in reference to standard shaft (Tolerance field h)

Description	Id.No.	Remarks	Illustration
Slide hammer	**0524 072**	to remove injectors all engines	
Adapter	**0524 029**	to be used with Id.No. 0524 072 all engines	
Angle method torque fixture	**0524 062**	to torque screws - cylinder head - main bearings - rod bearings all engines	
Engine turning fixture	**0524 045**	mounted on the flywheel housing all engines (not useable at D 9406 TI - PR 752, RL 52, use Id.No. 9183 785)	
Dial gauge **Pos.1** **Dial fixture Pos.2**	**7022 418** **7022 420**	to control the delivery begin from the distribution injection pump all engines with distribution injection pump	

Description	Id.No.	Remarks	Illustration
Hand crimp tool - Cannon M 22 5 20/1-01	**7367 086**	to produce flawless crimp connections. application, see „group 02.3.02."	
Crimp insert - Cannon CT 120090-20 TH 452	 **7409 779** **7367 084**	used with hand crimp tool Id.No. 7367 086 application, see „group 02.3.02."	
Reference gauge M 22 5 20/3-1	 **7409 718**	to check the hand crimp tool Id.No. 7367 086 application, see „group 02.3.02."	
Insertion tool for CA - B Crimp contacts CIT-F80-KIT complete consisting of: 1 Handle 1 Insert CIT 20 1 Insert CIT 16 1 Insert CIT 12 1 Insert CIT 8 1 Insert CIT 4 1 Insert CIT 0	 **7409 721** **7409 693** **7409 694** **7409 695** **7409 696** **7409 697** **7409 698** **7409 699**	to insert wired crimp contacts into the plug connectors. application, see „group 02.3.02."	
Extraction tools for CA - B crimp contacts CET-F80-KIT complete consisting of: 1 Handle 1 Insert CET 20 1 Insert CET 16 1 Insert CET 12 1 Insert CET 8 1 Insert CET 4 1 Insert CET 0	 **7409 700** **7409 701** **7409 702** **7409 703** **7409 704** **7409 705** **7409 706** **7409 707**	to remove wired crimp contacts from the plug connectors. depending if socket or pin contacts are removed, the corresponding side of the tool insert should be used. application, see „group 02.3.02."	
Insertion tool for KPSE crimp contacts MS 24256 A16 MS 24256 A20	 **7409 708** **7409 709**	application, see „group 02.3.02."	

6.2. Plate Thickness

The thickness of the reinforcement plate should be up to 2/3 (66%) of the thickness of the material to be reinforced.

6.3. Plate Quality

The yield and tensile strength of the reinforcement plate should be equal to the material to be reinforced.

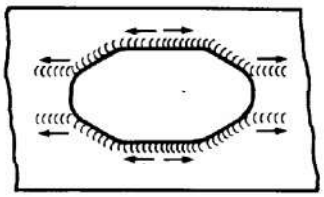
6.4. Plate Installation

The welded area of the crack should be ground so it is smooth and level.

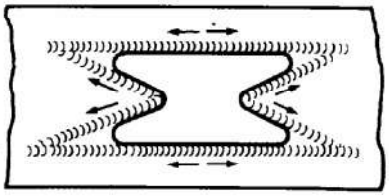
The size of the plate must be selected in such a way that the longer sides of the plate extend into the connecting construction of the material to be reinforced. The plate should also overlap the crack on each side by at least 1" (20 mm). The correct position and fit of the reinforcement plate is achieved through clamping and spot welding.

6.5. Plate Welding

The reinforcement plate should be welded on by running a welding bead alternately on both sides. The welding should always start in the middle of the plate and run towards the outside. Be certain to observe that each welding seam has proper run out.



← Direction of weld



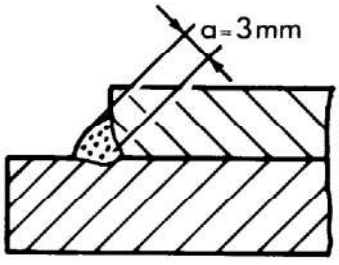
← Direction of weld

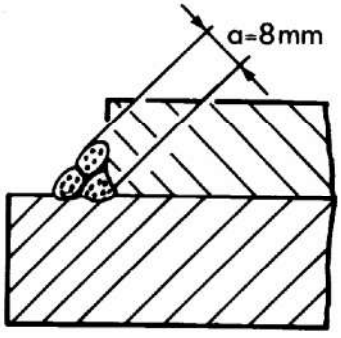
The size of the welding run "a" is figured out in reference to the thickness "k" of the reinforcement plate.

Use formula: a=0,5 k

Up to a welding run "a" of approx. 1/8" (3 mm) a single run can be made, however, as a general rule, a double run should be preferred.

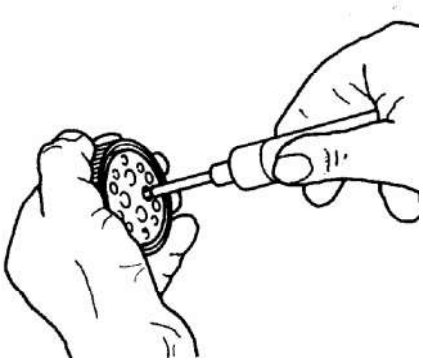
Above a welding run "a" of 1/8"(3 mm), the first run provides excellent penetration between the reinforcement plate and the basic material. Subsequent runs are added on top of the first run.





After the welding is completed, clean the welding seam as necessary. Grind the run out between reinforcement plate and basic material.

Push out the contacts with appropriate tool out of the insulator - see paragraph 3.2 by applying even and continuous pressure towards the connector, keep the tool parallel to the axis of the plug connector. Stop when the shoulder of the tool touches the front of the insulator. Carefully pull the tool from the insulator.



Remove all contacts in the same way, make sure to note different versions / tools.

⚠ **Important:** The tool must fit properly into or over the contacts.

The housing and seal normally stay on the wiring. If necessary, pull the wires and contacts carefully from the seal, remove the housing from the wires.

3.4. To wire the Contacts

Contact size		Contact type S=Socket P=Pin	Wire diameter		Stripping length (mm)	Adjustment - Crimp tool	
Metric	AWG		mm²	AWG		Dial No.	Color Crimping insert
15S	16S	P	1,0	18	$6,0^{+0,5}$	5	blue
		S				5	green
		P	1,5	16	$6,0^{+0,5}$	6	blue
		S				6	green
15	16	P	1,0	18	$6,0^{+0,5}$	5	green
		S				5	red
		P	1,5	16	$6,0^{+0,5}$	6	green
		S				6	red
25	12	P	2,5	12	$6,0^{+0,5}$	8	red
		S				8	red

Strip the wire as noted on chart and crimp - see paragraph 2.1 to 2.3

3.5. Insertion of Contacts

Note general guidelines in paragraph 1.

Push the plastic insulation over the housing onto the wires.

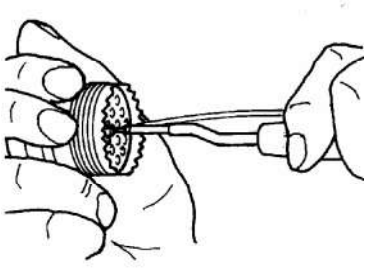
If housing and sealer were removed, push on housing, dip seal into isopropyl alcohol and guide contact with cable from the side marked with letter. Use the appropriate insertion tool.

⚠ **Important:** The seal housing must align with the insulator housing!

Note the installation position of the wire as noted on number coding plan.

Insert contacts into the guide tool, push the insertion tool to the top of the connector tip.

On socket type contacts, insert guide pin. Dip in isopropyl alcohol and insert straight into insulator until it snaps into position.



⚠ **Important:** Make sure to check number coding chart.

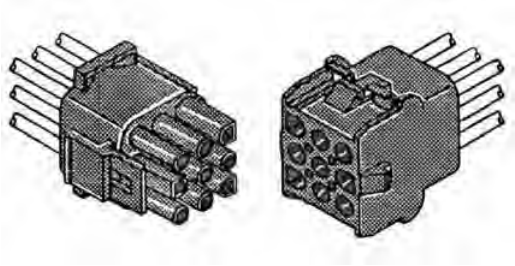
Remove guide pin and insertion tool. Slightly pull the wire to check proper seating of the contact, plug chambers with empty contacts.

Installation guidelines for MATE-N-LOK and JUNIOR POWER TIMER plug connectors

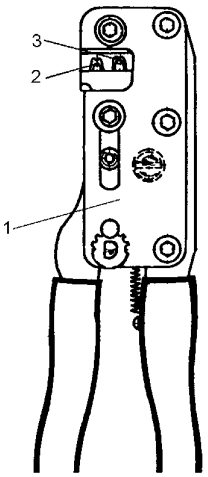
1. MATE-N-LOK

Design:

Plug with contact pin Socket with contact bushings



1.1. Use of hand crimping tool



Profile 1 Pos.2 Wire diameter 0.5 – 1.3 mm²

Profile 2 Pos.3 Wire diameter 1.3 – 2.1 mm²

Open the pliers, pos.1 all the way to insert the contact, which is to be crimped (note the correct profile) and slowly push the pliers together until the contact is lightly clamped on the crimping sleeve.

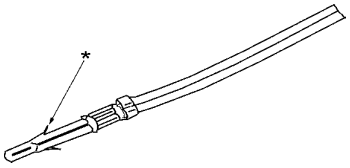
Insert the wire, which is to be insulated (insulation length 5 mm).

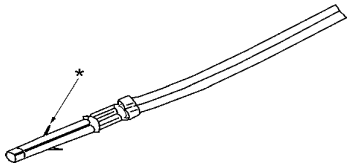
Push the pliers all the way together.

Pull the crimped contact from the pliers and check the crimping.

Contact pin with crimped wire Contact bushing with crimped wire

* = Contact notch





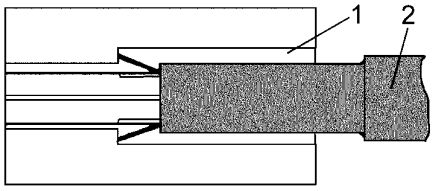
1.2. Installation of contacts

Installation is made without tools.

Note: Check contact notches before installation for damage or breaks.

Contacts must audibly click when engaging in the housing.

1.3. Removal of contacts



To remove the contacts, use special tool, see section 02.1.31.

Use:

Push the tool, pos.2 over the pin or bushing contact and push the contact notches together, pull the contact on the cable from housing, pos. 1 .

RL 42 B			F/N 683-3002→5320
DIESEL ENGINE			
Type			D 926 TI-E A2
Engine version			in line 6 - intercooled
Rating to ISO 9249		kW	172 (234 HP)
Rated RPM		1/min	1800
Low idle RPM		1/min	800^{+50}
High idle RPM		1/min	1900^{+60}
Displacement		l (cu. in)	9,96 (607,8)
Oil quantity incl. filter		l (qt)	25,5 (27)
Oil specification			see lube oil - group 1.3
Max. machine inclination - all directions			45° = 100%
Valve clearance -cold	intake/exhaust	mm	0,25 / 0,30
Firing order			1-5-3-6-2-4
Coolant capacity / DCA 4		l (gal)	62 / 2,4 (16,4 / 0,66)
Fuel tank capacity		l (gal)	450 (118,9)
Fuel consumption		appr. l/h (gal/h)	20 - 35 (5,3 - 9,2)
SPLITTERBOX			
Type			350 B 376
Gear version			1 stage spur gear
Ratio		i	0,86
Oil quantity		l (qt)	3 (3,2)
Oil specifications			see lube oil - group 1.3
HYDRAULIC SYSTEM			
Travel pumps		type	2xHPV 130
max. flow - Q max.		l/min (gal/min)	2x272 (2x71,8)
max operating pressure		bar	420
Tandem gear pump - repl.-/cool.-/pump contr.- circuit		type	PRN 55 + 17S SC37G
repl. / coolant circuit-	max. flow - Q max.	l/min (gal/min)	117 (31)
Max. operating pressure (SP) p max.		bar	27^{+3}
pump control -	max. flow - Q max.	l/min (gal/min)	33 (8,7)
	max. operating pressure (St) p max.	bar	52^{+5}
Travel motors		type	2xBMV 260
Variable flow working hydraulic pump		type	A10V140
max. flow - Q max.		l/min (gal/min)	292 (77,1)
stand by pressure (HD)		bar	30
Control valve block - working hydraulic		type	M7-3038 + M7-22-10/E100
max. operating pressure (HD) p max.		bar	285
Servo - operating pressure - working hydraulic (ND)		bar	25^{+5}
Variable motor hoist winch		type	A6VM107HD1D63
regulation begin HD		bar	190
Hydr. tank capacity		l (gal)	178 (47)
- +circuit capacity		l (gal)	88 (23)
Oil specifications			see lube oil - group 1.3
ELECTRICAL SYSTEM			
Voltage		V	24
Batteries			2x12V 143Ah (in series)
Alternator			28V 55A
Starter		kW	6,6
Automatic circuit breaker		A	35
Fuses		A	see Operation and Maintenance Manual

Customer:.....Mach.-Type.....F/N(PIN).....-.....Sm.-hours.....Date.....

Maintenance/Inspection by Operating Hours

WORK TO BE CARRIED OUT

by maintenance personnel — by authorized trained personnel
□ first and only maintenance interval — **OM** Operation Manual
○ repeat maintenance interval — **SM** Service Manual

① for correct oil level, use dipstick marks - for procedure and quantities, see OM
② for quality and viscosity guidelines see "Service fluids", SM - section 1.3
③ for adjustment values, see data page entries in SM

at delivery	every 8 - 10	every 50	every 250	every 500	every 1000	every 2000		Reference		Notes
							DIESEL ENGINE			
○	○	○	○	○	○	○	Check engine oil level and pressure	OM		①
○	○	○	○	○	○	○	Check coolant level	OM		①
	○	○	○	○	○	○	Check engine, radiator and belly pan for dirt - clean if necessary	OM		
	○	○	○	○	○	○	Check fuel filter water separator / drain if necessary	OM		
		○	○	○	○	○	Drain fuel tank condensation and sediments - at least once a week	OM		
			○	○	○	○	Replace engine oil - at least once a year	OM		①②
				○	○	○	Replace lube oil filter - at least once a year	OM	SM	
				○	○	○	Check radiator cap (RL 52 - 2 pcs.) for valve function and leaks, check fan condition	OM	SM	
				○	○	○	Replace coolant filter, check antifreeze / DCA4 percentage in coolant	OM	SM	①②
				○	○	○	Check condition and tension of V-belt	OM	SM	
○				○	○	○	Check oil, cooling and fuel system for leaks and condition	OM	SM	
○				□	○	○	Check air intake and exhaust system for tightness and leaks	OM	SM	
				□	○	○	Check oil pan and engine mounts for condition and tightness	OM	SM	
				□	○	○	Check engine RPM - adjust if necessary		SM	③
					○	○	Check and adjust valve clearance - with cold engine		SM	③
					○	○	Check and service injection pump and potentiometer linkage	OM	SM	
					○	○	RL 22B - Replace fuel pre- and fine filter elements - stage 1 and 2	OM		
					○	○	RL 42B / RL 52 - Check fuel prefilter strainer / clean if necessary	OM		
					○	○	RL 42B / RL 52 - Replace fuel filter catridge	OM		
					○	○	Grease flywheel teeth		SM	
					○	○	Check flame glow plug system (before start of cold season)		SM	
							Replace air filter elements - if necessary or at least once a year	OM		
							Replace oil separator (crankcase breather) - every 2 years	OM	SM	
							Replace coolant with antifreeze and DCA4 - every 2 years	OM	SM	①②
							Check / adjust fuel injectors - if necessary or at least every 3000 operating hours		SM	③
							HYDRAULIC SYSTEM			
○	○	○	○	○	○	○	Check oil level in hydraulic tank	OM		①
○	□	□	□	○	○	○	Clean magnetic rod - daily up to 250 operating hours	OM	SM	
				○	○	○	Replace return oil filter element in hydraulic tank, check all case drain filter inserts for deposits / contamination	OM	SM	
				○	○	○	Replace pressure filter (element) of the repl. circuit	OM		
○				○	○	○	Check attachment and travel hydraulic system for function and leaks, check hydraulic hose routing for chafing	OM	SM	
				○	○	○	Drain hydraulic tank condensation and sediments (at least every 6 month)	OM		
				○	○	○	Check hydraulic oil cooler for dirt / clean if necessary, and check fan condition on RL 52	OM		
				○	○	○	Check / adjust all hydraulic pressures according to adjustment checklist		SM	③
				○	○	○	Check mountings and fittings for tight seating	OM	SM	
						○	Replace hydraulic oil (refill via tank filter) - at least every 4 years - whenever "environmentally safe hydraulic fluids" are used request / observe any special guidelines from manufacturer	OM		①②

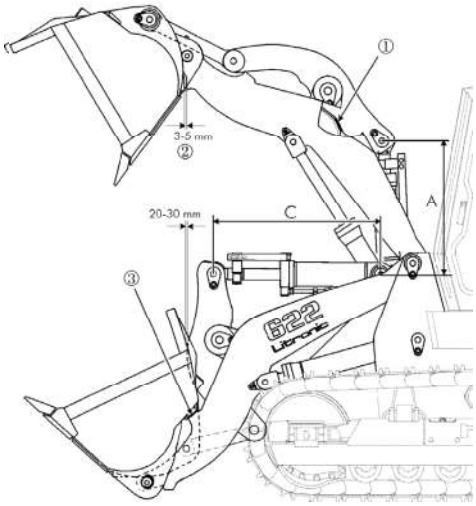
2.7.2 Crawler loaders - bucket stops and limit switch adjustment

With the bucket fully tilted in and in its **lowest position**, there must be a min. of 5 mm distance between the bucket and the linkage, and the bucket must touch the stops on both sides evenly.

With the bucket **fully raised** (limit switch disabled) and fully tilted out, the linkage must touch the stop, the back of the bucket may touch the stops (bucket unloaded).

Replace worn stops as outlined in group 13.2.

Hoist and bucket limit switches must be adjusted to suit application and to aid the operator. See "Operation and Maintenance Manual".



2.7.3 Pipe layer - hoist gear - cable winch

For further details on maintenance and inspection as well as important safety recommendations, refer to group 14, the winch manufacturer's instructions and the "Operation and Maintenance Manual".

2.7.4 Pipe layer - function free fall device

Caution: Secure machine and working area. The free fall area of the load has to be free. Observe safety guidelines.

Lift a suitable test load with a weight of appr. 1500 kg with the hoist gear and actuate the free fall device. The load has to drop down faster than normal lowering.

Note: for attaching loads and actuating the free fall device, observe all guidelines of the machine reflected operation manuals.

2.8. General inspection procedures

If any **maintenance problems** have been found, discuss the correct procedures with maintenance personnel.

If possible, check for possible **operational errors** and advise the machine operator, as necessary.

If additional measures, maintenance or inspections for **special attachments** are required, make sure to carry them out and record them on the inspection report.

Determine any **spare parts requirements** or any expected repairs, discuss with and inform the appropriate personnel.

15.<u>Basic adjustment - left track</u> and
16.<u>Straight run, right chain compared to the left chain</u>

A pre-check can be made during an inspection without closing off the control lines, limited to the following checklist points (right switch on test box to position "TEST"):

16.1	- forward 1	16.3	- forward 4
	- forward 2		- forward 5
	- reverse 1		- reverse 4
	- reverse 2		

Note: If the indication is outside the "green center" range for one of these tests, then all tests / adjustment steps must be made according to the check list (right switch on test box in straight run adjustment position "ADJUST").

Attention: If one of the stages 3 are selected, the chains are running at full speed.

Test steps for par. 15 "basic adjustment - left track " show the speed of the left chain in relation to the values stored in the test box. Adjustments are made on the left travel drive side.

Test steps for par. 16 "straight run, right chain compared to left chain " show the speed of the right chain in relation to the speed of the left chain. Adjustments are made on the right travel drive side.

Basic adjustments and straight run must be made in 3 groups, since the travel motors are hydraulically controlled by the pumps and there are 2 motors for each side.

Group 15.1 / 16.1= Check / adjustment of pumps. Close of servo lines to motors on pump outlets (motors remain on Q_{max}).

Correct adjustment for both groups: analog indicator "green center"

Group 15.2 / 16.2 = Check / adjustment of motor per side. Servo lines to motors on pump outlets are reconnected, close off servo lines to one motor per side (motors remain on Q_{max}).

Correct adjustment for group 15.2: Analog indicator exactly over the dividing line between the red indicator field ”SLOW” and the green indicator field. "Center green" may not be exceeded.

Correct adjustment for group 16.2: Analog indicator "Green center"

Group 15.3 / 16.3 = Check / adjustment of one motor per side. Servo lines to all motors are reconnected.

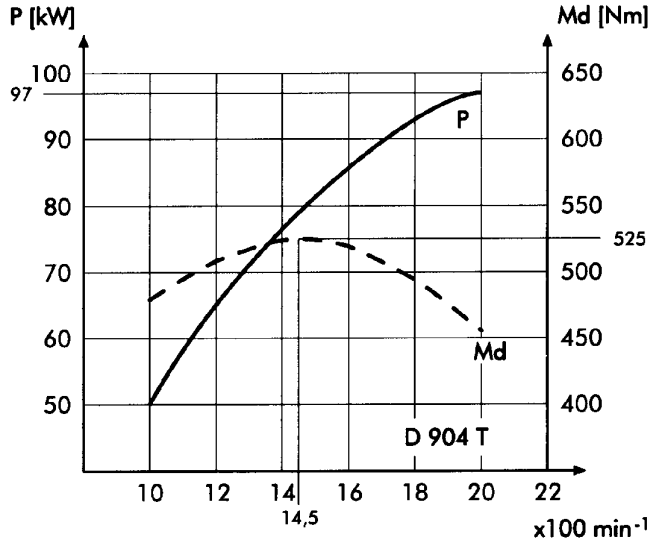
Correct adjustment for both groups: analog indicator "green center",
for 15.3, the red indicator field "FAST" may never be reached.

Note:
- If an existing adjustment is changed, change it in the corresponding direction past the required indication value. Then reset it to the required value - see above.
- Always make adjustments only after the chain stops turning.
- Correct adjustments until the analog indicator remains in the required range, even after several rechecks.
- If an adjustment must be made in stage 5 / mech. Q_{min} stop (group 15.3 / 16.3), determine the dimension of adjustment screw on both travel motors for the side to be adjusted.

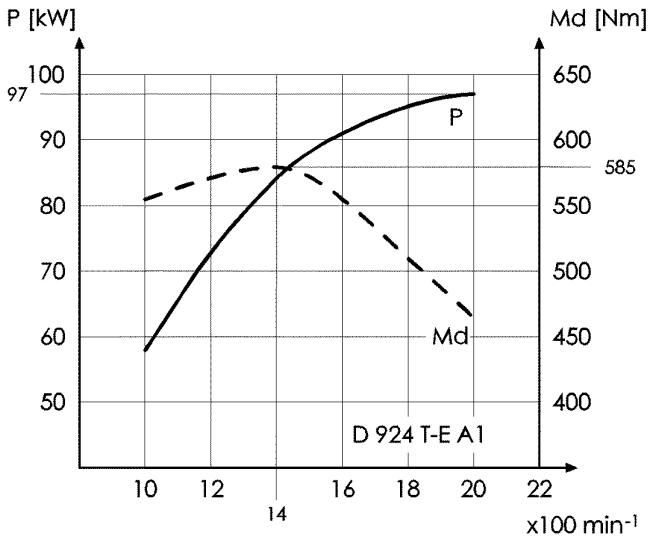
  Chain too quick → on travel motor with larger screw overlap, turn the adjustment screw in clockwise direction.

  Chain too slow → on travel motor with smaller screw overlap, turn the adjustment screw in counterclockwise direction.

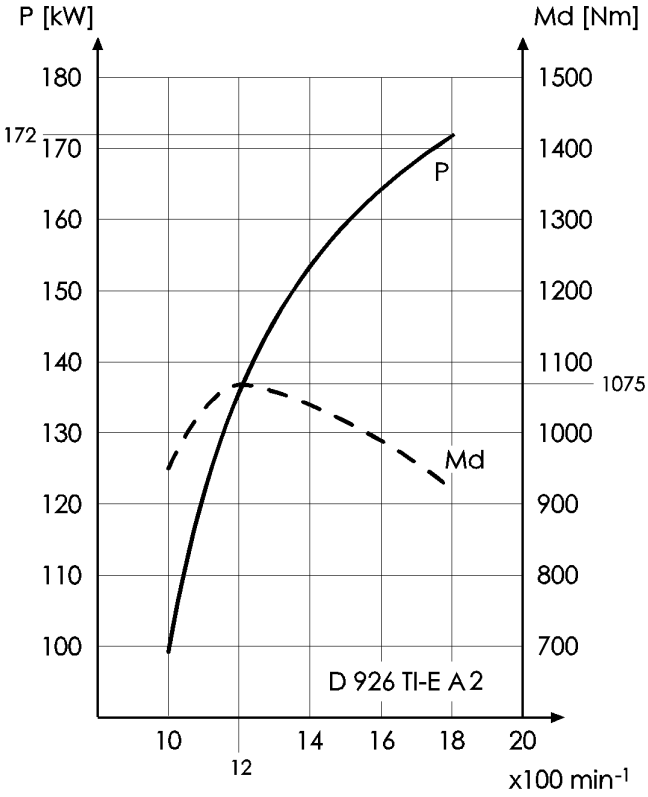
RL 422 F/N x-x-1001→3000



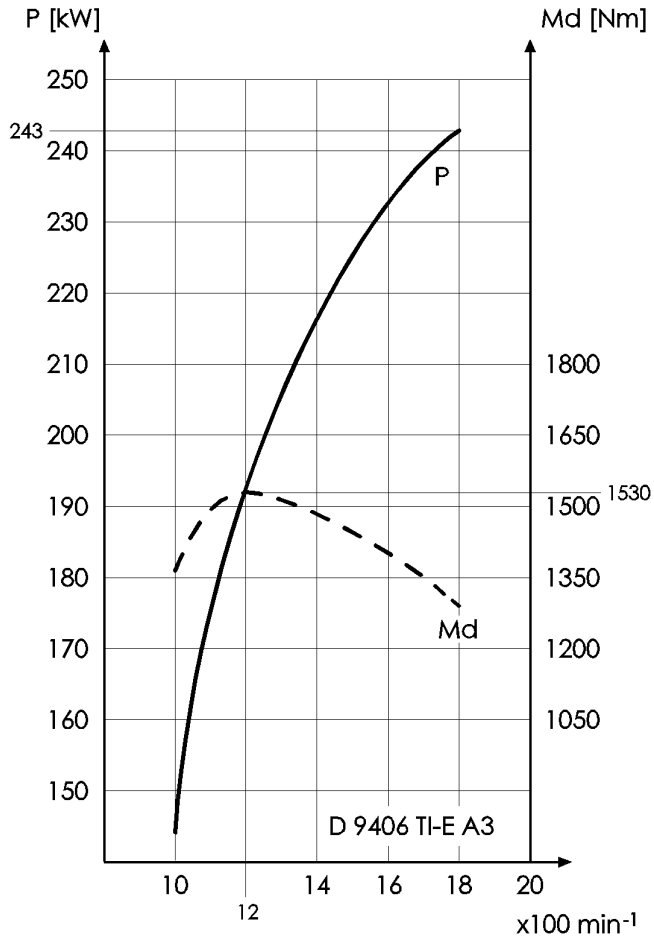
RL 22B F/N 615-3002→

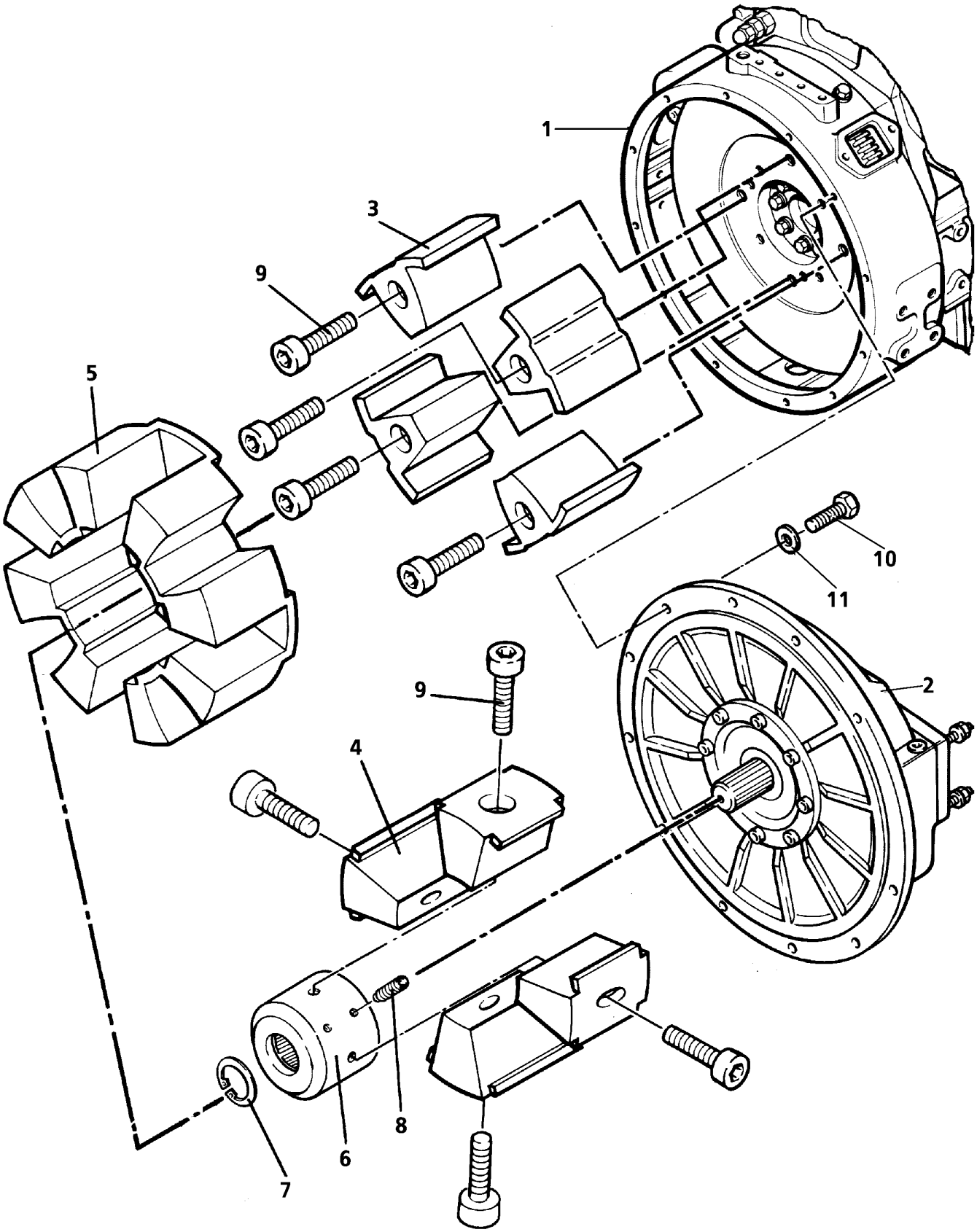


RL 42B F/N 683-3002→



RL 52 F/N 739-2001→





LIEBHERR

Benennung Description Dénomination

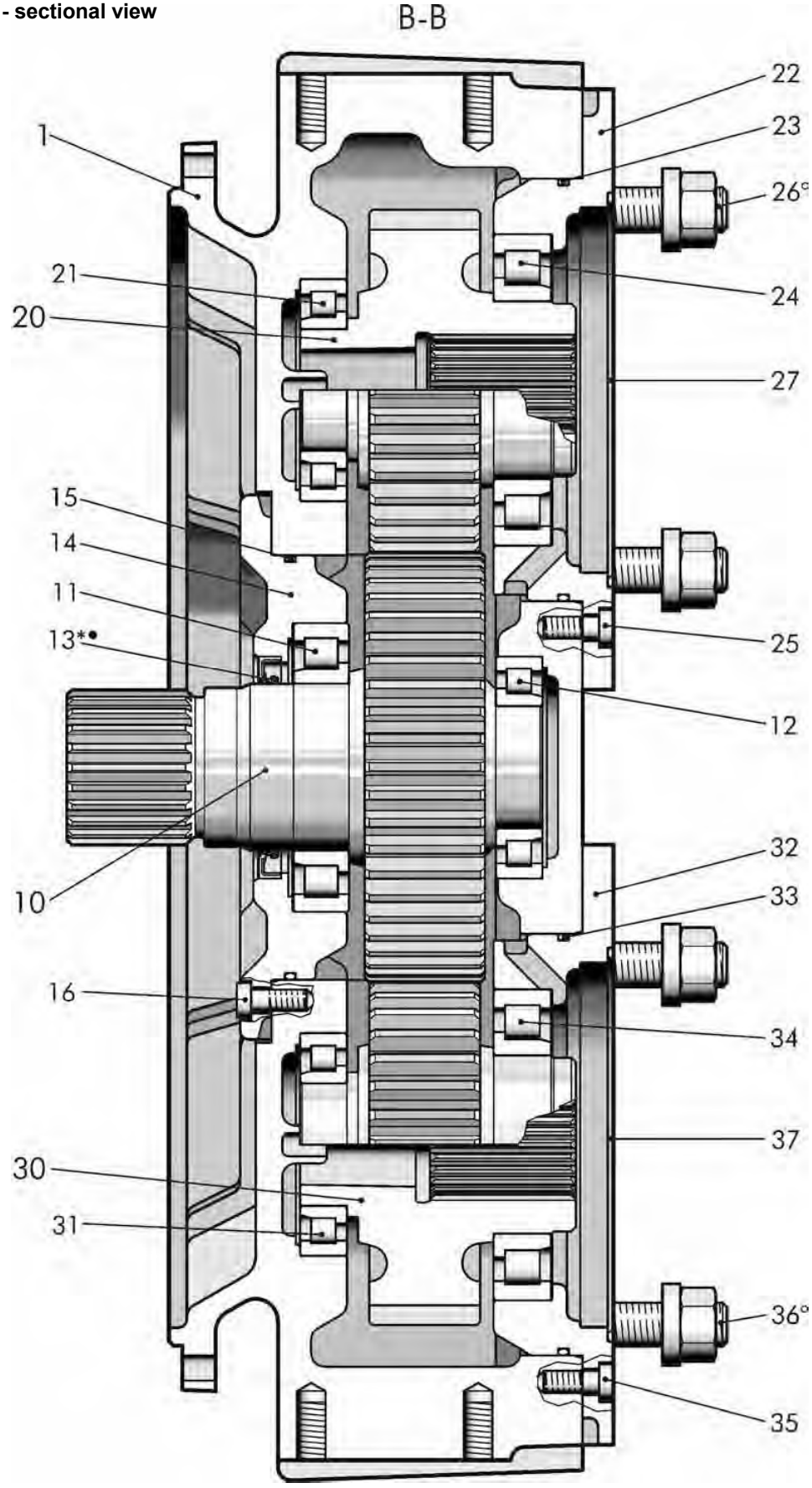
Coupling

Typ/ab	Type/from	Type/a partir de
PR 712	F/N xxx- 0103→	
PR 722	F/N xxx- 0103→	
RL (4)22	F/N xxx- 1001→	

Notes

Oil level dimensions A, B see page 5.1.00.01

Repositioned - sectional view



1. Description

The travel hydraulic system consists primarily of **two** independent **hydrostatic circuits**. A variable flow pump and variable flow motors for each drive operate in a **closed loop circuit** and each drive a travel gear / track .

The drives are always connected and also serve as the service brake.

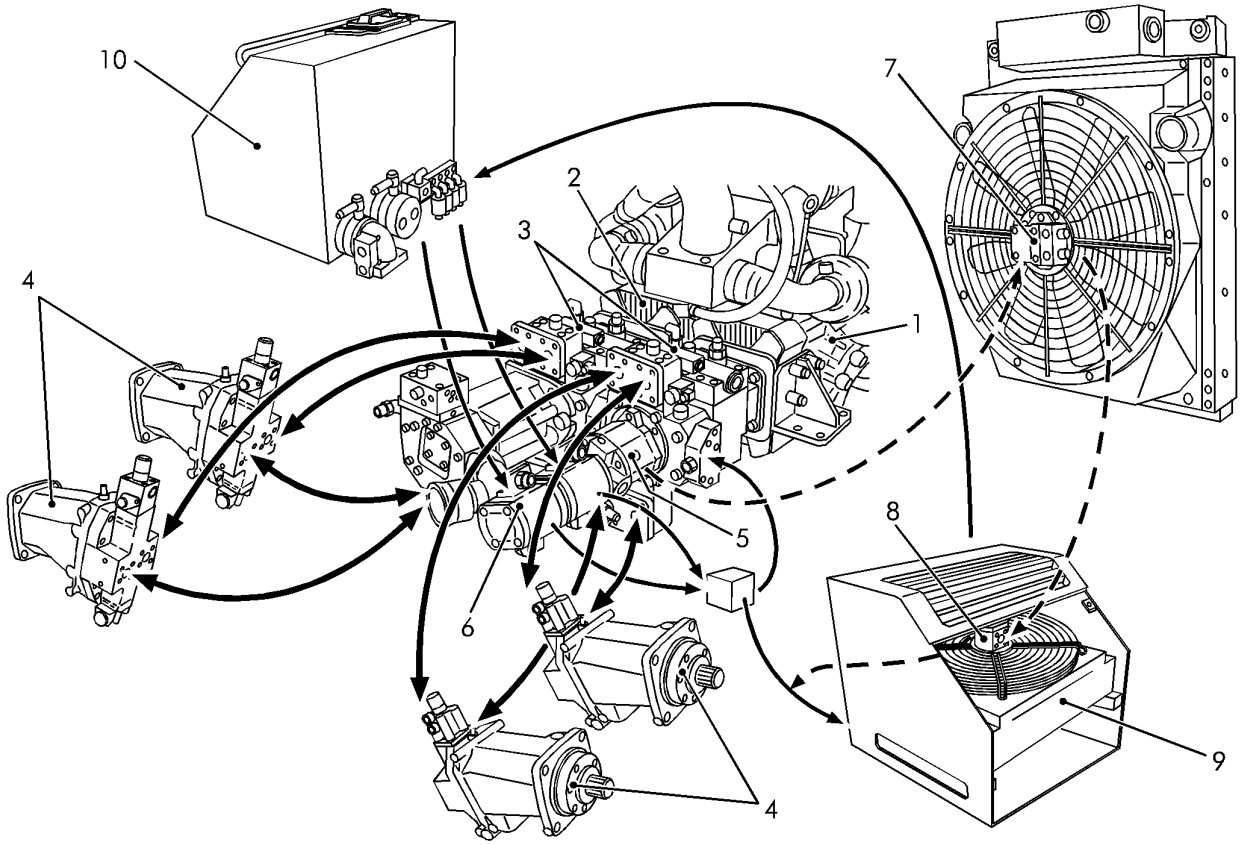
All travel and steering movements of the machine, from straight travel to counterrotation are infinitely variable by moving the travel lever. Control and regulation of the travel hydraulic system is handled by the electronic control system. The stepless regulation also makes maximum utilization of the existing Diesel engine power possible, since the result of force × speed can be held at a constant level .

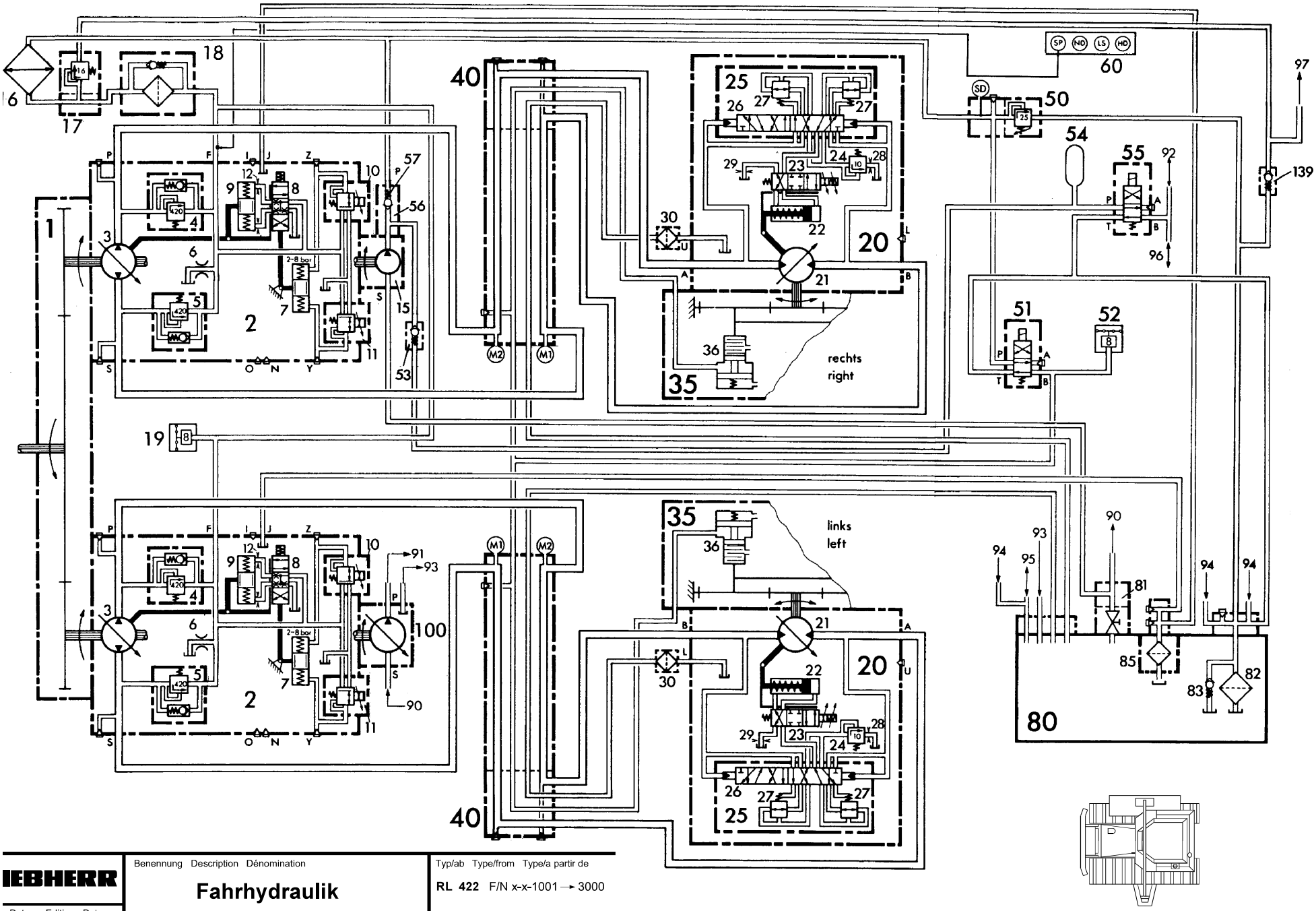
The pressure between travel pumps and motors depends on the travel resistance, the transferred torque on the angle of the variable flow motors.

The oil cooling system and hydraulic tank are also utilized for the working hydraulics of the machine.

2. Main components of drive train

1- Diesel engine
2- Splitter box
3- Swash plate type variable flow pump, right & left
4- Bent axis type variable flow motor
2 x right, 2 x left
5- Swash plate type - regulating pump (fan drive)
6- Gear pumps - replenishing
7- Axial piston fixed displ. motor / engine cooling fan
8- Gear motor/ hydraulic oil cooling fan
9- Hydr. oil cooler
10- Hydraulic tank
x- Travel gear with parking brake
(not shown)





LIEBHERR	Benennung Description Dénomination **Fahrhydraulik** **Travel hydraulic** **Hydraulique de translation**	Typ/ab Type/from Type/a partir de **RL 422** F/N x-x-1001 → 3000
Datum Edition Date **01 95**		Blatt Page Feuille **6.3.20.00**

Notes

Important information

The following adjustment instructions are intended for step by step machine adjustment; generally, only sections of the adjustments/instructions are required. However, it must be ensured that the required preconditions are met.

Use only glycerine-filled pressure gauges with a reading accuracy of ± 1% or even more accurate test devices. The range of the pressure gauge should be approx. 30%, max. 100% above the test value to be adjusted.

Use only the **test box with adapter** - see Special Tools, page 2.1.30.01. - to check the electronic system and the straight-run of the machine. For instructions, see group 10.4.00.

When adjusting the straight run, just as in actual application, the track tension must be the same on the left and right track - see Operation Manual.

Caution: To check / adjust the straight-run, park the machine on firm and level ground, raise it and securely support the machine to allow the chains to turn freely.

Secure the danger zone.

Observe all safety guidelines as outlined in group 1.2.01..

If the operator's cab is raised, the test box may only be used outside the machine and its danger zone. It is not permitted for persons to be on or near the crawler during these tests.

When putting the **machine into service**, proceed according to the instructions given in the **Operation Manual**. Check the right origin of the indicator lights .

Perform all tests and adjustments with Diesel-RPM, as indicated in the adjustment checklist and with the machine at operating temperature.

Any **problems or defects** detected during tests **must be fixed** immediately or as soon as possible, depending on the severity and type of problem.

For tests / adjustments, use the corresponding Adjustment Checklist, page 3.5.xx.xx.

The sequence of checks corresponds to system requirements, the following instructions have been matched to those requirements as much as possible. **The nominal adjustment values are noted on the checklist.**

A. Tests with standard measuring devices - adjustments

1. Visual tests and maintenance

Perform scheduled maintenance and inspection work before checking the system visually. For intermediate tests / adjustments, observe the following points.

1.1 Service items and filters

Check the **coolant** and **oil level** in the Diesel engine, splitter box and hydraulic tank. Add oil as necessary.

Check the **air filter** for contamination, damage, correct installation and correct type.

Add **fuel** as necessary, drain water and sediments from tank and **separator**. If there is any reduction of power, clean the **screen filter** and replace **the pre / fine filters**.

If components are thought to be damaged or worn, open / check the **hydraulic oil filter** for the affected part.

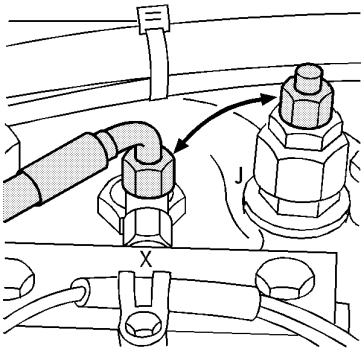
In case of temperature problems, check the **hydraulic oil cooler** and fan for contamination / damage.

2.2.1 Additional preparations for machine models **RL 52**

The travel motors (2 per side) on the RL 52 are controlled hydraulically from the pump remote control and start regulating shortly before the end of pump regulation. For function / schematics, see group 6.3.

Because of this overlap, the servo control of hydraulic motors must be disconnected when testing / adjusting the end of pump regulation.

Because internal leakage can cause a build-up in pressure and, as a result, change the motor adjustment, servo lines must be connected to ”tank" and may not be closed off.



Test / adjustment of pumps - travel speed and straight run:

Remove the servo line to the hydraulic motors on pump port X and connect to free housing port J. Close off connection X with the plug from the housing port.

Perform tests / adjustments as outlined in **checklist section ”disconnected servo lines"**.

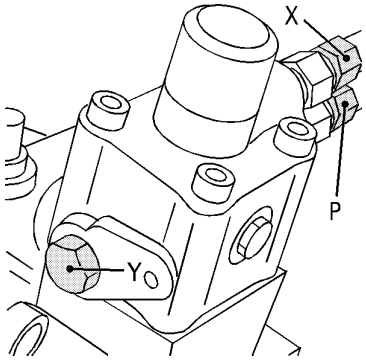
Reinstall parts after adjustment.

Test / adjustment of hydraulic motors - travel speed and straight run:

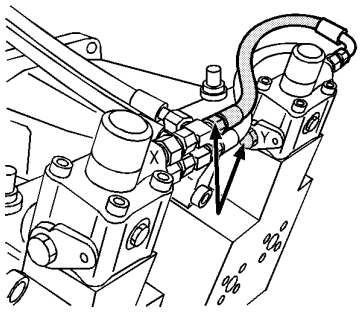
The four displacement motors must be tested / adjusted individually during the basic adjustment.

Therefore it is a need, to have on each side only one variable motor connected to the servo line before you start with the next tests/adjustments.

In travel direction forward the two motors in front are on the end of the servo line. Remove the plug from connection Y at the remote controls of this motors and install fittings as listed below (drawing shows left hand front motor, seen from the rear side of the machine = cover at the main frame)



Disconnect the servo lines "motor to motor" from the rear motors - connection X and connect the lines with the fittings at connection Y on the front motors. Close fittings at the rear motors with stopper and union nut.



Required parts:

2 x IdNo.	7404 259	Reducer fitting
2 x IdNo.	7410 458	Fitting
2 x IdNo.	7403 569	Elbow fitting
2 x IdNo.	7003 628	Stopper
2 x IdNo.	4600 562	Union nut

At the front motors connection X is now open to "tank", the rear motors are still connected to the servo lines.

Carry out tests/adjustments referring to the **checklist step "servo lines connected to one motor on each side"**, If necessary, adjust the rear motors.

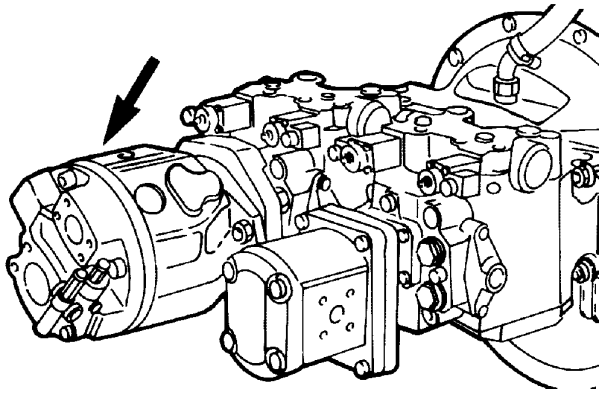
Note: The base adjustment (speed) for the left motor must be set to the line between the red and green field on the ”SLOW" side of the straight run indicator on the test box, the straight run of the right motor is as usual adjusted to the center of the green section. See ”test box application", group 10.4.

1. Description

The working hydraulic system operates with an open circuit. During operation, oil from the hydraulic tank flows from an on-demand type regulating pump via control valve to the end user (cylinder). The system pressure depends on the resistance which the attachment encounters and is limited by the pressure cut off. From the opposite side of the end user, oil flows via control valve back to the hydraulic tank. To avoid cavitation, return oil flow is slightly restricted. The control valves are shifted by oil from the replenishing circuit of the travel hydraulic via a pilot control valve (joystick).

The regulating pump for the working hydraulic is flanged onto the left side of travel pump and is driven together via the splitter box by the Diesel engine.

If travel and working hydraulic are actuated simultaneously, the working hydraulic always receives its full power requirement from the Diesel engine. The possible power demand of the travel hydraulic is limited by the horsepower regulation to the horsepower still available from the Diesel engine and thus protects the engine constantly from being overloaded.



2. Main components and their basic functions

2.1 Joystick
- 4-way
- 2-way additional at RL 42B and RL 52

2.2 Regulating pump, on demand control with pressure cut off

2.3 Control valve in sandwich design

2.4 Hydraulic cylinder

2.5 Hydraulic tank

2.6 Safety control

2.1. Pilot control valves (joysticks)

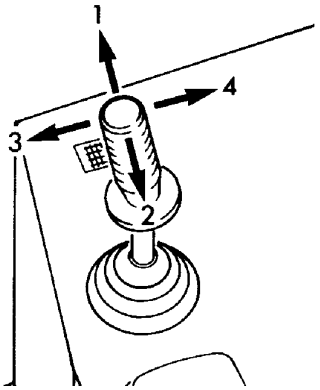
The servo oil is supplied from the replenishing circuit of the travel hydraulic. By moving the joystick in the appropriate direction, the direction and speed of the matching attachment function is controlled.

The basic functions of the working attachment - boom up / down and hook block hoist / lower - are controlled by the 4-way joystick mounted on the right side of the operator's platform.

Lever forward	(1)	-	lower hook block
Lever backward	(2)	-	hoist hook block
Lever left	(3)	-	lower boom
Lever right	(4)	-	lift boom

By moving the joystick lever diagonally, two attachment functions can be selected at the same time.

At machines RL 42B and RL 52 the function move counterweight in/out is actuated by a 2-way joystick. If the lever gets deflected to the front, the counterweight moves out, if the lever gets deflected to the rear, the counterweight moves in.



3.4.2 Working circuit

Pressurized oil flows from spool 122 to→pressure compensator 123 (→ LS)→spool 122→ control valve block-outlet B1 → connection block 136 → brake valve 160 B → 160 internal

160 internal → way valve 163 → pressure reducing valve 164 → load holding brake 171 (release).
→ check valve 166 → blocked.
→ shut off piston 165/front surface - see section 2.5.2.
→ check valve 161 variable motor 150 → 150 internal

150 internal → pressure relief valve 154.
→ Axial piston unit 151/hoist gear.
→ check valve 152 → piston 156, 157, 158 - see section 2.5.1.
→ check valve 153 → blocked.
→ external → check valve 137 → blocked.

Oil return from axial piston unit 151 to → brake valve 160 → internal - see section 2.5.2 → outlet B → control valve block 120 A1 → spool 122 → tank line/connection T → return filter 82 → tank 80.

Replenishing if necessary via check valve 137, from the tankline, which is preloaded by the check valve 139 with appr. 2 bar.

3.5 Hoist gear - lower

3.5.1 Servo control

Servo pressure build up from regulating piston 113 to → housing outlet 3 →→
→ pressure switch B23 (electr. safety switch free fall device).
→ control valve block 120-a1 → spool 122/displacement toward b1.
→ shuttle valve 118 → connection block X → variable motor X → pilot piston 156 (regulating).

3.5.2 Working circuit

Pressurized oil flows from spool 122 to→pressure compensator 123 (→ LS)→spool 122 →control valve block-outlet A1 → connection block 136 → brake valve 160 A → 160 internal

160 internal→ way valve 163 → pressure reducing valve 164 → load holding brake 171 (release).
→ check valve 167 → blocked.
→ shut off piston 165/front surface - see section 2.5.2.
→ check valve 162 → variable motor 150 → 150 internal

150 internal→ pressure relief valve 155.
→ axial piston unit 151/hoist gear.
→ check valve 153 → piston 156, 157, 158 - see section 2.5.1.
→ check valve 152 → blocked.
→ external → check valve 138 → blocked.

Oil return from axial piston unit 151 to → brake valve 160 → internal - see section 2.5.2 → outlet A → control valve block B1 → spool 122 → tank line/connection T → return filter 82 → tank 80.

Replenishing if necessary via check valve 137, from the tankline, which is preloaded by the check valve 139 with appr. 2 bar.

Notes

4. Check servo pressure

Check on test point ND with 0-40 (0-60) bar pressure gauge.(at machines RL 422 up to F/N x-x-1011 the test point has to be mounted in the pressure oil line to the pilot (servo) control valve, connection P)

The pressure results from the SP pressure of the travel hydraulic and the flow restriction between components and the test points (see schematic, section 6.3).

If the required pressure is not reached, check the components before (at oil flow direction) the test point connection.

If the required pressure is reached and problems occur due to low servo pressure, check the components after the test point connection.

Check components for flow problems (excessive restriction results in drop of pressure), as well as for leakage to tank connection (internal leaks).

5. Stand by pressure, adjustment of regulating pump - type A10V

Check on test point HD with 0-40 bar or 0-100 bar pressure gauge.

The initial check should always be made with a 0-100 bar (or higher) pressure gauge.

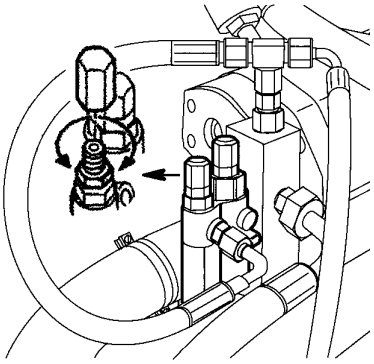
To check, make sure no working function is actuated.

5.1. Adjustment of load sensing regulator

If the pressure does not correspond to the nominal value, remove the cap on the LS regulator, loosen the lock nut and turn the adjustment screw until the nominal value is reached. To increase pressure, turn in clockwise direction, to decrease pressure, turn counterclockwise.

This adjustment also influences the Δp value (HD-LS) of LS regulation.

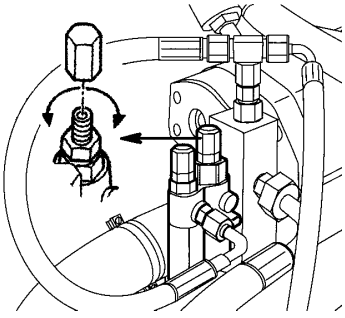
After adjustment, tighten the lock nut, install the cap and recheck the pressure setting.



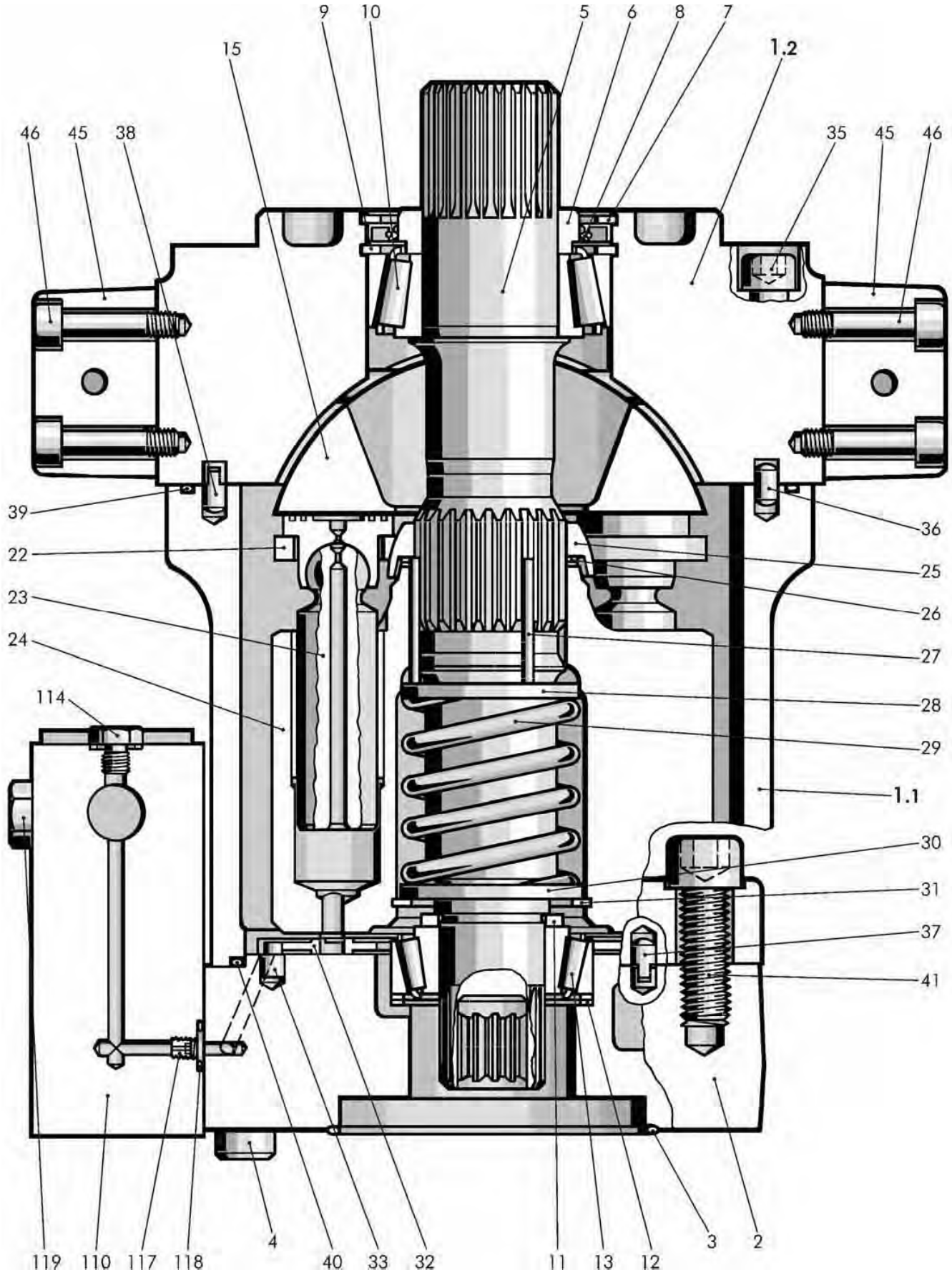
5.2. Block pressure cut off valves

Loosen the cap on the pressure cut off valve, loosen the lock nut and turn the adjustment screw in clockwise direction up to the end.

Turn back the adjustment screw ½ turn in counterclockwise direction, tighten the lock nut and install the cap.



Notes

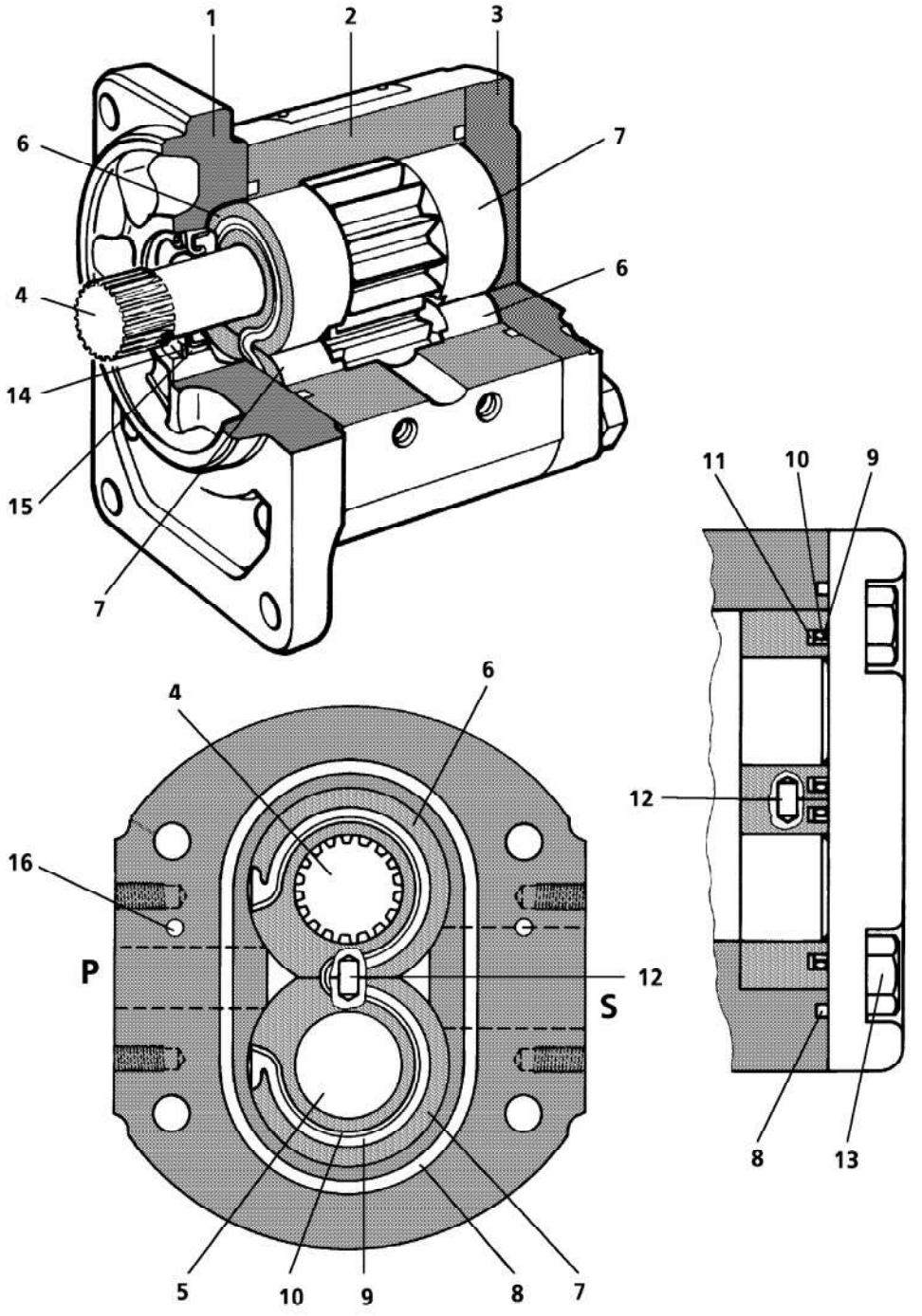


	Benennung Description Dénomination	Typ/ab Type/from Type/ a partir de
LIEBHERR		

07 01	**Variable pump** Travel hydraulic	**RL 42B** F/N 683-2001→ Blatt / Page / Feuille **8.1.40.02**

Notes

Notes



1 Input flange
2 Pump housing
3 End cover
4 Input shaft / gear
5 Driven gear
6 Bushing
7 Bushing
8 O-ring
9 Form gasket
10 Support gasket
11 Spacer
12 Dowel pin
13 Hex head screw
14 Snap ring
15 Shaft seal
16 Roll pin

Notes

Note: Position numbers have changed against the general description in 8.5.01.

description of micro switch Pos.4:

micro switch Pos.4 = S 33 at RL 422 F/N xxx-1001→3000

micro switch Pos.4 = S 16 at RL 22B F/N 615-2002→
RL 42B F/N 683-2002→
RL 52 F/N 739-2001→

* = shims drop out by newer pilot control valves / repair kits - adjustment given by high of the plunger flange.

Notes

Tightening torque for control valve parts:
(according to manufacturer list - dated11/97)

Pos.	M_A	Description
3	70^{+5} Nm	Hex head screw
4	20^{+5} Nm	Pressure relief valve
5	20^{+5} Nm	Flow control valve
6	160 Nm	Plug
30	9 Nm	Bleeder screw
31	10 Nm	Allen head screw
32	20 Nm	Plug
35	100 Nm	Plug
37	240 Nm	Plug
55	100 Nm	Pressure relief valve
65	240 Nm	Plug
75	100 Nm	Check valve
80	100 Nm	Pressure relief valve
85	200 Nm	Pressure compensator

Optional section

119	9 Nm	Bleeder screw
120	20 Nm	Plug
125	100 Nm	Plug
130	200 Nm	Pressure compensator

2.1 Function

The valve poppet 8 clearance is matched with the valve insert 5 and a crimp on the insert prevents the use of another valve poppet in place of the original, and at the same time, serves as a safety stop for the maximum stroke of valve poppet 8.

The spring area of the valve is relieved via a bore in valve sleeve 1 to the tank line T. The spring 10 pushes the valve poppet on its seat via washer 9, the path from P→T is closed off.

The system pressure in line P reaches the interior of the valve insert 5 via a bore, and pushes the front section of the valve poppet 8 against the spring 10.

If the pressure exceeds the spring force, the poppet 8 is moved against the spring and the path is opened from P via the valve insert 5 to T. The system pesuure P is now limited because oil is relieved.

If the system pressure decreases, the valve poppet 8 is pushed on its seat and oil must be displaced from the interior of the valve insert 5 via the clearance between the piston part of the valve poppet 8 and its bore in the insert 5. The resulting delay in the poppet movement reduces possible valve pressure fluctuations.

2.2 Pressure adjustment

Remove the cap 22, loosen lock nut 21. Turn the adjustment screw 18 to change the tension of spring 10 and therefore the system pressure P.

Turn adjustment screw clockwise	= to increase P_{max}
Turn the adjustment counterclockwise	= to decrease P_{max}

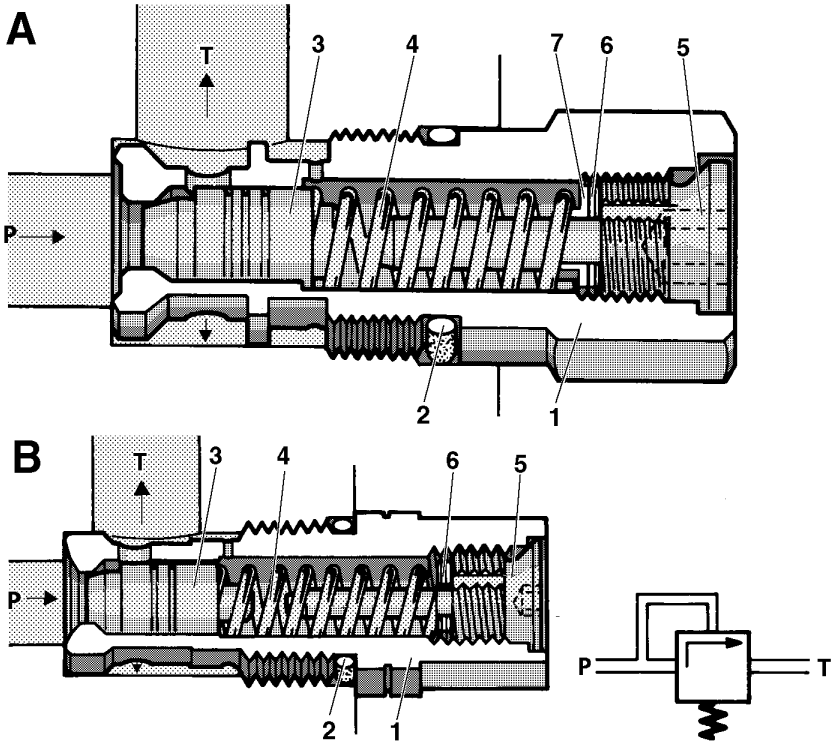
As soon as the required pressure relief setting has been reached, hold the adjustment screw 18 and tighten the lock nut 21. Install the cap and attach a lead seal.

3. Pressure relief valve – direct acting , preadjusted

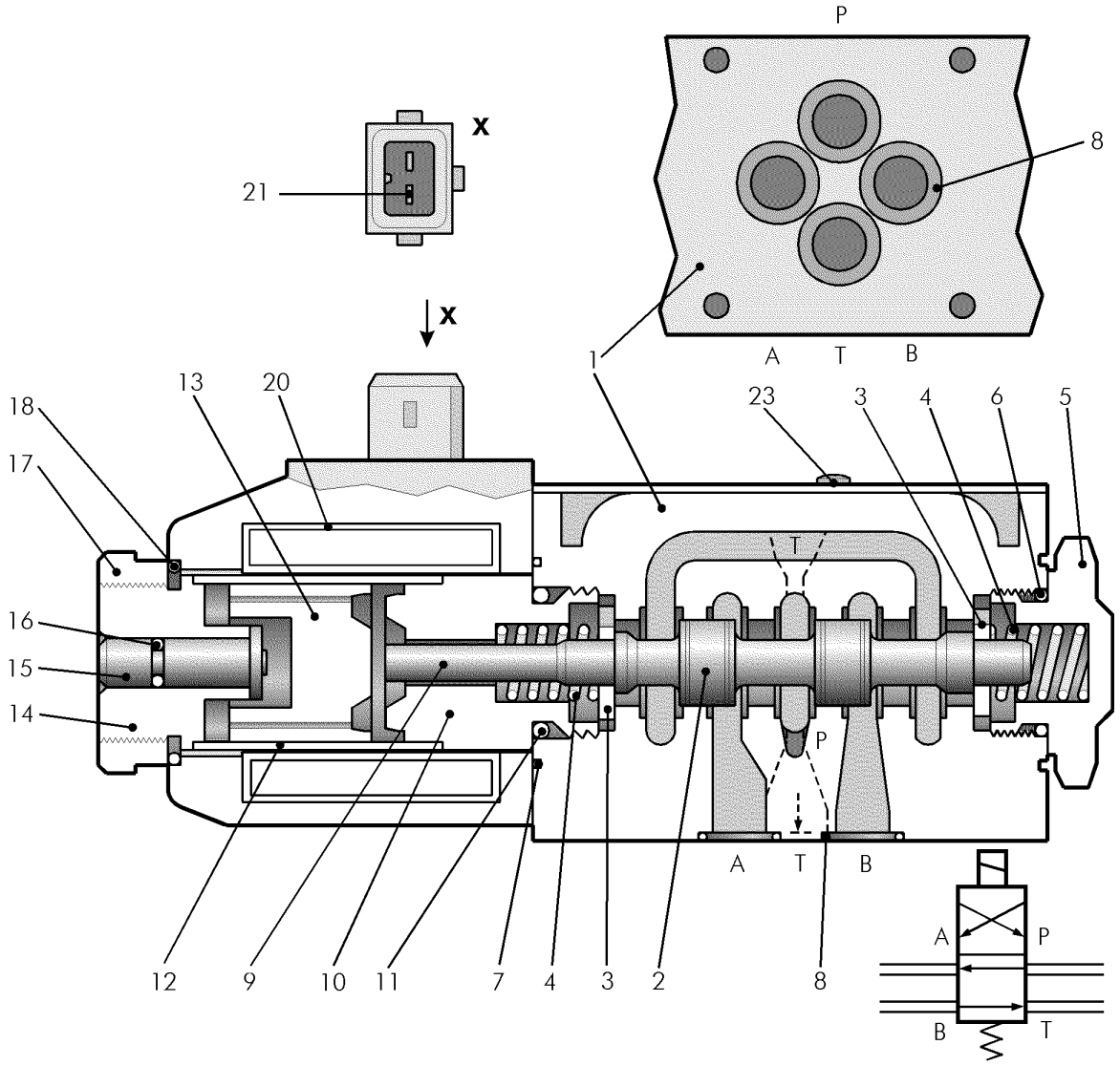
Version A - Nominal size 8
Version B - Nominal size 6

1 Valve sleeve
2 O-ring
3 Piston
4 Spring
5 Plug with guide pin
6 Shim
7 Spring washer

P Pressure channel
T Tank channel



1.2 **Version C**= Made by Vickers



1 Valve housing
2 Control piston
3 Retaining washer
4 Spring
5 Plug
6 O-Ring
7 O-Ring

8 O-Ring (4 each)

9 Pressure pin
10 Connector
11 O-Ring
12 Guide sleeve
13 Solenoid anchor
14 End bushing

15 Poppet - manual control
16 O-ring

17 Ring nut
18 O-ring

20 Solenoid housing with coil and socket
21 Electr. contacts

23 Cover / data tag

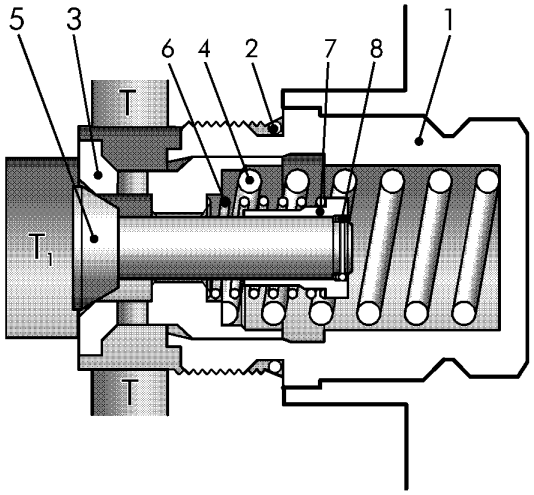
P Pressure connection
T Tank connection
A,B Control connections

Note: Connector 10, guide sleeve 12, end bushing 14 as well as solenoid anchor 13, poppet 15 and O-ring 16 are a single unit and will be destroyed if separated.

4. Dual check valve

This type of valve is used if the direction of oil flow in a line changes and if it is to be preset, at least in one direction. The valve seat must be installed in the carrier element.

1 Valve housing
2 O-ring
3 Piston
4 Spring
5 Valve poppet
6 Spring
7 Spring retainer
8 Snap ring



4.1 Function

Piston 3 is pressed by spring 4 onto its seat in the carrier element. The valve poppet 5 is pulled by the spring 6 via spring retainer 7/ring 8 into its seat in piston 3. The flow in both directions is blocked. The spring chamber is connected via a clearance between the valve poppet, the piston 3 and its cross drillings with the tank line T.

Flow direction $T_1 \rightarrow T$: The oil flow acts on the front surface of piston 3 and valve poppet 5. If the force resulting from the back pressure in T_1 exceeds the spring force and a counterforce in T, the piston 3 together with poppet 5 is pushed as one unit against the spring 4 and the path from $T_1 \rightarrow T$ is opened.

Flow direction $T \rightarrow T_1$: The oil flow acts on the poppet cone-surface and the spring side front surface of valve poppet 5. If the force resulting from the back pressure in T exceeds the counter force in T1, the valve poppet 5 is pushed against the spring 6, the path from $T \rightarrow T_1$ is opened via the bores in piston 3.

If the pressure difference between $T_1 \leftrightarrows T$ falls below the corresponding spring value, the path is closed again.

2. To seal cylinder

To seal, remove the piston rod or, if necessary, the complete cylinder from attachment of from machine.

Before removing hydraulic cylinder, observe all safety guidelines in section 1.2

- Park the machine on flat, solid ground and lower the attachment to the ground.
- Relieve hydraulic pressure.
  Turn the Diesel engine off, move the servo control several times to relieve pressure, open hydraulic tank breather valve.
- If necessary, knock out bearing pin with copper punch or similar tool to prevent splintering.
- Secure hydraulic cylinder and any other part with lift.
- Catch oil in appropriate container.

Depending on type of piston rod, remove half shell or bearing pin.

Secure cylinder before dismantling it any further.

Remove and close off hydraulic hoses.

Remove eventually existing connector valve blocks with pressure line, close off all lines.

When complete cylinder is removed, secure cylinder with a lift. Remove bearing pin and remove cylinder.

2.1 To disassemble cylinder

Remove screws of piston rod bearing.

Pull piston rod with piston and piston rod bearing from cylinder housing.

If necessary, use appropriate lift. Protect all parts from damage. Hold piston rod by the eye, or reinstall to attachment. Remove snap ring and remove piston nut. Remove piston with piston wrench from piston rod (see Special tools, section 2.1.22).

If there are endstopvalves mounted on the piston, remove retainer ring and press out the valvepiston including spring and bushing from the opposite side.

Pull piston rod bearing from piston rod.

Remove all seals and guide element from piston and piston rod..

2.1 Assembling

- Remove dust, dirt, chips and any other particles.
- Carefully check all parts before reusing them. If piston rods show any damage, such as dents or grooves, then they must be replaced.
- Before assembling, lightly oil or grease all parts and sealing elements.

Note:

The indication on the wires at the end of the page designate the „component/step“ of the continuation, Example: Y4 /10 = wire → solenoid valve Y4 in step 10 = servo cut off

Continuations from page 00 /1 step 7und page 00 /2 Schritt14 to X4 = panel plug are shown on page 00 /3

Connections from page 00 /1, step 7 and step 1 to X32-A1(*) are shown in detail on the electric schematic / electronic control in group.10.2..

Wiring on components (part of the component): always with colors, without number

Color codes:

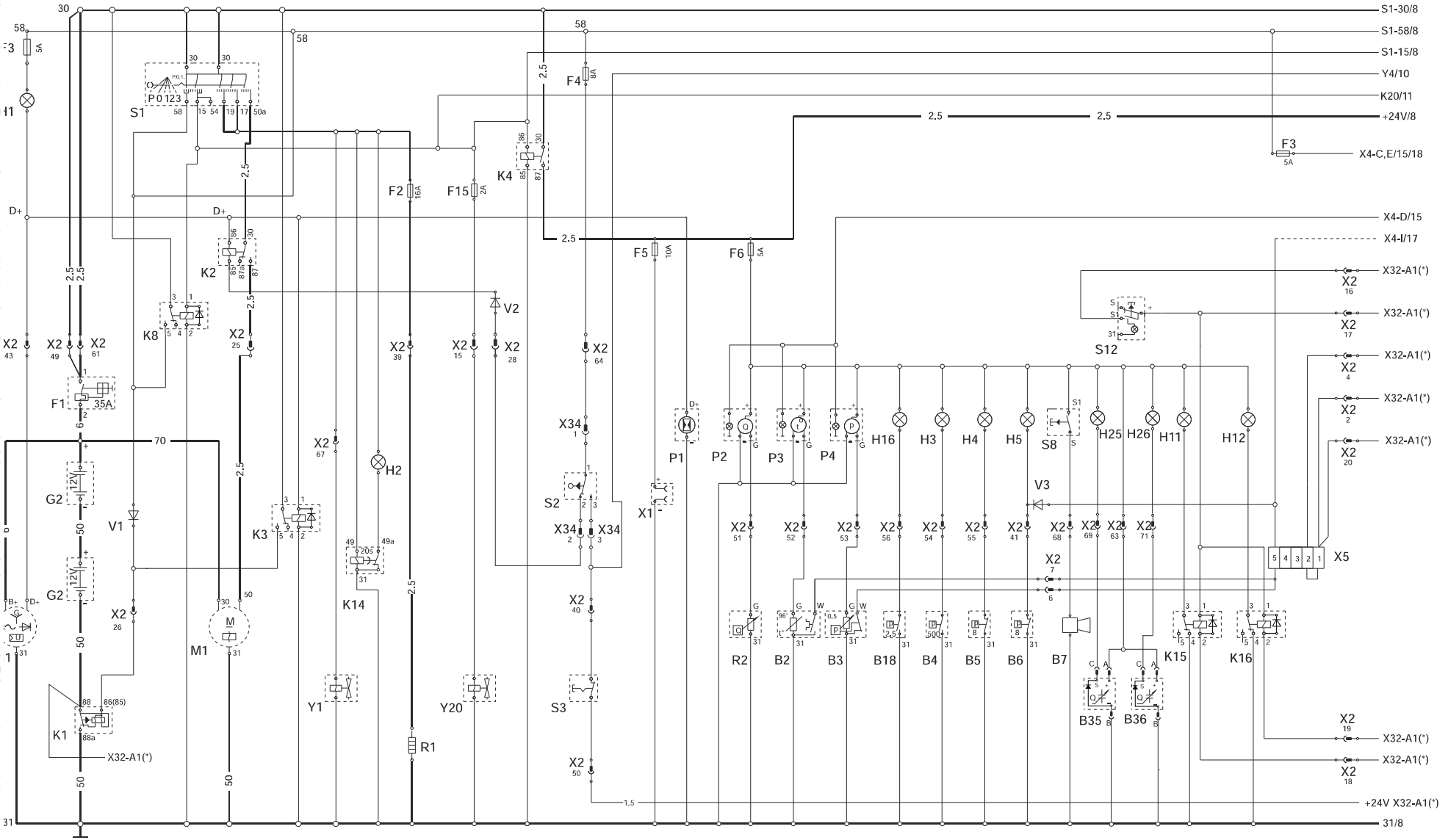
bl = blue	gr = gray
bl-ws = blue-white	rt = red
br = brown	rt-ws = red-white
br-ge = brown-yellow	sw = black
ge = yellow	
gn = green	

Numbers shown in wires on schematic = cross section of wire
wires without numbers = 1mm²

Automatic circuit breaker - fuse listing F1 - F29

pos.	Ampere	application - standard	- option	step
F1	35A	automatic circuit breaker /power supply		1
F2	16A	glow plug system		3
F3	5A	charge indicator, dome light	back up alarm, radio	1,7
F4	8A	electronic supply, servo cut off, starter cut off		4
F5	10A	electrical outlet 24V		5
F6	5A	instruments, indicator lights, horn		5,11,12
F7	8A	light front		11
F8	25A	power supply roof panel		11
F10	5A	hoist limiter, lift, tilt		9
F11	10A	heater	operator's seat with air suspension	8
F12	16A		air conditioner	8
F13	20A		refueling pump	13
F14	3A	free fall device		11
F15	2A	shut off solenoid (Diesel engine)		4
F16	3A	hoist limiter		9
F25	8A	windshield wiper and washer system door and side window		19
F26	8A	windshield wiper and washer system front, rear		19
F27	8A	working light front left, rear right, instrument lights		16
F28	8A	working light front right, rear left		16
F29	2A	warning light cab	warning light canopy	17

1	2	3	4	5	6	7
Stromversorgung Power supply Alimentation	Startanlage Start equipment Démarrage	Flammstartanlage Flame glow plug Prèchauffage	Sicherheitseinrichtung Safety installation Installation de sècurité	Steckdose, Anzeigeninstrumente, Warnlampen, Hupe Plug socket, Gauge - Indicator, Warning lamps, Horn Prise, Instruments de mesure, Voyants de controle, Klaxon	Elektronikùberwachung,Reduz., Fahrgeschw. Ölstandsùberwachung Doppellifetime Electronic System Guard,Red.Travel Speed Oillevel monitoring duo-cone seal area Controle electronique,Petite vitesse, Contrôle niveau d'huile double joint life-time area	Kabinenanschlüsse - X4,Anschlüsse - A1 Typprogrammierung - X5 Connections Cab - X4, Conections - A1 Machinetype programm - X5 Connexions cabin - X4, Connexions - A1 Type de programme - X5



Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

---- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

LIEBHERR

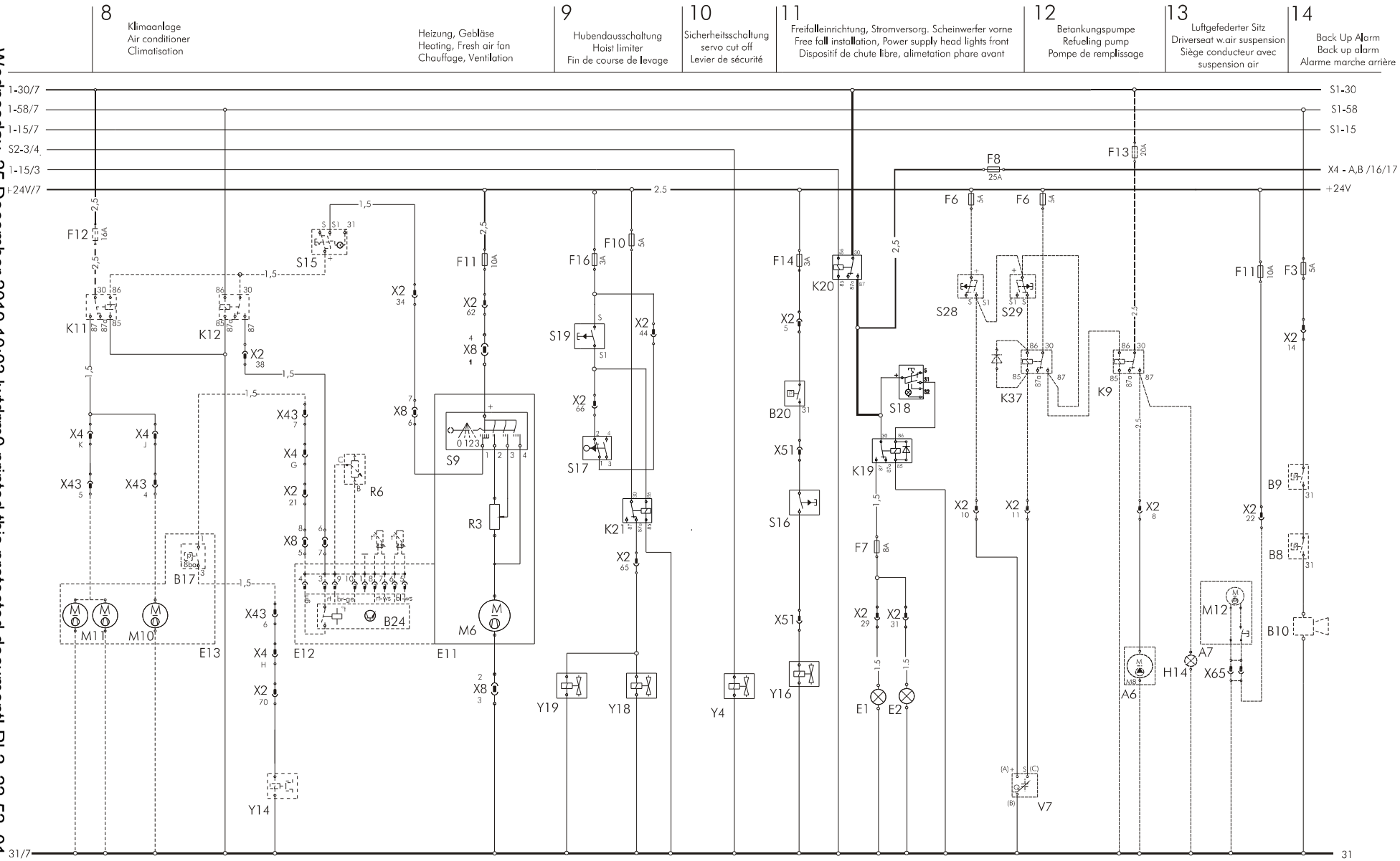
Datum Edition Date
01 07

Benennung Description Dénomination

Stromlaufplan
Current Flow Diagram
Schèmas électriques

Typ/ab Type/from Type/a partir de
RL 22 B F/N 615-3018→ **5551**

Blatt Page Feuille
9.1.22.00/1



Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

LIEBHERR

Datum Edition Date
01 02

Benennung Description Dénomination

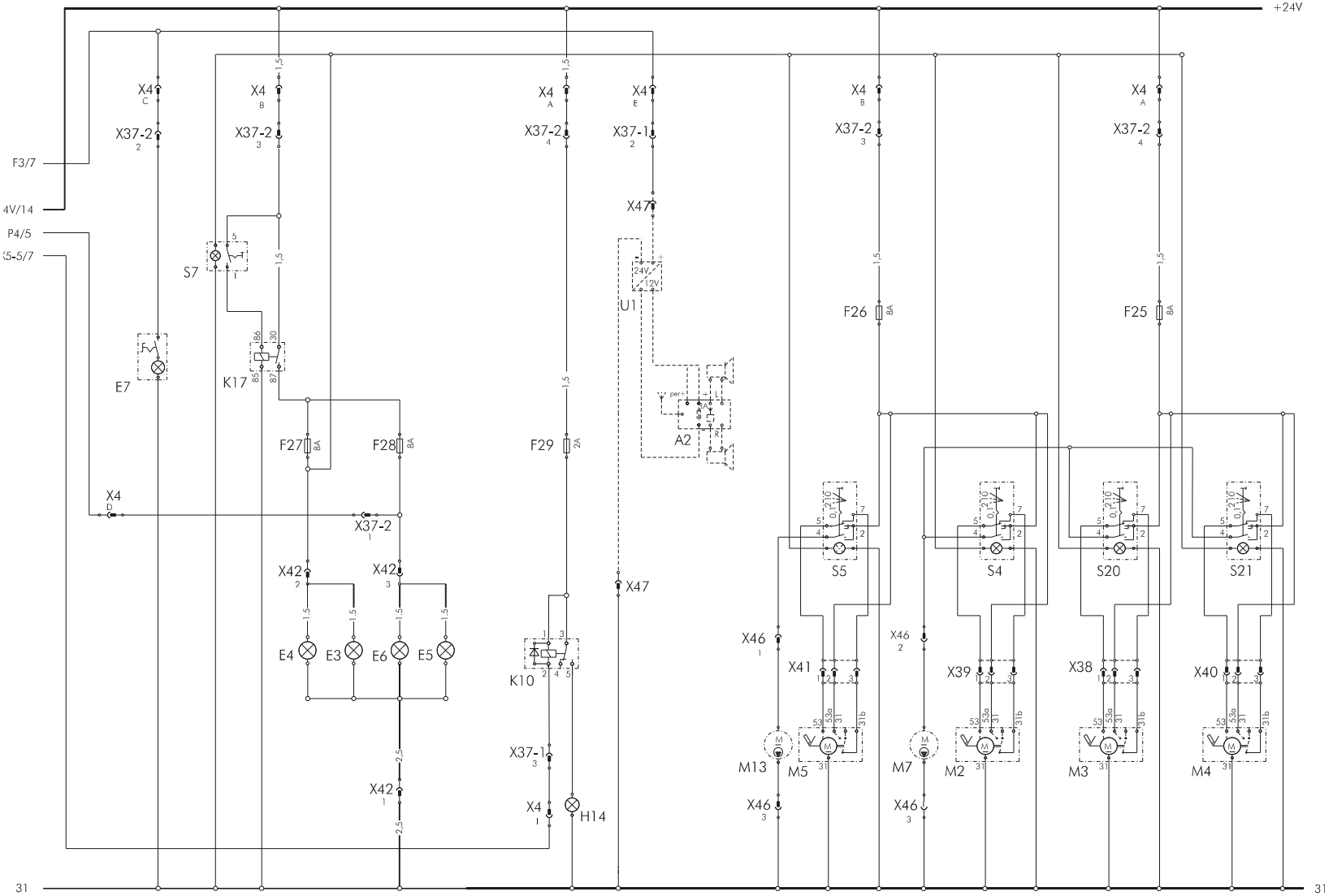
Stromlaufplan
Current Flow Diagram
Schèmas électriques

Typ/ab Type/from Type/a partir de

RL 42 B F/N 683-3002→5320

Blatt Page Feuille 9.1.40.00/2

15 Kabinenleuchte Dome light Eclaireage cabine	16 Arbeitsscheinwerfer Working lights Phares de travail	17 Warnleuchte Kabine Warning light cab Voyant d´alarme cabine	18 Radio	19 Wisch-Waschanlage:Hinten, Vorne, Links, Rechts Windshield wiper and washer System front, rear, left, right Cirquit essuie lave - glce avant, arrière, gauche, droit



abel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

LIEBHERR

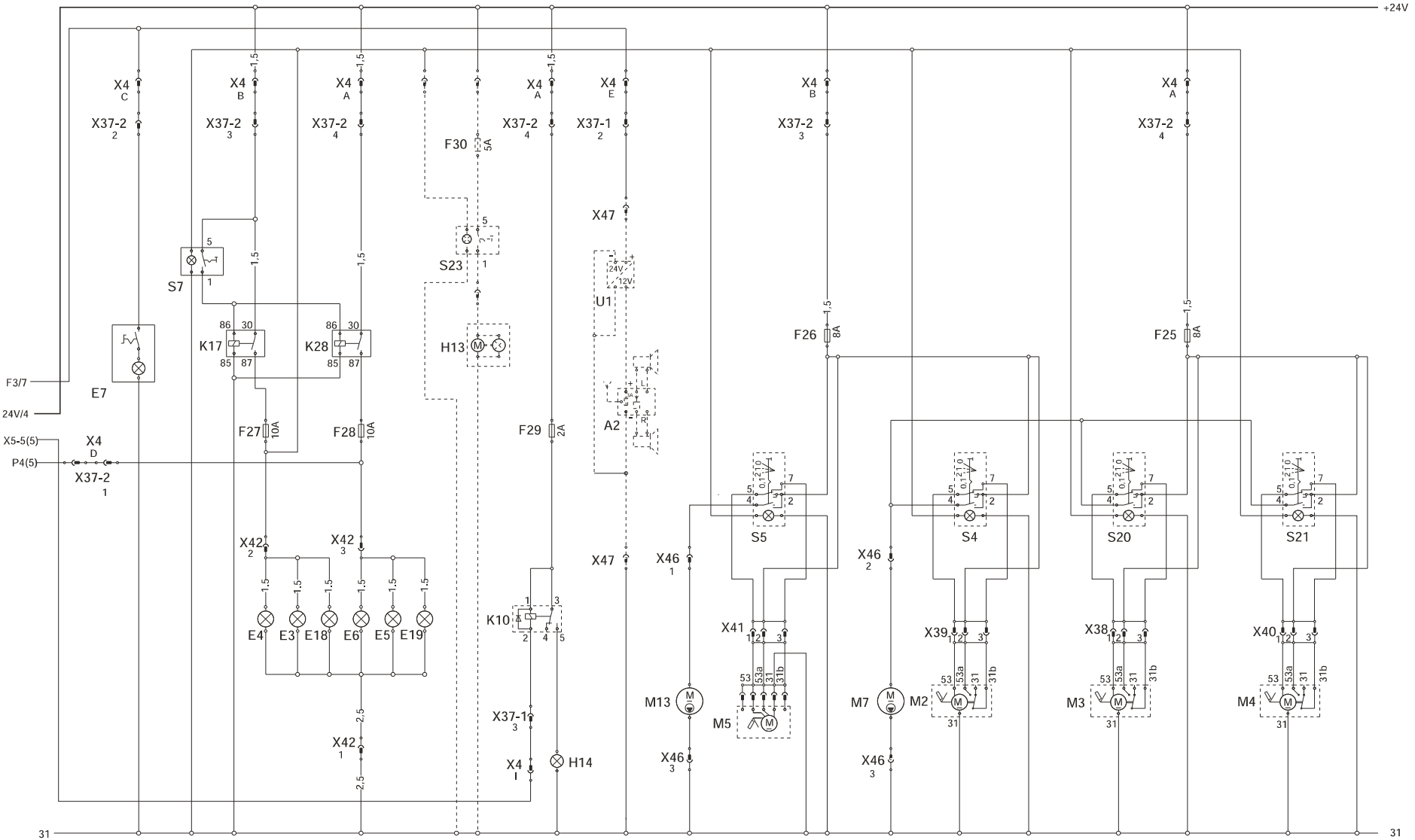
Datum Edition Date
01 02

Benennung Description Dénomination
Stromlaufplan
Current Flow Diagram
Schèmas électriques

Typ/ab Type/from Type/a partir de
RL 42 B F/N 683-5321→

Blatt Page Feuille 9.1.41.00/3

17	18	19	20	21	22
Fahrerstandbeleuchtung Dome light Eclairage cabine	Arbeitsscheinwerfer Working lights Phares de travail	Rundumleuchte Beacon light Girophare	Warnleuchte Kabine Warning light cab Voyant d´alarme cabine	Radio Radio Radio	Wisch-Waschanlage:Hinten, Vorne, Links, Rechts Windshield wiper and washer system: rear, front, left, right Circuit essuie - glace arriére, avant gauche, droit



Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

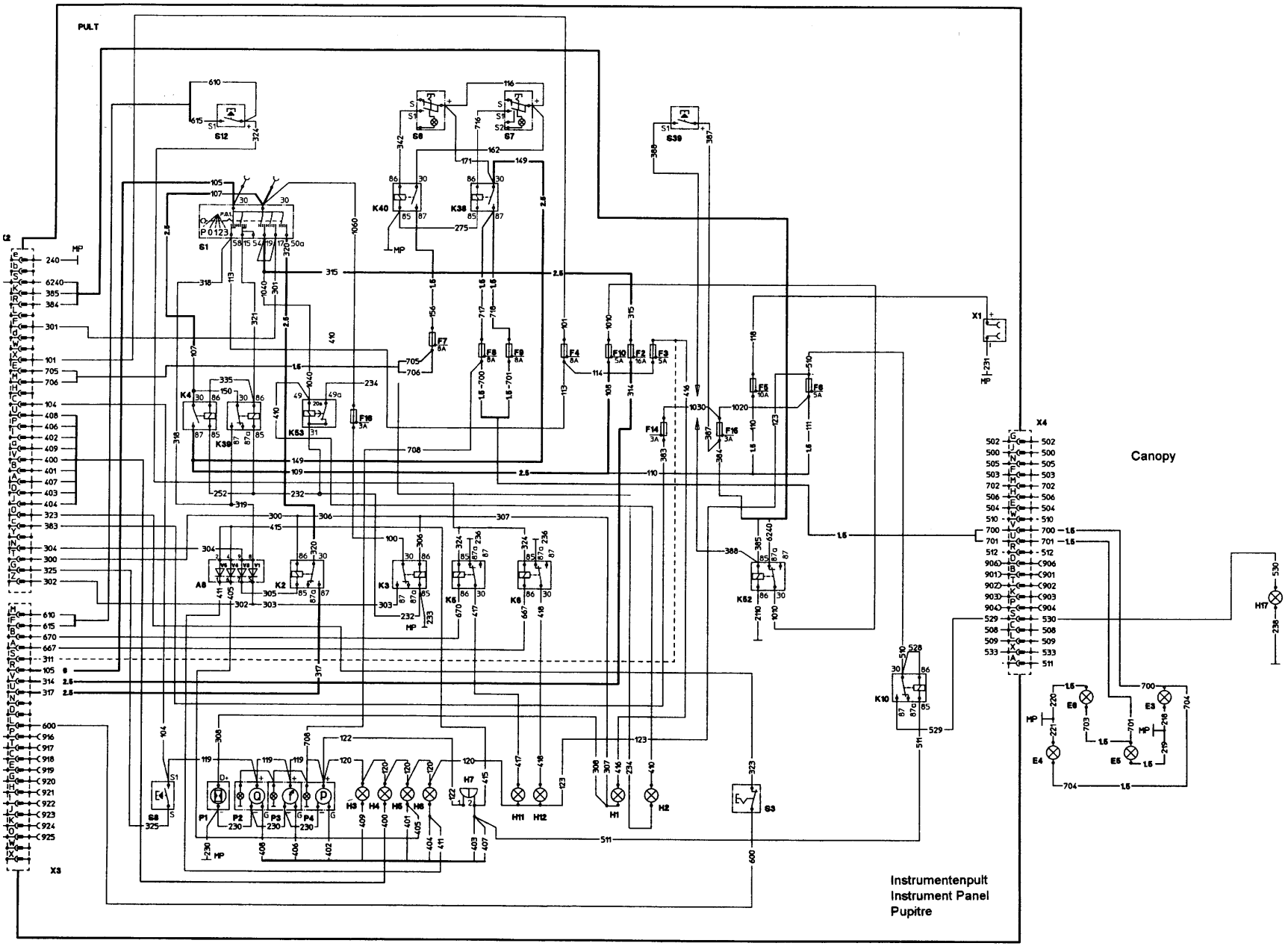
LIEBHERR

Datum Edition Date
01 07

Benennung Description Dénomination
Stromlaufplan
Current Flow Diagramm
Schèmas électriques

Typ/ab Type/from Type/a partir de
RL 52 F/N xxx - 2001→ 8101

Blatt Page Feuille 9.1.50.00/4



--------- Option verkabelt, nicht bestückt
Option wired, not equipped
Options non equipées

LIEBHERR

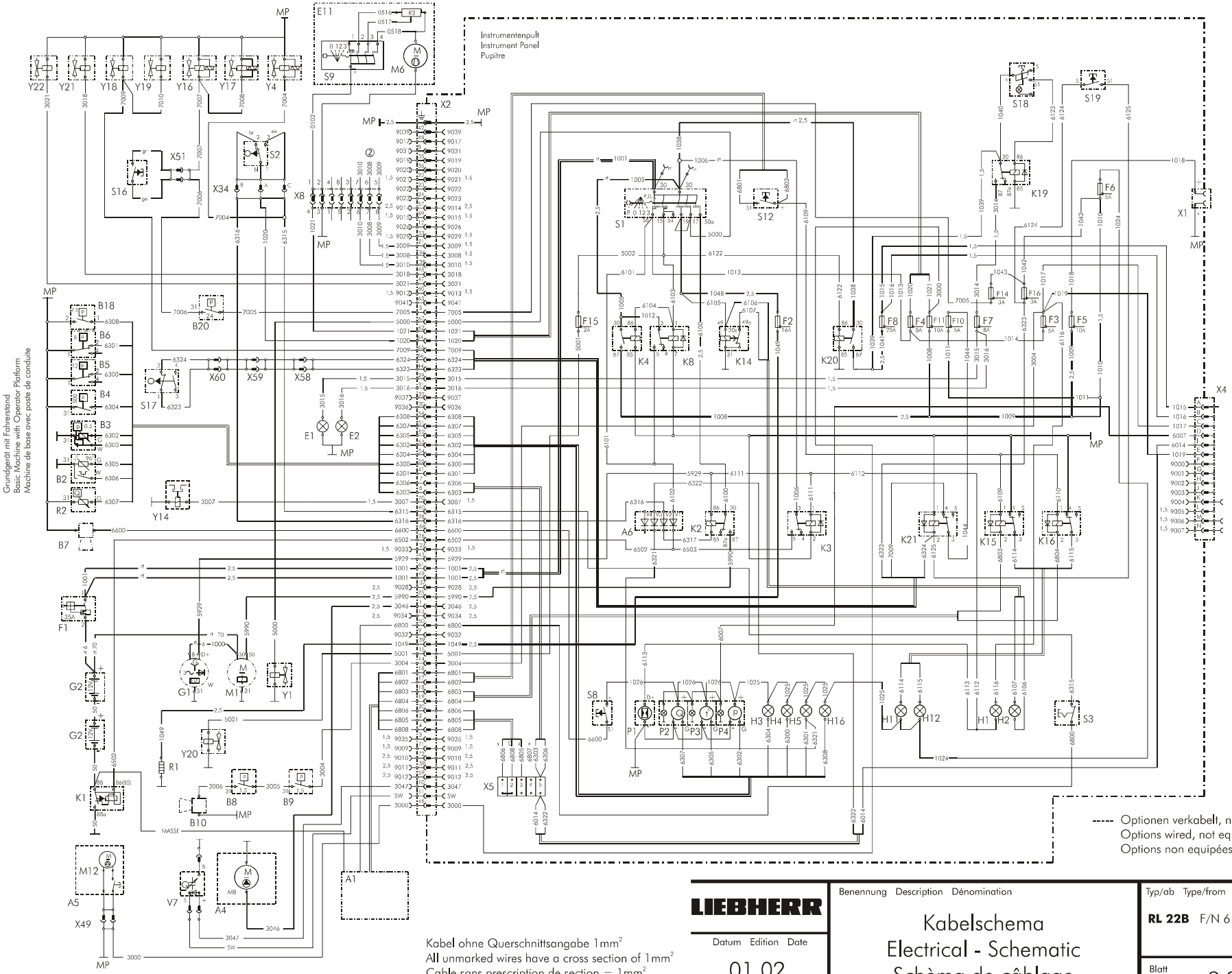
Datum Edition Date
01 95

Benennung Description Dénomination

Kabelschema
Electrical - Schematic
Schèma de câblage

Typ/ab Type/from Type/a partir de
RL 422 F/N x-x-1001→3000

Blatt Page Feuille 9.2.20.00/2



LIEBHERR

Datum Edition Date
01 02

Benennung Description Dénomination

Kabelschema
Electrical - Schematic
Schèma de câblage

Typ/ab Type/from Type/a partir de
RL 22B F/N 615-3002→3017

Blatt Page Feuille 9.2.21.00/1

Description parts list /schematic:

e.g. pos. description /area
A1 electronic box /B
/B = area basic machine with operators platform
/P = area instrument panel
/C = area cab

Wire - identifications

Connection wires in the machine (wiring harness):

red(rt)with number, e.g. 1001 = wires for main power supply

black(sw)without number = ground wire

white(ws)with ”MASSE” = minus supply to electronic-box(wire from K1 to A1)

white(ws)with number, e.g. 6800 = other wires

Wiring on components (part of the component): always with colors, without number

Color codes:	bl	=	blue	gr	=	gray
	bl-ws	=	blue-white	rt	=	red
	br	=	brown	rt-ws	=	red-white
	br-ge	=	brown-yellow	sw	=	black
	ge	=	yellow	gn	=	green

② = connections air conditioner see group17

MP = ground connection → main frame rear right / area battery box
→ instrument panel
→ roof panel (cab)

Automatic circuit breaker - fuse listing F1 - F29

pos.	Ampere	application - standard	- option	area
F1	35A	automatic circuit breaker /power supply		B
F2	16A	glow plug system		P
F3	5A	charge indicator, dome light	back up alarm, radio	P
F4	8A	electronic supply, servo cut off, starter cut off		P
F5	10A	electrical outlet 24V		P
F6	5A	instruments, indicator lights, horn, oil level sensor - travel gear - cone seal area		P
F7	8A	light front		P
F8	25A	power supply roof panel		P
F10	5A	hoist limiter, lift, tilt		P
F11	10A	heater	operator's seat with air suspension	P
F14	3A	free fall device		P
F15	2A	shut off solenoid (Diesel engine)		P
F16	3A	hoist limiter		P
F25	8A	windshield wiper and washer system door and side window		C
F26	8A	windshield wiper and washer system front, rear		C
F27	8A	working light front left, rear right, instrument lights		C
F28	8A	working light front right, rear left		C
F29	2A	warning light cab	warning light canopy	C

Description parts list /schematic:

e.g. pos. description /area
A1 electronic box /B
/B = area basic machine with operators platform
/P = area instrument panel
/C = area cab

Wire - identifications

Connection wires in the machine (wiring harness):

red(rt)with number, e.g. 1001 = wires for main power supply

black(sw)without number = ground wire

white(ws)with ”MASSE” = minus supply to electronic-box(wire from K1 to A1)

white(ws)with number, e.g. 6800 = other wires

Wiring on components (part of the component): always with colors, without number

Color codes:	bl	=	blue	gr	=	gray
	bl-ws	=	blue-white	rt	=	red
	br	=	brown	rt-ws	=	red-white
	br-ge	=	brown-yellow	sw	=	black
	ge	=	yellow	gn	=	green

② = connections air conditioner see group17

MP = ground connection → main frame rear right / area battery box
→ instrument panel
→ roof panel (cab)

Automatic circuit breaker - fuse listing F1 - F29

pos.	Ampere	application - standard	- option	area
F1	35A	automatic circuit breaker /power supply		B
F2	16A	glow plug system		P
F3	5A	charge indicator, dome light	back up alarm, radio	P
F4	8A	electronic supply, servo cut off, starter cut off		P
F5	10A	electrical outlet 24V		P
F6	5A	instruments, indicator lights, horn, oil level sensor - travel gear - cone seal area		P
F7	8A	light front		P
F8	25A	power supply roof panel		P
F10	5A	hoist limiter, lift, tilt		P
F11	10A	heater	operator's seat with air suspension	P
F14	3A	free fall device		P
F15	2A	shut off solenoid (Diesel engine)		P
F16	3A	hoist limiter		P
F25	8A	windshield wiper and washer system door and side window		C
F26	8A	windshield wiper and washer system front, rear		C
F27	8A	working light front left, rear right, instrument lights		C
F28	8A	working light front right, rear left		C
F29	2A	warning light cab	warning light canopy	C

Notes

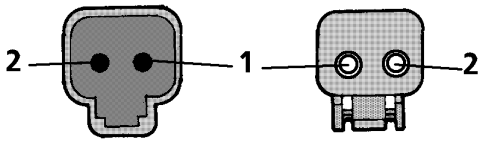
Color codes:

bl = blue
br = brown
ge = yellow
gn = green
gr = gray
rt = red
sw = black

8. Plug (2 poles) - air conditioner (Cannon - Deutsch)

Assignment acc. to application / see schematic

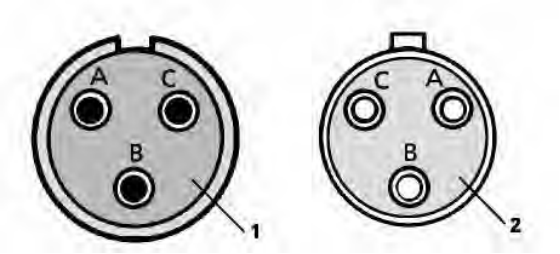
Plug in compressor	Socket on wiring harness



9. Plug (3 poles) - sensor Diesel tank (Cannon)

Assignment acc. to application / see schematic

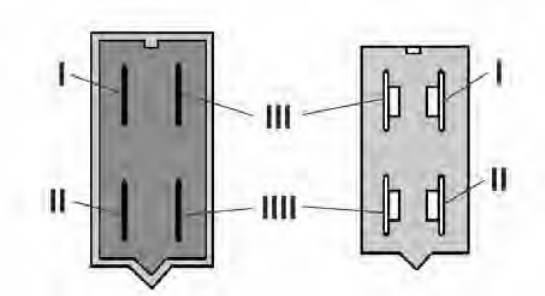
Plug in sensor	Socket on wiring harness



10. Plug (4 poles) - windshield wiper motors (AMP)

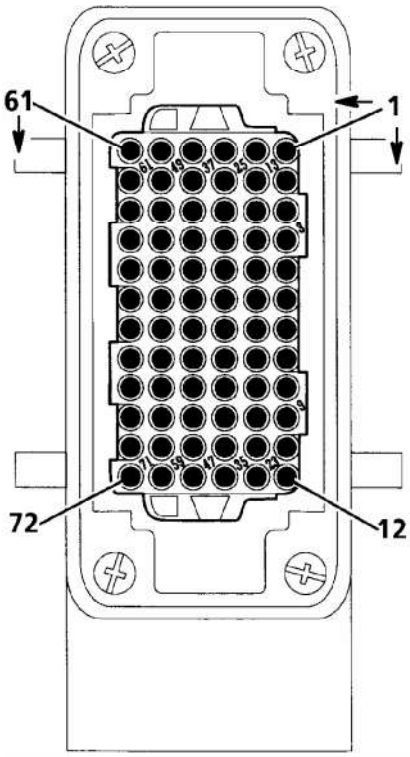
Assignment acc. to application / see schematic

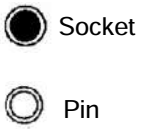
Plug in windshield wiper motors	Socket on wiring harness



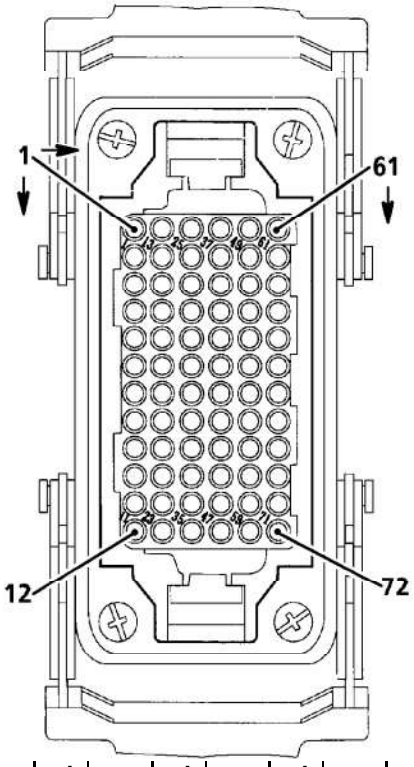
1. Panel plug X2 (72 poles) central wiring harness (Harting HAN 72 DD)

Socket on wiring harness





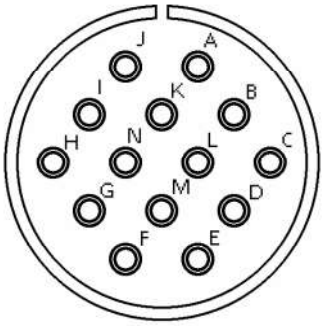
Plug in instrument panel

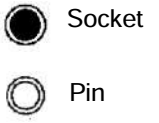


pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.
1	3046	8	6326	15	9038	22	9021	29	3015	36	6335	43	5929	50	6800	57	9014	64	1020	71	9009
2	9042	9	9032	16	9045	23	9022	30	9036	37	6336	44	6323	51	6307	58	9011	65	7009	72	9010
3	6331	10	3047	17	6854	24	9023	31	3016	38	3010	45	3117	52	6305	59	9012	66	6324		
4	6808	11	sw	18	6803	25	5990	32	9037	39	6500	46	3000	53	6302	60	9013	67	5000		
5	7005	12	9026	19	6804	26	6502	33	9029	40	6315	47	9016	54	6304	61	1001	68	6600		
6	6303	13	9034	20	9044	27	9033	34	3008	41	6301	48	9017	55	6300	62	1021	69	9015		
7	6306	14	3004	21	3009	28	6316	35	9019	42	5005	49	1001	56	6308	63	9041	70	3007		

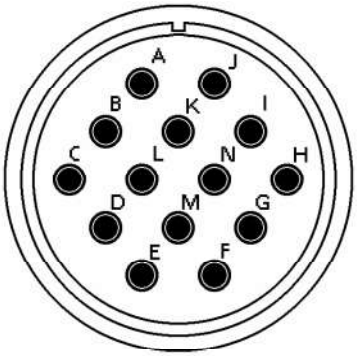
2. Panel plug X4 (14 poles) cab wiring harness (Cannon CA COM-E-20-27S-B-01)

Socket on wiring harness

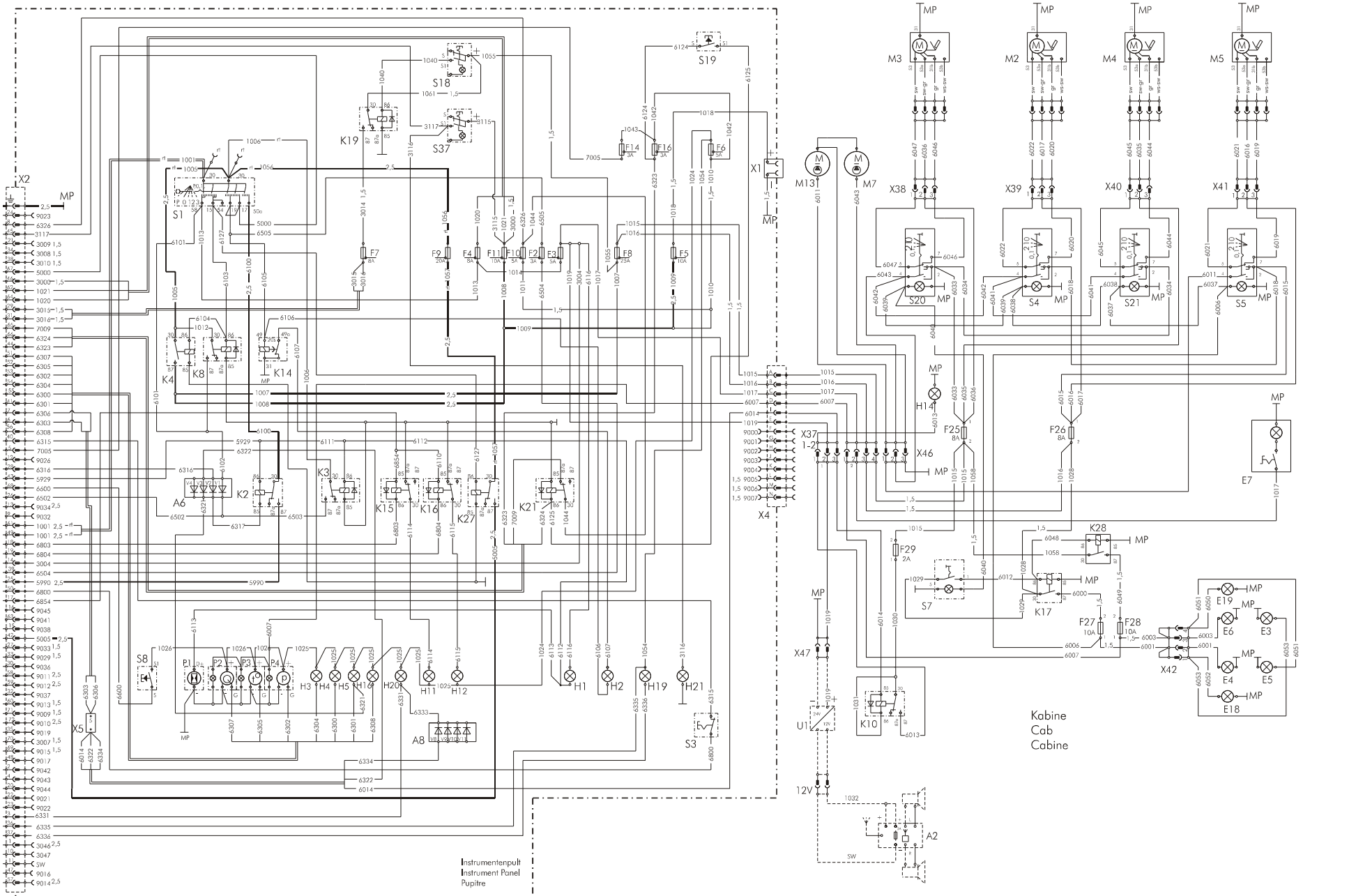




Plug in instrument panel



pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.
A	1015	D	6007	G	9001	J	9003	M	9006
B	1016	E	1019	H	9002	K	9004	N	9007
C	1017	F	9000	I	6014	L	9005		



Wednesday, 25.December 2019 10:04 lwtdrm0 printed this protected document! RL2_22-52_01-09_en.pdf ADMIN

Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

LIEBHERR

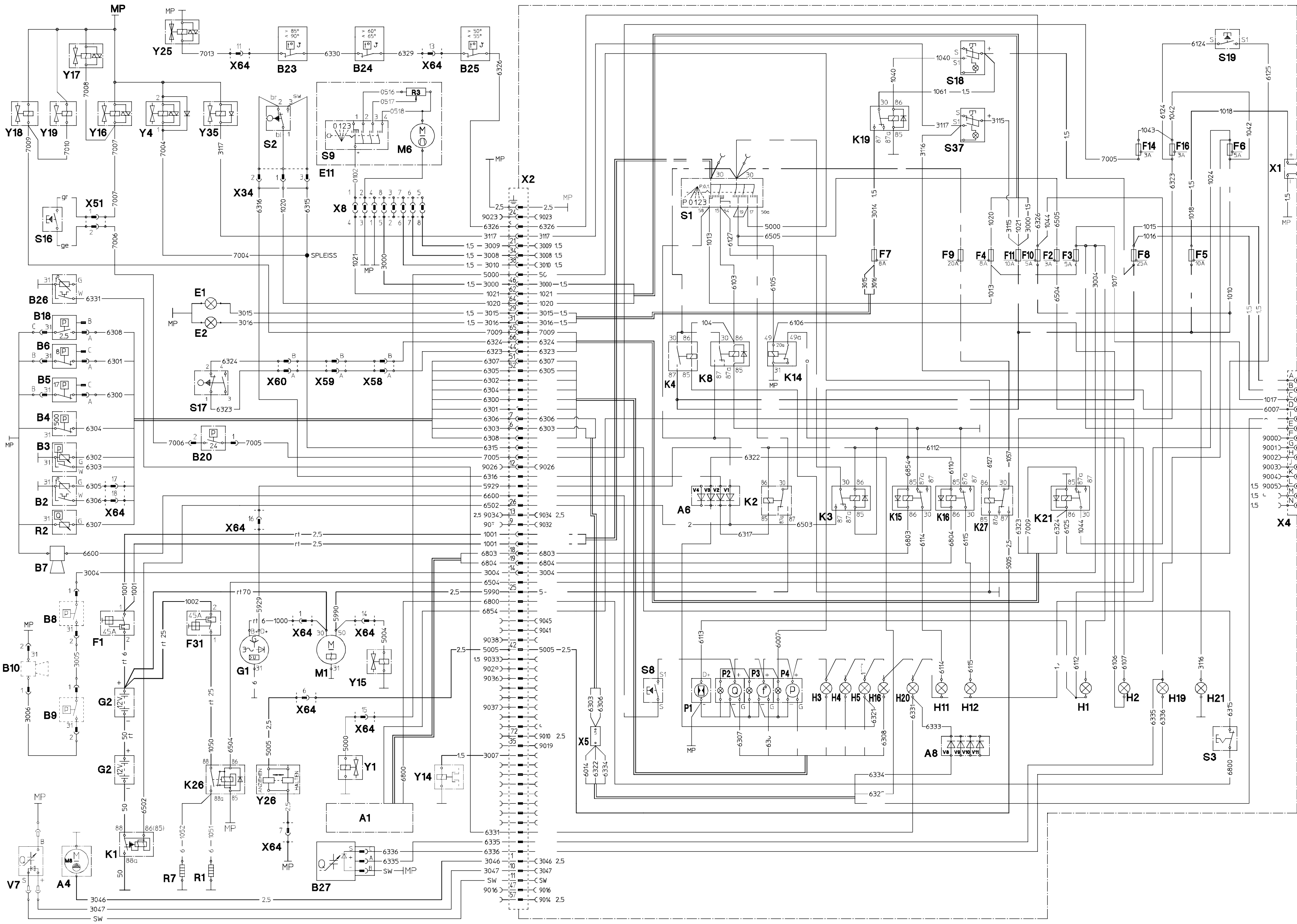
Datum Edition Date
01 04

Benennung Description Dénomination

Kabelschema
Electrical - Schematic
Schèmas électriques

Typ/ab Type/from Type/a partir de
RL 52 F/N xxx - 2001 → 5478

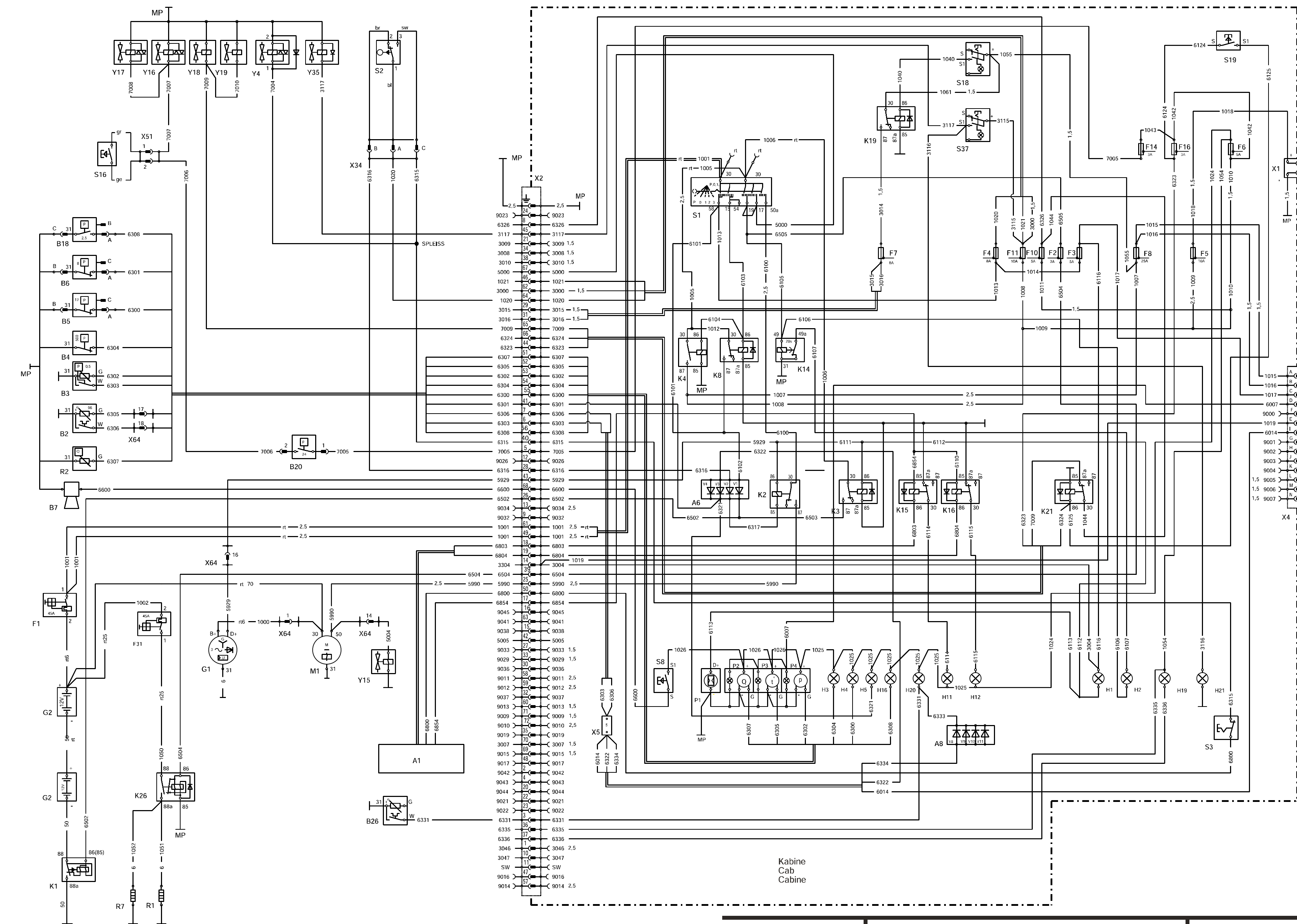
Blatt Page Feuille 9.2.50.00/2



Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

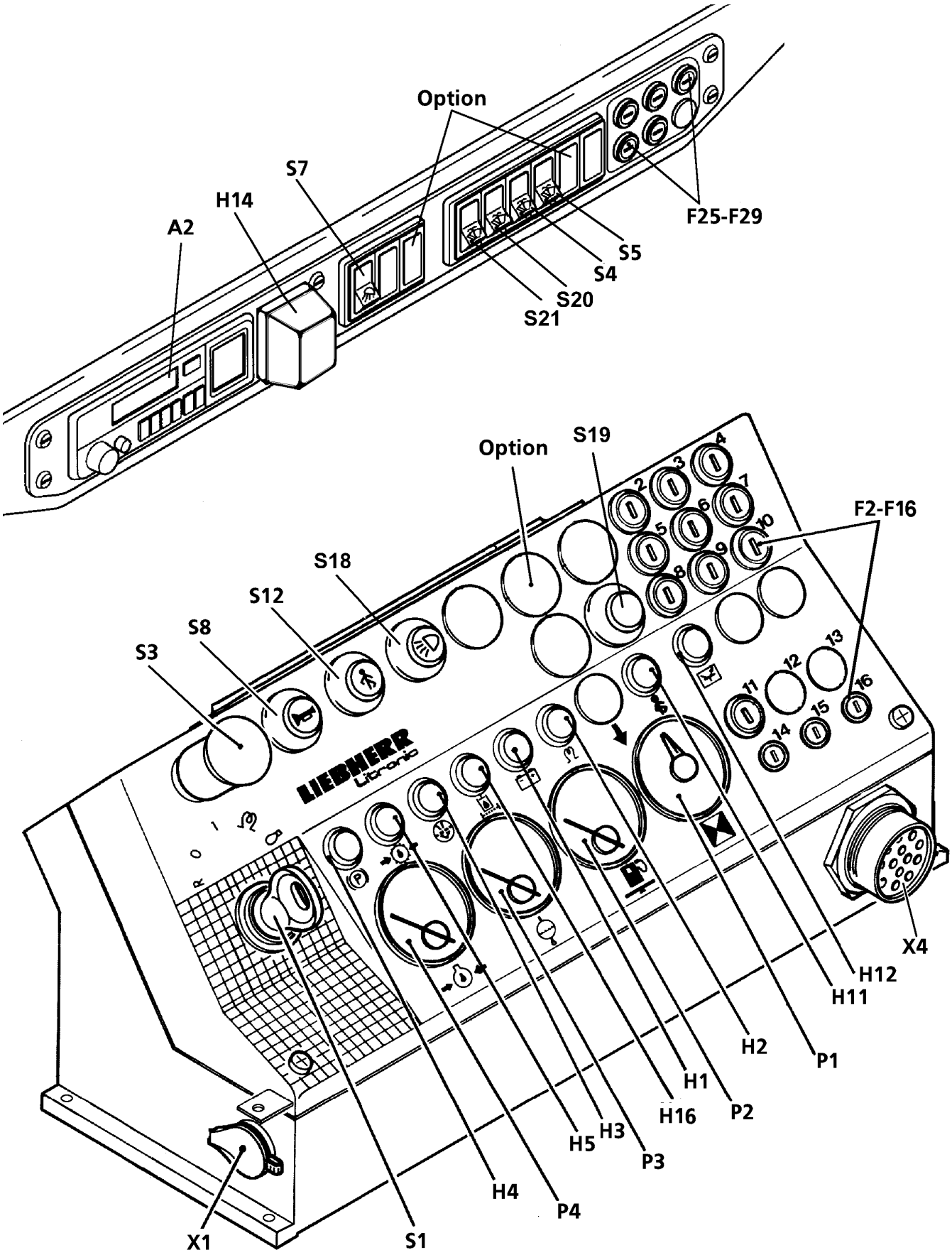
LIEBHERR	Benennung Description Dénomination	Typ/ab Type/from Type/a partir de
Datum Edition Date	Kabelschema	RL 52 F/N xxx - 5479→8101
01 07	Electrical - Schematic Schèmas électriques	Blatt Page Feuille 9.2.51.00/1



Kabel ohne Querschnittsangabe 1mm²
All unmarked wires have a cross section of 1mm²
Cable sans prescription de section = 1mm²

----- Optionen verkabelt, nicht bestückt
Options wired, not equipped
Options non equipées

LIEBHERR	Benennung Description Dénomination	Typ/ab Type/from Type/a partir de
Datum Edition Date 01 07	Kabelschema Electrical - Schematic Schèmas électriques	RL 52 F/N xxx - 8102 → Blatt Page Feuille 9.2.52.00/1


Option
S7
H14
A2
F25-F29
S5
S4
S20
S21
Option
S19
F2-F16
S18
S12
S8
S3
LIEBHERR
Litronic
X4
H12
H11
H2
P1
H1
H16
P2
H5
H3
P3
H4
P4
X1
S1

Sub Group Index

Notes

Note:

Color codes: sw = black

The numbers shown in wires on schematic = cross section of wire
unmarked wires have a cross section of 0,75 mm²

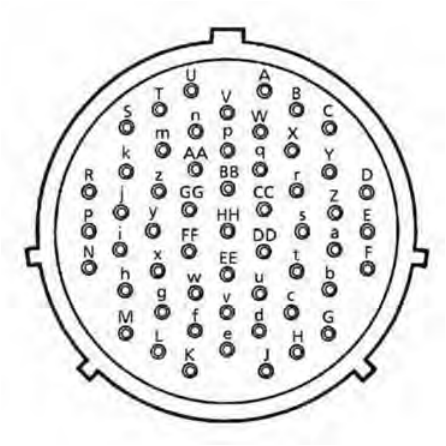
Wire numbered with. 6807* ist just mounted in RL 22B

Identification - Machine Model:

Model	Wire No.	Connection
RL 22 B	6805	X5/3 - A1/z
	6806	X5/1 - A1/y
	6807	X5/3 - A1/x
	6808	X5/2 - splice5
RL 42 B	6805	X5/1 - A1/1
	6806	X5/1 - A1/1
	6807*	not mounted
	6808	X5/2 - splice5

1. Plug (55 poles) central wiring harness /electronic box (Cannon KPSE 06 E 22-55 SB-DN)

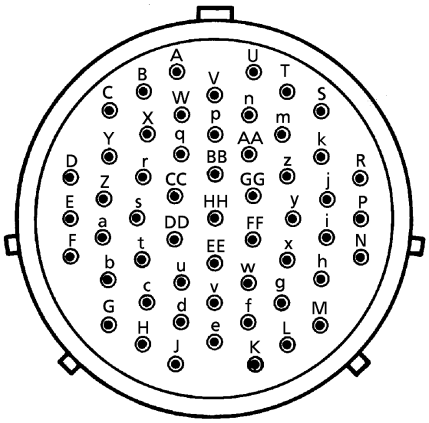
Plug in electronic box



Socket

Pin

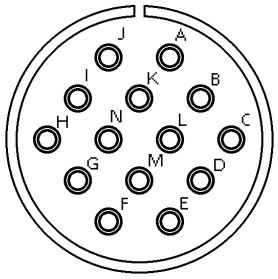
Socket on wiring harness



pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.
A	6849	H	6843	R	6815	Y	6827	f	6859	n	6841	v	---	CC	6855
B	Masse	J	6853	S	---	Z	---	g	6840	p	6860	w	3051	DD	6823
C	6800	K	6859	T	6839	a	6844	h	6809	q	6847	x	6857	EE	6832
D	6848	L	6814	U	6838	b	6850	i	---	r	6811	y	6858	FF	---
E	6845	M	6813	V	6860	c	6851	j	6810	s	6846	z	---	GG	---
F	6842	N	---	W	---	d	6803	k	---	t	3052	AA	6812	HH	---
G	6852	P	6856	X	---	e	---	m	---	u	6816	BB	6829		

2. Plug (14 poles) central wiring harness /travel joystick (Cannon CA 06COM-E-20-27S-B-03-A176-LH)

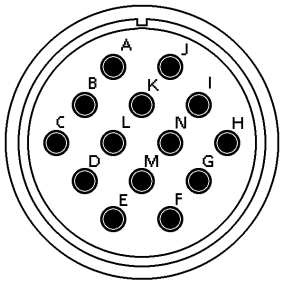
Plug in travel joystick



Socket

Pin

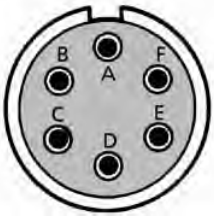
Socket on wiring harness



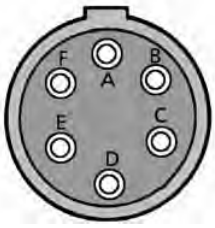
pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.	pole	c.no.
A	6809	D	6810	G	6812	J	6816	M	6853
B	6817	E	6811	H	6813	K	6814	N	6821
C	6815	F	6818	I	6820	L	6819		

3. Plug (6 poles) central wiring harness /potentiometer (Cannon CA 06 COM-E 14S-6 S-B-03-A176-LH)

Socket on wiring harness



Plug in potentiometer



pole	c.no.	pole	c.no.
A	6825	D	6824
B	6823	E	---
C	6822	F	---

Parts list for block diagram

A1 Electronic box

2 Overvoltage and polarity protection
3 Voltage stabilization
3.1 External supply
3.2 Internal supply

4 Shut off
5 Monitoring system
6 Command and switch values
7 Machine type program

10 Signal processing
11 Travel control range
12 Travel value processing
13 Travel ramp
14 Steering ramp
15 Steering value - left
16 Steering value - right
17 Engine speed processing
18 Rated value development
19 Load regulator
20 Travel and steering logic
21 Counterrotation
22 Straight run control
23 Speed limitation
24 Control signal Y13 (parking brake)
25 Max. current limitation

27 Pump and motor control stage - left chain
28 Pump and motor control stage - right chain

30 Engine - RPM/safety control - only CEP 12/06
31 Control stage Y53

B12 Travel joystick
a Travel signal
b Steering signal
c Signal release - travel
d Signal release - steering
e Signal counterrotation

B13 Sensor - Diesel engine RPM
B14 Sensor - RPM - travel drive left
B15 Sensor - RPM - travel drive right

G2 Batteries

H11 Indicator light "travel speed range"
H12 Indicator light "electronic fault indicator"

R5 Potentiometer - nominal RPM value

S1 Starter switch w. preheat position
S2 Neutral starting switch
S3 Emergency off switch
S12 Push button switch - travel speed range selection

X5 Serial connecting terminal

Y7 Proportional solenoid - travel motor left
Y8 Proportional solenoid - travel motor right
Y9 Proportional solenoid - travel pump left - reverse
Y10 Proportional solenoid - travel pump left - forward
Y11 Proportional solenoid - travel pump right - reverse
Y12 Proportional solenoid - travel pump right - forward
Y13 Solenoid valve - parking brake
Y53 Solenoid valve - Diesel engine - RPM/safety control

Type identification:

X12-PR 712
X22-PR 722 / LR 622 / RL (4)22
X32-PR 732 / LR 632
X42-PR 742 / RL 42
X52-PR 752 / RL 52

101 Diesel engine

102 Travel pump left
103 Travel pump right

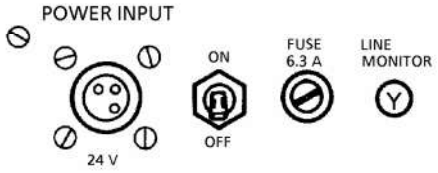
104 Travel motor left
105 Travel motor right

106 Regulating pump - working hydraulic

1.2. Operational readiness of test box (area1)

Move rocker switch to "ON" → test box is operational.

- Indicator light "LINE MONITOR" must light up.
- On panel indicator lights H 11 "low speed range" and H 12 "electronic fault" must go off.



If any of these prerequisites are not met, find problem and eliminate it.

Note: Additional indicator lights may light up (machine identification, battery voltage and diesel engine sensor) on the test box, but this is of no importance at this time.

Possible problems / causes e.g.:

- indicator light "LINE MONITOR" does not light up → no current supply from the instrument panel, plug power supply defective, test fuse in the instrument panel blown, indicator light defective, rocker switch defective,
- one indicator light on adapter does not light up → indicator light is defective,
- indicator light H 12 "Electronic" (plus H 11) does not go off→ connection/wiring harness malfunctioning, relays on instrument panel are not switching,
- indicator light "BRAKE RELEASE" lights up → short circuit against ground in wiring harness/magnetic brake solenoid,
- indicator lights "ERROR" (area 4), "COUNTER ROTATION" (area 9), "DEFECT" (area13) light up, analog indicators "TRAVEL" and "STEERING" receive signal → short circuit in wiring harness/RPM potentiometer
- indicator lights "ERROR" (area 4), "COUNTER ROTATION" (area 9), "BATTERY UNDERVOLTAGE" (8), and false readings in "MACH. MODEL" (area 6) and "ENGINE" on the adapter light up → minus line to electronic = cable no. 250 interrupted,

1.3. Lamp test (area 10)

Push "LAMP TEST" switch - all test box indicator lights, with the exception of the yellow "BRAKE RELEASE" light, must light up, or the indicator light is defective.

Note: Digital display in area 2 must have been activated and now be active since beginning of operational readiness of the test box.

2. <u>Tests according to adjustment checklist - Diesel engine not running</u>

2.1. Identification machine model (adapter + area 6)

Indicators light up automatically when test box is turned on and must match the machine.

4.3. Straight run - right track to left track (area 14 "STRAIGHT RUN TEST")

The speed of the right drive side (right track) is displayed in relation to the speed of the left drive side (left track).

Note for **PR 752** and **RL 52**:

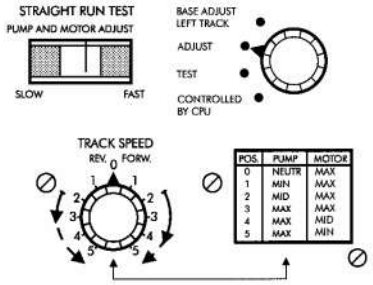
- to check/adjust stage 3=pump end stop, the servo lines to the variable displacement motors must be relieved to the tank (close off pump outlets). If they are not relieved, the tracks are running with a faster speed.
- for tests/adjustments of stage 4=begin of regulation/regulating range displacement motor, the two displacement motors per side must be tested/adjusted individually.
- observe sequence of tests according to checklist, page 3.5.50.01, and the instructions in "testing and adjusting - travel hydraulic", group 6.5, point 2.2,
- in some cases, after replacing a variable motor, it might be necessary to adjust stage 5 =maximum speed. See paragraph 6.5 - point 5 and 'test result's - exception', point 4.2

If the straight run test is only carried out as a routine check, and if no test is performed on base adjustment - left track according to point 4.2, then only minor corrections may be made, always adjusting the faster track in relation to the slower one in all speed ranges.

If base adjustment - left track is performed according to point 4.2, required adjustments on the right drive side can now be carried out.

Select **test program** "straight run" on the test box via the right rotary switch:

- for tests after completing "base adjustment - left track" as well as in general on adjustment corrections, turn rotary switch to position "ADJUST".
- turn rotary switch to position "TEST" for routine checks (=greater tolerance than in the case of "ADJUST").



Select **drive direction** and speed range according to the check list via left rotary switch "TRACK SPEED":

forward travel: turn rotary switch clockwise to range "FORW.",

reverse travel: turn rotary switch counterclockwise to range "REV.".

Speed range forward / reverse = range of adjustment:

stage 1 = regulating start pump	tests of travel start in both directions
stage 2 = regulating range pump	tests / adjustments in both directions
stage 3 = end stop pump	tests / adjustments in both directions
stage 4 = regulating range motor	tests in both directions, adjustments only in forward direction
stage 5 = maximum speed	only tests, adjustment only possible or required on PR 752 and RL 52

Note: The test in **step 1** is only necessary in a routine check, without testing the base adjustment - left track. There is no display reading - check for function of both tracks visually.
If the tracks are not running on both sides, or they are running fast, always carry out base adjustment - left track according to point 4.2.

The **test results** - straight run are displayed on the analog indicator "PUMP AND MOTOR ADJUST":

Display appears only when the track is running; the readings mean:

red indicator range "SLOW" - right drive side is running slower than the left during this step of the test
→ correction of adjustment required according to group 6.5,

green indicator range - difference between speeds right - left is within tolerance range for test step
→ no correction necessary,

red indicator range "FAST" - right drive side is running faster than the left during this step of the test
→ correction of adjustment required according to group 6.5,

3.1.2 Function test of indicator lights on the instrument panel

The „Enter“ button is assigned in Test step 1 with the function „Check Indicators“ **[Check Indicators]**. When the button is pressed, the indicator lights H11 „reduced speed“ and H12 „Electronic problem“ on the instrument panel are activated.

For arrangement of indicator lights on the instrument panel, see section 9.3.

Hold the „Enter“ button down

3.2. Test step 2 Travel joystick [Joystick]

3.2.1 Function check

In neutral position of the travel joystick, the center of the crosshairs appears green in the center and changes to transparent when the travel joystick is deflected.

The indicator in the crosshairs moves in the square sensor field according to the deflection. When the end position is reached, the corresponding bar changes to green, in diagonal deflection of the travel joystick, both associated bars change to green in the end position.

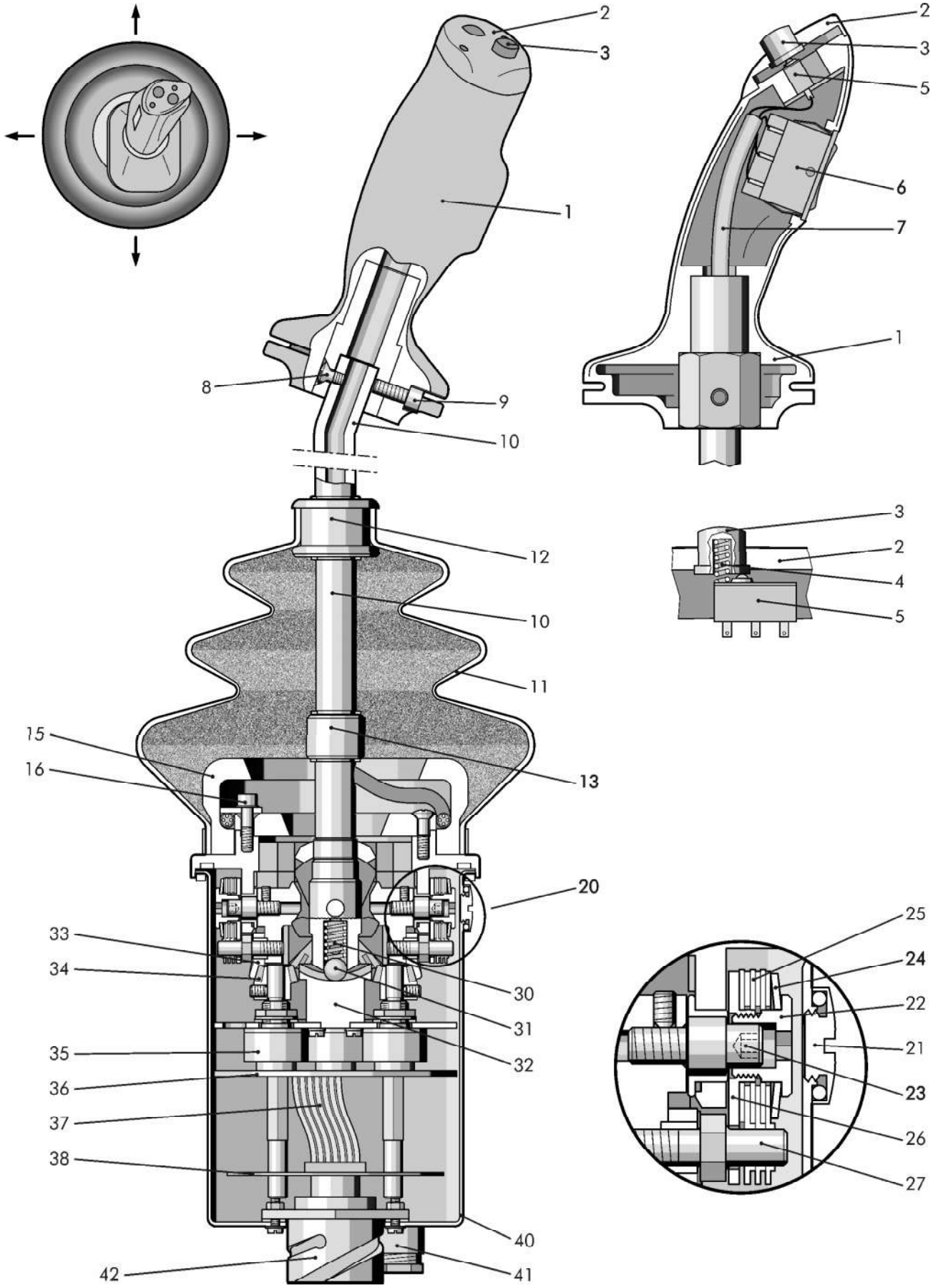
In case of an erroneous function of the travel joystick, the crosshairs on the display are not moved or the indicator light „ERROR“ **[Error]** lights up.

Travel joystick "Neutral"

Travel joystick "slightly deflected"

Notes

Installation Note: For the installation, the positioning mark (= notch or a red dot) on the carrier, must point in forward travel direction.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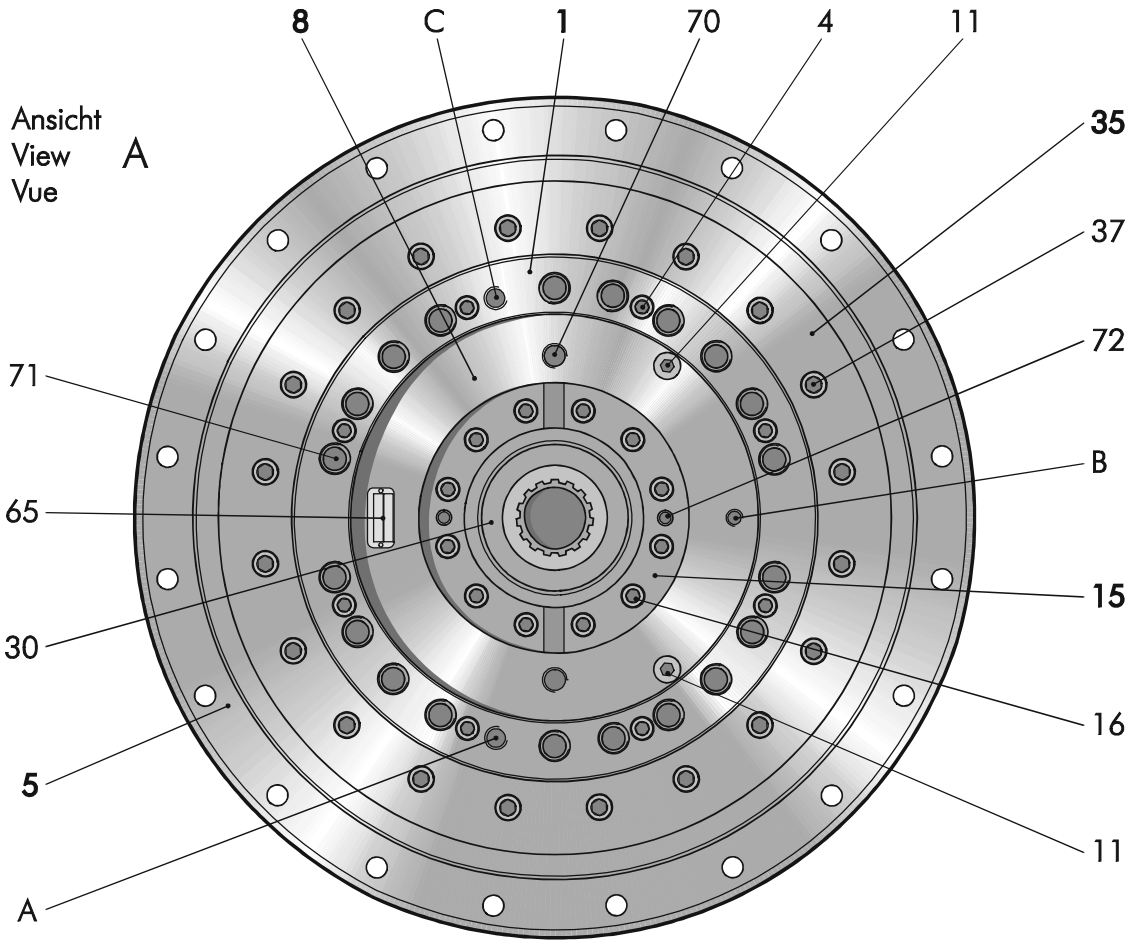
4

Notes

Note: Plugs position 63 and 64 - tightening torque approx. 160 Nm


Ansicht
View A
Vue
8
C
1
70
4
11
35
37
72
71
B
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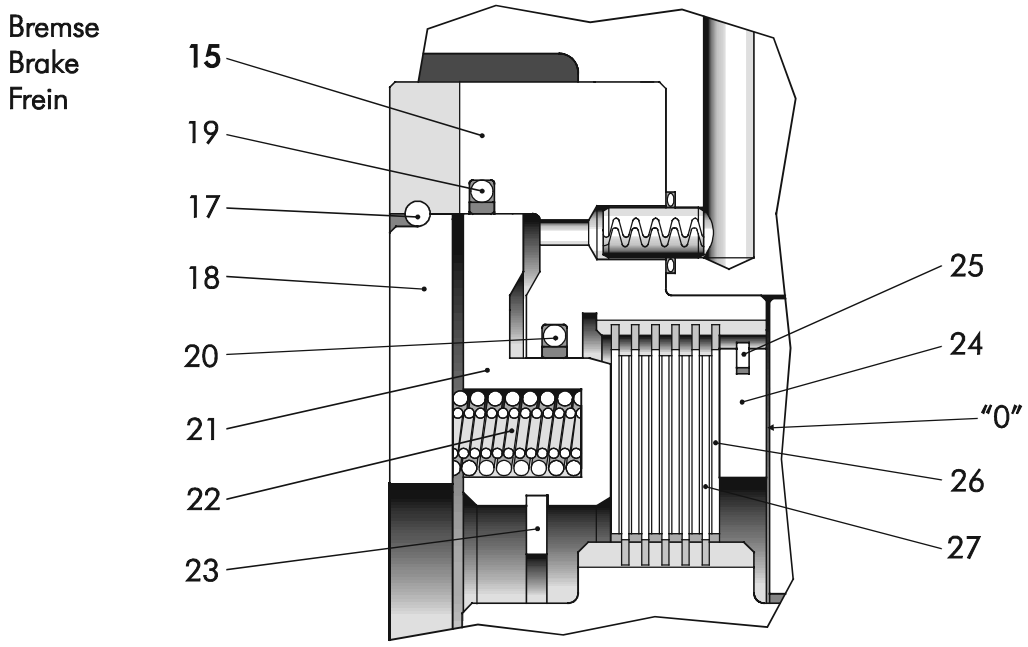
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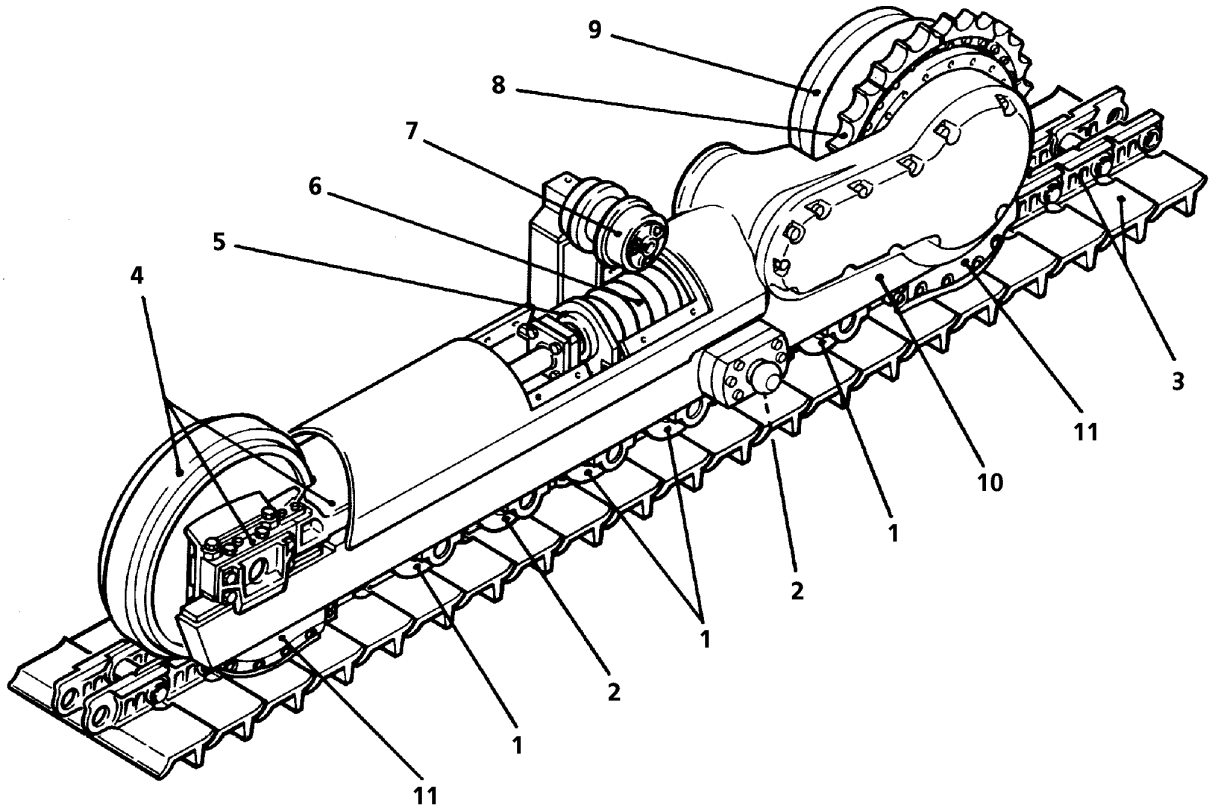
The travel power of the machine is transferred from the travel gear via the sprocket, track chain and track pads to the ground.

The idler, track and carrier rollers, guide the track chain and distribute the weight of the machine to the track pads. The result is even ground pressure, good traction and stable characteristics.



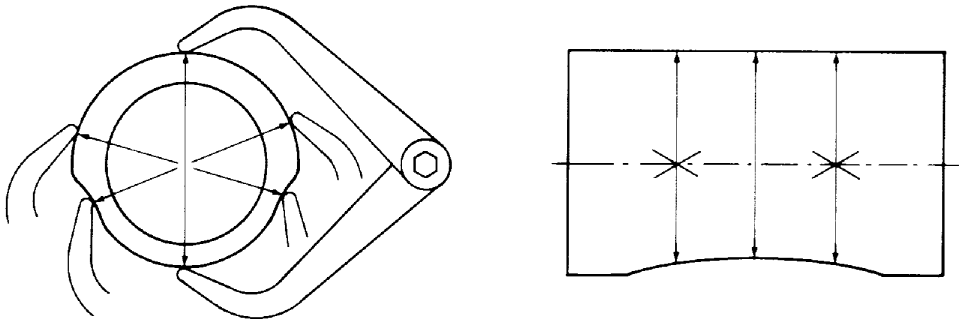
1	Track roller - single flange	7	Carrier roller
2	Track roller - double flange	8	Sprocket (segments)
3	Track chain assembly	9	Travel gear
4	Idler, complete	10	Roller frame
5	Grease cylinder	11	Track guide
6	Spring assembly		

Additional track components: Center track guards an guides (not illustrated)

On SALT chains, the radial wear determines the degree of wear. Some chain manufacturers list therefore the dimension from the underside of the bushing to the track pad. The forward and reverse drive dimensions should be checked as well since they can give conclusions as to the reasons for chain wear, such as: tracks chains too tight or material build up. For accuracy, measure several bushings and use the average dimension to determine the degree of wear.

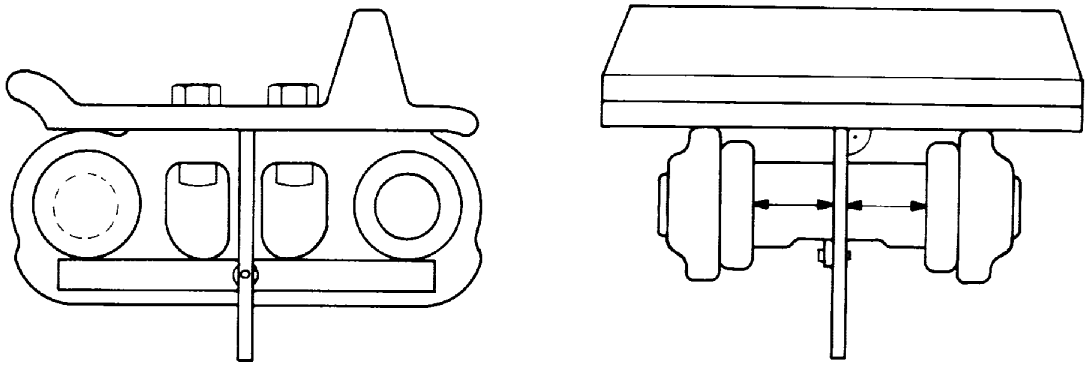
1.2.1 Measurement with outside calipers

Check wear of the bushing in the center. Open calipers far enough so they will slide easily over the bushing. Check dimension using the ruler. The dimension should be within a tolerance of max.+/- 0,25 mm (0,01").



1.2.2 Measurement with a depth gauge

This type of measurement is preferred on SALT chains since it is easier performed. In addition, the same reference point and the same measuring instrument can be used to measure the height of the track links.



Before the above method is used, check if the track pads are bent. Do not use this method if the pads are bent.

The wear dimension is the average wear of two bushings. Measure the wear on several bushings and use the average dimension to determine the amount of wear.

8. **Guidelines to use the wear charts**

All undercarriage components are manufactured to certain tolerances and are subject to improvement due to the advancement in the manufacturing process. For this reason, as well as the fact that there are different track component manufacturers, the values in the wear charts are rounded off. The wear charts are designed for average to heavy duty service of the undercarriage.

The increasing percentage values are broken down as follows:

0% = Approx. new dimension
xx% = Intermediate values for easier dertermination of remaining service life
xx % = Percentage value highlighted = wear limit / end of normal use
xx % = Increased wear due to run out of hardness layers and danger of breakage as well as possible damage to neighboring parts.

Example of use: - Bushings (oil lubricated) / external wear

Service life of tracks: 2940 operating hours

Measured value = 81.9 mm
is according to chart = approx. 84 %

Remaining to wear limit = approx. 16 %

At an average, for 1% wear, the service life is 35 operating hours (2940:84=35) .

Therefore, if the **working conditions remain the same**, the chain can remain in service for approx. 560 operating hours (35x16=560), in respect to the bushing external wear.

1.2 **Bushings** - external wear

1.2.1 - lubricated, measured w.depth gauge

mm	%	Inch
86.8	0	3.42
85.7	24	3.37
84.6	42	3.33
83.5	60	3.29
82.4	78	3.24
81.3	88	3.20
80.3	**100**	3.16
79.3	112	3.12
78.3	125	3.08

At the latest when the wear limit is reached, a decision must be made about the continued use of the components:

- Remachining / bolts and change bushings, or
- reuse the components until total wear limit is reached.

The time frame until the total wear limit is reached cannot be determined exactly, due to the variety of factors, however, it it usually accepted at up to 120% (starting at a wear limit of 100%).

For the determination of measures, the condition of the complete track and not only the individual components should be taken into consideration.

1.1 **Track chain pitch**
Internal wear
measured over 4 links

mm	%	inch
702,8	0	27,67
704,9	20	27,75
707,4	40	27,85
709,9	60	27,95
712,5	80	28,05
713,7	90	28,10
715,0	**100**	28,15
717,6	110	28,25
720,1	120	28,35

1.2 **Bushing** - external wear

1.2.1 - lubricated
measured w. depth gauge

mm	%	inch
74,2	0	**2,92**
73,2	20	2,88
72,1	40	2,84
70,9	61	2,79
69,4	79	2,73
68,3	91	2,69
67,6	**100**	2,66
66,6	112	2,62
65,8	121	2,59

1.2.2 - lubricated
measured diameter

mm	%	inch
62,0	0	**2,44**
61,0	20	2,40
59,9	40	2,36
58,7	61	2,31
57,2	79	2,25
56,1	91	2,21
55,4	**100**	2,18
54,4	112	2,14
53,6	121	2,11

1.2.3 - sealed
measured diameter

mm	%	inch
62,0	0	**2,44**
60,8	24	2,39
59,9	40	2,36
58,9	60	2,32
58,7	78	2,31
57,6	91	2,27
56,8	**100**	2,24
55,8	112	2,20
55,0	121	2,17

2. **Chain link** - height
measured w. depth gauge

mm	%	inch
109,0	0	4,29
106,8	17	4,20
104,8	33	4,13
102,7	50	4,04
100,5	67	3,96
98,5	83	3,88
96,3	**100**	3,79
94,9	110	3,74
93,5	120	3,68

3. **Track pads** - height of grousers

3.1 - single grouser
measured w. depth gauge

mm	%	inch
55,0	0	2,16
48,5	20	1,19
42,0	40	1,66
35,5	60	1,40
28,0	80	1,10
24,3	90	0,95
20,0	**100**	0,79
15,0	110	0,59
10,0	120	0,39

3.2 - double grouser
measured w. depth gauge

mm	%	inch
31,0	0	1,22
27,8	18	1,09
24,6	36	0,97
21,4	54	0,84
18,2	72	0,72
15,0	86	0,59
11,9	**100**	0,47
9,6	110	0,38
7,3	120	0,29

3.3 - triple grouser
measured w.depth gauge

mm	%	inch
25,3	0	1,00
22,2	18	0,87
19,1	36	0,75
16,0	54	0,63
12,9	72	0,51
9,7	86	0,38
6,5	**100**	0,26
4,2	110	0,17
1,9	120	0,07

4. **Sprocket**
Sprocket teeth wear
visual evaluation

Backlash of teeth only partially worn = good

Backlash of teeth worn teeth pointed = replace
(see page 12.2.01.05)

5. **Idler**
measured w. depth gauge

mm	%	inch
19,0	0	0,75
20,6	24	0,81
22,3	48	0,88
24,0	72	0,94
24,8	88	0,98
25,4	94	1,00
26,0	**100**	1,02
27,0	110	1,06
28,0	120	1,10

6. **Track roller**
single- and double flange
measured diameter

mm	%	inch
203,0	0	7,99
199,0	24	7,83
195,0	48	7,68
191,0	72	7,52
188,2	90	7,41
186,3	96	7,33
184,4	**100**	7,26
179,6	110	7,07
174,9	120	6,89

7. **Carrier roller**
measured diameter

mm	%	inch
171,5	0	6,75
169,0	20	6,65
166,5	40	6,56
164,0	60	6,46
161,4	80	6,35
159,8	92	6,29
158,8	**100**	6,25
157,5	110	6,20
156,2	120	6,15

Note: - For use of wear charts - see page 12.2.01.07 / reverse side and page 12.2.02.01
- New dimensions and reconditioning wear limits (= 100% wear) are supplied by the manufacturer. The intermediate values are approx. values in a wear curve.

1.1 **Track chain pitch**
Internal wear
measured over 4 links

mm	%	inch
864,0	0	34,01
868,5	25	34,19
874,0	50	34,41
880,0	75	34,65
887,0	**100**	34,92
	110	
	120	

1.2 **Bushing** - external wear

1.2.1 - lubricated
measured w. depth gauge

mm	%	inch
107,0	0	4,21
105,8	20	4,17
104,6	40	4,12
102,1	60	4,02
99,5	80	3,92
98,2	90	3,87
97,0	**100**	3,82
95,7	110	3,77
94,1	120	3,70

1.2.2 - lubricated
measured diameter

mm	%	inch
82,5	0	3,25
81,3	20	3,20
80,1	40	3,15
77,6	60	3,05
75,0	80	2,95
73,7	90	2,90
72,5	**100**	2,85
71,2	110	2,80
69,6	120	2,74

mm	%	inch
	0	
	20	
	40	
	60	
	80	
	90	
	100	
	110	
	120	

2. **Chain link** - height

measured w. depth gauge

mm	%	inch
150,0	0	5,91
148,0	20	5,83
146,0	40	5,75
144,0	60	5,67
140,7	80	5,54
139,0	90	5,47
137,5	**100**	5,41
136,0	110	5,35
134,5	120	5,30

3. **Track pads** - height of grousers

3.1 - single grouser
measured w. depth gauge

mm	%	inch
84,0	0	3,30
73,5	20	2,89
63,5	40	2,50
51,0	60	2,01
38,0	80	1,50
31,5	90	1,24
25,5	**100**	1,00
19,0	110	0,75
12,5	120	0,49

mm	%	inch
	0	
	20	
	40	
	60	
	80	
	90	
	100	
	110	
	120	

mm	%	inch
	0	
	20	
	40	
	60	
	80	
	90	
	100	
	110	
	120	

4. **Sprocket**
Sprocket teeth wear
visual evaluation

Backlash of teeth only partially worn = good

Backlash of teeth worn teeth pointed = replace
(see page 12.2.01.05)

5. **Idler**

measured w. depth gauge

mm	%	inch
22,0	0	0,87
23,3	25	0,92
25,0	50	0,98
27,5	75	1,08
31,0	**100**	1,22
	110	
	120	

6. **Track roller**
single- and double flange
measured diameter

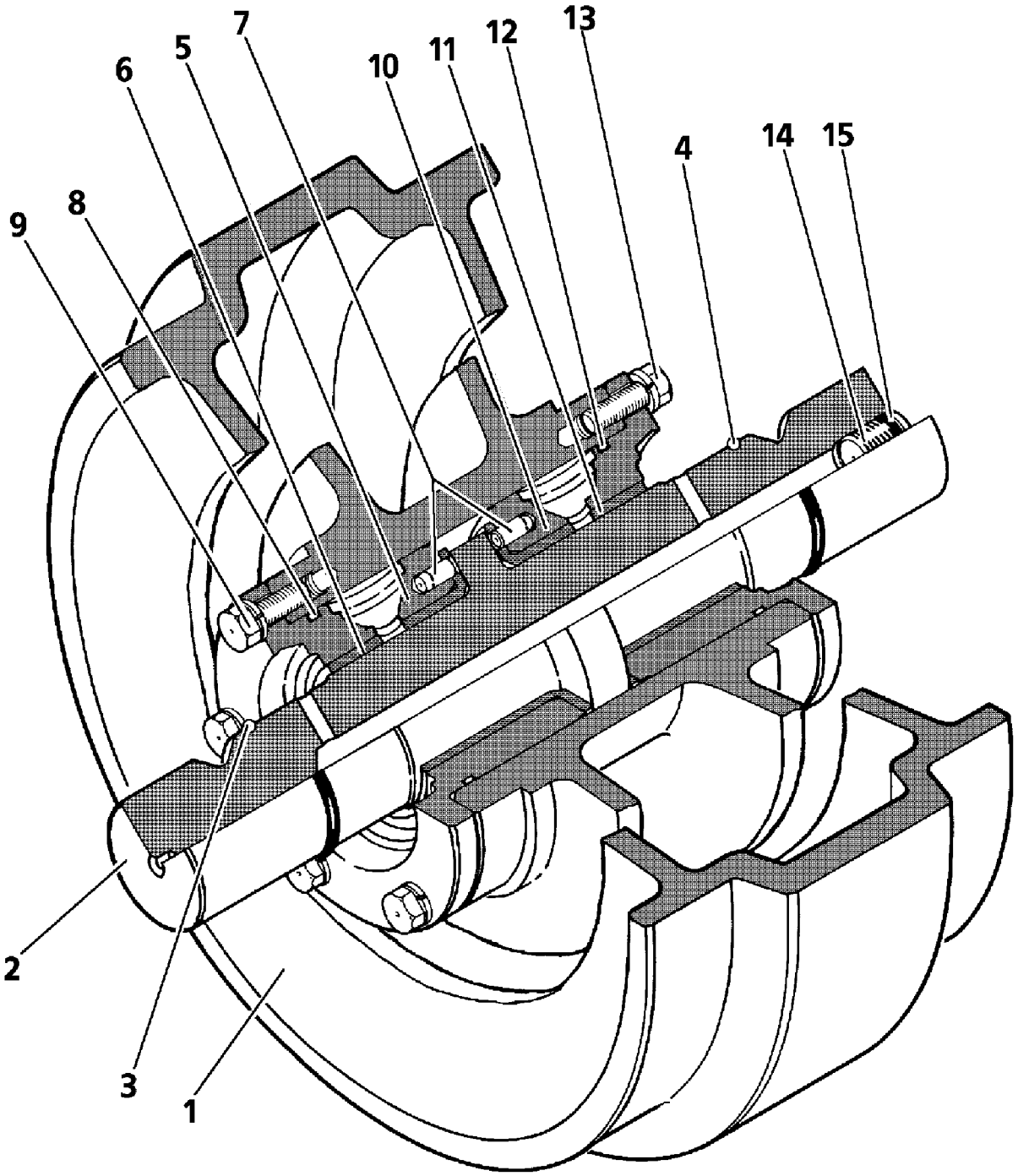
mm	%	inch
242,0	0	9,52
235,0	25	9,25
227,0	50	8,94
218,0	75	8,58
208,0	**100**	8,19
	110	
	120	

7. **Carrier roller**

measured diameter

mm	%	inch
191,0	0	7,52
187,5	25	7,38
183,5	50	7,22
179,0	75	7,05
171,0	**100**	6,73
	110	
	120	

Note: - For use of wear charts - see page 12.2.01.07 / reverse side and page 12.2.02.01
- New dimensions, intermediate values and reconditioning wear limits (= 100% wear) are supplied by the manufacturer.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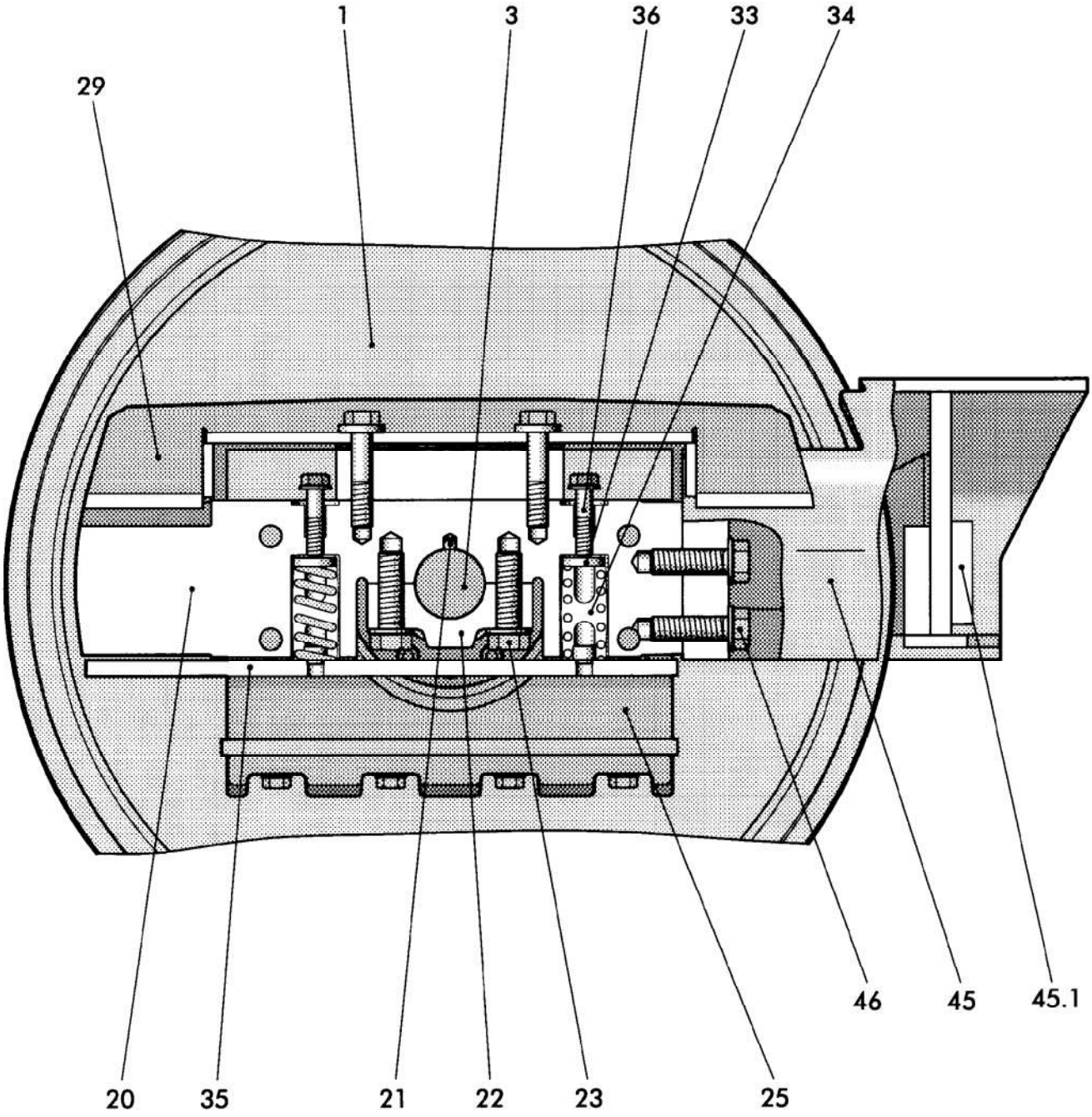
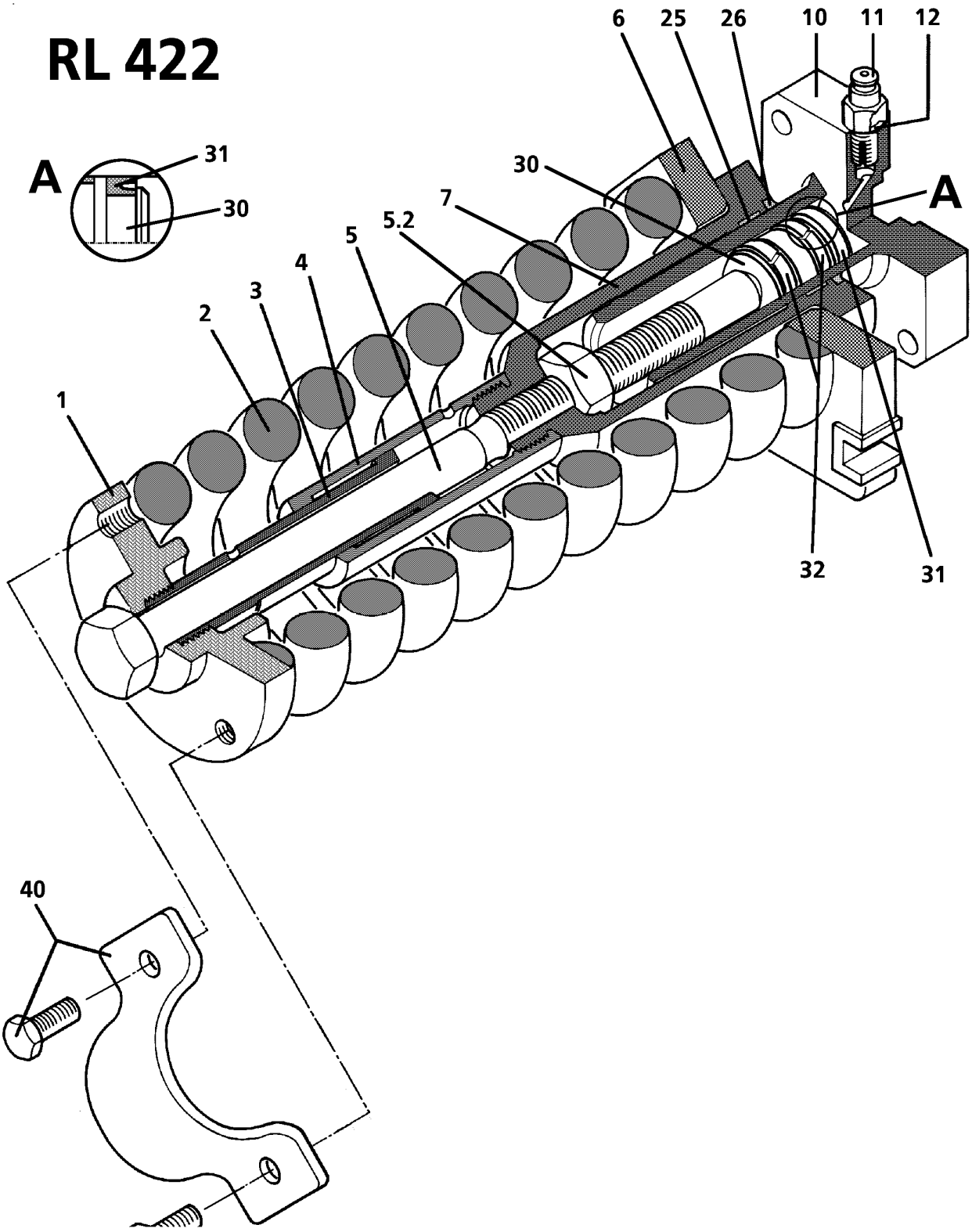


LIEBHERR	Benennung Description Dénomination **Front idler**	Typ/ab Type/from Type/ a partir de
Datum Edition Date **01 04**	**Track components**	**RL 52** F/N 739-2001→7421 Blatt Page Feuille **12.4.50.02**

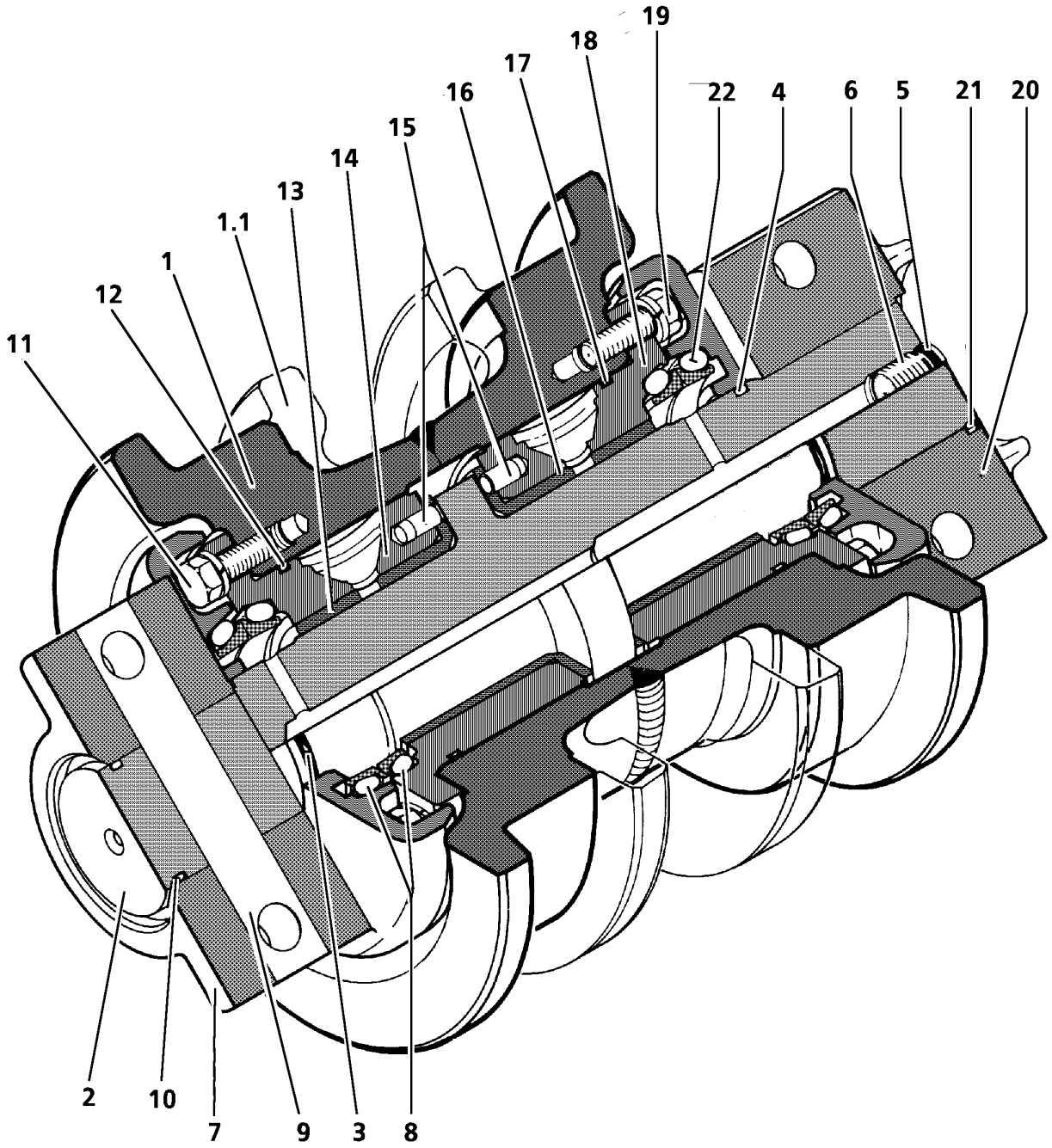
Ausführung Berco
Version Berco
Exècution Berco

RL 422



LIEBHERR	Benennung Description Dénomination **Spanneinheit**	Typ/ab Type/from Type/a partir de **RL 422** F/N x-x-1001→ 3000

01 00	**Ensemble de Tension**	Blatt Page Feuille **12.5.20.02**



1 **Single flange roller shell**
1.1 **Double flange roller shell**

2 Shaft
3 O-ring
4 O-ring
5 O-ring
6 Plug
7 Cover
8 Duo-cone seal
9 Roll pin
10 Lock ring
11 Hex head screw w. lock washer
12 O-ring
13 Bushing
14 Bushing retainer flange
15 Roll pin
16 Bushing
17 O-ring
18 Bushing retainer flange
19 Hex head screw w. lock ring
20 Cover
21 Lock ring
22 Duo-cone seal

Note: not valid for PR 752

Notes

Control measurement X with tightening torque for slotted nut, item 17:

The control measurement X must be present after reaching the proper tightening torque.

Model	Control measuement X (in mm)	with tightening torque item. 17
LR 622	$22^{\pm 0,8}$	1000 Nm
LR 632	$27^{\pm 1,0}$	1500 Nm
RL (4)22(B)	$22^{\pm 0,8}$	1000 Nm
RL 42B	$27^{\pm 1,0}$	1500 Nm

Tightening torques for flange mounting screws item. 21 (to track roller frame)

PR 712(B), PR 722(B). LR 622, RL (4)22(B)

Hex head screws(black) M16x50 - 10.9 (IdN°.4066 201)

Total tightening torque: 310 Nm / 228 ft. lbs.

Sequence to tighten screws (see drawing for screw position):

Step 1 = 100 Nm (73 ft. lbs.) 1→5→3→7
Step 2 = 100Nm (73 ft. lbs.) 2→6→4→8
Step 3 = 310Nm (228 ft. lbs.) 1→5→3→7
Step 4 = 310Nm (228 ft. lbs.) 2→6→4→8
Step 5 = 310Nm (228 ft. lbs.) 1→5→3→7
Step 6 = 310Nm (228 ft. lbs.) 2→6→4→8
Step 7 = 310Nm (228 ft. lbs.) 1 to 8 (1.check)
Step 8 = 310Nm(228 ft. lbs.) 1 to 8 (2.check)

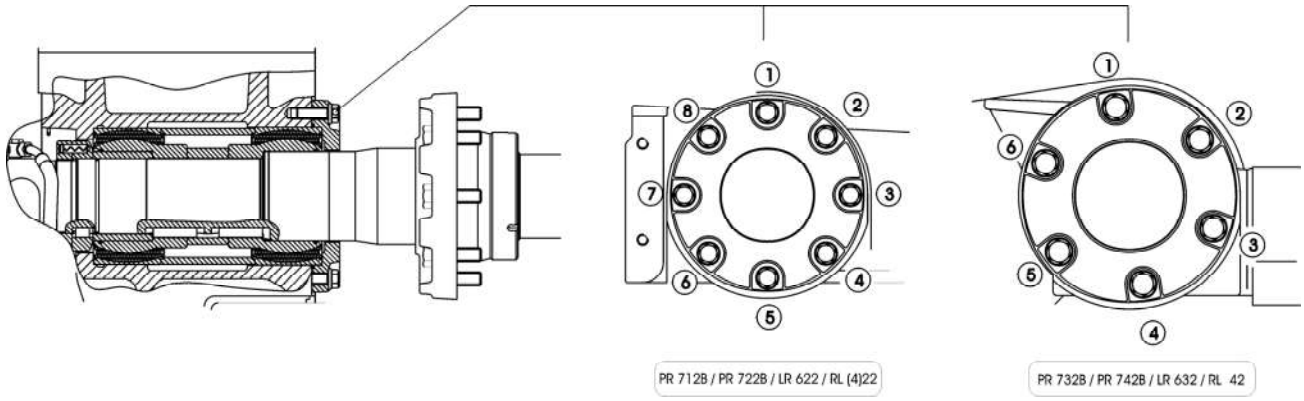
PR 732(B), PR 742(B). LR 632, RL 42B

Hex head screws(black) M20x60-10.9 (IdN°.10013 222)

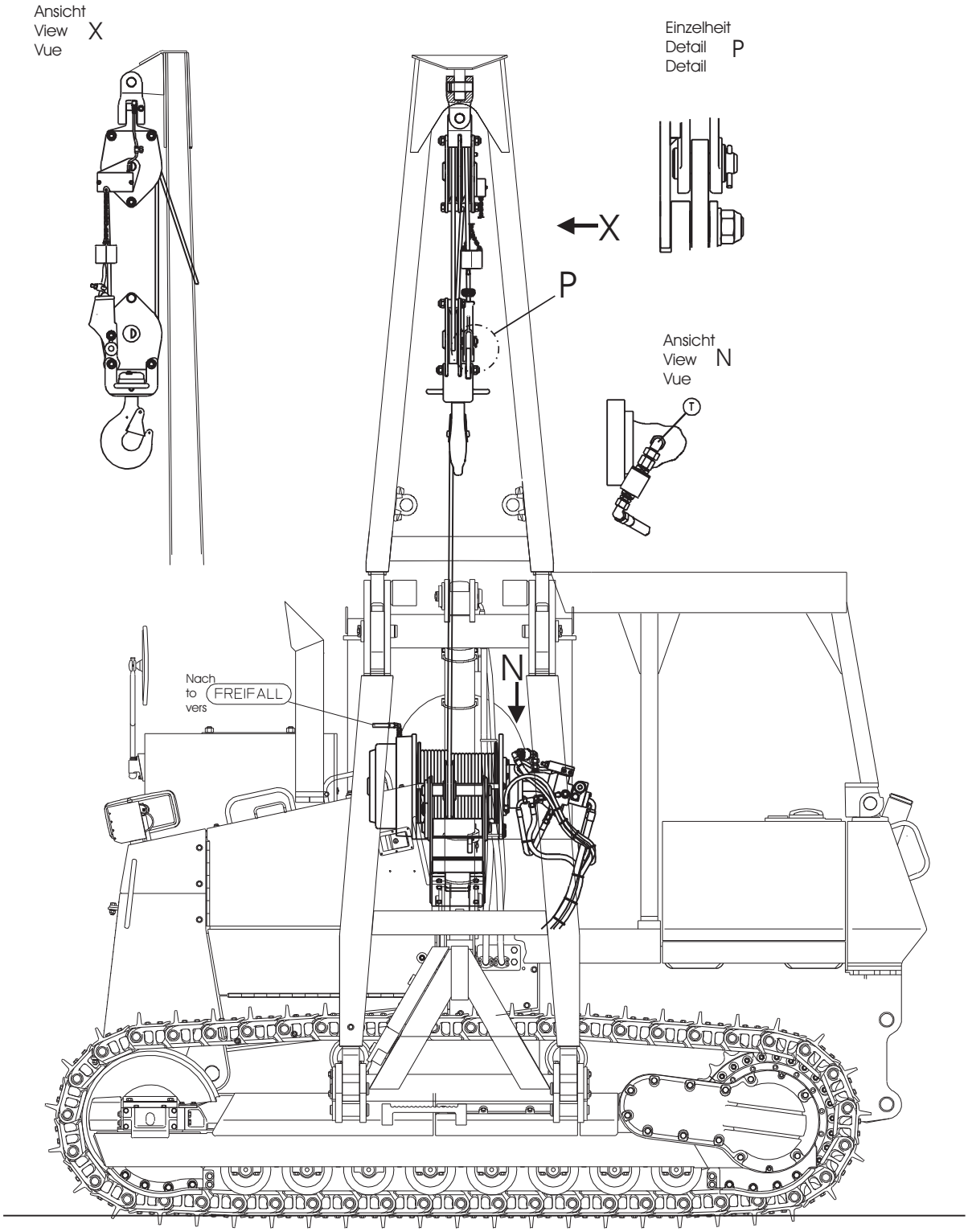
Total tightening torque: 620 Nm / 456 ft. lbs.

Sequence to tighten screws (see drawing for screw position):

Step 1 = 210Nm (154 ft. lbs.) 1→4→6
Step 2 = 210Nm (154 ft. lbs.) 3→5→2
Step 3 = 620Nm (456 ft. lbs.) 1→4→6
Step 4 = 620Nm (456 ft. lbs.) 3→5→2
Step 5 = 620Nm (456 ft. lbs.) 1→4→6
Step 6 = 620Nm (456 ft. lbs.) 3→5→2
Step 7 = 620Nm (456 ft. lbs.) 1 to 6 (1.check)
Step 8 = 620Nm (456 ft. lbs.) 1 to 6 (2.check)

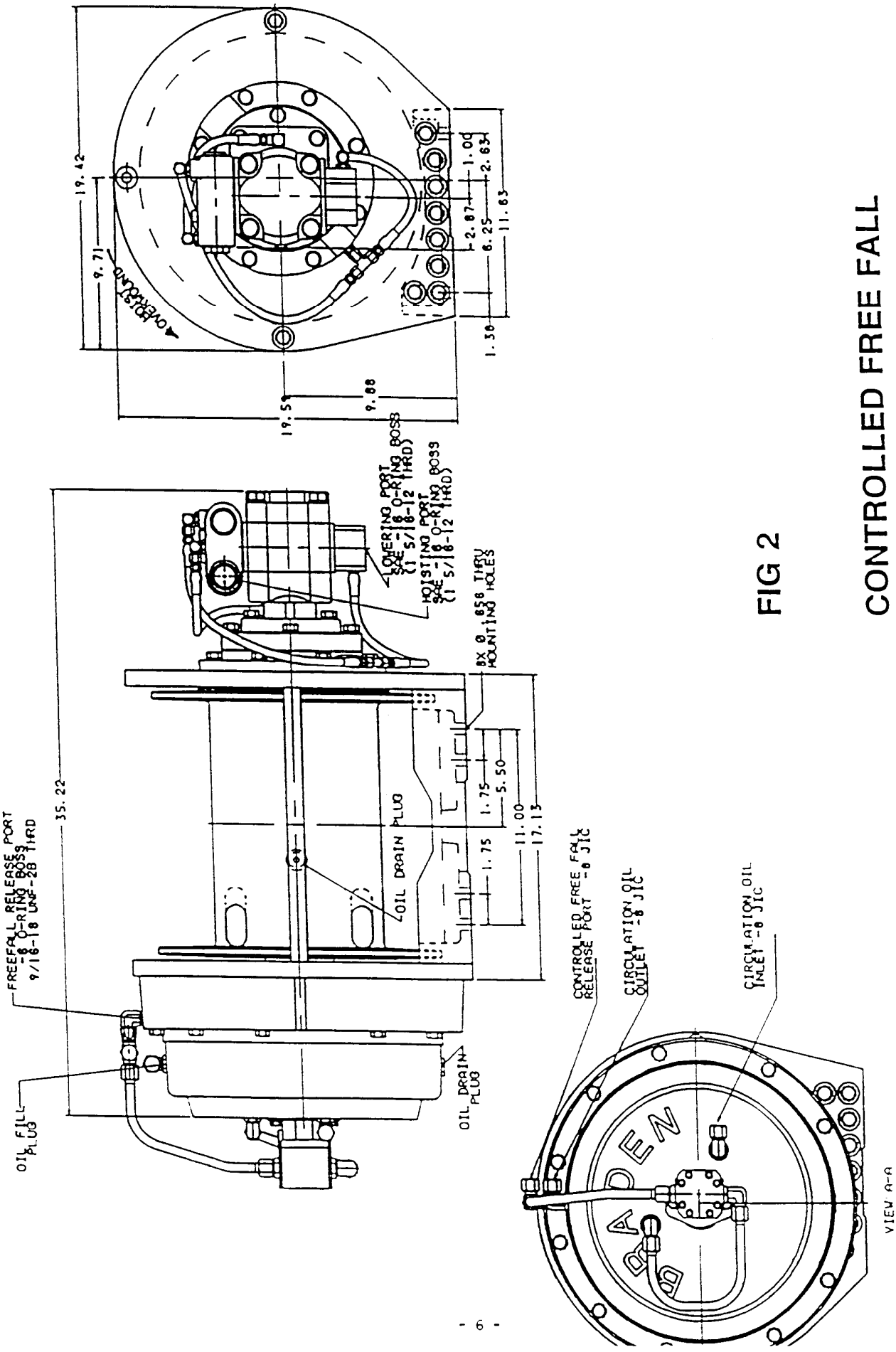


Caution: Carefully remove dirt and rust from the flange roller frame before installation to ensure a good connection.
After step 2, check the gap between the flange and the track roller frame - it must be the same around the complete circumference.
Repeat the tightening procedure (check) until the screws are seated tightly at the required tightening torque.



LIEBHERR	Benennung Description Dénomination Hubwerk	Typ/ab Type/from Type/a partir de RL 22 B F/N 615-3002 →

01 00	Hoist Gear Treuil de Levage	Blatt Page Feuille 14.2.20.01



that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature. Failure to use the proper type and viscosity of planetary gear oil may contribute to brake clutch slippage which could result in property damage, severe personal injury or death. Refer to "Recommended Planetary Gear Oil" for additional information.

3. **Vent Plug**

The vent plug is located in the brake housing on the full release free fall and on the motor mount on the controlled free fall. It is very important to keep this vent clean and unobstructed. Whenever gear oil is changed, remove the vent plug, clean in solvent and reinstall.

Do not paint over the vent or replace with a solid plug.

4. **Hydraulic System**

The original filter element should be replaced after the first fifty (50) hours of operation, then every 500 operating hours or three (3) months, or in accordance with the equipment manufacturer's recommendations.

5. **Wire Rope**

Inspect entire length of wire rope according to wire rope manufacturers recommendations.

6. **Mounting Bolts**

Tighten all winch base mounting bolts to recommended torque after the first one nundred (100) hours of operation, then every 1000 operating hours or six (6) months, whichever occurs first.

7. **Warm-up Procedure**

A warm-up procedure is recommended at eacn start-up and is essential at ambient temperatures below +40°F (4°C).

The prime mover should be run at its lowest recommended RPM with the hydraulic winch control valve in neutral allowing sufficient time to warm up the system. The winch should then be operated at low speeds, forward and reverse, several times to prime all lines with warm hydraulic oil and to circulate gear lubricant through the planetary gear sets.

⚠ WARNING

Failure to properly warm up the winch, particularly under low ambient temperature conditions, may result in temporary brake slippage due to high back pressures attempting to release the brake, which could result in property damage, severe personal injury or death.

8. **Recommended Planetary Gear Oil**

Field experience, supported by extensive engineering tests, indicates the use of the proper planetary gear oil is essential to reliable and safe operation of the brake clutch and obtaining long gear train life.

⚠ WARNING

Failure to use the proper type and viscosity of planetary gear oil may contribute to intermittent brake clutch slippage which could result in property damage, severe personal injury or death. Some gear lubricants contain large amounts of EP (extreme pressure) and anti-friction additives which may contribute to brake slippage and damage to brake friction discs or seals. Oil viscosity with regard to ambient temperature is also critical to reliable brake clutch operation. Our tests indicate that excessively heavy or thick gear oil may contribute to intermittent brake clutch slippage. Make certain that the gear oil viscosity used in your winch is correct for your prevailing ambient temperature.

For simplicity, BRADEN has listed one (1) readily available product in each temperature range which has been tested and found to meet our specifications. This is not to say that other lubricant brands would not perform equally as well.

If the listed lubricant brands are not available in your area, make certain your lubricant vendor supplies you with oil that is equivalent to those products listed below.

BRADEN planetary winches are factory filled with Texaco Meropa 150 or equivalent API GL-2/3 gear oil.

Notes

Notes - winch assembly:

1) Hex head screw - item 78, 83, 110 - apply Loctite No. 242 to threads
   - torque to 102 Nm (75ft.lbs)

2) At assembly measure thickness of brake pack stack-up (items 93 & 94) and spacer (item 97) Dimension “A”. If dimension is less than 2.150 inch (54,61 mm) add an additional divider plate (item 93) between divider plate (item 93) and spacer (item 97).

Notes - winch installation:

After repairs in the area “hoist gear - **free fall device**” the pressure lines have to be **bled**. Open the fittings on the winch housing and actuate the free fall device until all signs of air bubbles have gone. Retighten the fitting. If necessary, repeat this procedure for several times.

Fig. 2 Lowering 1

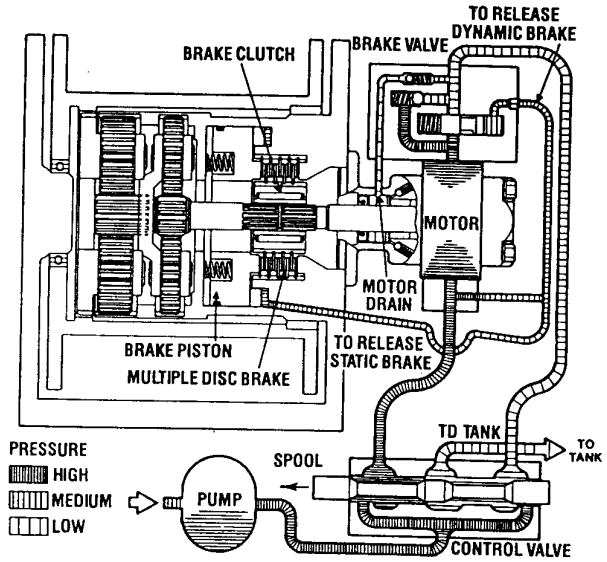
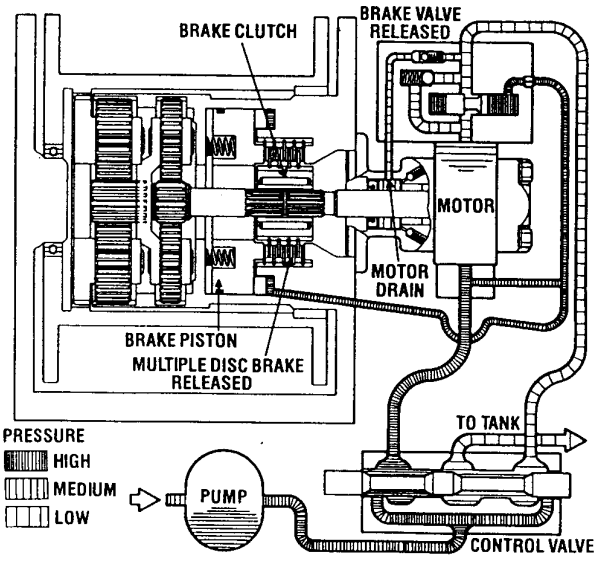


Fig. 3 Lowering 2

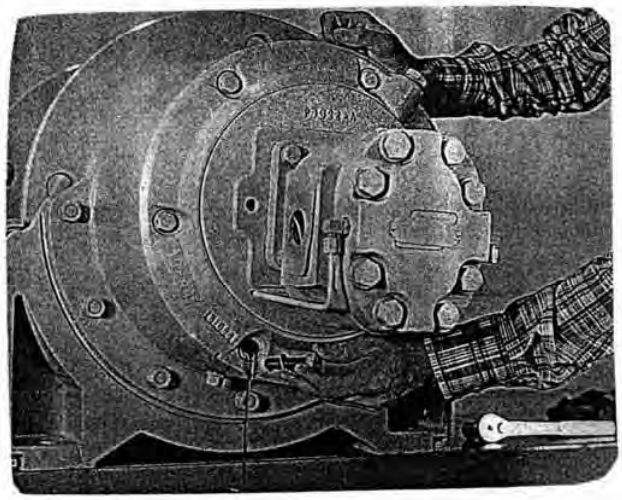


SECTION 6 *DISASSEMBLY & ASSEMBLY INSTRUCTIONS*

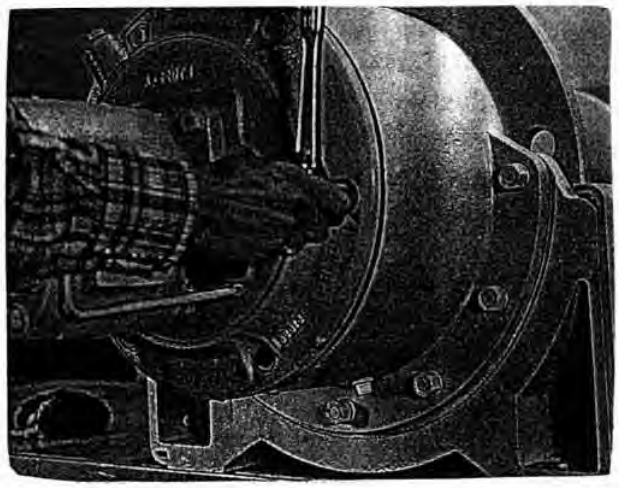
SECTION 6.1 *Primary Drive*

It is recommended that work on the primary drive assembly be done only in a clean shop equipped with suitable hoisting equipment.

Disassembly - Primary Drive



Drain oil from the primary housing by removing lowest capscrew (285) and seal washer (284) from the spring cover (281). Remove pipe plug (324) to vent the housing. If desired, the motor can be removed at this time to reduce the weight of the motor support assembly.



Remove spring cover (281) by slackening each capscrew (285) half a turn at a time progressively around the spring cover (281).

Assembly - Brake Hub

1. Install one spacer (312) and snap ring (311) in the brake hub (310). Assemble the end bearings (315) and cage assembly (316) into the brake hub (310) and install the other spacer (312) and snap ring (311).

2. Insert the sun gear (503) into the sprag assembly rotating it slightly in the free running direction. It is important that the sun gear be installed in the sprag assembly for the correct direction of rotation.

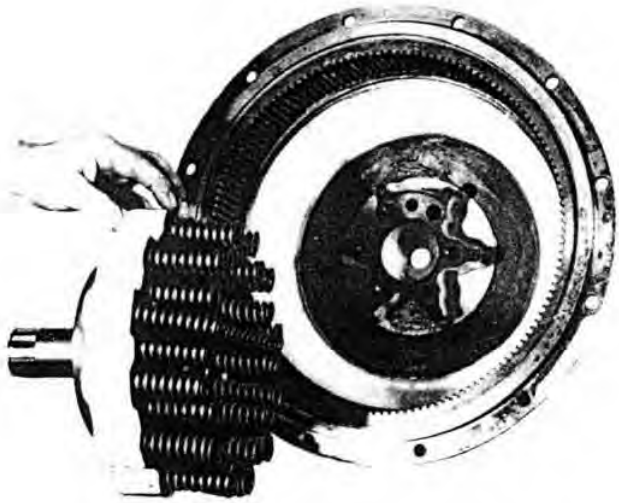
3. For winches that are to „winch in" in a clockwise direction, (viewed from the final drive end) check the brake hub rotation as follows:

4. Hold the gear end of the sun gear (503) in the left hand. The brake hub should rotate in a clockwise direction when looking at the splined bore of the sun gear (503). If the brake hub does not rotate in the correct direction, remove the sun gear from the brake hub assembly while rotating it slightly in the free running direction and reinstall it from the other side of the brake hub.

5. Install the brake hub assembly in the primary drive. See assembly instructions for the appropriate section.

6. Install the springs (423) and (424) (24 each) in the brake piston. Turn the free-fall end cover and install the brake piston and shaft in the end cover. Make sure that the brake port aligns with the hole in end cover. the pin must enter its clearance hole in the end cover before the capscrews can be installed. **(Fig. Q)**

Fig. Q



7. Install the 6 capscrews (429) and tighten progressively ½ turn at a time. (See Torque Chart)

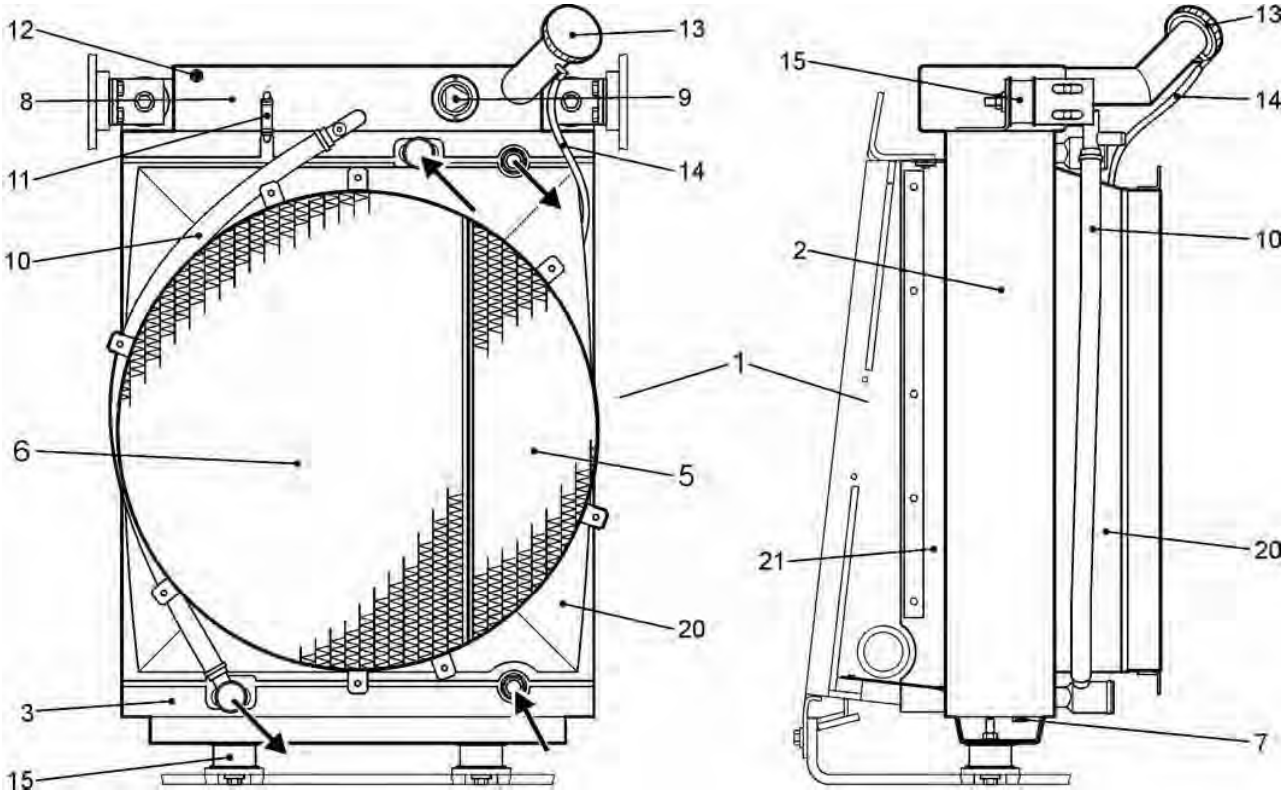
8. Install the 20 segments (416). Each segment must be installed so that its widest end rests on the step below the gear teeth and its narrowest end on the brake piston. **(Fig. R)**

Fig. R

SECTION 7.1 *Trouble Shooting - Winch*

Trouble	Probable Cause	Remedy
A) Winch will not pull maximum load.	1. System relief valve may be set too low.	– Install a pressure gauge and apply a stall pull on the winch. If pressure is low, increase relief valve setting until recommended pressure is obtained.
	2. If this trouble occurs suddenly after working at a maximum pull, a particle of dirt may be lodged under the system relief valve, holding it partially open. If this is the cause, a considerable loss in the line speed may be noticed as the load on the cable is increased.	– Remove relief valve, disassemble and clean parts thoroughly in a suitable solvent. Reassemble and install relief valve. Set pressure according to Remedy A-1.
	3. If the pump is belt driven, the belts may be slipping.	– Check belts when pump is at full pressure (stall pull on winch). Tighten belts if they are found to be slipping.
	4. The oil level in the reservoir may be too low. The suction line may be restricted or have an air leak causing cavitation at the inlet port. This may cause the pump to make a whining noise.	– Check oil level in the reservoir. Check the suction line for damage, externally and internally. Replace suction line if necessary.
	5. After all causes listed above have been investigated and it is found that the winch will not develop the maximum pull on the bare drum, the trouble may be in the winch.	– Install a pressure gauge and apply a stall pull on the winch. If the pressure is up to maximum and the bare drum line pull is less than the specified line pull, the trouble will be in the winch. Disassemble winch according to disassembly instructions and check that gear train turns freely. If gear train is found to be satisfactory, inspect the hydraulic motor according to service instructions for the hydraulic motor.

1. Cooler / radiator arrangement, front side
RL 422 F/N x-x-1001→3000, RL 22B F/N 615-3002→



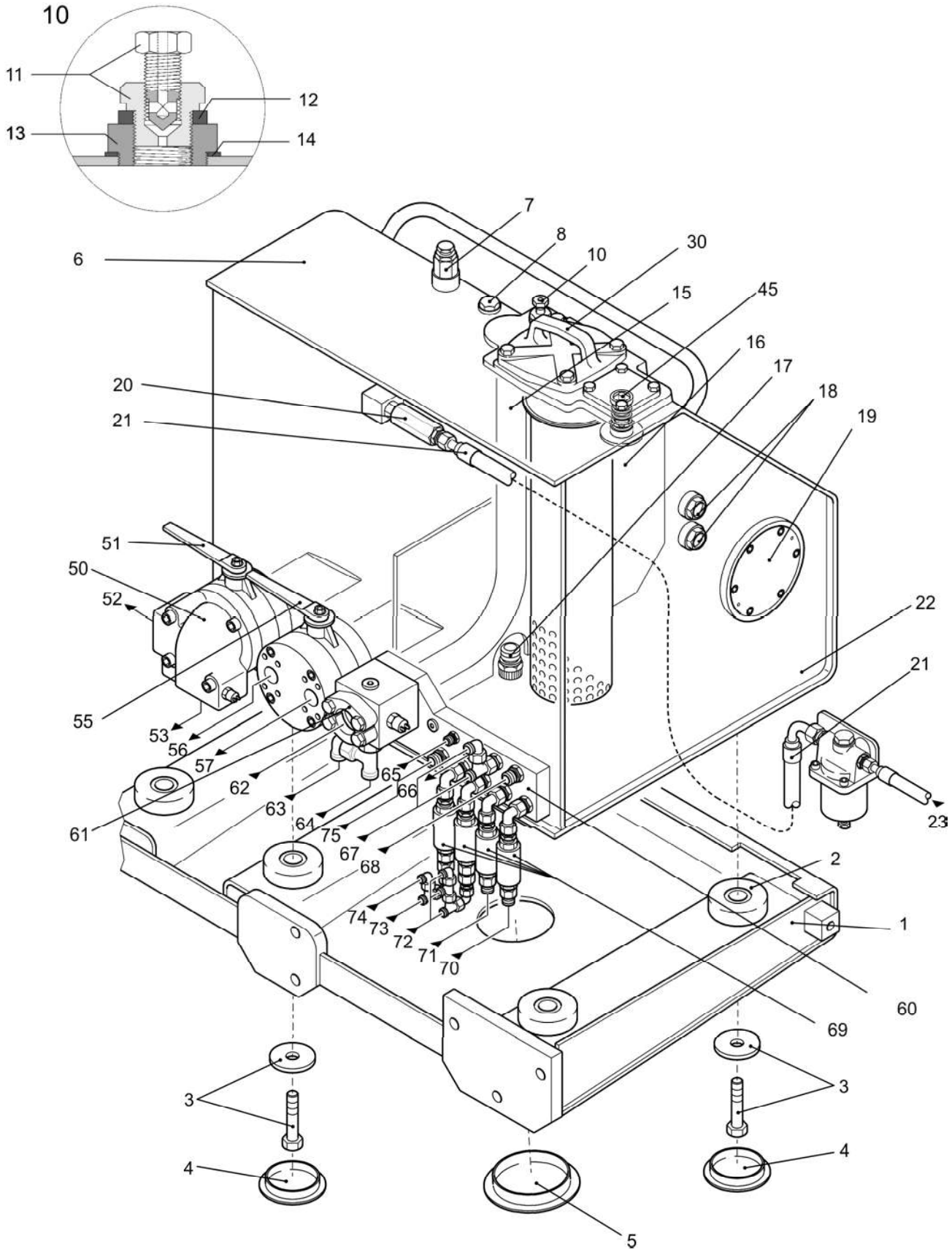
1 **cooler / radiator combination, complete**
2 frame section, side
3 frame section, bottom
15 elastic mount

5 **hydraulic oil cooler**
6 **water cooler**
7 plug with seal ring
8 expansion tank
9 sight gauge
10 connector hose - expansion
11 connector hose - vent
12 connection - engine vent
13 cooler cap
14 overflow hose
20 fan hood
21 air line elements

intake - outflow direction see arrows

Component arrangement and version can differ slightly from illustration, depending on manufacturing date and size.

Notes



	Benennung Description Dénomination	Typ/ab Type/from Type/ a partir de
LIEBHERR		

Sub Group Index

Parts list

1 **throttle control device** cpl.

2 housing - separated
3 housing frame
3.1 seal

5 **throttle control lever**
6 guide bushing
7 **shut off lever**
8 guide bushing

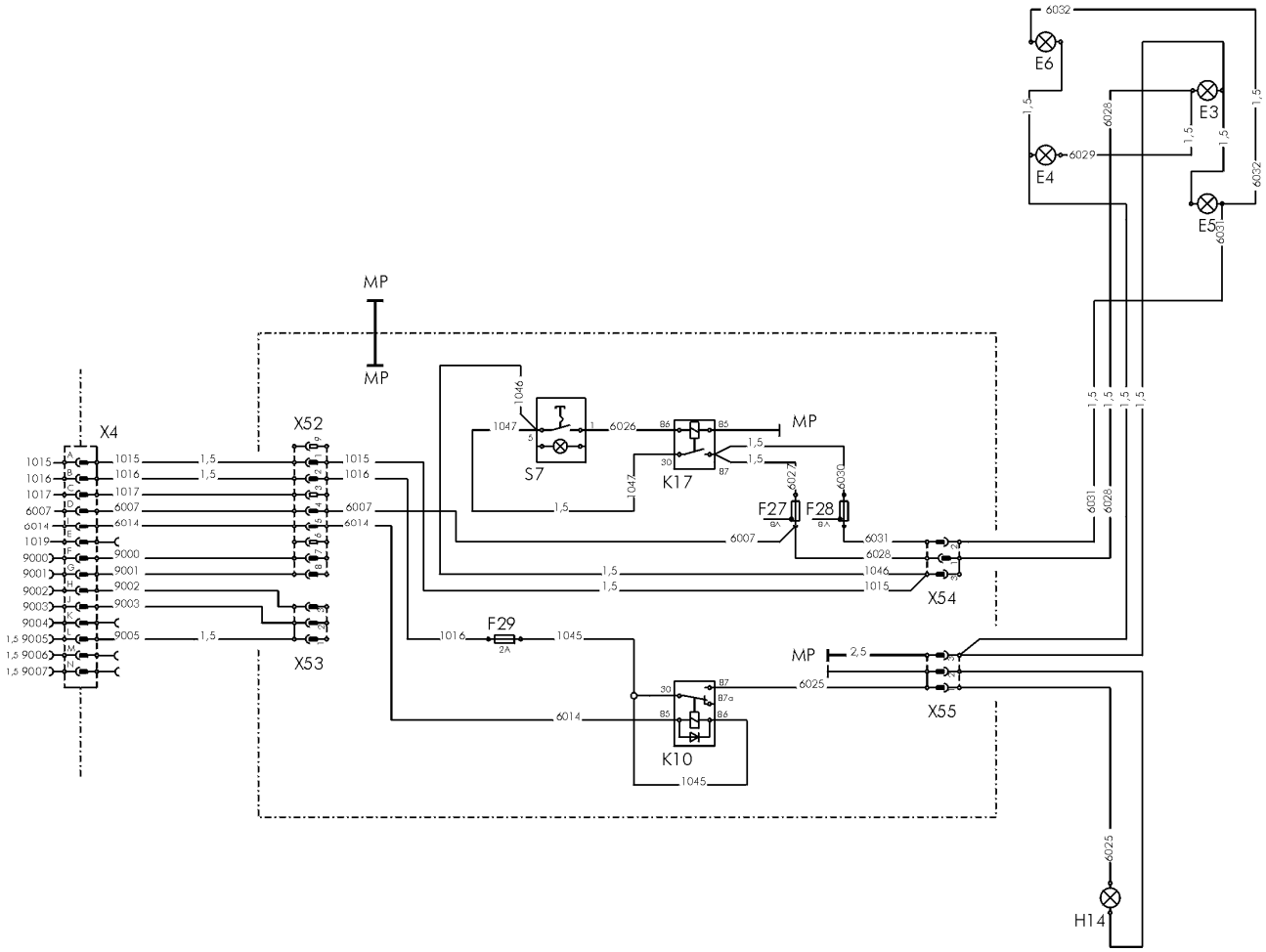
10 shaft
11 hex head nut (self locking) with washer
12 tension pin (rotation lock)
13 spacer
14 thrust washer
15 spring cup

20 guide rails
21 slide
22 sleeve
23 dowel pin
24 connector fitting - throttle control cable
25 connector fitting - shut off cable

26 stop screw with lock nut for throttle control lever
27 stop screw with lock nut for throttle control lever
28 socket head screw with washer, sleeve and nut
29 socket head screw with washer and nut

30 **shut off cable** cpl.
31 L-fitting with hex head nut
32 dust cover
33 cable with guide spring and connector rods
34 scraper ring
35 guide tube
36 dust cover
37 screw fitting
38 threaded coupling
39 hex head nut
40 washer
41 cable housing

50 **throttle control cable** cpl.
51 L-fitting with hex head nut
52 dust cover
53 cable with guide spring and connector rods
54 dust cover
55 threaded coupling
56 hex head nut
57 installation flange - separated with pivot sleeve
58 cable housing
59 protective hose
60 hose clamp

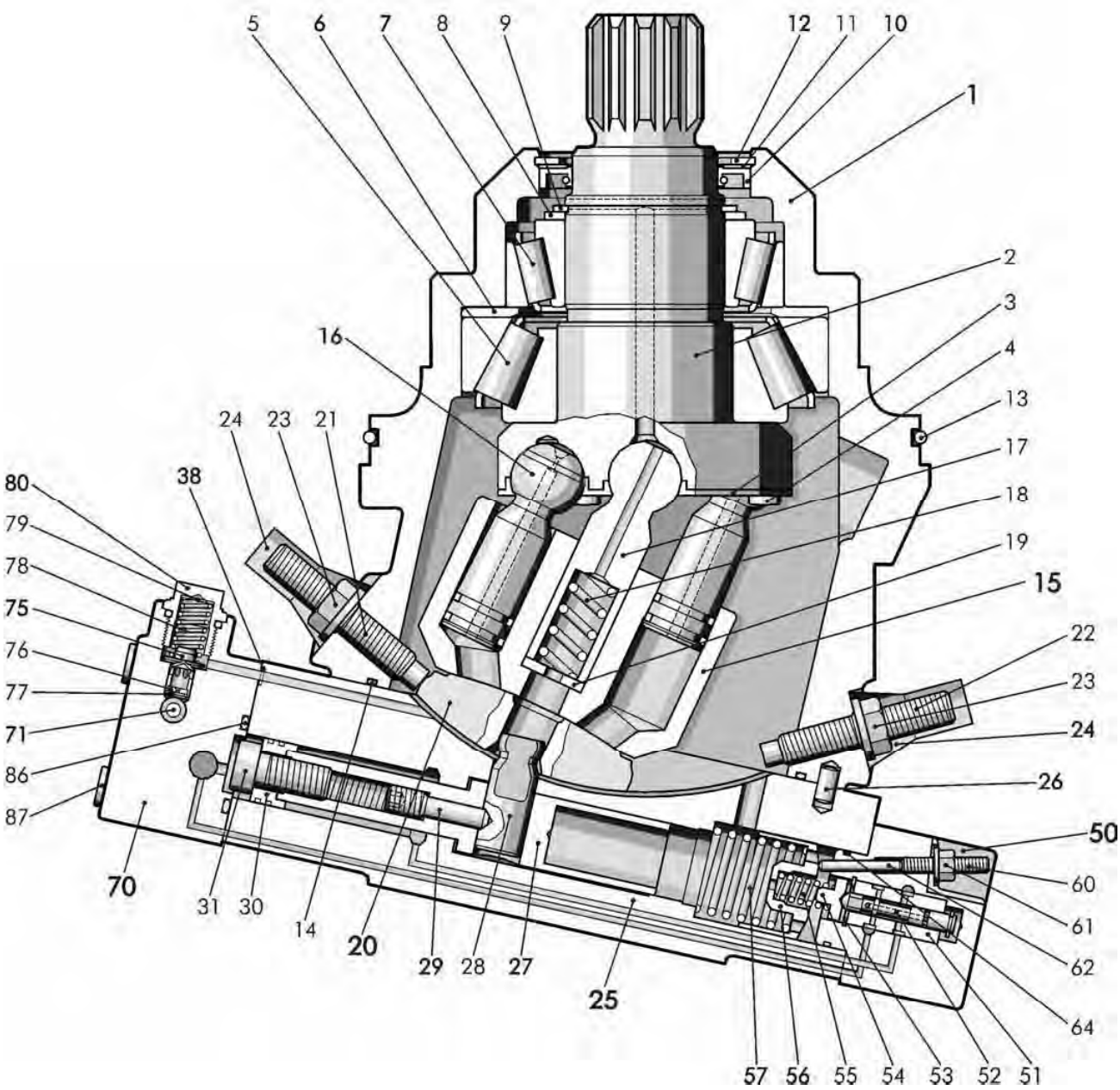


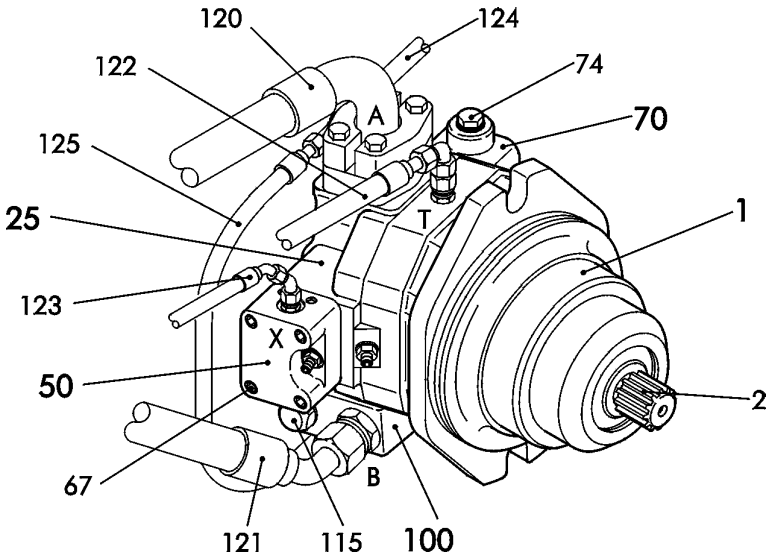
Pos. Description

E3	Working light - rear right
E4	Working light - front left
E5	Working light - rear left
E6	Working light - front right
F27	Fuse - Working lights front, rear right, instrument lights
F28	Fuse - Working lights front right, rear left
F29	Fuse - Warning light - canopy
H14	Warning light - activated by B2/B3/B6
K10	Relay - Warning light
K17	Relay - Working lights
MP	Ground connection
S7	Rocker switch - working lights, instrument lights
X4	Panel plug - cab wiring harness 14-pole
X52	Plug 9 pole
X53	Plug 3 pole
X54	Plug 3 pole
X55	Plug 3 pole

Wire No.	Connections Panel to X4 (see Group 9)
1015	from - F8
1016	from - F8
1017	from - F3
1019	from - F3
6007	to - P4
6014	from - X5-5
9000 ↓ 9007	Open connections

wo. No.	Ground connections - black





LIEBHERR	Benennung Description Dénomination	Typ/ab Type/from Type/a partir de
	Hydraulic motor	

controlled by moving the control lever a very small distance, or by operating the tractor engine, and therefore the tractor implement pump, at a lower RPM.

The hydraulic motor used with the “autospeed” control system is a variable displacement, piston-type motor with an internal load-sense circuit. This circuit contains a small piston which adjusts the angle of the motor rotating pump group from minimum to maximum displacement as the pressure on the motor work ports (A & B) increases due to the load applied to the winch gear train. When there is little or no load on the winch, the motor rotating group will remain at the preset minimum displacement. As the winch load increases, the pressure at the motor work ports will increase. This same pressure will also act on the load-sensing piston beneath the “X” and “G” ports. As the load-sense piston moves, it directs oil to the motor rotating group shift cylinder which increases the motor displacement to provide increased torque, or pulling power, at a lower line speed.

In this manner, the motor displacement will automatically adjust to provide the maximum hydraulic horsepower for any given line speed and line pull situation.

LOW-SPEED LOCK MODE:
Pressing the rocker switch on top of the control lever will force the variable displacement motor to shift the piston to the maximum displacement position, which will allow the winch to operate in the maximum line pull, minimum line speed mode, to enhance precise load control. When shifted into Low-Lock, the indicator light on the console adjacent to the joystick will light up. Press the rocker switch again to disable Low-Lock, and allow the winch to again operate in the autospeed mode. When in autospeed, the indicator light will be off.

DRUM CLUTCH RELEASE:
Pushing the control lever away from the operator directs oil to release the winch drum clutch. With the drum clutch released, the tractor can move away from a load while using the inherent resistance of the output and intermediate planet gear sets to keep the cable tight on the drum.

⚠ WARNING ⚠

Do NOT use the drum clutch to position suspended loads. Sudden load movement may result in personal injury or death. Suspended loads should be controlled by the main winch control valve using Haul-In or Pay-Out functions.

2-SPEED MODE:

The hydraulic motor used with 2-speed winch configuration is a vane-type motor. It may be operated in either high or low displacement, depending on winch load and speed requirements, and may be shifted “on the fly” via a toggle switch on the control lever. The motor can be used in the high displacement setting to maximize line speed capabilities. The low displacement setting can be used to maximize line pull capabilities.

⚠ CAUTION ⚠

The H110 hydraulic motor and gear ratio is configured to match the hydraulic system of a specific tractor. It may not be possible to mount the winch onto a different tractor model. Installation onto a tractor with a higher flow hydraulic system could result in overspeed damage to the motor and winch gear train. The maximum drum RPM in autospeed, no-load, with a piston motor, is listed below:

H110 – 156XXXX	28 RPM (+0, -1)
H110 – 245XXXX	18 RPM (+0, -1)

Consult the CARCO Field Service Department for details on retrofitting the winch to different tractors.

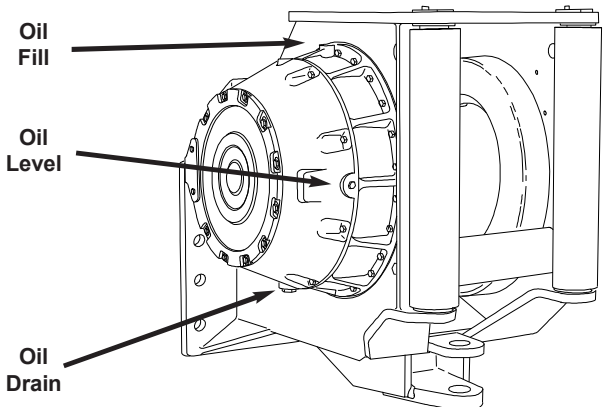
PREVENTIVE MAINTENANCE

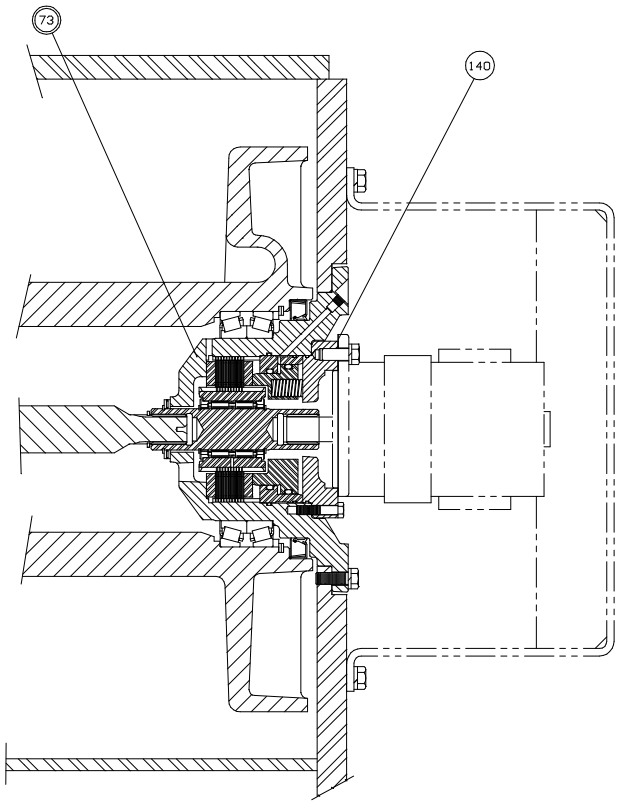
A regular program of preventive maintenance for your CARCO winch will minimize the need for emergency servicing and promote long product life and trouble-free service.

The service intervals suggested in this manual will optimize component service life. The intervals may be gradually increased or decreased with experience of a particular lubricant and evaluation of your application.

GEAR CASE OIL

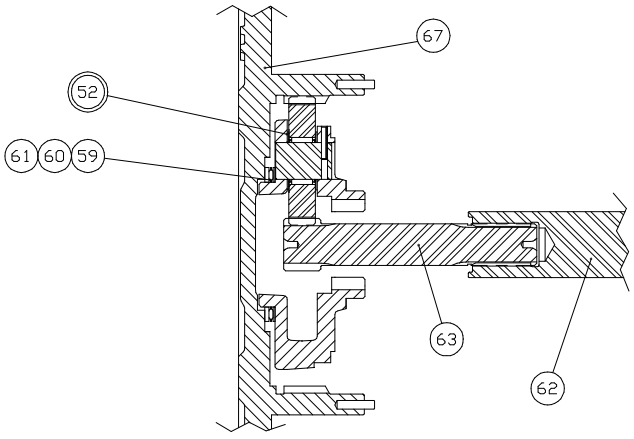
The winch assembly should be visually inspected for leaks at the beginning of each workday. If oil leaks are





Fixed Displacement Vane Motor Configuration

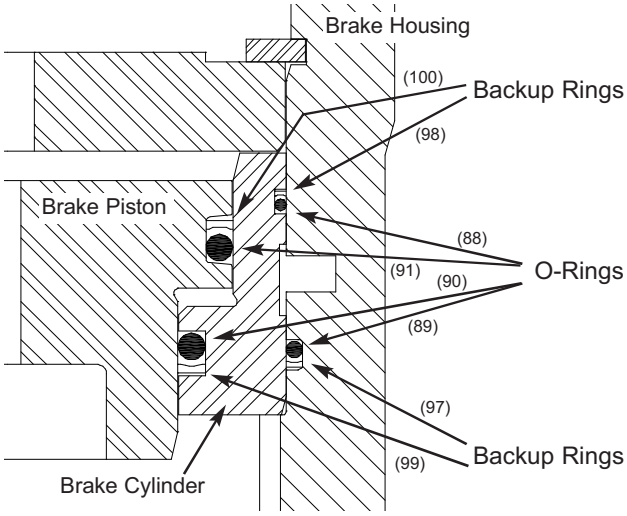
245:1 Ratio



Parts Key

Refer to appropriate Installation and Parts Manual for part numbers.

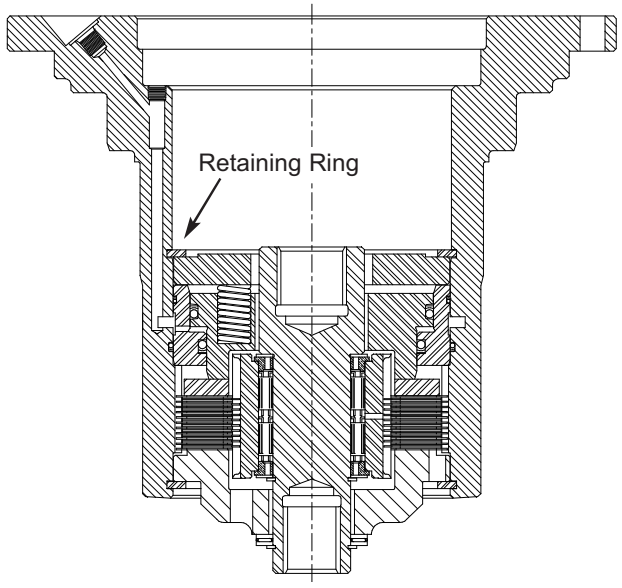
Item No.	Description	Qty.
1	Winch Housing	1
2	Cable Drum	1
3	Bearing Cone	4
4	Bearing Cup	4
5	Spacer Ring	2
6	Retaining Ring	2
7	Oil Seal	2
8	Output Planet Carrier Assembly	1
19	Secondary Planet Carrier Assembly	1
27	Drum Clutch	1
39	Hose	1
43	Retaining Ring	1
44	Secondary Sun Gear	1
45	Thrust Washer	1
46	Output Sun Gear	1
47	Output Ring Gear	1
48	O-ring	1
49	Capscrew. Hex Head	46
50	Washer	46
51	Spring	20
52	Primary Planet Carrier Assembly	1
59	Thrust Bearing Race	1
60	Thrust Bearing	1
61	Thrust Bearing Race	1
62	Intermediate Shaft	1
63	Primary Sun Gear/Shaft	1
64	Thrust Bearing Race	2
65	Thrust Bearing	1
66	Retaining Ring	2
67	Primary Planet Ring Gear/End Cover	1
68	Thrust Bearing Race	2
69	Thrust Bearing	1
70	O-ring	1
71	Capscrew. Hex Head	10
72	Washer, Hardened	10
73	Brake Housing Assembly	1
140	O-ring (Piston Motor) Gasket (Vane Motor)	1



Location of O-Rings and Backup Rings

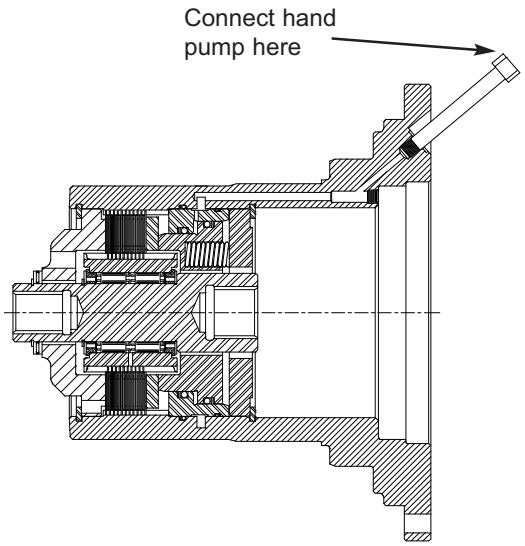
6. Install O-rings (items 88 thru 90) and backup rings (items 97 thru 99) into the brake housing and brake cylinder grooves. Lightly lubricate the brake housing bore with multi-purpose grease and carefully install the brake cylinder into the housing. Take the proper precautions to avoid cutting the O-rings during assembly. Make sure the brake cylinder is located against the splines inside the housing.

7. Install the O-ring (item 91) and backup ring (item (100) into the brake piston grooves. Lightly lubricate the outside surfaces of the brake piston with multi-purpose grease and install the piston into the cylinder. Take the proper precautions to avoid cutting the o-rings during assembly.



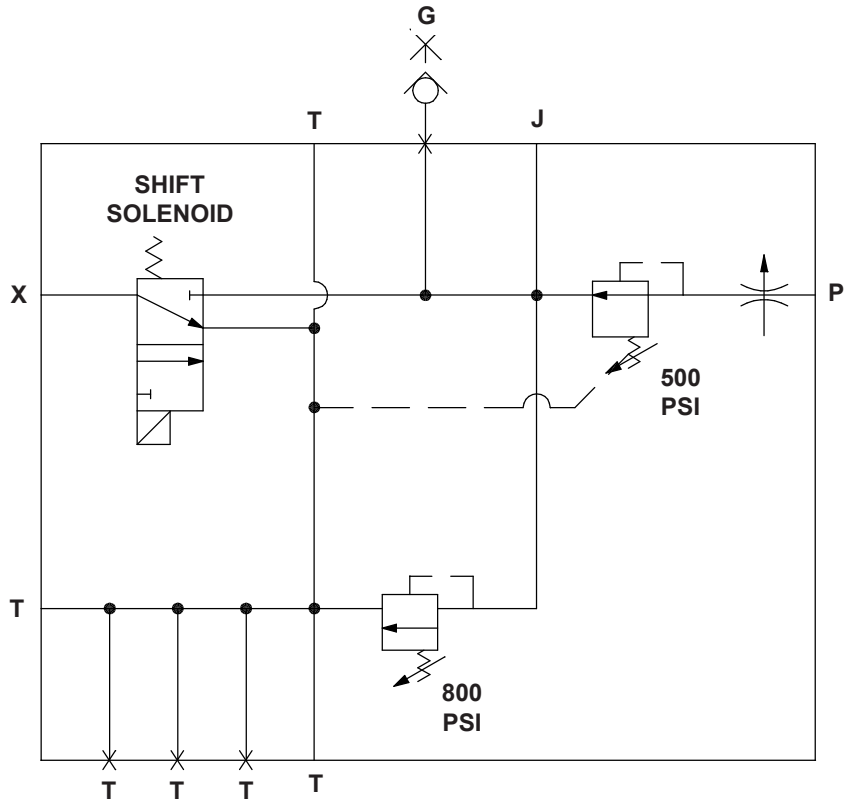
Completed Brake Housing Assembly

8. Install the brake springs (item 86) into the holes in the piston. Place the spring retainer (item 87) over the springs. Using a large socket or piece of tubing that will clear the brake shaft, apply only enough force with the press to permit installation of the retaining ring (item 95).

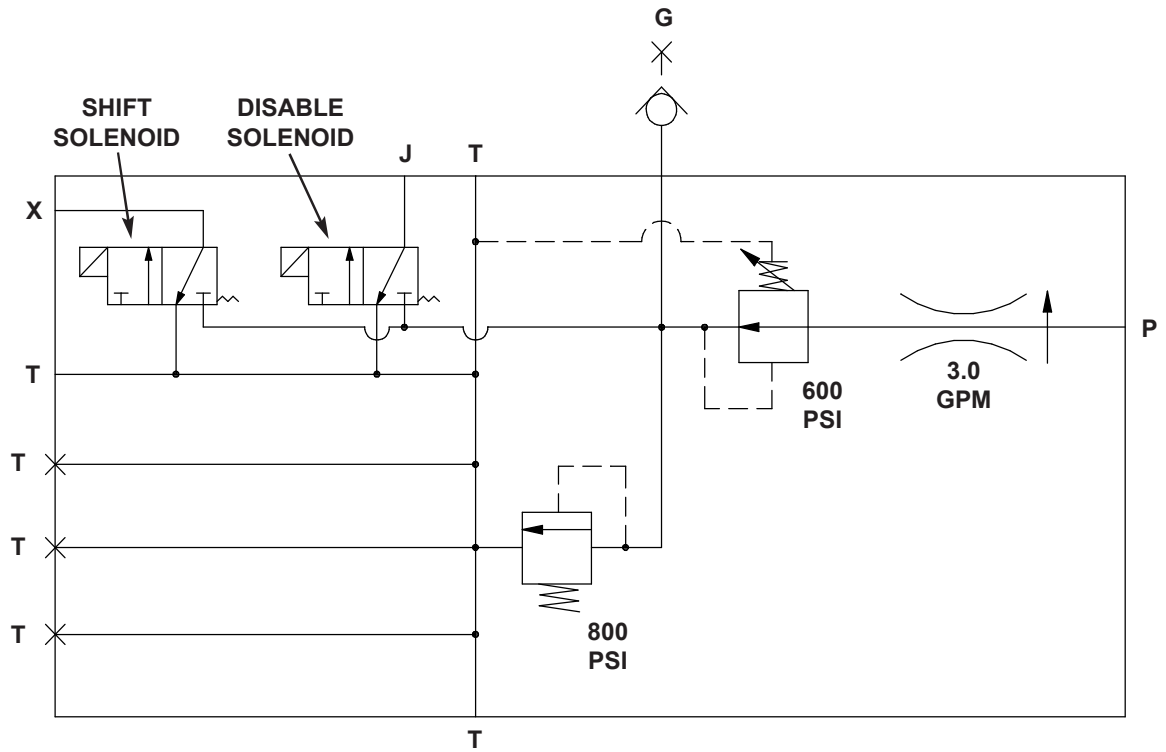


BRAKE ASSEMBLY PRESSURE TEST

Install the long fitting into the brake release port of the brake housing. Connect a hand pump with an accurate gauge and a shut-off valve. Apply 1,000 PSI (6900kPa) to the brake. Close the shut-off valve and let the unit stand for five (5) minutes. If after five (5) minutes, there is any pressure loss, the brake assembly should be disassembled for inspection of the sealing surfaces and brake piston seals.

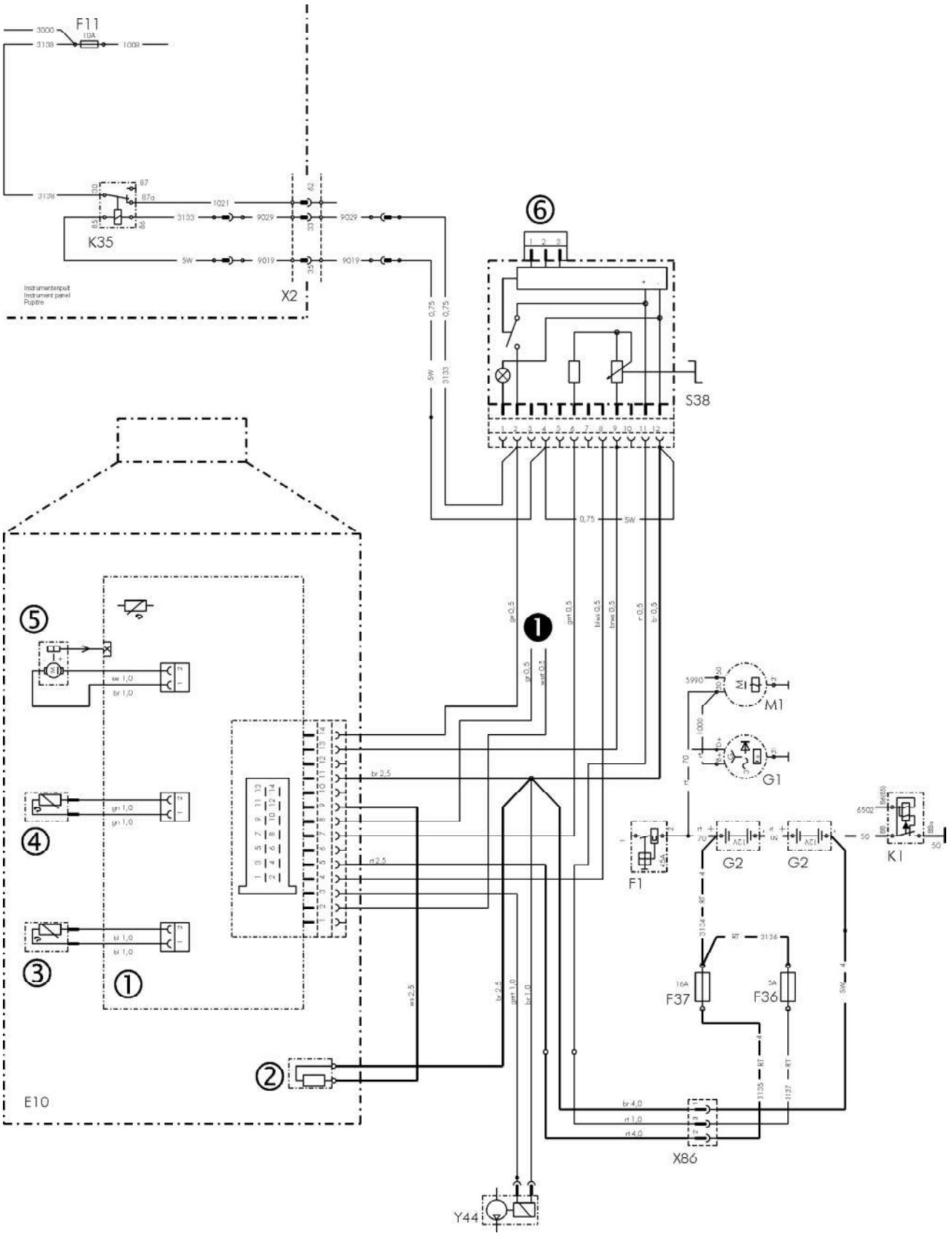


TYPICAL WINCH LOGIC VALVE CIRCUIT (SINGLE SOLENOID)



WINCH LOGIC VALVE CIRCUIT (WITH DISABLE SOLENOID)

Auxiliary heater „Eberspächer“



Every part of a construction equipment is subject to corrosion, especially during storage. The corrosion is comparable to wear and tear. In fact, the effects can exceed mechanical wear and tear and significantly shorten the life of the machine. Therefore, for longer storage, the machine and its components should be preserved according to specific guidelines.

Basically, these guidelines are broken down into the following storage periods:

1. Storage for an indefinite time period (usually unscheduled).
2. Storage for up to 3 months.
3. Storage for up to 6 months.
4. Storage for up to 12 months.
5. Return to service after storage.

Depending on the planned storage period, preservation procedures must be carried out accordingly.

1. **Storage for an Indefinite Time Period - Unscheduled**

   If the equipment is stored for an indefinite time period without preservation, it must be restarted and operated at no less than 14 day intervals to prevent corrosion and consequential damage.

   Proceed as follows:
   Start and operate the machine according to the Operation Manual. Operate the Diesel engine and hydraulic system until the recommended operating temperatures are reached (min 60° C) (140° F) in the hydraulic tank and 80° C (176° F) in the engine's cooling system.

   Activate all travel and working hydraulic functions alternately for approximately 20 minutes. Hydraulic cylinders must be fully extended and retracted. Actuate winches.

   Prior to starting the machine, check all oil levels and lubrication points. Add oil and lubricate as necessary.

   When storing the machine, fully retract all hydraulic cylinders. Fill fuel tank completely. On soft ground, park machine on wooden planks and secure against movement.

   Check batteries; if necessary, remove and recharge. Check electrical contacts and spray with an anti-corrosive agent.

   At every start-up, the recommended daily maintenance should be performed. In addition, the machine should be serviced as outlined in the maintenance schedule, as well as the engine manufacturer's operation manual.